

January 27, 2023

File: 101275.003

Township of Beckwith  
1702 9th Line Beckwith  
Carleton Place, Ontario  
K7C 3P2

Attention: Enam Hoque, M. PI

**Re: Third Party Review of Hydrogeological Assessment and Terrain Analysis:  
“Hydrogeological Assessment and Terrain Analysis, Grizzly Homes Subdivision,  
Beckwith, Ontario” prepared by McIntosh Perry and dated August 22, 2022  
(Project No.: CCO-22-0256)**

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GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by the Township of Beckwith to provide a review of McIntosh Perry reported titled “Hydrogeological Assessment and Terrain Analysis, Grizzly Homes Subdivision, Beckwith, Ontario” dated August 22, 2022, herein referred to as ‘McIntosh Perry report’.

The peer review was undertaken following the technical guideline documents for land development applications on private services:

- Ministry of the Environment, Conservation and Parks (MECP), August 1996. Procedure D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment.
- Ministry of the Environment, Conservation and Parks (MECP), August 1996. Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment.
- Ministry of the Environment, Conservation and Parks (MECP), April 1995. Hydrogeological Technical Information Requirements (TIR) For Land Development Applications.

## **BACKGROUND**

The McIntosh Perry report proposes the development of 30 residential lots on individual private water supply wells and septic systems. The proposed development property has an area of approximately 27 hectares (page 4), later specified to be 26.85 hectares based on available infiltration area (page 23) The minimum proposed lot size is not specified in the text or drawings, but the average lot size is 0.66 hectares (page 22).

The work undertaken by McIntosh Perry in support of the residential development includes:

- Review of background information, including land use, topography, drainage, geology, MECP water well records, climate data, potential sources of contamination;
- Supervision of the installation of four on-site test wells and hydraulic testing of four on-site and one off-site test wells, which is in accordance with D-5-5 requirements pertaining to the minimum of 5 wells required for the assessment based on the surface area of the Site;
- Water quality sampling from four on-site and one off-site test wells; and,
- Excavation of 15 test pits on the subject property.

## **HYDROGEOLOGICAL SETTING**

The McIntosh Perry report identifies the current land use of the subject site as primarily “undeveloped forested/shrub land with the exception of a single residential dwelling located on the northern portion of the Site”. Off-site land use is described as “residentially developed lands immediately north and south of the Site along Fourth Line Road and Perth Road, as well as to the east along Highway 15; otherwise, the surrounding land use is predominately forested land”. Residences on neighbouring properties are privately serviced by wells and septic systems. The topography is noted to be generally flat, sloping downwards slightly to the northwest, with the elevation ranging from 136 to 149 metres above sea level (asl). Wetland areas and a small local water body are located in the central portion of the site. The shallow groundwater flow at the local scale is inferred to generally be northwest but is expected to vary locally where it would flow towards surface water features, reflecting the local topography and hydrology (Figure 7). The McIntosh Perry Report does not provide an assessment of the regional groundwater flow direction. This should be assessed through background reports such as wellhead protection areas reports, or from static water levels obtained from water well records, for example.

The McIntosh Perry report indicates that the overburden thickness, as characterized by on-site test wells and test pits, ranges from 0.17 to 1.7 metres, with an average thickness of approximately 0.95 metres.

The bedrock geology was classified through a review of Ontario Geologic Survey (OGS) regional mapping and identified as dolostone and sandstone of the Beekmantown Group. The McIntosh Perry report notes that “areas exhibiting exposed bedrock were observed during fieldwork, closest to the south property boundary along Perth Road”. Also, shallow bedrock where less than 25 cm of native soil material was present was noted in test pits TP1, TP8, TP9, TP10 and TP11 located in the east and northeast portions of the site. The McIntosh Perry report states that the site is hydrogeologically sensitive and GEMTEC concurs with that statement.

## MECP PROCEDURE D-5-5: WATER SUPPLY ASSESSMENT

McIntosh Perry notes that the water supply assessment was completed in general accordance with MECP Procedure D-5-5; however, GEMTEC notes that the following requirement has not been met:

- Section 4.6 Land and Water Use Conflicts: *“where wells exist on or adjacent to the site, a survey of well owners, and sampling and analysis of representative well water, should be performed and reported.”*
  - No information is presented from the upgradient or downgradient residential properties. Given that the shallow groundwater flow direction may be influenced by surface water bodies at the Site, GEMTEC suggests sampling a few houses to the north, east and south of the Site.

### Water Quantity

All four on-site test wells (TW2 to TW5) were constructed with 12.8 metres (42 feet) of casing. The on-site test wells were completed in limestone and sandstone bedrock to depths of 30.5 to 42.7 metres. The off-site private well (TW1) was constructed with 12.2 metres (40 feet) of casing and completed in limestone and sandstone to a depth of 24.7 metres. Constant rate pumping tests, including recovery tests were completed in all five test wells. Some discrepancies between the well construction described in Section 3.3.2 and the well records were noted. Those discrepancies are noted below:

- TW2
  - The report states that the hole was grouted down to 9.76 m and the remainder of the hole was open when the water well record indicates that the neat cement slurry extends to 12.8 m bgs
- TW3
  - The report states the overburden thickness is 1.52 m while the well record indicates 0.46 m
  - The report states that the hole was grouted down to 9.75 m and the remainder of the hole was open when the water well record indicates that the neat cement slurry extends to 12.8 m bgs
  - The report states that water was encountered at 9.57 m, but the water well record indicates water found at depths of 27.4 and 34.7 m bgs
  - The well did not recover past 95% within 24 hours and the report mentions it is assumed that atmospheric pressure changes and further well development over the pumping and recovery period may have contributed to the failure to fully recover past 95%. McIntosh Perry should have monitored water levels in the pumping well and observation wells (this comment is applicable to all wells, not just TW3) and the atmospheric pressure during the pumping test and recovery

period using water level loggers and a barologger. In the absence of pressure data it is not possible to support this affirmation.

- TW4
  - The report states that the hole was grouted down to 9.8 m and the remainder of the hole was open when the water well record indicates that the neat cement slurry extends to 12.8 m bgs
  - The description of bedrock does not include a description of sandstone to 37.2 m bgs.
- TW5
  - The report states that the hole was grouted down to 9.75 m and the remainder of the hole was open when the water well record indicates that the neat cement slurry extends to 12.8 m bgs
  - The deepest depth where water was encountered in the borehole is presented as 35.2 m bgs while the water well record states 34.7 m bgs.

The test wells were pumped for a minimum of six hours at pumping rates ranging from 21 to 90 litres per minute. The measured drawdown during the constant-rate pumping tests ranged from approximately 0.24 to 4.79 metres. The data provided in McIntosh Perry's report and the methodology do not mention that the pumping rate was checked on a regular basis during the completion of the 6-hour tests. The pumping rate in each well should be monitored in order to confirm that it remains constant throughout the duration of the test. Drawdown was not observed in observation wells, except for observations of minimal drawdown in TW2 and TW3 (section 3.3.3 states 0.028 to 0.15 m) when TW4 was pumped.

McIntosh Perry's report states that "due to the distance between wells and accessibility throughout the property, observation well measurements were not recorded, with the exception of TW4". Water levels in each well should have been monitored with water level loggers and the atmospheric pressure should have been monitored with a barometric pressure logger in order to obtain synchronous pumping well and observation well data during the pumping tests and recovery periods. Given the easy access to pressure transducer technology, the distance or obstacles between observation wells should not be a reason not to acquire the data throughout of the tests.

McIntosh Perry is of the opinion that the aquifer is capable of supplying water at a flow rate greater than 18.75 litres per minute. GEMTEC agrees with this statement.

The McIntosh Perry report provided long term well yield and water level drawdown estimates using the Farvolden method, Moell Method and Cooper-Jacob graphical method, assuming pumping rates of 13.7 litres per minute. The calculated long term well yields range from 84.7 to 3,518 litres per minute, which is significantly greater than that required for residential use. GEMTEC agrees with this approach. However, McIntosh Perry's report does not present a

substantiated assessment of well interference based on distance-drawdown obtained from pumping test data or based on a simulation using conservative aquifer properties obtained during the completion of the pumping tests. For instance, the well response data graph for TW1 presented in Appendix E appears to feature cyclical water level fluctuations in the order of 0.1 metres. These could potentially result from pumping rate fluctuations or from pumping from wells on neighbouring properties. Such fluctuations were not observed in other test wells located farther away from developed lots. This suggests that well interference may be observed in the developed areas and although it does not appear to be problematic based on available drawdown in the wells, it should be assessed and quantified. The report should demonstrate that well interference will not be a problem for the subdivision or neighbouring well users if 30 wells are to be present in the subdivision. Potential effects of seasonal fluctuations should also be discussed.

The maximum theoretical drawdown across the site was noted to not exceed approximately 2.2 metres based on TW2 test results. The McIntosh Perry report concludes that “the bedrock aquifer is suitable for supplying the needs of 30 lots in the proposed development in terms of both quantity and quality when incorporating standard on-site sewage systems to service the individual lots” and that “based on typical residential demand, it is not expected that the subdivision will cause any water supply issues for the surrounding private wells that exist in the vicinity”. GEMTEC is of the opinion that McIntosh Perry does not provide sufficient justification that neighbouring water well users won’t be affected, and it is recommended that McIntosh Perry comment on the potential impact on neighbouring water well owners of an approximate 2.2 metre drawdown that may potentially compound due to well interference.

Furthermore, the lack of off-site private well survey information does not allow to identify potentially existing conditions with respect to water quantity or quality that may be exacerbated and impact the neighbouring well users. A private well survey and private well water sampling program should be conducted in order to assess background conditions prior to the construction of the proposed development. Given the hydrogeological sensitivity of the area, the private well survey and sampling program would provide key information pertaining to the well performance and water quality on properties where wells and septic systems have been present for a significant period of time.

## **Water Quality**

The water quality testing included the collection of “initial” and “post-test” water samples during the six-hour constant rate pumping tests, submitted to an accredited laboratory (Paracel) for “subdivision supply” parameters and select metals. The water quality sampling parameters meet the minimum required water quality parameters specified in MECP Procedure D-5-5. The summary of the water quality results table and the Laboratory Certificates of Analyses were reviewed as part of GEMTEC’s peer-review.

Microbiological testing results from TW1, TW2, TW3, TW4 and TW5 are reported to have non-detectable total coliform, e. coli and fecal coliforms. Based on those results, it appears the water is safe for consumption with respect to microbiological parameters. However, the methodology section of the McIntosh Perry report mentions the wells were pumped until no chlorine residual was detected using disposable testing strips prior to sampling. GEMTEC suggests providing the detection limit of the strips as it may potentially be too high and could potentially result in a false negative. For future sampling, GEMTEC suggests testing using a colorimeter with a method capable of obtaining a detection limit for free chlorine and total chlorine in the order of 0.02 mg/L. Given the presence of nitrate (discussed below) that could potentially be indicative of septic impacts, GEMTEC recommends also sampling for bacteria in the spring during the spring freshet in order to assess potential seasonal impacts linked to high infiltration periods.

McIntosh Perry states that “*based on the overall test results, the water quality will be acceptable in terms of health-related and most aesthetic parameters*”. GEMTEC does not fully agree with this statement due to significant nitrate concentrations reported in TW3 and TW4, ranging from 1.3 to 2.5 mg/L. Nitrate was also detected at lower concentrations ranging from 0.5 to 0.9 mg/L in TW2 and TW5. As per MECP procedure D-5-5, nitrate is a contaminant indicator and at concentrations above 10 mg/L are considered dangerous to infants and others. The McIntosh Perry report states that none of the background land uses (identified forested area, with forested/undeveloped and/or residential-rural properties) appear to pose any significant source of potential contamination to the proposed development (page 6). The report also mentions the presence of individual sewage systems on neighbouring properties. Given the surface water features at the site, it is possible that the shallow groundwater flow direction locally converges towards those features resulting in septic effluent transport towards the site. Nitrate concentrations could also originate from agricultural lands nearby. Although nitrate concentrations are below the MAC of 10 mg/L, the source of nitrate should be assessed prior to approving the construction of up to 30 additional dwellings at the site since, which is hydrogeologically sensitive. Based on the elevated nitrate concentrations detected in TW3 and TW4, it is GEMTEC’s opinion that additional testing and discussion is warranted. Seasonal sampling should be carried out in the wells and a private well sampling program should be carried out on properties surrounding the site. Residential sampling would help establish background conditions and assess the potential presence of impacts on developed lots.

As noted in the McIntosh Perry report, the hardness concentrations exceed the operational guideline for hardness in all samples (TW-5 was not tested for hardness). The hardness concentrations range from 255 to 293 mg/L and as per MECP Procedure D-5-5 the groundwater is considered to be hard. The McIntosh Perry report concludes that the hardness concentrations are readily treatable and if water softening is directed, the use of potassium salts is recommended. GEMTEC agrees that the hardness concentrations are within treatable limits. McIntosh Perry should inform future homeowners that the groundwater is considered to be hard and the health considerations with the use of conventional water softeners (i.e. increase sodium concentrations).



The sodium warning level of 20 mg/L was also exceeded in TW4-1 (22.2 mg/L, exceedance omitted in Table 8), TW5-1 (23.6 mg/L) and TW5-2 (24 mg/L).

The McIntosh Perry report identifies aesthetic objective (AO) exceedances of iron (TW1-1, TW1-2 and TW3-1), manganese (TW1-1, TW1-2, TW2-1, TW2-2 and TW3-1) and laboratory reported turbidity (TW1-1, TW1-2, TW2-1, TW3-1, TW3-2 and TW4-1) and colour (TW1-1 and TW1-2). The report concludes that the iron and manganese concentrations are readily treatable. GEMTEC agrees that the iron (maximum concentration of 0.9 mg/L) and manganese (maximum concentration of 0.078 mg/L) concentrations are within treatable limits listed in MECP Procedure D-5-5 of up to 10 mg/L and 1.0 mg/L for iron and manganese respectively.

The laboratory reported turbidity concentrations exceed the ODWQS aesthetic objective of 5.0 NTU in samples TW1-1, TW1-2, TW2-1 only, TW3-1, TW3-2 and TW4-1 only. The McIntosh Perry report notes that field measurements for turbidity in TW1, TW2, TW3, TW4 were below 0.9 NTU at the end of the six-hour pumping test and the laboratory results are typically considered exaggerated due to the precipitation of iron and other low-solubility solids with changes in temperature and pH. McIntosh Perry considered field measurements of turbidity as a more accurate indicator of turbidity. Based on the elevated iron concentrations detected in TW1 and TW3 and the reported field-measured turbidity concentrations of 0.9 NTU or less, GEMTEC agrees that the laboratory-measured turbidity may be exaggerated, and the field-measured turbidity, which meets the aesthetic objective, is more representative. Turbidity levels in TW2-2 and TW4-2 collected near the end of the pumping test decreased to 1.2 and 0.8 NTU, respectively, which appears to indicate a reduction of turbidity as the well was further developed.

Section 2.4.4 of the McIntosh Perry report states that the surrounding land uses are not expected to be a significant source of contamination. However, given the known presence of the Beckwith VOC plume it is GEMTEC's opinion that proposed developments in the Beckwith Township should also include VOCs in the list of parameters analyzed as part of the groundwater quality assessment conducted in the test wells. Although the plume has not been documented at the site to date, the list of typical subdivision package parameters does not include VOCs therefore their presence in the area might not necessarily be detected unless specific testing is conducted.

It is noted that the report does not include all field measured water quality results such as free chlorine readings and it is recommended that the data be provided for review.

In Section 6.1 of the McIntosh Perry report, more specifically the recommendations regarding water supply well construction, it is stated that " All future wells should adhere to the requirements of O. Reg. 903 (Wells), as amended, with regards to casing length, positive drainage, stickup height, etc." Given the hydrogeological sensitivity of the site, the minimum casing depth requirement of 6.1 metres (20 feet) is not sufficient to protect the water supply from nitrate and other potential contaminants in shallow bedrock. The report must specify a minimum recommended casing length in order to isolate the water supply aquifer from the shallow bedrock

and provide a rationale based on the distribution of nitrate concentrations, location of potential nitrate and other contaminant sources, water found depth, etc. Schematic cross-sections showing on-site and off-site nitrate distribution and water found depth could prove helpful for the completion of this exercise.

## **MECP PROCEDURE D-5-4: WATER QUALITY IMPACT RISK ASSESSMENT**

### **Terrain Analysis and Septic Impact Assessment**

The terrain analysis for the proposed development included the excavation of fifteen test pits across the site. The location of the test pits are shown on the Test Pit Location Plan - Drawing Number 07, which are sufficiently spaced to provide an approximate representation of on-site soil depths and distribution. The average overburden thickness, as stated in Section 4.2, is in the order of 0.95 m and the maximum overburden thickness is 1.7 metres. No grain size analyses were performed on soil samples. Grain size analyses should have been completed in order to provide additional information required for the soil classification for private sanitary servicing and to support the assessment of potential water quality impacts related to private septic systems.

The clay unit described in section 4.2.1.5 of the McIntosh Perry report is described as grey clay with trace sand and trace gravel, which resembles the description of a till layer. The description of the clay layer should be revised. The Soil classification for Private Sanitary Servicing needs to be supported by grain size analyses. Grain size analyses are required to support the statements made in Section 4.2.2.

The septic impact assessment is discussed in Section 4.3 of the McIntosh Perry Report and follows the MECP Procedure D-5-4 water quality impact assessment steps. The McIntosh Perry report identifies that the proposed development does not meet *Step 1 – Lot Size Considerations* as the average lot size is 0.66 hectares, below the 1.0 hectare considered to be sufficient to naturally attenuate septic impacts. Further, the McIntosh Perry report notes that based on site observations, the site cannot be determined to be hydrogeologically isolated from the groundwater supply aquifer and will not meet *Step 2 – Isolation*. GEMTEC agrees with these conclusions.

The septic impact assessment for the proposed development was completed following MECP Procedure D-5-4 *Step 3 – Contaminant Attenuation Considerations*. The McIntosh Perry report does not identify the receiving aquifer; GEMTEC considers the bedrock water supply aquifer to be the septic receiver. A weighted average nitrate concentration is presented based on variable soil types (47% topsoil over shallow bedrock or clay and 53% of sandy soil with gravel or trace clay), an available infiltration area of 24.14 hectares and incorporating a background nitrate concentration of 2.5 mg/L, which is the highest on-site concentration. McIntosh Perry concludes that the property can accommodate a subdivision of up to 30 lots to proceed while ensuring the Ontario Drinking Water Objective (ODWO) of 10 mg/L for nitrate-nitrogen is not exceeded, with a calculated concentration of 9.9 mg/L at the Site boundary. In order for GEMTEC to agree with



McIntosh Perry's conclusion, the following additional information should first be obtained: 1) the background nitrate concentration of 2.5 mg/L should be confirmed through additional seasonal sampling and nearby private well water sampling; 2) grain size analyses should be conducted in order to confirm the assumptions used in the soil parameters for the nitrate dilution calculations; and, 3) water surplus data used in the nitrate dilution calculation should be obtained from a station that is closer to the subject site, such as the Carleton-Place climate data station.

Given the presence of nitrate in the aquifer at the site at concentrations of up to 2.5 mg/L despite the lack of obvious sources beside private septic systems and distant agricultural land, it is GEMTEC's opinion that a study needs to be carried out to determine whether there is a connection between the shallow bedrock and the aquifer. The study could, for example, include the monitoring of hydraulic responses in deeper wells to the pumping in a shallow well, as well as an assessment of hydraulic responses in shallow and deep wells to precipitation events.

The McIntosh Perry report does not make recommendations pertaining to a minimum well casing depth that would be required to isolate the upper bedrock (receiving aquifer) from the bedrock supply aquifer. Given the hydrogeological sensitivity of the site, protective measures are required for septic systems and such measures should be presented in the report.

### **Surface Water Impacts**

Surface water features are present within the proposed development. As per MECP Procedure D-5-4 section 5.3 (d), McIntosh Perry should comment on the potential impact of the on-site discharge of sewage effluent into surface water.

## **SUMMARY AND RECOMMENDATIONS**

Based on a review of the McIntosh Perry report, GEMTEC has identified the need for supporting analyses and discussion to meet MECP Procedure D-5-4 and D-5-5 guidelines. GEMTEC does not recommend approval of the development at this time. The following information is recommended to support the development application:

### **Water Supply**

- As per MECP Procedure D-5-5, where wells exist on or adjacent to the site, a survey of well owners, and sampling and analysis of representative well water, should be performed and reported.
  - No information is presented from the upgradient or downgradient residential properties. Given that the shallow groundwater flow direction may be influenced by surface water bodies at the Site, GEMTEC suggests sampling a few houses to the north, east and south of the Site.

- The McIntosh Perry report identifies that the theoretical drawdown across the site to be up to 2.2 metres; however, the report does not comment on how a two-metre drawdown may interfere with neighbouring water well owners. GEMTEC recommends further discussion of the potential interference to neighbouring water wells users.
  - GEMTEC recommends McIntosh Perry to conduct a few additional pumping tests with observation wells and use water level loggers and a baro logger in order to obtain reliable observation well data and a defensible estimate of the storativity based on observation well data. If possible, running a pumping test at TW1 and monitoring neighbouring wells at different distances would be helpful for the assessment of well interference. Otherwise, an attempt to assess well interference using the test wells and/or a combination of pumping test data and numerical simulation should be made to support the statement made by the report that well interference will not be an issue at the site after development.
- GEMTEC recommends additional water quality sampling from test wells TW2, TW3, TW4 and TW5 during the spring freshet in order to assess potential groundwater impacts during periods of high infiltration. Private well surveys and sampling on neighbouring properties should be conducted concurrently.
  - Elevated nitrate concentrations in these wells, particularly in TW3 and TW4, indicate these test wells may be susceptible to bacterial contamination therefore bacteriological parameters should also be resampled in the spring. Field chlorine measurements should be provided along with the analytical results.
  - Seasonal nitrate concentration variations and the spatial distribution of nitrate concentrations should be assessed in order to confirm that a conservative background nitrate concentration was assumed for the determination of the maximum number of lots based on nitrate dilution calculations.
  - VOCs should be added to the list of parameters in at least two non-adjacent wells on-site.
- The report must specify a minimum recommended casing length in order to isolate the water supply aquifer from the shallow bedrock. It cannot rely on minimum requirements set in O. Reg. 903 (Wells) given the hydrogeological sensitivity of the site. A rationale based on the distribution of nitrate concentrations, location of potential nitrate and other contaminant sources, water found depth, etc. should be provided. Schematic cross-sections showing on-site and off-site nitrate distribution and water found depth could prove helpful for the completion of this exercise.

## Septic Impact Assessment

- McIntosh Perry indicates the site can support 30 residential lots while ensuring the Ontario Drinking Water Objective (ODWO) of 10 mg/L for nitrate-nitrogen is not exceeded, with a nitrate-nitrogen concentration of 9.9 mg/L at the property limit. In order for GEMTEC to agree with McIntosh Perry's conclusion, the following additional information should first be obtained:
  - the background nitrate concentration of 2.5 mg/L should be confirmed through additional seasonal sampling and nearby private well water sampling;
  - grain size analyses should be conducted in order to confirm the assumptions used in the soil parameters for the nitrate dilution calculations; and,
  - water surplus data used in the nitrate dilution calculation should be obtained from a station that is closer to the subject site, such as the Carleton-Place climate data station.
- Given the presence of nitrate in the aquifer at the site at concentrations of up to 2.5 mg/L despite the lack of obvious sources beside private septic systems and distant agricultural land, it is GEMTEC's opinion that a study needs to be carried out to determine whether there is a connection between the shallow bedrock and the aquifer.
  - The study could, for example, include the monitoring of hydraulic responses in deeper wells to the pumping in a shallow well, as well as an assessment of hydraulic responses in shallow and deep wells to precipitation events.
- GEMTEC recommends that McIntosh Perry comment on the potential impact of the on-site discharge of sewage effluent into surface water, in accordance with MECP Procedure D-5-4, Section 5.3 (d).
  - GEMTEC notes that surface water features are located within the proposed development.

## ADDITIONAL EDITORIAL COMMENTS

- Section 2.4.4 of the McIntosh Perry report states that the surrounding land uses are not expected to be a significant source of contamination. However, given the known presence of the Beckwith VOC plume it is GEMTEC's opinion that proposed developments in the Beckwith Township should also include VOCs in the list of parameters analyzed as part of the groundwater quality assessment conducted in the test wells. Although the plume has not been documented at the site to date, the list of typical subdivision package

parameters does not include VOCs therefore their presence in the area might not necessarily be detected unless specific testing is conducted.

- Section 2.4.4, last paragraph: Figure 2 should read Figure 3.
- Section 3.3.1, first paragraph: The first 3 sentences appear to be from another report, referring to seven test wells, groundwater elevations that do not match Table 2 and a groundwater flow direction to the southwest contrasting with the rest of the report with a mention of Mississippi Lake, which is not close to the site.
- Section 4.2.1.5: “the clay layer within TP14 is underlain by a relatively thick layer of topsoil (0.6 m)” should read “ the clay layer within TP14 is overlain by a relatively thick layer of topsoil (0.6 m)” according to the TP14 test pit log.
- Table 9: The header row of the Test Well 4 summary table reads as TW2 being the pumping test location while it should read TW4.

## LIMITATIONS

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

The investigation undertaken by GEMTEC with respect to this report and any recommendations or conclusions made in this report reflect the best judgments of GEMTEC based on the findings as conveyed by McIntosh Perry and the professional opinions of the qualified professional who conducted and signed the hydrogeological report. GEMTEC has not completed an independent site investigation to confirm the validity of the data presented in the hydrogeological report prepared by McIntosh Perry.


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

## CLOSURE

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



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