Kollaard Associates
Engineers
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Civil • Geotechnical •
Structural • Environmental •
Hydrogeology •

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REPORT ON

HYDROGEOLOGICAL INVESTIGATION
6787 HIRAM DRIVE
OSGOODE WARD, GREELY
CITY OF OTTAWA
ONTARIO

Submitted to:

Venom Motorsports Canada
6820 McKeown Drive
Greely, Ontario
K4P 1A2

DATE October 3, 2018

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October 3, 2018 180696

Venom Motorsports Canada
6820 McKeown Drive
Greely, Ontario
K4P 1A2

RE: HYDROGEOLOGICAL INVESTIGATION
EXISTING SUPPLY WELL
PROPOSED LIGHT INDUSTRIAL WAREHOUSE
6787 HIRAM DRIVE, GREELY
CITY OF OTTAWA, ONTARIO

Dear Sir:

This letter presents the results of an evaluation of the water quality and quantity for the well that will supply water for the above noted proposed light industrial development at 6787 Hiram Drive in the City of Ottawa, Ontario (see Key Plan, Figure 1). It is understood that the proposed light industrial development is to consist of a warehouse and office building.

The well in question was constructed by Air Rock Drilling Company of Richmond, Ontario on September 4, 2018. A Ministry of the Environment and Climate Change (MOECC) Well Record for the subject well (TW1) and the Certificate of Well Compliance, provided by the well driller, are provided as Attachment A.

A pumping test was carried out at the well, TW1, by a member of our engineering staff on September 12, 2018. The testing consisted of a 6 hour duration constant discharge rate pumping test. During the pumping test, water level measurements were made both manually and using a pressure transducer to monitor the drawdown of the water level in the well in response to pumping. Groundwater samples were collected from TW1 at about hour 3 and at hour 6 of the pumping test to characterize groundwater quality. After the pumping period, the pump was shut off and the recovery of the water level in the well was monitored for a period of time.

Groundwater Supply Evaluation

Water Demand

The water demand calculations were provided to Kollaard Associates Inc. by others. It is understood that the well was to provide a minimum flow rate of 30 litres/minute. The daily sewage design flow (also done by others) is indicated to be 2,680 litres/day.

Water Quantity

The well was pumped for six hours at a pumping rate of about 61.8 litres per minute. Over the course of the pumping test, the water level in the well dropped some 0.2 metres. At the end of the pumping test, about 30 minutes were required for 100 percent recovery of the total drawdown in the static water level created during pumping. This is based on manual water level measurements. According to the data logger, the well water level recovered after about 15 minutes. The discrepancy is due to measurement error from the data logger which is not vented (does not account for small water level fluctuations that may be due to atmospheric pressure changes). These errors are more significant when the drawdown is very small (as in this case where drawdown is only 0.2 metres).

The pumping test drawdown and recovery data and plots for TW1 are provided as Attachment B. The drawdown and recovery data provided were measured with reference to the top of the well casing at the test well location.

The pumping test data for the test well was 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.

Transmissivity was calculated using the following relationship:

$$T = \frac{2.3Q}{4\pi ds}$$

where Q is the pump rate, m^3/day
ds is the change in drawdown over one time log cycle, m
T is the transmissivity, m^2/day

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be about 540 m^2/day. Based on the recovery data the aquifer transmissivity is estimated to be about 226 m^2/day. A higher flow rate could provide a more accurate estimate of transmissivity. However, it is sufficient to demonstrate that the aquifer is capable of supplying the expected water demand for the site.

Water Quality

To determine the water quality of the groundwater supply, groundwater samples were obtained from the well during the pumping test and prepared/preserved in the field using appropriate techniques and submitted to Eurofins Environmental Testing in Ottawa, Ontario for the chemical, physical and bacteriological analyses listed in the MOECC guideline entitled Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, August 1996. The temperature, conductivity, pH, total dissolved solids, turbidity and residual chlorine levels of the groundwater were measured and qualitative observations of the odour and colour of the groundwater were made at periodic intervals during the pumping test. The results of the chemical, physical and bacteriological analyses of the water samples obtained from the test well and the field water quality are provided as Attachment C and in Table I, respectively.

The water quality as determined from the results of the analyses is acceptable. The water meets all the Ontario Drinking Water Standards (ODWS) health and aesthetic parameters tested for at the

test well except for aesthetic objectives for hardness, total dissolved solids and iron. Sodium is above the 20 mg/l medical advisory limit for those on sodium restricted diets.

Hardness
The water is considered to be hard by water treatment standards. Water with hardness above 80 to 100 milligrams per litre as $CaC0_3$ is often softened for domestic use. The hardness at the well is ~290 milligrams per litre. Water softening by conventional sodium ion exchange may 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 509 and 504 milligrams per litre after three and six hours of pumping, respectively, above the ODWS of 500 milligrams per litre. The Ryznar Stability Indices (RSI) and Langelier Saturation Indices (LSI) were calculated for the samples obtained and gave an RSI value of ~6.9, and LSI of ~0.6, respectively, indicating that the water is not corrosive and there is potential for scale to form and carbonate precipitation may occur. 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, the water samples had higher levels of hardness and iron. Sodium and chloride are well within their aesthetic objectives and are not elevated enough to affect the taste of the water significantly. In this case, the effect of elevated TDS is considered to affect mineral deposition, due to the potential for scale to form.

Iron
The iron level at TW1 after three and six hours of pumping is 0.41 and 0.37 milligrams per litre, respectively, which exceeds the ODWS aesthetic objective of 0.3 milligrams per litre. The iron level is well within the MOE treatability limit of 5.0 milligrams per litre using a water softener or manganese greensand filter. Manganese frequently occurs where iron is also present. The manganese level was measured at 0.02 milligrams per litre, which is within the aesthetic objective of 0.05 milligrams per litre.

The sodium level in the water is about 40-42 mg/l. The ODWSOG states that *"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."*

Wellhead Protection/Floodplain Considerations

Recommendations for well maintenance include; inspect wellhead annually to ensure that the casing is structurally sound, verify well cap is sealed and that surface water is not pooling around wellhead.

The supply well is located within the southwest portion of the site, while the location of the proposed septic system is within the northwest portion of the site, greater than 18 metres distance from the well location. The Site Plan that was provided to Kollaard Associates Inc. for review indicated that the proposed finished grade at the well location is about 99.76 metres geodetic elevation. The minimum top of casing elevation is at 100.16 metres to ensure that is at least 400 millimetres above the finished grade at the well location.

Additionally, the ground surface shall be graded such that it is the highest point on the ground surface within 3 metres radially from the exterior of the well casing and shall ensure that water does not collect or pond near the well head. The well has been properly grouted and cased to a depth of about 15.2 metres below the existing ground surface. The Site Plan indicates that armour stone is proposed around the wellhead to protect the well from physical damage. With these measures in place, it is considered that an adequate amount of wellhead protection is going to be in place to protect the water supply for the proposed light industrial use of the property. The well location is also appropriate for access in case of repairs and well maintenance.

Recommendations for wellhead protection include ensuring that potential contaminant sources are at least 15 metres and preferably at least 30 metres or more from the well. Possible contaminant sources include; chemical storage, garage and related chemicals, such as antifreeze, gasoline, oils, vehicle/boat/equipment storage, sewer lines, septic systems, animal enclosures, manure or compost piles. If liquid chemicals, such as antifreeze, oil and gasoline/diesel, and their waste products, are to be stored at the site, they should be done in containers approved for that purpose. The container(s) should be labelled with their contents. Secondary containment should be installed around all bulk liquid chemical or waste storage containers, to collect and contain leaks and spills from the tank and all connections. A lock on the well cap is useful to prevent vandalism.

The 1:100 year floodplain elevation at the site is indicated to be 99.78 metres geodetic. Information from the City of Ottawa indicates that the top of the well casing shall be at least 300 millimetres above the floodplain elevation (~100.08 metres). Based on the Site Plan grading information provided, the top of the well casing is indicated to be at 100.16 metres geodetic elevation, which will exceed the minimum elevation requirement due to the floodplain.

Therefore, the potential for contamination of the well due to flooding is minimized.

Conclusions

Based on the results of this evaluation it is considered that the well in question should supply water of adequate quantity and quality for the proposed development with suitable treatment and wellhead protection as indicated above.

We trust this letter provides sufficient information for your purposes. If you have any questions concerning this letter, please do not hesitate to contact our office.

Yours truly,

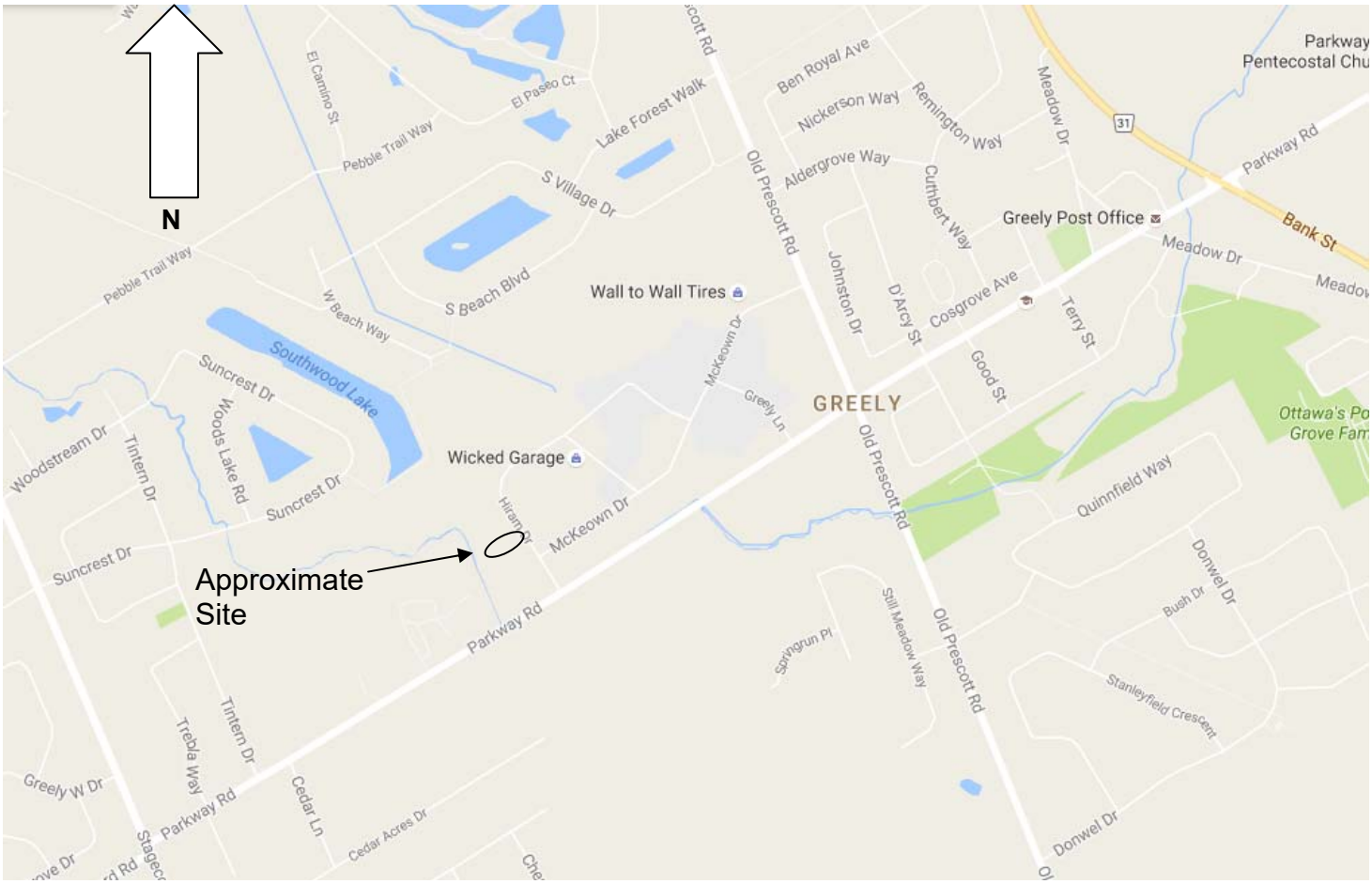
Kollaard Associates Inc.

Colleen Vermeersch, P. Eng.

Attachments:

	Figure 1	- Key Plan
	Table I	- Field Water Quality
	Attachment A	- Well Record and Certificate of Well Compliance
	Attachment B	- Pumping Test Data
	Attachment C	- Well Water Laboratory Test Results

KEY PLAN	FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 180696

Date October 2018

TABLE I

FIELD WATER QUALITY MEASUREMENTS
FOR TEST WELL

	Time Since Pumping Test Started (min)	Temp. (^{0}C)	pH	Turbidity (NTU)	Total Dissolved Solids (ppm)	Conductivity (µS)	Free chlorine (ppm)
TW 1	60	9.6	7.8	0.0	350	710	-
	120	9.5	7.4	0.0	350	692	-
	180	9.6	8.0	0.0	352	705	0.0
	240	9.8	7.7	0.0	340	696	-
	300	9.6	7.6	0.0	347	680	-
	360	9.7	8.2	0.0	346	670	0.0

ATTACHMENT A

MOE WELL RECORD FOR TW1
CERTIFICATE OF WELL COMPLIANCE
PROVIDED BY WELL DRILLER

Ontario — Ministry of the Environment and Climate Change

Tag#:A252779

A252779

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Venom Motorsports Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
6820 McKeown Drive	Greely	ON	K4P 1A2	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
6787 Hiram Drive	Osgoode	PLS	4

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD	8	18	454545	5011501	4M-351

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Clay			0'	35'
	Sand & Gravel			35'	44'
Grey & Black	Limestone			44'	55'
Grey & Black	Limestone			55'	80'
Grey & Black	Limestone			80'	94'
Grey & Black	Limestone			94'	115'
Grey & Black	Limestone			115'	123'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
50'	40'	Neat cement	10.92
40'	0'	Bentonite slurry	25.2

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

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

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188	+2'	50'
6"	open hole		50'	123'

Status of Well

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

Construction Record - Screen

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

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
80	☐	☐ Fresh ☒ Untested	
94	☐	☐ Fresh ☒ Untested	
115	☐	☐ Fresh ☒ Untested	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0'	50'	9 3/4"
50'	123'	6"

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: X

Pump intake set at (m/ft): 100

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 10.5'

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

Recommended pump depth (m/ft): 100'

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

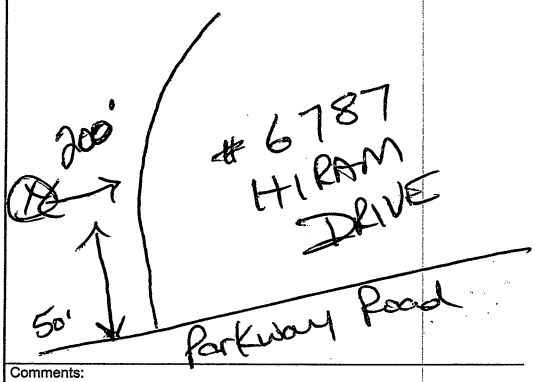
Well production (l/min / GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	9.7"		10.5"
1	10.1	1	9.7
2	10.2	2	9.7
3	10.2	3	9.7
4	10.3	4	9.7
5	10.3	5	9.7
10	10.5	10	9.7
15	10.5	15	9.7
20	10.5	20	9.7
25	10.5	25	9.7
30	10.5	30	9.7
40	10.5	40	9.7
50	10.5	50	9.7
60	10.5'	60	9.7"

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

1/2 HP 10 GPM SET AT 100 FEET

Well Contractor and Well Technician Information

115

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6859 Franktown Road, RR#1	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

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
6138382170	Hogan, Dan	T3058		2018/09/30

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2018/09/10	2018/09/04

Ministry Use Only

Audit No: Z276710

Received

0506E (2014/11)

Ministry's Copy

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of VENOM MOTORSPORTS INC.
located at #6787 HIRAM DRIVE, Greely
Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode).
Lot Part 5 Conc 4 Plan# 4M-351 S/L# Y

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 4TH day of SEPTEMBER 2018
Kenny Air Rock Drilling Co. Ltd.
Well Driller/Company

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

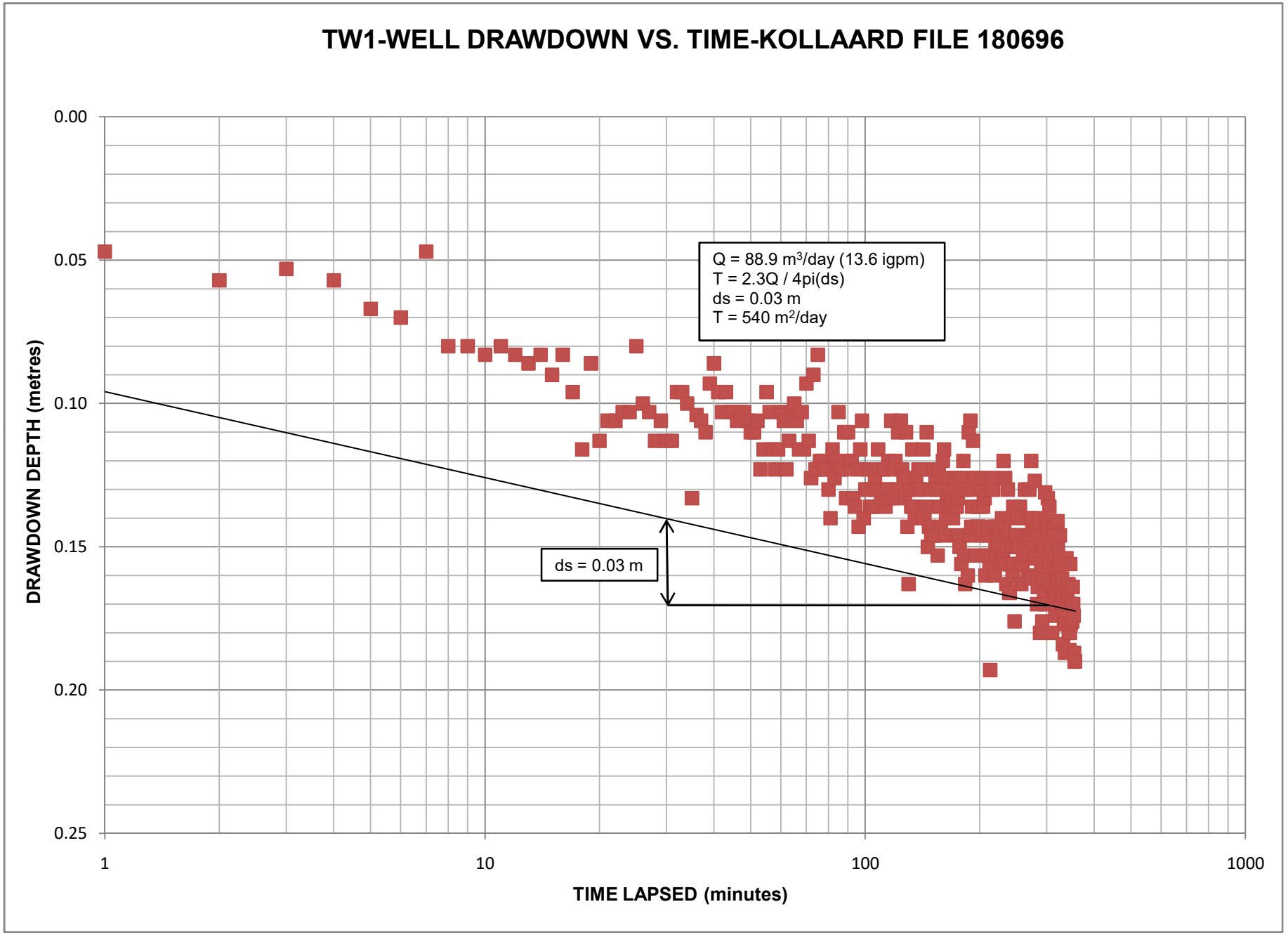
SIGNED this 3RD day of October, 2018.
Engineer

2018564
TAGA252779

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

ATTACHMENT B

PUMPING TEST DATA FOR TW1


TW1-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 180696
0.00
0.05
0.10
0.15
0.20
0.25
DRAWDOWN DEPTH (metres)
Q = 88.9 m3/day (13.6 igpm)
T = 2.3Q / 4pi(ds)
ds = 0.03 m
T = 540 m2/day
ds = 0.03 m
1
10
100
1000
TIME LAPSED (minutes)

Kollaard File 180696 Pump Rate 61.7 litres/minute

DRAWDOWN DATA TW-1

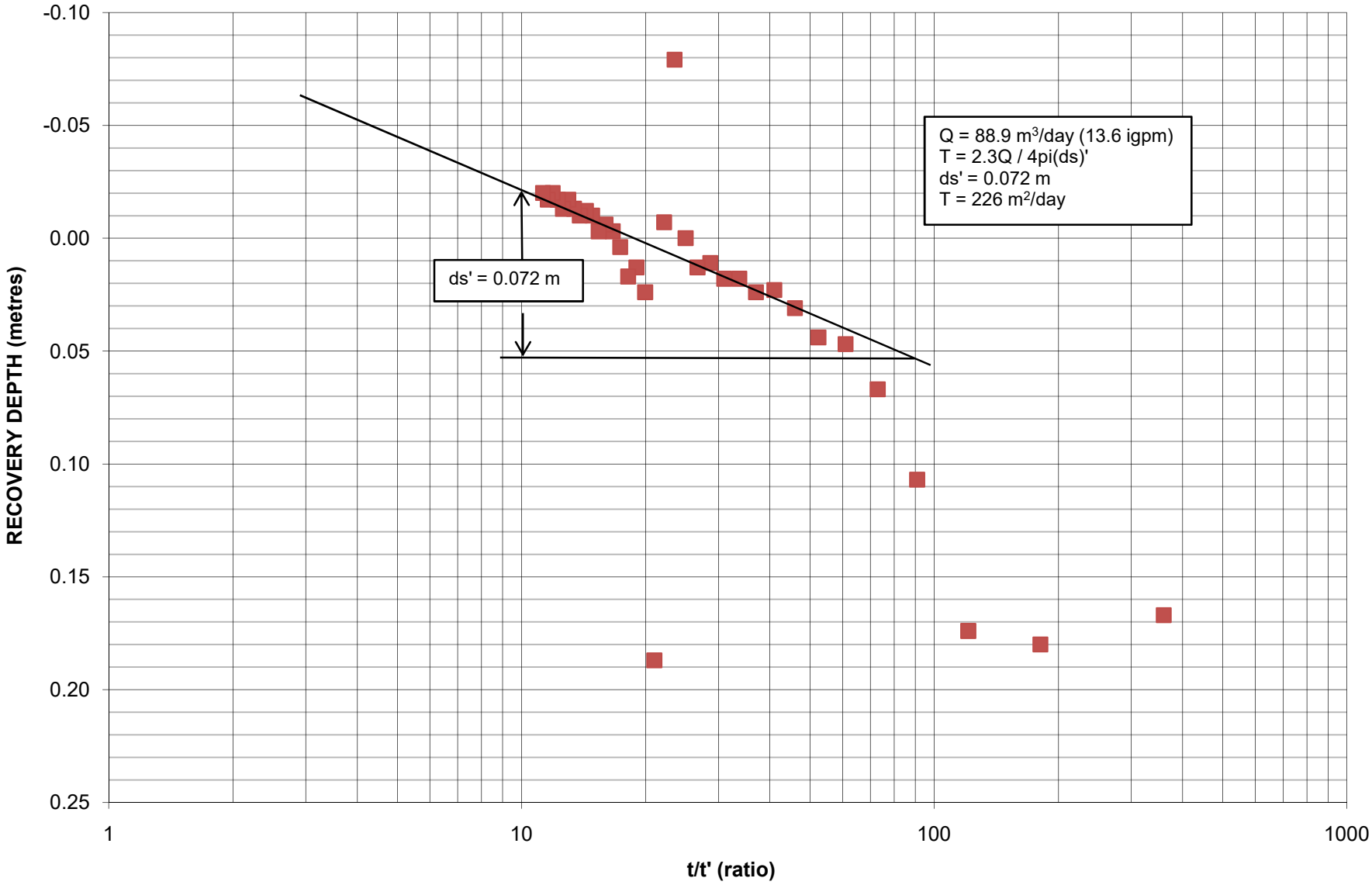
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	437.383	7.782	-2.71	-
1	436.926	7.782	-2.757	0.05
2	436.828	7.782	-2.767	0.06
3	436.861	7.782	-2.763	0.05
4	436.828	7.782	-2.767	0.06
5	436.73	7.782	-2.777	0.07
6	436.698	7.782	-2.78	0.07
7	436.926	7.782	-2.757	0.05
8	436.6	7.782	-2.79	0.08
9	436.6	7.782	-2.79	0.08
10	436.567	7.782	-2.793	0.08
11	436.6	7.782	-2.79	0.08
12	436.567	7.782	-2.793	0.08
13	436.535	7.782	-2.796	0.09
14	436.567	7.782	-2.793	0.08
15	436.502	7.782	-2.8	0.09
16	436.567	7.782	-2.793	0.08
17	436.437	7.782	-2.806	0.10
18	436.241	7.782	-2.826	0.12
19	436.535	7.782	-2.796	0.09
20	436.274	7.782	-2.823	0.11
21	436.339	7.782	-2.816	0.11
22	436.339	7.782	-2.816	0.11
23	436.372	7.782	-2.813	0.10
24	436.372	7.782	-2.813	0.10
25	436.6	7.782	-2.79	0.08
26	436.404	7.782	-2.81	0.10
27	436.372	7.782	-2.813	0.10
28	436.274	7.782	-2.823	0.11
29	436.339	7.782	-2.816	0.11
30	436.274	7.782	-2.823	0.11
31	436.274	7.782	-2.823	0.11
32	436.437	7.782	-2.806	0.10
33	436.437	7.782	-2.806	0.10
34	436.404	7.782	-2.81	0.10
35	436.078	7.782	-2.843	0.13
36	436.363	7.682	-2.814	0.10
37	436.339	7.782	-2.816	0.11
38	436.307	7.782	-2.82	0.11
39	436.47	7.782	-2.803	0.09
40	436.535	7.782	-2.796	0.09
41	436.437	7.782	-2.806	0.10
42	436.372	7.782	-2.813	0.10
43	436.437	7.782	-2.806	0.10
44	436.372	7.782	-2.813	0.10
45	436.372	7.782	-2.813	0.10
46	436.339	7.782	-2.816	0.11
47	436.372	7.782	-2.813	0.10
48	436.372	7.782	-2.813	0.10
49	436.339	7.782	-2.816	0.11
50	436.307	7.782	-2.82	0.11
51	436.307	7.782	-2.82	0.11
52	436.339	7.782	-2.816	0.11
53	436.176	7.782	-2.833	0.12
54	436.241	7.782	-2.826	0.12
55	436.437	7.782	-2.806	0.10
56	436.372	7.782	-2.813	0.10
57	436.241	7.782	-2.826	0.12
58	436.176	7.782	-2.833	0.12
59	436.241	7.782	-2.826	0.12
60	436.372	7.782	-2.813	0.10
61	436.339	7.782	-2.816	0.11
62	436.176	7.782	-2.833	0.12
63	436.274	7.782	-2.823	0.11
64	436.372	7.782	-2.813	0.10
65	436.404	7.782	-2.81	0.10
66	436.339	7.782	-2.816	0.11
67	436.241	7.782	-2.826	0.12
68	436.372	7.782	-2.813	0.10
69	436.241	7.782	-2.826	0.12
70	436.47	7.782	-2.803	0.09
71	436.274	7.782	-2.823	0.11
72	436.143	7.782	-2.836	0.13
73	436.502	7.782	-2.8	0.09
74	436.176	7.782	-2.833	0.12
75	436.567	7.782	-2.793	0.08
76	436.209	7.782	-2.83	0.12
77	436.209	7.782	-2.83	0.12
78	436.176	7.782	-2.833	0.12
79	436.176	7.782	-2.833	0.12
80	436.111	7.782	-2.84	0.13
81	436.013	7.782	-2.85	0.14
82	436.241	7.782	-2.826	0.12
83	436.143	7.782	-2.836	0.13
84	436.209	7.782	-2.83	0.12
85	436.372	7.782	-2.813	0.10

86	436.176	7.782	-2.833	0.12
87	436.176	7.782	-2.833	0.12
88	436.307	7.782	-2.82	0.11
89	436.078	7.782	-2.843	0.13
90	436.307	7.782	-2.82	0.11
91	436.209	7.782	-2.83	0.12
92	436.209	7.782	-2.83	0.12
93	436.078	7.782	-2.843	0.13
94	436.046	7.782	-2.846	0.14
95	436.176	7.782	-2.833	0.12
96	435.98	7.782	-2.853	0.14
97	436.241	7.782	-2.826	0.12
98	436.339	7.782	-2.816	0.11
99	436.013	7.782	-2.85	0.14
100	436.111	7.782	-2.84	0.13
101	436.111	7.782	-2.84	0.13
102	436.176	7.782	-2.833	0.12
103	436.046	7.782	-2.846	0.14
104	436.046	7.782	-2.846	0.14
105	436.046	7.782	-2.846	0.14
106	436.143	7.782	-2.836	0.13
107	436.111	7.782	-2.84	0.13
108	436.241	7.782	-2.826	0.12
109	436.176	7.782	-2.833	0.12
110	436.078	7.782	-2.843	0.13
111	436.111	7.782	-2.84	0.13
112	436.176	7.782	-2.833	0.12
113	436.046	7.782	-2.846	0.14
114	436.111	7.782	-2.84	0.13
115	436.209	7.782	-2.83	0.12
116	436.078	7.782	-2.843	0.13
117	436.339	7.782	-2.816	0.11
118	436.078	7.782	-2.843	0.13
119	436.176	7.782	-2.833	0.12
120	436.209	7.782	-2.83	0.12
121	436.111	7.782	-2.84	0.13
122	436.307	7.782	-2.82	0.11
123	436.111	7.782	-2.84	0.13
124	436.339	7.782	-2.816	0.11
125	436.176	7.782	-2.833	0.12
126	436.143	7.782	-2.836	0.13
127	436.078	7.782	-2.843	0.13
128	436.307	7.782	-2.82	0.11
129	435.98	7.782	-2.853	0.14
130	435.785	7.782	-2.873	0.16
131	436.111	7.782	-2.84	0.13
132	436.046	7.782	-2.846	0.14
133	436.241	7.782	-2.826	0.12
134	436.046	7.782	-2.846	0.14
135	436.013	7.782	-2.85	0.14
136	436.143	7.782	-2.836	0.13
137	436.111	7.782	-2.84	0.13
138	436.176	7.782	-2.833	0.12
139	436.111	7.782	-2.84	0.13
140	436.176	7.782	-2.833	0.12
141	436.013	7.782	-2.85	0.14
142	436.241	7.782	-2.826	0.12
143	436.013	7.782	-2.85	0.14
144	436.046	7.782	-2.846	0.14
145	436.307	7.782	-2.82	0.11
146	435.915	7.782	-2.86	0.15
147	435.98	7.782	-2.853	0.14
148	436.111	7.782	-2.84	0.13
149	435.948	7.782	-2.856	0.15
150	435.948	7.782	-2.856	0.15
151	436.176	7.782	-2.833	0.12
152	435.948	7.782	-2.856	0.15
153	436.143	7.782	-2.836	0.13
154	436.111	7.782	-2.84	0.13
155	435.883	7.782	-2.863	0.15
156	436.176	7.782	-2.833	0.12
157	436.046	7.782	-2.846	0.14
158	435.98	7.782	-2.853	0.14
159	436.111	7.782	-2.84	0.13
160	436.209	7.782	-2.83	0.12
161	436.241	7.782	-2.826	0.12
162	435.948	7.782	-2.856	0.15
163	436.013	7.782	-2.85	0.14
164	436.078	7.782	-2.843	0.13
165	436.046	7.782	-2.846	0.14
166	436.143	7.782	-2.836	0.13
167	436.078	7.782	-2.843	0.13
168	436.046	7.782	-2.846	0.14
169	436.078	7.782	-2.843	0.13
170	436.013	7.782	-2.85	0.14
171	436.111	7.782	-2.84	0.13
172	436.046	7.782	-2.846	0.14
173	436.143	7.782	-2.836	0.13
174	436.046	7.782	-2.846	0.14
175	436.078	7.782	-2.843	0.13
176	435.948	7.782	-2.856	0.15

177	435.915	7.782	-2.86	0.15
178	436.143	7.782	-2.836	0.13
179	435.85	7.782	-2.866	0.16
180	436.111	7.782	-2.84	0.13
181	436.209	7.782	-2.83	0.12
182	435.883	7.782	-2.863	0.15
183	435.785	7.782	-2.873	0.16
184	436.111	7.782	-2.84	0.13
185	436.111	7.782	-2.84	0.13
186	435.817	7.782	-2.87	0.16
187	436.307	7.782	-2.82	0.11
188	435.948	7.782	-2.856	0.15
189	436.339	7.782	-2.816	0.11
190	435.98	7.782	-2.853	0.14
191	436.046	7.782	-2.846	0.14
192	436.274	7.782	-2.823	0.11
193	436.143	7.782	-2.836	0.13
194	436.143	7.782	-2.836	0.13
195	435.883	7.782	-2.863	0.15
196	435.98	7.782	-2.853	0.14
197	436.046	7.782	-2.846	0.14
198	435.98	7.782	-2.853	0.14
199	435.98	7.782	-2.853	0.14
200	436.046	7.782	-2.846	0.14
201	436.111	7.782	-2.84	0.13
202	436.143	7.782	-2.836	0.13
203	435.948	7.782	-2.856	0.15
204	436.046	7.782	-2.846	0.14
205	436.078	7.782	-2.843	0.13
206	436.078	7.782	-2.843	0.13
207	435.817	7.782	-2.87	0.16
208	435.883	7.782	-2.863	0.15
209	435.948	7.782	-2.856	0.15
210	435.972	7.682	-2.854	0.14
211	435.98	7.782	-2.853	0.14
212	435.85	7.782	-2.866	0.16
213	435.491	7.782	-2.903	0.19
214	435.883	7.782	-2.863	0.15
215	436.143	7.782	-2.836	0.13
216	436.111	7.782	-2.84	0.13
217	436.111	7.782	-2.84	0.13
218	435.98	7.782	-2.853	0.14
219	435.817	7.782	-2.87	0.16
220	435.915	7.782	-2.86	0.15
221	435.883	7.782	-2.863	0.15
222	435.98	7.782	-2.853	0.14
223	435.915	7.782	-2.86	0.15
224	435.948	7.782	-2.856	0.15
225	435.948	7.782	-2.856	0.15
226	435.85	7.782	-2.866	0.16
227	435.85	7.782	-2.866	0.16
228	435.883	7.782	-2.863	0.15
229	436.013	7.782	-2.85	0.14
230	435.883	7.782	-2.863	0.15
231	436.209	7.782	-2.83	0.12
232	435.98	7.782	-2.853	0.14
233	436.143	7.782	-2.836	0.13
234	435.85	7.782	-2.866	0.16
235	435.785	7.782	-2.873	0.16
236	435.915	7.782	-2.86	0.15
237	436.111	7.782	-2.84	0.13
238	435.948	7.782	-2.856	0.15
239	435.752	7.782	-2.876	0.17
240	435.752	7.782	-2.876	0.17
241	435.85	7.782	-2.866	0.16
242	435.915	7.782	-2.86	0.15
243	436.013	7.782	-2.85	0.14
244	435.817	7.782	-2.87	0.16
245	436.046	7.782	-2.846	0.14
246	435.85	7.782	-2.866	0.16
247	435.654	7.782	-2.886	0.18
248	435.948	7.782	-2.856	0.15
249	435.948	7.782	-2.856	0.15
250	435.915	7.782	-2.86	0.15
251	436.013	7.782	-2.85	0.14
252	436.013	7.782	-2.85	0.14
253	435.915	7.782	-2.86	0.15
254	435.915	7.782	-2.86	0.15
255	436.046	7.782	-2.846	0.14
256	435.85	7.782	-2.866	0.16
257	435.785	7.782	-2.873	0.16
258	436.013	7.782	-2.85	0.14
259	435.85	7.782	-2.866	0.16
260	435.883	7.782	-2.863	0.15
261	435.915	7.782	-2.86	0.15
262	435.907	7.682	-2.861	0.15
263	436.111	7.782	-2.84	0.13
264	435.948	7.782	-2.856	0.15
265	435.883	7.782	-2.863	0.15
266	435.915	7.782	-2.86	0.15
267	435.817	7.782	-2.87	0.16

268	435.94	7.682	-2.857	0.15
269	436.013	7.782	-2.85	0.14
270	436.111	7.782	-2.84	0.13
271	435.948	7.782	-2.856	0.15
272	435.809	7.682	-2.871	0.16
273	436.209	7.782	-2.83	0.12
274	436.013	7.782	-2.85	0.14
275	435.972	7.682	-2.854	0.14
276	435.915	7.782	-2.86	0.15
277	435.883	7.782	-2.863	0.15
278	435.972	7.682	-2.854	0.14
279	436.135	7.682	-2.837	0.13
280	435.874	7.682	-2.864	0.15
281	435.972	7.682	-2.854	0.14
282	435.98	7.782	-2.853	0.14
283	435.72	7.782	-2.88	0.17
284	435.777	7.682	-2.874	0.16
285	435.948	7.782	-2.856	0.15
286	435.883	7.782	-2.863	0.15
287	436.013	7.782	-2.85	0.14
288	435.622	7.782	-2.89	0.18
289	435.817	7.782	-2.87	0.16
290	435.85	7.782	-2.866	0.16
291	435.915	7.782	-2.86	0.15
292	435.654	7.782	-2.886	0.18
293	435.809	7.682	-2.871	0.16
294	435.817	7.782	-2.87	0.16
295	435.752	7.782	-2.876	0.17
296	435.915	7.782	-2.86	0.15
297	436.103	7.682	-2.841	0.13
298	435.72	7.782	-2.88	0.17
299	435.948	7.782	-2.856	0.15
300	436.005	7.682	-2.851	0.14
301	435.98	7.782	-2.853	0.14
302	436.078	7.782	-2.843	0.13
303	435.98	7.782	-2.853	0.14
304	435.842	7.682	-2.867	0.16
305	436.046	7.782	-2.846	0.14
306	435.874	7.682	-2.864	0.15
307	435.915	7.782	-2.86	0.15
308	435.777	7.682	-2.874	0.16
309	435.915	7.782	-2.86	0.15
310	435.622	7.782	-2.89	0.18
311	435.972	7.682	-2.854	0.14
312	435.948	7.782	-2.856	0.15
313	435.752	7.782	-2.876	0.17
314	435.842	7.682	-2.867	0.16
315	435.874	7.682	-2.864	0.15
316	435.679	7.682	-2.884	0.17
317	435.711	7.682	-2.88	0.17
318	435.744	7.682	-2.877	0.17
319	435.809	7.682	-2.871	0.16
320	436.005	7.682	-2.851	0.14
321	435.915	7.782	-2.86	0.15
322	435.842	7.682	-2.867	0.16
323	435.809	7.682	-2.871	0.16
324	435.874	7.682	-2.864	0.15
325	435.948	7.782	-2.856	0.15
326	435.744	7.682	-2.877	0.17
327	435.752	7.782	-2.876	0.17
328	435.711	7.682	-2.88	0.17
329	435.809	7.682	-2.871	0.16
330	435.752	7.782	-2.876	0.17
331	435.581	7.682	-2.894	0.18
332	435.744	7.682	-2.877	0.17
333	435.654	7.782	-2.886	0.18
334	435.679	7.682	-2.884	0.17
335	435.548	7.682	-2.897	0.19
336	435.679	7.682	-2.884	0.17
337	435.646	7.682	-2.887	0.18
338	435.874	7.682	-2.864	0.15
339	435.777	7.682	-2.874	0.16
340	435.752	7.782	-2.876	0.17
341	435.711	7.682	-2.88	0.17
342	435.785	7.782	-2.873	0.16
343	435.622	7.782	-2.89	0.18
344	435.557	7.782	-2.896	0.19
345	435.613	7.682	-2.89	0.18
346	435.85	7.782	-2.866	0.16
347	435.646	7.682	-2.887	0.18
348	435.72	7.782	-2.88	0.17
349	435.711	7.682	-2.88	0.17
350	435.654	7.782	-2.886	0.18
351	435.777	7.682	-2.874	0.16
352	435.711	7.682	-2.88	0.17
353	435.679	7.682	-2.884	0.17
354	435.548	7.682	-2.897	0.19
355	435.516	7.682	-2.9	0.19
356	435.516	7.682	-2.9	0.19

TW1- WELL RECOVERY VS. TIME - KOLLAARD FILE 180696



Kollaard File 180696

RECOVERY DATA TW-1

t'	t / t'	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)	Recovery (%)
1	360	435.744	7.682	-2.877	0.167	11%
2	181.0	435.613	7.682	-2.89	0.18	4%
3	121.0	435.679	7.682	-2.884	0.174	7%
4	91.0	436.331	7.682	-2.817	0.107	43%
5	73.0	436.722	7.682	-2.777	0.067	64%
6	61.0	436.918	7.682	-2.757	0.047	75%
7	52.4	436.95	7.682	-2.754	0.044	76%
8	46.0	437.081	7.682	-2.741	0.031	83%
9	41.0	437.154	7.782	-2.733	0.023	88%
10	37.0	437.146	7.682	-2.734	0.024	87%
11	33.7	437.211	7.682	-2.728	0.018	90%
12	31.0	437.211	7.682	-2.728	0.018	90%
13	28.7	437.277	7.682	-2.721	0.011	94%
14	26.7	437.252	7.782	-2.723	0.013	93%
15	25.0	437.383	7.782	-2.71	0.00	100%
16	23.5	438.157	7.682	-2.631	-0.079	142%
17	22.2	437.448	7.782	-2.703	-0.007	104%
18	21.0	435.548	7.682	-2.897	0.187	0.0%
19	19.9	437.146	7.682	-2.734	0.024	87%
20	19.0	437.252	7.782	-2.723	0.013	93%
21	18.1	437.22	7.782	-2.727	0.017	91%
22	17.4	437.342	7.682	-2.714	0.004	98%
23	16.7	437.415	7.782	-2.707	-0.003	102%
24	16.0	437.44	7.682	-2.704	-0.006	103%
25	15.4	437.415	7.782	-2.707	-0.003	102%
26	14.8	437.481	7.782	-2.7	-0.01	105%
27	14.3	437.505	7.682	-2.698	-0.012	106%
28	13.9	437.481	7.782	-2.7	-0.01	105%
29	13.4	437.513	7.782	-2.697	-0.013	107%
30	13.0	437.546	7.782	-2.693	-0.017	109%
31	12.6	437.513	7.782	-2.697	-0.013	107%
32	12.3	437.546	7.782	-2.693	-0.017	109%
33	11.9	437.578	7.782	-2.69	-0.02	111%
34	11.6	437.546	7.782	-2.693	-0.017	109%
35	11.3	437.578	7.782	-2.69	-0.02	111%

ATTACHMENT C

RESULTS OF LABORATORY TESTING OF WELL WATER SAMPLES

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: 1816566
Date Submitted: 2018-09-12
Date Reported: 2018-09-19
Project: 180696
COC #:

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, Inorganics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

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.

Certificate of Analysis

eurofins | Environment Testing

Client: Kollaard Associates Inc.
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K0G 1J0
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Date Submitted: 2018-09-12
Date Reported: 2018-09-19
Project: 180696
COC #:

Group	Analyte	MRL	Units	Guideline	1387022 Water 2018-09-12 TW1-3Hr	1387023 Water 2018-09-12 TW1-6Hr
	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.					
Anions	Cl	1	mg/L	AO 250	88	86
	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	62	61
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	226	226
	Colour	2	TCU	AO 5	4	4
	Conductivity	5	uS/cm		783	775
	F	0.10	mg/L	MAC 1.5	0.20	0.20
	pH	1.00		6.5-8.5	8.00	8.00
	S2-	0.01	mg/L	AO 0.05	<0.01	<0.01
	TDS (COND - CALC)	1	mg/L	AO 500	509*	504*
	Turbidity	0.1	NTU	AO 5.0	3.3	2.2
Hardness	Hardness as CaCO3	1	mg/L	OG 100	293*	291*
Indices/Calc	Ion Balance	0.01			0.92	0.94
Metals	Ca	1	mg/L		68	67
	Fe	0.03	mg/L	AO 0.3	0.41*	0.37*
	K	1	mg/L		3	3
	Mg	1	mg/L		30	30
	Mn	0.01	mg/L	AO 0.05	0.02	0.02
	Na	2	mg/L	AO 200	40	42
Subcontract-Inorg	DOC	0.5	mg/L	AO 5	1.2	1.4
	N-NH3	0.01	mg/L		0.09	0.09
	Phenols	0.001	mg/L		<0.001	<0.001
	Tannin & Lignin	0.1	mg/L		<0.1	<0.1
	Total Kjeldahl Nitrogen	0.1	mg/L		0.2	0.2

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

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Project: 180696
COC #:

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 352625 **Analysis/Extraction Date** 2018-09-13 **Analyst** AC **Method** C SM2130B			
Turbidity	<0.1 NTU	102	70-130
Run No 352651 **Analysis/Extraction Date** 2018-09-13 **Analyst** SKH **Method** EPA 200.8			
Iron	<0.03 mg/L	92	91-109
Manganese	<0.01 mg/L	100	92.9-107
Run No 352697 **Analysis/Extraction Date** 2018-09-14 **Analyst** AA **Method** C SM2120C			
Colour	<2 TCU	100	90-110
Run No 352721 **Analysis/Extraction Date** 2018-09-14 **Analyst** Z S **Method** C SM4500-NO3-F			
N-NO2	<0.10 mg/L	97	80-120
N-NO3	<0.10 mg/L	107	80-120
Run No 352777 **Analysis/Extraction Date** 2018-09-17 **Analyst** H F **Method** M SM3120B-3500C			
Calcium	<1 mg/L	99	90-110
Potassium	<1 mg/L	104	87-113
Magnesium	<1 mg/L	97	76-124

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

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Report Number: 1816566
Date Submitted: 2018-09-12
Date Reported: 2018-09-19
Project: 180696
COC #:

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Sodium	<2 mg/L	85	82-118
Run No 352801 **Analysis/Extraction Date** 2018-09-17 **Analyst** Z S **Method** C SM4500-NO3-F			
N-NO2	<0.10 mg/L	100	80-120
N-NO3	<0.10 mg/L	105	80-120
Run No 352825 **Analysis/Extraction Date** 2018-09-17 **Analyst** H_F **Method** SM 4110			
Chloride	<1 mg/L	104	90-110
SO4	<1 mg/L	111	90-110
Run No 352877 **Analysis/Extraction Date** 2018-09-14 **Analyst** AET **Method** SUBCONTRACT P-INORG			
DOC	<0.5 mg/L	101	
N-NH3	<0.01 mg/L	101	
Phenols	<0.001 mg/L	88	69-132
Tannin & Lignin	<0.1 mg/L	80	
Total Kjeldahl Nitrogen	<0.1 mg/L	92	81-126
Run No 352927 **Analysis/Extraction Date** 2018-09-18 **Analyst** AET **Method** SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	96	90-110

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

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

Report Number: 1816566
Date Submitted: 2018-09-12
Date Reported: 2018-09-19
Project: 180696
COC #:

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Conductivity	<5 uS/cm	99	90-110
F	<0.10 mg/L	101	90-110
pH		99	90-110
Run No 352937 **Analysis/Extraction Date** 2018-09-19 **Analyst** AET **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 352948 **Analysis/Extraction Date** 2018-09-14 **Analyst** AET **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	107	

Guideline = ODWSOG *** = Guideline Exceedence**

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Certificate of Analysis

eurofins | Environment Testing

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:	1816565
Date Submitted:	2018-09-12
Date Reported:	2018-09-14
Project:	180696
COC #:	198008

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: _____

Krista Quantrill, Microbiology Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Eurofins (Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

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.

eurofins | Environment Testing

Certificate of Analysis

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1387020 Water 2018-09-12 TW1-3Hr	1387021 Water 2018-09-12 TW1-6Hr
Microbiology	Heterotrophic Plate Count	0	ct/1mL			0	3
Others	Escherichia Coli	0	ct/100mL	MAC 0		0	0
	Faecal Coliforms	0	ct/100mL			0	0
	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

Ryznar Stability Index

RSI = 2(pH_s) - pH

RSI << 6 → the scale tendency increases as the index decreases
RSI >> 7 → the calcium carbonate formation probably does not lead to a protective corrosion inhibitor film
RSI >> 8 → mild steel corrosion becomes an increasing problem

Langelier Saturation Index

LSI = pH - pH_s

If LSI is negative → no potential to scale, the water will dissolve $CaCO_3$
If LSI is positive → scale can form and $CaCO_3$ precipitation may occur
If LSI is close to zero → borderline scale potential, water quality or temperature change or evaporation could change the index

where pH measured from sample
pH_s = pH at saturation in calcite or calcium carbonate

$$pH_s = (9.3 + A + B) - (C + D)$$

$$A = \frac{\log_{10}[TDS] - 1}{10}$$

$$B = -13.12 \times \log_{10}(°C + 273) + 34.55$$

$$C = \log_{10}[Ca^{2+} as CaCO_3] - 0.4$$

$$D = \log_{10}[alkalinity as CaCO_3]$$

	TW1-3hr	TW1-6hr
pH	8.00	8.00
hardness [mg/l as $CaCo_3$]	293	291
Alkalinity [mg/l as $CaCo_3$]	226	226
total dissolved solids [mg/l]	509	504
temperature (°C)	9.6	9.7
→→ RSI	6.88	6.88
→→ LSI	0.56	0.56