

July 11, 2018 - Revised September 3, 2019
File: PH3333-LET.01-REV.02

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Geotechnical Engineering
Environmental Engineering
Archaeological Studies
Hydrogeology
Geological Engineering
Materials Testing
Building Science

Attention: **Mr. Abdo El-Arab**

Subject: **Water Supply Assessment for a
Proposed Site Plan Approval
6175 Rockdale Road
Vars, Ontario**

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INTRODUCTION

Further to your request, this firm has conducted a Water Supply Assessment in support of site plan approval of a proposed re-development of the commercial property located at 6175 Rockdale Road, Vars, Ontario. The purpose of these works has been to determine the suitability of the water supply aquifer underlying the site to service a re-development of the existing commercial layout.

DESCRIPTION OF PROPOSED DEVELOPMENT

The subject property is located at the southeast corner of Rockdale Road and Russland Road/Highway Lane in Vars, Ontario. The property consists of approximately 0.9 ha. over two lots. The lot is occupied by two commercial businesses which are serviced by an on site sewage system and a drilled well. The businesses consist of an Esso fuel station and a used car sales lot. There are two parcels at the existing development with the municipal address of 6175 Rockdale Road.

The land is to be re-developed with a new configuration with an upgraded Esso fuel station and convenience store. A drive-through serving only prepared food will be incorporated using paper service only. The existing drilled well will be retained for use. A portable hose for hand washing of cars only will be installed in the well. The well will not be used as a drinking water supply. Washrooms will be key access only to restrict access to non-drinking water. The drive-through / store will only serve pre-packaged food and drinks. There is no preparation of food or dishwashing required on-site. As such, no potable water supply is necessary for drive-through operations. Refer to Figure 1 below showing the proposed site location.



Figure 1: Key Plan

FIELDWORK PROGRAM

As a means to demonstrate the adequacy of the overburden aquifer underlying the subject lands, with respect to water quality and quantity, a shallow dug well was constructed by Maurice Cayer Ltd on March 16, 2018. The dug well (TW 1) was constructed adjacent to the northwest corner of the subject site and is located greater than 30 m from the proposed fuel tanks and the proposed sewage system. The Ministry of Environment, Conservation

and Parks (MECP) Water Well Record (WWR) indicates the well extends 4.9 m below the existing ground surface. The inside diameter of the well is 1.2 m and consisted of three tiles of 1.8 m height. See Paterson Drawing PH3333-3 for the approximate location of TW 1.

The tiles were set into limestone bedrock to a depth of approximately 1.2 m. Bedrock was encountered at 4.3 m depth and the casing extends down to approximately 5.3 m depth. The overburden material around the well casing consisted of a yellow sand to grey sand with some clay. A copy of the WWR can be found attached.

There is an existing drilled well on the site that is located west of the existing fuel bar and convenience store, and is located at the west edge of the asphalt parking area. The well is fully accessible with the 150 mm diameter steel casing extending approximately 200 - 300 mm above the existing ground surface. Due to the poor quality of water supply from the existing drilled well and the known poor water quality of the bedrock aquifer in the area, the owner elected to proceed with the installation of a dug well.

The ground surface surrounding the well is to be mounded appropriately to shed melt water away from it, and it is recommended to dump/stockpile snow away from the well. Existing grading is already designed to shed road water away for the well location along Russland Road. Four bollards should be placed around the well for additional protection and the locations of the bollards are to be determined at the time of construction. The site plan currently indicates evenly spaced bollards around the well, however, alternate spacing may be used at the time of construction to appropriately protect the well.

As a means to evaluate the water supply aquifer intercepted by the new well (TW 1), the well was subjected to a 6 hour constant rate pumping test. The pumping test was conducted on May 1, 2018 under the full-time supervision of Paterson.

Maurice Cayer Ltd. was retained to supply a submersible pump and generator for the pumping test. The submersible pump was placed approximately 0.3 m off the base of the well. The discharge hose was directed to the adjacent ditch along Russland Road in a downgradient direction based upon the slope of the existing landscaping and ditch. The discharge location was approximately 24 m downgradient of the well with the discharged water heading southward along Russland Road.

The pumping test (May 1, 2018) was carried out at a pumping rate of 22.5 L/min for a duration of 6 hours. Thereafter the pumping rate was lowered to 9 L/min for an additional 2.5 hours to determine if the turbidity level could be reduced. Additional pumping was performed on May 9, 2018, in an attempt, to reduce the turbidity level and to recover a bacteriological sample. During the pumping test, the pumping rate was periodically measured using the timed volume correlation method. The pump rate was maintained within 5% of the selected pump rate. The static water level was recorded and an electronic datalogger (Schlumberger Micro-Diver) was installed in the test well prior to the start of the

pumping test. The data logger recorded water levels at 15 second intervals. In addition, manual water level readings were taken at periodic intervals during the test.

Recovery data was collected for the well following the completion of the pumping. The well was noted to have achieved approximately 95% recovery approximately 85 minutes after the completion of the first pumping test. Further development of the well was performed and the water level was monitored for several days after the completion of the pumping.

Groundwater samples were collected at 3 hours and 8.5 hours after the start of pumping. Prior to collection of the groundwater samples, the free chlorine residual was tested and found to be within a range of 7.7 mg/L at the 3 hour mark and dropped to 0.06 mg/L by the end of the 8.5 hour period. The additional pumping, carried out on May 9, 2018, extended for a period of 7 hours, after which the free chlorine residual was verified to be non-detectable. The water samples were submitted for comprehensive testing of bacteriological, chemical and physical water quality parameters consistent with the standard 'Subdivision Supply' suite of parameters and additional parameters for VOCs and PHCs F1-F2.

An additional sample was taken of the raw water from the existing drilled well. There is no WWR available at the time of writing this report.

All samples were collected unfiltered and unchlorinated and were placed directly into clean bottles supplied by the analytical laboratory. Samples were placed immediately into a cooler with ice and were transported directly to the Eurofins laboratory in Ottawa. All samples were received by the laboratory within 24 hours of collection.

Furthermore, a series of field testing of the pumped water were carried out at the well head. The parameters tested at the well head included: pH, total dissolved solids, conductivity, turbidity and temperature.

AQUIFER ANALYSIS

Water Quantity

Pumping test data was analyzed using AquiferTest Pro (v. 2016.1) aquifer analysis software package by Schlumberger Water Services. Drawdown data was measured using an electronic water level tape and an electronic datalogger unit was also used to monitor drawdown in the test well.

| TABLE 1:SUMMARY OF WATER SUPPLY AQUIFER CHARACTERISTICS OF TW1 | |
|--|------------------------|
| AQUIFER PARAMETER | RESULT OF ANALYSIS |
| Transmissivity (m ² /day) | 1.33 x 10 ² |
| Pumping Rate (L/min) | 22.5 |
| Pre-test Static Water Level (m) | 2.08 |
| Post-test Static Water level (m) | 2.83 |
| Available Drawdown (s) (m) | 3.41 |
| % Drawdown During Pumping Test | 22.0 |
| Specific Capacity (L/min/m drawdown) | 30.0 |

The drawdown data was analyzed using the Theis with Jacob Correction, and the Papadopulos & Cooper methods of analysis. Aquifer transmissivity is estimated to be approximately 133 m²/day.

The pumping test results show that test well TW1 has a high yield. Drawdown at a pumping rate of 22.5 L/min for 6 hours was 0.75 m and was used for the analysis. 95% recovery was achieved approximately 85 minutes after the end of pumping. Additional pumping was completed subsequent to the 6 hour period in an attempt to reduce turbidity with further development for a total of 8.5 hours. The total volume of water pumped during the 8.5 hour pumping event was approximately 9,450 L. The proposed daily sewage design flow is 9,145 L. As the pumped volume exceeded the maximum daily sewage design flow with minimal drawdown (0.03 m) from the 2.0 hour to the 8.5 hour mark, the well is considered adequate in regards to quantity. Additionally, Part 8 of the Ontario Building Code typically overestimates the daily sewage design flows. As the washroom is based upon keyed access, it is not expected that the design flows will be achieved.

As the pumping test was completed on a dug well, the well storage of the existing dug well must be considered. The well storage of the existing dug well is approximately 3,639 L, equating to 2.6 well volumes being removed from the well prior to the termination of the pumping test.

The suitability of the aquifer to supply the proposed re-development was assessed based upon the methodology provided in MOECC Procedure D-5-5 (MOEE, 1996) and the proposed sewage daily design flows of 9,145 L/day. The usage of the water supply is proposed to be for the Service Station consisting of the gas bar at 560 L/day per gas nozzle (total of 12 nozzles), the convenience store at 155 m² at 5 L/day and two staff at 75 L/day. The water supply is intended to be used for hand washing and toilet supply only. The owner intends on importing bottled water for drinking purposes.

Based on the information summarized in Table 1, it is readily apparent that the new water supply well has intercepted a strong water supply aquifer which has more than sufficient quantity to service a fuel service station's needs of pump servicing, hand washing and bathroom facilities. The transmissivity aquifer parameter suggests a strong aquifer which is able to transmit significant quantities of water relatively quickly. It should be noted that the overburden aquifer's quantity may vary seasonally.

Water Quality

Field Data

Turbidity, electrical conductivity, total dissolved solids, pH and temperature were measured at the wellhead during the pumping test. The measurements and time intervals for each of these parameters are summarized on the graphical representation in Figure 2. In addition, chlorine test strips and a Hach Colorimeter II were used to measure the chlorine residual level. No chlorine residual was detected in the discharge water prior to the collection of the bacteriological water sample recovered at the end of the May 9 pumping event.

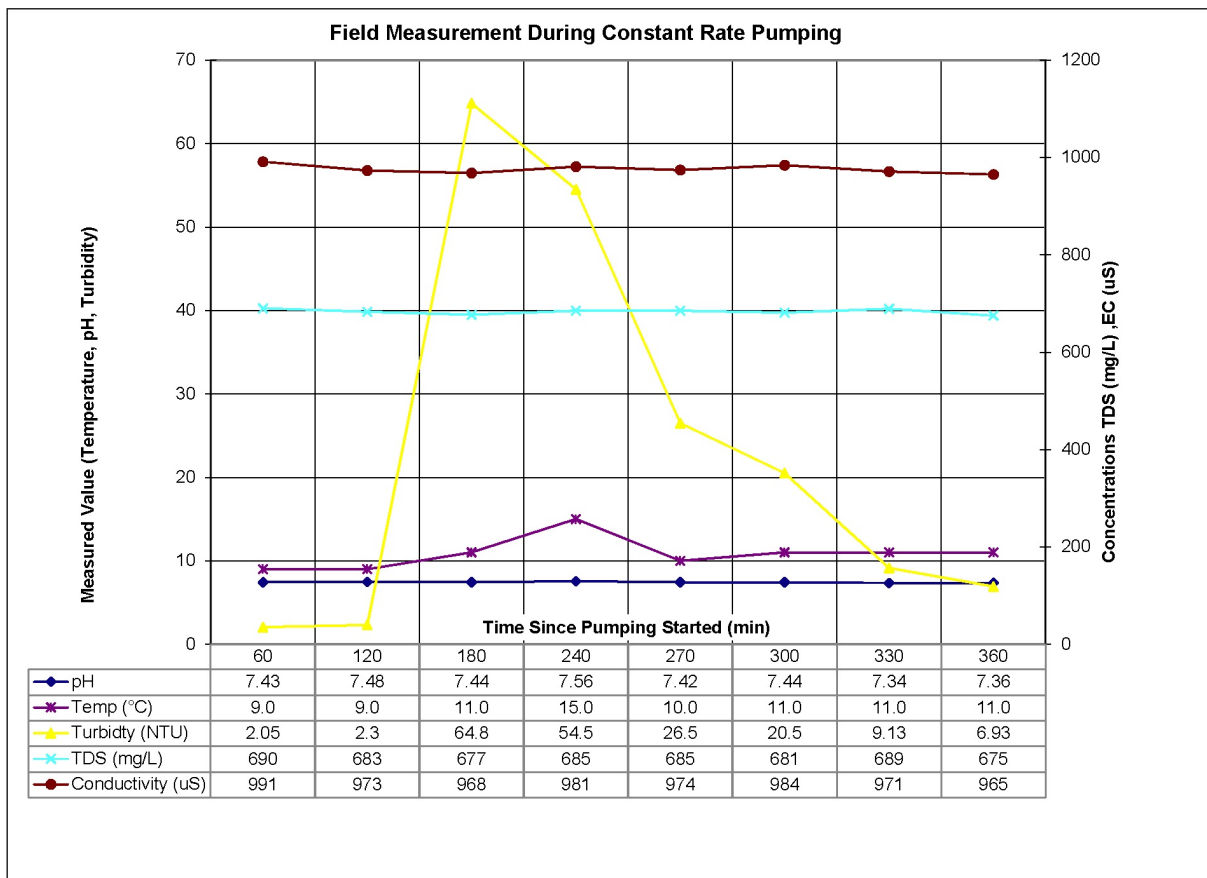


Figure 2: Field Measurement During Constant Rate Pumping

Laboratory Data

The laboratory water quality, from the standard subdivision package, obtained from the pumping test of TW 1 is provided in Table 2 below and the full laboratory analyses reports that include the VOCs and PHC results can be found attached. The existing drilled well on the property was sampled to determine a comparison of the groundwater aquifer quality and the overburden aquifer quality with the sample WS#3 taken from the existing service station bathroom tap. There is no water treatment system within the existing Service

Station.

The initial pumping test of TW1 contained a free chlorine residual at the completion of the pumping test and bacteriological testing was not performed on samples WS#1 or WS#2. Subsequent pumping to reduce turbidity and the free chlorine residual was performed with the bacteriological analysis results shown in Table 3 under WS#4.

| TABLE 2: GROUNDWATER GEOCHEMISTRY (TW 1 AND EXISTING DRILLED WELL) | | | | | | |
|---|----------|-----------|--------|------------|--------------|-----------------------|
| PARAMETER | UNITS | ODWS | | TW # 1 | | Existing Drilled Well |
| | | LIMIT | TYPE | 1-May-18 | 1-May-18 | 1-May-18 |
| | | | | WS#1 (3hr) | WS#2 (8.5hr) | WS#3 |
| MICROBIOLOGICAL | | | | | | |
| Escherichia Coli (E.Coli) | ct/100mL | 0 | MAC | - | - | - |
| Total Coliforms | ct/100mL | 0 | MAC | - | - | - |
| GENERAL CHEMICAL - HEALTH RELATED | | | | | | |
| Fluoride | mg/L | 1.5(2.4) | MAC | 0.15 | <0.10 | <0.10 |
| N-NO2 (Nitrite) | mg/L | 1 | MAC | <0.10 | <0.10 | <0.10 |
| N-NO3 (Nitrate) | mg/L | 10 | MAC | 0.35 | 0.22 | <0.10 |
| Turbidity (Laboratory) | NTU | 1.0 (5.0) | MAC/AO | 18.2 | 9 | 8.8 |
| Turbidity (Field) | NTU | 1.0 (5.0) | MAC/AO | 45.2 | 17.4 | - |
| N-NH3 (Ammonia) | mg/L | | | 0.03 | 0.10 | 1.2 |
| Total Kjeldahl Nitrogen | mg/L | | | 0.5 | 0.5 | 1.6 |
| GENERAL CHEMICAL - AESTHETIC RELATED | | | | | | |
| Hardness (as CaCO3) | mg/L | 100 | OG | 568 | 551 | 582 |
| Ion Balance | unitless | | | 0.92 | 0.9 | 0.9 |
| Total Dissolved Solids | mg/L | 500 | AO | 1,480 | 1,490 | 1,850 |
| Alkalinity (as CaCO3) | mg/L | 500 | OG | 330 | 418 | 503 |
| Chloride | mg/L | 250 | AO | 567 | 554 | 607 |
| Colour | TCU | 5 | AO | <2 | 2 | 5 |
| Conductivity | uS/cm | | | 2,270 | 2,290 | 2,850 |
| pH | unitless | 6.5-8.5 | AO | 7.82 | 7.79 | 7.74 |
| Sulphide | mg/L | 0.05 | AO | 0.03 | <0.02 | 0.47 |
| Sulphate | mg/L | 500 | AO | 54 | 82 | 53 |
| Calcium | mg/L | | | 196 | 191 | 177 |
| Iron | mg/L | 0.3 | AO | 0.36 | 0.22 | 0.77 |
| Potassium | mg/L | | | 14 | 7 | 9 |
| Magnesium | mg/L | | | 19 | 18 | 34 |
| Manganese | mg/L | 0.05 | AO | 0.5 | 0.42 | 1.22 |
| Sodium | mg/L | 200 | AO | 236 | 275 | 313 |
| Phenols | mg/L | | | <0.001 | <0.001 | <0.001 |
| Tannin & Lignin | mg/L | | | <0.1 | 0.1 | 0.5 |
| Dissolved Organic Carbon | mg/L | 5 | AO | 3.3 | 3.7 | 7.1 |
| <p>1. ODWS identifies the following types of parameters: MAC=Maximum Allowable Concentration AO = Aesthetic Objective OG= Operational Guideline</p> <p>2. Shaded Concentration Indicates an Exceedance of the ODWS Objective</p> | | | | | | |

| TABLE 3: GROUNDWATER GEOCHEMISTRY (TW 1) | | | | |
|---|----------|------------------------|--------|-----------------------------------|
| PARAMETER | UNITS | ODWS | | TW # 1 9-May-18 WS#4 (7 hr) |
| | | LIMIT | TYPE | |
| | | MICROBIOLOGICAL | | |
| Escherichia Coli (E.Coli) | ct/100mL | 0 | MAC | 0 |
| Total Coliforms | ct/100mL | 0 | MAC | 0 |
| GENERAL CHEMICAL - HEALTH RELATED | | | | |
| Fluoride | mg/L | 1.5(2.4) | MAC | - |
| N-NO2 (Nitrite) | mg/L | 1 | MAC | - |
| N-NO3 (Nitrate) | mg/L | 10 | MAC | - |
| Turbidity (Laboratory) | NTU | 1.0 (5.0) | MAC/AO | - |
| Turbidity (Field) | NTU | 1.0 (5.0) | MAC/AO | 1.2 |
| N-NH3 (Ammonia) | mg/L | | | - |
| Total Kjeldahl Nitrogen | mg/L | | | - |
| GENERAL CHEMICAL - AESTHETIC RELATED | | | | |
| Hardness (as CaCO3) | mg/L | 100 | OG | - |
| Ion Balance | unitless | | | - |
| Total Dissolved Solids | mg/L | 500 | AO | - |
| Alkalinity (as CaCO3) | mg/L | 500 | OG | - |
| Chloride | mg/L | 250 | AO | - |
| Colour | TCU | 5 | AO | - |
| Conductivity | uS/cm | | | - |
| pH | unitless | 6.5-8.5 | AO | - |
| Sulphide | mg/L | 0.05 | AO | - |
| Sulphate | mg/L | 500 | AO | - |
| Calcium | mg/L | | | - |
| Iron | mg/L | 0.3 | AO | - |
| Potassium | mg/L | | | - |
| Magnesium | mg/L | | | - |
| Manganese | mg/L | 0.05 | AO | - |
| Sodium | mg/L | 200 | AO | - |
| Phenols | mg/L | | | - |
| Tannin & Lignin | mg/L | | | - |
| Dissolved Organic Carbon | mg/L | 5 | AO | - |
| 1. ODWS identifies the following types of parameters: | | | | |
| MAC=Maximum Allowable Concentration | | | | |
| AO = Aesthetic Objective | | | | |
| OG= Operational Guideline | | | | |
| 2. Shaded Concentration Indicates an Exceedance of the ODWS Objective | | | | |

Two water samples were recovered during the initial pumping test of the well and submitted for laboratory analyses. The laboratory groundwater geochemistry results can be found attached.

The water quality of the subject water supply well meets all the Ontario Drinking Water Standards maximum acceptable concentrations (MAC). Furthermore, the water meets all the aesthetic objectives (AO) and operational guidelines (OG) with the exception of the following:

- hardness;
- TDS;
- chloride;
- iron;
- manganese; and
- sodium.

Exceedances of the above parameters are typical of the water supply in the subject aquifer. Each of these groundwater parameters are discussed in detail below.

Hardness

Hardness, expressed as calcium carbonate, an operational guideline, does not appear in the ODWS. Rather, it appears in the Technical Support Documents for Drinking Water Standards, Objectives and Guidelines (Technical Support Documents) as a parameter with an operational guideline of 100 mg/L. At the measured concentration of 568 and 551 mg/L, the water is considered to be hard to very hard, however it is exceeding the reasonable treatable limit of 500 mg/L, specified in Table 3 of the MOECC guidance document Procedure D-5-5 (1996), by a small margin. The hardness concentration can be treated using modern conventional water softener technologies.

TDS

Total dissolved solids (TDS) refers to the concentration of inorganic substances dissolved in water. The main constituents are typically chloride, sulphates, calcium, magnesium and bicarbonates. Water with a TDS concentration above 500 mg/L of TDS may not be palatable. Procedure D-5-5 does not provide a 'treatability limit' for TDS, but it does require written rationale that corrosion, encrustation or taste problems will not occur.

The Langelier Saturation Index (Langelier, 1936) is used to predict the calcium carbonate stability of water. It indicates whether the water will precipitate, dissolve or be in equilibrium with calcium carbonate.

The results of the Langelier calculation (LSI = 0.8) indicate the water is super saturated

and tends to precipitate a scale layer of calcium carbonate (scale forming and non-corrosive). See attached Langelier calculations for further details.

The presence of TDS in drinking water contributes to the palatability of the water and is strictly an aesthetic parameter. Generally, water with TDS levels in excess of 1,200 mg/L is considered to be unacceptable, however, the palatability of the water is dependant upon the user. The TDS level in the subject water supply was measured to be 1,490 mg/L, which may impact the taste of the drinking water to some users. If desired, a point-of-use reverse osmosis treatment unit can be used to reduce the TDS levels at a designated drinking water tap. However, the proposed usage of the water supply is currently for hand washing and bathroom usage.

Chloride

Chloride (Cl), an aesthetic parameter, was detected in the laboratory test sample at a concentration of 567 and 554 mg/L, which exceeds the ODWS aesthetic objective of 250 mg/L. The World Health Organization prepared a document "Chloride in Drinking-water" dated 1996 that concludes chloride concentrations in excess of 250 mg/L may potentially provide a detectable taste in the water. Consumers may become accustomed to chloride concentrations that exceed 250 mg/L. WHO noted that they would not be proposing limits for chlorides in drinking water. If desired, a reverse osmosis system would be able to reduce chloride levels.

Iron

An iron concentration of 0.36 and 0.22 mg/L was measured at the 3 and 8.5 hour interval, which is slightly above and below the aesthetic objectives in the ODWO. Concentrations exceeding the aesthetic objective of 0.3 mg/L may contribute to staining of plumbing fixtures and laundry. As per D-5-5, the results are below the level considered to be reasonably treatable. A conventional water softener can be used to reduce the levels of iron.

Manganese

The manganese concentration results of 0.5 and 0.42 mg/L is above the aesthetic objectives in the ODWO. Concentrations exceeding the aesthetic objective of 0.05 mg/L may contribute to staining of plumbing fixtures and laundry. As per D-5-5, the results are well below the level considered to be reasonably treatable (1.0 mg/L). A conventional water softener can be used to reduce the levels of manganese.

Sodium

Sodium (Na), an aesthetic parameter, was detected in the laboratory test sample at a concentration of 236 and 275 mg/L, which exceeds the ODWS aesthetic objective of 200 mg/L. Although sodium is not toxic and no maximum acceptable concentration has been set, concentrations above 20 mg/L require that the Medical Officer of Health be notified of the water quality results, so that this information may be passed on to local physicians for use in treatment of those requiring a sodium-restricted diet.

Turbidity

Turbidity, which is generally an aesthetic parameter, was detected in the laboratory test samples at values of 18.2 and 9.0 NTU at the 3 and 8.5 hour tests. The field results showed that turbidity increased around the 2.0 to 6.5 hour period of the initial test. Continued pumping showed a steady decrease towards the end of the pumping test. Field tests initially showed values of 1.15 to 2.05 NTU during the second pumping test over a seven hour period.

The ODWS maximum acceptable concentration for turbidity in drinking water entering the distribution system is 1 NTU. The Aesthetic Objective for turbidity in drinking water reaching the consumer is 5 NTU. In accordance with Procedure D-5-5, Table 2 does not reflect a maximum concentration considered reasonably treatable for turbidity. Rather, Procedure D-5-5 indicates that "particular care must be taken during testing to ensure that the bacteria requirements of Table 1 are met." Based on the test results, the bacteria requirements of Table 1 of D-5-5 have been met (E.Coli = 0 and Total Coliforms = 0).

It should be noted that the field turbidity testing indicated that the turbidly level reduced significantly during the pumping event. The field turbidity of 70.3 and 17.4 NTU was measured at the well head at approximately the 6 hour and 8.5 hour interval, respectively. Approximately 1 week after completion of the pumping test, the turbidity level was measured at 1.15 to 2.05 NTU. The high turbidity levels are related to sediment being mobilized and flushing into the well from the initial well construction. Further development of the well is expected to further reduce the turbidity levels.

EXISTING DRILLED WATER WELL SUPPLY

The existing drilled water well supply at the subject site is currently used for only hand washing and bathroom needs. When comparing the existing drilled well water supply to the proposed supply (TW 1), the existing drilled water well samples show exceedances for the same categories (Turbidity, Hardness, TDS, Chloride, Iron, Manganese and Sodium) as the proposed water well supply and also for Dissolved Organic Carbon (DOC) and Hydrogen Sulphide. The higher concentration of hydrogen sulphide was found in the existing drilled supply well. It was noted that the existing drilled supply has been in use for many years and is exhibiting worse water quality than the proposed water supply. There is no treatment system in place and the Service Station bathroom has a distinct odour of hydrogen sulphide (rotten eggs). This odour is common in other drilled wells in the area. Table 2 provides a comparison of the existing supply and TW 1 results.

The existing drilled water well supply will be retained for use. A portable hose for hand washing of cars only will be installed in this well.

CONCLUSIONS

Based on the information contained within the body of this report, the following conclusions can be drawn:

1. The water supply aquifer intercepted by TW 1 is considered to be adequate to support the proposed service station in the long term. However, seasonal variations of water quality and quantity in shallow aquifers may occur. It is recommended that the dug well water supply be used for hand washing and toilet use only. Disinfection (Ultraviolet treatment) is recommended and signs indicating the water is to be used for hand washing and toilet use only must be posted. Access to the bathroom will be restricted by key access through a request to an employee and is not considered a public supply.
2. The preferred water supply aquifer intercepted by TW 1 contains a water supply that contains only elevated concentrations of aesthetic parameters (Hardness, TDS, chloride, iron, manganese and sodium). Some of the concentrations are above the reasonable treatable limits of D-5-5, but they can be removed by readily available water conditioning equipment.
3. A water softener is recommended to facilitate the removal of the hardness, iron and manganese concentrations.
4. Turbidity had reduced to below 2 NTU during the further development of the well and it is expected to reduce upon further development of the well.
5. The sodium concentrations were measured to be above the 20 mg/L reporting limit and, as such, the Medical Officer of Health for the City of Ottawa should be informed to assist area physicians in the treatment of local residents on sodium reduced diets. However, the water supply is not to be used as a potable water supply.
6. The results of the water supply assessment have provided satisfactory evidence that the water supply aquifer underlying the subject lands can support the redeveloped property with respect to water quality and quantity for the proposed usage of hand washing and toilet flushing.
7. The existing drilled well is to be maintained as per O.Reg 903.

Mr. Abdo El-Arab
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We trust that this satisfies your present requirements. Should you have any questions regarding this submission, please do not hesitate to contact the undersigned.

Yours truly,

PATERSON GROUP INC.



Michael S. Killam, P. Eng.



Attachments:

- MECP Water Well Record
- Eurofins Certificate of Analysis
- AquiferTest Pro - Pumping Test Analysis Reports
- Langelier Saturation Index Calculation
- Paterson Drawing PH3333-1
- Paterson Drawing PH3333-2
- Paterson Drawing PH3333-3

Measurements recorded in: Metric Imperial

Well Owner's Information

First Name: **ABDO** Last Name / Organization: **EL-ARAB** E-mail Address: _____ Well Constructed by Well Owner

Mailing Address (Street Number/Name): **6175 Rockdale Road** Municipality: **OTTAWA** Province: **ONT** Postal Code: **K0A3H0** Telephone No. (inc. area code): **613 835 3525**

Well Location

Address of Well Location (Street Number/Name): **Same** Township: **OTTAWA** Lot: **27** Concession: **6**

County/District/Municipality: **OTTAWA** City/Town/Village: **VEVS** Province: **Ontario** Postal Code: **K0A3H0**

UTM Coordinates Zone: **83** Easting: **184730** Northing: **185020883** Municipal Plan and Sublot Number: _____ Other: _____

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

| General Colour | Most Common Material | Other Materials | General Description | Depth (m/ft) From | Depth (m/ft) To |
|----------------|----------------------|-----------------|---------------------|-------------------|-----------------|
| Brown | TOP Soil | | | 0 | 1 |
| Yellow | sand | | | 1 | 4 |
| grey | sand | clay | | 4 | 14 |
| grey | Rock | | | 14 | 18 |

Annular Space

| Depth Set at (m/ft) From | Depth Set at (m/ft) To | Type of Sealant Used (Material and Type) | Volume Placed (m³/ft³) |
|--------------------------|------------------------|--|------------------------|
| | | concrete sealants | 3 |
| | | 3 Tile 6 foot tall | |

Results of Well Yield Testing

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

If pumping discontinued, give reason: _____

Pump intake set at (m/ft): **13**

Pumping rate (l/min / GPM): **5**

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

Final water level end of pumping (m/ft): **8.8**

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

Recommended pump depth (m/ft): **13**

Recommended pump rate (l/min / GPM): **5**

Well production (l/min / GPM): **15+**

Disinfected? Yes No

| Time (min) | Draw Down | | Recovery | |
|--------------|--------------------|------------|--------------------|------------|
| | Water Level (m/ft) | Time (min) | Water Level (m/ft) | Time (min) |
| Static Level | 7.2 | | 8.8 | |
| 1 | 7.3 | 1 | 8.8 | |
| 2 | 7.3 | 2 | 8.7 | |
| 3 | 7.3 | 3 | 8.7 | |
| 4 | 7.3 | 4 | 8.7 | |
| 5 | 7.4 | 5 | 8.6 | |
| 10 | 7.7 | 10 | 8.4 | |
| 15 | 7.9 | 15 | 8.2 | |
| 20 | 8.0 | 20 | 8.1 | |
| 25 | 8.1 | 25 | 8.1 | |
| 30 | 8.2 | 30 | 8.0 | |
| 40 | 8.5 | 40 | 7.8 | |
| 50 | 8.6 | 50 | 7.8 | |
| 60 | 8.8 | 60 | 7.7 | |

Method of Construction

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

Well Use

- Diamond
- Jetting
- Driving
- Digging
- Public
- Domestic
- Livestock
- Irrigation
- Industrial
- Other, specify _____
- Commercial
- Municipal
- Test Hole
- Cooling & Air Conditioning
- Not used
- Dewatering
- Monitoring

Construction Record - Casing

| Inside Diameter (cm/in) | Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel) | Wall Thickness (cm/in) | Depth (m/ft) | |
|-------------------------|--|------------------------|--------------|----|
| | | | From | To |
| 48 | concrete | 4 | +2 | 18 |

Status of Well

- Water Supply
- Replacement Well
- Test Hole
- Recharge Well
- Dewatering Well
- Observation and/or Monitoring Hole
- Alteration (Construction)
- Abandoned, Insufficient Supply
- Abandoned, Poor Water Quality
- Abandoned, other, specify _____
- Other, specify _____

Construction Record - Screen

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

Water Details

| Water found at Depth (m/ft) | Kind of Water: |
|-----------------------------|--|
| 14 (m/ft) | <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____ |
| (m/ft) | <input type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____ |
| (m/ft) | <input type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____ |

Hole Diameter

| Depth (m/ft) From | Depth (m/ft) To | Diameter (cm/in) |
|-------------------|-----------------|------------------|
| 0 | 16 | 48 |

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Maurice Cayer LTD** Well Contractor's Licence No.: **1517**

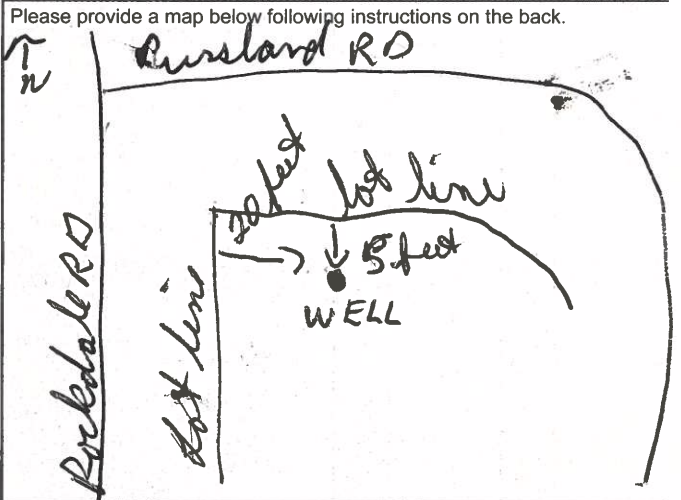
Business Address (Street Number/Name): **569 RT700 est Casselman** Municipality: **Nation**

Province: **ONT** Postal Code: **K0A1M0** Business E-mail Address: _____

Bus. Telephone No. (inc. area code): **613 7642192** Name of Well Technician (Last Name, First Name): **Rejean Cayer**

Well Technician's Licence No.: **717** Signature of Technician and/or Contractor: **Rejean Cayer** Date Submitted: **20180366**

Map of Well Location



Comments: _____

Well owner's information package delivered: Yes No

Date Package Delivered: **20180316**

Date Work Completed: **20180326**

Ministry Use Only

Audit No.: **2274762**

Received: _____

CERTIFICATE OF WELL COMPLIANCE

I, Rejean Cayer DO HEREBY CERTIFY that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of ABDO EL-ARAB (Name of Landowner), located at 6175 Rockdale Road Vano ont (Legal Description, Lot/Plan No.) in the Township of Osgoode Lot 27 CONCL KOA 3HO

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and Township Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

SIGNED this 9 day of April 2018

Maurice Cayer LTD
Well Driller/ Company

The Engineer on behalf of the landowner set out above CERTIFIES that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this 23rd day of April, 2018

M. S. Killam
Engineer



Client: Paterson Group
 154 Colonnade Rd. South
 Nepean, ON
 K2E 7T7
 Attention: Mr. Mike Killam
 PO#: 10449
 Invoice to: Paterson Group

Report Number: 1806662
 Date Submitted: 2018-05-02
 Date Reported: 2018-05-10
 Project: PH 3333
 COC #: 197584

| Group | Analyte | MRL | Units | Guideline | Lab I.D. | Sample Matrix | Sample Type | Sampling Date | Sample I.D. | |
|-------------------|-------------------------|-------|-------|-----------|------------|---------------|-------------|---------------|-------------|-------|
| | | | | | 1356872 | 1356873 | 1356874 | | | |
| | | | | | Water | Water | Water | | | |
| | | | | | 2018-05-01 | 2018-05-01 | 2018-05-01 | WS #1 | WS #2 | WS #3 |
| Calculations | Hardness as CaCO3 | 1 | mg/L | OG 100 | 568* | 551* | 582* | | | |
| | Ion Balance | 0.01 | | | 0.92 | 0.90 | 0.90 | | | |
| | TDS (COND - CALC) | 1 | mg/L | AO 500 | 1480* | 1490* | 1850* | | | |
| General Chemistry | Alkalinity as CaCO3 | 5 | mg/L | OG 500 | 330 | 418 | 503* | | | |
| | Chlorine (free) | 0.04 | mg/L | | | 0.17 | | | | |
| | Cl | 1 | mg/L | AO 250 | 567* | 554* | 607* | | | |
| | Colour | 2 | TCU | AO 5 | <2 | 2 | 5 | | | |
| | Conductivity | 5 | uS/cm | | 2270 | 2290 | 2850 | | | |
| | F | 0.10 | mg/L | MAC 1.5 | 0.15 | <0.10 | <0.10 | | | |
| | N-NO2 | 0.10 | mg/L | MAC 1.0 | <0.10 | <0.10 | <0.10 | | | |
| | N-NO3 | 0.10 | mg/L | MAC 10.0 | 0.35 | 0.22 | <0.10 | | | |
| | pH | 1.00 | | 6.5-8.5 | 7.82 | 7.79 | 7.74 | | | |
| | SO4 | 1 | mg/L | AO 500 | 54 | 82 | 53 | | | |
| | Turbidity | 0.1 | NTU | AO 5.0 | 18.2* | 9.0* | 8.8* | | | |
| Metals | Ca | 1 | mg/L | | 196 | 191 | 177 | | | |
| | Fe | 0.03 | mg/L | AO 0.3 | 0.36* | 0.22 | 0.77* | | | |
| | K | 1 | mg/L | | 14 | 7 | 9 | | | |
| | Mg | 1 | mg/L | | 19 | 18 | 34 | | | |
| | Mn | 0.01 | mg/L | AO 0.05 | 0.50* | 0.42* | 1.22* | | | |
| | Na | 2 | mg/L | AO 200 | 236* | 275* | 313* | | | |
| Nutrients | Total Kjeldahl Nitrogen | 0.1 | mg/L | | 0.5 | 0.5 | 1.6 | | | |
| Others | F1 (C6-C10) | 20 | ug/L | | <20 | <20 | | | | |
| | F2 (C10-C16) | 20 | ug/L | | 60 | <20 | | | | |
| Phenols | Phenols | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | | | |
| Subcontract | DOC | 0.5 | mg/L | AO 5 | 3.3 | 3.7 | 7.1* | | | |

Guideline = ODWSOG

* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
 154 Colonnade Rd. South
 Nepean, ON
 K2E 7T7
 Attention: Mr. Mike Killam
 PO#: 10449
 Invoice to: Paterson Group

Report Number: 1806662
 Date Submitted: 2018-05-02
 Date Reported: 2018-05-10
 Project: PH 3333
 COC #: 197584

| Group | Analyte | MRL | Units | Guideline | Lab I.D. | 1356872 | 1356873 | 1356874 |
|-------------------------|-----------------------------------|------|-------|-----------|---------------|------------|------------|------------|
| | | | | | Sample Matrix | Water | Water | Water |
| | | | | | Sample Type | 2018-05-01 | 2018-05-01 | 2018-05-01 |
| | | | | | Sampling Date | WS #1 | WS #2 | WS #3 |
| | | | | | Sample I.D. | | | |
| Subcontract | N-NH3 | 0.01 | mg/L | | | 0.03 | 0.10 | |
| | | 0.04 | mg/L | | | | | 1.20 |
| | S2- | 0.02 | mg/L | AO 0.05 | | 0.03 | <0.02 | 0.47* |
| | Tannin & Lignin | 0.1 | mg/L | | | <0.1 | 0.1 | 0.5 |
| VOCs | 1,1,1,2-tetrachloroethane | 0.5 | ug/L | | | <0.5 | <0.5 | |
| | 1,1,1-trichloroethane | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | 1,1,2,2-tetrachloroethane | 0.5 | ug/L | | | <0.5 | <0.5 | |
| | 1,1,2-trichloroethane | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | 1,1-dichloroethane | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | 1,1-dichloroethylene | 0.5 | ug/L | MAC 14 | | <0.5 | <0.5 | |
| | 1,2-dichlorobenzene | 0.4 | ug/L | MAC 200 | | <0.4 | <0.4 | |
| | 1,2-dichloroethane | 0.2 | ug/L | IMAC 5 | | <0.2 | <0.2 | |
| | 1,2-dichloropropane | 0.5 | ug/L | | | <0.5 | <0.5 | |
| | 1,3,5-trimethylbenzene | 0.3 | ug/L | | | <0.3 | <0.3 | |
| | 1,3-dichlorobenzene | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | 1,3-Dichloropropylene (cis+trans) | 0.3 | ug/L | | | <0.3 | <0.3 | |
| | 1,4-dichlorobenzene | 0.4 | ug/L | MAC 5 | | <0.4 | <0.4 | |
| | Acetone | 30 | ug/L | | | <30 | <30 | |
| | Benzene | 0.5 | ug/L | MAC 1 | | <0.5 | <0.5 | |
| | Bromodichloromethane | 0.3 | ug/L | | | 32.0 | 8.8 | |
| | Bromoform | 0.4 | ug/L | | | 1.8 | 1.5 | |
| | Bromomethane | 0.5 | ug/L | | | <0.5 | <0.5 | |
| c-1,2-Dichloroethylene | 0.4 | ug/L | | | <0.4 | <0.4 | | |
| c-1,3-Dichloropropylene | 0.2 | ug/L | | | <0.2 | <0.2 | | |
| Carbon Tetrachloride | 0.2 | ug/L | MAC 2 | | <0.2 | <0.2 | | |

Guideline = ODWSOG

* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
 154 Colonnade Rd. South
 Nepean, ON
 K2E 7T7
 Attention: Mr. Mike Killam
 PO#: 10449
 Invoice to: Paterson Group

Report Number: 1806662
 Date Submitted: 2018-05-02
 Date Reported: 2018-05-10
 Project: PH 3333
 COC #: 197584

| Group | Analyte | MRL | Units | Guideline | Lab I.D. | 1356872 | 1356873 | 1356874 |
|------------------------|--------------------------------|------|--------|-----------|---------------|------------|------------|------------|
| | | | | | Sample Matrix | Water | Water | Water |
| | | | | | Sample Type | 2018-05-01 | 2018-05-01 | 2018-05-01 |
| | | | | | Sampling Date | WS #1 | WS #2 | WS #3 |
| | | | | | Sample I.D. | | | |
| VOCs | Chloroethane | 0.2 | ug/L | | | <0.2 | <0.2 | |
| | Chloroform | 0.5 | ug/L | | | 54.8 | 9.6 | |
| | Dibromochloromethane | 0.3 | ug/L | | | 12.9 | 5.7 | |
| | Dichlorodifluoromethane | 0.5 | ug/L | | | <0.5 | <0.5 | |
| | Dichloromethane | 4.0 | ug/L | MAC 50 | | <4.0 | <4.0 | |
| | Ethylbenzene | 0.5 | ug/L | MAC 140 | | <0.5 | <0.5 | |
| | Ethylene Dibromide | 0.2 | ug/L | | | <0.2 | <0.2 | |
| | Hexane | 5 | ug/L | | | <5 | <5 | |
| | m/p-xylene | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | Methyl Ethyl Ketone (MEK) | 10 | ug/L | | | <10 | <10 | |
| | Methyl Isobutyl Ketone (MIBK) | 10 | ug/L | | | <10 | <10 | |
| | Methyl Tert Butyl Ether (MTBE) | 2 | ug/L | AO 15 | | <2 | <2 | |
| | Monochlorobenzene | 0.5 | ug/L | MAC 80 | | <0.5 | <0.5 | |
| | o-xylene | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | Styrene | 0.5 | ug/L | | | <0.5 | <0.5 | |
| | t-1,2-Dichloroethylene | 0.4 | ug/L | | | <0.4 | <0.4 | |
| | t-1,3-Dichloropropylene | 0.2 | ug/L | | | <0.2 | <0.2 | |
| | Tetrachloroethylene | 0.3 | ug/L | MAC 10 | | <0.3 | <0.3 | |
| | Toluene | 0.5 | ug/L | MAC 60 | | <0.5 | <0.5 | |
| | Trichloroethylene | 0.3 | ug/L | MAC 5 | | <0.3 | <0.3 | |
| Trichlorofluoromethane | 0.5 | ug/L | | | <0.5 | <0.5 | | |
| Vinyl Chloride | 0.2 | ug/L | MAC 1 | | <0.2 | <0.2 | | |
| Xylene; total | 0.5 | ug/L | MAC 90 | | <0.5 | <0.5 | | |
| VOCs Surrogates (%REC) | 1,2-dichloroethane-d4 | 0 | % | | | 103 | 105 | |
| | 4-bromofluorobenzene | 0 | % | | | 117 | 121 | |

Guideline = ODWSOG

* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: Paterson Group
 154 Colonnade Rd. South
 Nepean, ON
 K2E 7T7
 Attention: Mr. Mike Killam
 PO#: 10449
 Invoice to: Paterson Group

Report Number: 1806662
 Date Submitted: 2018-05-02
 Date Reported: 2018-05-10
 Project: PH 3333
 COC #: 197584

| Group | Analyte | MRL | Units | Guideline | Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D. | 1356872 Water 2018-05-01 WS #1 | 1356873 Water 2018-05-01 WS #2 | 1356874 Water 2018-05-01 WS #3 |
|---------------------|------------|-----|-------|-----------|--|---|---|---|
| VOCs Surrogates (%) | Toluene-d8 | 0 | % | | | 83 | 85 | |

Guideline = ODWSOG

*** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
 154 Colonnade Rd. South
 Nepean, ON
 K2E 7T7
 Attention: Mr. Mike Killam
 PO#: 23839
 Invoice to: Paterson Group

Report Number: 1807217
 Date Submitted: 2018-05-09
 Date Reported: 2018-05-11
 Project: PH3333
 COC #: 82891

| | |
|---------------|------------|
| Lab I.D. | 1358331 |
| Sample Matrix | Water |
| Sample Type | |
| Sampling Date | 2018-05-09 |
| Sample I.D. | WS#3 |

| Group | Analyte | MRL | Units | Guideline | |
|--------|------------------|-----|----------|-----------|---|
| Others | Escherichia Coli | 0 | ct/100mL | MAC 0 | 0 |
| | Total Coliforms | 0 | ct/100mL | MAC 0 | 0 |

Guideline = ODWSOG

* = Guideline Exceedence

Results relate only to the parameters tested on the samples submitted.

Analytical Method: AMBCOLM1

additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

154 Colonnade Road South
Ottawa, ON
K2E 7J5



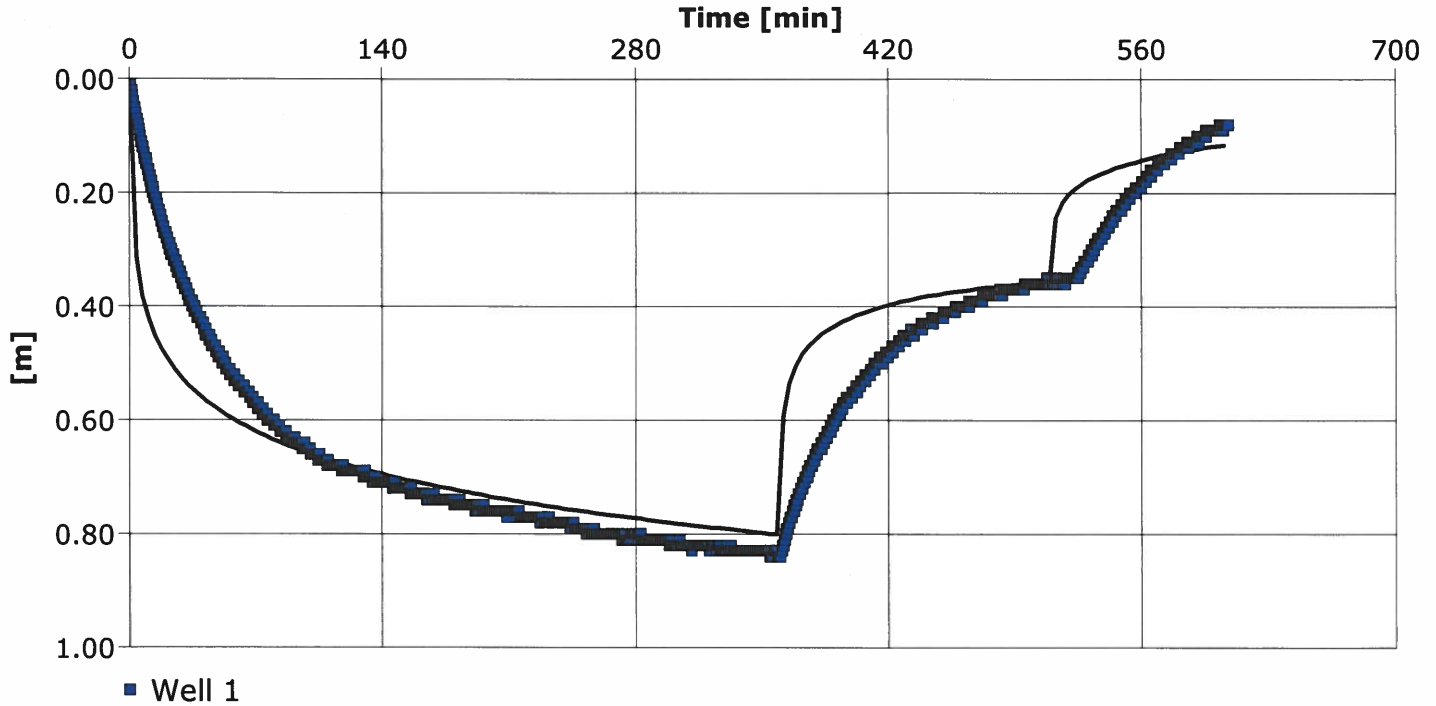
Pumping Test Analysis Report

Project: Vars Esso

Number: PH3333

Client: Abdo El Arab

| | | |
|--|--|---------------------------|
| Location: 6175 Rockdale Road, Vars | Pumping Test: Pumping Test with full data | Pumping Well: Well 1 |
| Test Conducted by: MK | | Test Date: 01/05/2018 |
| Analysis Performed by: MK | Theis with Jacob Correction | Analysis Date: 28/05/2018 |
| Aquifer Thickness: 4.30 m | Discharge: variable, average rate 17.824 [l/s] | |
| Pumping rate was reduced to lower turbidity. Part of recovery consists of pumping at a lower output. | | |

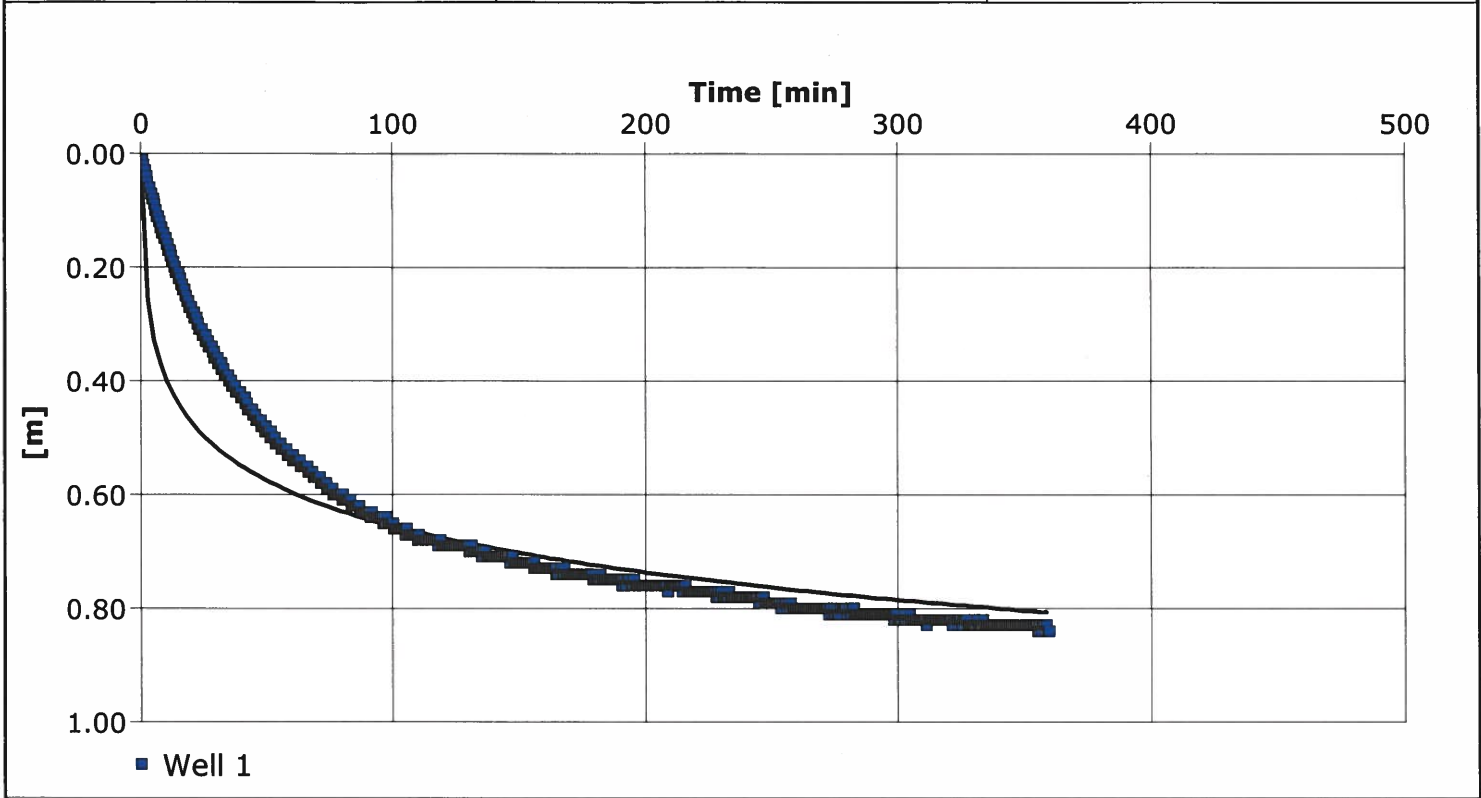


Calculation using Theis with Jacob Correction

| Observation Well | Transmissivity [m ² /d] | Hydraulic Conductivity [m/d] | Storage coefficient | Radial Distance to PW [m] |
|------------------|---------------------------------------|---------------------------------|---------------------|------------------------------|
| Well 1 | 1.64 × 10 ³ | 3.80 × 10 ² | | 0.6 |

| | | |
|---|-------------------------------------|--|
| 154 Colonnade Road South Ottawa, ON patersongroup K2E 7J5 <small>consulting engineers</small> | Pumping Test Analysis Report | |
| | Project: Vars Esso | |
| | Number: PH3333 | |
| | Client: Abdo El Arab | |

| | | |
|--|--|---------------------------|
| Location: 6175 Rockdale Road, Vars | Pumping Test: Pumping Test with full data | Pumping Well: Well 1 |
| Test Conducted by: MK | | Test Date: 01/05/2018 |
| Analysis Performed by: MK | Papadopoulos & Cooper | Analysis Date: 30/05/2018 |
| Aquifer Thickness: 4.30 m | Discharge: variable, average rate 17.824 [l/s] | |
| Pumping rate was reduced to lower turbidity. Part of recovery consists of pumping at a lower output. | | |



Calculation using Theis with Jacob Correction

| Observation Well | Transmissivity [m ² /d] | Hydraulic Conductivity [m/d] | Storage coefficient | Radial Distance to PW [m] |
|------------------|---------------------------------------|---------------------------------|---------------------|------------------------------|
| Well 1 | 1.07×10^3 | 2.49×10^2 | | 0.6×10^2 |

154 Colonnade Road South
Ottawa, ON
K2E 7J5



Pumping Test Analysis Report

Project: Vars Esso

Number: PH3333

Client: Abdo El Arab

Location: 6175 Rockdale Road, Vars

Pumping Test: Pumping Test with full data

Pumping Well: Well 1

Test Conducted by: MK

Test Date: 01/05/2018

Analysis Performed by:

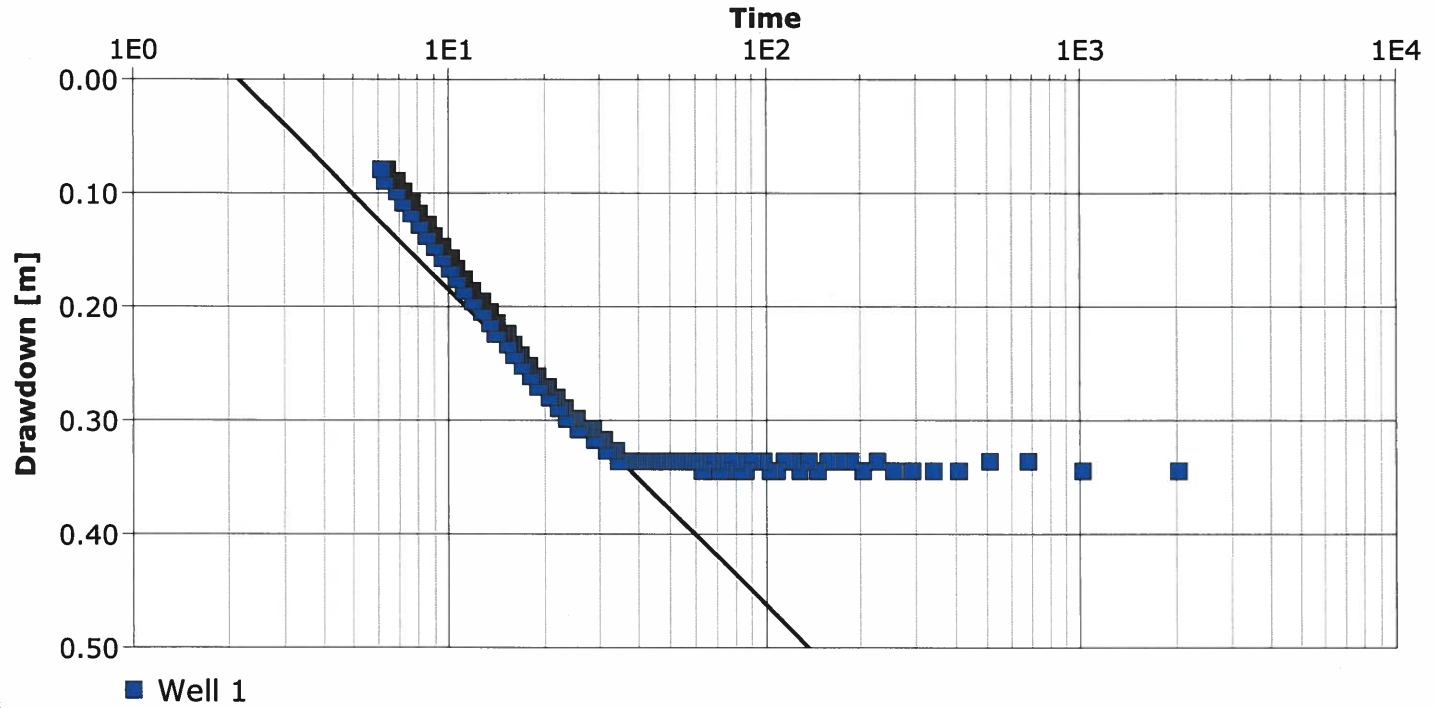
Theis Recovery

Analysis Date: 31/05/2018

Aquifer Thickness: 4.30 m

Discharge: variable, average rate 17.824 [l/s]

Pumping rate was reduced to lower turbidity. Part of recovery consists of pumping at a lower output.



Calculation using THEIS & JACOB

| Observation Well | Transmissivity [m ² /d] | Hydraulic Conductivity [m/d] | Radial Distance to PW [m] |
|------------------|---------------------------------------|---------------------------------|------------------------------|
| Well 1 | 1.02×10^3 | 2.36×10^2 | 0.6 |

154 Colonnade Road South
Ottawa, ON

patersongroup K2E 7J5
consulting engineers

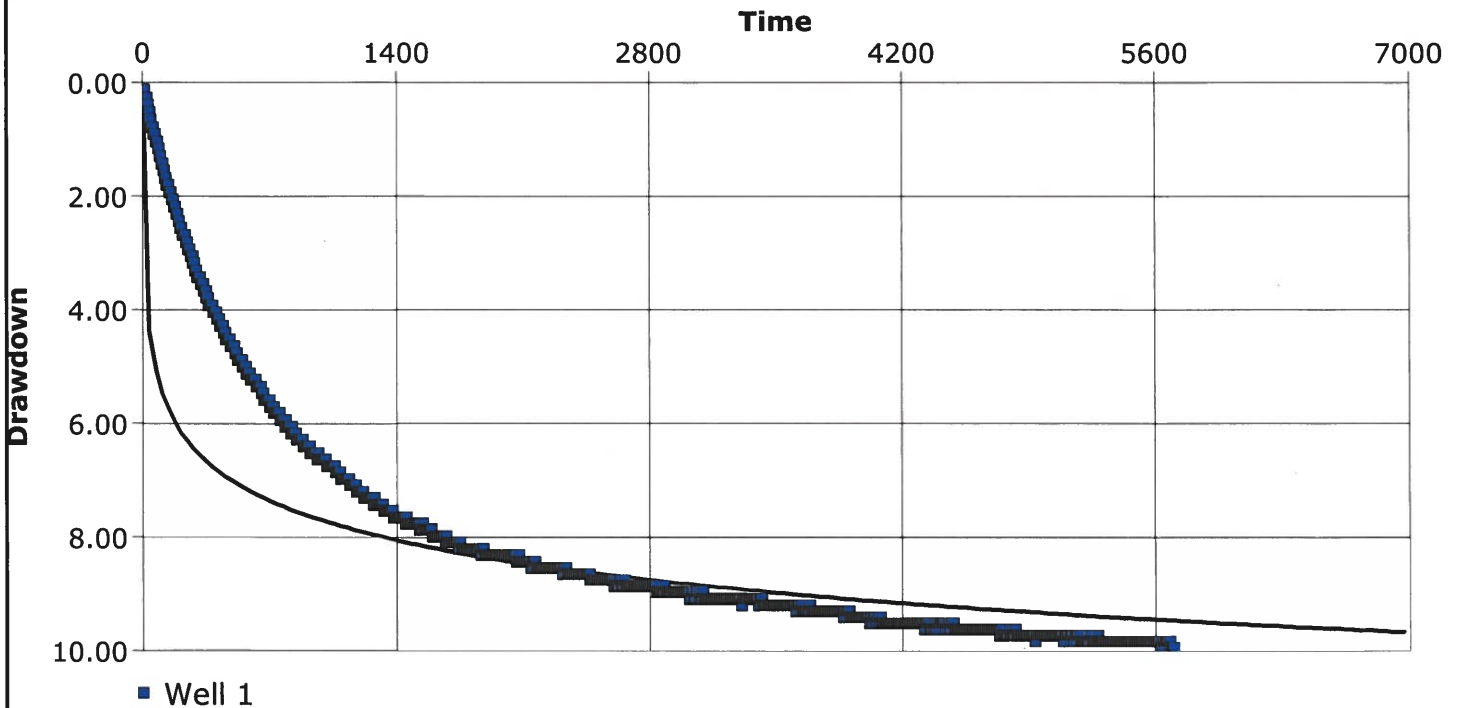
Pumping Test Analysis Report

Project: Vars Esso

Number: PH3333

Client: Abdo El Arab

| | | |
|--|--|---------------------------|
| Location: 6175 Rockdale Road, Vars | Pumping Test: Pumping Test with full data | Pumping Well: Well 1 |
| Test Conducted by: MK | | Test Date: 01/05/2018 |
| Analysis Performed by: MK | Theis with Jacob Correction (6 hours) | Analysis Date: 31/05/2018 |
| Aquifer Thickness: 4.30 m | Discharge: variable, average rate 17.824 [l/s] | |
| Pumping rate was reduced to lower turbidity. Part of recovery consists of pumping at a lower output. | | |



Calculation using Theis with Jacob Correction

| Observation Well | Transmissivity [m ² /d] | Hydraulic Conductivity [m/d] | Storage coefficient | Radial Distance to PW [m] |
|------------------|---------------------------------------|---------------------------------|---------------------|------------------------------|
| Well 1 | 1.61×10^3 | 3.73×10^2 | | 0.6 |

154 Colonnade Road South
Ottawa, ON

patersongroup K2E 7J5
consulting engineers

Pumping Test Analysis Report

Project: Vars Esso

Number: PH3333

Client: Abdo El Arab

Location: 6175 Rockdale Road, Vars Pumping Test: Pumping Test with full data Pumping Well: Well 1

Test Conducted by: MK Test Date: 01/05/2018

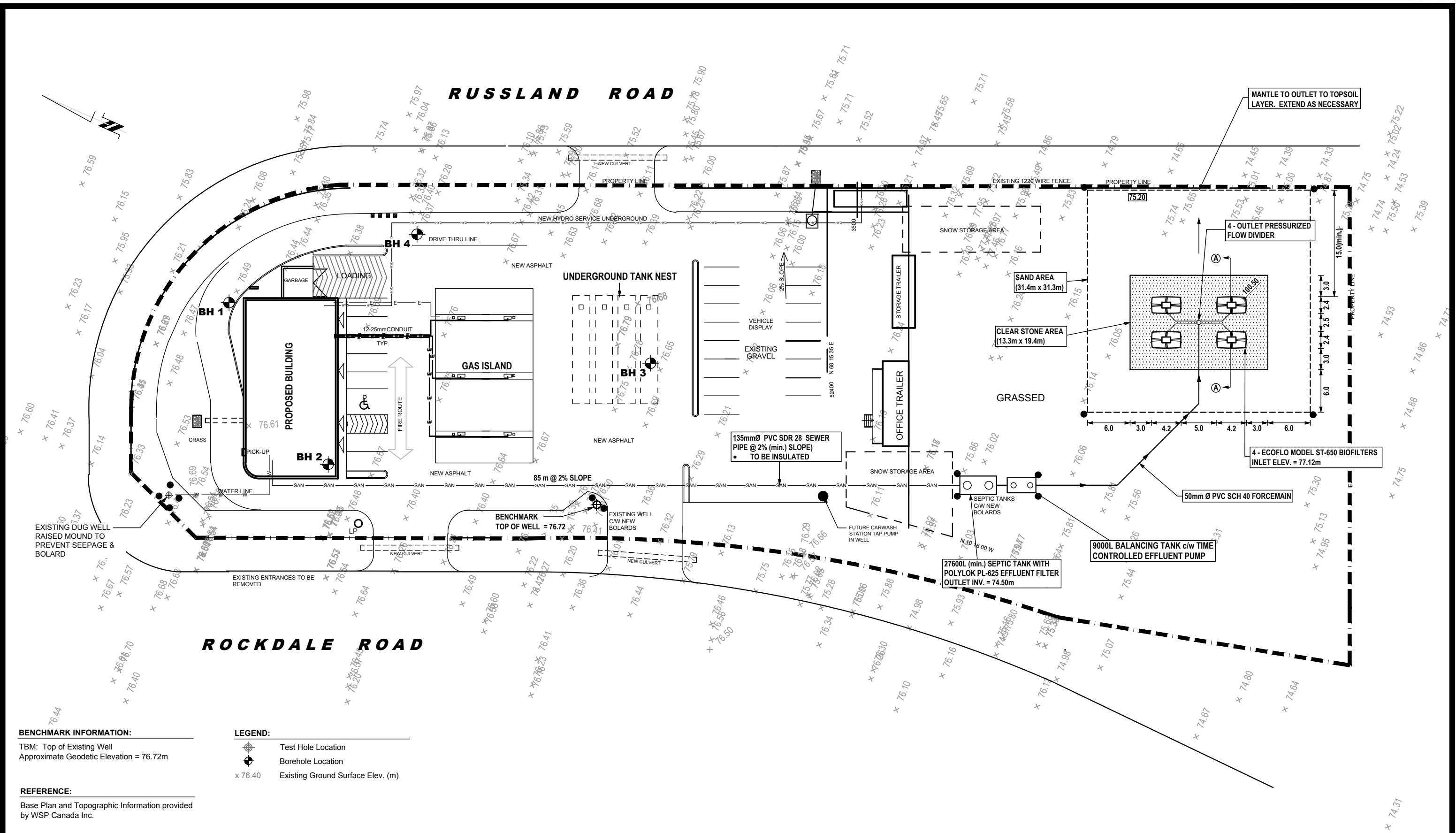
Aquifer Thickness: 4.30 m Discharge: variable, average rate 17.824 [l/s]

Pumping rate was reduced to lower turbidity. Part of recovery consists of pumping at a lower output.

| | Analysis Name | Analysis Performed by | Analysis Date | Method name | Well | T [m ² /d] | K [m/d] | S |
|---------|-----------------------------|-----------------------|---------------|-----------------------------|--------|------------------------|------------------------|---|
| 1 | Theis with Jacob Correction | MK | 28/05/2018 | Theis with Jacob Correction | Well 1 | 1.64 × 10 ³ | 3.80 × 10 ² | |
| 2 | Papadopoulos & Cooper | MK | 30/05/2018 | Theis with Jacob Correction | Well 1 | 1.07 × 10 ³ | 2.49 × 10 ² | |
| 3 | Theis Recovery | | 31/05/2018 | Theis Recovery | Well 1 | 1.02 × 10 ³ | 2.36 × 10 ² | |
| 4 | Theis with Jacob Correction | MK(hours) | 31/05/2018 | Theis with Jacob Correction | Well 1 | 1.61 × 10 ³ | 3.73 × 10 ² | |
| Average | | | | | | 1.33 × 10 ³ | 3.10 × 10 ² | |

| TW1 | | inputs | |
|------------|------|--------|-------------|
| pH | 7.79 | A | 0.22 |
| TDS | 1490 | B | 2.40 |
| Hardness | 551 | C | 2.34 |
| Alkalinity | 418 | D | 2.62 |
| Temp. | 9 | | |
| | | pHs = | 6.957722445 |

| Langelier Saturation Index (LSI) Calculation | | (Langelier, 1936) |
|---|---|---|
| $LSI = pH - pHs$ $pHs = (9.3 + A + B) - (C + D)$ Where: | | $A = (\text{Log}_{10} [\text{TDS}] - 1) / 10$ $B = -13.12 \times \text{Log}_{10} (\text{Ca} + 273) + 34.55$ $C = \text{Log}_{10} [\text{Ca}^{2+} \text{ as CaCO}_3] - 0.4$ $D = \text{Log}_{10} [\text{alkalinity as CaCO}_3]$ |
| | | LSI = 0.8 |
| LSI | Effect | |
| 0.5 to 2 | Water is super saturated and tends to precipitate a scale layer of calcium carbonate (scale forming but non-corrosive) | |
| 0 to 0.5 | Water is super saturated and tends to precipitate a scale layer of calcium carbonate (slightly scale forming and corrosive). | |
| 0 | Water is saturated (in equilibrium) with calcium carbonate. A scale layer of calcium carbonate is neither precipitated nor dissolved. | |
| 0 to -0.5 | Water is under saturated and tends to dissolve solid calcium carbonate (slightly corrosivebut non-scale forming). | |
| -0.5 to -2 | Water is under saturated and tends to dissolve solid calcium carbonate (seriously corrosive). | |



BENCHMARK INFORMATION:

TBM: Top of Existing Well
 Approximate Geodetic Elevation = 76.72m

LEGEND:

- Test Hole Location
- Borehole Location
- x 76.40 Existing Ground Surface Elev. (m)

REFERENCE:

Base Plan and Topographic Information provided by WSP Canada Inc.

patersongroup
 consulting engineers
 154 Colonnade Road, Ottawa, Ontario K2E 7J5

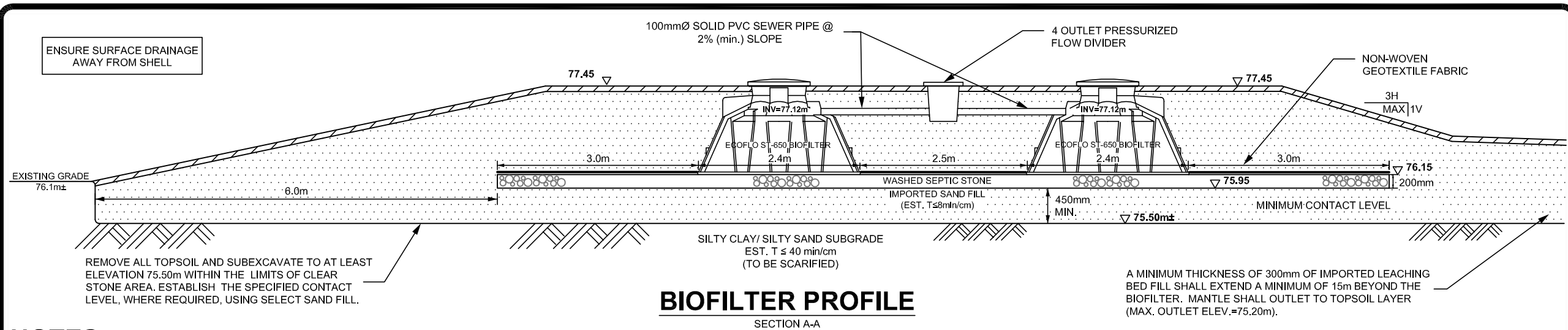
| | | |
|----------|----------------------------------|---|
| 03/09/19 | Updated to latest base plan | 4 |
| 14/06/19 | Issued with PH3333-LET.01-Rev.01 | 3 |
| 29/04/18 | Issued for Septic Permit | 2 |
| 02/02/18 | Issued for S.P.A. | 1 |
| DD/MM/YY | Description | 0 |

| | |
|---------|---|
| Client | ABDO EL-ARAB |
| Project | PROPOSED GAS BAR/CONVENIENCE STORE 6175 ROCKDALE ROAD OTTAWA (VARS), ONTARIO |

| | |
|---------|----------------------------------|
| Drawing | SEWAGE SYSTEM LAYOUT PLAN |
|---------|----------------------------------|

| | | | |
|--------------|------------------------|-------------|----|
| Scale: | 1:500 | Drawn by: | HV |
| Date: | 06/2019 | Checked by: | MK |
| Drawing no.: | PH3333-1(rev.4) | | |

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BIOFILTER PROFILE

SECTION A-A

NOTES:

1) ESTIMATE OF DAILY SEWAGE FLOW (Q)

THE PROPOSED DEVELOPMENT WILL CONSIST OF A GAS BAR WITH A CONVENIENCE STORE AND A TAKE-OUT RESTAURANT WITH PAPER SERVICE ONLY

- GAS BAR: 12 NOZZLES @ 560L/DAY = 6720 L/DAY
- CONVENIENCE STORE: 155 m² x 5 L/DAY = 775 L/DAY
- TAKE OUT RESTAURANT: 74m²/9.25m² X 190 L/DAY/m² = 1527 L/DAY
- + 2 STAFF @ 75 L/DAY = 150 L/DAY

TOTAL SEWAGE FLOW = 9145 L/DAY

DESIGN SEWAGE FLOW = 9200 L/DAY

2) SUBGRADE CONDITIONS

SOILS INFORMATION GATHERED BY PATERSON GROUP INC. ON JULY 17, 2017

| TH 1, ELEV. 74.97m | | TH 2, ELEV. 75.21m | | TH 3, ELEV. 75.88m | |
|---------------------|----------------------|---------------------|------------|-----------------------|-----------------------|
| 0-0.19 | TOPSOIL | 0-0.25 | TOPSOIL | 0-0.05 | TOPSOIL |
| 0.19-0.35 | SILTY SAND | 0.25-1.35 | SILTY CLAY | 0.05-1.35 | SILTY SAND, SOME CLAY |
| 0.35-1.35 | SILTY CLAY SOME SAND | | SOME SAND | | |
| - GWL @ 0.58m DEPTH | | - GWL @ 0.80m DETPH | | - DRY UPON COMPLETION | |

3) GREASE TRAP

- THE KITCHEN FLOW FROM THE TAKE-OUT RESTAURANT MUST OUTLET INTO AN INTERIOR GREASE TRAP TO BE DESIGNED BY MECHANICAL ENGINEER

4) TANKAGE

General

- ALL TANKS SHALL CONSIST OF PRECAST CONCRETE TANKS CONFORMING TO CSA-B66.
- THE ACTUAL TANK CONFIGURATION MAY DIFFER FROM THAT SHOWN PROVIDED THE MINIMUM SPECIFIED WORKING CAPACITY OF THE TANK MEET THE DESIGN REQUIREMENTS.
- ALL SEPTIC TANKS MUST BE CERTIFIED TO WITHSTAND ALL APPLICABLE LOADS. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR REVIEW.
- TANKS SHALL BE BEDDED ON A LAYER OF OPSS GRANULAR A COMPACTED TO AT LEAST 95% OF ITS SPMDD.
- TANKS SHALL BE CONNECTED USING 100 mmØ SDR35 PVC SEWER PIPE WITH WATERTIGHT CONNECTIONS.
- BACKFILL TANKS USING OPSS GRANULAR B TYPE 1 BACKFILL OR CLEAN SAND FILL. PLACE BACKFILL IN UNIFORM LAYERS NOT EXCEEDING 300 mm THICKNESS AND COMPACT TO AT LEAST 90% OF SPMDD.
- FINAL GRADING SHALL BE SHAPED TO ENSURE THAT SURFACE WATER IS DIRECTED AWAY FROM ALL TANKS.
- WORK AREA SHALL BE COVERED WITH A LAYER OF TOPSOIL OF AT LEAST 100mm IN THICKNESS.

Septic Tank

- INSTALL A 27,600 L (min.) PRECAST CONCRETE SEPTIC TANK.
- INSTALL POLYLOK PL-625 EFFLUENT FILTER ON OUTLET PIPE. EFFLUENT FILTER TO BE INSTALLED WITH BOTTOM PIPE SUPPORT AND EXTENDED HANDLE.
- EFFLUENT FILTER TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES.
- EFFLUENT FILTER TO BE CENTRED OVER ACCESS OPENING.
- A 600mmØ ULTRA RIB RISERS AND INSULATED COVER ASSEMBLY SHALL BE INSTALLED OVER TANK ACCESS OPENINGS.
- RISERS SHALL EXTEND TO AT LEAST 50mm ABOVE FINISHED GRADE.
- PIPE CONNECTIONS AT TANK SHALL BE WATERTIGHT.

Balancing Tank

- THE BALANCING TANK SHALL CONSIST OF A 9,000 L SINGLE COMPARTMENT PRECAST CONCRETE TANK. IF A TWO COMPARTMENT TANK IS BEING USED, 3-150 mm Ø FLOW HOLES SHALL BE INSTALLED NEAR THE BASE OF THE DIVIDER WALL OF THE BALANCING TANK.
- BALANCING TANK SHALL BE LOCATED IN SERIES AND DOWNSTREAM FROM THE SEPTIC TANK.
- TANKS SHALL BE CONNECTED USING 100 mm Ø SDR35 PVC SEWER PIPE WITH WATERTIGHT CONNECTIONS USING STAINLESS STEEL LINK SEALS OR APPROVED EQUIVALENT.
- THE ACCESS OPENING IN THE TANK LID OVER THE PUMP SHALL BE 600mmØ. A 750mmØ ULTRA RIB RISER PIPE SHALL BE CAST IN THE TANK LID AND EXTEND TO AT LEAST 50mm ABOVE FINISHED GRADE. A LOCKABLE INSULATED COVER SHALL BE INSTALLED ON RISER.
- THE BALANCING TANK SHALL BE EQUIPPED WITH AN ALTERNATING DUPLEX PUMP SYSTEM, OR SIMILAR. THE PUMPS (2) SHALL CONSIST OF MYERS ME3F, OR EQUIVALENT, (230V, 1PH) WITH CORD LENGTH TO SUIT.
- INSTALL REQUIRED FITTINGS AND PIPING FROM NEW PUMPS AND CONNECT A - 50 mm Ø SCH40 PVC FORCEMAINS.
- FORCEMAINS TO BE INSTALLED TO GRAVITY DRAIN AND OVERLAIN BY 50 mm THICK BY 600 mm WIDE INSULATION BOARDS.
- ALL PIPING CONNECTIONS TO BE GLUED.
- THE PUMPS SHALL BE OPERATED BY AN ALTERNATING DUPLEX TIME CONTROL PANEL.
- THE CONTROL PANEL SHALL ALTERNATE THE PUMPS AND THE PUMPS SHALL OPERATE EVERY 20 MINUTES WITH A RUN TIME OF 110 SECONDS AND DOSE VOLUME OF 230L.
- PUMP RUN TIME TO BE CONFIRMED IN THE FIELD.
- A CONTROL SWITCH SHALL OVERRIDE THE TIMER TO MAINTAIN THE LIQUID LEVEL WITHIN THE WORKING CAPACITY OF THE TANK.
- ALL ELECTRICAL WORKS MUST BE CARRIED OUT BY A QUALIFIED ELECTRICAL CONTRACTOR IN ACCORDANCE TO THE LATEST CODES, BYLAWS AND REGULATIONS.
- CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN ALL NECESSARY ELECTRICAL PERMITS AND COORDINATE ALL ELECTRICAL INSPECTIONS.

5) DISPOSAL FIELD SIZING REQUIREMENTS

- INSTALL ECOFLO MODEL ST-650 BIOFILTERS
- CLEAR STONE AREA REQUIRED = 9200/50 = 184m²
- CLEAR STONE AREA PROVIDED = 258.0m²
- SAND AREA REQUIRED = QT/400 = 9200(40)/400 = 920m²
- SAND AREA PROVIDED = 982.8m²

6) DISPOSAL FIELD CONSTRUCTION GUIDELINES

- REMOVE ALL EXISTING TOPSOIL, WITHIN THE LIMITS OF THE SAND AREA AND SUBEXCAVATE TO AT LEAST ELEVATION 75.50m, WHICHEVER IS GREATER.
- A MINIMUM THICKNESS OF 450mm OF LEACHING BED FILL SHALL BE INSTALLED OVER A SUITABLY PREPARED SUBGRADE.
- LEACHING BED FILL SHALL BE UNIFORM SAND WITH GRADING LIMITS SIMILAR TO 100% PASSING 13.2mm SIEVE, LESS THAN 5% PASSING 0.075mm SIEVE AND HAVE A PERCOLATION RATE OF 6-8 min/cm.
- A MINIMUM THICKNESS OF 200mm OF WASHED SEPTIC STONE SHALL BE INSTALLED, WITHIN THE SPECIFIED CLEAR STONE AREA, OVER LEACHING BED FILL.
- THE ECOFLO BIOFILTERS SHALL BE INSTALLED LEVEL ON THE CLEAR STONE LAYER IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- THE CLEAR STONE LAYER, BEYOND THE BIOFILTERS, SHALL BE COVERED WITH A NON-WOVEN GEOTEXTILE FABRIC. ALL BACKFILL MATERIALS SHALL CONSIST OF PERMEABLE SAND FILL.
- THE TOTAL WORK AREA SHOULD BE COVERED WITH APPROX. 100mm OF SANDY TOPSOIL AND SHALL BE VEGETATED AS SOON AS POSSIBLE.
- THE FINAL LANDSCAPED GRADING SHALL DIRECT SURFACE WATER AWAY FROM THE BIOFILTER.

- THE UNDERSIDE OF THE BIOFILTER LIDS SHALL EXTEND ABOVE THE FINAL LANDSCAPED GRADE.

7) MINIMUM CLEARANCE DISTANCES FROM BIOFILTER

- 3.1m FROM ANY PROPERTY LINE
- 5.1m FROM ANY STRUCTURE
- 15.1m FROM ANY DRILLED WELL
- 30.1m FROM ANY DUG WELL

8) MINIMUM CLEARANCE DISTANCES FROM TANKS

- 1.5m FROM ANY PROPERTY LINE
- 1.5m FROM ANY STRUCTURE
- 15.0m FROM ANY DRILLED WELL

9) GENERAL

- CONTRACTOR SHALL BE QUALIFIED AND REGISTERED UNDER PART 8 OF THE ONTARIO BUILDING CODE.
- ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE LATEST BY-LAWS, CODES AND REGULATIONS.
- CONTRACTOR SHALL REVIEW DRAWINGS IN DETAIL AND SHALL INFORM THE CONSULTANT OF ANY ERRORS AND/OR OMISSIONS ON DESIGN DRAWINGS IMMEDIATELY.
- CONTRACTOR SHALL VISIT THE SITE AND REVIEW ALL DOCUMENTATION TO BECOME FAMILIAR WITH THE SITE AND SUBSURFACE SOIL CONDITIONS TO DETERMINE SUITABLE METHODS OF CONSTRUCTION.
- CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT AND GRADING AS DETAILED ON THE DESIGN DRAWINGS THE CONTRACTOR IS RESPONSIBLE TO LOCATE AND PROTECT EXISTING UNDERGROUND SERVICES.
- THE MANUFACTURER PROVIDES A LIMITED WARRANTY OF THE SYSTEM COMPONENTS. THE OWNER OF THE BIOFILTER MUST SIGN A MAINTENANCE AGREEMENT WITH THE MANUFACTURER'S REPRESENTATIVE.
- THE PROPERTY OWNER IS RESPONSIBLE FOR THE ANNUAL COSTS ASSOCIATED WITH THE MAINTENANCE PROGRAM.
- THE FIRM OF PATERSON GROUP INC. HAS PROVIDED DESIGN SERVICES ONLY FOR THE SUBJECT SEWAGE SYSTEM. THE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES AND OUR INTERPRETATION OF PART 8 OF THE ONTARIO BUILDING CODE.
- INSPECTIONS BY THE CONSULTANT DURING THE INSTALLATION OF THE SYSTEM IS A REQUIREMENT OF SOME REGULATING AUTHORITIES AND IS STRONGLY RECOMMENDED BY THIS FIRM.

| DD/MM/YY | DESCRIPTION | REV. |
|----------|----------------------------------|------|
| 14/06/19 | Issued with PH3333-LET.01-Rev.01 | 3 |
| 29/04/19 | Issued for Septic Permit | 2 |
| 02/02/18 | Issued for S.P.A. | 1 |
| 19/07/17 | Issued for Discussion Purposed | 0 |

Consultant:

patersongroup
consulting engineers

Client:

ABDO EL-ARAB

Project:

**PROPOSED GAS BAR /
CONVENIENCE STORE**

**6175 ROCKDALE ROAD
OTTAWA (VARS), ONTARIO**

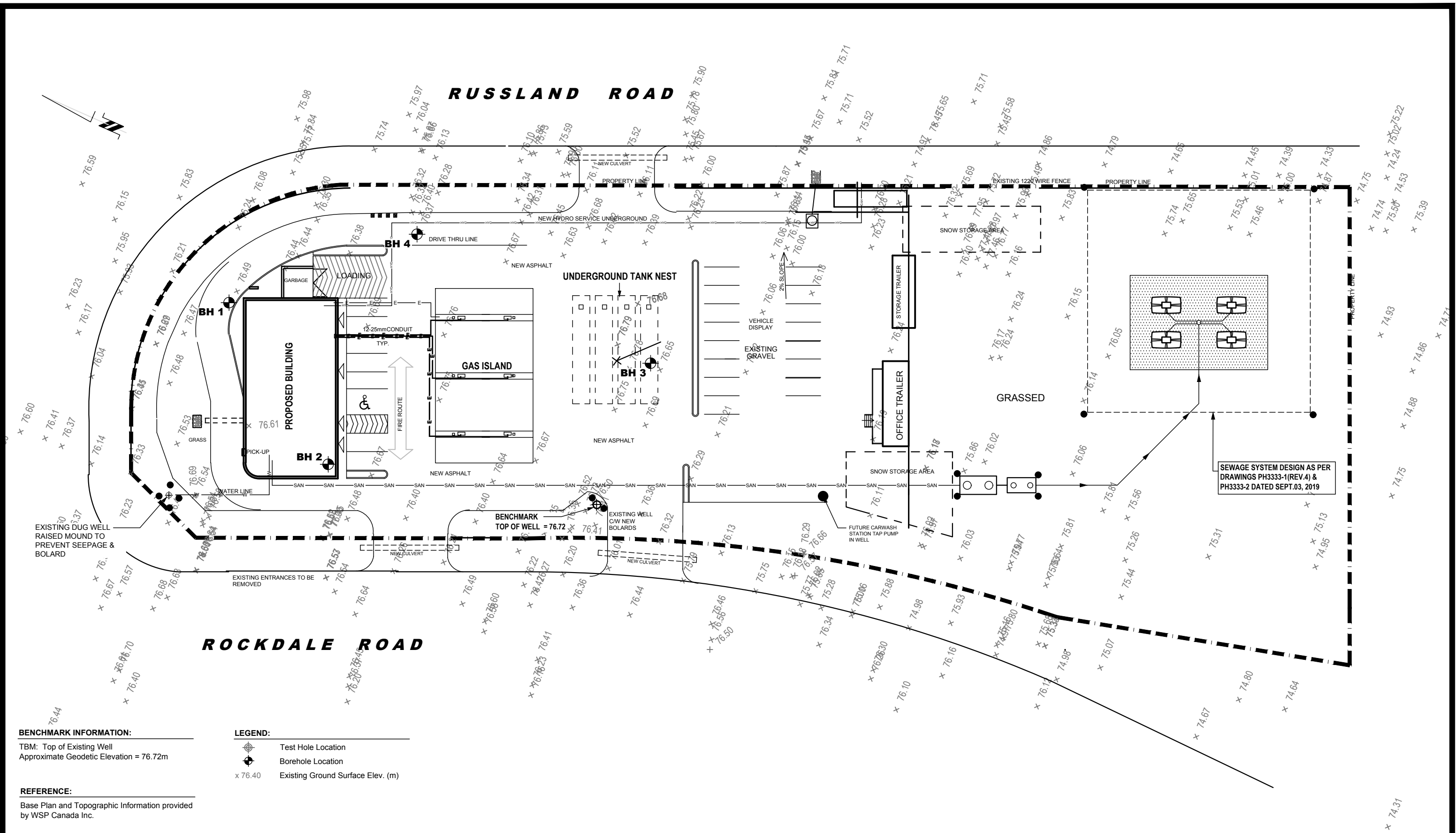
Drawing:

**SEWAGE SYSTEM
DETAIL & NOTES**

| | | | |
|--------|---------|-------------|-----|
| Scale: | N.T.S. | Drawn by: | HV |
| Date: | 06/2019 | Checked by: | AVS |

Drawing No.:
PH3333-2(rev.1)

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BENCHMARK INFORMATION:
 TBM: Top of Existing Well
 Approximate Geodetic Elevation = 76.72m

LEGEND:
 Test Hole Location
 Borehole Location
 x 76.40 Existing Ground Surface Elev. (m)

REFERENCE:
 Base Plan and Topographic Information provided by WSP Canada Inc.

SEWAGE SYSTEM DESIGN AS PER DRAWINGS PH3333-1(REV.4) & PH3333-2 DATED SEPT.03, 2019

patersongroup
 consulting engineers
 154 Colonnade Road, Ottawa, Ontario K2E 7J5

| DD/MM/YY | Description | 0 |
|----------|-------------------------------|---|
| 03/09/19 | Updated to latest base plan | 2 |
| 14/06/19 | Revision as per City Comments | 1 |
| 03/07/18 | Issued with PH3333-LET.01 | 0 |
| DD/MM/YY | Description | 0 |

Client
ABDO EL-ARAB
 Project
PROPOSED GAS BAR/CONVENIENCE STORE
 6175 ROCKDALE ROAD
 OTTAWA (VARS), ONTARIO

Drawing
WATER SUPPLY LOCATION PLAN

Scale: 1:500
 Date: 06/2019
 Drawing no.: **PH3333-3(Rev.2)**
 Drawn by: HV
 Checked by: MK

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