

## GAMAN CONSULTANTS INC.

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October 28, 2019

Mr. Scott McIntosh  
c/o Capes Engineering  
355310 Blue Mountain-Euphrasia Townline, Ontario  
NOH-1J0

Attention: Mr. Clayton Capes, P.Eng.

Dear sirs:

Re: Groundwater Supply Hydrogeological Evaluation  
Proposed 145166 16<sup>th</sup> Sideroad Meaford Campground  
File 19012.00

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GAMAN Consultants Inc. (GAMAN) is pleased to submit the results of a hydrogeological evaluation to assess the viability of servicing a 10-ha parcel of land with groundwater.

By way of background, Mr. McIntosh owns a 10-ha parcel of land located on Part Lot 15, Concession 11, Town of Meaford (formerly St. Vincent Township) in Grey County. The physical address of the site is 145166 16<sup>th</sup> Sideroad and the site location is illustrated in Figure 1. This report was prepared as a support document to the Functional Servicing and Stormwater Management Study by Capes Engineering that was prepared in support of the Zoning Bylaw Amendment and Site Plan Agreement.

### **A. SCOPE OF WORK**

The scope of work for this evaluation is premised on an evaluation of existing information. The tasks for this evaluation included:

- Review and compilation of MECP Water Well Records surrounding the site.
- Review of existing hydrogeologic maps and reports on file with GAMAN Consultants Inc. (GAMAN).
- Analysis of the potential effects of servicing the site with a groundwater supply.
- A predictive evaluation of the potential effects to neighbouring water supplies from the taking of groundwater to service the site.
- Preparation of a hydrogeological report to assess groundwater quantity, quality and groundwater interference.

## **B. PHYSICAL SETTING**

The subject property is situated within the Bighead Valley Physiographic Region as described by Chapman and Putnam (1984). Bighead Valley is an indentation in the Niagara Escarpment west of Meaford. It is about 13-km wide and situated between Griersville Rock and Bayview. The Bighead River drains this valley. The shoulders of the valley are covered with more than 300 drumlins. These oval-shaped hills resemble a nest because there are so many in the area. The stony clay loam on the drumlins are reported to be well drained.

The proposed campground is located near the headwaters to Bighead River. Topography at the site slopes downward from the northwest property boundary at about 300 masl, southeast towards the southeast property boundary at 280 masl as shown in Figure 2. Local drainage is generally southeast towards an unnamed tributary of Bighead River. The river discharges into Nottawasaga Bay at Meaford. We infer from local topography and drainage features that shallow groundwater direction mimics these features and also migrates in a southeasterly direction.

The underlying bedrock is comprised of Queenston Shale and is commonly referred to as red shale in MECP in water well records.

### **C. LOCAL WATER SUPPLIES**

Water well records were downloaded from the MECP database and they are detailed in Table 1. Table 1 provides information pertaining to about 18 water wells located on Lots 14-16, Concessions 11 and 12. The table details lithology, well depth, screen interval, static water level, pumping level and flow rates in imperial units. Figure 2 illustrates the location of 11 of these wells that are within about 500 metres of the property boundary.

The following is a summary of the information:

- Groundwater supplies are obtained from mostly drilled wells extending into various overburden and bedrock aquifers.
- There is one dug well (MECP #2514133) reported in the water well record database and this well is located more than 1,300 metres from the site.
- Most drilled overburden wells encountered groundwater at depths ranging from about 15 to 58 metres below grade. Test rates in these wells range from 2-10 Igpm (about 9-45 L/min).
- There are 3 drilled wells that extend into the bedrock aquifer. Test rates in these wells range from 4-8 Igpm (18-36 L/min).
- Groundwater quality is reported as fresh with one exception.

There is an existing well that services the dwelling at the site; however, the well record for this well is not apparent in the database. Several dwellings also appear near the site with no record of water wells in the database. These dwellings are identified separately from the MECP water wells in Figure 2 because they are presumed to be serviced with wells.

### **D. WATER REQUIREMENTS**

The Functional Servicing Study (Capes Engineering) documents the daily sewage demands for the site at 4,050 L/day for the campground and 2,000 L/day for the existing dwelling. The daily sewage flow is estimated at 6,050 L/day. The sewage capacity of the two inground subsurface sewage disposal systems limits the average water taking to 6,050 L/day.

The daily water demand of 6,050 L/day is similar to the theoretical water demands of three, 4-bedroom estates dwellings (2,250 L/day/dwelling) on 10-ha of land using design criteria in MECP Guideline D-5-5 for rural developments. This water taking is equivalent to a water taking of 8.4 L/min (1.8 Igpm) over a 12-hour period. The need for higher amounts of water over shorter periods of time (peak periods) can be accommodated with storage.

## **E. GROUNDWATER RECHARGE**

As precipitation falls to the ground in the form of snow or rain, it may infiltrate into the ground, cause runoff to occur and some will be subject to evaporation and transpiration through plants. The component of precipitation that infiltrates into the ground becomes recharge. The groundwater will move laterally and vertically through the subsurface and provide baseflow to watercourses or recharge to deeper aquifers.

Section C above described the occurrence of aquifers that provide water to domestic wells near the site. Infiltration rates for till-like soils could be in the range of 100-150 mm/yr. It is assumed that 25-50 mm/yr. of this total recharge rate reaches deeper aquifers. The amount of recharge to deeper aquifers beneath this 10-ha parcel could provide about 2,500-5,000 m<sup>3</sup>/year within the site alone. On a daily basis, this equates to about 6,850 to 13,700 L/day of recharge. The volume of daily recharge exceeds the proposed water requirements for the site and would be self-sustaining based on the estimates of water requirements in Section D.

## **F. THEORETICAL GROUNDWATER IMPACT ASSESSMENT**

The proposal to extract groundwater from one or more drilled wells to service the campground has the potential to temporarily lower groundwater levels in the overburden or bedrock aquifers.

Though no pumping tests have been completed for this evaluation to assess the properties of these aquifers, we have for conceptual purposes, completed a theoretical groundwater interference assessment based on conservative assumptions of aquifer properties from the water well test rates presented in Section C. Test pumping rates range from 9-45 L/min from wells extending to the overburden and bedrock aquifers. A conservative assumption of hydraulic properties associated with these well yields could result in a transmissivity of 10 m<sup>2</sup>/day and a storativity of 0.0001 for a confined overburden or bedrock aquifer.

The drawdown at a domestic well off-site potentially caused by pumping 6,050 L/day (6.05 m<sup>3</sup>/day) of water from this campground was calculated using the Theis Formula as follows:

$$s = Q / (4 \times \pi \times T) \times \text{Ln}\{(2.25 \times T \times t) / (r^2 \times S)\}$$

Where

s = drawdown in metres

Q = discharge rate (6.05 m<sup>3</sup>/day)

T = Aquifer Transmissivity (10 m<sup>2</sup>/day)

t = time of pumping (150 days per year for a campground)

r = distance from the campground well to a domestic well in metres

S = Aquifer Storativity dimensionless (1x10<sup>-4</sup>)

Table 2 shows the predicted drawdown at each off-site domestic well in the water well record database. The coloured wells in the table are wells appearing in Figure 2 and generally within about 500 metres of the site. The predicted interference at all off-site wells is minor compared with the theoretical available drawdown shown for each well in the table. We conclude the risk of an adverse impact on neighbouring water supplies resulting from this proposed water taking is low and unlikely to occur.

## **G. CONCLUSIONS AND RECOMMENDATIONS**

The following conclusions and recommendations presented below are premised on the results of information reviewed in this report.

- The results of this study reveal that fresh groundwater can be obtained from drilled wells extending into one or more deep aquifers.
- The proposed water requirements are limited by the sewage loading into one or more on-site subsurface sewage disposal (septic) systems at the site which is estimated at 6,050 L/day.
- The daily water taking, based on the sewage loading, equates to the needs of less than three, 4-bedroom estate residential dwellings on 10-ha of land.
- This 10-ha parcel of land could supply all of the daily water needs from groundwater recharge to the various deep aquifers below this site. This suggests that there is an ample quantity of groundwater to support this small water taking.
- A theoretical assessment of groundwater interference reveals minor changes in groundwater levels with little risk of an adverse effect to neighbouring water supplies.
- In our opinion, there should be a sufficient supply of groundwater for this proposed land use and neighbouring domestic wells are unlikely to be impacted by the taking of groundwater for this proposed campground.
- The need for water treatment to address other drinking water regulations and guidelines should be completed through consultation with the local health unit after the rezoning is approved.

## **H. LIMITATIONS AND USE**

This report has been prepared for the exclusive use of Mr. McIntosh for his exclusive use in the evaluation of this site. GAMAN Consultants Inc. accepts no responsibility for any damages incurred by any third party as a result of decisions made, or actions taken based upon the information contained within this report.

All background information used in the preparation of this assessment has been relied upon in good faith, and GAMAN does not accept any responsibility for any misstatements, inaccuracies, or deficiencies contained in those documents or records. The information

contained in this report should be evaluated, interpreted and implemented only in the context of the assignment.

The findings and conclusions included in this report reflect our best judgement in light of the information available at the time of report preparation and are valid only at the date of issuance. If additional information is provided in the future, such as the results of additional site-specific assessments or monitoring, GAMAN will be pleased to re-evaluate our conclusions contained within this report, and issue amendments, as required.

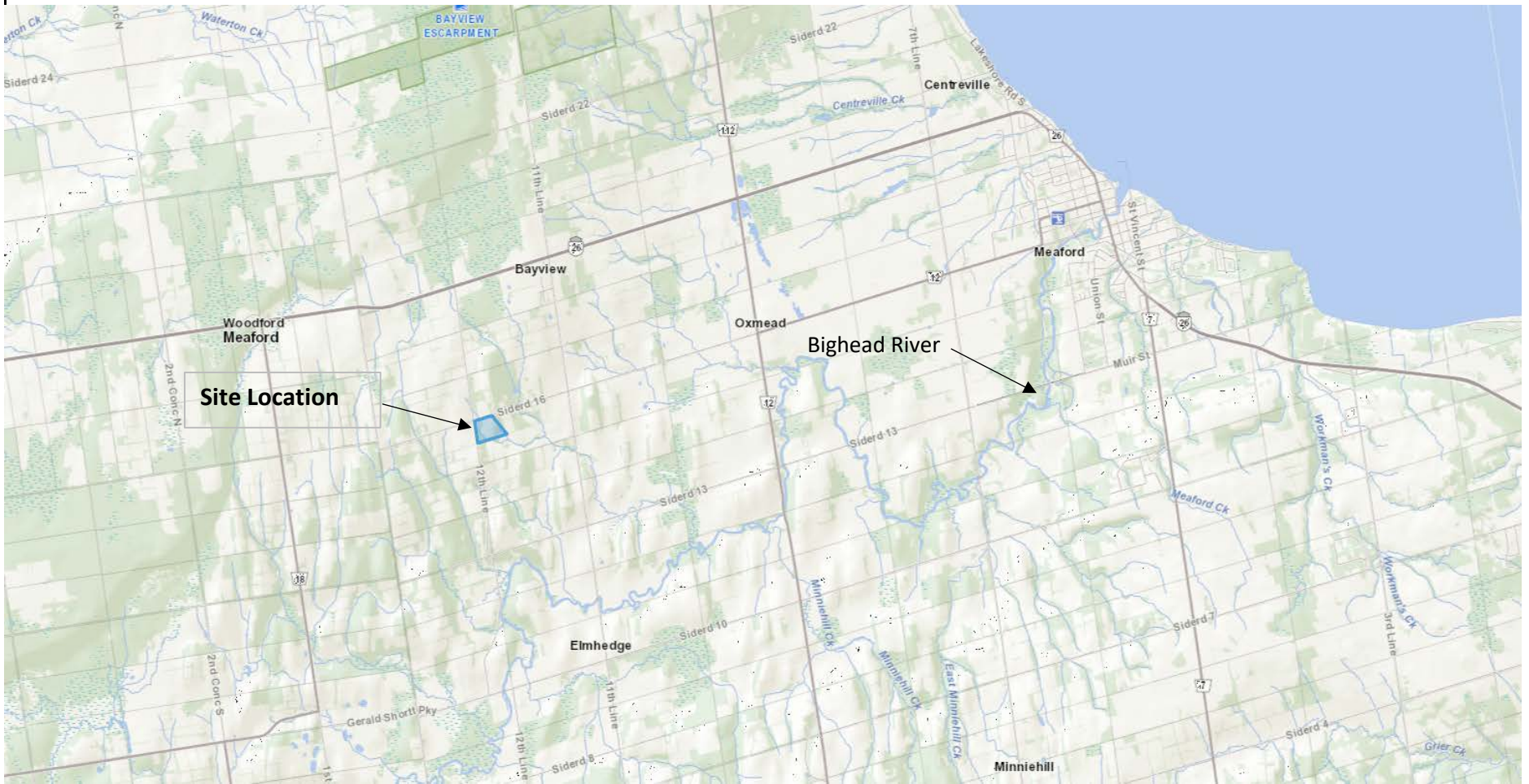
## **I. CLOSURE**

We trust that this is satisfactory for your current requirements.

Yours truly,  
GAMAN Consultants Inc.

A handwritten signature in black ink that reads "Gary R. Hendy". The signature is written in a cursive style with a large, stylized "G" and "H".

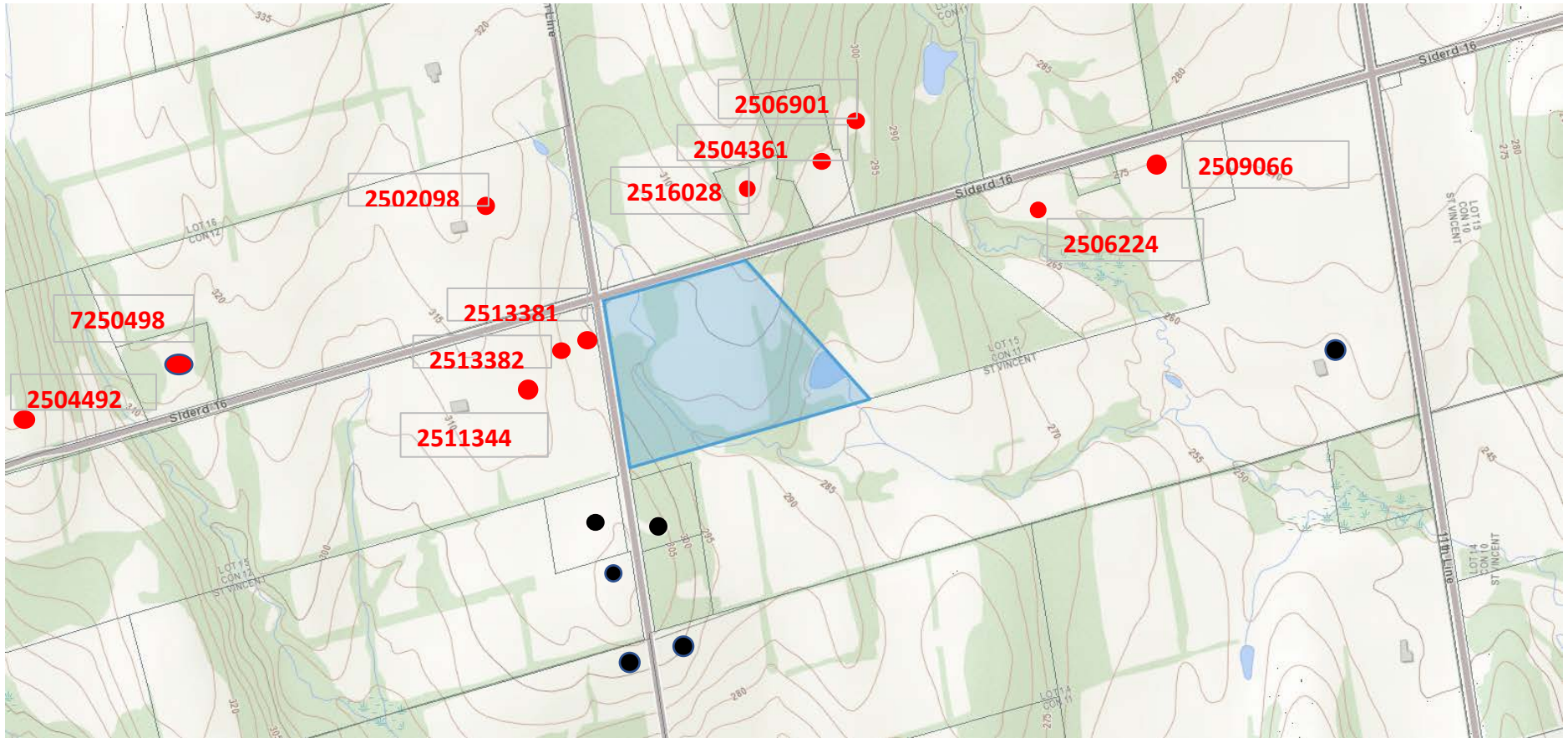
Gary R. Hendy, P.Eng.  
Consulting Engineer  
grh



NOTES

<b>SITE LOCATION</b>	
Groundwater Supply Hydrogeological Evaluation, 145166 16th Sideroad Campground, Meaford For Scott McIntosh	
Date:	Nov-19
Project:	19012.00
Scale:	NTS
Ref No:	
<b>GAMAN Consultants Inc.</b>	Figure <b>1</b>





**NOTES**

- MECP Water Well Location & Number (Approximate)
- Existing Dwelling from Google Earth
- Site Property

**WATER WELL LOCATION MAP**

Groundwater Supply Hydrogeological Evaluation, 145166 16th Sideroad,  
Meaford  
For Scott McIntosh

Date:	Nov-19	Scale:	NTS
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**GAMAN Consultants Inc.**

Figure

**TABLE 1: SUMMARY OF WATER WELL RECORDS**

Groundwater Supply Hydrogeological Evaluation, 145166 16th Sideroad Campground, Meaford (Project 19012.00)

St. Vincent Twp., Grey County (Con/Lot)	UTM (metres)	DATE BUILT & CONTRACTOR #	WELL DIA (in)	WATER FOUND (ft.bgl)	Static Level (ft.bgl)	Pumping Level (ft.bgl)	Test Rate (lgpm)	Time (hrs)	WELL USE	SCREEN top / Length (ft)	MOE WELL ID	FORMATION (feet below grade)
CON 11 014	17 527488 4937064 W	2006/08 1565	6.25	FR 0183	78	127	10	2	DO		2517043 A021744	LOAM 0001 BRWN CLAY 0030 BRWN CLAY GRVL 0180 GRVL SAND 0187
CON 11 014	17 523798 4935117 W	1999/11 3030	36 24	FR 0014 FR 0060	14			:	DO		2514133 (202103)	SNDY STNS 0014 BRWN CLAY STNS 0060 GREY SILT 0064 BRWN CLAY HARD STNS 0080
CON 11 015	17 524876 4936210 W	2009/03 1565	6.25 6.25	FR 0190	34	48	6	2.25	DO		7123031 A078587	LOAM 0001 RED CLAY GRVL STNS 0039 BRWN GRVL STNS CLAY 0134 BRWN CLAY STKY 0145 BRWN CLAY GRVL LYRD 0176 BRWN CLAY SOFT 0189 GRVL FGRD 0191
CON 11 015	17 524872 4936383 W	1975/07 1565	7 7	FR 0125	40	50	7	0.75	DO		2505219	PRDR 0120 GRVL 0121 CLAY 0123 GRVL 0130
CON 11 015	17 524495 4936723 W	1987/08 2576	6 5	FR 0294	120	160	10	0.1667	DO	0293 3	2509066 (10998)	BRWN LOAM 0001 RED CLAY GRVL 0020 RED CLAY GRVL SAND 0045 RED GRVL CLAY 0057 GREY CLAY STNS 0110 RED GRVL CLAY 0191 GRVL CLAY LYRD 0195 GREY GRVL CLAY 0228 RED CLAY GRVL 0270 BRWN GRVL CLAY SLTY 0280 GRVL FSND 0295 STNS CLAY 0310 RED SHLE 0330
CON 11 015	17 524265 4936623 W	1977/09 3741	6	FR 0088		18	3	0.1667	DO		2506224	LOAM 0001 CLAY GRVL 0088 SAND GRVL CLAY 0090

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CON 11 015	17 524885 4936383 W	1972/04 1565	7	FR 0118 FR 0120	40	76	2	1.5	ST DO		2503756	BLCK LOAM 0001 RED CLAY SAND BLDR 0010 BRWN CLAY SAND BLDR 0043 RED CLAY SAND STNS 0074 BRWN CLAY SAND GRVL 0118 GRVL 0121
CON 11 016	17 524515 4937073 W	1969/07 4716	5	FR 0144	63	148	3	0.125	ST DO		2502862	LOAM 0001 RED CLAY STNS 0028 RED CLAY GRVL 0064 BRWN CLAY 0084 RED CLAY GRVL 0135 CLAY SAND 0144 SAND GRVL 0153 GRVL 0157
CON 11 016	17 524715 4937323 W	1979/03 1565	6 6	FR 0240	115	146	5	4.166	ST DO		2506821	LOAM 0001 BRWN CLAY STNS 0034 BRWN CLAY GRVL 0050 GREY SILT SAND LYRD 0084 BRWN CLAY GRVL LYRD 0093 SILT GRVL LYRD 0125 BRWN GRVL SILT CMTD 0210 RED CLAY GRVL 0234 BLUE SHLE 0250
CON 11 016	17 523771 4936651 W	2004/06 6433	6.25	FR 0089	67	71	10	0.4167	DO		2516028 A001636	LOAM 0004 BRWN CLAY SAND STNS 0087 GREY GRVL 0091
CON 11 016	17 523965 4936773 W	1979/05 1565	6 6	FR 0129	14	19	4	0.625	DO		2506901	LOAM 0001 BRWN CLAY GRVL LYRD 0112 GREY SILT SAND GRVL 0133
CON 11 016	17 523915 4936723 W	1973/09 1565	6 6	FR 0062	17	25	4	0.75	DO		2504361	BLCK LOAM 0001 BRWN CLAY BLDR 0018 RED CLAY BLDR 0052 BRWN CLAY GRVL 0060 GRVL 0064

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St. Vincent Twp., Grey County (Con/Lot)	UTM (metres)	DATE BUILT & CONTRACTOR #	WELL DIA (in)	WATER FOUND (ft.bgl)	Static Level (ft.bgl)	Pumping Level (ft.bgl)	Test Rate (lgpm)	Time (hrs)	WELL USE	SCREEN top / Length (ft)	MOE WELL ID	FORMATION (feet below grade)
CON 12 015	17 523468 4936396 W	1997/08 1565	6 5	FR 0275 FR 0280 FR 0305 FR 0314	145	160	8	3	DO		2513382 (177428)	LOAM 0001 BRWN CLAY STNS GRVL 0060 BRWN CLAY GRVL 0100 GRVL CLAY 0128 CLAY GRVL 0268 RED SHLE LYRD 0290 GREY SHLE 0320
CON 12 015	17 523528 4936406 W	1997/08 1565							DO		2513381	LOAM 0001 RED CLAY STNS 0019 BRWN CLAY STNS BLDR 0050
CON 12 015	17 523404 4936335 W	1991/06 1565	6	FR 0086 FR 0090	46	56	4	1.6667	DO ST	0086 4	2511344	LOAM 0002 BRWN CLAY STNS 0049 GREY CLAY GRVL 0055 BRWN CLAY GRVL 0085 MSND 0092
CON 12 016	17 523315 4936623 W	1967/07 4726	5 5	FR 0049	21	45	10	0.1667	ST DO		2502098	LOAM 0001 RED CLAY 0009 CLAY GRVL 0049 GRVL 0056
CON 12 016	17 522502 4936311 W	1973/10 1565	7 7	FR 0080	23	60	2	0.8333	DO		2504492	LOAM 0001 CLAY GRVL BLDR 0027 GRVL CLAY 0080
CON 12 016	17 522790 4936360 W	2015/09 1565	6.25 6.25	OT 0085	23	51	4	0.8333	DO		7250498 A141734	LOAM 0002 BRWN CLAY STNS 0018 BRWN LMSN 0025 GREY SHLE 0036 RED SHLE 0112

Wells appearing in Figure 2

	Bedrock	Overburden	Units
Number	3	13	none
Min Rate	4	2	lgpm
max Rate	8	10	lgpm
Avg Rate	5.7	5.8	lgpm

**TABLE 2: PREDICTED GROUND WATER INTERFERENCE****Groundwater Supply Hydrogeological Assessment 145166 16th Sidroad Meaford Campground (19012.00)**

t (days)            T(m2/day)            S            Q(m3/day)  
 150            10.0            1.0E-04            6.05

MECP Well	UTM CO-ORDINATES OF MECP WELL		UTM Co-ordinates of Site Well (Approximate)		Distance to Site Well (metres)	Predicted Drawdown (metres)	Available Drawdown (metres)
	NORTHING	EASTING	NORTHING	EASTING			
2517043	4937064	527488	4936500	523795	3736	0.0	31.1
2514133	4935117	523798			1383	0.1	4.9
7123031	4936210	524876			1119	0.2	47.2
2505219	4936383	524872			1083	0.2	25.3
2509066	4936723	524495			735	0.2	48.8
2506224	4936623	524265			486	0.2	26.8
2503756	4936383	524885			1096	0.2	23.8
2502862	4937073	524515			920	0.2	24.7
2506821	4937323	524715			1234	0.1	38.1
2516028	4936651	523771			153	0.4	6.1
2506901	4936773	523965			322	0.3	29.9
2504361	4936723	523915			253	0.3	13.1
2513382	4936396	523468			343	0.3	39.6
2513381	4936406	523528			283	0.3	Na
2511344	4936335	523404			424	0.3	11.9
2502098	4936623	523315			496	0.2	8.5
2504492	4936311	522502			1307	0.1	17.4
7250498	4936360	522790			1015	0.2	18.9

MECP Wells appearing in Figure 2