May 4, 2017
MTE File No. C33886-100

Association of Professional Geoscientists of Ontario
Attn: Mr. Louis Kan, CEO
25 Adelaide Street East, Suite 1100
Toronto, Ontario M5C 3A1

Dear Mr. Kan:

Re: Formal Complaint Registered With the APGO
re: Peter A. Gray, P.Geo, Member No. 0335

Further to correspondence received by Nathaniel Howell, Acting Deputy Registrar for the APGO dated April 12, 2017, I am submitting this letter in acknowledgement of the complaint registered against me and including a response to the technical matters which have been raised by the Complainant, Associate Professor Sharon Cowling of the University of Toronto stating that I have submitted technical work that is "lacking in scientific integrity".

The following is a response to items raised by Nathaniel Howell's letter of April 12, 2017 and Appendix A of Ms. Cowling's letter of April 7, 2017. I maintain that MTE's technical work on the site and within the study area was extensive, thorough, and scientifically sound. The geological and hydrogeological work undertaken meets or exceeds the requirements for these types of investigations as specified by the MNRF for Aggregate Resource Act applications of this nature.

As a licensed member of the Association of Professional Geoscientists of Ontario, I understand my professional responsibility and confirm our geological and hydrogeological observations, conclusions, and recommendations maintain this professional obligation and are supported by extensive site specific data. In addition, the complaints from Ms. Cowling are not supported by evidence and she has not provided any data or completed her own investigations, calculations, or analysis or cited any publications or additional references to contradict MTE's assessment.

April 19, 2017; Letter to Margaret Berube, District Planner, MNRF, Regional Operations Division, Southern Region, Bancroft District, submitted by Sharon A. Cowling, Associate Professor, Dept. of Earth Science, University of Toronto

Paragraph 2: Ms. Cowling states that serious flaws are contained in MTE's reports, including a scientifically inaccurate evaluation of the hydrogeological regime of the study site.

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I maintain that MTE's technical work on the site and in the area was extensive and formed the basis from which our geological and hydrogeological observations, conclusions and recommendations have been made and are contained in our most recent Level 1 and Level 2 Hydrogeological Investigation Report for the Proposed Freymond Quarry dated December 1, 2016 which supersedes our other reports prepared for this site.

In determining the size of the study area for the 2016 report, MTE considered input from the 2015 public meeting to expand the size of the study area presented in the 2015 report. Factors including watershed and subwatershed boundaries, the surrounding lakes, the area of potential influence from quarrying operations (ie. zone of influence), and natural features were assessed. MTE completed a more detailed geologic and hydrogeologic analysis of the groundwater and surface water features and systems in the expanded area.

The work undertaken by MTE has included:

- A review of the *Aggregate Resources Act (R.S.O., 1990)* and the *Aggregate Resources Provincial Standards (1997)* for the preparation of a Level 1 and 2 Hydrogeological Assessment;
- A review of the Provincial Policy Statement (2014);
- A review of the *Clean Water Act (2006);*
- A review of the County of Hastings Official Plan;
- A review of the Township of Faraday Official Plan;
- A review of published geological and water resources maps;
- A review of Ontario Base Maps (OBM maps);
- A review of the Approved Assessment Report for the Trent Source Protection Area;
- A review of the Regional Groundwater Study for the Quinte Conservation Authority by Dillon Consulting Ltd. dated October 20, 2014;
- A review of the Trent Source Protection Plan;
- A review of the Madawaska River Water Management Plan;
- A review of the 2014 Annual Water Report for the Town of Bancroft;
- A review of comments received at the June 25, 2015 Public Open House, comments received by the County on July 1, 2015 from Steve Gaebel, a letter received by the County on July 14, 2015 from Tara McMurtry, Adrianne Schutt and Daisy McCabe-Lokosl; letters received from the County from Ms. Cowling on August 6 and August 28, 2015 and an email received by the County on September 16, 2015 from Sheila and Mike Schneider;
- An examination of water well records on file with the Ontario Ministry of the Environment and Climate Change (MOECC);
- Site specific field work that included:
    - Field reconnaissance completed during 26 Site visits from May 2009 to October 2016;

  - Construction of 13 bedrock groundwater monitoring wells;
  - 7 well performance tests performed on on-Site monitoring wells;
  - A pumping test to determine the well yield of MW7;
  - 26 Site visits to manually measure groundwater levels;
  - Continuous measurement of groundwater levels using pressure transducers (data loggers) installed in monitoring wells to develop a continuous water level data set spanning seven years; and
  - A geodetic survey and inspection of 15 private water wells within the study area.
- Establishment of the water table elevation beneath the Site;
- Determination of groundwater flow patterns beneath the Site; and
- Assessment of potential impacts to:
  - Groundwater aquifers;
  - Private well water supplies;
  - Groundwater recharge/discharge zones; and
  - Natural environmental features including springs, streams, rivers and lakes within the Study Area.

Paragraph 3: Ms. Cowling claims that MTE has completely misidentified the hydrological regime of the study site and that MTE claims that the study site is in an unconfined aquifer where surface water plays a more important role than groundwater in influencing the hydrological balance of the area and that the risk of underground faults and fissures is minimal to nil. Ms. Cowling further states that this is false since the watershed is a complex confined aquifer with four lakes whose primary source of water is from belowground springs and where a network of underground faults and fissures must be extensive.

MTE's December 1, 2016 report does not include the phrase 'unconfined aquifer' let alone describe the bedrock groundwater system at the study site as an unconfined aquifer. Appendix G presents an assessment of potential drawdown within the bedrock groundwater system. In this assessment, MTE uses an industry accepted analytical model for a clearly stated confined aquifer.

On Page 7 of MTE's December 1, 2016 report we describe the location of Class 1 and 2 faults in the area as mapped by the Ontario Geological Survey (Map 3385) and the Ministry of Northern Development and Mines (Map 2545).

According to the OGS, a Class 1 fault is traceable in surface exposures and a Class 2 fault is defined as cutting Precambrian basement rocks but not extending to the surface. In order to understand, document, and hydraulically test the nature of the fracture system in the study area, MTE completed:

- Field reconnaissance including 26 Site visits from May 2009 to October 2016;
- Construction of 13 bedrock groundwater monitoring wells;
- 7 well performance tests performed on on-Site monitoring wells;

- A pumping test to determine the well yield of MW7;
- 26 Site visits to manually measure groundwater levels;
- Continuous measurement of groundwater levels using pressure transducers (data loggers) installed in monitoring wells to develop a continuous water level data set spanning seven years; and
- A geodetic survey and inspection of 15 private water wells within the study area.

The results of this testing indicate that the flow through the fractures assessed by MTE, and data reported in the MOECC water well record database, is very slow (in comparison to data published in Freeze and Cherry, 1979, Fetter, 2001), ranging from 3.4×10^{-6} m/sec to 5.6×10^{-11} m/sec with a geometric mean of 7.9×10^{-10} m/sec.

In determining the potential drawdown caused by the removal of the rock and the natural drainage from the "fractures and fissures" on Site, MTE used an analytical model (based on Theis, 1935) and completed a water balance for the Site and area. Based on the analytical model and water balance (which considers the recharge of precipitation into the low permeability bedrock), the area lakes are sustained primarily by overland flow and runoff, as the fractures transmit too little water.

April 7, 2017; Letter to Louis Kan, CEO, Association of Professional Geoscientists, submitted by Sharon A. Cowling, Associate Professor, Dept. of Earth Science, University of Toronto

Appendix A: Overview

Paragraph 1: Ms. Cowling states as they relate to the Ontario Aggregate Resources Act (1991), both hydrogeological reports (2015, 2016) prepared by MTE are technically sound and correct.

Ms. Cowling acknowledges MTE's reports are technically sound and correct in the context for which they were prepared (i.e. to meet the standards set out under the Aggregate Resources Act for a below-water-table quarry application).

Paragraph 1: Scientifically, however, the <u>watershed</u> is the basic unit for the understanding hydrology and not the small study area within a watershed; therefore it is from this perspective that I view both HG-reports scientifically flawed and lacking of any basic scientific integrity. By ignoring water-shed level features, Mr. Gray was able to fabricate a false identity for the study site in question, implying that it was an unconfined aquifer where groundwater is relatively unimportant component of the hydrological balance and below ground faults fissures and springs are completely lacking.

MTE has correctly identified and cited in our 2016 report the specific watershed in which the Site and surrounding area are located. Furthermore, MTE identified a topographic high (a significant watershed feature) that separates the Site and area of study from the lakes located south of the Site.

Neither MTE's 2015 or 2016 reports use the phrase 'unconfined aquifer'. In our reports, MTE conceptualizes the bedrock groundwater system at the Site as a confined groundwater system where groundwater flows through localized vertical and horizontal fractures and not major regional faults (MTE 2016, page 18, Appendix G).

Specific Comments and Examples

Paragraph 2: In the first report (2016), MTE incorrectly identifies the type of hydrological regime present at the Site; they describe it as an "ideal confined aquifer" (middle page 23). A confined aquifer refers to groundwater where flow is restricted (i.e. blocked movement) by bedrock or some other non-permeable material. An "ideal" confined aquifer refers to conditions of absolutely minimal movement of groundwater into or out of the confined aquifer. Due to the presence of spring-fed lakes elsewhere in the watershed, the word "ideal" is incorrect because water must be moving from one place to another via underground springs created by faulting of the geological bedrock.

Ms. Cowling appears to have taken the phrase "ideal confined aquifer" out-of-context. The section of the 2015 Report Ms. Cowling is referring to deals with the selection of an analytical model MTE uses to assess a potential zone-of-influence from dewatering the proposed quarry. The analytical model (Theis, 1935) selected has a number of simplifying assumptions which define the aquifer as 'ideal'. The basic assumptions (Fetter, 2001) (also listed in MTE 2015, Page 23 and Page 24) are:

- The aquifer is bounded on the bottom by a confining layer;
- All geological formations are horizontal and have an infinite extent;
- The potentiometric surface of the aquifer is horizontal prior to the start of dewatering;
- All changes in the positions of the potentiometric surface are due to the effect of dewatering;
- The aquifer is homogeneous and isotropic;
- All flow is radial to the quarry;
- Groundwater flow is horizontal;
- Darcy's Law is valid;
- Groundwater has a constant density and viscosity;
- The quarry (well) is 'screened' over the entire thickness of the aquifer;
- The quarry (well) has an infinitesimal diameter and is 100% efficient;
- The aquifer is confined top and bottom;
- There is no source of recharge to the aquifer;

- The aquifer is compressible and water is released instantaneously from the aquifer as the head is lowered; and
- The well is pumped at a constant rate.

MTE agrees with Ms. Cowling that vertical movement of groundwater into or out of a confined aquifer may be 'restricted'; however, the horizontal movement of groundwater through a confined aquifer is not restricted relative to the overlying or underlying confining layers nor within the confined aquifer.

Ms. Cowling's definition of a confined aquifer where "*groundwater flow is restricted (i.e. blocked movement) by bedrock or some other non-permeable material and "ideal" confined aquifer refers to conditions of absolutely minimal movement into or out of the confined aquifer*" is misleading and technically incorrect. According to Freeze and Cherry (1979) "a confined aquifer is an aquifer that is confined between two aquitards. In a confined aquifer, the water level in a well usually rises above the top of the aquifer" p 48.

Paragraph 3: MTE did not call the study site an ideal aquifer in their second report (2016), rather preferring to use the statement: "The Site and study are located in the York River subwatershed which is part of the Madawaska watershed" (middle page 4). MTE went this route because an unconfined aquifer is a relatively uncomplicated hydrological regime, where faults/fissure/cracks are typically not present in the local geology and therefore springs and spring-fed lakes are generally no part of the hydrological landscape. I'm not sure why MTE decided to change the characterization of the hydrological regime but the actual characterization of the hydrological regime is that of a complex confined aquifer.

On page 18 of MTE's 2016 report, MTE states that "groundwater flows through secondary porosity features, including fractures and joints in the bedrock"; "groundwater flow moving towards private wells occurs through localized vertical and horizontal fractures"; "the top 10 to 30 m of bedrock is more fractured (Dillon, 2004) due to weathering by glaciations. Bedrock tends to become more competent or dense with depth where the connectivity of fractures is reduced". MTE makes no reference to the hydrogeologic regime being an "unconfined aquifer" and clearly reports the depth, occurrence, and frequency of fractures. This reporting is consistent from the 2015 to 2016 report.

Ms. Cowling also appears to have taken the above section out-of-context. The section of the 2016 Report Ms. Cowling is referring to describes the location of the Site relative to surface water features (i.e. river and lakes). MTE does not understand how a statement and section regarding the location of surface water features relative to the Site can be inferred, or referred to as an interpretation of a groundwater regime.

As indicated above, MTE does not use the phrase 'unconfined aquifer' in either the 2015 or 2016 report. We have consistently assessed the bedrock groundwater system between reports (2015 Report Section 6.7; 2016 Report Appendix G) as confined.

Paragraphs 4-5: By using Ontario Base Map (OBM), MTE showed an absence of large bodies of water present on the study site. MTE indicated that they relied on comments made by a subcontracted ecologist who identified that in addition to two small streams there were also two semi-permanent ponds and one permanent wetland within the 500 m radius of the proposed site. These smaller water features would not have appeared on the OBM. MTE goes on to describe the water balance of the site indicating that these streams and ponds have all formed as a result of seasonal rainfall over the land surface, with water collecting in the topographic lows. Groundwater is a major component of water balance evaluations, but MTE avoided its discussion because they pretended the site was an unconfined aquifer where groundwater is much less important. In reality, MTE should have discussed groundwater as a major component of the water balance of their study site because their study site was in fact a complex confined aquifer.

MTE indicates that they did perform a reconnaissance of the site for their second HG-report (2016) but fail to identify the permanent wetland that was identified in the previous report. A permanent wetland would have indicated the presence of groundwater on the surface. Because the site was described as containing Precambrian rock, the only way to get groundwater to travel through igneous and metamorphic rock to reach the surface is through fissures in the rock. In other words, MTE would have had to indicate the presence of a spring-fed wetland (which they did not)

Ms. Cowling is correct in that OBM's do not show all surface water features on the Site. The study team biologist identified a permanent surface water body in the north central portion of the Site and two semi-permanent ponds at or just beyond the south west Site boundary. There are no inlets or outlets from these ponds which are located in closed depressions that trap surface water drainage at elevations above the water table elevation. MTE observed water levels in these ponds were highest in spring before decreasing in size over the course of the year.

Ms. Cowling is correct that MTE performed an on-Site reconnaissance in 2016. This reconnaissance identified the three small on-Site ponds which correlate to those identified by the study team biologist and reported in the 2015 report. The wetland Ms. Cowling is referring to is not located on-Site but is associated with an in-line pond in the North Stream.

The wetland complex referred to by Ms. Cowling above is identified on the OBM (2015 Report – Figure 2) and was clearly associated with the North Stream (2015 report, page 7). No reference was made to it being permanent in the 2015 Report.

Our testing and analysis of the groundwater system at the Site indicates groundwater is a minor component to the overall water balance given the low permeable nature of the bedrock material at the Site and discontinuous and random nature of the fracture network. Our opinion is that the principal components of the water balance at the Site and study area due to the low permeability of the bedrock can only deductively be precipitation and overland runoff.

Ms. Cowling has repeated her statement that MTE has misclassified the hydrogeological regime of the Site as unconfined. MTE maintains that the phrase "unconfined aquifer" is not used in the 2015 and 2016 reports and has consistently assessed bedrock groundwater as a confined system. Furthermore, MTE does not consider an unconfined groundwater system any less important than a confined groundwater system. Unconfined systems are potentially more susceptible to adverse impacts as they lack the protection of a confining layer and are more responsive to climatic changes.

Paragraph 6: In their first report (2015), MTE does not identify any of the four spring-fed lakes found elsewhere in the watershed (up to 2,500m). In the second HG-report (2016), MTE identifies eight lakes within the vicinity of the Site (including lakes outside the immediate watershed), MTE asserting that "water entering these lakes with be primarily from surface water from the surrounding lands with a minor component from groundwater" (bottom, page 4). Although this statement is somewhat correct for all lakes grouped together, this statement is absolutely false for the four closest lakes to the site (i.e. Jeffery, Banner, Bay, and Spurr Lakes) all of which are spring-fed (by groundwater) and indicative of the hydrological regime of the entire watershed.

Ms. Cowling appears to have mis-interpreted our statement regarding the water source for lakes surrounding the Site. Ms. Cowling indicates the lakes she identifies above are spring-fed only but does not provide any data to support her claim and excludes the role that direct precipitation and surface water runoff have in supplying water to these lakes.

We maintain that bedrock groundwater will play a small role in the supply of water to these Lakes (as indicated otherwise by the above quote provided by Ms. Cowling), as the amount of bedrock groundwater entering these lakes relative to direct precipitation and surface runoff is low. This is due to the low permeable nature of the bedrock in which these lakes reside which limits infiltration and has low groundwater transmittal rates.

Paragraph 8: MTE relies on an outdated publication (i.e. Lumbers and Vertolli, 1998) to ascertain the likelihood of finding faults beneath the Site study Site but once again ignore looking at features found at the watershed-scale. Statements like "there is expected to be minor faulting on the Site" (first report; top of page 8) and "there are no faults mapped at the Site" (second report; middle of page 7) are blatantly false in the face of a watershed containing four spring-fed lakes. You cannot get spring-fed lakes if *there is an absence of faulting as geological processes involved in faulting produce fissures in rocks that allow confined groundwater to seep to surface to create these lakes.*

Regional scale fault mapping was conducted by the OGS and MTE relied on this map to determine if regional faults related to minor/major geological structures occurred at the Site. The mapping clearly shows the OGS did not map any of these features at the Site. MTE is not aware of a significant local geological event in Ontario since 1998 that could have resulted in new watershed scale geological features that would affect groundwater flow beyond those mapped by the OGS in 1998 and identified by MTE.

Ms. Cowling has incorrectly applied statements made specific to the Site and to the larger area. Our 2015 statement 'there is expected to be minor faulting at the Site' is an acknowledgment that despite the lack of regional scale faults mapped across the Site, MTE expects minor localized faulting/fracturing at the Site and that these features will transmit groundwater. MTE indicates consistently in both our 2015/2016 reports that groundwater encountered at the Site and surrounding area (water well records) will be transmitted through fractures in the bedrock mass but that the fracture network is localized and discontinuous. Further, our interpretations were based on our on-Site testing and analysis which determined that these fractures transmit groundwater at a very slow rate.

*Paragraph 9: There is one very obvious discrepancy between the different types of reports produced by MTE during their first application (in 2015). A separate environmental assessment report was authored by a subcontracted ecologist, who isn't a member of the APGO but who holds a higher post-secondary school degree (i.e. M.Sc). The ecologist describes the groundwater system that exists at the scale of the watershed in one succinct sentence: "In summary, the estimated groundwater table is at 375 m AMSL but varies over the Site because water is actually contained in fractures with the bedrock" (my italics; bottom, page 6). Somehow, MTE hydrogeologists missed this **basic** hydrological feature of the site and have gone to extremes to avoid using fissures and fractures within their reports.*

Ms. Cowling is incorrect in stating that *"MTE missed the basic hydrologic feature of the site and MTE has gone to extremes to avoid using fissures and fractures within their reports"*. In the 2015 report the words fracture, fractures, or fractured appear 24 times in the text body (not including table of contents or section headings). In the 2016 report these same words appear 25 times in the text body (not including table of contents, section headings, or appendices). To illustrate this point, the following is a selection of statements made regarding groundwater and fractures in both our 2015 and 2016 reports:

*MTE strived to map these common water producing zones (**fractures**) where possible while considering the approach discussed above. (MTE 2015, Section 3.1, pg. 9).*

*In deep **fractured** rock, this condition cannot exist and pressures at depth represent a potentiometric surface (i.e. MW4s and MW4d where groundwater elevations are above ground surface). (MTE 2015, Section 3.2.1, pg. 10)*

*However, the exact elevation at which groundwater will enter the operating quarry will vary across the Site as groundwater will actually discharge from **fractures** in the bedrock located at discrete elevations across the operating face. (MTE 2015, Section 3.2.1, pg. 11)*

*… groundwater elevations are potentiometric and water levels measured in monitoring wells that originate within **fractures** deep in the bedrock. (MTE 2015, Section 3.4, pg.12)*

*Recharge into the Precambrian bedrock groundwater surface is expected to be primarily controlled by the secondary porosity (i.e. **fractures**) of the bedrock mass. (MTE 2015, Section 5.2.1, pg. 16).*

*This borehole was cored and logged on-Site by an MTE representative to assess bedrock properties and **fractures**. (MTE 2016, Section 4.1, pg. 8)*

*Given the lack of water at these locations which was due to the limited number of **fractures** encountered during their drilling and installation… (MTE 2016, Section 4.2, pg. 8)*

*Since installation, groundwater levels have risen 27 metres at MW4s and 36 metres at MW4d as the wells equilibrate to the water pressure in the **fracture** that is being monitored. At MW4, the pressure in the **fractures** has risen to a level above ground surface. This relatively common occurrence is called a flowing artesian condition. (MTE 2016, Section 4.2, pg. 9).*

*This is because there is not enough water in the bedrock **fractures** to sustain a constant pumping rate for an extended period of time. (MTE 2016, Section 4.6, pg. 12)*

*This lower drawdown trend of water levels at 345 mAMSL suggests that MW7 encounters a water bearing **fracture** at this depth, which correlates to a **fracture** noted in the borehole log. (MTE 2016, Section 4.6.1, pg. 13)*

Given the above, we do not understand how Ms. Cowling states "*MTE hydrogeologists missed this **basic** hydrological feature of the site and have gone to extremes to avoid using fissures and fractures within their reports".*

Paragraphs 10 and 11: Hydraulic conductivity is an important parameter in Hydrogeology as it describes how fast or how slow water flows through below ground material (i.e. soil, rock, gravel, or clay), and in turn will influence the maximum distance *on which quarry activities will have an influence. MTE identifies a mean hydraulic conductivity of 1.6 x 10^{-5} m/day (fist report; page 26) which is indicative of an area composed of material that does not allow for fast water flow (i.e. Precambrian rock). This low hydraulic conductivity is used for groundwater modelling calculations as well as for determining the zone of influence (which was determined to be 500 m).*

In the second report (2016), MTE provides a range of hydraulic conductivities observed for the study site; from low conductivities such as 4.8 x 10^{-6} m/day to high conductivities such as 2.9 x 10^{-1} m/day [note: I have converted the units from s/day to m/day as the latter is the ISI unit for hydraulic conductivity]. If the area contains predominantly Precambrian rock types like MTE indicates, then what explains the presence of such high values of hydraulic conductivity (i.e. 2.9 x 10^{-1} m/day)? MTE does not address the reason for such a wide range of hydraulic conductivities (i.e. by five orders of magnitude) because it would have directly contradicted their claim that there were no faults (fissures) in the geological material below the site.

MTE does not agree with Ms. Cowling that a hydraulic conductivity value of 2.9x10^{-1} m/day (3.4x10^{-6} m/sec) represents a high conductivity value but based on published literature (Freeze and Cherry, 1979; Fetter 2001) considers this result to be slow. As stated in our response to Ms. Cowling's assertions made in Paragraph 9 above, MTE disagrees with Ms. Cowling's statement that we claim no fractures exist in the geological material below the Site. We have correctly identified the presence and nature of the fractures that exist at the Site and have documented the rate (including the range of measurements) that groundwater moves through these fractures.

Paragraph 12: A scientist with integrity would have used the full range of hydraulic conductivities to compute a range of zone of influences, rather than using the mean conductivity which actually means nothing from a scientific perspective. Instead of following scientific best-practice, MTE used the mean value which resulted in a relatively short (~500-800 m) zone of influence. If MTE had used the full range of hydraulic conductivities to calculate the zone of influence, the zone of influence would have extended well into the watershed and would have included the presence of spring-fed-only lakes.

Utilizing a geometric mean of hydraulic conductivity values is a common modelling practice to estimate the bulk hydraulic conductivity of a formation. The intent is to construct a reasonable representation of the system being modelled based on real site data. We maintain that a significant amount of technical vigor was employed in doing so in this case.

In closing, as a licensed member of the APGO, I understand my professional responsibility and confirm that our geological and hydrogeological observations, conclusions, and recommendations maintain this professional obligation and are supported by extensive site-specific data that is accurate, repeatable and defensible.

I trust that this letter addresses each point or complaint raised by Ms. Cowling and should you have any questions, or require further clarification, please do not hesitate to contact me directly.

Yours truly,

MTE CONSULTANTS INC.

PROFESSIONAL GEOSCIENTIST
PETER A. GRAY
PRACTISING MEMBER
0335
ONTARIO
May 4/17

Peter A. Gray, P.Geo, QP(ESA)
VP, Sr. Hydrogeologist

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REFERENCES

Dillon Consulting Limited, 2004: *Quinte Regional Groundwater Study, Final Report.*

Fetter, C.W., 2001: *Applied Hydrogeology 4th ed.,* Prentice Hall, Upper Saddle River, New Jersey, 07458.

Freeze, R.A., and Cherry, J.A., 1979: *Groundwater*, Prentice Hall Inc., Englewood Cliffs, N.J., 07632.

Lumbers, S.B., and Vertolli, V. M., 1998: *Geology of the Bancroft Area;* Ontario Geological Survey, Preliminary Map P.3385, scale 1:50 000.

Ontario's Ministry of Northern Development and Mines (MNDM); Map 2545, *Bedrock Geology of Ontario.*

Theis, C.V., 1935: *The lowering of the piezometer surface and the rate and discharge of a well using groundwater storage;* Transactions, American Geophysical Union, 16:519-24.