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REPORT ON

**HYDROGEOLOGICAL INVESTIGATION  
AND TERRAIN EVALUATION  
PROPOSED RESIDENTIAL SUBDIVISION  
3200 REIDS LANE  
OSGOODE WARD, CITY OF OTTAWA  
ONTARIO**

FILE # 210064

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## **1.0 INTRODUCTION**

Kollaard Associates Inc. was retained by Crestview Innovations Inc. of Ottawa, Ontario to undertake a hydrogeological investigation and terrain evaluation for a site located on Reids Lane. The site is located within Part of Lots 27 & 28, Concession 1, in Osgoode Ward, in the City of Ottawa, Ontario (See Key Plan, Figure 1).

The site consists of an area of approximately 3.5 hectares (8.7 acres) located on the north side of Osgoode Main Street within the village boundary of Osgoode Ward, Ottawa, Ontario. It is proposed to subdivide the site into some 7, average 0.40 hectare lots (minimum 0.4 hectare) for single family dwelling construction purposes. The proposed dwellings will be serviced by private septic systems and wells. The subject site consists mostly of open fields with scattered trees. There are no watercourses on the subject property.

The site is bordered on the west by the Osgoode Link Pathway (a former rail corridor), on the south and north sides by existing residential development and on the east by a municipally-owned woodlot. The existing dwellings to the north and south are serviced by private septic systems and wells.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by coarse-textured glaciomarine deposits of sand, gravel, minor silt and clay, predominantly consisting of foreshore and basinal deposits. The bedrock geology map indicates that the bedrock underlying the site consists of dolostone and sandstone of the Beekmantown Group (Attachment A).

## **2.0 FIELD PROCEDURES**

The objectives of this study were:

- to determine the shallow subsurface soil and groundwater conditions relative to the design of Class IV septic sewage disposal systems



- to investigate the potential quantity and quality of groundwater available from drilled wells for domestic supply

## 2.1 Terrain Evaluation

The field work for the terrain evaluation was carried out on February 3 and 4, 2021, during which time a total of six boreholes (numbered BH1 to BH6, inclusive) were put down across the site. The boreholes were advanced using a track mounted drill rig equipped with a 200 mm hollow stem auger owned and operated by CCC Drilling of Ottawa, Ontario. The approximate locations of the boreholes are provided in Site Plan, Figure 2.

The boreholes were put down throughout the site. The boreholes were advanced to depths of approximately 4.4 to 9.75 metres below the existing ground surface using 200 mm hollow stem augers. Borehole BH1 was continued to a depth of about 14.52 metres below the existing ground surface as a probe hole until bedrock was encountered. A member of our engineering staff recorded the soils types, depths to strata changes, and groundwater conditions at each borehole location. Groundwater conditions at the boreholes were noted at the time of drilling. Groundwater was also measured at a later date in standpipes installed within three of the boreholes at the time of drilling. The water levels in the standpipes were measured on February 12, 2021, and water samples were obtained from the standpipes for testing of background nitrogen levels. Surficial soil samples were obtained from Boreholes BH1, BH3 and BH5 for laboratory grain size distribution analysis. Two soil samples of underlying soils were also obtained from BH2 and BH4 and underwent hydrometer analysis. All particle analysis results are provided as Attachment C.

To obtain representative samples of the upper groundwater at the site for background testing of nitrogen species, three monitoring wells were installed using the *ASTM Standard D5092-04(2010) Standard Practice for Design and Installation of Groundwater Monitoring Wells*. The monitoring wells installed at BH1, BH3 and BH5 were tested for nitrogen species including nitrites, nitrates, Total Kjeldahl Nitrogen (TKN) and ammonia. The Record of Borehole Logs are provided herein.

### Monitoring Well Sampling Procedure

The sampling procedure was carried out using sampling protocols and methods described in “*Association of Professional Geoscientists of Ontario Guidance for Environmental Site Assessments under 153/04 (as amended), April 2011*”. On February 12, 2021, the static water levels were



measured in each of the standpipes. The standpipes were subsequently purged of approximately three well volumes, and allowed to recover between purgings, prior to water samples being obtained and tested for nitrogen species, including nitrites, nitrates, TKN and ammonia. As no drilling fluids were used during borehole construction, the purging of three well volumes was considered to be sufficient to obtain groundwater samples that were representative of the groundwater in the shallow aquifer. The standing water in the monitoring well was purged using a mechanical displacement pump.

## 2.2 Groundwater Supply Investigation

During the original investigation, to determine the quantity and quality of groundwater available for domestic water supply, three test wells, numbered TW1, TW2 and TW3, were pump tested and sampled. The approximate locations of the test wells are shown on the attached Site Plan, Figure 2. Air Rock Drilling Company Limited of Richmond, Ontario, drilled all three water supply wells on the subject property for the purpose of this hydrogeological investigation on April 26 and 27, 2021. To establish the existing water quality in the area, three offsite neighbouring wells were sampled for water quality. The locations of the test wells, neighbouring sampled wells and other area well records are provided herein as Well Locations, Figure 3. The well records for the wells and the Certificates of Compliance for the test wells are provided herein as Attachment B.

The water well records for the test wells supplied by the well driller indicate that nominal 15 centimetre inside diameter steel casings were installed through the overburden and were set well into the bedrock and grouted in place. The wells were drilled to final depths using a 15 centimetre diameter bit and completed as an open hole in the bedrock. TW1 and TW2 were drilled into the bedrock to final depths of some 76.2 and 74.4 metres, respectively, below the existing ground surface. TW3 was drilled to a depth of 30.5 metres. All three test wells were cased and grouted 3.0 metres into the bedrock with casing lengths of between 18.9 and 20.1 metres.

Pumping tests were conducted on TW1, TW2 and TW3 on May 12, May 10 and May 5, 2021, respectively. The testing consisted of 6 hour duration constant discharge rate pumping tests. During the pumping tests, water level measurements were made on a regular basis to monitor the drawdown of the water level in the wells in response to pumping. After the pumping period, the pump was shut off and the recovery of the water level in the test well was monitored for a period of



time. During the pumping tests, water levels at adjacent test wells were monitored, using pressure transducers, to determine the potential interference effects between the wells.

Groundwater samples were collected from the test wells at about hour 3 and at hour 6 of the pumping tests to characterize groundwater quality. The groundwater samples from the test wells were collected and prepared/preserved in the field using appropriate techniques and submitted to Eurofins Environmental Laboratory in Ottawa, Ontario for the chemical, physical and bacteriological analyses listed in the Ministry of the Environment (MOE) guideline entitled Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, August 1996 in addition to select heavy metals. The temperature, pH, turbidity, sulphide and residual chlorine levels of the groundwater were measured at periodic intervals during the pumping tests.

Water samples were obtained from three wells servicing existing dwellings located in close proximity to the site at 5560 Lombardy and 5566 Lombardy Drive, located northeast of the site and 5529 Osgoode Main Street, located south of the site. The groundwater samples from the three wells were collected and prepared/preserved in the field using appropriate techniques and submitted to Eurofins Environmental Laboratory in Ottawa, Ontario for the chemical, physical and bacteriological analyses listed in the Ministry of the Environment (MOE) guideline entitled "Technical Guideline for Water Supply Assessment for Subdivision Development on Individual Private Wells," dated July 1992.

### **3.0 TERRAIN EVALUATION**

#### **3.1 Soil and Groundwater Conditions**

This section provides a summarized account of the subsurface soil and groundwater conditions on the subject property based on the information obtained at the borehole locations. Details of the subsurface conditions at the borehole locations are presented in the attached Record of Boreholes. It is noted that in some cases the stratigraphic boundaries within the overburden represent a transition between soil types rather than an exact plane of geologic change. Subsurface conditions differing somewhat from those reported can be expected to exist at the site.

The six borehole locations encountered either fill (consisting of topsoil, sand and gravel), or topsoil. Underlying the surficial organic layers, the engineering staff identified the predominant surficial soil type at the site as fine to medium sand. Kollaard Associates Inc. (KAI) characterizes soil as fine to



medium sand based on textural indicators for grain size. The sand layer was identified to be between 0.7 and 3.0 metres in thickness. The sand layer transitioned from red brown to grey at depths of 0.40 metres below ground surface at BH2 and BH3, and between 0.9 and 1.8 metres at the other borehole locations. BH1 was terminated in sand and continued to presumed bedrock as a probe hole. No soils information below 3.7 metres depth is available from that borehole. Large boulders and/or possible bedrock occur at or below 14.5 metres depth at that location. Below the sand deposit at the other five boreholes (BH2-BH6), a layer of grey sandy silty clay was encountered, of between 0.4 and 1.2 metres in thickness. A silty sand layer of between 0.7 and 1.4 metres in thickness was encountered below the silty sandy clay layer at BH2, BH3, BH4 and BH6. A deposit of grey silty clay was encountered at boreholes BH2, BH4 and BH6. The thickness of this silty clay layer was 2.6 to 3.3 metres at BH2 and BH6. BH4 was terminated within the silty clay layer at a depth of 9.7 metres below existing ground surface. BH2 and BH6 encountered glacial till below the silty clay layer and were terminated on practical refusal on bedrock at depths of 9.0 and 6.7 metres, respectively.

Kollaard Associates Inc. (KAI) characterizes the receiving aquifer at the site as the red to grey fine to medium sand layer and upper portions of the sandy clay or sandy silty clay that was encountered below the sand at five of the borehole locations. The surficial soil is fine to medium sand based on textural indicators for grain size. Three representative samples were obtained from BH1, BH3 and BH5 from depths of 0.8 to 1.4 metres and submitted to a lab for grain size analyses.

The results of a sieve analysis (ASTM C136) on three samples of sand (BH1 - SS2 - 0.76 - 1.37m, BH3 - SS2 - 0.76 - 1.37m and BH5 - SS2 - 0.76 - 1.37m) indicates the samples have the following:

Sample	Depth (metres)	% Gravel	% Sand	% Silt & Clay
BH1	0.76 - 1.37m	0.0	96.5	3.5
BH3	0.76 - 1.37m	0.0	94.9	5.1
BH5	0.76 - 1.37m	0.0	96.7	3.3





The result of a hydrometer test (ASTM D422 and D2216) on one sample of subsurface sandy soil indicates the sample consists of fine sand with some silt and trace clay as follows:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH4-SS7	4.52 - 5.18m	0.0	85.9	10.1	4.0

The results of a hydrometer test (ASTM D422 and D2216) on a sample of subsurface glacial till soil indicates the sample consists of glacial till as follows:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH2-SS9	7.62 - 8.22m	17.7	32.1	45.2	5.0

The results of the laboratory testing are located in Attachment C.

The hydraulic conductivity was estimated for the three sand samples using the particle size analyses, as follows.

$$k = 0.35 (D_{15})^2$$

Where k = hydraulic conductivity, in cm/s

$D_{15}$  = the particle diameter where 15% of soil is passing, in mm

Sample	$D_{15}$ (mm)	K (cm/s)
BH1	0.26	$2.4 \times 10^{-2}$
BH3	0.27	$2.5 \times 10^{-2}$
BH5	0.29	$2.9 \times 10^{-2}$

Based on the above noted information, the hydraulic conductivity of the soil is expected to be  $\sim 2.6 \times 10^{-2}$  cm/s. The soil can be characterized as poorly graded sand. This is considered to be a soil of medium permeability.

The subsurface soils were also sampled. A sample of silty sand from BH4 had 14% fines (silt and clay sized particles) and the underlying glacial till at BH2 contained 50% fines. The silty clay was not sampled, however, it is expected to be of low permeability as it would be considered a fine grained soil. The underlying soils are of medium to low permeability.



The surficial and underlying soils at the site are of medium to low permeability. Based on the soils information, the site is not considered to be hydrogeologically sensitive as there are sufficient soils of medium to low permeability.

Groundwater monitoring wells were installed in three boreholes (BH1, BH3 and BH5). The ground surface and groundwater elevations were subsequently measured on February 12, 2021, as follows.

Monitoring Well	Ground Surface Elevations (masl)	Groundwater Elevations (masl)
		Feb.12, 2021
BH1	92.97	92.50
BH3	90.53	89.25
BH5	91.35	89.64

Water levels in the water supply wells at the site were also recorded after the wells were constructed on May 5, 2021, as follows.

Test Well	Top of Casing Elevations (masl)	Ground Surface Elevations (masl)	Groundwater Elevations (masl)
			May 5, 2021
TW1	93.17	92.78	86.45
TW2	93.08	92.60	86.55
TW3	91.90	91.34	87.37

The interpreted groundwater flow directions in the shallow overburden aquifer (sewage effluent receiving aquifer) and the deeper bedrock water supply aquifer are expected to be to the northwest and east to southeast, respectively, as shown on the attached Figure 2, Site Plan.

### 3.1.1 Shallow Groundwater Sampling

To obtain representative samples of the upper groundwater at the site for background testing of nitrogen species, three monitoring wells were installed using the *ASTM Standard D5092-04(2010) Standard Practice for Design and Installation of Groundwater Monitoring Wells*. The testing includes



nitrogen species nitrates, nitrites, Total Kjeldahl Nitrogen and ammonia. For details on construction and purging procedures see Section 2.1. For borehole locations, see Site Plan, Figure 2.

The following table summarizes the laboratory results for nitrogen measured at the shallow monitoring wells installed at three boreholes.

Table 3.1.1

Analyte (mg/L)	BH1	BH3	BH5
Sample Date (yy-mm-dd)	21-02-12	14-12-12	16-09-14
N-NO <sub>2</sub>	0.17	<0.10	<0.10
N-NO <sub>3</sub>	5.80	<0.10	<0.10
N-NH <sub>3</sub>	<0.010	<0.010	0.031
Total Kjeldahl Nitrogen (TKN)	0.393	0.331	0.245
Total Nitrogen = NO <sub>2</sub> +NO <sub>3</sub> +TKN	6.36	0.33	0.28

### 3.1.2 Land and Water Use Conflicts

The former use of the subject property and the current and historical uses of properties within the site vicinity have been evaluated in terms of the potential for groundwater contamination on the subject property. Information about the subject property and nearby properties was obtained from previous environmental reports completed for the subject property. Dillon Consulting completed a Phase I Environmental Site Assessment (ESA) in November 2016, with subsequent reports regarding debris removal, subsurface investigation, groundwater monitoring and decommissioning of monitoring wells. Based on a review of those reports, the following is noted.

- The Phase I ESA identified a former Imperial Oil fuel depot adjacent to the southwest corner of the site as having been the source for onsite minor soil and groundwater impacts in that portion of the site.
- Fill materials and debris piles across the site represent on site potential sources of contamination.
- Former retail fuel outlets or service garages existed at 5514, 5491, 5543 and 5566 Osgoode Main Street. These are identified as upgradient to the subject property with potential for groundwater contamination (due to PHCs and/or VOCs).



- A soil and groundwater investigation was carried out November 2017 with a total of four soil samples plus one duplicate sample were collected and tested for metals, select VOCs, PAHs and PCBs. Some of the soil samples exceeded the standards for PAHs, lead and arsenic. A total of five groundwater monitoring wells were installed across the site. The overburden groundwater flow direction was estimated to be to the north. Water samples were tested for metals, select VOCs (BTEX), PHCs and PAHs. The only exceedance was vanadium at three locations, which were slightly above the allowable limits for potable water. The source of vanadium was considered to be the silty clay soils which are known to have naturally occurring elevated vanadium levels. The report concludes that the groundwater at the site was not impacted by debris and fill materials that caused soil impacts. The report recommended additional testing of groundwater to confirm the initial testing results.
- In July 2018, the five monitoring wells were retested and the only exceedances were vanadium, at the same three locations. A subsequent review by the MOECC agreed that there was no groundwater impacts from the debris and fill materials at the site and the wells could be abandoned. A subsequent monitoring well decommissioning was carried out and records of well abandonment were provided and registered with the MOECC.

The above noted review of reports indicates that there were no groundwater impacts on the site from gasoline compounds (BTEX), hydrocarbon compounds (PHCs) or metals (with the exception of vanadium which was considered to be due to wells being in contact with silty clay, which is known to contain elevated vanadium. The results of vanadium testing and other metals testing in the groundwater wells indicates that there are no elevated vanadium levels or other metals that exceed the allowable limits for drinking water. The majority of former offsite sources of contamination, namely retail fuel outlets and automotive garages are no longer active, with the exceptions of 5543 Osgoode Main Street and 5566 Osgoode Main Street (Drummond's Gas Bar). These properties are sufficiently distant, between 40 and 140 metres to the east and southeast of the subject property, such that it is unlikely that there would be any impact on the subject site. The Drummond's gas station had all the previous tanks removed and has been updated with new tanks. Current gas stations are far less likely to cause impacts due to the use of double-walled insulated tanks which are usually constructed using fibreglass that does not degrade and leak, compared to the former use of steel tanks. It should also be noted that many of the existing water supply wells servicing dwellings on Osgoode Main Street are sand point wells. If there were issues with hydrocarbon impacts from nearby commercial development, those wells are much more likely to be impacted. Based on the review of the above noted reports and the current development near the



site, there are no concerns with respect to the quality of groundwater supply at the site from the offsite land uses and the historical use of the site.

A review of Permit to Take Water Mapping for a 1 kilometre radius around the site indicates that there is no major water taking activities in the area. The area surrounding the site is mostly developed, with the exception of a vacant parcel to the east. The recent groundwater pumping tests at the site indicate that there is sufficient water supply at the site to support development. As such, there are no concerns with existing development impacting the quantity of water supply at the site.

### **3.2 Class IV Septic Sewage Disposal Systems**

This section discusses the implications of the site-specific terrain conditions in terms of the feasibility of installing Class IV sewage disposal systems within the proposed subdivision.

#### **3.2.1 Septic System Envelopes**

The septic system envelope area (septic envelope) represents the area on a lot set aside for the construction of the leaching bed and is for the leaching bed only and does not include that area required for the septic tank or the isolation/separation distances required by the Ontario Building Code. The deposit or disposal of any materials or the placement of any structure or the operation of any equipment, other than material, structures or equipment required for the construction of the sewage system within or upon the septic envelope is prohibited.

The size of the septic envelopes are a function of the percolation time of the native soil in the vicinity of the septic envelope and/or the fill used for construction of a septic bed and the daily effluent loading to the septic bed. The native sandy soil at the site is of medium permeability, with an approximate percolation rate of 4 to 6 min/cm (based on Supplementary Guideline Table 2 Approximate Relationships of Soil Types to Permeability and Percolation rate in the Ontario Building Code). The groundwater table at the site is expected to be within 0.9 metres of the ground surface, based on shallow groundwater monitoring wells.

As a conservative approach to determining the expected largest septic system envelope required to service a single family dwelling at this site, a septic system envelope size was calculated assuming



a partially raised bed using a percolation rate of 8 minutes per centimetre for the imported sand required and a daily sewage flow of 3000 litres. A design flow of 3000 litres per day is suitable for a five bedroom dwelling with 250 square metres of finished area and 30 fixture units. The following formulae were used to calculate the size of the septic envelope:

The larger of

$$A = \frac{Q}{8} \quad \text{OR} \quad A = \frac{1.6QT}{200} \text{ plus}$$

4:1 Leaching Bed Side Slopes

Where            Q = daily sewage flow for the proposed dwelling (i.e., 3,000 litres per day)  
                      T = percolation rate of imported fill material

The size of the septic envelopes, based on the conservative approach described above, is approximately 375 square metres. In view of the minimum proposed lot sizes of about 4055 square metres, and average lot sizes of about 4290 square metres, sufficient area exists at each of the proposed lots for the construction of a conventional septic system that meets the requirements of the Ontario Building Code.

Prior to establishing the actual septic envelope (leaching bed) location on any particular lot, several test holes should be excavated to determine the consistency/variability of the overburden in the vicinity of the proposed septic envelope and percolation rate tests should be carried out to determine the actual envelope area and whether imported mantles are required.

Other site-specific considerations with respect to the locations of the septic envelopes (leaching beds) on the proposed lots are as follows:

- assuming that shallow groundwater flow within the upper overburden is from topographically higher areas to topographically lower areas, the septic envelopes should be situated in the topographically lower areas with the wells on the topographically higher areas
- the separation distances between septic envelopes and properly constructed drilled and cased wells should be at least twice the grade raise plus 15 metres for partially to fully raised beds as required by the Ontario Building Code



### **3.2.2 Leaching Bed Design Considerations**

The design of leaching beds is a combination of a number of interrelated factors including effluent discharge volume, properties of the soil materials in the leaching bed, length of distribution lines and the subsurface conditions. The construction of individual septic disposal systems on the proposed lots should be carried out in accordance with the specifications set out in the Ontario Building Code.

The design must ensure that the bottom of the absorption trenches is at least 0.9 metres above bedrock or soils that are unsuitable for treatment of septic effluent (those with excessively low permeability), and at least 0.9 metres above the seasonally high groundwater table.

Based on the soil and groundwater conditions at the site, partially raised septic system leaching beds are likely to be used. The actual leaching bed type appropriate for each lot will depend on the individual lot specific soil and groundwater conditions.

Any partially raised leaching beds should be constructed of imported sand having a percolation time of between 6 and 8 minutes per centimetre with less than 5 percent passing the #200 (0.074 mm) sieve. It is recommended that gradation analyses be carried out on any potential sand fill prior to leaching bed construction in order to verify that the percolation time of the fill material is acceptable.

### **3.3 Groundwater Impact Assessment**

#### **3.3.1 Criteria**

The Ministry of the Environment (MOE) Procedure D-5-4 provides guidelines for evaluating "the ability of the lands identified by and restricted to the development document, to treat sewage effluent to meet acceptable limits". The guideline requires that the representative background nitrate levels in the receiving groundwater be determined. Where background levels are greater than 10 milligrams per litre the ministry indicates development of the site should not be supported unless it can be demonstrated that existing levels of nitrates are the results of historical agricultural practices on the site. In addition, the guideline requires demonstration that the site is not obviously



hydrogeologically sensitive such as karstic areas, areas of fractured bedrock exposed at the surface, areas of thin soil cover or areas of highly permeable soils.

The guideline indicates that the assessment involves a three step process.

Step 1 regards lot size considerations. Where the lot size for each private residence within the development is an average of one hectare or larger and no lot is smaller than 0.8 hectares, and provided the site is not hydrogeologically sensitive, the risk that impact limits may be exceeded by individual systems is considered acceptable.

Step 2 is in regards to septic system isolation considerations. Developments are considered low risk when it can be demonstrated that sewage effluent is hydrogeologically isolated from existing or potential supply aquifers. For this case the most probable groundwater receiver for sewage is to be defined through information obtained through a test pit or test hole program, and the most probable lower hydraulic or physical boundary of the groundwater receiving sewage effluent is to be defined. The guideline indicates hydrogeologic information concerning lands up to 500 metres beyond the actual development boundary may be required. When it can be demonstrated that the sewage will not enter supply aquifers the lot density of the proposed development is determined based on the space required to install a suitable septic system at each lot in accordance with the Ontario Building Code.

Step 3 is in regards to contaminant attenuation considerations. For this case, it is required to assess the risk that the on-site sewage systems within the proposed development will cause a concentration of nitrate in groundwater above 10 milligrams per litre at the down gradient boundary of the site.

### **3.3.2 Site Conditions Evaluation**

In order to evaluate the background water quality conditions in the receiving aquifer, three shallow monitoring wells were installed at the site and tested for nitrogen species. The construction details are provided in Section 2.1, the Records of Boreholes are appended to the report and groundwater levels are reported in Section 3.1. Background nitrogen concentrations from the shallow groundwater receiving effluent were reported (Section 3.1.1) and the original laboratory testing results are in Attachment D. The Site Plan, Figure 2, shows the locations of the monitoring wells.





The Ministry of the Environment, Conservation and Parks (MECP) Guideline D-5-4 indicates that:

*“.....where nitrate concentrations between 0 and 10 mg/l are found, the MOECC may also decide not to support development if the proponent’s consultant cannot provide a reasonable explanation for the existing levels of nitrate concentrations in the groundwater. However, if it can be demonstrated that existing levels of nitrates are the result of historical agricultural practices on the site (for example farming, feed lot, etc.), the proponent may be able to argue that the nitrate levels will decline after development”*

The results of nitrogen testing (see Table 3.1.1) indicate that in two of the three borehole locations, total nitrogen levels were 0.28 to 0.33 mg/l. At BH1 (in the southeast portion of the site) the total nitrogen level was elevated at 6.36 mg/l. That location is in an area of fill placement and debris piles, along with where former (historical) buildings had been present at the site. It is considered that the fill and/or former buildings represent a point source for nitrogen. It is proposed to repeat the groundwater testing at a later date to confirm the initial results. However, the background nitrates at the site are considered to be acceptable for development purposes, based on the down gradient portions of the site having very low levels of nitrogen.

The site is not obviously hydrogeologically sensitive as no karstic areas, areas of fractured bedrock exposed at the surface or areas of highly permeable soils are indicated to be present at the site. Three soil samples of the surficial sandy soils were obtained and laboratory grain size distribution analysis was carried out. The surficial soils consist mainly of fine sand with low silt/clay content (3 to 5%) which has an average estimated hydraulic conductivity of  $\sim 2.6 \times 10^{-2}$  cm/s (Section 3.1). The soil can be characterized as poorly graded sand. This is considered to be a soil of medium permeability.

The subsurface soils were also sampled. A sample of silty sand from BH4 had 14% fines (silt and clay sized particles) and the underlying glacial till at BH2 contained 50% fines. The silty clay was not sampled, however, it is expected to be of low permeability as it would be considered a fine grained soil. The underlying soils are of medium to low permeability.



The surficial and underlying soils at the site are of medium to low permeability and the overburden thickness at the site is at least 15 metres or more in thickness. Based on the soils information, the site is not considered to be hydrogeologically sensitive.

The water supply aquifer at the site is considered to be confined, based on the following:

- The piezometric surfaces in the three water supply wells (see cross sections, Figures 4 and 5) are above the top of the aquifer (bedrock elevation); and
- the shape of the drawdown response curve observed in the pumping tests closely resembles the ideal response of a confined aquifer; and
- the storativity coefficient calculated using the drawdown response in adjacent wells is  $\sim 2.0 \times 10^{-4}$ , whereas specific yield in an unconfined aquifer is typically orders of magnitude higher

As the water supply aquifer is confined, this is indicative that there is some confining unit that prevents direct vertical migration of surface water into the water supply at depth. This is also indicative that the site is not hydrogeologically sensitive.

The minimum lot size proposed for the development is about 0.40 hectares. Accordingly, the above noted "Step 1" does not apply to this site. Hydrogeological isolation between the receiving and water supply aquifers was not evaluated for this site. Thus, "Step 3" was addressed for this site.

### **3.3.3 Step 3 Assessment**

The most probable groundwater receiver for sewage effluent is the red to grey fine to medium sand layer and upper portions of the sandy clay or sandy silty clay that was encountered below the sand at five of the borehole locations. To obtain a general indication as to the potential impact of septic effluent on the properties adjoining the proposed development, a nitrate dilution model was used. A daily effluent loading of 1000 litres per day per septic system was assumed and the expected impact of septic systems at this site was determined by considering the attenuation of nitrate in the effluent from an assumed 40 milligrams per litre (mg/l) ( $\text{NO}_3$  as N) after the septic system treatment to the property boundary by dilution as a result of the infiltration of meteoric water only. The following provides the basis whereby the infiltration reduction factors for the site were chosen for the dilution calculations.



Topographic, soil and land cover infiltration factors were selected from *Table 2* of the MOE *Hydrological Technical Information Requirements for Land Development Applications*. The following is a discussion of each of the infiltration reduction factors chosen for the site.

A soil infiltration factor of 0.40 for open sandy loam is appropriate for the septic effluent dilution calculations, based on the permeability of the soils encountered across the site. Given the continuous nature of the sandy overburden at the site, with between 3 and 5 % silt/clay content in all three sieve analyses, and all six borehole logs describe the surficial soil as fine to medium sand, a terrain map was not considered to be required to delineate the terrain distribution across the property.

The site is characterized by rolling terrain with highest elevations within the southeast portion of the site sloping to the northwest. The steepest slope across the site is to the northwest of about 6 metres over one kilometre and average slope across the site is to the northwest of about 3.0 metres per kilometre. The site is considered to be rolling with a slope infiltration factor of 0.20. Using *Table 10* of the Thornthwaite and Mather *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance*, a soil water holding capacity of 100 millimetres was provided for the sandy overburden at the site. The value was chosen based on the combination of mainly pasture (deep-rooted crops) in fine sand. However, post-development, it is expected that the site will be mainly grassed (shallow-rooted crops) and the soil is fine sand. The corresponding soil water holding capacity of the site for post development conditions is expected to be between about 50-75 millimetres. The selection of 100 millimetres is conservative, as it overestimates the applicable soil moisture retention for the soils, which results in underestimating the available moisture for infiltration.

The type of land cover observed at the site at the time of site visits and by use of satellite imagery consists mostly of cultivated lands, although there are scattered trees and shrubs across the site. It is expected that the post-development conditions at the site will consist mainly of grassy areas with few trees and shrubs. The land cover infiltration factor of 0.10 was selected, which corresponds to cultivated lands. This is a conservative prediction as it does not account for the mature trees which may be retained or the landscape trees and shrubs that will likely be cultivated on properties post development.



In order to determine water surplus estimates for the site area, a water surplus model was obtained using published information from Environment Canada (EC) for the City of Ottawa. The water balance model output the average yearly moisture surplus value, based on monthly moisture surplus averages for the period from 1983 to 2002. The expected moisture surplus or net potential infiltration for the site area was estimated at 3372 millimetres. The water balance model output data, provided by EC, are provided as Attachment E.

Hard Surfaced Areas post-development were calculated as follows. The total roadway area for the site is 2054 square metres, as provided by Novatech. There are also assumed to be 7 driveways each with varied lengths and 5 metres width for a total driveway area of 750 square metres. The footprint of the houses is assumed to be 200 m<sup>2</sup> each. The total hard surfaced areas using these values for post-development conditions are 4204 m<sup>2</sup>.

The results of the sewage dilution calculations indicate that the expected concentration of nitrate at the site boundary due to the proposed 7 sewage systems is about 9.6 milligrams per litre (Attachment E). This is within the Ministry of the Environment acceptable nitrate impact limit of 10 milligrams per litre.

Based on the impact assessment, the development of the site on private sewage disposal systems is not expected to have an adverse impact on groundwater resources in the site area.

## **4.0 GROUNDWATER SUPPLY INVESTIGATION**

### **4.1 Supply Aquifer**

As mentioned above, a bedrock geology map for the site area indicates that dolostone and sandstone of the Beekmantown Group underlie the site. The MOE well records for the test wells indicate the primary material encountered was limestone during drilling for all three test wells. The MOE well records for TW1 and TW2 indicate sandstone was encountered as a secondary material below 49 to 55 metres in depth, while TW3 which was a shallow well at 30 metres depth encountered limestone with no secondary material. A review of the MOE water well records for the test wells, Attachment B, indicate that TW1 and TW2 encountered water fractures during drilling in the bedrock at depths of some 72 to 74 metres. TW3 encountered fractures at depths of about 21



and 28 metres. Geological cross-sections of the site were prepared using soils and bedrock information from the MOE well records for the test wells and the Records of Boreholes. The geological cross sections are provided as Figures 4 and 5.

## 4.2 Water Quality

The results of the chemical, physical and bacteriological analyses of water samples obtained from the test wells are provided as Attachment F and field water quality data is provided in Table I. A summary of the laboratory test results is attached as Tables II and III. The water quality as determined from the results of the analyses is favourable. The water meets all the Ontario Drinking Water Standards (ODWS) health and aesthetic parameters tested for at the test wells except for the following:

- hardness at all of the wells
- total dissolved solids at all of the wells
- hydrogen sulphide at TW1 and TW2
- iron at TW2 and TW3
- organic nitrogen at TW1 and TW3
- sodium above 20 mg/l at all of the wells

### Hardness

The water samples from all of the test wells are considered hard by water treatment standards. Water with hardness above 80 to 100 milligrams per litre as  $\text{CaCO}_3$  is often softened for domestic use. The hardness at the test wells ranges from about 211 to 310 milligrams per litre. Water softening by conventional sodium ion exchange will reduce hardness and scaling on fixtures. However, it may also introduce relatively high concentrations of sodium into the drinking water, which may contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. Where ion exchange water softeners are used, a separate unsoftened water supply could be used for drinking and culinary purposes.

### Total Dissolved Solids

The total dissolved solids (TDS) were measured at 539 to 618 milligrams per litre, the three test wells, above the ODWS of 500 milligrams per litre. The Ryznar Stability Indices (RSI) and Langelier



Saturation Indices (LSI) were calculated for the samples and gave RSI values of between 7.1 and 7.5 and LSI values between 0.25 and 0.5. The values of RSI that are close to 7 and slightly above 7, indicate that the formation of calcium carbonate (i.e. scaling) does not lead to a protective corrosion inhibitor film on metal fixtures and pipes. However, there RSI value is less than 8, indicating that the water is not corrosive either. LSI values are corresponding positive, but close to zero, which indicates that the water has borderline scale potential, such that minor changes in the water quality, temperature could change the scale or corrosive potential of the water. The effect of elevated TDS levels on drinking water depends on the individual components, which are principally chlorides, sulphates, calcium, magnesium and bicarbonates. Depending on which parameters are elevated, TDS exceedances can include hardness, taste, mineral deposition or corrosion. In this case, all the test well water samples have high levels of hardness and elevated chlorides (155 to 180 mg/l) albeit within the operational guideline for hardness and the aesthetic objective (AO) for chlorides. Chloride is less than the AO and consequently the water palatability is still considered to be good. Therefore, the effect of elevated TDS is considered to be mostly associated with elevated hardness, which can cause mineral deposition, due to the potential for scale to form. As hardness is the cause of the elevated TDS, it is considered that treatment to reduce hardness (ion exchange water softeners) will reduce the mineral deposition associated with the TDS levels.

### Hydrogen Sulphide

Hydrogen sulphide levels at TW1 and TW2 are above the aesthetic objective of 0.05 mg/l. TW1 had sulphide levels of 1.10 mg/l and TW2 had lower levels at 0.24 to 0.27 mg/l. Hydrogen sulphide produces an odour and can affect the taste of water. When present in water with iron, it can also cause black staining of laundry items, black deposits on pipes and fixtures. Treatment to reduce sulphide includes aeration. Higher levels of sulphide where iron staining is also an issue (rust staining) may require treatment using chlorination followed by iron filter. Based on the sulphide levels at the site, it is considered that aeration is sufficient to reduce sulphide in the treated water. Well construction recommendations are also made later in this document to ensure that excessive sulphide levels are avoided in future wells at the proposed subdivision.

Three offsite wells were sampled and also had exceedances for hydrogen sulphide. The highest level was at 5560 Lombardy Drive with a hydrogen sulphide level of 8.3 mg/l. The well record for that well indicated that water fractures were encountered at 41 metres depth. In addition, a report for the adjacent subdivision located west of the site entitled "*Report on Site Conditions and Hydrogeology for Top Drawer Holdings Ltd., Proposed Subdivision, Village of Osgoode, March*"



1978 by Oliver, Mangione, McCalla & Associates Ltd.” was reviewed with regards to water quality. That report indicated that one of the test wells, drilled to 44 metres depth encountered sulphur water at a depth of about 38 metres depth. Based on this and the occurrence of high levels of hydrogen sulphide at one of the offsite wells (5560 Lombardy Drive), Kollaard Associates Inc. is providing well construction recommendations to ensure that the future wells avoid very elevated levels of hydrogen sulphide that are associated with the water fractures encountered at 38 to 41 metres depth.

### Iron

The level of iron at TW2 and TW3 was elevated for the first water samples obtained after three hours (iron levels of 0.46 and 0.54 mg/l), compared to the AO of 0.3 mg/l. However, by the end of the pumping tests, the iron levels were within aesthetic objectives for all three test wells and ranged from 0.11 to 0.21 mg/l. Three other area wells that were sampled also had iron levels within the acceptable limit of 0.3 mg/l. As a result, iron is considered to be within the aesthetic objective of 0.3 mg/l. It should also be noted that water softening to reduce hardness can also decrease iron.

### Organic Nitrogen

Organic nitrogen levels at TW1 and TW3 were 0.20 and 0.17 mg/l, respectively, compared to the operational guideline (OG) of 0.15 mg/l. Organic nitrogen is calculated by subtracting the ammonia from the Total Kjeldahl Nitrogen. Organic nitrogen has an OG due to its interaction with chlorine used in water treatment causing taste problems in the treated water. There is a correlation between DOC and organic nitrogen. Organic nitrogen levels above 0.15 mg/l are associated with DOC levels of 0.6 mg/l or greater. As groundwater is typically not treated using chlorine, the potential presence of organic nitrogen in some wells does not require treatment.

### Sodium

The sodium levels at all three test wells were between 64 and 98 mg/l, above the 20 milligrams per litre advisory level, whereby the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets. The sodium levels were well within the aesthetic objective of 200 mg/l.



### Sampling of Existing Neighbouring Wells

Neighbours of the site along Lombardy Drive and Osgoode Main Street were canvassed with regards to their servicing. At that time, some of the property owners/tenants along Osgoode Main Street indicated that the wellheads were either below grade or that sand point wells were in use. One property owner indicated that they do not have a sewage system but a holding tank. The following three wells were sampled as the owners indicated that they had drilled wells and sewage systems.

#### 5529 Osgoode Main Street

- water treatment: iron filter
- water potability: owner drinks water and indicates sulphur odour is present sometimes
- routine bacterial testing: Not since purchase (6 years previous), at which time results were acceptable
- septic system type, age, location and performance: conventional sewage system replaced within last 10 years and no issues
- Well location in east side yard and sewage system in rear yard

#### 5560 Lombardy Drive

- water treatment: aeration, chlorination, iron filter, water softener
- water potability: owner indicates sulphur is a nuisance and treatment equipment maintenance is excessive and problematic. A lot of frustration as adjacent neighbours don't have similar water quality complaints/issues and onerous treatment costs.
- routine bacterial testing: No, but no issues
- septic system type, age, location and performance: original conventional sewage system in front yard, ~5 years old
- Well location in back yard and sewage system in front yard

#### 5566 Lombardy Drive

- water treatment: proprietary filter media, iron filter and water softener
- water potability: Owner indicates sulphur is present.
- routine bacterial testing: No, but no issues





- septic system type, age, location and performance: original conventional sewage system in front yard, ~5 years old
- Well location in back yard and sewage system in front yard

A summary of the water quality obtained from the neighbouring wells and copies of well records (where available) are provided as Table II and Attachment B. The original laboratory test results are provided as Attachment G.

Well records for the wells at 5560 and 5566 Lombardy Drive were available for review. The well records indicate that the well depths are 49 metres and 73 metres, respectively. The well at 5529 Osgoode Main Street is much older and no well record could be confirmed. The well cap could not be removed at the time of the site visit to confirm well depth. However, based on the similarity of water quality in that well to the subject wells, it is considered to be obtaining water from the same formation as other bedrock wells in the area. The test wells on the site are between 30 metres in depth (TW3) and 74 and 76 metres in depth for TW1 and TW2, respectively.

The water quality at the existing wells was generally similar to that of the recently constructed test wells, with exceedances of TDS, hardness and hydrogen sulphide. The exception is the well at 5560 Lombardy Drive, which had very high levels of hydrogen sulphide. That well had a hydrogen sulphide level of 8.3 mg/l in the raw water. At the time of sampling the treated water was also sampled to confirm that hydrogen sulphide could be treated to within the aesthetic objective. The treated water had a hydrogen sulphide level of <0.01 mg/l.

### **4.3 Water Quantity**

The drawdown and recovery data and plots for TW1, TW2 and TW3 are provided as Attachments H, I and J, respectively. The drawdown and recovery data provided were measured with reference to the top of the well casing at each test well location.

The pumping test data for the test wells were analyzed using the method of Cooper and Jacob (1946). Although the assumptions on which these equations are based are not strictly met, this method provides a reasonable estimate of the aquifer transmissivity. The analysis of the data obtained during the pumping tests is summarized in the attached Table IV. The water levels in observation wells were monitored during the pumping tests at TW1, TW2 and TW3 and the data are



provided as Table VII. Where observation well drawdown had occurred, with interference between TW1 and TW2 during the pumping tests at those wells, corresponding curves of that data are provided as Attachment K. TW3 was too distant from TW2 and TW3 for any significant drawdown to be measured.

The following sections discuss the results of the analysis of the data obtained during the pumping tests with respect to test well yields.

#### **4.3.1 Test Well TW1**

The six hour duration pumping test was carried out at a discharge rate of 65 litres per minute. The static water level prior to testing was about 6.86 metres below the top of the well casing and the water level after six hours of pumping was about 8.24 metres below the top of the well casing for a total drawdown at the end of pumping of 1.38 metres. The available drawdown in the well is about 36 metres. The specific capacity of the well at this pumping rate is approximately 68 cubic metres per day per metre of drawdown.

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be 288 m<sup>2</sup>/day. Based on the recovery data the aquifer transmissivity is estimated to be 192 m<sup>2</sup>/day. The average transmissivity of the bedrock aquifer in the area of TW1 is estimated to be 240 m<sup>2</sup>/day. At the end of pumping, 95 percent recovery of the total drawdown in the static water level created during pumping occurred in about 14 minutes.

Based on the data obtained during the pumping test, it can be concluded that the well is capable of sustaining a short term yield of at least 65 litres per minute and that during the course of the six hour pumping period about 4 percent of the available drawdown in the test well was utilized.

#### **4.3.2 Test Well TW2**

The six hour duration pumping test was carried out at a discharge rate of 62 litres per minute. The static water level prior to testing was about 6.68 metres below the top of the well casing and the water level after six hours of pumping was about 7.72 metres below the top of the well casing for a total drawdown at the end of pumping of about 1.04 metres. The available drawdown in the well is



about 36.6 metres. The specific capacity of the well at this pumping rate is approximately 86 cubic metres per day per metre of drawdown.

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be 181 m<sup>2</sup>/day. Based on the pumping test recovery data, the transmissivity of the aquifer is estimated to be 203 m<sup>2</sup>/day. The average transmissivity of the bedrock aquifer in the vicinity of TW2 is calculated to be about 192 m<sup>2</sup>/day. At the end of pumping 95 percent recovery of the total drawdown in the static water level created during pumping occurred within about 75 minutes.

Based on the data obtained during the pumping test, it can be concluded that the well is capable of sustaining a short term yield of at least 62 litres per minute and that during the course of the six hour pumping period about 3 percent of the available drawdown in the test well was utilized.

#### **4.3.3 Test Well TW3**

The six hour duration pumping test was carried out at a discharge rate of 65 litres per minute. The static water level prior to testing was about 4.53 metres below the top of the well casing and the water level after six hours of pumping was about 4.76 metres below the top of the well casing for a total drawdown at the end of pumping of 0.23 metres. The available drawdown in this well is about 20.5 metres. The specific capacity of the well at this pumping rate is approximately 410 cubic metres per day per metre of drawdown.

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be 192 m<sup>2</sup>/day. Based on the pumping test recovery data, the transmissivity of the aquifer is estimated to be 203 m<sup>2</sup>/day. The average transmissivity of the bedrock aquifer in the vicinity of TW3 is calculated to be about 192 m<sup>2</sup>/day. At the end of pumping 90 percent recovery of the total drawdown in the static water level created during pumping occurred after 111 minutes. After 7 hours and 25 minutes, the static water level had recovered 100%.

Based on the data obtained during the pumping test, it can be concluded that the well is capable of sustaining a short term yield of at least 65 litres per minute and that during the course of the six hour pumping period about 1 percent of the available drawdown in the test well was utilized.



#### 4.3.4 Interference Effects

During pumping of the test wells, observation well drawdown was observed in each of the other test wells to measure interference effects. The data were obtained from pressure transducer loggers and confirmed with manual measurements. The transducer data is provided as Table 7. The mutual interference effects were calculated for a centrally located well (Lot 2) and the well interference at the property boundary was calculated for the down gradient property line along the north side of the site.

In order to estimate the maximum interference between future wells at the site, calculations were carried out to predict the cumulative thirty year drawdown due to the proposed 7 domestic wells at a central well in the proposed subdivision. The cumulative drawdown at the test wells was calculated for a thirty year pumping rate of 1100 litres per day which allows for four persons per household. The following formula was used for the calculation:

$$s = \frac{2.3Q}{4\pi T} \log\left(\frac{2.25Tt}{r^2 S}\right)$$

where Q = 30 year pumping rate, 1100 L/day

T = average transmissivity, 203 m<sup>2</sup>/day

t = duration, 30 years

S = storativity, 2.4 x 10<sup>-4</sup>

s = expected drawdown due to each of the other 6 wells

r = distance between the observation well and the pumped well, m

The results of the calculations indicate the thirty year drawdown at a centrally located well due to the interference from the other 6 wells in the subdivision is about 0.038 metres. The mutual well interference at the property boundary due to the 7 proposed wells was also estimated to determine the impact of the proposed development on water supply outside of the site. The expected thirty year drawdown at the site boundary was found to be about 0.044 metres.

Attachment B contains MOE Well Records of surrounding existing wells that were available for review. The indicated depths of the existing wells range from about 24 to 73 metres and accordingly are within an aquifer similar to the test wells which range in depth from about 30 to 76 metres. Based on the estimated thirty year drawdown noted above, the expected drawdown is minimal. All wells for which the MOE Well Records were obtained have sufficient available



drawdown such that the slight drop in water level that may occur should have no significant impact on water supply at our adjacent to the proposed subdivision. This provides reasonable assurance of adequate water supply in the proposed subdivision as well as at the existing wells.

#### TW1 observation well interference

During the pumping of TW1, pressure transducer logging was carried out at TW2 and TW3, located some 45 metres and 117 metres distance, respectively, from TW1. Total drawdown observed at TW2 and TW3 was about 0.39 metres and 0.00 metres, respectively. There was no drawdown response at TW3, which is considered to be due to the greater distance between that well and the pumped well. In fact, water levels rose slightly in that well during the test and then declined shortly after the test was completed (during recovery interval). It is possible that the water level rose due to the change (i.e. drop) in pressure at the piezometric surface that occurred as a result of the pumping of the adjacent well. The drop in pressure can contribute to a small rise in water levels of adjacent wells, due to the decrease in pressure head. This is indicative that there is a likely connection between the wells, but that the distance between them did not contribute to a drop in water level.

#### TW2 observation well interference

During the pumping of TW2, pressure transducer logging was carried out at TW1 and TW3, located some 45 metres and 117 metres distance, respectively, from TW2. Total drawdown observed at TW1 and TW3 was about 0.42 metres and 0.04 metres, respectively.

#### TW3 observation well interference

During the pumping of TW3, pressure transducer logging was carried out at TW1 and TW2, located some 117 metres and 118 metres distance, respectively, from TW3. There was no measurable drawdown response in either observation well during the pumping test at TW3. This was considered to be due to the distance between this well and the other wells.

Based on the interference observations, especially that between TW1 and TW3, which are constructed on adjacent proposed lots some 45 metres apart, it is considered that the level of interference is acceptable and will not cause unacceptable drawdown in adjacent future wells at the property.



#### 4.4 Groundwater Flow Directions

The groundwater flow directions in the receiving and water supply aquifers were determined based on the results of a topographic survey of the site and using the static water levels measured at the standpipes (overburden receiving aquifer) and test wells (bedrock water supply aquifer).

##### Receiving Aquifer

The static water level elevations at BH1, BH3 and BH5 were 92.50, 89.25 and 89.64 metres geodetic, respectively, measured on February 12, 2021. Based on that data, the receiving aquifer flow direction is indicated to be northwest across the site (see Figure 2), generally following the topographic slope at the site.

Monitoring Well	Ground Surface Elevations (masl)	Groundwater Elevations (masl)
		Feb.12, 2021
BH1	92.97	92.50
BH3	90.53	89.25
BH5	91.35	89.64

##### Confined Bedrock Water Supply Aquifer

The static water elevations at TW1, TW2 and TW3 were about 86.45, 86.55 and 87.37 metres geodetic, respectively, measured on May 5, 2021. Based on that data, the supply aquifer groundwater flow direction is indicated to be east-southeast across the site (see Figure 2).

Test Well	Top of Casing Elevations (masl)	Ground Surface Elevations (masl)	Groundwater Elevations (masl)
			May 5, 2021
TW1	93.17	92.78	86.45
TW2	93.08	92.60	86.55
TW3	91.90	91.34	87.37

##### Vertical Gradients

Based on elevations in the test wells, compared to the shallow monitoring wells, it is considered that a downward vertical gradient could exist between the receiving aquifer and the bedrock aquifer at the site.



## 4.5 Development Impacts and Neighbouring Land Uses

A description of existing and historical land uses at and near the site with the potential to impact the water supply at the site was previously noted (Section 3.1.2 Land and Water Use Conflicts). The existing land use up gradient of the site in terms of the water supply aquifer (i.e west-northwest) consists of scattered single family dwellings and agricultural lands, with the Rideau River some 2.4 kilometres to the east. The results of the water quality testing at the test wells indicate that there is no significant impact on the groundwater at the site due to the surrounding residential and agricultural development.

The topographical slopes and the shallow groundwater flow direction at the site are to the northwest. A review of current and historical land uses in the area suggests that the up gradient land is fully developed with residential and commercial development including up gradient potential sources of contamination, especially hydrocarbons, due to current and former automotive garages and service stations. In 2017, a total of five groundwater monitoring wells were installed across the site. The overburden groundwater flow direction was estimated to be to the north. Water samples were tested for metals, select VOCs (BTEX), PHCs and PAHs. The only exceedance was vanadium at three locations, which were slightly above the allowable limits for potable water. The source of vanadium was considered to be the silty clay soils which are known to have naturally occurring elevated vanadium levels. Since that time, there has been no new development of properties that could cause hydrocarbon contamination at the subject site. It is considered that there are no current impacts at the site from up gradient sources.

### 4.5.1 Impact to Surface Water Quality and Quantity

There are no surface water bodies at the site or within at least 250 metres or more. The closest water body is an unnamed watercourse that exists some 280 metres east-northeast of the site that is a tributary to the Doyle Creek municipal drain. Since the receiving aquifer at the site flows to the northwest, it is unlikely that the post development site could impact the surface water body that is up gradient of the site.



#### 4.6 Well Construction Methodology

Future wells drilled on the site should be constructed with a minimum 6 metres length of casing through the overburden and set at least 3 metres into the sound bedrock. The steel casing placed in the augerholes should be pressure grouted or displacement grouted into place. The material used to seal the annular space could consist of either a cement grout or a commercially available bentonite grout product. Cement grout mixtures should be allowed to set for a minimum two day period for normal cement or twelve hours for a high early strength cement prior to advancing the well further into bedrock. If a bentonite grout product is used, drilling need only be suspended for a few hours depending on the product used. Bentonite grout has the additional advantage of remaining flexible when set and therefore will not crack or shrink thereby ensuring as well as possible that surface water or shallow groundwater will not migrate along the annular space and into the well bore.

Once the casing has been sealed, the well should be advanced uncased in the bedrock until a water supply of sufficient quantity and quality is encountered.

Based on the three test wells constructed at the site, the following is noted. There is a fracture zone in the area that exists between 36 to 41 metres that produces high levels of hydrogen sulphide (up to 8.3 mg/l). Some wells may encounter sufficient water quantity and be drilled to a maximum depth of 30.5 metres, resulting in negligible levels of hydrogen sulphide. If water fractures do not provide sufficient well yields at that depth, the wells should be advanced deeper into the bedrock until sufficient water quantity is encountered. If wells encounter water fractures at depths of 36 to 41 metres, there may be high levels of hydrogen sulphide encountered (up to 8 mg/l). In this case, it is recommended that wells are advanced to the next fracture zone, which is at depths of 72 to 74 metres, with final well depths of about 74 to 76 metres to ensure sufficient water quantity. It should be noted that deeper wells drilled to these depths will likely have hydrogen sulphide levels of between 0.3 and 1.2 mg/l, which will require treatment.

The completed well should then be developed to maximize the yield. The well casings should be completed at least 400 millimetres above the highest point on the finished ground surface within three metres radially from the well after surface drainage is directed away from the well. The casing should be fitted with a pitless adapter to facilitate below ground plumbing and electrical





connections. Surface grading should be completed to direct surface water away from the well in order to ensure that water will not collect or pond in the vicinity of the well.

#### **4.7 Post Development Monitoring Program**

The results of this investigation indicate acceptable existing and expected impact on the groundwater quality at this site due to existing neighbouring land uses and the proposed development. The existing nitrate impacts on the receiving aquifer at the site are acceptable for development. The local hydrogeological conditions and existing water quantity and quality all indicate that the impact of the proposed development will not significantly impact the overall groundwater quality and quantity at the site. Septic effluent dilution calculations, which by experience are known to be a conservative estimate of actual impact, indicate any septic system impact at the site is within MECP requirements. There are only seven residential lots proposed for development. Accordingly, a groundwater monitoring program is not considered necessary for this site.

#### **5.0 SUMMARY AND CONCLUSIONS**

Based on the terrain evaluation and groundwater supply investigation at the proposed residential subdivision and the subsequent analysis of the data collected, the following summary and conclusions are provided:

- 1) Class IV sewage disposal systems with partially raised leaching beds will likely be used at this site depending on the lot specific soil and groundwater conditions. The leaching beds should be constructed to conform to the specifications set out in the Ontario Building Code. Any partially raised leaching beds should be constructed of imported sand having a percolation time of between 6 and 8 minutes per centimetre with less than 5 percent passing the #200 (0.074 mm) sieve. It is recommended that gradation analyses be carried out on any potential sand fill prior to leaching bed construction in order to verify that the percolation time of the fill material is acceptable.
- 2) There is a sufficient groundwater supply of acceptable drinking water quality in the bedrock aquifer system to satisfy the water requirements of the proposed subdivision. It is indicated



that most wells will be drilled to depths of about 30 metres to 76 metres and that individual well yields of 62 to 65 litres per minute will be typical.

- 3) There is a sufficient groundwater of acceptable drinking water quality in the bedrock aquifer system at this site as it meets all the ODWS concentrations for all health related chemical, physical and bacteriological parameters tested except for the following:

- Hardness:

Future wells at the site are expected to have hardness levels of between about 211 to 310 milligrams per litre. The recommended water treatment consists of ion exchange water softeners and maintaining a separate unsoftened water supply for drinking and culinary purposes.

- Total dissolved solids:

Some future wells at the site may slightly exceed the aesthetic objective of 500 mg/l for TDS at levels of 539 to 618 milligrams per litre. The Ryznar Stability Indices (RSI) and Langelier Saturation Indices (LSI) were calculated for the samples where TDS exceed with RSI of 7.1 to 7.5, and LSI of 0.25 and 0.50, indicate that the formation of calcium carbonate (i.e. scaling) does not lead to a protective corrosion inhibitor film on metal fixtures and pipes. However, there RSI value is less than 8, indicating that the water is not corrosive either. LSI values are corresponding positive, but close to zero, which indicates that the water has borderline scale potential, such that minor changes in the water quality, temperature could change the scale or corrosive potential of the water. The noted levels of TDS and the individual components that contribute to it include hardness and elevated chlorides (155 to 180 mg/l) albeit within the operational guideline for hardness and the aesthetic objective (AO) for chlorides. Treatment that removes hardness (i.e. water softeners) will reduce the scale potential. The palatability of water with chlorides less than the aesthetic objective of 250 mg/l are considered to be good.

- Hydrogen Sulphide:

Future wells constructed to depths of 36 metres and deeper are expected to encounter hydrogen sulphide above the aesthetic objective of 0.05 mg/l, at levels 0.24 to 1.10 mg/l. Hydrogen sulphide produces an odour and can affect the taste of water. When present in water with iron, it can also cause black staining of laundry items, black deposits on



- pipes and fixtures. Well construction methods are provided to ensure that very high levels of hydrogen sulphide can be avoided. This may require that wells that are deeper than 30.5 metres should be constructed to at least 72 metres to ensure that the water fractures that produce excessive hydrogen sulphide levels (up to 8 mg/l) are avoided. Treatment to reduce sulphide includes aeration. Higher levels of sulphide where iron staining is also an issue (rust staining) may require treatment using chlorination followed by iron filter. Based on the sulphide levels at the site, it is considered that aeration is sufficient to reduce sulphide in the treated water.
- **Organic Nitrogen:**  
Organic nitrogen levels may be slightly elevated at 0.17 to 0.20 mg/l, in some future wells, compared to the operational guideline (OG) of 0.15 mg/l. Organic nitrogen is calculated by subtracting the ammonia from the Total Kjeldahl Nitrogen. Organic nitrogen has an OG due to its interaction with chlorine used in water treatment causing taste problems in the treated water. There is a correlation between DOC and organic nitrogen. Organic nitrogen levels above 0.15 mg/l are associated with DOC levels of 0.6 mg/l or greater. As groundwater is typically not treated using chlorine, the potential presence of organic nitrogen in some wells does not require treatment.
  - **Sodium:**  
The sodium levels at all three test wells were between 64 and 98 mg/l, above the 20 milligrams per litre advisory level, whereby the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets. The sodium levels were well within the aesthetic objective of 200 mg/l. It is recommended that if water softeners are used to treat hardness and TDS levels, that an untreated drinking water tap is installed in the kitchen to ensure that excessive sodium levels in treated water are not consumed.
- 4) Mutual water level interference effects between neighbouring wells in the proposed subdivision are expected to be minimal. The impact of future wells at the proposed subdivision on neighbouring existing wells is expected to be minimal.



- 5) Future wells drilled on this property should be constructed with casing through the upper portion of bedrock and set at least 3 metres into the sound bedrock. The annulus of the casing should be grouted using a pressure injection method. Casing and grouting should extend to at least 6 metres below the existing ground surface. Well casings should be extended a minimum of 0.4 metres above the final finished ground surface at the well. Wells should be located at least 18 metres from fully raised septic fields, and up gradient of septic fields.
- 6) It is considered that the type of existing surrounding land use adjacent to the subject property should not impact the subject site from a water supply or water quality point of view.
- 7) Based on the impact assessment, the septic systems at the proposed 7 lots at this site are indicated to result in the impact on the groundwater quality at the site boundaries to be within acceptable limits established by the MOE.
- 8) The study findings recommend the following with regards to construction of septic systems at the site:
  - Partially raised leaching beds will likely be required at this site depending on the lot specific soil and groundwater conditions.
  - Leaching beds should be constructed to conform to the specifications set out in the Ontario Building Code.
  - Imported sand with a percolation time of between 6 and 8 minutes per centimetre and less than 5 percent passing the #200 (0.074 mm) sieve should be used to construct the raised leaching beds.
  - In situ percolation rate tests and/or gradation analyses should be carried out on any potential sand fill or native sand material prior to leaching bed construction in order to verify that the percolation time is acceptable.
  - The locations of sewage systems and wells should be placed in accordance with the Lot Development Plan with sewage systems located on the west sides of the lots with wells in the east side of the lots. This will ensure that wells are up gradient of sewage systems on each lot.



9) The study findings recommend the following with regards to construction and placement of water supply wells at the site:

- Well depths of some 30 to 76 metres and individual well yields of some 60 to 65 litres per minute will be typical for most wells. If water fractures are encountered at between 36 and 41 metres depth, there may be very high levels of hydrogen sulphide. To avoid poor water quality from this fracture zone, wells should be extended to some 74 to 76 metres to improve water quality.
- The well water supply at the site is suitable to provide in excess of 3000 litres/day, which is sufficient for a typical single family dwelling. The minimum well yield, as per MOE D-5-5, is 22.7 litres per minute (5 igpm).
- Well Placement: Wells should be located at least twice the grade raise plus 15 metres from the fully raised leaching beds, and at least 15 metres from septic tanks. Clearance distances for treatment units and distribution piping shall conform to OBC Tables 8.2.1.6. A and 8.2.1.6. B. Wells should be located such that surface water will not pool around the wellhead and the ground surface around the well should be the highest point for at least 3 metres radially outward.
- Well casings should be extended a minimum of 0.4 metres above the final finished ground surface at the well.
- Casing for wells should be minimum 6 metres in length and extend through the overburden and set at least 3.0 metres into the sound bedrock.
- Grouting procedure:
  - the annulus of the casing should be pressure injection grouted from the bottom of the casing up
  - the material used to seal annular space could consist of either a cement grout or a commercially available bentonite grout product and should be allowed to set prior to advancing the well further into bedrock; minimum two day period for normal cement, minimum twelve hours for a high early strength cement, or a few hours for a bentonite grout, depending on the product used
  - the well grouting operation and well casing length should be inspected and approved by an experienced hydrogeologist or geotechnical engineer to ensure that the grouting procedure and casing length are in accordance with the site hydrogeological investigation report and Ont. Reg. 903



- 10) Well and Sewage System Placement: The Lot Development Plan, Figure 6 indicates wells are to be located in the rear yards with sewage systems in the front west side yards. The sewage systems will outlet towards drainage ditches along the roadway, depending on the individual lot location. The separation distances between wells and sewage systems should be respected for each lot and for adjacent lots. Any change to the placements of the wells and/or sewage systems on any individual lot should ensure that there is no impairment to the placement of wells and sewage systems on adjacent lots.

Test Well Abandonment:

There are currently three test wells that were drilled on the subject site including TW1 (Lot 7), TW2 (Lot 6) and TW3 (Lot 1). These wells can be used as future water supply wells provided that the following is verified and/or carried out:

- wells shall be minimally three metres from the property lines in order to ensure that positive drainage is occurring away from the well head;
- wells shall meet or exceed the minimum separation distances to sewage systems and sewage tanks indicated by the Ontario Building Code; and
- wells should be protected from damage during construction.

Existing on-site monitoring wells, including the boreholes BH1, BH3 and BH5, should be properly abandoned in accordance with Ontario Well Regulation 903. A record of well abandonment should be produced for each well, prior to any construction at the site.

- 11) The maximum building footprint, based on the Terrain Study, is 200 m<sup>2</sup>. Larger building envelopes and/or coach houses and/or ground source heat pumps have not been evaluated as part of the Hydrogeology and Terrain Study. Any proposed use of these systems and/or larger building footprints and coach houses would require a hydrogeological assessment and/or terrain analysis.
- 12) Homeowners should be provided with information regarding well water testing, well maintenance and water and energy conservation. Homeowners should be referred to the MOE publication *Water Supply Wells – Requirements and Best Management Practices* manual, April 2015. Additional information and links on water conservation measures are offered at the [wellaware.ca](http://wellaware.ca) website.



Regards,

Kollaard Associates Inc.



Colleen Vermeersch, P. Eng.

TABLE I  
FIELD WATER QUALITY MEASUREMENTS  
FOR TEST WELLS

	Hours Since Pumping Test Started	Temp. (°C)	pH	Conductivity (µS)	TDS (ppm)	Turbidity (NTU)	Free Chlorine (mg/l)
TW 1	1	9.3	7.7	980	497	1.9	0.0
	2	9.3	8.0	990	500	0.6	-
	3	9.5	7.9	988	478	0.8	0.0
	4	9.6	7.7	940	480	0.6	-
	5	9.4	7.8	960	480	0.4	-
	6	9.4	7.7	955	385	0.6	0.0
TW 2	1	9.5	8.3	666	337	1.6	0.0
	2	9.5	7.9	788	395	0.7	-
	3	9.5	7.8	788	400	1.0	0.0
	4	9.5	7.3	840	430	1.0	-
	5	9.5	7.8	775	400	0.6	-
	6	9.5	7.8	850	430	0.6	0.0
TW 3	1	9.4	7.5	832	400	8.1	0.0
	2	9.4	7.3	855	435	4.5	-
	3	9.5	7.8	885	445	1.7	0.0
	4	9.4	7.8	880	447	0.9	-
	5	9.5	7.6	903	463	0.6	-
	6	9.5	7.4	880	445	0.5	0.0



TABLE II

## SUMMARY OF SUBDIVISION WATER CHEMISTRY FOR TEST AND SAMPLED WELLS

Parameter	Guideline	TW1		TW2		TW3		5529 Osgoode Main	5560 Lombardy	5566 Lombardy
		3hr	6hr	3hr	6hr	3hr	6hr			
<b>Alkalinity</b> [mg/l]	OG 500	143	142	139	140	154	157	132	172	178
<b>Chloride</b> [mg/l]	AO/MCCRT 250	178	180	155	165	167	173	163	222	187
<b>Colour</b> [TCU]	AO 5 MCCRT 7	<2	<2	<2	<2	<2	2	2	<2	<2
<b>Conductivity</b> [uS/cm]		951	945	829	879	879	916	862	1160	1050
<b>DOC</b> [mg/l]	AO 5	1.8	2.0	1.8	2.1	1.9	1.9	1.8	1.2	1.5
<b>Fluoride</b> [mg/l]	MAC 1.5	0.83	0.85	0.94	0.89	0.17	0.16	1.19	1.48	0.69
<b>Hydrogen Sulphide</b> [mg/l]	AO 0.05	<b>1.10</b>	<b>1.10</b>	<b>0.27</b>	<b>0.24</b>	<0.01	<0.01	<b>1.22</b>	<b>8.30</b> (raw) <0.01 (treated)	<b>0.30</b>
<b>Ammonia</b> [mg/l]		0.307	0.303	0.290	0.307	0.171	0.168	0.387	0.381	0.320
<b>Nitrite</b> [mg/l]	MAC 1.0	<0.50	<0.50	<0.10	<0.10	<0.10	<0.10	<0.10	<0.50	<0.50
<b>Nitrate</b> [mg/l]	MAC 10.0	<0.50	<0.50	<0.10	<0.10	<0.10	<0.10	<0.10	<0.50	<0.50
<b>pH</b>		8.19	8.20	8.05	8.01	8.01	8.08	8.21	8.35	8.17
<b>Phenols</b> [mg/l]		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
<b>Sulphate</b> [mg/l]	AO 500	44	44	47	41	49	50	23	46	60
<b>Tannin &amp; Lignin</b> [mg/l]		0.1	0.1	0.1	0.2	0.7	0.6	<0.10	0.2	0.4
<b>TDS</b> [mg/l]	AO 500	<b>618</b>	<b>614</b>	<b>539</b>	<b>571</b>	<b>571</b>	<b>595</b>	<b>560</b>	<b>754</b>	<b>682</b>
<b>TKN</b> [mg/l]		0.391	0.504	0.272	0.323	0.184	0.337	0.503	0.698	0.505
<b>Organic Nitrogen</b> [mg/l]	AO 0.15	0.08	<b>0.20</b>	0.00	0.02	0.01	<b>0.17</b>	0.12	<b>0.32</b>	<b>0.18</b>
<b>Turbidity</b> [NTU]	AO 5.0	2.2	1.1	<b>5.7</b>	1.2	3.2	1.5	2.4	<b>28.3</b>	1.8
<b>Hardness</b> [mg/l]	OG 100	<b>229</b>	<b>229</b>	<b>211</b>	<b>233</b>	<b>298</b>	<b>310</b>	<b>161</b>	<b>170</b>	<b>234</b>
<b>Ion Balance</b>		1.01	1.01	0.97	1.01	1.00	1.02	0.88	1.03	1.03
<b>Calcium</b> [mg/l]		44	44	40	44	65	68	30	35	46
<b>Magnesium</b> [mg/l]		29	29	27	30	33	34	21	20	29
<b>Potassium</b> [mg/l]		11	11	11	11	4	4	9	9	10
<b>Sodium</b> [mg/l]	AO 200	98	98	78	80	64	67	78	171	126
<b>Iron</b> [mg/l]	AO 0.3	0.16	0.11	<b>0.46</b>	0.14	<b>0.54</b>	0.21	0.20	0.11	0.07
<b>Manganese</b> [mg/l]	AO 0.05	0.01	0.01	0.02	0.01	0.01	0.01	0.01	<0.01	0.01

TABLE III

## SUMMARY OF HEAVY METALS TESTING IN SUBDIVISION TEST WELLS

Parameter	Guideline	TW1		TW2		TW3	
		3hr	6hr	3hr	6hr	3hr	6hr
<b>Aluminum</b> [mg/l]	OG 0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<b>Arsenic</b> [mg/l]	IMAC 0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Boron</b> [mg/l]	IMAC 5.0	0.53	0.54	0.57	0.58	0.06	0.06
<b>Barium</b> [mg/l]	MAC 1.0	0.08	0.07	0.26	0.20	0.32	0.33
<b>Cadmium</b> [mg/l]	MAC 0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
<b>Cobalt</b> [mg/l]	*0.0038	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
<b>Chromium</b> [mg/l]	MAC 0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Copper</b> [mg/l]	AO 1.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Mercury</b> [mg/l]	MAC 0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
<b>Lead</b> [mg/l]	MAC 0.010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Antimony</b> [mg/l]	IMAC 0.006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
<b>Selenium</b> [mg/l]	MAC 0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Strontium</b> [mg/l]	** 7.0	3.92	3.87	3.28	3.64	0.662	0.677
<b>Uranium</b> [mg/l]	MAC 0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Vanadium</b> [mg/l]	*0.0062	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Zinc</b> [mg/l]	AO 5.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Guideline refers to Ontario Drinking Water Standards, Objectives and Guidelines except where noted

\* O. Reg 153/04 standard Table 2 for potable groundwater

\*\* Health Canada health related maximum

TABLE IV

## SUMMARY OF PUMPING TEST RESULTS AND WELL PARAMETERS

Well	Tp (m <sup>2</sup> /day)	Tr (m <sup>2</sup> /day)	Tav (m <sup>2</sup> /day)	Q (m <sup>3</sup> /day)	SC (m <sup>3</sup> /day/m)	ho m	hf m	Td m	TD m	CS m	AD m
TW1	288	192	240	94.3	68.3	6.86	8.24	1.38	76.20	0.60	36.4
TW2	181	203	192	88.9	85.7	6.68	7.72	1.04	74.37	0.60	36.6
TW3	192	163	177	94.3	409.8	4.53	4.76	0.23	30.48	0.60	20.5

Average Transmissivity: 203 m<sup>2</sup>/day

Well	% Available Drawdown Used
TW1	3.79%
TW2	2.83%
TW3	1.12%

Note:

- Tp: Transmissivity as calculated from pumping data (m<sup>2</sup>/day)
- Tr: Transmissivity as calculated from recovery data (m<sup>2</sup>/day)
- Tav: Average transmissivity (average of pumping and recovery) (m<sup>2</sup>/day)
- Q: Test pumping rate (m<sup>3</sup>/day)
- SC: Specific Capacity (m<sup>3</sup>/day/m)
- ho: Static water level (below top of casing) at beginning of pumping test (metres)
- hf: Water level (below top of casing) at end of 6 hour pumping test (metres)
- Td: Total drawdown (metres)
- TD: Total depth of well (below ground surface) (metres)
- CS: Casing stickup above ground surface (metres)
- AD: Approximate available drawdown (metres)

TABLE V  
MUTUAL WELL INTERFERENCE AT CENTRAL LOT

Storativity            2.4.E-04            based on storativity estimate using drawdown  
in observation wells (cooper-jacob straight-line)  
Transmissivity        203 m<sup>2</sup>/day        average calculated value using cooper-jacob  
T                        2.E-03 m<sup>2</sup>/s  
Q                        1100 L/day  
Q                        1.27E-05 m<sup>3</sup>/s  
Duration                30 years  
Duration                946080000 s  
2.3Q/(4πiT)            0.0010

Lot	Distance [m]	30 Year Drawdown [m]
1	47.8	0.007
3	49.5	0.007
4	138	0.006
5	110	0.006
6	108	0.006
7	126	0.006
Cumulative aquifer drawdown at centre well [metres]		0.038

TABLE VI  
WELL INTERFERENCE AT PROPERTY BOUNDARY

Storativity	2.4.E-04	based on storativity estimate using drawdown in observation wells (cooper-jacob straight-line)
Transmissivity	203 m <sup>2</sup> /day	average calculated value using cooper-jacob
T	2.E-03 m <sup>2</sup> /s	
Q	1100 L/day	
Q	1.27E-05 m <sup>3</sup> /s	
Duration	30 years	
Duration	946080000 s	
2.3Q/(4piT)	0.0010	

Lot	Distance [m]	30 Year Drawdown [m]
1	29.2	0.007
2	55.7	0.007
3	100	0.006
4	192	0.006
5	158	0.006
6	145	0.006
7	145	0.006
Cumulative aquifer drawdown at north property corner [m]		0.044

TABLE VII

DRAWDOWN IN OBSERVATION WELLS  
DURING PUMPING TESTS

DATE 5-May-21  
 PUMPED WELL: TW3  
 OBSERVATION WELL: TW1  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r: 117.2 metres  
 PUMPING RATE, Q: 94.3 m3/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-6.73	
15	-6.73	0.00
30	-6.73	0.00
45	-6.74	0.01
60	-6.75	0.02
75	-6.76	0.03
90	-6.74	0.01
105	-6.73	0.00
120	-6.72	0.00
135	-6.72	-0.01
150	-6.72	-0.01
165	-6.74	0.01
180	-6.74	0.02
195	-6.74	0.02
210	-6.74	0.01
225	-6.74	0.01
240	-6.74	0.01
255	-6.74	0.01
270	-6.74	0.01
285	-6.73	0.01
300	-6.73	0.00
315	-6.74	0.01
330	-6.74	0.01
345	-6.73	0.00
360	-6.74	0.02
375	-6.76	0.03
390	-6.73	0.00
405	-6.73	0.00
420	-6.73	0.01

TABLE VII (continued)

DATE 5-May-21  
 PUMPED WELL: TW3  
 OBSERVATION WELL: TW2  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r:  
 PUMPING RATE, Q:

117.6 metres  
 94.3 m<sup>3</sup>/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-6.63	0
15	-6.63	0.00
30	-6.63	0.00
45	-6.63	0.00
60	-6.64	0.01
75	-6.65	0.03
90	-6.66	0.03
105	-6.64	0.01
120	-6.63	0.00
135	-6.63	0.00
150	-6.62	-0.01
165	-6.62	-0.01
180	-6.64	0.01
195	-6.65	0.02
210	-6.65	0.02
225	-6.64	0.01
240	-6.64	0.01
255	-6.64	0.02
270	-6.64	0.01
285	-6.64	0.01
300	-6.64	0.01
315	-6.63	0.00
330	-6.64	0.01
345	-6.64	0.01
360	-6.63	0.00
375	-6.65	0.02
390	-6.67	0.04
405	-6.63	0.00
420	-6.63	0.01

TABLE VII (continued)

DATE 10-May-21  
 PUMPED WELL: TW2  
 OBSERVATION WELL: TW1  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r: 45 metres  
 PUMPING RATE, Q: 88.9 m<sup>3</sup>/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-7.07	0
15	-7.39	0.32
30	-7.41	0.34
45	-7.43	0.36
60	-7.44	0.37
75	-7.44	0.37
90	-7.44	0.37
105	-7.45	0.38
120	-7.45	0.38
135	-7.46	0.39
150	-7.46	0.39
165	-7.46	0.39
180	-7.47	0.40
195	-7.47	0.40
210	-7.48	0.40
225	-7.49	0.42
240	-7.49	0.42
255	-7.49	0.42
270	-7.49	0.42
285	-7.49	0.42
300	-7.49	0.42
315	-7.50	0.43
330	-7.50	0.43
345	-7.50	0.43
360	-7.50	0.43
375	-7.19	0.12
390	-7.17	0.10
405	-7.17	0.10
420	-7.17	0.10
435	-7.15	0.08
450	-7.14	0.07
465	-7.14	0.07
480	-7.13	0.06
495	-7.15	0.08
510	-7.14	0.07
525	-7.14	0.07
540	-7.14	0.07
555	-7.13	0.06
570	-7.13	0.06
585	-7.13	0.06
600	-7.13	0.05
615	-7.13	0.06
630	-7.12	0.05
645	-7.12	0.04
660	-7.14	0.07
675	-7.11	0.04
690	-7.10	0.03
705	-7.09	0.02
720	-7.09	0.02
735	-7.08	0.01
750	-7.08	0.01



TABLE VII (continued)

DATE 10-May-21  
 PUMPED WELL: TW2  
 OBSERVATION WELL: TW3  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r:  
 PUMPING RATE, Q:

117.6 metres  
 88.9 m<sup>3</sup>/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-4.61	0
15	-4.61	0.00
30	-4.65	0.03
45	-4.61	0.00
60	-4.60	-0.02
75	-4.61	0.00
90	-4.61	0.00
105	-4.61	-0.01
120	-4.60	-0.01
135	-4.61	-0.01
150	-4.62	0.01
165	-4.62	0.01
180	-4.60	-0.01
195	-4.63	0.02
210	-4.64	0.03
225	-4.63	0.02
240	-4.65	0.04
255	-4.64	0.03
270	-4.62	0.01
285	-4.61	0.00
300	-4.61	0.00
315	-4.61	0.00
330	-4.61	0.00
345	-4.60	-0.02
360	-4.60	-0.02
375	-4.59	-0.02
390	-4.60	-0.02
405	-4.60	-0.02
420	-4.61	0.00
435	-4.62	0.01
450	-4.61	0.00
465	-4.61	0.00
480	-4.62	0.00
495	-4.61	0.00

TABLE VII (continued)

DATE 12-May-21  
 PUMPED WELL: TW1  
 OBSERVATION WELL: TW2  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r: 44.6 metres  
 PUMPING RATE, Q: 94.3 m<sup>3</sup>/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-6.73	0
15	-7.02	0.29
30	-7.03	0.30
45	-7.04	0.31
60	-7.04	0.31
75	-7.06	0.33
90	-7.06	0.33
105	-7.06	0.33
120	-7.07	0.34
135	-7.07	0.34
150	-7.07	0.34
165	-7.08	0.35
180	-7.09	0.36
195	-7.10	0.37
210	-7.09	0.36
225	-7.09	0.36
240	-7.09	0.36
255	-7.09	0.36
270	-7.11	0.38
285	-7.11	0.38
300	-7.11	0.38
315	-7.11	0.38
330	-7.12	0.39
345	-7.12	0.39
360	-7.12	0.39
375	-6.80	0.07
390	-6.80	0.06
405	-6.78	0.05
420	-6.78	0.05
435	-6.77	0.04
450	-6.77	0.04
465	-6.76	0.03
480	-6.77	0.04
495	-6.75	0.02
510	-6.77	0.04
525	-6.75	0.02
540	-6.74	0.01
555	-6.73	0.00

TABLE VII (continued)

DATE 12-May-21  
 PUMPED WELL: TW1  
 OBSERVATION WELL: TW3  
 DISTANCE BETWEEN PUMPED  
 WELL AND OBSERVATION WELL, r:  
 PUMPING RATE, Q:

117.2 metres  
 94.3 m<sup>3</sup>/day

Time Lapsed (minutes)	Depth (metres)	h-ho (metres)
0	-4.65	0
15	-4.66	0.00
30	-4.64	-0.02
45	-4.64	-0.01
60	-4.63	-0.02
75	-4.63	-0.02
90	-4.62	-0.03
105	-4.61	-0.04
120	-4.62	-0.03
135	-4.60	-0.05
150	-4.61	-0.05
165	-4.60	-0.05
180	-4.62	-0.04
195	-4.62	-0.04
210	-4.61	-0.04
225	-4.60	-0.05
240	-4.61	-0.04
255	-4.62	-0.04
270	-4.62	-0.03
285	-4.61	-0.04
300	-4.62	-0.04
315	-4.62	-0.04
330	-4.61	-0.04
345	-4.63	-0.03
360	-4.61	-0.04
375	-4.61	-0.04
390	-4.60	-0.06
405	-4.61	-0.04
420	-4.61	-0.04
435	-4.62	-0.04
450	-4.63	-0.03
465	-4.61	-0.04
480	-4.64	-0.01
495	-4.63	-0.02
510	-4.66	0.01
525	-4.65	0.00

TABLE VIII  
ESTIMATE OF STORATIVITY BY COOPER-JACOB METHOD

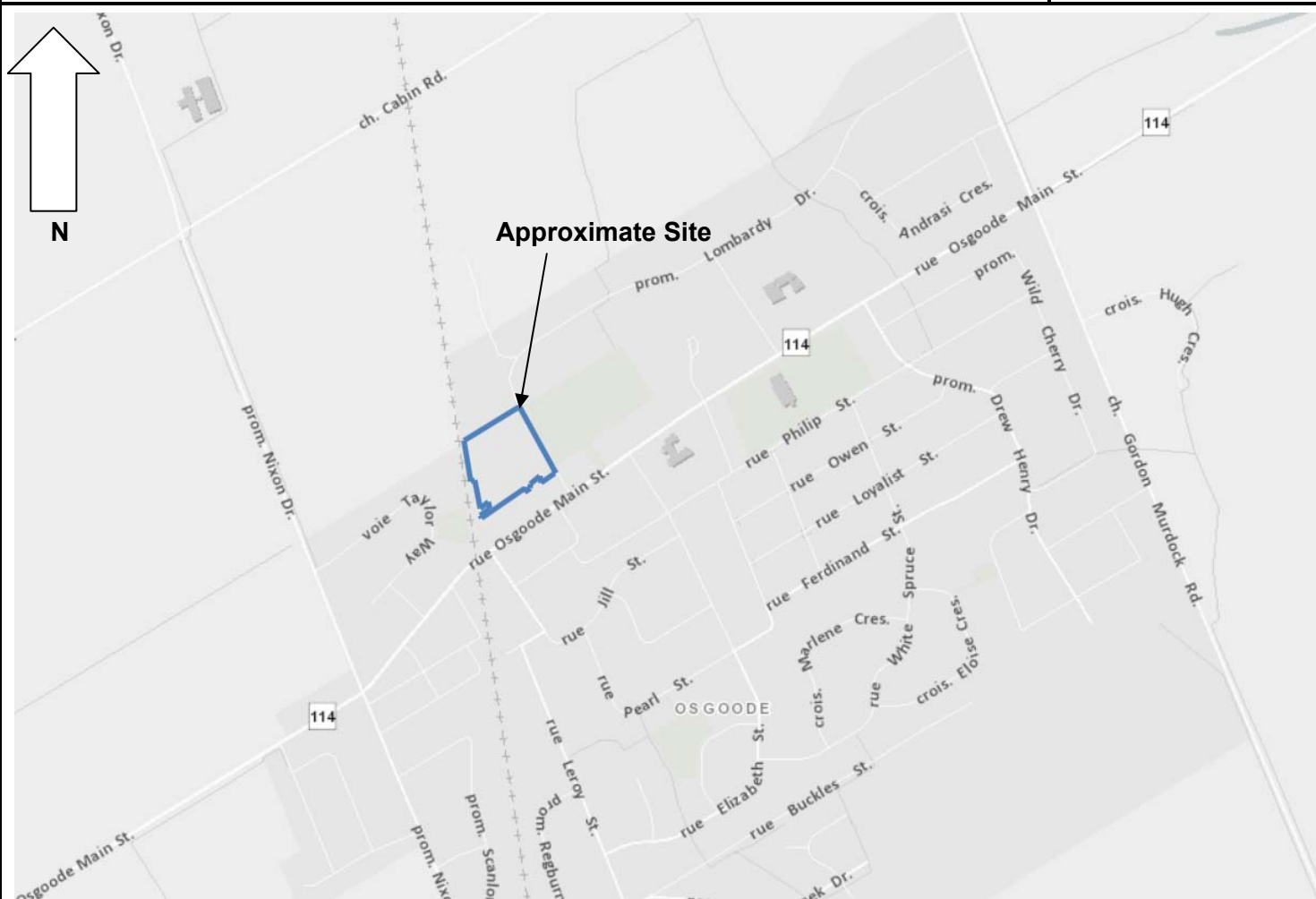
A curve of drawdown versus time was generated for observation wells as an adjacent well was pumped (see Table 7 and Attachment K)

Based on the Cooper-Jacob formula, the following values of storativity were calculated.

Pump well	Observation Well	r (m)	Q (m <sup>3</sup> /day)	t <sub>0</sub> (min)	T (m <sup>2</sup> /day)	S
TW2	TW1	44.6	88.9	1.4	180.7	2.0E-04
TW1	TW2	44.6	94.3	1.2	288	2.7E-04
						2.4E-04

# KEY PLAN

# FIGURE 1



**NOT TO SCALE**

FIGURE 2



- TW1
- Approximate Water Well Location
  - ⊕ Approximate Borehole Location
  - BH1
  - ← Approximate Receiving Aquifer Flow Direction
  - ↗ Approximate Water Supply Aquifer Flow Direction

NOTE: This drawing to be read in conjunction with accompanying report.

REV.	NAME	DATE	DESCRIPTION

**K** Kollaard Associates  
Engineers

PO. BOX 189, 210 PRESCOTT ST (613) 860-0923  
KEMPTVILLE ONTARIO info@kollaard.ca  
KOG 1J0 FAX (613) 258-0475  
http://www.kollaard.ca

CLIENT: MILES YANG

PROJECT: PROPOSED RESIDENTIAL SUBDIVISION

LOCATION: 3200 REIDS LANE  
OSGOODE, ONTARIO

DRAWING: SITE PLAN

DESIGNED BY: — DATE: AUGUST 2021

DRAWN BY: CV SCALE: 1:750

KOLLAARD FILE NUMBER: 210064

FIGURE 3

TW1



Approximate Water Well Location

NOTE: This drawing to be read in conjunction with accompanying report.

REV.	NAME	DATE	DESCRIPTION



**Kollaard Associates**  
Engineers

PO. BOX 189, 210 PRESCOTT ST (613) 860-0923  
KEMPTVILLE ONTARIO info@kollaard.ca  
KOG 1JO FAX (613) 258-0475  
http://www.kollaard.ca

CLIENT: *MILES YANG*

PROJECT: *PROPOSED RESIDENTIAL SUBDIVISION*

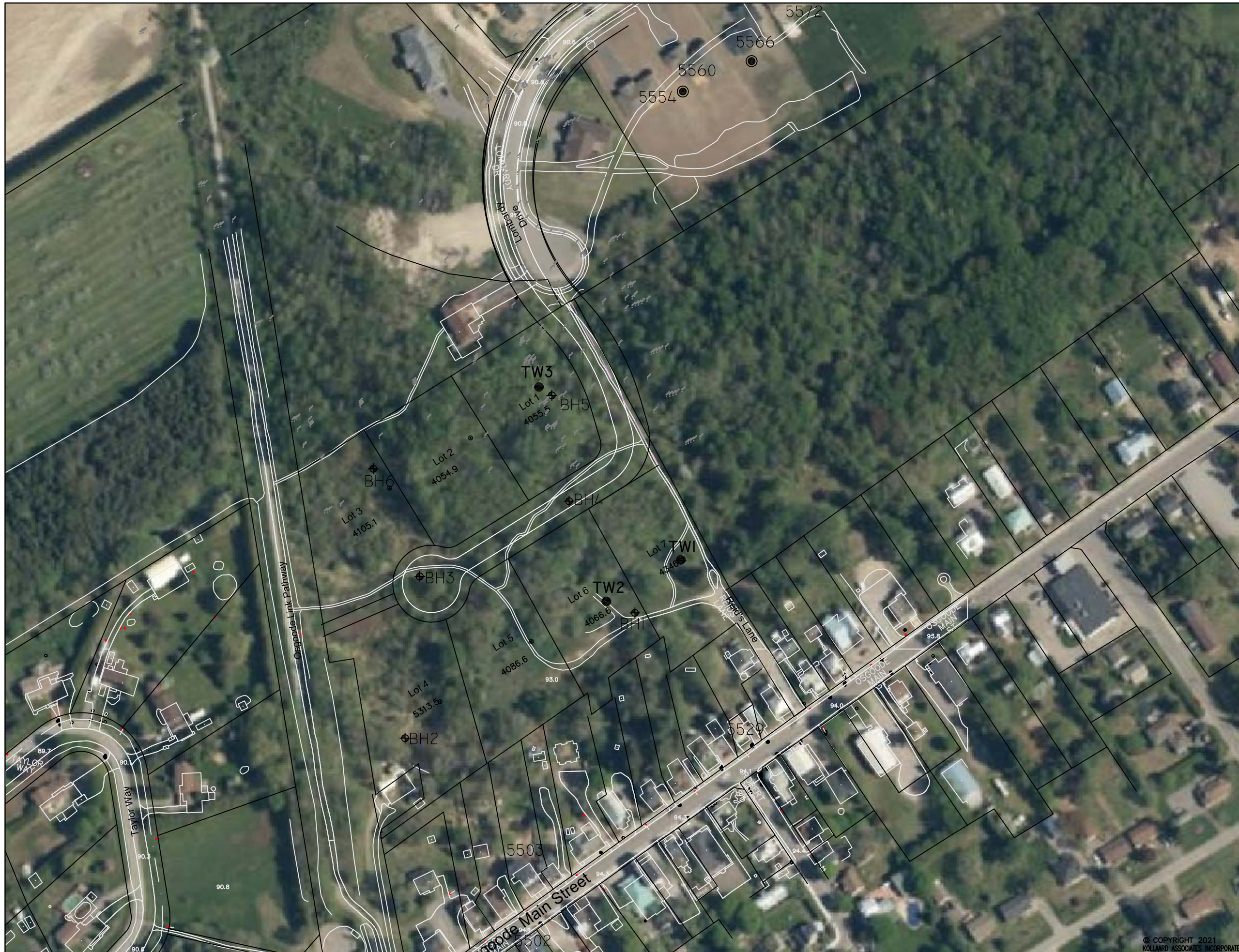
LOCATION: *3200 REIDS LANE  
OSGOODE, ONTARIO*

DRAWING: *WELL LOCATIONS*

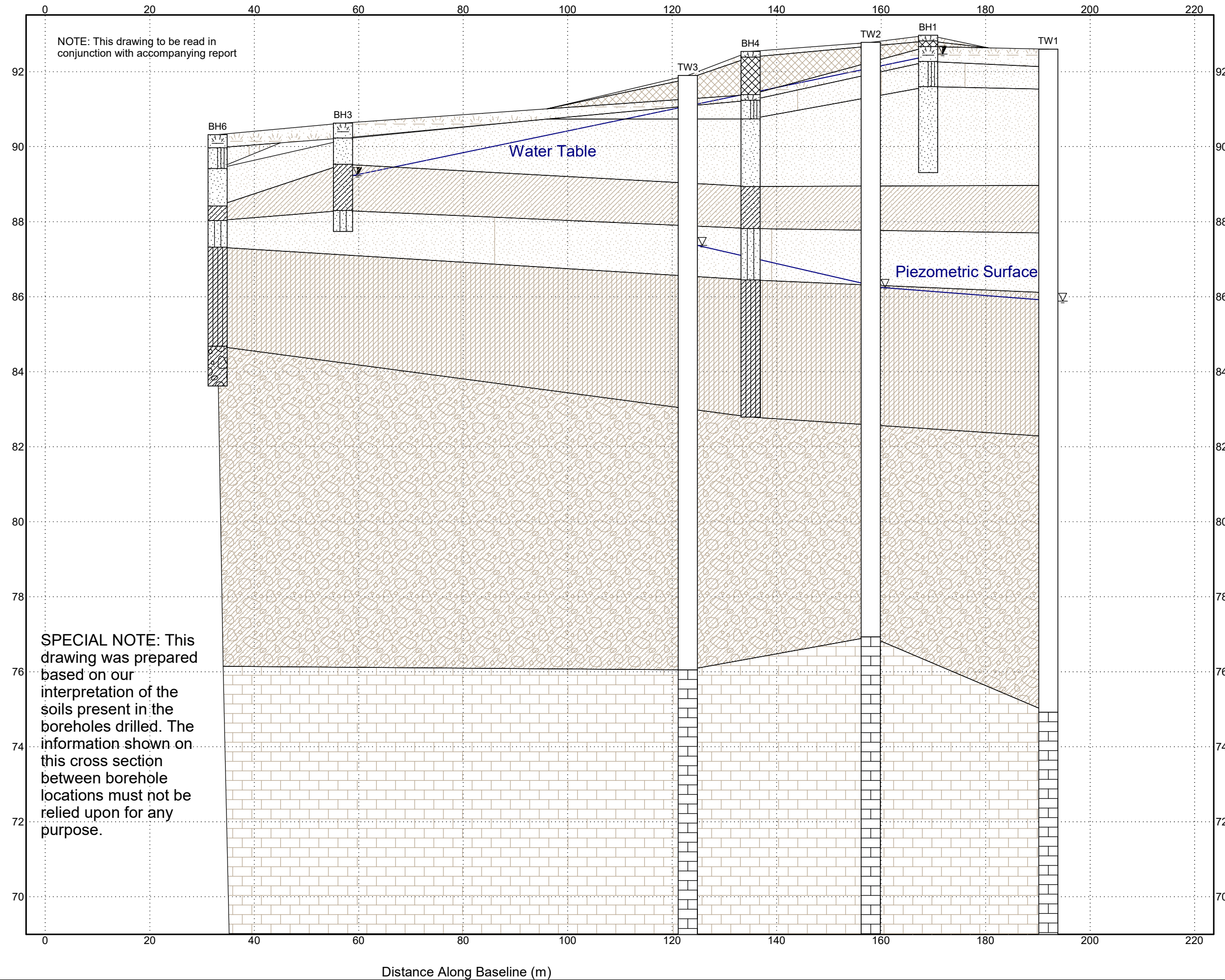
DESIGNED BY: —	DATE: AUGUST 2021
-------------------	----------------------

DRAWN BY: CV	SCALE: 1:1500
-----------------	------------------

KOLLAARD FILE NUMBER: 210064
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CROSS-SECTION KOLLAARD 210064-CROSSSECTION GPJ GINT STD CANADA GDT 21-8-19



NOTE: This drawing to be read in conjunction with accompanying report

**SPECIAL NOTE:** This drawing was prepared based on our interpretation of the soils present in the boreholes drilled. The information shown on this cross section between borehole locations must not be relied upon for any purpose.

**FIGURE 4**

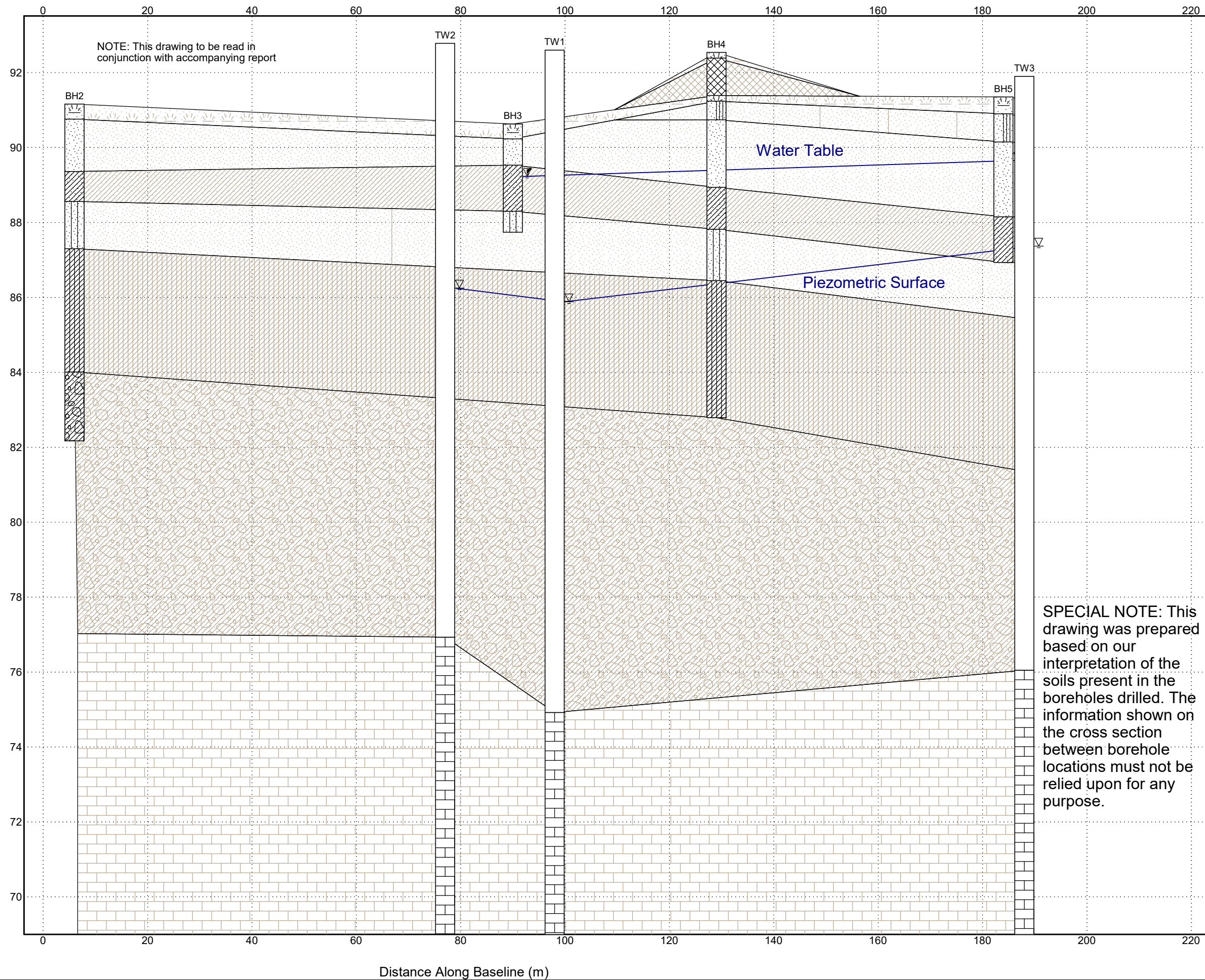
- TOPSOIL
- Yellow brown sand and gravel (FILL)
- Red brown fine to medium SAND, trace silt
- Grey fine to medium SAND
- Grey sandy CLAY, trace silt
- Grey SILTY SAND
- Grey SILTY CLAY
- Grey silty sand, trace to some gravel, cobbles and boulders, trace clay (GLACIAL TILL)
- LIMESTONE BEDROCK

**Kollaard Associates**  
Engineers  
210 Prescott Street, Unit 1 613-860-0923  
P.O. Box 189 info@kollaard.ca  
Kemptville, Ontario  
K0G 1J0 Fax: 613-258-0475

<b>CLIENT:</b> Miles Yang	
<b>PROJECT:</b> Proposed Residential Subdivision	
<b>LOCATION:</b> 3200 Reids Lane. Osgoode, Ottawa, Ontario	
<b>DRAWING:</b> East-West Cross Section	
<b>DESIGNED BY:</b> CV	<b>DATE:</b> July 2021
<b>DRAWN BY:</b> CI	<b>SCALE:</b> 1:100
<b>PROJECT NUMBER:</b> 210064	



CROSS-SECTION KOLLAARD 210064-CROSSSECTION GPJ GINT STD CANADA GDT 21-8-19



**FIGURE 5**

- TOPSOIL**
- Yellow brown sand and gravel (FILL)**
- Red brown fine to medium SAND, trace silt**
- Grey fine to medium SAND**
- Grey sandy CLAY, trace silt**
- Grey SILTY SAND**
- Grey SILTY CLAY**
- Grey silty sand, trace to some gravel, cobbles and boulders, trace clay (GLACIAL TILL)**
- LIMESTONE BEDROCK**

**Kollaard Associates**  
Engineers  
210 Prescott Street, Unit 1 613-860-0923  
P.O. Box 189 info@kollaard.ca  
Kemptville, Ontario  
K0G 1J0 Fax: 613-258-0475

**CLIENT:**  
Miles Yang

**PROJECT:**  
Proposed Residential Subdivision

**LOCATION:**  
3200 Reids Lane.  
Osgoode, Ottawa, Ontario

**DRAWING:**  
North-South Cross Section




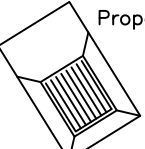
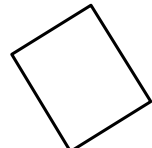
**DESIGNED BY:** CV      **DATE:** July 2021

**DRAWN BY:** CI      **SCALE:** 1:100

**PROJECT NUMBER:**  
210064

FIGURE 6



- TW1
-  Approximate Water Well Location
-  Approximate Borehole Location
- BH1
-  Proposed Water Well Location
-  Proposed sewage system
-  Proposed house

NOTE: This drawing to be read in conjunction with accompanying report.

REV.	NAME	DATE	DESCRIPTION

 **Kollaard Associates**  
Engineers

PO, BOX 189, 210 PRESCOTT ST (613) 860-0923  
KEMPTVILLE ONTARIO info@kollaard.ca  
K0G 1J0 FAX (613) 258-0475  
http://www.kollaard.ca

CLIENT: MILES YANG

PROJECT: PROPOSED RESIDENTIAL SUBDIVISION

LOCATION: 3200 REIDS LANE  
OSGOODE, ONTARIO

DRAWING: LOT DEVELOPMENT PLAN

DESIGNED BY: - DATE: AUGUST 2021

DRAWN BY: CV SCALE: 1:750

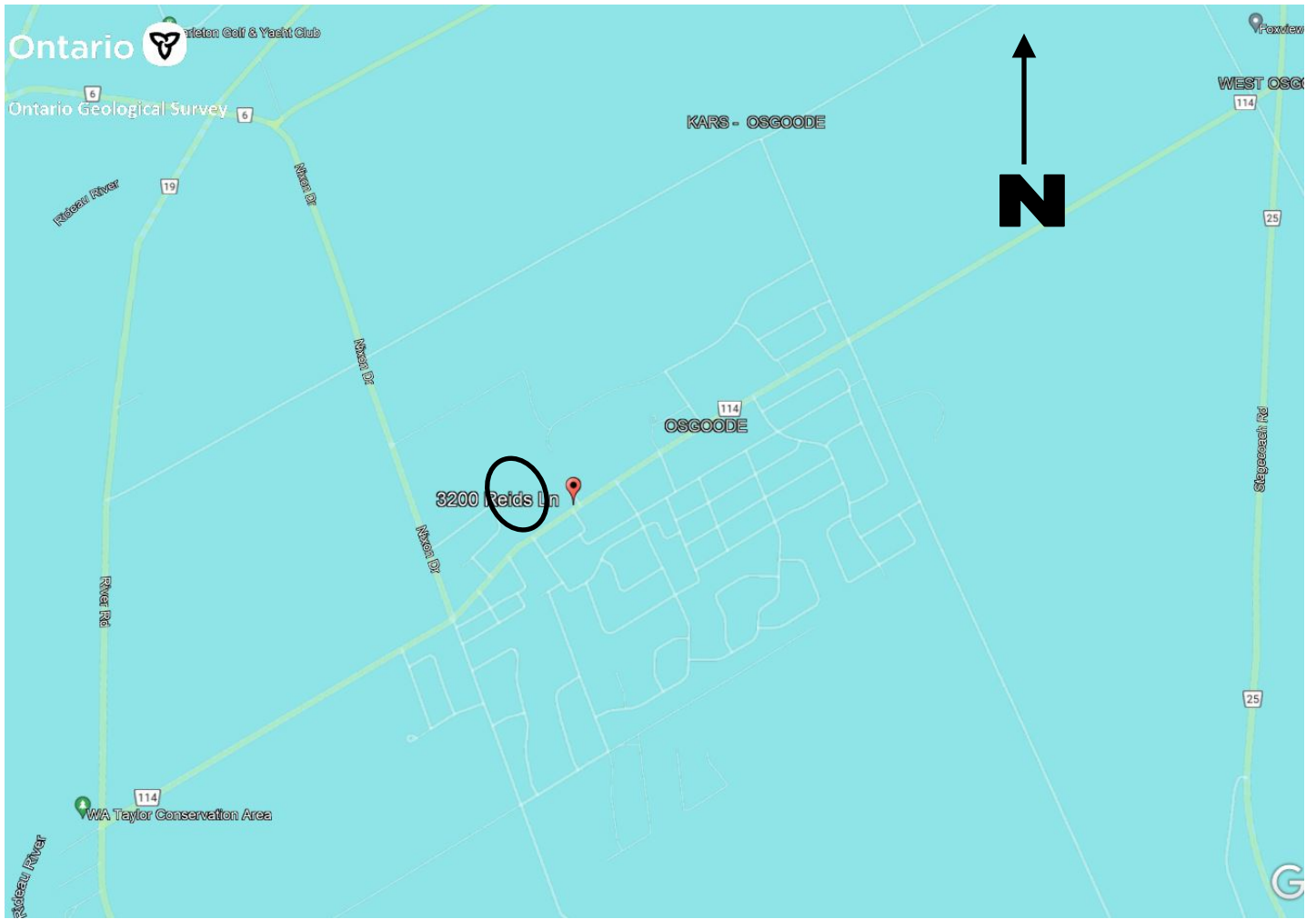
KOLLAARD FILE NUMBER: 210064



ATTACHMENT A

SURFICIAL AND BEDROCK GEOLOGY MAPS

# BEDROCK GEOLOGY MAP

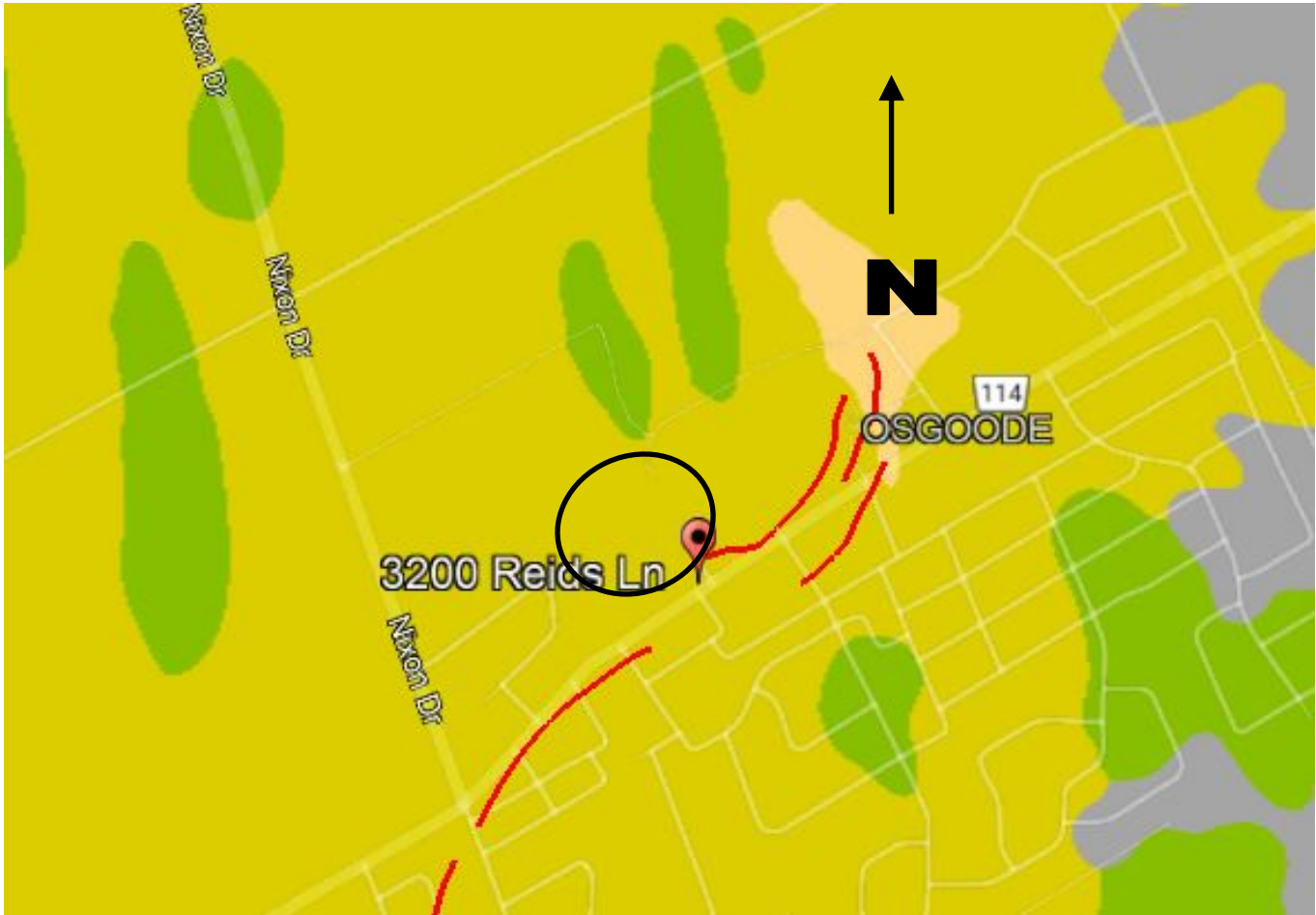


1:250,000 scale Bedrock Geology Map MRD 126, issued 2003

## LOWER ORDOVICIAN

**53** Dolostone, sandstone: Beekmantown Gp.

# SURFICIAL GEOLOGY MAP



## PLEISTOCENE

- 12** Older alluvial deposits: clay, silt, sand, gravel, may contain organic remains
- 11** Coarse-textured glaciomarine deposits: sand, gravel, minor silt and clay
  - 11a Deltaic deposits
  - 11b Littoral deposits
  - 11c Foreshore and basinal deposits

Ontario Geological Survey of Ontario, issued 2003



ATTACHMENT B

CERTIFICATE OF WELL COMPLIANCES AND MOE WATER WELL RECORDS FOR TEST  
WELLS AND AREA WELL RECORDS



Well Tag#: **A318366** (Below)  
**A318366**

Measurements recorded in:  Metric  Imperial

Page \_\_\_\_\_ of \_\_\_\_\_

**Well Owner's Information**

First Name \_\_\_\_\_ Last Name/Organization **Crestview Innovation Inc.** E-mail Address \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name) **12 Escade Drive** Municipality **Ottawa** Province **ON** Postal Code **K2G 6R9** Telephone No. (inc. area code) \_\_\_\_\_

**Well Location**

Address of Well Location (Street Number/Name) **3200 Reids Lane** Township **Osgode** Lot **P/L 27+28 1** Concession \_\_\_\_\_

County/District/Municipality **Ottawa Carleton** City/Town/Village **Osgoode** Province **Ontario** Postal Code \_\_\_\_\_

UTM Coordinates: Zone **18** Easting **452113** Northing **4999346** Municipal Plan and Sublot Number **4R-20040 (Parts 4+5)** Other **TW# 1**

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	Sand	Cobble		0'	25'
	Clay			25'	38'
	Gravel		(Packed)	38'	56'
Grey	Limestone			56'	180'
Grey	Limestone	w/ Grey Sandstone Mix		180'	244'
Grey	Limestone	w/ Grey Sandstone Mix		244'	250'

\* Test Well # 1 of 3 \*

**Annular Space**

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
66'	56'	Neat cement	9.36
56'	0'	Bentonite slurry	21

**Results of Well Yield Testing**

After test of well yield, water was:		Draw Down		Recovery	
<input type="checkbox"/> Clear and sand free	<input type="checkbox"/> Other, specify <b>Not tested</b>	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason:		Static Level	229"		30.2"
Pump intake set at (m/ft) <b>240</b>		1	27.9	1	25.0
Pumping rate (l/min/GPM) <b>20</b>		2	28.9	2	23.3
Duration of pumping <b>1</b> hrs + <b>0</b> min		3	29.2	3	22.9
Final water level end of pumping (m/ft) <b>30.2"</b>		4	29.4	4	22.9
If flowing give rate (l/min/GPM)		5	29.5	5	
Recommended pump depth (m/ft) <b>140'</b>		10	29.8	10	
Recommended pump rate (l/min/GPM) <b>20</b>		15	29.9	15	
Well production (l/min/GPM) <b>20</b>		20	30.0	20	
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		25	30.0	25	
		30	30.1	30	
		40	30.1	40	
		50	30.2	50	
		60	30.2	60	

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used

Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering

Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring

Boring  Digging  Irrigation  Cooling & Air Conditioning

Air percussion  Industrial  Other, specify \_\_\_\_\_

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	66'	<input checked="" type="checkbox"/> Water Supply
6"	Open Hole		66'	250'	<input type="checkbox"/> Replacement Well

**Construction Record - Screen**

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)		Status of Well
			From	To	
					<input type="checkbox"/> Test Hole
					<input type="checkbox"/> Recharge Well
					<input type="checkbox"/> Dewatering Well
					<input type="checkbox"/> Observation and/or Monitoring Hole
					<input type="checkbox"/> Alteration (Construction)
					<input type="checkbox"/> Abandoned, Insufficient Supply
					<input type="checkbox"/> Abandoned, Poor Water Quality
					<input type="checkbox"/> Abandoned, other, specify _____
					<input type="checkbox"/> Other, specify _____

**Water Details**

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

**Hole Diameter**

Depth (m/ft)	Diameter (cm/in)
0' - 66'	93/4"
66' - 250'	6"

**Well Contractor and Well Technician Information**

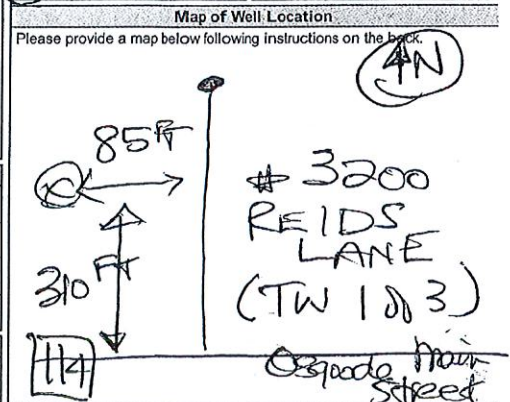
Business Name of Well Contractor **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No. **7681**

Business Address (Street Number/Name) **6659 Franktown Road** Municipality **Richmond**

Province **ON** Postal Code **K0A 2Z0** Business E-mail Address **air-rock@sympatico.ca**

Bus. Telephone No. (inc. area code) **8138382170** Name of Well Technician (Last Name, First Name) **Hanna, Jeremy**

Well Technician's Licence No. **T3632** Signature of Technician and/or Contractor \_\_\_\_\_ Date Submitted **2021 05 31**



Comments: **1/2 HP - 10 GPM Set @ 140 ft**

Well owner's information package delivered  Yes  No

Date Package Delivered **2021 04 27** Date Work Completed **2021 04 28**

Ministry Use Only: Audit No. **2355079** Received \_\_\_\_\_

# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: CRESTVIEW INNOVATION INC.

Location: # 3200 REIDS LANE, Osgoode

Part 27  
LOT: 228 CON: 1 PLAN # 4R-20040 SITE # Part 415

Ottawa-Carleton / Geographical Township of Osgoode

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 City 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 26<sup>th</sup> Day of APRIL, 2021

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. ( C-7681 )

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 11<sup>th</sup> day of May, 2021

  
(Engineer)

TAG A 318366  
TW# 1 of 3  
2021241

Shaping our future together  
Ensemble, formons notre avenir

City of  
Client 5  
8743 Vir



Kollaard Associates

Engineers  
P.O. Box 189  
210 Prescott Street, Unit 1  
Kemptville, Ontario K0G 1J0





Measurements recorded in:  Metric  Imperial

Page \_\_\_ of \_\_\_

Well Owner's Information

First Name: \_\_\_\_\_ Last Name/Organization: **Crestview Innovation Inc.** E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name): **12 Escade Drive** Municipality: **Ottawa** Province: **ON** Postal Code: **K2G 6R9** Telephone No. (inc. area code): \_\_\_\_\_

Well Location

Address of Well Location (Street Number/Name): **3200 Reids Lane** Township: **Osgoode** Lot: **P/L 27428 1** Concession: \_\_\_\_\_

County/District/Municipality: **Ottawa Carleton** City/Town/Village: **Osgoode** Province: **Ontario** Postal Code: \_\_\_\_\_

UTM Coordinates: Zone: **18** Easting: **452078** Northing: **4999307** Municipal Plan and Sublot Number: **4R-2004D (Parts 4+5)** Other: **TW#2**

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)
				From To
	Sand & Boulders	Clay, Gravel		0' 52'
Grey & Black	Limestone			52' 180'
Grey & Black	Limestone	w/ Gray & White Sandstone Mix		180' 238'
Grey & Black	Limestone	w/ Gray & White Sandstone Mix		238' 244'

\* Test Well #2 of 3 \*

**Annular Space**

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
52' / 52'	Neat cement	10.9
52' / 0'	Bentonite slurry	21

**Results of Well Yield Testing**

After test of well yield, water was:  
 Clear and sand free  
 Other, specify **Not tested**

If pumping discontinued, give reason: \_\_\_\_\_

Draw Down	Recovery		
Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
	Static Level: 22.5'		27.8'
1	26.7	1	22.5
2	27.2	2	22.5
3	27.5	3	
4	27.6	4	
5	27.7	5	
10	27.7	10	
15	27.7	15	
20	27.8	20	
25	27.8	25	
30	27.8	30	
40	27.8	40	
50	27.8	50	
60	27.8	60	

Pump intake set at (ft): **220**

Pumping rate (l/min/GPM): **20**

Duration of pumping: **1** hrs + **0** min

Final water level end of pumping (m/ft): **27.8**

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

Recommended pump depth (m/ft): **140'**

Recommended pump rate (l/min/GPM): **20**

Well production (l/min/GPM): **20**

Abandoned?  Yes  No

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used  
 Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering  
 Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring  
 Boring  Digging  Irrigation  Cooling & Air Conditioning  
 Air percussion  Industrial  Other, specify \_\_\_\_\_

**Construction Record - Casing**

Inside Diameter (m/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	62'	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
6"	Open Hole		62'	244'	

**Construction Record - Screen**

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

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Hole Diameter	
		Depth (m/ft)	Diameter (m/in)
		From	To
238'		0' 62'	9 3/4"
		62' 244'	6"

**Well Contractor and Well Technician Information**

Business Name of Well Contractor: **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No.: **7681**

Business Address (Street Number/Name): **655 Franktown Road** Municipality: **Richmond**

Province: **ON** Postal Code: **K0A 2Z0** Business E-mail Address: **air-rock@sympatico.ca**

Bus. Telephone No. (inc. area code): **8138382170** Name of Well Technician (Last Name, First Name): **Hanna, Jeremy**

Well Contractor's Licence No.: **13532** Signature of Technician and/or Contractor: \_\_\_\_\_ Date: **2021** Dec **05** 31

**Map of Well Location**

Please provide a map below following instructions on the back.

Comments: **1/2 HP 10 GPM @ 140 FT**

Well owner's information package delivered:  Yes  No

Date Package Delivered: **2021** Nov **29**

Date Work Completed: **2021** Oct **27**

Ministry Use Only: Audit No. **Z355078**

Received: \_\_\_\_\_

# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: CRESTVIEW INNOVATION INC.

Location: # 3200 REIDS LANE, Osgoode

Part 27  
LOT: 28 CON: 1 PLAN # 4R-20040 SITE # Part 415

Ottawa-Carleton / Geographical Township of Osgoode

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 City 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 27<sup>TH</sup> Day of APRIL, 2021

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. ( C-7681 )

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 11<sup>th</sup> day of May, 2021,

TAG A318392  
TW#2 of 3  
2021242

(Engineer)

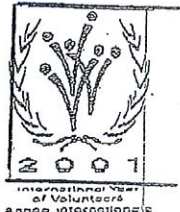
Shaping our future together  
Ensemble, formons notre avenir

City of Ottawa  
Client Service Centre  
8263 Victoria Street



Kollaard Associates

Engineers  
P.O. Box 189  
210 Prescott Street, Unit 1  
Kemptville, Ontario K0G 1J0



# CERTIFICATE OF WELL COMPLIANCE



I ( **Jeremy Hanna** ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: CRESTVIEW INNOVATION INC.

Location: # 3200 REIDS LANE, Osgoode

Part 27  
LOT: 228 CON: 1 PLAN # 4R-20040 SITE # Part 415

Ottawa-Carleton / Geographical Township of Osgoode

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 City 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 26<sup>th</sup> Day of APRIL, 2021

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. ( C-7681 )

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 11<sup>th</sup> day of May, 2021

  
(Engineer)

TAG A318365  
TW# 2 of 3  
2021240.

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City of Ottawa  
Client Services  
8243 Victoria



Kollaard Associates

Engineers  
P.O. Box 189  
210 Prescott Street, Unit 1  
Kemptville, Ontario K0G 1J0



Measurements recorded in:  Metric  Imperial

Page \_\_\_ of \_\_\_

Well Owner's Information

First Name: \_\_\_\_\_ Last Name/Organization: **Crestview Innovation Inc.** E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name): **12 Escade Drive** Municipality: **Ottawa** Province: **ON** Postal Code: **K2G 6R9** Telephone No. (inc. area code): \_\_\_\_\_

Well Location

Address of Well Location (Street Number/Name): **3200 Reids Lane** Township: **Osgoode** Lot: **P/L 27-28-1** Concession: \_\_\_\_\_

County/District/Municipality: **Ottawa Carleton** City/Town/Village: **Osgoode** Province: **Ontario** Postal Code: \_\_\_\_\_

UTM Coordinates: Zone: **18** Easting: **452036** Northing: **4999431** Municipal Plan and Sublot Number: **4R-20040** Other: **(Parts 4+5) TW3**

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)
From	To			From To
	Sand	Stones		0' 11'
	Clay			11' 37'
	Boulders	Gravel		37' 52'
Grey	Limestone			52' 70'
Grey	Limestone			70' 93'
Grey	Limestone			93' 100'

\* Test Well # 3 of 3 \*

**Annular Space**

Depth Set at (m)	Type of Sealant Used (Material and Type)	Volume Placed (m³)
From To		
62' 52'	Neat cement	9.38
52' 0'	Bentonite slurry	25.2

**Results of Well Yield Testing**

Time (min)	Water Level (m)	Recovery	
		Time (min)	Water Level (m)
Static Level	15.3'	16.2'	
1	15.5	1	15.3
2	15.5	2	15.3'
3	15.6	3	
4	15.6	4	
5	15.6	5	
10	15.7	10	
15	15.8	15	
20	15.9	20	
25	15.9	25	
30	16.0	30	
40	16.1	40	
50	16.2	50	
60	16.2	60	

After test of well yield, water was:  
 Clear and sand free  
 Other, specify **Not tested**

If pumping discontinued, give reason: \_\_\_\_\_

Pump intake set at (m): **80**

Pumping rate (l/min / GPM): **20**

Duration of pumping: **4 hrs + 0 min**

Final water level end of pumping (m): **16.2'**

If flowing give rate (l/min/GPM): \_\_\_\_\_

Recommended pump depth (m): **80'**

Recommended pump rate (l/min/GPM): **20**

Well production (l/min/GPM): **20**

Disinfected?  Yes  No

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used  
 Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering  
 Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring  
 Boring  Irrigation  Industrial  Cooling & Air Conditioning  
 Percussion  Other, specify \_\_\_\_\_

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	62'	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
6"	Open Hole		62'	100'	

**Construction Record - Screen**

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

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Unstested	Hole Diameter	
		Depth (m/ft)	Diameter (cm/in)
70' (m/ft)	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	0' 62'	9.4"
93' (m/ft)	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	62' 100'	6"

**Well Contractor and Well Technician Information**

Business Name of Well Contractor: **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No.: **7681**

Business Address (Street Number/Name): **6659 Franktown Road** Municipality: **Richmond**

Province: **ON** Postal Code: **K0A 2Z0** Business E-mail Address: **air-rock@sympatico.ca**

Bus. Telephone No. (inc. area code): **6138382170** Name of Well Technician (Last Name, First Name): **Hanna, Jeremy**

Well Technician's Licence No.: **13632** Signature of Technician and/or Contractor: \_\_\_\_\_ Date Submitted: **05 31**

**Map of Well Location**

Please provide a map below following instructions on the back

**Comments:**  
**1/2 HR 10 GPM @ 80 FT**

Well owner's Information package delivered:  Yes  No

Date Package Delivered: **2021 04 27**

Date Work Completed: **2021 04 26**

Ministry Use Only  
Audit No: **2355080**

Received: \_\_\_\_\_

Print only in spaces provided.  
Mark correct box with a checkmark, where applicable.

11

1533843

Municipality 15009

Con. CON

OTTAWA-CARLETON

County or District: **CARLETON**  
 Township/Borough/City/Town/Village: **OSGOODE (Ottawa)**  
 Con block tract survey, etc.: **1 Plan 393**  
 Lot: **46 & 47**  
 Address: **5503 OSGOODE Main St.**  
 Date completed: **9 day of 03**

21  
 2  
 10 12 17 18 24 25 26 30 31 47

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)					
General colour	Most common material	Other materials	General description	Depth - feet	
				From	To
Brown Sand			Packed	0	14
Grey Clay			thick	14	30
Grey Clay & stones			HARD Pan	30	50
Grey Limestone			MED HARD	50	80
54' of 6 1/4" casing 1 DRIVE SHOE 1 WELL CAP 2 Bags of Bentonite Quick Grout					

31  
 32  
 10 14 15 21 43 65 75 80

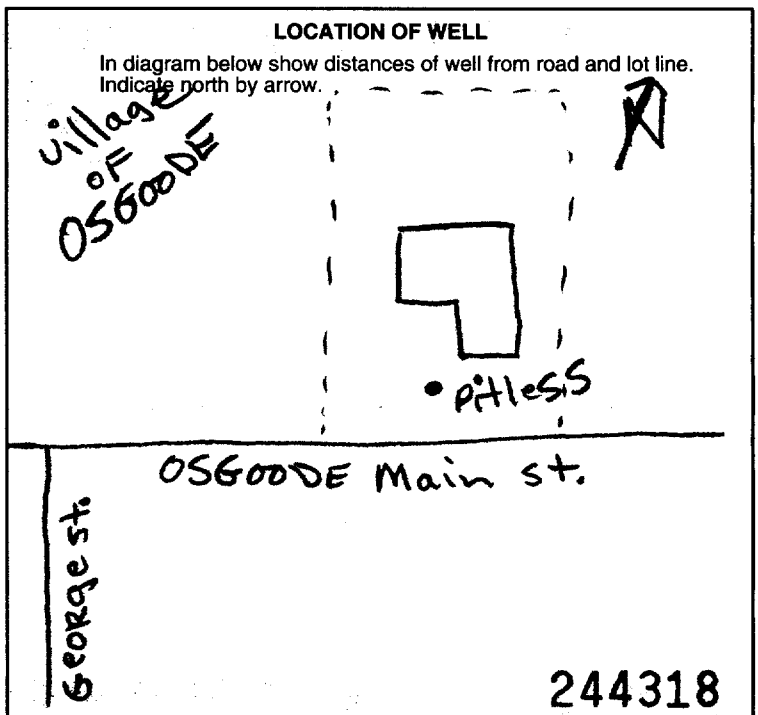
41 WATER RECORD			
Water found at - feet	Kind of water		
68	1 <input type="checkbox"/> Fresh 2 <input type="checkbox"/> Salty	3 <input checked="" type="checkbox"/> Sulphur 4 <input checked="" type="checkbox"/> Minerals 6 <input type="checkbox"/> Gas	14
15-18	1 <input type="checkbox"/> Fresh 2 <input type="checkbox"/> Salty	3 <input type="checkbox"/> Sulphur 4 <input type="checkbox"/> Minerals 6 <input type="checkbox"/> Gas	19
20-23	1 <input type="checkbox"/> Fresh 2 <input type="checkbox"/> Salty	3 <input type="checkbox"/> Sulphur 4 <input type="checkbox"/> Minerals 6 <input type="checkbox"/> Gas	24
25-28	1 <input type="checkbox"/> Fresh 2 <input type="checkbox"/> Salty	3 <input type="checkbox"/> Sulphur 4 <input type="checkbox"/> Minerals 6 <input type="checkbox"/> Gas	29
30-33	1 <input type="checkbox"/> Fresh 2 <input type="checkbox"/> Salty	3 <input type="checkbox"/> Sulphur 4 <input type="checkbox"/> Minerals 6 <input type="checkbox"/> Gas	34

51 CASING & OPEN HOLE RECORD				
Inside diam inches	Material	Wall thickness inches	Depth - feet	
			From	To
6 1/4"	1 <input checked="" type="checkbox"/> Steel 2 <input type="checkbox"/> Galvanized 3 <input type="checkbox"/> Concrete 4 <input checked="" type="checkbox"/> Open hole 5 <input type="checkbox"/> Plastic	.188	0	53
6"	1 <input type="checkbox"/> Steel 2 <input type="checkbox"/> Galvanized 3 <input type="checkbox"/> Concrete 4 <input type="checkbox"/> Open hole 5 <input type="checkbox"/> Plastic		53	80

SCREEN	Sizes of opening (Slot No.)	Diameter	Length
	31-33	34-38	39-40
		inches	feet
	Material and type	Depth at top of screen	
		feet	

61 PLUGGING & SEALING RECORD		
<input checked="" type="checkbox"/> Annular space <input type="checkbox"/> Abandonment		
Depth set at - feet		Material and type (Cement grout, bentonite, etc.)
From	To	
0	53	Bentonite Quick Grout
18-21	22-25	
26-29	30-33	

71 PUMPING TEST	Pumping test method		Pumping rate	Duration of pumping		
	1 <input type="checkbox"/> Pump	2 <input checked="" type="checkbox"/> Bailer	12 GPM	1	Hours Mins	
	Static level		Water level end of pumping		Water levels during	
	19-21	22-24	15 minutes	30 minutes	45 minutes	60 minutes
	26 feet	60 feet	40 feet	60 feet	60 feet	
If flowing give rate		Pump intake set at		Water at end of test		
GPM		feet		<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Cloudy		
Recommended pump type		Recommended pump setting		Recommended pump rate		
<input type="checkbox"/> Shallow <input checked="" type="checkbox"/> Deep		70 feet		10 GPM		



54 FINAL STATUS OF WELL		
1 <input checked="" type="checkbox"/> Water supply	5 <input type="checkbox"/> Abandoned, insufficient supply	9 <input type="checkbox"/> Unfinished
2 <input type="checkbox"/> Observation well	6 <input type="checkbox"/> Abandoned, poor quality	10 <input type="checkbox"/> Replacement well
3 <input type="checkbox"/> Test hole	7 <input type="checkbox"/> Abandoned (Other)	
4 <input type="checkbox"/> Recharge well	8 <input type="checkbox"/> Dewatering	

55-56 WATER USE		
1 <input checked="" type="checkbox"/> Domestic	5 <input type="checkbox"/> Commercial	9 <input type="checkbox"/> Not use
2 <input type="checkbox"/> Stock	6 <input type="checkbox"/> Municipal	10 <input type="checkbox"/> Other
3 <input type="checkbox"/> Irrigation	7 <input type="checkbox"/> Public supply	
4 <input type="checkbox"/> Industrial	8 <input type="checkbox"/> Cooling & air conditioning	

57 METHOD OF CONSTRUCTION		
1 <input checked="" type="checkbox"/> Cable tool	5 <input type="checkbox"/> Air percussion	9 <input type="checkbox"/> Driving
2 <input type="checkbox"/> Rotary (conventional)	6 <input type="checkbox"/> Boring	10 <input type="checkbox"/> Digging
3 <input type="checkbox"/> Rotary (reverse)	7 <input type="checkbox"/> Diamond	11 <input type="checkbox"/> Other
4 <input type="checkbox"/> Rotary (air)	8 <input type="checkbox"/> Jetting	

Name of Well Contractor <b>B. MOORE WELL DRILLING 6455</b>	Well Contractor's Licence No. <b>6455</b>
Address <b>Box 436 OSGOODE ON. K0A 2W0</b>	
Name of Well Technician <b>BOB MOORE</b>	Well Technician's Licence No. <b>7-0319</b>
Signature of Technician/Contractor <b>BOB MOORE</b>	Submission date <b>9 day 01 month 03 yr</b>

MINISTRY USE ONLY	Data source	Contractor	Date received
		<b>6455</b>	<b>JUN 10 2003</b>
	Date of inspection	Inspector	
Remarks			<b>CSS.ES3</b>

Measurements recorded in:  Metric  Imperial

**Well Owner's Information**

First Name: Baresite Construction Last Name / Organization: Baresite Construction E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name): 2354 Summerside Drive Municipality: Manotick Province: ON Postal Code: K4M 1B4 Telephone No. (inc. area code): 613 457 4422

**Well Location**

Address of Well Location (Street Number/Name): 5572 Lombardy Drive Township: Osgoode Lot: pt 1+2+22 Concession: 3715171

County/District/Municipality: Ottawa City/Town/Village: Osgoode Province: Ontario Postal Code: \_\_\_\_\_

UTM Coordinates: Zone 18 Easting 452172 Northing 4999621 Municipal Plan and Sublot Number: RP4R-14828 pt lot #32+33 on Plan 4m.830 Other: \_\_\_\_\_

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	Fill		Soft	0	2'
Black	Topsoil		Soft	2'	3'
Grey	Sand, Stones		Packed	3'	54'6"
Grey	Limestone		Hard	54'6"	101'

**Annular Space**

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
From 59'6" To 49'6"	Cement Pressure Grouted	13.54
49'6" to 0	Bentonite Pressure Grouted	20.31

**Results of Well Yield Testing**

After test of well yield, water was:	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
<input checked="" type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify _____	Static Level	15.6		16.3
If pumping discontinued, give reason:	1	15.7	1	15.9
	2	15.7	2	15.9
Pump intake set at (m/ft): <u>90'</u>	3	15.8	3	15.9
Pumping rate (l/min / GPM): <u>19 gpm</u>	4	15.8	4	15.8
Duration of pumping: <u>1 hrs + 0 min</u>	5	15.9	5	15.8
Final water level end of pumping (m/ft): <u>16.3</u>	10	15.9	10	15.7
If flowing give rate (l/min / GPM):	15	16.0	15	15.7
	20	16.1	20	15.7
Recommended pump depth (m/ft): <u>80'</u>	25	16.2	25	15.6
Recommended pump rate (l/min / GPM): <u>10 gpm</u>	30	16.2	30	↓
Well production (l/min / GPM):	40	16.1	40	
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <u>165</u>	50	16.1	50	
	60	16.3	60	

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used  
 Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering  
 Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring  
 Boring  Digging  Irrigation  Cooling & Air Conditioning  
 Air percussion  Industrial  Other, specify \_\_\_\_\_  
 Other, specify \_\_\_\_\_

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
97/8"	Mud		0	59'6"	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
6 1/4"	Steel	.188	0	59'6"	
6 1/8"	Open Hole		59'6"	101'	

**Construction Record - Screen**

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

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Depth (m/ft)	Diameter (cm/in)
75'	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	From To	
93'	<input type="checkbox"/> Gas <input checked="" type="checkbox"/> Untested	0 59'6"	97/8"
	<input type="checkbox"/> Gas <input type="checkbox"/> Untested	59'6" 101'	6 1/8"

**Well Contractor and Well Technician Information**

Business Name of Well Contractor: 1425486 Ontario Ltd. of a Splash Well Drilling Well Contractor's Licence No.: 4877

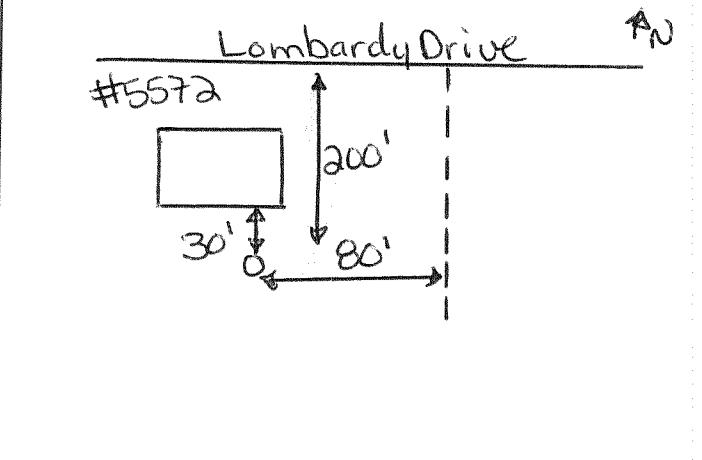
Business Address (Street Number/Name): PO BOX 1083 Municipality: Prescott

Province: ON Postal Code: K0E 1T0 Business E-mail Address: \_\_\_\_\_

Bus. Telephone No. (inc. area code): 613/925 4885 Name of Well Technician (Last Name, First Name): Ferguson, Todd

Well Technician's Licence No.: TA 78 Signature of Technician and/or Contractor: Todd Ferguson Date Submitted: 2014/05/30

**Map of Well Location**



Comments: 165 Chlorine after Drilling & Chlorine after Yield Test

Well owner's information package delivered:  Yes  No

Date Package Delivered: 2014/05/18 Date Work Completed: 2014/05/08

**Ministry Use Only**

Audit No.: Z 176050

Received: JUN 19 2014



Measurements recorded in:  Metric  Imperial

Tag#: A193395

Page of

Well Owner's Information

First Name, Last Name / Organization, E-mail Address, Mailing Address (Street Number/Name), Municipality, Province, Postal Code, Telephone No. (inc. area code)

Well Location

Address of Well Location (Street Number/Name), Township, Lot, Concession, County/District/Municipality, City/Town/Village, Province, Postal Code, UTM Coordinates, Zone, Easting, Northing, Municipal Plan and Sublot Number, Other

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

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From, To

Annular Space table with columns: Depth Set at (m/ft) From, To, Type of Sealant Used (Material and Type), Volume Placed (m³/ft³)

Method of Construction and Well Use checkboxes: Cable Tool, Rotary (Conventional/Reverse), Boring, Air percussion, Diamond, Jetting, Driving, Digging, Public, Commercial, Not used, Domestic, Municipal, Dewatering, Livestock, Test Hole, Monitoring, Irrigation, Cooling & Air Conditioning, Industrial, Other, specify

Construction Record - Casing table with columns: Inside Diameter (cm/in), Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel), Wall Thickness (cm/in), Depth (m/ft) From, To, Status of Well

Construction Record - Screen table with columns: Outside Diameter (cm/in), Material (Plastic, Galvanized, Steel), Slot No., Depth (m/ft) From, To

Water Details and Hole Diameter tables

Well Contractor and Well Technician Information: Business Name of Well Contractor, Well Contractor's Licence No., Business Address (Street Number/Name), Municipality, Province, Postal Code, Business E-mail Address, Bus. Telephone No. (inc. area code), Name of Well Technician (Last Name, First Name), Well Technician's Licence No., Signature of Technician and/or Contractor, Date Submitted

Results of Well Yield Testing table with columns: Draw Down (Time (min), Water Level (m/ft)), Recovery (Time (min), Water Level (m/ft)), Pump intake set at (m/ft), Pumping rate (l/min / GPM), Duration of pumping, Final water level end of pumping (m/ft), If flowing give rate (l/min / GPM), Recommended pump depth (m/ft), Recommended pump rate (l/min / GPM), Well production (l/min / GPM), Disinfected?

Map of Well Location: Please provide a map below following instructions on the back. Includes a hand-drawn map showing Lombardy Drive, well location #5566, and dimensions (80' x 80').



Measurements recorded in:  Metric  Imperial

Tag# A193411

Page \_\_\_\_\_ of \_\_\_\_\_

Well Owner's Information

First Name, Last Name / Organization, E-mail Address, Mailing Address (Street Number/Name), Municipality, Province, Postal Code, Telephone No. (inc. area code)

Well Location

Address of Well Location (Street Number/Name), Township, Lot, Concession, County/District/Municipality, City/Town/Village, Province, Postal Code, UTM Coordinates, Zone, Easting, Northing, Municipal Plan and Sublot Number

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

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From, To

Annular Space

Table with columns: Depth Set at (m/ft) From, To, Type of Sealant Used (Material and Type), Volume Placed (m³/ft³)

Results of Well Yield Testing

Table with columns: After test of well yield, water was, Draw Down (Time, Water Level), Recovery (Time, Water Level), Pumping rate, Duration of pumping, Final water level end of pumping, Recommended pump depth, Recommended pump rate, Well production, Disinfected?

Method of Construction

Well Use

Checkboxes for Method of Construction (Cable Tool, Rotary, Boring, etc.) and Well Use (Public, Commercial, Domestic, etc.)

Construction Record - Casing

Status of Well

Table with columns: Inside Diameter (cm/in), Open Hole OR Material, Wall Thickness (cm/in), Depth (m/ft) From, To, Status of Well (Water Supply, Replacement Well, etc.)

Construction Record - Screen

Table with columns: Outside Diameter (cm/in), Material, Slot No., Depth (m/ft) From, To

Water Details

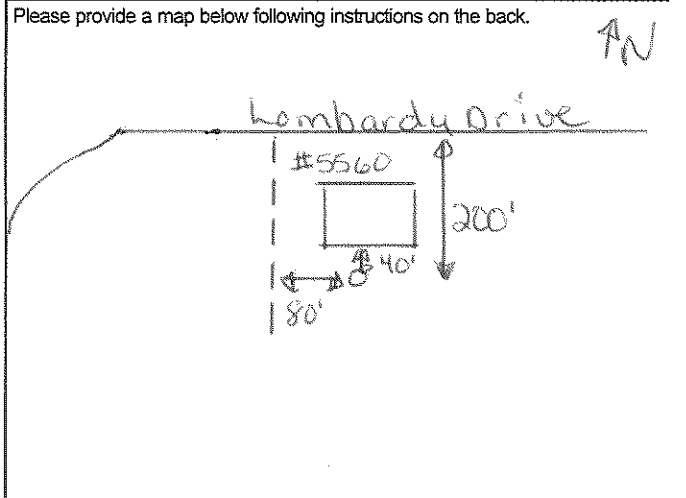
Hole Diameter

Table with columns: Water found at Depth (m/ft), Kind of Water (Fresh, Untested), Hole Diameter (Depth, Diameter)

Well Contractor and Well Technician Information

Business Name of Well Contractor, Well Contractor's Licence No., Business Address, Municipality, Province, Postal Code, Business E-mail Address, Bus. Telephone No., Name of Well Technician, Well Technician's Licence No., Signature of Technician and/or Contractor, Date Submitted

Map of Well Location



Comments: 145 Chlorine after Drilling, 4 Chlorine after Yield Test. Well owner's information package delivered, Date Package Delivered, Date Work Completed, Ministry Use Only (Audit No. 2243019, Received)



Measurements recorded in:  Metric  Imperial

Tag# A193412

Page \_\_\_\_\_ of \_\_\_\_\_

**Well Owner's Information**

 First Name: \_\_\_\_\_ Last Name / Organization: Beresite Construction E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

 Mailing Address (Street Number/Name): 2354 Summerside Drive Municipality: Manotick ON Province: ON Postal Code: K4M1B4 Telephone No. (inc. area code): 61337151711
**Well Location**

 Address of Well Location (Street Number/Name): 5554 Lombardy Drive Township: Osacode Lot: pt lot 31 Plan 4m-830 Concession: \_\_\_\_\_

 County/District/Municipality: Ottawa City/Town/Village: Osacode Province: Ontario Postal Code: K0A0W0

 UTM Coordinates: Zone 18 Easting 452066 Northing 4999583 Municipal Plan and Sublot Number: Part 5116 RP43-14828 Other: \_\_\_\_\_

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	Clay		Packed	0	8'
Brown	Sand		Packed	8'	15'
Grey	Sand	Gravel	Packed	15'	51'6"
Grey	Limestone		Hard	51'6"	121'

Annular Space		
Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
From	To	
51'6"	46'6" Cement Pressure Grouted	6.77
46'6"	0 Bentonite Pressure Grouted	13.54

Method of Construction		Well Use	
<input type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input type="checkbox"/> Commercial
<input checked="" type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input checked="" type="checkbox"/> Domestic	<input type="checkbox"/> Municipal
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input type="checkbox"/> Test Hole
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Cooling & Air Conditioning
<input checked="" type="checkbox"/> Air percussion		<input type="checkbox"/> Industrial	
<input type="checkbox"/> Other, specify _____		<input type="checkbox"/> Other, specify _____	

Construction Record - Casing			Status of Well	
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)	
			From	To
97/8"	Mud (Open Hole)		0	56'6"
6 1/4"	Steel	1.88	0	56'6"
6 1/8"	Open Hole		56'6"	121'

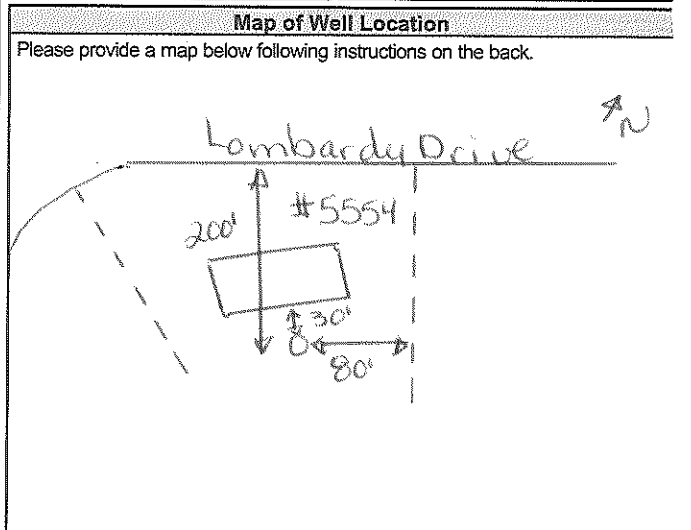
Construction Record - Screen				
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details		Hole Diameter	
Water found at Depth: <u>115' (m/ft)</u> <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Depth (m/ft) From: _____ To: _____	Diameter (cm/in): _____
Water found at Depth: _____ (m/ft) <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested	0 56'6"	97/8"
Water found at Depth: _____ (m/ft) <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested	56'6"	121' 6 1/8"

Well Contractor and Well Technician Information	
Business Name of Well Contractor: <u>14254860 Ontario Ltd</u>	Well Contractor's Licence No.: <u>4181717</u>
Business Address (Street Number/Name): <u>PO BOX 1083</u>	Municipality: <u>Prescott</u>
Province: <u>ON</u> Postal Code: <u>K0A0W0</u>	Business E-mail Address: _____

Bus. Telephone No. (inc. area code): <u>613912541825</u>	Name of Well Technician (Last Name, First Name): <u>Ferawson, Johnathon</u>
Well Technician's Licence No.: <u>2181519</u>	Signature of Technician and/or Contractor: _____ Date Submitted: <u>2016/11/30</u>

Results of Well Yield Testing					
After test of well yield, water was:		Draw Down		Recovery	
<input checked="" type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify _____		Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: _____		Static Level	<u>16.9</u>		<u>56.4</u>
Pump intake set at (m/ft): <u>110'</u>		1	<u>21.05</u>	1	<u>50.85</u>
Pumping rate (l/min / GPM): <u>7 gpm</u>		2	<u>23.15</u>	2	<u>45.7</u>
Duration of pumping: <u>1 hrs + 0 min</u>		3	<u>25.2</u>	3	<u>42.4</u>
Final water level end of pumping (m/ft): <u>56.4</u>		4	<u>27</u>	4	<u>39.3</u>
If flowing give rate (l/min / GPM): _____		5	<u>28.65</u>	5	<u>36</u>
		10	<u>35</u>	10	<u>23.4</u>
		15	<u>39.5</u>	15	<u>18.3</u>
		20	<u>43</u>	20	<u>17.6</u>
Recommended pump depth (m/ft): <u>110'</u>		25	<u>45.8</u>	25	<u>17.05</u>
Recommended pump rate (l/min / GPM): <u>7 gpm</u>		30	<u>47.5</u>	30	<u>17.025</u>
Well production (l/min / GPM): _____		40	<u>52.8</u>	40	<u>17</u>
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <u>140</u>		50	<u>54.85</u>	50	<u>17</u>
		60	<u>56.4</u>	60	<u>16.975</u>


 Comments: 140 Chlorine after Drilling & Chlorine after Yield Test

Well owner's information package delivered: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Date Package Delivered: <u>2016/11/30</u>	Ministry Use Only Audit No.: <u>2243020</u> Received: <u>DEC 1 6 2016</u>
Date Work Completed: <u>2016/11/30</u>		

31G/4h



GROUND WATER BRANCH  
15 No 7116  
MAY 21 1963  
ONTARIO WATER RESOURCES COMMISSION

UTM 118Z 452110E

5R 4999080N

Elev. 4R 10310

The Ontario Water Resources Commission Act

# WATER WELL RECORD

Basin 25 | |  
County or District Carleton Place

Township, Village, Town or City Osgoode

Con. I P.1 Lot 28

Date completed 2 Feb 63  
(day month year)

Owner Coady Constr Co  
(print in block letters)

Address 220 Ellendale Cres  
Ottawa

### Casing and Screen Record

Inside diameter of casing 5"  
Total length of casing 62'  
Type of screen  
Length of screen  
Depth to top of screen  
Diameter of finished hole 5"

### Pumping Test

Static level 31  
Test-pumping rate 8 G.P.M.  
Pumping level 60  
Duration of test pumping 1 hr  
Water clear or cloudy at end of test cloudy  
Recommended pumping rate 8 G.P.M.  
with pump setting of 75 feet below ground surface

### Well Log

#### Overburden and Bedrock Record

sand  
clay  
hardpan  
blue limestone

### Water Record

From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
0	20'	100	fresh
20	36'	120	fresh
36	59	131	"
59	133		

For what purpose(s) is the water to be used?

Post office

Is well on upland, in valley or on hillside? upland

Drilling or Boring Firm Capital Water Supply

Address 1243 Heron Rd

Licence Number 482 976

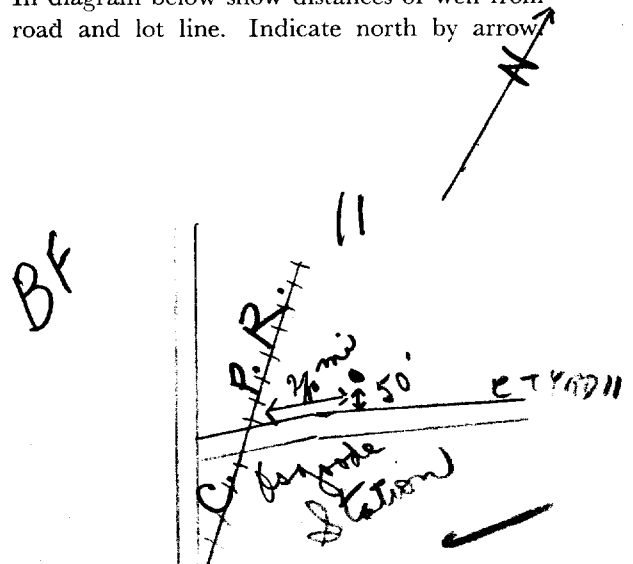
Name of Driller or Borer S Huff

Date 4 Feb 1963

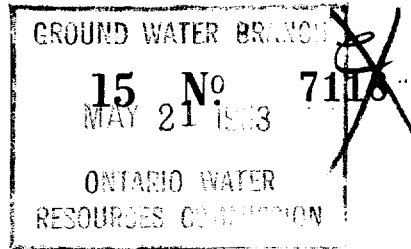
Walter Kavanagh  
(Signature of Licensed Drilling or Boring Contractor)

### Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



31G/4h



UTM 118<sup>Z</sup> 45<sup>Z</sup> 2119<sup>0</sup> 0<sup>E</sup>

Con 5<sup>R</sup> 4999<sup>0</sup> 8<sup>0</sup> 0<sup>N</sup>

The Ontario Water Resources Commission Act

Elev. 4<sup>R</sup> 1031<sup>0</sup>

# WATER WELL RECORD

Basin 25 | Carl  
County or District

Township, Village, Town or City Osgoode

Con. I P.d Lot 28

Date completed 2 Feb 63  
(day month year)

Owner Coady Constr Co  
(print in block letters)

Address 220 Ellendale Cres  
Ottawa

### Casing and Screen Record

Inside diameter of casing 5"  
Total length of casing 62'  
Type of screen  
Length of screen  
Depth to top of screen  
Diameter of finished hole 5"

### Pumping Test

Static level 31  
Test-pumping rate 8 G.P.M.  
Pumping level 60  
Duration of test pumping 1 hr  
Water clear or cloudy at end of test cloudy  
Recommended pumping rate 8 G.P.M.  
with pump setting of 75 feet below ground surface

### Well Log

Overburden and Bedrock Record

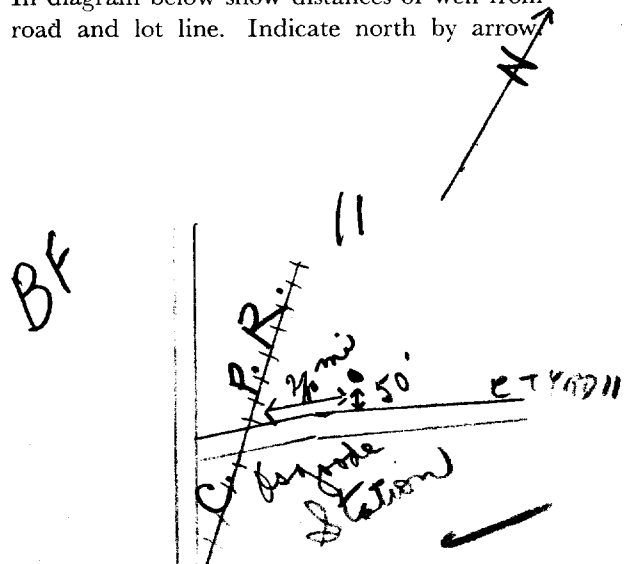
### Water Record

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
<u>sand</u>	<u>0</u>	<u>20'</u>	<u>100</u>	<u>fresh</u>
<u>clay</u>	<u>20</u>	<u>36'</u>	<u>120</u>	<u>fresh</u>
<u>hardpan</u>	<u>36</u>	<u>59</u>	<u>131</u>	<u>"</u>
<u>blue limestone</u>	<u>59</u>	<u>133</u>		

For what purpose(s) is the water to be used? Post office  
Is well on upland, in valley or on hillside? upland  
Drilling or Boring Firm Capital Water Supply  
Address 1243 Heron Rd  
Licence Number 482<sup>976</sup>  
Name of Driller or Borer S Huff  
Address  
Date 4 Feb 1963  
Walter Kavanagh  
(Signature of Licensed Drilling or Boring Contractor)

### Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Print only in spaces provided.  
Mark correct box with a checkmark, where applicable.

11

1533843

Municipality  
15009

Con.  
CON

OTTAWA-CARLETON

County or District: **CARLETON**  
 Township/Borough/City/Town/Village: **OSGOODE (Ottawa)**  
 Con block tract survey, etc.: **1 Plan 393**  
 Lot: **46 & 47**  
 Address: **5503 OSOODE Main St.**  
 Date completed: **9 day of 03**

21

U  
M 10 12 17 18 24 25 26 30 31 47

**LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)**

General colour	Most common material	Other materials	General description	Depth - feet	
				From	To
Brown Sand			Packed	0	14
Grey Clay			thick	14	30
Grey Clay & stones			HARD Pan	30	50
Grey Limestone			MED HARD	50	80
54' of 6 1/4" casing 1 DRIVE SHOE 1 WELL CAP 2 Bags of Bentonite Quick Grout					

31

32

**41 WATER RECORD**

Water found at - feet	Kind of water			
68	1 <input type="checkbox"/> Fresh	3 <input checked="" type="checkbox"/> Sulphur	4 <input checked="" type="checkbox"/> Minerals	14
15-18	2 <input type="checkbox"/> Salty	6 <input type="checkbox"/> Gas	19	
20-23	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	24
25-28	2 <input type="checkbox"/> Salty	6 <input type="checkbox"/> Gas	29	
30-33	1 <input type="checkbox"/> Fresh	3 <input type="checkbox"/> Sulphur	4 <input type="checkbox"/> Minerals	34
	2 <input type="checkbox"/> Salty	6 <input type="checkbox"/> Gas	60	

**51 CASING & OPEN HOLE RECORD**

Inside diam inches	Material	Wall thickness inches	Depth - feet	
			From	To
6 1/4	1 <input checked="" type="checkbox"/> Steel	.188	0	53
6"	2 <input type="checkbox"/> Galvanized		53	80
17-18	3 <input type="checkbox"/> Concrete			20-23
	4 <input checked="" type="checkbox"/> Open hole			
	5 <input type="checkbox"/> Plastic			
24-25	1 <input type="checkbox"/> Steel			27-30
	2 <input type="checkbox"/> Galvanized			
	3 <input type="checkbox"/> Concrete			
	4 <input type="checkbox"/> Open hole			
	5 <input type="checkbox"/> Plastic			

**SCREEN**

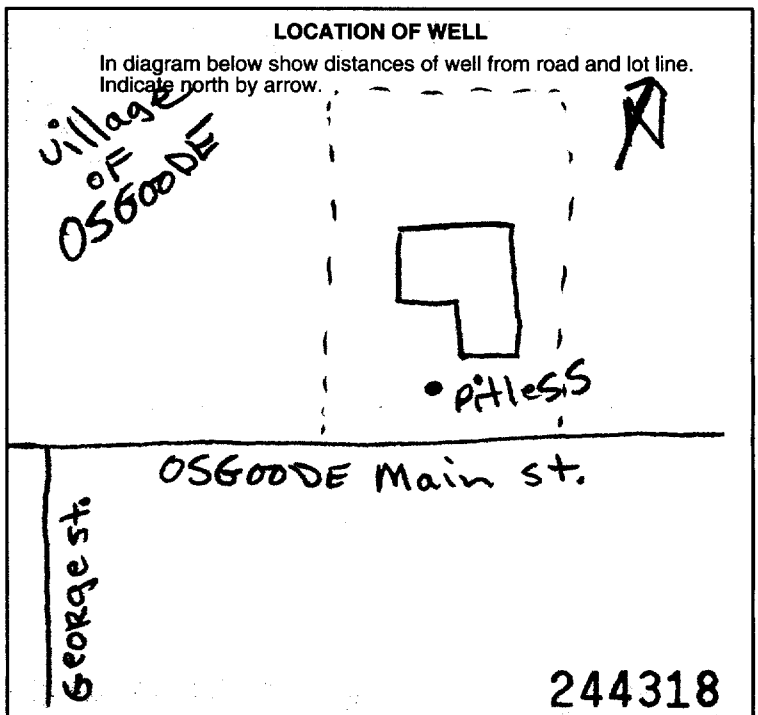
Sizes of opening (Slot No.)	Diameter inches	Length feet
Material and type		Depth at top of screen feet

**61 PLUGGING & SEALING RECORD**

Depth set at - feet		Material and type (Cement grout, bentonite, etc.)
From	To	
0	53	Bentonite Quick Grout
18-21	22-25	
26-29	30-33	

**71 PUMPING TEST**

Pumping test method	Pumping rate	Duration of pumping
1 <input type="checkbox"/> Pump 2 <input checked="" type="checkbox"/> Bailer	12 GPM	1 Hours
Static level	Water level end of pumping	Water levels during
26 feet	60 feet	15 minutes 40 feet
		30 minutes 60 feet
		45 minutes 60 feet
		60 minutes 60 feet
If flowing give rate	Pump intake set at	Water at end of test
	70 feet	X Clear
Recommended pump type	Recommended pump setting	Recommended pump rate
X Deep		10 GPM



**FINAL STATUS OF WELL**

1  Water supply  
 2  Observation well  
 3  Test hole  
 4  Recharge well

5  Abandoned, insufficient supply  
 6  Abandoned, poor quality  
 7  Abandoned (Other)  
 8  Dewatering

9  Unfinished  
 10  Replacement well

**WATER USE**

1  Domestic  
 2  Stock  
 3  Irrigation  
 4  Industrial

5  Commercial  
 6  Municipal  
 7  Public supply  
 8  Cooling & air conditioning

9  Not use  
 10  Other

**METHOD OF CONSTRUCTION**

1  Cable tool  
 2  Rotary (conventional)  
 3  Rotary (reverse)  
 4  Rotary (air)

5  Air percussion  
 6  Boring  
 7  Diamond  
 8  Jetting

9  Driving  
 10  Digging  
 11  Other

Name of Well Contractor: **B. MOORE WELL DRILLING 6455**  
 Well Contractor's Licence No.: **6455**  
 Address: **Box 436 OSOODE ON. K0A 2W0**  
 Name of Well Technician: **BOB MOORE**  
 Well Technician's Licence No.: **7-0319**  
 Signature of Technician/Contractor: **BOB MOORE**  
 Submission date: **9 day 01 yr 03**

**MINISTRY USE ONLY**

Data source: **6455**  
 Contractor: **6455**  
 Date received: **JUN 10 2003**  
 Date of inspection: \_\_\_\_\_  
 Inspector: \_\_\_\_\_  
 Remarks: \_\_\_\_\_

**CSS.ES3**

Measurements recorded in:  Metric  Imperial

**Well Owner's Information**

5502 Osgoode Main  
County/District/Municipality: Osgoode  
City/Town/Village: Osgoode  
23  
Province: Ontario Postal Code: K0A 2W0  
Ottawa  
UTM Coordinates Zone Easting Northing: NAD 83 18 452037 499 1220  
Municipal Plan and Sublot Number: Other

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
Brown	Sand		Hard	0	2.5
Yellow	Coarse Sand		Soft	2.5	9.7
Grey	clay		Soft	9.7	13.5
Grey	gravel		packed	13.5	14.9
Grey	limestone		layered	14.9	24.3

**Annular Space**

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
0 6	ciment grout	4 Bag

**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): 19

Pumping rate (l/min / GPM): 56

Duration of pumping: 1 hrs + min

Final water level end of pumping (m/ft): 8.51

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

Time (min)	Draw Down		Recovery	
	Water Level (m/ft)	Time (min)	Water Level (m/ft)	Time (min)
Static Level	7.80		8.51	
1	8.00	1	8.08	
2	8.07	2	7.94	
3	8.19	3	7.83	
4	8.25	4	7.81	
5	8.30	5	7.80	
10	8.41	10	7	
15	8.47	15		
20	8.47	20		
25	8.47	25		
30	8.48	30		
40	8.48	40		
50	8.50	50		
60	8.51	60		

Recommended pump depth (m/ft): 19

Recommended pump rate (l/min / GPM): 56

Well production (l/min / GPM): 80

Disinfected?  Yes  No

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used  
 Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering  
 Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring  
 Boring  Digging  Irrigation  Cooling & Air Conditioning  
 Air percussion  Industrial  Other, specify

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
1555	Steel	.48	4.60	14.9	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify
1555	Open Hole		14.9	24.3	

**Construction Record - Screen**

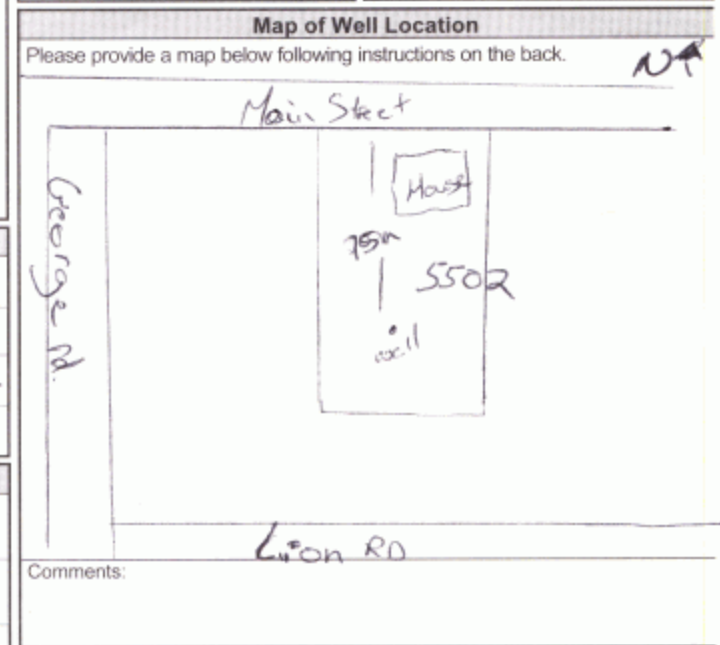
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input checked="" type="checkbox"/> Fresh <input type="checkbox"/> Untested	Depth (m/ft)	Diameter (cm/in)
20	<input type="checkbox"/> Gas <input type="checkbox"/> Other, specify	0 6	21.23
		6 24.3	15.55

**Well Contractor and Well Technician Information**

Business Name of Well Contractor: Bourgeois well Drilling  
 Well Contractor's Licence No.:  
 Business Address (Street Number/Name): 1178 Route 900 East  
 Municipality: NATION  
 Province: Ontario Postal Code: K0A 3C0 Business E-mail Address: NA  
 Bus. Telephone No. (inc. area code): 613 987 5291 Name of Well Technician (Last Name, First Name): Michael Genier  
 Well Technician's Licence No.: 3493 Signature of Technician and/or Contractor: [Signature] Date Submitted: 2009 02 20



Well owner's information package delivered:  Yes  No

Date Package Delivered: Y|Y|Y|Y|M|M|D|D: 2009 02 17

Date Work Completed: 2009 02 17

**Ministry Use Only**

Audit No. Z 90541  
 Received: [Stamp] MAY 11 2009



ATTACHMENT C

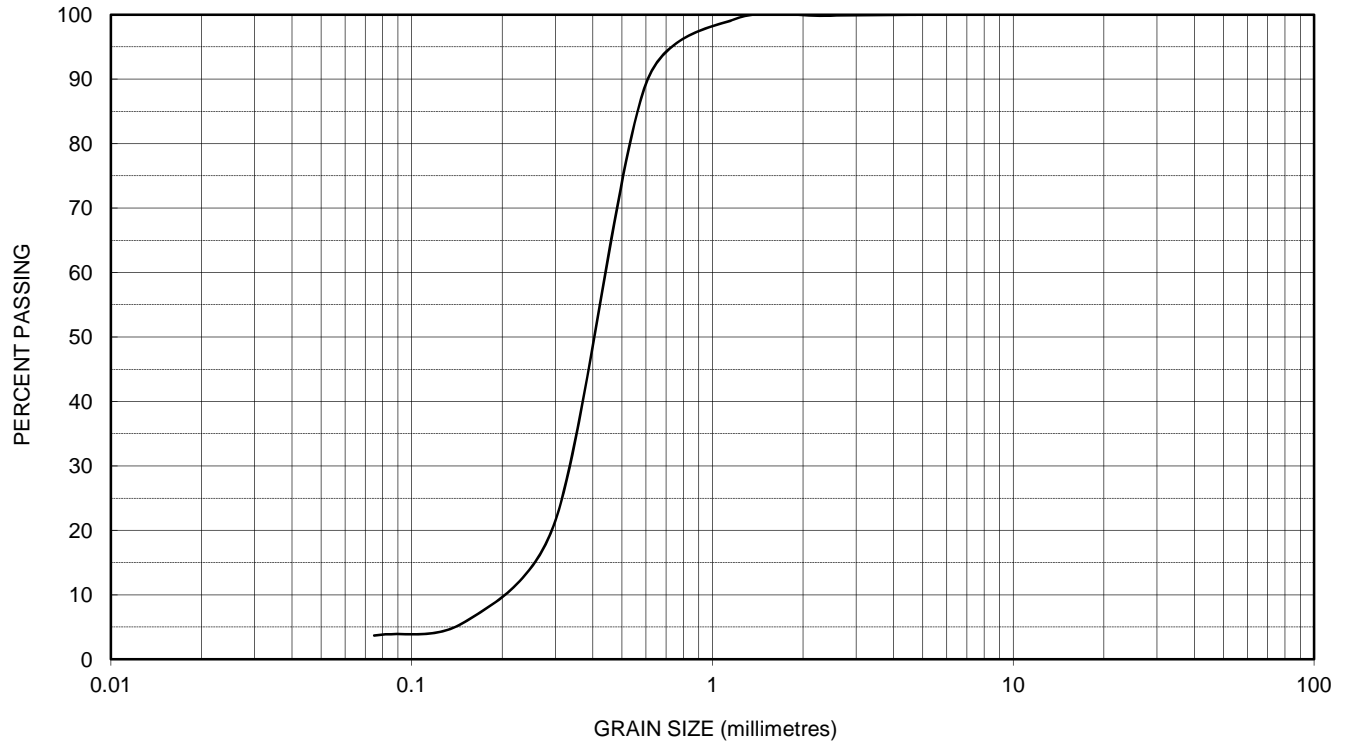
GRAIN SIZE ANALYSES OF REPRESENTATIVE SOIL SAMPLES

# Grain Size Distribution Analysis



Kollaard Associates  
Engineers

## SAND



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13.2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING								100.0	99.8	99.3	89.2	21.4	5.8	3.7

CLIENT: Crestview Innovations Inc.	
PROJECT: 3200 Reids Lane, Ossgoode	OUR REF.: 210064
TYPE OF MATERIAL: Sand	INTENDED USE: Residential
DATE SAMPLED: February 3, 2021	DATE TESTED: February 11, 2021
SOURCE: BH1 - 0.76-1.37	SAMPLE NO: SS2
REMARKS:	



Kollaard Associates  
Engineers

Box 189, 210 Prescott Street  
Kemptville, Ontario K0G 1J0  
(613) 860-0923, FAX: (613) 258-0475

*Dean Tataryn*

Issued by:

Dean Tataryn, B.E.S., EP

Date:

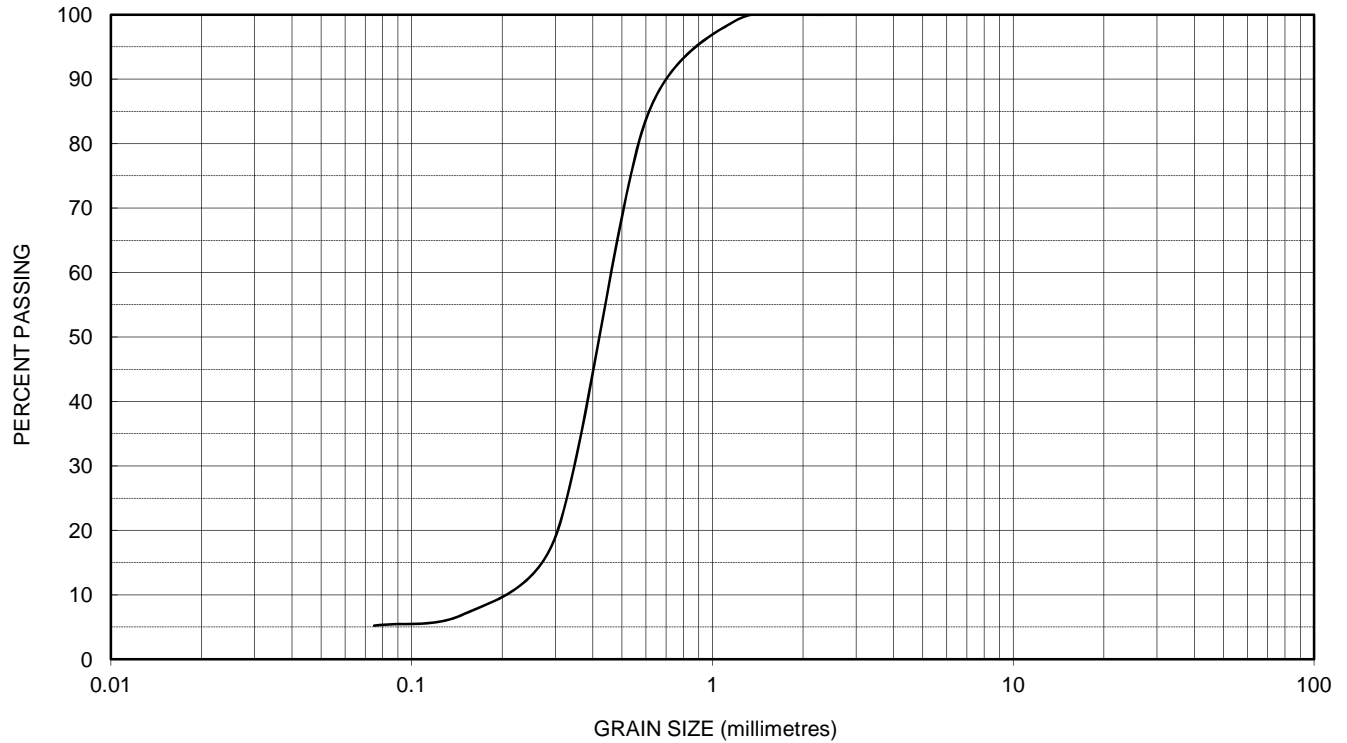
February 12, 2021

# Grain Size Distribution Analysis



Kollaard Associates  
Engineers

## SAND



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13.2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING									100.0	99.0	83.7	19.0	7.1	5.2

CLIENT: Crestview Innovations Inc.	
PROJECT: 3200 Reids Lane, Ossgoode	OUR REF.: 210064
TYPE OF MATERIAL: Sand	INTENDED USE: Residential
DATE SAMPLED: February 3, 2021	DATE TESTED: February 11, 2021
SOURCE: BH3 - 0.76 - 1.37	SAMPLE NO: SS2
REMARKS:	



Kollaard Associates  
Engineers

Box 189, 210 Prescott Street  
Kemptville, Ontario K0G 1J0  
(613) 860-0923, FAX: (613) 258-0475

Issued by:

Date:

*Dean Tartaryn*

Dean Tartaryn, B.E.S. EP  
February 12, 2021

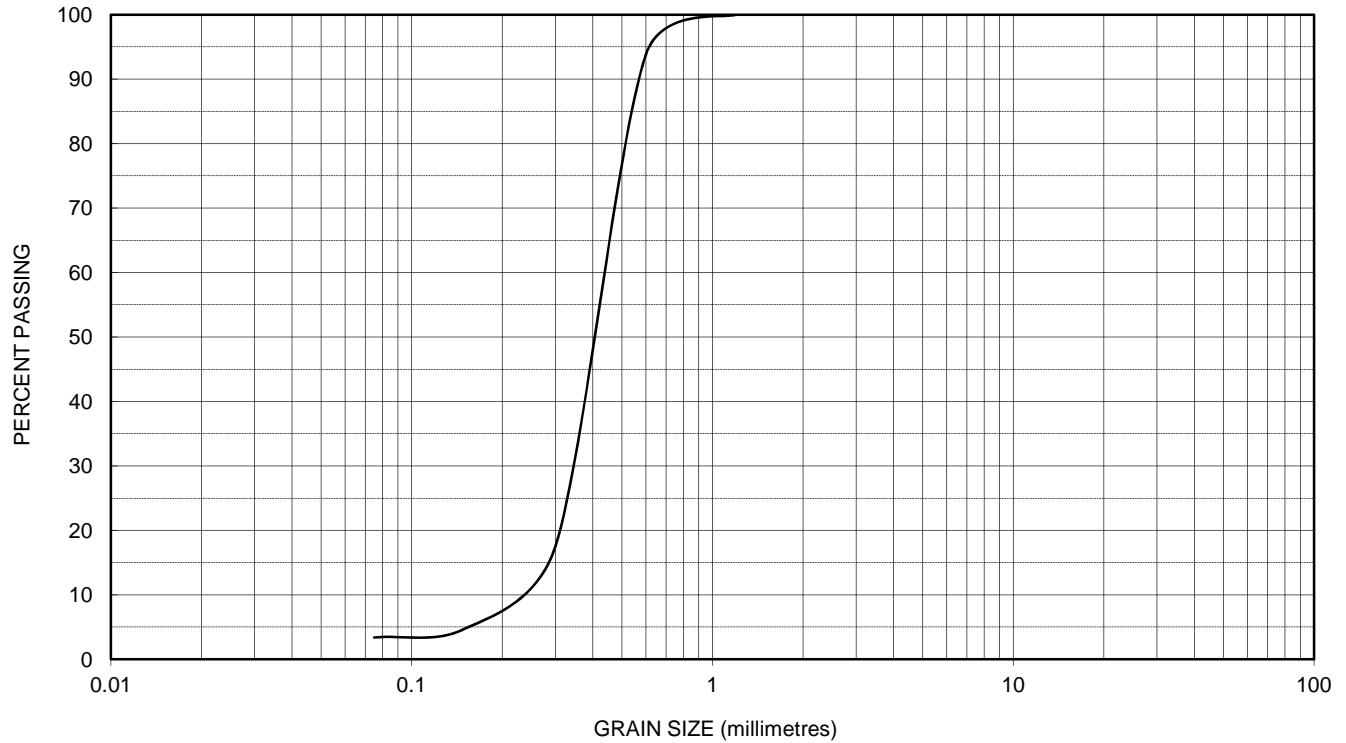


# Grain Size Distribution Analysis



Kollaard Associates  
Engineers

## SAND



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13.2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING									100.0	99.9	93.8	17.5	4.7	3.4

CLIENT: Crestview Innovations Inc.	
PROJECT: 3200 Reids Lane, Ossgoode	OUR REF.: 210064
TYPE OF MATERIAL: Sand	INTENDED USE: Residential
DATE SAMPLED: February 3, 2021	DATE TESTED: February 11, 2021
SOURCE: BH5 - 0.76 - 1.37	SAMPLE NO: SS2
REMARKS:	



Kollaard Associates  
Engineers

Box 189, 210 Prescott Street  
Kemptville, Ontario K0G 1J0  
(613) 860-0923, FAX: (613) 258-0475

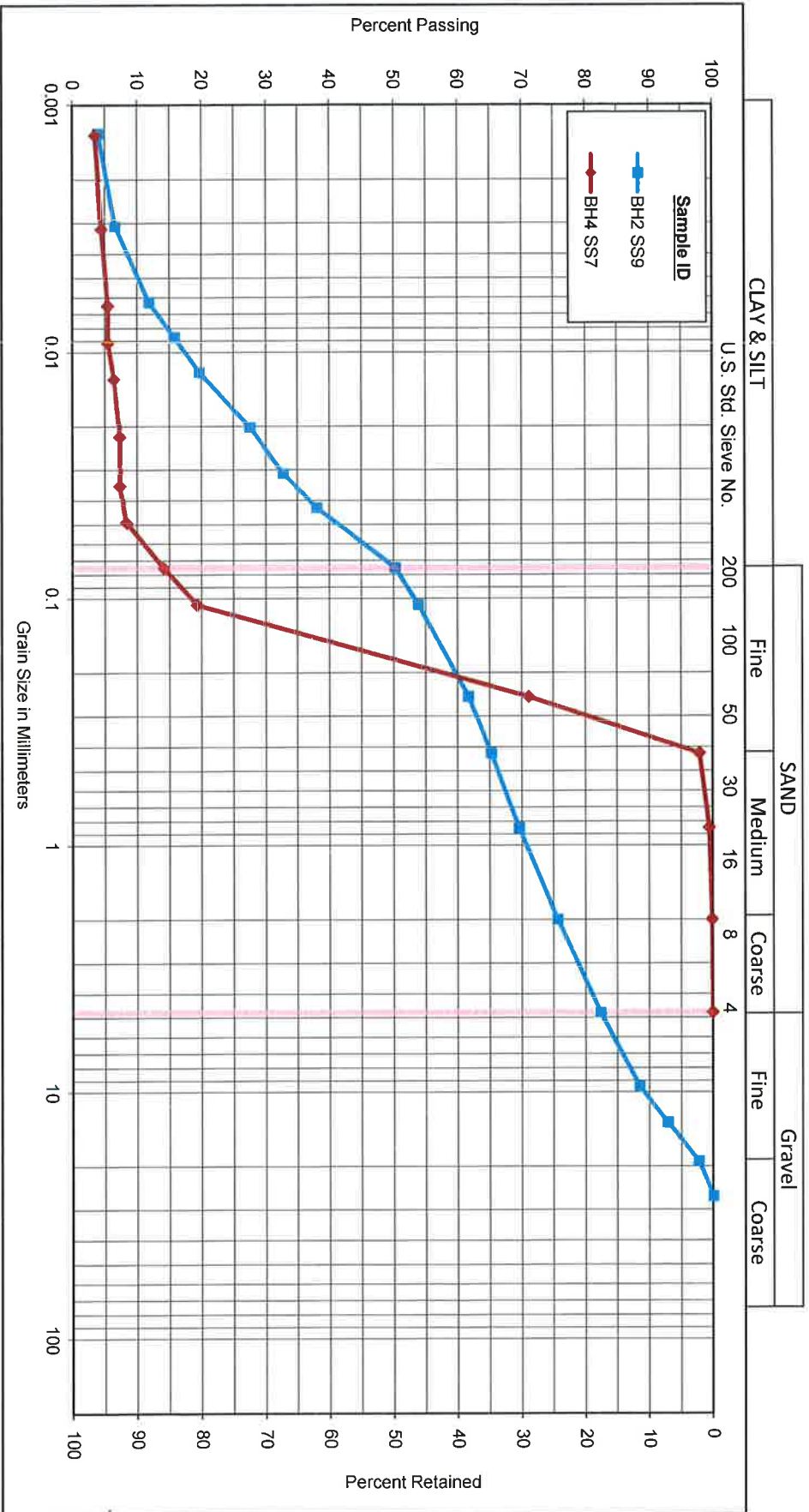
Issued by:

Date:

*Dean Tataryn*

Dean Tataryn, B.E.S. EP  
February 12, 2021

# Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH2 SS9	7.62-8.22 m	17.7	32.1	45.2	5.0
BH4 SS7	4.52-5.18 m	0.0	85.9	10.1	4.0

## GRAIN SIZE DISTRIBUTION

Figure No.



Kollaard Associates Inc. File # 210064  
3200 Reid Lane, Osgoode

Project No. 122410003

### PROJECT DETAILS

Client:	Kollaard Associates Inc. File # 210064	Project No.:	122410003
Project:	3200 Reid Lane, Osgoode	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates Inc.
Source:	BH2	Date Sampled:	February 4, 2021
Sample No.:	SS9	Tested By:	Denis Rodriguez
Sample Depth:	7.62-8.22 m	Date Tested:	February 15, 2021

### SOIL INFORMATION

Liquid Limit (LL)	
Plasticity Index (PI)	
Soil Classification	
Specific Gravity (G <sub>s</sub> )	2.750
Sq. Correction Factor (α)	0.978
Mass of Dispersing Agent/Litre	40
	g

### CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W <sub>d</sub> ), (g)	101.04
Air Dried Mass (W <sub>a</sub> ), (g)	101.21
Hygroscopic Corr. Factor (F=W <sub>a</sub> /W <sub>d</sub> )	0.9983
Air Dried Mass in Analysis (M <sub>a</sub> ), (g)	56.58
Oven Dried Mass in Analysis (M <sub>d</sub> ), (g)	56.48
Percent Passing 2.0 mm Sieve (P <sub>20</sub> ), (%)	75.62
Sample Represented (W <sub>v</sub> ), (g)	74.69

### HYDROMETER DETAILS

Volume of Bulb (V <sub>b</sub> ), (cm <sup>3</sup> )	63.0
Length of Bulb (L <sub>2</sub> ), (cm)	14.47
Length from '0' Reading to Top of Bulb (L <sub>1</sub> ), (cm)	10.29
Scale Dimension (h <sub>s</sub> ), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm <sup>2</sup> )	27.25
Meniscus Correction (H <sub>m</sub> ), (g/L)	1.0

START TIME 9:33 AM

### HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H <sub>s</sub> Divisions g/L	H <sub>e</sub> Divisions g/L	Temperature T <sub>e</sub> °C	Corrected Reading R = H <sub>s</sub> - H <sub>e</sub> g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
15-Feb-21	9:34 AM	1	36.0	7.0	21.0	29.0	37.99	10.63404	9.84835	0.013126	0.04280
15-Feb-21	9:35 AM	2	32.0	7.0	21.0	25.0	32.75	11.25404	9.84835	0.013126	0.03114
15-Feb-21	9:38 AM	5	28.0	7.0	21.0	21.0	27.51	11.87404	9.84835	0.013126	0.02023
15-Feb-21	9:48 AM	15	22.0	7.0	21.0	15.0	19.65	12.80404	9.84835	0.013126	0.01213
15-Feb-21	10:03 AM	30	19.0	7.0	21.0	12.0	15.72	13.26904	9.84835	0.013126	0.00873
15-Feb-21	10:33 AM	60	16.0	7.0	21.0	9.0	11.79	13.73404	9.84835	0.013126	0.00628
15-Feb-21	1:43 PM	250	12.0	7.0	22.0	5.0	6.5492	14.35404	9.61570	0.012970	0.00311
16-Feb-21	9:33 AM	1440	10.0	7.0	22.0	3.0	3.9295	14.86404	9.61570	0.012970	0.00131

Reviewed By: *Brian Proulx*  
Date: *February 23, 2021*

Remarks:

### WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	56.48
Sample Weight after Hydrometer and Wash (g)	20.26
Percent Passing No. 200 Sieve (%)	64.1
Percent Passing Corrected (%)	48.50

### PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	1062.00
Sample Weight After Sieve (g)	1059.20
Percent Loss in Sieve (%)	0.26

### SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5	0.0	100.0
19.0	25.1	97.6
13.2	76.8	92.8
9.5	122.9	88.4
4.75	187.6	82.3
2.00	258.9	75.6
Total (C + F) <sup>1</sup>	1059.20	
0.850	4.50	69.60
0.425	7.77	65.22
0.250	10.43	61.66
0.106	16.24	53.88
0.075	18.98	50.21
PAN	20.26	

Note 1: (C + F) = Coarse + Fine

### PROJECT DETAILS

Client:	Kollaard Associates Inc. File # 210064	Project No.:	122410003
Project:	3200 Reid Lane, Osgoode	Test Method:	LST702
Material Type:	Soil	Sampled By:	Kollaard Associates Inc.
Source:	BH4	Date Sampled:	February 3, 2021
Sample No.:	SS7	Tested By:	Denis Rodriguez
Sample Depth	4.52-5.18 m	Date Tested:	February 15, 2021

### SOIL INFORMATION

Liquid Limit (LL)	
Plasticity Index (PI)	
Soil Classification	
Specific Gravity (G <sub>s</sub> )	2.750
Sg. Correction Factor (α)	0.978
Mass of Dispersing Agent/Litre	24 g

### HYDROMETER DETAILS

Volume of Bulb (V <sub>b</sub> ), (cm <sup>3</sup> )	63.0
Length of Bulb (L <sub>2</sub> ), (cm)	14.47
Length from '0' Reading to Top of Bulb (L <sub>1</sub> ), (cm)	10.29
Scale Dimension (h <sub>s</sub> ), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm <sup>2</sup> )	27.25
Meniscus Correction (H <sub>m</sub> ), (g/L)	1.0

START TIME 9:40 AM

### CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W <sub>d</sub> ), (g)	80.13
Air Dried Mass (W <sub>a</sub> ), (g)	80.22
Hygroscopic Corr. Factor (F=W <sub>a</sub> /W <sub>d</sub> )	0.9989
Air Dried Mass in Analysis (M <sub>a</sub> ), (g)	99.30
Oven Dried Mass in Analysis (M <sub>d</sub> ), (g)	99.19
Percent Passing 2.0 mm Sieve (P <sub>2.0</sub> ), (%)	99.89
Sample Represented (W <sub>v</sub> ), (g)	99.30

### HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H <sub>s</sub> Divisions g/L	H <sub>c</sub> Divisions g/L	Temperature T <sub>c</sub> °C	Corrected Reading R = H <sub>s</sub> - H <sub>c</sub> g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
15-Feb-21	9:41 AM	1	12.0	3.5	22.0	8.5	8.37	14.35404	9.61570	0.012970	0.04914
15-Feb-21	9:42 AM	2	11.0	3.5	22.0	7.5	7.39	14.50904	9.61570	0.012970	0.03493
15-Feb-21	9:45 AM	5	11.0	3.5	22.0	7.5	7.39	14.50904	9.61570	0.012970	0.02209
15-Feb-21	9:55 AM	15	10.0	3.5	21.5	6.5	6.40	14.66404	9.73081	0.013047	0.01290
15-Feb-21	10:10 AM	30	9.0	3.5	21.5	5.5	5.42	14.81904	9.73081	0.013047	0.00917
15-Feb-21	10:40 AM	60	9.0	3.5	21.5	5.5	5.42	14.81904	9.73081	0.013047	0.00648
15-Feb-21	1:50 PM	250	8.0	3.5	22	4.5	4.43	14.97404	9.61570	0.012970	0.00317
16-Feb-21	9:40 AM	1440	7.0	3.5	22	3.5	3.45	15.12904	9.61570	0.012970	0.00133

Reviewed By: *Brian Pezard*

Date: *February 23/2021*

Remarks:

### WASH TEST DATA

Oven Dry Mass In Hydrometer Analysis (g)	99.19
Sample Weight after Hydrometer and Wash (g)	87.02
Percent Passing No. 200 Sieve (%)	12.3
Percent Passing Corrected (%)	12.25

### PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	623.50
Sample Weight After Sieve (g)	623.40
Percent Loss in Sieve (%)	0.02

### SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75	0.0	100.0
2.00	0.7	99.9
<b>Total (C + F)<sup>1</sup></b>	<b>623.40</b>	
0.850	0.44	99.44
0.425	1.99	97.88
0.250	28.60	71.09
0.106	80.00	19.32
0.075	85.18	14.11
PAN	86.94	

Note 1: (C + F) = Coarse + Fine



ATTACHMENT D

RESULTS OF LABORATORY NITROGEN TESTING OF RECEIVING AQUIFER SAMPLES



## Environment Testing

## Certificate of Analysis

Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#: Kollaard Associates Inc.  
Invoice to: Kollaard Associates Inc.

Report Number: 1947810  
Date Submitted: 2021-02-12  
Date Reported: 2021-02-18  
Project: 210064  
COC #: 211512

Page 1 of 3

### Dear Colleen Vermeersch:

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Addrine Thomas  
2021.02.18  
14:41:20 -05'00'

APPROVAL:

Addrine Thomas, Inorganics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: <http://www.cala.ca/scopes/2602.pdf>.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.



# Environment Testing

## Certificate of Analysis

Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1947810  
 Date Submitted: 2021-02-12  
 Date Reported: 2021-02-18  
 Project: 210064  
 COC #: 211512

Group	Analyte	MRL	Units	Guideline	1542143 GW 2021-02-12 MW2	1542144 GW 2021-02-12 MW4	1542145 GW 2021-02-12 MW6
Nutrients	N-NH3	0.010	mg/L		<0.010	<0.010	0.031
	Total Kjeldahl Nitrogen	0.100	mg/L		0.393	0.331	0.245
	N-NO2	0.10	mg/L		0.17	<0.10	<0.10
Others	N-NO3	0.10	mg/L		5.80	<0.10	<0.10

### Guideline = \* = 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



# Environment Testing

## Certificate of Analysis

Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1947810  
 Date Submitted: 2021-02-12  
 Date Reported: 2021-02-18  
 Project: 210064  
 COC #: 211512

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 396258 <b>Method</b> C-SM4500-NO3-F	<b>Analysis/Extraction Date</b> 2021-02-16	<b>Analyst</b> SKH	
N-NO2	<0.10 mg/L	96	
N-NO3	<0.10 mg/L	103	
<b>Run No</b> 396301 <b>Method</b> EPA 350.1	<b>Analysis/Extraction Date</b> 2021-02-17	<b>Analyst</b> SKH	
N-NH3	<0.010 mg/L	100	80-120
<b>Run No</b> 396312 <b>Method</b> EPA 351.2	<b>Analysis/Extraction Date</b> 2021-02-17	<b>Analyst</b> SKH	
Total Kjeldahl Nitrogen	<0.100 mg/L	112	70-130

#### Guideline = \* = Guideline Exceedence

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ATTACHMENT E

SEPTIC EFFLUENT DILUTION CALCULATIONS

SEPTIC EFFLUENT DILUTION CALCULATIONS

Number of Lots	7
Gross Site Area	35438 m <sup>2</sup>
Env. Can. Water Surplus (NPI)	372 mm

Hard Surface Area (Post-Development)

Roadway (220 metres x 7 metres)	2054
Driveways (varied lengths x 5 metres width x #lots)	750
Dwellings (200 m <sup>2</sup> x #lots)	<u>1400</u>
Total	4204 m <sup>2</sup>

Net Infiltration Area = Gross Site Area - Hard Surface Area (Post-Development)  
31234 m<sup>2</sup>

Infiltration Reduction Factor:

Topography (rolling)	0.20
Soil (open sandy loam)	0.40
<u>Cover (cultivated/orchard)</u>	<u>0.10</u>
Total IRF	0.70

Septic Dilution For 7 Septic Systems:

$$\frac{\text{Number of Lots} \times 365 \text{ m}^3 \text{ Effluent Per Year} \times 40 \text{ mg/L NO}_3}{\text{Number of Lots} \times 365 \text{ m}^3 \text{ Effluent Per Year} + (\text{Net Infiltration Area} \times 0.372 \text{ NPI} \times \text{IRF})} = 9.6 \text{ mg/L NO}_3\text{-N}$$



ATTACHMENT F

RESULTS OF LABORATORY TESTING OF TEST WELL WATER SAMPLES

Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
Date Submitted: 2021-05-13  
Date Reported: 2021-05-20  
Project: 210064  
COC #: 873626


Page 1 of 7

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**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

  
Addrine  
Thomas  
2021.05.20  
16:03:15 -04'00'

APPROVAL: \_\_\_\_\_

Addrine Thomas, Inorganics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

Group	Analyte	MRL	Units	Guideline	1556912 Water 2021-05-12 TW#1-3 hr	1556913 Water 2021-05-12 TW#1-6 hr
Anions	Cl	1	mg/L	AO 250	178	180
	F	0.10	mg/L	MAC 1.5	0.83	0.85
	N-NO2	0.10	mg/L	MAC 1.0	<0.50	<0.50
	N-NO3	0.10	mg/L	MAC 10.0	<0.50	<0.50
	SO4	1	mg/L	AO 500	44	44
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	143	142
	Colour	2	TCU		<2	<2
	Conductivity	5	uS/cm		951	945
	DOC	0.5	mg/L	AO 5	1.8	2.0
	pH	1.00		6.5-8.5	8.19	8.20
	S2-	0.01	mg/L	AO 0.05	1.10*	1.10*
	TDS (COND - CALC)	1	mg/L	AO 500	618*	614*
	Turbidity	0.1	NTU	AO 5.0	2.2	1.1
Hardness	Hardness as CaCO3	1	mg/L	OG 100	229*	229*
Indices/Calc	Ion Balance	0.01			1.03	1.03
Metals	Al	0.01	mg/L	OG 0.1	<0.01	<0.01
	As	0.001	mg/L	IMAC 0.01	<0.001	<0.001
	B	0.01	mg/L	IMAC 5.0	0.53	0.54
	Ba	0.01	mg/L	MAC 1.0	0.08	0.07
	Ca	1	mg/L		44	44
	Cd	0.0001	mg/L	MAC 0.005	<0.0001	<0.0001
	Co	0.0002	mg/L		<0.0002	<0.0002
	Cr	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Cu	0.001	mg/L	AO 1.0	<0.001	<0.001
	Fe	0.03	mg/L	AO 0.3	0.16	0.11

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.

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

Group	Analyte	MRL	Units	Guideline	1556912 Water 2021-05-12 TW#1-3 hr	1556913 Water 2021-05-12 TW#1-6 hr
Metals	Hg	0.0001	mg/L	MAC 0.001	<0.0001	<0.0001
	K	1	mg/L		11	11
	Mg	1	mg/L		29	29
	Mn	0.01	mg/L	AO 0.05	0.01	0.01
	Na	2	mg/L	AO 200	98	98
	Pb	0.001	mg/L	MAC 0.010	<0.001	<0.001
	Sb	0.0005	mg/L	IMAC 0.006	<0.0005	<0.0005
	Se	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Sr	0.001	mg/L		3.92	3.87
	U	0.001	mg/L	MAC 0.02	<0.001	<0.001
	V	0.001	mg/L		<0.001	<0.001
	Zn	0.01	mg/L	AO 5.0	<0.01	<0.01
Nutrients	N-NH3	0.010	mg/L		0.307	0.303
	Total Kjeldahl Nitrogen	0.100	mg/L		0.391	0.504
Subcontract	Phenols	0.001	mg/L		<0.0010	<0.0010
	Tannin & Lignin	0.1	mg/L		0.1	0.1

Guideline = ODWSOG

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400541 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> K B <b>Method</b> C SM2130B			
Turbidity	0.6 NTU	101	70-130
<b>Run No</b> 400603 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SKH <b>Method</b> C SM2120C			
Colour	<2 TCU	102	90-110
<b>Run No</b> 400654 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SKH <b>Method</b> EPA 200.8			
Aluminum	<0.01 mg/L	106	80-120
Arsenic	<0.001 mg/L	100	80-120
Boron (total)	<0.01 mg/L	106	80-120
Barium	<0.01 mg/L	95	80-120
Cadmium	<0.0001 mg/L	100	80-120
Cobalt	<0.0002 mg/L	104	80-120
Chromium Total	<0.001 mg/L	105	80-120
Copper	<0.001 mg/L	105	80-120
Iron	<0.03 mg/L	99	80-120
Mercury	<0.0001 mg/L	90	80-120

Guideline = ODWSOG

\* = Guideline Exceedence

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 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: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Manganese	<0.01 mg/L	100	80-120
Lead	<0.001 mg/L	106	80-120
Antimony	<0.0005 mg/L	96	80-120
Selenium	<0.001 mg/L	94	80-120
Strontium	<0.001 mg/L	94	80-120
Uranium	<0.001 mg/L	107	80-120
Vanadium	<0.001 mg/L	104	80-120
Zinc	<0.01 mg/L	104	80-120
<b>Run No</b> 400665 <b>Analysis/Extraction Date</b> 2021-05-15 <b>Analyst</b> SWS			
<b>Method</b> SM2320,2510,4500H/F			
F	<0.10 mg/L	100	90-110
pH		100	90-110
<b>Run No</b> 400666 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SWS			
<b>Method</b> SM 5310B			
DOC	<0.5 mg/L	89	80-120
<b>Run No</b> 400717 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SKH			
<b>Method</b> EPA 350.1			
N-NH3	<0.010 mg/L	99	80-120

**Guideline = ODWSOG**

**\* = Guideline Exceedence**

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 Methods references and/or additional QA/QC information available on request.

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400719 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SKH			
<b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	102	70-130
<b>Run No</b> 400737 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> Z S			
<b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	100	90-110
Potassium	<1 mg/L	102	87-113
Magnesium	<1 mg/L	98	76-124
Sodium	<2 mg/L	105	82-118
<b>Run No</b> 400792 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SWS			
<b>Method</b> SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	97	90-110
Conductivity	<5 uS/cm	97	90-110
<b>Run No</b> 400797 <b>Analysis/Extraction Date</b> 2021-05-19 <b>Analyst</b> AET			
<b>Method</b> SM 4110			
Chloride	<5 mg/L		90-110
N-NO2	<0.50 mg/L	98	90-110
N-NO3	<0.50 mg/L	105	90-110
SO4	<5 mg/L	100	90-110

**Guideline = ODWSOG**

**\* = Guideline Exceedence**

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 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: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953233  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873626

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400811 <b>Analysis/Extraction Date</b> 2021-05-19 <b>Analyst</b> AET <b>Method</b> C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
<b>Run No</b> 400865 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Phenols	<0.0010 mg/L	98	
Tannin & Lignin	<0.10 mg/L	103	
<b>Run No</b> 400982 <b>Analysis/Extraction Date</b> 2021-05-20 <b>Analyst</b> AET <b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	104	80-120

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Certificate of Analysis

Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953218  
Date Submitted: 2021-05-13  
Date Reported: 2021-05-16  
Project: 210064  
COC #: 873626

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Dragana  
Dzeletovic  
2021.05.16  
08:33:26 -04'00'

APPROVAL: \_\_\_\_\_  
Dragana Dzeletovic-Andric, Microbiology Team Lead

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**Certificate of Analysis**

Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953218  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-16  
 Project: 210064  
 COC #: 873626

Group	Analyte	MRL	Units	Guideline	Lab I.D.	Sample Matrix	Sample Type	Sampling Date	Sample I.D.		
					1556873	Water		2021-05-12	TW#1-3 hr	1556874	Water
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0							
	Faecal Coliforms	0	ct/100mL								
	Heterotrophic Plate Count	0	ct/1mL								
	Total Coliforms	0	ct/100mL	MAC 0							

Guideline = ODWSOG

\* = Guideline Exceedence

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Analytical Method: AMBCOLM1

additional QA/QC information available on request.

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Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1952974  
Date Submitted: 2021-05-11  
Date Reported: 2021-05-19  
Project: 210064  
COC #: 873496


Page 1 of 7

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**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

APPROVAL:  Addrine  
Thomas  
2021.05.19  
16:06:04  
~~04:00~~  
Addrine Thomas, Inorganics Supervisor

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 Invoice to: Kollaard Associates Inc.

Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

Group	Analyte	MRL	Units	Guideline	1556262 Water 2021-05-10 TW2-3 hrs	1556263 Water 2021-05-10 TW2-6 hrs
Anions	Cl	1	mg/L	AO 250	155	165
	F	0.10	mg/L	MAC 1.5	0.94	0.89
	N-NO2	0.10	mg/L	MAC 1.0	<0.10	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10	<0.10
	SO4	1	mg/L	AO 500	47	41
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	139	140
	Colour	2	TCU		<2	<2
	Conductivity	5	uS/cm		829	879
	DOC	0.5	mg/L	AO 5	1.8	2.1
	pH	1.00		6.5-8.5	8.05	8.01
	S2-	0.01	mg/L	AO 0.05	0.27*	0.24*
	TDS (COND - CALC)	1	mg/L	AO 500	539*	571*
	Turbidity	0.1	NTU	AO 5.0	5.7*	1.2
Hardness	Hardness as CaCO3	1	mg/L	OG 100	211*	233*
Indices/Calc	Ion Balance	0.01			0.97	1.01
Metals	Al	0.01	mg/L	OG 0.1	<0.01	<0.01
	As	0.001	mg/L	IMAC 0.01	<0.001	<0.001
	B	0.01	mg/L	IMAC 5.0	0.57	0.58
	Ba	0.01	mg/L	MAC 1.0	0.26	0.20
	Ca	1	mg/L		40	44
	Cd	0.0001	mg/L	MAC 0.005	<0.0001	<0.0001
	Co	0.0002	mg/L		<0.0002	<0.0002
	Cr	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Cu	0.001	mg/L	AO 1.0	<0.001	<0.001
	Fe	0.03	mg/L	AO 0.3	0.46*	0.14

Guideline = ODWSOG

\* = Guideline Exceedence

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Client: Kollaard Associates Inc.  
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Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

Group	Analyte	MRL	Units	Guideline	1556262 Water 2021-05-10 TW2-3 hrs	1556263 Water 2021-05-10 TW2-6 hrs
Metals	Hg	0.0001	mg/L	MAC 0.001	<0.0001	<0.0001
	K	1	mg/L		11	11
	Mg	1	mg/L		27	30
	Mn	0.01	mg/L	AO 0.05	0.02	0.01
	Na	2	mg/L	AO 200	78	80
	Pb	0.001	mg/L	MAC 0.010	<0.001	<0.001
	Sb	0.0005	mg/L	IMAC 0.006	<0.0005	<0.0005
	Se	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Sr	0.001	mg/L		3.28	3.64
	U	0.001	mg/L	MAC 0.02	<0.001	<0.001
	V	0.001	mg/L		<0.001	<0.001
	Zn	0.01	mg/L	AO 5.0	<0.01	<0.01
Nutrients	N-NH3	0.010	mg/L		0.290	0.307
	Total Kjeldahl Nitrogen	0.100	mg/L		0.272	0.323
Subcontract	Phenols	0.001	mg/L		<0.0010	<0.0010
	Tannin & Lignin	0.1	mg/L		0.1	0.2

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Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400409 <b>Analysis/Extraction Date</b> 2021-05-12 <b>Analyst</b> K B <b>Method</b> C SM2130B			
Turbidity	<0.1 NTU	101	70-130
<b>Run No</b> 400492 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> K B <b>Method</b> C SM2120C			
Colour	<2 TCU	87	90-110
<b>Run No</b> 400510 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> SKH <b>Method</b> EPA 200.8			
Aluminum	<0.01 mg/L	100	80-120
Arsenic	<0.001 mg/L	102	80-120
Boron (total)	<0.01 mg/L	108	80-120
Barium	<0.01 mg/L	89	80-120
Cadmium	<0.0001 mg/L	97	80-120
Cobalt	<0.0002 mg/L	114	80-120
Chromium Total	<0.001 mg/L	109	80-120
Copper	<0.001 mg/L	116	80-120
Iron	<0.03 mg/L	103	80-120
Mercury	<0.0001 mg/L	96	80-120

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 K0G 1J0  
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 Invoice to: Kollaard Associates Inc.

Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Manganese	<0.01 mg/L	99	80-120
Lead	<0.001 mg/L	111	80-120
Antimony	<0.0005 mg/L	90	80-120
Selenium	<0.001 mg/L	87	80-120
Strontium	<0.001 mg/L	86	80-120
Uranium	<0.001 mg/L	110	80-120
Vanadium	<0.001 mg/L	108	80-120
Zinc	<0.01 mg/L	108	80-120
<b>Run No 400520 Analysis/Extraction Date 2021-05-12 Analyst SWS</b>			
<b>Method SM 5310B</b>			
DOC	<0.5 mg/L	92	80-120
<b>Run No 400525 Analysis/Extraction Date 2021-05-14 Analyst AET</b>			
<b>Method SM 4110</b>			
N-NO2	<0.10 mg/L	101	90-110
N-NO3	<0.10 mg/L	105	90-110
SO4	<1 mg/L	100	90-110
<b>Run No 400564 Analysis/Extraction Date 2021-05-13 Analyst SKH</b>			
<b>Method EPA 350.1</b>			
N-NH3	<0.010 mg/L	106	80-120

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 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
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 Invoice to: Kollaard Associates Inc.

Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400568 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> SKH			
<b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	95	70-130
<b>Run No</b> 400570 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> SWS			
<b>Method</b> SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	98	90-110
Conductivity	<5 uS/cm	100	90-110
F	<0.10 mg/L	101	90-110
pH		100	90-110
<b>Run No</b> 400624 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> Z S			
<b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	99	90-110
Potassium	<1 mg/L	102	87-113
Magnesium	<1 mg/L	98	76-124
Sodium	<2 mg/L	102	82-118
<b>Run No</b> 400722 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> AET			
<b>Method</b> SM 4110			
Chloride	<5 mg/L		90-110

**Guideline = ODWSOG**

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1952974  
 Date Submitted: 2021-05-11  
 Date Reported: 2021-05-19  
 Project: 210064  
 COC #: 873496

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400734 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> AET <b>Method</b> C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
<b>Run No</b> 400761 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> AET <b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	92	80-120
<b>Run No</b> 400865 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Phenols	<0.0010 mg/L	103	
Tannin & Lignin	<0.10 mg/L	100	

**Guideline = ODWSOG**

**\* = Guideline Exceedence**

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Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1952957  
Date Submitted: 2021-05-11  
Date Reported: 2021-05-13  
Project: 210064  
COC #: 873496

Page 1 of 2

---

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Steven

Tosh

2021.05.13

11:33:30

-04'00'



APPROVAL:

---

Steven Tosh, Operations Manager

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Certificate of Analysis

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210 Prescott St., Box 189
Kemptville, ON
K0G 1J0
Attention: Ms. Colleen Vermeersch
PO#:
Invoice to: Kollaard Associates Inc.

Report Number: 1952957
Date Submitted: 2021-05-11
Date Reported: 2021-05-13
Project: 210064
COC #: 873496

Table with 7 columns: Group, Analyte, MRL, Units, Guideline, Lab I.D., Sample Matrix, Sample Type, Sampling Date, Sample I.D. Rows include Microbiology, Escherichia Coli, Faecal Coliforms, Heterotrophic Plate Count, Total Coliforms.

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.

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210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1952723  
Date Submitted: 2021-05-06  
Date Reported: 2021-05-13  
Project: 210064  
COC #: 873355

Page 1 of 8

---

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:



Addrine Thomas  
2021.05.13  
15:56:08 -04'00'

APPROVAL:

---

Addrine Thomas, Inorganics Supervisor

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 Invoice to: Kollaard Associates Inc.

Report Number: 1952723  
 Date Submitted: 2021-05-06  
 Date Reported: 2021-05-13  
 Project: 210064  
 COC #: 873355

Group	Analyte	MRL	Units	Guideline	1555611 Water 2021-05-05 TW#3-3 hr	1555612 Water 2021-05-05 TW#3-6 hr
Anions	Cl	1	mg/L	AO 250	167	173
	F	0.10	mg/L	MAC 1.5	0.17	0.16
	N-NO2	0.10	mg/L	MAC 1.0	<0.10	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10	<0.10
	SO4	1	mg/L	AO 500	49	50
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	154	157
	Colour	2	TCU		<2	2
	Conductivity	5	uS/cm		879	916
	DOC	0.5	mg/L	AO 5	1.9	1.9
	pH	1.00		6.5-8.5	8.01	8.08
	S2-	0.01	mg/L	AO 0.05	<0.01	<0.01
	TDS (COND - CALC)	1	mg/L	AO 500	571*	595*
	Turbidity	0.1	NTU	AO 5.0	3.2	1.5
Hardness	Hardness as CaCO3	1	mg/L	OG 100	298*	310*
Indices/Calc	Ion Balance	0.01			1.00	1.02
Metals	Al	0.01	mg/L	OG 0.1	<0.01	<0.01
	As	0.001	mg/L	IMAC 0.01	<0.001	<0.001
	B	0.01	mg/L	IMAC 5.0	0.06	0.06
	Ba	0.01	mg/L	MAC 1.0	0.32	0.33
	Ca	1	mg/L		65	68
	Cd	0.0001	mg/L	MAC 0.005	<0.0001	<0.0001
	Co	0.0002	mg/L		<0.0002	<0.0002
	Cr	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Cu	0.001	mg/L	AO 1.0	<0.001	<0.001
	Fe	0.03	mg/L	AO 0.3	0.54*	0.21

Guideline = ODWSOG

\* = Guideline Exceedence

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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: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1952723  
 Date Submitted: 2021-05-06  
 Date Reported: 2021-05-13  
 Project: 210064  
 COC #: 873355

Group	Analyte	MRL	Units	Guideline	1555611 Water 2021-05-05 TW#3-3 hr	1555612 Water 2021-05-05 TW#3-6 hr
Metals	Hg	0.0001	mg/L	MAC 0.001	<0.0001	<0.0001
	K	1	mg/L		4	4
	Mg	1	mg/L		33	34
	Mn	0.01	mg/L	AO 0.05	0.01	0.01
	Na	2	mg/L	AO 200	64	67
	Pb	0.001	mg/L	MAC 0.010	<0.001	<0.001
	Sb	0.0005	mg/L	IMAC 0.006	<0.0005	<0.0005
	Se	0.001	mg/L	MAC 0.05	<0.001	<0.001
	Sr	0.001	mg/L		0.662	0.677
	U	0.001	mg/L	MAC 0.02	<0.001	<0.001
	V	0.001	mg/L		<0.001	<0.001
	Zn	0.01	mg/L	AO 5.0	<0.01	<0.01
Nutrients	N-NH3	0.010	mg/L		0.171	0.168
	Total Kjeldahl Nitrogen	0.100	mg/L		0.184	0.337
Subcontract	Phenols	0.001	mg/L		<0.0010	<0.0010
	Tannin & Lignin	0.1	mg/L		0.7	0.6

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**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400186 <b>Analysis/Extraction Date</b> 2021-05-07 <b>Analyst</b> K B <b>Method</b> C SM2130B			
Turbidity	<0.1 NTU	101	70-130
<b>Run No</b> 400216 <b>Analysis/Extraction Date</b> 2021-05-07 <b>Analyst</b> AET <b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	82	80-120
<b>Run No</b> 400254 <b>Analysis/Extraction Date</b> 2021-05-07 <b>Analyst</b> SKH <b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	101	70-130
<b>Run No</b> 400261 <b>Analysis/Extraction Date</b> 2021-05-07 <b>Analyst</b> SWS <b>Method</b> SM 5310B			
DOC	<0.5 mg/L	89	80-120
<b>Run No</b> 400292 <b>Analysis/Extraction Date</b> 2021-05-10 <b>Analyst</b> Z S <b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	105	90-110
Potassium	<1 mg/L	106	87-113
Magnesium	<1 mg/L	103	76-124
Sodium	<2 mg/L	106	82-118

**Guideline = ODWSOG**

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 COC #: 873355

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400294 <b>Analysis/Extraction Date</b> 2021-05-10 <b>Analyst</b> SKH			
<b>Method</b> EPA 200.8			
Aluminum	<0.01 mg/L	100	80-120
Arsenic	<0.001 mg/L	97	80-120
Boron (total)	<0.01 mg/L	103	80-120
Cobalt	<0.0002 mg/L	100	80-120
Chromium Total	<0.001 mg/L	99	80-120
Copper	<0.001 mg/L	100	80-120
Iron	<0.03 mg/L	96	80-120
Manganese	<0.01 mg/L	98	80-120
Selenium	<0.001 mg/L	92	80-120
Vanadium	<0.001 mg/L	100	80-120
Zinc	<0.01 mg/L	99	80-120
<b>Run No</b> 400341 <b>Analysis/Extraction Date</b> 2021-05-10 <b>Analyst</b> SKH			
<b>Method</b> EPA 350.1			
N-NH3	<0.010 mg/L	108	80-120
<b>Run No</b> 400382 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> K B			
<b>Method</b> C SM2120C			
Colour	<2 TCU	82	90-110

**Guideline = ODWSOG**

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 COC #: 873355

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400384 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SKH <b>Method</b> EPA 200.8			
Barium	<0.01 mg/L	94	80-120
Cadmium	<0.0001 mg/L	99	80-120
Mercury	<0.0001 mg/L	91	80-120
Lead	<0.001 mg/L	105	80-120
Antimony	<0.0005 mg/L	100	80-120
Strontium	<0.001 mg/L	93	80-120
Uranium	<0.001 mg/L	105	80-120
<b>Run No</b> 400405 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SKH <b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	130	70-130
<b>Run No</b> 400415 <b>Analysis/Extraction Date</b> 2021-05-12 <b>Analyst</b> AET <b>Method</b> SM 4110			
N-NO2	<0.10 mg/L	99	90-110
N-NO3	<0.10 mg/L	101	90-110
SO4	<1 mg/L	95	90-110
<b>Run No</b> 400418 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SWS <b>Method</b> C SM4500-FC			

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Report Number: 1952723  
 Date Submitted: 2021-05-06  
 Date Reported: 2021-05-13  
 Project: 210064  
 COC #: 873355

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
F	<0.10 mg/L	94	90-110
<b>Run No</b> 400423 <b>Analysis/Extraction Date</b> 2021-05-10 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Phenols	<0.0010 mg/L	101	
Tannin & Lignin	<0.10 mg/L	100	
<b>Run No</b> 400441 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SWS <b>Method</b> C SM2510B			
Conductivity	<5 uS/cm	99	95-105
<b>Run No</b> 400442 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SWS <b>Method</b> SM2320,2510,4500H/F			
pH	5.85	100	90-110
<b>Run No</b> 400451 <b>Analysis/Extraction Date</b> 2021-05-11 <b>Analyst</b> SWS <b>Method</b> SM 2320B			
Alkalinity (CaCO <sub>3</sub> )	<5 mg/L	100	95-105
<b>Run No</b> 400525 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> AET <b>Method</b> SM 4110			
Chloride	<1 mg/L	100	90-110
<b>Run No</b> 400544 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> AET <b>Method</b> C SM2340B			

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
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 K0G 1J0  
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Report Number: 1952723  
 Date Submitted: 2021-05-06  
 Date Reported: 2021-05-13  
 Project: 210064  
 COC #: 873355

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			

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Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1952724  
Date Submitted: 2021-05-06  
Date Reported: 2021-05-09  
Project: 210064  
COC #: 873355

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

*Dragana Dzeletovic*  
Dragana  
Dzeletovic  
2021.05.09  
10:54:46 -04'00'

APPROVAL: \_\_\_\_\_  
Dragana Dzeletovic-Andric, Microbiology Team Lead

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: <http://www.cala.ca/scopes/2602.pdf>.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.



Certificate of Analysis

Client: Kollaard Associates Inc.
210 Prescott St., Box 189
Kemptville, ON
K0G 1J0
Attention: Ms. Colleen Vermeersch
PO#:
Invoice to: Kollaard Associates Inc.

Report Number: 1952724
Date Submitted: 2021-05-06
Date Reported: 2021-05-09
Project: 210064
COC #: 873355

Table with 7 columns: Group, Analyte, MRL, Units, Guideline, Lab I.D., Sample Matrix, Sample Type, Sampling Date, Sample I.D. Rows include Microbiology tests like Escherichia Coli, Faecal Coliforms, Heterotrophic Plate Count, and Total Coliforms.

Guideline = ODWSOG

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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



ATTACHMENT G

RESULTS OF LABORATORY TESTING OF EXISTING NEIGHBOURING WELL WATER  
SAMPLES



Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953824  
Date Submitted: 2021-05-21  
Date Reported: 2021-06-01  
Project: 210064  
COC #: 106009


Page 1 of 6

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**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

  
Addrine  
Thomas  
2021.06.01  
16:17:46 -04'00'

APPROVAL: \_\_\_\_\_

Addrine Thomas, Inorganics Supervisor

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 Date Reported: 2021-06-01  
 Project: 210064  
 COC #: 106009

Group	Analyte	MRL	Units	Guideline	Result
					Lab I.D. 1558614 Sample Matrix Water Sample Type Sampling Date 2021-05-21 Sample I.D. 5529 Osgoode Main
Anions	Cl	1	mg/L	AO 250	163
	F	0.10	mg/L	MAC 1.5	1.19
	SO4	1	mg/L	AO 500	23
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 30-500	132
	Colour (True)	2	TCU		2
	Conductivity	5	uS/cm		862
	DOC	0.5	mg/L	AO 5	1.8
	pH	1.00		6.5-8.5	8.21
	S2-	0.01	mg/L	AO 0.05	1.22*
	TDS (COND - CALC)	1	mg/L		560
	Turbidity	0.1	NTU	AO 5	2.4
Hardness	Hardness as CaCO3	1	mg/L	OG 80-100	161*
Indices/Calc	Ion Balance	0.01			0.88
Metals	Ca	1	mg/L		30
	Fe	0.03	mg/L	AO 0.3	0.20
	K	1	mg/L		9
	Mg	1	mg/L		21
	Mn	0.01	mg/L	AO 0.05	0.01
	Na	2	mg/L	AO 200	78
Nutrients	N-NH3	0.010	mg/L		0.387
	Total Kjeldahl Nitrogen	0.100	mg/L		0.503
Others	N-NO2	0.10	mg/L	MAC 1.0	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10
Subcontract	Phenols	0.001	mg/L		<0.0010
	Tannin & Lignin	0.1	mg/L		<0.10

Guideline = ODWSOG

\* = Guideline Exceedence

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 COC #: 106009

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 401175 <b>Analysis/Extraction Date</b> 2021-05-25 <b>Analyst</b> SWS			
<b>Method</b> C SM2130B			
Turbidity	<0.1 NTU	100	70-130
<b>Run No</b> 401245 <b>Analysis/Extraction Date</b> 2021-05-26 <b>Analyst</b> SWS			
<b>Method</b> SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	103	90-110
Conductivity	<5 uS/cm	99	90-110
F	<0.10 mg/L	100	90-110
pH		99	90-110
<b>Run No</b> 401327 <b>Analysis/Extraction Date</b> 2021-05-27 <b>Analyst</b> AET			
<b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	98	80-120
<b>Run No</b> 401387 <b>Analysis/Extraction Date</b> 2021-05-27 <b>Analyst</b> SKH			
<b>Method</b> C SM4500-NO3-F			
N-NO2	<0.10 mg/L	94	
N-NO3	<0.10 mg/L	101	
<b>Run No</b> 401397 <b>Analysis/Extraction Date</b> 2021-05-28 <b>Analyst</b> SKH			
<b>Method</b> EPA 200.8			
Iron	<0.03 mg/L	105	80-120

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 Date Reported: 2021-06-01  
 Project: 210064  
 COC #: 106009

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Manganese	<0.01 mg/L	112	80-120
<b>Run No</b> 401398 <b>Analysis/Extraction Date</b> 2021-05-27 <b>Analyst</b> SKH <b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	90	70-130
<b>Run No</b> 401411 <b>Analysis/Extraction Date</b> 2021-05-28 <b>Analyst</b> SWS <b>Method</b> C SM2120C			
Colour (True)	<2 TCU	98	90-110
<b>Run No</b> 401449 <b>Analysis/Extraction Date</b> 2021-05-28 <b>Analyst</b> Z S <b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	104	90-110
Potassium	<1 mg/L	107	87-113
Magnesium	<1 mg/L	105	76-124
Sodium	<2 mg/L	109	82-118
<b>Run No</b> 401482 <b>Analysis/Extraction Date</b> 2021-05-31 <b>Analyst</b> SWS <b>Method</b> SM 5310B			
DOC	<0.5 mg/L	108	80-120
<b>Run No</b> 401484 <b>Analysis/Extraction Date</b> 2021-05-31 <b>Analyst</b> AET <b>Method</b> SM 4110			
SO4	2 mg/L	115	90-110

Guideline = ODWSOG

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 COC #: 106009

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 401528 <b>Analysis/Extraction Date</b> 2021-05-31 <b>Analyst</b> SKH <b>Method</b> EPA 350.1			
N-NH3	<0.010 mg/L	108	80-120
<b>Run No</b> 401582 <b>Analysis/Extraction Date</b> 2021-05-28 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Phenols	<0.0010 mg/L	102	
Tannin & Lignin	<0.10 mg/L	106	
<b>Run No</b> 401632 <b>Analysis/Extraction Date</b> 2021-06-01 <b>Analyst</b> AX <b>Method</b> SM 4110			
Chloride	<5 mg/L		90-110
<b>Run No</b> 401654 <b>Analysis/Extraction Date</b> 2021-06-01 <b>Analyst</b> AET <b>Method</b> C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			

Guideline = ODWSOG

\* = Guideline Exceedence

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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: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953824  
Date Submitted: 2021-05-21  
Date Reported: 2021-06-01  
Project: 210064  
COC #: 106009

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***Sample Comment Summary***

Sample ID: 1558614 5529 Osgoode Main Turbidity ran past holding timeThe Ion Balance is outside Eurofins acceptable tolerance levels. All results have been confirmed.

**Guideline = ODWSOG**

**\* = Guideline Exceedence**

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Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953822  
Date Submitted: 2021-05-21  
Date Reported: 2021-05-23  
Project: 210064  
COC #: 106009

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Dragana  
Dzeletovic

*Dragana Dzeletovic* 2021.05.23

10:47:43

APPROVAL: \_\_\_\_\_ -04'00'

Dragana Dzeletovic-Andric, Microbiology Team Lead

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Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: <http://www.cala.ca/scopes/2602.pdf>.

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953822  
 Date Submitted: 2021-05-21  
 Date Reported: 2021-05-23  
 Project: 210064  
 COC #: 106009

Lab I.D.	1558612
Sample Matrix	Water
Sample Type	
Sampling Date	2021-05-21
Sample I.D.	5529 Osgoode Main

Group	Analyte	MRL	Units	Guideline	
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0	0
	Faecal Coliforms	0	ct/100mL		0
	Heterotrophic Plate Count	0	ct/1mL		10
	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



Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953235  
Date Submitted: 2021-05-13  
Date Reported: 2021-05-20  
Project: 210064  
COC #: 873627

Page 1 of 5

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**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:



Addrine  
Thomas  
2021.05.20  
16:02:46 -04'00'

APPROVAL:

---

Addrine Thomas, Inorganics Supervisor

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:   
 Invoice to: Kollaard Associates Inc.

Report Number: 1953235  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873627

Group	Analyte	MRL	Units	Guideline	1556917 Water 2021-05-12 5560 Lombardy	1556918 Water 2021-05-12 5566 Lombardy	1556919 Water 2021-05-12 5560 Lombardy - treated
Anions	Cl	1	mg/L	AO 250	222	187	
	F	0.10	mg/L	MAC 1.5	1.48	0.69	
	N-NO2	0.10	mg/L	MAC 1.0	<0.50	<0.50	
	N-NO3	0.10	mg/L	MAC 10.0	<0.50	<0.50	
	SO4	1	mg/L	AO 500	46	60	
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	172	178	
	Colour	2	TCU		<2	<2	
	Conductivity	5	uS/cm		1160	1050	
	DOC	0.5	mg/L	AO 5	1.2	1.5	
	pH	1.00		6.5-8.5	8.35	8.17	
	S2-	0.01	mg/L	AO 0.05	8.30*	0.30*	<0.01
	TDS (COND - CALC)	1	mg/L	AO 500	754*	682*	
Hardness	Turbidity	0.1	NTU	AO 5.0	28.3*	1.8	
	Hardness as CaCO3	1	mg/L	OG 100	170*	234*	
Indices/Calc	Ion Balance	0.01			1.03	1.03	
Metals	Ca	1	mg/L		35	46	
	Fe	0.03	mg/L	AO 0.3	0.11	0.07	
	K	1	mg/L		9	10	
	Mg	1	mg/L		20	29	
	Mn	0.01	mg/L	AO 0.05	<0.01	0.01	
	Na	2	mg/L	AO 200	171	126	
Nutrients	N-NH3	0.010	mg/L		0.381	0.320	
	Total Kjeldahl Nitrogen	0.100	mg/L		0.698	0.505	
Subcontract	Phenols	0.001	mg/L		<0.0010	<0.0010	
	Tannin & Lignin	0.1	mg/L		0.2	0.4	

Guideline = ODWSOG

\* = Guideline Exceedence

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953235  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873627

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400541 <b>Analysis/Extraction Date</b> 2021-05-13 <b>Analyst</b> K B <b>Method</b> C SM2130B			
Turbidity	0.6 NTU	101	70-130
<b>Run No</b> 400603 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SKH <b>Method</b> C SM2120C			
Colour	<2 TCU	102	90-110
<b>Run No</b> 400654 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SKH <b>Method</b> EPA 200.8			
Iron	<0.03 mg/L	99	80-120
Manganese	<0.01 mg/L	100	80-120
<b>Run No</b> 400666 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> SWS <b>Method</b> SM 5310B			
DOC	<0.5 mg/L	89	80-120
<b>Run No</b> 400717 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SKH <b>Method</b> EPA 350.1			
N-NH3	<0.010 mg/L	99	80-120
<b>Run No</b> 400719 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SKH <b>Method</b> EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	102	70-130

**Guideline = ODWSOG**

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953235  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873627

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400737 <b>Analysis/Extraction Date</b> 2021-05-18 <b>Analyst</b> Z S <b>Method</b> M SM3120B-3500C			
Calcium	<1 mg/L	100	90-110
Potassium	<1 mg/L	102	87-113
Magnesium	<1 mg/L	98	76-124
Sodium	<2 mg/L	105	82-118
<b>Run No</b> 400792 <b>Analysis/Extraction Date</b> 2021-05-17 <b>Analyst</b> SWS <b>Method</b> SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	97	90-110
Conductivity	<5 uS/cm	97	90-110
F	<0.10 mg/L	91	90-110
pH		100	90-110
<b>Run No</b> 400797 <b>Analysis/Extraction Date</b> 2021-05-19 <b>Analyst</b> AET <b>Method</b> SM 4110			
Chloride	<5 mg/L		90-110
N-NO2	<0.50 mg/L	98	90-110
N-NO3	<0.50 mg/L	105	90-110
SO4	<5 mg/L	100	90-110

**Guideline = ODWSOG**

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Client: Kollaard Associates Inc.  
 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953235  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-20  
 Project: 210064  
 COC #: 873627

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 400811 <b>Analysis/Extraction Date</b> 2021-05-19 <b>Analyst</b> AET <b>Method</b> C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
<b>Run No</b> 400865 <b>Analysis/Extraction Date</b> 2021-05-14 <b>Analyst</b> AET <b>Method</b> SUBCONTRACT-A			
Phenols	<0.0010 mg/L	98	
Tannin & Lignin	<0.10 mg/L	103	
<b>Run No</b> 400982 <b>Analysis/Extraction Date</b> 2021-05-20 <b>Analyst</b> AET <b>Method</b> C SM4500-S2-D			
S2-	<0.01 mg/L	104	80-120

**Guideline = ODWSOG**

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Certificate of Analysis

Client: Kollaard Associates Inc.  
210 Prescott St., Box 189  
Kemptville, ON  
K0G 1J0  
Attention: Ms. Colleen Vermeersch  
PO#:  
Invoice to: Kollaard Associates Inc.

Report Number: 1953220  
Date Submitted: 2021-05-13  
Date Reported: 2021-05-16  
Project: 210064  
COC #: 873627

**Dear Colleen Vermeersch:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

Dragana  
Dzeletovic  
*Dragana Andric* 2021.05.16  
08:34:53  
-04'00'

APPROVAL: \_\_\_\_\_  
Dragana Dzeletovic-Andric, Microbiology Team Lead

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 210 Prescott St., Box 189  
 Kemptville, ON  
 K0G 1J0  
 Attention: Ms. Colleen Vermeersch  
 PO#:  
 Invoice to: Kollaard Associates Inc.

Report Number: 1953220  
 Date Submitted: 2021-05-13  
 Date Reported: 2021-05-16  
 Project: 210064  
 COC #: 873627

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1556876 Water  2021-05-12 5560 Lombardy	1556877 Water  2021-05-12 5566 Lombardy
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0		0	0
	Faecal Coliforms	0	ct/100mL			0	0
	Heterotrophic Plate Count	0	ct/1mL			0	197
	Total Coliforms	0	ct/100mL	MAC 0		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

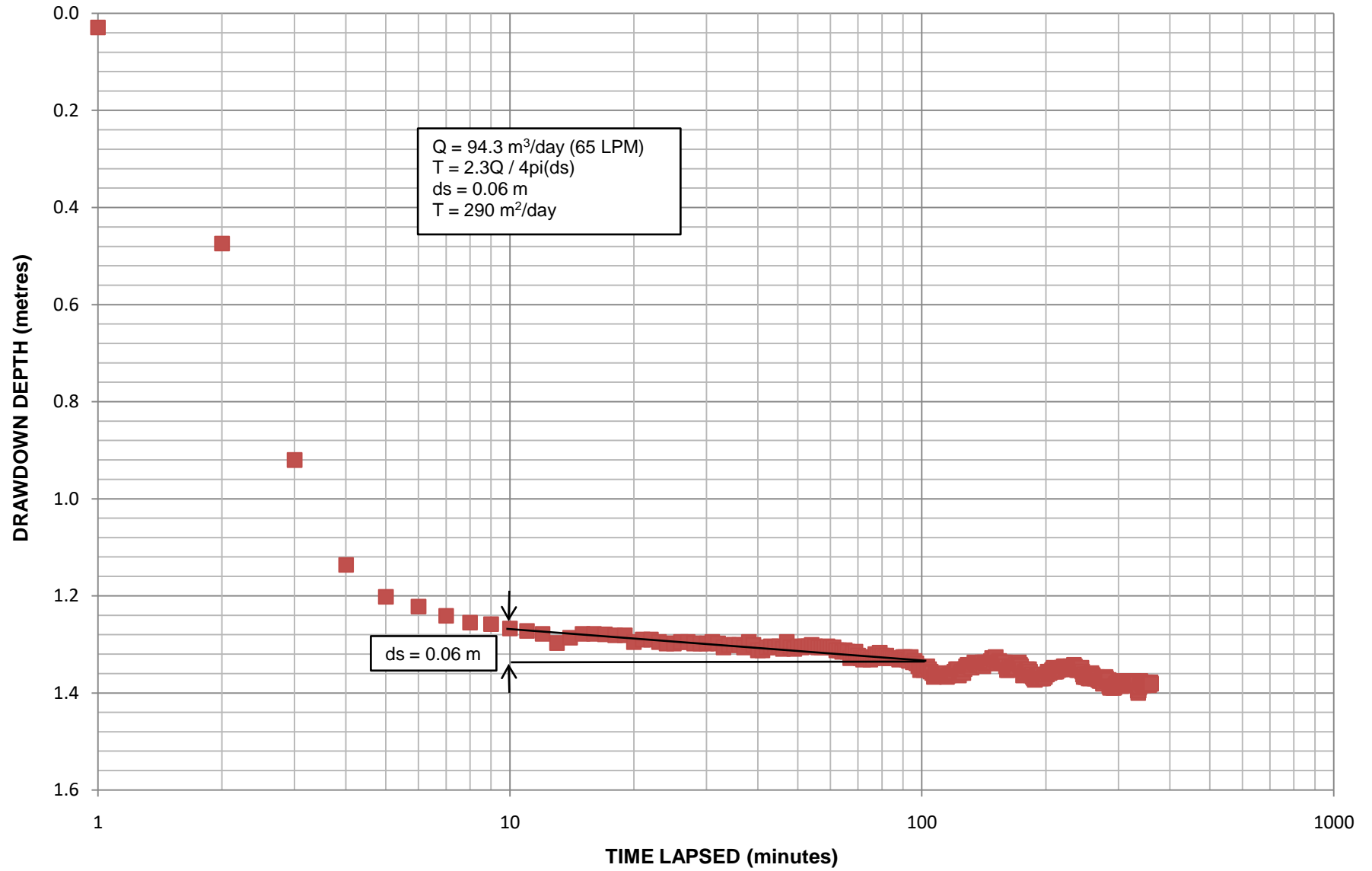


ATTACHMENT H

PUMPING TEST DATA FOR TW1



# TW1-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 210064



## DRAWDOWN DATA TW1

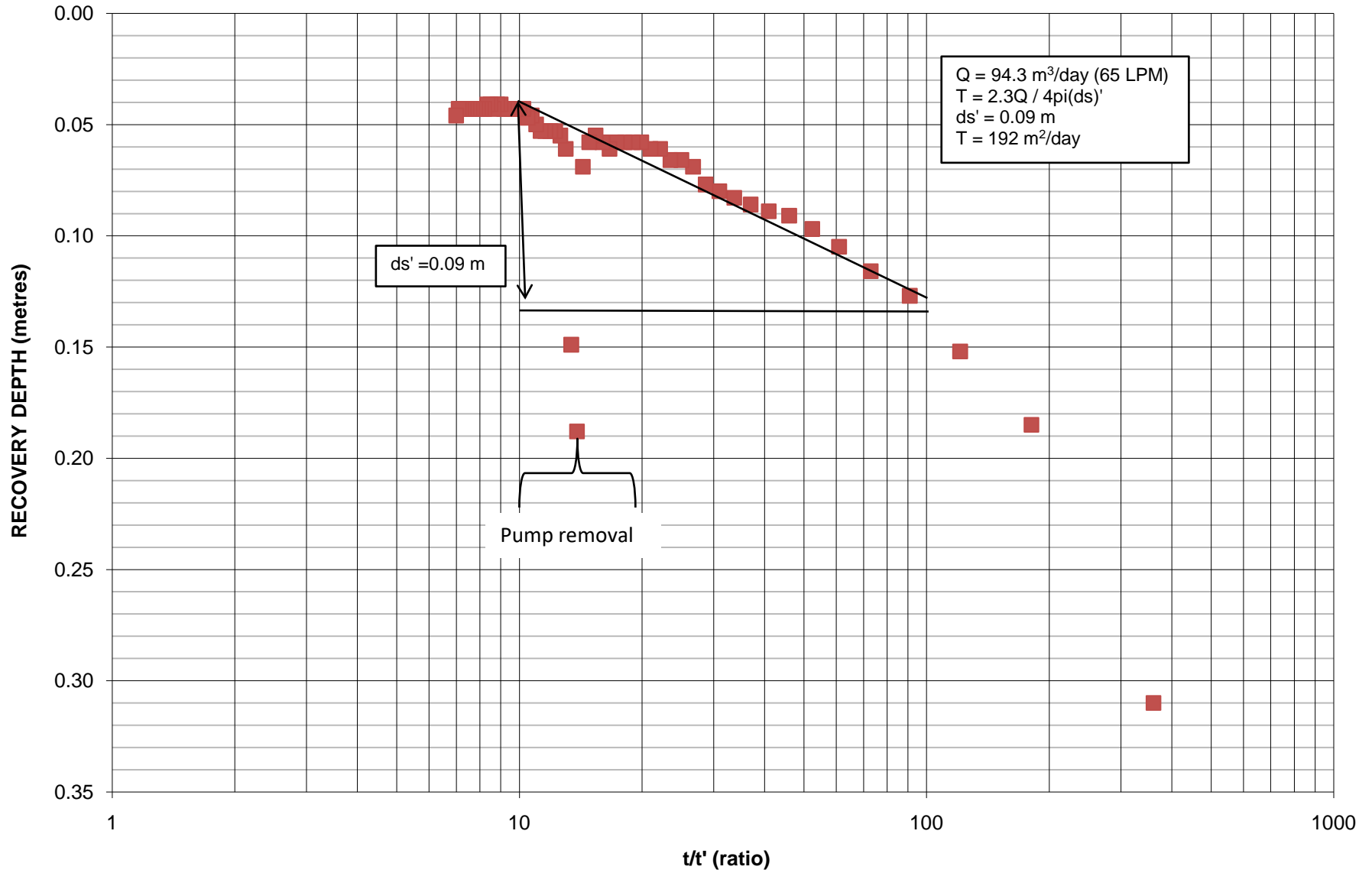
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	388.094	8.382	-6.86	0.00
1	387.814	8.282	-6.889	0.03
2	383.442	8.282	-7.334	0.47
3	379.072	8.282	-7.78	0.92
4	376.956	8.282	-7.996	1.14
5	376.305	8.282	-8.062	1.20
6	376.115	8.282	-8.082	1.22
7	375.925	8.282	-8.101	1.24
8	375.789	8.282	-8.115	1.26
9	375.754	8.182	-8.118	1.26
10	375.672	8.182	-8.127	1.27
11	375.618	8.182	-8.132	1.27
12	375.564	8.182	-8.138	1.28
13	375.374	8.182	-8.157	1.30
14	375.483	8.182	-8.146	1.29
15	375.564	8.182	-8.138	1.28
16	375.564	8.182	-8.138	1.28
17	375.555	8.082	-8.139	1.28
18	375.528	8.082	-8.141	1.28
19	375.528	8.082	-8.141	1.28
20	375.393	8.082	-8.155	1.30
21	375.447	8.082	-8.15	1.29
22	375.447	8.082	-8.15	1.29
23	375.393	8.082	-8.155	1.30
24	375.366	8.082	-8.158	1.30
25	375.366	8.082	-8.158	1.30
26	375.393	8.082	-8.155	1.30
27	375.393	8.082	-8.155	1.30
28	375.366	8.082	-8.158	1.30
29	375.366	8.082	-8.158	1.30
30	375.366	8.082	-8.158	1.30
31	375.393	8.082	-8.155	1.30
32	375.366	8.082	-8.158	1.30
33	375.284	8.082	-8.166	1.31
34	375.338	8.082	-8.161	1.30
35	375.338	8.082	-8.161	1.30
36	375.338	8.082	-8.161	1.30
37	375.284	8.082	-8.166	1.31
38	375.393	8.082	-8.155	1.30
39	375.338	8.082	-8.161	1.30
40	375.23	8.082	-8.172	1.31
41	375.23	8.082	-8.172	1.31
42	375.284	8.082	-8.166	1.31
43	375.311	8.082	-8.164	1.30
44	375.284	8.082	-8.166	1.31
45	375.311	8.082	-8.164	1.30
46	375.257	8.082	-8.169	1.31
47	375.393	8.082	-8.155	1.30
48	375.284	8.082	-8.166	1.31
49	375.257	8.082	-8.169	1.31
50	375.311	8.082	-8.164	1.30
51	375.284	8.082	-8.166	1.31
52	375.311	8.082	-8.164	1.30
53	375.311	8.082	-8.164	1.30
54	375.338	8.082	-8.161	1.30
55	375.311	8.082	-8.164	1.30
56	375.284	8.082	-8.166	1.31
57	375.284	8.082	-8.166	1.31
58	375.284	8.082	-8.166	1.31
59	375.311	8.082	-8.164	1.30
60	375.284	8.082	-8.166	1.31
61	375.284	8.082	-8.166	1.31
62	375.23	8.082	-8.172	1.31
63	375.23	8.082	-8.172	1.31
64	375.203	8.082	-8.175	1.32
65	375.23	8.082	-8.172	1.31
66	375.203	8.082	-8.175	1.32
67	375.067	8.082	-8.188	1.33
68	375.176	8.082	-8.177	1.32
69	375.203	8.082	-8.175	1.32
70	375.121	8.082	-8.183	1.32
71	375.067	8.082	-8.188	1.33
72	375.04	8.082	-8.191	1.33
73	375.094	8.082	-8.186	1.33
74	375.094	8.082	-8.186	1.33
75	375.04	8.082	-8.191	1.33
76	375.067	8.082	-8.188	1.33
77	375.149	8.082	-8.18	1.32
78	375.121	8.082	-8.183	1.32
79	375.176	8.082	-8.177	1.32
80	375.121	8.082	-8.183	1.32
81	375.067	8.082	-8.188	1.33
82	375.121	8.082	-8.183	1.32
83	375.067	8.082	-8.188	1.33
84	375.067	8.082	-8.188	1.33
85	375.067	8.082	-8.188	1.33
86	375.067	8.082	-8.188	1.33

87	375.067	8.082	-8.188	1.33
88	375.04	8.082	-8.191	1.33
89	375.067	8.082	-8.188	1.33
90	375.094	8.082	-8.186	1.33
91	375.094	8.082	-8.186	1.33
92	375.04	8.082	-8.191	1.33
93	375.013	8.082	-8.194	1.33
94	375.094	8.082	-8.186	1.33
95	374.986	8.082	-8.197	1.34
96	375.013	8.082	-8.194	1.33
97	374.959	8.082	-8.199	1.34
98	374.904	8.082	-8.205	1.35
99	374.823	8.082	-8.213	1.35
100	374.85	8.082	-8.211	1.35
101	374.823	8.082	-8.213	1.35
102	374.85	8.082	-8.211	1.35
103	374.904	8.082	-8.205	1.35
104	374.85	8.082	-8.211	1.35
105	374.796	8.082	-8.216	1.36
106	374.769	8.082	-8.219	1.36
107	374.688	8.082	-8.227	1.37
108	374.742	8.082	-8.222	1.36
109	374.715	8.082	-8.224	1.36
110	374.715	8.082	-8.224	1.36
111	374.715	8.082	-8.224	1.36
112	374.715	8.082	-8.224	1.36
113	374.742	8.082	-8.222	1.36
114	374.769	8.082	-8.219	1.36
115	374.688	8.082	-8.227	1.37
116	374.715	8.082	-8.224	1.36
117	374.742	8.082	-8.222	1.36
118	374.769	8.082	-8.219	1.36
119	374.769	8.082	-8.219	1.36
120	374.796	8.082	-8.216	1.36
121	374.85	8.082	-8.211	1.35
122	374.85	8.082	-8.211	1.35
123	374.715	8.082	-8.224	1.36
124	374.769	8.082	-8.219	1.36
125	374.796	8.082	-8.216	1.36
126	374.769	8.082	-8.219	1.36
127	374.85	8.082	-8.211	1.35
128	374.904	8.082	-8.205	1.35
129	374.932	8.082	-8.202	1.34
130	374.904	8.082	-8.205	1.35
131	374.904	8.082	-8.205	1.35
132	374.877	8.082	-8.208	1.35
133	374.932	8.082	-8.202	1.34
134	374.986	8.082	-8.197	1.34
135	374.959	8.082	-8.199	1.34
136	374.932	8.082	-8.202	1.34
137	374.932	8.082	-8.202	1.34
138	374.932	8.082	-8.202	1.34
139	374.932	8.082	-8.202	1.34
140	374.986	8.082	-8.197	1.34
141	374.904	8.082	-8.205	1.35
142	374.986	8.082	-8.197	1.34
143	374.959	8.082	-8.199	1.34
144	374.959	8.082	-8.199	1.34
145	374.986	8.082	-8.197	1.34
146	374.986	8.082	-8.197	1.34
147	375.013	8.082	-8.194	1.33
148	375.067	8.082	-8.188	1.33
149	374.986	8.082	-8.197	1.34
150	375.04	8.082	-8.191	1.33
151	375.094	8.082	-8.186	1.33
152	374.986	8.082	-8.197	1.34
153	374.959	8.082	-8.199	1.34
154	375.013	8.082	-8.194	1.33
155	374.986	8.082	-8.197	1.34
156	374.959	8.082	-8.199	1.34
157	374.959	8.082	-8.199	1.34
158	374.986	8.082	-8.197	1.34
159	374.986	8.082	-8.197	1.34
160	374.904	8.082	-8.205	1.35
161	374.823	8.082	-8.213	1.35
162	374.823	8.082	-8.213	1.35
163	374.904	8.082	-8.205	1.35
164	374.85	8.082	-8.211	1.35
165	374.877	8.082	-8.208	1.35
166	374.877	8.082	-8.208	1.35
167	374.877	8.082	-8.208	1.35
168	374.904	8.082	-8.205	1.35
169	374.932	8.082	-8.202	1.34
170	374.877	8.082	-8.208	1.35
171	374.959	8.082	-8.199	1.34
172	374.986	8.082	-8.197	1.34
173	374.932	8.082	-8.202	1.34
174	374.904	8.082	-8.205	1.35
175	374.85	8.082	-8.211	1.35
176	374.715	8.082	-8.224	1.36
177	374.769	8.082	-8.219	1.36
178	374.796	8.082	-8.216	1.36
179	374.796	8.082	-8.216	1.36

180	374.85	8.082	-8.211	1.35
181	374.823	8.082	-8.213	1.35
182	374.85	8.082	-8.211	1.35
183	374.796	8.082	-8.216	1.36
184	374.715	8.082	-8.224	1.36
185	374.742	8.082	-8.222	1.36
186	374.688	8.082	-8.227	1.37
187	374.66	8.082	-8.23	1.37
188	374.633	8.082	-8.233	1.37
189	374.66	8.082	-8.23	1.37
190	374.715	8.082	-8.224	1.36
191	374.688	8.082	-8.227	1.37
192	374.688	8.082	-8.227	1.37
193	374.715	8.082	-8.224	1.36
194	374.66	8.082	-8.23	1.37
195	374.742	8.082	-8.222	1.36
196	374.66	8.082	-8.23	1.37
197	374.66	8.082	-8.23	1.37
198	374.688	8.082	-8.227	1.37
199	374.688	8.082	-8.227	1.37
200	374.742	8.082	-8.222	1.36
201	374.742	8.082	-8.222	1.36
202	374.796	8.082	-8.216	1.36
203	374.769	8.082	-8.219	1.36
204	374.769	8.082	-8.219	1.36
205	374.796	8.082	-8.216	1.36
206	374.796	8.082	-8.216	1.36
207	374.823	8.082	-8.213	1.35
208	374.85	8.082	-8.211	1.35
209	374.877	8.082	-8.208	1.35
210	374.796	8.082	-8.216	1.36
211	374.796	8.082	-8.216	1.36
212	374.796	8.082	-8.216	1.36
213	374.85	8.082	-8.211	1.35
214	374.823	8.082	-8.213	1.35
215	374.85	8.082	-8.211	1.35
216	374.85	8.082	-8.211	1.35
217	374.85	8.082	-8.211	1.35
218	374.877	8.082	-8.208	1.35
219	374.85	8.082	-8.211	1.35
220	374.85	8.082	-8.211	1.35
221	374.904	8.082	-8.205	1.35
222	374.904	8.082	-8.205	1.35
223	374.85	8.082	-8.211	1.35
224	374.877	8.082	-8.208	1.35
225	374.877	8.082	-8.208	1.35
226	374.877	8.082	-8.208	1.35
227	374.877	8.082	-8.208	1.35
228	374.877	8.082	-8.208	1.35
229	374.904	8.082	-8.205	1.35
230	374.877	8.082	-8.208	1.35
231	374.85	8.082	-8.211	1.35
232	374.877	8.082	-8.208	1.35
233	374.85	8.082	-8.211	1.35
234	374.932	8.082	-8.202	1.34
235	374.904	8.082	-8.205	1.35
236	374.877	8.082	-8.208	1.35
237	374.85	8.082	-8.211	1.35
238	374.823	8.082	-8.213	1.35
239	374.85	8.082	-8.211	1.35
240	374.823	8.082	-8.213	1.35
241	374.85	8.082	-8.211	1.35
242	374.85	8.082	-8.211	1.35
243	374.85	8.082	-8.211	1.35
244	374.877	8.082	-8.208	1.35
245	374.796	8.082	-8.216	1.36
246	374.742	8.082	-8.222	1.36
247	374.688	8.082	-8.227	1.37
248	374.742	8.082	-8.222	1.36
249	374.688	8.082	-8.227	1.37
250	374.688	8.082	-8.227	1.37
251	374.688	8.082	-8.227	1.37
252	374.742	8.082	-8.222	1.36
253	374.742	8.082	-8.222	1.36
254	374.66	8.082	-8.23	1.37
255	374.715	8.082	-8.224	1.36
256	374.66	8.082	-8.23	1.37
257	374.715	8.082	-8.224	1.36
258	374.769	8.082	-8.219	1.36
259	374.742	8.082	-8.222	1.36
260	374.715	8.082	-8.224	1.36
261	374.688	8.082	-8.227	1.37
262	374.66	8.082	-8.23	1.37
263	374.66	8.082	-8.23	1.37
264	374.66	8.082	-8.23	1.37
265	374.66	8.082	-8.23	1.37
266	374.688	8.082	-8.227	1.37
267	374.688	8.082	-8.227	1.37
268	374.633	8.082	-8.233	1.37
269	374.66	8.082	-8.23	1.37
270	374.606	8.082	-8.235	1.38
271	374.606	8.082	-8.235	1.38
272	374.633	8.082	-8.233	1.37

273	374.606	8.082	-8.235	1.38
274	374.633	8.082	-8.233	1.37
275	374.552	8.082	-8.241	1.38
276	374.606	8.082	-8.235	1.38
277	374.688	8.082	-8.227	1.37
278	374.66	8.082	-8.23	1.37
279	374.688	8.082	-8.227	1.37
280	374.66	8.082	-8.23	1.37
281	374.633	8.082	-8.233	1.37
282	374.606	8.082	-8.235	1.38
283	374.606	8.082	-8.235	1.38
284	374.633	8.082	-8.233	1.37
285	374.498	8.082	-8.246	1.39
286	374.471	8.082	-8.249	1.39
287	374.471	8.082	-8.249	1.39
288	374.498	8.082	-8.246	1.39
289	374.498	8.082	-8.246	1.39
290	374.498	8.082	-8.246	1.39
291	374.471	8.082	-8.249	1.39
292	374.471	8.082	-8.249	1.39
293	374.471	8.082	-8.249	1.39
294	374.498	8.082	-8.246	1.39
295	374.525	8.082	-8.244	1.38
296	374.552	8.082	-8.241	1.38
297	374.552	8.082	-8.241	1.38
298	374.552	8.082	-8.241	1.38
299	374.552	8.082	-8.241	1.38
300	374.606	8.082	-8.235	1.38
301	374.552	8.082	-8.241	1.38
302	374.552	8.082	-8.241	1.38
303	374.579	8.082	-8.238	1.38
304	374.552	8.082	-8.241	1.38
305	374.498	8.082	-8.246	1.39
306	374.552	8.082	-8.241	1.38
307	374.552	8.082	-8.241	1.38
308	374.579	8.082	-8.238	1.38
309	374.552	8.082	-8.241	1.38
310	374.525	8.082	-8.244	1.38
311	374.525	8.082	-8.244	1.38
312	374.552	8.082	-8.241	1.38
313	374.579	8.082	-8.238	1.38
314	374.552	8.082	-8.241	1.38
315	374.579	8.082	-8.238	1.38
316	374.606	8.082	-8.235	1.38
317	374.525	8.082	-8.244	1.38
318	374.579	8.082	-8.238	1.38
319	374.525	8.082	-8.244	1.38
320	374.552	8.082	-8.241	1.38
321	374.552	8.082	-8.241	1.38
322	374.579	8.082	-8.238	1.38
323	374.552	8.082	-8.241	1.38
324	374.579	8.082	-8.238	1.38
325	374.579	8.082	-8.238	1.38
326	374.525	8.082	-8.244	1.38
327	374.606	8.082	-8.235	1.38
328	374.552	8.082	-8.241	1.38
329	374.579	8.082	-8.238	1.38
330	374.525	8.082	-8.244	1.38
331	374.579	8.082	-8.238	1.38
332	374.579	8.082	-8.238	1.38
333	374.552	8.082	-8.241	1.38
334	374.416	8.082	-8.255	1.40
335	374.362	8.082	-8.26	1.40
336	374.416	8.082	-8.255	1.40
337	374.471	8.082	-8.249	1.39
338	374.498	8.082	-8.246	1.39
339	374.606	8.082	-8.235	1.38
340	374.579	8.082	-8.238	1.38
341	374.579	8.082	-8.238	1.38
342	374.552	8.082	-8.241	1.38
343	374.579	8.082	-8.238	1.38
344	374.552	8.082	-8.241	1.38
345	374.525	8.082	-8.244	1.38
346	374.525	8.082	-8.244	1.38
347	374.552	8.082	-8.241	1.38
348	374.579	8.082	-8.238	1.38
349	374.579	8.082	-8.238	1.38
350	374.579	8.082	-8.238	1.38
351	374.579	8.082	-8.238	1.38
352	374.579	8.082	-8.238	1.38
353	374.579	8.082	-8.238	1.38
354	374.579	8.082	-8.238	1.38
355	374.552	8.082	-8.241	1.38
356	374.525	8.082	-8.244	1.38
357	374.579	8.082	-8.238	1.38
358	374.552	8.082	-8.241	1.38
359	374.579	8.082	-8.238	1.38
360	374.552	8.082	-8.241	1.38

# TW1- WELL RECOVERY VS. TIME - KOLLAARD FILE 210064



**RECOVERY DATA TW-1**

<b>t'</b>	<b>t / t'</b>	<b>Abs Pres (kPa)</b>	<b>Temp (°C)</b>	<b>Water Level (m)</b>	<b>Drawdown (m)</b>	<b>Recovery (%)</b>
1	361	385.053	8.082	-7.17	0.31	78%
2	181.0	386.275	8.082	-7.045	0.19	87%
3	121.0	386.601	8.082	-7.012	0.15	89%
4	91.0	386.846	8.082	-6.987	0.13	91%
5	73.0	386.954	8.082	-6.976	0.12	92%
6	61.0	387.063	8.082	-6.965	0.11	92%
7	52.4	387.144	8.082	-6.957	0.10	93%
8	46.0	387.199	8.082	-6.951	0.09	93%
9	41.0	387.226	8.082	-6.949	0.09	94%
10	37.0	387.253	8.082	-6.946	0.09	94%
11	33.7	387.28	8.082	-6.943	0.08	94%
12	31.0	387.307	8.082	-6.94	0.08	94%
13	28.7	387.335	8.082	-6.937	0.08	94%
14	26.7	387.416	8.082	-6.929	0.07	95%
15	25.0	387.443	8.082	-6.926	0.07	95%
16	23.5	387.443	8.082	-6.926	0.07	95%
17	22.2	387.498	8.082	-6.921	0.06	96%
18	21.0	387.498	8.082	-6.921	0.06	96%
19	19.9	387.525	8.082	-6.918	0.06	96%
20	19.0	387.525	8.082	-6.918	0.06	96%
21	18.1	387.525	8.082	-6.918	0.06	96%
22	17.4	387.525	8.082	-6.918	0.06	96%
23	16.7	387.498	8.082	-6.921	0.06	96%
24	16.0	387.525	8.082	-6.918	0.06	96%
25	15.4	387.552	8.082	-6.915	0.05	96%
26	14.8	387.525	8.082	-6.918	0.06	96%
27	14.3	387.416	8.082	-6.929	0.07	95%
28	13.9	386.248	8.082	-7.048	0.19	86%
29	13.4	386.628	8.082	-7.009	0.15	89%
30	13.0	387.498	8.082	-6.921	0.06	96%
31	12.6	387.552	8.082	-6.915	0.05	96%
32	12.3	387.579	8.082	-6.913	0.05	96%
33	11.9	387.579	8.082	-6.913	0.05	96%
34	11.6	387.579	8.082	-6.913	0.05	96%
35	11.3	387.579	8.082	-6.913	0.05	96%
36	11.0	387.606	8.082	-6.91	0.05	96%
37	10.7	387.642	8.182	-6.906	0.05	97%
38	10.5	387.633	8.082	-6.907	0.05	97%
39	10.2	387.669	8.182	-6.903	0.04	97%
40	10.0	387.669	8.182	-6.903	0.04	97%
41	9.8	387.669	8.182	-6.903	0.04	97%
42	9.6	387.669	8.182	-6.903	0.04	97%
43	9.4	387.669	8.182	-6.903	0.04	97%
44	9.2	387.669	8.182	-6.903	0.04	97%
45	9.0	387.696	8.182	-6.901	0.04	97%
46	8.8	387.696	8.182	-6.901	0.04	97%
47	8.7	387.669	8.182	-6.903	0.04	97%
48	8.5	387.696	8.182	-6.901	0.04	97%
49	8.3	387.696	8.182	-6.901	0.04	97%
50	8.2	387.669	8.182	-6.903	0.04	97%
51	8.1	387.669	8.182	-6.903	0.04	97%
52	7.9	387.669	8.182	-6.903	0.04	97%
53	7.8	387.669	8.182	-6.903	0.04	97%
54	7.7	387.669	8.182	-6.903	0.04	97%
55	7.5	387.669	8.182	-6.903	0.04	97%
56	7.4	387.669	8.182	-6.903	0.04	97%
57	7.3	387.669	8.182	-6.903	0.04	97%
58	7.2	387.669	8.182	-6.903	0.04	97%
59	7.1	387.669	8.182	-6.903	0.04	97%
60	7.0	387.642	8.182	-6.906	0.05	97%

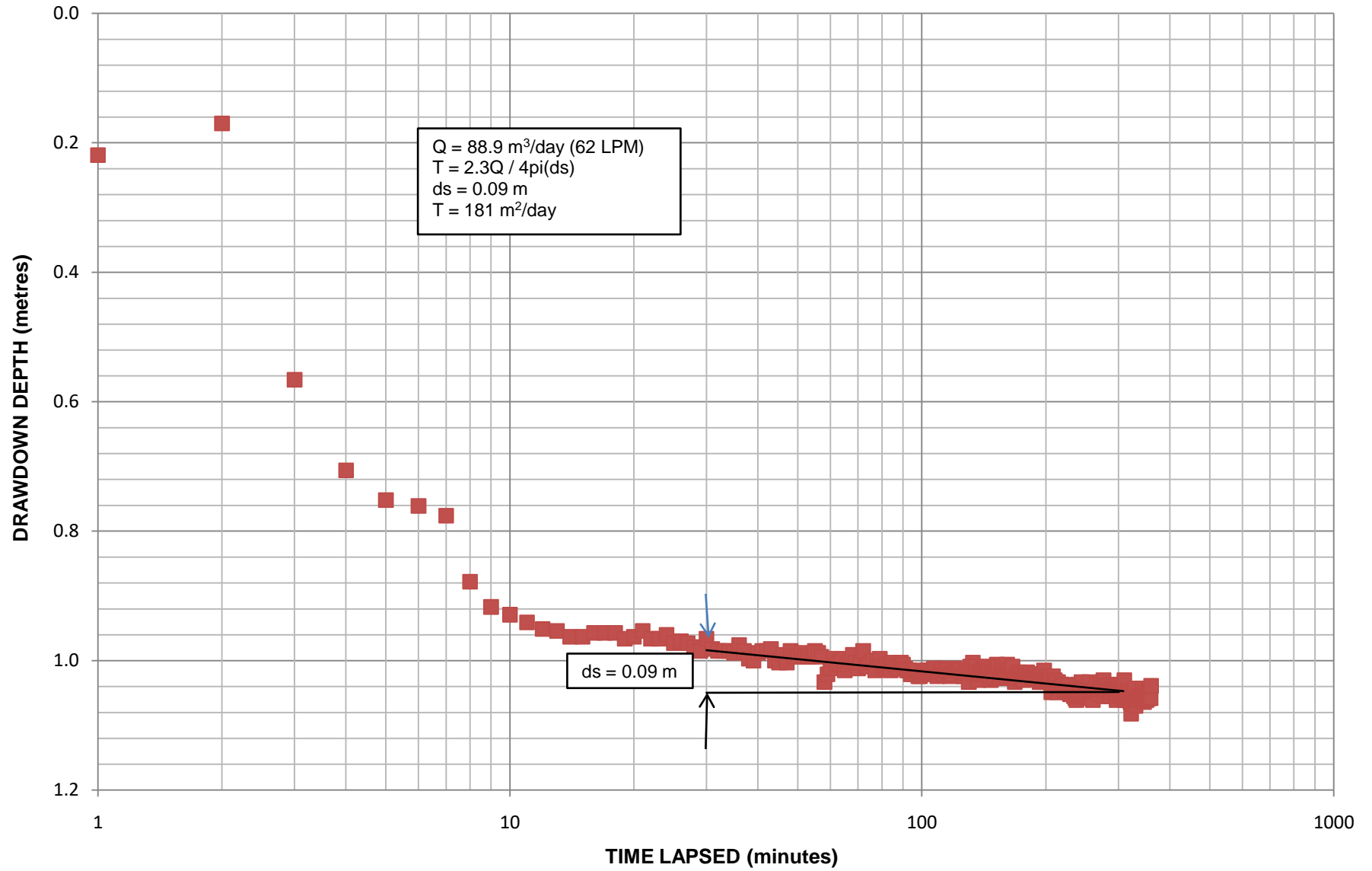


ATTACHMENT I

PUMPING TEST DATA FOR TW2



# TW2-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 210064



## DRAWDOWN DATA TW2

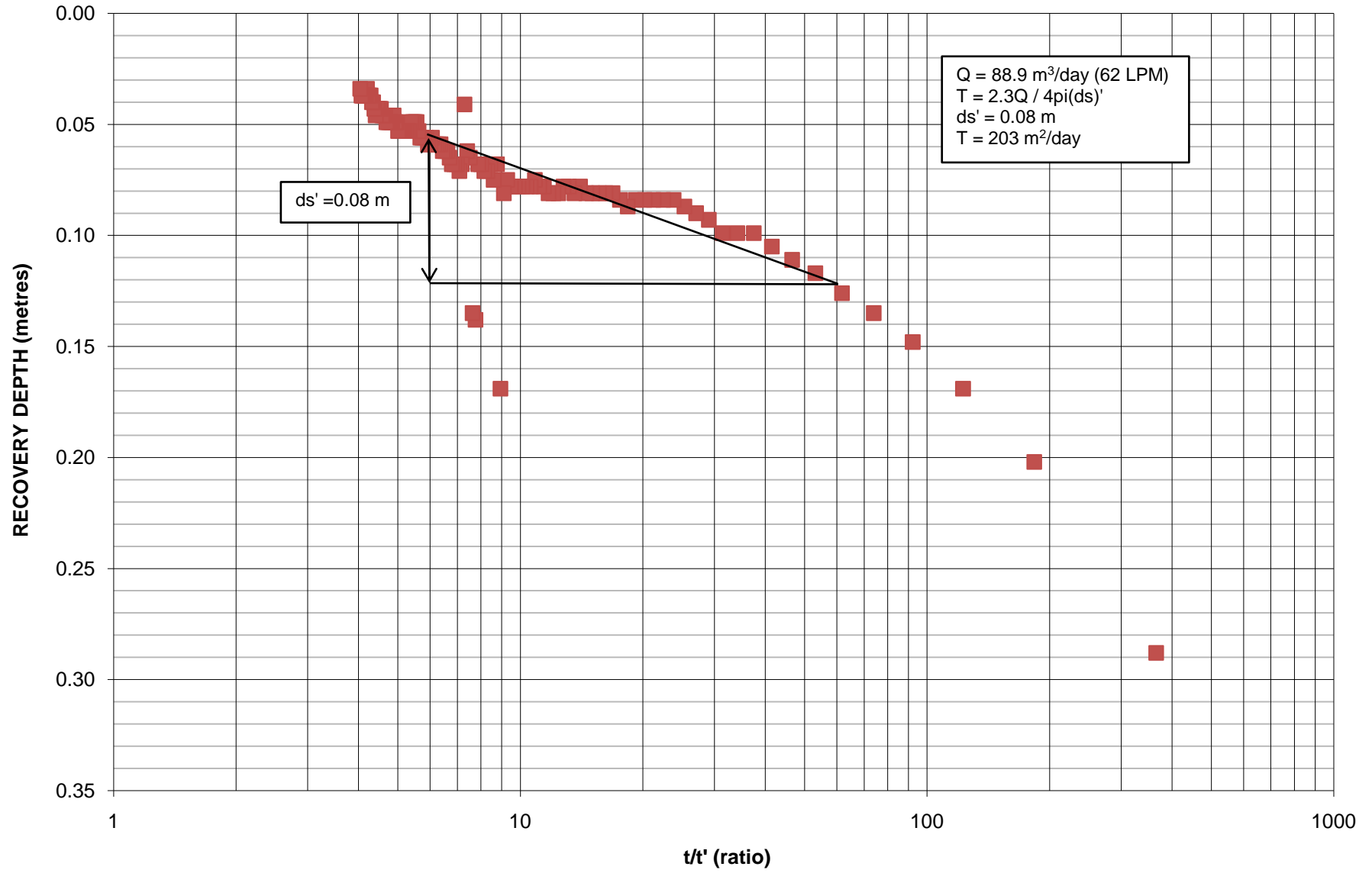
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	392.344	8.182	-6.68	0.00
1	390.194	8.182	-6.899	0.22
2	390.672	8.182	-6.85	0.17
3	386.79	8.182	-7.246	0.57
4	385.417	8.182	-7.386	0.71
5	384.969	8.182	-7.432	0.75
6	384.88	8.182	-7.441	0.76
7	384.73	8.182	-7.456	0.78
8	383.738	8.082	-7.558	0.88
9	383.35	8.082	-7.597	0.92
10	383.231	8.082	-7.609	0.93
11	383.112	8.082	-7.621	0.94
12	383.022	8.082	-7.631	0.95
13	382.992	8.082	-7.634	0.95
14	382.903	8.082	-7.643	0.96
15	382.903	8.082	-7.643	0.96
16	382.962	8.082	-7.637	0.96
17	382.955	7.983	-7.637	0.96
18	382.955	7.983	-7.637	0.96
19	382.866	7.983	-7.646	0.97
20	382.896	7.983	-7.643	0.96
21	382.985	7.983	-7.634	0.95
22	382.866	7.983	-7.646	0.97
23	382.866	7.983	-7.646	0.97
24	382.926	7.983	-7.64	0.96
25	382.806	7.983	-7.653	0.97
26	382.836	7.983	-7.65	0.97
27	382.806	7.983	-7.653	0.97
28	382.746	7.983	-7.659	0.98
29	382.687	7.983	-7.665	0.99
30	382.866	7.983	-7.646	0.97
31	382.717	7.983	-7.662	0.98
32	382.687	7.983	-7.665	0.99
33	382.687	7.983	-7.665	0.99
34	382.687	7.983	-7.665	0.99
35	382.657	7.983	-7.668	0.99
36	382.776	7.983	-7.656	0.98
37	382.687	7.983	-7.665	0.99
38	382.567	7.983	-7.677	1.00
39	382.538	7.983	-7.68	1.00
40	382.657	7.983	-7.668	0.99
41	382.687	7.983	-7.665	0.99
42	382.687	7.983	-7.665	0.99
43	382.717	7.983	-7.662	0.98
44	382.538	7.983	-7.68	1.00
45	382.508	7.983	-7.683	1.00
46	382.627	7.983	-7.671	0.99
47	382.508	7.983	-7.683	1.00
48	382.687	7.983	-7.665	0.99
49	382.597	7.983	-7.674	0.99
50	382.597	7.983	-7.674	0.99
51	382.657	7.983	-7.668	0.99
52	382.597	7.983	-7.674	0.99
53	382.597	7.983	-7.674	0.99
54	382.597	7.983	-7.674	0.99
55	382.687	7.983	-7.665	0.99
56	382.657	7.983	-7.668	0.99
57	382.597	7.983	-7.674	0.99
58	382.209	7.983	-7.713	1.03
59	382.329	7.983	-7.701	1.02
60	382.418	7.983	-7.692	1.01
61	382.567	7.983	-7.677	1.00
62	382.478	7.983	-7.686	1.01
63	382.508	7.983	-7.683	1.00
64	382.567	7.983	-7.677	1.00
65	382.388	7.983	-7.695	1.02
66	382.478	7.983	-7.686	1.01
67	382.538	7.983	-7.68	1.00
68	382.627	7.983	-7.671	0.99
69	382.508	7.983	-7.683	1.00
70	382.418	7.983	-7.692	1.01
71	382.508	7.983	-7.683	1.00
72	382.687	7.983	-7.665	0.99
73	382.448	7.983	-7.689	1.01
74	382.448	7.983	-7.689	1.01
75	382.508	7.983	-7.683	1.00
76	382.538	7.983	-7.68	1.00
77	382.388	7.983	-7.695	1.02
78	382.538	7.983	-7.68	1.00
79	382.567	7.983	-7.677	1.00
80	382.448	7.983	-7.689	1.01
81	382.478	7.983	-7.686	1.01
82	382.448	7.983	-7.689	1.01
83	382.418	7.983	-7.692	1.01
84	382.388	7.983	-7.695	1.02
85	382.508	7.983	-7.683	1.00
86	382.448	7.983	-7.689	1.01

87	382.448	7.983	-7.689	1.01
88	382.418	7.983	-7.692	1.01
89	382.508	7.983	-7.683	1.00
90	382.478	7.983	-7.686	1.01
91	382.418	7.983	-7.692	1.01
92	382.388	7.983	-7.695	1.02
93	382.388	7.983	-7.695	1.02
94	382.329	7.983	-7.701	1.02
95	382.358	7.983	-7.698	1.02
96	382.329	7.983	-7.701	1.02
97	382.388	7.983	-7.695	1.02
98	382.299	7.983	-7.704	1.02
99	382.299	7.983	-7.704	1.02
100	382.358	7.983	-7.698	1.02
101	382.329	7.983	-7.701	1.02
102	382.358	7.983	-7.698	1.02
103	382.388	7.983	-7.695	1.02
104	382.358	7.983	-7.698	1.02
105	382.388	7.983	-7.695	1.02
106	382.388	7.983	-7.695	1.02
107	382.418	7.983	-7.692	1.01
108	382.418	7.983	-7.692	1.01
109	382.299	7.983	-7.704	1.02
110	382.358	7.983	-7.698	1.02
111	382.388	7.983	-7.695	1.02
112	382.418	7.983	-7.692	1.01
113	382.329	7.983	-7.701	1.02
114	382.388	7.983	-7.695	1.02
115	382.388	7.983	-7.695	1.02
116	382.329	7.983	-7.701	1.02
117	382.299	7.983	-7.704	1.02
118	382.329	7.983	-7.701	1.02
119	382.329	7.983	-7.701	1.02
120	382.418	7.983	-7.692	1.01
121	382.388	7.983	-7.695	1.02
122	382.388	7.983	-7.695	1.02
123	382.388	7.983	-7.695	1.02
124	382.388	7.983	-7.695	1.02
125	382.329	7.983	-7.701	1.02
126	382.299	7.983	-7.704	1.02
127	382.299	7.983	-7.704	1.02
128	382.358	7.983	-7.698	1.02
129	382.329	7.983	-7.701	1.02
130	382.209	7.983	-7.713	1.03
131	382.448	7.983	-7.689	1.01
132	382.358	7.983	-7.698	1.02
133	382.508	7.983	-7.683	1.00
134	382.329	7.983	-7.701	1.02
135	382.448	7.983	-7.689	1.01
136	382.358	7.983	-7.698	1.02
137	382.239	7.983	-7.71	1.03
138	382.329	7.983	-7.701	1.02
139	382.358	7.983	-7.698	1.02
140	382.388	7.983	-7.695	1.02
141	382.358	7.983	-7.698	1.02
142	382.418	7.983	-7.692	1.01
143	382.448	7.983	-7.689	1.01
144	382.388	7.983	-7.695	1.02
145	382.388	7.983	-7.695	1.02
146	382.329	7.983	-7.701	1.02
147	382.239	7.983	-7.71	1.03
148	382.418	7.983	-7.692	1.01
149	382.269	7.983	-7.707	1.03
150	382.358	7.983	-7.698	1.02
151	382.299	7.983	-7.704	1.02
152	382.478	7.983	-7.686	1.01
153	382.448	7.983	-7.689	1.01
154	382.269	7.983	-7.707	1.03
155	382.269	7.983	-7.707	1.03
156	382.358	7.983	-7.698	1.02
157	382.448	7.983	-7.689	1.01
158	382.299	7.983	-7.704	1.02
159	382.388	7.983	-7.695	1.02
160	382.299	7.983	-7.704	1.02
161	382.478	7.983	-7.686	1.01
162	382.358	7.983	-7.698	1.02
163	382.388	7.983	-7.695	1.02
164	382.329	7.983	-7.701	1.02
165	382.299	7.983	-7.704	1.02
166	382.448	7.983	-7.689	1.01
167	382.269	7.983	-7.707	1.03
168	382.209	7.983	-7.713	1.03
169	382.269	7.983	-7.707	1.03
170	382.329	7.983	-7.701	1.02
171	382.329	7.983	-7.701	1.02
172	382.358	7.983	-7.698	1.02
173	382.299	7.983	-7.704	1.02
174	382.299	7.983	-7.704	1.02
175	382.299	7.983	-7.704	1.02
176	382.329	7.983	-7.701	1.02
177	382.239	7.983	-7.71	1.03
178	382.329	7.983	-7.701	1.02
179	382.358	7.983	-7.698	1.02

180	382.358	7.983	-7.698	1.02
181	382.299	7.983	-7.704	1.02
182	382.329	7.983	-7.701	1.02
183	382.329	7.983	-7.701	1.02
184	382.329	7.983	-7.701	1.02
185	382.299	7.983	-7.704	1.02
186	382.269	7.983	-7.707	1.03
187	382.299	7.983	-7.704	1.02
188	382.299	7.983	-7.704	1.02
189	382.269	7.983	-7.707	1.03
190	382.329	7.983	-7.701	1.02
191	382.269	7.983	-7.707	1.03
192	382.269	7.983	-7.707	1.03
193	382.209	7.983	-7.713	1.03
194	382.299	7.983	-7.704	1.02
195	382.239	7.983	-7.71	1.03
196	382.239	7.983	-7.71	1.03
197	382.239	7.983	-7.71	1.03
198	382.388	7.983	-7.695	1.02
199	382.239	7.983	-7.71	1.03
200	382.299	7.983	-7.704	1.02
201	382.209	7.983	-7.713	1.03
202	382.269	7.983	-7.707	1.03
203	382.239	7.983	-7.71	1.03
204	382.209	7.983	-7.713	1.03
205	382.269	7.983	-7.707	1.03
206	382.06	7.983	-7.729	1.05
207	382.09	7.983	-7.726	1.05
208	382.299	7.983	-7.704	1.02
209	382.179	7.983	-7.717	1.04
210	382.239	7.983	-7.71	1.03
211	382.179	7.983	-7.717	1.04
212	382.209	7.983	-7.713	1.03
213	382.06	7.983	-7.729	1.05
214	382.209	7.983	-7.713	1.03
215	382.12	7.983	-7.723	1.04
216	382.12	7.983	-7.723	1.04
217	382.12	7.983	-7.723	1.04
218	382.179	7.983	-7.717	1.04
219	382.179	7.983	-7.717	1.04
220	382.15	7.983	-7.719	1.04
221	382.15	7.983	-7.719	1.04
222	382.09	7.983	-7.726	1.05
223	382.09	7.983	-7.726	1.05
224	382.09	7.983	-7.726	1.05
225	382.06	7.983	-7.729	1.05
226	382.15	7.983	-7.719	1.04
227	382.06	7.983	-7.729	1.05
228	382.09	7.983	-7.726	1.05
229	382.03	7.983	-7.732	1.05
230	382.06	7.983	-7.729	1.05
231	382.03	7.983	-7.732	1.05
232	382.09	7.983	-7.726	1.05
233	382.09	7.983	-7.726	1.05
234	382	7.983	-7.735	1.06
235	382.06	7.983	-7.729	1.05
236	381.971	7.983	-7.738	1.06
237	381.941	7.983	-7.741	1.06
238	382	7.983	-7.735	1.06
239	382.179	7.983	-7.717	1.04
240	382.03	7.983	-7.732	1.05
241	382.06	7.983	-7.729	1.05
242	382.15	7.983	-7.719	1.04
243	382.09	7.983	-7.726	1.05
244	382.209	7.983	-7.713	1.03
245	382.12	7.983	-7.723	1.04
246	382.12	7.983	-7.723	1.04
247	382.09	7.983	-7.726	1.05
248	382.03	7.983	-7.732	1.05
249	382.03	7.983	-7.732	1.05
250	381.971	7.983	-7.738	1.06
251	382.03	7.983	-7.732	1.05
252	382	7.983	-7.735	1.06
253	381.971	7.983	-7.738	1.06
254	382.03	7.983	-7.732	1.05
255	382.209	7.983	-7.713	1.03
256	382	7.983	-7.735	1.06
257	382.09	7.983	-7.726	1.05
258	382.03	7.983	-7.732	1.05
259	382.03	7.983	-7.732	1.05
260	381.941	7.983	-7.741	1.06
261	382.06	7.983	-7.729	1.05
262	382.06	7.983	-7.729	1.05
263	382.06	7.983	-7.729	1.05
264	382.12	7.983	-7.723	1.04
265	382.06	7.983	-7.729	1.05
266	382.179	7.983	-7.717	1.04
267	382.06	7.983	-7.729	1.05
268	382.03	7.983	-7.732	1.05
269	382.09	7.983	-7.726	1.05
270	382.09	7.983	-7.726	1.05
271	382.179	7.983	-7.717	1.04
272	382.09	7.983	-7.726	1.05

273	382.12	7.983	-7.723	1.04
274	382.12	7.983	-7.723	1.04
275	382.12	7.983	-7.723	1.04
276	382.239	7.983	-7.71	1.03
277	382	7.983	-7.735	1.06
278	382.12	7.983	-7.723	1.04
279	382.15	7.983	-7.719	1.04
280	382	7.983	-7.735	1.06
281	382.12	7.983	-7.723	1.04
282	382.09	7.983	-7.726	1.05
283	382.15	7.983	-7.719	1.04
284	382.09	7.983	-7.726	1.05
285	382	7.983	-7.735	1.06
286	382.06	7.983	-7.729	1.05
287	382.03	7.983	-7.732	1.05
288	382	7.983	-7.735	1.06
289	382.179	7.983	-7.717	1.04
290	382.15	7.983	-7.719	1.04
291	382.12	7.983	-7.723	1.04
292	382.09	7.983	-7.726	1.05
293	382.09	7.983	-7.726	1.05
294	382.09	7.983	-7.726	1.05
295	382	7.983	-7.735	1.06
296	382.09	7.983	-7.726	1.05
297	381.941	7.983	-7.741	1.06
298	382.03	7.983	-7.732	1.05
299	382.12	7.983	-7.723	1.04
300	382.09	7.983	-7.726	1.05
301	382.06	7.983	-7.729	1.05
302	382.03	7.983	-7.732	1.05
303	382.06	7.983	-7.729	1.05
304	382	7.983	-7.735	1.06
305	382.03	7.983	-7.732	1.05
306	382.03	7.983	-7.732	1.05
307	382.06	7.983	-7.729	1.05
308	382.03	7.983	-7.732	1.05
309	382	7.983	-7.735	1.06
310	382.239	7.983	-7.71	1.03
311	381.941	7.983	-7.741	1.06
312	382.03	7.983	-7.732	1.05
313	381.971	7.983	-7.738	1.06
314	382.06	7.983	-7.729	1.05
315	382	7.983	-7.735	1.06
316	382.09	7.983	-7.726	1.05
317	381.941	7.983	-7.741	1.06
318	382.06	7.983	-7.729	1.05
319	381.971	7.983	-7.738	1.06
320	382.06	7.983	-7.729	1.05
321	381.911	7.983	-7.744	1.06
322	381.732	7.983	-7.762	1.08
323	381.881	7.983	-7.747	1.07
324	381.911	7.983	-7.744	1.06
325	381.971	7.983	-7.738	1.06
326	382.03	7.983	-7.732	1.05
327	382	7.983	-7.735	1.06
328	381.941	7.983	-7.741	1.06
329	382.12	7.983	-7.723	1.04
330	381.851	7.983	-7.75	1.07
331	381.971	7.983	-7.738	1.06
332	381.941	7.983	-7.741	1.06
333	381.971	7.983	-7.738	1.06
334	381.941	7.983	-7.741	1.06
335	381.941	7.983	-7.741	1.06
336	381.971	7.983	-7.738	1.06
337	382	7.983	-7.735	1.06
338	381.941	7.983	-7.741	1.06
339	382	7.983	-7.735	1.06
340	382	7.983	-7.735	1.06
341	382	7.983	-7.735	1.06
342	381.941	7.983	-7.741	1.06
343	382.12	7.983	-7.723	1.04
344	381.971	7.983	-7.738	1.06
345	382	7.983	-7.735	1.06
346	381.911	7.983	-7.744	1.06
347	381.971	7.983	-7.738	1.06
348	382.06	7.983	-7.729	1.05
349	382	7.983	-7.735	1.06
350	382	7.983	-7.735	1.06
351	381.941	7.983	-7.741	1.06
352	381.971	7.983	-7.738	1.06
353	381.971	7.983	-7.738	1.06
354	382.06	7.983	-7.729	1.05
355	381.971	7.983	-7.738	1.06
356	382.09	7.983	-7.726	1.05
357	381.971	7.983	-7.738	1.06
358	382.09	7.983	-7.726	1.05
359	381.971	7.983	-7.738	1.06
360	382.15	7.983	-7.719	1.04
361	382.06	7.983	-7.729	1.05
362	382	7.983	-7.735	1.06
363	381.941	7.983	-7.741	1.06
364	382.06	7.983	-7.729	1.05
365	382.179	7.983	-7.717	1.04

# TW2- WELL RECOVERY VS. TIME - KOLLAARD FILE 210064



**RECOVERY DATA TW-2**

t'	t / t'	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)	Recovery (%)
1	366.0	389.523	7.983	-6.968	0.29	73%
2	183.5	390.359	7.983	-6.882	0.20	81%
3	122.7	390.687	7.983	-6.849	0.17	84%
4	92.3	390.896	7.983	-6.828	0.15	86%
5	74.0	391.016	7.983	-6.815	0.14	87%
6	61.8	391.105	7.983	-6.806	0.13	88%
7	53.1	391.195	7.983	-6.797	0.12	89%
8	46.6	391.255	7.983	-6.791	0.11	90%
9	41.6	391.314	7.983	-6.785	0.11	90%
10	37.5	391.374	7.983	-6.779	0.10	91%
11	34.2	391.374	7.983	-6.779	0.10	91%
12	31.4	391.374	7.983	-6.779	0.10	91%
13	29.1	391.434	7.983	-6.773	0.09	91%
14	27.1	391.464	7.983	-6.77	0.09	91%
15	25.3	391.494	7.983	-6.767	0.09	92%
16	23.8	391.523	7.983	-6.764	0.08	92%
17	22.5	391.523	7.983	-6.764	0.08	92%
18	21.3	391.523	7.983	-6.764	0.08	92%
19	20.2	391.523	7.983	-6.764	0.08	92%
20	19.3	391.523	7.983	-6.764	0.08	92%
21	18.4	391.494	7.983	-6.767	0.09	92%
22	17.6	391.523	7.983	-6.764	0.08	92%
23	16.9	391.553	7.983	-6.761	0.08	92%
24	16.2	391.553	7.983	-6.761	0.08	92%
25	15.6	391.553	7.983	-6.761	0.08	92%
26	15.0	391.553	7.983	-6.761	0.08	92%
27	14.5	391.553	7.983	-6.761	0.08	92%
28	14.0	391.583	7.983	-6.758	0.08	93%
29	13.6	391.553	7.983	-6.761	0.08	92%
30	13.2	391.583	7.983	-6.758	0.08	93%
31	12.8	391.583	7.983	-6.758	0.08	93%
32	12.4	391.553	7.983	-6.761	0.08	92%
33	12.1	391.553	7.983	-6.761	0.08	92%
34	11.7	391.553	7.983	-6.761	0.08	92%
35	11.4	391.583	7.983	-6.758	0.08	93%
36	11.1	391.583	7.983	-6.758	0.08	93%
37	10.9	391.613	7.983	-6.755	0.08	93%
38	10.6	391.583	7.983	-6.758	0.08	93%
39	10.4	391.583	7.983	-6.758	0.08	93%
40	10.1	391.583	7.983	-6.758	0.08	93%
41	9.9	391.583	7.983	-6.758	0.08	93%
42	9.7	391.583	7.983	-6.758	0.08	93%
43	9.5	391.583	7.983	-6.758	0.08	93%
44	9.3	391.613	7.983	-6.755	0.08	93%
45	9.1	391.553	7.983	-6.761	0.08	92%
46	8.9	390.687	7.983	-6.849	0.17	84%
47	8.8	391.673	7.983	-6.748	0.07	94%
48	8.6	391.613	7.983	-6.755	0.08	93%
49	8.4	391.673	7.983	-6.748	0.07	94%
50	8.3	391.643	7.983	-6.751	0.07	93%
51	8.2	391.643	7.983	-6.751	0.07	93%
52	8.0	391.673	7.983	-6.748	0.07	94%
53	7.9	391.673	7.983	-6.748	0.07	94%
54	7.8	390.986	7.983	-6.818	0.14	87%
55	7.6	391.016	7.983	-6.815	0.14	87%
56	7.5	391.703	7.983	-6.745	0.07	94%
57	7.4	391.733	7.983	-6.742	0.06	94%
58	7.3	391.942	7.983	-6.721	0.04	96%

59	7.2	391.673	7.983	-6.748	0.07	94%
60	7.1	391.643	7.983	-6.751	0.07	93%
61	7.0	391.673	7.983	-6.748	0.07	94%
62	6.9	391.673	7.983	-6.748	0.07	94%
63	6.8	391.673	7.983	-6.748	0.07	94%
64	6.7	391.703	7.983	-6.745	0.07	94%
65	6.6	391.74	8.082	-6.742	0.06	94%
66	6.5	391.74	8.082	-6.742	0.06	94%
67	6.4	391.74	8.082	-6.742	0.06	94%
68	6.4	391.77	8.082	-6.739	0.06	94%
69	6.3	391.77	8.082	-6.739	0.06	94%
70	6.2	391.77	8.082	-6.739	0.06	94%
71	6.1	391.77	8.082	-6.739	0.06	94%
72	6.1	391.799	8.082	-6.736	0.06	95%
73	6.0	391.77	8.082	-6.739	0.06	94%
74	5.9	391.77	8.082	-6.739	0.06	94%
75	5.9	391.799	8.082	-6.736	0.06	95%
76	5.8	391.799	8.082	-6.736	0.06	95%
77	5.7	391.799	8.082	-6.736	0.06	95%
78	5.7	391.799	8.082	-6.736	0.06	95%
79	5.6	391.829	8.082	-6.733	0.05	95%
80	5.6	391.859	8.082	-6.729	0.05	95%
81	5.5	391.859	8.082	-6.729	0.05	95%
82	5.5	391.859	8.082	-6.729	0.05	95%
83	5.4	391.859	8.082	-6.729	0.05	95%
84	5.3	391.829	8.082	-6.733	0.05	95%
85	5.3	391.829	8.082	-6.733	0.05	95%
86	5.2	391.829	8.082	-6.733	0.05	95%
87	5.2	391.829	8.082	-6.733	0.05	95%
88	5.1	391.829	8.082	-6.733	0.05	95%
89	5.1	391.829	8.082	-6.733	0.05	95%
90	5.1	391.829	8.082	-6.733	0.05	95%
91	5.0	391.829	8.082	-6.733	0.05	95%
92	5.0	391.859	8.082	-6.729	0.05	95%
93	4.9	391.859	8.082	-6.729	0.05	95%
94	4.9	391.889	8.082	-6.726	0.05	96%
95	4.8	391.859	8.082	-6.729	0.05	95%
96	4.8	391.859	8.082	-6.729	0.05	95%
97	4.8	391.859	8.082	-6.729	0.05	95%
98	4.7	391.859	8.082	-6.729	0.05	95%
99	4.7	391.859	8.082	-6.729	0.05	95%
100	4.7	391.889	8.082	-6.726	0.05	96%
101	4.6	391.889	8.082	-6.726	0.05	96%
102	4.6	391.889	8.082	-6.726	0.05	96%
103	4.5	391.919	8.082	-6.723	0.04	96%
104	4.5	391.919	8.082	-6.723	0.04	96%
105	4.5	391.919	8.082	-6.723	0.04	96%
106	4.4	391.919	8.082	-6.723	0.04	96%
107	4.4	391.889	8.082	-6.726	0.05	96%
108	4.4	391.919	8.082	-6.723	0.04	96%
109	4.3	391.949	8.082	-6.72	0.04	96%
110	4.3	391.949	8.082	-6.72	0.04	96%
111	4.3	391.979	8.082	-6.717	0.04	97%
112	4.3	391.979	8.082	-6.717	0.04	97%
113	4.2	391.979	8.082	-6.717	0.04	97%
114	4.2	392.008	8.082	-6.714	0.03	97%
115	4.2	391.979	8.082	-6.717	0.04	97%
116	4.1	391.979	8.082	-6.717	0.04	97%
117	4.1	391.979	8.082	-6.717	0.04	97%
118	4.1	391.979	8.082	-6.717	0.04	97%
119	4.1	391.979	8.082	-6.717	0.04	97%
120	4.0	392.008	8.082	-6.714	0.03	97%

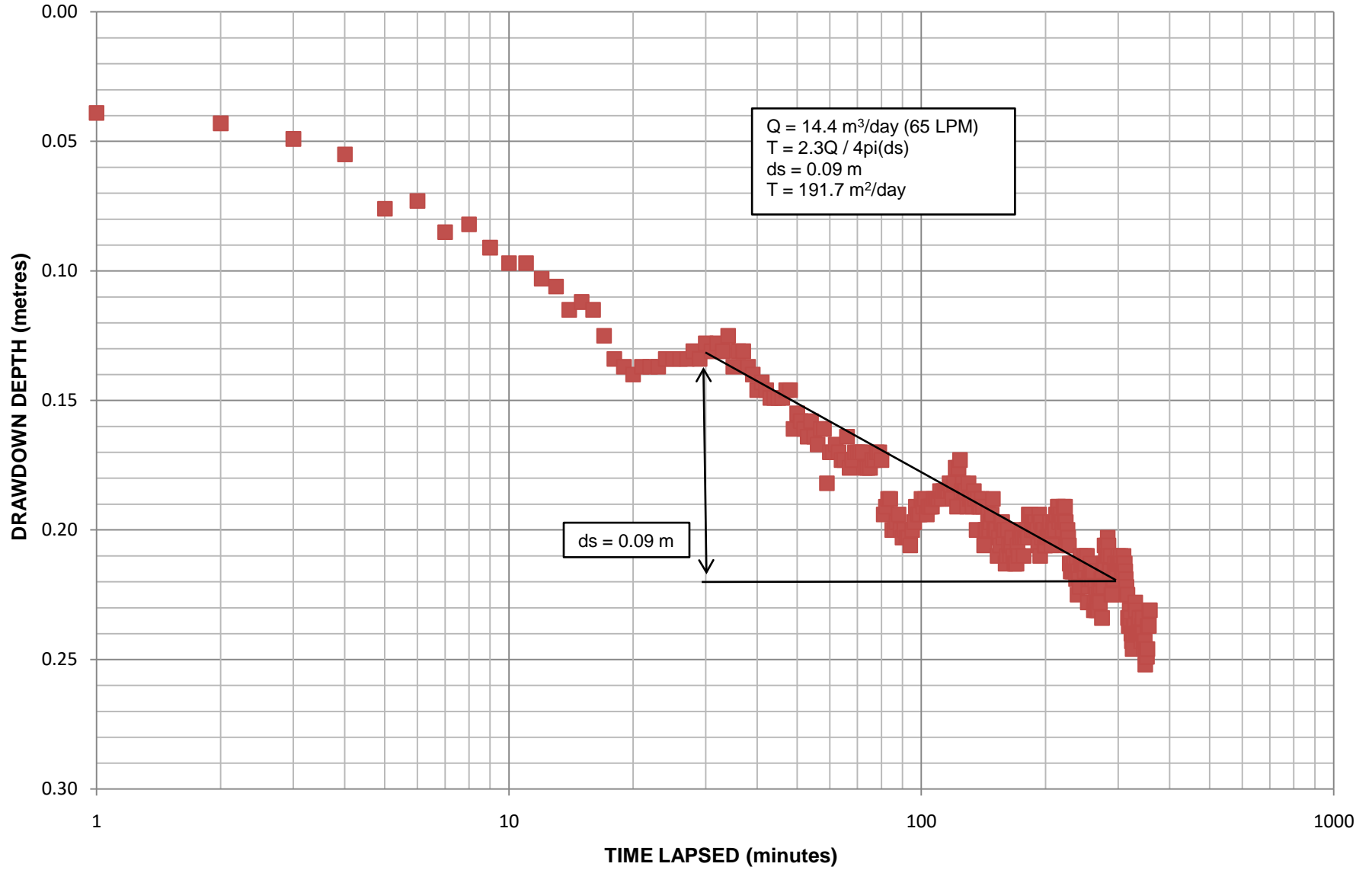




ATTACHMENT J

PUMPING TEST DATA FOR TW3

# TW3-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 210064



**DRAWDOWN DATA TW3**

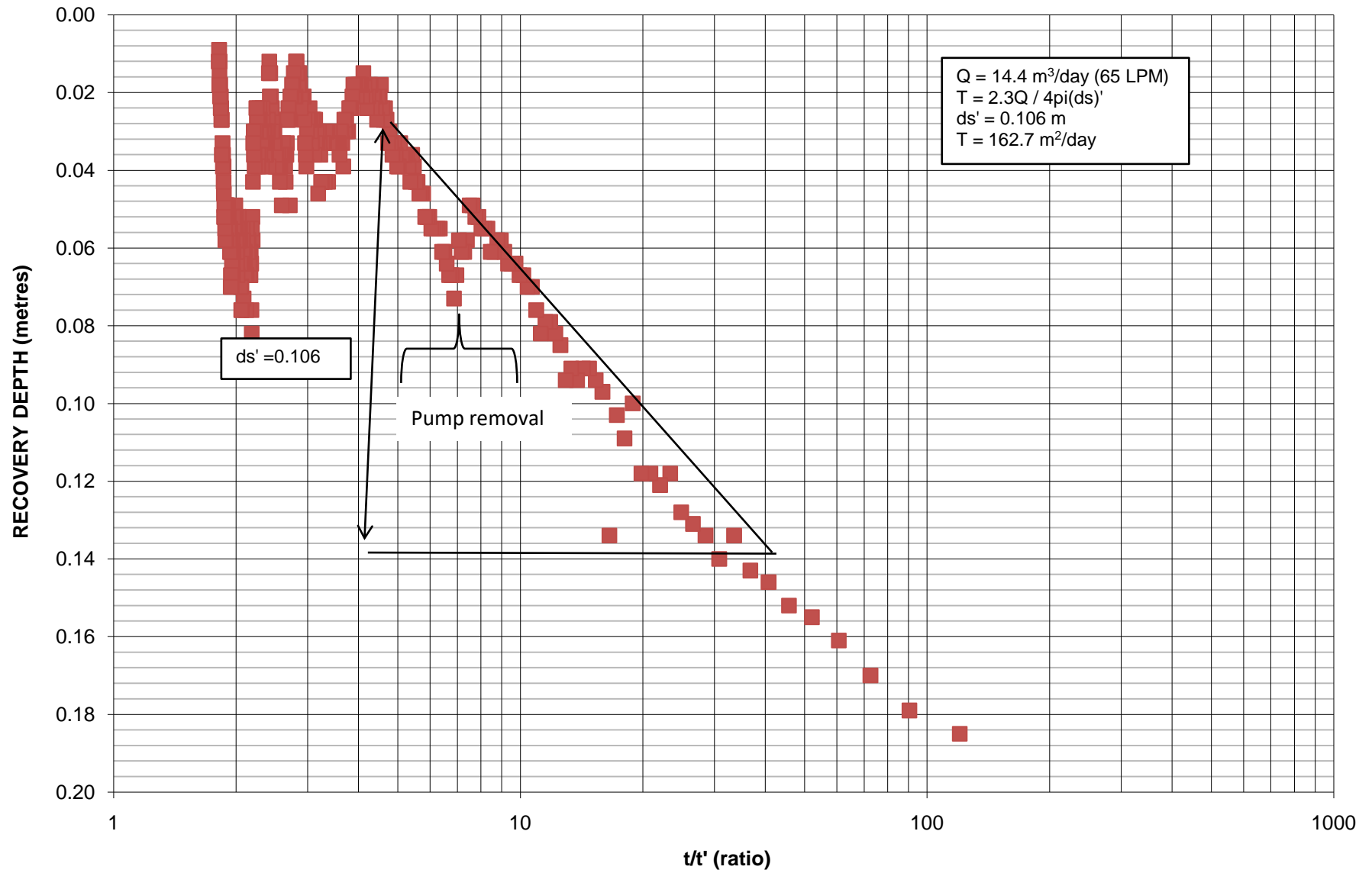
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	359.25	7.983	-4.53	0.00
1	358.863	7.983	-4.569	0.04
2	358.833	7.983	-4.573	0.04
3	358.774	7.983	-4.579	0.05
4	358.714	7.983	-4.585	0.05
5	358.506	7.983	-4.606	0.08
6	358.535	7.983	-4.603	0.07
7	358.416	7.983	-4.615	0.09
8	358.446	7.983	-4.612	0.08
9	358.357	7.983	-4.621	0.09
10	358.297	7.983	-4.627	0.10
11	358.297	7.983	-4.627	0.10
12	358.238	7.983	-4.633	0.10
13	358.208	7.983	-4.636	0.11
14	358.118	7.983	-4.645	0.11
15	358.148	7.983	-4.642	0.11
16	358.118	7.983	-4.645	0.11
17	358.029	7.983	-4.655	0.13
18	357.94	7.983	-4.664	0.13
19	357.91	7.983	-4.667	0.14
20	357.88	7.983	-4.67	0.14
21	357.91	7.983	-4.667	0.14
22	357.91	7.983	-4.667	0.14
23	357.91	7.983	-4.667	0.14
24	357.94	7.983	-4.664	0.13
25	357.94	7.983	-4.664	0.13
26	357.94	7.983	-4.664	0.13
27	357.94	7.983	-4.664	0.13
28	357.969	7.983	-4.661	0.13
29	357.94	7.983	-4.664	0.13
30	357.999	7.983	-4.658	0.13
31	357.969	7.983	-4.661	0.13
32	357.999	7.983	-4.658	0.13
33	357.969	7.983	-4.661	0.13
34	358.029	7.983	-4.655	0.13
35	357.91	7.983	-4.667	0.14
36	357.969	7.983	-4.661	0.13
37	357.969	7.983	-4.661	0.13
38	357.91	7.983	-4.667	0.14
39	357.88	7.983	-4.67	0.14
40	357.82	7.983	-4.676	0.15
41	357.85	7.983	-4.673	0.14
42	357.82	7.983	-4.676	0.15
43	357.791	7.983	-4.679	0.15
44	357.791	7.983	-4.679	0.15
45	357.791	7.983	-4.679	0.15
46	357.791	7.983	-4.679	0.15
47	357.82	7.983	-4.676	0.15
48	357.82	7.983	-4.676	0.15
49	357.672	7.983	-4.691	0.16
50	357.731	7.983	-4.685	0.15
51	357.701	7.983	-4.688	0.16
52	357.672	7.983	-4.691	0.16
53	357.642	7.983	-4.694	0.16
54	357.701	7.983	-4.688	0.16
55	357.642	7.983	-4.694	0.16
56	357.612	7.983	-4.697	0.17
57	357.672	7.983	-4.691	0.16
58	357.672	7.983	-4.691	0.16
59	357.463	7.983	-4.712	0.18
60	357.582	7.983	-4.7	0.17
61	357.582	7.983	-4.7	0.17
62	357.612	7.983	-4.697	0.17
63	357.582	7.983	-4.7	0.17
64	357.552	7.983	-4.703	0.17
65	357.552	7.983	-4.703	0.17
66	357.642	7.983	-4.694	0.16
67	357.523	7.983	-4.706	0.18
68	357.552	7.983	-4.703	0.17
69	357.582	7.983	-4.7	0.17
70	357.582	7.983	-4.7	0.17
71	357.582	7.983	-4.7	0.17
72	357.582	7.983	-4.7	0.17
73	357.523	7.983	-4.706	0.18
74	357.523	7.983	-4.706	0.18
75	357.523	7.983	-4.706	0.18
76	357.552	7.983	-4.703	0.17
77	357.552	7.983	-4.703	0.17
78	357.582	7.983	-4.7	0.17
79	357.582	7.983	-4.7	0.17
80	357.552	7.983	-4.703	0.17
81	357.344	7.983	-4.724	0.19
82	357.374	7.983	-4.721	0.19
83	357.403	7.983	-4.718	0.19
84	357.403	7.983	-4.718	0.19
85	357.284	7.983	-4.73	0.20

86	357.284	7.983	-4.73	0.20
87	357.314	7.983	-4.727	0.20
88	357.344	7.983	-4.724	0.19
89	357.284	7.983	-4.73	0.20
90	357.255	7.983	-4.733	0.20
91	357.284	7.983	-4.73	0.20
92	357.255	7.983	-4.733	0.20
93	357.255	7.983	-4.733	0.20
94	357.225	7.983	-4.736	0.21
95	357.284	7.983	-4.73	0.20
96	357.314	7.983	-4.727	0.20
97	357.374	7.983	-4.721	0.19
98	357.344	7.983	-4.724	0.19
99	357.344	7.983	-4.724	0.19
100	357.403	7.983	-4.718	0.19
101	357.374	7.983	-4.721	0.19
102	357.403	7.983	-4.718	0.19
103	357.344	7.983	-4.724	0.19
104	357.374	7.983	-4.721	0.19
105	357.374	7.983	-4.721	0.19
106	357.374	7.983	-4.721	0.19
107	357.403	7.983	-4.718	0.19
108	357.403	7.983	-4.718	0.19
109	357.403	7.983	-4.718	0.19
110	357.403	7.983	-4.718	0.19
111	357.433	7.983	-4.715	0.19
112	357.403	7.983	-4.718	0.19
113	357.433	7.983	-4.715	0.19
114	357.433	7.983	-4.715	0.19
115	357.433	7.983	-4.715	0.19
116	357.433	7.983	-4.715	0.19
117	357.463	7.983	-4.712	0.18
118	357.433	7.983	-4.715	0.19
119	357.403	7.983	-4.718	0.19
120	357.463	7.983	-4.712	0.18
121	357.523	7.983	-4.706	0.18
122	357.374	7.983	-4.721	0.19
123	357.523	7.983	-4.706	0.18
124	357.552	7.983	-4.703	0.17
125	357.433	7.983	-4.715	0.19
126	357.463	7.983	-4.712	0.18
127	357.433	7.983	-4.715	0.19
128	357.433	7.983	-4.715	0.19
129	357.374	7.983	-4.721	0.19
130	357.463	7.983	-4.712	0.18
131	357.403	7.983	-4.718	0.19
132	357.403	7.983	-4.718	0.19
133	357.374	7.983	-4.721	0.19
134	357.433	7.983	-4.715	0.19
135	357.403	7.983	-4.718	0.19
136	357.284	7.983	-4.73	0.20
137	357.403	7.983	-4.718	0.19
138	357.374	7.983	-4.721	0.19
139	357.374	7.983	-4.721	0.19
140	357.403	7.983	-4.718	0.19
141	357.374	7.983	-4.721	0.19
142	357.225	7.983	-4.736	0.21
143	357.284	7.983	-4.73	0.20
144	357.284	7.983	-4.73	0.20
145	357.344	7.983	-4.724	0.19
146	357.284	7.983	-4.73	0.20
147	357.314	7.983	-4.727	0.20
148	357.344	7.983	-4.724	0.19
149	357.403	7.983	-4.718	0.19
150	357.284	7.983	-4.73	0.20
151	357.284	7.983	-4.73	0.20
152	357.284	7.983	-4.73	0.20
153	357.195	7.983	-4.74	0.21
154	357.255	7.983	-4.733	0.20
155	357.225	7.983	-4.736	0.21
156	357.314	7.983	-4.727	0.20
157	357.314	7.983	-4.727	0.20
158	357.255	7.983	-4.733	0.20
159	357.284	7.983	-4.73	0.20
160	357.165	7.983	-4.743	0.21
161	357.195	7.983	-4.74	0.21
162	357.284	7.983	-4.73	0.20
163	357.225	7.983	-4.736	0.21
164	357.195	7.983	-4.74	0.21
165	357.225	7.983	-4.736	0.21
166	357.255	7.983	-4.733	0.20
167	357.195	7.983	-4.74	0.21
168	357.165	7.983	-4.743	0.21
169	357.165	7.983	-4.743	0.21
170	357.165	7.983	-4.743	0.21
171	357.225	7.983	-4.736	0.21
172	357.195	7.983	-4.74	0.21
173	357.255	7.983	-4.733	0.20
174	357.255	7.983	-4.733	0.20
175	357.284	7.983	-4.73	0.20
176	357.255	7.983	-4.733	0.20

177	357.195	7.983	-4.74	0.21
178	357.255	7.983	-4.733	0.20
179	357.255	7.983	-4.733	0.20
180	357.284	7.983	-4.73	0.20
181	357.255	7.983	-4.733	0.20
182	357.344	7.983	-4.724	0.19
183	357.344	7.983	-4.724	0.19
184	357.344	7.983	-4.724	0.19
185	357.284	7.983	-4.73	0.20
186	357.314	7.983	-4.727	0.20
187	357.284	7.983	-4.73	0.20
188	357.314	7.983	-4.727	0.20
189	357.314	7.983	-4.727	0.20
190	357.284	7.983	-4.73	0.20
191	357.284	7.983	-4.73	0.20
192	357.225	7.983	-4.736	0.21
193	357.344	7.983	-4.724	0.19
194	357.195	7.983	-4.74	0.21
195	357.314	7.983	-4.727	0.20
196	357.255	7.983	-4.733	0.20
197	357.284	7.983	-4.73	0.20
198	357.284	7.983	-4.73	0.20
199	357.225	7.983	-4.736	0.21
200	357.225	7.983	-4.736	0.21
201	357.255	7.983	-4.733	0.20
202	357.255	7.983	-4.733	0.20
203	357.284	7.983	-4.73	0.20
204	357.255	7.983	-4.733	0.20
205	357.314	7.983	-4.727	0.20
206	357.255	7.983	-4.733	0.20
207	357.225	7.983	-4.736	0.21
208	357.284	7.983	-4.73	0.20
209	357.314	7.983	-4.727	0.20
210	357.314	7.983	-4.727	0.20
211	357.284	7.983	-4.73	0.20
212	357.344	7.983	-4.724	0.19
213	357.344	7.983	-4.724	0.19
214	357.374	7.983	-4.721	0.19
215	357.374	7.983	-4.721	0.19
216	357.314	7.983	-4.727	0.20
217	357.344	7.983	-4.724	0.19
218	357.344	7.983	-4.724	0.19
219	357.314	7.983	-4.727	0.20
220	357.284	7.983	-4.73	0.20
221	357.374	7.983	-4.721	0.19
222	357.314	7.983	-4.727	0.20
223	357.374	7.983	-4.721	0.19
224	357.314	7.983	-4.727	0.20
225	357.225	7.983	-4.736	0.21
226	357.284	7.983	-4.73	0.20
227	357.255	7.983	-4.733	0.20
228	357.225	7.983	-4.736	0.21
229	357.165	7.983	-4.743	0.21
230	357.135	7.983	-4.746	0.22
231	357.165	7.983	-4.743	0.21
232	357.135	7.983	-4.746	0.22
233	357.135	7.983	-4.746	0.22
234	357.165	7.983	-4.743	0.21
235	357.165	7.983	-4.743	0.21
236	357.135	7.983	-4.746	0.22
237	357.106	7.983	-4.749	0.22
238	357.165	7.983	-4.743	0.21
239	357.046	7.983	-4.755	0.23
240	357.135	7.983	-4.746	0.22
241	357.106	7.983	-4.749	0.22
242	357.076	7.983	-4.752	0.22
243	357.195	7.983	-4.74	0.21
244	357.165	7.983	-4.743	0.21
245	357.165	7.983	-4.743	0.21
246	357.165	7.983	-4.743	0.21
247	357.165	7.983	-4.743	0.21
248	357.195	7.983	-4.74	0.21
249	357.135	7.983	-4.746	0.22
250	357.165	7.983	-4.743	0.21
251	357.195	7.983	-4.74	0.21
252	357.195	7.983	-4.74	0.21
253	357.016	7.983	-4.758	0.23
254	357.076	7.983	-4.752	0.22
255	357.106	7.983	-4.749	0.22
256	357.106	7.983	-4.749	0.22
257	357.165	7.983	-4.743	0.21
258	357.135	7.983	-4.746	0.22
259	357.106	7.983	-4.749	0.22
260	357.106	7.983	-4.749	0.22
261	357.135	7.983	-4.746	0.22
262	356.986	7.983	-4.761	0.23
263	357.016	7.983	-4.758	0.23
264	357.076	7.983	-4.752	0.22
265	356.986	7.983	-4.761	0.23
266	357.046	7.983	-4.755	0.23
267	357.016	7.983	-4.758	0.23

268	356.986	7.983	-4.761	0.23
269	357.046	7.983	-4.755	0.23
270	357.076	7.983	-4.752	0.22
271	357.016	7.983	-4.758	0.23
272	357.076	7.983	-4.752	0.22
273	357.106	7.983	-4.749	0.22
274	356.957	7.983	-4.764	0.23
275	357.135	7.983	-4.746	0.22
276	357.076	7.983	-4.752	0.22
277	357.165	7.983	-4.743	0.21
278	357.225	7.983	-4.736	0.21
279	357.165	7.983	-4.743	0.21
280	357.195	7.983	-4.74	0.21
281	357.225	7.983	-4.736	0.21
282	357.195	7.983	-4.74	0.21
283	357.255	7.983	-4.733	0.20
284	357.225	7.983	-4.736	0.21
285	357.195	7.983	-4.74	0.21
286	357.135	7.983	-4.746	0.22
287	357.135	7.983	-4.746	0.22
288	357.195	7.983	-4.74	0.21
289	357.046	7.983	-4.755	0.23
290	357.046	7.983	-4.755	0.23
291	357.106	7.983	-4.749	0.22
292	357.106	7.983	-4.749	0.22
293	357.106	7.983	-4.749	0.22
294	357.135	7.983	-4.746	0.22
295	357.165	7.983	-4.743	0.21
296	357.135	7.983	-4.746	0.22
297	357.135	7.983	-4.746	0.22
298	357.135	7.983	-4.746	0.22
299	357.165	7.983	-4.743	0.21
300	357.195	7.983	-4.74	0.21
301	357.165	7.983	-4.743	0.21
302	357.165	7.983	-4.743	0.21
303	357.165	7.983	-4.743	0.21
304	357.195	7.983	-4.74	0.21
305	357.165	7.983	-4.743	0.21
306	357.135	7.983	-4.746	0.22
307	357.135	7.983	-4.746	0.22
308	357.135	7.983	-4.746	0.22
309	357.195	7.983	-4.74	0.21
310	357.165	7.983	-4.743	0.21
311	357.165	7.983	-4.743	0.21
312	357.135	7.983	-4.746	0.22
313	357.106	7.983	-4.749	0.22
314	357.076	7.983	-4.752	0.22
315	357.046	7.983	-4.755	0.23
316	357.046	7.983	-4.755	0.23
317	356.957	7.983	-4.764	0.23
318	356.927	7.983	-4.767	0.24
319	356.927	7.983	-4.767	0.24
320	356.986	7.983	-4.761	0.23
321	356.957	7.983	-4.764	0.23
322	356.927	7.983	-4.767	0.24
323	356.897	7.983	-4.77	0.24
324	356.867	7.983	-4.773	0.24
325	356.838	7.983	-4.776	0.25
326	356.897	7.983	-4.77	0.24
327	356.927	7.983	-4.767	0.24
328	356.897	7.983	-4.77	0.24
329	356.927	7.983	-4.767	0.24
330	357.016	7.983	-4.758	0.23
331	356.986	7.983	-4.761	0.23
332	356.897	7.983	-4.77	0.24
333	356.897	7.983	-4.77	0.24
334	356.897	7.983	-4.77	0.24
335	356.897	7.983	-4.77	0.24
336	356.927	7.983	-4.767	0.24
337	356.897	7.983	-4.77	0.24
338	356.957	7.983	-4.764	0.23
339	356.897	7.983	-4.77	0.24
340	356.897	7.983	-4.77	0.24
341	356.867	7.983	-4.773	0.24
342	356.897	7.983	-4.77	0.24
343	356.927	7.983	-4.767	0.24
344	356.957	7.983	-4.764	0.23
345	356.897	7.983	-4.77	0.24
346	356.838	7.983	-4.776	0.25
347	356.867	7.983	-4.773	0.24
348	356.867	7.983	-4.773	0.24
349	356.778	7.983	-4.782	0.25
350	356.808	7.983	-4.779	0.25
351	356.838	7.983	-4.776	0.25
352	356.808	7.983	-4.779	0.25
353	356.838	7.983	-4.776	0.25
354	356.927	7.983	-4.767	0.24
355	356.927	7.983	-4.767	0.24
356	356.927	7.983	-4.767	0.24
357	356.986	7.983	-4.761	0.23
358	356.986	7.983	-4.761	0.23

# TW3- WELL RECOVERY VS. TIME - KOLLAARD FILE 210064



**RECOVERY DATA TW-3**

<b>t'</b>	<b>t / t'</b>	<b>Abs Pres (kPa)</b>	<b>Temp (°C)</b>	<b>Water Level (m)</b>	<b>Drawdown (m)</b>	<b>Recovery (%)</b>
1	359.0	357.195	7.983	-4.74	95.24	
2	180.0	357.344	7.983	-4.724	95.22	
3	120.3	357.433	7.983	-4.715	0.19	12%
4	90.5	357.493	7.983	-4.709	0.18	15%
5	72.6	357.582	7.983	-4.7	0.17	19%
6	60.7	357.672	7.983	-4.691	0.16	23%
7	52.1	357.731	7.983	-4.685	0.15	26%
8	45.8	357.761	7.983	-4.682	0.15	28%
9	40.8	357.82	7.983	-4.676	0.15	30%
10	36.8	357.85	7.983	-4.673	0.14	32%
11	33.5	357.94	7.983	-4.664	0.13	36%
12	30.8	357.88	7.983	-4.67	0.14	33%
13	28.5	357.94	7.983	-4.664	0.13	36%
14	26.6	357.969	7.983	-4.661	0.13	38%
15	24.9	357.999	7.983	-4.658	0.13	39%
16	23.4	358.089	7.983	-4.648	0.12	44%
17	22.1	358.059	7.983	-4.651	0.12	42%
18	20.9	358.089	7.983	-4.648	0.12	44%
19	19.8	358.089	7.983	-4.648	0.12	44%
20	18.9	358.267	7.983	-4.63	0.10	52%
21	18.0	358.178	7.983	-4.639	0.11	48%
22	17.3	358.238	7.983	-4.633	0.10	51%
23	16.6	357.94	7.983	-4.664	0.13	36%
24	15.9	358.297	7.983	-4.627	0.10	54%
25	15.3	358.327	7.983	-4.624	0.09	55%
26	14.8	358.357	7.983	-4.621	0.09	57%
27	14.3	358.357	7.983	-4.621	0.09	57%
28	13.8	358.327	7.983	-4.624	0.09	55%
29	13.3	358.357	7.983	-4.621	0.09	57%
30	12.9	358.327	7.983	-4.624	0.09	55%
31	12.5	358.416	7.983	-4.615	0.09	60%
32	12.2	358.446	7.983	-4.612	0.08	61%
33	11.8	358.476	7.983	-4.609	0.08	62%
34	11.5	358.476	7.983	-4.609	0.08	62%
35	11.2	358.446	7.983	-4.612	0.08	61%
36	10.9	358.506	7.983	-4.606	0.08	64%
37	10.7	358.565	7.983	-4.6	0.07	67%
38	10.4	358.565	7.983	-4.6	0.07	67%
39	10.2	358.595	7.983	-4.597	0.07	68%
40	10.0	358.595	7.983	-4.597	0.07	68%
41	9.7	358.625	7.983	-4.594	0.06	70%
42	9.5	358.625	7.983	-4.594	0.06	70%
43	9.3	358.625	7.983	-4.594	0.06	70%
44	9.1	358.655	7.983	-4.591	0.06	71%
45	9.0	358.684	7.983	-4.588	0.06	72%
46	8.8	358.684	7.983	-4.588	0.06	72%



47	8.6	358.655	7.983	-4.591	0.06	71%
48	8.5	358.655	7.983	-4.591	0.06	71%
49	8.3	358.714	7.983	-4.585	0.05	74%
50	8.2	358.714	7.983	-4.585	0.05	74%
51	8.0	358.714	7.983	-4.585	0.05	74%
52	7.9	358.744	7.983	-4.582	0.05	75%
53	7.8	358.744	7.983	-4.582	0.05	75%
54	7.6	358.774	7.983	-4.579	0.05	77%
55	7.5	358.774	7.983	-4.579	0.05	77%
56	7.4	358.684	7.983	-4.588	0.06	72%
57	7.3	358.655	7.983	-4.591	0.06	71%
58	7.2	358.655	7.983	-4.591	0.06	71%
59	7.1	358.684	7.983	-4.588	0.06	72%
60	7.0	358.595	7.983	-4.597	0.07	68%
61	6.9	358.535	7.983	-4.603	0.07	65%
62	6.8	358.595	7.983	-4.597	0.07	68%
63	6.7	358.595	7.983	-4.597	0.07	68%
64	6.6	358.625	7.983	-4.594	0.06	70%
65	6.5	358.655	7.983	-4.591	0.06	71%
66	6.4	358.655	7.983	-4.591	0.06	71%
67	6.3	358.714	7.983	-4.585	0.05	74%
68	6.3	358.714	7.983	-4.585	0.05	74%
69	6.2	358.714	7.983	-4.585	0.05	74%
70	6.1	358.714	7.983	-4.585	0.05	74%
71	6.0	358.714	7.983	-4.585	0.05	74%
72	6.0	358.744	7.983	-4.582	0.05	75%
73	5.9	358.744	7.983	-4.582	0.05	75%
74	5.8	358.744	7.983	-4.582	0.05	75%
75	5.8	358.803	7.983	-4.576	0.05	78%
76	5.7	358.803	7.983	-4.576	0.05	78%
77	5.6	358.803	7.983	-4.576	0.05	78%
78	5.6	358.833	7.983	-4.573	0.04	80%
79	5.5	358.833	7.983	-4.573	0.04	80%
80	5.5	358.863	7.983	-4.569	0.04	81%
81	5.4	358.893	7.983	-4.566	0.04	83%
82	5.4	358.833	7.983	-4.573	0.04	80%
83	5.3	358.863	7.983	-4.569	0.04	81%
84	5.3	358.893	7.983	-4.566	0.04	83%
85	5.2	358.893	7.983	-4.566	0.04	83%
86	5.2	358.893	7.983	-4.566	0.04	83%
87	5.1	358.893	7.983	-4.566	0.04	83%
88	5.1	358.923	7.983	-4.563	0.03	84%
89	5.0	358.863	7.983	-4.569	0.04	81%
90	5.0	358.863	7.983	-4.569	0.04	81%
91	4.9	358.893	7.983	-4.566	0.04	83%
92	4.9	358.923	7.983	-4.563	0.03	84%
93	4.8	358.893	7.983	-4.566	0.04	83%
94	4.8	358.923	7.983	-4.563	0.03	84%
95	4.8	358.952	7.983	-4.56	0.03	86%
96	4.7	358.923	7.983	-4.563	0.03	84%

97	4.7	358.982	7.983	-4.557	0.03	87%
98	4.7	359.012	7.983	-4.554	0.02	89%
99	4.6	358.982	7.983	-4.557	0.03	87%
100	4.6	359.012	7.983	-4.554	0.02	89%
101	4.5	359.072	7.983	-4.548	0.02	91%
102	4.5	359.042	7.983	-4.551	0.02	90%
103	4.5	359.042	7.983	-4.551	0.02	90%
104	4.4	358.982	7.983	-4.557	0.03	87%
105	4.4	359.012	7.983	-4.554	0.02	89%
106	4.4	359.042	7.983	-4.551	0.02	90%
107	4.3	359.042	7.983	-4.551	0.02	90%
108	4.3	359.012	7.983	-4.554	0.02	89%
109	4.3	359.072	7.983	-4.548	0.02	91%
110	4.3	359.072	7.983	-4.548	0.02	91%
111	4.2	359.042	7.983	-4.551	0.02	90%
112	4.2	359.012	7.983	-4.554	0.02	89%
113	4.2	359.042	7.983	-4.551	0.02	90%
114	4.1	359.072	7.983	-4.548	0.02	91%
115	4.1	359.101	7.983	-4.545	0.01	93%
116	4.1	359.042	7.983	-4.551	0.02	90%
117	4.1	359.072	7.983	-4.548	0.02	91%
118	4.0	359.072	7.983	-4.548	0.02	91%
119	4.0	359.072	7.983	-4.548	0.02	91%
120	4.0	359.072	7.983	-4.548	0.02	91%
121	4.0	359.042	7.983	-4.551	0.02	90%
122	3.9	359.072	7.983	-4.548	0.02	91%
123	3.9	359.072	7.983	-4.548	0.02	91%
124	3.9	359.072	7.983	-4.548	0.02	91%
125	3.9	359.042	7.983	-4.551	0.02	90%
126	3.8	359.012	7.983	-4.554	0.02	89%
127	3.8	359.012	7.983	-4.554	0.02	89%
128	3.8	359.012	7.983	-4.554	0.02	89%
129	3.8	358.952	7.983	-4.56	0.03	86%
130	3.8	358.952	7.983	-4.56	0.03	86%
131	3.7	358.982	7.983	-4.557	0.03	87%
132	3.7	358.952	7.983	-4.56	0.03	86%
133	3.7	358.982	7.983	-4.557	0.03	87%
134	3.7	358.863	7.983	-4.569	0.04	81%
135	3.7	358.923	7.983	-4.563	0.03	84%
136	3.6	358.952	7.983	-4.56	0.03	86%
137	3.6	358.952	7.983	-4.56	0.03	86%
138	3.6	358.893	7.983	-4.566	0.04	83%
139	3.6	358.923	7.983	-4.563	0.03	84%
140	3.6	358.923	7.983	-4.563	0.03	84%
141	3.5	358.923	7.983	-4.563	0.03	84%
142	3.5	358.923	7.983	-4.563	0.03	84%
143	3.5	358.923	7.983	-4.563	0.03	84%
144	3.5	358.923	7.983	-4.563	0.03	84%
145	3.5	358.923	7.983	-4.563	0.03	84%
146	3.5	358.923	7.983	-4.563	0.03	84%

147	3.4	358.923	7.983	-4.563	0.03	84%
148	3.4	358.923	7.983	-4.563	0.03	84%
149	3.4	358.952	7.983	-4.56	0.03	86%
150	3.4	358.923	7.983	-4.563	0.03	84%
151	3.4	358.833	7.983	-4.573	0.04	80%
152	3.4	358.952	7.983	-4.56	0.03	86%
153	3.3	358.952	7.983	-4.56	0.03	86%
154	3.3	358.952	7.983	-4.56	0.03	86%
155	3.3	358.833	7.983	-4.573	0.04	80%
156	3.3	358.923	7.983	-4.563	0.03	84%
157	3.3	358.923	7.983	-4.563	0.03	84%
158	3.3	358.923	7.983	-4.563	0.03	84%
159	3.3	358.833	7.983	-4.573	0.04	80%
160	3.2	358.833	7.983	-4.573	0.04	80%
161	3.2	358.893	7.983	-4.566	0.04	83%
162	3.2	358.923	7.983	-4.563	0.03	84%
163	3.2	358.952	7.983	-4.56	0.03	86%
164	3.2	358.803	7.983	-4.576	0.05	78%
165	3.2	358.923	7.983	-4.563	0.03	84%
166	3.2	358.952	7.983	-4.56	0.03	86%
167	3.1	358.923	7.983	-4.563	0.03	84%
168	3.1	358.982	7.983	-4.557	0.03	87%
169	3.1	358.893	7.983	-4.566	0.04	83%
170	3.1	358.982	7.983	-4.557	0.03	87%
171	3.1	358.982	7.983	-4.557	0.03	87%
172	3.1	358.982	7.983	-4.557	0.03	87%
173	3.1	358.923	7.983	-4.563	0.03	84%
174	3.1	358.952	7.983	-4.56	0.03	86%
175	3.0	358.982	7.983	-4.557	0.03	87%
176	3.0	359.012	7.983	-4.554	0.02	89%
177	3.0	358.982	7.983	-4.557	0.03	87%
178	3.0	358.982	7.983	-4.557	0.03	87%
179	3.0	358.982	7.983	-4.557	0.03	87%
180	3.0	358.952	7.983	-4.56	0.03	86%
181	3.0	358.863	7.983	-4.569	0.04	81%
182	3.0	358.893	7.983	-4.566	0.04	83%
183	3.0	358.923	7.983	-4.563	0.03	84%
184	2.9	358.982	7.983	-4.557	0.03	87%
185	2.9	359.042	7.983	-4.551	0.02	90%
186	2.9	359.042	7.983	-4.551	0.02	90%
187	2.9	359.042	7.983	-4.551	0.02	90%
188	2.9	359.042	7.983	-4.551	0.02	90%
189	2.9	359.042	7.983	-4.551	0.02	90%
190	2.9	359.012	7.983	-4.554	0.02	89%
191	2.9	359.072	7.983	-4.548	0.02	91%
192	2.9	359.101	7.983	-4.545	0.01	93%
193	2.9	359.072	7.983	-4.548	0.02	91%
194	2.8	359.072	7.983	-4.548	0.02	91%
195	2.8	359.101	7.983	-4.545	0.01	93%
196	2.8	359.101	7.983	-4.545	0.01	93%

197	2.8	359.131	7.983	-4.542	0.01	94%
198	2.8	359.131	7.983	-4.542	0.01	94%
199	2.8	359.042	7.983	-4.551	0.02	90%
200	2.8	359.042	7.983	-4.551	0.02	90%
201	2.8	359.042	7.983	-4.551	0.02	90%
202	2.8	359.101	7.983	-4.545	0.01	93%
203	2.8	359.072	7.983	-4.548	0.02	91%
204	2.8	359.072	7.983	-4.548	0.02	91%
205	2.7	359.072	7.983	-4.548	0.02	91%
206	2.7	359.042	7.983	-4.551	0.02	90%
207	2.7	359.042	7.983	-4.551	0.02	90%
208	2.7	359.042	7.983	-4.551	0.02	90%
209	2.7	358.774	7.983	-4.579	0.05	77%
210	2.7	358.982	7.983	-4.557	0.03	87%
211	2.7	359.012	7.983	-4.554	0.02	89%
212	2.7	359.012	7.983	-4.554	0.02	89%
213	2.7	358.982	7.983	-4.557	0.03	87%
214	2.7	358.982	7.983	-4.557	0.03	87%
215	2.7	358.923	7.983	-4.563	0.03	84%
216	2.7	358.893	7.983	-4.566	0.04	83%
217	2.6	358.833	7.983	-4.573	0.04	80%
218	2.6	358.863	7.983	-4.569	0.04	81%
219	2.6	358.893	7.983	-4.566	0.04	83%
220	2.6	358.893	7.983	-4.566	0.04	83%
221	2.6	358.893	7.983	-4.566	0.04	83%
222	2.6	358.923	7.983	-4.563	0.03	84%
223	2.6	358.893	7.983	-4.566	0.04	83%
224	2.6	358.893	7.983	-4.566	0.04	83%
225	2.6	358.774	7.983	-4.579	0.05	77%
226	2.6	358.893	7.983	-4.566	0.04	83%
227	2.6	358.893	7.983	-4.566	0.04	83%
228	2.6	358.863	7.983	-4.569	0.04	81%
229	2.6	358.833	7.983	-4.573	0.04	80%
230	2.6	358.863	7.983	-4.569	0.04	81%
231	2.5	358.863	7.983	-4.569	0.04	81%
232	2.5	358.893	7.983	-4.566	0.04	83%
233	2.5	358.863	7.983	-4.569	0.04	81%
234	2.5	358.863	7.983	-4.569	0.04	81%
235	2.5	358.863	7.983	-4.569	0.04	81%
236	2.5	358.893	7.983	-4.566	0.04	83%
237	2.5	358.863	7.983	-4.569	0.04	81%
238	2.5	358.863	7.983	-4.569	0.04	81%
239	2.5	358.893	7.983	-4.566	0.04	83%
240	2.5	358.923	7.983	-4.563	0.03	84%
241	2.5	358.952	7.983	-4.56	0.03	86%
242	2.5	358.923	7.983	-4.563	0.03	84%
243	2.5	358.952	7.983	-4.56	0.03	86%
244	2.5	358.982	7.983	-4.557	0.03	87%
245	2.5	358.982	7.983	-4.557	0.03	87%
246	2.5	358.952	7.983	-4.56	0.03	86%

247	2.4	359.012	7.983	-4.554	0.02	89%
248	2.4	359.012	7.983	-4.554	0.02	89%
249	2.4	359.042	7.983	-4.551	0.02	90%
250	2.4	359.042	7.983	-4.551	0.02	90%
251	2.4	359.101	7.983	-4.545	0.01	93%
252	2.4	359.042	7.983	-4.551	0.02	90%
253	2.4	359.131	7.983	-4.542	0.01	94%
254	2.4	359.101	7.983	-4.545	0.01	93%
255	2.4	358.863	7.983	-4.569	0.04	81%
256	2.4	358.982	7.983	-4.557	0.03	87%
257	2.4	358.952	7.983	-4.56	0.03	86%
258	2.4	358.952	7.983	-4.56	0.03	86%
259	2.4	358.923	7.983	-4.563	0.03	84%
260	2.4	358.923	7.983	-4.563	0.03	84%
261	2.4	358.893	7.983	-4.566	0.04	83%
262	2.4	358.952	7.983	-4.56	0.03	86%
263	2.4	358.923	7.983	-4.563	0.03	84%
264	2.4	358.893	7.983	-4.566	0.04	83%
265	2.4	358.923	7.983	-4.563	0.03	84%
266	2.3	358.923	7.983	-4.563	0.03	84%
267	2.3	358.952	7.983	-4.56	0.03	86%
268	2.3	358.923	7.983	-4.563	0.03	84%
269	2.3	358.923	7.983	-4.563	0.03	84%
270	2.3	358.982	7.983	-4.557	0.03	87%
271	2.3	359.012	7.983	-4.554	0.02	89%
272	2.3	358.863	7.983	-4.569	0.04	81%
273	2.3	358.923	7.983	-4.563	0.03	84%
274	2.3	358.952	7.983	-4.56	0.03	86%
275	2.3	358.952	7.983	-4.56	0.03	86%
276	2.3	358.952	7.983	-4.56	0.03	86%
277	2.3	358.893	7.983	-4.566	0.04	83%
278	2.3	358.982	7.983	-4.557	0.03	87%
279	2.3	359.012	7.983	-4.554	0.02	89%
280	2.3	358.982	7.983	-4.557	0.03	87%
281	2.3	358.982	7.983	-4.557	0.03	87%
282	2.3	358.893	7.983	-4.566	0.04	83%
283	2.3	358.863	7.983	-4.569	0.04	81%
284	2.3	358.982	7.983	-4.557	0.03	87%
285	2.3	358.982	7.983	-4.557	0.03	87%
286	2.3	358.982	7.983	-4.557	0.03	87%
287	2.2	359.012	7.983	-4.554	0.02	89%
288	2.2	359.012	7.983	-4.554	0.02	89%
289	2.2	358.952	7.983	-4.56	0.03	86%
290	2.2	358.952	7.983	-4.56	0.03	86%
291	2.2	358.952	7.983	-4.56	0.03	86%
292	2.2	358.863	7.983	-4.569	0.04	81%
293	2.2	358.863	7.983	-4.569	0.04	81%
294	2.2	358.893	7.983	-4.566	0.04	83%
295	2.2	358.893	7.983	-4.566	0.04	83%
296	2.2	358.952	7.983	-4.56	0.03	86%

297	2.2	358.923	7.983	-4.563	0.03	84%
298	2.2	358.833	7.983	-4.573	0.04	80%
299	2.2	358.684	7.983	-4.588	0.06	72%
300	2.2	358.744	7.983	-4.582	0.05	75%
301	2.2	358.714	7.983	-4.585	0.05	74%
302	2.2	358.446	7.983	-4.612	0.08	61%
303	2.2	358.506	7.983	-4.606	0.08	64%
304	2.2	358.625	7.983	-4.594	0.06	70%
305	2.2	358.655	7.983	-4.591	0.06	71%
306	2.2	358.595	7.983	-4.597	0.07	68%
307	2.2	358.595	7.983	-4.597	0.07	68%
308	2.2	358.595	7.983	-4.597	0.07	68%
309	2.2	358.625	7.983	-4.594	0.06	70%
310	2.2	358.625	7.983	-4.594	0.06	70%
311	2.2	358.655	7.983	-4.591	0.06	71%
312	2.1	358.655	7.983	-4.591	0.06	71%
313	2.1	358.684	7.983	-4.588	0.06	72%
314	2.1	358.655	7.983	-4.591	0.06	71%
315	2.1	358.684	7.983	-4.588	0.06	72%
316	2.1	358.684	7.983	-4.588	0.06	72%
317	2.1	358.714	7.983	-4.585	0.05	74%
318	2.1	358.714	7.983	-4.585	0.05	74%
319	2.1	358.595	7.983	-4.597	0.07	68%
320	2.1	358.506	7.983	-4.606	0.08	64%
321	2.1	358.595	7.983	-4.597	0.07	68%
322	2.1	358.595	7.983	-4.597	0.07	68%
323	2.1	358.595	7.983	-4.597	0.07	68%
324	2.1	358.595	7.983	-4.597	0.07	68%
325	2.1	358.625	7.983	-4.594	0.06	70%
326	2.1	358.655	7.983	-4.591	0.06	71%
327	2.1	358.655	7.983	-4.591	0.06	71%
328	2.1	358.655	7.983	-4.591	0.06	71%
329	2.1	358.535	7.983	-4.603	0.07	65%
330	2.1	358.625	7.983	-4.594	0.06	70%
331	2.1	358.684	7.983	-4.588	0.06	72%
332	2.1	358.655	7.983	-4.591	0.06	71%
333	2.1	358.714	7.983	-4.585	0.05	74%
334	2.1	358.684	7.983	-4.588	0.06	72%
335	2.1	358.625	7.983	-4.594	0.06	70%
336	2.1	358.506	7.983	-4.606	0.08	64%
337	2.1	358.565	7.983	-4.6	0.07	67%
338	2.1	358.506	7.983	-4.606	0.08	64%
339	2.1	358.565	7.983	-4.6	0.07	67%
340	2.1	358.565	7.983	-4.6	0.07	67%
341	2.0	358.625	7.983	-4.594	0.06	70%
342	2.0	358.684	7.983	-4.588	0.06	72%
343	2.0	358.714	7.983	-4.585	0.05	74%
344	2.0	358.684	7.983	-4.588	0.06	72%
345	2.0	358.714	7.983	-4.585	0.05	74%
346	2.0	358.744	7.983	-4.582	0.05	75%

347	2.0	358.744	7.983	-4.582	0.05	75%
348	2.0	358.714	7.983	-4.585	0.05	74%
349	2.0	358.684	7.983	-4.588	0.06	72%
350	2.0	358.714	7.983	-4.585	0.05	74%
351	2.0	358.714	7.983	-4.585	0.05	74%
352	2.0	358.595	7.983	-4.597	0.07	68%
353	2.0	358.655	7.983	-4.591	0.06	71%
354	2.0	358.625	7.983	-4.594	0.06	70%
355	2.0	358.655	7.983	-4.591	0.06	71%
356	2.0	358.684	7.983	-4.588	0.06	72%
357	2.0	358.684	7.983	-4.588	0.06	72%
358	2.0	358.684	7.983	-4.588	0.06	72%
359	2.0	358.744	7.983	-4.582	0.05	75%
360	2.0	358.714	7.983	-4.585	0.05	74%
361	2.0	358.774	7.983	-4.579	0.05	77%
362	2.0	358.714	7.983	-4.585	0.05	74%
363	2.0	358.714	7.983	-4.585	0.05	74%
364	2.0	358.744	7.983	-4.582	0.05	75%
365	2.0	358.744	7.983	-4.582	0.05	75%
366	2.0	358.714	7.983	-4.585	0.05	74%
367	2.0	358.714	7.983	-4.585	0.05	74%
368	2.0	358.744	7.983	-4.582	0.05	75%
369	2.0	358.655	7.983	-4.591	0.06	71%
370	2.0	358.655	7.983	-4.591	0.06	71%
371	2.0	358.595	7.983	-4.597	0.07	68%
372	2.0	358.625	7.983	-4.594	0.06	70%
373	2.0	358.684	7.983	-4.588	0.06	72%
374	2.0	358.684	7.983	-4.588	0.06	72%
375	2.0	358.625	7.983	-4.594	0.06	70%
376	2.0	358.655	7.983	-4.591	0.06	71%
377	1.9	358.565	7.983	-4.6	0.07	67%
378	1.9	358.595	7.983	-4.597	0.07	68%
379	1.9	358.595	7.983	-4.597	0.07	68%
380	1.9	358.565	7.983	-4.6	0.07	67%
381	1.9	358.684	7.983	-4.588	0.06	72%
382	1.9	358.655	7.983	-4.591	0.06	71%
383	1.9	358.714	7.983	-4.585	0.05	74%
384	1.9	358.655	7.983	-4.591	0.06	71%
385	1.9	358.714	7.983	-4.585	0.05	74%
386	1.9	358.684	7.983	-4.588	0.06	72%
387	1.9	358.714	7.983	-4.585	0.05	74%
388	1.9	358.684	7.983	-4.588	0.06	72%
389	1.9	358.714	7.983	-4.585	0.05	74%
390	1.9	358.714	7.983	-4.585	0.05	74%
391	1.9	358.744	7.983	-4.582	0.05	75%
392	1.9	358.744	7.983	-4.582	0.05	75%
393	1.9	358.774	7.983	-4.579	0.05	77%
394	1.9	358.744	7.983	-4.582	0.05	75%
395	1.9	358.774	7.983	-4.579	0.05	77%
396	1.9	358.774	7.983	-4.579	0.05	77%

397	1.9	358.744	7.983	-4.582	0.05	75%
398	1.9	358.774	7.983	-4.579	0.05	77%
399	1.9	358.774	7.983	-4.579	0.05	77%
400	1.9	358.774	7.983	-4.579	0.05	77%
401	1.9	358.684	7.983	-4.588	0.06	72%
402	1.9	358.744	7.983	-4.582	0.05	75%
403	1.9	358.774	7.983	-4.579	0.05	77%
404	1.9	358.774	7.983	-4.579	0.05	77%
405	1.9	358.774	7.983	-4.579	0.05	77%
406	1.9	358.684	7.983	-4.588	0.06	72%
407	1.9	358.714	7.983	-4.585	0.05	74%
408	1.9	358.744	7.983	-4.582	0.05	75%
409	1.9	358.774	7.983	-4.579	0.05	77%
410	1.9	358.744	7.983	-4.582	0.05	75%
411	1.9	358.774	7.983	-4.579	0.05	77%
412	1.9	358.744	7.983	-4.582	0.05	75%
413	1.9	358.803	7.983	-4.576	0.05	78%
414	1.9	358.833	7.983	-4.573	0.04	80%
415	1.9	358.863	7.983	-4.569	0.04	81%
416	1.9	358.863	7.983	-4.569	0.04	81%
417	1.9	358.893	7.983	-4.566	0.04	83%
418	1.9	358.863	7.983	-4.569	0.04	81%
419	1.9	358.893	7.983	-4.566	0.04	83%
420	1.9	358.923	7.983	-4.563	0.03	84%
421	1.9	358.893	7.983	-4.566	0.04	83%
422	1.8	358.893	7.983	-4.566	0.04	83%
423	1.8	358.893	7.983	-4.566	0.04	83%
424	1.8	358.982	7.983	-4.557	0.03	87%
425	1.8	358.982	7.983	-4.557	0.03	87%
426	1.8	358.982	7.983	-4.557	0.03	87%
427	1.8	359.012	7.983	-4.554	0.02	89%
428	1.8	359.012	7.983	-4.554	0.02	89%
429	1.8	359.042	7.983	-4.551	0.02	90%
430	1.8	359.012	7.983	-4.554	0.02	89%
431	1.8	359.042	7.983	-4.551	0.02	90%
432	1.8	359.072	7.983	-4.548	0.02	91%
433	1.8	359.042	7.983	-4.551	0.02	90%
434	1.8	359.072	7.983	-4.548	0.02	91%
435	1.8	359.131	7.983	-4.542	0.01	94%
436	1.8	359.101	7.983	-4.545	0.01	93%
437	1.8	359.072	7.983	-4.548	0.02	91%
438	1.8	359.161	7.983	-4.539	0.01	96%
439	1.8	359.131	7.983	-4.542	0.01	94%
440	1.8	359.131	7.983	-4.542	0.01	94%
441	1.8	359.161	7.983	-4.539	0.01	96%
442	1.8	359.191	7.983	-4.536	0.01	97%
443	1.8	359.191	7.983	-4.536	0.01	97%
444	1.8	359.191	7.983	-4.536	0.01	97%
445	1.8	359.25	7.983	-4.53	0.00	100%

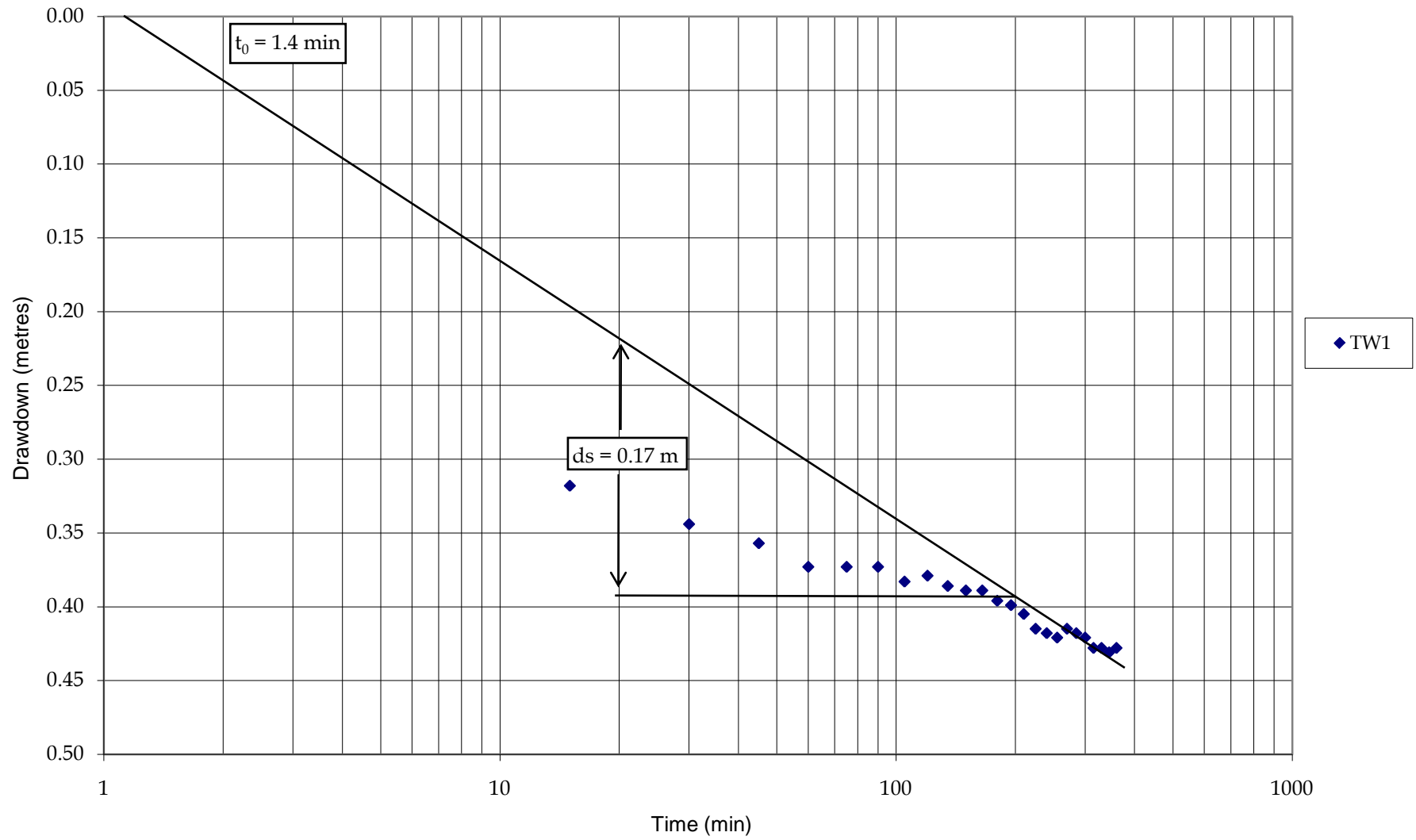




ATTACHMENT K

OBSERVATION WELL DATA USING PRESSURE TRANSDUCER LOGGERS

Drawdown vs. Time in Observation Well During Pumping Test for TW2



Drawdown vs. Time in Observation Well During Pumping Test for TW1

