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REPORT ON

HYDROGEOLOGICAL AND TERRAIN STUDY
PROPOSED RESIDENTIAL LOT SEVERANCES
3970 STONECREST ROAD
WEST CARLETON - MARCH WARD
CITY OF OTTAWA, ONTARIO

Submitted to:

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DATE September 24, 2023 (revision 1)
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DISTRIBUTION

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November 14, 2022 (rev. Sept. 24, 2023) 220625

Hugh Thayer
3970 Stonecrest Road
Woodlawn, Ontario
K0A 3M0

RE: HYDROGEOLOGICAL AND TERRAIN STUDY
PROPOSED RESIDENTIAL LOT SEVERANCES
3970 STONECREST ROAD
WEST CARLETON - MARCH WARD
CITY OF OTTAWA, ONTARIO

Kollaard Associates Inc. was retained by Mr. Hugh Thayer to undertake a hydrogeological and terrain study for proposed residential lot severances with frontage on Stonecrest Road in Woodlawn, Ontario (Key Plan, Figure 1).

It is understood that it is being proposed to sever two residential lots, each lot consisting of about 0.8 hectares (2.0 acres) in area. The retained parcel consists of about 30.6 acres (12.4 hectares). There is currently no dwelling on the retained parcel, which contains only a shed and sea container. There is an existing well that was constructed on the retained parcel to service a building (private aircraft hangar) that was destroyed by fire. One of the proposed severed lots (currently identified as 3970 Stonecrest Road) contains an existing dwelling, well and sewage system. A Site Plan Sketch is provided as Figure 2, which shows the locations of the proposed severed lots, the existing wells, dwellings and the test pits.

The purpose of the two severances is to sever an existing residence and allow single family dwelling development on the other proposed severed lot that is to be serviced by a well and on-site sewage disposal.

This report consists of an evaluation of the water quality and quantity for the existing well on the proposed retained portion of the property. Information from available well records and surficial geology maps was also used to characterize soils with regards to a septic impact assessment for the proposed severed lots.

The assessment was carried out on a drilled well to ensure that the water quality and quantity is acceptable using the following guidelines; Ministry of the Environment, Conservation and Parks (MECP) Guidelines D-5-4 and D-5-5 and the Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG).

HYDROGEOLOGICAL STUDY

Background

A bedrock geology map for the site area indicates the bedrock at the site consists of dolostone and sandstone of the Beekmantown Group as well as carbonate metasedimentary rocks, marble, calc-silicate rocks, skarn, and tectonic breccias of the Grenville Supergroup and Flinton Group.

The surficial geology map indicates that the proposed severed lots (front part of the property) are located within an area of fine-textured glaciomarine deposits, with some organic deposits possibly in the southeast portion of the site (where poorly drained/ponding is observed in the aerial photographs). One well record, indicated to be for a well located directly across the road from the proposed severed lots, indicates that a deposit of hardpan (glacial till), some 5.5 metres in thickness, was encountered.

The retained portion of the property (north part) is located within an area of glaciofluvial deposits with possible shallow bedrock in the northwest portion of the site. The well record for the well located on the retained lot (and the well used for the assessment) indicated that soil thickness at that portion of the site is some 1.8 metres in thickness.

The well records for area wells indicate that the soil thickness overlying bedrock ranges from 2.4 to 12.2 metres in thickness, with an average soil thickness of about 5.8 metres for the four area wells. The overburden is described as till, sand, and clay.

A review of topographical information from the City of Ottawa online mapping indicates that the site topography is sloped towards the northeast of the proposed severed lots.

Two test pits were put down on August 9, 2023, in the approximate locations of the future sewage system areas for the proposed severed lot and the proposed retained lot. The test pit locations are shown on the Site Plan Sketch, Figure 2. The test pits was put down by the client using excavating equipment provided and operated by the client and were observed by a Kollaard Associates Inc. staff member. The test pit (TP1) put down on the proposed severed lot 2 (vacant lot) encountered about 0.30 metres of topsoil overlying red brown to grey brown silty sand. The test pit was terminated in the silty sand at 2.2 metres depth. No water was encountered in the test pit during excavating. Test pit (TP2) was put down on the retained lot. That test pit encountered red brown to grey brown silty clay and was terminated within the silty clay at 2.4 metres depth. No refusal was encountered in either test pit. TP2 encountered groundwater at about 2.2 metres below existing ground surface.

The well construction for the well used for this assessment was recorded in the well record as follows. There is about 1.8 metres of soil overlying limestone bedrock. The well casing length is 6.1 metres with total well depth of 68.6 metres. Water fractures were encountered during drilling at depths of 17, 26, and 67 metres. The well yield test indicated that the well testing rate was about 36 litres per minute. The well drawdown after one hour was 25.6 metres. The specific capacity of the well pumping at that rate was 1.4 litres per minute per metre of drawdown. Based on the results of the well yield test, the recommended pumping rate was about 29.5 litres per minute.

The well record for the test well and area well records are provided herein as Attachment A. A well record could not be matched for the proposed severed lot at the site which contains a pre-existing single family dwelling. No well construction details for that well were located and the well was not used in this assessment. The approximate year of house construction was between 1999 and 2002

based on a review of aerial photographs. No area well records were indicated to have been constructed within that interval.

Area Well Records

A review of four area well records was carried out. The well records are provided (Attachment A). The depths of the wells are indicated to be between 12 and 63 metres, obtaining water from limestone and granite aquifers. Test pumping rates for the area wells were 22.7 to 45.5 litres per minute. Recommended pumping rates were between 18.2 and 27.3 litres per minute. The well records indicated overburden depths of 2.4 to 12.2 metres consisting of till, sand, and clay. All area wells had over 6 metres of casing below the ground surface.

Existing Well

A Kollaard Associates Inc. technician observed the well during the site visit of August 9, 2023. The existing dwelling at the site is serviced using a dug well that is located in the rear yard with the sewage system in the front yard. The well consists of a 1.2 metre diameter concrete casing. The well cap was observed to be securely in place and the cover was in good condition with no obvious cracks or damage. The area around the well is sloped to ensure that water does not pool near the wellhead. The well is located away from any parking areas, chemical storage, equipment and animals. The area for at least 3 or more metres around the well is vegetated. The sewage system is located on the opposite side of the front yard and the separation distance meets the minimum 30 metres setback from the well. Based on the observations carried out at the time of the site visit, the well has been sited appropriately and is being maintained in compliance with Ontario Well Regulation 903 as it applies to existing dug wells and well maintenance. The well construction and its compliance with O. Reg. 903 cannot be verified as the construction record of the well could not be located. It is not possible to assess compliance of a previously constructed well without an available well record to review.

The home owner completed a well questionnaire regarding the well water quality and quantity. The well questionnaire is provided herein (Attachment E). The owner indicates that they have resided at the property since 1997. The well is indicated to be a dug well also constructed in 1997. The well is located in the rear yard. The owner indicates that they do consume the water and the water treatment consists of a water softener. The owner indicates that they test the water yearly and have never had any bacterial occurrence. The owner also indicates that they have never experienced a water shortage in the well.

It is understood from City of Ottawa policy that the servicing of a proposed severed lot on dug wells would require an assessment of the existing well water quality and quantity or the well would have to be decommissioned in favour of a drilled well. The owner has agreed to decommission the existing dug well and have a new drilled well constructed to service the existing dwelling on the proposed severed lot at 3970 Stonecrest Road.

Water Quantity

A pumping test was carried out on June 9, 2022, on the drilled well at the proposed retained property, identified as TW1 in Figure 2.

The testing consisted of a 6 hour duration pumping test. During the pumping test, water level measurements were made on a regular basis to monitor the drawdown of the water level in the well in response to pumping and water levels were monitored at one minute intervals using a pressure transducer. Hourly field water quality readings were recorded for the water temperature, pH, total

dissolved solids (conductivity) and turbidity. After the pump was shut off, the recovery of the water level in the well was measured until about 95% recovery of static water level had been achieved or for 24 hours.

The well was pumped for about 360 minutes at a pumping rate of about 24 litres per minute. Over the course of the pumping test, the water level in the well dropped 9.91 metres in response to that rate. At the end of pumping, 95 percent recovery of the total drawdown in the static water level created during pumping was measured after about 45 minutes.

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

The pumping test data for the test well was analyzed using the method of Cooper and Jacob (1946). Although the assumptions on which these equations are based are not strictly met, this method provides a reasonable estimate of the aquifer transmissivity.

Transmissivity was calculated using the following relationship:

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

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

Based on the pumping test drawdown data, the transmissivity of the aquifer is estimated to be about 4.8 m^2/day. Based on the recovery data from the pumping test, the transmissivity is estimated to be about 3.3 m^2/day. The pumping rate and duration that were used were sufficient to confirm that the well yield is sufficient for the proposed use.

Based on the data obtained during the six hour pumping test, it can be concluded that the well is capable of sustaining a short term yield of at least 24 litres per minute. During the course of the pumping period, about 25 percent of the available drawdown in the test well was utilized, based on the recommended pump depth of 47.3 metres and the static water level recorded the day of the pumping test (4.50 metres). The specific capacity of the well based on the pumping rate used is 1.4 litres per minute per metre of drawdown.

The typical residential peak demand rate is 22.5 litres per minute for a five bedroom dwelling. It is considered that the pumping rate used was sufficient to meet peak residential demands.

Based on the above noted assessment of the test well and what is known about the aquifer from adjacent wells, it is considered that future wells constructed in the same aquifer (to similar depths) on the proposed severed lot will provide sufficient water for domestic use for a residential dwelling.

Water Quality

During the pumping test, hourly field readings of pH, temperature, turbidity and total dissolved solids (conductivity) were recorded.

The results of the chemical, physical and bacteriological analyses of the water samples obtained from the test well are provided in Attachment C. A summary of the water quality measured in the field are provided as Table I, Water Quality Measurements for Test Well.

Groundwater samples were prepared and preserved in the field using appropriate techniques. Chlorine residuals were measured prior to obtaining water samples for lab submission and free chlorine was measured to be zero. The water samples were submitted to Eurofins Environmental Laboratory in Ottawa, Ontario, for the chemical, physical and bacteriological analyses listed in the MECP guideline entitled Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment, August 1996.

The water quality as determined from the results of the analyses is acceptable. The water meets all the Ontario Drinking Water Standards, Objectives and Guidelines (ODWSOG) health and aesthetic parameters tested for at the test well except for fluoride, total dissolved solids, organic nitrogen, hardness and strontium.

Fluoride
The owner obtained a water sample and tested fluoride level prior to the pumping test. The fluoride level at that time was reported by the laboratory at a level of 0.94 mg/L on June 2, 2022. Fluoride was measured during the pumping test on June 9, 2022, after three and six hours at a level of 1.85 mg/l. The ODWSOG specifies a Maximum Acceptable Concentration (MAC) for fluoride of 1.5 mg/l. Levels above the MAC must be reported to the local Medical Officer of Health. The following is the statement regarding fluoride from that document.

> *Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/l but less than 2.4 mg/l, the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.*

Fluoride is considered to be naturally occurring in this case. The following information was extracted from a document entitled “Fluoride in Groundwater: Origin and Health Impacts” Helene Pauwels, Shakeel Ahmed, which discusses naturally occurring fluoride. The dolostone and sandstone of Beekmantown Group is part of the Ordovician strata and was deposited by marine tidal deposition.

> *In sedimentary basins, the sources of fluoride are mainly fluorite (CaF_2), fluoroapatite ($Ca_5(PO_4)3F$), and marine clays on which fluoride may be adsorbed. Weathering, a key process regarding the mobilization of fluoride through groundwater, takes place and evolves along the groundwater flow path. Consequently, fluoride concentrations tend to increase in the direction of groundwater flow from the recharge to the discharge area. In heterogeneous contexts, such as crystalline aquifers, fluoride concentrations increase with depth, as does residence time. In other words, the older the water, the higher the fluoride concentration. Interaction time is thus a key parameter in fluoride concentration, and under temperate climates, where recharge ensures a significant flow rate, the increase of fluoride concentration is favoured within large basins compared to small aquifers.*

<u>City of Ottawa Groundwater Study</u>

Information was provided by the City of Ottawa regarding a groundwater and well water testing study. The well records for the two other wells with fluoride exceedances and the map of the locations are provided as Attachment F.

The information indicates that there is very little available information within close proximity of the site. The closest well that was reviewed as part of the study is some ~2.8 km east of the site. The well record from that location (See attached Well ID 1515000) indicates that the well depth is some 36 metres in depth in limestone. The limestone is also overlain by a significant deposit of clay followed by gravel. The fluoride level reported from the study is some 4.2 mg/L. There is a second well located about 5 km to the northeast that has a fluoride level of 2.45 mg/L. That well (See attached Well ID 1523355) is indicated to be some 38 metres in depth. However the well is indicated to be screened in the sandy overburden and not a bedrock well. As such, its construction is not in a similar formation as the well servicing the subject property.

The other wells that are indicated to be within some 4 km of the subject property are all for screened wells in sand and all of these wells are located some 3 to 4 kilometres northeast of the site. The well depths vary from 12 to 17 metres in depth and report low fluoride levels of 0.04 to 0.2 mg/L fluoride. None of these wells is constructed in the same aquifer as the subject well.

The above noted study does not provide enough data to be able to determine a local trend in the fluoride levels as the aquifers are different (overburden versus bedrock), the depth to bedrock is different and the fracture depths may differ, which results in differing water quality.

Colgrove, Laura M., "A Regional Chemical Characterization and Analysis of Groundwater in Eastern Ontario" (2016). Electronic Thesis and Dissertation Repository. 4203. https://ir.lib.uwo.ca/etd/4203

The above noted study discusses the water chemistry across eastern Ontario and includes the subject area. It discusses how the inundation of Champlain Sea deposits (mainly clay aquitards east of Ottawa) saturated the bedrock aquifers with saline water and depending on how confined the underlying bedrock aquifer is (in relation to overburden deposits and the bedrock topography) or its “hydrogeological condition” affects the groundwater chemistry. This is because the recharge areas (elevated bedrock topography and little to no overburden) in the west allows for the mixing of fresh water (calcium dominant, higher pH) with the underlying bedrock deposits that are affected by Champlain Sea water (mineralized with elevated salt, chlorides and dissolution reactions which dissolve fluoride and cause elevated fluoride). The east region (characterized by significant clay aquitard) has resulted in confined bedrock aquifers that do not receive fresh water and hence the groundwater is older and more likely to have higher mineralized water (sodium chloride dominant which also includes elevated fluorides). The report indicates that Nepean, March and Oxford formations have calcium and carbonate water type and from upper bedrock which is recharged by meteoric water transitions with depth to a more confined condition (deeper bedrock aquifer) that is older and is characterized by sodium carbonate (ion exchange). At discharge areas (example bogs) with large overburden deposits, the deep bedrock is affected by remnant Champlain Sea water or diffusion of solutes from the overlying marine clay deposits which cause the discharge areas to be characterized by sodium and chloride.

Interpretation of Above Noted Studies

The above noted study is a regional scale study but it does provide insight into where fluoride levels are expected to be higher regionally. The same concepts can be applied locally to the City of Ottawa Groundwater Study.

The subject site is at a higher elevation than the wells to the east and the groundwater flow gradient of the groundwater flow path is mostly eastward (especially in the deeper bedrock regime) and the discharge areas would be down gradient (east) and likely have more overburden deposits. On a

local scale, then, considering the Ottawa Groundwater Study, the other well (Well ID 1515000) that is further east and has elevated fluoride may be partially due to the confining conditions caused by the clay deposit and that it is further along the flow path (hence longer residence time).

The water quality of the water supply in the well does provide some indications that there is mixing of fresh water from upper aquifer as there is calcium and carbonate (hardness 350 mg/l) in addition to sodium (60 mg/l) and chloride (200 mg/l). So the well does exhibit both characteristics of the unconfined and confined aquifers.

The age of the bedrock and well depth are closely associated with fluoride levels. The deeper wells encounter older water. That is because the deeper bedrock aquifer ground water chemistry is based on mineral composition, physical contact, residence time and oxidation-reduction reactions. The water quality (fluoride level) is due to interactions between groundwater and the sedimentary bedrock that was originally deposited about 470 million years ago. The deeper the water is obtained from in the groundwater regime, the older the water is and it is less affected by climactic factors than shallow groundwater in the upper aquifer.

The above noted factors far outweigh any seasonal or temporal trends over the next 50 years or so (approximate service life of the well). As such, no significant trend in fluoride levels is expected to occur over this time period given that the water quality is determined by the mixing of fresh water with the deeper confined aquifer.

Based on all the available information, the main predictor for fluoride level at the site is still dominated by well depth. The deeper the well, the more likely it is to access a more confined aquifer with less recharge and older more mineralized water.

The well depth is ~68 metres. Future wells drilled on the site should ensure that the well depth does not exceed this depth. Attempts should be made to ensure well depth is less than 68 metres to achieve the lowest fluoride level while still maintaining sufficient water quantity to service a proposed dwelling. Recommendations regarding well construction and water quality testing are provided in the Recommendations section at the end of this report.

Kollaard Associates Inc. considers that fluoride levels are within the upper limit of 2.4 mg/l for this well and are generally expected to be less than 2.4 mg/l and close to 1.85 mg/l over the long term. Where present in groundwater, as with other minerals, fluoride level typically increases with depth as the deeper water has had a longer residence time with the naturally occurring minerals than shallow water. As such, in order to ensure that fluoride levels are acceptable in the future well on the proposed severed lot, the construction of future wells should be limited to depths of about 68 metres or less. It is also recommended that upon well construction, a water sample should be obtained and tested for fluoride to ensure that the fluoride level is within the established limit of 1.5 mg/l. Where fluoride levels exceed 1.5 mg/l but are less than 2.4 mg/l, that information should be registered on title to ensure that future homeowners are aware of the occurrence of fluoride in addition to that information being provided to the local Medical Officer of Health (Ottawa Public Health). This is in accordance with the above noted recommendations from the Ministry of Health and Long Term Care. A Fluoride Fact Sheet is provided as Attachment D. Fluoride levels above 2.4 mg/l are not acceptable for new development purposes in the City of Ottawa.

Total Dissolved Solids

Total dissolved solids (TDS) level was 645 milligrams per litre and is above the ODWS aesthetic objective (AO) of 500 milligrams per litre. Where TDS levels exceed the AO, comments regarding treatment include “written rationale that corrosion, encrustation or taste problems will not occur”,

according to the MECP D-5-5 Guideline. The Technical Support Document for Ontario Drinking-water Quality Standards, Objectives and Guidelines, states the following with regards to TDS.

> *"The term total dissolved solids refers to inorganic substances dissolved in water. The principal constituents of TDS are chloride, sulphates, calcium, magnesium and bicarbonates. The effects of TDS on drinking water quality depend on the levels of the individual components. Excessive hardness, taste, mineral deposition or corrosion are common properties of highly mineralized water. The palatability of drinking water with a TDS level less than 500 mg/L is generally considered to be good."*

To provide the required rationale regarding the TDS level of 645 mg/L measured at the well, the Ryznar Stability Index (RSI) and Langelier Saturation Index (LSI) were calculated for the water sample to determine the corrosivity or scale formation potential of the water. The RSI value is 6.98, and LSI is 0.43, indicating that the water has borderline scale potential and is not expected to be corrosive. In this case, the other constituents that contribute to TDS, including sodium, sulphates and chlorides are all well within their aesthetic objectives. The aesthetic objectives are established for sodium and chlorides based on water palatability. A sodium level of 53 mg/L and a chloride level of 202 mg/L are within the aesthetic objectives of 200 mg/L and 250 mg/L, respectively. As such, they are not present at sufficient levels to contribute to taste. Sulphates are also present at a level of 60 mg/L. Sulphate at less than 150 mg/L does not result in noticeable taste, as stated in the Technical Support Document. TDS is also contributed to by calcium, magnesium and bicarbonates. These are the components of TDS that also cause high hardness. Consequently, the way to reduce the TDS levels is through the reduction of hardness. The water sample had a moderately high level of hardness, which causes scale formation but does not affect taste. The Technical Support document states that hard water has a tendency to form scale deposits and can cause scum with soap. It does not state taste issues in association with high levels of hardness. Therefore, it is considered that treatment to reduce hardness will also reduce the potential for scale formation.

Organic Nitrogen

Organic Nitrogen is calculated by the difference between Total Kjeldahl Nitrogen and the ammonia nitrogen. Organic nitrogen was found to be 0.45 mg/l and 0.71 mg/l after three and six hours, respectively. The following information was obtained from the Technical Support document for the ODWSOG. The operational guideline for organic nitrogen is 0.15 mg/l. Organic nitrogen levels of about 0.15 mg/L are associated with DOC contributions of 0.6 mg/l. High levels of organic nitrogen may be caused by septic tank or sewage effluent contamination. In this case, the organic nitrogen is not considered to be caused by sewage contamination. There are no sewage systems near the well location and there is no indicator of any other surficial contaminants (such as nitrate or nitrite, bacteria) that would also be present if sewage effluent was the source of the organic nitrogen. The DOC level in the water is some 0.8 to 1.0 mg/l, which is well within the DOC aesthetic objective of 5 mg/l but is above 0.6 mg/L which indicates that DOC level is consistent with organic nitrogen. It is noted that sedimentary bedrock deposits are known to carry nitrogen as organic matter accumulates during sedimentation and becomes part of the bedrock over time. Water containing elevated organic nitrogen that is treated with chlorine can cause unwanted disinfection by-products that affect taste and odour of treated water. As such, the OG for organic nitrogen is relevant with regard to chlorine treated water. Groundwater in private wells is not treated using chlorine as UV treatment is more common in a residential setting. As such, no treatment recommendation is required for the presence of organic nitrogen.

Hardness
The water is considered to be hard by water treatment standards. Water with hardness above 80 to 100 milligrams per litre as $CaC0_3$ is often softened for domestic use. The hardness at the well is 366 milligrams per litre, which is considered poor but tolerable. Treatment using ion exchange water softeners is effective to reduce hardness.

Water softening by conventional sodium ion exchange may introduce relatively high concentrations of sodium into the drinking water, which may contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. To reduce sodium intake (and strontium intake, see below) from the untreated water or from water softened water, a point of use reverse osmosis system in the kitchen for water used for drinking and culinary purposes is recommended.

Trace Metals
All trace metals were detected within the MAC or IMAC, where indicated, except for strontium. The strontium level is of particular concern in the Ottawa area, due to its naturally occurring presence at elevated levels in some sedimentary bedrock, such as limestone and sandstone. Strontium currently has a proposed Maximum Acceptable Concentration (MAC) by Health Canada of 7.0 mg/L. The proposed MAC is established as there are a few studies that indicate a potential for adverse effects of strontium for humans. Since the highest sensitivity to adverse bone effects occurs in the first year of life, infants are the most sensitive to strontium toxicity. The level of strontium measured in the raw water supply at this site is ~6.8 to 7.1 mg/L, indicating that the strontium level is marginally exceeding the acceptable proposed limit. Strontium may be reduced from water by the use of ion exchange water softeners or a point of use reverse osmosis treatment unit for any water used for drinking or culinary purposes.

Groundwater Impact Assessment

The Ministry of the Environment, Conservation and Parks (MECP) Procedure D-5-4 provides guidelines for evaluating "the ability of the lands identified by and restricted to the development to treat sewage effluent to meet acceptable limits". The guideline requires that the representative background nitrate levels in the receiving groundwater be determined. Where background levels are greater than 10 milligrams per litre the ministry indicates development of the site should not be supported unless it can be demonstrated that existing levels of nitrates are the result of historical agricultural practices on the site. In addition, the guideline requires demonstration that the site is not obviously hydrogeologically sensitive such as karstic areas, areas of fractured bedrock exposed at the surface, areas of thin soil cover or areas of highly permeable soils.

The guideline indicates that the assessment involves a three step process.

Step 1 regards lot size considerations. Where the lot size for each private residence within the development is an average of one hectare or larger and no lot is smaller than 0.8 hectares, and provided the site is not hydrogeologically sensitive, the risk that impact limits may be exceeded by individual systems is considered acceptable.

The proposed severed and retained residential lots occupy areas of ~0.80, ~0.80, and ~12.4 hectares, respectively. A test pit put down in one of the proposed severed lots encountered about 1.8 metres of soils including topsoil (0.10 metres thickness), silty sand (0.10 to 0.60 metres), and silty clay (0.60 metres and below). The test pit was terminated in silty clay at 1.8 metres. A well record for the property directly across the road at 3987 Stonecrest Road, indicates that the overburden thickness was some 5.5 metres consisting of hardpan (glacial till).

Hydrogeological Sensitivity

Based on the information from available well records for the site and surrounding wells and information from the test pit put down on one of the proposed severed lots, there is at least 2 metres or more of soil at the proposed severed lots. A site is considered to be potentially hydrogeologically sensitive if the soil cover at and surrounding the site is generally less than 2 metres in thickness. The area well records describe soil thickness as between 2.4 to 12.2 metres, with an average soil thickness of 5.8 metres. The well records indicate that uppermost water fractures were encountered at depths of some 17 metres or more in depth. The water quality for the well that was assessed had no detectible presence of nitrates or nitrites, indicating no current impact from sewage or agricultural nutrients. Based on the available information sources, the site is not hydrogeologically sensitive.

Sewage Design Considerations

Based on the site conditions encountered in one test pit on one of the proposed severed lots, it is likely that a future sewage system design for the severed property may be a partially to fully raised bed, dependent on the silt and clay content of the soils at the site and the groundwater elevation, which were not fully assessed. One of the proposed severed lots is already developed with a single family dwelling, well and sewage system.

Based on the above noted site conditions and with consideration of the large lot sizes, the groundwater impact of the proposed development is within the impact limits established by the MECP.

RECOMMENDATIONS

Well Construction and Maintenance Requirements

The following information is provided for any future well construction on the proposed severed and retained lots:

- The future well construction shall conform with Ontario Well Regulation 903 and the well grouting and casing installation shall be certified by a Professional Engineer or Geoscientist and a Certificate of Well Compliance shall be provided for the well at the time of construction; AND
- The target aquifer for any future wells is the dolostone aquifer which is expected to encounter sufficient yields of some 18 to 27 Litres per minute for wells of depths of between 28 and 68 metres. A maximum well depth of 68 metres or less should be provided for any future well at the site. It is recommended that once a water fracture is encountered, the well should be surged to develop the fractures rather than drill the well deeper. A well yield of some 14 to 19 litres per minute is adequate for domestic water uses; AND
- Fluoride warning: The fluoride level is expected to increase with well depth. The assessed well located on the retained lot having a depth of some 68 metres encountered a fluoride level of about 1.85 mg/l. The expected water quality for future wells servicing the proposed severed lots is acceptable for long term use provided that well depths are less than 68 metres and with the additional fluoride testing to verify fluoride levels upon construction. If possible, well depths should be as shallow as possible while still achieving at least sufficient well yields; AND

- Upon well construction, a water sample shall be obtained and tested for fluoride content. If fluoride levels exceed 1.5 mg/l, that shall be immediately reported to Ottawa Public Health and registered on title for future owners to be informed.
- For well construction and maintenance requirements, future home owners are referred to the Ontario Well Regulation 903 and the MECP publication "*Water Supply Wells: Requirements and Best Management Practices"* (rev. January 2021) which are both available on-line at the following links:
  https://www.ontario.ca/laws/regulation/900903
  https://www.ontario.ca/page/water-supply-wells-requirements-and-best-practices

Existing Well on Proposed Severed Parcel (3970 Stonecrest Road)

- The existing dwelling located at 3970 Stonecrest Road is serviced using a dug well. The existing dug well that currently services the dwelling at 3970 Stonecrest Road has not been evaluated with regards to water quality and water quantity. Compliance of well construction in accordance with O. Reg. 903 with regards to casing sealing and grouting could not be verified as no well record was available.
- It is recommended that the existing dug well be decommissioned in favour of a drilled bedrock well that is constructed as per the above noted well construction requirements.
- The following shall be provided to the City of Ottawa:
  - Proof of well decommissioning (in the form of a Ministry of Environment well abandonment record) of the dug well
  - MOE well record, Certificate of Compliance and fluoride testing results of a replacement constructed drilled well.
- Alternatively, a hydrogeological assessment would be required to assess the water quality and quantity of the existing dug well to the satisfaction of the City of Ottawa.

The proposed sewage system on the proposed severed and retained lots should be constructed and located as follows:

- The sewage system should be located down gradient of the drilled well with a minimum separation distance of 15 or more metres (dependent on grade raise) between the drilled well and the sewage leaching bed in accordance with the Ontario Building Code; AND
- Use of Best Management Practices for the sewage system design, installation, use and maintenance, such as the Do's and Don'ts which are included in the publication "*Septic Smart! Understanding Your Home's Septic System*" available at the following link from the local conservation authority < https://www.rvca.ca/rvca-publications/resources >

The following is identified for the expected water quality:

Hardness

- The bedrock water supply aquifer is likely to yield water with hardness of about 352 to 366 milligrams per litre, which exceeds the operational guideline of 80 to 100 mg/l. Treatment using ion exchange water softeners is effective to reduce hardness. Water softening by conventional sodium ion exchange may introduce relatively high concentrations of sodium into the drinking water, which may contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. Where ion exchange water softeners are used, it is recommended that a point of use reverse osmosis system be installed in the kitchen for drinking and culinary purposes to remove sodium from drinking water.
- The total dissolved solids exceed the aesthetic objective of 500 mg/l. The elevated TDS is due to high hardness, which contributes calcium, magnesium and bicarbonates to the TDS

levels. The elevated TDS and hardness are reduced through the water softening which will reduce potential for scale formation.

Total Dissolved Solids

- Total dissolved solids (TDS) level was 645 milligrams per litre and is above the ODWS aesthetic objective (AO) of 500 milligrams per litre.
- The RSI value is 6.98, and LSI is 0.43, indicating that the water has borderline scale potential and is not expected to be corrosive. In this case, the other constituents that contribute to TDS, including sodium, sulphates and chlorides are all well within their aesthetic objectives. TDS is also contributed to by calcium, magnesium and bicarbonates. These are the components of TDS that also cause high hardness.
- A water softener to reduce hardness is effective to reduce the potential for scale formation.

Fluoride

- Fluoride may be elevated in future wells and be present at levels above 1.5 mg/l, which is the Maximum Acceptable Concentration (MAC) for fluoride. Levels above the MAC must be reported to the local Medical Officer of Health. Fluoride levels above 2.4 mg/l exceed the drinking water limit and are not acceptable for development purposes. Based on information about other area wells and the geological unit present at the site, Kollaard Associates professional opinion is that wells drilled on the proposed severed lots will have fluoride levels of between 0.9 mg/l and 1.85 mg/l.
- It is recommended that upon well construction, a water sample should be obtained and tested for fluoride to ensure that the fluoride level is within the established limit of 1.5 mg/l. Where fluoride levels exceed 1.5 mg/l but are less than 2.4 mg/l, that information should be registered on title to ensure that future homeowners are aware of the occurrence of fluoride in addition to that information being provided to the local Medical Officer of Health (Ottawa Public Health). This is in accordance with the recommendations from the Ministry of Health and Long Term Care.
- The expected water quality for future wells servicing the proposed severed lots is acceptable for long term provided that well depths are less than 68 metres and with the additional testing as per the above noted recommendations.
- The recommendation for water treatment to reduce consumption of fluoride is a Point of Use reverse osmosis system at the drinking water tap (generally in the kitchen) to treat the water used for drinking and cooking. RO system can remove 85-92% of fluoride in the well water.
- The attached Fluoride Fact Sheet is provided for consideration of future owners of the proposed severed lots to reduce exposure to fluorides from other sources (Attachment D).

Strontium

- Strontium levels are marginally above the proposed MAC by Health Canada of 7.0 mg/L. Strontium was measured at 6.8 to 7.1 mg/L. The proposed MAC is established as there are a few studies that indicate a potential for adverse effects of strontium for humans. Since the highest sensitivity to adverse bone effects occurs in the first year of life, infants are the most sensitive to strontium toxicity.
- Strontium may be reduced from water by the use of ion exchange water softeners or a point of use reverse osmosis treatment unit for any water used for drinking or culinary purposes. Further information regarding strontium in drinking water is provided (Attachment D).

Organic Nitrogen

- Organic nitrogen was found to be 0.45 mg/l and 0.71 mg/l after three and six hours, respectively compared to the operational guideline (OG) for organic nitrogen is 0.15 mg/l.

Higher levels are typically associated with DOC contributions of 0.6 mg/l. The issue with organic nitrogen above these levels is that water containing elevated organic nitrogen that is treated with chlorine can cause unwanted disinfection byproducts that affect taste and odour of treated water. The OG for organic nitrogen is relevant with regard to chlorine treated water.

- Typically, groundwater in private wells is not treated using chlorine as UV treatment is more common in a residential setting. As such, no treatment recommendation is required for the presence of organic nitrogen. The DOC level in the water is some 0.8 to 1.0 mg/l, which is well within the DOC aesthetic objective of 5 mg/l.

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

Regards,

Kollaard Associates Inc.

Colleen Vermeersch, P. Eng.

Attachments:

	Table I	Summary of Hourly Field Water Quality
	Table 2	Test Pit Log
	Figure 1	Key Plan
	Figure 2	Site Plan Sketch
	Attachment A	TW1-Well Record and Area Well Records
	Attachment B	TW1-Pumping Test Data
	Attachment C	TW1-Laboratory Water Testing Results
	Attachment D	Fluoride and Strontium Fact Sheets
	Attachment E	Well Water Questionnaire-3970 Stonecrest Road
	Attachment F	City of Ottawa Groundwater Study Data and Map

TABLE I

FIELD WATER QUALITY MEASUREMENTS
FOR TEST WELL 1

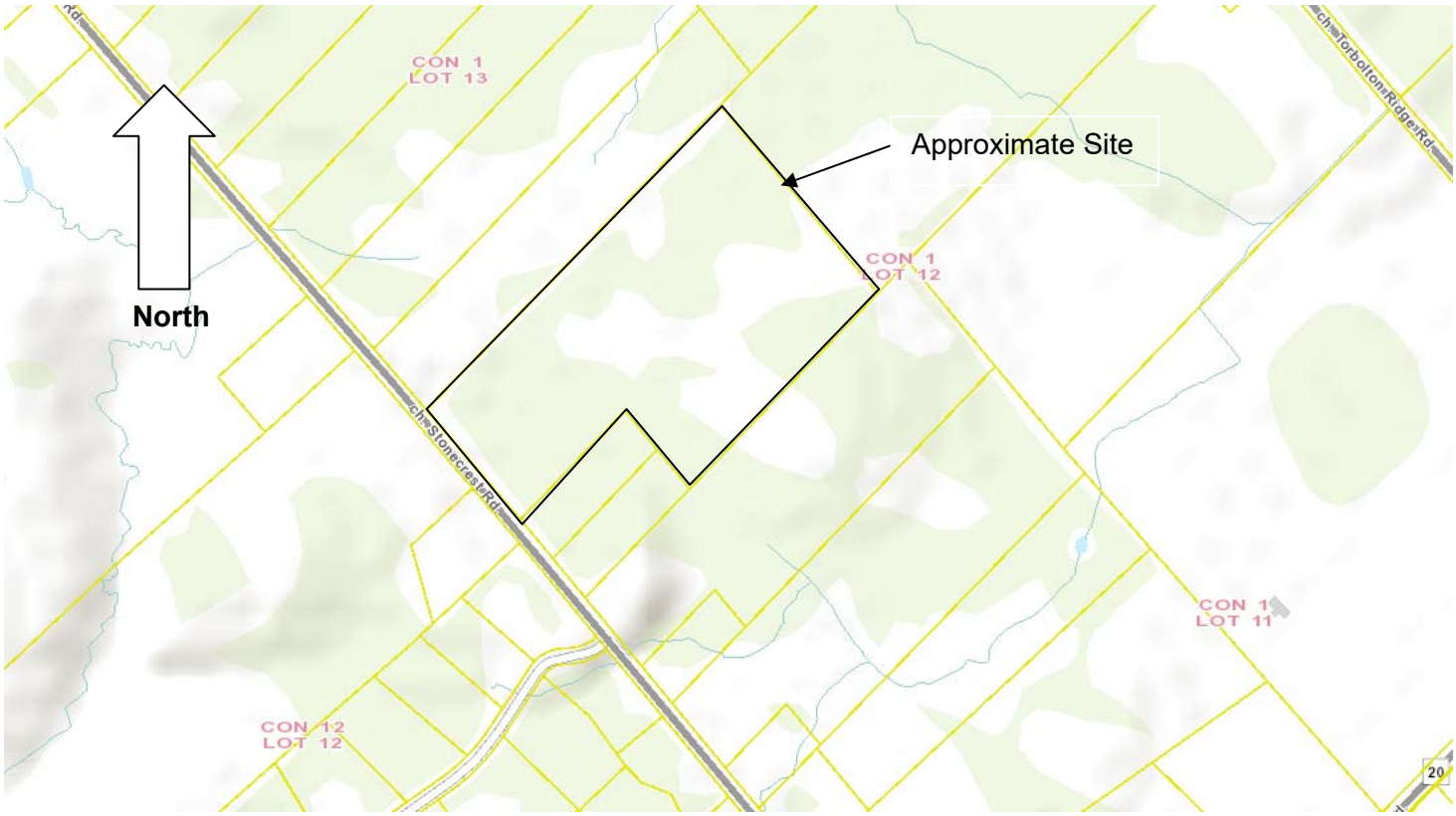
Time Since Pumping Test Started (min)	**Temperature** (^{0}C)	**pH**	**Turbidity** (NTU)	**Total Dissolved Solids** (ppm)	**Conductivity** (µS)	**Free Chlorine** (ppm)
60	10.3	7.85	2.05	537	1080	0.03
120	10.3	7.79	0.37	536	1073	-
180	10.3	7.73	1.55	534	1068	0.00
240	10.5	7.82	2.77	542	1083	-
300	10.8	7.77	2.31	540	1082	-
360	11.0	7.77	2.42	538	1076	0.00

TABLE 2

RECORD OF TEST PITS
3970 STONECREST ROAD, WOODLAWN, ONTARIO

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP1	0.00 – 0.30	TOPSOIL
	0.30 – 1.60	Red brown SILTY SAND
	1.60 – 2.20	Grey brown SILTY SAND
	2.20	End of test pit in SILTY SAND
Test pit dry, August 9, 2023.		
TP2	0.00 – 0.30	TOPSOIL
	0.30 – 1.00	Red brown SILTY CLAY
	1.00 – 2.40	Grey brown SILTY CLAY
	2.40	End of test pit in SILTY CLAY
Some groundwater observed at about 2.2 metres below the existing ground surface, August 9, 2023.		

KEY PLAN	FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 220625

Date June 2022

DRAWING NUMBER:
FIGURE 2

LEGEND:

Approximate well location

Approximate test pit location

TP1

NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers

PO, BOX 189, 210 PRESCOTT ST
KEMPTVILLE ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

(613) 860-0923
info@kollaard.ca

CLIENT:
HUGH THAYER

TITLE:
SITE PLAN SKETCH

LOCATION:
3970 STONECREST ROAD
WEST CARLETON-MARCH WARD
CITY OF OTTAWA, ONTARIO

DESIGNED BY:	*DATE:*
--	AUGUST 2022
DRAWN BY:	*SCALE:*
CV	1:1,000

KOLLAARD FILE NUMBER:
220625

ATTACHMENT A

TW1 WELL RECORD AND MECP AREA WELL RECORDS

Ontario — Ministry of the Environment, Conservation and Parks

Well Tag No. (Place Sticker and/or Print Below) A324086

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
Hugh.	thayer		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
				6136019112

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3970 STONECREST RD	West Carleton	12	1

County/District/Municipality	City/Town/Village	Province	Postal Code
	Ruberco	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	412636	5030974	12	

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
white/grey	limestone			6'	225
	overburden	FILL	Rock & Fill	0'	6'

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	20'	Cement Grout	4 Bags 20

Method of Construction

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

Well Use

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

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼	STEEL	.188	0'	20'

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	Hole Diameter Depth To	Hole Diameter (cm/in)
57' ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0	20	6¼
219 ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	20		6"
225 ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify		225	

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify _____

If pumping discontinued, give reason:

Pump intake set at (m/ft): 110

Pumping rate (l/min / GPM): 8

Duration of pumping: 1 hrs + _____ min

Final water level end of pumping (m/ft): 101

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 155

Recommended pump rate (l/min/GPM): 65

Well production (l/min/GPM): 6.

Disinfected? ☑ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		17		101
1		17.58	1	98
2		23	2	88
3		28	3	85
4		33	4	78
5		36	5	75
10		37	10	57
15		39	15	41
20		53	20	26
25		59	25	17
30		65	30	
40		77	40	
50		90	50	
60		101	60	

Map of Well Location

Please provide a map below following instructions on the back.

County/District/Municipality	City/Town/Village	Province	Postal Code
	Kinburn	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	411263	5033074	12	

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
white/grey	Limestone			6'	22'
	overburden	Fill	Road Fill	0'	6'

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	20'	Cement Grout	4 Bags 80

Method of Construction

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

Well Use

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

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
6¼	STEEL	.188	0'	20'

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	Gas	Other, specify
57'	☐ Fresh ☐ Untested	☐	
219	☐ Fresh ☐ Untested	☐	
85	☐ Fresh ☐ Untested	☐	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	20	6¼
20	225	6"

Results of Well Yield Testing

After test of well yield, water was:
- ☑ Clear and sand free
- ☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 110

Pumping rate (l/min / GPM): 8

Duration of pumping: 1 hrs + ____ min

Final water level end of pumping (m/ft): 101

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 155

Recommended pump rate (l/min/GPM): 65

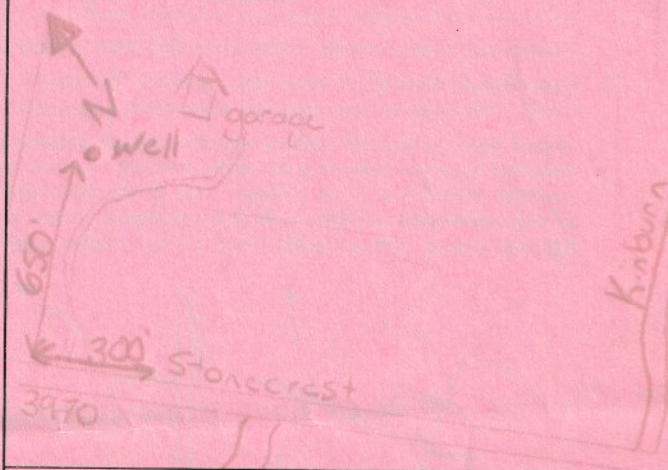
Well production (l/min/GPM): 6

Disinfected?
- ☑ Yes
- ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		17		101
1		17.58	1	98
2		23	2	88
3		28	3	85
4		33	4	78
5		36	5	75
10		37	10	57
15		39	15	41
20		53	20	26
25		59	25	17
30		65	30	
40		77	40	
50		90	50	
60		101	60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1KM off Kinburn

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Colts Plumbing Inc.	7763

Business Address (Street Number/Name)	Municipality
2547 County Rd 29	Missp. Mills

Province	Postal Code	Business E-mail Address
ON	K0A2X0	Plumbing by Colts@gmail.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6139905645	SIMON SKUSE

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
13710		

Well owner's information package delivered
- ☐ Yes
- ☐ No

Date Package Delivered

Date Work Completed

Ministry Use Only

Audit No. Z 370238

Received

0506E (2020/06) © Queen's Printer for Ontario, 2020

Well Owner's Copy

MINISTRY OF THE ENVIRONMENT

The Ontario Water Resources Act

WATER WELL RECORD

ONTARIO

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 1512360 | MUNICIP. 15001 | CON. GRN 12

COUNTY OR DISTRICT: CARLETON

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: ~~FOR BOSTON~~ FITZROY

CON., BLOCK, TRACT, SURVEY, ETC.: XII

LOT: 012

[redacted] #2 WOODLAWN, ONT

DATE COMPLETED: DAY 10 MO. 11 YR 72

032730 | RG. 4 | ELEVATION 0290 | RC. 5 | BASIN CODE 25

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	HARD PAN			0	18
	LIMESTONE			18	92

31 | 0018 | 14 | 0092 | 15

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0065	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
0070	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
0085	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
0090	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
06	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0020
~~6~~ 4	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE			~~20~~ 0092
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
13	17	~~CEMENT~~ GROUT

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☒ BAILER

PUMPING RATE: 0006 GPM

DURATION OF PUMPING: 01 HOURS 00 MINS

WATER LEVELS DURING: 1 ☐ PUMPING 2 ☒ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
017 FEET	052 FEET	024 FEET	019 FEET	018 FEET	018 FEET

IF FLOWING GIVE RATE: GPM

PUMP INTAKE SET AT: FEET

WATER AT END OF TEST: 1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP

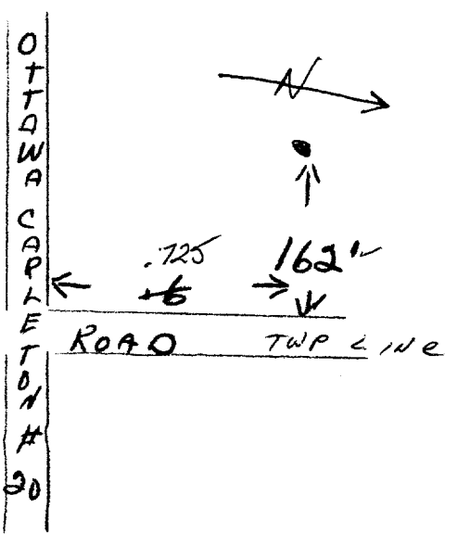
RECOMMENDED PUMP SETTING: 065 FEET

RECOMMENDED PUMPING RATE: 0005 GPM

0002 GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 01

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING

1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: MCLEAN WATER SUPPLY LTD — LICENCE NUMBER: 3504

ADDRESS: 1532 RAVEN AVE, OTTAWA, ONT

NAME OF DRILLER OR BORER: R. LASALLE — LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: R. LaSalle — SUBMISSION DATE: DAY 14 MO. 11 YR 72

OFFICE USE ONLY

DATA SOURCE 1 | CONTRACTOR 3504 | DATE RECEIVED 120273

DATE OF INSPECTION | INSPECTOR K

REMARKS: P K WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 07-091

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 (1 2)

1521926

MUNICIP (10 14) CON. (15 22 23 24)

COUNTY OR DISTRICT: OTTAWA CARLETON
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: WEST CARLETON
CON. BLOCK, TRACT, SURVEY, ETC: 1
LOT (25-27): 12
DATE COMPLETED (48-53): DAY 28 MO 10 YR 87

[redacted]

RING (24) RC (25) ELEVATION (26) RC (30) BASIN CODE (31) II III IV (47)

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
BROWN	SANDY	LOAM	LOOSE	0	8'
GREEN	GRANITE	WHITE	HARD	8'	60'
RED	GRANITE	GREEN	HARD	60'	75
WHITE	GRANITE		HARD	75	120'
RED	GRANITE	QUARTZ LAYERS	HARD	120'	130'

31 (1 2)
32 (10 14 15 21 32 43 54 65 75 80)

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
56 (10-13)	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS (14)
118 (15-18)	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS (19)
(20-23)	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS (24)
(25-28)	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS (29)
(30-33)	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS (34 80)

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 4 (10-11)	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC (12)	.188	0	22 (12-16)
6" (17-18)	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE 5 ☐ PLASTIC (19)		22	130' (20-23)
(24-25)	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC (26)			(27-30)

SCREEN

SIZE(S) OF OPENING (SLOT NO.) (31-33)	DIAMETER (34-38) INCHES	LENGTH (39-40) FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN (41-44) FEET	(80)

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
0 (10-13)	21 (18-17)	CEMENT GROUT TYPE 10
(18-21)	(22-25)	
(26-29)	(30-33) (80)	

71 PUMPING TEST

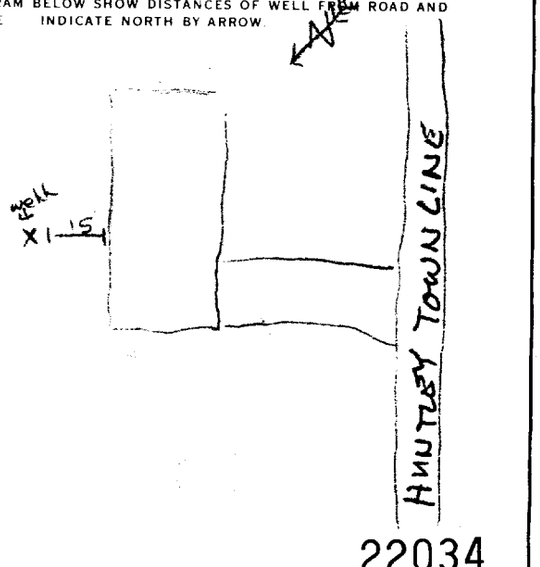
PUMPING TEST METHOD (10): 1 ☒ PUMP 2 ☐ BAILER
PUMPING RATE (11-14): 6 GPM
DURATION OF PUMPING (15-16 HOURS, 17-18 MINS): 2 HOURS

STATIC LEVEL (19-21)	WATER LEVEL END OF PUMPING (22-24)	WATER LEVELS DURING (25): 1 ☐ PUMPING 2 ☐ RECOVERY	15 MINUTES (26-28)	30 MINUTES (29-31)	45 MINUTES (32-34)	60 MINUTES (35-37)
25 FEET	120 FEET		120 FEET	120 FEET	120 FEET	120 FEET

IF FLOWING, GIVE RATE (38-41): GPM
PUMP INTAKE SET AT: 120 FEET
WATER AT END OF TEST (42): 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING (43-45): 120 FEET
RECOMMENDED PUMPING RATE (46-49): 6 GPM
(50-53)

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



22034

DRILLERS REMARKS

FINAL STATUS OF WELL (54)

1 ☒ WATER SUPPLY 5 ☐ ABANDONED, INSUFFICIENT SUPPLY
2 ☐ OBSERVATION WELL 6 ☐ ABANDONED, POOR QUALITY
3 ☐ TEST HOLE 7 ☐ UNFINISHED
4 ☐ RECHARGE WELL 9 ☐ DEWATERING

WATER USE (55-56)

1 ☒ DOMESTIC 5 ☐ COMMERCIAL
2 ☐ STOCK 6 ☐ MUNICIPAL
3 ☐ IRRIGATION 7 ☐ PUBLIC SUPPLY
4 ☐ INDUSTRIAL 8 ☐ COOLING OR AIR CONDITIONING
☐ OTHER 9 ☐ NOT USED

METHOD OF CONSTRUCTION (57)

1 ☐ CABLE TOOL 6 ☐ BORING
2 ☐ ROTARY (CONVENTIONAL) 7 ☐ DIAMOND
3 ☐ ROTARY (REVERSE) 8 ☐ JETTING
4 ☐ ROTARY (AIR) 9 ☐ DRIVING
5 ☒ AIR PERCUSSION ☐ DIGGING ☐ OTHER

5222

CONTRACTOR

NAME OF WELL CONTRACTOR: VALLEY DRILLING CO. LTD.
WELL CONTRACTOR'S LICENCE NUMBER: 5222
ADDRESS: P.O. BOX 437 CARP, ONT
NAME OF WELL TECHNICIAN: S. SKUSE (T-0310) BILL BISSON
WELL TECHNICIAN'S LICENCE NUMBER: T-0190
SIGNATURE OF TECHNICIAN/CONTRACTOR:
SUBMISSION DATE: DAY ____ MO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE (58) | CONTRACTOR (59-62) | DATE RECEIVED (63-68): NOV 10 1987 (80)
DATE OF INSPECTION | INSPECTOR
REMARKS

CSS/ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

Ministry of the Environment

Ontario

OTTAWA - CARLETON

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 1524054 | MUNICIP 15010 | CON. CON | 01

COUNTY OR DISTRICT: West Carleton

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: West Carleton.

CON. BLOCK, TRACT, SURVEY, ETC.: Plan 511130

LOT: 12

[redacted] 52 Baldwin ST woodlawn ONT

DATE COMPLETED: DAY 6 MO 11 YR 89

RC | ELEVATION | RC | BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Sand	Fill	compacted	0	10
white	Dolomite	Quartz	medium Hard	10	189
Grey	Shale	dolomite, mica	medium Soft	189	205

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
200	1 ☒ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☒ STEEL; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE	.188	0	22
6 1/8	1 ☐ STEEL; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☒ OPEN HOLE		22	205
	1 ☐ STEEL; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE:

DEPTH TO TOP OF SCREEN FEET:

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
22	5	Cement Grout

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER

PUMPING RATE: 5 GPM

DURATION OF PUMPING: 2 HOURS ___ MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
25 FEET	100 FEET	35 FEET	47 FEET	76 FEET	100 FEET

IF FLOWING, GIVE RATE: ___ GPM

PUMP INTAKE SET AT: 175 FEET

WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY

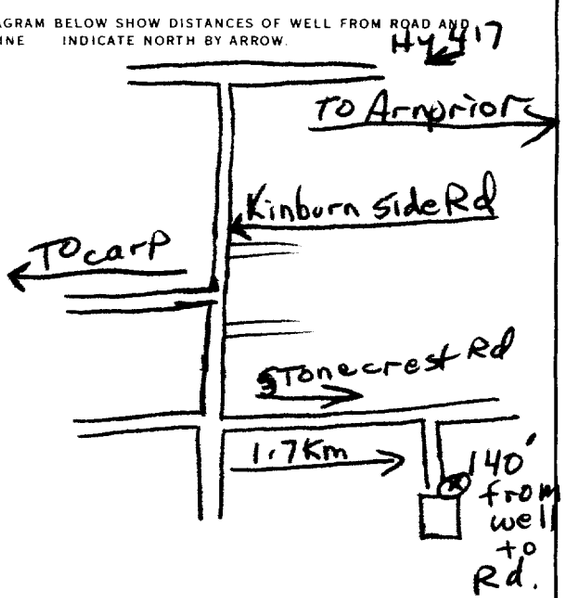
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP

RECOMMENDED PUMP SETTING: 175 FEET

RECOMMENDED PUMPING RATE: 5 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED

WATER USE

1 ☒ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF DRILLING

1 ☐ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☒ ROTARY (AIR); 5 ☒ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: Giffin Well Drilling LTD

LICENCE NUMBER: 2307

ADDRESS: RR #2 Renfrew ONT

NAME OF DRILLER OR BORER: Paul Giffin, Tim Behm

LICENCE NUMBER: T-0271

SIGNATURE OF CONTRACTOR: Paul Giffin

SUBMISSION DATE: DAY 15 MO 11 YR 89

OFFICE USE ONLY

DATA SOURCE:

CONTRACTOR: 2307

DATE RECEIVED: NOV 21 1989

DATE OF INSPECTION:

INSPECTOR:

REMARKS:

CSSIES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1524233

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT: Ottawa Carleton	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Dunrobin	CON: 1 Lot 2	LOT: 12
OWNER (SURNAME FIRST): Greenside Const.	ADDRESS: Nepean Ont. K2E 7K3 Suite 111-223 Colonnade Rd.	DATE COMPLETED: DAY 7 MO 2 YR 90	

Torbolton MUNICIP. Phase 2 CON. 01 Lot 2

21 | ZONE | EASTING | NORTHING | RC | ELEVATION | RC | BASIN CODE | II | III | IV

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Clay		Packed	0	1'
Brown	Sand	Clay	Packed	1'	17'
Brown	Sand		Med	17'	25'
Grey	Sand	Pea Stone	Course	25'	31'
Brown	Sand	Grey Sand	Med	31'	40'

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
25 to 28	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	188	0	25
5 1/2	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	188	15'	25
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
8	6 INCHES	3 FEET

MATERIAL AND TYPE: Stainless Steel

DEPTH TO TOP OF SCREEN: 25 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
0	20	Cement

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	10 GPM	2 HOURS ____ MINS

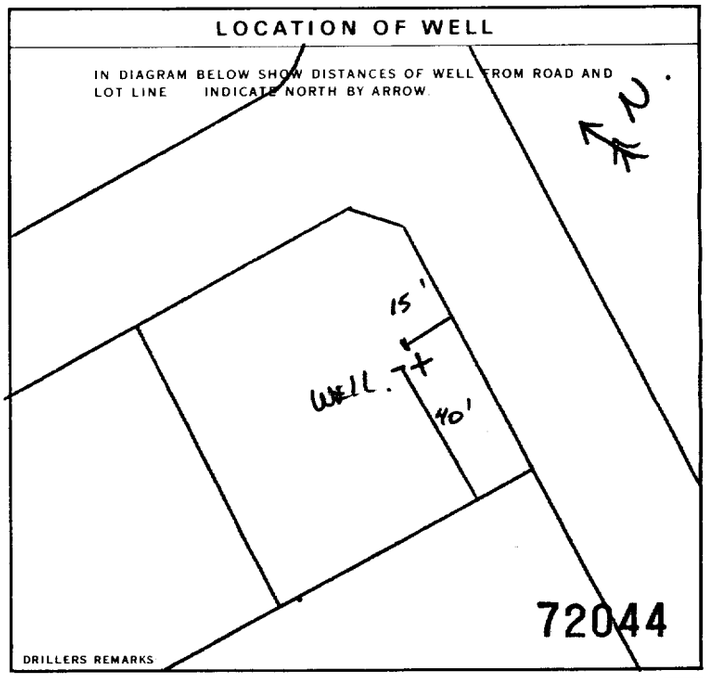
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (1 ☐ PUMPING 2 ☐ RECOVERY)	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
10 FEET	20 FEET		20 FEET	20 FEET	20 FEET	20 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	20 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☒ SHALLOW ☐ DEEP	20 FEET	4 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



72044

DRILLERS REMARKS

FINAL STATUS OF WELL: 1 ☐ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED; ☐ DEWATERING

WATER USE: 1 ☒ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF CONSTRUCTION: 1 ☐ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☒ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING; ☐ DIGGING; ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
Valley Drilling Inc	5222
ADDRESS: P.O. Box 437 Carp, Ont	
NAME OF WELL TECHNICIAN: Bill Bisson	WELL TECHNICIAN'S LICENCE NUMBER: 7-0190
SIGNATURE OF TECHNICIAN/CONTRACTOR	SUBMISSION DATE: DAY ____ MO ____ YR ____

OFFICE USE ONLY

DATA SOURCE	CONTRACTOR	DATE RECEIVED
	5222	MAR 28 1990
DATE OF INSPECTION	INSPECTOR	
REMARKS		

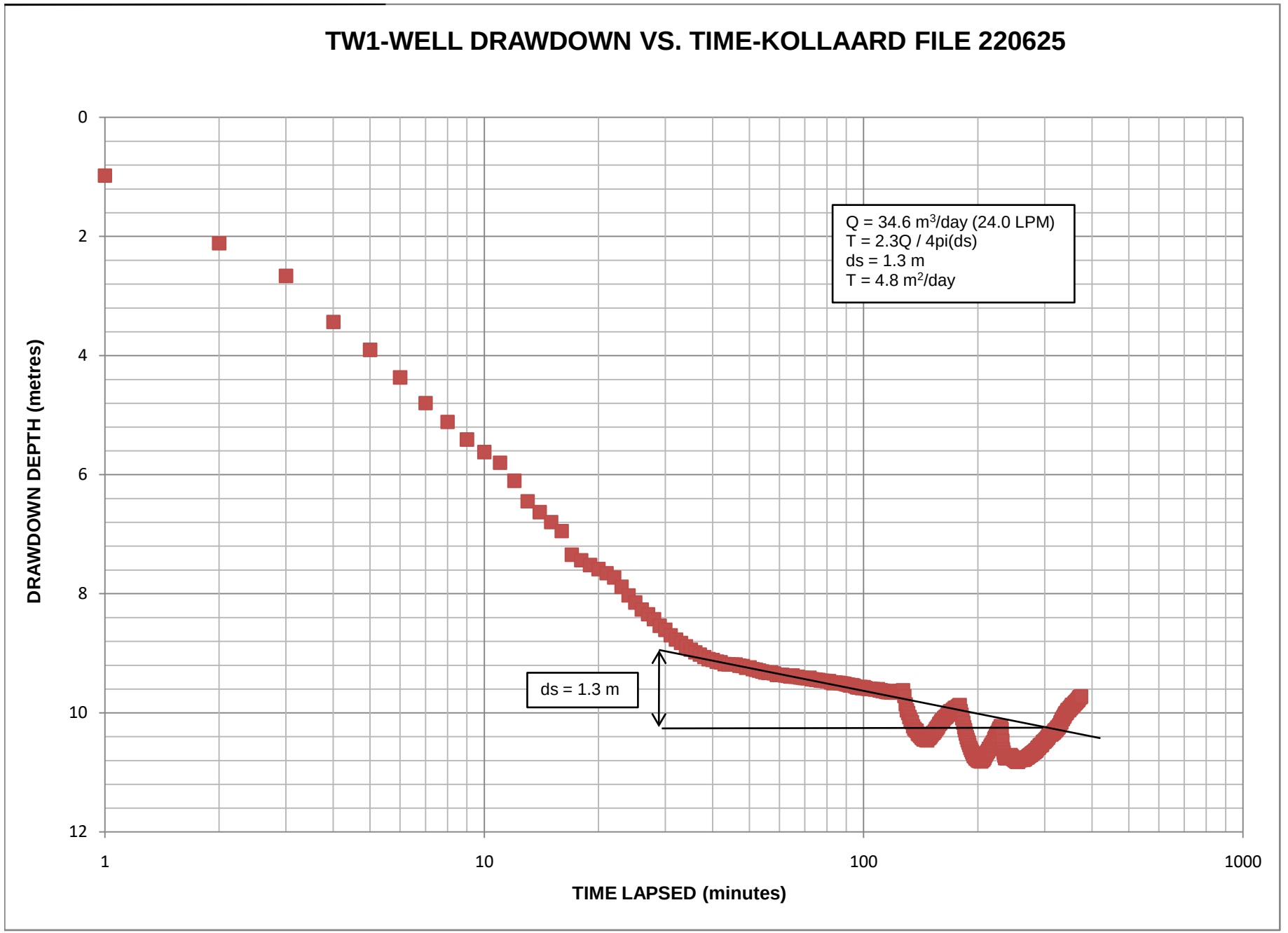
CCS. GS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

ATTACHMENT B

PUMPING TEST DATA


TW1-WELL DRAWDOWN VS. TIME-KOLLAARD FILE 220625
DRAWDOWN DEPTH (metres)
0
2
4
6
8
10
12
1
10
100
1000
TIME LAPSED (minutes)
Q = 34.6 m3/day (24.0 LPM)
T = 2.3Q / 4pi(ds)
ds = 1.3 m
T = 4.8 m2/day
ds = 1.3 m

Kollaard File 220625 Pump Rate 23.5 litres/minute

DRAWDOWN DATA TW1

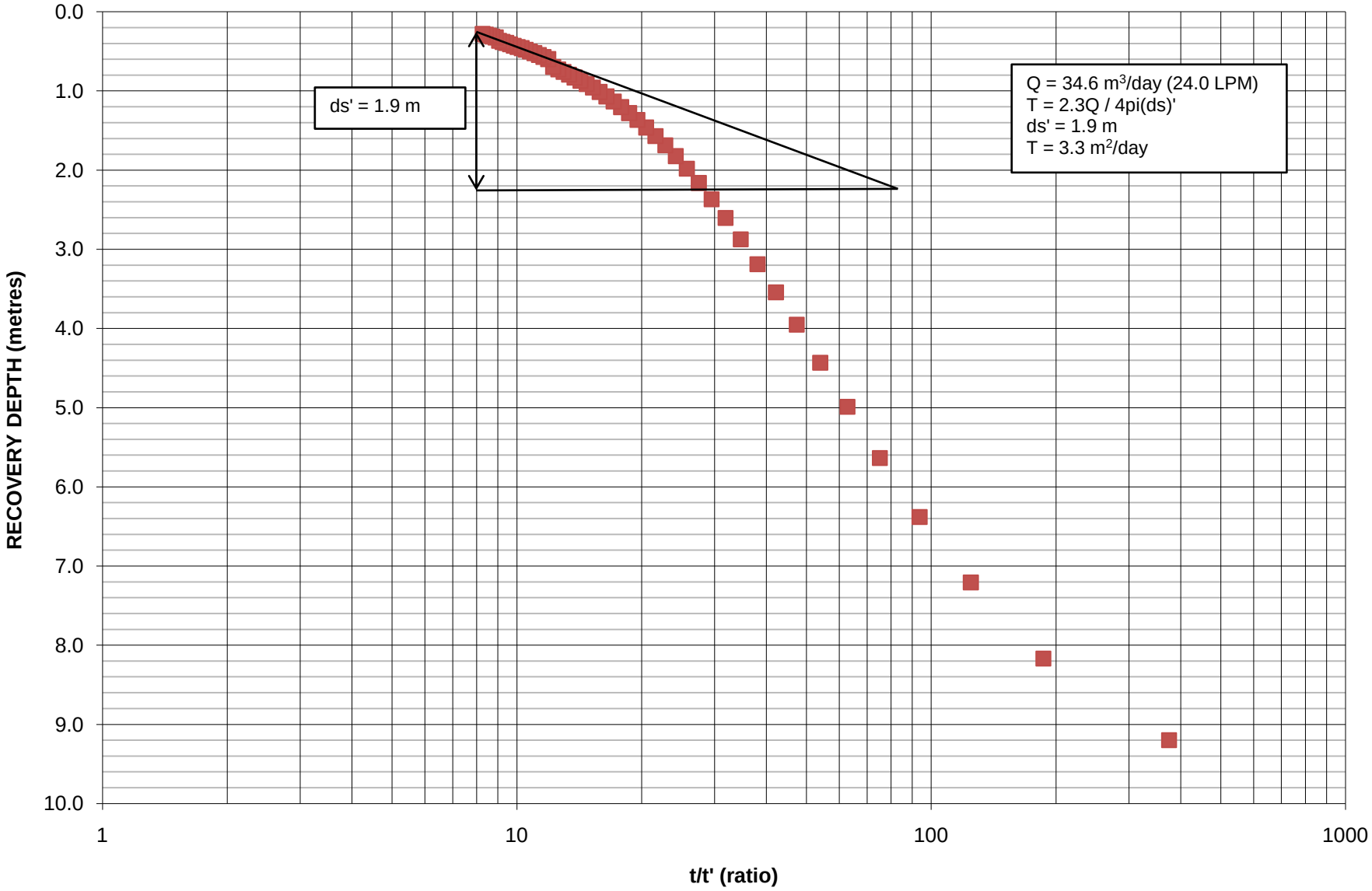
Time Lapsed (minutes)	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)
0	439.295	8.481	-4.5	0.00
1	429.715	8.481	-5.477	0.98
2	418.563	8.481	-6.614	2.11
3	413.198	8.481	-7.161	2.66
4	405.611	8.481	-7.935	3.44
5	401.016	8.481	-8.403	3.90
6	396.482	8.481	-8.866	4.37
7	392.242	8.481	-9.298	4.80
8	389.145	8.481	-9.614	5.11
9	386.253	8.481	-9.909	5.41
10	384.18	8.481	-10.12	5.62
11	382.428	8.481	-10.299	5.80
12	379.451	8.481	-10.602	6.10
13	376.096	8.481	-10.945	6.45
14	374.288	8.481	-11.129	6.63
15	372.655	8.481	-11.295	6.80
16	371.176	8.581	-11.446	6.95
17	367.271	8.581	-11.844	7.34
18	366.367	8.581	-11.937	7.44
19	365.581	8.581	-12.017	7.52
20	364.911	8.581	-12.085	7.59
21	364.241	8.581	-12.153	7.65
22	363.542	8.581	-12.225	7.73
23	361.999	8.581	-12.382	7.88
24	360.579	8.68	-12.527	8.03
25	359.415	8.68	-12.645	8.15
26	358.251	8.68	-12.764	8.26
27	357.465	8.68	-12.844	8.34
28	356.651	8.68	-12.927	8.43
29	355.574	8.68	-13.037	8.54
30	354.905	8.68	-13.105	8.61
31	354.003	8.68	-13.197	8.70
32	353.305	8.68	-13.269	8.77
33	352.753	8.68	-13.325	8.83
34	352.2	8.68	-13.381	8.88
35	351.648	8.68	-13.438	8.94
36	351.212	8.68	-13.482	8.98
37	350.834	8.68	-13.521	9.02
38	350.427	8.68	-13.562	9.06
39	350.078	8.68	-13.598	9.10
40	349.933	8.68	-13.612	9.11
41	349.671	8.68	-13.639	9.14
42	349.555	8.68	-13.651	9.15
43	349.264	8.68	-13.681	9.18
44	349.235	8.68	-13.684	9.18
45	349.206	8.68	-13.687	9.19
46	349.206	8.68	-13.687	9.19
47	349.002	8.68	-13.707	9.21
48	348.944	8.68	-13.713	9.21
49	348.654	8.68	-13.743	9.24
50	348.741	8.68	-13.734	9.23
51	348.45	8.68	-13.764	9.26
52	348.334	8.68	-13.775	9.28
53	348.189	8.68	-13.79	9.29
54	348.043	8.68	-13.805	9.31
55	347.898	8.68	-13.82	9.32
56	347.811	8.68	-13.829	9.33
57	347.898	8.68	-13.82	9.32
58	347.724	8.68	-13.838	9.34
59	347.491	8.68	-13.861	9.36
60	347.469	8.779	-13.864	9.36
61	347.498	8.779	-13.861	9.36
62	347.411	8.779	-13.87	9.37
63	347.352	8.779	-13.876	9.38
64	347.236	8.779	-13.887	9.39
65	347.381	8.779	-13.873	9.37
66	347.178	8.779	-13.893	9.39
67	347.178	8.779	-13.893	9.39
68	347.062	8.779	-13.905	9.41
69	347.033	8.779	-13.908	9.41
70	346.946	8.779	-13.917	9.42
71	346.917	8.779	-13.92	9.42
72	347.033	8.779	-13.908	9.41
73	346.771	8.779	-13.935	9.44
74	346.742	8.779	-13.938	9.44
75	346.684	8.779	-13.944	9.44
76	346.655	8.779	-13.947	9.45
77	346.568	8.779	-13.956	9.46
78	346.51	8.779	-13.961	9.46
79	346.51	8.779	-13.961	9.46
80	346.452	8.779	-13.967	9.47
81	346.481	8.779	-13.964	9.46
82	346.277	8.779	-13.985	9.49
83	346.132	8.779	-14	9.50
84	346.248	8.779	-13.988	9.49
85	346.19	8.779	-13.994	9.49
86	346.19	8.779	-13.994	9.49
87	346.103	8.779	-14.003	9.50
88	346.074	8.779	-14.006	9.51
89	346.045	8.779	-14.009	9.51

90	345.929	8.779	-14.021	9.52
91	345.9	8.779	-14.024	9.52
92	345.725	8.779	-14.041	9.54
93	345.812	8.779	-14.033	9.53
94	345.725	8.779	-14.041	9.54
95	345.58	8.779	-14.056	9.56
96	345.435	8.779	-14.071	9.57
97	345.406	8.779	-14.074	9.57
98	345.493	8.779	-14.065	9.57
99	345.289	8.779	-14.086	9.59
100	345.464	8.779	-14.068	9.57
101	345.318	8.779	-14.083	9.58
102	345.231	8.779	-14.092	9.59
103	345.202	8.779	-14.095	9.60
104	345.202	8.779	-14.095	9.60
105	345.144	8.779	-14.101	9.60
106	345.144	8.779	-14.101	9.60
107	345.086	8.779	-14.107	9.61
108	345.086	8.779	-14.107	9.61
109	345.144	8.779	-14.101	9.60
110	344.912	8.779	-14.124	9.62
111	344.97	8.779	-14.118	9.62
112	344.825	8.779	-14.133	9.63
113	344.883	8.779	-14.127	9.63
114	344.737	8.779	-14.142	9.64
115	344.679	8.779	-14.148	9.65
116	344.621	8.779	-14.154	9.65
117	344.766	8.779	-14.139	9.64
118	344.592	8.779	-14.157	9.66
119	344.592	8.779	-14.157	9.66
120	344.592	8.779	-14.157	9.66
121	344.563	8.779	-14.16	9.66
122	344.679	8.779	-14.148	9.65
123	344.854	8.779	-14.13	9.63
124	344.766	8.779	-14.139	9.64
125	344.766	8.779	-14.139	9.64
126	344.854	8.779	-14.13	9.63
127	344.941	8.779	-14.121	9.62
128	344.011	8.779	-14.216	9.72
129	342.646	8.779	-14.355	9.86
130	341.659	8.779	-14.456	9.96
131	341.194	8.779	-14.504	10.00
132	340.555	8.779	-14.569	10.07
133	340.004	8.779	-14.625	10.13
134	339.684	8.779	-14.657	10.16
135	339.017	8.779	-14.726	10.23
136	338.61	8.779	-14.767	10.27
137	338.407	8.779	-14.788	10.29
138	338.262	8.779	-14.802	10.30
139	337.797	8.779	-14.85	10.35
140	337.623	8.779	-14.868	10.37
141	337.42	8.779	-14.888	10.39
142	337.188	8.779	-14.912	10.41
143	337.043	8.779	-14.927	10.43
144	336.869	8.779	-14.945	10.45
145	336.869	8.779	-14.945	10.45
146	336.724	8.779	-14.959	10.46
147	336.695	8.779	-14.962	10.46
148	337.043	8.779	-14.927	10.43
149	337.159	8.779	-14.915	10.42
150	337.362	8.779	-14.894	10.39
151	337.652	8.779	-14.865	10.37
152	337.884	8.779	-14.841	10.34
153	337.972	8.779	-14.832	10.33
154	338.204	8.779	-14.808	10.31
155	338.552	8.779	-14.773	10.27
156	338.726	8.779	-14.755	10.26
157	338.987	8.779	-14.729	10.23
158	339.365	8.779	-14.69	10.19
159	339.539	8.779	-14.672	10.17
160	339.829	8.779	-14.643	10.14
161	339.975	8.779	-14.628	10.13
162	340.062	8.779	-14.619	10.12
163	340.352	8.779	-14.589	10.09
164	340.526	8.779	-14.572	10.07
165	340.613	8.779	-14.563	10.06
166	340.846	8.779	-14.539	10.04
167	341.02	8.779	-14.521	10.02
168	341.223	8.779	-14.501	10.00
169	341.484	8.779	-14.474	9.97
170	341.484	8.779	-14.474	9.97
171	341.572	8.779	-14.465	9.97
172	341.746	8.779	-14.447	9.95
173	341.833	8.779	-14.438	9.94
174	342.036	8.779	-14.418	9.92
175	342.094	8.779	-14.412	9.91
176	342.123	8.779	-14.409	9.91
177	342.268	8.779	-14.394	9.89
178	342.385	8.779	-14.382	9.88
179	342.53	8.779	-14.367	9.87
180	341.542	8.779	-14.468	9.97
181	340.933	8.779	-14.53	10.03
182	340.352	8.779	-14.589	10.09
183	339.597	8.779	-14.666	10.17
184	338.871	8.779	-14.74	10.24
185	338.378	8.779	-14.791	10.29

186	337.797	8.779	-14.85	10.35
187	337.217	8.779	-14.909	10.41
188	336.753	8.779	-14.956	10.46
189	336.346	8.779	-14.998	10.50
190	335.911	8.779	-15.042	10.54
191	335.476	8.779	-15.087	10.59
192	335.128	8.779	-15.122	10.62
193	334.808	8.779	-15.155	10.66
194	334.518	8.779	-15.184	10.68
195	334.17	8.779	-15.22	10.72
196	333.996	8.779	-15.238	10.74
197	333.735	8.779	-15.264	10.76
198	333.706	8.779	-15.267	10.77
199	333.561	8.779	-15.282	10.78
200	333.416	8.779	-15.297	10.80
201	333.329	8.779	-15.306	10.81
202	333.358	8.779	-15.303	10.80
203	333.271	8.779	-15.311	10.81
204	333.213	8.779	-15.317	10.82
205	333.387	8.779	-15.3	10.80
206	333.503	8.779	-15.288	10.79
207	333.619	8.779	-15.276	10.78
208	333.822	8.779	-15.255	10.76
209	334.141	8.779	-15.223	10.72
210	334.373	8.779	-15.199	10.70
211	334.634	8.779	-15.172	10.67
212	334.808	8.779	-15.155	10.66
213	334.983	8.779	-15.137	10.64
214	335.302	8.779	-15.104	10.60
215	335.302	8.779	-15.104	10.60
216	335.679	8.779	-15.066	10.57
217	335.94	8.779	-15.039	10.54
218	336.027	8.779	-15.03	10.53
219	336.317	8.779	-15.001	10.50
220	336.462	8.779	-14.986	10.49
221	336.898	8.779	-14.942	10.44
222	337.13	8.779	-14.918	10.42
223	337.391	8.779	-14.891	10.39
224	337.565	8.779	-14.874	10.37
225	337.913	8.779	-14.838	10.34
226	338.059	8.779	-14.823	10.32
227	338.407	8.779	-14.788	10.29
228	338.639	8.779	-14.764	10.26
229	338.726	8.779	-14.755	10.26
230	339.046	8.779	-14.723	10.22
231	338.523	8.779	-14.776	10.28
232	336.636	8.779	-14.968	10.47
233	335.244	8.779	-15.11	10.61
234	334.692	8.779	-15.167	10.67
235	334.199	8.779	-15.217	10.72
236	333.793	8.779	-15.258	10.76
237	333.822	8.779	-15.255	10.76
238	333.735	8.779	-15.264	10.76
239	333.88	8.779	-15.249	10.75
240	333.909	8.779	-15.246	10.75
241	334.025	8.779	-15.235	10.74
242	334.054	8.779	-15.232	10.73
243	334.054	8.779	-15.232	10.73
244	334.286	8.779	-15.208	10.71
245	334.112	8.779	-15.226	10.73
246	334.025	8.779	-15.235	10.74
247	333.851	8.779	-15.252	10.75
248	333.619	8.779	-15.276	10.78
249	333.59	8.779	-15.279	10.78
250	333.445	8.779	-15.294	10.79
251	333.387	8.779	-15.3	10.80
252	333.271	8.779	-15.311	10.81
253	333.271	8.779	-15.311	10.81
254	333.155	8.779	-15.323	10.82
255	333.155	8.779	-15.323	10.82
256	333.3	8.779	-15.308	10.81
257	333.474	8.779	-15.291	10.79
258	333.445	8.779	-15.294	10.79
259	333.503	8.779	-15.288	10.79
260	333.474	8.779	-15.291	10.79
261	333.561	8.779	-15.282	10.78
262	333.532	8.779	-15.285	10.79
263	333.619	8.779	-15.276	10.78
264	333.503	8.779	-15.288	10.79
265	333.648	8.779	-15.273	10.77
266	333.59	8.779	-15.279	10.78
267	333.822	8.779	-15.255	10.76
268	333.822	8.779	-15.255	10.76
269	333.88	8.779	-15.249	10.75
270	333.909	8.779	-15.246	10.75
271	333.996	8.779	-15.238	10.74
272	334.083	8.779	-15.229	10.73
273	334.199	8.779	-15.217	10.72
274	334.228	8.779	-15.214	10.71
275	334.315	8.779	-15.205	10.71
276	334.286	8.779	-15.208	10.71
277	334.518	8.779	-15.184	10.68
278	334.547	8.779	-15.181	10.68
279	334.576	8.779	-15.178	10.68
280	334.721	8.779	-15.164	10.66
281	334.75	8.779	-15.161	10.66

282	334.866	8.779	-15.149	10.65
283	334.866	8.779	-15.149	10.65
284	335.07	8.779	-15.128	10.63
285	335.012	8.779	-15.134	10.63
286	335.215	8.779	-15.113	10.61
287	335.418	8.779	-15.093	10.59
288	335.534	8.779	-15.081	10.58
289	335.476	8.779	-15.087	10.59
290	335.592	8.779	-15.075	10.58
291	335.824	8.779	-15.051	10.55
292	335.824	8.779	-15.051	10.55
293	335.998	8.779	-15.033	10.53
294	335.911	8.779	-15.042	10.54
295	335.998	8.779	-15.033	10.53
296	336.288	8.779	-15.004	10.50
297	336.433	8.779	-14.989	10.49
298	336.52	8.779	-14.98	10.48
299	336.491	8.779	-14.983	10.48
300	336.578	8.779	-14.974	10.47
301	336.753	8.779	-14.956	10.46
302	336.753	8.779	-14.956	10.46
303	336.927	8.779	-14.939	10.44
304	336.985	8.779	-14.933	10.43
305	337.188	8.779	-14.912	10.41
306	337.159	8.779	-14.915	10.42
307	337.449	8.779	-14.885	10.39
308	337.478	8.779	-14.882	10.38
309	337.739	8.779	-14.856	10.36
310	337.681	8.779	-14.862	10.36
311	337.739	8.779	-14.856	10.36
312	337.681	8.779	-14.862	10.36
313	337.768	8.779	-14.853	10.35
314	337.855	8.779	-14.844	10.34
315	337.913	8.779	-14.838	10.34
316	337.943	8.779	-14.835	10.34
317	338.03	8.779	-14.826	10.33
318	338.175	8.779	-14.811	10.31
319	338.349	8.779	-14.794	10.29
320	338.291	8.779	-14.8	10.30
321	338.407	8.779	-14.788	10.29
322	338.523	8.779	-14.776	10.28
323	338.581	8.779	-14.77	10.27
324	338.784	8.779	-14.749	10.25
325	338.813	8.779	-14.746	10.25
326	338.871	8.779	-14.74	10.24
327	339.017	8.779	-14.726	10.23
328	339.162	8.779	-14.711	10.21
329	339.22	8.779	-14.705	10.21
330	339.568	8.779	-14.669	10.17
331	339.771	8.779	-14.649	10.15
332	339.655	8.779	-14.66	10.16
333	340.149	8.779	-14.61	10.11
334	340.236	8.779	-14.601	10.10
335	340.236	8.779	-14.601	10.10
336	340.497	8.779	-14.575	10.08
337	340.584	8.779	-14.566	10.07
338	340.7	8.779	-14.554	10.05
339	340.933	8.779	-14.53	10.03
340	341.107	8.779	-14.512	10.01
341	341.194	8.779	-14.504	10.00
342	341.223	8.779	-14.501	10.00
343	341.252	8.779	-14.498	10.00
344	341.484	8.779	-14.474	9.97
345	341.659	8.779	-14.456	9.96
346	341.717	8.779	-14.45	9.95
347	341.717	8.779	-14.45	9.95
348	341.688	8.779	-14.453	9.95
349	341.978	8.779	-14.424	9.92
350	342.036	8.779	-14.418	9.92
351	341.978	8.779	-14.424	9.92
352	342.21	8.779	-14.4	9.90
353	342.21	8.779	-14.4	9.90
354	342.501	8.779	-14.37	9.87
355	342.472	8.779	-14.373	9.87
356	342.53	8.779	-14.367	9.87
357	342.53	8.779	-14.367	9.87
358	342.617	8.779	-14.358	9.86
359	342.762	8.779	-14.344	9.84
360	342.849	8.779	-14.335	9.84
361	342.849	8.779	-14.335	9.84
362	342.995	8.779	-14.32	9.82
363	343.024	8.779	-14.317	9.82
364	343.111	8.779	-14.308	9.81
365	343.227	8.779	-14.296	9.80
366	343.256	8.779	-14.293	9.79
367	343.43	8.779	-14.276	9.78
368	343.372	8.779	-14.281	9.78
369	343.605	8.779	-14.258	9.76
370	343.75	8.779	-14.243	9.74
371	343.808	8.779	-14.237	9.74
372	343.866	8.779	-14.231	9.73
373	343.837	8.779	-14.234	9.73
374	343.953	8.779	-14.222	9.72

TW1- WELL RECOVERY VS. TIME - KOLLAARD FILE 220625



Kollaard File 220625

RECOVERY DATA TW-1

t'	t / t'	Abs Pres (kPa)	Temp (°C)	Water Level (m)	Drawdown (m)	Recovery (%)
1	375	349.096	8.779	-13.698	9.20	5%
2	186.5	359.189	8.779	-12.669	8.17	16%
3	124.7	368.625	8.779	-11.706	7.21	26%
4	93.8	376.73	8.779	-10.88	6.38	34%
5	75.2	384.027	8.779	-10.136	5.64	42%
6	62.8	390.365	8.779	-9.489	4.99	49%
7	54.0	395.832	8.779	-8.932	4.43	54%
8	47.4	400.542	8.779	-8.452	3.95	59%
9	42.2	404.551	8.779	-8.043	3.54	64%
10	38.1	408.036	8.779	-7.688	3.19	67%
11	34.7	411.112	8.779	-7.374	2.87	70%
12	31.9	413.749	8.779	-7.105	2.61	73%
13	29.5	416.065	8.779	-6.869	2.37	76%
14	27.5	418.088	8.779	-6.663	2.16	78%
15	25.7	419.848	8.779	-6.483	1.98	80%
16	24.2	421.403	8.779	-6.324	1.82	81%
17	22.8	422.753	8.779	-6.187	1.69	83%
18	21.6	423.897	8.779	-6.07	1.57	84%
19	20.5	424.954	8.779	-5.962	1.46	85%
20	19.6	425.893	8.779	-5.867	1.37	86%
21	18.7	426.744	8.779	-5.78	1.28	87%
22	17.9	427.478	8.779	-5.705	1.21	88%
23	17.1	428.183	8.779	-5.633	1.13	88%
24	16.5	428.8	8.779	-5.57	1.07	89%
25	15.8	429.358	8.779	-5.513	1.01	90%
26	15.3	429.886	8.779	-5.459	0.96	90%
27	14.7	430.356	8.779	-5.412	0.91	91%
28	14.3	430.738	8.779	-5.373	0.87	91%
29	13.8	431.141	8.68	-5.331	0.83	91%
30	13.4	431.494	8.68	-5.295	0.80	92%
31	13.0	431.846	8.68	-5.26	0.76	92%
32	12.6	432.148	8.779	-5.229	0.73	93%
33	12.2	432.463	8.68	-5.197	0.70	93%
34	11.9	433.433	8.68	-5.098	0.60	94%
35	11.6	433.697	8.68	-5.071	0.57	94%
36	11.3	433.932	8.68	-5.047	0.55	94%
37	11.0	434.167	8.68	-5.023	0.52	95%
38	10.8	434.373	8.68	-5.002	0.50	95%
39	10.5	434.579	8.68	-4.981	0.48	95%
40	10.3	434.784	8.68	-4.96	0.46	95%
41	10.0	434.931	8.68	-4.945	0.45	95%
42	9.8	435.078	8.68	-4.93	0.43	96%
43	9.6	435.255	8.68	-4.912	0.41	96%
44	9.4	435.431	8.68	-4.894	0.39	96%
45	9.2	435.549	8.68	-4.882	0.38	96%
46	9.1	435.695	8.68	-4.867	0.37	96%
47	8.9	436.107	8.68	-4.825	0.33	97%
48	8.7	436.225	8.68	-4.813	0.31	97%
49	8.6	436.342	8.68	-4.801	0.30	97%
50	8.4	436.46	8.68	-4.789	0.29	97%
51	8.3	436.548	8.68	-4.78	0.28	97%

ATTACHMENT C

WATER QUALITY RESULTS

Certificate of Analysis

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

Report Number: 1978919
Date Submitted: 2022-06-09
Date Reported: 2022-06-16
Project: 220625
COC #: 891662

Dear Colleen Vermeersch:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Emma-Dawn Ferguson 2022.06.16 15:48:10 -04'00'

APPROVAL: _____
Emma-Dawn Ferguson, Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

eurofins | Environment Testing

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1630242 Water 2022-06-09 TW1-3hrs	1630243 Water 2022-06-09 TW1-6hrs
Anions	Cl	1	mg/L	AO 250		194	202
	F	0.10	mg/L	MAC 1.5		1.85*	1.85*
	N-NO2	0.10	mg/L	MAC 1.0		<0.10	<0.10
	N-NO3	0.10	mg/L	MAC 10.0		<0.10	<0.10
	SO4	1	mg/L	AO 500		62	60
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 30-500		187	186
	Colour (True)	2	TCU			<2	<2
	Conductivity	5	uS/cm			978	992
	pH	1.00		6.5-8.5		7.77	7.84
	Phenols	0.001	mg/L			<0.001	<0.001
	S2-	0.01	mg/L	AO 0.05		<0.01	<0.01
	TDS (COND - CALC)	1	mg/L	AO 500		636*	645*
	Turbidity	0.1	NTU	AO 5		0.6	0.6
Hardness	Hardness as CaCO3	1	mg/L	OG 80-100		352*	366*
Indices/Calc	Ion Balance	0.01				0.93	0.91
Metals	Ag	0.0001	mg/L			<0.0001	<0.0001
	Al	0.01	mg/L	OG 0.1		<0.01	<0.01
	As	0.001	mg/L	IMAC 0.01		<0.001	<0.001
	B	0.01	mg/L	IMAC 5.0		0.21	0.20
	Ba	0.01	mg/L	MAC 1.0		0.18	0.19
	Be	0.0005	mg/L			<0.0005	<0.0005
	Ca	1	mg/L			90	94
	Cd	0.0001	mg/L	MAC 0.005		<0.0001	<0.0001
	Co	0.0002	mg/L			<0.0002	<0.0002
	Cr	0.001	mg/L	MAC 0.05		<0.001	<0.001

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

eurofins | Environment Testing

Certificate of Analysis

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Project: 220625
COC #: 891662

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1630242 Water 2022-06-09 TW1-3hrs	1630243 Water 2022-06-09 TW1-6hrs
Metals	Cu	0.001	mg/L	AO 1		<0.001	<0.001
	Fe	0.03	mg/L	AO 0.3		0.06	0.07
	Hg	0.0001	mg/L	MAC 0.001		<0.0001	<0.0001
	K	1	mg/L			6	6
	Mg	1	mg/L			31	32
	Mn	0.01	mg/L	AO 0.05		0.02	0.02
	Mo	0.005	mg/L			<0.005	<0.005
	Na	1	mg/L	AO 200		60	53
	Ni	0.005	mg/L			<0.005	<0.005
	Pb	0.001	mg/L	MAC 0.010		<0.001	<0.001
	Sb	0.0005	mg/L	IMAC 0.006		<0.0005	<0.0005
	Se	0.001	mg/L	MAC 0.05		<0.001	<0.001
	Sr	0.001	mg/L			6.83	7.11
	Tl	0.0001	mg/L			<0.0001	<0.0001
	U	0.001	mg/L	MAC 0.02		<0.001	<0.001
	V	0.001	mg/L			<0.001	<0.001
	Zn	0.01	mg/L	AO 5		0.01	<0.01
Nutrients	N-NH3	0.010	mg/L			0.142	0.175
	Total Kjeldahl Nitrogen	0.100	mg/L			0.592	0.890
Subcontract	Tannin & Lignin	1.0	mg/L			<1.0	<1.0
Subcontract-Inorg	DOC	0.5	mg/L	AO 5		1.0	0.8

Guideline = ODWSOG *** = Guideline Exceedence**

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 423522 **Analysis/Extraction Date** 2022-06-10 **Analyst** NF **Method** C SM2130B			
Turbidity	<0.1 NTU	99	70-130
Run No 423561 **Analysis/Extraction Date** 2022-06-10 **Analyst** SD **Method** EPA 200.8			
Silver	<0.0001 mg/L	114	80-120
Aluminum	<0.01 mg/L	107	80-120
Arsenic	<0.001 mg/L	103	80-120
Boron (total)	<0.01 mg/L	108	80-120
Barium	<0.01 mg/L	104	80-120
Beryllium	<0.0005 mg/L	107	80-120
Cadmium	<0.0001 mg/L	105	80-120
Cobalt	<0.0002 mg/L	103	80-120
Chromium Total	<0.001 mg/L	105	80-120
Copper	<0.001 mg/L	108	80-120
Iron	<0.03 mg/L	100	80-120
Mercury	<0.0001 mg/L	117	80-120
Manganese	<0.01 mg/L	104	80-120

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Certificate of Analysis

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

Report Number: 1978919
Date Submitted: 2022-06-09
Date Reported: 2022-06-16
Project: 220625
COC #: 891662

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Molybdenum	<0.005 mg/L	96	80-120
Nickel	<0.005 mg/L	106	80-120
Lead	<0.001 mg/L	113	80-120
Antimony	<0.0005 mg/L	93	80-120
Selenium	<0.001 mg/L	112	80-120
Strontium	<0.001 mg/L	101	80-120
Thallium	<0.0001 mg/L	111	80-120
Uranium	<0.001 mg/L	98	80-120
Vanadium	<0.001 mg/L	103	80-120
Zinc	<0.01 mg/L	118	80-120
Run No 423616 **Analysis/Extraction Date** 2022-06-12 **Analyst** ML **Method** EPA 350.1			
N-NH3	<0.010 mg/L	106	80-120
Run No 423622 **Analysis/Extraction Date** 2022-06-13 **Analyst** AaN **Method** SM 4110			
N-NO2	<0.10 mg/L	105	90-110
N-NO3	<0.10 mg/L	106	90-110
SO4	<1 mg/L	105	90-110

Guideline = ODWSOG *** = Guideline Exceedence**

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Methods references and/or additional QA/QC information available on request.

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Date Submitted: 2022-06-09
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Project: 220625
COC #: 891662

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 423655 **Analysis/Extraction Date** 2022-06-13 **Analyst** AsA **Method** C SM4500-FC			
F	<0.10 mg/L	100	90-110
Run No 423658 **Analysis/Extraction Date** 2022-06-13 **Analyst** Z S **Method** M SM3120B-3500C			
Calcium	<1 mg/L	101	90-110
Potassium	<1 mg/L	102	87-113
Magnesium	<1 mg/L	95	76-124
Sodium	<1 mg/L	107	82-118
Run No 423693 **Analysis/Extraction Date** 2022-06-13 **Analyst** AsA **Method** SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	100	90-110
Conductivity	<5 uS/cm	99	90-110
pH		100	90-110
Run No 423696 **Analysis/Extraction Date** 2022-06-10 **Analyst** AET **Method** SUBCONTRACT-A			
Tannin & Lignin	<1.0 mg/L	101	
Run No 423704 **Analysis/Extraction Date** 2022-06-14 **Analyst** AaN **Method** SM 4110			

Guideline = ODWSOG *** = Guideline Exceedence**

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

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Report Number: 1978919
Date Submitted: 2022-06-09
Date Reported: 2022-06-16
Project: 220625
COC #: 891662

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Chloride	<5 mg/L		90-110
Run No 423728 **Analysis/Extraction Date** 2022-06-13 **Analyst** AET **Method** SUBCONTRACT-CA-INORG			
DOC			
Run No 423794 **Analysis/Extraction Date** 2022-06-14 **Analyst** SKH **Method** EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	101	70-130
Run No 423798 **Analysis/Extraction Date** 2022-06-15 **Analyst** AsA **Method** C SM2120C			
Colour (True)	<2 TCU		80-120
Run No 423864 **Analysis/Extraction Date** 2022-06-16 **Analyst** AET **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 423951 **Analysis/Extraction Date** 2022-06-16 **Analyst** Z S **Method** SM5530D/EPA420.2			
Phenols	<0.001 mg/L	101	50-120

Guideline = ODWSOG *** = Guideline Exceedence**

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Methods references and/or additional QA/QC information available on request.

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

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Attention: Ms. Colleen Vermeersch
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Invoice to: Kollaard Associates Inc.

Report Number: 1978919
Date Submitted: 2022-06-09
Date Reported: 2022-06-16
Project: 220625
COC #: 891662

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 423952 **Analysis/Extraction Date** 2022-06-16 **Analyst** AsA **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	90	80-120

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

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Attention: Ms. Colleen Vermeersch
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Invoice to: Kollaard Associates Inc.

Report Number: 1978919
Date Submitted: 2022-06-09
Date Reported: 2022-06-16
Project: 220625
COC #: 891662

Sample Comment Summary

Sample ID: 1630242 TW1-3hrs For this report: Cl MRL elevated due to matrix interference (dilution was done).

Guideline = ODWSOG *** = Guideline Exceedence**

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Methods references and/or additional QA/QC information available on request.

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

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K0G 1J0
Attention: Ms. Colleen Vermeersch
PO#:
Invoice to: Kollaard Associates Inc.

Report Number: 1978920
Date Submitted: 2022-06-09
Date Reported: 2022-06-13
Project: 220625
COC #: 891662

Dear Colleen Vermeersch:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Emma-Dawn Ferguson 2022.06.13 10:37:21 -04'00'

APPROVAL: _____
Emma-Dawn Ferguson, Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

eurofins | Environment Testing

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

Report Number: 1978920
Date Submitted: 2022-06-09
Date Reported: 2022-06-13
Project: 220625
COC #: 891662

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1630244 Water 2022-06-09 TW1-3hrs	1630245 Water 2022-06-09 TW1-6hrs
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0		0	0
	Heterotrophic Plate Count	0	ct/1mL			31	25
	Total Coliforms	0	ct/100mL	MAC 0		0	0

Guideline = ODWSOG *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Analytical Method: AMBCOLM1
additional QA/QC information available on request.

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

Certificate of Analysis

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

Report Number: 1978338
Date Submitted: 2022-06-02
Date Reported: 2022-06-06
Project: 3970 Stonecrest
COC #: 891347

Dear Colleen Vermeersch:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Emma-Dawn Ferguson, Chemist

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Certificate of Analysis

eurofins | Environment Testing

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

Report Number: 1978338
Date Submitted: 2022-06-02
Date Reported: 2022-06-06
Project: 3970 Stonecrest
COC #: 891347

				Lab I.D.	1628763
				Sample Matrix	Water
				Sample Type	
				Sampling Date	2022-06-02
				Sample I.D.	3970 Stonecrest
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	F	0.10	mg/L	MAC 1.5	0.94

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

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Attention: Ms. Colleen Vermeersch
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Invoice to: Kollaard Associates Inc.

Report Number: 1978338
Date Submitted: 2022-06-02
Date Reported: 2022-06-06
Project: 3970 Stonecrest
COC #: 891347

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 423156 **Analysis/Extraction Date** 2022-06-03 **Analyst** AsA **Method** SM2320,2510,4500H/F			
F	<0.10 mg/L	101	90-110

Guideline = ODWSOG *** = Guideline Exceedence**

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

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

Ryznar Stability Index

RSI = 2(pH_s) - pH

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

Langelier Saturation Index

LSI = pH - pH_s

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

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

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

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

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

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

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

	TW1-3hr	TW1-final
pH	7.77	7.84
hardness [mg/l as $CaCO_3$]	352	366
Alkalinity [mg/l as $CaCO_3$]	187	186
total dissolved solids [mg/l]	636	645
temperature (°C)	10.3	11
A	0.18035	0.18096
B	2.37652	2.36246
C	2.14654	2.16348
D	2.27184	2.26951
pH_s	7.43849	7.41043
→→ RSI	7.10697	6.98085
→→ LSI	0.33151	0.42957

ATTACHMENT D

FLUORIDE AND STRONTIUM FACT SHEETS

Information for private well owners

Know Your Well Water Quality – Fluoride

What is fluoride?

Fluoride is a naturally occurring element found in some rock types. Fluoride is used in some industrial processes, for example, aluminium production. Many foods contain fluoride. Foods rich in fluoride include black tea with 3.7 milligrams per litre (mg/L) and raisins with 2.3 mg/L. https://ndb.nal.usda.gov/ndb/nutrients/report?nutrient1=313&nutrient2=&nutrient3=&&max=25&subset=0&offset=425&sort=f&totCount=526&measureby=g

Fluoride may also be added to consumer products, including dental products such as toothpaste and mouth wash to help prevent tooth decay. Toothpastes may contain 1,000-1,500 mg/L of fluoride but these products are not supposed to be swallowed.

How can fluoride get into my well water?

Fluoride occurs naturally in groundwater. Natural concentrations vary widely from area to area across Ontario, depending primarily on the geology, but also influenced by the chemical properties of groundwater. Elevated concentrations of fluoride are often associated with the mineral fluorite in limestone and dolomite bedrock, as well as with soft water found in shale bedrock and clay soils.

Can fluoride in well water affect me or my family's health?

According to Health Canada the optimal level of fluoride in drinking water to promote dental health is 0.7mg/L. Fluoride may be added to community drinking water where naturally occurring fluoride levels are below 0.7 mg/L.

Too much fluoride increases the risk of dental fluorosis in children, a condition that affects the appearance of teeth and can result in small white flecks to larger white markings on teeth. Fluorosis occurs while the tooth is forming below the gums (usually during the ages of 0-6 years) and not after the tooth is exposed in the mouth. Mild dental fluorosis is a cosmetic condition and does not affect children's health.

Consuming very high levels of fluoride over a long period of time can result in skeletal fluorosis, a disease with symptoms similar to arthritis. These symptoms may include difficulty moving and joint pain. This condition may come from long-term consumption of drinking water with very high naturally occurring levels of fluoride, well above the levels that have been found in Ontario groundwater.

Are there standards for fluoride levels in drinking water?

Ontario's drinking water standard for fluoride is 1.5 mg/L. Levels above 1.5 mg/L must be reported to the local Medical Officer of Health.

How do I know how much fluoride is in my water?

In drinking water, fluoride has no taste or odour. It can only be detected through chemical testing.

Have your well water tested by an accredited laboratory to find out how much fluoride, 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 can provide you with a sample bottle and instructions on how to take a sample.

You should test your well for fluoride:

- At least once to determine if fluoride is present in your well water.
- Regularly, if your well's fluoride levels are near the drinking water standard.
- Every three (3) years in areas known to have elevated levels. See the question below "How do I know if high fluoride levels have been found in well water in my community?"
- If you have a treatment system to remove fluoride from your water, test the treated water annually to ensure it is working properly.

What should I do if a high concentration of fluoride is found in my well water?

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

If your well water has levels of fluoride above 2.4 mg/L, consider installing a filter or treatment system to remove fluoride, or using another source of water for drinking and preparing food. For treatment options, consult with a water treatment professional. Alternate sources of water include bottled water or a public water system.

For more information you can contact your local public health unit. Contact information is available at http://www.health.gov.on.ca/en/common/system/services/phu/locations.aspx.

How can I find out if fluoride has been found in private well water supplies in my community?

To see what provincial information is available on whether fluoride has been found in or around your community you can visit the websites below. If there is monitoring information available near your well location the information can give an indication about the presence of fluoride in the area. If high levels of fluoride are found in your region, your well water could have high concentrations of fluoride and you should test it.

- The monitoring information available at https://www.ontario.ca/environment-and-energy/map-provincial-groundwater-monitoring-network shows approximate locations of provincial groundwater monitoring wells and the information available for each well. The information is based on measurements taken over a number of years. A map based on this monitoring information is attached to this fact sheet.
- The information available at http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearth/ambient-groundwater-geochemistry shows approximate

locations and information collected at individual drinking water wells in southern Ontario by the Ontario Geological Survey. The information is based on a single sample at each location.

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Informations pour les propriétaires de puits privés

Sachez quelle est la qualité de votre eau de puits – fluorure

Qu'est-ce que le fluorure?

Le fluorure est un composé naturel présent dans certains types de roches. Il sert à certains procédés industriels, par exemple dans la production d'aluminium. De nombreux aliments en contiennent. Les aliments riches en fluorure comprennent le thé noir avec 3,7 milligrammes par litre (mg/L) et les raisins secs avec 2,3 mg/L. https://ndb.nal.usda.gov/ndb/nutrients/report?nutrient1=313&nutrient2=&nutrient3=&&max=25&subset=0&offset=425&sort=f&totCount=526&measureby=g

Le fluorure peut également être ajouté aux produits de consommateur, y compris les produits dentaires tels que le dentifrice et le rince-bouche pour aider à prévenir la carie. Les dentifrices peuvent contenir de 1 000 à 1 500 mg/L de fluorure, mais ces produits ne doivent pas être avalés.

Comment le fluorure peut-il pénétrer dans mon eau de puits?

Le fluorure est présent à l'état naturel dans les eaux souterraines. Les concentrations naturelles varient considérablement d'une région à l'autre de l'Ontario, en fonction principalement de la géologie, mais elles sont aussi influencées par les propriétés chimiques des eaux souterraines. Des concentrations plus élevées sont souvent associées à la présence de fluorine dans le substrat rocheux du calcaire et de la dolomie, ainsi qu'à l'eau douce trouvée dans le substrat rocheux du schiste et les sols argileux.

Le fluorure présent dans l'eau des puits peut-il affecter ma santé ou celle de ma famille?

Selon Santé Canada, le niveau optimal de fluorure dans l'eau potable pour favoriser l'hygiène dentaire est de 0,7 mg/L. On peut en ajouter au réseau municipal d'eau potable lorsque les concentrations naturelles sont inférieures à 0,7 mg/L.

Une quantité excessive de fluorure augmente, chez les enfants, le risque de fluorose dentaire, maladie qui affecte l'apparence des dents en y produisant des taches blanches, grandes ou petites. La fluorose se produit pendant que la dent se forme sous les gencives (habituellement entre 0 et 6 ans) et non après avoir poussé. La fluorose dentaire légère est une affection cosmétique qui n'affecte pas la santé des enfants.

Consommer des niveaux très élevés de fluorure sur une longue période peut entraîner une fluorose osseuse, maladie aux symptômes similaires à ceux de l'arthrite. Ces symptômes peuvent inclure des difficultés à bouger et des douleurs articulaires. Ce trouble peut provenir de la consommation à long terme d'eau potable contenant des concentrations naturelles très élevées de fluorure, bien au-delà des niveaux observés dans les eaux souterraines de l'Ontario.

Existe-t-il des normes de concentration de fluorure dans l'eau potable?

La norme de l'Ontario en matière d'eau potable pour le fluorure est de 1,5 mg/L. Les concentrations supérieures doivent être signalées au médecin hygiéniste local.

Comment connaître la quantité de fluorure dans mon eau de puits?
Dans l'eau potable, le fluorure n'a pas de goût ni d'odeur. Il ne peut être détecté que par des tests chimiques.

Faites analyser votre puits par un laboratoire accrédité pour déterminer la teneur en fluorure, le cas échéant, de l'eau de votre puits. La liste des laboratoires autorisés à effectuer des analyses de l'eau potable en Ontario figure à l'adresse https://www.ontario.ca/fr/page/laboratoires-autorises. Le laboratoire peut vous fournir une bouteille d'échantillonnage et des instructions sur la façon de prélever un échantillon.

Vous devriez tester le niveau de fluorure de votre puits :

- Au moins une fois pour déterminer si du fluorure se trouve dans l'eau de votre puits.
- Régulièrement, si vos niveaux de fluorure sont proches de la norme de l'eau potable.
- Tous les trois (3) ans dans les régions connues pour avoir des niveaux élevés. Voir la question ci-dessous « Comment puis-je savoir si des concentrations élevées de fluorure ont été trouvées dans l'eau de puits de ma ville ou de mon village? »
- Si vous avez un système de traitement pour éliminer le fluorure de votre eau, testez l'eau traitée chaque année pour vous assurer qu'il fonctionne correctement.

Que dois-je faire si une concentration élevée de fluorure se trouve dans l'eau de mon puits?

C'est à vous qu'il incombe d'assurer la potabilité de l'eau de votre puits.

Si l'eau de votre puits contient des concentrations de fluorure supérieures à 2,4 mg/L, envisagez d'installer un filtre ou un système de traitement pour éliminer le fluorure ou d'utiliser une autre source d'eau pour boire et préparer des aliments. Pour les options de traitement, consultez un professionnel du traitement des eaux. Les autres sources d'eau comprennent l'eau embouteillée ou un réseau public d'alimentation en eau.

Pour de plus amples renseignements, communiquez avec votre bureau de santé publique local, dont les coordonnées figurent à http://www.health.gov.on.ca/fr/common/system/services/phu/locations.aspx.

Comment puis-je savoir si du fluorure a été trouvé dans les réserves d'eau de puits privés de ma ville ou de mon village?

Pour prendre connaissance des données de la province sur la présence de fluorure dans votre région, vous pouvez consulter les sites Web ci-dessous. Si des informations de surveillance sont disponibles près de votre puits, elles peuvent donner une indication de la présence de fluorure dans la région. Si vous trouvez des niveaux élevés de fluorure dans votre région, l'eau de votre puits pourrait contenir de fortes concentrations de fluorure et vous devriez la tester.

- Les informations figurant à l'adresse https://www.ontario.ca/fr/environnement-et-energie/carte-du-reseau-provincial-de-controle-des-eaux-souterraines montrent l'emplacement approximatif des puits de surveillance des eaux souterraines provinciales et les renseignements sur chaque puits. Cette information se fonde sur des mesures prises sur plusieurs années. Une carte basée sur cette information de surveillance est jointe à cette fiche d'information.
- Les informations figurant à l'adresse http://www.mndm.gov.on.ca/fr/mines-et-des-mineraux/applications/ogsearth/geochimie-des-eaux-souterraines-ambiantes montrent des emplacements approximatifs et des informations recueillies dans les puits d'eau potable du sud de l'Ontario par la Commission géologique de l'Ontario, qui n'a prélevé qu'un seul échantillon par emplacement.

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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

1. Agency for Toxic Substances Disease Registry (ATSDR) 2004. Toxicological Profile for Strontium: Strontium. Division of Toxicology and Human Health Services; April 2004. Available from: STRONTIUM (cdc.gov)

2. Health Canada 2019a. Guidelines for Canadian Drinking Water Quality Guideline Technical Document: Strontium. May, 2019. Available from: Guidelines for Canadian Drinking Water Quality: Guideline technical document - Strontium (canada.ca)

3. Health Canada 2019b. Water Talk – Strontium in drinking water. Available from: Water Talk - Strontium in drinking water - Canada.ca

4. Ozgur, S., Sumer, H. and Kocoglu, G. (1996). Rickets and soil strontium. Arch. Dis. Child., 75(6): 524–526. *Cited In: Health Canada (2019a).*

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.

8. Cai Y-H, Yang XJ, Schäfer AI. (2020). Removal of Naturally Occurring Strontium by Nanofiltration/Reverse Osmosis from Groundwater. Membranes. Oct 30;10(11):321.

ATTACHMENT E

WELL WATER QUESTIONNAIRE
EXISTING DWELLING AT 3970 STONECREST ROAD

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

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology
(613) 860-0923
FAX: (613) 258-0475

Name : HUGH THAYER Address: 3970 STONECREST RD

*Phone # or email: HUGH.THAYER@GMAIL.COM 613-601-9132

*Phone number is best in case an adverse test result needs to be provided. Email is good for sending test results.

1) How long have you lived here? 23 YEARS

2) When was drilled well constructed? Do you know the well driller name? 1997 SELF

3) Where is well located (front/rear/side yard)? Is well head above grade (i.e. accessible)? BACK YES

4) Do you know the well depth? If so, please provide. 26 FT

5) What type of water treatment do you have? (i.e water softeners, UV systems, iron filters etc.) WATER SOFTENER

6) Do you drink the water? If not, why? (sulphur smell, poor taste, bacteria, sediment, cloudiness, etc.) YES

7) Do you test the water potability (bacterial testing)? If so, have you ever had a poor result? YES YEARLY NEVER

8) Have you ever experienced water shortages or required well servicing/repair? If so, describe. NO

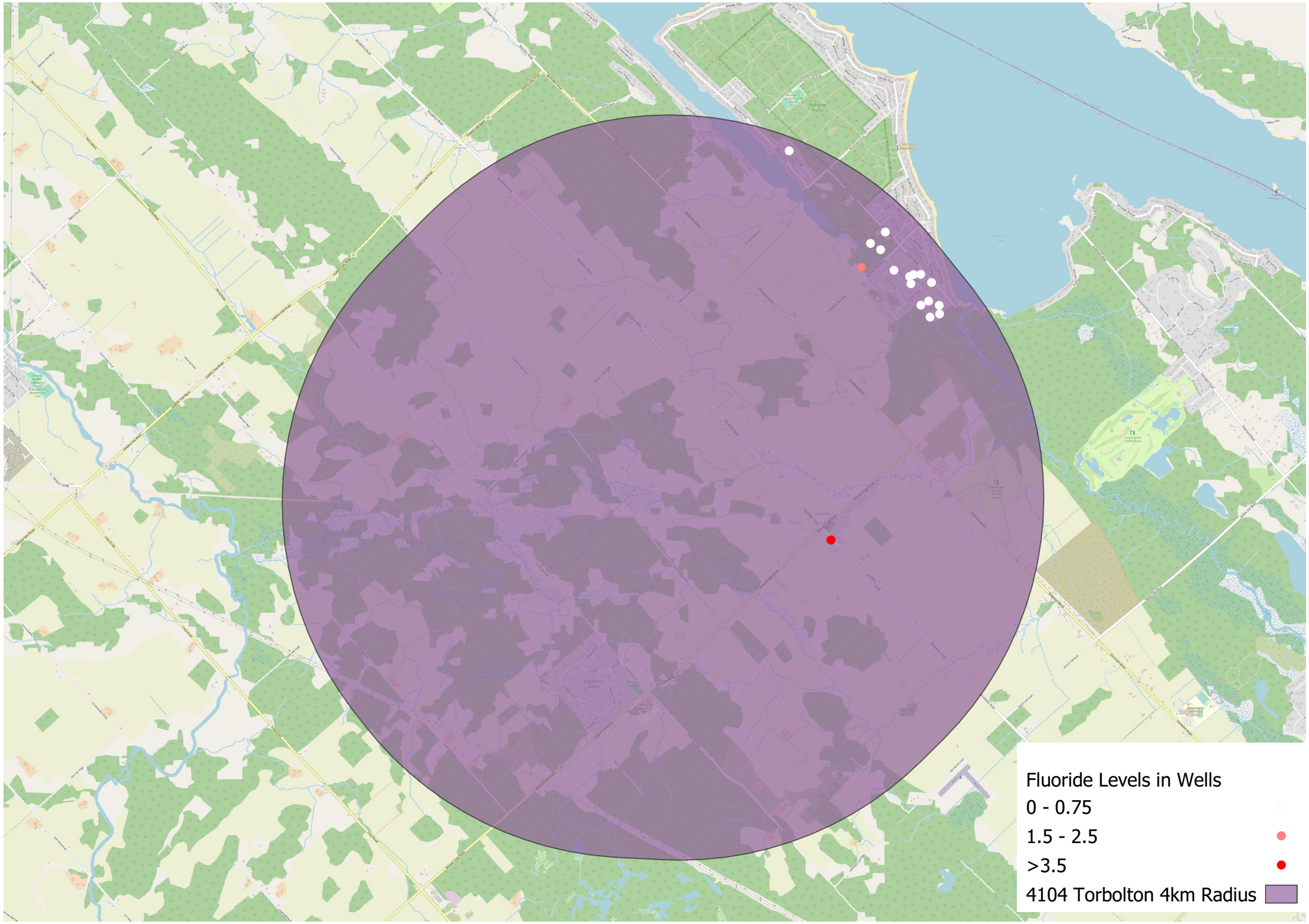
9) When was septic system installed? Has it ever been replaced? Does septic system perform well? 2000 NO YES

10) What type of septic system do you have? (ie. conventional/Clearstream/Ecoflo etc.)

11) Where is the septic system located? FRONT OF HOUSE

ATTACHMENT F

INFORMATION FROM CITY OF OTTAWA GROUNDWATER STUDY


Fluoride Levels in Wells
0 - 0.75
1.5 - 2.5
>3.5
4104 Torbolton 4km Radius

Ministry of the Environment
Ontario

55537

ATT: [redacted]

The Ontario Water Resources Act

WATER WELL RECORD

1523355

1. PRINT ONLY IN SPACES PROVIDED
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11

MUNICIP 15010 CON. CON 04

COUNTY OR DISTRICT: OTTAWA CARLETON
TOWNSHIP, BOROUGH CITY, TOWN, VILLAGE: WEST CARLETON
CON BLOCK, TRACT, SURVEY ETC: NE 1/2 LOT 14 CONC 4
LOT: 12
OWNER (SURNAME FIRST): [redacted]
ADDRESS: 102 WALLGREEN CARP K0A-1L0
R.W. CONNELLY ASSO. LTD
DATE COMPLETED: DAY 16 MO 6 YR 88

21 ZONE: UTM WE EASTING: 22 NORTHING: 42 RC: ELEVATION: RC: BASIN CODE:

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Light Brown	Sand		Loose	0	6'
Brown	Sand	&	Packed	6'	14'
Brown	Sand	Grey Silt	Packed	14'	17'
Greyish Blue	Clay		Wet	17'	80'
Grey	Silt	Quicksand, Clay Layers	wet (Putty like)	80'	115'
Grey	Sand		Fine	115'	125'
Grey	Sand	Brown Sand	Fine, Med	125'	

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
125	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	0	
5 1/2	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188		
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.): 12
DIAMETER: 6 INCHES
LENGTH: 3 FEET
MATERIAL AND TYPE: Telescoping Stainless Steel
DEPTH TO TOP OF SCREEN: 122 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
0	40'	Cement Grout

PUMPING TEST

71

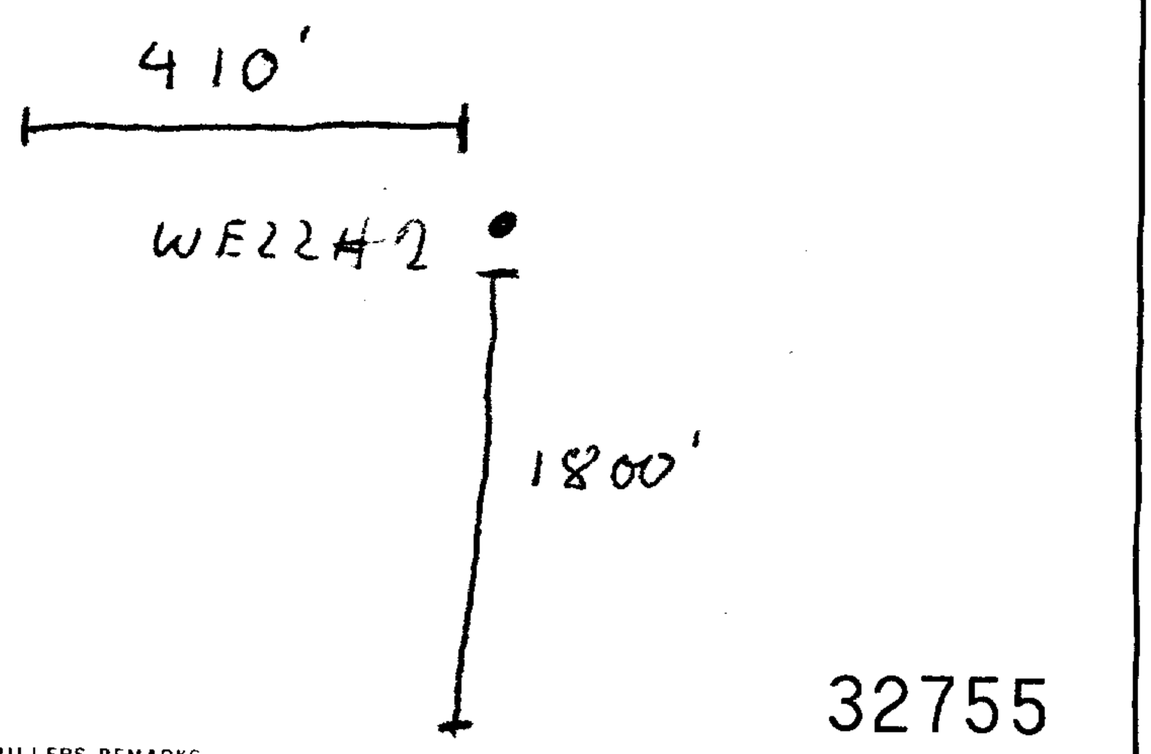
PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER
PUMPING RATE: 6 GPM
DURATION OF PUMPING: 6 HOURS 0 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
27 FEET	100 FEET	4 FEET	3 FEET	2 FEET	4 FEET

IF FLOWING, GIVE RATE: — GPM
PUMP INTAKE SET AT: 60 FEET
WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: 60 FEET
RECOMMENDED PUMPING RATE: 5 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



32755

DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☐ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☒ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED 9 ☐ DEWATERING

WATER USE

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF CONSTRUCTION

1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: Valley Drilling Co. Ltd
WELL CONTRACTOR'S LICENCE NUMBER: 5222
ADDRESS: P.O. Box 4137 Carp Ont
NAME OF WELL TECHNICIAN: Bill Bisson
WELL TECHNICIAN'S LICENCE NUMBER: T-0190
SIGNATURE OF TECHNICIAN/CONTRACTOR:
SUBMISSION DATE: DAY — MO — YR —

OFFICE USE ONLY

DATA SOURCE
CONTRACTOR: 5222
DATE RECEIVED: APR 04 1989
DATE OF INSPECTION
INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

WWISCode	WellDepth	F	Well Type
1515000	36.3	4.185	Drilled bedrock
1521449	15.5		
1521929	16.8	0.12	screened
1520149	17.7		
1523334	16.8		
1523337	16.8		
1516847	44.2		
1511355	46.3		
1525149	13.7		
1525150	12.2	0.04	screened
1525151	12.2	0.06	screened
1525148	13.7	0.08	screened
		0.07	unknown
		0.3	unknown
		0.2	unknown
		0.05	unknown
		0.3	unknown
		0.2	unknown
		0.3	unknown
	11.6	0.08	screened
1523354	15.2	0.1	screened
1523355	38.1	2.45	screened in sand
1523339	15.2	0.1	screened
1527831	16.5	0.2	screened

MINISTRY OF THE ENVIRONMENT

The Ontario Water Resources Act

WATER WELL RECORD

ONTARIO

31 F/8 h

1. PRINT ONLY IN SPACES PROVIDED
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11 | 1515000 | MUNICIP. 15010 | CON. CON | 02

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Carleton	Torbolton	2	010

[redacted] odlawn, Ont.

DATE COMPLETED DAY 25 MO. 08 YR. 75

RC.	ELEVATION	RC.	BASIN CODE	II	III	IV
4	238	4	26			

1515000 18 414848 5033674 JUL 08, 1977 302

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
	Clay			0	58
	Gravel			58	60
	Limestone			60	119

31 0058 05 0060 11 0119 15

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0114	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL — #5
0119	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL — #5
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
06	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0060 ~~60~~
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10 ~~15~~		Cement Grout

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE GPM.	DURATION OF PUMPING HOURS / MINS.
1 ☐ PUMP 2 ☒ BAILER	0003 ~~24~~	02 HOURS 00 MINS.

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (1 ☐ PUMPING 2 ☒ RECOVERY)			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
000 FEET	110 FEET	075 FEET	045 FEET	025 FEET	012 FEET

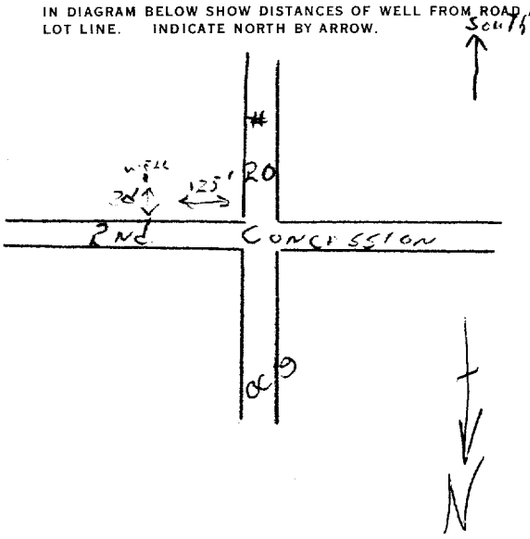
IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM.	FEET	1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	100 FEET	0003 ~~24~~ GPM.

GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL 1433

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL 54 — 1 ☒ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED

WATER USE 55-56 — 01 — 1 ☒ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF DRILLING 57 — 1 — 1 ☒ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☐ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: McLean Water Supply Ltd. — LICENCE NUMBER: 3504

ADDRESS: 1532 Raven Ave. Ottawa, Ont.

NAME OF DRILLER OR BORER: M. Mallon — LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: [signature] — SUBMISSION DATE: DAY 26 MO. 8 YR. 75

OFFICE USE ONLY

DATA SOURCE 58: 1 — CONTRACTOR 59-62: 3504 — DATE RECEIVED 63-68: 081075 — 80

DATE OF INSPECTION: 22 Mar 76 — INSPECTOR: KM P/R Dyl

REMARKS:

P

WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 07-091

Certificate of Well Compliance

SIMON SKUSE DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of HUGH THAYER (name of landowner), located at 3970 STONECREST RD (Legal description, Lot/Plan No.) in the City of Ottawa (Geographic Township of TORBOLTON) Lot 12, Concession 1, Plan # SR-8889 S/L# PIN # 04568-0113

WE CERTIFY FURTHER that we are aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to the site and City Standards.

AND WE DO HEREBY CERTIFY THAT the said well has been drilled, cased, and grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 24 day of JANUARY 2024.

COLT'S PLUMBING C.7763

Well Driller/Company

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

Signed this 6th day of March, 2024.

C Vermeer

Engineer

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

County/District/Municipality	City/Town/Village	Province	Postal Code
OTTAWA	WOODLAWN	Ontario	K0A 3M0

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	412172	5032885		

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

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
GREY	CLAY		PACKED	0	20
GREY	GRANITE		SOFT	20	149

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	23	BENTONITE	5 bags

Method of Construction

- [ ] Cable Tool
- [ ] Diamond
- [ ] Rotary (Conventional)
- [ ] Jetting
- [ ] Rotary (Reverse)
- [ ] Driving
- [ ] Boring
- [ ] Digging
- [x] Air percussion
- [ ] Other, specify

Well Use

- [ ] Public
- [ ] Commercial
- [ ] Not used
- [x] 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
6¼	STEEL	188	0	24

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	Other, specify
140	[ ] Fresh [x] Untested	[ ] Gas
	[ ] Fresh [ ] Untested	[ ] Gas
	[ ] Fresh [ ] Untested	[ ] Gas

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	24	6¼
24	149	6"

Results of Well Yield Testing

After test of well yield, water was:
- [x] Clear and sand free
- [ ] Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 120

Pumping rate (l/min / GPM): 5

Duration of pumping: ____ hrs + ____ min

Final water level end of pumping (m/ft): 74

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft): 140

Recommended pump rate (l/min/GPM): 5

Well production (l/min/GPM): 6

Disinfected?
- [x] Yes
- [ ] No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		9.6		
1		15.9	1	74
2		18.6	2	72.1
3		19.1	3	69.2
4		21.7	4	66.5
5		24.4	5	62.1
10		36.1	10	63
15		45.8	15	51.1
20		54	20	42.7
25		60	25	33.7
30		60.9	30	28.1
40		66.7	40	19
50		69	50	8
60		74	60	4

Map of Well Location

Please provide a map below following instructions on the back.

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
OH'S PLUMBING INC	

Business Address (Street Number/Name)	Municipality
2547 [illegible]	

Province	Postal Code	Business E-mail Address
ONT		[illegible]

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
[illegible]	[illegible]

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
[illegible]		

Comments:

Well owner's information package delivered
- [ ] Yes
- [ ] No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: Y Y Y Y M M D D

Ministry Use Only

Audit No. Z 381583

Received

Well Owner's Copy

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS : 3822531

WORK REQUEST : 100266249

Report Date : 2024-02-13

Kollaard Associates Inc.
210 Prescott St., Box 189
Kemptville, ON
K0G 1J0
Attention : Colleen Vermeersch

Reception Date :	2024-02-08
Project :	220625
Sampler :	NA
PO Number :	Not Applicable
Temperature :	11 °C

Analysis	Quantity	External Method
Fluoride (Water, Auto/ISE)	1	Modified from SM 4500-F A and 4500-F C
Metals Scan (Water, ICP/MS)	1	Modified from EPA 200.8

Criteria :
A : Ontario Regulation 170/03

Sample status upon receipt :

7505920
Compliant

Certificate Comments :

Revision 1: This is an amendment and supersedes certificate 3822364.

Notes :

- All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated.
- Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at https://directory.cala.ca/
- Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Legend :

RL : Reporting limit	N/A : Not applicable	* : Analysis conducted by external subcontracting
QC : Reference material (QC)	1 : Results in annex	^ : Analysis not accredited

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS - RESULTS

Client : Kollaard Associates Inc.
Project : 220625

Reception Date: 2024-02-08

					Eurofins Sample No :	**7505920**				
					Matrix :	Raw water				
					Sampling Date :	2024-01-09				
					Client Sample Identification :	3970 Stonecrest				
General Chemistry	**RL**	**Unit**	**Criteria A**	**Criteria B**	**Criteria C**					
Fluoride	0.1	mg/L	1.5			<0.10				

			Eurofins Sample No :	**7505920**						
			Matrix :	Raw water						
			Sampling Date :	2024-01-09						
			Client Sample Identification :	3970 Stonecrest						
Metals (ICP/MS)	**RL**	**Unit**								
Strontium	0.001	mg/L	0.610							

Approved by :

Emma-Dawn Ferguson,
Enviromental Chemist

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS - QUALITY CONTROL

Client : Kollaard Associates Inc.
Project : 220625

Reception Date: 2024-02-08

Parameter	Unit	RL	Blank	QC		Matrix Spike		Duplicate	
				Recovery %	Range %	Recovery %	Range %	RPD %	Range %
Fluoride (Water, Auto/ISE)									
Method : Fluoride by autotitrator, ion selective electrode. Internal method: OTT-I-AT-WI45398.									
Fluoride	mg/L	0.1	<0.10	102	90-110				
Associated Samples : 7505920								Prep Date: 2024-02-12 Analysis Date: 2024-02-13	
Metals Scan (Water, ICP/MS)									
Method : Metals (Water, ICP/MS). Internal method: AMMTFQE1.									
Strontium	mg/L	0.001	<0.001	100	80-120	91	70-130	0	0-20
Associated Samples : 7505920								Prep Date: 2024-02-09 Analysis Date: 2024-02-08	

Where RPD % is reported as "-" the calculation is not available because one or both of the duplicates is within 5 times the RL.

eurofins

DRINKING WATER CHAIN-OF-CUSTODY

146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1 - Phone: 613-727-5692, Fax: 613-727-5222

100266249

Printed On : 2024-02-08 14:51:27

CLIENT INFORMATION		WATERWORKS INFORMATION	
Company: Kollaard Associates Inc.		Waterworks Name:	
Contact: Colleen Vermeersch		Waterworks #:	
Address: 210 Prescott St, Kemptville, On K0G 1J0		Contact:	
Telephone: 613-860-0923 ext230	Fax:	Address:	
Email #1:	#2:	Telephone:	Fax:
Project: 220625		Cell Phone:	
PO #:	Quote #: 170314	Email #1:	#2:

REGULATION/GUIDELINE REQUIRED

☐ O. Reg 170 ☐ O. Reg 170 15.1 ☑ ODWSOG ☑ Private Well ☐ None
☐ O. Reg 318/319 ☐ O. Reg 243 ☐ GCDWQ ☐ Other:

TURN-AROUND TIME (Business Days)

☐ 1 Day* (100%) ☐ 2 Day** (50%) ☐ 3-5 Days (25%) ☑ 5-7 Days (Standard)

Please contact the laboratory in advance to determine rush availability. Surcharges may apply to rush service. Note that some tests (i.e. O. Reg. 170 Schedule 24 pesticides may take up to 3 weeks to analyze). Please see notes (on reverse) about TAT policies.

The optimal temperature conditions during transport must be less than 10°C. Sample(s) cannot be frozen. Note that for drinking water samples, all exceedances will be reported where (and how) the application legislation requires.
The COC must be complete upon submission of the samples, there will be a $25 surcharge if required information is missing (required fields are shaded in grey).

		Sample Details						Sample Analysis Required							Field Measurements			
Sample ID	Date/Time Collected	Sample Type Code (see below)	Resample? Y = Yes N = No	MOE/MOH Reportable? Y = Yes N = No	# of Containers	SPL Code/Watertrax	Sample Location (i.e. Kitchen, POE)	Subdivision parameters	Kollaard Subdivisionbacteria	Kollaard Special Metals	Strontium	Fluoride			Total Chlorine	Free Chlorine	Field Turbidity	Sample RN# (Lab Use Only)
3970 Stonecrest	01-09 / 11:30	PW	N	N	8		wellhead				✓	✓						7505920

Sample Type Codes for Drinking Water: RW = Raw Water, TW = Treated Water at Point of Entry to distribution, TW-NT = Untreated Water at Point of Entry to distribution, DW = Distribution, RP = Residential Plumbing, NRP = Non-Residential Plumbing, S = Standing, F = Flushed, PW = Private Well

	PRINT	SIGN	DATE/TIME	TEMP (°C)
Sampled By:				
Relinquished By:				
Received By:		SM	2/8/24	11

COMMENTS:

Please filter the sample for strontium testing-field filtering was NOT carried out X Do not add Lab filtration confirmed by client - L.K 2024-02-08

AFCOCDW.8

Copies: White - Laboratory, Yellow - Sampler