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Hydrogeological Investigation & Terrain Analysis
Proposed Commercial Building
4 Campbell Reid Court
Ottawa, Ontario

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Submitted to:

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Ottawa, Ontario

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained to carry out a hydrogeological investigation and terrain analysis in support of a proposed commercial building to be located at 4 Campbell Reid Court in Ottawa, Ontario. The site location is provided in Figure 1, which is located following the text of this report.

The objectives of the investigation are the following:

- Confirm that the construction of any new well is in accordance with the Ministry of Environment, Conservation and Parks (MECP) requirements;
- Confirm that the quality of the well water meets the Ontario Drinking Water Standards and maximum treatable limits prescribed in MECP Procedure D-5-5;
- Confirm that the quantity of water meets the MECP requirements; and,
- Confirm that the septic impact assessment meets the MECP requirements.

2.0 SITE BACKGROUND

2.1 Project Description

Plans are being prepared to construct a commercial building at 4 Campbell Reid Court in Ottawa, Ontario. The proposed development includes a vet clinic, access roadway and office parking areas. The proposed building will have a footprint of about 504 metres squared and will be a slab-on-grade (i.e., basementless) construction and will be serviced with a water supply well and septic system. A copy of the most current Site Development Plan is provided in the Appendix A.

The site is currently developed and includes one residential dwelling serviced by a conventional on-site septic system and bedrock water supply well (PW4). The total site area is 0.80 hectares.

2.2 Site Geology

Surficial geology maps of the Ottawa area (Ontario Geologic Survey, 2010) indicate that the proposed site has an overburden thickness of about 0 to 1 metre. Bedrock geology maps (Armstrong and Dodge, 2007) show that the site is underlain by Paleozoic aged sandstone and dolostone bedrock of the March formation. Two west-east oriented faults are located within 500 metres of the site, with dolostones of the Oxford Formation to the east and sandstones of the Nepean Formation to the north.

Beneath the site, the uppermost bedrock formation is a sandstone unit that is interpreted to be part of the March Formation, which is an interbedded grey quartz sandstone, dolomitic quartz sandstone, and blue-grey sandy dolostone and dolostone. The March Formation is underlain by the Nepean Formation, which can be characterized as a quartz sandstone that is thinly bedded to massive and well sorted. The sandstone is variable in colour and can be white to light grey, brown, reddish brown and green.

Available karst mapping (Brunton and Dodge, 2008) does not indicate the presence of any inferred or potential karstic features.

2.3 Previous Site Investigations

Previous studies completed at the site were reviewed as part of the site characterization and include the following:

- "Geotechnical Investigation, Proposed Commercial Building, 4 Campbell Reid Court, Ottawa, Ontario" dated July 9, 2021 (herein referred to as GEMTEC geotechnical investigation).

- "Phase One Environmental Site Assessment, 4 Campbell Reid Court, Ottawa, Ontario" dated September 30, 2021 (herein referred to as GEMTEC Phase One ESA).

- "Phase Two Environmental Site Assessment, 4 Campbell Reid Court, Ottawa, Ontario" dated July 18, 2022 (herein referred to as GEMTEC Phase Two ESA).

The relevant subsurface information from the geotechnical investigation is discussed in the terrain analysis section below. The GEMTEC Phase One ESA identified one area of potential environmental concern associated with fill of unknown quality on the site. The relevant results from the GEMTEC Phase Two ESA are provided below:

- MECP Table 6 SCS residential use soil exceedances of electrical conductivity from BH22-3.
    - The soil exceedances on-site is located in part of the proposed commercial development, particularly, under the proposed access to the parking lot of the veterinary clinic. As such, the measure electrical conductivity does not exceed the commercial standards, which would be applicable to this portion of the property.

- MECP Table 6 SCS and Ontario Drinking Water Quality Standard (ODWQS) groundwater exceedance for barium in PW4. Barium was reported to be 4.4 mg/L, which exceeds the Table 6 SCS and ODWQS standard of 1.0 mg/L.
    - No barium exceedances to Table 6 SCS were detected in the soils. Based on measured concentration of barium in soil, the low solubility of barium in groundwater, the typical sparse vertical fracture patterns in the limestone and dolostone bedrock, and that the groundwater sample was collected from a relatively deep aquifer (approximately 25 meters below ground surface), it is unlikely that the barium concentration in the groundwater sampled is due to the fill material at surface.
    - The soil was classified as non-hazardous and may be disposed of at an MECP licensed landfill. No other areas of potential environmental concern were identified.

- A substantial source of barium in groundwater can occur from leaching and eroding of barium from sedimentary rocks (Health Canada, 2020); however, barium is seldom at concentrations greater than 1.0 mg/L (MECP, 2006). Elevated barium concentrations may also be the result of anthropogenic activities such as the use of barium-rich fertilizers and insecticides, drilling mud, and shale gas development.
- The samples analyzed for the ESA investigation were field filtered, representing dissolved barium concentrations, and are not directly comparable to the ODWQS guidelines for total metal concentrations.
- Additional sampling completed on June 13, 2023 reported elevated total barium concentrations of 4.27 mg/L.

- Groundwater quality assessed in the upper bedrock aquifer through sampling of one on-site private well (PW4). A groundwater sample was submitted for analysis of PAHs, PHCs F1 to F4, and VOCs, all of which reported non-detectable concentrations.

3.0 TERRAIN ANALYSIS

3.1 Subsurface Conditions

The subsurface conditions at the site are described in the geotechnical and Phase Two ESA investigations completed by GEMTEC. The field work for the geotechnical investigation was carried out on June 23, 2021. At that time, five test pits numbered 21-1 to 21-5, inclusive, were advanced at the site to depths ranging from about 1.0 to 1.3 metres below existing grade (elevations 91 to 92 metres, geodetic). The Phase 2 ESA included six boreholes advanced at the site in March 2022 to depths of about 0.5 to 1.8 metres below existing grade (elevations 91 to 93 metres, geodetic).

The results of the boreholes and test pits are provided on the Record of Borehole and Test Pit sheets in Appendix B. The locations of the test holes are shown on the Site Plan, Figure 1.

A summary of the soil conditions, based on the geotechnical and Phase 2 ESA investigations, are summarized below.

3.1.1 Fill Material

Fill material, having a thickness of between 0.3 and 1.0 metres, was encountered at all test pit locations. The composition of the fill material can be generally described as dark brown/grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders, and construction debris.

3.1.2 Former Topsoil

Below the fill material, a layer of former topsoil with an average thickness of 0.2 meters, was encountered at all test pit locations except at test pit 21-1. It is composed of dark brown silty clay with organic material.

3.1.3 Glacial Till

A deposit of glacial till was encountered at test pit locations 21-1, 21-2, 21-3 and 21-5. The glacial till deposit has a thickness of about 0.1 and 0.2 metres and extends to depths of about 1.0 and 1.3 metres below ground surface (elevation 91.8 and 92.0 metres). The glacial till can generally be described as brown silty sand with trace to some clay and trace gravel. Cobbles and boulder sized rock fragments can also be found throughout the glacial till.

3.1.4 Inferred Bedrock

Practical shovel refusal occurred in all the test holes between 1.0 and 1.8 metres below ground surface (elevation 91.8 to 93.0 metres).

It should be noted that practical shovel refusal can sometimes occur on nested boulders or rock, or on a fractured / weathered bedrock zone above the rock head level. Shovel refusal depth can also be dependant on the excavation equipment used and thus may not be representative of the upper surface of the bedrock.

3.2 Overburden Groundwater Levels

The GEMTEC geotechnical investigation notes that minor groundwater seepage was observed at the bottom of test pit 21-3 at a depth of about 1.0 metres below existing grade during the relatively short period the test pit was open. All other test pits were dry prior to backfilling. No standpipe piezometers were installed as part of the previous geotechnical or Phase Two ESA investigations.

Groundwater flow often reflects topographic features and typically flows toward nearby lakes, rivers, and wetland areas. Based on the topography of the area, it is expected that regionally local shallow groundwater flow may trend north/easterly towards the Shirley's Bay and the Ottawa River.

It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation. Also, a perched groundwater level may be present within the fill material.

4.0 GROUNDWATER SUPPLY INVESTIGATION

4.1 Background Water Well Records

A search of the Ministry of Environment, Conservation and Parks (MECP) water well records (https://www.ontario.ca/environment-and-energy/map-well-records) returned 47 waters well records within 500 metres of the subject site (locations displayed on figure 2). The results of the well record search are provided in Appendix C. The well depths range from 11.6 to 103.6 metres below ground surface, with an average well depth of 26.8 metres. The recommended pumping

rates provided by the well drillers range from 11.4 to 113.6 litres per minute, with an average of 29.9 litres per minute.

A review of the well construction details indicates that most wells are completed within the dolostone and/or sandstone bedrock of the March or Nepean Formations. Due to strong similarities, the dolostone were regularly identified as limestone in the MECP water well records.

4.2 Test Wells

Three test wells were utilized as part of the hydrogeological investigation for the site. A summary of the test wells is provided below.

- PW4: Existing on-site water supply well currently servicing residential dwelling at 4 Campbell Reid Court.
- PW6: Neighbouring water supply well.
- TW22-1: Newly drilled on-site test well to service proposed development.

A well camera inspection was completed for PW4 on November 5, 2021, to determine well construction details. During the inspection, water was observed flowing into the well casing sat a depth of approximately 3.3 meters below top of casing. The inflowing water is the result of an improperly sealed old pitless adapter (adapter connecting to submersible pump tubing to supply water to residence). Due to the infiltration of shallow formation water, the well was susceptible to bacteria and other sources of contamination. A repair was attempted; however, water inflow was observed flowing into the well casing during the pumping test performed on November 10, 2021. The overburden surrounding the well casing was excavated down to the source of the leak at approximately 3.3 meters below top of casing, and backfilled with cement on December 22, 2021.

A water supply well (TW22-1) was constructed at 4 Campbell Reid Court on April 14, 2022, by a licensed MECP well contractor (Air Rock Drilling Co. Ltd; License No. 7681). The well casing was extended to 29.3 metres below ground surface. The approximate location of the water well is provided on the Site Plan, Figure 1 and a copy of the MECP Water Well Record for TW22-1 is provided in Appendix C.

The construction details from the MECP Water Well Record are summarized in Table 1:

Table 1: On-Site Water Well Construction Details

	TW22-1	PW4(1)	PW6
Well Tag #	A318575	-	-
Depth to Bedrock	1.2 metres	-	-

	TW22-1	PW4[1]	PW6
Length of Well Casing	31.1 metres	14.3 metres[2]	-
Length of Well Casing Above Ground Surface	0.6 metres	-	-
Length of Well Casing Below Ground Surface	30.5 metres	-	-
Length of Well Casing Set Into Bedrock	29.3 metres	-	-
Depth Water Found	38.7 & 76.2 metres	-	-
Total Well Depth	79.2 metres	25.1 metres	-
Overburden Description	Sand and boulders	-	-
Bedrock Description	Grey sandstone	-	-

Note:
1. Well specifications based on well camera inspection completed by Air Rock Drilling Ltd.
2. Old pitless adapter not sealed and water leakage into well bore observed at approximately 3.3 metres below top of casing.

4.3 Groundwater Quantity

An on-site water supply well will be used to service the proposed veterinary clinic and may also supply the existing residential dwelling. The maximum anticipated water demand is calculated as follows:

- Residential dwelling = 18.75 litres per minute
  - 3.75 litres per person x 5 persons in a 4-bedroom home
  - 2,250 litres per day (450 litres per person x 5 persons in a 4-bedroom home)
- Veterinary clinic = 12 litres per minute
  - Daily design flow of 700 litres per day
  - Anticipated maximum flow rate of approximately 12 litres per minute (pumping at a rate of 12 litres per minute over a period of 2-hour would be equal to two times the daily design septic flows, considered to be representative of maximum water quantity requirements).
- Maximum anticipated pumping rate = 30.75 litres per minute

A pumping test was carried out on TW22-1, the proposed water supply well for the development. The well was pumped on May 4, 2022 at a constant rate of 42.0 litres per minute for a period of eight hours. The water from the pumping test was discharged to the ground surface approximately 10 metres away from the test well such that the discharge flow was away from the well head.

Water level and flow rate measurements were taken at regular intervals throughout the pumping test. Water levels were also taken during the recovery phase of the pumping test (after the pump was turned off). The pumping test drawdown and recovery graph is provided in Appendix D.

During the pumping test the water level decreased approximately 15.1 metres from a static water level of 1.27 metres below ground surface, following approximately 60 minutes of pumping. After 60 minutes, the water level decreased an additional 0.68 metres during the remaining seven hours of pumping. Frequent flow rate measurements confirmed that the pumping was maintained at a constant rate of 42.0 litres per minute. Minor water level fluctuations at 60 and 240 minutes of pumping may be attributed to neighbouring use of water supply. The pumping test withdrew approximately 20,160 litres.

The transmissivity of the water supply aquifer was estimated from the pumping test drawdown data using Aqtesolv (Version 4.5), a commercially available software program from HydroSOLVE Inc. An analysis of the pumping test and recovery data was carried out using the Papadopoulos-Cooper and Theis recovery method of analyses. The results of the Aqtesolv analyses are provided in Appendix D.

The Papadopoulos-Cooper and Theis recovery analyses indicate that the transmissivity of the water supply aquifer is calculated to be 5 m^2/day and 2 m^2/day respectively. The maximum drawdown in the water level of the well was approximately 15.8 metres following eight hours of pumping at a flow rate of 42.0 litres per minute. Based on a static water level of 1.3 metres below ground surface, the total well depth of 79.2 metres and the water level after eight hours of pumping, the remaining available drawdown in the well is approximately 62.1 metres.

4.4 Groundwater Quality

4.4.1 Background Water Quality

In order to assess the background water quality, water quality samples were collected from the private water supply well servicing the on-site residential dwelling (PW4) and neighbouring residential property (PW6). A summary of the water quality testing completed is provided below:

Table 2: Water Quality Sampling – Private Wells

Well ID	Sampling Date	Sampling Location	Parameters Analyzed
PW4	Jun 3, 2021	Outdoor tap[1]	TDS, chloride, nitrate
	Jun 14, 2021	Outdoor tap	Subdivision Package[2]
	Oct 5, 2021	Pitless adapter[3]	Chloride
	Nov 10, 2021	Direct from well during 8-hour pumping test	Subdivision Package[2], Trace Metals
	Mar 29, 2022	Outdoor tap	Subdivision Package[2]
	June 13, 2023	Outdoor tap	Subdivision Package[2], Trace Metals
PW6	Sep 1, 2021	Outdoor tap	Subdivision Package[2], Trace Metals
	Mar 30, 2021	Outdoor tap	Subdivision Package[2]

Notes:
1. Samples collected from outdoor tap confirmed to bypass any water treatment systems
2. Subdivision package is a standard set of parameters including bacteria, general inorganics, anion/cations, and metals.
3. Sample collected from water flowing into old pitless adapter not properly sealed, located approx. 3.3 metres below top of casing.

The laboratory certificates of analysis and water quality result sheets for PW4 and PW6 are provided in Appendix E.

Elevated levels of chloride were reported in PW4 and PW6. Other parameters such as total dissolved solids, hardness and sodium are associated with the elevated chloride concentrations. Based on the available data, PW4 has greater variability in chloride concentrations, which may be associated with the poor well construction (i.e. leaking pitless adapter) as evident by elevated surface water indicators: tannin and lignings, dissolved organic carbon, ammonia and total kjeldahl nitrogen. The chloride concentration in PW4 exceeded 500 mg/L on multiple sampling events (June 2021 and March 2022), and the well is considered to be a mineralized (Ontario Regulation 903).

Bacteria was detected in PW4 (fecal and total coliform) on June 14, 2021. Following well chlorination, bacteria was not resampled in PW4, as the well camera inspection identified inflowing water from an unsealed pitless adapter allowing water from the shallow subsurface to run in to the well. The leaking pitless adapter is presumed to be the source of bacteria and nitrate detected during the sampling completed on November 10, 2021. The leaking pitless adapter in PW4 was repaired on December 22,2021. Follow-up sampling completed on March 29, 2022 found non-detectable bacteria (total coliform, e.coli and fecal coliform) and nitrate; however, surface water indicators such as dissolved organic carbon, tannin and lignins, ammonia and total kjeldahl nitrogen remain elevated. Bacteria and nitrates were not detected in PW6 in the September 2021 or March 2022 sampling events.

Based on information provided by the City of Ottawa (see Appendix E), the OHIG database indicates that private wells in the vicinity of the site display high chloride levels. The source of the chloride unknown, but the OHIG database indicates that the chloride contamination is localized. The source of the chloride may be associated with road salting, as the site is located near a major intersection which may be more susceptible to salt loading.

4.4.2 Test Well 22-1 Water Quality

Water samples were collected during the pumping test on TW22-1 by a GEMTEC technologist after four and eight hours of pumping. Samples were submitted to Paracel Laboratories, a CALA-certified laboratory, located in Ottawa for analysis of ‘subdivision package’ and ‘trace metals’ parameters. Field measured water quality parameters and copies of the laboratory certificates of analysis for the water samples are provided in Appendix E.

The results of the laboratory analysis on the water samples collected from TW22-1 are also summarized in Appendix E, along with the applicable standards, guidelines and objectives provided in the Ontario Drinking Water Quality Standards (ODWQS).

The following comments are provided regarding the drinking water quality and exceedances of the ODWQS during the TW22-1 pump test:

Bacteriological Results

Total chlorine measurements at the time of bacteriological sampling confirmed that total chlorine concentrations in the groundwater were non-detectable.

The results of the bacteriological analysis of the May 4, 2022, water samples indicate that the water samples met all the standards of the ODWQS for bacteriological parameters. In addition, the concentration of other bacteria indicator species such as fecal coliform, were determined to be non-detectable in all the water samples.

Based on the bacteriological testing, the water is suitable for consumption.

Chemical Results

The results of the chemical testing on the water samples indicate the ODWQS operational guideline for hardness, and the aesthetic objectives for iron, manganese, chloride, sodium, total dissolved solids, and turbidity were exceeded in the water samples. Also, strontium exceeds Health Canada's (2019) maximum acceptable concentration.

The above noted exceedances are discussed in the follow sections:

Hardness

The hardness of the water samples was reported to be 491 and 594 mg/L as $CaCO_3$, which exceeds the ODWQS operational guideline for hardness. Water having a hardness above 100 milligrams per litre as $CaCO_3$ is often softened for domestic use. Water softeners are widely used throughout rural areas to treat hardness and there is no upper treatable limit for hardness. The ODQWS indicates that hardness levels exceeding 200 mg/L as $CaCO_3$ is considered poor but tolerable and hardness levels exceeding 500 mg/L as $CaCO_3$ is unacceptable for most domestic purposes.

Iron

Iron levels were reported to be 1.3 mg/L after eight hours of pumping, which exceeds the ODWQS aesthetic objective of 0.3 mg/L. Iron may cause staining of plumbing fixtures and laundry. The iron level is lower than the maximum concentration considered reasonably treatable (10 mg/L) provided in Table 3 of the MECP Guideline D-5-5. Water softeners and/or manganese greensand filters are recommended for iron treatment in Table 3 of the MECP Guideline D-5-5 for concentrations less than 5.0 mg/L.

Manganese

Manganese levels were reported to be 0.081 mg/L after eight hours of pumping, which exceeds the aesthetic objective of 0.05 mg/L by the ODWQS. Manganese can be associated with causing staining of plumbing fixtures and laundry. The manganese levels are below the maximum concentration considered reasonably treatable (1.0 mg/L) provided in Table 3 of the MECP Guideline D-5-5. Manganese can be treated using water softeners or manganese greensand filters.

Chloride

The chloride concentrations were reported to be 378 mg/L and 385 mg/L during the 4hr and 8hr samples respectively, which exceeds the ODWQS aesthetic objective of 250 mg/L. Chloride levels above 250 mg/L produces a detectable salty taste. Chloride is naturally occurring, generally in the form of sodium, potassium and calcium salts.

Sodium

The sodium concentrations were reported to be 169 and 201 mg/L, in the 4hr and 8hr samples, respectively. The sodium concentration of 201 mg/L exceeds the warning level for persons on sodium restricted diets of 20 mg/L and the aesthetic objective and maximum concentration considered to be reasonably treatable of 200 mg/L.

Total Dissolved Solids

The total dissolved solids (TDS) concentrations were 972 and 954 mg/L in the 4hr and 8hr samples, respectively. The TDS concentrations exceed the ODWQS aesthetic objective of 500 mg/L. Total dissolved solids refer to inorganic substances such as chloride, sulphates, calcium, magnesium, and bicarbonates that are dissolved in water.

Elevated levels of TDS can lead to problems associated with encrustation and corrosion. To determine the corrosive nature of the groundwater, the Langelier Saturation Index (LSI) was calculated for the samples obtained from the well. These values are based on the TDS, field measured temperature, pH, alkalinity, and calcium observed in the sample. The LSI was calculated to be 0.69 using an average groundwater temperature of 10°C. This indicates that the water is slightly scale forming but noncorrosive.

Turbidity

The laboratory analysis of the 4hr and 8hr water samples indicates turbidity levels of 9.4 and 5.6, respectively, which exceeds the aesthetic objective of 5 NTU listed by the ODWQS. However, it should be noted that turbidity may be affected by various factors to which the water sample would have been subjected to from the time of sampling to the time of analysis.

As such, field measurements of turbidity are generally more representative of the water being sampled. The field measurements of turbidity were 3.51 and 1.33 NTU at the 4hr and 8hr sampling time, respectively, and are within the ODWQS aesthetic objective of 5 NTU.

Strontium

The strontium concentration was 15 mg/L in the 8-hr sample collected on May 4, 2022, which exceeds the Health Canada (2019) maximum acceptable concentration of 7.0 mg/L. It is noted that strontium does not have a maximum acceptable concentration (MAC) under the Ontario Drinking Water Standards.

For further information related to strontium in drinking water, please refer to the City of Ottawa document displayed in Appendix F.

4.5 Long-term Water Level Monitoring TW22-1

Water levels in TW22-1 were monitored at 15-minutre intervals from May 10, 2022 to June 10, 2022. The long-term water level data is provided in Appendix D. Over the monitoring period, the

water level ranged from approximately 1.3 to 1.8 metres below top of casing, with an average water level of 1.6 metres below top of casing. The water level fluctuations do not correlate with significant rain events, based on precipitation data obtained from the Ottawa CDA RCS weather station. For example, the water level in TW22-1 continued to decrease for up to five days following two significant (25+mm) rain events on May 15 and May 16, 2022. Furthermore, the groundwater temperature in TW22-1 remained constant (8.83 to 8.88°C) over the monitoring period. The lack of correlation between precipitation, temperature and water levels in TW22-1 suggests that there is no rapid infiltration of surficial sources (i.e. precipitation, potential septic effluent, etc.) to the water supply aquifer.

4.6 Hydrogeological Conceptual Model

The local hydrogeological conditions consist of a thin layer of overburden overlying dolostone and/or sandstone of the March Formation, underlain by the sandstone of the Nepean Formation. According to the water well record for TW22-1, drilled to 79.2 meters below ground surface, sandstone was the only rock formation encountered during drilling. The well may be completed in the March Formation and/or the Nepean Formation. The different formations are lithologically similar, and therefore, the ability to discern the difference between aquifer types, or the contact between the units is not possible.

5.0 IMPACT ASSESSMENT

The impact on groundwater and surface water resources due to wastewater treatment and disposal by the onsite sewage disposal system on the site is assessed in the following sections.

It should be noted that the following information is provided for general guidance purposes only and that the septic system installed on the subject site should be designed using specific subsurface conditions at the location of the proposed septic system. In all cases, the septic system design must conform to the Ontario Building Code (OBC) requirements.

5.1 Hydrogeological Sensitivity

Areas of thin soils cover, fractured bedrock exposed at ground surface and karst environments contribute to hydrogeological sensitivity of the site, which may not allow for sufficient attenuative processes for on-site septic systems and negatively impact the receiving aquifer. Areas of thin soil cover, generally taken to be less than two metres, were encountered at the site. The overburden thickness measured on the site ranges from 0 to 1.8 metres. Karst mapping (Brunton and Dodge, 2008) does not indicate the presence of any inferred or potential karstic features.

5.1.1 Nitrates

Based on the MECP water well records, the receiving aquifer for the septic effluent is the sandstone bedrock aquifer. Groundwater samples from the receiving aquifer, as sampled from PW4 and PW6, do not indicate significant impacts from septic effluent. It is noted that the nitrate

concentration in PW4 was 2.5 mg/L on November 10, 2021, which is attributed to the leaking pitless adapter, allowing water to enter the well from the shallow subsurface and nearby septic. Following repair and re-sampling of PW4 in March 2022, the nitrate concentrations were non-detectable. The nitrate concentrations were also non-detectable to 0.1 mg/L in PW6 and newly constructed on-site test well TW22-1.

5.1.2 Chloride

The on-site water supply wells PW4 and TW22-1, along with the neighbouring water supply well PW6 are impacted by chlorides. The chloride concentrations in PW6 are consistent between the two sampling events in September 2021 and March 2022 with chloride concentrations of 459 and 460 mg/L respectively. The chloride concentration in the newly constructed on-site test well TW22-1 were 378 and 385 mg/L in the 4-hour and 8-hour pumping test samples.

The chloride concentration in the existing on-site well PW4 display significant variations in chloride, ranging from 337 to 820 mg/L (refer to water quality summary in Appendix E). The variability in chloride concentrations may be the result of the leaking pitless adapter, which allows surficial salt sources (e.g. softener salts, septic, etc.) to enter the water supply aquifer, naturally occurring in the water supply aquifer or road salting. The chloride concentration has exceeded 500 mg/L on multiple sampling events and the well is mineralized (O.Reg 903).

Based on information from the City of Ottawa's OHIG database (Appendix E), multiple water supply wells within approximately 500 metres of the site have elevated chloride concentrations of up to 631 mg/L. The chloride concentrations in nearby residential subdivision private wells are low, generally less than 100 mg/L. The well construction details for the chloride concentrations presented in the OHIG database were not provided and as such, it is unknown if the chloride concentrations occur in different geologic units or depth intervals. Bedrock geologic mapping suggests that the water supply wells are completed in dolostone bedrock of the March Formation. Given the site and surrounding area is hydrogeologically sensitive due to thin soils, the elevated chlorides may be caused by road salting, which would be concentrated at the major intersection of Dunrobin Road and March Road.

5.2 Groundwater Impacts

5.2.1 On-Site Septic

The potential risk to groundwater resources on and off the subject site was assessed in accordance with Ministry of Environment Procedure D-5-4: Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment. To evaluate the groundwater impacts, lot size considerations as well as nitrate dilution calculations for commercial properties outlined in MECP D-5-4 were followed.

According to MECP Procedure D-5-4, lot sizes of 1.0 hectare or larger are assumed to be sufficient for attenuative processes to reduce nitrate-nitrogen to acceptable concentrations in

groundwater below adjacent properties. The proposed development lot size is 0.80 hectares and thus does not meet lot size considerations. Furthermore, the hydrogeologically sensitive terrain identified on-site may reduce nitrate attenuation. As such, the risks of individual on-site septic systems were assessed using nitrate-nitrogen contaminant loading.

The maximum allowable concentration of nitrate in the groundwater at the boundaries of the subject property is 10 milligrams per litre as per the Ministry of the Environment, Conservation and Parks' guideline D-5-4, dated August 1996.

The nitrate concentration at the site boundary was calculated using the following information:

- Subject site area of 0.80 hectares (refer to Lot Development Plan, Appendix A);
- Hard surface areas of 2,303m^2 (29% of total site area, refer to Figure 3);
- Water holding capacity of soils (WHC) based on information obtained from Table 3.1 of the Ministry of Environment Stormwater Management Planning and Design Manual, dated March 2003;
    - Soil Factor of 0.4, representing open sandy loam
    - Cover Factor of 0.1, representing cultivated land
    - Topography Factor of 0.2, rolling land with average slope of 2.8 m to 3.8 m/km
- Post-Development water holding capacity; 75 mm: Urban lawns, sandy loam.
- An annual water surplus of 0.380 metres/year (post-development) for soils with a water holding capacity of 75 mm.
    - Ottawa International Airport (1939-2013). Water Surplus data sheet provided in Appendix G
- Negligible background nitrate concentration in the receiving aquifer; and,
- The use of advanced treatment systems in the construction of the septic systems at the commercial lot, capable of reducing the concentration of nitrate in the effluent exiting the treatment unit to a maximum of 20 mg/L (this concentration value was utilized when re-simplifying the formula provided in D-5-4 for the purpose of determining the factor used to determine the maximum allowable flow for each lot from the determined available infiltration volume. The factor becomes 1 versus 3 as is the case without advanced treatment).

The nitrate impact assessment was completed in accordance with MECP Procedure D-5-4 for commercial properties. The site is currently developed, and the existing residential dwelling will remain. Therefore, the maximum allowable daily design sanitary sewage flow (DDSSF) for the proposed commercial lot will include septic flows of 1,000 litres per day for the residential dwelling, in accordance with residential nitrate impact assessments. The calculated maximum allowable flow for the site is summarized in Table 3 below and calculations are provide in Appendix G. is summarized in the table below.

Table 3: Maximum Commercial Septic Flows for Land Parcel

	Maximum allowable septic flow		Maximum Number of Users[2]	
Hard Surface Area (%)	Conventional Septic	Advanced Septic[1] (50% nitrate reduction)	Conventional Septic	Advanced Septic[1] (50% nitrate reduction)
29 %	1,380 L/day	4,139 L/day	18	55

Notes:
1. The advanced treatment septic system should be certified for a minimum nitrate reduction of 50%.
2. Maximum number of users assumes 75 litres per day per person.

The calculations displayed in Table 3 pertain to the maximum septic flows for the total land area. The site has an existing residential dwelling, which requires a septic flow of 1,000 litres per day as per the MECP D-5-4 guidelines. The remaining maximum septic flow, after subtracting the residential septic usage represents the land parcel's capacity to support the proposed commercial development. The commercial development's maximum calculated septic flow values are displayed in Table 4.

Table 4: Maximum Septic Flows for Proposed Commercial Development

	Maximum allowable septic flow		Maximum Number of Users[2]	
Hard Surface Area (%)	Conventional Septic	Advanced Septic[1] (50% nitrate reduction)	Conventional Septic	Advanced Septic[1] (50% nitrate reduction)
29 %	380 L/day[3]	3,139 L/day[3]	5	41

Notes:
1. The advanced treatment septic system should be BNQ certified for a minimum nitrate reduction of 50%.
2. Maximum number of users assumes 75 litres per day per person.
3. Maximum allowable septic flow for commercial development after 1,000 litres per day subtracted for the existing residential dwelling.

The calculated maximum allowable septic flow for the proposed veterinary clinic is 380 litres per day utilizing a conventional septic system and 3,139 litres per day with the implementation of an advanced treatment septic system.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the results of this investigation, the following conclusions and professional opinions are provided:

- The surficial soils encountered at the site consist of dark brown/grey gravelly sandy silt fill material, ranging in thickness from 0.3 to 1.0 metres below ground surface.

- The GEMTEC Phase One ESA identified one area of potential environmental concern associated with fill of unknown quality on the site. The Phase 2 ESA completed by GEMTEC concludes that the fill is non-hazardous and may be disposed of at an MECP licensed landfill. No other areas of potential environmental concern were identified.
    - Electrical conductivity exceedances in soil from BH22-3 exceeds the MECP Table 6 SCS for residential use; however, the soils will be located in part of the proposed commercial development, which meets MECP Table 6 SCS for commercial use.
    - Barium exceeds applicable MECP Table 6 SCS in groundwater; however, no barium exceedances detected in soils. Barium in groundwater is unlikely to be attributed to fill material at surface. Barium in TW22-1 and PW6 are within the ODWQS maximum acceptable concentrations.

- The site is hydrogeologically sensitive due to thin soils and protective measures are recommended to safeguard the water supply aquifer.
    - Proposed water supply well was completed with extended well casing of approximately 30 metres below ground surface.
    - Proposed water supply well TW22-1 is situated hydraulically cross gradient to the septic system.
    - Existing septic system is located greater than 30 metres from neighbouring water supply well and at least 60 metres from downgradient residential properties.

- The water supply aquifer is impacted by chlorides.
    - The existing on-site water supply well PW4 is mineralized, with chloride concentrations ranging from 337 to 1050 mg/L. The chloride concentrations may vary seasonally, with the lowest concentrations reported in November 2021 and highest concentrations in June 2021 and March 2022. It is understood that PW4 will be abandoned in accordance with O.Reg 903.
        - The water quality from PW4 suggests it is susceptible to contamination from surficial sources due to the presence of elevated organic parameters (dissolved organic carbon, tannin and lignin, ammonia and total kjeldahl nitrogen).
        - It is noted that the leaking pitless adapter in PW4 was repaired, eliminating potential near surface sources (e.g. septic, softener salt discharge, road

salts, etc.) that may have negatively impacted PW4. Seasonal monitoring would be required to determine the effectiveness of the repair and groundwater quality.

        - Total barium concentrations were reported to be 4.27 mg/L in PW4, which exceeds the ODWQS maximum acceptable concentration of 1 mg/L.

    - The source of chloride is unknown but may be attributed to road salting based on the location of the site (major intersection) and available chloride data from the City of Ottawa's OHIG database which shows the elevated chloride concentrations are localized to wells near March Road and Dunrobin Road.

    - Neighbouring private well PW6 and newly constructed on-site test well TW22-1 are also impacted by chloride, with chloride concentrations exceeding the aesthetic objective and maximum concentration considered to be reasonably treatable of 250 mg/L; the chloride concentrations are less than 500 mg/L.

        - In contrast with PW4, the chloride concentrations in PW6 have remained consistent over the monitoring period.

- The groundwater quality of the upper bedrock aquifer was assessed as part of the Phase 2 ESA, in which a groundwater sample from PW4 was submitted for analysis of PAHs, PHCs F1 to F4, and VOCs. All parameters tested reported non-detectable concentrations and are within the ODWQS standards (where applicable).

- The test well (TW22-1) is capable of pumping 20,160 litres per day, which is more than five times greater than the anticipated maximum water demand of 3,650 litres (equivalent to two times the maximum daily design septic flow of 700 L/day, plus 2,250 litres per day to support a five-person dwelling). Based on the sustained pumping rate of 42 litres per minute over eight hours and the remaining available drawdown of approximately 62 metres, the proposed water supply well is capable of providing sufficient groundwater for the proposed vet clinic and existing residential property (if required).

- The groundwater quality in the proposed water supply well (TW22-1) exceeds the ODWQS for the operational guideline for hardness, the aesthetic objectives for iron, manganese, chloride, sodium and total dissolved solids, and the maximum concentration considered to be reasonably treatable for chloride and sodium. Strontium exceeds Health Canada's (2019) maximum acceptable concentration of 7 mg/L. No ODWQS maximum acceptable concentration is defined for strontium.

    - Significant groundwater quality treatment required for operational guideline, aesthetic and health-related parameters. A treatment specialist was retained to

determine the treatment options necessary for the on-site well TW22-01. It is understood that PW4 will be decommissioned. The treatment recommendations and associated costs are displayed in Appendix H.

  - To limit treatment costs, it may be more economical to only use groundwater for plumbing system in the veterinary clinic and provide bottled water to employees.

- The maximum allowable daily design sanitary sewage flows (DDSSF) for the site is calculated to be 1,380 litres per day utilizing a conventional septic system and 4,139 litres per day with the use of an advanced treatment septic system.

  - Subtracting the required septic flows of 1,000 litres per day for the existing residential dwelling in accordance with MECP Procedure D-5-4 residential nitrate dilution requirements, the maximum allowable daily design flow for the proposed veterinary clinic is 380 L/day utilizing a conventional septic system and 3,139 litres per day with the implementation of an advanced treatment septic system.

- Septic impacts to the proposed water supply aquifer and neighbouring properties are not anticipated.
  - On-site water supply well TW22-1 constructed with extended well casing and long term water level and groundwater temperature monitoring do not indicate rapid infiltration of surface waters / sources (e.g. precipitation, septic effluent, etc.).
  - Septic impacts (i.e. nitrate) are non-detectable in neighbouring water supply well PW6 and newly constructed on-site test well TW22-1.
  - TW22-1 and PW6 do not display elevated organic parameters concentrations in comparison to PW4, which showed signs of surficial impacts.
  - Proposed septic system (refer to development plan in Appendix A) is located greater 30 metres from any neighbouring private well.

6.2 Recommendations

Based on the results of this investigation, the following water supply, septic system and groundwater impact mitigation measures recommendations are provided:

6.2.1 Water Supply Recommendations

- It is recommended that the property owners construct, maintain and test their drinking water well in accordance with the Ministry of the Environment and Climate Change document “Water Supply Wells - Requirements and Best Management Practices, Revised April 2015”;
- Private well PW4, currently supplying the residential dwelling at 4 Campbell Reid Court is mineralized, with chloride concentrations above 500 mg/L. In addition, PW4 is susceptible to surficial contamination as evident by elevated organic parameters concentrations. It is

recommended that PW4 be abandoned by a licensed well technician in accordance with O.Reg 903.
    - After PW4 is abandoned, the existing residential dwelling can be connected to TW22-1.
- Treatment is available for TW22-1, and recommended treatment systems have been recommended by a water quality treatment specialist, which is displayed in Appendix H.
    - Strontium exceeds the federal guidelines maximum acceptable concentration. For short and long-term consumption of groundwater consultation with the local public health office is recommended. Additional information can also be obtained from the City of Ottawa's Strontium in Drinking Water Information Sheet and Health Canada's (2019) Strontium Guideline Technical Document.
    - Regular groundwater quality testing should be completed post-treatment to confirm the effectiveness of the treatment systems, particularly for the health-related exceedance of strontium.

6.2.2 Septic System Recommendations

- It is understood that the proposed development will be serviced by advanced treatment septic sewage disposal system, which should achieve a minimum of 50% reduction in nitrogen, approved under the Ontario Building Code, prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B). The advanced treatment septic system is recommended to be BNQ certified. A site-specific investigation should be conducted for the design of the septic system;
- It is required that the property owners enter a maintenance agreement with authorized agents of the advanced treatment septic system manufacturer for the service life of the system;
- The maximum allowable daily design sanitary sewage flows (DDSSF) for the proposed veterinary clinic should be 380 L/day utilizing a conventional septic system and 3,139 litres per day with the implementation of an advanced treatment septic system; and,
- It is recommended that the property owners construct, maintain and check their on-site septic system in accordance with the Ontario Building Code.

7.0 LIMITATIONS OF REPORT

This report was prepared for Dr. Andrzej Olender and is intended for the exclusive use of Dr. Andrzej Olender. This report may not be relied upon by any other person or entity without the express written consent of GEMTEC and Dr. Andrzej Olender. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgments of GEMTEC based on the site

conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared. This report has been prepared for the application noted and it is based, in part, on visual observations made at the site, subsurface investigations at discrete locations and depths and laboratory analyses of specific chemical parameters and material during a specific time interval, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future site conditions, portions of the site that were unavailable for direct investigation, subsurface locations on the site that were not investigated directly, or chemical parameters, materials or analysis which were not addressed.

Should new information become available during future work, including excavations, borings or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.

8.0 CLOSURE

We trust that this report is sufficient for your purposes. If you have any questions or require additional information, please call.

Brent Redmond, M.A.Sc., P.Geo.
Hydrogeologist

Andrius Paznekas, M.Sc., P.Geo.
Hydrogeologist

BR/AP/JPG

9.0 REFERENCES

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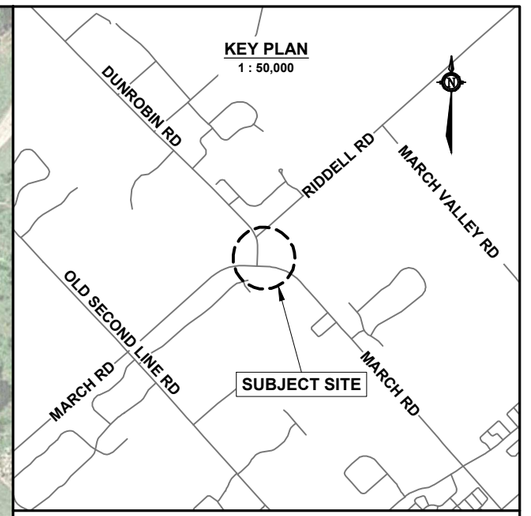


LEGEND

BH/ TP/ TW/ PW # ← BOREHOLE/ TEST PIT/ TEST WELL/ PRIVATE WELL ID

XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

BOREHOLE LOCATION
(Phase 2 ESA investigation by GEMTEC)

TEST WELL APPROXIMATE LOCATION
(current investigation by GEMTEC)

PRIVATE WELL APPROXIMATE LOCATION
(current investigation by GEMTEC)

TEST PIT LOCATION
(geotechnical investigation by GEMTEC)

APPROXIMATE PROPERTY BOUNDARY

Scale
1:1000
0 20 40 60m

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing
SITE PLAN

Client
DR. ANDRZEJ OLENDER

Project
65103.01

HYDROGEOLOGICAL INVESTIGATION
4 CAMPBELL REID COURT
KANATA, OTTAWA, ONTARIO

Drwn by
S.L.

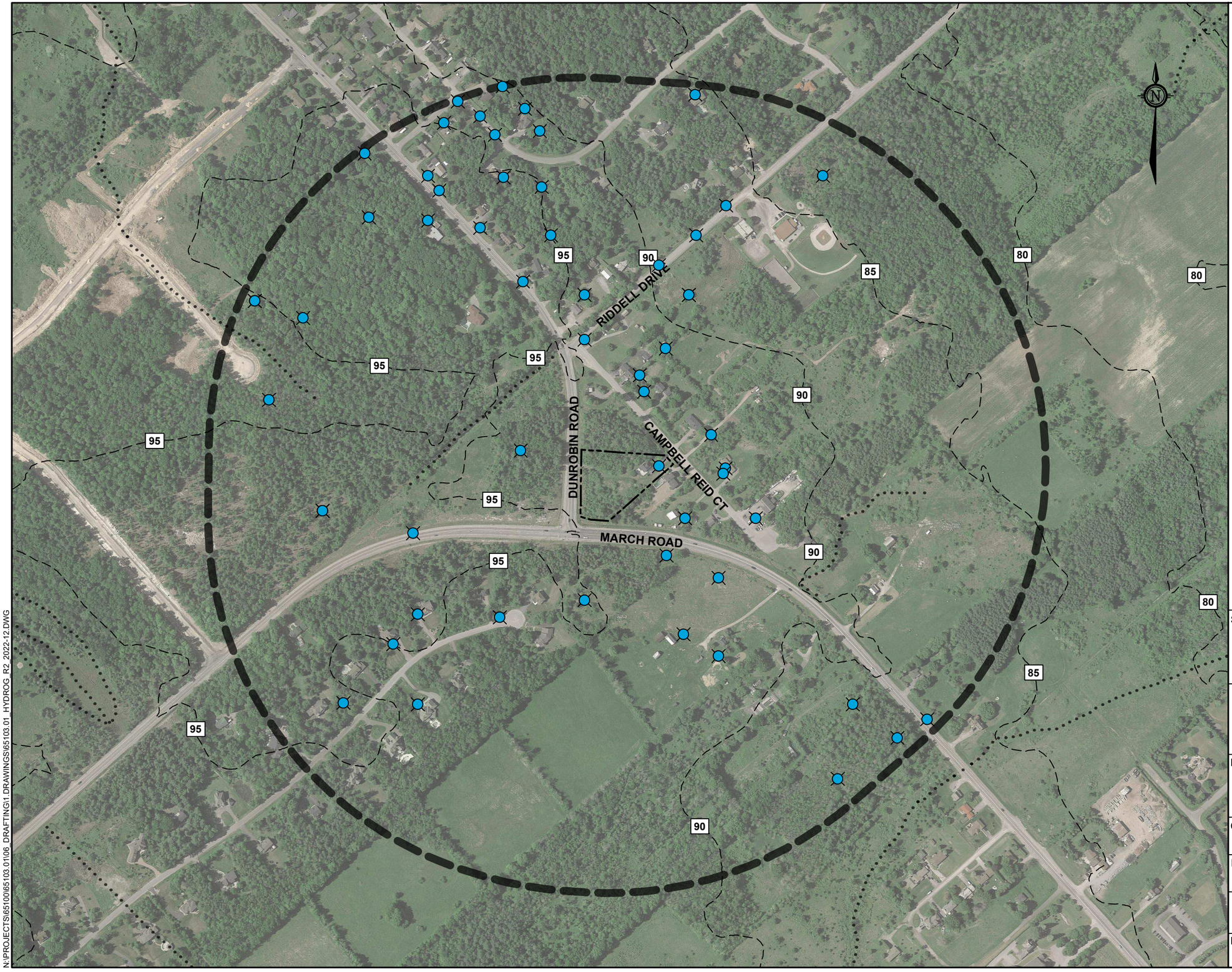
Chkd by
A.P.

Date
DECEMBER, 2022

Rev.
2

FIGURE 1

N:\PROJECTS\65100\65103.01\06_DRAFTING\1_DRAWINGS\65103.01_HYDROG_R2_2022-12.DWG



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- **STUDY AREA** (500m RADIUS FROM THE PROPERTY BOUNDARY)
- 90 — CONTOUR INTERVAL, IN METRES (ONTARIO BASE MAPPING, OBM)
- SURFACE WATER (OBM)
- MECP WELL LOCATION

Scale 1:2500

0 50 100 150m

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing: ENVIRONMENTAL FEATURES

Client: DR. ANDRZEJ OLENDER

Project: 65103.01

HYDROGEOLOGICAL INVESTIGATION
4 CAMPBELL REID COURT
KANATA, OTTAWA, ONTARIO

Drwn by	Chkd by
S.L.	A.P.

Date: DECEMBER, 2022

Rev.: 2

FIGURE 2

N:\PROJECTS\65100\65103.01\06_DRAFTING\1_DRAWINGS\65103.01_HYDROG_R2_2022-12.DWG

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- STUDY AREA (250m RADIUS FROM THE PROPERTY BOUNDARY)
- HARD SURFACES = 2302.89 m² (29% OF LOT AREA)

Scale 1:500

0 10 20 30m

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive
Ottawa, ON K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing: SITE SURFACES

Client: DR. ANDRZEJ OLENDER

Project: 65103.01

HYDROGEOLOGICAL INVESTIGATION
4 CAMPBELL REID COURT
KANATA, OTTAWA, ONTARIO

Drwn by: S.L.

Chkd by: A.P.

Date: DECEMBER, 2022

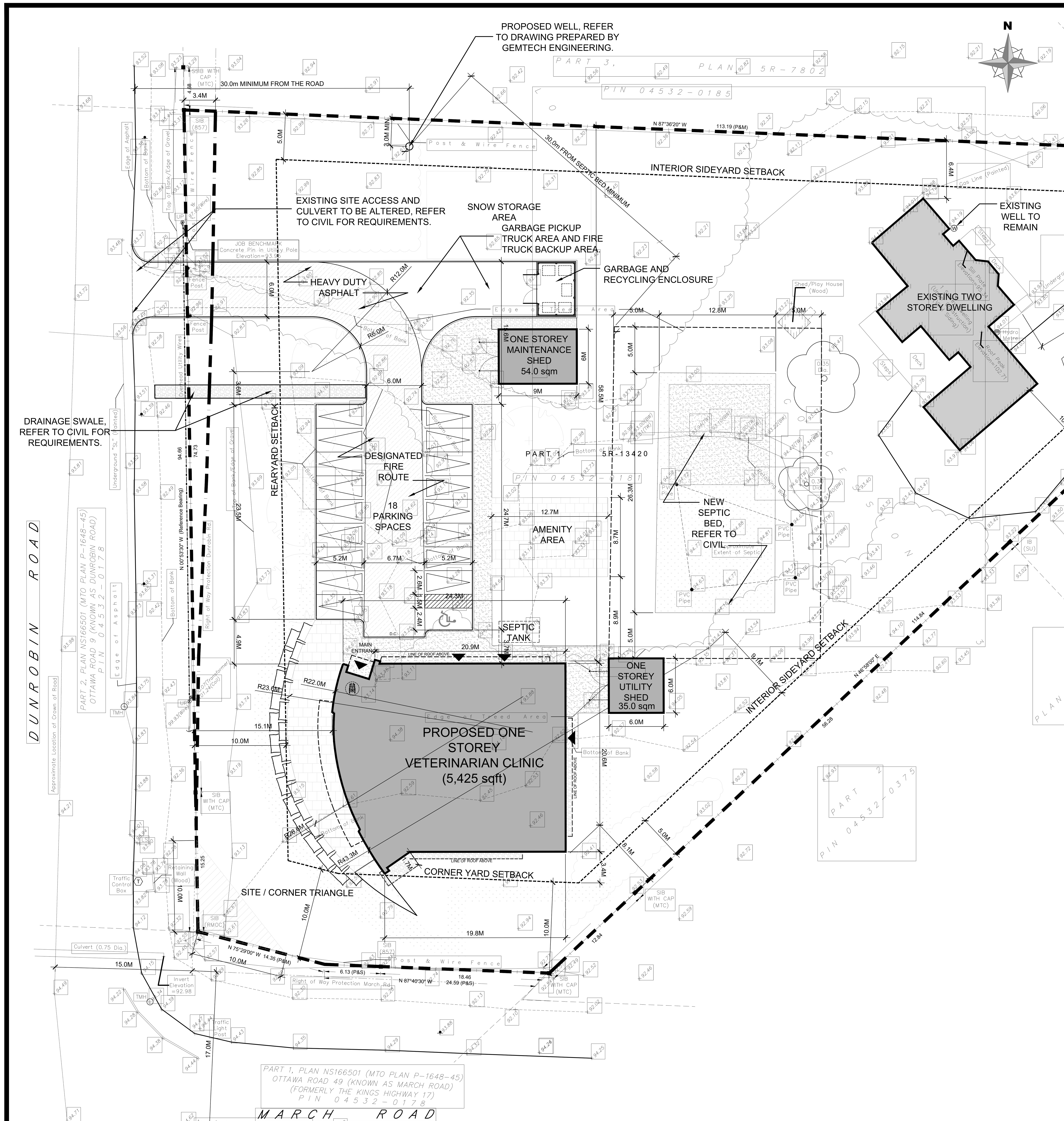
Rev.: 2

FIGURE 3

N:\PROJECTS\65100\65103.01\06_DRAFTING\1.DRAWINGS\65103.01_HYDROG_R2_2022-12.DWG

APPENDIX A

Lot Development Plan



1 SP-01 SITE PLAN
SCALE = 1:250

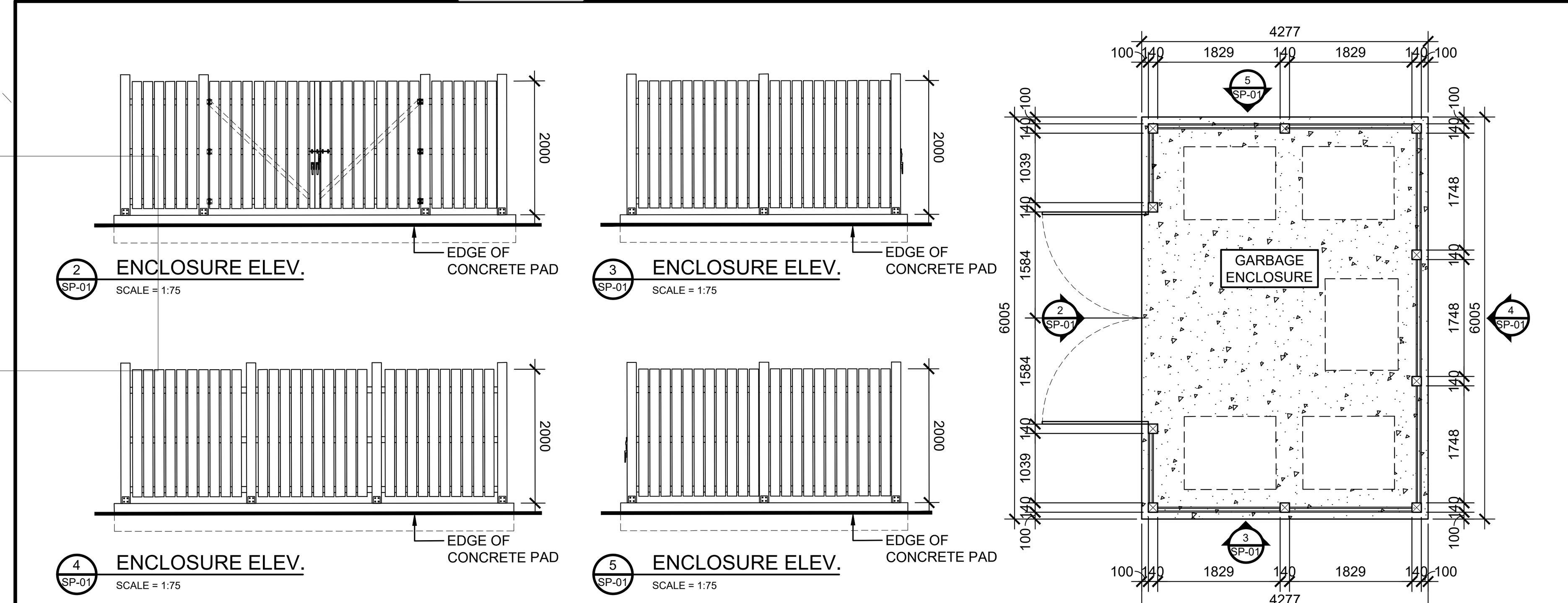
6 SP-01 LOCATION PLAN
SCALE = N.T.S.

PLAN OF SURVEY
INFORMATION SHOWN HAS BEEN TAKEN FROM
FAIRHALL, MOFFATT & WOODLAND LDT.
100–600 TERRY FOX DR,
KANATA, ON
Tel.613–591–2580

TOPOGRAPHIC PLAN OF SURVEY
PART OF LOT 15
CONCESSION 3
(GEOGRAPHIC TOWNSHIP OF MARCH)
CITY OF OTTAWA

NOTES:
BEARINGS ARE ASTRONOMIC AND ARE REFERRED TO THE EASTERLY LIMIT OF DUNROBIN ROAD AS SHOWN ON PLAN 5R–13420, HAVING A BEARING OF N00*53'30"W.

NOTE:
SNOW WILL BE STORED ON SITE.



SITE STATISTICS 4 CAMPBELL REID COURT		
ITEM	REQUIRED	PROVIDED
Zone — Current RU		
Lot Area	8000 sqm	7917 sqm (Minor Variance required)
Lot Width	50.0 m	25.84 m (Minor Variance required)
Maximum Building Height	12.0m	8.7 m (Existing two storey house) 5.6 m (Proposed Veterinary Clinic)
Minimum Front Yard (Campbell Reid Court)	10.0m	27.7 m (Existing two storey house)
Minimum Interor Side Yard	5.0 m	6.4 m (Existing two storey house) 8.1 m (Proposed Veterinary Clinic)
Minimum Corner Side Yard (March Road)	10.0m	10.0m
Minimum Rear Yard (Dunrobin Road)	10.0m	15.1 m (Proposed Veterinary Clinic)
Building Footprint	n/a	221 sqm (Existing two storey house) 504 sqm
Maximum Lot Coverage	20%	220 sqm (Existing two storey house) 504 sqm (Proposed Veterinary Clinic) 54 sqm (Maintenance Shed) 35 sqm (Utility Shed) 813 sqm TOTAL 10%
Parking Spaces	4 Spaces per 100 sqm of animal hospital GFA Minus exterior walls, washrooms and utility/ Laundry room 431 sqm 18.3 required	18 Spaces
Max. Total area (accessory structures)	5% of total lot area = 395.85 sqm	89 sqm

CLIENT:
A & G OLENDER HOLDINGS LTD.
1405 Houston Crescent
Ottawa, Ontario
K2W 1B6

LEGEND:

- PROPERTY LINE
- PROPERTY SETBACK
- OHW — OVERHEAD WIRES
- ROW PROTECTION
- EXISTING BUILDING
- BUILDING ENTRANCE
- W.P. — WALL MOUNTED LIGHT
- H.P. — HYDRO POLE
- F.H. — FIRE HYDRANT
- M.H. — MANHOLE
- C.B. — CATCH BASIN
- RETAINING WALL
- D.C. — DEPRESSED CURB
- X 100.00 — EXISTING GRADE
- 100.00 — PROPOSED GRADE
- INTERLOCK PAVERS
- DESIGNATED FIRE ROUTE

No.	REVISIONS	BY	DATE
13			
12			
11	FOR REVIEW	JP	DEC. 06 2022
10	FOR REVIEW	JP	NOV. 30 2022
09	FOR REVIEW	PE	SEPT. 21 2022
08	FOR REVIEW	PE	AUG. 08 2022
07	FOR REVIEW	PE	MAR. 14 2022
06	FOR REVIEW	PE	OCT. 28 2021
05	FOR REVIEW	PE	OCT. 07 2021
04	FOR REVIEW	PE	AUG 03 2021
03	FOR REVIEW	PE	JULY 21 2021
02	FOR REVIEW	PE	JULY 09 2021
01	FOR REVIEW	PE	MAY 18 2021

P2 concepts

CONSULTING ENGINEERS
ARCH–NOVA Design Inc.
45 Banner Rd.,
Nepean, ON,
K2H 8X5
613–702–3403
contact@archnova.ca

DESIGNED BY: P.E. DRAWN BY: P.E. APPROVED BY: P.E.

PROJECT
4 CAMPBELL REID COURT
PROPOSED VETERINARIAN CLINIC

DRAWING TITLE
SITE PLAN

PROJECT NO.
0423
DATE
MAY., 18, 2021

SP-01

APPENDIX B

Record of Borehole and Test Pit Sheets

RECORD OF TEST PIT 21-1

CLIENT: TSH Custom Homes
PROJECT: Proposed Commercial Building-4 Campbell Reid Court
JOB#: 65103.01
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jun 23 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		93.12					Backfilled with excavated material
	Dark brown to grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders and construction debris (FILL MATERIAL)		92.82 / 0.30	1	GS		M	
1	Dark brown silty clay, trace to some sand and gravel with organic material (FILL MATERIAL)		92.02 / 1.10	2	GS			
	Brown silty sand, trace to some clay, trace gravel (GLACIAL TILL)		91.82 / 1.30	3	GS		M	
2	Test pit terminated due to practical shovel refusal on inferred bedrock surface							
3								
4								
5								

SHEAR STRENGTH (Cu), kPA: 10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: P.B.
CHECKED: G.D.

RECORD OF TEST PIT 21-2

CLIENT: TSH Custom Homes
PROJECT: Proposed Commercial Building-4 Campbell Reid Court
JOB#: 65103.01
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jun 23 2021

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
	SOIL PROFILE					10 20 30 40 50 60 70 80 90		
0	Ground Surface		92.89					Backfilled with excavated material
	Dark brown to grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders and construction debris (FILL MATERIAL)		92.19	1	GS			
	Dark brown silty clay with organic material (FORMER TOPSOIL)		0.70 92.04	2	GS			
1	Brown silty sand, trace to some clay, trace gravel (GLACIAL TILL)		0.85 91.89	3	GS			
	Test pit terminated due to practical shovel refusal on inferred bedrock surface		1.00					
2								
3								
4								
5								

GEMTEC
Consulting Engineers and Scientists

LOGGED: P.B.
CHECKED: G.D.

RECORD OF TEST PIT 21-3

CLIENT: TSH Custom Homes
PROJECT: Proposed Commercial Building-4 Campbell Reid Court
JOB#: 65103.01
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jun 23 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		92.86					Backfilled with excavated material
	Dark brown to grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders and construction debris (FILL MATERIAL)			1	GS			
			92.06					
	Dark brown silty clay with organic material (FORMER TOPSOIL)		0.80 / 91.91	2	GS			
1	Brown silty sand, trace to some clay, trace gravel (GLACIAL TILL)		0.95	3	GS			
	Test pit terminated due to practical shovel refusal on inferred bedrock surface		1.00					Groundwater seepage observed at about 1.0 metres below existing grade on June 23, 2021.
2								
3								
4								
5								

SHEAR STRENGTH (Cu), kPA: 10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: P.B.
CHECKED: G.D.

RECORD OF TEST PIT 21-4

CLIENT: TSH Custom Homes
PROJECT: Proposed Commercial Building-4 Campbell Reid Court
JOB#: 65103.01
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jun 23 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		93.21			10 20 30 40 50 60 70 80 90		Backfilled with excavated material
	Dark brown to grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders and construction debris (FILL MATERIAL)			1	GS			
1			92.21					
	Dark brown silty clay with organic material (FORMER TOPSOIL)		1.00	2	GS			
			92.01					
	Test pit terminated due to practical shovel refusal on inferred bedrock surface		1.20					
2								
3								
4								
5								

GEMTEC
Consulting Engineers and Scientists

LOGGED: P.B.
CHECKED: G.D.

RECORD OF TEST PIT 21-5

CLIENT: TSH Custom Homes
PROJECT: Proposed Commercial Building-4 Campbell Reid Court
JOB#: 65103.01
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jun 23 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		93.26			10 20 30 40 50 60 70 80 90		Backfilled with excavated material
	Dark brown to grey gravelly sandy silt with organics, rootlets, roots, cobbles, boulders and construction debris (FILL MATERIAL)			1	GS			
1			92.26					
	Dark brown silty clay with organic material (FORMER TOPSOIL)		1.00 / 92.06	2	GS			
	Brown silty sand, trace to some clay, trace gravel (GLACIAL TILL)		1.20 / 91.96	3	GS		M	
	Test pit terminated due to practical shovel refusal on inferred bedrock surface		1.30					
2								
3								
4								
5								

GEMTEC
Consulting Engineers and Scientists

LOGGED: P.B.
CHECKED: G.D.

GEO - TESTPIT LOG 65103.01_GINT_V01_2021_07_05.GPJ GEMTEC 2018.GDT 9/7/21

RECORD OF BOREHOLE 22-01

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.18									
0	Direct Push	Brown sandy silt with gravel (FILL)			1		381		Metals, PAHs, PHCs, PCBs, VOCs	HEX: 5; IBL: 3			Native backfill
1				91.97									
		End of borehole Auger refusal		1.21									

GEMTEC
Consulting Engineers and Scientists

LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

RECORD OF BOREHOLE 22-02

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.27									
0	Direct Push	Brown sand (FILL)			1		558.8		Metals, PAHs, PHCs, PCBs, VOCs	HEX: 0; IBL: 1			Native backfill
1		Dark organic matter (PEAT)		92.18 1.09									
		End of borehole Auger refusal		92.05 1.22									

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LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

RECORD OF BOREHOLE 22-03

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
	Direct Push	Ground Surface		93.27									
0		Gravel, grey sand and fines (FILL)			1		584.2			HEX: 0; IBL: 0			Naitve backfill
				92.36									
		End of borehole Auger refusal		0.91									

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LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

RECORD OF BOREHOLE 22-04

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.25									
0	Direct Push	Dark grey brown sand with some gravel (FILL)		92.72									
		End of borehole Auger refusal		0.52	1	SS	444.5			HEX:10 ; IBL: 1			Native backfill
1													

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LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

RECORD OF BOREHOLE 22-05

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.64									
0	Direct Push	Brown coarse sand with gravel (FILL)	FILL	93.13	1	CA	1092.2		Metal, PAHs, PHCs, PCBs, VOCs	HEX: 0; IBL: 0			Native backfill
		grey clay and sily clay with organics		0.51	2				Metal, PAHs, PHCs, PCBs, VOCsMetal, PAHs, PHCs, PCBs, VOCs	HEX: 5; IBL: 0			
1				92.55 1.09									

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LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

RECORD OF BOREHOLE 22-06

CLIENT: Dr. Andrzej Olender
PROJECT: Phase Two ESA, 4 Campbell Court, Kanata ON
JOB#: 65103.01
LOCATION: 4 Campbell Court, Kanata, ON

SHEET: 1 OF 1
DATUM: Unknown
BORING DATE: Mar 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.57									
0	Direct Push	Brown sandy silt, some gravel (FILL)			1		609.6		Metal, PAHs, PHCs, PCBs, VOCs	HEX: 5; IBL: 0			Native backfill
1				92.05									
		Brown sandy silt, wet		1.52	2		304.8		Metal, PAHs, PHCs, PCBs, VOCs	HEX: 0; IBL: 0			
		Peat		91.75									
		End of borehole Auger refusal		1.82 91.75									

GEMTEC
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LOGGED: EW
CHECKED: MB

ENV - BOREHOLE LOG CAMPBELL COURT GINT.GPJ GEMTEC 2018.GDT 5/3/22

APPENDIX C

Well Record Summary & TW22-1 Water Well Record

MECP Water Well Record Compilation
(4 Campbell Reid Court – 500m search radius)

Well ID	Completed	Depth (m)	Depth to Bedrock (m)	Static Water Level (m bgs)	Water Found (m bgs)	Water Detail	Well Use
1503423	02/04/58	30.5	0.61	4.3	15.2, 30.5	FR	DO
1503424	01/03/59	17.1	0.0	5.5	17.1	FR	DO
1503425	06/05/59	18.3	0.61	0.9	18.3	FR	DO
1503426	26/05/59	21.3	0.30	2.7	21.3	FR	DO
1503427	21/03/62	19.2	2.44	3.7	16.8	FR	DO
1503430	27/07/65	25	0.61	6.7	2.4	FR	DO
1503432	03/06/66	18.3	0.0	3.7	18.3	FR	DO
1503433	05/06/66	21.3	0.0	3.7	15.2	FR	DO
1503440	19/06/66	19.2	0.0	3.7	18.6	FR	DO
1503362	20/12/55	11.6	2.29	3	9.1	FR	PS
1503364	15/09/49	16.5	0.30	5.2	15.8	FR	ST
1503365	10/02/56	24.4	1.83	4.9	22.9	FR	DO
1503366	17/09/60	18.3	0.30	2.7	18.3	FR	DO
1503367	21/08/64	19.8	0.0	4.3	19.2	FR	DO
1503368	05/02/58	13.4	0.0	4.3	12.8	FR	DO
1503415	15/02/49	15.8	0.61	4.3	7.6, 15.8	FR	DO
1503418	21/05/62	12.2	0.61	2.4	11.6	FR	DO
1503419	10/08/62	48.8	0.30	3.7	27.4	FR	PS
1503420	20/05/68	18.9	0.61	5.2	18.3	FR	DO
1503421	25/07/56	12.5	0.0	4.3	11.6	FR	DO
1503441	21/06/66	18.6	0.0	3.7	18.3	FR	DO
1503444	22/05/67	18.6	0.0	2.1	18.6	FR	DO
1510217	03/10/69	21.3	3.66	8.5	20.1	FR	CO
1511038	28/08/70	26.8	-	4.6	26.8	FR	DO
1511125	16/04/71	24.4	0.61	0.9	14.6	FR	DO
1511129	28/04/71	23.5	-	3	16.8	FR	ST
1511422	15/09/71	15.2	1.52	2.1	12.5, 14.6	FR	DO
1511609	20/11/71	14.9	1.52	8.5	13.7	FR	DO
1513750	15/01/74	38.1	1.22	3.4	18.3, 38.1	FR	DO
1513876	13/11/73	25.6	0.0	0.6	24.4	FR	DO
1514694	08/05/75	22.3	0.61	3	20.7	FR	DO
1515842	05/01/77	30.2	2.13	2.4	27.4	FR	DO
1520303	28/10/85	25.6	1.83	7	18.3, 24.1	FR	DO
1520307	28/10/85	19.2	0.61	4.6	17.7	FR	DO
1532914	18/06/02	22.9	0.0	0.9	19.2	UK	DO
1533414	26/10/02	45.7	0.61	12.5	25.6, 42.4	UK	DO
1533821	02/04/03	-	-	-	-	-	NU
1536251	03/01/06	22.9	1.21	5.2	-	-	DO
1536614	25/05/06	-	-	-	-	-	-
7043840	13/04/07	24.8	0.0	6.5	-	-	DO
7104231	13/07/07	103.6	-	-	-	-	DO
7145844	24/03/10	73.2	1.52	3.3	26.2, 56.7, 71.3	UT	DO
7147345	28/04/10	67.1	1.22	2.9	30.5, 64.6	UT	DO
7173721	29/07/11		-				
7210759	29/08/13	24.4	2.13	2.9	21.3	UT	DO
7265385	26/04/16	24.4	1.22	0.2	14.6, 21, 21.9	UT	DO
1503426	02/04/58	41.942	1.52	4.0	15.2, 30.6	#N/A	#N/A

MECP Water Well Record Compilation
(4 Campbell Reid Court – 500m search radius)

"Well Use"	
DO	Domestic
ST	Livestock
IR	Irrigation
IN	Industrial
CO	Commercial
MN	Municipal
PS	Public
AC	Cooling and A/C
NU	Not Used
OT	Other

"Water Detail"	
FR	Fresh
SA	Salty
SU	Sulphur
MN	Mineral
UK	Unknown
GS	Gas
IR	Iron

TH	Test Hole
DE	Dewatering
MO	Monitoring
MT	Monitoring Test

GEMTEC
Consulting Engineers and Scientists

Ontario — Ministry of the Environment, Conservation and Parks

W Tag#:A318575 (Print Below)

A318575

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	March Veterinary Professional Corporation		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
591 March Road	Kanata	ON	K2K 2M5	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
4 Campbell Reid Court	March	15	3

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

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	424962	5024954		

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
	Sand	& Boulders		0'	4'
Grey	Sandstone			4'	127'
Grey	Sandstone			127'	250'
Grey	Sandstone			250'	260'

* A & G OLENDER HOLDINGS LTD. *

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
100'	90'	Neat cement	14.04
90'	0'	Bentonite slurry	25.2

Method of Construction

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

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'	100'
6"	Open Hole		100'	260'

Construction Record - Screen

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

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

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
127 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify	0'	100'	9 3/4"
250 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify	100'	260'	6"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

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): 250

Pumping rate (l/min / GPM): 15

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 25.9'

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

Recommended pump depth (m/ft): 150'

Recommended pump rate (l/min/GPM): 15

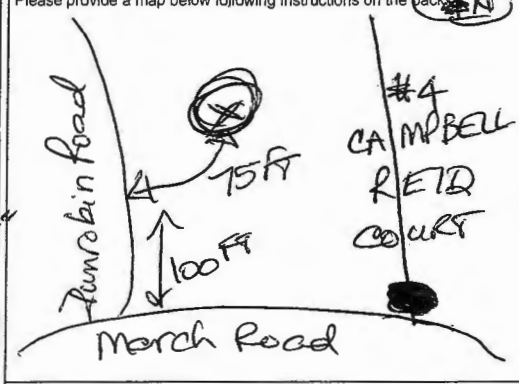
Well production (l/min/GPM): 15

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	319"		25.9'
1	9.3	1	16
2	11.7	2	11.7
3	13.5	3	8.7
4	14.7	4	6.6
5	15.4	5	5.3
10	19	10	3.9
15	21.1	15	3.9
20	22.5	20	3.9
25	22.9	25	3.9
30	23.2	30	3.9
40	24.5	40	3.9
50	25.3	50	3.9
60	25.9'	60	3.6"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: Htp-150MSL@150FT

Well Contractor and Well Technician Information

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

Business Address (Street Number/Name)	Municipality
6859 Franktown Road	Richmond

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

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

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
13632		2022 04 30

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Date Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2022 04 18	2022 04 14

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Received

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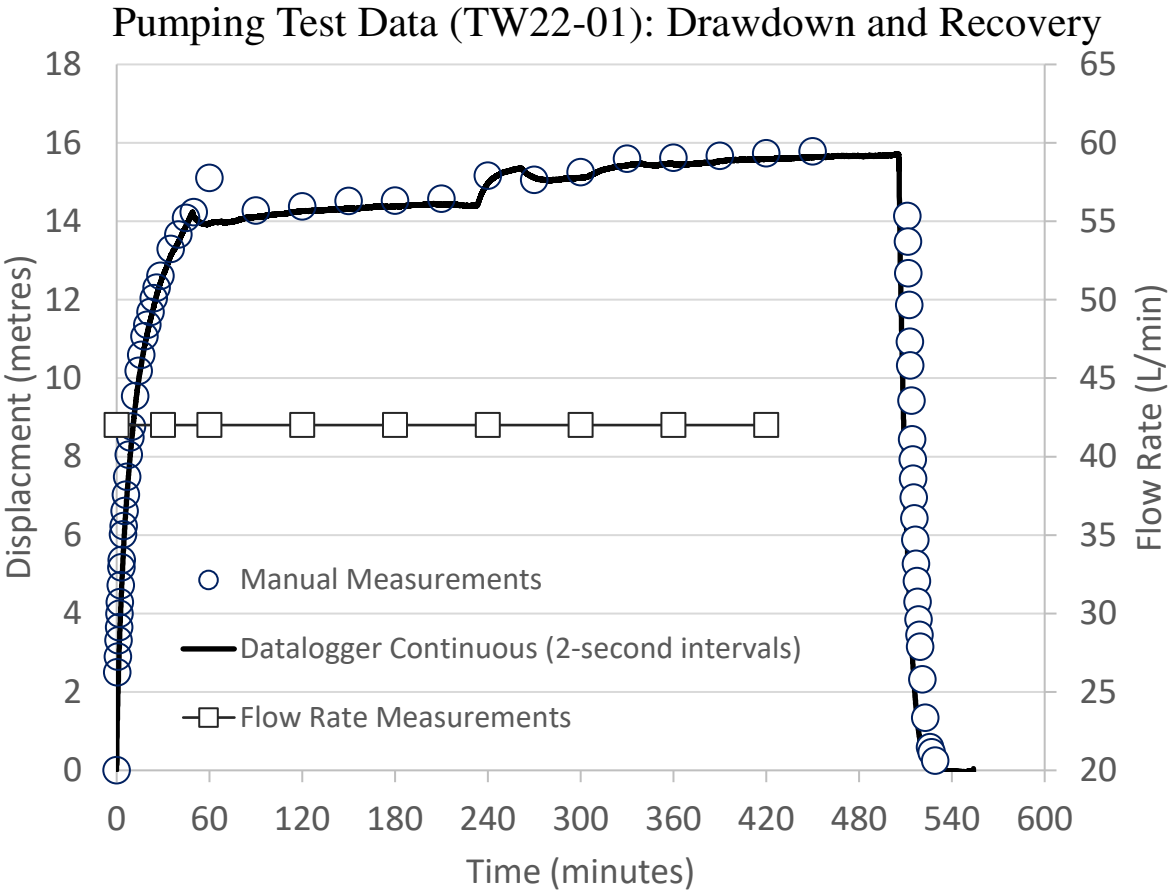
APPENDIX D

Pumping Test Data & Water Level Monitoring

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis
	Project: Hydrogeological Investigation
	Project Number: 65103.01
	Client: Dr. Andrzej Olender

Location: 4 Campbell Reid Court, Ottawa, Ontario		
Test Conducted by: SE & DM	Pumping Well: TW22-01	P-Test Date: May 4, 2022
Analysis Performed by: AP	Measurement: Manual and Logger	Analysis Date: June 17, 2022
Aquifer Thickness: 49 m	Discharge: Constant 42 L/min	Duration: 8.4 hours



Water Levels TW22-1

Static : 1.26 m below top of casing

TOC = 0.59 m above ground surface

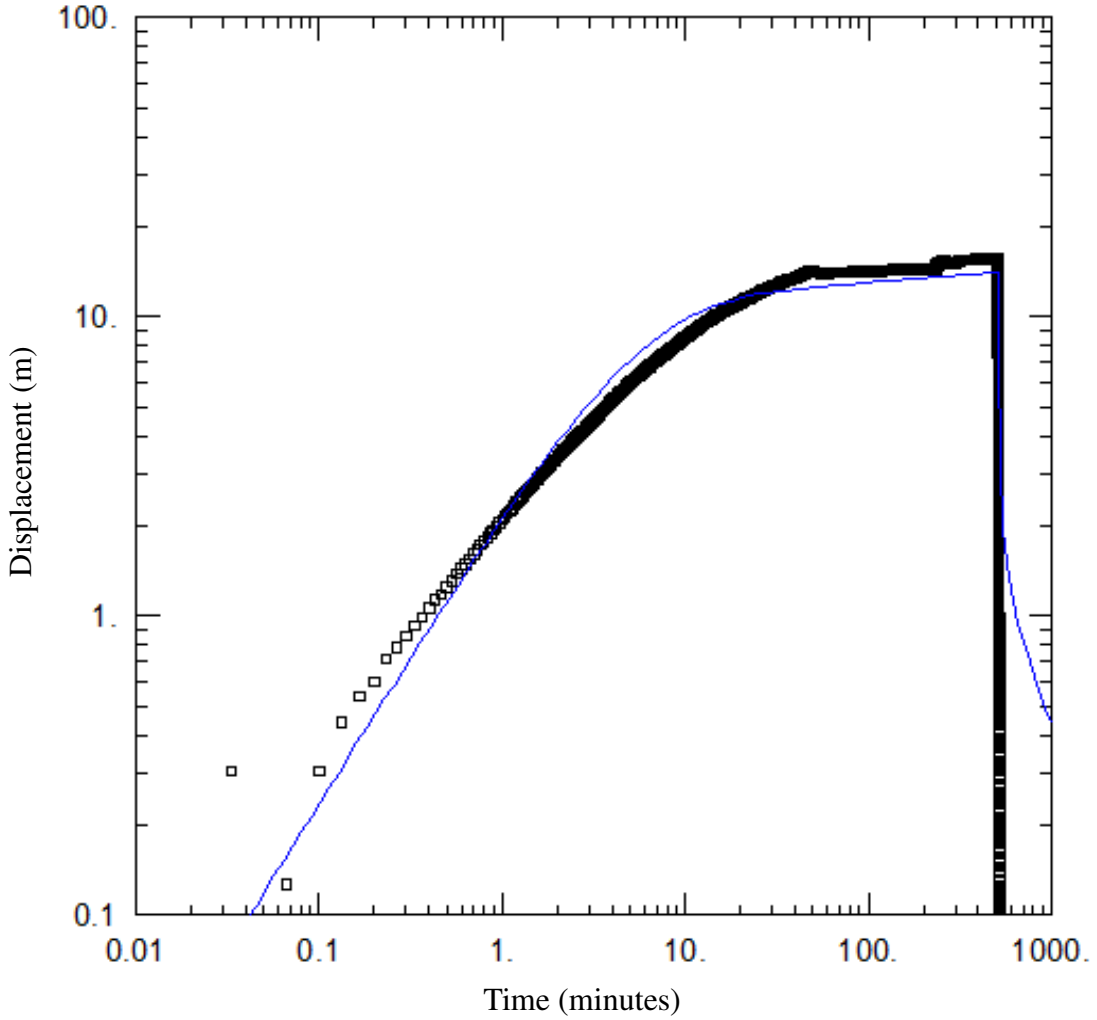
End of pump test (8.5-hours): 15.70 m below top of casing

Following recovery (5 mins): 1.21 m below top of casing

GEMTEC
Consulting Engineers and Scientists

Pumping Test Analysis		
Project: Hydrogeological Investigation		
Project Number: 65103.01		
Client: Dr. Andrzej Olender		
Location: 4 Campbell Reid Court, Ottawa, Ontario		
Test Conducted by: SE & DM	Pumping Well: TW22-01	P-Test Date: May 4, 2022
Analysis Performed by: AP	Method: Papadopulos-Cooper	Analysis Date: June 17, 2022
Aquifer Thickness: 49 m	Discharge: Constant 42 L/min	Duration: 8.5 hours

Pumping Test Data (TW22-01): Drawdown Analysis

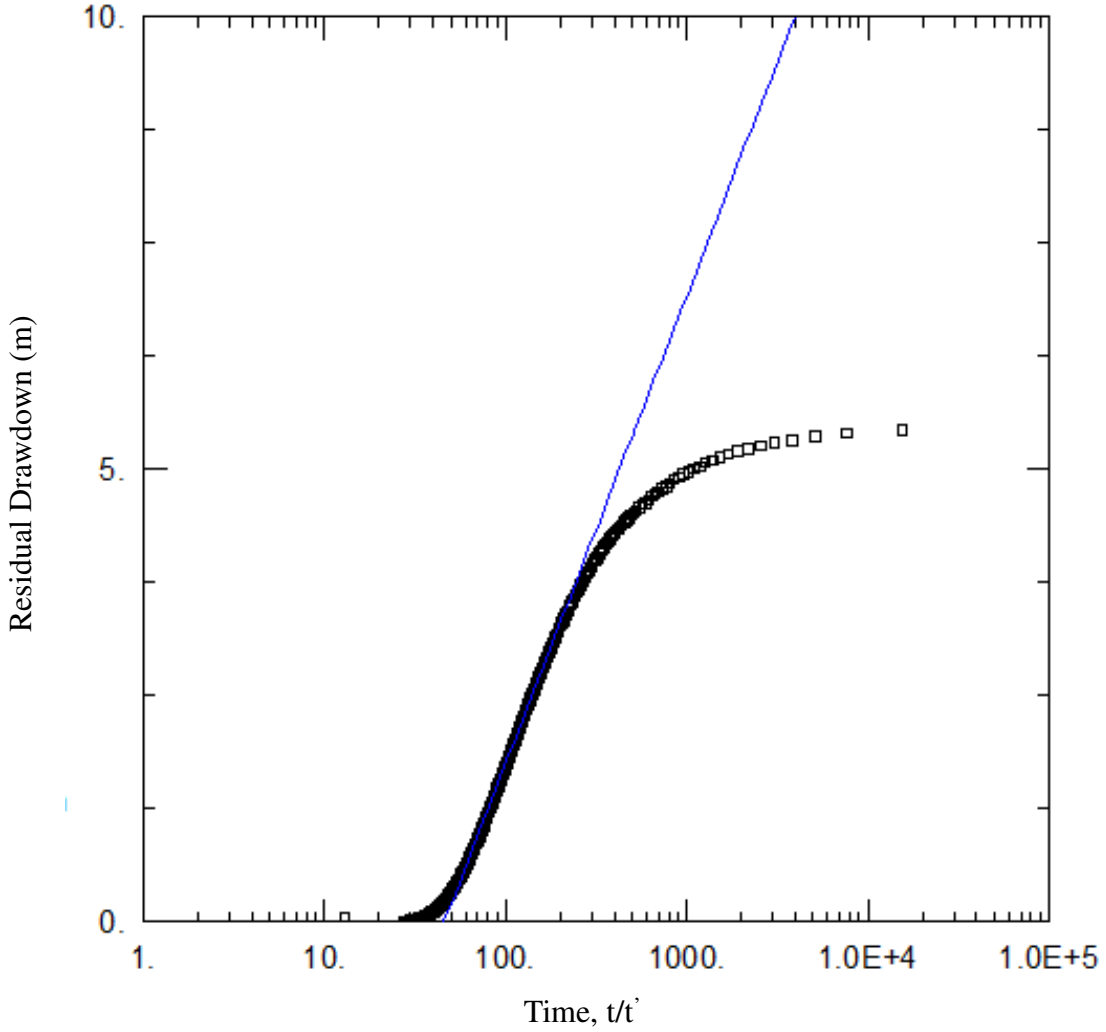


Transmissivity: 5 m^2/day (6 x 10^{-5} m/s)

GEMTEC
Consulting Engineers and Scientists

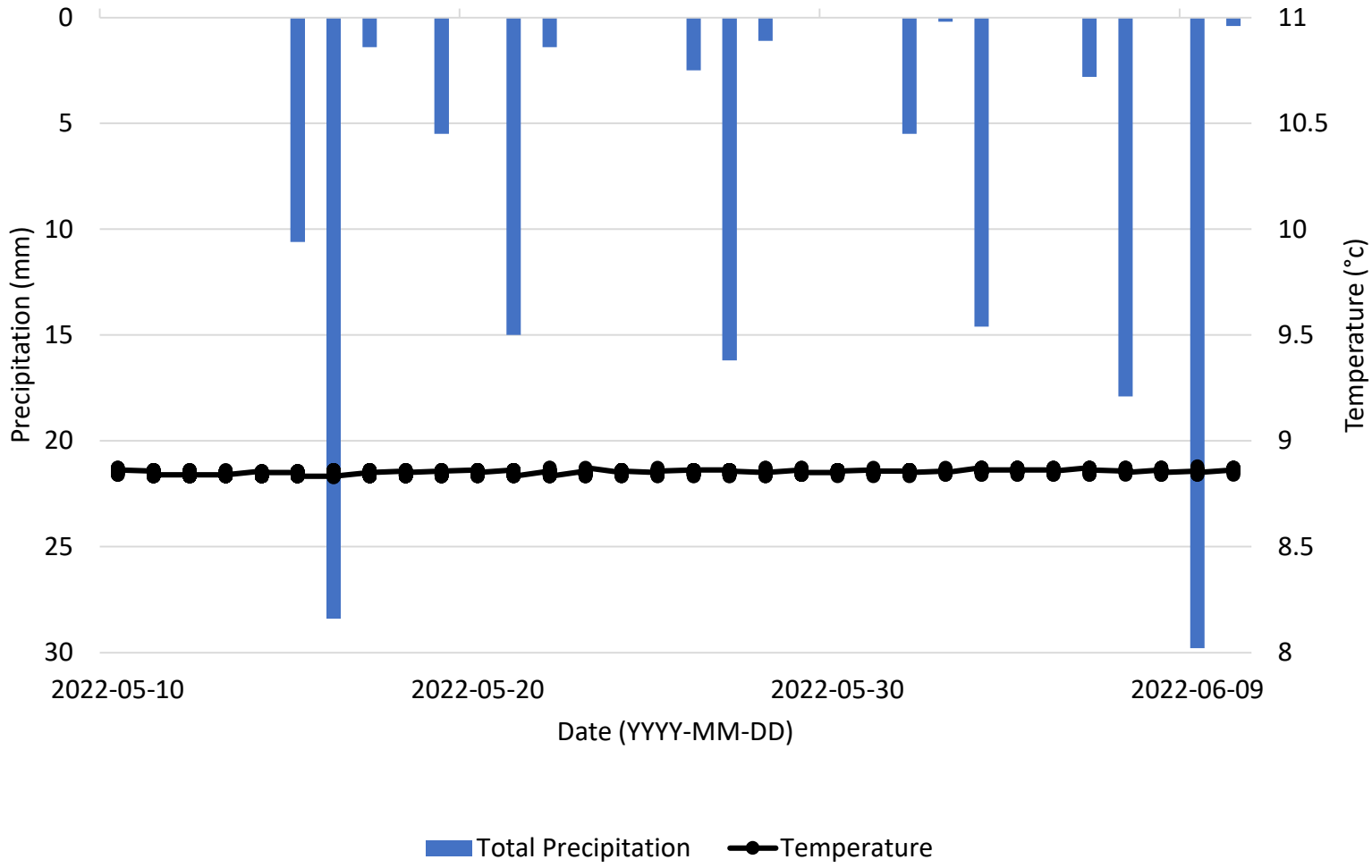
Pumping Test Analysis		
Project: Hydrogeological Investigation		
Project Number: 65103.01		
Client: Dr. Andrzej Olender		
Location: 4 Campbell Reid Court, Ottawa, Ontario		
Test Conducted by: SE & DM	Pumping Well: TW22-01	P-Test Date: May 4, 2022
Analysis Performed by: AP	Method: Theis Recovery	Analysis Date: June 17, 2022
Aquifer Thickness: 49 m	Discharge: Constant 42 L/min	Duration: 8.5 hours

Pumping Test Data (TW22-01): Recovery Analysis



Transmissivity: 2 m^2/day (2 x 10^{-5} m/s)

Groundwater Temperature and Precipitation Data
TW22-1



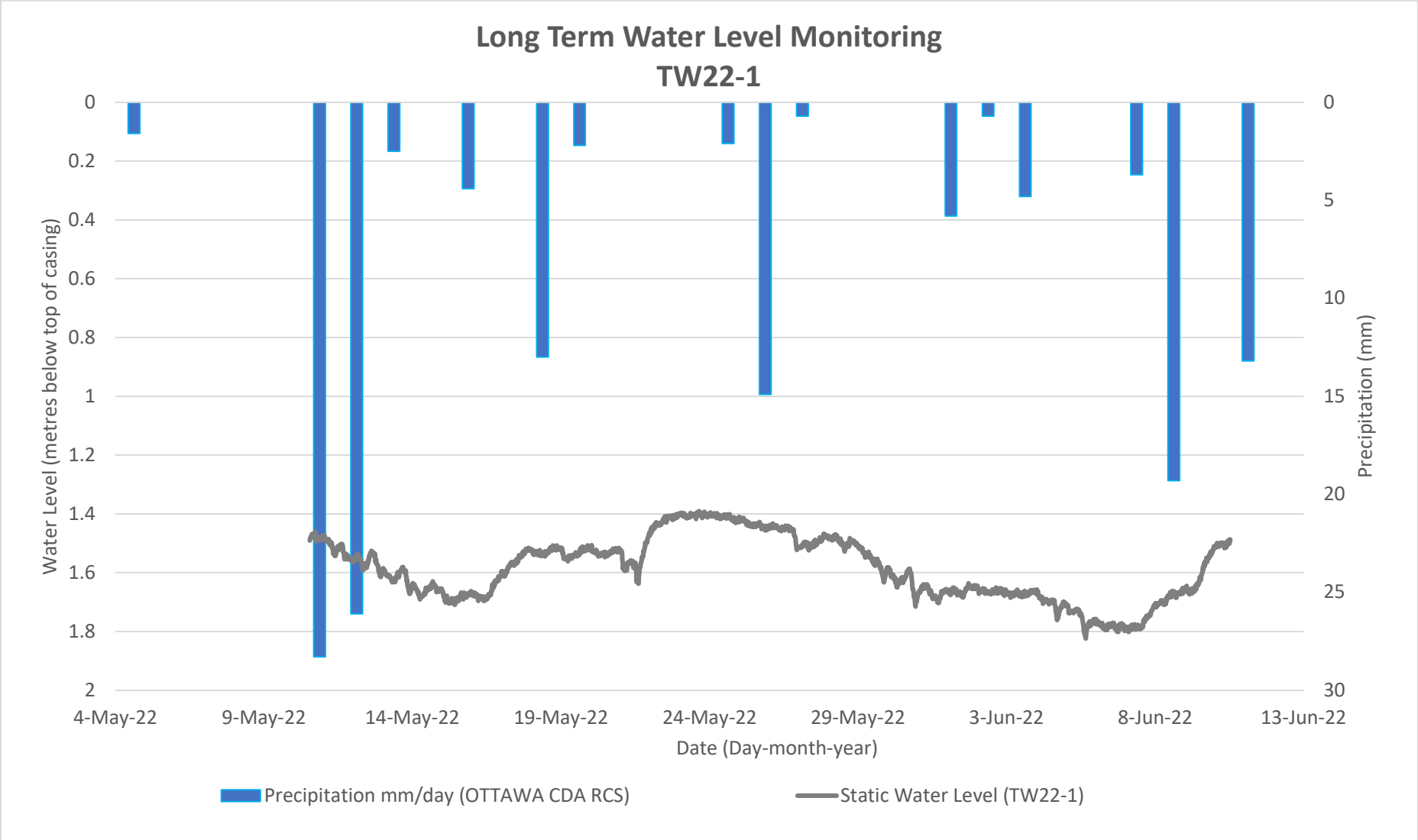
Notes:

1. Precipitation data downloaded from the Ottawa International Airport Weather Station, Climate ID: 6106001.

GEMTEC
Consulting Engineers and Scientists

Project: 65103.01

Date: June 2022



GEMTEC
Consulting Engineers and Scientists

Project: 65103.01

Date: June 2022

APPENDIX E

Laboratory Certificates & Summary Tables & OHIG Chloride Maps

Summary of Test Well Field Water Quality Measurements
TW22-1

Test Well	Time Since Initiaion of Pump (Hours)	Temp (°C)	pH	Electrical Cond. (µS/cm)	Total Dissolved Solids (ppm)	Turbidity (NTU)	Apparent Colour[1] (TCU[2])	True Colour[3] (TCU)	Free Chlorine (mg/L)	Total Chlorine (mg/L)
TW21-01	1	9.5	7.23	1329	665	14.8	-	-	-	-
	2	9.7	7.77	1334	667	5.97	-	-	-	-
	3	9.7	7.89	1329	665	3.89	27	ND (<5)	ND (<0.02)	ND (<0.02)
	4	10.4	8.06	1358	679	3.51	-	-	-	-
06-Oct-21	5	10.9	8.04	1372	686	3.63	-	-	-	-
	6	10.5	8.15	1371	686	1.76				
	7	10.6	8.18	1380	690	1.24				
	8	9.8	7.74	1328	664	1.33	10	ND (<5)	ND (<0.02)	ND (<0.02)

NOTES:

1. Apparent Colour = Unfiltered sample
2. TCU = True Colour Units
3. True Colour = Sample filtered using 0.45 micron filter
4. 'ND' = No concentration detected above method detection limit
5. '-' = No value provided

Summary of Test Well Labratory Water Quality Measurements

PW6 (1 of 2)

Parameter	Units	PW6 01-Sep-21	PW6 30-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters					
E. Coli	CFU/100 mL	ND (1)	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	ND (1)	ND (1)	-	-
Total Coliforms	CFU/100 mL	ND (1)	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	ND (10)	ND (10)	-	-
General Inorganics					
Alkalinity, total	mg/L	298	316	30-500	OG
Ammonia as N	mg/L	0.15	0.09	-	-
Dissolved Organic Carbon	mg/L	4.2	4.1	5	AO
Colour	TCU	7	3	5	AO
Colour, apparent	ACU	83	78	-	-
Conductivity	uS/cm	2240	2070	-	-
Hardness	mg/L	546	423	80-100	OG
pH	pH Units	7.7	7.6	6.5-8.5	OG
Phenolics	mg/L	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	1230	1130	500	AO
Sulphide	mg/L	ND (0.02)	ND (0.02)	0.05	AO
Tannin & Lignin	mg/L	0.3	0.2	-	-
Total Kjeldahl Nitrogen	mg/L	0.3	ND (0.1)	-	-
Total Organic Nitrogen[6]	mg/L	0.2	<0.10	0.15	MAC
Turbidity	NTU	6.9	8.2	5	AO
Anions					
Chloride	mg/L	459	460	250	AO
Fluoride	mg/L	0.4	0.5	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	ND (0.1)	10[4]	MAC
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	1.0[4]	MAC
Sulphate	mg/L	58	59	500	AO
Metals					
Calcium	mg/L	171	137	-	-
Iron	mg/L	1.5	0.9	0.3	AO
Magnesium	mg/L	29.1	19.5	-	-
Manganese	mg/L	0.380	0.174	0.05	AO
Potassium	mg/L	4.0	2.8	-	-
Sodium	mg/L	275	244	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

PW6 (2 of 2)

Parameter	Units	PW6 01-Sep-21	PW6 30-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trace Metals					
Aluminum	mg/L	ND (0.001)	-	0.1	OG
Antimony	mg/L	ND (0.0005)	-	0.006	MAC
Arsenic	mg/L	ND (0.001)	-	0.025	MAC
Barium	mg/L	0.989	-	1	MAC
Boron	mg/L	0.04	-	5	MAC
Cadmium	mg/L	ND (0.0001)	-	0.005	MAC
Chromium	mg/L	ND (0.001)	-	0.05	MAC
Copper	mg/L	0.0147	-	1	AO
Lead	mg/L	ND (0.0001)	-	0.01	MAC
Selenium	mg/L	ND (0.001)	-	0.01	MAC
Uranium	mg/L	0.0009	-	0.02	MAC
Zinc	mg/L	0.006	-	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200

Summary of Test Well Labratory Water Quality Measurements

PW4 (1 of 2)

Parameter	Units	PW4 03-Jun-21	PW4 14-Jun-21	PW4 2021-10-05 (Pitless Adapter)	PW4 2021-11-10 (Ptest 4-hr)	PW4 2021-11-10 (Ptest 8-hr)	PW4 29-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters									
E. Coli	CFU/100 mL	-	ND (1)	-	-	-	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	-	**2**	-	-	-	ND (1)	-	-
Total Coliforms	CFU/100 mL	-	**8**	-	-	-	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	-	190	-	-	-	ND (10)	-	-
General Inorganics									
Alkalinity, total	mg/L	-	288	-	-	402	300	30-500	OG
Ammonia as N	mg/L	-	0.37	-	-	0.21	0.35	-	-
Dissolved Organic Carbon	mg/L	-	**9.9**	-	-	**8.4**	**7.5**	5	AO
Colour	TCU	-	**9**	-	-	-	**20**	5	AO
Colour, apparent	ACU	-	311	-	-	-	400	-	-
Conductivity	uS/cm	-	3370	-	-	2110	3160	-	-
Hardness	mg/L	-	**559**	-	-	**614**	**603**	80-100	OG
pH	pH Units	-	7.6	-	-	7.2	7.3	6.5-8.5	OG
Phenolics	mg/L	-	0.002	-	-	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	**1830**	**1880**	-	-	**1270**	**1860**	500	AO
Sulphide	mg/L	-	ND (0.02)	-	-	ND (0.02)	ND (0.02)	0.05	AO
Tannin & Lignin	mg/L	-	0.9	-	-	0.4	1.9	-	-
Total Kjeldahl Nitrogen	mg/L	-	0.6	-	-	0.7	0.5	-	-
Total Organic Nitrogen[6]	mg/L	-	**0.2**	-	-	**0.5**	**0.2**	0.15	MAC
Turbidity	NTU	-	26.2	-	-		46.7	5	AO
Anions									
Chloride	mg/L	**820**	**771**	141	**337**	**355**	**766**	250	AO
Fluoride	mg/L	-	0.1	-	-	0.6	0.3	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	ND (0.1)	-	-	2.5	ND (0.1)	10[4]	MAC
Nitrite as N	mg/L	-	ND (0.05)	-	-	ND (0.05)	ND (0.25)	1.0[4]	MAC
Sulphate	mg/L	-	45	-	-	174	42	500	AO
Metals									
Calcium	mg/L	-	191	-	-	204	204	-	-
Iron	mg/L	-	**6.8**	-	-	**2.5**	**6.9**	0.3	AO
Magnesium	mg/L	-	19.9	-	-	25.4	22.8	-	-
Manganese	mg/L	-	**0.472**	-	-	**0.475**	**0.442**	0.05	AO
Potassium	mg/L	-	2.4	-	-	5.2	2.8	-	-
Sodium	mg/L	-	**411**	-	198	**203**	**360**	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

PW4 (2 of 2)

Parameter	Units	PW4 03-Jun-21	PW4 14-Jun-21	PW4 2021-10-05 (Pitless Adapter)	PW4 2021-11-10 (Ptest 4-hr)	PW4 2021-11-10 (Ptest 8-hr)	PW4 29-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trace Metals									
Aluminum	mg/L	-	-	-	-	0.004	-	0.1	OG
Antimony	mg/L	-	-	-	-	ND (0.0005)	-	0.006	MAC
Arsenic	mg/L	-	-	-	-	ND (0.001)	-	0.025	MAC
Barium	mg/L	-	-	-	-	0.444	-	1	MAC
Boron	mg/L	-	-	-	-	0.07	-	5	MAC
Cadmium	mg/L	-	-	-	-	ND (0.0001)	-	0.005	MAC
Chromium	mg/L	-	-	-	-	ND (0.001)	-	0.05	MAC
Copper	mg/L	-	-	-	-	0.0031	-	1	AO
Lead	mg/L	-	-	-	-	ND (0.0001)	-	0.01	MAC
Selenium	mg/L	-	-	-	-	ND (0.001)	-	0.01	MAC
Uranium	mg/L	-	-	-	-	0.0019	-	0.02	MAC
Zinc	mg/L	-	-	-	-	0.009	-	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200

Summary of Test Well Labratory Water Quality Measurements

TW22-1 (1 of 2)

Parameter	Units	TW22-1 (4-hr) 04-May-22	TW22-1 (8-hr) 04-May-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters					
E. Coli	CFU/100 mL	ND (1)	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	ND (1)	ND (1)	-	-
Total Coliforms	CFU/100 mL	ND (1)	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	ND (10)	ND (10)	-	-
General Inorganics					
Alkalinity, total	mg/L	315	317	30-500	OG
Ammonia as N	mg/L	0.14	0.14	-	-
Dissolved Organic Carbon	mg/L	1.8	1.9	5	AO
Colour	TCU	ND (2)	2	5	AO
Colour, apparent	ACU	77	51	-	-
Conductivity	uS/cm	1780	1720	-	-
Hardness	mg/L	491	594	80-100	OG
pH	pH Units	7.7	7.8	6.5-8.5	OG
Phenolics	mg/L	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	972	954	500	AO
Sulphide	mg/L	0.03	0.02	0.05	AO
Tannin & Lignin	mg/L	ND (0.1)	ND (0.1)	-	-
Total Kjeldahl Nitrogen	mg/L	0.2	0.1	-	-
Total Organic Nitrogen[6]	mg/L	0.1	-	0.15	MAC
Turbidity	NTU	9.4	5.6	5	AO
Anions					
Chloride	mg/L	**378**	**385**	250	AO
Fluoride	mg/L	0.6	0.5	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	0.1	10[4]	MAC
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	1.0[4]	MAC
Sulphate	mg/L	53	53	500	AO
Metals					
Calcium	mg/L	147	188	-	-
Iron	mg/L	ND (0.1)	**1.3**	0.3	AO
Magnesium	mg/L	30.1	30.5	-	-
Manganese	mg/L	0.025	**0.081**	0.05	AO
Potassium	mg/L	6.6	7.2	-	-
Sodium	mg/L	169	**201**	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

TW22-1 (2 of 2)

Parameter	Units	TW22-1 (4-hr) 04-May-22	TW22-1 (8-hr) 04-May-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trace Metals					
Mercury	mg/L	-	ND (0.0001)	0.001	MAC
Aluminum	mg/L	-	0.007	0.1	MAC
Antimony	mg/L	-	ND (0.0005)	0.006	MAC
Arsenic	mg/L	-	ND (0.001)	0.01	MAC
Barium	mg/L	-	0.247	1	MAC
Beryllium	mg/L	-	ND (0.0005)	-	-
Boron	mg/L	-	0.22	5	MAC
Cadmium	mg/L	-	ND (0.0001)	0.005	MAC
Calcium	mg/L	-	188	-	-
Chromium	mg/L	-	ND (0.001)	0.05	MAC
Cobalt	mg/L	-	ND (0.0005)	-	-
Copper	mg/L	-	ND (0.0005)	-	-
Iron	mg/L	-	**1.3**	0.3/5-10	AO/MCT
Lead	mg/L	-	ND (0.0001)	0.01	MAC
Magnesium	mg/L	-	30.5	-	-
Manganese	mg/L	-	0.081	0.05/1.0	AO/MCT
Molybdenum	mg/L	-	ND (0.0005)	-	-
Nickel	mg/L	-	ND (0.001)	-	-
Potassium	mg/L	-	7.2	-	-
Selenium	mg/L	-	ND (0.001)	0.05	MAC
Silver	mg/L	-	ND (0.0001)	-	-
Sodium	mg/L	-	**201**	20/200/200	WL/AO/MCT
Strontium	mg/L	-	**15**	7	MAC[11]
Thallium	mg/L	-	ND (0.001)	-	-
Uranium	mg/L	-	0.0006	-	-
Vanadium	mg/L	-	ND (0.0005)	-	-
Zinc	mg/L	-	ND(0.005)	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200
11. Health Canada (2019) guidelines

Summary of Test Well Field Water Quality Measurements
TW22-1

Test Well	Time Since Initiaion of Pump (Hours)	Temp (°C)	pH	Electrical Cond. (µS/cm)	Total Dissolved Solids (ppm)	Turbidity (NTU)	Apparent Colour[1] (TCU[2])	True Colour[3] (TCU)	Free Chlorine (mg/L)	Total Chlorine (mg/L)
TW21-01	1	9.5	7.23	1329	665	14.8	-	-	-	-
	2	9.7	7.77	1334	667	5.97	-	-	-	-
	3	9.7	7.89	1329	665	3.89	27	ND (<5)	ND (<0.02)	ND (<0.02)
	4	10.4	8.06	1358	679	3.51	-	-	-	-
06-Oct-21	5	10.9	8.04	1372	686	3.63	-	-	-	-
	6	10.5	8.15	1371	686	1.76				
	7	10.6	8.18	1380	690	1.24				
	8	9.8	7.74	1328	664	1.33	10	ND (<5)	ND (<0.02)	ND (<0.02)

NOTES:

1. Apparent Colour = Unfiltered sample
2. TCU = True Colour Units
3. True Colour = Sample filtered using 0.45 micron filter
4. 'ND' = No concentration detected above method detection limit
5. '-' = No value provided

Summary of Test Well Labratory Water Quality Measurements

PW6 (1 of 2)

Parameter	Units	PW6 01-Sep-21	PW6 30-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters					
E. Coli	CFU/100 mL	ND (1)	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	ND (1)	ND (1)	-	-
Total Coliforms	CFU/100 mL	ND (1)	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	ND (10)	ND (10)	-	-
General Inorganics					
Alkalinity, total	mg/L	298	316	30-500	OG
Ammonia as N	mg/L	0.15	0.09	-	-
Dissolved Organic Carbon	mg/L	4.2	4.1	5	AO
Colour	TCU	7	3	5	AO
Colour, apparent	ACU	83	78	-	-
Conductivity	uS/cm	2240	2070	-	-
Hardness	mg/L	546	423	80-100	OG
pH	pH Units	7.7	7.6	6.5-8.5	OG
Phenolics	mg/L	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	1230	1130	500	AO
Sulphide	mg/L	ND (0.02)	ND (0.02)	0.05	AO
Tannin & Lignin	mg/L	0.3	0.2	-	-
Total Kjeldahl Nitrogen	mg/L	0.3	ND (0.1)	-	-
Total Organic Nitrogen[6]	mg/L	0.2	<0.10	0.15	MAC
Turbidity	NTU	6.9	8.2	5	AO
Anions					
Chloride	mg/L	459	460	250	AO
Fluoride	mg/L	0.4	0.5	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	ND (0.1)	10[4]	MAC
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	1.0[4]	MAC
Sulphate	mg/L	58	59	500	AO
Metals					
Calcium	mg/L	171	137	-	-
Iron	mg/L	1.5	0.9	0.3	AO
Magnesium	mg/L	29.1	19.5	-	-
Manganese	mg/L	0.380	0.174	0.05	AO
Potassium	mg/L	4.0	2.8	-	-
Sodium	mg/L	275	244	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

PW6 (2 of 2)

Parameter	Units	PW6 01-Sep-21	PW6 30-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trace Metals					
Aluminum	mg/L	ND (0.001)	-	0.1	OG
Antimony	mg/L	ND (0.0005)	-	0.006	MAC
Arsenic	mg/L	ND (0.001)	-	0.025	MAC
Barium	mg/L	0.989	-	1	MAC
Boron	mg/L	0.04	-	5	MAC
Cadmium	mg/L	ND (0.0001)	-	0.005	MAC
Chromium	mg/L	ND (0.001)	-	0.05	MAC
Copper	mg/L	0.0147	-	1	AO
Lead	mg/L	ND (0.0001)	-	0.01	MAC
Selenium	mg/L	ND (0.001)	-	0.01	MAC
Uranium	mg/L	0.0009	-	0.02	MAC
Zinc	mg/L	0.006	-	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200

Summary of Test Well Labratory Water Quality Measurements

PW4 (1 of 2)

Parameter	Units	PW4 03-Jun-21	PW4 14-Jun-21	PW4 2021-10-05 (Pitless Adapter)	PW4 2021-11-10 (Ptest 4-hr)	PW4 2021-11-10 (Ptest 8-hr)	PW4 29-Mar-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters									
E. Coli	CFU/100 mL	-	ND (1)	-	-	-	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	-	**2**	-	-	-	ND (1)	-	-
Total Coliforms	CFU/100 mL	-	**8**	-	-	-	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	-	190	-	-	-	ND (10)	-	-
General Inorganics									
Alkalinity, total	mg/L	-	288	-	-	402	300	30-500	OG
Ammonia as N	mg/L	-	0.37	-	-	0.21	0.35	-	-
Dissolved Organic Carbon	mg/L	-	**9.9**	-	-	**8.4**	**7.5**	5	AO
Colour	TCU	-	**9**	-	-	-	**20**	5	AO
Colour, apparent	ACU	-	311	-	-	-	400	-	-
Conductivity	uS/cm	-	3370	-	-	2110	3160	-	-
Hardness	mg/L	-	**559**	-	-	**614**	**603**	80-100	OG
pH	pH Units	-	7.6	-	-	7.2	7.3	6.5-8.5	OG
Phenolics	mg/L	-	0.002	-	-	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	**1830**	**1880**	-	-	**1270**	**1860**	500	AO
Sulphide	mg/L	-	ND (0.02)	-	-	ND (0.02)	ND (0.02)	0.05	AO
Tannin & Lignin	mg/L	-	0.9	-	-	0.4	1.9	-	-
Total Kjeldahl Nitrogen	mg/L	-	0.6	-	-	0.7	0.5	-	-
Total Organic Nitrogen[6]	mg/L	-	**0.2**	-	-	**0.5**	**0.2**	0.15	MAC
Turbidity	NTU	-	26.2	-	-		46.7	5	AO
Anions									
Chloride	mg/L	**820**	**771**	141	**337**	**355**	**766**	250	AO
Fluoride	mg/L	-	0.1	-	-	0.6	0.3	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	ND (0.1)	-	-	2.5	ND (0.1)	10[4]	MAC
Nitrite as N	mg/L	-	ND (0.05)	-	-	ND (0.05)	ND (0.25)	1.0[4]	MAC
Sulphate	mg/L	-	45	-	-	174	42	500	AO
Metals									
Calcium	mg/L	-	191	-	-	204	204	-	-
Iron	mg/L	-	**6.8**	-	-	**2.5**	**6.9**	0.3	AO
Magnesium	mg/L	-	19.9	-	-	25.4	22.8	-	-
Manganese	mg/L	-	**0.472**	-	-	**0.475**	**0.442**	0.05	AO
Potassium	mg/L	-	2.4	-	-	5.2	2.8	-	-
Sodium	mg/L	-	**411**	-	198	**203**	**360**	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

PW4 (2 of 2)

Parameter	Units	PW4 03-Jun-21	PW4 14-Jun-21	PW4 2021-10-05 (Pitless Adapter)	PW4 2021-11-10 (Ptest 4-hr)	PW4 2021-11-10 (Ptest 8-hr)	PW4 29-Mar-22	Ontario Drinking Water Standard	Type of Standard(1,2,3)
Trace Metals									
Aluminum	mg/L	-	-	-	-	0.004	-	0.1	OG
Antimony	mg/L	-	-	-	-	ND (0.0005)	-	0.006	MAC
Arsenic	mg/L	-	-	-	-	ND (0.001)	-	0.025	MAC
Barium	mg/L	-	-	-	-	0.444	-	1	MAC
Boron	mg/L	-	-	-	-	0.07	-	5	MAC
Cadmium	mg/L	-	-	-	-	ND (0.0001)	-	0.005	MAC
Chromium	mg/L	-	-	-	-	ND (0.001)	-	0.05	MAC
Copper	mg/L	-	-	-	-	0.0031	-	1	AO
Lead	mg/L	-	-	-	-	ND (0.0001)	-	0.01	MAC
Selenium	mg/L	-	-	-	-	ND (0.001)	-	0.01	MAC
Uranium	mg/L	-	-	-	-	0.0019	-	0.02	MAC
Zinc	mg/L	-	-	-	-	0.009	-	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200

Summary of Test Well Labratory Water Quality Measurements

TW22-1 (1 of 2)

Parameter	Units	TW22-1 (4-hr) 04-May-22	TW22-1 (8-hr) 04-May-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters					
E. Coli	CFU/100 mL	ND (1)	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	ND (1)	ND (1)	-	-
Total Coliforms	CFU/100 mL	ND (1)	ND (1)	0	MAC
Heterotrophic Plate Count	CFU/mL	ND (10)	ND (10)	-	-
General Inorganics					
Alkalinity, total	mg/L	315	317	30-500	OG
Ammonia as N	mg/L	0.14	0.14	-	-
Dissolved Organic Carbon	mg/L	1.8	1.9	5	AO
Colour	TCU	ND (2)	2	5	AO
Colour, apparent	ACU	77	51	-	-
Conductivity	uS/cm	1780	1720	-	-
Hardness	mg/L	491	594	80-100	OG
pH	pH Units	7.7	7.8	6.5-8.5	OG
Phenolics	mg/L	ND (0.001)	ND (0.001)	-	-
Total Dissolved Solids	mg/L	972	954	500	AO
Sulphide	mg/L	0.03	0.02	0.05	AO
Tannin & Lignin	mg/L	ND (0.1)	ND (0.1)	-	-
Total Kjeldahl Nitrogen	mg/L	0.2	0.1	-	-
Total Organic Nitrogen[6]	mg/L	0.1	-	0.15	MAC
Turbidity	NTU	9.4	5.6	5	AO
Anions					
Chloride	mg/L	**378**	**385**	250	AO
Fluoride	mg/L	0.6	0.5	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	0.1	10[4]	MAC
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	1.0[4]	MAC
Sulphate	mg/L	53	53	500	AO
Metals					
Calcium	mg/L	147	188	-	-
Iron	mg/L	ND (0.1)	**1.3**	0.3	AO
Magnesium	mg/L	30.1	30.5	-	-
Manganese	mg/L	0.025	**0.081**	0.05	AO
Potassium	mg/L	6.6	7.2	-	-
Sodium	mg/L	169	**201**	200 [20][5]	AO

Summary of Test Well Labratory Water Quality Measurements

TW22-1 (2 of 2)

Parameter	Units	TW22-1 (4-hr) 04-May-22	TW22-1 (8-hr) 04-May-22	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trace Metals					
Mercury	mg/L	-	ND (0.0001)	0.001	MAC
Aluminum	mg/L	-	0.007	0.1	MAC
Antimony	mg/L	-	ND (0.0005)	0.006	MAC
Arsenic	mg/L	-	ND (0.001)	0.01	MAC
Barium	mg/L	-	0.247	1	MAC
Beryllium	mg/L	-	ND (0.0005)	-	-
Boron	mg/L	-	0.22	5	MAC
Cadmium	mg/L	-	ND (0.0001)	0.005	MAC
Calcium	mg/L	-	188	-	-
Chromium	mg/L	-	ND (0.001)	0.05	MAC
Cobalt	mg/L	-	ND (0.0005)	-	-
Copper	mg/L	-	ND (0.0005)	-	-
Iron	mg/L	-	**1.3**	0.3/5-10	AO/MCT
Lead	mg/L	-	ND (0.0001)	0.01	MAC
Magnesium	mg/L	-	30.5	-	-
Manganese	mg/L	-	0.081	0.05/1.0	AO/MCT
Molybdenum	mg/L	-	ND (0.0005)	-	-
Nickel	mg/L	-	ND (0.001)	-	-
Potassium	mg/L	-	7.2	-	-
Selenium	mg/L	-	ND (0.001)	0.05	MAC
Silver	mg/L	-	ND (0.0001)	-	-
Sodium	mg/L	-	**201**	20/200/200	WL/AO/MCT
Strontium	mg/L	-	**15**	7	MAC[11]
Thallium	mg/L	-	ND (0.001)	-	-
Uranium	mg/L	-	0.0006	-	-
Vanadium	mg/L	-	ND (0.0005)	-	-
Zinc	mg/L	-	ND(0.005)	5	AO

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Laboratory qualifier - A2C Background counts greater than 200
11. Health Canada (2019) guidelines

Langelier Saturation Index Calculation

Project: 65103.01
Location: 4 Campbell Reid Court
Sample ID: **TW22-1 8hr**
Well Tag: A318575

Inputs

pH =	7.8	
Total Dissolved Solids =	954	
Calcium (as $CaCO_3$) =	470	Note: Ca (as CaCO3) = 2.5 x Ca
Alkalinity (as $CaCO_3$) =	317	
Temperature (^oC) =	10	Assumed average groundwater temperature

Where Langelier Saturation Index (LSI) is defined as: $LSI = pH - pH_s$

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

And:

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

$$B = -13.12 \cdot \log_{10}[Temp + 273] + 34.55$$

$$C = \log_{10}[Calcium] - 0.4$$

$$D = \log_{10}[Alkalinity]$$

Output:

A =	0.20
B =	2.38
C =	2.27
D =	2.50
pH_s =	7.11

LSI = 0.69

LSI Value	Indication
-2.0 to -0.5	Serious corrosion
-0.5 to 0.0	Slight corrosion but non-scale forming
LSI = 0	Balanced but corrosion possible
0.0 to 0.5	Slightly scale forming and corrosive
0.5 to 2	Scale forming but non corrosive

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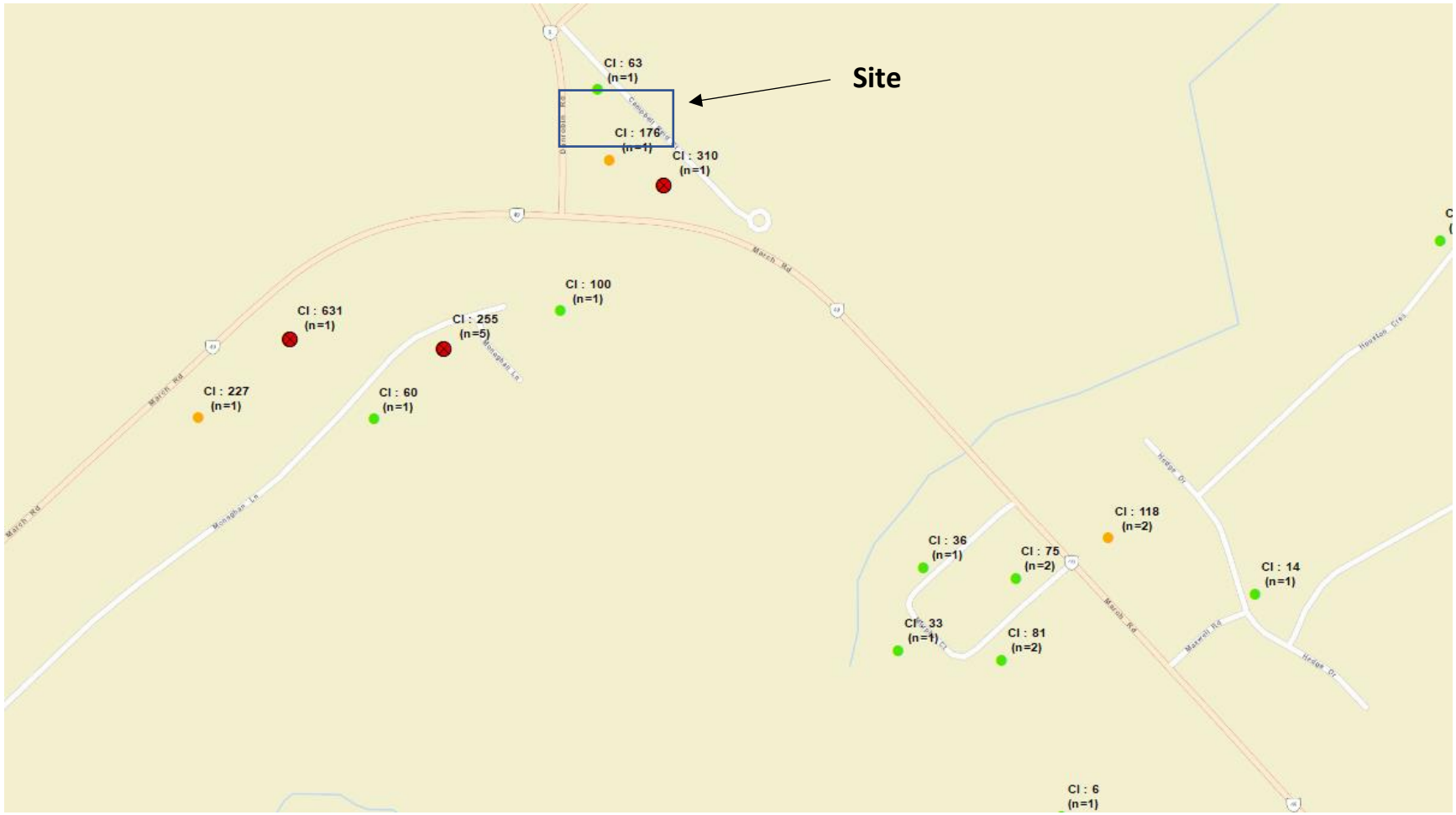

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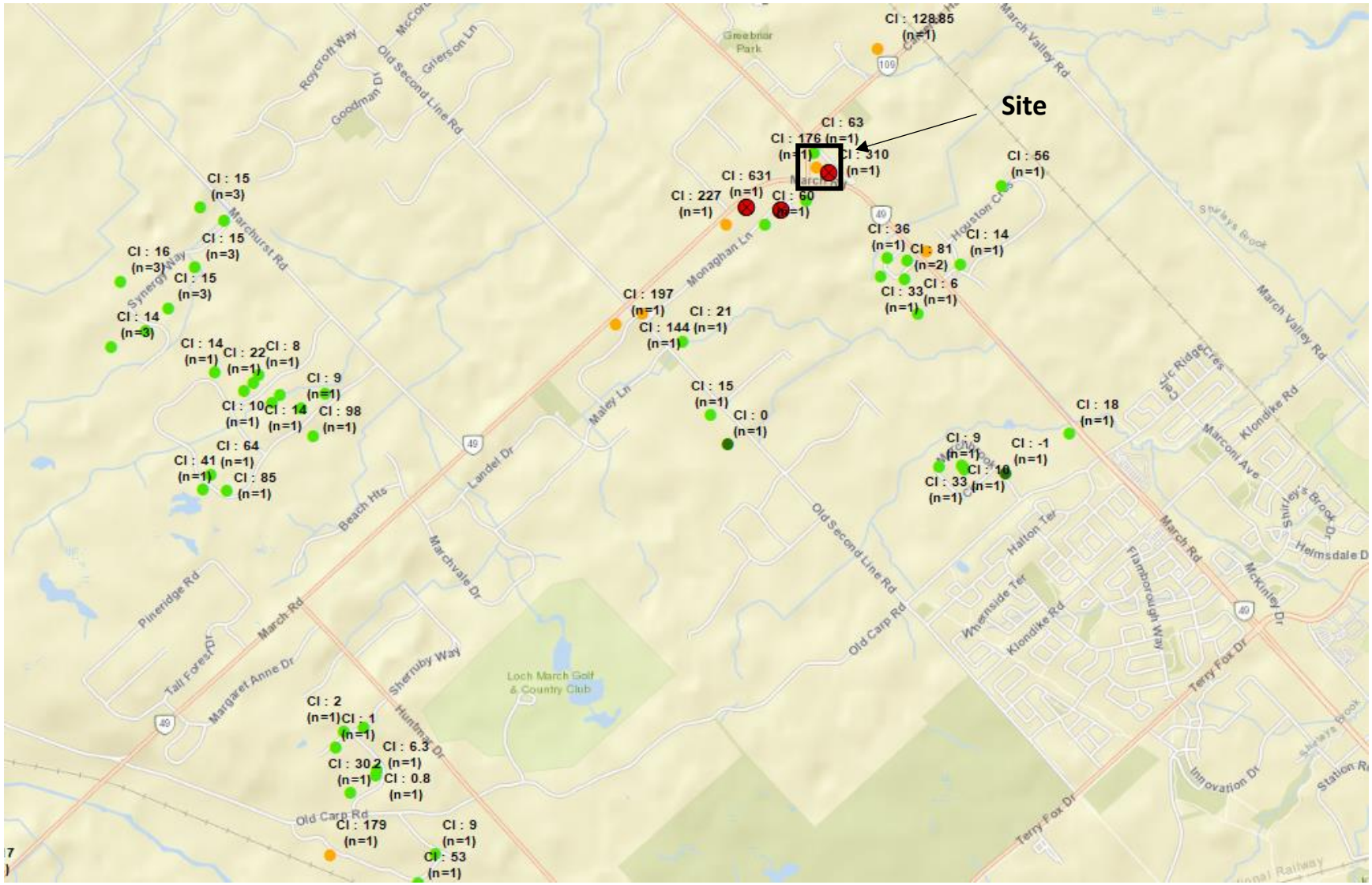
Chloride Map – OHIG Database (2 of 2)

Data provided by: Michel Kearney (City of Ottawa)

Project: 65103.01

June 2022



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Chloride Map – OHIG Database (1 of 2)

Data provided by: Michel Kearney (City of Ottawa)

Project: 65103.01

June 2022

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 14068

Report Date: 8-Jun-2021
Order Date: 3-Jun-2021

Order #: 2123457

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2123457-01	PW-04

GEMTEC Note: PW-04 referenced as PW4 in report.

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 08-Jun-2021

Order Date: 3-Jun-2021

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	4-Jun-21	4-Jun-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	7-Jun-21	8-Jun-21

Certificate of Analysis

Report Date: 08-Jun-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 3-Jun-2021

Client PO:

Project Description: 65103.01

	Client ID:	PW-04	-	-	-
	Sample Date:	03-Jun-21 12:15	-	-	-
	Sample ID:	2123457-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
General Inorganics					
Total Dissolved Solids	10 mg/L	1830	-	-	-
Anions					
Chloride	1 mg/L	820	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Nitrate as N	ND	0.1	mg/L						
General Inorganics									
Total Dissolved Solids	ND	10	mg/L						

Certificate of Analysis

Report Date: 08-Jun-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 3-Jun-2021

Client PO:

Project Description: 65103.01

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L	820			NC	10	
Nitrate as N	824	0.5	mg/L	ND			NC	10	
General Inorganics									
Total Dissolved Solids	1700	10	mg/L	1830			7.4	10	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	8.76	1	mg/L	ND	87.6	85-115			
Nitrate as N	1.00	0.1	mg/L	ND	100	79-120			
General Inorganics									
Total Dissolved Solids	98.0	10	mg/L	ND	98.0	75-125			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 14078

Report Date: 21-Jun-2021
Order Date: 14-Jun-2021

Order #: 2125154

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2125154-01	PW21-04

GEMTEC Note: PW21-04 referenced as PW4 in report.

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 21-Jun-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 14-Jun-2021

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	16-Jun-21	16-Jun-21
Ammonia, as N	EPA 351.2 - Auto Colour	17-Jun-21	17-Jun-21
Anions	EPA 300.1 - IC	16-Jun-21	16-Jun-21
Colour	SM2120 - Spectrophotometric	15-Jun-21	15-Jun-21
Colour, apparent	SM2120 - Spectrophotometric	15-Jun-21	15-Jun-21
Conductivity	EPA 9050A- probe @25 °C	16-Jun-21	16-Jun-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	17-Jun-21	17-Jun-21
E. coli	MOE E3407	15-Jun-21	15-Jun-21
Fecal Coliform	SM 9222D	15-Jun-21	15-Jun-21
Heterotrophic Plate Count	SM 9215C	15-Jun-21	15-Jun-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	16-Jun-21	16-Jun-21
pH	EPA 150.1 - pH probe @25 °C	16-Jun-21	16-Jun-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	16-Jun-21	16-Jun-21
Hardness	Hardness as CaCO3	16-Jun-21	16-Jun-21
Sulphide	SM 4500SE - Colourimetric	17-Jun-21	17-Jun-21
Tannin/Lignin	SM 5550B - Colourimetric	16-Jun-21	16-Jun-21
Total Coliform	MOE E3407	15-Jun-21	15-Jun-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	16-Jun-21	17-Jun-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	16-Jun-21	17-Jun-21
Turbidity	SM 2130B - Turbidity meter	15-Jun-21	15-Jun-21

Certificate of Analysis

Report Date: 21-Jun-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 14-Jun-2021

Client PO:

Project Description: 65103.01

	Client ID:	PW21-04	-	-	-
	Sample Date:	14-Jun-21 09:30	-	-	-
	Sample ID:	2125154-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	2	-	-	-
Total Coliforms	1 CFU/100 mL	8	-	-	-
Heterotrophic Plate Count	10 CFU/mL	190	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	288	-	-	-
Ammonia as N	0.01 mg/L	0.37	-	-	-
Dissolved Organic Carbon	0.5 mg/L	9.9	-	-	-
Colour	2 TCU	9	-	-	-
Colour, apparent	2 ACU	311	-	-	-
Conductivity	5 uS/cm	3370	-	-	-
Hardness	mg/L	559	-	-	-
pH	0.1 pH Units	7.6	-	-	-
Phenolics	0.001 mg/L	0.002	-	-	-
Total Dissolved Solids	10 mg/L	1880	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	0.9	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.6	-	-	-
Turbidity	0.1 NTU	26.2	-	-	-
Anions					
Chloride	1 mg/L	771	-	-	-
Fluoride	0.1 mg/L	0.1 [1]	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	45	-	-	-
Metals					
Calcium	0.1 mg/L	191	-	-	-
Iron	0.1 mg/L	6.8	-	-	-
Magnesium	0.2 mg/L	19.9	-	-	-
Manganese	0.005 mg/L	0.472	-	-	-
Potassium	0.1 mg/L	2.4	-	-	-
Sodium	0.2 mg/L	411	-	-	-

Certificate of Analysis

Report Date: 21-Jun-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 14-Jun-2021

Client PO:

Project Description: 65103.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	5.29	1	mg/L	5.30			0.2	10	
Fluoride	0.71	0.1	mg/L	0.72			1.2	10	
Nitrate as N	0.13	0.1	mg/L	0.13			0.8	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	21.7	1	mg/L	21.8			0.4	10	
General Inorganics									
Alkalinity, total	120	5	mg/L	120			0.1	14	
Ammonia as N	0.226	0.01	mg/L	0.214			5.2	17.7	
Dissolved Organic Carbon	1.5	0.5	mg/L	1.7			9.8	37	
Colour	9	2	TCU	9			0.0	12	
Colour, apparent	313	2	ACU	311			0.6	12	
Conductivity	265	5	uS/cm	267			0.7	5	
pH	8.1	0.1	pH Units	8.1			0.2	3.3	
Phenolics	0.002	0.001	mg/L	0.002			9.8	10	
Total Dissolved Solids	78.0	10	mg/L	86.0			9.8	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.51	0.1	mg/L	0.59			14.6	16	
Turbidity	26.3	0.1	NTU	26.2			0.4	10	
Metals									
Calcium	7.2	0.1	mg/L	7.1			1.7	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	1.7	0.2	mg/L	1.8			1.5	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	0.6	0.1	mg/L	0.6			1.7	20	
Sodium	14.0	0.2	mg/L	14.0			0.2	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	2			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	150	10	CFU/mL	190			24.0	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	14.4	1	mg/L	5.30	90.8	77-123			
Fluoride	1.64	0.1	mg/L	0.72	92.2	79-121			
Nitrate as N	1.22	0.1	mg/L	0.13	109	79-120			
Nitrite as N	0.907	0.05	mg/L	ND	90.7	84-117			
Sulphate	30.5	1	mg/L	21.8	86.5	74-126			
General Inorganics									
Ammonia as N	0.450	0.01	mg/L	0.214	94.4	81-124			
Dissolved Organic Carbon	12.3	0.5	mg/L	1.7	106	60-133			
Phenolics	0.026	0.001	mg/L	0.002	97.1	69-132			
Total Dissolved Solids	102	10	mg/L	ND	102	75-125			
Sulphide	0.54	0.02	mg/L	ND	108	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	113	71-113			
Total Kjeldahl Nitrogen	2.25	0.1	mg/L	0.59	83.0	81-126			
Metals									
Calcium	15900	0.1	mg/L	7090	88.5	80-120			
Iron	2220	0.1	mg/L	51.5	86.8	80-120			
Magnesium	10700	0.2	mg/L	1760	89.2	80-120			
Manganese	49.1	0.005	mg/L	2.20	93.7	80-120			
Potassium	9120	0.1	mg/L	598	85.2	80-120			
Sodium	22000	0.2	mg/L	14100	78.4	80-120			QM-07

Qualifier Notes:

Sample Qualifiers :

1 : Sample contained significant interference - results may be biased as a result.

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Jean-Philippe Gobeil

Client PO:
Project: 65103.01
Custody: 15548

Report Date: 8-Sep-2021
Order Date: 1-Sep-2021

Order #: 2136400

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2136400-01	PW-6

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 08-Sep-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 1-Sep-2021

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	2-Sep-21	2-Sep-21
Ammonia, as N	EPA 351.2 - Auto Colour	3-Sep-21	3-Sep-21
Anions	EPA 300.1 - IC	2-Sep-21	2-Sep-21
Colour	SM2120 - Spectrophotometric	2-Sep-21	2-Sep-21
Colour, apparent	SM2120 - Spectrophotometric	2-Sep-21	2-Sep-21
Conductivity	EPA 9050A- probe @25 °C	2-Sep-21	2-Sep-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	2-Sep-21	2-Sep-21
E. coli	MOE E3407	1-Sep-21	1-Sep-21
Fecal Coliform	SM 9222D	1-Sep-21	1-Sep-21
Heterotrophic Plate Count	SM 9215C	1-Sep-21	1-Sep-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	3-Sep-21	3-Sep-21
pH	EPA 150.1 - pH probe @25 °C	2-Sep-21	2-Sep-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	3-Sep-21	3-Sep-21
Hardness	Hardness as CaCO3	3-Sep-21	3-Sep-21
Sulphide	SM 4500SE - Colourimetric	7-Sep-21	7-Sep-21
Tannin/Lignin	SM 5550B - Colourimetric	3-Sep-21	3-Sep-21
Total Coliform	MOE E3407	1-Sep-21	1-Sep-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	7-Sep-21	7-Sep-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	2-Sep-21	7-Sep-21
Turbidity	SM 2130B - Turbidity meter	2-Sep-21	2-Sep-21

Certificate of Analysis

Report Date: 08-Sep-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 1-Sep-2021

Client PO:

Project Description: 65103.01

	Client ID:	PW-6	-	-	-
	Sample Date:	01-Sep-21 12:00	-	-	-
	Sample ID:	2136400-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	298	-	-	-
Ammonia as N	0.01 mg/L	0.15	-	-	-
Dissolved Organic Carbon	0.5 mg/L	4.2	-	-	-
Colour	2 TCU	7	-	-	-
Colour, apparent	2 ACU	83	-	-	-
Conductivity	5 uS/cm	2240	-	-	-
Hardness	mg/L	546	-	-	-
pH	0.1 pH Units	7.7	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	1230	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	0.3	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.3	-	-	-
Turbidity	0.1 NTU	6.9	-	-	-
Anions					
Chloride	1 mg/L	459	-	-	-
Fluoride	0.1 mg/L	0.4	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	58	-	-	-
Metals					
Aluminum	0.001 mg/L	<0.001	-	-	-
Antimony	0.0005 mg/L	<0.0005	-	-	-
Arsenic	0.001 mg/L	<0.001	-	-	-
Barium	0.001 mg/L	0.989	-	-	-
Boron	0.01 mg/L	0.04	-	-	-
Cadmium	0.0001 mg/L	<0.0001	-	-	-
Calcium	0.1 mg/L	171	-	-	-
Chromium	0.001 mg/L	<0.001	-	-	-
Copper	0.0005 mg/L	0.0147	-	-	-

Certificate of Analysis

Report Date: 08-Sep-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 1-Sep-2021

Client PO:

Project Description: 65103.01

	Client ID:	PW-6	-	-	-
	Sample Date:	01-Sep-21 12:00	-	-	-
	Sample ID:	2136400-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Iron	0.1 mg/L	1.5	-	-	-
Lead	0.0001 mg/L	<0.0001	-	-	-
Magnesium	0.2 mg/L	29.1	-	-	-
Manganese	0.005 mg/L	0.380	-	-	-
Potassium	0.1 mg/L	4.0	-	-	-
Selenium	0.001 mg/L	<0.001	-	-	-
Sodium	0.2 mg/L	275	-	-	-
Uranium	0.0001 mg/L	0.0009	-	-	-
Zinc	0.005 mg/L	0.006	-	-	-

Certificate of Analysis

Report Date: 08-Sep-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 1-Sep-2021

Client PO:

Project Description: 65103.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium	ND	0.001	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Sodium	ND	0.2	mg/L						
Uranium	ND	0.0001	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	105	1	mg/L	105			0.1	10	
Fluoride	1.88	0.1	mg/L	1.86			1.1	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	ND	1	mg/L	ND			NC	10	
General Inorganics									
Alkalinity, total	297	5	mg/L	298			0.4	14	
Ammonia as N	0.339	0.01	mg/L	0.280			19.4	17.7	QR-05
Dissolved Organic Carbon	2.2	0.5	mg/L	2.9			26.6	37	
Colour	20	2	TCU	20			0.0	12	
Colour, apparent	85	2	ACU	83			2.4	12	
Conductivity	2190	5	uS/cm	2240			2.0	5	
pH	7.7	0.1	pH Units	7.7			0.3	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	92.0	10	mg/L	96.0			4.3	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	0.2	0.1	mg/L	0.2			10.7	11	
Total Kjeldahl Nitrogen	0.57	0.1	mg/L	0.72			NC	16	
Turbidity	0.1	0.1	NTU	0.1			0.0	10	
Metals									
Aluminum	ND	0.001	mg/L	ND			NC	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.989	0.001	mg/L	0.989			0.0	20	
Boron	0.04	0.01	mg/L	0.04			2.0	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	171	0.1	mg/L	171			0.1	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0146	0.0005	mg/L	0.0147			1.2	20	
Iron	1.4	0.1	mg/L	1.5			1.7	20	
Lead	ND	0.0001	mg/L	ND			NC	20	
Magnesium	28.0	0.2	mg/L	29.1			3.8	20	
Manganese	0.372	0.005	mg/L	0.380			2.0	20	
Potassium	3.9	0.1	mg/L	4.0			2.6	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	273	2.9	mg/L	275			0.8	20	
Uranium	0.0008	0.0001	mg/L	0.0009			1.1	20	
Zinc	0.006	0.005	mg/L	0.006			0.6	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100 mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	113	1	mg/L	105	81.6	77-123			
Fluoride	2.77	0.1	mg/L	1.86	91.5	79-121			
Nitrate as N	0.97	0.1	mg/L	ND	97.1	79-120			
Nitrite as N	1.12	0.05	mg/L	ND	112	84-117			
Sulphate	9.10	1	mg/L	ND	91.0	74-126			
General Inorganics									
Ammonia as N	0.536	0.01	mg/L	0.280	103	81-124			
Dissolved Organic Carbon	12.0	0.5	mg/L	2.9	90.6	60-133			
Phenolics	0.024	0.001	mg/L	ND	97.8	69-132			
Total Dissolved Solids	106	10	mg/L	ND	106	75-125			
Sulphide	0.52	0.02	mg/L	ND	103	79-115			
Tannin & Lignin	1.0	0.1	mg/L	0.2	82.4	71-113			
Total Kjeldahl Nitrogen	2.35	0.1	mg/L	0.72	81.5	81-126			
Metals									
Aluminum	47.0	0.001	mg/L	0.780	92.3	80-120			
Antimony	48.3	0.0005	mg/L	0.0143	96.6	80-120			
Arsenic	52.6	0.001	mg/L	0.135	105	80-120			
Barium	52.4	0.001	mg/L	ND	105	80-120			
Boron	47.1	0.01	mg/L	ND	94.3	80-120			
Cadmium	45.2	0.0001	mg/L	0.0061	90.4	80-120			
Calcium	9790	0.1	mg/L	ND	97.9	80-120			
Chromium	55.0	0.001	mg/L	0.395	109	80-120			
Copper	61.7	0.0005	mg/L	14.7	94.0	80-120			
Iron	3810	0.1	mg/L	1450	94.4	80-120			
Lead	41.2	0.0001	mg/L	0.0639	82.2	80-120			
Magnesium	38600	0.2	mg/L	29100	94.6	80-120			
Manganese	50.6	0.005	mg/L	ND	101	80-120			
Potassium	15000	0.1	mg/L	3970	111	80-120			
Selenium	45.0	0.001	mg/L	0.038	90.0	80-120			
Sodium	9860	0.2	mg/L	ND	98.6	80-120			
Uranium	47.3	0.0001	mg/L	0.854	92.8	80-120			
Zinc	48.0	0.005	mg/L	6.07	83.8	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

QR-05 : Duplicate RPDs higher than normally accepted. Remaining batch QA\QC was acceptable. May be sample effect.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 15756

Report Date: 13-Oct-2021
Order Date: 5-Oct-2021

Order #: 2141237

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2141237-01	PW-4 Pitlet

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 13-Oct-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 5-Oct-2021

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	6-Oct-21	6-Oct-21

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Certificate of Analysis

Report Date: 13-Oct-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 5-Oct-2021

Client PO:

Project Description: 65103.01

Sample Results

Chloride

Matrix: Drinking Water

Paracel ID	Client ID	Sample Date	Units	MDL	Result
2141237-01	PW-4 Pitlet	5-Oct-21	mg/L	1	141

Laboratory Internal QA/QC

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Matrix Blank									
Chloride	**ND**	**1**	**mg/L**						
Matrix Duplicate									
Chloride	**205**	**1**	**mg/L**	**196**			**4.58**	**10**	
Matrix Spike									
Chloride	10.3	1	mg/L	ND	103	85-115			

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 15784

Report Date: 18-Nov-2021
Order Date: 15-Nov-2021

Order #: 2147073

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2147073-01	TW21-01 4hr
2147073-02	TW21-01 8hr

GEMTEC Note: PW21-04 referenced as PW04 in report.

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 18-Nov-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 15-Nov-2021

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	16-Nov-21	16-Nov-21
Ammonia, as N	EPA 351.2 - Auto Colour	16-Nov-21	16-Nov-21
Anions	EPA 300.1 - IC	16-Nov-21	16-Nov-21
Conductivity	EPA 9050A- probe @25 °C	16-Nov-21	16-Nov-21
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	17-Nov-21	17-Nov-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	16-Nov-21	16-Nov-21
pH	EPA 150.1 - pH probe @25 °C	16-Nov-21	16-Nov-21
Phenolics	EPA 420.2 - Auto Colour, 4AAP	16-Nov-21	16-Nov-21
Hardness	Hardness as CaCO3	16-Nov-21	16-Nov-21
Sulphide	SM 4500SE - Colourimetric	17-Nov-21	17-Nov-21
Tannin/Lignin	SM 5550B - Colourimetric	17-Nov-21	17-Nov-21
Total Dissolved Solids	SM 2540C - gravimetric, filtration	16-Nov-21	16-Nov-21
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	16-Nov-21	16-Nov-21

Certificate of Analysis

Report Date: 18-Nov-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 15-Nov-2021

Client PO:

Project Description: 65103.01

	Client ID:	TW21-01 4hr	TW21-01 8hr	-	-
	Sample Date:	10-Nov-21 12:10	10-Nov-21 16:10	-	-
	Sample ID:	2147073-01	2147073-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
General Inorganics					
Alkalinity, total	5 mg/L	-	402	-	-
Ammonia as N	0.01 mg/L	-	0.21	-	-
Dissolved Organic Carbon	0.5 mg/L	-	8.4	-	-
Conductivity	5 uS/cm	-	2110	-	-
Hardness	mg/L	-	614	-	-
pH	0.1 pH Units	-	7.2	-	-
Phenolics	0.001 mg/L	-	<0.001	-	-
Total Dissolved Solids	10 mg/L	-	1270	-	-
Sulphide	0.02 mg/L	-	<0.02	-	-
Tannin & Lignin	0.1 mg/L	-	0.4	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	-	0.7	-	-
Anions					
Chloride	1 mg/L	337	355	-	-
Fluoride	0.1 mg/L	-	0.6	-	-
Nitrate as N	0.1 mg/L	-	2.5	-	-
Nitrite as N	0.05 mg/L	-	<0.05	-	-
Sulphate	1 mg/L	-	174	-	-
Metals					
Aluminum	0.001 mg/L	-	0.004	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.444	-	-
Boron	0.01 mg/L	-	0.07	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	-	204	-	-
Chromium	0.001 mg/L	-	<0.001	-	-
Copper	0.0005 mg/L	-	0.0031	-	-
Iron	0.1 mg/L	-	2.5	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	-	25.4	-	-
Manganese	0.005 mg/L	-	0.475	-	-
Potassium	0.1 mg/L	-	5.2	-	-
Selenium	0.001 mg/L	-	<0.001	-	-
Sodium	0.2 mg/L	198	203	-	-
Uranium	0.0001 mg/L	-	0.0019	-	-

Certificate of Analysis

Report Date: 18-Nov-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 15-Nov-2021

Client PO:

Project Description: 65103.01

	Client ID:	TW21-01 4hr	TW21-01 8hr	-	-
	Sample Date:	10-Nov-21 12:10	10-Nov-21 16:10	-	-
	Sample ID:	2147073-01	2147073-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Zinc	0.005 mg/L	-	0.009	-	-

Certificate of Analysis

Report Date: 18-Nov-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 15-Nov-2021

Client PO:

Project Description: 65103.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Metals									
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium	ND	0.001	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Sodium	ND	0.2	mg/L						
Uranium	ND	0.0001	mg/L						
Zinc	ND	0.005	mg/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L	355			NC	10	
Fluoride	0.56	0.1	mg/L	0.56			0.1	10	
Nitrate as N	2.51	0.1	mg/L	2.52			0.2	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	182	1	mg/L	174			4.3	10	
General Inorganics									
Alkalinity, total	398	5	mg/L	402			1.1	14	
Ammonia as N	0.225	0.01	mg/L	0.213			5.5	17.7	
Dissolved Organic Carbon	8.6	0.5	mg/L	8.4			2.7	37	
Conductivity	2090	5	uS/cm	2110			1.2	5	
pH	7.2	0.1	pH Units	7.2			0.6	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	92.0	10	mg/L	98.0			6.3	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	0.5	0.1	mg/L	0.4			7.2	11	
Total Kjeldahl Nitrogen	0.38	0.1	mg/L	0.37			2.2	16	
Metals									
Aluminum	0.004	0.001	mg/L	0.004			0.9	20	
Antimony	0.0006	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.003	0.001	mg/L	0.003			0.1	20	
Boron	0.11	0.01	mg/L	0.12			2.4	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	19.2	0.1	mg/L	18.5			3.6	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0006	0.0005	mg/L	0.0006			3.0	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	ND	0.0001	mg/L	ND			NC	20	
Magnesium	4.1	0.2	mg/L	4.1			0.8	20	
Manganese	0.014	0.005	mg/L	0.014			3.2	20	
Potassium	1.4	0.1	mg/L	1.3			1.9	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	21.9	0.2	mg/L	21.1			3.7	20	
Uranium	0.0006	0.0001	mg/L	0.0005			5.9	20	
Zinc	ND	0.005	mg/L	ND			NC	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	9.84	1	mg/L	ND	98.4	85-115			
Fluoride	1.37	0.1	mg/L	0.56	81.9	79-121			
Nitrate as N	3.55	0.1	mg/L	2.52	103	79-120			
Nitrite as N	1.12	0.05	mg/L	ND	112	84-117			
Sulphate	186	1	mg/L	174	116	74-126			
General Inorganics									
Ammonia as N	0.482	0.01	mg/L	0.213	108	81-124			
Dissolved Organic Carbon	21.0	0.5	mg/L	8.4	127	60-133			
Phenolics	0.023	0.001	mg/L	ND	93.6	69-132			
Total Dissolved Solids	94.0	10	mg/L	ND	94.0	75-125			
Sulphide	0.48	0.02	mg/L	ND	95.2	79-115			
Tannin & Lignin	1.4	0.1	mg/L	0.4	100	71-113			
Total Kjeldahl Nitrogen	2.49	0.1	mg/L	0.37	106	81-126			
Metals									
Aluminum	49.7	0.001	mg/L	4.11	91.2	80-120			
Antimony	44.0	0.0005	mg/L	0.499	87.1	80-120			
Arsenic	46.5	0.001	mg/L	0.081	92.9	80-120			
Barium	46.8	0.001	mg/L	3.25	87.1	80-120			
Boron	42.1	0.01	mg/L	ND	84.3	80-120			
Cadmium	41.6	0.0001	mg/L	0.0048	83.1	80-120			
Calcium	8090	0.1	mg/L	ND	80.9	80-120			
Chromium	40.8	0.001	mg/L	0.247	81.1	80-120			
Copper	43.9	0.0005	mg/L	ND	87.7	80-120			
Iron	2120	0.1	mg/L	44.2	83.2	80-120			
Lead	41.7	0.0001	mg/L	0.0786	83.2	80-120			
Magnesium	12600	0.2	mg/L	4110	84.7	80-120			
Manganese	54.0	0.005	mg/L	13.9	80.1	80-120			
Potassium	10700	0.1	mg/L	1330	93.9	80-120			
Selenium	42.8	0.001	mg/L	0.139	85.3	80-120			
Sodium	29300	0.2	mg/L	21100	81.6	80-120			
Uranium	46.0	0.0001	mg/L	0.529	91.0	80-120			
Zinc	43.4	0.005	mg/L	2.44	81.8	80-120			

Qualifier Notes:

Login Qualifiers :

Sample - Received frozen - General chemistry bottle

Applies to samples: TW21-01 8hr

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON0 K2K 2A9
Attn: Brent Redmond

Client PO:
Project: 65103.01
Custody: 15621

Report Date: 4-Apr-2022
Order Date: 29-Mar-2022

Order #: 2214211

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2214211-01	PW22-01
2214211-02	PW22-01 F

GEMTEC Note: PW22-01 referenced as PW4 in report.

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 04-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Mar-2022

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	31-Mar-22	31-Mar-22
Ammonia, as N	EPA 351.2 - Auto Colour	1-Apr-22	4-Apr-22
Anions	EPA 300.1 - IC	30-Mar-22	30-Mar-22
Colour	SM2120 - Spectrophotometric	30-Mar-22	30-Mar-22
Colour, apparent	SM2120 - Spectrophotometric	30-Mar-22	30-Mar-22
Conductivity	EPA 9050A- probe @25 °C	31-Mar-22	31-Mar-22
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	31-Mar-22	31-Mar-22
E. coli	MOE E3407	30-Mar-22	30-Mar-22
Fecal Coliform	SM 9222D	30-Mar-22	30-Mar-22
Hardness	Hardness as CaCO3	1-Apr-22	1-Apr-22
Heterotrophic Plate Count	SM 9215C	30-Mar-22	30-Mar-22
Metals, ICP-MS	EPA 200.8 - ICP-MS	1-Apr-22	1-Apr-22
pH	EPA 150.1 - pH probe @25 °C	31-Mar-22	31-Mar-22
Phenolics	EPA 420.2 - Auto Colour, 4AAP	30-Mar-22	30-Mar-22
Hardness	Hardness as CaCO3	1-Apr-22	1-Apr-22
Sulphide	SM 4500SE - Colourimetric	1-Apr-22	1-Apr-22
Tannin/Lignin	SM 5550B - Colourimetric	30-Mar-22	30-Mar-22
Total Coliform	MOE E3407	30-Mar-22	30-Mar-22
Total Dissolved Solids	SM 2540C - gravimetric, filtration	30-Mar-22	30-Mar-22
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	31-Mar-22	31-Mar-22
Turbidity	SM 2130B - Turbidity meter	31-Mar-22	31-Mar-22

Certificate of Analysis

Report Date: 04-Apr-2022

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 29-Mar-2022

Client PO:

Project Description: 65103.01

	Client ID:	PW22-01	PW22-01 F	-	-
	Sample Date:	29-Mar-22 14:00	29-Mar-22 14:00	-	-
	Sample ID:	2214211-01	2214211-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100mL	ND	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-
Total Coliforms	1 CFU/100mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	300	-	-	-
Ammonia as N	0.01 mg/L	0.35	-	-	-
Dissolved Organic Carbon	0.5 mg/L	7.5	-	-	-
Colour	2 TCU	20	17	-	-
Colour, apparent	2 ACU	400	19	-	-
Conductivity	5 uS/cm	3160	-	-	-
Hardness	mg/L	-	3.11	-	-
Hardness	mg/L	603	-	-	-
pH	0.1 pH Units	7.3	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	1860	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	1.9	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.5	-	-	-
Turbidity	0.1 NTU	46.7	0.2	-	-
Anions					
Chloride	1 mg/L	766	-	-	-
Fluoride	0.1 mg/L	0.3	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.25 [1]	-	-	-
Sulphate	1 mg/L	42	-	-	-
Metals					
Calcium	0.1 mg/L	204	1.2	-	-
Iron	0.1 mg/L	6.9	<0.1	-	-
Magnesium	0.2 mg/L	22.8	<0.2	-	-
Manganese	0.005 mg/L	0.442	-	-	-
Potassium	0.1 mg/L	2.8	-	-	-
Sodium	0.2 mg/L	360	-	-	-

Certificate of Analysis

Report Date: 04-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100mL						
Fecal Coliforms	ND	1	CFU/100mL						
Total Coliforms	ND	1	CFU/100mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 04-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	74.0	1	mg/L	74.8			1.1	10	
Fluoride	0.47	0.1	mg/L	0.48			0.5	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	17.3	1	mg/L	17.3			0.1	10	
General Inorganics									
Alkalinity, total	300	5	mg/L	300			0.0	14	
Ammonia as N	0.097	0.01	mg/L	0.091			6.4	17.7	
Dissolved Organic Carbon	1.7	0.5	mg/L	1.6			11.0	37	
Colour	ND	2	TCU	ND			NC	12	
Colour, apparent	20	2	ACU	19			5.1	12	
Conductivity	3130	5	uS/cm	3160			1.0	5	
pH	7.2	0.1	pH Units	7.3			1.9	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	230	10	mg/L	222			3.5	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.48	0.1	mg/L	0.48			0.3	16	
Turbidity	0.1	0.1	NTU	0.2			6.9	10	
Metals									
Calcium	10.8	0.1	mg/L	10.9			0.9	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	2.6	0.2	mg/L	2.5			0.5	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	1.1	0.1	mg/L	1.1			0.6	20	
Sodium	22.8	0.2	mg/L	22.8			0.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Certificate of Analysis

Report Date: 04-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 29-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	83.5	1	mg/L	74.8	86.8	77-123			
Fluoride	1.42	0.1	mg/L	0.48	94.7	79-121			
Nitrate as N	1.05	0.1	mg/L	ND	105	79-120			
Nitrite as N	1.13	0.05	mg/L	ND	113	84-117			
Sulphate	26.5	1	mg/L	17.3	91.3	74-126			
General Inorganics									
Ammonia as N	0.368	0.01	mg/L	0.091	111	81-124			
Dissolved Organic Carbon	14.0	0.5	mg/L	1.6	125	60-133			
Phenolics	0.027	0.001	mg/L	ND	107	67-133			
Total Dissolved Solids	98.0	10	mg/L	ND	98.0	75-125			
Sulphide	0.48	0.02	mg/L	ND	96.8	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	96.8	71-113			
Total Kjeldahl Nitrogen	2.49	0.1	mg/L	0.48	101	81-126			
Metals									
Calcium	19300	0.1	mg/L	10900	84.1	80-120			
Iron	2270	0.1	mg/L	2.7	90.6	80-120			
Magnesium	11400	0.2	mg/L	2550	88.7	80-120			
Manganese	47.5	0.005	mg/L	0.493	94.0	80-120			
Potassium	10300	0.1	mg/L	1100	92.4	80-120			
Sodium	30900	0.2	mg/L	22800	81.3	80-120			

Qualifier Notes:

Login Qualifiers :

Metals sample was decanted from the generals container and preserved at the lab
Applies to samples: PW22-01 F

Sample - Not preserved - Metals
Applies to samples: PW22-01 F

Sample - Not submitted in the correct container - Metals
Applies to samples: PW22-01 F

Sample Qualifiers :

1 : Elevated detection limit because of dilution required due to the presence of high levels of non-target analytes.

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON0 K2K 2A9
Attn: Brent Redmond

Client PO:
Project: 65103.01
Custody: 15625

Report Date: 5-Apr-2022
Order Date: 30-Mar-2022

Order #: 2214302

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2214302-01	PW22-02

GEMTEC Note: PW22-02 referenced as PW6 in report.

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 05-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 30-Mar-2022

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	31-Mar-22	31-Mar-22
Ammonia, as N	EPA 351.2 - Auto Colour	1-Apr-22	4-Apr-22
Anions	EPA 300.1 - IC	31-Mar-22	31-Mar-22
Colour	SM2120 - Spectrophotometric	31-Mar-22	31-Mar-22
Colour, apparent	SM2120 - Spectrophotometric	31-Mar-22	31-Mar-22
Conductivity	EPA 9050A- probe @25 °C	31-Mar-22	31-Mar-22
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	31-Mar-22	31-Mar-22
E. coli	MOE E3407	31-Mar-22	31-Mar-22
Fecal Coliform	SM 9222D	31-Mar-22	31-Mar-22
Heterotrophic Plate Count	SM 9215C	31-Mar-22	31-Mar-22
Metals, ICP-MS	EPA 200.8 - ICP-MS	1-Apr-22	1-Apr-22
pH	EPA 150.1 - pH probe @25 °C	31-Mar-22	31-Mar-22
Phenolics	EPA 420.2 - Auto Colour, 4AAP	31-Mar-22	31-Mar-22
Hardness	Hardness as CaCO3	1-Apr-22	1-Apr-22
Sulphide	SM 4500SE - Colourimetric	1-Apr-22	1-Apr-22
Tannin/Lignin	SM 5550B - Colourimetric	1-Apr-22	4-Apr-22
Total Coliform	MOE E3407	31-Mar-22	31-Mar-22
Total Dissolved Solids	SM 2540C - gravimetric, filtration	31-Mar-22	31-Mar-22
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	31-Mar-22	31-Mar-22
Turbidity	SM 2130B - Turbidity meter	31-Mar-22	31-Mar-22

PARACEL LABORATORIES LTD.

Order #: 2214302

Certificate of Analysis

Report Date: 05-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 30-Mar-2022

Client PO:

Project Description: 65103.01

	Client ID:	PW22-02	-	-	-
	Sample Date:	30-Mar-22 10:00	-	-	-
	Sample ID:	2214302-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100mL	ND	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-
Total Coliforms	1 CFU/100mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	316	-	-	-
Ammonia as N	0.01 mg/L	0.09	-	-	-
Dissolved Organic Carbon	0.5 mg/L	4.1	-	-	-
Colour	2 TCU	3	-	-	-
Colour, apparent	2 ACU	78	-	-	-
Conductivity	5 uS/cm	2070	-	-	-
Hardness	mg/L	423	-	-	-
pH	0.1 pH Units	7.6	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	1130	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	0.2	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	-	-	-
Turbidity	0.1 NTU	8.2	-	-	-
Anions					
Chloride	1 mg/L	460	-	-	-
Fluoride	0.1 mg/L	0.5	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	59	-	-	-
Metals					
Calcium	0.1 mg/L	137	-	-	-
Iron	0.1 mg/L	0.9	-	-	-
Magnesium	0.2 mg/L	19.5	-	-	-
Manganese	0.005 mg/L	0.174	-	-	-
Potassium	0.1 mg/L	2.8	-	-	-
Sodium	0.2 mg/L	244	-	-	-

Certificate of Analysis

Report Date: 05-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 30-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Calcium	ND	0.1	mg/L						
Iron	ND	0.1	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Potassium	ND	0.1	mg/L						
Sodium	ND	0.2	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100mL						
Fecal Coliforms	ND	1	CFU/100mL						
Total Coliforms	ND	1	CFU/100mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Certificate of Analysis

Report Date: 05-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 30-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	450	5	mg/L	460			2.2	10	
Fluoride	0.47	0.1	mg/L	0.47			0.9	10	
Nitrate as N	ND	0.1	mg/L	ND			NC	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	59.3	1	mg/L	59.3			0.0	10	
General Inorganics									
Alkalinity, total	300	5	mg/L	300			0.0	14	
Ammonia as N	0.097	0.01	mg/L	0.091			6.4	17.7	
Dissolved Organic Carbon	1.7	0.5	mg/L	1.6			11.0	37	
Colour	ND	2	TCU	ND			NC	12	
Colour, apparent	2	2	ACU	2			0.0	12	
Conductivity	3130	5	uS/cm	3160			1.0	5	
pH	7.2	0.1	pH Units	7.3			1.9	3.3	
Phenolics	0.001	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	60.0	10	mg/L	60.0			0.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.48	0.1	mg/L	0.48			0.3	16	
Turbidity	0.1	0.1	NTU	0.2			6.9	10	
Metals									
Calcium	10.8	0.1	mg/L	10.9			0.9	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	2.6	0.2	mg/L	2.5			0.5	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	1.1	0.1	mg/L	1.1			0.6	20	
Sodium	22.8	0.2	mg/L	22.8			0.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	2	1	CFU/100mL	2			0.0	30	
Heterotrophic Plate Count	ND	10	CFU/mL	10			NC	30	

Certificate of Analysis

Report Date: 05-Apr-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 30-Mar-2022

Client PO:

Project Description: 65103.01

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	10.1	1	mg/L	ND	101	85-115			
Fluoride	1.40	0.1	mg/L	0.47	92.8	79-121			
Nitrate as N	1.01	0.1	mg/L	ND	101	79-120			
Nitrite as N	1.04	0.05	mg/L	ND	104	84-117			
Sulphate	67.1	1	mg/L	59.3	78.6	74-126			
General Inorganics									
Ammonia as N	0.368	0.01	mg/L	0.091	111	81-124			
Dissolved Organic Carbon	14.0	0.5	mg/L	1.6	125	60-133			
Phenolics	0.029	0.001	mg/L	ND	115	67-133			
Total Dissolved Solids	98.0	10	mg/L	ND	98.0	75-125			
Sulphide	0.48	0.02	mg/L	ND	96.8	79-115			
Tannin & Lignin	1.1	0.1	mg/L	ND	108	71-113			
Total Kjeldahl Nitrogen	2.49	0.1	mg/L	0.48	101	81-126			
Metals									
Calcium	19300	0.1	mg/L	10900	84.1	80-120			
Iron	2270	0.1	mg/L	2.7	90.6	80-120			
Magnesium	11400	0.2	mg/L	2550	88.7	80-120			
Manganese	47.5	0.005	mg/L	0.493	94.0	80-120			
Potassium	10300	0.1	mg/L	1100	92.4	80-120			
Sodium	30900	0.2	mg/L	22800	81.3	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 16199

Report Date: 11-May-2022
Order Date: 4-May-2022

Order #: 2219389

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2219389-01	TW22-01 4hr
2219389-02	TW22-01 8hr

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 11-May-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 4-May-2022

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	5-May-22	5-May-22
Ammonia, as N	EPA 351.2 - Auto Colour	5-May-22	9-May-22
Anions	EPA 300.1 - IC	5-May-22	6-May-22
Colour	SM2120 - Spectrophotometric	5-May-22	5-May-22
Colour, apparent	SM2120 - Spectrophotometric	5-May-22	5-May-22
Conductivity	EPA 9050A- probe @25 °C	5-May-22	5-May-22
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	6-May-22	6-May-22
E. coli	MOE E3407	5-May-22	5-May-22
Fecal Coliform	SM 9222D	5-May-22	5-May-22
Heterotrophic Plate Count	SM 9215C	5-May-22	5-May-22
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	6-May-22	6-May-22
Metals, ICP-MS	EPA 200.8 - ICP-MS	9-May-22	10-May-22
pH	EPA 150.1 - pH probe @25 °C	5-May-22	5-May-22
Phenolics	EPA 420.2 - Auto Colour, 4AAP	5-May-22	5-May-22
Hardness	Hardness as CaCO3	9-May-22	10-May-22
Sulphide	SM 4500SE - Colourimetric	9-May-22	10-May-22
Tannin/Lignin	SM 5550B - Colourimetric	6-May-22	6-May-22
Total Coliform	MOE E3407	5-May-22	5-May-22
Total Dissolved Solids	SM 2540C - gravimetric, filtration	5-May-22	6-May-22
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	9-May-22	9-May-22
Turbidity	SM 2130B - Turbidity meter	5-May-22	5-May-22

PARACEL LABORATORIES LTD.

Order #: 2219389

Certificate of Analysis

Report Date: 11-May-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 4-May-2022

Client PO:

Project Description: 65103.01

	Client ID:	TW22-01 4hr	TW22-01 8hr	-	-
	Sample Date:	04-May-22 12:00	04-May-22 16:00	-	-
	Sample ID:	2219389-01	2219389-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100mL	ND	ND	-	-
Total Coliforms	1 CFU/100mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	10	-	-
General Inorganics					
Alkalinity, total	5 mg/L	315	317	-	-
Ammonia as N	0.01 mg/L	0.14	0.14	-	-
Dissolved Organic Carbon	0.5 mg/L	1.8	1.9	-	-
Colour	2 TCU	<2	2	-	-
Colour, apparent	2 ACU	77	51	-	-
Conductivity	5 uS/cm	1780	1720	-	-
Hardness	mg/L	491	594	-	-
pH	0.1 pH Units	7.7	7.8	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	972	954	-	-
Sulphide	0.02 mg/L	0.03	0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.2	0.1	-	-
Turbidity	0.1 NTU	9.4	5.6	-	-
Anions					
Chloride	1 mg/L	378	385	-	-
Fluoride	0.1 mg/L	0.6	0.5	-	-
Nitrate as N	0.1 mg/L	<0.1	0.1	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-
Sulphate	1 mg/L	53	53	-	-
Metals					
Mercury	0.0001 mg/L	-	<0.0001	-	-
Aluminum	0.001 mg/L	-	0.007	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.247	-	-
Beryllium	0.0005 mg/L	-	<0.0005	-	-
Boron	0.01 mg/L	-	0.22	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	147	188	-	-

Certificate of Analysis

Report Date: 11-May-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 4-May-2022

Client PO:

Project Description: 65103.01

	Client ID:	TW22-01 4hr	TW22-01 8hr	-	-
	Sample Date:	04-May-22 12:00	04-May-22 16:00	-	-
	Sample ID:	2219389-01	2219389-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Chromium	0.001 mg/L	-	<0.001	-	-
Cobalt	0.0005 mg/L	-	<0.0005	-	-
Copper	0.0005 mg/L	-	<0.0005	-	-
Iron	0.1 mg/L	<0.1	1.3	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	30.1	30.5	-	-
Manganese	0.005 mg/L	0.025	0.081	-	-
Molybdenum	0.0005 mg/L	-	<0.0005	-	-
Nickel	0.001 mg/L	-	<0.001	-	-
Potassium	0.1 mg/L	6.6	7.2	-	-
Selenium	0.001 mg/L	-	<0.001	-	-
Silver	0.0001 mg/L	-	<0.0001	-	-
Sodium	0.2 mg/L	169	201	-	-
Strontium	0.01 mg/L	-	15.0	-	-
Thallium	0.001 mg/L	-	<0.001	-	-
Uranium	0.0001 mg/L	-	0.0006	-	-
Vanadium	0.0005 mg/L	-	<0.0005	-	-
Zinc	0.005 mg/L	-	<0.005	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Mercury	ND	0.0001	mg/L						
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Beryllium	ND	0.0005	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Molybdenum	ND	0.0005	mg/L						
Nickel	ND	0.001	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Silver	ND	0.0001	mg/L						
Sodium	ND	0.2	mg/L						
Strontium	ND	0.01	mg/L						
Thallium	ND	0.001	mg/L						
Uranium	ND	0.0001	mg/L						
Vanadium	ND	0.0005	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100mL						
Fecal Coliforms	ND	1	CFU/100mL						
Total Coliforms	ND	1	CFU/100mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	220	5	mg/L	221			0.2	10	
Fluoride	0.18	0.1	mg/L	0.19			5.6	10	
Nitrate as N	0.18	0.1	mg/L	0.18			0.9	10	
Nitrite as N	ND	0.05	mg/L	ND			NC	10	
Sulphate	85.8	1	mg/L	85.6			0.3	10	
General Inorganics									
Alkalinity, total	321	5	mg/L	325			1.1	14	
Ammonia as N	ND	0.01	mg/L	ND			NC	17.7	
Dissolved Organic Carbon	1.2	0.5	mg/L	1.3			7.1	37	
Colour	ND	2	TCU	ND			NC	12	
Colour, apparent	75	2	ACU	77			2.6	12	
Conductivity	1280	5	uS/cm	1340			4.7	5	
pH	7.5	0.1	pH Units	7.5			0.3	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	748	10	mg/L	744			0.5	10	
Sulphide	0.04	0.02	mg/L	0.04			2.7	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.22	0.1	mg/L	0.26			NC	16	
Turbidity	0.2	0.1	NTU	0.2			4.7	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			NC	20	
Aluminum	0.098	0.001	mg/L	0.100			1.5	20	
Antimony	ND	0.0005	mg/L	0.0013			NC	20	
Arsenic	0.008	0.001	mg/L	0.007			1.5	20	
Barium	0.072	0.001	mg/L	0.074			2.6	20	
Beryllium	ND	0.0005	mg/L	ND			NC	20	
Boron	0.13	0.01	mg/L	0.13			0.5	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	117	0.1	mg/L	111			5.2	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Cobalt	ND	0.0005	mg/L	ND			NC	20	
Copper	0.224	0.0005	mg/L	0.220			1.5	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	0.0014	0.0001	mg/L	0.0014			4.8	20	
Magnesium	22.5	0.2	mg/L	21.1			6.3	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Molybdenum	0.0086	0.0005	mg/L	0.0087			1.1	20	
Nickel	0.002	0.001	mg/L	0.002			2.1	20	
Potassium	1.7	0.1	mg/L	1.6			5.3	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Silver	ND	0.0001	mg/L	ND			NC	20	
Sodium	15.0	0.2	mg/L	14.3			4.7	20	
Thallium	ND	0.001	mg/L	ND			NC	20	
Uranium	0.0011	0.0001	mg/L	0.0013			13.2	20	
Vanadium	ND	0.0005	mg/L	ND			NC	20	
Zinc	0.130	0.005	mg/L	0.129			0.7	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	10.7	1	mg/L	ND	107	85-115			
Fluoride	1.27	0.1	mg/L	0.19	108	79-121			
Nitrate as N	1.19	0.1	mg/L	0.18	101	79-120			
Nitrite as N	1.04	0.05	mg/L	ND	104	84-117			
Sulphate	95.3	1	mg/L	85.6	97.1	74-126			
General Inorganics									
Ammonia as N	0.265	0.01	mg/L	ND	106	81-124			
Dissolved Organic Carbon	10.2	0.5	mg/L	1.3	89.4	60-133			
Phenolics	0.024	0.001	mg/L	ND	97.7	67-133			
Total Dissolved Solids	92.0	10	mg/L	ND	92.0	75-125			
Sulphide	0.52	0.02	mg/L	0.04	96.0	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	98.9	71-113			
Total Kjeldahl Nitrogen	2.20	0.1	mg/L	0.26	97.0	81-126			
Metals									
Mercury	0.0033	0.0001	mg/L	ND	111	70-130			
Aluminum	138	0.001	mg/L	99.8	75.7	80-120			QM-07
Antimony	44.1	0.0005	mg/L	1.25	85.6	80-120			
Arsenic	60.4	0.001	mg/L	7.39	106	80-120			
Barium	117	0.001	mg/L	73.6	86.9	80-120			
Beryllium	52.2	0.0005	mg/L	0.0202	104	80-120			
Boron	173	0.01	mg/L	134	77.8	80-120			QM-07
Cadmium	49.2	0.0001	mg/L	0.0589	98.3	80-120			
Calcium	119000	0.1	mg/L	111000	81.4	80-120			
Chromium	50.8	0.001	mg/L	0.682	100	80-120			
Cobalt	48.3	0.0005	mg/L	0.0676	96.6	80-120			
Copper	256	0.0005	mg/L	220	70.7	80-120			QM-07
Iron	2360	0.1	mg/L	47.4	92.6	80-120			
Lead	44.4	0.0001	mg/L	1.45	85.8	80-120			
Magnesium	31100	0.2	mg/L	21100	99.9	80-120			
Manganese	53.2	0.005	mg/L	3.55	99.3	80-120			
Molybdenum	54.6	0.0005	mg/L	8.72	91.8	80-120			
Nickel	48.4	0.001	mg/L	2.13	92.5	80-120			
Potassium	11800	0.1	mg/L	1610	102	80-120			
Selenium	49.7	0.001	mg/L	0.289	98.9	80-120			
Silver	38.9	0.0001	mg/L	0.0058	77.8	80-120			QM-07
Sodium	23800	0.2	mg/L	14300	95.0	80-120			
Thallium	50.8	0.001	mg/L	0.079	102	80-120			
Uranium	48.6	0.0001	mg/L	1.26	94.7	80-120			
Vanadium	50.9	0.0005	mg/L	0.195	101	80-120			
Zinc	164	0.005	mg/L	129	69.3	80-120			QM-07

Qualifier Notes:

Login Qualifiers :

Container and COC sample IDs don't match - Sample labelled as TW22-01 4hr, chain of custody reads TW22-01 3hr

Applies to samples: TW22-01 4hr

Container and COC sample IDs don't match - Sample labelled as TW22-01 8hr, chain of custody reads TW22-01 6hr

Applies to samples: TW22-01 8hr

Metals sample was decanted from the generals container and preserved at the lab
ICP metals bottle

Applies to samples: TW22-01 8hr

Sample Qualifiers :

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 65103.01
Custody: 16251

Report Date: 19-Jun-2023
Order Date: 13-Jun-2023

Order #: 2324201

This Certificate of Analysis contains analytical data applicable to the following samples as submitted :

Paracel ID	Client ID
2324201-01	PW21-04
2324201-02	PW21-04 (Filtered)

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 19-Jun-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 13-Jun-2023

Client PO:

Project Description: 65103.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	14-Jun-23	14-Jun-23
Ammonia, as N	EPA 351.2 - Auto Colour	14-Jun-23	14-Jun-23
Anions	EPA 300.1 - IC	14-Jun-23	15-Jun-23
Colour	SM2120 - Spectrophotometric	14-Jun-23	14-Jun-23
Colour, apparent	SM2120 - Spectrophotometric	14-Jun-23	14-Jun-23
Conductivity	EPA 9050A- probe @25 °C	14-Jun-23	14-Jun-23
Dissolved Organic Carbon	MOE 3247B - Combustion IR	15-Jun-23	16-Jun-23
E. coli	MOE E3407	14-Jun-23	14-Jun-23
Fecal Coliform	SM 9222D	14-Jun-23	14-Jun-23
Heterotrophic Plate Count	SM 9215C	14-Jun-23	14-Jun-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	14-Jun-23	15-Jun-23
pH	EPA 150.1 - pH probe @25 °C	14-Jun-23	14-Jun-23
Phenolics	EPA 420.2 - Auto Colour, 4AAP	14-Jun-23	15-Jun-23
Hardness	Hardness as CaCO3	14-Jun-23	15-Jun-23
Sulphide	SM 4500SE - Colourimetric	15-Jun-23	16-Jun-23
Tannin/Lignin	SM 5550B - Colourimetric	14-Jun-23	14-Jun-23
Total Coliform	MOE E3407	14-Jun-23	14-Jun-23
Total Dissolved Solids	SM 2540C - gravimetric, filtration	15-Jun-23	16-Jun-23
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	15-Jun-23	15-Jun-23
Turbidity	SM 2130B - Turbidity meter	14-Jun-23	14-Jun-23

Certificate of Analysis

Report Date: 19-Jun-2023

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 13-Jun-2023

Client PO:

Project Description: 65103.01

	Client ID:	PW21-04	PW21-04 (Filtered)	-	-
	Sample Date:	13-Jun-23 02:45	13-Jun-23 02:45	-	-
	Sample ID:	2324201-01	2324201-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100mL	ND	-	-	-
Total Coliforms	1 CFU/100mL	ND	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	298	-	-	-
Ammonia as N	0.01 mg/L	0.38	-	-	-
Dissolved Organic Carbon	0.5 mg/L	9.3	-	-	-
Colour	2 TCU	18	-	-	-
Colour, apparent	2 ACU	344	-	-	-
Conductivity	5 uS/cm	3860	-	-	-
Hardness	mg/L	599	-	-	-
pH	0.1 pH Units	7.7	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	2250	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-
Tannin & Lignin	0.1 mg/L	1.0	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.6	-	-	-
Turbidity	0.1 NTU	30.1	-	-	-
Anions					
Chloride	1 mg/L	1050	-	-	-
Fluoride	0.1 mg/L	0.3	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	43	-	-	-
Metals					
Aluminum	0.001 mg/L	0.020	0.005	-	-
Antimony	0.0005 mg/L	<0.0005	<0.0005	-	-
Arsenic	0.001 mg/L	<0.001	<0.001	-	-
Barium	0.001 mg/L	4.27	3.74	-	-
Beryllium	0.0005 mg/L	<0.0005	<0.0005	-	-
Boron	0.01 mg/L	0.01	<0.01	-	-
Cadmium	0.0001 mg/L	<0.0001	<0.0001	-	-
Calcium	0.1 mg/L	204	182	-	-
Chromium	0.001 mg/L	<0.001	<0.001	-	-

Certificate of Analysis

Report Date: 19-Jun-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 13-Jun-2023

Client PO:

Project Description: 65103.01

	Client ID:	PW21-04	PW21-04 (Filtered)	-	-
	Sample Date:	13-Jun-23 02:45	13-Jun-23 02:45	-	-
	Sample ID:	2324201-01	2324201-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Cobalt	0.0005 mg/L	<0.0005	<0.0005	-	-
Copper	0.0005 mg/L	0.0011	<0.0005	-	-
Iron	0.1 mg/L	5.8	4.8	-	-
Lead	0.0001 mg/L	0.0002	<0.0001	-	-
Magnesium	0.2 mg/L	21.6	18.3	-	-
Manganese	0.005 mg/L	0.569	0.493	-	-
Molybdenum	0.0005 mg/L	0.0006	0.0006	-	-
Nickel	0.001 mg/L	0.001	<0.001	-	-
Potassium	0.1 mg/L	2.9	2.6	-	-
Selenium	0.001 mg/L	<0.001	<0.001	-	-
Silver	0.0001 mg/L	<0.0001	<0.0001	-	-
Sodium	0.2 mg/L	428	475	-	-
Strontium	0.01 mg/L	6.28	5.77	-	-
Thallium	0.001 mg/L	<0.001	<0.001	-	-
Uranium	0.0001 mg/L	0.0008	0.0006	-	-
Vanadium	0.0005 mg/L	0.0021	0.0016	-	-
Zinc	0.005 mg/L	0.007	0.006	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Fluoride	ND	0.1	mg/L						
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						
Sulphate	ND	1	mg/L						
General Inorganics									
Alkalinity, total	ND	5	mg/L						
Ammonia as N	ND	0.01	mg/L						
Dissolved Organic Carbon	ND	0.5	mg/L						
Colour	ND	2	TCU						
Colour, apparent	ND	2	ACU						
Conductivity	ND	5	uS/cm						
Phenolics	ND	0.001	mg/L						
Total Dissolved Solids	ND	10	mg/L						
Sulphide	ND	0.02	mg/L						
Tannin & Lignin	ND	0.1	mg/L						
Total Kjeldahl Nitrogen	ND	0.1	mg/L						
Turbidity	ND	0.1	NTU						
Metals									
Aluminum	ND	0.001	mg/L						
Antimony	ND	0.0005	mg/L						
Arsenic	ND	0.001	mg/L						
Barium	ND	0.001	mg/L						
Beryllium	ND	0.0005	mg/L						
Boron	ND	0.01	mg/L						
Cadmium	ND	0.0001	mg/L						
Calcium	ND	0.1	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Iron	ND	0.1	mg/L						
Lead	ND	0.0001	mg/L						
Magnesium	ND	0.2	mg/L						
Manganese	ND	0.005	mg/L						
Molybdenum	ND	0.0005	mg/L						
Nickel	ND	0.001	mg/L						
Potassium	ND	0.1	mg/L						
Selenium	ND	0.001	mg/L						
Silver	ND	0.0001	mg/L						
Sodium	ND	0.2	mg/L						
Strontium	ND	0.01	mg/L						
Thallium	ND	0.001	mg/L						
Uranium	ND	0.0001	mg/L						
Vanadium	ND	0.0005	mg/L						
Zinc	ND	0.005	mg/L						
Microbiological Parameters									
E. coli	ND	1	CFU/100mL						
Total Coliforms	ND	1	CFU/100mL						
Fecal Coliforms	ND	1	CFU/100mL						
Heterotrophic Plate Count	ND	10	CFU/mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	4.83	1	mg/L	4.82			0.1	20	
Fluoride	0.73	0.1	mg/L	0.75			2.9	20	
Nitrate as N	0.16	0.1	mg/L	0.16			1.1	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Sulphate	23.2	1	mg/L	23.3			0.3	20	
General Inorganics									
Alkalinity, total	24.9	5	mg/L	24.6			1.4	14	
Ammonia as N	0.247	0.01	mg/L	0.264			6.4	17.7	
Dissolved Organic Carbon	1.2	0.5	mg/L	1.5			21.1	37	
Colour	19	2	TCU	18			5.4	12	
Colour, apparent	345	2	ACU	344			0.3	12	
Conductivity	127	5	uS/cm	129			1.4	5	
pH	8.7	0.1	pH Units	8.7			0.2	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	74.0	10	mg/L	74.0			0.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	1.0	0.1	mg/L	1.0			2.0	11	
Total Kjeldahl Nitrogen	0.42	0.1	mg/L	0.37			12.2	16	
Turbidity	0.1	0.1	NTU	0.1			0.0	10	
Metals									
Aluminum	0.078	0.001	mg/L	0.079			0.9	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.011	0.001	mg/L	0.012			4.3	20	
Beryllium	ND	0.0005	mg/L	ND			NC	20	
Boron	ND	0.01	mg/L	ND			NC	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	7.7	0.1	mg/L	7.8			0.9	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Cobalt	ND	0.0005	mg/L	ND			NC	20	
Copper	0.0038	0.0005	mg/L	0.0039			3.1	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Lead	0.0004	0.0001	mg/L	0.0004			0.9	20	
Magnesium	1.8	0.2	mg/L	1.8			2.7	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Molybdenum	ND	0.0005	mg/L	ND			NC	20	
Nickel	ND	0.001	mg/L	ND			NC	20	
Potassium	0.7	0.1	mg/L	0.7			0.5	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Silver	ND	0.0001	mg/L	ND			NC	20	
Sodium	14.1	0.2	mg/L	14.5			2.6	20	
Thallium	ND	0.001	mg/L	ND			NC	20	
Uranium	ND	0.0001	mg/L	ND			NC	20	
Vanadium	ND	0.0005	mg/L	ND			NC	20	
Zinc	0.006	0.005	mg/L	0.006			5.4	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	15.8	1	mg/L	4.82	110	70-124			
Fluoride	1.73	0.1	mg/L	0.75	98.2	70-130			
Nitrate as N	1.28	0.1	mg/L	0.16	113	77-126			
Nitrite as N	0.919	0.05	mg/L	ND	91.9	82-115			
Sulphate	33.1	1	mg/L	23.3	98.5	70-130			
General Inorganics									
Ammonia as N	1.31	0.01	mg/L	0.264	105	81-124			
Dissolved Organic Carbon	18.2	0.5	mg/L	9.3	89.0	60-133			
Phenolics	0.027	0.001	mg/L	ND	109	67-133			
Total Dissolved Solids	92.0	10	mg/L	ND	92.0	75-125			
Sulphide	0.50	0.02	mg/L	ND	99.6	79-115			
Tannin & Lignin	2.0	0.1	mg/L	1.0	99.2	71-113			
Total Kjeldahl Nitrogen	1.34	0.1	mg/L	0.37	97.3	81-126			
Metals									
Aluminum	116	0.001	mg/L	75.3	81.7	80-120			
Arsenic	49.0	0.001	mg/L	0.280	97.5	80-120			
Barium	54.9	0.001	mg/L	11.9	86.0	80-120			
Beryllium	47.6	0.0005	mg/L	0.0064	95.1	80-120			
Boron	50.4	0.01	mg/L	6.68	87.4	80-120			
Cadmium	45.9	0.0001	mg/L	0.0229	91.7	80-120			
Calcium	17900	0.1	mg/L	7770	101	80-120			
Chromium	50.4	0.001	mg/L	0.321	100	80-120			
Cobalt	46.9	0.0005	mg/L	0.0297	93.7	80-120			
Copper	50.1	0.0005	mg/L	3.88	92.5	80-120			
Iron	2300	0.1	mg/L	50.8	90.0	80-120			
Lead	43.0	0.0001	mg/L	0.430	85.2	80-120			
Magnesium	11300	0.2	mg/L	1820	95.0	80-120			
Manganese	52.2	0.005	mg/L	3.11	98.3	80-120			
Molybdenum	44.1	0.0005	mg/L	0.288	87.7	80-120			
Nickel	47.5	0.001	mg/L	0.487	94.0	80-120			
Potassium	10800	0.1	mg/L	694	101	80-120			
Selenium	46.5	0.001	mg/L	0.142	92.8	80-120			
Silver	44.2	0.0001	mg/L	0.0254	88.4	80-120			
Sodium	22800	0.2	mg/L	14500	83.1	80-120			
Thallium	44.0	0.001	mg/L	0.019	88.0	80-120			
Uranium	44.7	0.0001	mg/L	0.0154	89.3	80-120			
Vanadium	50.5	0.0005	mg/L	0.140	101	80-120			
Zinc	51.9	0.005	mg/L	5.84	92.1	80-120			

Qualifier Notes:

Login Qualifiers :

Container(s) - Labeled improperly/insufficient information - One bacteria bottle was labelled with a collection date of 06-13-04, and the chain of custody reads 06-13-23.

Applies to samples: PW21-04

Sample Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

PARACEL LABORATORIES LTD

Paracel ID: 2324201

Paracel Order Number	Chain Of Custody Ontario Drinking Water Samples
2324201	№ 16251

Client Name:	GEMTEC	Project Ref:	65103.01	Waterworks Name:	Samples Taken By:
Contact Name:	Andrius Paznekas	Quote #:		Waterworks Number:	Name: Bella Ruppert
Address:		PO #:		Address:	Signature: Bella Ruppert
After Hours Contact:		E-mail:	andrius.paznekas@gemtec.ca		Page ____ of ____
Telephone:		Fax:		Public Health Unit:	Turn Around Time Required: ☐ 1 day ☐ 2 day ☐ 3 day ☑ 4 day

Samples Submitted Under: (Indicate **ONLY one**)
☐ ON REG 170/03 ☐ ON REG 319/08 ☐ Private Well
☐ ON REG 243/07 ☑ Other O Reg 169/03

Have LSN forms been submitted to MOE/MOHLTC?: ☐ Yes ☐ No ☐ N/A

Are these samples for human consumption?: ☐ Yes ☑ No

All information must be completed before samples will be processed.

Sample Type: R = Raw ; T = Treated ; D = Distribution; P = Plumbing
Source Type: G = Ground Water; S = Surface Water
Reportable: Requires AWQI reporting as per Regulation - Y = Yes; N = No

	LOCATION NAME	SAMPLE ID	Sample Type: R/T/D/P	Source Type: G / S	Reportable: Y / N	Resample	SAMPLE COLLECTED DATE	SAMPLE COLLECTED TIME	# of Containers	Free/Combined Chlorine Residual mg/L	Standing / Flushed: S / F (REG 243)	Required Analyses: Total Coliform/E. Coli	HPC	Lead	THM	Subd. package	13 Bacteria	trace metals	Filtered + unFiltered
1		PW21-04	R	G	N	/	06-13-23	2:45	11										
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments: Colour in ACU and TCU

Method of Delivery: Walk-in

Relinquished By (Sign): Bella Ruppert	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Bella Ruppert	Date/Time: June 13/23 3:55 pm	Date/Time: June 13/23 17:52	Date/Time: June 14/23 10:01 am
Date/Time: 06-13-23 3:55	Temperature: 12.2 °C	Temperature: 10.4 °C	pH Verified: ☑ By:

APPENDIX F

City of Ottawa- Strontium In Drinking Water

Information in this document provided by Public Health Ontario

04/06/2022

STRONTIUM IN DRINKING WATER

Questions and Answers for the Public

WHAT IS STRONTIUM?

Strontium is a naturally occurring element that can be found nearly everywhere in the environment in small amounts. Air, dust, soil, foods, and drinking water can all contain traces of strontium. We are all exposed to some strontium; however, eating or drinking small amounts of strontium is not harmful. There is a radioactive form of strontium that does not occur in nature and is usually associated with nuclear power plants or nuclear weapons testing which is not discussed here.

Strontium is a naturally occurring element that is widely distributed in the environment and has been identified in many different minerals. Natural strontium is not radioactive and exists as a mixture of four stable isotopes (^{84}Sr, ^{86}Sr, ^{87}Sr, ^{88}Sr). Radioactive isotopes of strontium can be formed in nuclear reactors or during the explosion of nuclear weapons (^{90}Sr) while other radioactive isotopes (^{89}Sr) are made for use in medical imaging.[1,2]

Strontium is the 15th most abundant element in the earth's crust, found at a concentration of approximately 0.04% and is present in sea water at a concentration of 0.0008% (or 8 mg/L). In its pure form, strontium is a hard white coloured metal; however, it is rarely found in its pure form in the earth's crust. Strontium dissolved in water is a result of water coming into contact (running through and/or over) rocks and/or soil containing strontium. Strontium readily reacts with water and oxygen and is often found as strontium carbonate ($SrCO_3$) and strontium sulphate ($SrSO_4$) in minerals but may also exist in other compounds such as strontium phosphate [$Sr_3(PO_4)_2$].[1,2]

HOW CAN STRONTIUM GET INTO MY WELL WATER?

Some types of rock are rich in strontium. If there is water in this type of rock then the strontium will dissolve and move from the rock into the water. If a well draws water from strontium rich rock, the water will most likely contain higher than average levels of strontium. The amount of strontium within bedrock can vary so that some parts may be rich in strontium while others are not.

People may be exposed to low levels of strontium through eating food, drinking water, breathing air or ingesting small amounts of soil and dust containing strontium. Food and drinking water represent the main sources of exposure to strontium; however, the contribution from these sources can be highly variable.[1,2]

The concentration of strontium in Canadian drinking water can vary greatly, depending on the anthropogenic activities and/or geological formations situated near the drinking water source. Drinking water from groundwater typically has a higher strontium concentration than drinking water sourced from surface water (lakes and rivers). A survey of strontium concentrations in drinking water measured in various location across Canada (from lakes, rivers and groundwater) found mean (185 µg/L), median (115 µg/L) and 75th percentile (250 µg/L) strontium concentrations in raw drinking water (n= 124; 41

samples from lakes, 48 from rivers, 35 from wells).[2] Dietary exposure to strontium among Canadian adults and young children (6 months to 4 years) were estimated to range from 19.1 – 26.7 (µg/kg bw/day) and 64.9 – 69.6 (µg/kg bw/day), respectively.[2] Grains, dairy products and leafy vegetables contribute the greatest percentage of dietary strontium to humans.[1]

CAN STRONTIUM AFFECT MY HEALTH?

No health related effects from exposure to strontium have been observed at levels typically found in an average diet and the surrounding environment. Strontium is very similar to calcium and can, under certain conditions, replace calcium in the bone. Infants and young children with calcium and/or vitamin D deprived diets who ingest too much strontium can develop a strontium-related bone condition, called strontium rickets. Strontium rickets is a bone disorder that may weaken or soften bones, stunt growth or cause bone deformities. Individuals who do not get enough calcium and/or vitamin D are more susceptible to the effects of strontium.

Strontium has been shown to have both beneficial and adverse effects to the bone of animals and humans. Multiple clinical trials have observed that supplementation with strontium salts (strontium ranelate – a prescription drug approved in 2004 for use in the European Union for treating osteoporosis in the elderly but its use was later restricted) of 680 – 1,360 mg strontium per day resulted in improved bone density in osteoporotic patients.[2]

The adverse effects of strontium on bone formation are related to its chemical similarity to calcium.[1,2] Because strontium is similar to calcium in terms of its chemical properties, shared metabolic pathways, and interactions with similar cellular and molecular components of the organism, strontium can replace calcium in bones, potentially causing rickets – a bone disorder that can weaken or soften bones, stunt growth, or cause bones deformities.[2,3] The young are particularly susceptible to the effects of strontium due to the inability to discriminate between strontium and calcium during specific periods of bone formation and growth.[1]

The Agency for Toxic Substances and Disease Registry (ATSDR) indicated that there are '…no harmful effects of stable strontium in humans at the levels typically found in the environment'; however, effects on bone can occur when children are both exposed to high concentrations (doses were not specified) of strontium while also experiencing calcium and vitamin D deficiencies.[1,2] Although many animal studies (involving laboratory mice and rats) have observed bone abnormalities (rickets with reduce bone mineralization and osteoid accumulation) following exposure to high doses of strontium (through food, drinking water or supplements), only a few epidemiological studies have documented the effects of environmental exposure to strontium on humans. Health Canada summarized a study by Özgür et al. (1996) that reported a possible link between high strontium exposures and rickets in Turkish children aged 6 – 60 months (n = 2,140) living in an area with elevated concentrations of strontium in soil (> 350 ppm) and where nutrition was based primarily on grain cereals.[2,4]

The toxic effects of strontium on bone formation may be reduced in the presence of elevated calcium in drinking water or through adequate levels of calcium in the diet. Sufficient levels of calcium and vitamin D in the body can lower the amount of strontium incorporated into bones, decreasing the likelihood of adverse effects of strontium on the bones of children with adequate calcium and vitamin D status.[2]

ARE THERE STANDARDS FOR STRONTIUM IN DRINKING WATER?

There are currently no Ontario standards for strontium in drinking water. There are no national standards for strontium in the United States, Europe or Australia. The World Health Organization also has not set a standard for strontium.

Health Canada recently developed a drinking water guideline for strontium. The maximum acceptable concentration (MAC) for strontium in drinking water is 7,000 µg/L (or 7 mg/L) to protect infants (identified as the most sensitive age group) from strontium-related adverse effects on bone formation. The MAC for strontium was developed using toxicity information from a study that investigated the effects of strontium on bones in young rats that were supplemented with strontium through their drinking water.

The United States Environmental Protection Agency (US EPA) does not currently have a federal drinking water standard for strontium; however, the US EPA reports a lifetime health advisory level (HAL) of 4,000 µg/L (or 4 mg/L).[3] HALs are established for 1 day, 10 days, and life-time exposure periods and can be defined as 'an estimate of acceptable drinking water levels for a chemical substance based on health effects information. HALs are not a legally enforceable Federal standard, but serve as a technical guidance to assist Federal, State, and local officials.[5] The lifetime HAL for strontium was based on a study in young rats where high strontium in the diet caused weakened bones. The dose at which no strontium related effects occur was taken from this study. This dose, the No-Observed-Adverse-Effect-Level (or NOAEL), was then reduced by a factor of 300 times, to be cautious when applying the study results to people, resulting in an oral reference dose (RfD) of 0.6 mg/kg/day.[6] Assuming a body weight of 70 kg, a daily drinking water rate of 2 L/day and a 20% source allocation factor, a lifetime HAL of 4mg/L of strontium was derived.[5]

The Health Canada Drinking Water Guidelines provide a maximum acceptable concentration (MAC) for strontium of 7,000 µg/L (of 7 mg/L). The Health Canada MAC was derived to protect infants (identified as the most sensitive age group) from strontium-related adverse effects on bone formation (i.e., decreased bone mineralization) using toxicity information from Marie et al. (1985) who investigated the effects of strontium on bone mineralization rates in young weaning male rats supplemented with strontium (via drinking water) over a 9 week period.[2] From this study, a No-Observed-Adverse-Effect-Level (NOAEL) of 425,000 (µg/kg body weight/day) for the reduction in bone mineralization was identified. A 300-fold total uncertainty factor (10 for interspecies variability, 10 for intraspecies variability including sensitivities in pregnant women and adolescents, and 3 for database deficiencies) was applied to the NOAEL, resulting in a tolerable daily intake (TDI) for strontium of 1,417 (µg/kg body weight/day). Applying a drinking water source allocation factor of 0.5, an average body weight (of 7 kg) and a drinking water rate (of 0.75 L/day) for infants (age 0 to 6 months) to the TDI (of 1,417 µg/kg body weight/day), a MAC for strontium of 7,000 µg/L was developed.[2]

HOW DO I KNOW HOW MUCH STRONTIUM IS IN MY WELL WATER?

Water containing strontium will not taste, smell, or look different. If your water comes from a well, especially where the water has been running through strontium rich rock, it may contain a high level of strontium. In this case, testing the water for strontium will tell you how much is present.

Have your well water tested by an accredited laboratory to find out how much uranium, if any, is in your well water. A list of laboratories licensed to perform drinking water tests in Ontario is available at:

https://www.ontario.ca/page/list-licensed-laboratories. The laboratory will provide you with a sample bottle and instructions on how to take a sample.

WHAT SHOULD I DO IF STRONTIUM IS FOUND IN MY WELL WATER?

You are responsible for ensuring your well water is safe to drink.

If you live in a region with high strontium, you can obtain professional advice about ways to reduce strontium in your drinking water. There are forms of water treatment that are effective in reducing strontium levels in water. A water treatment professional should be consulted before you decide on what type of treatment may be suitable for your water supply. You can also use an alternative source of drinking water including bottled water or water from a public system.

Strontium exposure through skin contact or inhalation of vapours while showering or bathing does not pose a health risk. If drinking water contains high levels of strontium, there are methods to remove it.[3]

At a municipal scale, chemical precipitation, ion exchange, nanofiltration (NF) and reverse osmosis (RO) are potential available treatment technologies for total strontium reduction. [2,3,7,8] Other strategies for reducing exposure to strontium include blending and interconnecting with another water system or switching to a new source.[2] On an individual residential basis, NF, RO or treatment devices using ion exchange would be effective at removing strontium. [2,3,7,8] While organizations that like NSF have not certified technology for this purpose, the treatment technologies discussed here have demonstrated effectiveness and testing the treated water for strontium will demonstrate how effective it is for a given design and source water matrix. In addition to testing, metrics like conductivity could be used after calibration on a given system design on a specific source water matrix to indicate effectiveness of any ion reducing technologies, like RO and NF. It is noted that reverse osmosis systems should be installed only at the point of use as treated water maybe corrosive to pluming components.[2,3]

References for Strontium

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5. United States Environmental Protection Agency (US EPA) 2018. 2018 Edition of the Drinking Water Standards and Health Advisories Tables. EPA 822-F-18-001. March 2018. Available from: 2018 Edition of the Drinking Water Standards and Health Advisories Tables (EPA 822-F-18-001)

6. United States Environmental Protection Agency (US EPA) 1992. Integrated Risk Information System (IRIS). Chemical Assessment Summary. Strontium; CASRN 7440-24-6. Available from: Strontium (CASRN 7440-24-6) | IRIS | US EPA

7. Wadekar SS, Vidic RD. (2018). Insights into the rejection of barium and strontium by nanofiltration membrane from experimental and modeling analysis. J Membr Sci. Oct 15;564:742–52.

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APPENDIX G

Nitrate Dilution Calculations

Allowable Flows - Commercial Septic Systems - 4 Campbell Reid Court, Kanata, Ontario

Site	Area m^2	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Annual Water Surplus (m^3/year)	Infiltration Volume (m^3/year)	Hard Surface Area	Available Infiltration (litres per day)[1]
4 Campbell Reid Court	8000	0.20	0.40	0.10	0.70	0.380	2128	0.29	4139

Calculated Maximum Septic Flow for Total Land Parcel:

	Maximum allowable septic flow[2,3]		Maximum Number of Users[4]	
Hard Surface Area (%)	Conventional Septic	Advanced Septic (50% nitrate reduction)	Conventional Septic	Advanced Septic (50% nitrate reduction)
29%	1,380 L/day	4,139 L/day	18	55

Calculated Maximum Septic Flow for Proposed Development

	Maximum allowable septic flow[2,3]		Maximum Number of Users[4]	
Hard Surface Area (%)	Conventional Septic	Advanced Septic (50% nitrate reduction)	Conventional Septic	Advanced Septic (50% nitrate reduction)
29%	380 L/day	3,139 L/day	5	41

Notes:
1. Available infiltration (litres per day) = Infiltration volume (m3/year) x (1000 litres/m3) / (365 days/year) x (1 - hard surface area)
2. Incorporates a value of 20 mg/L nitrate in the discharged effluent from the tertiary treatment system. The calculated maximum allowable flow is based on a simplification of the formula provided in Section 5.6.3, utilizing a concentration of 20 mg/L of Nitrate in the effluent discharging from the tertiary treatment unit
3. Assumes a single combined septic system
4. Assumes 75 litres per day per person

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2020 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 75 MM HEAT INDEX... 36.69

LONG... 75.67 LOWER ZONE..... 45 MM A..... 1.079

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	25	83	74	295
28- 2	-9.0	56	10	17	1	1	0	26	112	74	351
31- 3	-2.8	66	31	78	5	5	0	103	69	75	416
30- 4	5.7	73	68	74	31	31	0	111	0	75	490
31- 5	13.1	76	76	0	80	80	0	14	0	56	566
30- 6	18.3	85	85	0	116	107	-9	5	0	30	651
31- 7	20.9	88	88	0	136	103	-33	3	0	11	739
31- 8	19.6	84	84	0	118	84	-34	1	0	11	823
30- 9	14.8	82	82	0	75	65	-10	4	0	24	906
31-10	8.3	77	77	0	37	36	-1	14	0	52	77
30-11	1.3	76	59	8	10	10	0	38	9	71	154
31-12	-6.9	79	27	14	1	1	0	36	47	74	233
AVE	6.0	TTL 904	699	205	610	523	-87	380			

DESIGN CALCULATIONS
FOR CLASS 2, 4 & 5 ON-SITE SEWAGE SYSTEM

Owner: Dr. Olander	Designer: Mrdja	Jun-21

STEP 1

DAILY SEWAGE FLOW (Based on Hydraulic Loads for Fixtures, Floor Area, and Number of Bedrooms)

Plumbing Fixture Description	Existing Number of Fixtures	Proposed Number of Fixtures	Total x Fixture Units Value = Number of Fixture Units		
Bathroom group (toilet, sink, bathtub)			0	6	0
Toilet (alone)			0	4	0
Washbasin			0	1.5	0
Bathtub or Shower			0	1.5	0
Kitchen Sink(s)			0	1.5	0
Bar Sink			0	1.5	0
Dishwasher			0	1.5	0
Washing Machine			0	1.5	0
Bidet			0	1	0
Laundry Tub			0	1.5	0
Other:			0		0
				Total Fixture Units	**24.5**

Proposed: 220 m^2 2368.1 ft^2

Existing: 195 m^2 2099 ft^2

Total Finished Floor Area Excluding Area of Finished Basement

0.00 m^2

0.00 ft^2

(Multiply m^2 x 10.764 = ft^2)

From the chart below, please calculate the expected daily sewage flow for your proposed building, and mark the total in the space provided. For non-residential occupancies see Table 8.2.1.3 B O.B.C.

Residential Occupancy	Existing	Q in Litres	Calculations
1 Bedroom		750	0
2 Bedrooms		1100	0
3 Bedrooms		1600	0
4 Bedrooms	1	2000	2000
5 Bedrooms		2500	0
Additional Flow for:			0
Each Bedroom over 5		500	0
Floor Space for each 10m^2 over 200 m^2 up to 400 m^2	0	100	0
Floor Space for each 10m^2 over 400 m^2 up to 600 m^2		75	0
Floor Space for each 10m^2 over 600 m^2 **OR***		50	0
Each fixture unit over 20 fixture units total	4.5	50	225
Total			2225

NOTE: Where you need to do multiple calculations, signified by the "OR" in the table, do the calculation for daily sewage flow based on bedrooms and floor space first, then fixture units, and use the larger of the two calculations.

Other Occupancy (Table 8.2.1.3 (B)			
Establishment Type: Veterinary Clinic	**Occupant Load**	**Volume (Liters)**	**Calculations**
Per practitioner	2	275	550
Per employee per 8 hours shift	2	75	150
Per stall, kennel or cage if floor drain connected		**75**	0
		Total	**700**

EXPECTED DAILY DESIGN SEWAGE FLOW (Q) **2,925.00** Liters

(Use Q for the following calculations)

STEP 2

PROPERTY SOIL PROFILE AND PERCOLATION RATE (T) DESCRIPTION

Please refer to the APH website pages titled **Property Soil Profile & Percolation Rate** to find how to determine the percolation rate of the soil on your site. Percolation rate (T) is measured as minutes per centimetre, and measures the rate at which water drains into the soil. Please indicate the T-time of your site, or imported fill, below.

Soil Type	Coarse Gravel, no fines	Gravel, some small rocks	Gravel, sand mix, some fines	Sand, fairly uniform, some fines	Sandy, Loam mix	Silty, Loam, almost clay	Clay, smears well, rolls into ribbon
T-time Min/cm	0 to 1	1 to 5	5 to 10	10 to 15	15 to 25	25 to 50	> 50

ON-SITE PROFILE (Subtract useable depth of Soil from 1.5m (5') for depth of imported fill)

Soil Depth Meters	Percolation Rate T	Soil Type (see above)	Depth of Rock/Impervious Soil/GroundwaterTable √
0.2			
0.4			
0.6	8	sand	1
0.8			
1.0			
1.2			
1.4			
1.6			

Topsoil to be removed:				
Depth		m	0	(ft)
Usable Existing Soil:				
Depth	0.25	m	0.825	(ft)
Imported Fill:				
Depth	0.75	m	2.475	(ft)
Percolation Rate		(T)	10	min/cm
Excavation of Existing Soil:				
Depth		m	0	(ft)

CONTACT AREA CALCULATION

If you do not have a minimum of 250 mm (10") of useable soil on the property, you will need to import the mantle, or contact area. Choose T range, divide Q by Loading Rate for T.

Percolation Time (T) of Soil (min/cm)	Loading Rates (L/m2/day)	Q
1 < T ≤ 20	10	2925
20 < T ≤	8	
35 < T ≤	6	
T > 50	4	
Column 1	2	

Contact Area **Daily Sewage Flow (Q)÷ Loading Rate =** **292.50** **m^2**

STEP 3

A) SEPTIC TANK SIZE CALCULATION To calculate the minimum capacity of your septic tank, use the following formulas. Minimum tank size is 3600 Litres.

Residential:	**Q** =	2225	**2 x Q =**	4450	**Litres**	**Tank Size:**	5,000.00
Other Occupants:	**Q** =	700.00	**3 x Q =**	2,100.00	**Litres**	**Tank Size:**	

B) LEACHING BED LENGTH CALCULATION **(Divide meters by 0.305 to convert to feet)**

Length (m)= (QxT)/200	117.00	**(m)**	383.61	**ft**

DESCRIPTION

Number of Runs:	**10**	**D - Box**	Y N	**Header**	Y N
Distance between runs	**1.60**				
Run length	**11.70**				
Leaching Bed Width	**33.00**				
Leaching Bed Area	**518.10**				

FILTER BED

Where you may not have sufficient area on your property to install a leaching bed, you may install a filter bed for your distribution system.

FILTER BED CALCULATION **(Multiply m_2 x 10.764 to convert T to ft_2)**

If your daily sewage flow is less than 3000 litres per day, perform calculation 1), or if your daily sewage flow exceeds 3000 litres per day, perform calculation 2).

1) Filter Bed Surface Area = Q ÷75 expressed as m^2					
Q	2,925.00	/	**75**	=	39.00 m^2
2) Filter Bed Surface Area = Q ÷50 expressed as m^2					
Q	2,925.00	/	**50**	=	58.50 m^2

Where Percolation Rate T < 11.5 then Q/75 = Area of filter bed 39 m^2 or 419.8 ft^2

The total square area is calculated by measuring the length, and multiplying it against the width. In most instances, the filter bed is constructed long and narrow, as opposed to a square. This helps the bed "breathe," as more oxygen can penetrate the filter bed from the sides, and from above.

Filter Bed Loading Area	**58.50**	**m^2**	**Length m**	**15**	**Width m**	**3.90**
	629.69	**ft^2**	**Length ft**	**49.50**	**Width ft**	**12.87**

EXTENDED CONTACT AREA

Where Percolation Rate T > 11.5 then (Q x T)/850 = Extended Contact Area _____ m_2 or ___ 27.53 m2

Filter Bed Loading Area	**27.53**	**m^2**	**Length m**	**16**	**Width m**	**1.72**
	296.33	**ft^2**	**Length ft**	**52.81**	**Width ft**	**5.68**

Refer to Sizing a Grey Water System located at the end of the description for a Class 2 – Leaching Pit system located on the APH website at www.algomapublichealth.com

APPENDIX H

Water Treatment Recommendations

PV WELL WATER
WE KEEP WATER FLOWING

QUOTE #1696

SENT ON:

Jun 13, 2023

RECIPIENT:

Andrzej Olender

Ottawa, Ontario

SENDER:

PV Plumbing & Water Inc.

3831 Carp Road
Carp, Ontario K0A 1L0

PRODUCT / SERVICE	DESCRIPTION	QTY.	UNIT PRICE	TOTAL
TW22-1	-2 Cube Clack Iron Filter (Birm) -60K Clack Softener -Vectapure 360 POU RO -UV MAX D4 System w/ 10" Filter Price includes equipment and installation.	1	$7,000.00	$7,000.00
Estimated Annual Service Cost	Annual Service Includes -Replace UV Bulb, Clean or Replace Sleeve, Replace Pre Filter for UV -Replace RO Filters -Clean and Lubricate Softener -Clean and Lubricate Iron Filter Labour and materials estimated in price.	1	$1,050.00	$1,050.00
Scope	These estimates are based on historical data from previous water tests. 10GPM Flow Rate. Estimated price is for planning purposes only and a fresh water test will be required from each well prior to final quotation of the systems.			

This quote is valid for the next 30 days, after which values may be subject to change.

Subtotal	$8,050.00
HST (13.0%)	$1,046.50
Total	$**9,096.50**

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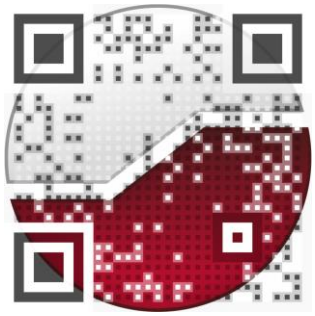

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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