

**REPORT  
ON  
PUMPING TEST  
1823 Vermilion Lake Road  
FOR  
TULLOCH Engineering Inc.  
Sudbury, Ontario**

**FILE COPY**

**FEBRUARY 2019**



**S. A. Kirchhefer Limited**

CONSULTING ENGINEER AND PLANNER

Sudbury Ontario

**S.A. Kirchhefer Limited**

Consulting Engineer and Planner

364 Lloyd Street  
Sudbury, Ontario P3B 1P3  
(705) 673-0594

February 22, 2019



Mr. Kevin Jarus, M.PI, MCIP, RPP.  
1942 Regent Street  
Sudbury, ON  
P3E 5V5

Dear Mr. Jarus,

We are pleased to submit the report on the Availability of Potable Water at Club Richelieu, 1823 Vermilion Lake Road.

We trust that the report is sufficiently detailed and acceptable to you and to your client.

It was a pleasure working with you on this project, and the assistance you provided was greatly appreciated.

Yours truly

S. A. Kirchhefer Limited



S. A. Kirchhefer, Ph.D., P. Eng.

SAK:d

Encls.

Report dated February 2019

**Report**  
  
on  
  
**Availability of Potable Water**

Prepared for  
  
**Tulloch Engineering**

by  
  
**S. A. Kirchhefer Limited**  
Consulting Engineer  
364 Lloyd St  
Sudbury, ON P3B 1P3

T 705 673 0594

February 2019

## **Table of Contents**

i. Letter

1)	Existing Site Conditions.....	1
2)	Assessment of Existing Water Supply Well .....	3
3)	Summary and Recommendations .....	5

## Report

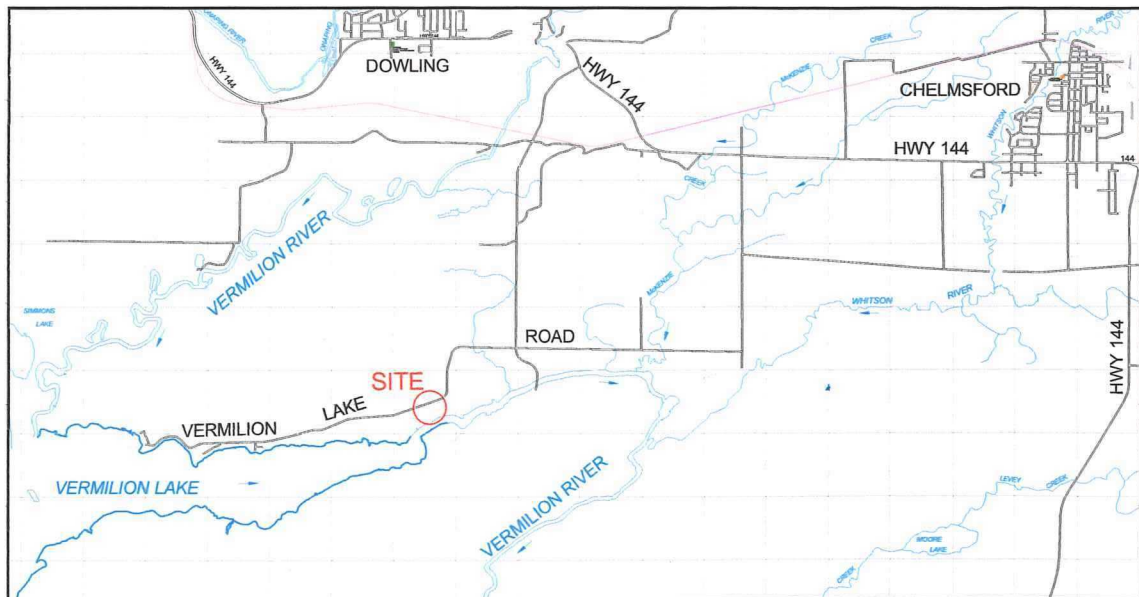
on

## Availability of Potable Water

It is the objective of the present report to assess the availability of potable water in terms of both quantity and quality at 1823 Vermilion Lake Road.

### 1) Existing Site Conditions

The site is located to the southwest of Chelmsford, at 1823 Vermilion Lake Road. Physically, the site covers an acreage of about 6.4 ha and it extends from Vermilion Lake Road in a southerly direction, towards the shoreline of Vermilion Lake. The general location of the site is indicated in **Figure 1**.



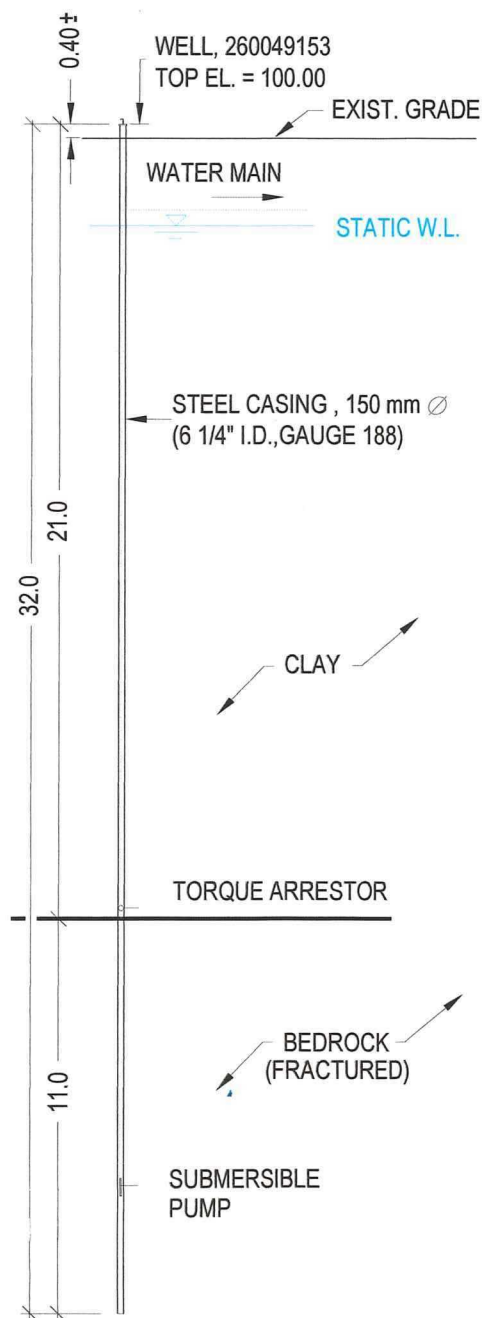
**Figure 1: Location**

The site characteristics show a relatively flat topography which declines towards the lake. According to the grade, the on-site drainage system, which includes primarily overland flow, discharges directly into the lake.

The regional geology is described by pertinent literature and supporting maps published by the Ministry of Natural Resources. For example, the overburden<sup>1</sup> is classified as a clay or clayey silt, while the underlying bedrock<sup>2</sup> is identified as a carbonaceous slate belonging to the Onwatin Formation of the Whitewater Group.

The regional geology (overburden) is confirmed by existing well records. At the site, a 150 mm Ø drilled well was installed in 2003. According to the records, the well penetrates 21.0 m of clayey overburden, and, thereafter, advances for another 11.0 m into bedrock. The total depth is reported to be 32.0 m.

The existing well was used to make an initial assessment of the aquifer's performance. Following a preliminary pumping test, geotechnical modelling was applied to evaluate further the performance for selected pumping rates. Details on the pumping test, including the findings in the field, are presented below.



**Figure 2: Existing Water Supply Well**

<sup>1</sup> Ontario Geological Survey, Map 2397, SUDBURY, Sudbury Rim, Quaternary Geology,

<sup>2</sup> Ontario Geological Survey, Map 2361, SUDBURY – COBALT, Geological Compilation Series

## **2) Assessment of Existing Water Supply Well**

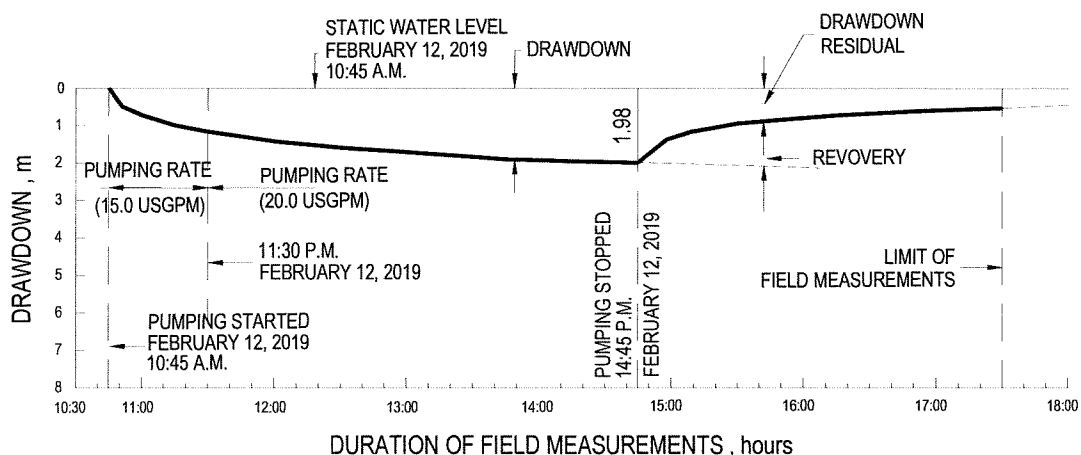
In most cases, pumping tests of a water well are carried out for several reasons. They typically include a quantitative assessment to see how much water would be available, and second, a qualitative assessment to see if the raw water meets applicable standards for drinking water – or can be treated to meet the standards.

### **2.1 Quantitative Assessment - Pumping Test**

Briefly, a pumping test involves the measurement of drawdowns in a well at a selected pumping rate. The obtained field data provides a sound basis for various tasks, including the calculation of principle factors of aquifer performance. Applicable standards for a pumping test vary, and they depend largely on the size of a project, or on the extent of water demand. For example, for non-municipal water supply systems servicing a small community, a 24 hour duration of pumping might be sufficient. At the other end of the scale, for a single family home, the following City of Sudbury standards apply:

- a) Pumping Rate = 3.0 USGPM,
- b) Pumping Duration = 4 hrs, and
- c) Full Recovery of the well within 24 hours.

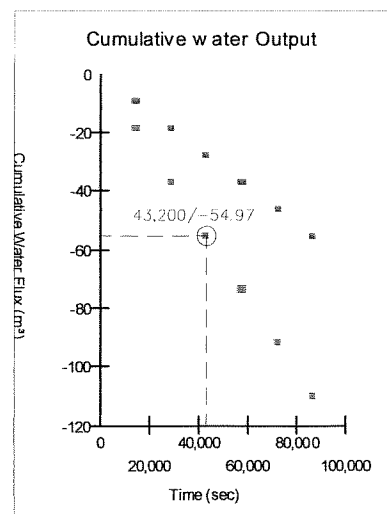
In the present case, the existing well was pumped for four (4) hours. At first, a constant pumping rate of 15.0 USGPM was selected. Following an initial assessment of the well's performance (after 45 minutes), the pumping rate was increased to 20 USGPM. Water levels in the well were recorded until the pumping stopped. Thereafter, the recovery of the water level was measured. To assist the reader, both the drawdown and the recovery are plotted with respect to time, and the resulting curves are shown in **Figure 3**. According to the figure, the maximum drawdown is 1.98 m, and full recovery is estimated to occur after an idle period of about 7 hours.



**Figure 3: Existing Water Supply Well – Drawdown & Recovery Curves**

The field data is also utilized for the development of a suitable geotechnical model<sup>3</sup>. After calibrating the model (radial flow to a well), the drawdown is readily computed for selected both pumping rates and time intervals.

A summary of the pumping test results is presented in **Table 1**. In addition, the table shows the predicted performance of the aquifer, based on a 24 hour, full recovery. It is noted that the daily cumulative water flux is estimated to be 55.0 m<sup>3</sup>. Adhering to the daily water output would allow the well to recover fully on a daily basis.



Usually, the pumping duration and the pumping rate vary, and they are governed typically by site-specific demands of water. For instance, if a daily, full recovery were not a concern, the well could be pumped at a significantly higher rate (say 60 USGPM over 24 hours, or more).

<sup>3</sup> Seep/W 2012, Geo-Slope International, Calgary, Alberta, Canada



PUMPING TEST RESULTS		PREDICTED DAILY
12-Feb-19		AQUIFER PERFORMANCE
DURATION, hrs	4	12
PUMPING RATE	20 USGPM±	20 USGPM
MAX. DRAWDOWN	1.98	2.2
RECOVERY, hrs	7.0 (ESTIMATED)	12
TOTAL OUTPUT	17.3 m <sup>3</sup>	55.0

**Table 1: Aquifer Performance**

## **2.2 Qualitative Assessment – Analytical Analysis**

Prior to terminating the pumping of the well, samples of the well water (raw) were secured and sent to Testmark Laboratories for analysis. The analytical results, which are found at the back of the report, are interpreted as follows:

- a. The results of the bacteriological analysis suggest that the ground water is safe for human consumption. Neither Ecoli nor Total Coliform are reported to be present.
- b. The chemistry of the sampled ground water meets the Ontario Drinking Water Standards with the exception of hardness, manganese, and sodium. Elevated levels of the first two parameters are often found in the natural environment, but the elevated levels are not a health related concern. The higher concentration of sodium is most likely caused by road salt. Since the concentration exceeds 20 mg/L, the local health unit should be advised accordingly.

## **3) Summary and Recommendations**

A simplified pumping test was conducted with the objective of obtaining an indication of the aquifer's performance and of the quality of the well water. The test protocol followed, by and large, to the City of Greater Sudbury standards. The test data collected in the field was also utilized for the calibration of a geotechnical model which is capable of analyzing radial flow to a well. With the help of the calibrated model, the performance of the aquifer was further evaluated.

The results indicate that the aquifer allows a daily extraction of 55.0 m<sup>3</sup> of water, if full recovery is a requirement.

The quality of the well water meets the Ontario Drinking Water Standards with a few exceptions. The exceptions relate mostly to aesthetic objectives, but are not a concern relating to health. In contrast, the local medical officer of health should be notified that the sodium concentration exceeds 20 mg/L.

Therefore, it is recommended that the permanent pumping system be fitted to the expected operating characteristics of the well. In addition, the raw water could be treated if it is desirable that the aesthetic objectives are fully met.

S. A. Kirchhefer, Ph.D., P. Eng,



**S. A. Kirchhefer Limited**

364 Lloyd Street, Sudbury, ON, P3B 1P3

T 705 673 0594

E: [sig@kirchhefer.ca](mailto:sig@kirchhefer.ca)



SAK:d

**IK Laboratories Ltd.**

o Quality and Service

**CERTIFICATE OF ANALYSIS**

Client:	Sig Kirchhefer	Work Order Number:	365695
Company:	S.A. Kirchhefer Ltd.	PO #:	
Address:	364 Lloyd Street	Regulation:	None
	Sudbury, ON, P3B 1P3	Project #:	Richelieu
Phone/Fax:	(705) 673-0594 / (705) 673-0832	DWS #:	
Email:	sig@kirchhefer.ca	Sampled By:	Sig Kirchhefer
Date Order	2/13/2019	Analysis Started:	2/13/2019
Received:		Analysis Completed:	2/21/2019
Arrival Temperature:	11 °C		

**WORK ORDER SUMMARY**

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
1832	1417046	Ground Water	None	SAMPLE CONTAINED RESULT EXCEEDENCES.	2/12/2019	2:35 PM

**METHODS AND INSTRUMENTATION**

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Alkalinity (A1.0)	Garson	Determination of Alkalinity by Titration	Modified from APHA-2320B
Anions Water (mg/L by IC) (A5)	Garson	Determination of Anions in Water by Ion Chromatography	Modified from SW846-9056A
Conductivity of Water (A12)	Garson	Determination of Conductivity in Water at 25°C	Modified from SM 2510 B
EC/TC/Back by MF on DC (A10)	Garson	Determination of E. coli and Total Coliforms in water by Membrane Filtration on DC Media	Modified from MOE E3407
ICPMS Reg. Water (A13)	Garson	Determination of Metals in Water by ICP/MS	Modified from SW846-6020A
pH of Water (A2.0)	Garson	Determination of Water pH by Ion Selective Electrode	Modified from APHA-4500H+ B



**TESTMARK Laboratories Ltd.**

*Committed to Quality and Service*

## CERTIFICATE OF ANALYSIS

S.A. Kirchhefer Ltd.

Reg. Hardness (A13)

Garson

Determination of Total Hardness

Work Order Number: 365695

Modified from APHA-2340B

TSS (A27)

Garson

Determination of Total Suspended Solids in water by gravimetry

Modified from SM-2540

Turbidity (A21)

Garson

Determination of Turbidity by Nephelometry

Modified from APHA-2130B

## REPORT COMMENTS

BACTI LOT #1547

This report has been approved by:

Khaled Omari, Ph.D.

Laboratory Director

**TESTMARK Laboratories Ltd.***Committed to Quality and Service***CERTIFICATE OF ANALYSIS**

S.A. Kirchhefer Ltd.

Work Order Number: 365695

**WORK ORDER RESULTS**

Sample Description	1832			
Lab ID	1417046			
Anions	Result	MDL	Units	Criteria: ODWS
Chloride	20	0.2	mg/L	250
Fluoride	0.24	0.025	mg/L	1.5
Nitrate (as N)	<0.02	0.02	mg/L	10
Nitrite (as N)	<0.008	0.008	mg/L	1
Sulphate	0.7	0.5	mg/L	500

Sample Description	1832			
Lab ID	1417046			
General Chemistry	Result	MDL	Units	Criteria: ODWS
Conductivity	459	1	µS/cm	~
M-Alkalinity (pH 4.5)	248	2	mg/L as CaCO <sub>3</sub>	~
pH	8.09	N/A	pH	~
Total Hardness (as CaCO <sub>3</sub> ) (Calc.)	157	0.1	mg/L	100
Turbidity	1.1	0.1	NTU	5

Sample Description	1832			
Lab ID	1417046			
Metals	Result	MDL	Units	Criteria: ODWS
Aluminum	2	1	ug/L	~



**TESTMARK Laboratories Ltd.***Committed to Quality and Service***CERTIFICATE OF ANALYSIS**

S.A. Kirchhefer Ltd.

Work Order Number: 365695

Antimony	<0.5	0.5	ug/L	6
Arsenic	2	1	ug/L	10
Barium	33	1	ug/L	1000
Beryllium	<0.5	0.5	ug/L	~

Sample Description	1832
Lab ID	1417046

Metals	Result	MDL	Units	Criteria: ODWS
Bismuth	<1	1	ug/L	~
Boron	741	2	ug/L	5000
Cadmium	<0.1	0.1	ug/L	5
Calcium	34100	500	ug/L	~
Cerium	<1	1	ug/L	~
Cesium	<1	1	ug/L	~
Chromium	<1	1	ug/L	50
Cobalt	<0.1	0.1	ug/L	~
Copper	4	1	ug/L	1000
Europium	<1	1	ug/L	~
Gallium	1	1	ug/L	~
Iron	173	20	ug/L	300
Lanthanum	<1	1	ug/L	~
Lead	0.1	0.1	ug/L	10
Lithium	9	5	ug/L	~
Magnesium	17500	4	ug/L	~

**TESTMARK Laboratories Ltd.***Committed to Quality and Service***CERTIFICATE OF ANALYSIS**

S.A. Kirchhefer Ltd.

Work Order Number: 365695

Manganese	74	1	ug/L	50
Mercury	<0.1	0.1	ug/L	1
Molybdenum	3	1	ug/L	~
Nickel	<1	1	ug/L	~
Niobium	<1	1	ug/L	~
Potassium	1990	100	ug/L	~
Rubidium	1	1	ug/L	~
Scandium	1	1	ug/L	~
Selenium	<0.5	0.5	ug/L	50

Sample Description	1832
Lab ID	1417046

Metals	Result	MDL	Units	Criteria: ODWS
Silver	<0.1	0.1	ug/L	~
Sodium	31700	1000	ug/L	20000
Strontium	352	1	ug/L	~
Sulfur	850	800	ug/L	~
Thallium	<0.1	0.1	ug/L	~
Thorium	<1	1	ug/L	~
Tin	<1	1	ug/L	~
Titanium	<1	1	ug/L	~
Tungsten	<1	1	ug/L	~
Uranium	<1	1	ug/L	20



**TESTMARK Laboratories Ltd.**

*Committed to Quality and Service*

## CERTIFICATE OF ANALYSIS

S.A. Kirchhefer Ltd.

Work Order Number: 365695

Vanadium	<1	1	ug/L	~
Yttrium	<1	1	ug/L	~
Zinc	12	1	ug/L	5000
Zirconium	<1	1	ug/L	~

Sample Description	1832
Lab ID	1417046

Microbiology	Result	MDL	Units	Criteria: ODWS
Escherichia coli	0	1	CFU/100mL	1
Total Coliform	0	1	CFU/100mL	1

Sample Description	1832
Lab ID	1417046

Solids	Result	MDL	Units	Criteria: ODWS
Total Suspended Solids	<0.67	0.67	mg/L	~

## LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

[rr]: After a parameter name indicates a re-run of that parameter. Sample may not have been handled according to the recommended temperature, hold time and head space requirements of the method after the initial analysis.

MDL: Method detection limit or minimum reporting limit.

Quality Control: All associated Quality Control data is available on request.

Exceedences: HIGHLIGHTED CELLS INDICATE THAT THE RESULT EXCEEDS A REGULATORY LIMIT. CALCULATED UNCERTAINTY ESTIMATIONS ARE NOT APPLIED FOR DETERMINING SAMPLE EXCEEDANCES.

Benzo(b)fluoranthene: Results for benzo(b)fluoranthene may include contributions from benzo(j)fluoranthene.