

January 25, 2019

File: 62672.03

Pinecrest Remembrance Services
2500 Baseline Road
Ottawa, Ontario
K2C 3H9

Attention: Mr. John Cole

**Re: Hydrogeological Assessment – Comments / Update
Highland Park Cemetery Visitation Centre
2037 McGee Side Road
Ottawa, Ontario**

This letter presents comments and updates for a previously completed hydrogeological assessment for the above noted subject site by Houle Chevrier Engineering Ltd. (HCEL) entitled “Hydrogeological Assessment, Highland Park Cemetery Visitation Centre, 2037 McGee Side Road, Ottawa, Ontario” dated July 2010. No new field work was performed for this update.

1.0 WATER QUANTITY

As part of the original study, a newly drilled water supply well was drilled on February 18, 2010 and due to low well yields, the well was further developed using cable tool drill rig and hydro-fractured on April 30, 2010. The well was pumped on May 18, 2010 at a rate of approximately 22.5 litres per minute for approximately six hours. The measured drawdown of the water level in the water supply well was approximately 12.12 metres which represents approximately 15.7 percent of the available drawdown in the water supply well. The resulting groundwater withdrawal was approximately 8,100 litres and the well recovered 95% within 130 minutes after the pump was shut off.

Based on the site plan details at the time of the initial investigation, the water demand (septic) is expected to be 6,900 litres per day. The pumping test conducted on the water supply well withdrew approximately 8,100 litres and sufficient quantities of water are available from the water supply well for the proposed development.

2.0 WATER QUALITY

Multiple water quality samples were collected for the water supply well including before and after well development (cable tool) and hydro-fracturing. A summary of the water quality exceedances

is provided in the table below. Additional detail and discussion can be found in the original HCEL Hydrogeological Assessment report.

Table 1: Water Quality Exceedances Summary

Date	Parameter Exceeded ¹	Concentration	ODWS Limit	Notes
Feb. 18, 2010	Well Drilled/Cable Tool			
Feb. 19, 2010	Total Coliform	<10 ct/100 mL	0 ct/100 mL	Exceedance due to elevated detection limit
	Escherichia Coli	<10 ct/100 mL	0 ct/100 mL	Exceedance due to elevated detection limit
	Colour	17 TCU	5 TCU	-
	Fluoride	3.17 mg/L	1.5 mg/L	-
	Hydrogen Sulphide	1	0.05 mg/L	Elevated Detection Limit
	Turbidity	>100 NTU	5 NTU	Elevated turbidity due to cable tool drill rig
	Sodium	125 mg/L	20 mg/L	Exceeds warning level for persons on sodium restricted diets only
	Iron	1.54 mg/L	0.3 mg/L	-
	Manganese	0.06 mg/L	0.05 mg/L	-
	Organic Nitrogen	0.18 mg/L	0.15 mg/L	-
Mar. 5, 2010	Fluoride	2.71 mg/L	1.5 mg/L	Parameters tested: colour, fluoride, H ₂ S, turbidity, iron and manganese
	Hydrogen Sulphide	3.80 mg/L	0.05 mg/L	
	Turbidity	36.7 NTU	5 NTU	
Mar. 16, 2010	Fluoride	2.94 mg/L	1.5 mg/L	Parameters tested: fluoride
Mar. 18, 2010	Fluoride	3.32 mg/L	1.5 mg/L	Parameters tested: fluoride
Apr. 30, 2010	Hydro-Fractured			
May 5, 2010	Fluoride	1.93 mg/L	1.5 mg/L	Parameters tested: fluoride
May 18, 2010	Total Coliform	6 ct/100 mL (3 and 6-hr sample)	0 ct/100 mL	-

Date	Parameter Exceeded ¹	Concentration	ODWS Limit	Notes
May 18, 2010	Fluoride	1.68 and 2.12 mg/L (3 and 6-hr sample)	1.5/2.4 mg/L ²	-
	Sodium	123 and 177 mg/L (3 and 6-hr sample)	20/200 mg/L ³	-
	Hydrogen Sulphide	0.17 and 0.75 mg/L (3 and 6-hr sample)	0.05 mg/L	-
	Total Dissolved Solids	520 and 683 mg/L (3 and 6-hr sample)	500 mg/L	-
	Turbidity	11.2 and 22.9 NTU (3 and 6-hr sample)	5.0 NTU	-
	Hardness	128 and 121 mg/L as CaCO ₃ (3 and 6-hr sample)	100 mg/L as CaCO ₃	-
Jun. 9, 2010	Total Coliform re-tested (0 ct/100mL)			Parameters tested: total coliforms

Notes:

1. Unless stated in the notes, full 'subdivision package' parameters tested.

Naturally occurring fluoride concentrations in the range of 1.5 to 2.4 mg/L can be address through local boards of health.

2. Sodium concentration does not exceed aesthetic objective and exceeds warning level of 20 mg/L for persons on sodium restricted diets only.

The water quality does not meet the Ontario Drinking Water Standards (ODWS), Maximum Acceptable Concentrations, and the Maximum Concentration Considered Reasonably Treatable (MCCRT) for the following parameters:

- Total Coliform (<10 ct/100 mL and 6 ct/100 mL measured on February 19, 2010 and May 18, 2010 respectively) exceed the ODWS Maximum Acceptable Concentrations.
 - Following well chlorination and additional well development on June 8-9, 2010 the total coliform decreased to non-detectable concentrations (0 ct/100 mL) which meets the ODWS Maximum Acceptable Concentration of 0 ct/100 mL.
- Total dissolved solids (520 and 683 mg/L) exceeds the ODWS aesthetic objective of 500 mg/L.

- Langelier Saturation Index (LSI) and Ryznar Stability Index (RSI) calculations demonstrate the water is considered to have a slight but tolerable scaling and corrosive potential. Discernable taste problems due to TDS exceedances are not anticipated.
- Laboratory measured turbidity (11.2 and 22.9 mg/L) exceeds the ODWS aesthetic objective of 5 NTU.
 - Additional well development conducted on June 9, 2010 reported field measurements of turbidity ranging from 1.95 to 2.76 NTU (refer to Table 4 in HCEL Hydrogeological Assessment Report).
- Sodium (123 and 177 mg/L) exceeds the ODWS 'warning level' of 20 mg/L for persons on sodium restricted diets.
 - The sodium exceedance should be reported to the local Medical Officer of Health.
- Fluoride (1.68 and 2.12 mg/L) exceeds the Maximum Acceptable Concentration of 1.5 mg/L.
 - Where naturally occurring fluoride concentrations are greater than 1.5 mg/L but less than 2.4 mg/L the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.
 - The local medical officer of health was notified of the sodium and fluoride concentrations found in the test well and concurred that education and notification to the users of the well for consumption purposes is an acceptable approach.
- Hydrogen Sulphide (0.17 and 0.75 mg/l) exceeds the ODWS aesthetic objective of 0.05 mg/L.
 - Ingestion of large quantities of hydrogen sulphide gas can produce toxic effects in humans, although unlikely for someone to consume large quantities due to the unpleasant taste and odour.
 - An unofficial addendum to Procedure D-5-5 (July 6, 1995) indicates that sulphide concentrations of up to 2.5 mg/L can be reasonably treated with manganese greensand filters or through aeration.
- Hardness (128 and 121 mg/L) exceeds the ODWS operational guideline.

- Within the Procedure D-5-5 treatability limits (500 mg/L) and can be treated using conventional water softeners.

Based on a review of the HCEL Hydrogeological Assessment report, several water quality parameters do not meet the ODWS as outlined in MOECC Procedure D-5-5; however, all parameters are within MOECC Procedure D-5-5 treatability limits. The use of multiple water treatment systems are required to provide potable water for the proposed development and a water quality specialist is recommended to design the water treatment system. Alternatively, groundwater can be used for the plumbing system only and potable water (e.g. bottled water) can be provided to employees and guests. Refer to the HCEL Hydrogeological Assessment report for recommendations regarding water quality.

Due to the prior total coliform exceedances and ODWS water quality exceedances in the test well, it is recommended that the test well be chlorinated, circulated and tested for 'subdivision package' parameters following connection to ensure the groundwater meets the maximum acceptable concentrations for bacteria and provides updated water quality concentrations for the design of the water treatment systems.

3.0 GROUNDWATER IMPACT ASSESSMENT

A geotechnical investigation completed by GEMTEC, entitled "Geotechnical Investigation, Highland Park Cemetery Visitation Centre, 2037 McGee Side Road, Ottawa, Ontario" and dated January 25, 2019, discusses the subsurface conditions at the subject site. A surficial layer of topsoil, generally ranging in thickness from about 0.1 metres to 0.3 metres, was encountered in all of the boreholes and test pits. Topsoil on the subject site was generally determined to be underlain by deposits silty clay, sandy silt and glacial till. A detailed discussion on the subsurface conditions can be found in the aforementioned geotechnical report.

Calculations were carried out to assess the potential impact of septic effluent on the properties adjoining the proposed development using a nitrate dilution model (Thornthwaite Water Balance method). The nitrate concentration at the site boundaries was calculated to be 1.53 mg/L; refer to the HCEL Hydrogeological Assessment Report for input data and assumptions). Furthermore, the background nitrate concentrations as measured in the overburden soils (two monitoring wells) and the bedrock test well reported non-detectable (<0.10 mg/L) nitrate concentrations.

4.0 CARP ROAD CORRIDOR CONSIDERATIONS

One of the objectives of the Carp Road Corridor Community Design Plan is to ensure natural hydrogeologic regime (e.g. groundwater recharge) is maintained. The "Carp Road Corridor Community Design Plan" publication #3-08, dated June 2004 indicates that the subject site is located within an agricultural resource and marginal resource area (refer to Schedule 1) and does not fall within a moderate or high recharge area as indicated on the environmental features (Schedule 2) figure. Similarly, the Dillon Consulting Limited report entitled "Carp Road Corridor

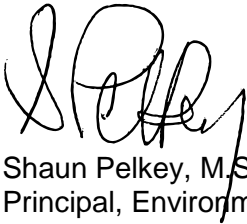
Groundwater Study” dated November 30, 2004 indicates the subject site is located within an area of low to moderate groundwater infiltration which has weak to strong downward vertical groundwater gradients.

Based on the results of the subsurface investigation (refer to Geotechnical Report), the subject site is underlain by deposits silty clay, sandy silt and glacial till which is not expected to have significant recharge. Given the size of the proposed development (1,400 m²) relative to the subject site area (120 acre; 485,623 m²), no significant reductions in groundwater recharge are anticipated.

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



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