



Hydrogeological Assessment for Lot Severance - 112 Pleasant Bay Road, Prince Edward County

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Prepared for:
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1.0 Introduction

Brauer Homes (Client) retained Cambium Inc (Cambium) to complete a hydrogeological assessment for a proposed severance at 112 Pleasant Bay Road, Concession 3, Lakeside Lot 24, Township of Ameliasburgh, Prince Edward County (Site). We understand that the Client intends on severing one lot from the Site. The proposed severance and retained lot will be serviced by private, on-site systems for potable water and wastewater treatment.

The County of Prince Edward (the County) requires a hydrogeological assessment in support of the proposed severance, including the following:

- A new well be installed on both the retained and severed parcels.
- A pumping test be completed on the newly installed well according to the Ministry of Environment, Conservation, and Parks (MECP) Guideline D-5-5 (MOE, 1996).
- Water quality assessed for the newly installed well according to parameters outlined in Guideline D-5-5.
- Water levels of adjacent water supply wells be monitored prior to, during, and after the pumping test described above. The adjacent wells be sampled for bacteria and nitrate. A survey is to be conducted of owners of adjacent land for additional well information.
- A nitrate loading impact assessment as per MECP Guideline D-5-4 (MOE, 1996a).

1.1 Site Description

The Site is approximately 1.8 ha and is irregularly shaped. The Site is vacant and undeveloped with frontage to Pleasant Bay Road on the south and east sides of the property. Lands to the west and north are rural residential. Lands east and south of the Site are agricultural. The Site topography slopes down to the northwest where a creek forms the Site boundary. The creek runs west and drains into Pleasant Bay.

The Client intends to sever one lot and retain one lot on the Site. The severed lot is approximately 0.5 ha and the retained lot is approximately 1.3 ha. The proposed severance



plan is attached in Appendix A. In March of 2022, the Client installed two dug supply wells (one within the proposed severance and retained lot). The wells were labelled PW-1 and PW-2 and were installed to depths of 6.40 and 6.71 metres below ground surface (mbgs), respectively. Well records of the newly installed wells are attached in Appendix B. The Site plan, including the location of the newly installed dug wells, is included as Figure 1.



2.0 Methodology

This section outlines the methodology followed to complete the hydrogeological assessment. The hydrogeological assessment involved several field tasks which included a test pit investigation, water well survey and six-hour pumping tests of PW-1 and PW-2. The scope of work was reviewed with the Client, Prince Edward County (The County) and Quinte Conservation (QC) prior to the commencement of the work program. The fields tasks are discussed below in detail.

2.1 Document Review

A review of available relevant background information was completed, which included the following resources:

- Ministry Water Well Information System (WWIS) website provided by the Ministry of Environment, Conservation and Parks (MECP, 2022a)
- Physiography of Southern Ontario (Chapman, L.J. and D.F. Putnam, 1984)
- Surficial geology of Southern Ontario, Miscellaneous Release – Data 128 revised, scale 1:50,000 (Ontario Geological Survey, 2010)
- Paleozoic Geology of Southern Ontario, Miscellaneous Release – Data 219, scale 1:50,000 (Armstrong, D.K. and Dodge, J.E.P., 2007)
- Bedrock Geology of Ontario, Miscellaneous Release – Data 126 - Revision 1, scale 1:250,000 (Ontario Geological Survey, 2011)
- Source Protection Information Atlas (SPIA) (MECP, 2022b)

2.2 Subsurface Investigation

Cambium completed a test pit investigation on November 24, 2021 to determine the subsurface conditions at the Site. The test pits were excavated using a backhoe under the supervision of Cambium to depths ranging from 1.63 mbgs to 1.83 mbgs. A total of four test



pits, designated as TP101-22 through TP104-22, were advanced throughout the area of the proposed retained and severed lot.

Soil samples were logged in the field for soil type, colour, odour, etc. Open test pits were backfilled with excavated soils and compacted with the backhoe bucket. A total of three soil samples were submitted for grain size and hydrometer analysis.

Test pit logs are provided in Appendix C. Locations of the test pits are included in Figure 1. Results of the intrusive subsurface investigation are discussed in 3.2.

2.3 Physical Laboratory Testing

Physical laboratory testing, including three grain size and hydrometer analyses (LS-702, 705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Results are presented in Appendix D.

2.4 Well Installation

The Client retained Frank's Drilling and Blasting Ltd. to install two new supply wells within the boundary of the proposed lots. The Client coordinated with the driller directly; however, Cambium provided input and direction as needed. The well installation records of the new supply wells, referred to herein as PW-1 and PW-2. The locations of the supply wells are outlined on Figure 1.

2.4.1 PW-1

Well PW-1 (MECP Tag # A330618) was installed in the eastern portion of the retained lot. The coordinates of PW-1 are UTM Zone 18T and 302024 mE, 4871198 mN.

PW-1 was installed to a depth of approximately 6.4 metres below ground surface (mbgs). PW-1 was chlorinated upon completion. During installation, topsoil was determined to be 0.3 m deep, underlain by brown, sandy loam to bedrock contact at 2.5 mbgs. Blue limestone bedrock continued to termination depth at 6.40 mbgs. The recommended well production rate referenced of the record is 90+ L/min.



2.4.2 PW-2

Well PW-2 (MECP Tag # A330619) was installed in the eastern portion of the proposed severance. The coordinates of PW-2 are UTM Zone 18T and 302035 mE, 4871173 mN.

PW-2 was installed to a depth of approximately 6.7 metres below ground surface (mbgs).

PW-2 was chlorinated upon completion. During installation, topsoil was determined to be 0.3 m deep, underlain by brown, sandy loam to bedrock contact at 1.4 mbgs. Blue limestone bedrock continued to termination depth at 6.71 mbgs. The recommended well production rate referenced of the record is 90+ L/min.

2.5 Limited Water Well Survey

On November 24, 2021, letters were hand-delivered to two properties adjacent the Site, 64 and 118 Pleasant Bay Road. The letters indicated that a pumping test would be occurring at the Site at some point in the future and requested permission to investigate/monitor private supply wells. There were no respondents to the November 24, 2021 letter delivery. In early August 2022 a second attempt was made to contact both adjacent properties. The owners of 118 Pleasant Bay Road were successfully contacted and gave Cambium permission to access their private supply well. The location of the private supply well at 118 Pleasant Bay Road is outlined on Figure 1. A copy of the residential letter and questionnaire are included in Appendix E.

2.6 Pumping Tests

On August 22 and 23, 2022, Cambium staff visited the Site to complete six-hour pump tests on PW-1 and PW-2. A licenced well contractor (Well Busters Canada Inc.) was retained to install a pump in the wells to facilitate the tests. Discharge water was directed to ground surface and allowed to flow west, away from the wellhead.

The water levels of both pumping wells were monitored continuously during the pumping tests with automated level logging equipment. The water level of the well that services 118 Pleasant Bay Road was also monitored manually with a water level tape during both tests. All



equipment used in the 118 Pleasant Bay Road well was decontaminated prior to use. Further details and results regarding the pumping tests are discussed in Section 4.0.

Cambium staff chlorinated each well prior to testing and monitored concentration of free residual chlorine throughout each test. A water sample was collected and retained under a chain of custody for delivery to a CALA-accredited laboratory for analysis. Samples were analysed for all parameters outlined in Guideline D-5-5 (MOE, 1996).

It is noted that the samples from PW-1 and PW-2 were both collected on August 23, 2022 (i.e., the day of the second test). A sample could not be collected from PW-1 on August 22, 2022 because the water became increasingly turbid near the end of the test. The turbid water did not allow on-site instruments to measure the concentration of free chlorine residual in the discharge water. In the morning of August 23, Cambium staff confirmed the concentration of residual chlorine in PW-1 (to be non-detect) and collected a water sample by use of a bailer prior to the testing of PW-2. The water sample from PW-2 was collected at the end of the test of that well (on August 23, 2022).

A water sample was collected from the well that services 118 Pleasant Bay Road on August 24, 2022. The well discharges to a cistern, which is drawn upon by the dwelling for consumptive use. The sample was collected from a spigot that feeds directly from the cistern. The spigot was decontaminated before the sample was collected.

The certificate of analyses off all samples are attached in Appendix E.



3.0 Geological and Hydrogeological Setting

The topography of the Site gently slopes down towards the northwest. Surface flows will follow topography and drain towards the creek on the northwest boundary. The creek eventually flows into Pleasant Bay, which then flows to Lake Ontario.

Physiographic mapping indicates the landform of the Site as Limestone Plains within the Prince Edward Peninsula region. The Ameliasburgh area generally contains about two feet of till overlying Paleozoic limestone bedrock (Chapman & Putnam, 1984).

Surficial geology mapping indicates the soil in the area of the Site is classified as Paleozoic bedrock in the southern portion, and fine-textured glaciolacustrine deposits of silt and clay, minor sand and gravel in the northern portion of the Site. The bordering creek bed is described as organic deposits of peat, muck, and marl (Ontario Geological Survey, 2010).

Bedrock at the Site is limestone and shale described as nodular to black laminated Collingwood limestone of the Lindsay formation (Armstrong & Dodge, 2007).

3.1 Vulnerable and Regulated Areas

As per the MECP Source Protection Information Atlas (SPIA), the Site is located within the Quinte Source Protection Area. The Site is not located within a municipal well head protection area, or significant groundwater recharge area, but is within a highly vulnerable aquifer (HVA) with a vulnerability score of 6.

3.2 Results of Subsurface Investigation

A layer of topsoil was encountered at each test pit and ranged in thickness from 0.38 m and 0.43 m. The soils encountered beneath the topsoil were variable across the Site.

At test pit TP101-21 predominantly sand soil was encountered from 0.41 mbgs to 1.68 mbgs. Underlying the sand was silty clay sediments that extended to 1.83 mbgs.

At test pits TP102-21 and TP103-21 generally silt/clayey sediments were observed beneath the topsoil, and extended to test pit termination.



At TP104-21 silt and clay sediment extended from 0.43 mbgs to 0.91 mbgs. Underlying the silt and clay were sand and gravel sediments that extended to test pit termination.

Groundwater seepage was observed at each test pit and ranged in depth between 0.61 mbgs and 1.55 mbgs. Bedrock was not encountered during the test pit investigation.

3.2.1 Grain Size Analyses

Laboratory grain-size sieve and hydrometer analyses were completed on three samples of the native soil collected from test pits TP101-21, TP 103-21, and TP 104-21. Results are shown in Table 1. The estimated T-times of tested soils range from 10 min/cm to >50 min/cm.

The two occurrences of coarser grained sediments reported T-Times of 10 min/cm. Whereas the finer grained sediments sampled from TP103-21 reported a T-Time of greater than 50 min/cm. The finer grained sediments are the predominant soil type at the Site. The designer of on-site wastewater treatment systems should take into consideration the variability of soil conditions.

Table 1 Grain-Size Analysis

| Borehole | Depth (mbgs) | Soil | % Gravel | % Sand | % Silt | % Clay | T-Time (min/cm) |
|----------|--------------|--|----------|--------|--------|--------|-----------------|
| TP101-21 | 0.41 – 1.68 | Sand, some silt, some gravel, trace clay | 15 | 63 | 19 | 3 | 10 |
| TP103-21 | 0.89 – 1.70 | Silty clay, trace sand | 0 | 6 | 31 | 63 | >50 |
| TP104-21 | 0.91 – 1.78 | Sand and gravel, some silt, trace clay | 37 | 40 | 19 | 4 | 10 |

3.3 Surrounding Water Well Records

The MECP Water Well Information System (WWIS) was accessed to review water well records in the area of the Site. There are 27 water well records located within approximately 500 m of the Site, summarized in Table 2 below. The following well types were identified:

- Twenty-one (21) well records were for water supply.
- Six (6) well records were for well abandonments.



Table 2 Water Well Record Information

| | | Total Depth (mbgs) | Depth Water Encountered (m) | Static Water Level (mbgs) | Recommended Pumping Rate (lpm) |
|----------------------------|------|---------------------------|------------------------------------|----------------------------------|---------------------------------------|
| Bedrock Wells Count: 26 | Min | 6.1 | 2.13 | 1.0 | 5 |
| | Max | 33.8 | 25.9 | 9.0 | 68 |
| | Avg. | 15.8 | 9.40 | 3.9 | 26 |

As per the MECP records, the soil profile generally consists of clay and gravel underlain by limestone bedrock. Twenty six of the wells were extended into bedrock described as grey limestone. Bedrock contact was found between 1.22 and 5.29 mbgs, average of 2.83 mbgs. The average well depth was 15.82 m, ranging from 6.1 to 33.8 mbgs. The average static water level was 3.91 mbgs, ranging from 1.0 to 9.0 mbgs.

The depth of bedrock contact and soil description of overburden provided by the well records was similar to the conditions encountered on-site as part of the intrusive subsurface investigation and well drilling activities.

As per Guideline D-5-5, the minimum yield rate for a private water well is 13.7 Lpm, or three imperial gallons per minute. The WWIS report indicates an average yield of 26 Lpm, which is greater than the recommended yield for residential use.

3.4 Hydrogeological Conditions

Shallow overburden at the Site was variable, and ranged from sand and gravel, sand to clay and silt. Bedrock was not encountered during the test pit investigation, however bedrock was encountered at 1.4 mbgs and 2.5 mbgs during the installation of the supply wells.

Groundwater seepage was observed between 0.61 mbgs and 1.55 mbgs during the test pit investigation. The static water levels of PW-1 and PW-2 ranged between 0.61 mbgs and 1.02 mbgs upon installation. Groundwater flow within the shallow overburden sediments is inferred to be northwest, towards the creek.

There is a limestone bedrock aquifer in the area of the Site that is drawn upon for local water supplies. Supply wells PW-1 and PW-2 intercepted the limestone bedrock aquifer.



The property owner of 118 Pleasant Bay Road provided information regarding the supply well on that property. The MECP Well ID of the 118 Pleasant Bay Road well is 5307492 and that well was installed to a depth of 22.8 mbgs in bedrock. Clay overburden was reported to a depth of 4.5 mbgs. Groundwater was encountered at a depth 5.7 mbgs in bedrock.

The hydraulic connectivity of the water bearing overburden sediments, and the bedrock aquifer is not known. However, it is considered likely that some degree of hydraulic connection exists between these two units.



4.0 Results

4.1 Pumping Test of PW-1

The pumping test of PW-1 commenced on August 22, 2022 at 10:35. The static water level was 4.39 metres below top of pipe (mtop) prior to pumping and there was 2.02 m of available drawdown in the well. The pumping rate was initially set at 19 L/min then reduced to 15 L/min at 238 minutes into the test. The flow rate was maintained at 15 L/min for the remainder of the test (i.e., from 238 minutes elapsed until 360 minutes elapsed). The water level of PW-1 lowered continuously from static conditions to 5.82 mtop (a drawdown of 1.43 m, or 71% of the available drawdown) just prior to the completion of the pumping test.

The pumping test was terminated at 16:35 on August 22, 2022. In total, 6,352 L of water was withdrawn from the well. The water level of PW-1 recovered continuously and at the commencement of the test of PW-2 at 9:10 the next day (August 23, 2021) the water level was 5.17 mtop (a recovery depth of 0.65 m, and percent recovery of 45%). The water level of PW-1 recovered to 4.49 mtop (a recovery depth of 1.33 m, and percent recovery of 93%) by 13:20 on August 24, 2022. The water level fluctuations of PW-1 are outlined on Figure 3.

4.1.1 Monitoring Well Influences

The water withdrawal from well PW-1 did not induce an influence on the water level of PW-2 or the well at 118 Pleasant Bay Road.

The water level of 118 Pleasant Bay Road ranged between 20 mtop and 21 mtop (which is significantly deeper than the water level reported on August 23, 2022). However, the owner of 118 Pleasant Bay Road indicated that house keeping staff were at the property that day and would be using the water. In consideration of the above, water withdrawal from well PW-1 was not interpreted to influence the 118 Pleasant Bay Road well.

4.2 Pumping Test of PW-2

The pumping test of PW-2 commenced on August 23, 2022 at 9:10. The static water level was 3.37 mtop prior to pumping and there was 3.31 m of available drawdown in the well. The



pumping rate was set at 15 L/min for the duration of the test. The generator running the pump malfunctioned between 20 and 70 minutes elapsed into the test. After 70 minutes elapsed the generator functioned as normal. The water level of PW-2 lowered continuously (with exception of the short period when the generator was not functioning) from static conditions to 4.16 mtop (a drawdown of 0.79 m, or 24% of the available drawdown) just prior to the completion of the pumping test.

The pumping test was terminated at 16:10 on August 23, 2022. Water was withdrawn from well PW-2 for a total of 420 minutes. In total, 5,550 L of water was withdrawn from the well.

The water level of PW-2 recovered continuously to 3.59 mtop (a recovery depth of 0.57 m, and percent recovery of 72%) by 9:10 on August 24, 2022. By 13:20 on August 24, 2022 the water level had recovered to 3.55 mtop (a recovery depth of 0.61 m, and percent recovery of 77%). The water level fluctuations of PW-2 are outlined on Figure 3.

4.2.1 Monitoring Well Influences

The water withdrawal from well PW-2 did not induce an influence on the water level of PW-1 or the well at 118 Pleasant Bay Road. The water level of PW-1 was recovering continuously from the test the day prior.

The water level of 118 Pleasant Bay Road slightly increased during the pumping test (from approximately 7.29 mtop to 6.89 mtop). The water level of well 118 Pleasant Bay Road recorded on August 23 was significantly shallower than the level measured on August 22. As outlined above, the owner of the well indicated there was water withdrawal from 118 Pleasant Bay Road on August 22. Water withdrawal from well PW-2 was not interpreted to influence the 118 Pleasant Bay Road well.

4.3 Pumping Test Results Discussion

The water levels of wells PW-1 and PW-2 did not recover to 90% (or greater) of static conditions within a 24 hour period (including water withdrawal). However, the total water volume withdrawn from both wells was greater than the minimum requirements outlined by Guideline D-5-5. The per person water requirement per day is referenced as 450 L in



Guideline D-5-5. Further, the number of people living in a dwelling is equal to the number of bedrooms plus one. The number of bedrooms is assumed to be 4, unless other specified. As such, the total daily water withdrawal volume is assumed to be 2,250 L/day (i.e., 5 people x 450 L/day/person). The peak demand rate outlined in Guideline D-5-5 is 3.75 L/min per person, which equates to 19 L/min. The peak demand rate is assumed to occur for a period of 2 hours per day.

During the pumping tests, a total of 6,352 L of water was withdrawn from PW-1 and 5,550 L of water were withdrawn from PW-2. The projected withdrawal and recovery influences if only 2,250 L/day of water are withdrawn from PW-1 and PW-2 are discussed below.

4.3.1 Projected Drawdown PW-1

On August 22, 2022 a total of 2,280 L of water was withdrawn from well PW-1 after 120 minutes of pumping at a rate of 19 L/min. At 120 minutes elapsed into the pumping test of PW-1 the water level had lowered from 4.39 mtop (static) to 4.94 mtop, resulting in a drawdown of 0.55 m.

A drawdown of 0.55 m can provide the total daily water demand rate of 2,250 L. The well was tested at the peak demand rate of 19 L/min.

Between the end of the pumping test at 16:35 on August 22 and 13:20 on August 24 (a period of 44 hours, 25 minutes), the water level of PW-1 recovered from 5.85 mtop to 4.49 mtop (a recovery depth of 1.33 m). The average recovery rate during this time period was 0.030 m/hr.

To recover 0.55 m at a rate of 0.030 m/hr will take approximately 18 hours, 20 minutes. With inclusion of the 2 hour pumping time, well PW-1 can provide 2,250 L/day on a daily basis, and recover to static conditions within approximately 21 hours. The yield of PW-1 is considered sufficient and sustainable since the water withdrawal and recovery cycle allows for 100% water level recovery within a 24 hour period.

The testing was completed in August when water levels are generally at their annual average low. Even during dry times of the year there is sufficient available drawdown in the well to



account for daily use. Further, there were no influences reported at well PW-2 and the 118 Pleasant Bay Road well.

The yield of well PW-1 is considered suitable for domestic usage from a 4 bedroom dwelling.

4.3.2 Projected Drawdown PW-2

On August 23, 2022 a total of 2,280 L of water was withdrawn from well PW-1 after 150 minutes of pumping at a rate of 15 L/min. At 150 minutes elapsed into the pumping test of PW-2 the water level had lowered from 3.37 mtop (static) to 3.57 mtop, resulting in a drawdown of 0.20 m.

A drawdown of 0.20 m can provide the total daily water demand rate of 2,250 L. The well was not tested at the peak demand rate. However, there is sufficient storage in the well to accommodate an instantaneous demand rate of 19 L/min.

Between the end of the pumping test at 16:10 on August 23 and 13:20 on August 24 (a period of 21 hours, 10 minutes), the water level of PW-1 recovered from 4.16 mtop to 3.55 mtop (a recovery depth of 0.61 m). The average recovery rate during this time period was 0.029 m/hr.

To recover 0.20 m at a rate of 0.029 m/hr will take approximately 7 hours. With inclusion of the 2 hour pumping time, well PW-2 can provide 2,250 L/day on a daily basis, and recover to static conditions within 9 hours. The yield of PW-2 is considered sufficient and sustainable since the water withdrawal and recovery cycle allows for 100% water level recovery within a 24 hour period.

The testing was completed in August when water levels are generally at their annual average low. Even during dry times of the year there is sufficient available drawdown in the well to account for daily use. Further, there were no influences reported at well PW-1 and the 118 Pleasant Bay Road well.



4.4 Water Quality

The water samples collected from PW-1 and PW-2 were compared against the Ontario Drinking Water Quality Standards (ODWQS) (Ministry of Environment, 2006). Water samples were collected after the residual chlorine was confirmed to be non-detectable.

The water sample from PW-1 reported turbidity (11.0 NTU), hardness (284 mg/L), iron (0.422 mg/L) and manganese (0.112 mg/L) at concentrations greater than ODWQS criteria. The concentration of sodium (40.3 mg/L) was greater than the 20 mg/L threshold for when the local Medical Officer of Health should be notified. The concentration of total coliform was 1 cfu/100ml. The concentration of nitrate and E.Coli were less than ODWQS criteria.

The water sample from PW-2 reported hardness (322 mg/L) at a concentration greater than ODWQS criteria. The concentration of total coliform was 25 cfu/100ml. The concentration of nitrate and E.Coli were less than ODWQS criteria.

The water sample from 118 Pleasant Bay Road reported E.Coli and nitrate at concentrations less than ODWQS criteria. The concentration of total coliform was 8 cfu/100ml.

4.4.1 PW-1 Treatability

The turbidity of well PW-1 increased during the second half of the test. Chlorine residual measurements were made continuously during the test of PW-1. Residual chlorine was detected in the discharge water of well PW-1 (during the first half of the test when the turbidity was relatively low), but was decreasing during the measurement period. Residual chlorine could not be measured by the on-site instrument (the colorimeter) during the second half of the test due to increased turbidity. As such, it was decided to collect the water sample the next morning (August 23, 2022) after the well had been allowed to rest, and the turbidity was allowed to decrease. The turbidity decreased and free residual chlorine was reported as non-detectable on the morning of August 23, 2022. Subsequently a sample was collected with a bailer. The cause of the increased turbidity of the discharge water in the second half of the test is likely attributable to the well not being fully developed. Further water withdrawal and usage from the well will likely develop the well and thereby decrease the turbidity. It is noted that the



Client had pumped PW-1 prior to the pumping test in efforts to partially develop the well. However, the Client did not stress well PW-1 to the same degree as was completed during the August 22, 2022 pumping test.

Regardless of the above, the water quality of PW-1 is considered suitable. Turbidity can be treated with appropriate filtration (as needed). Hardness, iron and manganese can be treated with other common treatment technologies. E.Coli was not detected in the water sample from PW-1 and total coliform was only reported as 1 cfu/100 ml. The total coliform concentration of 1 cfu/100 ml is greater than ODWQS criteria, but less than the 6 cfu/100 ml threshold outlined by Procedure D-5-5. However, as due diligence Cambium recommends that bacterial disinfection be included in the water treatment system as a matter of safety and because the well does not have 6 m of watertight casing. The concentration of sodium (40.3 mg/L) was greater than the 20 mg/L threshold for when the local Medical Officer of Health should be notified. Those who draw on well PW-1 as a water supply should be made aware of this condition.

4.4.2 PW-2 Treatability

The water quality of PW-2 is considered acceptable. The ODWQS exceedance of hardness can be treated with conventional treatment technology. E.Coli was not detected, but total coliform was reported at 25 cfu/100 ml (which is an ODWQS exceedance, and greater than the Guideline D-5-5 threshold of 6 cfu/100 ml). The total coliforms are to be expected in a shallow well which does not have 6 m of watertight casing. Bacterial disinfection should be included in the water treatment system of well PW-2.



5.0 Procedure D-5-4 Nitrate Loading Impact Assessment

As per Guideline D-5-4 (MOE, 1996a), an assessment was completed to determine the feasibility of utilizing on-site sewage disposal for the development.

Within effluent, nitrate is considered the limiting contaminant due to the human health concerns. 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 lots on the Site.

This nitrate loading assessment outlined herein predicts the maximum amount of nitrate (and therefore effluent) that can be disposed of on-site, while maintaining boundary concentrations of nitrate at less than 10 mg/L.

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 thirty-year climate normal data collected between 1981 and 2010 at the Trenton A weather station (Climate Identifier ID: 6158875) was used. The data was accessed through the Environment Canada website (Environment Canada, 2022). The total yearly precipitation, on average was 911 mm (786 mm of which was rainfall).



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 539 mm/year and the water surplus calculated to be 372 mm per year (1.02 mm/day). Evapotranspiration calculations are attached in Appendix G.

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, 2006). The infiltration factor was determined to be 0.4 based on the topography, soils and cover.

In addition to calculating the infiltration factor for the Site, the area of the Site was measured (via available mapping) to determine the total volume of available dilution water generated in each portion of the Site. The calculations of available dilution water for each portion of the Site have been outlined below in Table 3.

Table 3 Available Dilution Calculations

| Infiltration Factor | |
|---|---|
| Topography | Hilly = 0.1 |
| Soil | Sand to Clay soils = 0.2 |
| Cover | Vacant Grass Lot = 0.1 |
| Infiltration Factor (I) | 0.4 |
| Volume of Precipitation Water | |
| Site Area (A) (m ²) | 17,982 |
| Surplus (S) (m/day) | 0.00102 |
| Volume of Surplus Water Per Day (AxS) | 18.33 m³/day (18,330 L/day) |
| Volume of Available Dilution Water Per Day ((AxS)xI) | 7.33 m³/day (7,330 L/day) |
| Volume of Runoff Water Per Day ((AxS)x(1-I)) | 11.00 m³/day (11,000 L/day) |

5.2 Predictive Assessment

Total nitrogen (all species) ultimately converts to nitrate through the wastewater treatment process. Nitrate is considered to be the critical contaminant in sewage effluent. At the time this document was prepared no development plans were available for review; however, this assessment will provide the maximum daily septic effluent that the Site can assimilate



(assuming that the entire Site area is referenced for dilution calculations). The nitrate loading assessment benchmark is 10 mg/L, which is that maximum allowable concentration of nitrate in drinking water (as per the ODWQS criteria (MOE, 2006)).

It was assumed that effluent disposed on-site will be of residential strength. It is industry standard to assume that residential strength sewage has a nitrate concentration of 40 mg/L. Procedure D-5-4 indicates that the daily septic loading rate per dwelling is 1,000 L/day.

To determine the adequate lot density for the Site, a mass balance calculation is used to determine the sewage loading for nitrate on the property boundary. The mass balance calculation is outlined below:

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

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 (2 dwellings x 1000 L/day = 2,000 L/day)
- C_e = Concentration of nitrate in effluent (40 mg/L)
- Q_i = Volume of available dilution water
- C_i = Concentration of nitrate in dilution (precipitation) water (0.1 mg/L)

In order 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 equation have been outlined in Table 4.



Table 4 Predictive Assessment of Nitrate Concentrations – Conventional

| Variable | Value |
|---------------------------------------|------------------|
| Q_e | 2,000 L/day |
| C_e | 40 mg/L |
| C_i | 0.1 mg/L |
| Q_i | 7,330 L/day |
| Q_t | 9,330 L/day |
| NO_3 at property boundary (C_t) | 8.65 mg/L |

If 2,000 L of domestic strength effluent is disposed of on-site per day, then the diluted concentration of nitrate will be 8.65 mg/L (if conventional on-site wastewater treatment systems are used).

It is noted that the concentration of nitrate reported from wells PW-1 and PW-2 ranged from 4.90 mg/L to 5.89 mg/L (average of 5.40 mg/L). The existing on-site concentrations of nitrate are less than the ODWQS criteria limit of 10 mg/L and are also less than the projected effluent dilution concentrations that result from nitrate loading of proposed wastewater treatment systems. Therefore, the boundary concentrations of nitrate at the Site are anticipated to be between 8.65 mg/L and 5.40 mg/L once the dilution water mixes with the shallow aquifer.

The boundary concentration of nitrate is projected to be less than 10 mg/L, therefore development of residential dwellings on the proposed severed and retained lots is considered feasible.



6.0 Conceptual Site Layout

The proposed severance (and retained lot) will presumably be developed with single family, four bedroom, dwellings. According to Table 8.2.1.3.A of the Ontario Building Code (OBC) (Ministry of Municipal Affairs and Housing, Housing Development and Buildings Branch., 1997), the daily design flow for a four bedroom dwelling is 2,000 L/day. As a conservative measure (and for continuity within this report) the daily sewage loading rate for each proposed severance was assumed to be 2,250 L/day, as calculated for the water quantity assessment.

(Note: the conceptual placement/installation of the dwellings and wastewater treatment systems described in this section do not constitute actual development plans for the proposed severances. The layouts described herein were completed to demonstrate that developing the proposed severances with private on-site water supply and wastewater treatment systems is possible. Soil and groundwater conditions at the Site must be confirmed as part of the detailed design of the wastewater treatment system).

The shallowest depth of groundwater was measured to be 0.61 mbgs (from the test pits and supply wells). Further, the soils on-site were variable however the predominant soil texture varies between silt and clay (with a T-Time of >50 min/cm). In consideration of the above the conceptual wastewater treatment systems will be partially raised and built with imported fill. The system will also require a mantle consisting of imported fill. The bottom of the partially raised system will be 0.61 mbgs. The top of the system will extend approximately 0.94 m above grade. The imported fill for the fully raised systems was assumed to have a T-Time of 8 mins/cm.

The length of distribution pipe for the leaching bed was calculated to be 90 m from the following equation (Section 8.7.3.1.(2) of the OBC):

$$L = \frac{QT}{200}$$

Where :

- L = Total length of distribution pipe in metres
- Q = The daily design flow
- T = T-Time of imported fill



Conceptually, the distribution pipes can be installed in 8 runs, each being 12.2 m long (40 ft), and spaced on 1.6 m centres. Based on this conceptual design, the footprint of the distribution pipes will be 12.2 m long and 11.2 m wide. The height of the wastewater treatment system was assumed to be 0.94 m above grade. Including a fill buffer of 0.8 m around the distribution pipes, and 3:1 side slopes, the total length of the raised leaching bed will be 19.5 m and the width will be approximately 18.5 m. The footprint of the portion of the wastewater treatment raised above grade system will be approximately 361 m². The mantle will extend an additional 15 m from the distribution lines, and will be inground. The dimensions of the entire system including mantle, will be approximately 33.5 m x 19.5 m (total area of 653 m²).

According to Table 8.7.4.1.A of the OBC, the total footprint of a fully raised leaching bed must allow for a loading rate of, at most, 4 L/m² for those soils that exhibit a T-Time greater than 50 min/cm. A daily design flow of 2,250 L/day, at a loading rate of 4 L/m² requires a minimum footprint of the leaching bed (including mantle) to be 562.5 m². The conceptual design of the system accounts for a total area of 653 m², which is greater than the minimum required area.

The placement of the conceptual wastewater treatment systems for each lot (and reserve beds) are outlined on Figure 4. Also included on Figure 4 is the conceptual dwelling footprint (assumed to be 150 m²), and the setback distances outlined in the OBC. The setback distance from the existing wells (onsite and offsite) do not intercept the raised portion of the conceptual systems (where the distribution pipes will be installed). The conceptual site layout indicates that development of single family dwellings (serviced with a private supply well and wastewater treatment system) within the proposed severance and retained lots are feasible. Adjacent properties are not anticipated to be influenced by the proposed development (with regards to wastewater loading and groundwater supply).



7.0 Closing

Brauer Homes retained Cambium to complete a hydrogeological assessment for a proposed severance at 112 Pleasant Bay Road, Concession 3, Lakeside Lot 24, Township of Ameliasburgh, Prince Edward County.

The results of the testing outlined herein indicates that the newly installed supply wells can provide the daily water demand rate for single family residential dwellings on a continuous basis. No influences to off-site groundwater users were noted. The water quality of both wells was relatively good, however treatment for some parameters and bacteria disinfection will be required.

The nitrate loading assessment indicates that the concentration of nitrate will be less than 10 mg/L at the property boundary.

The conceptual Site layout indicates that a wastewater treatment system and reserve bed can be accommodated within the retained and severed lots.

In summary, developing the proposed severance (and retained lot) with single family dwellings that are provided water and water servicing from private systems is feasible.

Respectfully submitted,

Cambium Inc.

Nicole Heikoop, GIT
Project Coordinator



Cameron MacDougall, P. Geo.
Project Manager



8.0 References

- Armstrong, D., & Dodge, J. (2007). *Paleozoic geology of southern Ontario, Miscellaneous Release - Data 219*. Ontario Geological Survey.
- Chapman, L. J., & Putnam, D. F. (1984). *The Physiography of Southern Ontario*. Ontario: Ministry of Natural Resources.
- Environment Canada. (2022). *Canadian Climate Normals 1981-2010 Station Data*. Retrieved 02 04, 2017, from http://climate.weather.gc.ca/index_e.html
- Ministry of Environment. (2006). *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines*.
- Ministry of Municipal Affairs and Housing, Housing Development and Buildings Branch. (1997). *Ontario Building Code 1997, containing the Building Code Act and O. Reg. 403/97*. Toronto, ON.
- MOE. (1996). *D-5-5 Private Wells: Water Supply Assessment*. MECP.
- MOE. (1996a). *Procedure D-5-4, Technical Guideline for Individual On-Site Sewage System: Water Quality Impact Risk Assessment*. Ministry of Environment.
- MOE. (2006). *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines*. Ministry of the Environment.
- Ontario Geological Survey. (2010). *Surficial Geology of Southern Ontario, Miscellaneous Release - Data 128-REV. Scale 1:50,000*.
- S. Lawrence Dingman. (2008). *Physical Hydrology, Second Edition*.



9.0 Standard Limitations

Limited Warranty

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Site Assessments

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

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

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The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.



Appended Figures

O:\GIS\MXD\13600-13699\13604-001 Brauer Homes - HydroGeo - Pleasant Bay Rd - PEC\2022-09-12 FIG 1 - Site Plan.mxd



HYDROGEOLOGICAL ASSESSMENT
BRAUER HOMES
 112 Pleasant Bay Road,
 Conescon, Ontario

LEGEND

- Residential Well
- Test Well
- Test Pit
- Site (approximate)

Notes:
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 - Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



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 www.cambium-inc.com

SITE PLAN

| | | | |
|--------------|-----------|-------------|-----------------------|
| Project No.: | 13604-001 | Date: | September 2022 |
| Scale: | 1:1,500 | Rev.: | |
| Created by: | MAT | Projection: | NAD 1983 UTM Zone 18N |
| Checked by: | CM | Figure: | 1 |



**HYDROGEOLOGICAL
ASSESSMENT**
BRAUER HOMES
112 Pleasant Bay Road,
Conescon, Ontario

LEGEND

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

Notes:
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
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**MECP WELL RECORDS
WITHIN 500m**

| | | | |
|--------------|-----------|-------------|-----------------------|
| Project No.: | 13604-001 | Date: | September 2022 |
| Scale: | 1:6,000 | Rev.: | |
| Created by: | PAS | Projection: | NAD 1983 UTM Zone 18N |
| Checked by: | CM | Figure: | 2 |

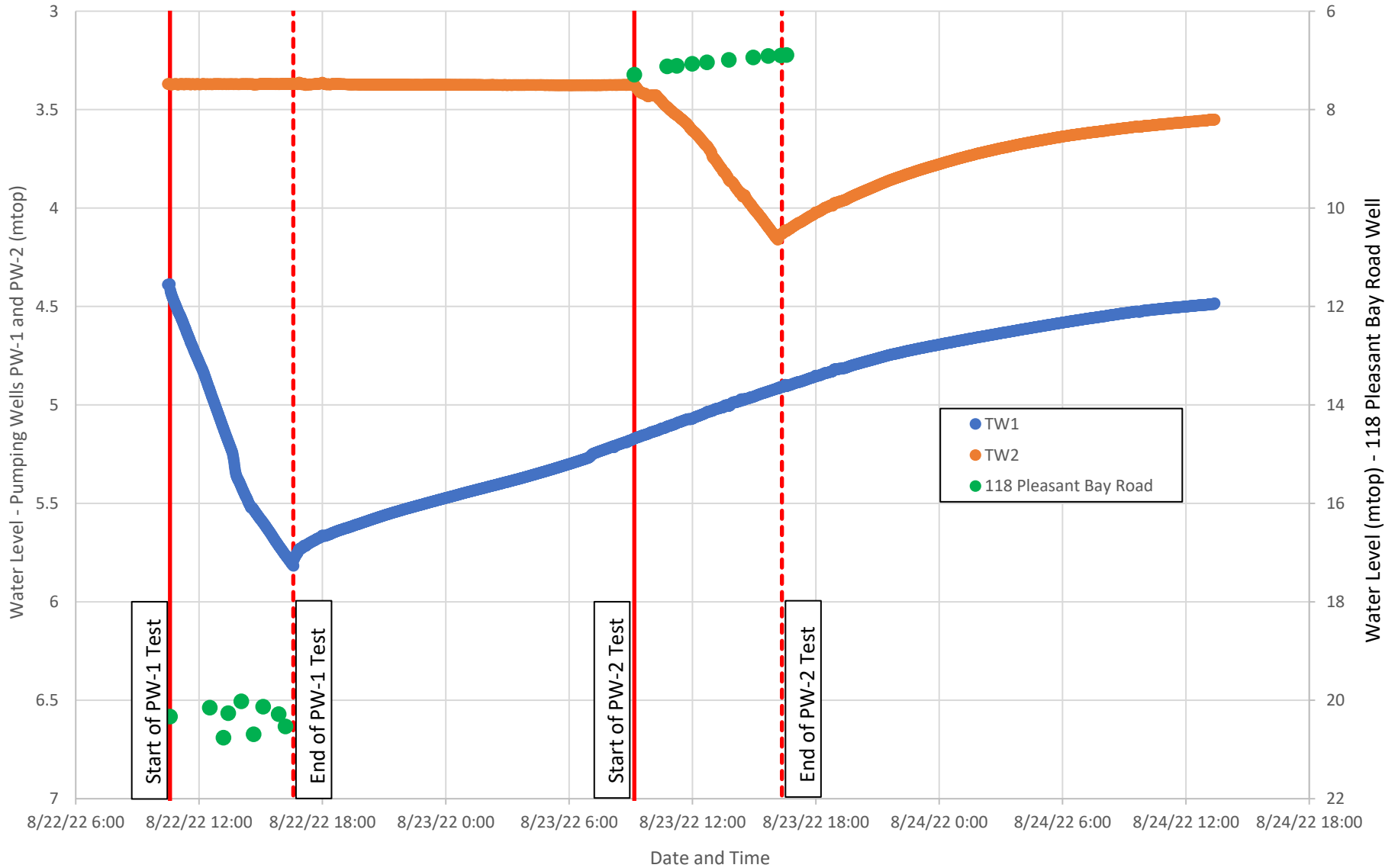


Figure 3 - Hydrographs - PW-1 and PW-2 (August 22 and 23, 2022)



**HYDROGEOLOGICAL
ASSESSMENT
BRAUER HOMES**
112 Pleasant Bay Road,
Conescon, Ontario

LEGEND

- Residential Well
- Test Well
- Test Pit
- Proposed Severance
- 4.9m Property Boundary Setback
- 31.9m Well Buffer
- Potential Structure Footprint (150m²)
- Proposed Building Envelope
- Site (approximate)
- Proposed Wastewater System**
- Partially Raised Distribution Lines
- Inground, Imported Fill Mantle
- Reserve Distribution Area
- Reserve Mantle Area

Notes:
 - Site boundaries are approximate; boundaries were obtained from a property sketch created by Watson Land Surveys Ltd. Project No. 13169-B-21, dated April 11, 2022.
 - Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
 - Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.



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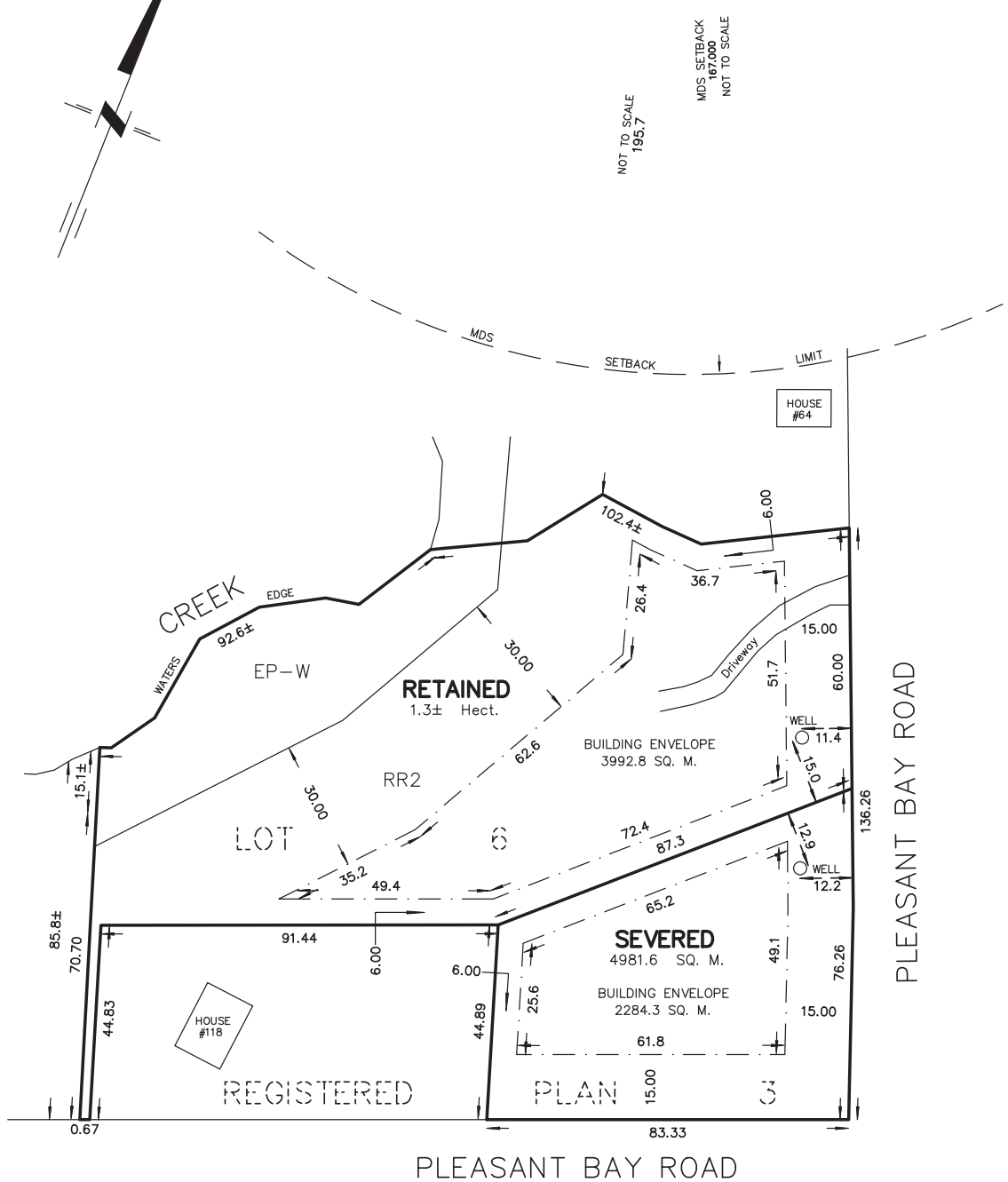
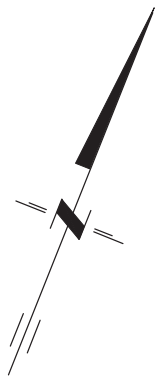
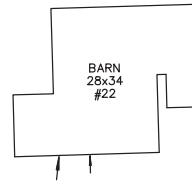
CONCEPTUAL SITE LAYOUT

| | | | |
|--------------|-----------|-------------|-----------------------|
| Project No.: | 13604-001 | Date: | September 2022 |
| Scale: | 1:1,000 | Rev.: | |
| Created by: | MAT | Projection: | NAD 1983 UTM Zone 18N |
| Checked by: | CM | Figure: | 4 |



Appendix A
Proposed Severance Plan and Land Information

SKETCH
 PART OF LOT 6
 REGISTERED PLAN 3
 TOWNSHIP OF HILLIER
 NOW IN THE MUNICIPALITY OF
 THE COUNTY OF PRINCE EDWARD
 METRIC SCALE 1 : 1000



NOTES :

SETBACKS ARE DERIVED FROM RR2 ZONING PEC
 MDS - MINIMUM DISTANCE SEPARATION

| | | |
|--|--------------------------------------|-------------------------------|
| 218 CHURCH STREET BELLEVILLE, ONTARIO | WATSON LAND SURVEYORS Ltd. | K8N - 3C3 (613) 962 - 9521 |
| APRIL 11, 2022 | | PROJECT № 13169-B-21 |



Appendix B
Supply Well Records

Measurements recorded in: Metric Imperial

Well Owner's Information

First Name: _____ Last Name/Organization: **BRAUER HOUSING DEVELOPMENTS INC** E-mail Address: **jamie@brauerhomes.com** Well Constructed by Well Owner

Mailing Address (Street Number/Name): **414 CTY RD #28** Municipality: **BELLEVILLE** Province: **ON** Postal Code: **K8N 4Z7** Telephone No. (inc. area code): **613 921 0042**

Well Location

Address of Well Location (Street Number/Name): **40 PLEASANT BAY RD** Township: **HILLIER** Lot: **A11076** Concession: **RP3**

County/District/Municipality: **PRINCE EDWARD COUNTY** City/Town/Village: **CONSECON** Province: **Ontario** Postal Code: **K0K 1T0**

UTM Coordinates: Zone: **18** Easting: **302035** Northing: **4871193** Municipal Plan and Sublot Number: _____ Other: _____

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 1.3 |
| BROWN | SANDY LOAM | | | 1.3 1.4 |
| BLUE | LIMESTONE | | | 1.4 6.71 |

Annular Space

Depth Set at (m/ft) From: **0** To: **2.5** Type of Sealant Used (Material and Type): **CLAY** Volume Placed (m³/ft³): **20**

Method of Construction

Cable Tool Rotary (Conventional) Rotary (Reverse) Boring Air percussion Other, specify _____

Diamond Jetting Driving Digging

Well Use

Public Domestic Livestock Irrigation Industrial Other, specify _____

Commercial Municipal Test Hole Cooling & Air Conditioning Not used Dewatering Monitoring

Construction Record - Casing

| Inside Diameter (cm/in) | Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel) | Wall Thickness (cm/in) | Depth (m/ft) | |
|-------------------------|--|------------------------|--------------|------|
| | | | From | To |
| 90 | CONCRETE | 7.6 | 0 | 6.71 |

Status of Well

Water Supply Replacement Well Test Hole Recharge Well Dewatering Well Observation and/or Monitoring Hole Alteration (Construction) Abandoned, Insufficient Supply Abandoned, Poor Water Quality Abandoned, other, specify _____ 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: **3** (m/ft) Kind of Water: Fresh Untested Gas Other, specify _____

Water found at Depth: _____ Kind of Water: Fresh Untested Gas Other, specify _____

Water found at Depth: _____ Kind of Water: Fresh Untested Gas Other, specify _____

Hole Diameter

| Depth (m/ft) | Diameter (cm/in) | | |
|--------------|------------------|------|----|
| | | From | To |
| | | | |

Well Contractor and Well Technician Information

Business Name of Well Contractor: **FRANK'S DRILLING & BLASTING LTD** Well Contractor's Licence No.: **68881**

Business Address (Street Number/Name): **P.O. BOX 100** Municipality: **NEWBURGH**

Province: **ON** Postal Code: **R0K 2S0** Business E-mail Address: **info@fadbtd.com**

Bus. Telephone No. (inc. area code): **613 378 2178** Name of Well Technician (Last Name, First Name): **FRANK GREG**

Well Technician's Licence No.: **2603** Signature of Technician and/or Contractor: _____ Date Submitted: **2022 03 24**

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): **6.71**

Pumping rate (l/min / GPM): **675**

Duration of pumping: **60** hrs **60** min

Final water level end of pumping (m/ft): **3.81**

If flowing give rate (l/min/GPM): _____

Recommended pump depth (m/ft): **6.71**

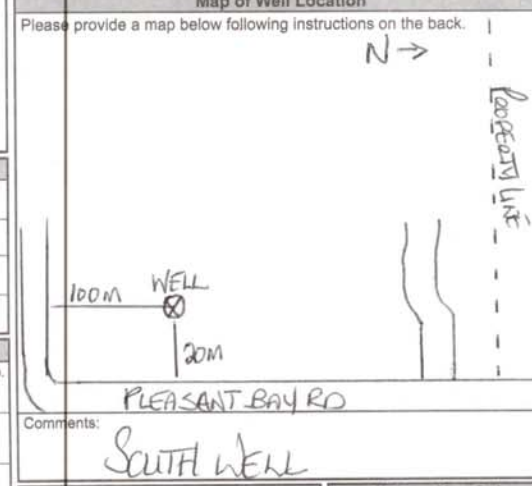
Recommended pump rate (l/min/GPM): _____

Well production (l/min/GPM): **90+**

Disinfected? Yes No

| Time (min) | Draw Down | | Recovery | |
|--------------|--------------------|------------|--------------------|------------|
| | Water Level (m/ft) | Time (min) | Water Level (m/ft) | Time (min) |
| Static Level | 6.1 | | 3.81 | |
| 1 | | 1 | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | 5 | | |
| 10 | | 10 | | |
| 15 | | 15 | | |
| 20 | | 20 | | |
| 25 | | 25 | | |
| 30 | | 30 | | |
| 40 | | 40 | | |
| 50 | | 50 | | |
| 60 | 3.81 | 60 | 3.30 | |

REMARKS: **DUG WELL RECOVERED - GOOD CAL RECOVERY = 20+ GPM**



Comments: _____

Well owner's information package delivered: Yes No

Date Package Delivered: **2022 03 24** Date Work Completed: **2022 03 15**

Ministry Use Only

Audit No.: **2374207**

Received: _____

Measurements recorded in: Metric Imperial

Tag#: A330618

Page ___ of ___

Well Owner's Information

First Name: _____ Last Name/Organization: **BRAUER HOUSING DEVELOPMENTS INC** E-mail Address: **jamie@brauertomes.ca** Well Constructed by Well Owner

Mailing Address (Street Number/Name): **414 CITY RD #28** Municipality: **KENNELVILLE** Province: **ON** Postal Code: **K8N 4Z7** Telephone No. (inc. area code): **(613) 921-0042**

Well Location

Address of Well Location (Street Number/Name): **70 PLEASANT BAY RD** Township: **HILLIER** Lot: **PLOT 6** Concession: **RP3**

County/District/Municipality: **PRINCE EDWARD COUNTY** City/Town/Village: **CONSECON** Province: **Ontario** Postal Code: **K0K 1T0**

UTM Coordinates: Zone: **18** Easting: **302024** Northing: **4871198** Municipal Plan and Sublot 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 |
| | BLACK TOPSOIL | | | 0 .3 |
| | BROWN SANDY LOAM | | | .3 2.5 |
| | BLUE LIMESTONE | | | 2.5 6.40 |

Annular Space

| Depth Set at (m/ft) | Type of Sealant Used (Material and Type) | Volume Placed (m ³ /ft ³) |
|---------------------|--|--|
| From To | | |
| 0 2.5 | CLAY | 20 |

Results of Well Yield Testing

| Time (min) | Draw Down | | Recovery | |
|--------------|---------------------|------------|--------------------|------------|
| | Water Level (m/ft) | Time (min) | Water Level (m/ft) | Time (min) |
| Static Level | 1.02 | | 4.45 | |
| 1 | | 1 | | |
| 2 | DUG WELL | | | |
| 3 | RESERVE = 9000 GALS | | | |
| 4 | RECOVERY = 20+ GPM | | | |
| 5 | | 5 | | |
| 10 | | 10 | | |
| 15 | | 15 | | |
| 20 | | 20 | | |
| 25 | | 25 | | |
| 30 | | 30 | | |
| 40 | | 40 | | |
| 50 | | 50 | | |
| 60 | 4.45 | 60 | 3.93 | |

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

If pumping discontinued, give reason: _____

Pump intake set at (m/ft): **6.40**

Pumping rate (l/min / GPM): **975**

Duration of pumping: **hrs + 60 min**

Final water level end of pumping (m/ft): **4.45**

If flowing give rate (l/min/GPM): _____

Recommended pump depth (m/ft): **6.40**

Recommended pump rate (l/min/GPM): **907**

Well production (l/min/GPM): **907**

Disinfected? Yes No

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 checked="" 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 type="checkbox"/> Test Hole | <input type="checkbox"/> Monitoring |
| <input type="checkbox"/> Boring | <input checked="" type="checkbox"/> Digging | <input type="checkbox"/> Irrigation | <input type="checkbox"/> Cooling & Air Conditioning | |
| <input type="checkbox"/> Air percussion | | <input type="checkbox"/> Industrial | | |
| <input type="checkbox"/> Other, specify _____ | | <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 | |
| 90 | CONCRETE | 7.6 | 0 | 6.40 | <input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input 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 <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____ |
|-----------------------------|---|
| 3 | |
| | |
| | |

Hole Diameter

| Depth (m/ft) | Diameter (cm/in) |
|--------------|------------------|
| From | To |
| | |

Well Contractor and Well Technician Information

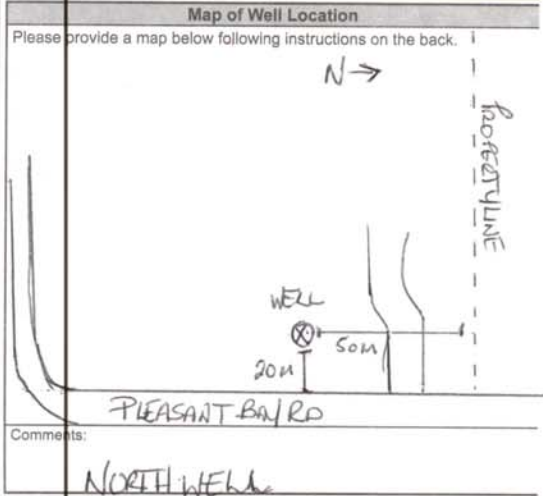
Business Name of Well Contractor: **FRANKS DRILLING & BLASTING LTD** Well Contractor's Licence No.: **6881**

Business Address (Street Number/Name): **P.O. BOX 100** Municipality: **NEWBURGH**

Province: **ON** Postal Code: **K0K 2S0** Business E-mail Address: **info@fdbtd.com**

Bus. Telephone No. (inc. area code): **613 378 2178** Name of Well Technician (Last Name, First Name): **GREG PAER**

Well Technician's Licence No.: **2603** Signature of Technician and/or Contractor: _____ Date Submitted: **20220324**



Comments: **NORTH WELL**

| | | |
|---|---|---|
| Well owner's information package delivered: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Date Package Delivered: 20220324 | Ministry Use Only Audit No: Z374206 |
| Date Work Completed: 20220315 | Received: _____ | |

Instructions for Completing Form

- For use in the Province of Ontario only. This document is a permanent legal document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN: _____ CON: _____ LOT: _____

Address of Well Location (County/District/Municipality): **Prince Edward** Township: **Hillier** Loc: **24** Section: **III**

RR#/Street Number/Name: **Pleasant Bay Rd.** City/Town/Village: **Hillier** Site/Compartment/Block/Tract etc.:

GPS Reading: NAD: **83** Zone: **18** Easting: **301977** Northing: **4871100** Unit Make/Model: **Garmin ETREX** Mode of Operation: Undifferentiated Averaged Differentiated, specify _____

Log of Overburden and Bedrock Materials (see instructions)

| General Colour | Most common material | Other Materials | General Description | Depth Metres | |
|----------------|----------------------|-----------------|---------------------|--------------|------|
| | | | | From | To |
| Brown | Clay | | Packed | 0 | 1.5 |
| Brown | Clay | Shale Limestone | Broken | 1.5 | 4.5 |
| Grey | Limestone | | Hard | 4.5 | 22.8 |

Hole Diameter

| Depth From | Metres To | Diameter Centimetres |
|------------|-----------|----------------------|
| 0 | 4.5 | 20.3 |
| 4.5 | 22.8 | 15.5 |

Construction Record

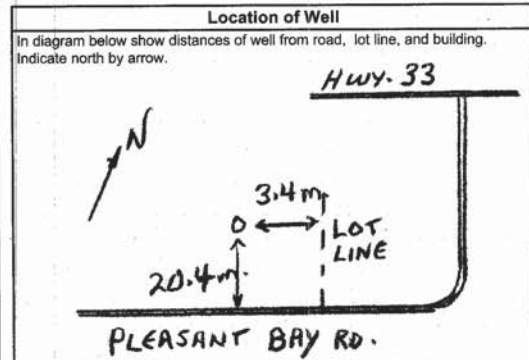
| Inside diam centimetres | Material | Wall thickness centimetres | Depth Metres | |
|---|--|----------------------------|--------------|------|
| | | | From | To |
| Casing | | | | |
| 15.8 | <input checked="" type="checkbox"/> Steel <input type="checkbox"/> Fibreglass <input type="checkbox"/> Plastic <input type="checkbox"/> Concrete <input type="checkbox"/> Galvanized | .48 | 0 | 5.4 |
| Screen | | | | |
| Outside diam | <input type="checkbox"/> Steel <input type="checkbox"/> Fibreglass <input type="checkbox"/> Plastic <input type="checkbox"/> Concrete <input type="checkbox"/> Galvanized | Slot No. | | |
| No Casing or Screen | | | | |
| <input checked="" type="checkbox"/> Open hole | | | 4.8 | 22.8 |

Test of Well Yield

| Pumping test method | Draw Down Time min | Water Level Metres | Recovery Time min | | Water Level Metres |
|--------------------------------------|--------------------|--------------------|-------------------|--------------------|--------------------|
| | | | Time min | Water Level Metres | |
| Pump | | | | | |
| Pump intake set at - (metres) | Static Level | 3.3 | | | 10.0 |
| Pumping rate - (litres/min) | 1 | 4.2 | 1 | | 9.4 |
| Duration of pumping | 2 | 5.3 | 2 | | 8.9 |
| Final water level end of pumping | 3 | 6.3 | 3 | | 8.5 |
| Recommended pump type | 4 | 6.5 | 4 | | 8.2 |
| Recommended pump depth | 5 | 6.8 | 5 | | 8.1 |
| Recommended pump rate - (litres/min) | 10 | 7.6 | 10 | | 7.5 |
| If flowing give rate - (litres/min) | 15 | 8.0 | 15 | | 7.0 |
| | 20 | 8.4 | 20 | | 6.6 |
| | 25 | 8.7 | 25 | | 6.2 |
| | 30 | 9.0 | 30 | | 5.9 |
| | 40 | 9.5 | 40 | | 5.5 |
| | 50 | 9.7 | 50 | | 5.2 |
| | 60 | 10.0 | 60 | | 5.0 |

Plugging and Sealing Record Annular space Abandonment

| Depth set at - Metres From | To | Material and type (bentonite slurry, neat cement slurry) etc. | Volume Placed (cubic metres) |
|----------------------------|----|---|------------------------------|
| 4.5 | 0 | Bentonite | .13 |



Method of Construction

| | | | |
|--|---|----------------------------------|----------------------------------|
| <input checked="" type="checkbox"/> Cable Tool | <input type="checkbox"/> Rotary (air) | <input type="checkbox"/> Diamond | <input type="checkbox"/> Digging |
| <input type="checkbox"/> Rotary (conventional) | <input type="checkbox"/> Air percussion | <input type="checkbox"/> Jetting | <input type="checkbox"/> Other |
| <input type="checkbox"/> Rotary (reverse) | <input type="checkbox"/> Boring | <input type="checkbox"/> Driving | |

Water Use

| | | | |
|--|-------------------------------------|---|--------------------------------|
| <input checked="" type="checkbox"/> Domestic | <input type="checkbox"/> Industrial | <input type="checkbox"/> Public Supply | <input type="checkbox"/> Other |
| <input type="checkbox"/> Stock | <input type="checkbox"/> Commercial | <input type="checkbox"/> Not used | |
| <input type="checkbox"/> Irrigation | <input type="checkbox"/> Municipal | <input type="checkbox"/> Cooling & air conditioning | |

Final Status of Well

| | | | |
|--|---|---|---|
| <input checked="" type="checkbox"/> Water Supply | <input type="checkbox"/> Recharge well | <input type="checkbox"/> Unfinished | <input type="checkbox"/> Abandoned, (Other) |
| <input type="checkbox"/> Observation well | <input type="checkbox"/> Abandoned, insufficient supply | <input type="checkbox"/> Dewatering | |
| <input type="checkbox"/> Test Hole | <input type="checkbox"/> Abandoned, poor quality | <input type="checkbox"/> Replacement well | |

Well Contractor/Technician Information

Name of Well Contractor: **CHALK WELL DRILLING LTD.** Well Contractor's Licence No.: **1507**

Business Address (street name, number, city etc.): **R. R. # 6, Napanee, ONTARIO**

Name of Well Technician (last name, first name): **R. Ian Chalk** Well Technician's Licence No.: **T-0047**

Signature of Technician/Contractor: *[Signature]* Date Submitted: **2005 11 07**

Audit No. **Z 23758** Date Well Completed: **2005 11 07**

Was the well owner's information package delivered? Yes No

Ministry Use Only

Data Source: _____ Contract: **1507**

Date Received: **NOV 30 2005** Date of Inspection: _____

Remarks: _____ Well Record Number: _____



Appendix C
Test Pit Logs



| Test Pit ID | Depth (mbgs ¹) | Material Description | Sample |
|-------------|----------------------------|--|--------|
| TP101-21 | 0.00-0.41 | Topsoil | |
| | 0.41-1.68 | Brown fine-med sand, some silt, trace-some clay, trace gravel + boulders, loose, wet. | GS1 |
| | 1.68-1.83 | Light brown silt clay, some sand, trace gravel + boulders, moist-wet, compacted. | GS2 |
| | | GW seepage at 0.61 m, pooling at bottom of TP. | |
| TP 102-21 | 0.00-0.41 | Topsoil | |
| | 0.41-1.63 | Brown silt, some clay, trace sand, trace gravel, some boulders, lightly compacted, wet | GS1 |
| | | GW seepage at 0.91 m, pooling at bottom of TP. | |
| TP103-21 | 0.00-0.38 | Topsoil | |
| | 0.38-0.89 | Brown sandy clay, trace silt + gravel, some cobbles, loose, dry | GS1 |
| | 0.89-1.70 | Grey/brown sandy clay, trace silt, some gravel + cobbles + boulders, hard, moist-wet | GS2 |
| | 0.00-0.00 | GW seepage at 1.55 m | |
| TP104-21 | 0.00-0.43 | Topsoil | |
| | 0.43-0.91 | Brown silt and clay, trace sand, trace gravel, loose, moist | GS1 |
| | 0.91-1.78 | Grey/brown gravelly sand and silt, trace clay, loose, wet-saturated | GS2 |
| | | GW seepage at 1.09 m, pooling at bottom of TP. | |

1. mbgs = metres below ground surface



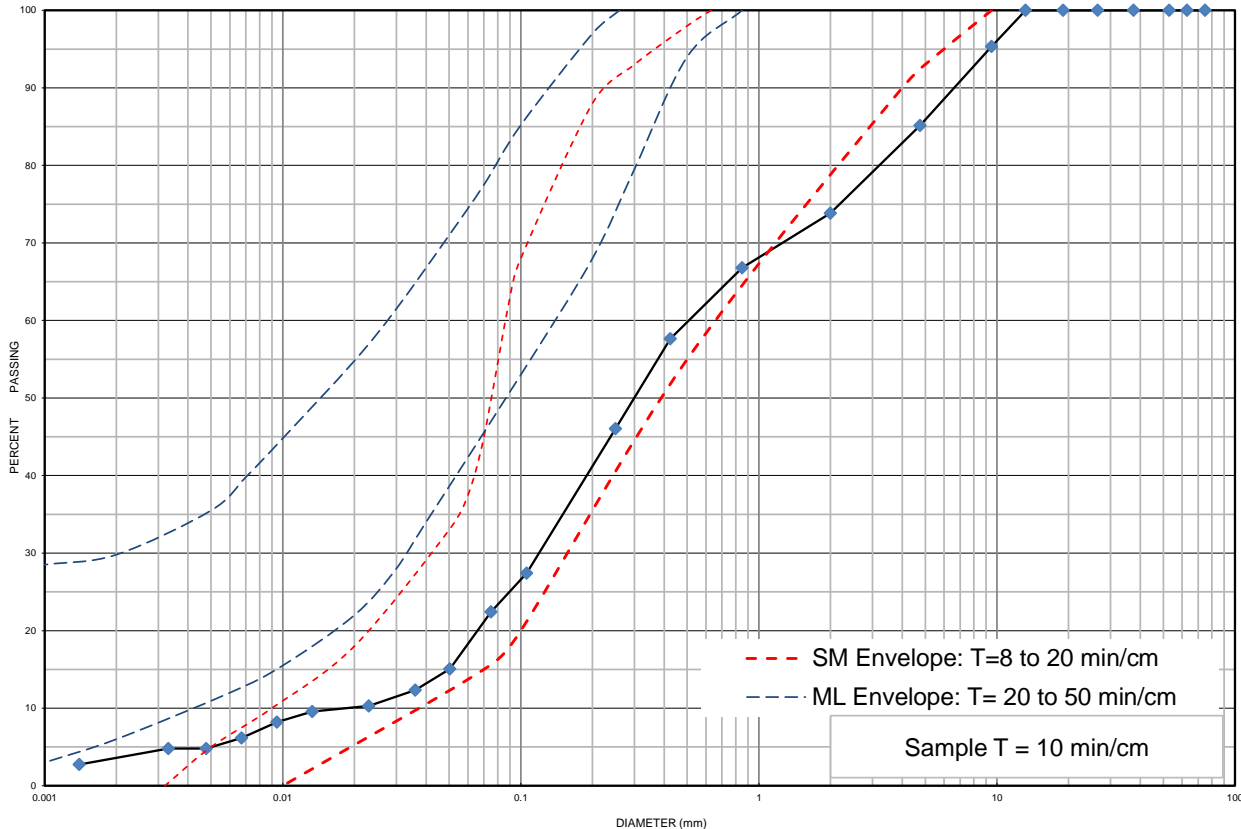
Appendix D
Grain Size Analyses



Grain Size Distribution Chart

Project Number: 13604-001 **Client:** Brauer Homes
Project Name: Hydrogeological Assessment - Pleasant Bay Rd PEC
Sample Date: November 24, 2021 **Sampled By:** Cameron MacDougall - Cambium Inc.
Location: TP 101-21 GS 1 **Depth:** **Lab Sample No:** S-22-0207

| 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 101-21 | GS 1 | | 15 | 63 | 19 | 3 | 10.9 |
| Description | | Classification | D ₆₀ | D ₃₀ | D ₁₀ | C _u | C _c |
| Sand some Silt some Gravel trace Clay | | SM | 0.510 | 0.125 | 0.016 | 31.88 | 1.91 |

Additional information available upon request

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

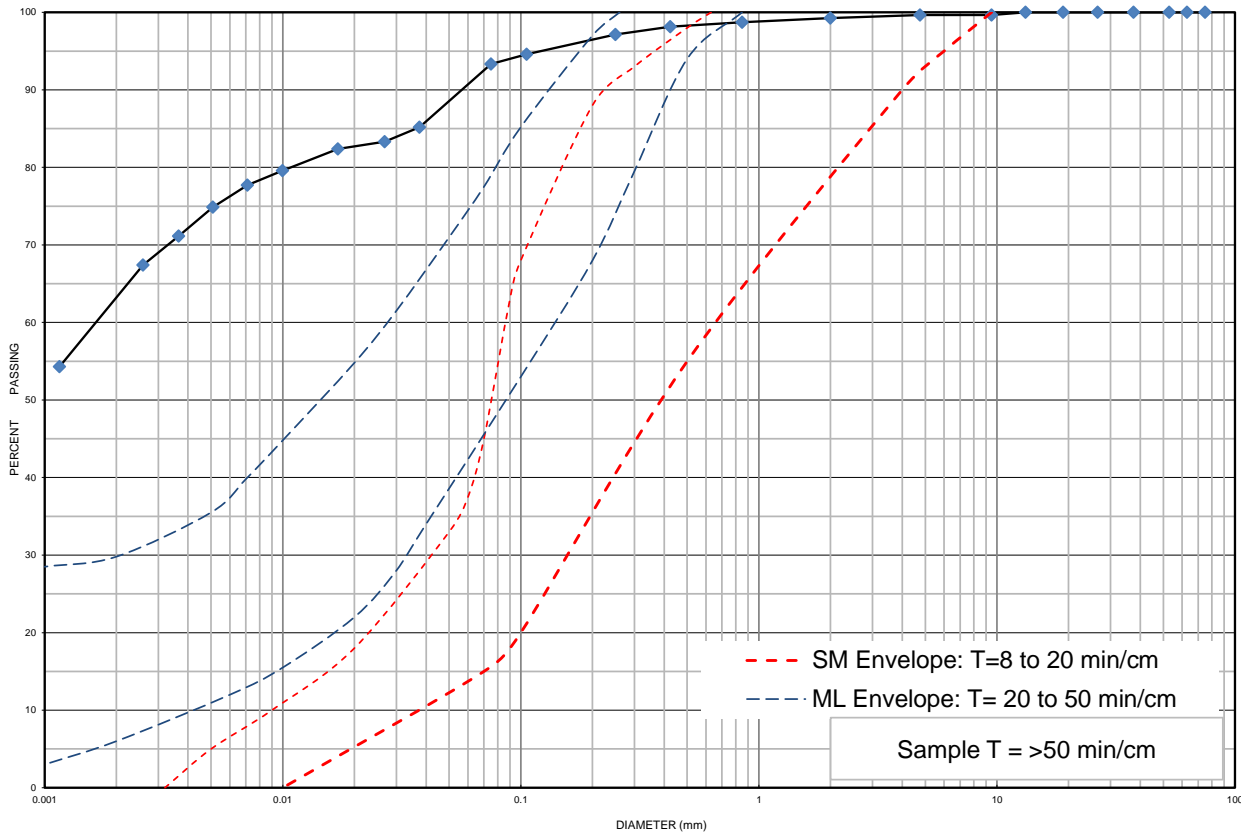
Date Issued: February 4, 2022



Grain Size Distribution Chart

Project Number: 13604-001 **Client:** Brauer Homes
Project Name: Hydrogeological Assessment - Pleasant Bay Rd PEC
Sample Date: November 24, 2021 **Sampled By:** Cameron MacDougall - Cambium Inc.
Location: TP 103-21 GS 2 **Depth:** **Lab Sample No:** S-22-0208

| 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 103-21 | GS 2 | | 0 | 6 | 31 | 63 | 35.4 |
| Description | | Classification | D ₆₀ | D ₃₀ | D ₁₀ | C _u | C _c |
| Silty Clay trace Sand | | CL | 0.0016 | - | - | - | - |

Additional information available upon request

Issued By: 
 (Senior Project Manager)

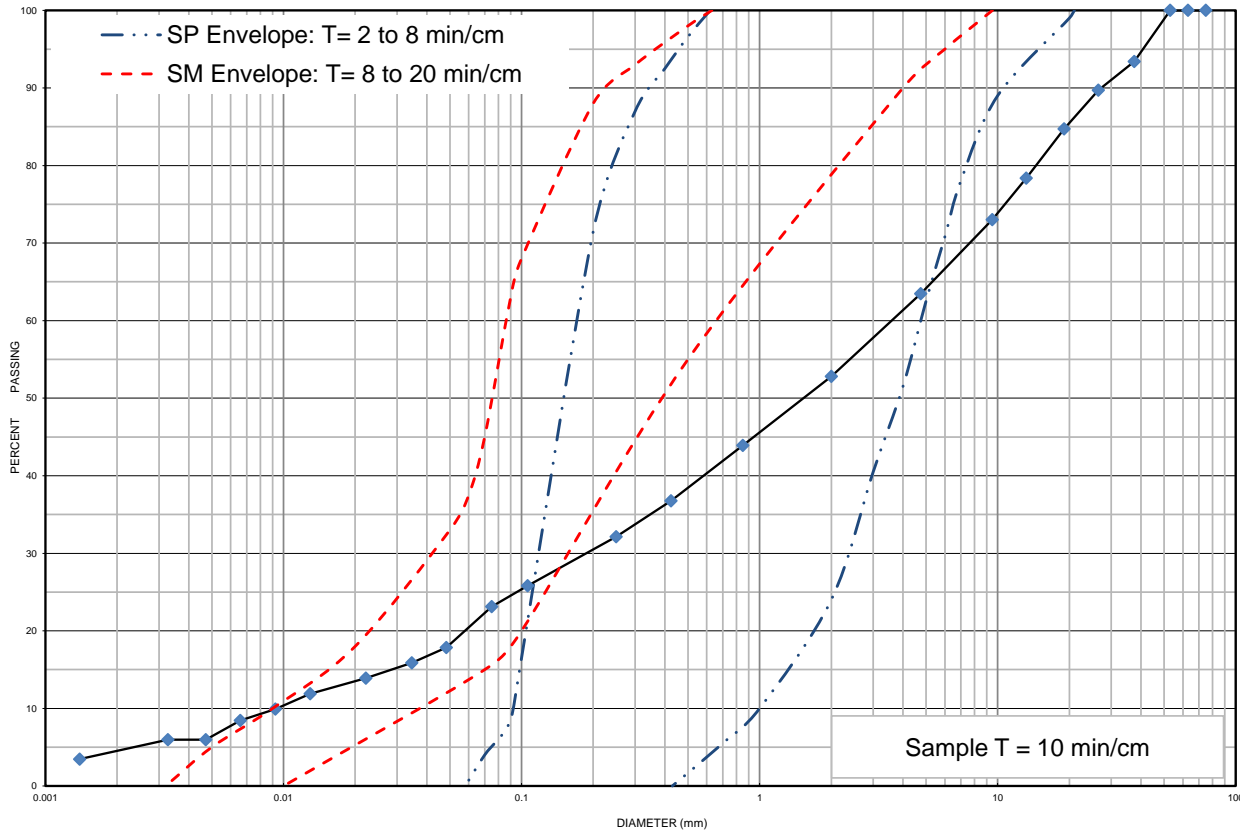
Date Issued: February 4, 2022



Grain Size Distribution Chart

Project Number: 13604-001 **Client:** Brauer Homes
Project Name: Hydrogeological Assessment - Pleasant Bay Rd PEC
Sample Date: November 24, 2021 **Sampled By:** Cameron MacDougall - Cambium Inc.
Location: TP 104-21 GS 2 **Depth:** **Lab Sample No:** S-22-0209

| 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 104-21 | GS 2 | | 37 | 40 | 19 | 4 | 8.5 |
| Description | | Classification | D ₆₀ | D ₃₀ | D ₁₀ | C _u | C _c |
| Sand and Gravel some Silt trace Clay | | SM | 3.6000 | 0.1900 | 0.0091 | 395.60 | 1.10 |

Additional information available upon request

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

Date Issued: February 4, 2022



Appendix E
Water Well Survey Information



Environmental
Geotechnical
Building Sciences
Construction Quality
Verification

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations
Peterborough
Kingston
Barrie
Oshawa
Calgary

Laboratory
Peterborough

 Professional Engineers
Ontario



November 9, 2021

«Address»
«City», «Province»
«Postal_Code»

Dear property owner,

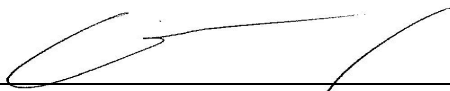
Cambium Inc. (Cambium) is completing a hydrogeological assessment of the property located at Concession 3 Lakeside, Lot 24, Township of Ameliasburg, Prince Edward County (the Site). The hydrogeological assessment is being completed in support of proposed residential severances at the Site.

We (Cambium) are characterizing background conditions in the area and identifying groundwater users nearby. As part of the assessment, we are requesting information from adjacent residents about their private supply well. Please see the attached questionnaire and complete as much information as possible. Upon completion please scan the document (or take a photograph) and email back to cameron.macdougall@cambium-inc.com. Please note you are not obligated to complete this form as participation on your part is voluntary. If you wish to provide your information please return the attached form within 2 weeks of receipt.

We may request permission to investigate your well at a later date (if deemed necessary) to monitor groundwater conditions adjacent the Site during future field assessments. If you have any questions regarding this assessment, please contact Cameron MacDougall at 1-705-742-7900.

Thank you. Best regards,

Cambium Inc.



Cameron MacDougall, P.Geo.
Project Coordinator

CJM

Attached: Water Well Survey Questionnaire



CAMBIUM INC.
BASELINE ASSESSMENT OF RESIDENTIAL WATER SUPPLY

Resident/Owner: _____ Info. Provided By: _____

Address: _____

Phone: Home _____ Work _____

Email Address: _____

Part I: Well Construction Details

Location of Well: _____

Well Record Number (i.e., tag on well) _____

Record Available?: _____ (attach copy) Construction Date: _____

Well Depth (m): _____ Diameter (cm): _____

Casing Length (m): _____ Diameter (cm): _____

Screen Installed? _____ Depth to Water From Ground Surface (m) _____

Details (slot size, diameter, length, depth) _____

Depth to Bedrock: _____ Bedrock Type: _____

Part II: Pump Installation Details

Pump Type (submersible, centrifugal, jet, etc.): _____

Manufacturer/Model No.: _____ Power: _____

Design Pumping Rate (units): _____ Design Head (m): _____

Setting Depth (m): _____ Discharge Line (materials, diameter): _____

Pitless Adaptor (type, depth) : _____

Storage Details (pressure or holding tanks, filters or other treatment, operating pressures, etc.):



CAMBIUM INC.
BASELINE ASSESSMENT OF RESIDENTIAL WATER SUPPLY

Part III: Groundwater Usage

What is groundwater used for (specify for each well)?

Water quantity (problems, amounts)

Water Discharge (septic system, settling ponds, other surface water, age, location, etc.)

Water Quality Tested ? : _____ (attach results if available)

Water quality (odour, taste, colour, hardness)

Diagram:



Appendix F
Certificates of Analysis



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Project : 13604-002

30-August-2022

Cambium Inc.

Attn : Cameron MacDougall

194 Sofia Street
Peterborough, ON
K9H 1E3, Canada

Phone: 705-742-7900
Fax:705-742-7907

Date Rec. : 23 August 2022
LR Report: CA14665-AUG22
Reference: 13604-002, Cameron MacDougall

Copy: Final # 1

CERTIFICATE OF ANALYSIS

Final Report

| Analysis | 1: Analysis Start Date | 3: Analysis Completed Date | 6: RL | 7: North Well | 8: South Well |
|----------------------------|------------------------------|-------------------------------------|----------|------------------|------------------|
| Sample Date & Time | | | | 23-Aug-22 08:25 | 23-Aug-22 15:10 |
| Temp Upon Receipt [°C] | *** | *** | *** | *** | *** |
| Alkalinity [mg/L as CaCO3] | 24-Aug-22 | 25-Aug-22 | 2 | 288 | 278 |
| Colour [TCU] | 24-Aug-22 | 25-Aug-22 | 3 | < 3 | < 3 |
| Conductivity [uS/cm] | 24-Aug-22 | 25-Aug-22 | 2 | 668 | 646 |
| pH [No unit] | 24-Aug-22 | 25-Aug-22 | 0.05 | 7.93 | 7.99 |
| TDS [mg/L] | 24-Aug-22 | 25-Aug-22 | 30 | 314 | 309 |
| Turbidity [NTU] | 24-Aug-22 | 25-Aug-22 | 0.1 | 11.0 | 1.60 |
| DOC [mg/L] | 25-Aug-22 | 26-Aug-22 | 1 | 2 | 1 |
| Cl [mg/L] | 26-Aug-22 | 30-Aug-22 | 1 | 24 | 14 |
| F [mg/L] | 25-Aug-22 | 25-Aug-22 | 0.06 | 0.19 | 0.13 |
| NH3+NH4 [as N mg/L] | 24-Aug-22 | 25-Aug-22 | 0.1 | 0.6 | < 0.1 |
| SO4 [mg/L] | 26-Aug-22 | 30-Aug-22 | 2 | 26 | 26 |
| NO2 [as N mg/L] | 26-Aug-22 | 30-Aug-22 | 0.03 | < 0.03 | < 0.03 |
| NO3 [as N mg/L] | 26-Aug-22 | 30-Aug-22 | 0.06 | 4.90 | 5.89 |
| Organic N [mg/L] | 24-Aug-22 | 30-Aug-22 | 0.5 | < 0.5 | < 0.5 |
| TKN [as N mg/L] | 24-Aug-22 | 25-Aug-22 | 0.5 | < 0.5 | < 0.5 |
| Hardness [mg/L as CaCO3] | 25-Aug-22 | 26-Aug-22 | | 284 | 322 |
| Ca (tot) [mg/L] | 25-Aug-22 | 26-Aug-22 | 0.01 | 94.6 | 112 |
| Fe (tot) [mg/L] | 25-Aug-22 | 26-Aug-22 | 0.007 | 0.422 | 0.082 |
| Mg (tot) [mg/L] | 25-Aug-22 | 26-Aug-22 | 0.001 | 11.5 | 10.2 |
| Mn (tot) [mg/L] | 25-Aug-22 | 26-Aug-22 | 0.00001 | 0.112 | 0.0165 |
| Na (tot) [mg/L] | 25-Aug-22 | 26-Aug-22 | 0.01 | 40.3 | 8.32 |
| Total Coliform [cfu/100mL] | 24-Aug-22 | 25-Aug-22 | | 1 | 25 |
| E.coli [cfu/100mL] | 24-Aug-22 | 25-Aug-22 | | 0 | 0 |

Note: Un-ionized ammonia calculated using lab results for pH and temperature.

Temperature of Sample upon Receipt: 9 degrees C



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Project : 13604-002

LR Report : CA14665-AUG22

Cooling Agent Present: Yes
Custody Seal Present: Yes
Chain of Custody Number: 031464

*Jill Campbell, B.Sc., GISAS
Project Specialist,
Environment, Health & Safety*

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Project : 13604-002

31-August-2022

Cambium Inc.
Attn : Cameron MacDougall

194 Sofia Street
Peterborough, ON
K9H 1E3, Canada

Phone: 705-742-7900
Fax: 705-742-7907

Date Rec. : 24 August 2022
LR Report: CA14690-AUG22
Reference: 13604-002, Cameron MacDougall

Copy: 1

CERTIFICATE OF ANALYSIS

Final Report

| Analysis | 1: Analysis Start Date | 2: Analysis Start Time | 3: Analysis Date | 4: Analysis Completed Time | 5: Residential Well |
|----------------------------|------------------------------|------------------------------|------------------------|----------------------------------|------------------------|
| Sample Date & Time | | | | | 24-Aug-22 13:45 |
| Temp Upon Receipt [°C] | *** | *** | *** | *** | *** |
| Total Coliform [cfu/100mL] | 25-Aug-22 | 12:38 | 26-Aug-22 | 14:24 | 8* |
| E.coli [cfu/100mL] | 25-Aug-22 | 12:38 | 26-Aug-22 | 14:24 | 0 |
| NO2 [as N mg/L] | 30-Aug-22 | 12:13 | 31-Aug-22 | 10:32 | < 0.03 |
| NO3 [as N mg/L] | 30-Aug-22 | 12:13 | 31-Aug-22 | 10:32 | 0.68 |
| NO2+NO3 [as N mg/L] | 30-Aug-22 | 12:13 | 31-Aug-22 | 10:32 | 0.68 |

Total and/or Free Residual Chlorine was not analyzed by SGS Environmental Services.
Temperature of Sample upon Receipt: 2 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes
Chain of Custody Number: 031472

Method Descriptions

| Parameter | Description | SGS Method Code |
|--------------------------|---|---------------------------|
| E. Coli | E.coli by membrane filtration on DC media | ME-CA-[ENV]MIC-LAK-AN-001 |
| Nitrate (as N) | Nitrate by Ion Chromatography | ME-CA-[ENV]IC-LAK-AN-001 |
| Nitrate + Nitrite (as N) | Total Nitrate/Nitrite by Ion Chromatography | ME-CA-[ENV]IC-LAK-AN-001 |
| Nitrite (as N) | Nitrite by Ion Chromatography | ME-CA-[ENV]IC-LAK-AN-001 |
| Total Coliform | Total Coliform by membrane filtration on DC media | ME-CA-[ENV]MIC-LAK-AN-001 |

Brad Moore Hon. B.Sc
Project Specialist,
Environment, Health & Safety



SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : 13604-002
LR Report : CA14690-AUG22

Quality Control Report

| Inorganic Analysis | | | | | | | | | | | | | |
|--|-----------------|------|--------------|-----------|----------|-----|---------------------|--------------------|---------------------|------|-----------------------------------|---------------------|------|
| Parameter | Reporting Limit | Unit | Method Blank | Duplicate | | | | LCS / Spike Blank | | | Matrix Spike / Reference Material | | |
| | | | | Result 1 | Result 2 | RPD | Acceptance Criteria | Spike Recovery (%) | Recovery Limits (%) | | Spike Recovery (%) | Recovery Limits (%) | |
| | | | | | | | % | | Low | High | | Low | High |
| <i>Anions by IC - QCBatchID: DIO0669-AUG22</i> | | | | | | | | | | | | | |
| Nitrate (as N) | 0.06 | mg/L | <0.06 | | | ND | 20 | 100 | 90 | 110 | NV | 75 | 125 |
| Nitrate + Nitrite (as N) | 0.06 | mg/L | <0.06 | | | NA | | NA | | | NA | | |
| Nitrite (as N) | 0.03 | mg/L | <0.03 | | | ND | 20 | 96 | 90 | 110 | 95 | 75 | 125 |
| Microbiological | | | | | | | | | | | | | |
| Parameter | Method Blank | | Duplicate | | | | | | | | | | |
| <i>Microbiology - QCBatchID: BAC9413-AUG22</i> | | | | | | | | | | | | | |
| E. Coli | ACCEPTED | | ACCEPTED | | | | | | | | | | |
| Total Coliform | ACCEPTED | | ACCEPTED | | | | | | | | | | |



Appendix G
Nitrate Loading Calculations



Water Balance Calculations

| THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL | | | | | | | | | | | | | |
|---|------------|----------|-------|-------|-----------------------|-----------------|---------|-------|---------|-------|----------|-------|-------------------|
| modified from Dingman 2002: Box 7-3 (pg 315) using ET model of Hamon (1963) | | | | | | | | | | | | | |
| | Input Data | | | | | Computed Values | | | | | | | |
| | | | | | | | | | | | | | Surplus 372 mm/yr |
| Weather Station Location: Trenton | | | | | Latitude: 44.1 degree | | | | | | | | |
| Solar Declination (degree) | -20.6 | -12.6 | -1.5 | 10.0 | 19.0 | 23.1 | 21.0 | 13.4 | 2.6 | -9.0 | -18.5 | -23.0 | |
| DayLength (hr)* | 9.2 | 10.3 | 11.8 | 13.3 | 14.6 | 15.3 | 14.9 | 13.8 | 12.3 | 10.8 | 9.5 | 8.8 | |
| Available Water Storage Capacity | | 0.20 m/m | | | Root Depth | | 1500 mm | | SOILmax | | 300.0 mm | | |
| MONTHLY WATER BALANCE DATA | | | | | | | | | | | | | |
| Temperatures in C, water-balance terms in mm. | | | | | | | | | | | | | |
| Month: | J | F | M | A | M | J | J | A | S | O | N | D | Year |
| ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== | ===== |
| TEMPERATURE (T) | -6.8 | -5.7 | -0.7 | 6.6 | 12.7 | 18.0 | 20.7 | 19.7 | 15.3 | 8.6 | 3.0 | -3.3 | |
| PRECIPITATION (P) | 68.1 | 56.5 | 62.3 | 77.3 | 79.4 | 78.3 | 69.0 | 72.2 | 90.1 | 83.6 | 95.5 | 79.0 | 911 |
| RAIN | 34.2 | 29.2 | 41.1 | 72.2 | 79.4 | 78.3 | 69.0 | 72.2 | 90.1 | 83.3 | 86.9 | 50.4 | 786 |
| SNOW | 34 | 27 | 21 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 29 | 125 |
| MELT FACTOR (F) | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.50 | 0.00 | |
| PACK | 67 | 94 | 115 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 33 | |
| MELT | 0 | 0 | 0 | 120 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 125 |
| INPUT (W) | 34 | 29 | 41 | 193 | 79 | 78 | 69 | 72 | 90 | 84 | 91 | 50 | 911 |
| POTENTIAL ET (PET) | 0 | 0 | 0 | 42 | 69 | 97 | 115 | 100 | 67 | 40 | 23 | 0 | 552 |
| NET INPUT (ΔW) | 34 | 29 | 41 | 151 | 10 | -19 | -46 | -28 | 23 | 44 | 68 | 50 | |
| SOIL MOISTURE (SOIL) | 300 | 300 | 300 | 300 | 300 | 282 | 242 | 221 | 244 | 288 | 300 | 300 | |
| ΔSOIL | 0 | 0 | 0 | 0 | 0 | -18 | -40 | -21 | 23 | 44 | 12 | 0 | |
| ET | 0 | 0 | 0 | 42 | 69 | 96 | 109 | 94 | 67 | 40 | 23 | 0 | 539 |
| SURPLUS=W-ET-ΔSOIL | 34 | 29 | 41 | 151 | 10 | 0 | 0 | 0 | 0 | 0 | 56 | 50 | 372 |
| Notes: | | | | | | | | | | | | | |
| Precipitation, Rain, Temperature, and Latitude are inputted parameters | | | | | | | | | | | | | |
| SOILmax = available water storage capacity * root depth | | | | | | | | | | | | | |
| m = month | | | | | | | | | | | | | |
| D = Day length (hrs) = 2*cos ⁻¹ (-tan(Latitude)*tan(Declination))/0.2618 [calculation is in radian] | | | | | | | | | | | | | |
| SNOW _m = P _m -RAIN _m | | | | | | | | | | | | | |
| F _m = 0 if T _m <= 0°C; F _m = 0.167*T _m if 0°C < T _m < 6°C; F _m = 1 if T _m >= 6°C | | | | | | | | | | | | | |
| PACK _m = (1-F _m)*(SNOW _m +PACK _{m-1}) | | | | | | | | | | | | | |
| MELT = F _m *(SNOW _m +PACK _{m-1}) | | | | | | | | | | | | | |
| W _m = RAIN _m +MELT _m | | | | | | | | | | | | | |
| PET = 0 if T _m < 0; otherwise PET = 2.98*0.611*exp(17.3*T _m /(T _m +237))/(T _m +237.2)*Number of days in month [Hamon ET model (1963)] | | | | | | | | | | | | | |
| ΔW _m = W _m -PET _m | | | | | | | | | | | | | |
| SOIL = min{[ΔW _m +SOIL _{m-1}], SOILmax}, if ΔW _m >0; otherwise SOIL = SOIL _{m-1} * exp(ΔW/SOILmax) | | | | | | | | | | | | | |
| ΔSOIL = SOIL _{m-1} -SOIL _m | | | | | | | | | | | | | |
| ET = PET if W _m > PET; otherwise, ET=W _m -ΔSOIL | | | | | | | | | | | | | |



Nitrate Attenuation

Calculations for Rural Developments

| Input Data | | Computed Values | |
|------------------------------|----------------------------|-----------------|----------------------------|
| <u>Areas</u> | LOT #1 | LOT #2 | Total |
| LOT AREA (m ²) | 13,000 | 4,982 | 17981.6 |
| <u>Surplus water</u> | <u>Infiltration Factor</u> | | |
| 0.372 m/yr | Hilly | | 0.1 |
| 0.001019 m/day | Loam | | 0.2 |
| 18.32502 m ³ /day | Clutivated land | | 0.1 |
| | Total | | 0.4 |
| <u>Vol of surplus water</u> | | | |
| 18.32502 m ³ /day | | | |
| available dilution | 7.3300 m ³ /day | <u>Runoff</u> | 10.995 m ³ /day |

PREDICTED NITRATE CONCENTRATIONS

| | Conventional | Tertiary |
|-------------|--------------|----------|
| Qe | 2000 | |
| Ce | 40 | |
| Qi | 7330.01 | |
| Ci | 0.1 | |
| Qt | 9330.01 | |
| mg/L | 8.65 | |