

March 01, 2018

Our File Ref.: 170254

Mr. Bob Cousins 2930 French Hill Road Ottawa, Ontario K4C 1K7

Attention: Bob Cousins

Subject: Hydrogeological Assessment & Terrain Analysis – Proposed Land Development 8015 Russell Road, Ottawa (Vars), Ontario

Dear Mr. Cousins,

1 INTRODUCTION

LRL Associates Ltd. (LRL) was retained by Mr. Bob Cousins to complete a hydrogeological assessment & terrain analysis at 8015 Russell Road in Ottawa (Vars), Ontario in support of a proposed commercial development. The assessment was carried out to determine if the current lot can adequately and safely be supplied with potable water in accordance with the Ontario Drinking Water Standards (ODWS) and that the property has soil conditions that are suitable for on-site sewage disposal without impairing the use of groundwater resources on the site and adjacent lands.

The assessment was conducted per the MOECC *"Hydrogeological Technical Information Requirements for Land Development Applications"* (April 1995), which include the following guidelines and procedures:

- Guideline D-5 Planning for Sewage and Water Services (August 1996); and
- Procedure D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment (August 1996)

The assessment involved a desktop review of available information on the geology and hydrogeology of the site and adjacent lands, as well as fieldwork consisting of digging test pits for soil sampling and installation of piezometers (with groundwater sampling), as well as installation of a test well for conducting a 24-hr pump test with further groundwater sampling of the quality of the aquifer in the area.

2 SITE AND AREA DESCRIPTION

The site is located at 8015 Russell Road in a Rural Industrial (RH) zoned area of Ottawa (Vars), Ontario. The location of the subject site is presented in **Figure 1**. The site is irregular in shape, being approximately 640 m wide (east-west) by between 110 and 153 m deep (north-south) with a total site area of approximately 89 954 m². The property is currently undeveloped with fields/cleared land and mature treed areas, see **Figure 2**. It is understood that the property will

be developed with a commercial building approximately 1859 m², supplied with a private well and septic, see **Figure 3** for proposed locations. Historical photos of the site indicated earth-moving activities in the central portion of the property since 2005¹, although it is LRL's understanding that no development took place. Land development in the surrounding area consists of mostly agricultural, low density residential and industrial land use, such as:

- Residential and vacant land to the north;
- Russell Road, followed by residential and agricultural land use to the south;
- Industrial (Tomlinson Ready Mix Concrete Supplier) to the east; and
- Frank Kenny Road, followed by residential and agricultural land use to the west.

The topography of the land is generally flat with an approximate elevation around 72 m above mean sea level. The nearest bodies of water are Shaws Creek located 72 m west from the south-west corner of the property line, and a tributary of Shaws Creek located 177 m north from the north-east corner of the property.

3 PROPOSED WATER SUPPLY

It is understood that the proposed development on the site will be serviced by a private water well.

A newly constructed "Test Well" (Well Tag No. A236235) was installed on the site by Bourgeois Well Drilling in January 2018 in order to assess the potential quality and quantity of the bedrock aquifer. The approximate location of the test well (TW1) is presented in **Figure 2**. A copy of the Water Well Record (WWR) is included in **Appendix A**.

It was described on the WWR for the Test Well that the underlying subsurface material encountered was brown clay with silt from grade to 3.1 m bgs, transitioning to grey clay with silt from 3.1 to 4.8 m bgs, over grey shale to a depth of 36.6 m bgs where the well was terminated. The recommended pumping rate was indicated as 100 L/min.

4 GEOLOGY & HYDROGEOLOGY

4.1 Geological Mapping

Surficial soil deposit maps² indicate that overburden material consists of a till, plain/ hummocky to rolling with local relief less than 5 m (to the north and southern portions of site) and/or between 5 - 25 m in the central portion of the site. The bedrock maps³ indicate similar bedrock that is described as limestone, dolostone, shale, arkose and sandstone.

Based on review of geological maps and available Ministry of the Environment and Climate Change (MOECC) WWR (presented in the table below), it is anticipated that the supply aquifer on the property would be that of the shale and/or limestone bedrock formation and is consistent to the test well and data provided for the nearby wells.

4.2 Water Well Record Review

A search of the Ontario Ministry of the Environment and Climate Change (MOECC) WWR database was conducted to locate available WWRs within 500 m of the site based on reported

¹ City of Ottawa; geoOttawa Interactive Mapping Software; Retrieved from https://ottawa.ca/en/city-hall/get-know-your-city/maps-ottawa#geoottawa; 2018.

² St-Onge, D.A., Surficial Geology, Lower Ottawa Valley, Ontario, Map 2140A, Geological Survey of Canada, 2009.

³ Ontario Geological Survey 1991. Bedrock geology of Ontario, southern sheet; Ontario Geological Survey, Map 2544, scale 1:1 000 000.

UTM coordinates thirteen (13) WWRs were available. Copies of available WWRs are included in **Appendix A** and their approximate locations are presented in **Figure 4**.

4.2.1 Subsurface Stratigraphy

The general subsurface conditions described in the thirteen (13) well records from within 500 m radius of the site are as follows:

	Distance			urface Stratigra		Static			
MOE Well Number	and Direction from Site (m)	Depth (m)	Clay (m)	Sand (m)	Gravel/ hard-pan (m)	Weathered Bedrock/ Bedrock (m)	Groundwater Encountered (m)	Water Level (m)	Type of water
7179701	47 SW	18.4	3.1 - 6	0 – 3.1	6 - 7.1	7.1 – 18.4 (Limestone)	15	1.62	Untested
7229010	68 SW	18.1	0 – 7.27		7.27 – 9.09	9.09 – 18.1 (Limestone)	9.09	2.82	Fresh
7229011	53 SW	18.8	0 - 9.09		9.09 - 10.9	10.9 – 18.8 (Limestone)	10.9	2.77	Fresh
7229012	51 SW	12.7	0 – 7.27		7.27 – 9.09	9.09 – 12.7 (Limestone)	9.09	2.8	Fresh
1535359	46 SW	18.2	0.6 - 3.0	0-0.6	3.0 - 6.0	6.0 – 18.2	15.8; 13.7	2.65	Fresh
7207127	25 W	18.5	0 – 4.5			4.5 – 18.5 (Limestone)	17	3.21	Untested
5606153	32 SW	23.8	0 - 6.09			6.09 – 23.8 (Shale)	22	4.15	Fresh
1511791	38 SW	33.8	0 – 7.3			7.3 – 33.8 (Shale/Limestone)	21.3; 33.5	1.5	Fresh
1519681	55 NE	12.8			0 - 4.8	4.8 – 12.8 (Shale)	8.8	5.4	Fresh
1521089	55 NE	10.1			0 - 4.8	4.8 – 10.1 (Shale)	9.4	1.8	Fresh
1522272	42 SE	36.5			0 – 2.7	2.7 – 36.5 (Limestone)	21.3; 35.1	10.6	Fresh
1533155	55 NE	36.6	0 - 3.96			3.96 – 36.5 (Shale)	7.6; 30.4	3.0	Fresh
1533156	56 NE	57.9	0 - 4.5			4.5 – 57.9 (Limestone/Shale)	7.6	3.0	Fresh

*Distances are based on NAD83 UTM coordinates provided on the WWRs.

The well records show that that the geological conditions within 500 m are generally similar and described to consist of till material including sand, clay, hardpan and/or gravel material (from surface to 10.9 m below ground surface (bgs)), over limestone and/or shale bedrock (from 2.7 to 10.9 m bgs. Of the thirteen (13) well records found, all were drilled wells into bedrock. The well depths ranged from 10.1 to 57.9 m bgs.

4.3 Water Supply Assessment

Based on review of geological maps and well records in the area it is anticipated that the proposed supply aquifer would be that of the upper bedrock consisting of shale, which is consistent with the test well that was used as part of this assessment. The proposed water supply for the development is the bedrock aquifer. Future wells for the development should be installed into the bedrock up to the depth of the test well (36.6 m).

5 FIELDWORK

5.1 Test Pits and Piezometer Installation

On January 18, 2018, four (4) test pits were completed across the proposed retained lot to determine the general upper soil and groundwater conditions, as well as to establish the depth of overburden in the area. The test pits were advanced using a hydraulic shovel operated by the client. LRL was present to supervise and document the advancement of the test pits. The locations of the test pits are presented in **Figure 2** with the Test Pit Logs included in **Appendix D**.

The general subsurface soil encountered in the test pits consisted of a layer of sand and gravel fill with concrete and brick debris (up to approximately 1.9 m bgs), over silty grey clay (with the exception of sand in TP2), up to at least 2.8 m deep. Bedrock was not encountered in the test pits. Water was found at approximately 1.2 to 2.1 m bgs.

A 25 mm open tube PVC piezometer was installed in test pits TP1, TP2, TP3 and TP4 to allow for groundwater elevation measurement and sampling of the perched water found in the overburden, herein referred to as groundwater. Groundwater samples were collected from piezometers TP1, TP2, TP3 and TP4 on January 18, 2018 and were submitted for laboratory analyses for select nitrate species parameters. The laboratory Certificate of Analysis is included in **Appendix C.** Select soil samples from TP1, TP2 and TP3 were submitted to LRL Materials Testing Laboratories for grain size/sieve and hydrometer analysis. Laboratory results reported that the subsurface native soil in the submitted soil samples consist of silty clay with trace to some fine to medium sand, with the exception of TP2 that indicated native fine to medium grained sand with some silt and clay and trace fine gravel. The laboratory certificates of analysis are included in **Appendix E**.

5.1.1 Pumping test

LRL conducted a pumping test on the new test well on January 24, 2018 in order to assess the quality and quantity of the aquifer. The test well was pumped for a total of 1860 minutes (approximately 31 hours) at 44 L/min for the first 8 hours, and then at 26 L/min for the duration of the test.

The drawdown was measured during the pumping and recovery periods using an electronic water level tape. Following the pump's cessation, the pumping well's recovery was monitored until a minimum of 95% recovery was achieved.

5.2 Groundwater Quality

5.2.1 Field measurements

Throughout the pumping test the following field parameters were measured and recorded:

- Turbidity, chlorine and colour using a Lamotte TC-3000 Trimeter; and
- Conductivity, total dissolved solids (TDS) and pH using a portable meter (Hanna Instruments HI 98129).

The summary of the field measurements are provided in the table included in Appendix B.

5.2.2 Groundwater Samples

Groundwater samples were collected for laboratory analysis during the pumping test to assess the quality of the proposed supply aquifer. The water samples were collected after three (3), eight (8), and thirty-one (31) hours of pumping. The water samples were collected directly into laboratory prepared bottles and were submitted to the laboratory for analysis of a "subdivision" package. The laboratory Certificates of Analysis from Paracel Laboratories Ltd. (Ottawa, Ontario) are included in **Appendix C**. The groundwater analytical results are discussed in Section 6.1.2.

5.3 Groundwater Quantity

5.3.1 Pump Test

The test well was pumped at approximately 44 L/min for 8 hours, then at 26 L/min for the duration of the test. The field data of the pumping tests, which include flow rates, water levels and measurement intervals, are presented in **Appendix B.** The maximum drawdown throughout the test was approximately 3.37 m or 10% of the available water column in the well.

6 RESULTS

6.1 Water Quality

6.1.1 Groundwater Results from Test Pits

Table 3 summarizes the water quality analysis from the test pit piezometers for nitrates, nitrites, ammonia and total kjeldahl nitrogen (TKN). The Laboratory Certificate of Analysis are included in **Appendix C**.

Levels of nitrate and nitrite were non-detect (<0.1 and <0.05 mg/L, respectively) with the exception of nitrate in TP2 which was 0.3 mg/L; and nitrite in TP2 which was 0.97 mg/L and <0.25 mg/L in TP3. All results remained below the MAC of 10 mg/L for nitrate and 1 mg/L for nitrite.

6.1.2 Groundwater Results from Test Well (A236235)

Table 1 summarizes the water analysis and also includes the relative (ODWS) (O. Reg. 169/03) for the parameters tested. The analytical results for the untreated water samples collected meet the ODWS for the parameters tested except for the following:

- Fecal coliforms were reported at 1 CFU/100 mL in the thirty-one (31) hour sample, above the ODWS of 0 CFU/100 mL. The presence of fecal coliforms may indicate that other harmful bacteria could be present. Fecal coliforms and other bacteria can be disinfected/deactivated through filtration and disinfection, such as chlorination or UV disinfection. However, the efficiency of the treatment can be affected by the high turbidity.
- Turbidity was reported at a level of 55.7 NTU in the three (3) hour sample, 40.5 NTU in the eight (8) hour sample, and 8.3 NTU in the thirty-one (31) hour sample. All results were above the MAC of 1 NTU if a treatment system is required to provide filtration and above the AO of 5 NTU. The level is also above the D-5-5 level considered reasonably treatable of 5 NTU. Turbidity decreased with additional pumping, however, the level after thirty-one (31) hours was still above the AO and D-5-5 limit of 5 NTU; and the MAC of 1 NTU if treatment is required to provide filtration.
- Colour was reported to be 18 and 9 TCU after three (3) and eight (8) hours of pumping, respectively, above the ODWS AO of 5 TCU, and above the MOECC D-5-5 limit of 7 TCU in both the samples. With continued pumping colour levels decreased and results for the thirty-one (31) hour sample were 3 TCU, below ODWS AO and the MOECC D-5-5 limits. High levels of colour may indicate that dissolved organic material is present in the water which may cause an increase in disinfectant by-products. Colour can be reduced through carbon filtration.
- pH was reported to be 8.7, 8.7, and 8.6 for the three (3), eight (8), and thirty-one (31) hours of pumping, respectively, above the ODWS OG limits (6.5 8.5 pH).

- Sulphide was reported to be 1.42 mg/L; 1.56 mg/L; and 1.38 mg/L after three (3), eight (8), and thirty-one (31) hours of pumping, respectively, above the AO of 0.05 mg/L. Sulphide can cause an unpleasant taste and odour which cab be reduced by, but not limited to, a manganese greensand filtration system or aeration.
- Iron was reported to be 400 ug/L and 800 ug/L after three (3) and eight (8) hours, being above the ODWS AO 300 ug/L. With continued pumping levels dropped below the ODWS AO limits, being <100 ug/L for the thirty-one (31) hour sample.
- Sodium was reported to be 100 mg/L; 101 mg/L; and 97.4 mg/L after three (3), eight (8) and thirty-one (31) hours of pumping, respectively, which is below the ODWS AO and the level considered reasonably treatable in Procedure D-5-5 of 200 mg/L. However, the concentrations are above the 20 mg/L warning level notification limit for those on a sodium restricted diet. The local Medical Officer of Health should be notified of these levels so that this information may be communicated to local physicians with regards to homeowners who follow a sodium-restricted diet. Sodium can be reduced through the use of a point-of-use reverse osmosis system, if required.
- Hardness was reported to be 6.3; 7.9 and 8.6 mg/L after the three (3), eight (8) and thirty-one (31) hours of pumping, which are below the Operational Guideline (OG) of 80 mg/L.
 - The Langelier Saturation Index (LSI) is used to determine the calcium carbonate stability of water and the pH at which water is saturated with calcium carbonate (pHs). The Ryznar Stability Index (RI) is used to determine the aggressiveness of water which can indicate the scale and corrosion potential. The calculations for RI and LSI for the thirty-one (31) hour sample are shown in Table 2. Using a water temperature of 10°C, the LSI was calculated to be -0.3 at thirty-one (31) hours which indicates the water is slightly corrosive but not scale forming. The RI was calculated to be 9.3 at thirty-one (31) hours which indicate intolerable corrosion.

6.2 Water Quantity

6.2.1 Water Quantity of wells within 500 m radius

A summary of the quantity of water reported for the thirteen (13) wells within a 500 m radius of the site are in the following table. The well records are included in **Appendix A** and their approximate locations are presented in **Figure 4**.

	Distance and	Depth		Pump Test Details								
MOE Well Number	Direction from Site	(m)	Pump Rate (L/min)	Duration (min)	Drawdown (m)	Specific Capacity (L/Sec/m)	Recovery (%)	Recommended Pump Rate (L/min)				
7179701	47 SW	18.4	6.45	60	4.8		100	6.45				
7229010	68 SW	18.1	63	60	0.7		100	90				
7229011	53 SW	18.8	63	60	0.53		100	63				
7229012	51 SW	12.7	58.5	60	6.25		100	67.5				
1535359	46 SW	18.2	60	60	1.8		98	22.7				
7207127	25 W	18.5	20	60	2.16		99	20				
5606153	32 SW	23.8	20	60	2.67		86	30				
1511791	38 SW	33.8		60	9.1			45.4				

1519681	55 NE	12.8	26.5	60	2.5	 	18.9
1521089	55 NE	10.1	94.7	60	1.5	 	37.9
1522272	42 SE	36.5	30.3	90	25.9	 	22.7
1533155	55 NE	36.5	94.7	60	9.0	 	56.8
1533156	56 NE	57.9	11.3	120	54.9	 72	11.3

As shown, all WWR tap into the bedrock aquifer. Based on the details provided in the well records obtained, the recommended pumping rates were reported to be between 11.3 L/min and 94.7 L/min.

6.2.2 Quantity of Test Well (A236235)

The initial static water level was measured as 1.48 m below top of casing (BTOC). The drawdown at eight (8) hours of pumping at 44 L/min was 3.37 m bgs. This represents approximately 10% of the available drawdown in the well. At eight (8) hours the pumping rate was adjusted to 26 L/min, with a drawdown of 2.52 m bgs, representing 7% of the available drawdown.

The specific capacity of the well at eight (8) hours of pumping at a rate of approximately 44 L/min is calculated to be 0.218 L/s/m, see **Table 5** for specific capacity calculations.

The well achieved approximately 97.9% recovery within 76 minutes of the end of pumping. Based on the observed drawdown and recovery, it is concluded that the long-term yield of the test well is in excess of the tested pumping rate of 44 L/min.

6.2.2.1 Quantity for Proposed Development Use

The proposed development involves construction of a multiuse 1895 m² building on the center portion of the property; therefore, the required aquifer yield has been derived from the City of Ottawa's Water Distribution Guidelines, July 2010 and the MOECC's Design Guidelines for Drinking-Water Systems, 2008.

The anticipated average daily flow demands have been evaluated based on the septic design prepared by Dimensional Analysis. See **Appendix F** for attached septic design and sewage system details.

Based on the septic design, the anticipated daily flow demand is 2 850 L/day. The average daily flow demand was estimated based on the anticipated daily flow demand of 2 850 L/day over an 8 hour period as 5.9 L/min. The maximum daily flow is estimated as 4 275 L/day or 8.9 L/min (1.5 times the average daily flow) and the peak hourly flow is estimated as 16.0 L/min (1.8 times the maximum daily flow).

7 TERRAIN ANALYSIS

The terrain analysis was conducted to demonstrate that the unconsolidated material on the site is appropriate for the construction of an on-site subsurface sewage disposal system.

The subsurface conditions indicated for the site are considered suitable for a Class IV septic sewage disposal system with a fully raised leaching bed depending on the lot specific soil and groundwater conditions at the actual location of the proposed septic system leaching bed. The leaching bed should be constructed to conform to the specifications set out in the Ontario Building Code (OBC).

As part of this assessment, an analysis was carried out to ensure that sufficient space exists on the property for the construction of a septic system in accordance with the OBC. Based off septic designs and sewage system details an area of approximately 882 m² is required for the septic bed assuming 8 pipes each having a length of 18.2 m and a spacing of 1.6 m between the pipes,

with mantle of 15 m in length along the down gradient portion of the bed. See **Appendix F** for details.

It is proposed that a lot size of $89,954 \text{ m}^2$, with $85,137 \text{ m}^2$ of area available for infiltration is considered sufficient area for the installation of a septic system in accordance with the OBC to service a commercial property with a design sewage flow of up to 2 850 L/day, see **Table 4** for nitrate attenuation calculations.

7.1 Groundwater Impact Assessment

The groundwater impact assessment addresses the ability of the land to attenuate the sewage effluent created by the development. Three methods for conducting the assessment are outlined in MOE's *Procedure D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment* (1996):

- Lot Size Consideration for lot greater than 10 000 m²;
- System Isolation Consideration for areas where the septic system is hydrogeologically isolated from the potable water source; and
- Contaminate Attenuation Consideration for sites that do not meet the above two points.

Based on the review of the available information and site visit, the site is not hydrogeologically sensitive (i.e. areas of karst formations, bedrock outcrops, or thin soil over highly permeable soils).

In this hydrogeological assessment the "Contaminant Attenuation" case was considered.

7.1.1 Contaminant Attenuation Method (Predictive Assessment)

The Contaminant Attenuation Method (Predictive Assessment) was used to determine the impact of the individual on-site septic systems at the boundary of the proposed developed lot. This procedure assesses the risk that the individual on-site systems will cause the concentration of the nitrate-nitrogen at the boundary to exceed 10 mg/L at the property boundaries. Dilution is the attenuation mechanism considered for nitrates, with precipitation being the only source of infiltration. The following parameters and assumptions were used in the nitrate attenuation calculations:

- Infiltration factors for the proposed development lot was;
 - a. Flat topography;
 - b. An assumption of clay loam;
 - c. Cultivated Land/ woodland;
 - Background nitrate concentration was not detected in submitted water samples thus for this calculation the background concentration is set to 0 mg/l;
 - e. Impervious areas of 1895 m^2 for the building and 2922 m^2 of impervious area; and
 - f. Moisture surplus values from the Ottawa weather station (Environment Canada, 2011). This value is considered representative of Vars, Ontario.

The detailed calculations for the proposed development is presented in the attached Nitrate Attenuation Calculations table, see **Table 4**. Based on the proposed lot size and soil conditions,

the calculated levels of nitrates at the property limits will be 2.05 mg/L respectively. This meets the procedure's guideline of 10.0 mg/L at the properties boundaries. Based on the "**Contaminant Attenuation Method**" the currently proposed severed lot size and soil conditions are suitable to attenuate the nitrate impacts generated by the septic systems on the development.

8 CONCLUSIONS

Based on our review of available information and the results of the groundwater sampling and laboratory analytical program the following conclusions are made.

- 1. A test well (TW1) was installed on the site and was tested for quality and quantity in accordance with MOECC Procedures D-5 & D-5-4. The test well was installed into the inferred shale bedrock to a depth of approximately 36.6 m bgs.
- 2. Based on the results of the investigation the long-term yield of the tested well appears to be in excess of the tested rate of 44 L/min and 26 L/min.
- 3. Based on LRL's desktop review of the hydrogeology and geology of the site and surrounding area, site visits and calculations for the "Contaminant Attenuation Method"; a total lot size of 89 954 m² (with 27 647 m² of the total lot size consisting of cultivated land), produces a calculated nitrate level at the limits of the proposed severed lot as 2.9 mg/L, below the procedure's guideline of 10 mg/L. Therefore, the soil conditions are suitable to attenuate the nitrates.
- 4. The results of the final samples submitted from the test well generally met the Procedure D-5-5 and ODWS limits for the tested parameters with the following exceptions:
 - Fecal coliforms were reported at 1 CFU/100 mL in the thirty-one (31) hour sample, above the ODWS of 0 CFU/100 mL. The presence of fecal coliforms may indicate that other harmful bacteria could be present. Fecal coliforms and other bacteria can be disinfected/deactivated through filtration and disinfection, such as chlorination or UV disinfection. However, the efficiency of the treatment can be affected by the high turbidity.
 - Turbidity was reported at a level of 55.7 NTU in the three (3) hour sample, 40.5 NTU in the eight (8) hour sample, and 8.3 NTU in the thirty-one (31) hour sample. All results were above the MAC of 1 NTU if a treatment system is required to provide filtration and above the AO of 5 NTU. The level is also above the D-5-5 level considered reasonably treatable of 5 NTU. Turbidity decreased with additional pumping, however, the level after thirty-one (31) hours was still above the AO and D-5-5 limit of 5 NTU; and the MAC of 1 NTU if treatment is required to provide filtration.
 - Colour was reported to be 18 and 9 TCU after three (3) and eight (8) hours of pumping, respectively, above the ODWS AO of 5 TCU, and above the MOECC D-5-5 limit of 7 TCU in both the samples. With continued pumping colour levels decreased and results for the thirty-one (31) hour sample were 3 TCU, below ODWS AO and the MOECC D-5-5 limits.
 - pH was reported to be 8.7, 8.7, and 8.6 for the three (3), eight (8), and thirty-one (31) hours of pumping, respectively, above the ODWS OG limits (6.5 8.5 pH).
 - Sulphide was reported to be 1.42 mg/L; 1.56 mg/L; and 1.38 mg/L after three (3), eight (8) and thirty-one (31) hours of pumping, respectively, above the AO of 0.05 mg/L.

- Iron was reported to be 400 ug/L and 800 ug/L after three (3) and eight (8) hours, being above the ODWS AO 300 ug/L. With continued pumping levels dropped below the ODWS AO limits, being <100 ug/L for the thirty-one (31) hour sample.
- Sodium was reported to be 100 mg/L; 101 mg/L; and 97.4 mg/L after three (3), eight (8) and thirty-one (31) hours of pumping, respectively, which is below the ODWS AO and the level considered reasonably treatable in Procedure D-5-5 of 200 mg/L. However, the concentrations are above the 20 mg/L warning level notification limit for those on a sodium restricted diet. The local Medical Officer of Health should be notified of these levels so that this information may be communicated to local physicians with regards to homeowners who follow a sodium-restricted diet. Sodium can be reduced through the use of a point-of-use reverse osmosis system, if required.
- Hardness was reported to be 6.3 mg/L; 7.9 mg/L and 8.6 mg/L after the three (3), eight (8) and thirty-one (31) hours of pumping, which are below the Operational Guideline (OG) of 80 mg/L.

9 **RECOMMENDATIONS**

- 1. It is recommended that the well be pumped further in an attempt to reduce the turbidity to acceptable levels. Following additional pumping if turbidity is acceptable (<5 NTU) additional samples should be collected for microbiological parameters.
- 2. Treatment options should be considered on an individual basis. Conventional treatment options exist for the parameters exceeding the ODWS and D-5-5 guidelines, which include the following (based off the 31-hr sample results):
 - Turbidity above 5 NTU is not considered reasonably treatable above 5 NTU;
 - Fecal Coliforms and other microbiological bacteria can be reduced through filtration and a disinfection treatment system such as chlorination or UV disinfection;
 - Sodium can be reduced by a point-of-use reverse osmosis system; and
 - Sulphide can be reduced through aeration.
- 3. Water should be tested on an individual basis and a water treatment specialist be consulted prior to the final design and installation of any water treatment system.
- 4. The owner is advised to have their water regularly analysed for bacteria and septic indicator parameters, such as chloride, ammonia, nitrates, nitrites, Total Kjeldahl Nitrogen, E. coli and total coliforms.
- 5. The owner should maintain their well as outlined in the Ontario Ministry of Agricultural and Rural Affairs Best Management Series Water Wells and O. Reg. 903/90.
- 6. All future wells shall be drilled by a licensed well contractor in accordance with Ontario Regulation 903/90, as amended and the MOECCs Water Supply Wells Requirements and Best Management Practices (December 2009). The construction, casing and sealing must comply with the applicable regulation and practices. The well casing should be installed into sound bedrock to a minimum depth of 6.1 m below the final surface grade.

Future wells should not be installed deeper than the test well (i.e. 36.6 m) due to the uncertainty of the water quality in the deeper aquifer. However, in the event that a deeper well is required, the well water should be tested prior to consumption. The well water sample should be collected following pumping of the well for a minimum of six

(6) hours and tested at an accredited laboratory for at least the parameters tested in this assessment.

7. Should the test well not be used or required to supply future intended use it must be decommissioned in accordance with Ontario Regulation 903/90.

10 LIMITATIONS

The findings contained in this report are based on data and information collected during the Hydrogeological Assessment & Terrain Analysis of the subject property conducted by LRL Associates Ltd. The conclusions and recommendations are based solely on the site conditions encountered at the time of our fieldwork on January 10; 24 & 25, 2018, supplemented by desktop information and data obtained as described in this report. The information presented in this report represents the soil and groundwater conditions at the locations sampled. Due to natural variations in geological conditions, no inference is made to the soil or groundwater conditions between sampling points. No assurance is made regarding changes in conditions subsequent to the time of this investigation. If additional information is discovered or obtained, LRL Associates Ltd. should be requested to re-evaluate the conclusions presented in this report and to provide amendments as required.

In evaluating the subject property, LRL Associates Ltd. has relied in good faith on information provided by individuals as noted in this report. We assume that the information provided is factual and accurate. We accept no responsibility for any deficiencies, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretation or fraudulent acts of the persons contacted.

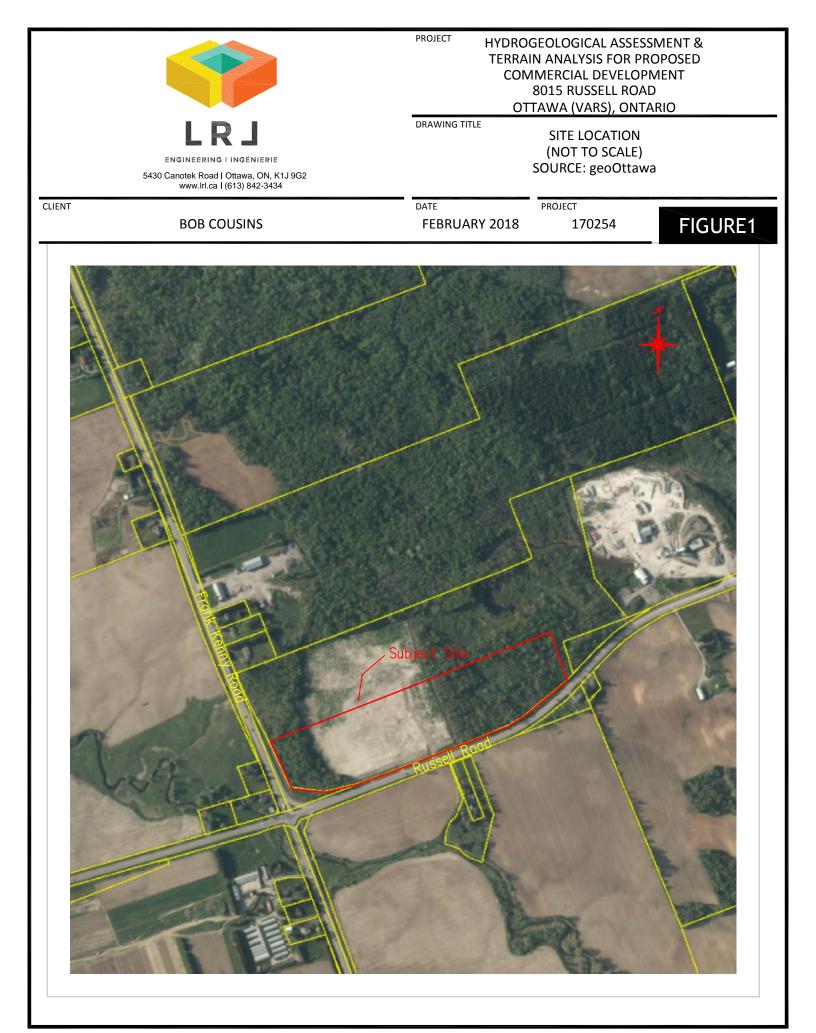
Yours truly, LRL Associates Ltd.

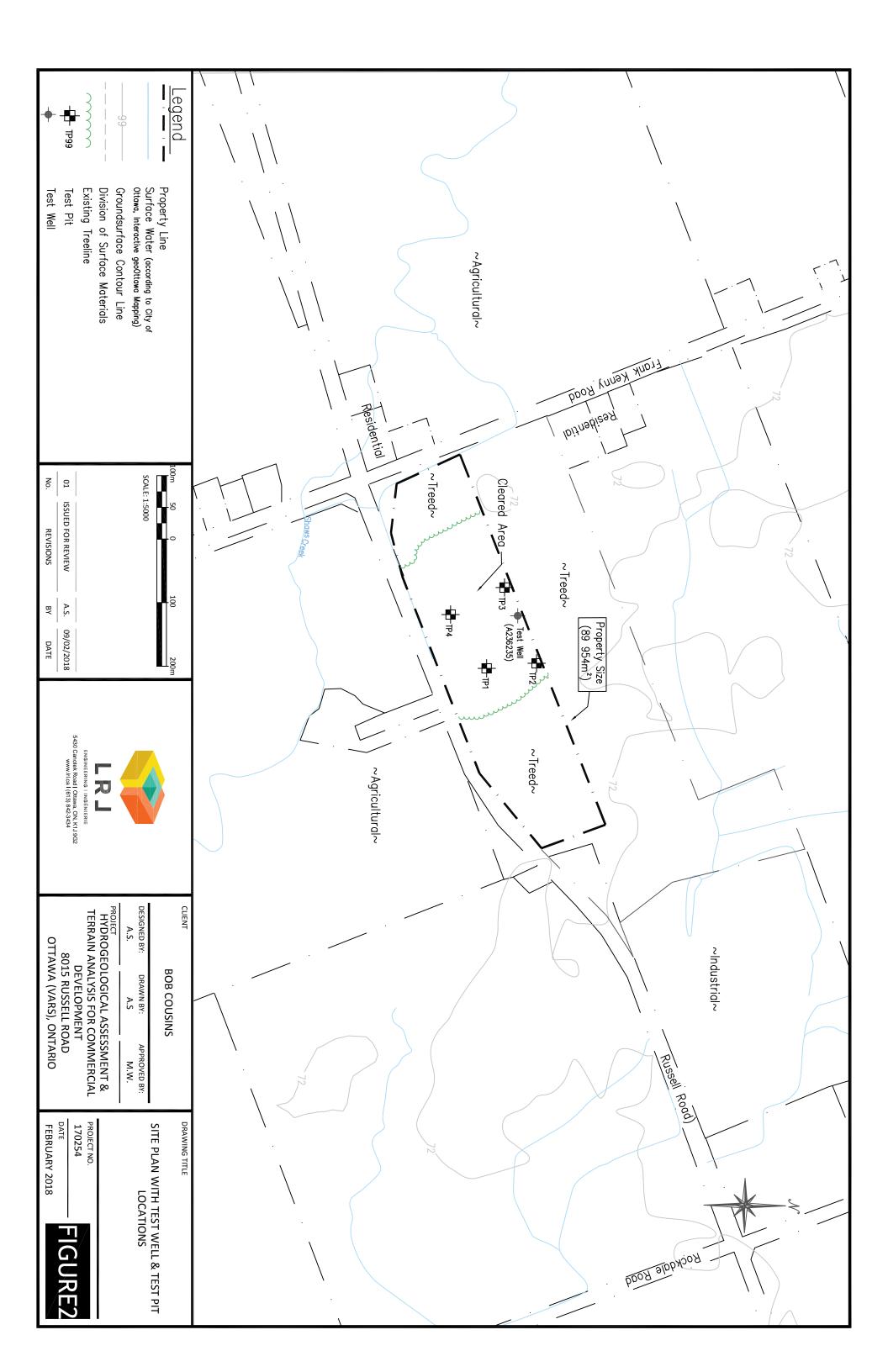
Andrea Sare Environmental Technician

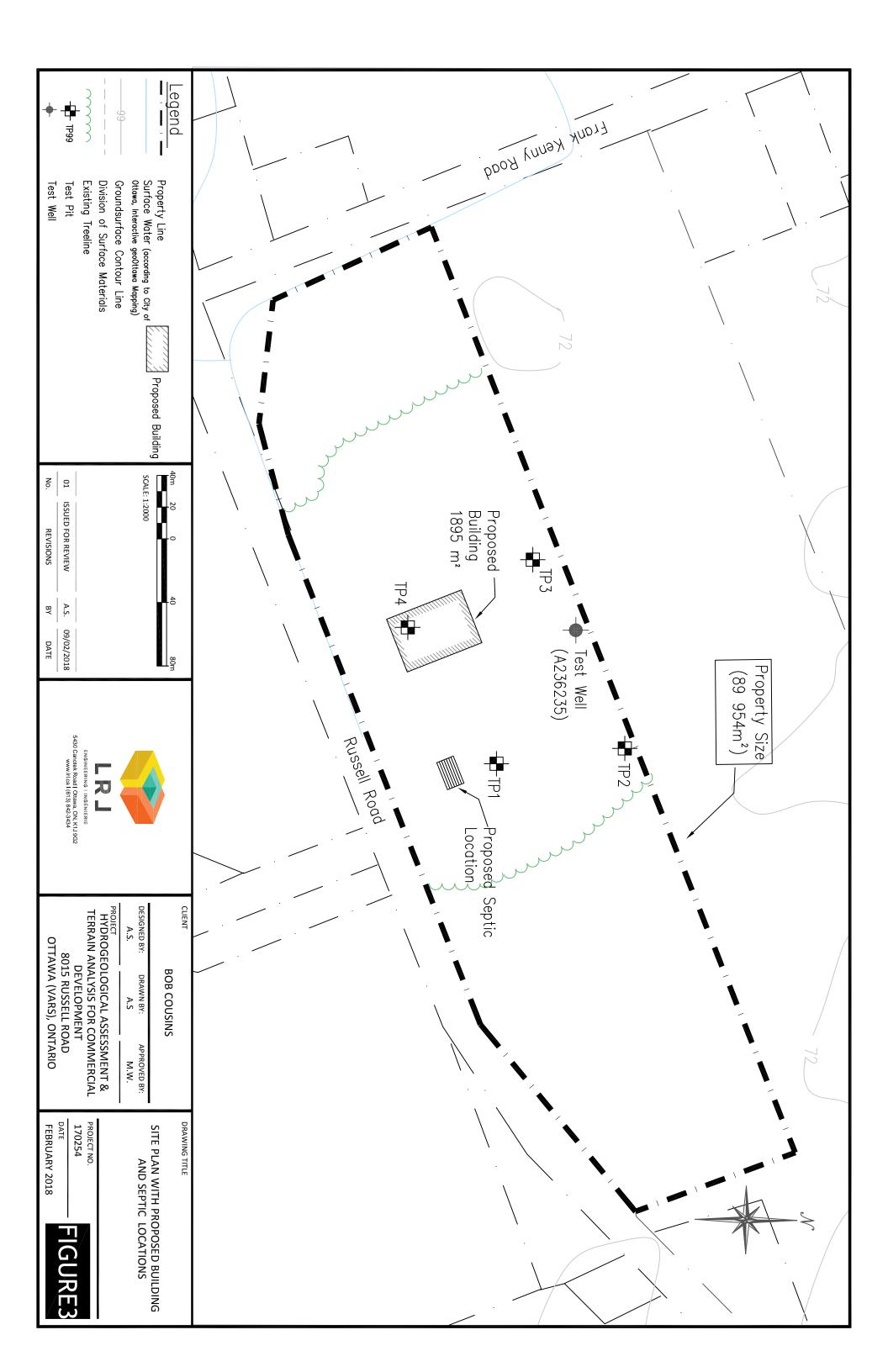
PROFESSIONAL 10011020 Matthew Whitney, P. Ei

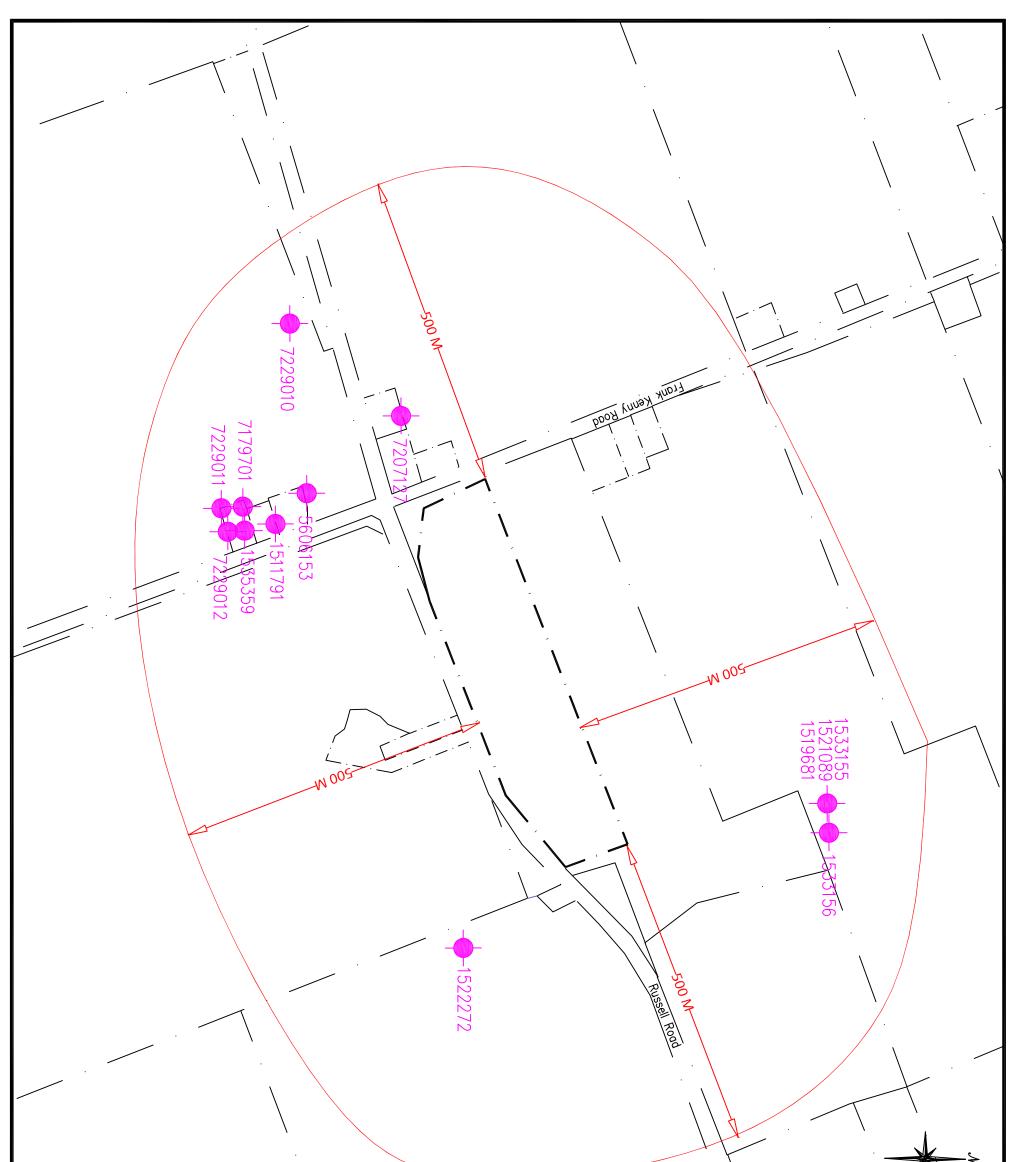
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Figure 1: Site Location Figure 2: Site Plan With Test Well & Test Pits Locations Figure 3: Site Plan With Proposed Building & Septic Locations Figure 4: MOECC Wells Within 500 m Radius Of The Site Table 1: Summary of Analysis of Water Sample Collected from Supply Well Table 2: Langelier and Ryznar Calculations- 8015 Russell Road 31hr Table 3: Summary of Analysis of Water Samples Collected from the Test Pits Table 4: Nitrate Attenuation Calculations Table 5: Specific Capacity and Long term Availability Appendix A: Well Records of Wells Within 500 m of Site Appendix B: Pump Test Data Appendix C: Laboratory Analysis Appendix D: Test Pit Logs Appendix E: Sieve/Hydrometer Analysis Results Appendix F: Septic Design FIGURES









				Koickdale Road
PROJECT NO. 170254 DATE FEBRUARY 2018	A.S. A.S. M.W. PROJECT HYDROGEOLOGICAL ASSESSMENT & TERRAIN ANALYSIS FOR PROPOSED COMMERCIAL DEVELOPMENT 8015 RUSSELL ROAD OTTAWA (VARS), ONTARIO DRAWING TITLE MOECC WELLS WITHIN 500 M RADIUS	ENGINEERING I INGÉNIERIE 5430 Canotek Road I Ottawa, ON, KIJ 962 www.ll.cal (613) 642-5434 BOB COUSINS BY: DRAWN BY: APPI	01 ISSUED FOR REVIEW A.S. NO. REVISIONS BY	Legend Well With MOECC Tag Number Property Line Wells Within 500 m Radius from Property Line

TABLES

Table 1

Summary of Analysis of Water Sample Collected from the Supply Well

Hydrogeological Assessment and Terrain Analysis For Proposed Commercial Development

8015 Russell Road, Ottawa, O	Intario
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				RL File: 170)254			
			Ontario De Water Sta	•		Sample		
					MOECC	8015 Russell	8015 Russell	8015 Russel
Parameter	Units	MRL	Standard	Туре	D-5-5⁵	Road-3hr	Road-8hr	Road-31hr
Sample Date (d/m/y)								
Microbiological Parameters								
E. Coli	CFU/100 mL	1	0	MAC		<1	<1	<1
Fecal Coliforms	CFU/100 mL	1	0 1	MAC		<1	<1	<u>1</u>
Heterotrophic Plate Count	CFU/ml	10				<1	<10	10
Fotal Coliforms	CFU/100 mL	1	0/5 ¹	MAC		<1	<1	<1
General Inorganics								
Alkalinity, total	mg/L	5	30 - 500	OG		229	230	235
Ammonia as N	mg/L	0.01				0.81	0.78	0.83
Dissolved Organic Carbon	mg/L	0.5	5	AO	10	1.6	0.8	2.4
Colour	TCU	2	5	AO	7	<u>18</u>	<u>9</u>	3
Conductivity	uS/cm	5				521	519	531
Hardness	mg/L	1	80 - 100	OG		<u>6.3</u>	<u>7.9</u>	<u>8.6</u>
эΗ	pH Units	0.05	6.5 - 8.5	OG		<u>8.7</u>	<u>8.7</u>	<u>8.6</u>
Phenolics	mg/L	0.001				<0.001	<0.001	<0.001
Fotal Dissolved Solids	mg/L	10	500	AO		332	324	320
Sulphide	mg/L	0.02	0.05	AO		<u>1.42</u>	<u>1.56</u>	<u>1.38</u>
Fannin & Lignin	mg/L	0.1				1.1	1.1	1.4
Fotal Kjeldahl Nitrogen	mg/L	0.1				0.9	0.8	0.7
Organic Nitrogen (Calculated)	mg/L		0.15	OG		0.09	0.02	-0.13
Furbidity	NTU	0.1	1/5 ²	MAC/AO	5	55.4	40.5	<u>8.3</u>
Anions								
Chloride	mg/L	1	250	AO	250	23	22	23
Fluoride	mg/L	0.1	1.5 ³ /2.4	MAC		0.5	0.4	0.4
Nitrate as N	mg/L	0.1	10	MAC		<0.1	<0.1	<0.1
Nitrite as N	mg/L	0.05	1	MAC		<0.05	<0.05	<0.25[1]
Sulphate	mg/L	1	500	AO	500	25	25	26
Metals								
Calcium	ug/L	100				1600	1700	2300
ron	ug/L	100	300	AO	10000	<u>400</u>	<u>800</u>	<100
Magnesium	ug/L	200				600	900	700
Vanganese	ug/L	50	50	AO	1000	20	20	17
Potassium	ug/L	100				3000	4100	3500
Sodium	mg/L	0.2	20 ⁴ /200	AO	200	100	101	97.4

OG Operational Guideline

ODWS MAC Maximum Acceptable Concentration NA AO Aesthetic Objective

UNDERLINE Parameter level above ODWS

Notify Medical Officer of Health Italics

Not Analysed

BOLD Parameter level above D-5-5 maximum treatability limits

[1] Elevated reporting limit due to matrix interference.

¹ As per Table 1 of MOECC's technical guideline "D-5-5 Private Wells: Water Supply Assessment"

² 1.0 NTU OG if treatment system required to provide filtration for disinfection. 5.0 NTU AO for all points of consumption.

³ Where supplies of naturally occuring flouride at levels above 1.5 mg/L but below 2.4 mg/L the Ministry of

Health recommends notification of local board of health of levels to avoid excesses exposure from other

⁴ Health related warning level at which Local Medical Officer of Health should be notified of levels.

⁵ MOECC D-5-5 guideline, maximum concentration considered reasonably treatable.

Table 2

Langelier and Ryznar Calculations- 8015 Russell Road 31hr Hydrogeological Assessment & Terrain Analysis For Proposed Commercial Development 8015 Russell Road, Ottawa (Vars), Ontario LRL File: 170254

Analyzed Parameters

TDS (mg/L)	320
Hardness(mg/L)	8.6
alkalinity(mg/L)	235
pH (pH units)	8.6
Temperature °C	10

Langelier

Where	A= (Log10(TDS)-1)/10	=	0.150515
	B= (-13.12*Log10(T°C+273)+34.55	=	2.382562
	C= Log10(Hardness)-0.4	=	0.5344985
	D= Log10(Alkalinity)	=	2.3710679
	Where	B= (-13.12*Log10(T°C+273)+34.55 C= Log10(Hardness)-0.4	B= (-13.12*Log10(T°C+273)+34.55 = C= Log10(Hardness)-0.4 =

Ryznar

RI=2pHs-pH

pHs=	8.92751
LSI=	-0.3
RI=	9.25502

Langelier

-2.0 < -0.5	Serious Corrosion
-0.5 < 0	Slightly corrosive but non-scale forming
LSI = 0.0	Balanced but pitting corrosion possible
0.0 < 0.5	Slightly scale forming and corrosive
0.5 < 2	Scale forming but non corrosive

http://www.lenntech.com/calculators/langelier/index/langelier.htm

Ryznar 4.0-5.0 Heavy Scale 5.0-6.0 Light Scale Light Scale or Corrosion 6.0-7.0 7.0-7.5 **Corrosion Significant** 7.5-9.0 Heavy Corrosion 9.0+ Corrosion is Intolerable

http://www.lenntech.com/calculators/ryznar/index/ryznar.htm

Table 3Summary of Analysis of Water Samples Collected from the Test Pits.

Hydrogeological Assessment and Terrain Analysis For Proposed Commercial development

8015 Russell Road, Ottawa (Vars), Ontario

				Ontario Drinking Water Standards				
Parameter	Units	MRL	Standard	Туре	TP1	TP2	TP3	TP4
Sample Date (d/m/y)					18/01/2018	18/01/2018	18/01/2018	18/01/2018
Anions								
Ammonia	mg/L	0.01			1.03	10.7	1.48	0.33
Total Kjeldahl Nitrogen	mg/L	0.1			13.8	20.7	15.3	5.7
Nitrate as N	mg/L	0.1	10	MAC	<0.1	0.3	<0.1	<0.1
Nitrite as N	mg/L	0.05	1	MAC	<0.05	0.97	<0.25[1]	<0.05

<u>NOTES</u>

[1] Elevated reporting limit due to matrix interference

MRL Minimum Reportable Limit

MAC Maximum Acceptable Concentration

ODWS Ontario Drinking Water Standards (2006)

Table 4

Nitrate Attenuation Calculations

Hydrogeological Assessment & Terrain Analysis For Proposed Commercial Development

8015 Russell Road, Ottawa (Vars), Ontario

LRL File: 170254

1. Potential Infiltration

Weather Station Ottawa

		Infiltration Factor (IF) ¹						Moisture Surplus (MS)					filtration (PI) i) (mm)	
No.	Section Area (m ²)	Topography	Value	Soil	Value	Cover	Value	Total	Ground Cover	Soil Type	Moisture Retention ² (mm)	Moisture Surplus ³ (mm)	Section	Weighted
1	62,307	Flat	0.3	Clay Loam	0.2	Woodland	0.2	0.7	Moderately Rooted Crops	3 Clay Loam	150	336	235.2	162.9
	,			Ciay Loan	0.2		0.2	0.7	, , ,	3 Ciay Luarii		330		
2	27,647	Flat	0.3	Clay Loam	0.2	Cultivated Land	0.1	0.6	Shallow Rooted Crops	4 Clay Loam	100	363	217.8	66.9
Total	89,954												Total	229.9

Total 89,954

2. Area Available for Infiltration

Number of Lots		n	1
Approximate footprint of house/garage	Э	Н	1895 m ²
Approximate paved area		d ⁴	2085 m ²
Approximate Area of Stormwater Man	agement Pond		837 m ²
Approximate Length of Road		L	0 m
Approximate Width of Road		w	0 m
Total Area of Property			89954 m ²
Impervious Area			4817.0 m ²
Roads	l x w	0 m ²	
Retention Pond	l x w	837 m ²	
Driveway	n x d	2085 m ²	
Houses	n x H	1895 m ²	
Area available Infiltration		A	85,137 m ²

3. Nitrate Diluation Calculations

Nitrate Concentration of Infiltration	C _i	⁰ mg/L ⁶
Site Infiltration	$Q_i = A^* PI$	19569 m ³
Daily Sewage Volume per Lot ⁵	Q _d	2.9 m ³
Maximum Yearly Sewage Volume (water)	Q _e =365*n*Q _d	1059 m ³
Nitrate Concentration in Sewage ⁵	C _e	40 mg/L
Maximum Allowable Nitrate Concentration at Boundary	C _m	10.0 mg/L
Increase in Nitrate Concentration at Boundaries	$C = (Q_e C_e + Q_i C_i) / (Q_e + Q_i)$	2.05 mg/L

NOTES

1 Table 2: Infiltration Factors, Hydrogical Technical Information Requirements for Land Development Applications, Ministry of the Energy and Environment, April 1995.

2 Thornthwaite and Mather's (1957) Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance.

3 Moisture surplus for data for Mason Anger (Environment Canada Meteorological Service of Canada, 2010).

4 Area based on proposed civil design drawings

5 As per Technical Guideline for Individual On-Site Sewage Systems: Water Quality and Impact Risk Assessment, Ministry of the Energy and Environment, August 1996.

6 Average of nitrate concentrations from test pits water sample collected on January 18, 2018 **APPENDIX A**

Well Records of Wells Within 500 m of the Site

		Resources Commission Act 4. 316/6 d
Water management in Ontario 1. PRINT ONLY IN S		1511791. LLAGE CON., BLOCK, TRACT, SURVEY, ETC.
Runger Mari	n comberlan	RC. ELEVATION RC. BASIN CODE II II III III
GENERAL COLOUR MOST COMMON MATERIAL	OG OF OVERBURDEN AND BE	Image: Weight of the second
Aloch Lage	Roch	24 72
Bray Limestone	Rock	72 117
(31) base tast 1 1002	28/17 1 01/1/2/51	
32 10 14 15 21 41 WATER RECORD WATER FOUND KIND OF WATER	51 CASING & OPEN HC	DEPTH - FEET U FROM TO C MATERIAL AND TYPE DEPTH TO TOP 41-44 80
20-23 1 20-23	Incres Incres 10-11 STEEL 12 2 GALVANIZED 3 3 CONCRETE 4 4 OPEN HOLE 19	13-16 13-16 0 SCREEN FEET 61 PLUGGING & SEALING RECORD DEPTH SET AT - FEET UNTERIM AND TYPE (CEMENT GROUT,
1 FRESH 3 SULPHUR 2 SALTY 4 MINERAL 25-28 1 FRESH 3 SULPHUR 2 SALTY 4 MINERAL 25-28 1 FRESH 3 SULPHUR 2 SALTY 4 MINERAL 30-33 1 FRESH 3 SULPHUR 2 SALTY 4 MINERAL	2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 24-25 1 STEEL 26 2 GALVANIZED 3 CONCRETE	FROM TO MATERIAL AND TIPE LEAD PACKER, ETC.) 10-13 14-17 27-30 18-21 22-25 26-29 30-33 80
TI PUMPING TEST METHOD	GPM 15-16 00 17 HOURS 00 17 1 DE DIIMPING	I7-18 IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.
LEVEL END OF PUMPING 19-21 22-24 15 MINUTES 26-2 05 FEET 3.5 FEET 200 FEET	$\begin{array}{c} 2 \\ \hline 2 \\ 2 \\$	
IF FLOWING, GIVE RATE 38-41 PUMP INTAKE S GIVE RATE CPM. RECOMMENDED PUMP TYPE RECOMMENDED PUMP SETTING Go-53 GPM. /FT. SPECIF		46-49 GPM
FINAL STATUS OF WELL 55-56 54 1 Wwater Supply 2 0 observation well 3 Test Hole 4 Recharge well	 5 ABANDONED, INSUFFICIENT SUPPI 6 ABANDONED, POOR QUALITY 7 UNFINISHED 	PLY TSO
WATER USE USE USE USE USE USE USE USE USE USE	5 COMMERCIAL 6 MUNICIPAL 7 PUBLIC SUPPLY 8 COOLING OR AIR CONDITIONING 9 NOT USED	St The VIL
METHOD 57 OF 2 DRILLING 4 Rotary (Air) 5 air percussion		DRILLERS REMARKS:
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25-28 1	FRESH 3 SULPHUR 29 SALTY 4 MINERAL	06 3 CONCRETE 4 24-25 1 STEEL 26		0103	10-13 14-17 18-21 22-25		
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50-53	<u> </u>	70 FEET RATE 5 GPM ECIFIC CAPACITY		
FINAL	54 1 💢 WATER SUPPLY 2 🔲 OBSERVATION WE	5 🔲 ABANDONED, INSUFFICIENT SUPPLY		
STATUS OF WELL	3 D TEST HOLE	7 UNFINISHED		
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METHOD	2 CABLE TOOL			
OF DRILLING	3 🗇 ROTARY (REVERS) 4 🗍 ROTARY (AIR) 5 🗍 AIR PERCUSSION	E) 8 🗍 JETTING 9 🗋 DRIVING		
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UNPING TEST MET	ALTY A MINERAL	4 DOPEN HOLE	PUMPING]
1 D PUMP	2 BAILER DO	101 GPM 01 HO	-16 <u>50</u> 17-18 MINS PUMPING		· · · · · · · · · · · · · · · · · · ·	OCATION OF	F WELL FROM ROLE	
LEVEL	END OF WATER LI PUMPING 22-24 15 MINUTES	30 MINUTES 45 MINUTES	RECOVERY 60 MINUTES	LOTI	LINE ND	ICATE NORTH BY ARRO		<i>*</i>
US IF FLOWING,	255 FEET 031 FEE 38-41 PUMP INTAKE S	042 FEET 055 F	2-34 FEET 055 FEET		1		8	
19-21 19-21 19-21 19-21 19-21 19-21 FEET SIVE RATE SIVE RATE RECOMMENDED PUM	GPM	58 FEET 1 🗆 CLEAR			1		1 20	
SHALLOW	PUMP	PUMPING	00 2 GPM		E) X	
L	54 1 WAYER SUPPLY	s 🗍 ABANDONED, INSU] 7				
FINAL STATUS OF WELL	2 OBSERVATION WELL 3 TEST HOLE		· · ·				K MC-KNE	ELY MU
	4 DOMESTIC						L KN	
WATER USE O	2 C STOCK 3 C IRREGATION 4 INDUSTRIAL	MUNICIPAL DUBLIC SUPPLY COOLING OR AIR COND	ITIONING)		YNNC	
	0 OTHER	9 🗌 NO	T USED		-		\searrow	
METHOD OF	1 D CABLE TOOL 2 C ROTARY (CONVENTI 3 ROTARY (REVERSE)	= -				USSELL	Rack	
DRILLING	4 🗌 ROTARY (AIR) 5 🗍 AIR PERCUSSION	9 DRIVING		DRHUGERS REMAR		1 terr		
NAME OF WELL C	FENIER WE	11 Dans un	CENCE NUMBER			DATRACTOR 59-62 DAT		3 10
ADDRESS	ASSELMAN O	NT KAA	1771 1 MAN			2351		
	RORBORER .		CENCE NUMBER					
SIGNATURE OF CO	ONTRACTOR	SUBMISSION DATE	4371 C E2	OFFICE			зî.	
VINO 1	Y OF THE ENVIRON		<u> </u>				C	-4-77 FORM 7

MINISTRY	OF	THE	ENVIRONMENT	COP

ntario	1. PRINT ONLY IN ; 2. CHECK 🛛 CORR	SPACES PROVIDED	11 '	15196	;81 [<u></u>	
UNTY OR DISTRICT	- CARLETON	TOWNSHIP, BOROUGH. CIT CUMBERL,			CON. BLOC	O 14 K TRACT, SURVEY	ETC		21 73 LOT 25-2 7 (7)
NER (SURNAME FIR		ADDRESS	hAN	A-N'	<u></u>	1894 6 <u> </u>	DATE COMPLETE	мо 5	
		7 M ING		ELEVATION				14	1V
	LC	G OF OVERBURDEN	N AND BEDROC	26 CK MATERIA	ALS (SEE INSTR	UCTIONS)			
NERAL COLOUR	MOST COMNON MATERIAL	OTHER MA	TERIALS		GENERAL DI	ESCRIPTION		DEPTH FROM	- FEET TO
BROWN	HARDVAN				· · · · · · · · · · · · · · · · · · ·			0	16
FACK	SHALE							1	42
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2				₄					
	TER RECORD	51 CASING &		ECORD	Z (SLOT NO.)	DPENING 3	1-33 DIAMETER	34-38 L INCHES	ENGTH 39
10-13 1 D	FRESH 3 SULPHUR 14	DIAM NATERIAL INCHES	THICKNESS INCHES FROM	м 🔨 то		ND TYPE	DEP OF S	TH TO TOP	41-44
11-10 1 []	SALTY 4 I MINERAL	G 4 2 □ GALVANIZED 1 □ CONCRETE 4 □ OPEN HOLE	1.80 0	167-16	61	PLUGGING	& SEALING	G RECO	RD
20-23 1 []	SALTY 4 I MINERAL FRESH 3 SULPHUR 24 SALTY 4 MINERAL	17-16 Gren HOLE 2 GALVANIZED	9	20-23	DEPTH SET AT	- FEET M	ATERIAL AND TYP		NT GROUT. CKER. ETC.)
25-28 1	FRESH 3 SULPHUR 29	3 CONCRETE 4 OPEN HOLE 24-25 1 STEEL 20	6	27-30	10-13	14-17			
30-33 t 🗆	FRESH 3 SULPHUR 34 10 SALTY 4 MINERAL	2 🗌 GALVANIZED 3 🔲 CONCRETE 4 🗌 OPEN HOLE			26-29	30-33 80			
PUMPING TEST MET		B-14 DURATION OF P		712	LOC	ATION O	FWELL		
T D PUMP STATIC	WATER LEVEL 25 END OF WATER LE				AGRAM BELOW SH			N ROAD A	1D
LEVEL 10-21	PUMPING 22-24 15 MINUTES 26-28	2 U 30 MINUTES 45 MINUTES	RECOVERY 60 NINUTES -34 35-37	-	avan				
IF FLOWING. GIVE RATE RECOMMENDED PUM	26 FEET 7 FEET 30-41 PUMP INTAKE S		OF TEST	个	hu	1			
RECOMMENDED PUN	GPN AF TYPE RECOMMENDED PUMP	28 FEET 1 CLEAR 43-45 RECOMMENDED PUMPING		1					
C SHALLOW		28 FEET RATE	<u>5</u> gpn						
FINAL	34 1 WATER SUPPLY 2 DESERVATION WELL	S ABANDONED, INSU	11			3			
STATUS OF WELL	3 [] TEST HOLE 4 [] RECHARGE WELL	7 🗍 UNFINISHED			4325	10			
SS WATER	I DOMESTIC I STOCK I IRRIGATION	S COMMERCIAL S MUNICIPAL 7 PUBLIC SUPPLY			+325 *				
USE		COOLING OR AIR COND	11		16,00			ł	
METHOD	57) CABLE TOOL 2 D ROTARY (CONVENTI				RUSSEX	1 6	2		
OF DRILLING	3 🗍 ROTARY (REVERSE) 4 🗍 ROTARY (AIR)					~ ′	Ð		
NAME OF WELL C		A	CENCE NUMBER	DRILLERS REMAR	KS: S& CONTRAC	TOR 59-62 04	d in A	c û	5
ADDRESS	ENTER WELL	LURILING :	2351	DATE OF INSPE	CTION	INSPECTOR	21-01	νσ	U
BOX 10	50 ASSELM	MAN ONT K.	OA-JUO CENCE NUMBER						
SUGN TYPE OF C	JENIER	SUBMISSION DATE		OFFICE					
		DAY 13 NO.	5 851	5					~

Min	istry			The	Ontario	Water Resourc	es Act		
of t	he		WA	TER	W	ELL	RE	CO	RD
Ontario Env	/ironment	SPACES PROVIDED					8 %	ы.	
COUNTY OR DISTRICT		TOWNSHIP, BOROUGH.		15191		BLOCK, TRACT, SURVEY			LOT 25-27
07740	Constant	Currer	AND			7			20
		3	NA	UAN				3 NO 5	41-53 YR <u>85</u>
1 2	4 10 12	IG				BASIN CODE	 1 1 1		•• •
		OG OF OVERBURDI	EN AND BEDF	OCK MATERI	ALS (SEE)	INSTRUCTIONS)			47
GENERAL COLOUR	MOST COMMON MATERIAL	OTHER N	ATERIALS		GENER	AL DESCRIPTION		DEPTH FROM	FEET TO
BROWN	HARDPAN							0	16
BLACK	SHALE						- · · · · · · · · · · · · · · · · · · ·	16	42
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	TER RECORD	51 CASING 8	OPEN HOLE			SI OF OPENING 3 END (65 1-33 DIAME	TER 34-38 L	75 80 ENGTH 39-40
WATER FOUND AT - FEET	KIND OF WATER $\frac{14}{14}$ FRESH 3 \Box SULPHUR $\frac{14}{14}$	INSIDE DIAM MATERIAL INCHES		DEPTH - FEET FROM TO		RIAL AND TYPE	1	INCHES DEPTH TO TOP OF SCREEN	FEET 41-44 30
29 '	SALTY 4 _ MINERAL	6 1911 I STEEL 2 GALVANIZE 3 CONCRETE	["] 1.88	0 16		•			FEET
2] SALTY 4 [] MINERAL	4] OPEN HOLE	19	20-2	DEPTH		& SEAL	TYPE (CEME	NT GROUT
] FRESH ³ [] SULPHUR ²⁴] SALTY ⁴ [] MINERAL	t 🗌 GALVANIZE 3 🔲 CONCRETE			FROM 10	10 -13 14-17		LEAD PA	CKER, ETC.)
2 [] FRESH 3 [] SULPHUR ²⁹] SALTY 4 [] MINERAL	4 🗌 OPEN HOLE 24-25 1 🗍 STEEL 2 🗍 GALVANIZE	26	27-30	,	-21 22-25			
] FRESH 3 [] SULPHUR ^{34 40}] Salty 4 [] Mineral	CONCRETE OPEN HOLE			26-	29 30-33 60			
71 PUMPING TEST MET	THOD 10 PUMPING RATE	7 1	15-16 17-18	712	J L	OCATION O	FWEL		
STATIC LEVEL	WATER LEVEL 25 END OF WATER LI		HOURS O MINE D PUMPING RECOVERY			OW SHOW DISTANCES DICATE NORTH BY ARE		FROM ROAD A	ND
	PUMPING 22-24 15 MINUTES 26-20	30 MINUTES 45 MINUT			an the				
	1 26 FEET 17 FEE 38-41 PUMP INTAKE S		FEET 26 FEE		NI				
U O FEET	GPM RECOMMENDED		AR 2 CLOUDY						
G SHALLOW	PUMP	28 FEET. RATE	<u> </u>						
	34 1 WATER SUPPLY	s 🗌 ABANDONED, IN	SHEFICIENT SHPPLY]]					
FINAL STATUS	2 DOBSERVATION WEL					,]õ			
OF WELL	4 D BECHARGE WELL				*	325 10			
WATER	2 🗋 STOCK 3 🗍 IRRIGATION 4 🗍 INDUSTRIAL	MUNICIPAL PUBLIC SUPPLY OPUBLIC OP AND CO			1650				
USE	□ OTHER	COOLING OR AIR CO D	NDITIONING NOT USED		V			·	
METHOD	57 1 C CABLE TOOL 2 C ROTARY (CONVENT		٩D		RUSS	EZZ F	2D		
OF DRILLING	3 COTARY (REVERSE 4 ROTARY (AIR) 5 AIR PERCUSSION) # [] JETTIN 9 [] DRIVIN			·	•			
NAME OF WELL	CONTRACTOR ,	^	LICENCE NUMBER	DRILLERS REMA		ONTRACTOR 59-62 0	EC VED	068	543-44 40
ADDRESS	ENTER WEL	LURIAING	2351	SOURCE	PECTION	INSPECTOR	K L		
BOX NAME OF DRILL	GO ASSEL	MAN ONT 1	KOA-JUO					·	<u>, </u>
NAME OF DRILL NAME OF DRILL	CONTRACTOR	SUBMISSION DATE	2351			Lups	7	<::ss.s ⁸	(X)
Allon	contractor tenie	DAY 13 M	0. <u>5</u> yr.85	ÖE	·	WDE			7.
MINISTRY O	F THE ENVIRONME							FORM NO. 0506-	-4-77 FORM 7

Min	istry		, 					urces Act		
of the		١	NAT					RE	ECO	RD
Ontario	1. PRINT ONLY IN S 2. CHECK 🛛 CORRI	PACES PROVIDED ECT BOX WHERE APPLICABLE	1 2	132	1089		. <u>1. 1</u> . 1	L L		72 /1 74
COUNTY OR DISTRICT		TOWNSHIP, BOROUGH, CITY,			-	ZON BLOG	CK, TRACT, SUI	IVEY, ETC.		2 <i>(</i>]
			<u>v</u>						MPLETED	(5.51 y .%
		.	1. 1	2152.54	29 29	a See	1 2.4			
	12 12 12 12 12 12 12 12 12 12 12 12 12 1	OG OF OVERBURDEN			ERIALS (CEE INSTR				4.7
GENERAL COLOUR	MOST	OTHER MATE					ESCRIPTION		DEPTH	- FEET
<u> </u>	COMMON MATERIAL HARD PAN	,							0	16
BROW N BLACK	SHALL		<u> </u>						16	33
PARCI	JUNE									
								_		
		······								
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31					<u> i i </u>					
				43				31-33 DIA		75 80
WATER FOUND		51 CASING & C	WALL	DEPTH - FEE	CREEN	(SLOT NO)			INCHES	FEET
	FRESH 3 SULPHUR 14	DIAM. MATERIAL INCHES	inches		SCH SCH	MATERIAL	AND TYPE		DEPTH TO TOP OF SCREEN	41-44 30 FEET
2/ 15-18 1	□ SALTY ⁴ □ MINERAL □ FRESH ³ □ SULPHUR ¹⁹	6 14 2 D GALVANIZED	1.58		8"	51	PLUGG	NG & SE	ALING RECO	ORD
20-23 1	SALTY 4 D MINERAL FRESH 3 D SULPHUR 24	4				DEPTH SET A	TO TO	MATERIAL A		ENT GROUT. ACKER: ETC.)
2	SALTY ⁴ MINERAL FRESH ³ SULPHUR ²⁹	3 🗌 CONCRETE 4 🗍 OPEN HOLE				10-13	14 - 17			1
2	□ SALTY 4 □ MINERAL □ FRESH 3 □ SULPHUR ³⁴ 30	24-25 1			27-30	18-21	22-25	80		
2	SALTY 4 MINERAL	I OPEN HOLE								
71 PUMPING TEST M	ETHOD IO PUMPING RATE	3 15-11						OF WE		
STATIC	PUMPING	EVELS DURING	PUMPING RECOVERY		IN DIAGRA LOT LINE		SHOW DISTA TE NORTH B		L FROM ROAD	AND
	26-2	8 29-31 32-					١			
G IF FLOWING, GIVE RATE	ET FEET D FEET FEET FEET S8-41 PUMP INTAKE	SET AT WATER AT END C	OF TEST 42		1				-7	
SOLUTION AND A CONTRACT OF FLOWING, GIVE RATE	GPM. UNP TYPE RECOMMENDED PUMP	- D FEET	2 CLOUDY				$, \downarrow \downarrow$	con	1	
SHALLO		26 FEET RATE	1 <i>0</i> gpm			0 to 15	· > -	CON		
FINAL	54 1 WATER SUPPLY	s 🗌 ABANDONED, INSUF			~	⁄ን 🐪				
STATUS OF WELL	2 OBSERVATION WE 3 TEST HOLE 4 REGATARGE WELL	6 ABANDONED POOR 7 UNFINISHED	QUALITY			99				
	55-56 1 DOMESTIC 2 STOCK	5 🗍 COMMERCIAL 6 🗍 MUNICIPAL	A		((7		Ruc	SEIL R	カ
WATER USE	3 ARRIGATION 4 3 NDUSTRIAL	 PUBLIC SUPPLY COOLING OR AIR CONDI 	TIONING			V			1211	_
	57 OTHER	9 🗌 NOT	USED							
METHOD	CABLE TOOL CABLE TOOL ROTARY (CONVEN CONVEN						1			
DRILLING		•		DRILLERS	REMARKS	Ņ	VARS			
	L CONTRACTOR	∧ ∪ic	ENCE NUMBER			58 CONTR		62 DATE RECEN	30187	63-68 80
HOLD RODRESS	GENIER WED	+ DAULING	2351		OF INSPECTION		INSPECTO		JUI01	
TA BAX H	-7 (ASSELLMA	WONT KON	A - JM B		PKS					
NAME OF DRIL NAME OF DRIL VON SIGNATURE OF	GENIER CONTRACTOR	SUBMISSION DATE	351	OFFICE						
hon	- K	DAY MO	YR,	ö			<u></u>			C. A.
MINICTE	RY OF THE ENVIRO	MENT COPY							FURMINU, US0	

Min of th	istry ne		Ţ		.				Water Reso		°C.O	PN
Ontario Env	ironment	SPACES PRO					222			сом.		
COUNTY OR DISTRICT	2. CHECK 🗵 CORP	ECT BOX WH							N. BLOCK TRACT. SU	14 15 RVEY ETC	<u> </u>	22 23 74 LOT 23-27
Ottawa,	Carleton			rland					7and 8	DATE COM		$\frac{2}{1}$
Jean Gau	uthier, Const.			rland,	Ont					DAY	2 мо _0	4 <u>vr_88</u>
21	ZONE BASTING		NORTHING		Ļ			(<u>-</u>	BASIN CODE	<u> </u>		
	L(DG OF O	VERBURDEN	AND BE	DROC	ск м	ATERIA	LS (SEE	INSTRUCTIONS		.	
GENERAL COLOUR	MOST COMMON MATERIAL		OTHER MAT	ERIALS				GENE	RAL DESCRIPTION		DEPTH FROM	· FEET TO
Brown	Hardpen	Bou	lders]	Hard			0	6
Grey	Gravel		lders					Loose	· · · · · · · · · · · · · · · · · · ·		6	9
Grey	Limestone	Roc	:k]	Hard			9	120
		·										
31		<u> </u>				<u>_</u>					<u> </u>	
						ليب						(
41 WA	TER RECORD	51	CASING & C	OPEN HO					E(S) OF OPENING OT NO)	31-33 DIAME	TER 34-38 L	
WATER FOUND AT - FEET	KIND OF WATER	INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	FROM	ЕРТН - F M	то	SCRE	TERIAL AND TYPE		INCHES DEPTH TO TOP OF SCREEN	FEET 41-44 30
70 ' 2	SALTY 4 IMINERALS 6 I GAS	10-11	1 STEEL 2 GALVANIZED 3 CONCRETE	4 00	0		13-16					FEET
	SALTY 4 I MINERALS 6 I GAS	6 2	4 DOPEN HOLE 5 DPLASTIC	1.88	0		40 20-23		I SET AT - FEET	MATERIAL AND	TYPE (CEME	NT GROUT
2] FRESH 3 □SULPHUR 24 4 □ MINERALS] SALTY 6 □ GAS	6	2 GALVANIZED 3 CONCRETE 4 GOPEN HOLE 5 PLASTIC		40		120	FROM	10-13 14-17			CKER. ETC)
2] FRESH 3 □ SULPHUR 4 4 □ MINERALS] SALTY 6 □ GAS	24-25	1 D STEEL 2 D GALVANIZED				27-30	0	18-21 40	Cement	Grout	
] FRESH 3 □SULPHUR 34 % 4 □ MINERALS] SALTY 6 □ GAS		3 CONCRETE 4 OPEN HOLE 5 PLASTIC						26-29 30-33	80		
71	HOD IO PUMPING RATE	0	11-14 DURATION OF PU	" <u>a</u> a '	17-18			İ	LOCATION	OF WEL	L	
STATIC LEVEL	WATER LEVEL 25	EVELS DURI	N G.	RS M PUMPING RECOVERY	uns		IN DIA LOT LI		LOW SHOW DISTAI		FROM ROAD A	v□ 2
	22-24 15 MINUTES	1	ES 45 MINUTES 29-31 32	60 MINUTE	5-37							
	120 FEET 70 FEET 38-47 PUMP INTAKE		FEET 90 FE WATER AT END C		EET 42							40
IF FLOWING. GIVE RATE	GPM 10 MP TYPE RECOMMENDED	-	FEET 1 CLEAR	2 🗌 CLOU 4	DY	-	<u> </u>	HF	RANK	KENNY	RD	D
G SHALLOW	DEEP SETTING	100	PUMPING FEET RATE	6	GPM		200			E		
FINAL	\$4 1 De WATER SUPPLY	• 🗆	ABANDONED, INSUF	FICIENT SUPPI			0	(-)	MILE-	-> +		161
STATUS OF WELL	2 OBSERVATION WEL	, 🗆	ABANDONED POOR UNFINISHED	QUALITY			3	<u> </u>		μ		E
	4 C RECHARGE WELL 5-56 1 DOMESTIC	5 🗌 cor								A K		A
WATER USE	2 🗋 STOCK 3 🗋 IRRIGATION 4 🔲 INDUSTRIAL		NICIPAL BLIC SUPPLY DLING OR AIR CONDI	TIONING						er	4	
	D OTHER		• 🗆 NOT	USED								4
METHOD OF	1 CABLE TOOL 2 A ROTARY (CONVENT		6 BORING 7 DIAMOND									
CONSTRUCTION	3 □ ROTARY (REVERSE 4 □ ROTARY (AIR) 5 □ AIR PERCUSSION)	 Detting Driving Digging 	D OTHER			RS REMARK	<.			260	030
NAME OF WELL	CONTRACTOR		WELL	CONTRACTO	- 11	> 50	TA	54		-62 DATE RECEIVED		63-68 80
ADDRESS St-Alb	d Well-Drillin	y		4646		oNL	TE OF INSPE	CTION	4646		2.4 198	8
St-Alb	ert Ontario			TECHNICIA	N'S		MARES					
Narcel	Reymond TECHyciany Sontractor	}-		0522		OFFICE			4			
Mai	~ Pama	<u></u>]	DAY 14 MO_	04 yr.	<u>88</u>	5			: 		<u> </u>	CIEC
MINISTRY	Y OF THE ENVIRO	NMENT	COPY							FO	RM NO. 0506 (1	1/86) FORM 9

Ministry of the	\ A/A T	The Ontario Water Resources Act ER WELL RE	
Ontario Environment			
	SPACES PROVIDED	10 14 15 CON BLOCK TRACT, SURVEY, ETC	DIN 1 000 22 23 24 LOT 23-27
ATTAILLA C. IT.	CumberLANd	CONC 8	20
	Cumber	RLAND ONT, DAV 2 ELEVATION RC BASIN CODE II	<u>8 мод 7 ук</u> 89,
1 2 M 10 12	17 18 24 25		
MOST	DG OF OVERBURDEN AND BEDROC		DEPTH - FEET
GENERAL COLOUR COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	FROM TO
BRAY Limestone		5077	120 112
·			
			,
			1 75 80 HETER 34-38 LENGTH 39-40
41 WATER RECORD	51 CASING & OPEN HOLE RI		INCHES FEET
$\begin{array}{c c} A & 1 & 7EE1 \\ \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$	INCHES INCHES FRU ¹ 10-11 1 DSTEEL	N TO MATERIAL AND TYPE	DEPTH TO TOP 41-44 30 OF SCREEN FEET
$\begin{array}{c c} & & & & & & \\ \hline & & & & & \\ \hline & & & & &$	2 □ GALVANIZED 3 □ CONCRETE 4 □ OPEN HOLE 5 □ PLASTIC	61 PLUGGING & SEA	LING RECORD
20-23 1 FRESH 3 SULPHUR 24 2 SALTY 6 GAS	17-14 1 STEEL 19 2 GALVANIZED 3 GOORETE 4 OPEN HOLE 1/20	20-23 DEPTH SET AT FEET MATERIAL AT FROM TO MATERIAL AT 10-13 14-17	O TYPE (CEMENT GROUT LEAD PACKER ETC.)
25-26 1 □ FRESH 3 □ SULPHUR 29 2 □ SALTY 6 □ GAS	24-25 1 D LASTIC 7	27:30 10:21 22:25	
30-33 1 □ FRESH 3 □ SULPHUR 34 4 □ MINERALS 2 □ SALTY 6 □ GAS	$ \begin{array}{c} 2 \Box GALVANIZED \\ 3 \Box CONCRETE \\ 4 \Box OPEN HOLE \\ 5 \Box PLASTIC \end{array} $	26-29 30-33 80	
71 PUMPING TEST NETHOD 10 PUMPING RAT	7 15-16 17-18	LOCATION OF WE	_ L
STATIC WATER LEVEL 25 LEVEL END OF WATER L	GPNHOURSHINS I DUMPING LEVELS DURING Z RECOVERY	IN DIAGRAM BELOW SHOW DISTANCES OF WELI LOT LINE INDICATE NORTH BY ARROW.	FROM ROAD AND
19-21 22-24 IS MINUTES 40 60 60 ²⁶⁻²	a <u>29-31</u> <u>32-34</u> <u>35-37</u>		1 N
	SET AT WATER AT END OF TEST 42		
IF FLOWING, GIVE RATE 30-41 PUMP INTAKE GIVE RATE GPM RECOMMENDED PUMP TYPE RECOMMENDED PUMP	PUMPING	É.	
SHALLOW DEEP SETTING		3	
FINAL 1 U WATER SUPPLY 2 OBSERVATION WE	 ABANDONED. INSUFFICIENT SUPPLY ABANDONED POOR QUALITY 	e	. 250F
STATUS J TEST HOLE OF WELL • WELL	7 UNFINISHED Dewatering	1 1 1	. 150 .
WATER 3 IRRIGATION	5 COMMERCIAL 6 D MUNICIPAL 7 D PUBLIC SUPPLY		Ţ
USE 4 D INDUSTRIAL	COOLING OR AIR CONDITIONING		
S7 CABLE TOOL	BORING TIONAL) 7 DIAMOND	FRANK KENNY	
OF 3 CONSTRUCTION CONSTRUCTION ROTARY (REVERSI CONSTRUCTION CONSTRUCTION CONSTRUCTION AIR PERCUSSION	E) I DETTING I DRIVING DIGGING OTHER	DRILLERS REMARKS	51997
NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S	DATA 58 CONTRACTOR 59.52 DATE RECEIVE	
HO DEND R Well DRÍ KODRESS ST-ALBERT ON NAME OF WELL TECHNICIAN	Hing.	DUUD AIG	091989
A ST-ALBERT ON	VIARIO		
Signature of Achine Contractor	1-0522 SUBNISSION DATE	OFFICE	
MINISTRY OF THE ENVIRON	DAY <u>J8 MO 07 YR</u> 89		ORM NO. 0506 (11/86) FORM 9

Ministry of Environment and Energy	The Ontario Water Resources Act WATER WELL RECORD
Print only in spaces provided. Mark correct box with a checkmark, where applicable.	1532869 Municipality Con.
OTTAWA CARLETON	10 14 15 22 23 24
County or District LVANE OHILLIP CUMBE	PLAND
Address 4918 FR	ANIC KENINY PUAN
	RC Elevation RC Basin Code III IV
	BEDROCK MATERIALS (see instructions) Depth – feet
General colour Most common material Other mate	rials General description From To
BROWN JUPSOIL	CLAV $1'7'$
Drumu PISSUREN DRUMU	
10 14 15 21 32 41 WATER RECORD 51 CASING & OPEN Water found Kind of water Inside Wall	HOLE RECORD Sizes of opening 31-33 Diameter 34-38 Length 39-40
at - feet Vind of water olam inches inches	Depth - feet Image: Control of the section of the s
15-10 1 □ Fresh ³ □ Sulphur ¹⁹ 2 4 0 Open hole	
2 □ Salty c □ Gas 17-18 1 □ Steel 19 20-23 1 □ Fresh 3 □ Sulphur 24 2 □ Galvanized	20-23 Control 20
23-24 \$ Gais 4 □ Open hole 23-24 \$ Grach 3 □ Sulphur ²⁹ 5 □ Plastic	From To Material and type (Cement grout, bentonite, etc.)
30-33 1 Fresh 3 Concrete 3 Concrete	27-30 27-30 27-30 27-30 27-30 28-29 28-29 20-33 80 5EALER
2 E Salty c □ Gas 4 □ Open hole 5 □ Plastic	26-29 30-33 80
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GILLES SARAULT T-21-24	CSS.ES2
Signature of Technician/Contractor Submission date	
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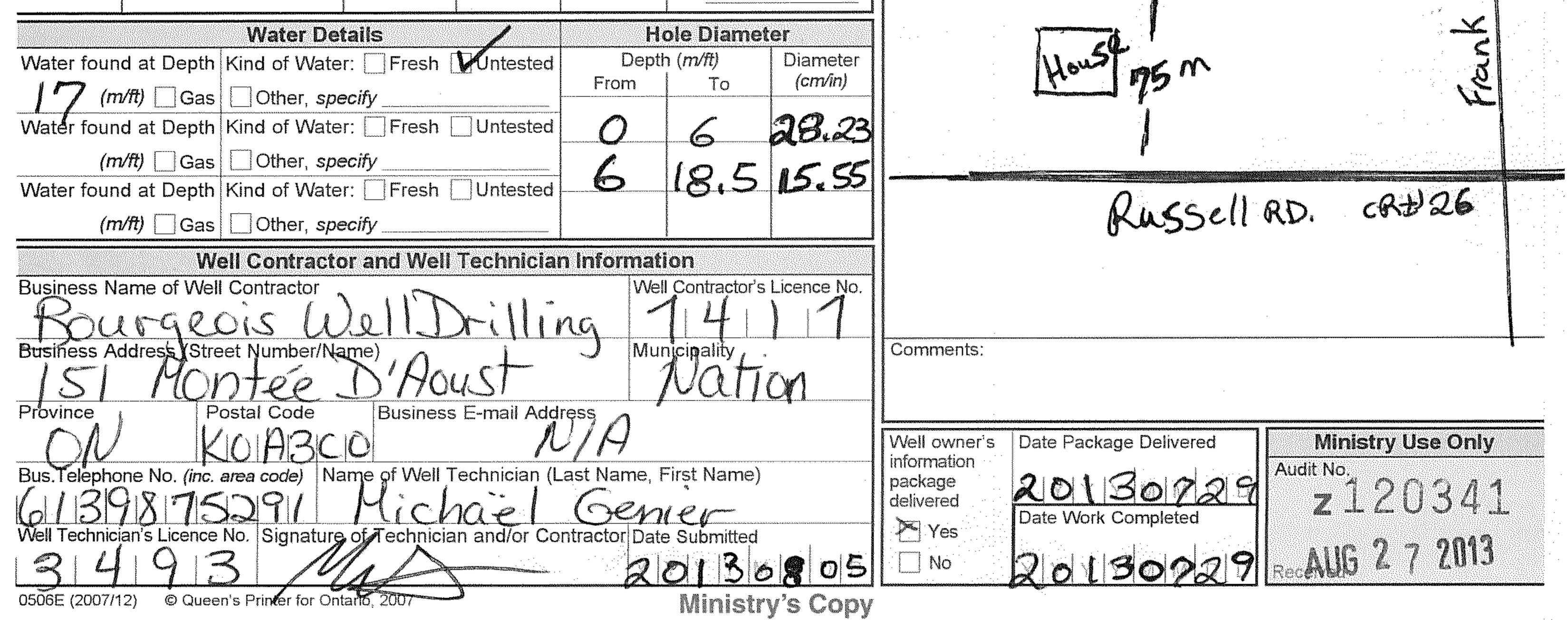
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Water found Kind of Water	Steel Fibregla	ss			hrs +2 min Final water level end	3 4.75 3	4.90
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	ethod of Construction			· · · · ·	100m/ 15120/2	J. O.	
Cable Tool Rotary (al	· · · · · · · · · · · · · · · · · · ·	=	Digging Other	M	0100	K K	
Rotary (reverse) Boring	Driving     Water Use				+5120 /2	<b>J</b>	
Domestic Industrial		upply	Other	5		~	
Stock Commerce		air conditioning		Audit No.		e Well Completed	MM DD
Water Supply Recharge well	Final Status of Well	ed 🔄 🗌 Abandor	ped (Other)	Was the well ov		e Delivered YYYY	MM DD
Observation well Abandoned, ir	nsufficient supply	ing		package delivere			
Test Hole Abandoned, p Well Contr				Dette 0	Ministry Uso		
Name of Well Contractor	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Well Contractor's Lie	cence No.	Data Source		ntractor 1414	
Business Address (street name, pumbe	r oity oto )			Date Received		te of Inspection YYYY	MM DD
	A, CILY BIC.)			CFD n	1 2005	I	
Name of Well Technician (last name, fir	one	Well Technician's Li	cence No. 2	SEP 0 Remarks	1 2005   we	I Record Number	
STATON Name of Well Technician (last name, fir Signature of Upphaleiem/Gentractor	one	Well Technician's Li	MM, DD		1 2005   We	I Record Number	

Ontario	Ministry of the Environr	nent	Well Tag Nc	A106049	Regulation 903 On		Record sources Act
Measurements recorded in	: Metric					Page	of
The second state of the se	a preside	tmaranna X	En la constant anna da a da		99929		

Address of Well Loc	ation (Street Number/Na	me) T	ownship Cumber	Lot Davad Lot	) Concess	sion	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
County/District/Mun	icipality	C	ity/Town/Village	<u>ILAYIQ</u>	Province Ontario	Postal	
UTM Coordinates Z	کے one Easting	Northing N	Iunicipal Plan and Suble	ot Number	Other		TOHU
NAD 8 3	844016	15024514					
Overburden and " General Colour	Sedrock Materials/Aba Most Common Mate	ndonment Sealing Reco erial Oth	r <b>a</b> ( <i>see instructions on the</i> er Materials	General Descriptio	n	Dep From	th ( <i>m/ft</i> )   To
Broch	- Las	5:1-	ŀ	Hard		$\frown$	4.5
Crey	lineston.			Jayered		4.5	18.5
						*       	
		······································					
	Ann	ular Space		······································	/ell Yield Testii		
Depth Set at ( <i>m/ft)</i> From   To	, · · ·	Sealant Used a <i>l and Type</i> )	Volume Placed (m³/ft³)	After test of well yield, water was:	Time Water L		ecovery Water Level
6	cinen	t arout	.2m ³	Other, <i>specify</i> If pumping discontinued, give reason	( <i>min</i> ) ( <i>m/ft</i> ) Static	) (min)	(m/ft)
				In pumping disconditional, give reason	$\frac{ \text{Level}_{1} }{1} = \frac{2}{2} C$	1	$\frac{2}{101}$
				Pump intake set at (m))	$-\frac{1}{2}$	1 2	TA
				16	$-\frac{2}{3}$	7 3	4.04
	Construction		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Pumping rate (I/min) GPM)	$\begin{vmatrix} 1 \\ 4 \\ 1 \end{vmatrix}$	2 $4$	430
Cable Tool		Public Comme Domestic Municipa	al Dewatering	Duration of pumping	540	25	4 H
Rotary (Reverse) Boring	Driving L Digging C	Livestock Test Ho	le Monitoring & Air Conditioning	Final water level end of pumping	$\overline{v}$ 10 $\zeta$ $\zeta$		221
Air percussion Other, <i>specify</i>		] Industrial ] Other, <i>specify</i>	······································	5.37 If flowing give rate (I/min / GPM)	15 207	15	2.57
	onstruction Record -		Status of Well		20 Cf 7	3 20	227
Diameter (Galvai	Hole OR Material   Wall nized, Fibreglass,   Thickne te, Plastic, Steel)   <i>(cm/ir</i>	988	Water Supply	Recommended pump depth (m/)	25 Cf X	F 25	2.22
	· · · · · · · · · · · · · · · · · · ·	8 4 / C		Recommended pump rate	30 49	30	3.22
$\left  \begin{array}{c} D_{1} \\ D_{1} \\ P_{1} \\ P_{2} \\ P_{3} \\ P_{3$	steel of	0.000	Dewatering Well     Observation and/or	Well production (I/min / GPM)	40 5,1	<b>4</b> 0	3.22
15.55 Ope	nacole	0 18.2	- Monitoring Hole		50 52	S 50	3.22
	······		<ul> <li>(Construction)</li> <li>Abandoned,</li> </ul>	Disinfected?	60 5.3	<b>4</b> 60	3.22
	Construction Record -	Screen	Insufficient Supply	\$424}+;~;+;+;+;+;+;+;+;+;+;+;+;+;+;+;+;+;+;+	Vell Location	B B	
Outside Diameter <i>(cm/in)</i> (Plastic,	Material Galvanized, Steel) Slot N	lo.   Depth ( <i>m/ft</i> ) From   To	Water Quality	Please provide a map below following	g instructions on th	те раск.	2 MA
			specify	B. M.			2
			Other, <i>specify</i>	$\dot{2}$ , $\sigma$ ,	2001	m	2



Ministry of the Environ and Climate Change Measurements recorded in: XMetric Imp	O D D C C	: A 2 3 6 2 3 5 アース [ Regulation 9	Well Record 03 Ontario Water Resources Act
		25	Page of
Well Owner's Information           First Name         Last Name / Org           25722		E-mail Address N/A	Well Constructed by Well Owner
Mailing Address (Street Number/Name) 2930 French Hill Well Location	Road Cumberla	MO ON Postal Code	Telephone No. (inc. area code)
Address of Well Location (Street Number Name)	Township	Lot	Concession
County/District/Municipality	City/Tpwn/Village		rovince Postal Code
UTM Coordinates Zone Easting			Intario K4B1J4
NAD 8 3 18 97698550 Overburden and Bedrock Materials/Abandonn	24552 hent Sealing Record (see instructions on the	e back of this form)	
General Colour Most Common Material	Other Materials	General Description	Depth ( <i>m/ft</i> ) From To
Brown clay	Silt	Hard	0 3.1
Grew Stan	SEL	Hard	3.1 4.8
3 share		- ogli coi	1.0 36.6
Depth Set at (m/ft) Type of Sealan	t Used Volume Placed	Results of Well After test of well yield, water was:	Draw Down Recovery
From To (Material and T 6.2 B ciment	<u>уре)</u> (m³/ft³)	Other, specify	Water Level         Time         Water Level           min)         (m/ft)         (min)         (m/ft)
bid & Cinter s	grow and	I Dumping discontinued, dive reason.	tatic evel 1.48 3.50
		Pump intake set at (m))	12.29 13.04
		Pumping rate (Think GPM)	2 2.51 2 2.69
Method of Construction           Cable Tool         Diamond         Public	Well Use	60	4 2.72 4 2.09
Rotary (Conventional)       Jetting         Rotary (Reverse)       Driving         Livesto		Duration of pumping hrs +min	5 2.78 5 1.98
Boring     Digging       Air percussion     Industri	lal	Final water level end of pumping (m/ft)	10 2.97 10 1. 70
Other, specify Other, Construction Record - Casing	and the second		15 3_1/ 15 1.52
Inside Diameter (Galvanized, Fibreglass, Thickness	Depth (m/ft)     Prom       To     Replacement Well	Recommended pump depth (m/ft)	20 2.2 20 1.51
(cm/in) Concrete, Plastic, Šteel) (cm/in) 15,55 Steel .48 t	Image: Note of the second seco	Recommended nump rate	30 2 22 30 1 49
15.53 Open Hole 6	2 36.6 Dewatering Well		40 3.41 40 1.49
opacine o	Monitoring Hole	1 PA	50 3.47 50 1.49
	Abandoned,		60 3,50 60 1.49
Outside Material Stot No.	Depth ( <i>m/ft</i> ) Water Quality	Map of Well Please provide a map below following	
	From To Abandoned, other, specify		~ 1
	Other, specify	N.V.	.11
Water Details	Hole Diameter	2 175 M	- well
Water found at Depth Kind of Water: Fresh XU ( <i>m/ft</i> ) Gas Other, specify	ntested Depth ( <i>m/ft</i> ) Diameter From To ( <i>cm/in</i> )		
Water found at Depth Kind of Water: Fresh U ( <i>m/ft</i> ) Gas Other, specify	0 011-0- (6 (	2	95 m
Water found at Depth Kind of Water: Fresh U	ntested 6.2 36.6 15.55	12	-15-11-
(m/ft) Gas Other, specify Well Contractor and Well Tec	hnician Information		
Business Name of Well Contractor	014 Well Contractor's Licence No.	Russ	sell RD.
Business Addreess (Street Number/Name)	Muhicipality	Comments	
Province Postal Code Business E-r		Wall outports Date Desires Date	Minister II 0
	nician (Last Name, First Name)	Well owner's information package delivered	Audit No. <b>Z</b> 276175
Well Technician's Licence No. Signature of Technician an	d/or Contractor Date Submitted	Yes Date Work Completed	
3 4 4 3  0506E (2014/11)	Ministry's Copy	□ No 2018012	© Queen's Printer for Ontario, 2014

APPENDIX B Pump Test Data

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#### Pump Test Data

Hydrogeolgical Assessment and Terrain Analysis For Proposed Commercial Development 8015 Russell Road, Ottawa (Vars), Ontario

LRL File No. 170254

	Technician: A. Sare
A236235	Pump Depth (m): 29.5
36.6	Start Time: 8:09 AM 01.24.2018
	End Time: 3:25:00 PM 01.25.2018
0.16	Average Pump Rate (L/min): 44 L/min & 26 L/min
1.48	
	36.6  0.16

						Field Pa	arameters		
Time ¹ (min)	Water Level (Pump In) (m BTC)	Drawdown (m)	Flow Rate (L/min)	Turbidity (NTU)	Residual Chlorine (mg/L)	Colour (TCU)	рН	Conductivity (μs)	Total Dissolved (mg/L)
0.0	1.48	0.00	44						
0.3	1.80	0.32							
1	1.94	0.46							
1.5	2.05	0.57							
2	2.14	0.66							
2.5	2.21	0.73							
3	2.27	0.79							
3.5	2.32	0.84							
4	2.36	0.88							
4.5	2.41	0.93							
5	2.43	0.95							
6	2.49	1.01							
7	2.53	1.05							
8	2.59	1.11							
9	2.64	1.16							
10	2.68	1.20							
15	2.82	1.34							
20	2.93	1.45							
25	2.98	1.50							
30	3.04	1.56							
40	3.12	1.64							
50	3.17	1.69							
60	3.21	1.73	44	38.4	0.01	519	8.50	1787	849
120	3.30	1.82	44	43.7	0.00	573	9.16	728	364
180	3.34	1.86	40	44.0	0.00	562	9.08	677	336
240	3.35	1.87	56	40.6	0.02	523	9.04	587	294
300	3.36	1.88	44	36.7	0.01	477	9.24	611	304
360	3.37	1.89	48	34.4	0.00	452	9.27	530	278
420	3.37	1.89	48	32.6	0.00	410	9.19	528	257
480	3.37	1.89	48	29.8	0.02	398	9.00	511	255
480.5	2.67	1.19	26						
756	2.52	1.04							
1316	2.52	1.04	28	9.4	0.02	79	9.20	533	267
1650	2.53	1.05	26	7.8	0.02	61	7.84	1392	695
1710				7.2		63			
1770	2.53	1.05	24	7.2		54	8.77	759	383
1880				7.0		44	8.75	510	255
1860	2.53	1.05	28	7.0	0.01	46	9.04	518	292
Recovery				% Recovery					
1876	2.53	1.05		44.4					
1935	1.54	0.06		96.8					
1946	1.53	0.05		97.4					
1965	1.52	0.04		97.9					

1 Time elapse from pump turning on. BTC: Below Top of Casing NM: Not Measured

APPENDIX C Laboratory Analysis



RELIABLE.

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# Certificate of Analysis

## LRL Associates Ltd.

5430 Canotek Road Ottawa, ON K1J 9G2 Attn: Andrea Sare

Client PO: Project: 170254 Custody: 7339

Report Date: 31-Jan-2018 Order Date: 25-Jan-2018

Order #: 1804341

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

#### Paracel ID **Client ID**

1804341-01	8015 Russell Rd-3hr
1804341-02	8015 Russell Rd-8hr
1804341-03	8015 Russell Rd-31hr

Approved By:

Mark Foto

Mark Foto, M.Sc. Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



## **Analysis Summary Table**

Report Date: 31-Jan-2018 Order Date: 25-Jan-2018

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	25-Jan-18	25-Jan-18
Ammonia, as N	EPA 351.2 - Auto Colour	29-Jan-18	29-Jan-18
Anions	EPA 300.1 - IC	26-Jan-18	27-Jan-18
Colour	SM2120 - Spectrophotometric	25-Jan-18	25-Jan-18
Conductivity	EPA 9050A- probe @25 °C	25-Jan-18	25-Jan-18
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	30-Jan-18	31-Jan-18
E. coli	MOE E3407	25-Jan-18	25-Jan-18
Fecal Coliform	SM 9222D	25-Jan-18	25-Jan-18
Heterotrophic Plate Count	SM 9215C	25-Jan-18	25-Jan-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	29-Jan-18	29-Jan-18
рН	EPA 150.1 - pH probe @25 °C	25-Jan-18	25-Jan-18
Phenolics	EPA 420.2 - Auto Colour, 4AAP	26-Jan-18	26-Jan-18
Subdivision Package	Hardness as CaCO3	29-Jan-18	29-Jan-18
Sulphide	SM 4500SE - Colourimetric	26-Jan-18	26-Jan-18
Tannin/Lignin	SM 5550B - Colourimetric	25-Jan-18	25-Jan-18
Total Coliform	MOE E3407	25-Jan-18	25-Jan-18
Total Dissolved Solids	SM 2540C - gravimetric, filtration	26-Jan-18	30-Jan-18
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	26-Jan-18	26-Jan-18
Turbidity	SM 2130B - Turbidity meter	26-Jan-18	25-Jan-18



Order #: 1804341

Report Date: 31-Jan-2018 Order Date: 25-Jan-2018

Project Description: 170254

	Client ID:	8015 Russell Rd-3hr	8015 Russell Rd-8hr	8015 Russell Rd-31hr	-
	Sample Date: Sample ID:	24-Jan-18 1804341-01	24-Jan-18 1804341-02	25-Jan-18 1804341-03	-
	MDL/Units	Drinking Water	Drinking Water	Drinking Water	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	ND	ND	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	1	-
Total Coliforms	1 CFU/100 mL	ND	ND	ND	-
Heterotrophic Plate Count	10 CFU/mL	<10	<10	<10	-
General Inorganics			•		
Alkalinity, total	5 mg/L	229	230	235	-
Ammonia as N	0.01 mg/L	0.81	0.78	0.83	-
Dissolved Organic Carbon	0.5 mg/L	1.6	0.8	2.4	-
Colour	2 TCU	18	9	3	-
Conductivity	5 uS/cm	521	519	531	-
Hardness	mg/L	6.3	7.9	8.6	-
рН	0.1 pH Units	8.7	8.7	8.6	-
Phenolics	0.001 mg/L	<0.001	<0.001	<0.001	-
Total Dissolved Solids	10 mg/L	332	324	320	-
Sulphide	0.02 mg/L	1.42	1.56	1.38	-
Tannin & Lignin	0.1 mg/L	1.1	1.1	1.4	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.9	0.8	0.7	-
Turbidity	0.1 NTU	55.4	40.5	8.3	-
Anions					
Chloride	1 mg/L	23	22	23	-
Fluoride	0.1 mg/L	0.5	0.4	0.4	-
Nitrate as N	0.1 mg/L	<0.1	<0.1	<0.1	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.25 [1]	-
Sulphate	1 mg/L	25	25	26	-
Metals					
Calcium	0.1 mg/L	1.6	1.7	2.3	-
Iron	0.1 mg/L	0.4	0.8	<0.1	-
Magnesium	0.2 mg/L	0.6	0.9	0.7	-
Manganese	0.005 mg/L	0.020	0.020	0.017	-
Potassium	0.1 mg/L	3.0	4.1	3.5	-
Sodium	0.2 mg/L	100	101	97.4	-



Order #: 1804341

Report Date: 31-Jan-2018

Order Date: 25-Jan-2018

Project Description: 170254

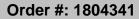
## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						



## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	22.8	1	mg/L	22.8			0.1	10	
Fluoride	0.46	0.1	mg/L	0.46			0.6	10	
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	25.0	1	mg/L	24.8			0.7	10	
General Inorganics									
Alkalinity, total	27.2	5	mg/L	27.5			1.0	14	
Ammonia as N	0.020	0.01	mg/L	0.032			47.9	17.7	QR-01
Dissolved Organic Carbon	11.5	0.5	mg/L	10.2			12.4	37	
Colour	ND	2	TCU	ND				12	
Conductivity	137	5	uS/cm	137			0.5	11	
рН	7.1	0.1	pH Units	7.2			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	52.0	10	mg/L	52.0			0.0	10	
Sulphide	ND	0.02	mg/L	ND				10	
Tannin & Lignin	0.2	0.1	mg/L	0.2			0.0	11	
Total Kjeldahl Nitrogen	0.98	0.1	mg/L	0.88			11.1	10	QR-01
Turbidity	0.5	0.1	NTU	0.5			1.9	10	
Metals									
Calcium	14.2	0.1	mg/L	14.4			1.5	20	
Iron	ND	0.1	mg/L	ND			0.0	20	
Magnesium	2.2	0.2	mg/L	2.3			5.9	20	
Manganese	ND	0.005	mg/L	ND			0.0	20	
Potassium	0.7	0.1	mg/L	0.7			4.1	20	
Sodium	3.8	0.2	mg/L	4.1			6.2	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	ND	10	CFU/mL	30			0.0	30	



Report Date: 31-Jan-2018 Order Date: 25-Jan-2018

Project Description: 170254



## Method Quality Control: Spike

Project Description: 170254
Order Date: 25-Jan-2018
Report Date: 31-Jan-2018

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	32.2	1	mg/L	22.8	94.5	78-112			
Fluoride	1.36	0.1	mg/L	0.46	90.5	73-113			
Nitrate as N	0.99	0.1	mg/L	ND	98.8	81-112			
Nitrite as N	0.982	0.05	mg/L	ND	98.2	76-117			
Sulphate	34.0	1	mg/L	24.8	92.0	75-111			
General Inorganics									
Ammonia as N	0.273	0.01	mg/L	0.032	96.4	81-124			
Dissolved Organic Carbon	11.5	0.5	mg/L	0.8	106	60-133			
Phenolics	0.026	0.001	mg/L	ND	105	69-132			
Total Dissolved Solids	106	10	mg/L		106	75-125			
Sulphide	0.45	0.02	mg/L	ND	90.8	79-115			
Tannin & Lignin	1.0	0.1	mg/L	0.2	82.4	71-113			
Total Kjeldahl Nitrogen	3.01	0.1	mg/L	0.88	107	81-126			
Metals									
Calcium	883		ug/L		88.3	80-120			
Iron	851		ug/L	15	83.7	80-120			
Magnesium	2920		ug/L	2290	62.5	80-120		Q	M-07
Manganese	55.4		ug/L	2.90	105	80-120			
Potassium	1560		ug/L	729	83.5	80-120			
Sodium	962		ug/L		96.2	80-120			

### Order #: 1804341



#### Sample Qualifiers :

1: Elevated Reporting Limit due to matrix interference.

#### QC Qualifiers :

- QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.
- QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

#### **Sample Data Revisions**

None

#### Work Order Revisions / Comments:

None

#### **Other Report Notes:**

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.



RELIABLE.

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# Certificate of Analysis

## LRL Associates Ltd.

5430 Canotek Road Ottawa, ON K1J 9G2 Attn: Andrea Sare

Client PO: Project: 170254 Custody: 29955

Report Date: 23-Jan-2018 Order Date: 19-Jan-2018

Order #: 1803451

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1803451-01	TP1
1803451-02	TP2
1803451-03	TP3
1803451-04	TP4

Approved By:

Mark Foto

Mark Foto, M.Sc. Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Order #: 1803451

Report Date: 23-Jan-2018 Order Date: 19-Jan-2018

Project Description: 170254

## **Analysis Summary Table**

Analysis	Method Reference/Description	Extraction Date Analysis Date
Ammonia, as N	EPA 351.2 - Auto Colour	22-Jan-18 22-Jan-18
Anions	EPA 300.1 - IC	19-Jan-18 20-Jan-18
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	23-Jan-18 23-Jan-18



Order #: 1803451

Report Date: 23-Jan-2018 Order Date: 19-Jan-2018

Project Description: 170254

	Client ID:	TP1	TP2	TP3	TP4
	Sample Date:	18-Jan-18	18-Jan-18	18-Jan-18	18-Jan-18
	Sample ID:	1803451-01	1803451-02	1803451-03	1803451-04
	MDL/Units	Water	Water	Water	Water
General Inorganics					
Ammonia as N	0.01 mg/L	1.03	10.7	1.48	0.33
Total Kjeldahl Nitrogen	0.1 mg/L	13.8	20.7	15.3	5.7
Anions				-	• •
Nitrate as N	0.1 mg/L	<0.1	0.3	<0.1	<0.1
Nitrite as N	0.05 mg/L	<0.05	0.97	<0.25 [1]	<0.05



Order #: 1803451

Report Date: 23-Jan-2018 Order Date: 19-Jan-2018

Project Description: 170254

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions Nitrate as N Nitrite as N	ND ND	0.1 0.05	mg/L mg/L						
General Inorganics Ammonia as N Total Kjeldahl Nitrogen	ND ND	0.01 0.1	mg/L mg/L						



Order #: 1803451

Report Date: 23-Jan-2018

Order Date: 19-Jan-2018

Project Description: 170254

## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	0.24	0.1	mg/L	0.26			6.0	20	
Nitrite as N	0.057	0.05	mg/L	0.057			0.0	20	
General Inorganics									
Total Kjeldahl Nitrogen	34.6	2.0	mg/L	40.2			15.0	10	QR-05



Order #: 1803451

Report Date: 23-Jan-2018 Order Date: 19-Jan-2018

Project Description: 170254

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	1.23	0.1	mg/L	0.26	97.0	81-112			
Nitrite as N	1.09	0.05	mg/L	0.057	103	76-117			
General Inorganics									
Ammonia as N	0.245	0.01	mg/L		98.1	81-124			
Total Kjeldahl Nitrogen	1.97	0.1	mg/L		98.5	81-126			



#### Sample Qualifiers :

1: Elevated Reporting Limit due to matrix interference.

#### QC Qualifiers :

QR-05 : Duplicate RPDs higher than normally accepted. Remaing batch QA\QC was acceptable. May be sample effect.

## Sample Data Revisions

None

#### Work Order Revisions / Comments:

None

### **Other Report Notes:**

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference. APPENDIX D Test Pit Logs



Project No.: 170254

Client: Bob Cousins

Date: January 18, 2018

Excavation Method: Hydraulic Shovel

Location: 8015 Russell Road, Ottawa (Vars), Ontario

Project: Hydrogeological Assessment & Terrain Analysis

Field Personnel: AS

S	UBSURFACE PROFILE	SAN	<b>IPLE</b>	DATA				Wet	er Cor	tont			
Depth	Soil Description	Elev./Depth (m)	Lithology	Sample Number	× (kl	<b>Strength</b> ² a) × 150 200	▼	25	(%) 50 uid Li (%) 50	⊽ 75	Wate (Stand Open Ex	lpipe	e or
$\begin{array}{c} 0 \\ \hline m \\ 0 \\ \hline m \\ 1 \\ \hline m \\ 2 \\ \hline m \\ 1 \\ \hline m \\ 2 \\ \hline m \\ 1 \\ \hline m \\ 2 \\ \hline m \\ 1 \\ \hline m \\$	Ground Surface TOPSOIL Sandy loam, dark brown, dry. FILL Sand and gravel, brown, some brick and concrete debris (ranging from 0.3 m to 0.9 m), moist. Water found at 1.29 m bgs. SILTY CLAY Trace fine to medium grained sand, dark grey, wet, weathered in appearance. End of Test Pit	99.52 1.29 97.92 2.89		TP1-1 TP1-2 TP1-3									0.45 m bgs January 18, 2018
Eastin	g: 470572 N	lorthing:	50245 <i>°</i>	10		BGS: Below	Gro	und Su	rface				
Groun		op of Ri	ser Elev	<b>v.:</b> 101.64	0 m)	submitted for	or ger	neral ch	nemistry	/ and nutrier	18, 2018 and nts paramete I Ammonia).		
Excav	ation Width: 1.6 m E	xcavatio	on Leng	<b>)th:</b> 4.2 m	. 4.2 m								



Project No.: 170254

Client: Bob Cousins

Date: January 18, 2018

Excavation Method: Hydraulic Shovel

Project: Hydrogeological Assessment & Terrain Analysis

Location: 8015 Russell Road, Ottawa (Vars), Ontario

Field Personnel: AS

S	UBSURFACE PROFILE	SAN	<b>IPLE</b>	DATA				ater Con	4 4	
Depth	Soil Description	Elev./Depth (m)	Lithology	Sample Number	Shear S × (kl 50 100	$ \begin{array}{c cccc} \hline & (\%) & \hline \\ & 25 & 50 & 75 \\ \hline \\ & \\ \hline \\ & \\ Liquid Limit \\ \hline \\ & (\%) & \hline \\ & 25 & 50 & 75 \\ \hline \end{array} $			Water Level (Standpipe or Open Excavation)	
$\begin{array}{c} 0 \\ \hline m \\ 0 \\ \hline m \\ 1 \\ 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 1$	Ground Surface TOPSOIL Sandy loam, dark brown, dry. FILL Sand and gravel, reddish-brown, some brick and concrete debris (ranging from 0.9 m to 1.2 m), dry to moist. Wood debris found at 1 m bgs. Water found at 1.2 m bgs. SAND Fine to medium grained sand with some silt and clay, trace fine gravel, dark grey, wet, increase in clay content with depth. End of Test Pit Ground Test Pit	99.50 1.98 99.28 2.20		TP2-1 TP2-2 TP2-3		BGS: Below	Ground S			0.70 m bgs January 18, 2018
										ad of toot pit
	atum: Property pin by south-west entrar dsurface Elevation: 101.476			oad (100.0) <b>v.:</b> 102.236		Groundwate	r sample	collected of	on January [.]	
-				<b>jth:</b> 3.9 m		Groundwater sample collected on January 18, 2018 and submitted for general chemistry and nutrients parameters (Nitrate, Nitrite, Total Kjeldahl Nitrogen and Ammonia).				



Project No.: 170254

Client: Bob Cousins

Date: January 18, 2018

Excavation Method: Hydraulic shovel

Project: Hydrogeological Assessment & Terrain Analysis

Location: 8015 Russell Road, Ottawa (Vars), Ontario

Field Personnel: AS

	S	UBSURFACE PROFILE	SA	MPLE	DATA						
Denth		Soil Description	Elev./Depth (m)	Lithology	Sample Number	× (kl	<b>Strength</b> Pa) × 150 200	▼ 25	ter Cont (%) 50 quid Lin (%) 50	⊽ 75	Water Level (Standpipe or Open Excavation)
0 ft	m _ 0	Ground Surface	101.66 0.00						1		
- - - 1 -	-	FILL Sand and gravel, brown, trace clay & brick debris, dry.	0.00		TD2.4						
	_		101.06	<b>;</b> ; ;	TP3-1						018
2 - - 3	_	<b>SILTY CLAY</b> Some fine to medium grained sand, trace fine gravel, dark grey, wet at 2.1 m bgs, weathered appearance.	0.60		TP3-2						1.48 m bgs January 18, 2018
- - - 4	- 1 -			# # # #							3 m bgs Jar
- - 5- -	_										1.48 m
- 6 - - -	- - 2										
7	_		99.26 2.40	H H H H	TP3-3						
8_ - -	_	End of Test Pit	2.40								
9   -	-										
10 	- 3										
- - 11	-										
- - 12	-										
- - 13	-										
E	astin	g: 470441 N	Northing	: 502454	42	1	BGS: Below	v Ground S	urface		1
s	ite Da	atum: Property pin by south-west entrar	nce off Ru	ussell R	oad (100.0		submitted for	or general c	hemistry	and nutrie	18, 2018 and nts parameters d Ammonia).
G	Foun	dsurface Elevation: 101.656	op of Ri	ser Elev	<b>v.:</b> 102.286	3		nie, rulai N	Joindin N	augen alle	27 minonaj.
E	xcava	ation Width: 1.6 m E	Excavatio	on Leng	<b>,th:</b> 4.2 m						



Project No.: 170254

Client: Bob Cousins

Date: January 18, 2018

Excavation Method: Hydraulic shovel

Project: Hydrogeological Assessment & Terrain Analysis

Location: 8015 Russell Road, Ottawa (Vars), Ontario

Field Personnel: AS

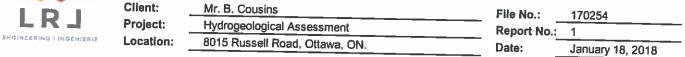
S		SA	<b>NPLE</b>	DATA						
Depth	Soil Description	Elev./Depth (m)	Lithology	Sample Number	× (kl	<b>Strength</b> Pa) × 150 200	▼ 25	er Content (%) ⊽ 50 75 uid Limit (%) □ 50 75	Water Level (Standpipe or Open Excavation)	
0 ft m	Ground Surface	101.46								
- - - 1 - - - - - - - - - - - - - - - -	FILL Sand and gravel, dark brown, trace cobbles and boulders trace to some wood & brick debris, dry to moist.	0.00		TP4-1					y 18, 2018	
3									1.55 m bgs January 18, 2018	
6				TP4-2						
	<b>SILTY CLAY</b> Trace to some fine to medium grained sand, dark grey, moist to wet at 1.5 m bgs, weathered in appearance.	99.55		TP4-3						
8—	End of Test Pit	99.05 2.40								
9										
10 3									-	
 - - 11 -									-	
12									-	
- - 13 -									_	
Eastin	<b>g</b> : 470490	Northing	: 502445	52		BGS: Below	Ground Su	face		
Groun		Top of Ri	ser Elev	oad (100.0 <b>v.:</b> 102.005 <b>)th:</b> 4.2 m		Groundwater sample collected on January 18, 2018 and submitted for general chemistry and nutrients parameters (Nitrate, Nitrite, Total Kjeldahl Nitrogen and Ammonia).				

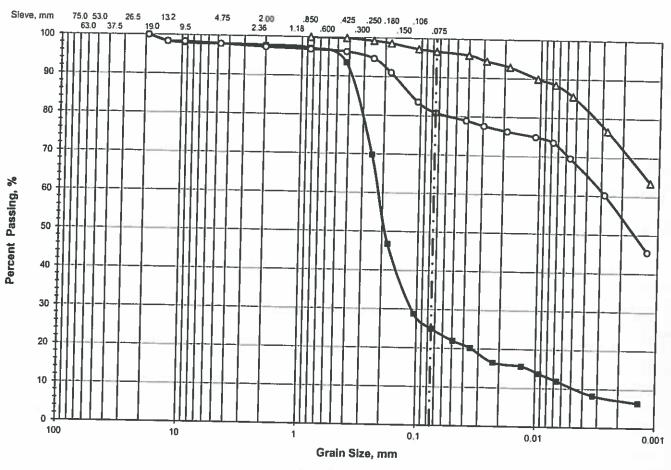
APPENDIX E

Sieve/Hydrometer Analysis Results

## LRL Associates Ltd. PARTICLE SIZE ANALYSIS

ASTM D 422 / LS-702





Unified Soll Classification System

	> 75 mm	% GR	AVEL		% SAND	)	% FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt	
Δ	0.0	0.0	0.0	0.0	0.2	3.1	26.2	Clay
	0.0	0.0	2.2	0.1	4.2	68.5		70.5
0	0.0	0.0	2.1	0.7	0.9	15.5	<u>18,0</u> 	7.0
							26.2	52.7

	Location	Sample	Depth, m	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀		
	TP1	Sa 2	1.57				- 15	<u> </u>		C _u
	TP2	Sa 2	1,98	0.2201	0.1898	0.1108	0.0118	0.0049	11.4	44.0
0	TP3	Sa 2	0.61	0.0028	0.0017			0,0049	11.4	44.9
L L										

APPENDIX F Septic Design

## Schedule 1: Designer Information

Use one form for each individual who	reviews and takes re	esponsibility for design acti	vities with respect b	o the project.
A. Project Information				
Building number, street name	SSEZL ROX	<del>-</del>	Unit no.	Lot/con,
dunkcipality GTTAWA	Postal code	Plan number/ other des	cription	
3. Individual who reviews and	takes responsibil			
Name P. SAVAPID		FITT MLENSION	IAL ANAL	4515
Street address	SIZNWARL CU	ENTLER ROAD	Unit no.	Lot/con.
LENE SAULT	Postal code	(Province	E-mail	
eleptione number 613) 362 - 8312	Fax number		Cell number	
. Design activities undertaken livision C]	n by individual ide	ntified in Section B. [I	Building Code Tr	able 3.5.2.1. of
House	HVAC	- House	Building	Structural
Small Buildings	Building	g Services		- House
Largo Buildings	Detecti	on, Lighting and Power	Plumbing	- All Buildings
Complex Buildings escription of designer's work	Fire Pro	otection		Sewage Systems
I review and take respon	t name) sibility for the design	work on behalt of a firm re	gistered under subs	ection 3.2.4.of Divisio
C, or the Building Code. Individual BCIN:		e firm is registered, in the a	appropriate classes	/categories.
Firm BCIN:	43452			
I review and take respon- under subsection 3.2.5.c Individual BCIN:	sibility for the design a f Division C, of the Bu	and am qualified in the app uilding Code.	propriate category a	s an 'other designer"
Basis for exemption	from registration:	The second second		
	pt from the registratio from registration and	n and cualification require qualification:	ments of the Buildin	g Code.
pertify that:				
<ol> <li>The information contained in</li> <li>I have submitted this applicat</li> </ol>			8	
Data Dec 28,	-	Signature of Designar	H)	
IOTE:			14	
For the purposes of this form, "individ	ual" means the "person"	referred to in Clause 3.2.4.7(1	(c).of Division C, Art	cle 3.2.5.1. of Division C
all other persons who are exempt from	n qualification under Sut	osections 3.2.4, and 3.2.5 of C	J vision G.	THE REAL PROPERTY OF THE PROPERTY OF THE REAL PROPE

2. Schedule 1 is not required to be completed by a holder of a license, temporary license, or a contificate of practice, issued by the Ontaric Association of Architects. Schedule 1 is also not required to be completed by a holder of a license to practise, a limited license to practise, or a certificate of authorization, issued by the Association of Professional Engineers of Ontario.

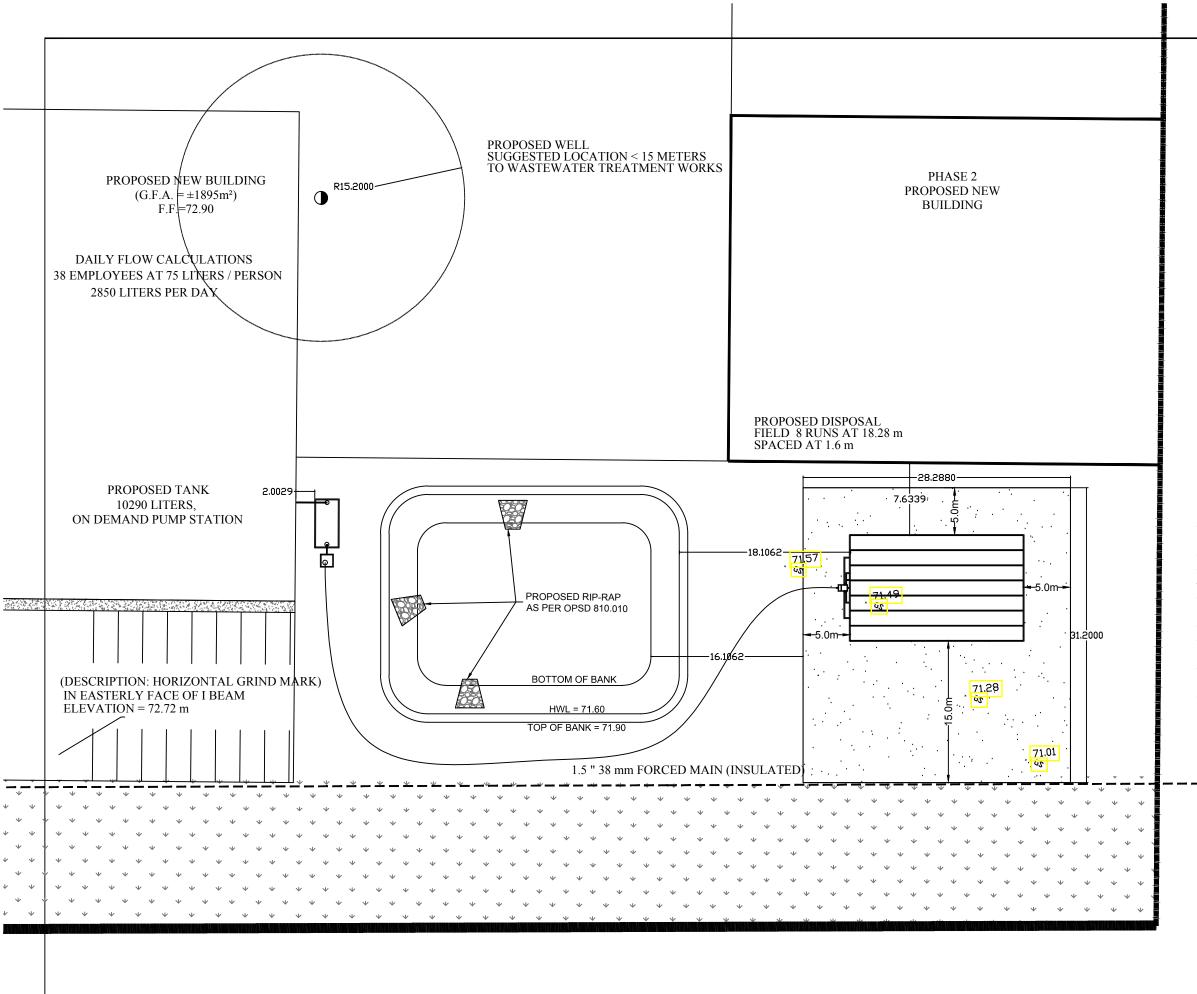
Application for a Permit to Construct or Demolish - Effective January 1, 2014

OSSO version June 2014

Ottawa Septic Bureau des systèmes System Office septiques d'Ottawa Schedu Proposed Complete Secti	Services
1. Engineered         Yes         Yoo         3. Type of work proposed         New Installation         Replacement         Alteration         5. Residential Sewage Design Flow Info.         Bedrooms         House (floor area)         m²         People         Total Fixture Units         Schedule 8)         Residential Flow         L/day         7. Type of System         Treatment Unit         Class 2 – Leaching Pit         Class 3 – Cesspool	<ul> <li>2. Water supply</li> <li>Proposed</li> <li>Existing</li> <li>4. Type of Well</li> <li>Dug/bored/Sandpoint well</li> <li>Drilled well</li> <li>Municipal</li> <li>Other</li> <li>6. Sewage Design Flow <u>Other Occupancies</u> Design Flow <u>2656</u> L/day</li> <li>Detailed sewage flow calculations: <u>38 ampleymers X 75 L/Person</u></li> <li>Class 4 - BMEC Area Bed (Schedule 11)</li> <li>Fully raised</li> <li>Partially raised</li> <li>In-ground</li> <li>Class 4 - "Type A" Dispersal (Schedule 13)</li> </ul>
Class 4 – Shallow Buried Trench Class 4 – Trench (Sebedule 9) Fully: raised Partially raised In-ground Class 4 – Filter Media (Schedule 10) Fully raised Partially raised In-ground	<ul> <li>Fully raised</li> <li>Partially raised</li> <li>In-ground</li> <li>Class 4 "Type B" Dispersal (schedule 14)</li> <li>Fully raised</li> <li>Partially raised</li> <li>In-ground</li> <li>Class 5 - Holding Tank (90001, min)</li> <li>Tank/TreatmentUnit/PumpChamber ONLY</li> <li>Effluent Filter/Risers ONLY</li> </ul>

OSSO Version June 2014

wa Sepue Bureau des systèmes am Office septiques d'Ottawa	Schedu Sewage Syste	7.5 million (1997)	Do Not Complete Permit No Revision No Date
Type of System CLASS 4	TRENTH	9	(Schedule
Septic/Holding Tank Size: 1829	O Litres	Make:	
Septie Tank Effluent Filter Make:	POLYLOK	Model:	PL 525
Treatment Unit - Make & Model			
Number of Units:		Other:	
Refer to Typical Drawing # A1			s) required YES.
Mantle Information:			Rate 859 L/15
Native or imported =15m in	direction(s	) No	te: Alarm required for all
Slope subgrade	% slop	e	nping systems
Site to be Scarified (If clay)	VES NO		
Clay Seal Required (If bedrock)	YES / NO		
🛛 Trench			
Distribution Pipe Length 145		□ Shallow	Buried Trench
Loading Area 882		Pipe Len	gth n
Type of Chamber Pipts 2			
Length of Chamber 18.2	m	⊐ Filter M	edia Bed
BMEC Area Bed		Stone	n
🗆 Туре А		Extended	Base m ²
🖵 Туре В		Pipe	m
Stone	m²	Weight o	f Filter Media K
Sand	m²	Loading 2	Area m
Pipe	m		
Lincar Loading	$_L/m^2$		
Tank/Treatment Unit/Pump Cl     Effluent Filter & Riser ONLY     Construction Notes:		ement ONLY	
	· · · · · · · · · · · · · · · · · · ·		



#### NOTE:

#### 1. ALL TREATMENT UNITS AND LEACHING BEDS ARE TO BE INSTALLED IN ACCORDANCE WITH MINIMUM ONTARIO BUILDING CODE CLEARANCE DISTANCES.

2. CARE IS TO BE EXERCISED DURING CONSTRUCTION ACTIVITIES NEAR OVERHEAD HYDRO WIRES.

3. EXISTING ELEVATIONS ARE APPROXIMATE, CONTRACTOR MUST VERIFY ALL ELEVATIONS AND DIMENSIONS PRIOR TO CONSTRUCTION.

4. SOIL CONDITIONS ARE ACCURATE FOR THE LOCATIONS SHOWN, CONTRACTOR MUST CONTACT THE DESIGN ENGINEER OR REGULATORY AUTHORITY SHOULD SOIL CONDITIONS DIFFER.

5. LOT TO BE SERVICED WITH A DRILLED WELL.

### LEGEND

100.438	PROPOSED ELEVATION
100.438	EXISTING ELEVATION
	EXISTING WORKS
	PROPOSED SEWAGE WORKS
	PROPERTY LINE
TBM	TEMPORARY BENCH MARK
	(DESCRIPTION: HORIZONTAL GRIND MARK)
	IN EASTERLY FACE OF I BEAM
	ELEVATION = $72.72 \text{ m}$

CODES:	BM =
HS = HOUSE	FIB =
$\overline{CL} = \overline{CENTER} LINE$	ST PI
<b>CD = CENTER LINE OF DITCH</b>	PL = 1
SIB = STEEL IRON BAR	TP = T
<b>GS = GROUND SHOT</b>	DRW
<b>EP = EDGE OF PAVEMENT</b>	bot sv
<b>OG = ORIGINAL GROUND</b>	BBR =
TW = TOP OF WELL	ST = S
HK = HYDRO KIOSK	ga = 0
<b>GD = GRAVEL DRIVEWAY</b>	CSL =
HP = HYDRO POLE	ED =
TS = TOP OF SLOPE	t of b

BM = BENCH MARK FIB = FOUND IRON BAR ST PI = STAND PIPE PL = PROPERTY LINE TP = TEST PIT DRW = DRILLED WELL bot sw = BOTTOM OF SWALE BBR = BOTTOM-BRICK ST = SEPTIC TANK ga = GARAGE CSL = CONCRETE SLAB ED = EDGE OF DITCH t of b = TOP OF BANK

15m SETBACK

Drawn by:	prs Des	Designed by: prs				Checked by: prs			
Description			Date	Approved					
City of	Plan#	Lot	Sublot	Con					
Ottawa					No.: SD/227	27/2017			
Civic Address 8015 RUSSELL ROAD					Date: Dec. 28, 2017		Scale: 1:400		
DIMENSIONAL ANALYSIS BCIN 13527, 43452									
ON-SITE SEWAGE TREATMENT PLAN FOR OF: BOB COUSINS									

