May 1, 2018
MTE File No.: C33886-100

Mr. John Porritt, P. Geo
Senior Hydrogeologist
Greer Galloway Consulting Engineers
1620 Wallbridge Loyalist Road
Belleville, ON K8N 4Z5

Dear Mr. Porritt:

Response to Township Peer Review Comments, August 4, 2017
Re: Level 1 and Level 2 Hydrogeological Investigation Report,
Proposed Freymond Quarry

The Greer Galloway Group Inc. hereby referred to as "Greer Galloway" was retained by the County of Hastings to carry out a peer review of MTE's Level 1 and Level 2 Hydrogeological Investigation for the proposed Freymond Quarry. The following letter is written in response to comments received from the Greer Galloway in their letter dated August 4, 2017. The delay in response to comments received is related to additional work undertaken by MTE in the fall of 2017 to better address comments presented herein. This letter is structured such that comments from Greer Galloway requiring a response from MTE Consultants Inc. (MTE) are repeated in italics, followed by the response. For ease of reference MTE has numbered each individual comment. For supporting documentation MTE has attached the following:

- Attachment 1 – Rock Quality Analysis
- Attachment 2 – Proposed Stormwater Management Facility
- Attachment 3 – Response to MOECC Comments Re: Level 1 And Level 2 Hydrogeological Investigation Report, Proposed Freymond Quarry
- Attachment 4 – South Stream Analysis

RESPONSE TO COMMENTS FROM GREER GALLOWAY LETTER DATED AUGUST 4, 2017

Greer Galloway Comment (Page 3, Hydrogeological Level 1)

Comment # 1: *The report discusses the impact of residual ammonia from blasting on water quality and indicates that this will be mitigated through retention ponds within the quarry before discharge to surface water. The report describes the presence of secondary sulphides within a borehole (MW7), and presents a geology map suggesting some extraction may take place within a unit of graphitic schist with pyrite. The report does not address the potential impact to groundwater or surface water from the*

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, Ontario N2B 3X9
Phone: 519-743-6500
Fax: 519-743-6513
www.mte85.com

weathering of these sulphides. (A response to this concern was provided by MTE in an email dated 22JUN17 attached).

MTE Response

In response to Greer Galloway`s comment regarding the potential impact to groundwater or surface water from acid rock drainage (ARD) due to the weathering of sulphides on-Site, MTE researched the prevalence of acid rock drainage from quarries in Ontario. MTE was unable to find any published reports or articles related to ARD for aggregate quarries in Ontario. This search revealed that in some cases the occurrence of ARD in Ontario is related to ore mining operations. MTE has also contacted the Ontario Geological Survey (OGS) regarding the potential of ARD and were directed to the following two reports which they believed were the most relevant:

- Pyrrhotite and associated sulphides and their relationship to acid rock drainage in the Halifax Formation, Meguma Group, Nova Scotia; and
- Multi-Media Geochemical Baseline Study in the Vicinity of the Cal Graphite Deposit, Butt Township.

MTE reviewed these two reports, and a summary of each is provided below:

The report related to ARD in Nova Scotia indicates that the Halifax Formation consists of slate with thin metasiltstone interbeds. The abundance of pyrrhotite within the Halifax Formation was noted as being an important factor in ARD as pyrrhotite weathers significantly faster than other sulphide minerals (Fox, Robinson, & Zentilli, 1997). Regarding the Freymond Site, the occurrence of pyrrhotite was not noted in the core log or in the rock quality analysis completed for MW7. Due to the difference in geology between the Halifax Formation and that on-Site (Medium to High metamorphic grade calcareous mudstone and sandstone intercalated thin units of silacious marble & a minor amount of schist) and due to the absence of pyrrhotite, MTE does not consider the results from this report applicable to the Site.

The Cal-Graphite mine is located approximately 120 km northwest of the proposed Freymond Quarry in the Township of Butt. The Cal-Graphite mine was a graphite mine in operation from 1990 to 1994 (Dyer, Bajc, & Jackson, 1996). In context to Greer Galloway's comment, MTE made note of the following from the Cal-Graphite Report:

- The natural buffering capacity of the till and galciofluvial deposits were considered low (due to the low carbonate content);
- Local lakes partly underlain or adjacent to calcite veins had a natural high buffering capacity;

- Sulphide bearing waste rock was contributing to acid drainage; and
- "The distribution of oxidized, graphitic ore-bearing till and stratified deposits is likely the most important factor in the development of acidic drainage in the area. This natural effect has been exacerbated by the disturbance and placement of this material into natural drainage pathways."

The report also noted work done by Cameron (1979) which suggests that sulphide mineralization containing continuously connected graphite has a higher oxidation rate. Rock quality testing from core taken from MW7 indicates that the rock on-Site is composed of quartz, biotite, muscovite and calcite with minor amounts of iron oxides (pyrite and magnetite). The occurrence of graphite was not noted in the borehole core log for MW7 or in the rock quality analysis.

Therefore based on the lack of graphite and pyrrhotite observed in the core log for MW7 and rock quality analysis, and the absence of contributing oxidized till on-Site MTE considers the potential for ARD to be low. Further, two of three rock samples submitted for analysis were identified as marble (**Attachment 1**) indicating a portion of carbonate, which may act to "buffer", or counter any effects of sulphide weathering. As outlined in **Attachment 2 – Freymond Quarry Proposed Stormwater Management Facility**[1], TSS, total ammonia and total petroleum hydrocarbons shall be sampled monthly under non-freezing conditions, after significant rainfall events (> 8mm). In addition during sampling pH and temperature will be measured and recorded in-situ. Un-ionized ammonia concentrations will be calculated using the total ammonia concentration, temperature and pH. In addition, MTE recommends bi-weekly in-situ pH measurements from the SWM Facility discharge during the operating season to ensure pH levels are within the PWQO (6.5-8.5). pH will act as a trigger mechanism and in the case of an exceedance of the PWQO additional sampling will take place.

Any on-Site impacts to water will be managed by the SWM facility and will have to meet the Provincial Water Quality Objectives prior to being discharged.

Greer Galloway Comment (Page 3, Hydrogeological Level 2: Groundwater Aquifers)

Comment # 2: *More interpretation in relation to lithology of aquifers would assist in predicting non-stormwater discharge from the quarry. The report describes slow static level recovery in some boreholes but with artesian conditions in one borehole.*

[1] Attachment 2 reflects comments received from the Ministry of Natural Resources and Forestry on Appendix E of MTE's Level 1 and Level 2 Hydrogeological Investigation for the proposed Freymond Quarry.

MTE Response

In December 2017 MTE undertook two 24 hour pumping tests (PTTW No. 1205-ASYT3W), one on MW7 and one on MW8 see **Attachment 3 – Response to MOECC Comments Re: Level 1 and Level 2 Hydrogeological Investigation Report, Proposed Freymond Quarry**. Throughout the pumping tests water levels were measured from on-Site monitoring wells and the two closest off-Site domestic wells (PW2 & PW13) (**Figure 1 of Attachment 3**). Only one on-Site monitoring well (MW3d) was found to respond to pumping at MW7 while no wells responded to pumping at MW8. The 24 hour pumping test conducted on MW7 indicated that MW7 was incapable of producing 52 L/min (74,000 L/day) over the entire pumping period. The pumping rate was noted to decrease to 30 L/min (43,200 L/Day) by the end of the test. MW8 was also unable to sustain 52 L/min and was incapable of sustaining >15 L/min after 4.5 hours of pumping.

Based on this testing, and the lithology of the bedrock as described above, individual, and discrete fractures that are encountered will provide non-stormwater discharge from the quarry at low rates and volumes due to their discrete nature and low hydraulic conductivities.

Greer Galloway Comment (Page 3, Hydrogeological Level 2: Discharge to surface water)

Comment # 3: *The report presents a model showing the interpreted discharge to the North and South Streams. "Precipitation and groundwater collected in the quarry are to be directed to a SWM facility where fines and other potential contaminants introduced during blasting and quarrying will be allowed to settle or be removed." However the Technical Memorandum – Stormwater Management Facility (Appendix E) states that groundwater contribution to the facility is assumed to be negligible.*

MTE Response

The SWM Facility has been designed to provide erosion control for a 25mm 4-hour Chicago design storm event in which the pond inflow or the rate at which water enters the SWM Facility was calculated to be 162,540 L/min (**Attachment 2)**. As such, MTE considers the possible groundwater input of 30 L/min to be negligible regarding the capacity of the SWM Facility.

Comment # 4: *The report does not fully address the impact of extraction below the water table in proximity to the South Stream. (A response to this concern was provided by MTE in an email dated 22JUN17 – attached).*

MTE Response

In response to comments from Greer Galloway on the South Stream MTE performed additional work in the fall of 2017 to better characterize the South Stream, the details of which can be found in **Attachment 4 – South Stream**

Analysis. The flow calculated by the catchment assessment on SW1 showed good agreement with the on-Site measured flow, indicating that flow in the South Stream is maintained primarily by overland runoff. Based on the proposed Site plans, water originating at the headwaters of the main branch of the South Stream will continue to flow downstream.

Greer Galloway Comment (Page 3, Hydrogeological Level 2: Proposed water diversion, storage, and drainage facilities on site)

Comment # 5: *The report provides a plan for water diversion, storage, and drainage facilities, however these facilities may not reflect the potential diversion of groundwater flows during the following extraction.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 3.

Greer Galloway Comment (Page 4, Hydrogeological Level 2: Methodology)

Comment Number 6: *The methodology of the Investigation effectively identifies wells, surface water features and flows, topography, and drainage. Seven boreholes (Monitor Wells) are constructed within the proposed extraction area. The monitor well in the centre of the property was constructed by diamond drill coring, and the core logged. Cuttings from the other boreholes were not logged. Groundwater conditions in the monitor wells are documented. Groundwater flows are modelled using published values for typical bedrock materials and not from values determined on site.*

MTE Response

The only published values used by MTE were related to the porosity of the bedrock. These porosity values were only used for the Macro Drainage Analysis (Appendix F of MTE's 2016 Level 1 and Level 2 Hydrogeological Report). Field tests were conducted to determine other elements used to establish "Groundwater flows" at the Site including:

- Single well hydraulic response tests;
- Water levels/elevations;
- Measured gradients; and
- Pumping tests

MTE's 2016 Level 1 and Level 2 Hydrogeological Report included two groundwater flow maps (shallow & deep) which were created using water level data taken from on-Site wells. The groundwater gradient calculated from these maps was 0.04 m/m for the shallow system and 0.08 m/m for the deep. Two

additional groundwater flow maps using water level measurements taken on December 1, 2017 can be seen in **Figures 1 & 2**. Groundwater gradients calculated based on the 2017 data were comparable to those values calculated based on 2014 measurements.

Greer Galloway Comment (Page 4, Hydrogeological Level 2: Impact Assessment)

Comment # 7: *An impact assessment is provided. Impacts to the South Stream require additional modelling to demonstrate any potential intersection with extraction to 30 metres below the water table.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 4.

Comment # 8: *Assessment of impacts on domestic wells directly to the north of the site should use drawdown of water table following extraction, and use site data from boreholes.*

MTE Response

The following summarizes domestic wells north of the Site.

- There are three domestic wells within close proximity north of the Site (PW2, PW13 and PW 11);
- Of these three, two (PW13 and PW11) are noted to have ground elevations (337.25 mAMSL (PW13) and 325.33 mAMSL (PW11)), below the final floor elevation (338.00 mAMSL) in the northwest corner of the quarry and as such will not be impacted by the proposed quarry;
- PW2 and PW13 are noted to be within the zone of influence as indicated on **Figure 23** of MTE's Level 1 and Level 2 Hydrogeological Investigation; and
- PW2 is noted to have a ground elevation (353.32 mAMSL) above the proposed quarry floor.

Pumping tests conducted in December 2017 on MW7 and MW8 (open boreholes) indicated the limited lateral extent of fractures encountered on-Site (**Attachment 3)**. PW13 and PW2 were monitored throughout the pumping tests as these wells were within the predicted zone of influence. Neither PW2 nor PW13 showed a response to the pumping tests on MW7 or MW8, indicating a lack of hydraulic connection between the fractures encountered on-Site and those off-Site.

Comment # 9: *The potential for impact on surface water from oxidation of exposed sulphides is not addressed. (A response to this concern was provided by MTE in an email dated 22JUN17 – attached).*

MTE Response

Please see MTE Response to Greer Galloway Comment # 1.

Greer Galloway Comment (Page 4, Hydrogeological Level 2: Mitigation Measures Including Trigger Mechanisms)

Comment # 10: *The report describes mitigation measures including retention ponds to improve discharge water quality. More description of sampling protocols and additional quality parameters to reflect additional potential chemical impacts from oxidation of exposed bedrock during extraction should be included.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 1.

Greer Galloway Comment (Page 4, Hydrogeological Level 2: Contingency plan)

Comment # 11: *Section 7.3 Spills Plan of the report states that "As per Condition 3.5 of the Aggregate Resources Act Provincial Standards, a spills plan will be prepared".*

MTE Response

As per ARA standards a Spills Contingency Program will be developed prior to site preparation.

Comment # 12: *Contingency plans should also be prepared to deal with potential: 1. Impacts to neighbouring wells – flow; 2. Impacts to neighbouring wells – water quality; 3. Impact to South Stream – flow; 4.Impact to South Stream – water quality; 5. Increased or unanticipated flow of groundwater into quarry.*

MTE Response

The Well Interference Complaints Procedure outlined in MTE's Level 1 and Level 2 Hydrogeological Investigation describes a proposed contingency plan that can be executed if a groundwater interference is reported during activities at the Freymond Quarry. In addition a Spills plan (to be developed prior to Site preparation) will outline procedures to be taken in the event of a spill on-Site.

In regards to *Impact to the South Stream - flow* please see MTE Response to Greer Galloway Comment # 4.

In regards to *Impact to the South Stream – water quality* please see MTE Response to Greer Galloway Comment # 1.

In regards to *increased or unanticipated flow of groundwater into the quarry* please see MTE Response to Greer Galloway Comment # 2 and Comment # 3.

Greer Galloway Comment (Page 4, Hydrogeological Level 2: Monitoring plan)

Comment # 13: *A program is presented for monitoring groundwater, private wells, and SWM (storm water management). The groundwater monitoring plan does not provide information on sampling protocols or parameters to be tested. The private well monitoring does not provide information on sampling protocols or parameters to be tested.*

MTE Response

Table 1 summarizes the revised monitoring program for the proposed Freymond quarry.

The selection of private wells for monitoring was based on the following criteria:
The Resident is;

1. Within the predicted zone of influence; and
2. Requested to participate in the monitoring program

Given these criteria PW2 is the only private well that MTE recommends monitoring for water quality. Although PW13 is within the zone of influence as per Figure 23 of MTE's Level 1 and Level 2 Hydrogeological Investigation, an elevation survey indicated that the ground surface at PW13 is below the proposed quarry floor at the northwest corner of the quarry and therefore will not be affected.

MTE recommends PW2 be sampled for background water quality and be analyzed for general chemistry, hardness, pH and total metals.

The results of the groundwater monitoring shall be presented in an annual report. This report shall be submitted to the MNRF and MOECC by March 31 of each calendar year. The report shall present and interpret the results of the groundwater monitoring as it relates to the development of the quarry and shall be prepared by a Qualified Person (i.e. an independent hydrogeologist).

In addition MTE will continue taking groundwater levels from those residents currently enrolled in the private well monitoring program.

Comment # 14: *Consideration should be given to use of automated levelloggers with barometric control, to be coupled with blasting records.*

MTE Response

A barometric pressure transducer is currentlty installed on-Site. Given that levelloggers are installed within the majority of on-Site monitoring wells MTE considers the use of off-Site levelloggers to be unnecessary at this time.

Comment # 15: *The SWM monitoring plan consists of a recommendation to apply for an ECA for the construction of a SWM facility. The Technical Memorandum included as Appendix E to the report, does not address groundwater discharge resulting from extraction below the water table in the calculation for design of the facility.*

MTE Response

Please refer to MTE's Response to Greer Galloway Comment # 2 and Comment # 3.

Greer Galloway Comment (Page 5, Geology and Hydrogeology: Soil Cover)

Comment # 16: *Section 3.1 indicates that "Specifically, the Site is mapped by the Ontario Geological Survey as predominantly bedrock surface…" This information is taken from the literature. Photographs provided with the report show mixed tree cover suggesting soil cover, and with ponds (pans) suggesting an accumulation of organic material.*

MTE Response

OGS Quaternary geology mapping displays locations where overburden deposits are found in thicknesses greater than one metre. The Site is mapped by the OGS as predominately bedrock, exposed or with very thin drift at the surface with glaciofluvial outwash and deltaic deposits along its southeastern edge. On-Site reconnaissance confirms that much of this Site is covered with thin drift, with small localized pockets of soil and other organic matter.

Greer Galloway Comment (Page 5, Data Interpretation)

Comment # 17: *More use could be made of sections to represent information from all boreholes to help with interpretation.*

MTE Response

An additional cross section was created to aid in the interpretation of the proposed quarry as it relates to nearby domestic wells and the South Stream, see **Attachment 4**.

Comment # 18: *Seven boreholes have been constructed, but not all were used in determining hydraulic conductivity. MW4 was not used in the interpretation due to flowing conditions. This is a significant anomalous situation which should be addressed through inclusion into the interpretation of groundwater conditions.*

MTE Response

MTE disagrees as noted in Section 4.6 and Table 4 of MTE's Level 1 and Level 2 Hydrogeological Investigation, hydraulic conductivity data from the recovery tests at MW4s and MW4d were used in the overall determination of on-Site hydraulic conductivity.

Greer Galloway Comment (Page 6, Data Interpretation: Section 3.3)

Comment # 19: *More cross-sections would be helpful, especially in the west portion of the proposed quarry where impacts on groundwater would be greater, to help with interpretation of potential impacts to the South Stream.*

MTE Response

Please refer to MTE's Response to Greer Galloway Comment # 17.

Comment # 20: *Six of the seven borehole were not logged for lithology. MW1 and MW5 may be collared in the graphite schist represented on the geological mapping. This material would have very low transmissivity, and metamorphism and lithology would promote sealing of fractures (secondary permeability). This might explain slow recoveries.*

MTE Response

Agreed.

Greer Galloway Comment (Page 6, Data Interpretation: Section 4.2: groundwater levels)

Comment # 21: *Groundwater levels: MW1 and MW5 exhibit low flow in comparison to the other wells. This may be related to lithology and general competence of the rock (stress relief in graphite schist?). MW4: the static level is reported as above casing. The*

data from this well have not been represented on a section. This well, located in the southwest corner of the proposed extraction area, is very close to the South Stream (Figure 2). A review of the topography presented in Figure 3 suggests the collar elevation for this well to be very close to the stream elevation immediately to the south. It is possible, as suggested in the report, that confining conditions may occur. However this raises concerns that the flow generated through these confining conditions may be supported by the South Stream.

MTE Response

In reference to the last sentence of Greer Galloway's comment (above) MTE assumes Greer Galloway means to say "…conditions may be supporting the South Stream". An additional cross section was created to aid in the interpretation of the proposed quarry as it relates to nearby domestic wells and the South Stream, see **Attachment 4**. The groundwater elevation of MW4s on December 1, 2017 was measured to be 370.49 mAMSL while the surface water elevation of the South Stream at SW1 on November 21, 2017 was measured to be 368.01 mAMSL. The groundwater elevation in MW4s and MW4d is representative of confining pressures in fractures at depth. MTE did not observe any groundwater springs at MW4s or MW4d. Therefore despite the groundwater elevation in MW4s being above that of the surface water elevation at SW1, the South Stream is not necessarily maintained by groundwater discharge. Should groundwater at depth be contributing flow to the South Stream at this area of the Site, the quantities would be very low based on agreement between the flow measured on-Site at SW1 (14.7 L/s) and the estimated flow at SW1 due to surface runoff (10.0 L/s).

Greer Galloway Comment (Page 6, Data Interpretation: Section 4.5: groundwater vertical hydraulic gradients)

Comment # 22: *Groundwater vertical hydraulic gradients: These have been calculated from all wells with exception of MW4 and 7. MW1 and MW5 are reported to have not yet achieved equilibrium. MW4 is a flowing well (discharge). It is possible that hydrogeologic conditions are more variable across the site than can be represented by these wells.*

MTE Response

Based on water level data collected on December 1, 2017 from MW4s and MW4d a vertical hydraulic gradient of 0.25 was calculated, representing an upward groundwater gradient at this location. Groundwater vertical hydraulic gradients were not calculated for MW7, as MW7 was constructed as an open borehole and does not screen a discrete interval.

Groundwater vertical hydraulic gradients cannot be calculated for MW1 or MW5 because as of December 2017, MW1d still has not achieved equilibrium and MW5d has been consistently dry since completion.

In response to the above comment the following actions were taken to further characterize the variability of the hydraulic conditions across the Site:

- A review of all on-Site hydrogeologic data;
- The construction of two open boreholes (MW7 & MW8);
- The testing of MW7 & MW8 via a 24 hour pumping test; and
- The analysis of pumping test results (**Attachment 3**)

Through the installation and testing of both multi-level wells and open boreholes MTE has more than adequately assessed the hydraulic conditions of the Site to verify the variability across the Site.

The results from the pumping tests on MW7 & MW8 are in agreement with those outlined in MTE's 2016 report.

Greer Galloway Comment (Page 6, Data Interpretation: Section 4.6.1: Pumping Test of MW7)

Comment # 23: *Pumping Test of MW7: A discharge rate of 52L/min X 1440 = 74,000 litres per day achieved steady state at approximately 6 metres above the proposed quarry floor. Hydrograph 2 shows steady state being achieved twice during the flow testing, Opening fractures and reducing confining pressure may increase the flow above what has been envisaged in the water management plans, requiring additional diversion to the South Stream.*

MTE Response

Please refer to MTE's Response to Greer Galloway Comment # 2 and Comment # 3.

Greer Galloway Comment (Page 6, Data Interpretation: Section 4.7: Private Wells)

Comment # 24: *There are two wells of concern to the north of the proposed extraction area: PW2 and PW13. The PW11 static level is directly linkable to the North Stream and is not a concern. PW3 and PW4 will be of concern if diversion or impacts to the South Stream occur upgradient of the wells. (Section B-B' shows static level for PW3 below bed of South Stream and below proposed quarry floor).*

MTE Response

Regarding PW2 and PW13 please refer to MTE's Response to Greer Galloway Comment # 8.

Both PW3 and PW4 are outside the catchment area of the South stream (**Figure 3**). PW3 and PW4 are located in a topographic low compared to the lands directly south and east. As such PW3 and PW4 likely obtain water from areas to the south and east and not from the Site.

Greer Galloway Comment (Page 6, Data Interpretation: Section 5.2: Proposed Water Diversion, Storage, and Drainage Facilities)

Comment # 24: *Based on flow testing of MW7 it is possible that a combination of pumping and diversion of over 50,000 litres per day of groundwater may be required to allow extraction below the water table. In addition, interaction of the South Stream flow with the quarry may require additional surface diversion beyond that envisaged in the report.*

MTE Response

MTE wishes to clarify that there will be no active pumping on-Site or diversion of the South Stream. Pumping test results indicated that neither MW7 nor MW8 was capable of sustaining a flow rate > 35 L/min. Please see MTE Response to Greer Galloway Comment # 2 and Comment # 4.

Greer Galloway Comment (Page 7, Data Interpretation: Section 5.3: Stormwater Management Facility)

Comment # 25: *The report provides some information on dealing with quantity and quality issues related to quarry drainage but recommends a Stormwater Management Report including a Water Management Plan as part of an ECA. This should be prepared. It appears the Stormwater Management Facility is to be used to deal with routine groundwater discharge quality issues. This approach to permitting needs to be clarified.*

MTE Response

An ECA will be applied for prior to the construction of the SWM Facility. The application for the ECA had not been prepared and submitted to the MOECC since the MOECC will not process such applications until the land-use has been approved. Regarding how the Stormwater Management Facility is to be used to deal with routine groundwater discharge quality issues please refer to MTE's Response to Greer Galloway Comment # 1.

Greer Galloway Comment (Page 7, Data Interpretation: Section 6.0: Impact Assessment)

Comment # 26: *The Technical Memorandum (Appendix F) states: "recharge into the Precambrian bedrock groundwater surface is expected to be controlled by the secondary porosity (i.e. fractures). The secondary porosity of crystalline bedrock is on the order of 2-5%". Given the grade and type of metamorphism, this porosity may not have a strong relationship to permeability or hydraulic conductivity on this site. The hydraulic conductivity data from slug tests would be more useful than an estimate based on generalized porosity values applied to metamorphic rocks.*

MTE Response

MTE disagrees and interprets the secondary porosity to be directly linked to the hydraulic conductivity, which was directly measured at the Site. An estimate of porosity was only used when estimating the amount of infiltration for the Macro Drainage Analysis (Appendix F of MTE's Level 1 and Level 2 Hydrogeological Investigation). Zone of Influence calculations were based on on-Site hydraulic conductivity data.

Comment # 27: *The Drainage Analysis suggests a reduction in North Catchment runoff by an average of 100m^3/day (annualized) and an increase in the South Catchment of 150m^3/day which may result in a net increase in discharge of 50m^3/day to the South Stream. Although this volume is not a significant amount on an annualized basis, it may have an impact on the stream at certain times of the year, and on any fish habitat. A PTTW for this diversion may be required.*

MTE Response

The SWM Facility has been designed in such a way as to provide peak flow attenuation and erosion control. An assessment of fish habitat will be completed by Riverstone Inc. and provided to the agencies upon completion. The quarry will not be actively taking water from or diverting the South Stream as such a PTTW for diversion will not be required.

Greer Galloway Comment (Page 7, Data Interpretation: Section 6.2: Groundwater Drawdown and Zone of Influence (Appendix G))

Comment # 28: *The geometric mean for hydraulic conductivity is based on the results from 7 monitor wells, which show a wide variability. A worst case scenario should also be evaluated, since opening the quarry will possibly increase the flow and near surface (of the quarry floor) hydraulic conductivity.*

MTE Response

When calculating the zone of influence the following assumptions were made:

- The bedrock excavation is modeled to perform as a circular well with an effective area equivalent to the Site;
- The aquifer is homogenous and isotropic;
- The bedrock system performs as a uniform porous medium; and
- The hydraulic conductivity is constant and homogeneous throughout.

Based on the assumption that the aquifer is homogenous and isotropic if the highest K (which was correlated to the presence of a fracture in MW7) is used then the assumption would presume that the entire quarry has the same hydraulic properties as the fracture. Single well hydraulic response tests from other wells on-Site and pumping tests performed on MW7 and MW8 (**Attachment 3**) indicate that the K obtained from the slug tests performed on MW7 are not representative of the bedrock as a whole. MTE maintains that the geometric mean (which accounts for all measured K values) and not the highest K is the most appropriate when estimating the bulk hydraulic conductivity of the Site.

Greer Galloway Comment (Page 7, Data Interpretation: Section 6.3: Aquifers)

Comment # 29: *The report suggests that PW2 and PW13 be monitored "to ensure these wells are within historical (pre-quarry) levels (Hydrographs 3-12). "PW3 and PW4 may be accessing the water table which may be supported by the South Stream drainage. Impacts to this drainage flow and quality are anticipated in the report and these wells may be impacted, depending on the effectiveness of the resultant South Stream as a groundwater/surface water divide.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 24.

Comment # 30: *The report states that "…PW3 (I assume this is an editing error and PW2 is meant) and PW13 are located within close proximity to the quarry (Figure 23) but measured groundwater elevations (Hydrograph 3) indicate that groundwater levels in these wells are below that of the proposed quarry floor and therefore will not be affected by quarry activities."*

MTE Response

PW3 is meant, as PW2 is a sealed artesian well and a water level cannot be measured.

Comment # 31: *Presently, the report identifies a groundwater gradient towards the north from the proposed quarry property and towards PW2 and PW13. Following extraction, this groundwater gradient will change, and this change may impact these wells. In the case of PW2 specifically, its proximity to the proposed operation may result in water quality impacts from blasting opening fractures above the reported Water Found depth. Some discussion of the possible variation between vertical and horizontal hydraulic conductivity would assist in prediction of impacts to this well.*

MTE Response

The groundwater gradient will change as a result of the proposed quarry being below the water table and creating an inward groundwater pressure (Zettel, 2018). As noted, no water quality impacts are predicted, however if there were water quality impacts the water would flow towards the quarry rather than PW2. If there was an impact to water quantity or quality to PW2 then procedures as outlined in the Well Interference Complaint procedure will be followed. Additionally PW2 is reported to be completed at an elevation of approximately 286.6 mAMSL or 51.4 metres below the proposed quarry floor elevation.

Greer Galloway Comment (Page 8, Data Interpretation: Section 6.4: Bedrock Groundwater Flow)

Comment # 32: *The report presents a hydraulic conductivity (K) geometric mean to represent the Site of 7.9 x 10^{-10} metres per second. The report assumes a decrease in K with depth, and discounts data from MW4.*

MTE Response

Hydraulic Conductivity data from MW4 was not discounted and was included in the calculation of the geometric mean see Table 4 of MTE's Level 1 and Level 2 Hydrogeological Investigation Report.

Comment # 33: *MW7: "had a relatively higher hydraulic conductivity than the bedrock at other monitoring wells (10^{-6} m/s vs 10^{-10} m/s). During the pumping test a decrease in water level was also noted in MW3d which is located 180 m away from MW7, likely because it is screened across the same water bearing zone or fracture. MW3d is the only well that showed a response to the testing conducted on MW7. This lack of response at other monitoring wells highlights the discontinuous and random nature of the fractures within the bedrock." A representation could be made that opening the quarry is equivalent to completing a giant well which will link fractures and homogenize the flow. Therefore the highest K should be used instead of the mean.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 28.

Comment # 34: *This section concludes that "it is apparent that the rate of flow into the quarry will be very slow, particularly in the vertical direction, when extraction occurs." If there is a differential between vertical and horizontal conductivity, then this should be quantified.*

MTE Response

The differential between vertical and horizontal conductivity can be up to 20 for limestone/dolomite and up to 10 for shale (Domenico & Schwartz, 1990). Due to the metamorphic nature of the rock MTE anticipates the differential between vertical and horizontal conductivity to be greater than those values listed above, and therefore plays an insignificant role in predicting the amount of groundwater discharging into the quarry.

Comment # 35: *Horizontal conductivity on the west, south, and north faces will be a factor, affecting gradient to PW2 and PW13, and gradient and impact on the South Stream. Blasting may increase the horizontal conductivity.*

MTE Response

Please see MTE Response to Greer Galloway Comment # 2 and Greer Galloway Comment # 4. Blasting will increase horizontal conductivity, but a review of the Blast Impact Analysis conducted by Explotech Engineering Ltd. on the proposed quarry as well as others (Golder, 2008) indicated that fracturing or permanent deformation will be limited to the immediate area surrounding the blast hole.

In addition blasting will be carried out in accordance with NPC-119 which outlines limits for blasting operations at a quarry. Blasting performed in accordance with NPC-119 is intended to limit both noise and vibration, thereby limiting the potential to increase of horizontal conductivity.

Greer Galloway Comment (Page 8, Section 6.6: Blasting)

Comment # 36: *It is agreed that water quality could be impacted by blasting, both on-site to surface water and in the groundwater. These impacts should be addressed in a water discharge treatment program to include monitoring of critical water quality parameters. The report suggests that this water quality will be dealt with in a storm water management plan, but limited information is presented to demonstrate this. In*

addition, the discharge quality management may not be suitable for incorporation in to the stormwater management plan, and should be treated as a separate issue.

MTE Response

Please see **Attachment 2**: Proposed Stormwater Management Facility for information regarding how water quantity and water quality will be managed and the proposed monitoring program.

Greer Galloway Comment (Page 8, Section 6.7: Streams, Rivers, Lakes, and Ponds)

Comment # 37: *A review of the Technical Memorandum (Appendix F) stated: "recharge into the Precambrian bedrock groundwater surface is expected to be controlled by the secondary porosity (i.e. fractures). The secondary porosity of crystalline bedrock is on the order of 2-5%." Given the grade and type of metamorphism, this porosity may not have a strong relationship to permeability or hydraulic conductivity on this site. The hydraulic conductivity data from slug tests would be more useful than an estimate based on generalized porosity values applied to metamorphic rocks.*

MTE Response

Please see MTE response to Greer Galloway Comment # 26.

Comment # 38: *The Drainage Analysis suggests a reduction in North Catchment runoff by an average of 100m^3/day (annualized) and an increase in the South Catchment of 150m^3/day which may result in a net increase of discharge of 50m^3/day to the South Stream. Section 7.4 states that there will be an increase in flows to the South Stream of approximately 1.4L/s (121m^3/day). This may have an impact on the stream at certain times of the year, and on any fish habitat. A PTTW for this diversion may be required.*

MTE Response

Please see MTE response to Greer Galloway Comment # 27.

Comment # 39: *The report states: "There will be no discharges of quarry water to the North Stream. As such, there is no potential for the proposed quarry to affect the water quality or quantity of the North Stream." The proposed quarry straddles the watershed divide between the North Stream and South Stream. The report states that the area provides weak recharge to groundwater. Figures 12 and 13 display an interpretation of shallow and deep groundwater gradient to the North Stream over a large portion of the quarry site. Figure 23 presents an estimation of the zone of influence post extraction which shows a reversal of the groundwater gradient over a significant portion of the North and South Streams catchment areas. This latter gradient is consistent with the*

values for groundwater gradients presented in Figures 12 and 13. The post extraction zone of influence intersects the South Stream and the flood plain of the North Stream.

MTE Response

The proposed final floor elevation of the quarry is approximately 10 m higher than the elevation of the North Stream. The North Stream will continue to receive surface water runoff from areas north of the property boundary and the quarry floor will not undercut the base of the North Stream.

Comment # 40: *The proponent should demonstrate what effect these changes in groundwater gradient will have on the South Stream as a result of the groundwater volumes diverted to the quarry floor.*

MTE Response

Please see MTE response to Greer Galloway Comment # 4.

Greer Galloway Comment *(Page 9, Mitigative Measures: Well Interference)*

Comment # 41: *Well owners experiencing disruption or quality problems normally contact their municipality or regulatory agencies before contacting the operator. A more detailed response procedure including a flow chart should be presented and approved by the municipality. To protect the quarry operator from possibly unfounded complaints regarding water quantitiy, consideration should be given to the use of automated levelloggers in selected wells closest to the operation, to include barometric control. This would provide more direct correlation of blasting activities with water levels.*

MTE Response

Any complaints made by well owners regarding water quantity or quality interference due to quarry activities should be forwarded to the operator and will be dealt with in accordance with the Well Interference Complaints Procedure. MTE maintains that the Well Interference Complaints Procedure presented in the 2016 Level 1 and Level 2 Hydrogeological Investigation Report is sufficient at this time. Regarding Levelloggers, please see MTE response to Greer Galloway Comment #14.

Greer Galloway Comment (Page 9, Mitigative Measures: Bedrock Groundwater and Quarry Operations)

Comment # 42: *The zone of influence shown in Figure 23 suggests an extensive area of influence which may have an effect on flow regimes in both the North and South Stream. PW13 and PW2 are within the zone of influence, and changes to flow regimes*

in the streams may affect the streams' support of the groundwater in the vicinity of PW3 and PW4.

MTE Response

Please see MTE response to Greer Galloway Comment # 24. In addition, MTE evaluated PW2 for the installation of a data logger for long-term monitoring. Due to artesian conditions present at PW2, long-term monitoring via a data logger installation is not appropriate at this location (see **Attachment 3** for details). As per MTE response to Greer Galloway Comment # 13, the ground surface at PW13 is below the proposed quarry floor at the northwest corner of the quarry and as such, MTE does not interpret this well as being a candidate for long-term monitoring.

Comment # 43: *Monitoring of all participating private wells should include use of automated levelloggers, set to a suitable frequency. Blasting records should be maintained and be readily available for use in addressing any complaints from neighboring well owners.*

MTE Response

Regarding Levelloggers, please see MTE response to Greer Galloway Comment #14. Blast records will be kept and maintained by the operator.

Greer Galloway Comment (Page 10, Mitigative Measures: SWM Monitoring)

Comment # 44: *An Environmental Compliance Assessment should be prepared, as indicated.*

MTE Response

Prior to the construction of the SWM Facility (pending Site Plan approval) an ECA will be required. Please see MTE response to Greer Galloway Comment # 25.

Comment # 45: *Water quality from groundwater discharge should be addressed as a separate item from stormwater management.*

MTE Response

MTE disagrees as any groundwater or surface water on-Site, will be directed to the SWM Facility prior to being discharged to the natural environment. Please see MTE response to Greer Galloway Comment # 1 on how water quality from groundwater discharge will be monitored.

Greer Galloway Comment (Page 10, Required Permits)

Comment # 46: *The report (section 8.0) states that "Given the current mining plan, which incorporates dewatering the Site via gravity drainage without active pumping, a PTTW will not be required to maintain dry working conditions in the proposed quarry."*

Written confirmation should be obtained from the Ministry of the Environment and Climate Change that a Permit to Take Water is not required for this operation.

MTE Response

MTE has documented the results from the pumping tests conducted on MW7 & MW8 in December 2017 (see Appendix 3). The pumping tests indicated that neither well could sustain a pumping rate of > 35 L/s (50,000 L/day) for an extended period of time. As such, MTE maintains a PTTW for groundwater discharge is not necessary pending MOECC approval.

Comment # 47: *Section 7.5 states that an ECA (Environmental Compliance Assessment) will be required prior to the construction of the SWM (Storm Water Management) facility. The report proposes using the SWM facility to control and monitor discharge water quality from the quarry operation. However, limited information is provided on how this facility will provide the two functions. A completed plan for management of water discharge from the quarry operation should be prepared as part of this investigation, as this is a critical part of quarry operations.*

MTE Response

MTE assumes Greer Galloway means to say "…*ECA (Environmental Compliance **Approval**)*". Please see **Attachment 3** for information regarding how on-Site water quantity and water quality will be managed.

Comment # 48: *The flow reported in Section 7.4 of the report: "Flows to the South Stream are expected to increase by approximately 1.4 L/s (121m^3/day) due to the increase in runoff from the Site." Should be considered separately from stormwater management.*

MTE Response

MTE disagrees as the increase in runoff to the South Stream will be controlled via the SWM Facility.

Comment # 49: *The Stormwater Management Facility – Technical Memorandum included as Appendix E of the report, states "Additional flow due to groundwater seepage from the excavation was assumed to be negligible." (p2).*

MTE Response

Please refer to MTE's response to Greer Galloway Comment # 2.

Comment # 50: Greer Galloway Comment (Page 10, Recommendations for additional information to support the Level 1 and Level 2 Hydrogeological Investigation Report):

For ease of reference, MTE has maintained the recommendations numbering as presented by Greer Galloway.

1. *Address additional information requirements in Aggregate Resources Provincial Standards checklist above.*

MTE Response

Please refer to MTE's responses to Greer Galloway Comments # 2-15.

2. *Present more detailed modeling on groundwater flow in the western portion of the proposed quarry to include all applicable well flow data, through a section to include the South Stream and the private wells PW2 and PW13 to the north. Assess impacts on flow regime of South Stream from quarrying in the western portion of the site, to demonstrate any potential change in groundwater movement to stream in relation to the quarry floor.*

MTE Response

In response to comments from Greer Galloway on the South Stream MTE performed additional work to better characterize the South Stream, the details of that work can be found in **Attachment 4**. Impacts on the flow regime of the South Stream have been addressed in MTE's response to Greer Galloway Comment # 4.

3. *Assess the potential for changes to pH in discharge to South Stream from oxidation of sulphides by exposure of fresh bedrock during extraction (acid mine drainage). Provide more information on how a lower pH might be mitigated on site before discharge.*

MTE Response

Please see MTE's response to Greer Galloway Comment # 1. While it is presented by MTE that natural pH buffering may occur (see MTE's

response to Greer Galloway Comment # 1) low pH may also be mitigated by the incorporation of an on-Site treatment facility that would buffer low pH water prior to discharge to the natural environment.

4. *Develop a monitoring program for groundwater quality before discharge to South Stream, to address potential impacts from ammonia and acidity.*

MTE Response

Please see MTE's response to Greer Galloway Comment # 1.

5. *Develop a response plan to neighbouring well owner complaints for approval by the municipality.*

MTE Response

Please see MTE's response to Greer Galloway Comment # 12.

6. *Develop contingency plans for unexpected increased discharge of groundwater using maximum flow data from testing.*

MTE Response

Please see MTE's response to Greer Galloway Comment # 3. As such, the SWM Facility designed by MTE is sufficiently designed to manage any increased discharge resulting from groundwater.

7. *Obtain written confirmation from the Ministry of the Environment and Climate Change that a permit to take water is not required for this operation.*

MTE Response

Agreed.

Following your review of our response, if there are any remaining questions or comments, we would appreciate an opportunity to meet with Greer Galloway to further elaborate on our responses and the work completed to date. Should you have any questions or would like to schedule a meeting, please do not hesitate to contact the undersigned.

Yours truly,

MTE CONSULTANTS INC.

PROFESSIONAL GEOSCIENTIST
T. FRASER CUMMINGS
PRACTISING MEMBER
2801
ONTARIO

PROFESSIONAL GEOSCIENTIST
PETER A. GRAY
PRACTISING MEMBER
0335
ONTARIO

Fraser Cummings, M.Sc., P.Geo.
Hydrogeologist

Peter A. Gray, P.Geo. QP_{ESA}
VP, Senior Hydrogeologist

TFC:scp
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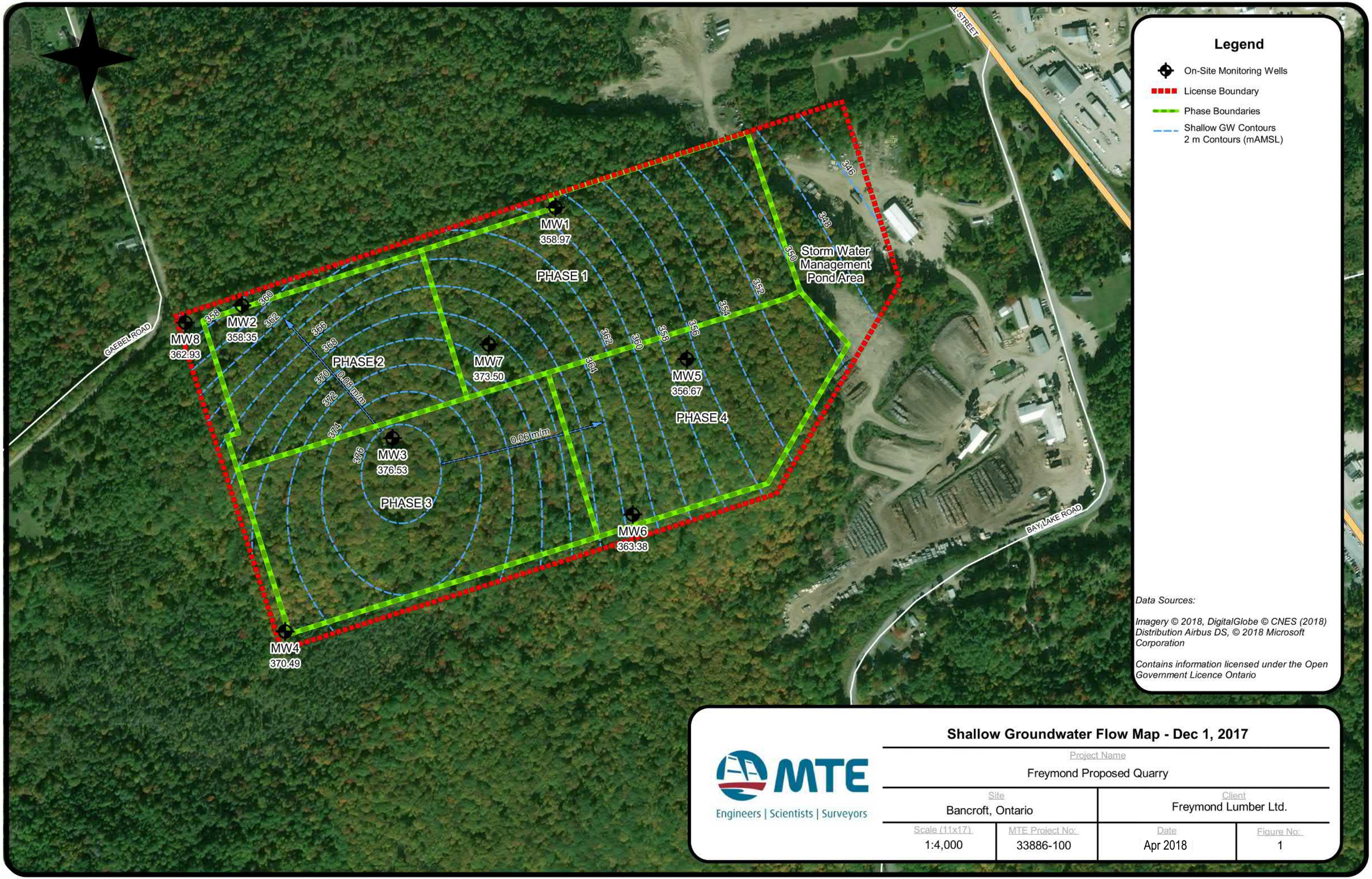
FIGURES



Legend

- On-Site Monitoring Wells
- License Boundary
- Phase Boundaries
- Shallow GW Contours
  2 m Contours (mAMSL)

Data Sources:

Imagery © 2018, DigitalGlobe © CNES (2018) Distribution Airbus DS, © 2018 Microsoft Corporation

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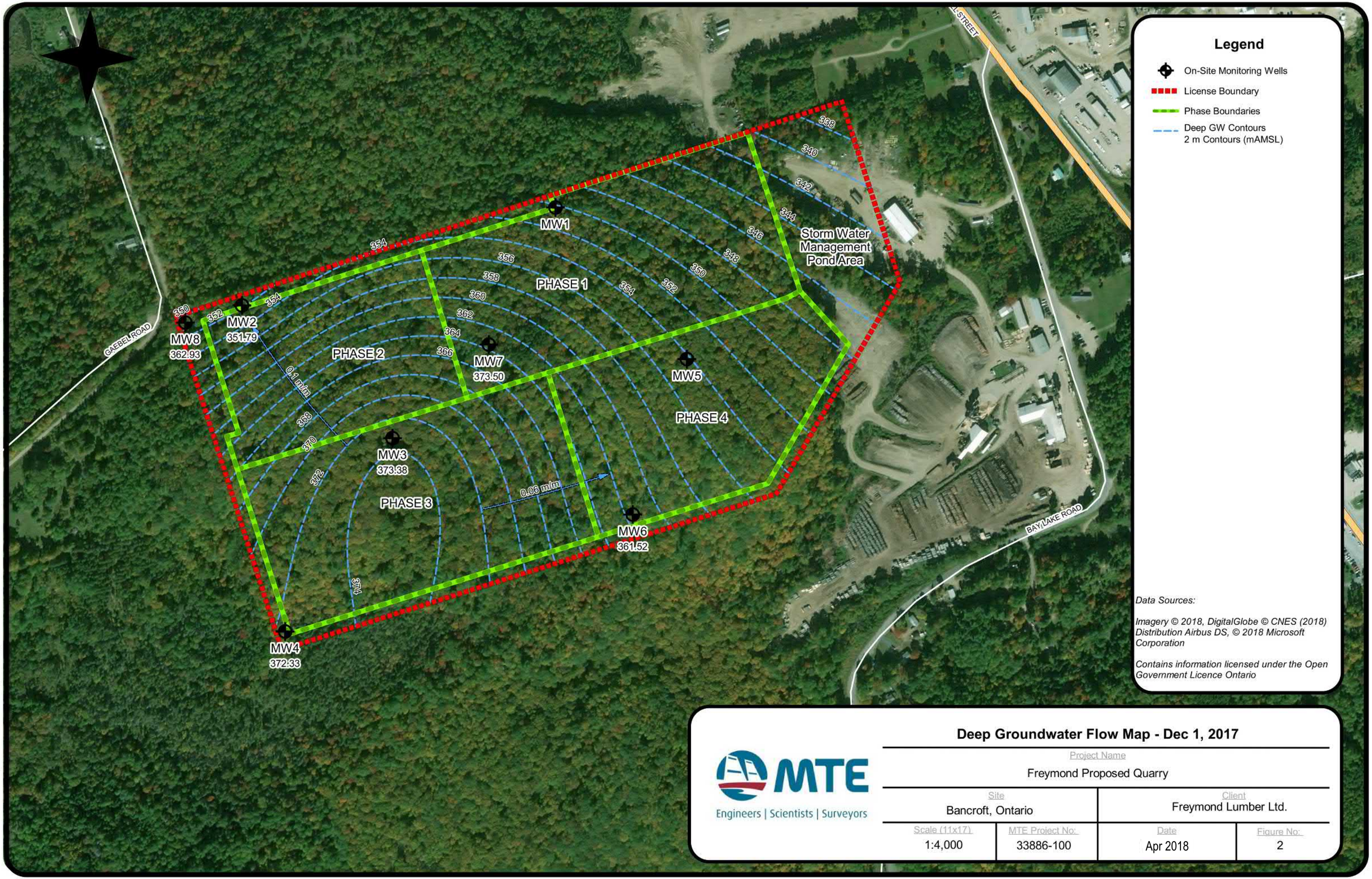
MTE
Engineers | Scientists | Surveyors

Shallow Groundwater Flow Map - Dec 1, 2017

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:4,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 1

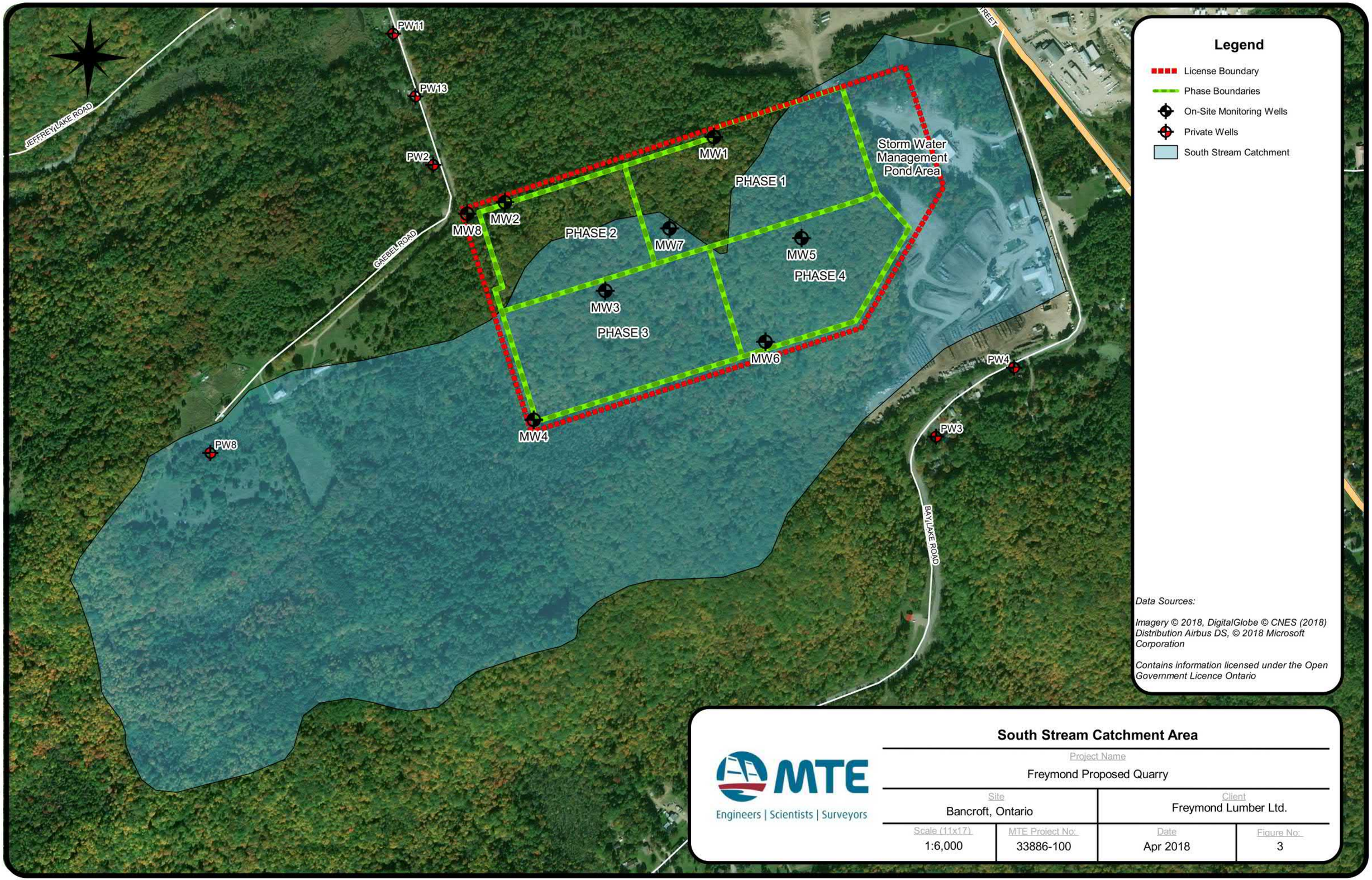
Project No: 33866-100 Q:/33866/Maps/33886-100 Freymond Quarry.qgs
GW Flow
March 09, 2018 - 12:02 - Plotted By: fcummings



Deep Groundwater Flow Map - Dec 1, 2017

MTE Engineers | Scientists | Surveyors

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:4,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 2



Project No: 33866-100 Q:\33866\Maps\33866-100 Freymond Quarry.qgs

GW Flow

April 19, 2018 - 10:50 - Plotted By: fcummings

MTE
Engineers | Scientists | Surveyors

South Stream Catchment Area

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:6,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 3

TABLES

Table 1: Freymond Quarry – Proposed Water Monitoring Schedule

Item	Station	Type of Monitoring	Number of Events								
			Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov
Groundwater Monitors	MW1s, MW1d, MW2s, MW2d, MW3s, MW3d, MW4s, MW4d MW5s, MW5d, MW6s, MW6d, MW7, MW8	Water Level	1	1	1	1	1	1	1	1	1
	MW1s, MW2s, MW2d, MW3s, MW3d, MW5s, MW6s, MW6d, MW7, MW8	Logger Download	1	1	1	1	1	1	1	1	1
	MW4s[1], MW4d[1]	Logger Download	1				1				1
	MW8[2]	Water Sample [3]					1				
Private Wells	PW3, PW5, PW7, PW8, PW9, PW11, PW12, PW13, PW14, PW15	Water Level	1	1	1	1	1	1	1	1	1
Surface Water	SWM Facility	In-Situ pH measurement	2	2	2	2	2	2	2	2	2
Surface Water	SWM Facility	Water Sample[4]	1	1	1	1	1	1	1	1	1

[1] Due to the artesian conditions and slow recovery at MW4s and MW4d, data loggers in these wells will be downloaded seasonally (March, July, and November).
[2] MW8 will be sampled as it is the closest on-Site monitoring well to domestic wells along Gaebel Road (i.e. PW2, PW13 & PW11).
[3] Water will be sampled for general chemistry, hardness, pH and total metals.
[4] In accordance with the monitoring program for the proposed Stormwater Management Facility, TSS, total ammonia and total petroleum hydrocarbons shall be sampled monthly under non-freezing conditions, after significant rainfall events (> 8mm).