



**PEER REVIEW ASSESSMENT OF A
LEVEL 1/2 HYDROGEOLOGICAL TECHNICAL REPORT
SUBMITTED IN SUPPORT OF A QUARRY ZONING
APPLICATION REVIEW**

Proposed Norval Quarry (Brampton Brick Limited)
West Half of Lot 12, Concession 6
City of Brampton (former Township of Chingacousy)

May 2011

PREPARED FOR:

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PROJECT NO.: 111-53308-00



May 25, 2011

The Corporation of the City of Brampton
2 Wellington Street West
Brampton, ON
L6Y 4R2

Re: Proposed Norval Quarry (Brampton Brick Limited)

Peer Review Assessment of a Level 1/2 Hydrogeological Technical Report Submitted in Support of a Quarry Zoning Application Review
File 111-53308-00

GENIVAR Inc. (GENIVAR) is pleased to present the enclosed report, which provides a summary and discussion of technical comments raised during our hydrogeological, hydrological, and design & operations peer-review of the following documents, as prepared by Golder Associates Ltd. on behalf of Brampton Brick Limited.

- Golder Associates Ltd., July 2010. *Report on Level 1/2 Hydrogeological Technical Report, Norval Quarry, Brampton Brick Limited.* Report No. 07-1112-0100.
- Golder Associates Ltd., December 9, 2010. *Level 1/2 Hydrogeological Technical Report, Norval Quarry, Brampton Brick Limited, Dated July 2010, Updated Appendix F, Table F.1 for Off Site Wells.* Technical Memorandum prepared by Phyllis McCrindle and addressed to Brad Cobbledick (BBL).

In summary, based on this hydrogeological, hydrological and design & operations peer review, it is our opinion that the Level 1/2 Hydrogeological Technical report (Golder Associates, July 2010) supplied by Brampton Brick does not warrant approval by required legislation and is therefore unacceptable to the City of Brampton.

- The report provided does not include all of the technical items required for a level 1/2 hydrogeological study under the Aggregate Resources of Ontario Provincial Standards.
- The report provided identifies predicted hydrogeological / hydrological impacts associated with the proposed quarry operation that does not satisfy Section 2.2 of the Provincial Policy Statement, nor Section 4.14 of the City of Brampton's Official Plan.

The opinions expressed in this peer review (including appendices) may be supplemented, reconsidered or otherwise revised by the author(s) due to new or previously unknown information.

We trust that the information provided herein is sufficient for you needs at this time. Please contact us if you have any questions or comments.

Respectfully submitted,
GENIVAR Inc.

A handwritten signature in black ink that reads "A. G. Hims".

Andrew G. Hims, M.Sc., P.Eng.
Consulting Engineer
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JAM:

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1. INTRODUCTION

1.1 Background

In December 2008, Brampton Brick Limited (the ‘Proponent’) filed an application for a Zoning By-law Amendment with the City of Brampton (the ‘City’) relating to a 34.9 ha (86.2 ac) property located on the east side of Winston Churchill Boulevard (Regional Road 19) / Old Pinecrest Road, approximately 0.5 km north of the Hamlet of Norval. The site affected by the application is included as Part of the West Half of Lot 12, Concession 6 WHS (West of Hurontario Street), in the City of Brampton (former Township of Chingacousy), Regional Municipality of Peel (see Figure 1). The intent of the re-zoning application is to permit the extraction of shale and related uses on the subject property (requiring industrial zoning). It is our understanding that the shale resource on the site is intended to be extracted for the manufacture of clay brick.



FIGURE 1: Location of Proposed Shale Quarry (Long Environmental, 2010)

In support of its Zoning By-law Amendment application, the Proponent has submitted to the City a Planning Report, a Draft Site Plan and a number of technical reports, including a Preliminary Hydrological and a Preliminary Hydrogeological report (both prepared by Golder Associates Ltd.).

A review of the November 2008 Draft Site Plan indicates that the proposed shale quarry operation consists of three (3) primary components, including: (i) a 9.35 ha (23.1 ac) extraction area, to be excavated in two stages, (ii) a separate stockpile area, and (iii) access / egress from Winston Churchill Boulevard. A copy of the Draft Site Plan submitted as part of the Proponent’s December 2008 Zoning By-law Amendment application is included as Figure 2.

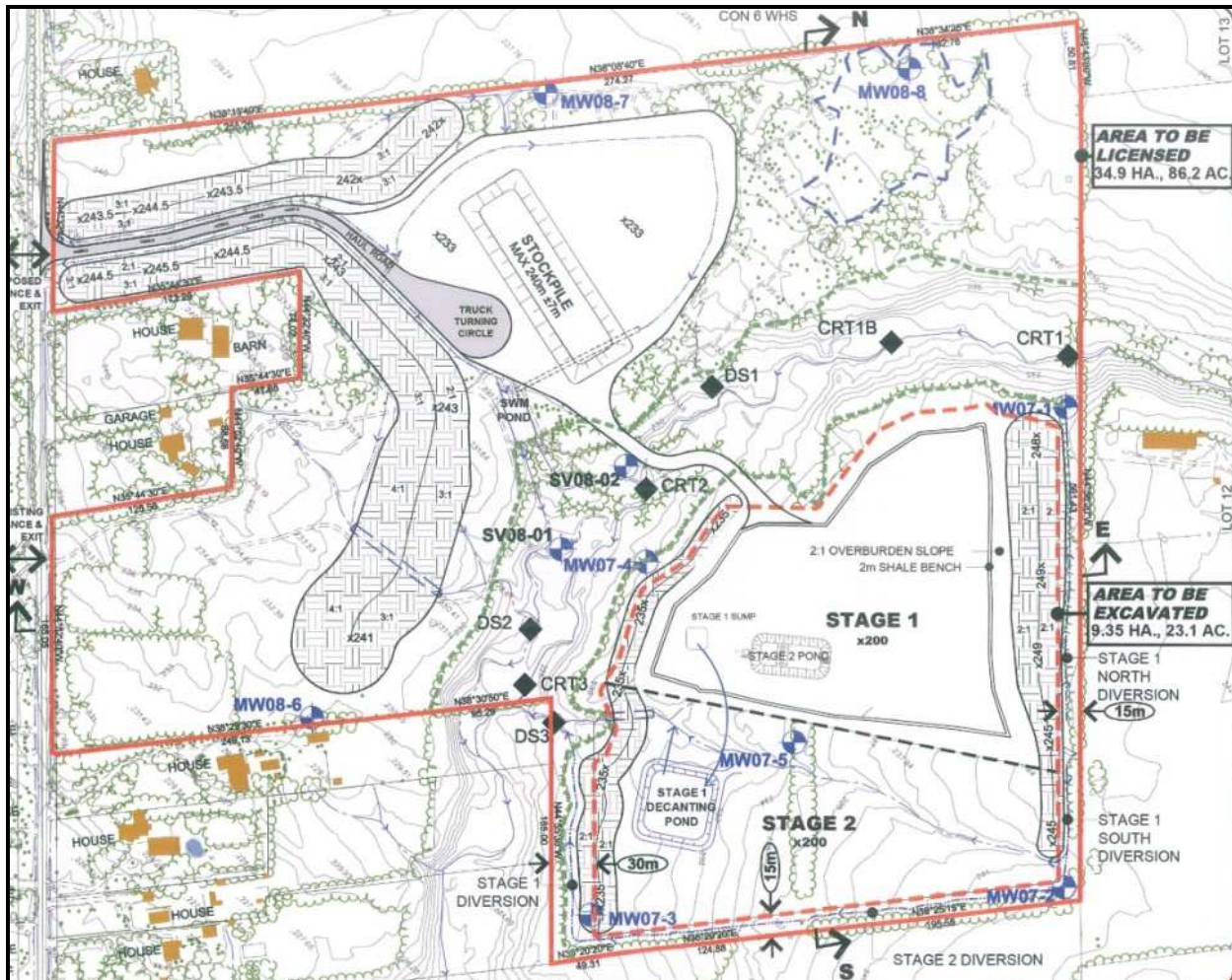


FIGURE 2: Proposed Quarry Operational Plan – Draft (Long Environmental, 2008)

On August 12th, 2010, the Proponent filed an application with the Ontario Ministry of Natural Resources (MNR) for a Category 2 Class “A” quarry license (extraction below the water table) under the Aggregate Resources Act (R.S.O. 1990). The reports and related materials submitted with the Proponent’s Aggregate Resources Act (ARA) license application were received by the City in September 2010. The ARA application package includes an updated Site Plan Report (complete with mapping and prescribed technical reports), as well as a Level 1/2 Hydrogeological Technical Report (prepared by Golder Associates Ltd.). Certain technical reports that were included with ARA application submission are revised versions of those that were originally included with their December 2008 re-zoning application package. It is prudent to note here that significant modification to the quarry site plans was included as part of the Proponent’s ARA submission. The current (Final) Site Plan for the proposed Norval Quarry is included as Figure 3.

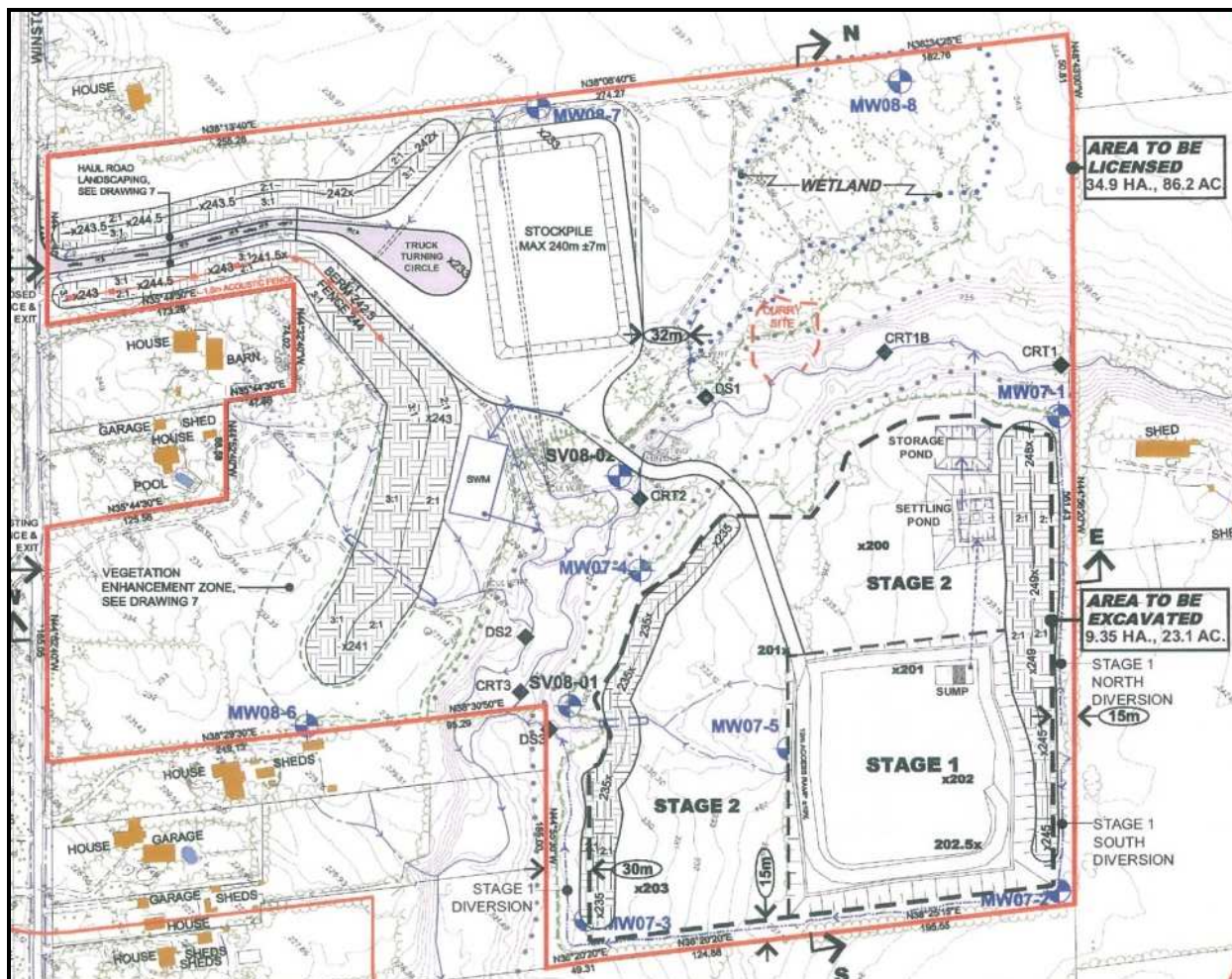


FIGURE 3: Proposed Quarry Operational Plan – Final (Long Environmental, 2010)

1.1.1 Site Location and Description

Geographically, the proposed quarry property (the ‘Site’) is located on the West Half of Lot 12, Concession 6 WHS, in the City of Brampton, Regional Municipality of Peel. The Site is bounded to the west by Winston Churchill Boulevard (Regional Road 19) / Old Pinecrest Road, which also serves as the boundary between the Regional Municipality of Peel (City of Brampton) to the east and the Regional Municipality of Halton (Town of Halton Hills) to the west.

The Terms of Reference (ToR) provided by the City for the assignment included a number of additional informational items regarding the Site, a summary of which is provided in tabular format below.

FEATURE	DETAILS
Official Plan Designation (current)	<ul style="list-style-type: none"> → Northwest Brampton Policy Area; → North-South Corridor Area; and → Shale Resource Area
Greenbelt Plan Designation	<ul style="list-style-type: none"> → Natural Heritage System

Surface Water	<ul style="list-style-type: none"> → Property bisected by a perennial tributary of the Credit River that drains agricultural lands to the northeast of the site. → Two (2) ephemeral drainage features are located on-site which direct runoff from lands to the east of the main tributary channel course (located within the proposed extraction area). → Three (3) drainage channels (1 perennial, 2 ephemeral) are located on-site which drain the property to the west of the main tributary channel course. → Property includes an area identified as an unevaluated wetland that is identified in the Greenbelt Plan as a significant hydrological and natural heritage feature.
Natural Heritage	<ul style="list-style-type: none"> → Significant woodland identified on the property along the valley of the perennial tributary. → An unevaluated wetland that is identified in the Greenbelt Plan as a significant hydrological and natural heritage feature.
Water Wells	<ul style="list-style-type: none"> → Wells are utilized locally as a source of water for residential and agricultural purposes.

1.2 Roles and Responsibilities of the Peer Reviewer

According to the ToR for this assignment, the roles and responsibilities of the hydrology, hydrogeology, and design and operations peer reviewer is as follows:

“...to ensure the completeness and accuracy of submitted technical information in these areas of expertise, provide recommendations on the acceptability of the proposal and necessary mitigation or enhancements and provide input to the public consultation process. A geomorphology review will be included in this peer review exercise. The work from the peer review will assist the JART in the evaluation of the application / studies and provide recommendations for additional work / studies of deficiencies in data collection and evaluation.”

1.3 Principles and Approach to the Assignment

The City of Brampton has developed a structured document entitled, *Guideline Principles and Questions for Brampton Peer Reviewers – Brampton Brick Peer Review* to provide a complete understanding of the approach to be undertaken by GENIVAR in this hydrology, hydrogeology and design and operations peer review. In this regard, GENIVAR is included as part of a multi-disciplinary Consultant team responsible to the City of Brampton (as the ‘Client’).

The guiding principles for this assignment are as follows:

- The City of Brampton will have full responsibility for directing the peer review.
- All peer reviewers are to conduct an independent review of the applicant’s report / study based on the terms of reference and guideline questions established by the City of Brampton.
- Communication between the peer reviewer and the report / study author is to be “open”. The peer reviewer shall have the opportunity to ask questions and to request additional information for clarification. All discussion and correspondence are conducted “without prejudice”.
- The peer reviewer and the report / study author must not negotiate or settle any issues with his / her peer or undertake any original research while conducting the peer review.
- The peer reviewer is to be directed by the City of Brampton alone and not by any other group or person who may have an interest in the matter.
- The peer reviewers for the City of Brampton will collaborate amongst themselves as a team on like-minded issues.

- The purpose of the peer review is to determine whether the Proponent's report / study addresses all of the issues regarding the proposal and adheres to the standard tests in the discipline and to the relevant provincial plans, policies, guidelines, standards, and the applicable Brampton and Peel official plan policies.

In conjunction with the above, the City has also defined a number of specific questions that were to be addressed by each peer review Consultant in the evaluation of the Proponent's submitted documentation. Those questions are provided on the following table.

ITEM	QUESTIONS
Purpose	<ul style="list-style-type: none"> → Is the purpose of the work clearly stated in the applicant's report / study, so I understand it? → Are all relevant and probable issues and impacts encompassed by the purpose? → Is the purpose worded so that it encompasses the questions that are relevant to my discipline?
Methodology	<ul style="list-style-type: none"> → Is the methodological approach to the purpose technically sound to permit my objective review of issues, data, facts, and appropriate to fulfill the purpose? → Are there technical concerns related to the methodology and assumptions that may compromise the analysis and/or the conclusions of the report/study?
Information	<ul style="list-style-type: none"> → Are relevant data and facts clearly and consistently presented in the applicant's report/study? → Is the information useful and is the data used critical to the conclusions? → Are the data useful and accurate, or do I have concerns about their quality? → Are complete, relevant and appropriate data sets provided? → Are the relevant data and other information sufficiently detailed? Is anything missing?
Certainty	<ul style="list-style-type: none"> → Are certainties and uncertainties of the proposal's success openly and objectively stated in the applicant's report/study? → Are all assumptions clearly stated? Are the assumptions reasonable? → Are the standards or thresholds commonly accepted in my discipline identified and appropriately utilized?
Conclusion	<ul style="list-style-type: none"> → Are the conclusions of the report/study supported by and follow from the work undertaken? → Are the conclusions relevant to the purpose/objectives of the work? → Would I reach the same conclusions, and if not, then what conclusions would I reach? → Do the conclusions satisfy the applicable policies of the Official Plans and provincial plans, policies, guidelines and standards?
Mitigation / Monitoring	<ul style="list-style-type: none"> → Are realistic mitigation measures (or contingency plans) proposed in the applicant's report/study? Are they presented in sufficient detail? → Do the proposed measures mitigate the impacts? → Will the proposed measures be adequate to address outstanding concerns?
Issue / Gaps	<ul style="list-style-type: none"> → Are there issue gaps arising from my review? → Were all identified issues addressed? → Are there additional issues identified through my review that need to be addressed? → Are there any key issues (from the perspective of my discipline) that have not been studied?

Adequacy

- Generally, does the applicant's report/study adequately address the stated purpose?
- Does the applicant's report/study adequately address the stated purpose, from the perspective of my discipline? Is there anything that I would have done differently?
- Is the applicant's report/study complete?

1.4 Available Documents

1.4.1 Documents Reviewed

The following two (2) documents represent the primary focus of this hydrology, hydrogeology and design and operations peer review.

- Golder Associates Ltd., July 2010. *Report on Level 1/2 Hydrogeological Technical Report, Norval Quarry, Brampton Brick Limited.* Report No. 07-1112-0100.
- Golder Associates Ltd., December 9, 2010. *Level 1/2 Hydrogeological Technical Report, Norval Quarry, Brampton Brick Limited, Dated July 2010, Updated Appendix F, Table F.1 for Off Site Wells.* Technical Memorandum prepared by Phyllis McCrindle and addressed to Brad Cobbleddick (BBL).

In addition to the above, the following two (2) preliminary reports were also considered as part of this peer review.

- Golder Associates Ltd., November 2008. *Report on Preliminary Hydrogeological Assessment of the Proposed Norval Quarry, Norval, Ontario.* Report No. 07-1112-0100.
- Golder Associates Ltd., November 2008. *Report on Preliminary Hydrological Assessment of the Proposed Norval Quarry, Norval, Ontario.* Report No. 07-1112-0100.

1.4.2 Other Documents

A summary listing of other technical reports submitted in support of the Proponent's Zoning By-law Amendment application and ARA License application is provided below.

- Long Environmental Consultants Inc., November 2008. *Norval Quarry – Planning Report.*
- Long Environmental Consultants Inc., August 2010. *Norval Quarry – Site Plan Report.*
- Brampton Brick Limited, September 2008. *Report on Shale Quarry.*
- Beacon Environmental Limit, September 2010. *Level 1/2 Natural Environment Report.*
- Archaeological Services Inc., November 2008. *Cultural Heritage Resource Study, Stages 1 & 2.*
- Archaeological Services Inc., July 2010. *Heritage Impact Assessment.*
- Archaeological Services Inc., July 2010. *Curry Site Stage 3 Archaeological Assessment.*
- Archaeological Services Inc., July 2010. *Curry Family Cemetery, Stage 3 Archaeological Assessment.*
- Todhunter Associates, July 2010. *Visual Assessment & Vegetation Management Plan.*
- Aercoustics Engineering Limited, July 2010. *Noise Control Study.*

It should be noted that, as per the ToR for this assignment, GENIVAR did not peer review any of the technical documents described above. Rather, peer review of those documents was completed by other Consultants as part of a multi-disciplinary team responsible to the City of Brampton.

2. PEER REVIEW SUMMARY

2.1 Main Issues

COMMENT

- The Main Tributary (MT) can naturally act as a losing stream and exhibit perched surface water conditions during certain periods of the year. This observation questions one of the main assumptions of the Consultant's numerical groundwater model that uses the MT as a constant head boundary. During periods of vertical water loss by the MT and perched conditions, water table drawdown can extend below the MT to the western portion of the site.
- The predicted effects of surface water temperature changes and the influence of groundwater discharge (or loss of discharge) on the water temperature cannot be assessed as continuous upstream and downstream surface water temperatures were not available for the MT for calibration.
- The simulation of the on-site northwest wetland as a recharge feature with a constant head contradicts observed conditions and simulates groundwater levels above existing ground surface elevations.
- The report does not provide contingency measures in the event that the proposed mitigation is not effective.
- The report does not provide the time required to form the rehabilitation lake. This information will allow for the consideration of the duration for pumping from the lake to the MT (and potentially other local surface water features) for mitigation purposes and the effects of potential changes in surrounding land use to the water balance calculations. A water balance assessment is required to show that there is sufficient water for mitigation and post-quarry lake development.
- Trigger mechanisms are required for mitigation discharge to the MT, other watercourses, and the wetland(s), and for implementation of contingencies for the protection of groundwater and surface water resources.
- Mitigation of water loss within the MT by pumping from a settling pond or discharge from the rehabilitation lake is noted; however potential effects to the MT upstream of the proposed quarry site are not quantified.
- Predicted impacts to some off-site wells, including Well #33, indicate the potential for water level drawdown below the typical water bearing zone of greatest quantity and quality, which could be unacceptable as deeper bedrock provides less water that may be more mineralized (poorer quality).
- On-site information on wetlands and groundwater discharge suggests that the off-site wetlands are also dependent on groundwater discharge. As no specific off-site investigation / testing was completed to confirm groundwater recharge / discharge conditions, the impact assessment should consider that off-site wetlands are groundwater dependent.
- The constant head boundary conditions considered for the model have a notable influence on the model calibration and the predicted quarry effects. Information presented suggests that the model does not adequately simulate existing conditions. As a result, the predicted quarry effects on water resources are questionable.

2.2 Recommendations

COMMENT

- The numerical groundwater model and related impact assessment should be re-evaluated and consider:
 - The use of arithmetic means for the hydraulic conductivity of each layer.
 - No constant head boundaries for the MT and related on-site tributaries, as well as wetlands.
 - Off-site wetlands as groundwater dependent.
 - A calibrated model assessment with other statistical methods.
- Additional upstream and downstream continuous temperature monitoring and analyses are required.
- Groundwater data for the southeastern portion of the on-site northwest wetland unit #42 is required.
- Contingencies to address the potential for 'high fracture flows' noted in the report should be provided.

- Additional information is required along the reach of the MT to assess the occurrence of and extent of perched watercourse conditions.
- The source and approval criteria for fill material to be used as part of rehabilitation should be provided.
- A comprehensive monitoring program, inclusive of mitigation measures (including trigger mechanisms) and a contingency plan to protect water resources are required to fulfill the technical requirements for a Hydrogeological Level 2 report, as per the Aggregate Resources of Ontario Provincial Standards (Section 2.2.2). It is recommended that this information be incorporated into the Site Plan notes, such that the authority for its approval (as well as future amendments) is borne by MNR and can be linked directly to the quarry operation itself (as a land use).
- The water well impact assessment should consider the current pump setting and the depth / location of Model Layers 2 and 3. This assessment is especially important for Well #33, which shows the greatest predicted drawdown effect.
- A discussion on the predicted concentrations of salts (chloride and sodium) and changes from baseline conditions within local surface water features should be provided. This discussion should also be considered as part of the Natural Environment Assessment.

2.3 Specific Comments

2.3.1 Executive Summary

COMMENT

- Refer to peer review comments for Sections 1.0 to 11.0.

2.3.2 Section 1.0 (Introduction)

SUB-SECTION	COMMENT
1.1	<ul style="list-style-type: none"> → The area west of the MT (25 ha) and to the east (13 ha) provides a total area of 38 ha. However, in the same paragraph the site is referenced as 35 ha. Which value is correct? → Certain study components required by the Aggregate Resources of Ontario Provincial Standards (AROPS) for a Hydrogeological Level 2 technical report in support of a Category 2, Class “A” quarry license application to extract aggregate below the established groundwater table are not identified in the “main objectives” or “work program” (i.e., trigger mechanisms, contingencies, and a water budget for the proposed rehabilitation plan). Although not specifically identified in this section of the report, some of the required components are included in other section of the report body (i.e., monitoring and mitigation).
1.3	<ul style="list-style-type: none"> → The generalized phasing plans for the proposed quarry operation are shown on Figure 1.2 and are reported to be based on the “April 2010 Draft Site Plan”. In this regard, it is also reported that a “Final Site Plan” was produced in July 2010, and that “minor modifications” occurred between the “Draft” and “Final” Site Plan. If the July 2010 Final Site Plan was available at the time of report preparation, it is questioned why the report figures were not updated to incorporate those “minor modifications”? In contrast to the figures however, the report text has been updated to reflect the current proposed operational plan.
Figure 1.2	<ul style="list-style-type: none"> → Indicates incorrect locations for operational water management aspects of proposed quarry operation. As a matter of correctness, this figure should be updated to reflect the current proposed operational plan.

2.3.3 Section 2.0 (Regional Setting)

SUB-SECTION	COMMENT
2.1	→ The area of the MT watershed is noted as 474 km ² . This appears too large based on Figure 2.1.
2.6	→ The interpretation of wetland Nos. 44, 45 and 46 as being "...likely largely the result of precipitation and surface runoff containment with depressions on low permeability soils" due to their "relatively high topographic location" is not supported by any field-based assessment by the Consultant. Unless proven otherwise, these features conservatively should be considered as groundwater dependant for the purposes of ascertaining potential impact(s) associated with the proposed quarry operation (during both the extraction and post-quarrying rehabilitation phases) and for defining mitigative measures.

2.3.4 Section 3.0 (Field Investigations)

SUB-SECTION	COMMENT
3.1.2	<p>→ It is reported that MW07-05 was "...left as an open hole for subsequent monitoring well installation as part of the 2008 drilling program". Are groundwater level data available for the open borehole prior to monitor installation, such that a general water table elevation within the bedrock can be established?</p> <p>This elevation is important as it represents the 'equalized' hydraulic pressure from all contributing and non-contributing fractures within the shale bedrock along the open borehole length, similar to that which will exist within the quarry upon completion of extraction. This value should be compared against the modelled final lake elevation of 228 m asl. to determine whether the groundwater table within the bedrock will rise sufficiently to meet the goals of the proposed quarry rehabilitation plan.</p> <p>→ MW08-06, MW08-07 and MW08-08 are reported to be "...cored in to the Queenston Shale to depths of "30 m to <u>35 m</u>". A review of the borehole logs presented in Appendix B indicates that the total depth of the boreholes is 30.6 m, 30.6 m and 30.9 m, respectively. When the overburden is removed, the boreholes actually only extend about 25 m to 27 m into the shale.</p>
3.1.3	→ Well completion details are reported to be contained in Appendix A. Rather, they are presented in Appendix B.
3.2.5	→ What is the rationale for excluding surface water flow monitoring during "extended dry periods"? Characterization of the lowest flow conditions within local surface water courses is critical to the prediction of impact(s) associated with the proposed quarry.
3.2.7	→ Why has dissolved oxygen (D.O.) not been included as a field parameter? D.O. is a critical parameter for the assessment of aquatic health and should be incorporated in future monitoring programs.

2.3.5 Section 4.0 (Site Geology)

SUB-SECTION	COMMENT
4.1	→ Surficial deposits of silty sand appear to be closer to silt or sandy silt based on particle size distribution curves presented in Appendix C. A number of these layers are likely part of the weathered shale bedrock based on the gravel content and particle size curves. Thus, the interpreted elevation of the weathered bedrock surface may be higher and the more conductive weathered shale thickness (Layer 2) greater than presented in Figure 8.1.
Figure 4.3	→ The borehole bottom elevation for MW07-01 is shown to be approximately 203.5 m asl on the figure. In comparison, the borehole depth elevation denoted on the borehole log contained in Appendix B is 204.09 m asl. Which value is correct?
Figure 4.5	→ The stratigraphic contacts for MW08-6 are not correct on the figure based on the borehole log information contained in Appendix B. The base elevation of the watercourse at CRT3 should be 222 m asl per Page 3 of Appendix G.

2.3.6 Section 5.0 (Baseline Site Hydrogeology)

SUB-SECTION	COMMENT
5.2.2	→ It would be beneficial to consider the arithmetic mean hydraulic conductivity values for the bedrock as water movement would be preferentially through the zones of higher hydraulic conductivity. The use of the arithmetic mean could influence the predicted drawdown effect of the quarry and may result in a greater distance of drawdown influence.
5.3.1	→ Water levels at SV08-02 show upward hydraulic gradients for groundwater. It is interesting to note that based on the hydrograph in Appendix E, there was an approximately 5 month period in 2009 when the MT surface water levels were greater than the groundwater levels and a slightly shorter period when groundwater levels were below the base of the MT (227 m asl per the cross-section) and the surface water flow appeared perched above the underlying water table. This recharge indicates periods of natural surface water recharge (losing stream) from the MT within the central portion of the site. The recharge and perched conditions affect the use of the MT as a constant head boundary in the groundwater model and suggest that water table drawdown can occur below the MT, which would enhance the predicted drawdown effects to the west of the MT. Additional assessment and clarification is required.
	→ Within the southeastern portion of the site the hydraulic gradients within the deeper shale are upward at MW07-3 and at MW08-6 (seasonally), whereas hydraulic gradients are downward at other monitoring well nests further to the north. This pattern indicates that deeper hydraulic gradients are upward as one gets closer to the Credit River. This pattern is reasonable.
	→ Within the higher elevation areas of the site the groundwater table is near surface, which results in localized and seasonal seeps or springs. This is apparent for Wetland No. 42 and in the area of MW07-5 and SV08-1, where seeps / springs were observed during the site visit on November 9, 2010. Groundwater seepage also occurs along the base of the slopes adjacent to the MT, with observed seeps within the northern portion of the MT during the site visit on November 9, 2010. This is consistent with the observations in the Golder report.
5.4.1	→ The low constituent concentrations within shallow groundwater on the site are indicative of recharge from precipitation. Regionally, this shallow groundwater provides good water quality to wells and surface water and should be maintained for water supplies and the natural environment. Deeper groundwater is more mineralized and typically shows poorer quality.

	→ An assessment of the effects on groundwater recharge from the proposed quarry and operations should be provided
5.4.1 / 5.4.2	→ An incorrect (outdated) citation utilized for the Ontario Drinking Water Standards (January 2001). An alternate outdated (June 2003) citation and values are indicated on the analytical data tables presented in Appendix F. The correct values that should be used for comparison are contained in the MOE document entitled, "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines" (June 2006 update).
5.4.2	→ Numerous inconsistencies are noted in the analytical data presented on Table F.1 with that of the Laboratory Certificate of Analysis reports. This has led to errors in the text discussion of ODWQS exceedances in the groundwater samples obtained from Neighbouring Private Wells. Those errors in both this section of the report text and associated data tables were corrected by the Consultant through the issuance of a Technical Memorandum (with related attachments) on December 9, 2010. Errors translated to the report conclusions have not yet been rectified and require updating.
Figure 5.1	→ Based on the presented hydraulic conductivity values, the hydraulic conductivity used for Layers 3 and 4 (in Figure 8.1) should be greater by about half an order of magnitude (5×10^{-6} m/s to 5×10^{-7} m/s) to account for the greater influence of the more conductive portions of the weathered shale.
Figure 5.2	→ The groundwater elevation (wet season) at MW08-7 should be 236.92 m asl, not 239.92 m asl. Some groundwater elevations are missing, such as at MW07-1 and MW07-3. Groundwater elevation contours are not notably affected by the error / omissions.
Figure 5.3	→ The groundwater elevation for MW07-3 is not correct. Values from monitoring well MW07-3-C should be used for comparison to monitoring well intake elevations for other monitoring nests. Groundwater elevation contours are affected in the southeast corner of the site.

2.3.7 Section 6.0 (Baseline Site Hydrology)

SUB-SECTION	COMMENT
6.1	→ The water that feeds Drainage Feature B is a result of runoff, as noted, but also discharge from an agricultural field tile at the site boundary. Notable flow was observed discharging from this tile during the site visit on November 9, 2010. This field tile may have been installed to control the high water table levels that occur in this area, as observed at MW08-8.
	→ In addition to contribution from runoff, Drainage Feature E is also fed by groundwater seeps as observed near MW07-5 and SV08-01 during the site visit of November 9, 2010.
6.2	→ We could not find Figure G-7C to review the total flow hydrograph
	→ The report is not clear in this section on the occurrence of surface water recharge of the groundwater as observed during the summer and fall at SV08-02 based on the hydrographs presented in Appendix E. During this time the MT is a losing stream, with the recharge insufficient to maintain the water table at the same elevation as surface water. This observation indicates that the model's use of a constant head boundary at the MT is not supportable and that drawdown as a result of the quarry can extend further to the west than predicted.
6.3	→ It is unclear where the value of 36.2 L/s for total annual surplus originates. In Section 6.2.2 the value is 32.6 L/s

6.4	→ Although a PWQO limit presently does not exist for chloride or sodium, a discussion of the baseline concentrations of sodium and chloride in local surface water is warranted (both watercourses and wetlands). This is due to the fact that both parameters are known to exist at elevated levels in the deeper groundwater zones within the shale, and that collected groundwater influx to the quarry is proposed to be discharged to the local surface water environs for mitigation.
6.5	→ A comparison of surface water temperatures between CRT1, CRT2, CRT3, and CRT4 is not presented and the on-site baseline influence of groundwater discharge on surface water temperatures was not determined. As a result, the predicted effects of temperature change cannot be calibrated and trigger levels cannot be established that would indicate a quarry effect on surface water. Additional upstream and downstream continuous temperature monitoring and analyses are required.

2.3.8 Section 7.0 (Groundwater – Surface Water Interactions)

SUB-SECTION	COMMENT
7.1	→ For the North Location discussion, the staff gauge data were not available for review. Based on the hydrograph information for MW08-8 in Appendix E, the wetland represents a constant groundwater discharge location. There are insufficient data to indicate if the eastern portion of the wetland exhibits recharge conditions. Additional data are required to confirm the assumptions for this location.
7.2	→ For the Central Location discussion, the comment that the watercourse “flows on top of bedrock” is not supported by Cross-Section B-B’ (Figure 4.4), which indicates about 2 m of overburden below the watercourse in this area. Based on the available information, the ‘select periods’ of MT recharge of the groundwater occurred from July 2010 through December 2010. Based on an interpolation of ground surface elevations, the surface water is also perched above the underlying water table during periods of the year. There are insufficient data to determine the extent of this seasonal recharge or perched conditions along the length of the watercourse. This information is required to support the model’s use of the constant head boundary for the MT.
7.3	→ The continuous water level data for CRT-3 is not provided in Appendix E as noted in the text.

2.3.9 Section 8.0 (Groundwater Flow Modelling)

SUB-SECTION	COMMENT
8.1	→ The use of an “equivalent porous medium” is considered reasonable. The report notes that, “However, if encountered, fracture flow may account for a significant component of quarry inflows not accounted herein”. Contingencies should be identified to mitigate the effects of high fracture inflows, if detected.
	→ The implicit assumption that flow within the MT will continue and will be sufficient to make up for potential losses due to quarrying is not supported by the information presented. Additional discussion is required to address the seasonal losing stream and perched conditions for the MT and the effects from potential water level drawdown below the MT.
	→ The steady state assumption is reasonable, but average conditions should reconsider the effects of the losing stream for the MT.

8.2	<p>→ The depth of the active groundwater zone is presented as 40 m below the top of the rock. In contrast, page 17 (Section 4.2) indicates a depth of less than 20 m and page 19 indicates a depth of 25 m (Section 5.2.2). These differences should be explained for the development of the numerical groundwater model.</p> <p>→ The assumption of 'good connectivity' between the stream and the shallow groundwater system is questionable owing to seasonal perched conditions within a portion of the MT.</p>
8.3	<p>→ What is the source of the low permeability fill for the quarry sidewalls? If fill that originates off-site is to be used, the criteria for fill acceptance should be provided.</p>
8.4	<p>→ The dominant influence of the MT on the drawdown is questionable owing to the observed poor hydraulic connection between the MT and the underlying layer (seasonal perched conditions). This boundary effect should be reconsidered for the steady state conditions and effects to the northwestern wetland reassessed.</p> <p>→ For continuous layers across the model it is anticipated that greatest drawdown extent will occur within the layer of highest hydraulic conductivity (Layer 2). This effect will be most notable with the reconsideration of the boundary condition at the MT. Rationale for the presentation of only Layer 4 in the report is required.</p> <p>→ The modelling results indicate that there is a loss of water from the MT as a result of the drawdown effects from the quarry. What is the leakage of the MT and how does this compare to the seasonal flow within the MT?</p> <p>→ The 'bias' of the MT in influencing the drawdown to the east should be discussed in further detail. We question if this bias results in greater drawdown to the east – it may actually reduce the drawdown to the east when the influence of the constant head boundary for the MT to the north and south of the proposed quarry is considered.</p> <p>→ Final rehabilitation drawdown should be reconsidered with the potential for drawdown to extend below the MT.</p> <p>→ For the rehabilitation conditions a water balance should be presented to confirm the timing and effectiveness of lake formation during mitigation of the MT (as well as potentially other surface water courses / wetlands, if required), and that the lake will actually achieve a final elevation of 228 m asl.</p>
8.4.5	<p>→ Discussion on the timing to form the rehabilitation lake should be provided. Based on a rough estimate using the predicted groundwater seepage rate of 532 m³/day (full excavation) to 10 m³/day (final lake), plus water surplus for the 9.3 ha, it is estimated that between 10 to over 100 years will be required to fill the lake. The use of lake water for MT (and potentially other local surface water features) mitigation during lake filling will extend this time to fill. The time for lake filling will also influence the water balance assessment for post-quarry as land use around the quarry property may change.</p>
	<p>→ The placement of 'low permeability' berms around the perimeter walls of the quarry extraction area should be discussed with specific regard to their potential impact to lake filling and the availability of surplus water for on-going mitigation during rehabilitation.</p>
8.5	<p>→ The need for a PTTW will also need to consider the water surplus that collects within the extraction area as a result of direct precipitation.</p>

2.3.10 Section 9.0 (Impact Assessment)

SUB-SECTION	COMMENT
9.1.1	<p>→ It is questioned whether sufficient overburden material will exist within the Stage 1 excavation area to construct the site screening berms as indicated. If a deficit of available on-site material exists to construct the berms and additional fill that originates off-site is to be used, the criteria for fill acceptance should be provided.</p> <p>→ Report does not identify construction of a storage pond (as shown on the Final Site Plan – July 2010) as part of the Site Preparation activities.</p>
9.1.3	<p>→ The text indicates that the settling pond is within the northeastern corner of the site, while the figure indicates the pond is in the northwestern corner. We assume that the figure is correct.</p> <p>→ For Stage 1, is this discharge from the settling pond to the MT planned to occur via gravity or pumping? If by gravity, discharge into the MT will be controlled by quarry dewatering rates – discussion is required to determine if these rates will match baseline flow conditions in the MT. If by pumping – what are the triggers to initiate and deactivate discharge?</p>
9.1.4	<p>→ For Stage 2, what are the triggers to initiate and deactivate discharge to the MT?</p>
9.2	<p>→ Discussion is required on the potential change in rate and timing of discharge from the settling pond to the MT and the difference from baseline conditions.</p>
9.2.5	<p>→ Discharge from the rehabilitation lake into the MT will not provide mitigation to upstream conditions. What are the potential effects to upstream flow rates?</p>
9.3	<p>→ Requires a discussion on post-rehabilitation effects when there will be less water surplus than pre-quarry conditions as a result of greater water loss from the lake (evaporation) than water loss from the existing land use (evapotranspiration).</p>
9.4.1	<p>→ Per previous comments, the drawdown distances should be re-evaluated in consideration of the potential perched conditions for the MT and higher hydraulic conductivity for Layer 2.</p>
9.4.2	<p>→ The impact analysis presented for the water wells is reasonable for hydrogeologic conditions where the quantity and quality of water would be generally constant over the entire borehole length; however this is not typically the case for the local shale bedrock environment. Based on the conceptual hydrogeologic setting, most water wells obtain an acceptable quantity and quality of water from the overburden or upper portion of the shale bedrock. Drawdown below this more productive zone for the water wells could have an adverse impact on the well use. It is recommended that the impact assessment consider the current pump setting and the depth / location of Layers 2 and 3. This assessment is especially important for Well #33, which shows the greatest predicted drawdown effect.</p>
9.6.1	<p>→ A discussion is required to address reduced flow upstream of the site within the MT.</p>
9.6.11	<p>→ An impact assessment to potential changes to the temperature of surface water as a result of the loss of groundwater discharge should be provided.</p>
9.6.2	<p>→ A discussion on the predicted concentrations of salts (chloride and sodium) and changes from baseline conditions within local surface water features should be provided. This discussion should be considered as part of the Natural Environment Assessment.</p>

2.3.11 Section 10.0 (Recommended Monitoring Program)

SUB-SECTION	COMMENT
10.1	→ The proposed monitoring program is considered reasonable to assess potential effects to groundwater levels at the site boundary. The off-site monitoring should also provide the ability for private water wells to be added to the program in the event that access becomes available. All water wells within 500 m of the site boundary should be part of the monitoring program where access is granted.
10.3	→ The surface water monitoring program is considered reasonable, but should include continuous water level and temperature monitoring within the MT at the upstream (CRT1) and downstream (CRT3) site boundaries.
	→ The monitoring program should include an on-site weather station (similar to the existing station) to monitor daily precipitation for input to an annual review of the water balance assessment.
10.5	→ The Well Complaint / Response Action Plan proposed in the report is considered to be deficient in respect of the following items: <ul style="list-style-type: none"> • Consideration for water quality complaints (as a reduction in water level can result in more mineralized water within a well). • The plan required more affirmative responses and actions to complaints. • A standard time-line for the provision of a temporary water supply and provision of a permanent water supply is required. • Contingency options in the event that a suitable well cannot be installed on a well owner's property should be identified. • Assurance of adequate financial resources to carry out the Action Plan until stabilization of the lake levels during rehabilitation is required.
	→ Trigger levels (quantity and quality) for groundwater and surface water are not provided that would initiate the implementation of contingency measures if adverse effects from the quarry or end use occur.
	→ Contingencies are not provided for unacceptable effects to surface water quantity or quality, or effects to the natural environment as a result of effects to groundwater quantity or quality.

2.3.12 Section 11.0 (Potential Mitigation Requirements)

SUB-SECTION	COMMENT
11.1	→ See the comments related to the Well Complaint / Response Action Plan (Section 10.5).
11.2	→ The mitigation does not include contingencies for off-site effects to wetlands or an assessment of adequate water (water balance) to provide water from the quarry to mitigate adverse impacts. Contingencies for water quality effects are not provided.
11.3	→ The report does not provide sufficient analyses of potential impacts and mitigation to effects within the MT upstream of the proposed quarry lake discharge point.

2.3.13 Section 12.0 (Conclusions)

COMMENT

- Review comments on the data analyses and interpretation are provided for Sections 1.0 to 11.0. It is anticipated that some of the conclusions presented in Section 12.0 will change as a result of addressing the review comments.

2.3.14 Report Appendices

2.3.14.1 Appendix G (Hydrogeological Component Assessment Report)

Most review comments for Appendix G are presented above for Sections 1.0 to 11.0 of the main report. Additional comments are provided as follows.

SUB-SECTION	COMMENT
3.1	→ Drainage Feature A is an intermittent watercourse as it also has a component of groundwater baseflow. This baseflow can occur independent of precipitation as observed for the lower reaches of the watercourse during the November 9, 2010 site visit.
	→ Drainage Feature B – A review of data presented in Attachment C did not identify periods of no flow within the feature. In addition, during the site visit of November 9, 2010, a notable groundwater contribution to flow within the watercourse was observed to originate from the field tile at the site boundary near MW08-7. Therefore, findings indicate that flow within the watercourse is perennial. The effects of perennial flow should be evaluated as part of the impact assessment.
	→ Drainage Features D and E are also fed by groundwater discharge that occurs as a result of seasonally high water table levels. Discharge was observed during the November 9, 2010, site visit. The loss of this groundwater discharge and its contribution to downstream flow and temperature within the MT should be assessed.
	→ Based on the observed contribution of groundwater to the on-site wetland, the interpretation that the off-site wetlands are not dependent on groundwater is questionable without supporting technical data. It is recommended that without groundwater information at the off-site wetlands, the impact assessment should conservatively assume that the off-site wetlands are groundwater discharge features and the wetland impact assessment be re-visited.

2.3.14.2 Appendix H (Numerical Groundwater Flow Modelling)

Most review comments for Appendix H are presented above for Sections 1.0 to 11.0 of the main report. Additional comments are provided as follows.

SUB-SECTION	COMMENT
4.3	<ul style="list-style-type: none"> → The use of a constant head boundary for the MT is questioned in the review comments for the main report. In addition, the use of constant head boundaries for the on-site tributaries for the MT as part of the calibrated model should be reconsidered owing to the following. <ul style="list-style-type: none"> • Most of the tributaries (watercourses) for the MT are dry for periods of the year with groundwater discharge into the watercourses occurring at different times and at different elevations. In effect, groundwater discharge into the watercourses reflects the water table elevation, which dominantly changes depending on upgradient recharge. Therefore, the use of constant head boundaries for these watercourses is not representative of observed conditions.

	<ul style="list-style-type: none"> The number of constant head boundaries over the small area of the site ‘forces’ the water level calibration.
4.5	<p>→ A comparison of the interpreted on-site contours with the model's simulated contours is difficult owing to the different contour intervals. Figures H-11 and H-12 should be presented with 5 m contour intervals.</p> <p>→ It is apparent that the simulated contours for the northwest wetland indicate a recharge feature while the interpreted contours based on observed conditions indicate a discharge feature. This difference is highlighted by the simulated 240 m asl contour that cuts through the northwest wetland – this contour is about 6 m to 7 m above ground surface at the southeastern corner of the northwest wetland. Therefore, it is apparent that the use of a constant head of 241.3 m asl for the northwest wetland in the model is not reflective of observed conditions and provides erroneous results.</p> <p>→ Further discussion is required regarding the NRMS results for the calibrated model. It is expected that the on-site NRMS (Site Calibration Plot) would be better than the off-site NRMS (Global Calibration Plot) as the on-site data represent consistent water level dates, whereas the off-site MOE wells represent water levels obtained over different years and seasons.</p> <p>→ The on-site NRMS of 11.2% is greater than the industry target of 10%. A lower NRMS is expected as most of the on-site wells are located near watercourses that were simulated a constant head boundaries. See review comments on the boundary conditions above (Section 4.3). Most calculated heads were greater than observed heads. It is recommended that the model be re-visited and less on-site constant head boundaries used.</p> <p>→ Additional calibration statistics should be provided, including: correlation coefficients, eigenvalues and eigenvectors, composite scaled sensitivities, and 95% confidence limits.</p>
5.2	<p>→ As noted above, the simulated heads for the northwest wetland are erroneous and should be re-evaluated.</p> <p>→ The MT leakage reduces the drawdown below the MT. Considering the occurrence of seasonal perched conditions for the MT, a re-evaluation of the amount of leakage from the MT should be completed.</p> <p>→ A discussion on potential impacts to groundwater conditions at off-site wetlands is required.</p>
5.3	<p>→ The effects of less groundwater seepage into the extraction area should be re-evaluated in consideration of previous review comments.</p>

3. QUESTIONS TO BE ASSESSED BY THE PEER REVIEWER

3.1 Purpose

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Is the purpose of the work clearly and understandably stated in the applicant's report?	→ Yes.	→ n/a
Does the purpose set out the proper direction to undertake the study?	→ No.	→ Although not discussed in Section 1.1 ("Overview") of the report, some of the required components are included in the report body (i.e., monitoring and mitigation). → Certain other components required by the Aggregate Resources of Ontario Provincial Standards (AROPS) for a Hydrogeological Level 2 technical report in support of a Category 2, Class "A" quarry license application to extract aggregate below the established groundwater table are not included (i.e., trigger mechanisms, contingencies, and a water budget for the proposed rehabilitation plan).

3.2 Methodology

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Is the methodological approach technically sound? Is the review of issues, data, facts objective and appropriate?	→ Yes, the methodological approach used generally is considered to be appropriate. → Yes, the review of issues, data, facts is generally considered to be objective and appropriate, although additional information is required in certain areas.	→ Due to the absence of certain required informational items, it is difficult to confirm those interpretations, conclusions and recommendations posed by the consultant in their report. Conservative assumptions would be required to confirm based on the information provided to-date.

Does the peer review identify any technical concerns stemming from the methodology (and assumptions made to inform the methodology) that may compromise the analysis and/or conclusions of the report?	→ No.	→ n/a
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3.3 Information

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Are relevant data and facts clearly and consistently presented in the technical report?	<ul style="list-style-type: none"> → Yes, in most cases. → In some instances data is missing or is presented incorrectly. Some inconsistencies in the data interpretation provided are also noted. 	<ul style="list-style-type: none"> → Where identified, the shortcomings of the current report can be addressed through the peer review process. → Lack of some data limited the review of those assumptions and interpretations presented.
Is information gathered from appropriate sources? Is the information useful? Accurate? Are there concerns regarding their quality or validity?	<ul style="list-style-type: none"> → Yes, information is gathered from appropriate sources and is useful to the interpretation provided in the report. → Information gathered generally is accurate, although some presentation errors have been identified. → Data quality and validity appears generally to be consistent with standard industry practice. 	<ul style="list-style-type: none"> → Where identified, those errata can be addressed through the peer review process.
Is the data used critical to the conclusions?	<ul style="list-style-type: none"> → Yes. 	<ul style="list-style-type: none"> → n/a
<p>Is the Brampton Brick Report thorough / comprehensive / complete?</p> <p>To respond to this question, peer reviewers must consider accuracy, appropriateness and timing / seasonality of the data collection (if applicable).</p> <p>Where specific technical report warrants, there may be a need to consider broader connections (i.e., water inter-relationships). Please indicate if you feel this is lacking in the Brampton Brick report and what broader connections should be considered.</p>	<ul style="list-style-type: none"> → The technical report, as presented, generally is thorough, comprehensive and complete. However, certain key components of the evaluation are lacking (i.e., trigger mechanisms, contingencies, and a water budget for the proposed rehabilitation plan). → A general notation is provided to establish a linkage to the Natural Environment report in Section 1.1 (“Overview”). This described linkage needs to be clarified and explored further with the Natural Environment peer review consultant. 	<ul style="list-style-type: none"> → The Hydrogeological Level 1/2 Technical Report, as presented, is considered to be incomplete as it relates specifically to the informational requirements specified in the AROPS.

<p>How comprehensive and complete are the recommended mitigation and monitoring measures proposed by Brampton Brick? This includes assessing direct and indirect impacts; short and long term aspects.</p>	<p>→ Mitigation and monitoring measures, as proposed, are incomplete.</p>	<p>→ Unacceptable impacts to groundwater levels in the bedrock are predicted to occur to the northeast and east of the proposed quarry.</p> <p>→ Sufficient detail regarding the operational plan for surface water mitigation during rehabilitation (i.e., lake filling stage) has not been provided.</p> <p>→ The need to supplement flows within the upper reaches of the Main Tributary both during and upon completion of lake filling has not been addressed in any detail.</p> <p>→ Additional monitoring may be required to address predicted changes to water resources and the natural environment, which has not been considered in the current report.</p> <p>→ The duration of the proposed monitoring programs should extend beyond the timeframe of a Permit To Take Water (i.e., 10 years), as is currently proposed.</p>
<p>The gap analysis will assess the relative importance of the data gaps and limitations to the project and identify potential options for addressing them. As such, a recommendation from a peer reviewer could be that additional survey and baseline monitoring must be undertaken as the project proceeds, provided the necessary frameworks are in place to direct this data collection and any changes that are triggered.</p>	<p>→ Gaps identified include: (i) the absence of trigger mechanisms to assess quarry impact, (ii) insufficient detail for contingency measures in the event of adverse impact(s), and (iii) the absence of an operational water budget for the lake filling stage of rehabilitation, inclusive of ongoing mitigation (i.e., how many years will filling take, which may affect the duration of mitigation measures post-quarrying).</p>	<p>→ No process to identify an unacceptable impact for the initiation of contingency measures.</p> <p>→ The anticipated need and duration of mitigation post-quarrying (i.e., during the timeframe required for the lake to fill) has not been addressed.</p>

3.4 Certainty

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
<p>Are certainties and uncertainties of the proposal's success openly and objectively stated in the applicant's report / study?</p>	<p>→ Yes, although additional analyses are required to address some of those uncertainties which have been identified in the report.</p>	<p>→ Unidentified impacts that have not been considered may occur. Additional contingencies may be required that affect the overall water balance.</p>
<p>Are all assumptions clearly stated? Are the assumptions reasonable? Analysis of assumptions and parameters.</p>	<p>→ Yes, the assumptions and limitations are identified in the appropriate sections of the report. Some assumptions utilized in the analysis should be assessed and re-visited.</p>	<p>→ Unidentified impacts that have not been considered may occur. Additional contingencies may be required that affect the overall water balance.</p>
<p>Are the standards or thresholds commonly accepted in this type of technical area identified and appropriately utilized? (i.e., transportation, soils, natural environment? Etc...)</p>	<p>→ Yes, as it pertains to the data analysis (i.e., ODWQS, PWQO, etc.).</p> <p>→ No, as it pertains to the acceptable level of impact associated with the proposed quarry operation.</p>	<p>→ No process to identify an unacceptable impact (trigger mechanism) for the initiation of contingency measures.</p>

3.5 Conclusion

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
<p>Do the conclusions satisfy the applicable policies of the relevant policy documents that need to be consulted as per the specific discipline (i.e., Official Plan, Provincial legislation, standards and guidelines, etc...)? This should be informed by the policy matrix. Have implications relating to required jurisdiction and agency approvals including environmental assessments been identified?</p>	<p>→ Does not satisfy Section 2.2 of the PPS, nor Section 4.14 of the City of Brampton's OP.</p>	<p>→ n/a</p>
<p>Are the conclusions relevant to the purpose / objective and supported by the work undertaken by the report authors?</p>	<p>→ Yes, although conclusions regarding the establishment of trigger mechanisms and details on contingency measures are not provided.</p>	<p>→ No process to identify an unacceptable impact (trigger mechanism) for the initiation of contingency measures.</p>

Based on the peer review, would the same conclusions be determined?	→ No.	<ul style="list-style-type: none"> → Mitigation measures for groundwater impacts are required. → Additional analyses are required for: (i) on-site and off-site wetlands, (ii) groundwater drawdown to the west of the Main Tributary, (iii) water loss from main tributary both during and post-rehabilitation, (iv) potential on-site surface water temperature change, and (v) operational water budget and need for mitigation during the lake filling stage.
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3.6 Mitigation / Monitoring

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Are realistic mitigation measures / rehabilitation plans proposed in the applicant's report? Is there sufficient detail?	→ Yes, although there is insufficient detail.	→ Difficult to evaluate the effectiveness and timeline of the proposed mitigation programs / rehabilitation plans based on the information provided to-date.
Do the proposed measures mitigate the impacts? Is the end result desirable from a technical point of view?	<ul style="list-style-type: none"> → No, not for groundwater. → Potentially for surface water, although additional input from Natural Environment is required. 	→ Does not satisfy Section 2.2 of the PPS, nor Section 4.14 of the City of Brampton's OP.
Will the proposed measures be adequate to address outstanding concerns?	→ No.	→ Does not satisfy Section 2.2 of the PPS, nor Section 4.14 of the City of Brampton's OP.

3.7 Issue / Gaps

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Are there issue gaps arising from the review?	→ The report appears to sufficiently identify those key issues (groundwater, surface water, etc.) that are typical to this type of proposed undertaking.	→ n/a

Were the identified issues addressed in the technical report?	→ Yes	→ n/a
Are there key issues, related to the specific technical report, that have not been considered?	<p>→ Yes, there are key issues that have not been considered in the report. Those issues include:</p> <ul style="list-style-type: none"> • Protection of water levels within a private water well to the immediate northeast of the proposed quarry property (#33). • Adequate characterization of off-site Provincially Significant Wetlands (PSW's) and the potential for impact as a result of quarry operations. • Flow and temperature effects within the upper reaches of the Main Tributary post-rehabilitation. • Water management during the lake filling stage of rehabilitation. 	<p>→ High potential for off-site impacts to local water resources and, potentially, the natural environment.</p> <p>→ Potential natural environment effects to on-site surface water features.</p>

3.8 Adequacy

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
Does the applicant's report / study adequately address the stated purpose?	→ The report does not include all of the technical items required for a Level 1/2 hydrogeological study under the AROPS.	→ n/a
Is there anything that should, in your opinion, have been done differently?	→ Report generally follows standard industry practice, although additional analyses, mitigation, trigger mechanisms, water budget, and contingency details are required.	→ n/a

4. CLOSURE

Based on this hydrogeological, hydrological and design & operations peer review, it is our opinion that the Level 1/2 Hydrogeological Technical report (Golder Associates, July 2010) supplied by Brampton Brick does not warrant approval by required legislation and is therefore unacceptable to the City of Brampton. The major deficiencies identified in this peer review are as follows:

- The report provided does not include all of the technical items required for a level 1/2 hydrogeological study under the Aggregate Resources of Ontario Provincial Standards.
- The report provided identifies predicted hydrogeological / hydrological impacts associated with the proposed quarry operation that does not satisfy Section 2.2 of the Provincial Policy Statement, nor Section 4.14 of the City of Brampton's OP.

The opinions expressed in this peer review (including appendices) may be supplemented, reconsidered or otherwise revised by the author(s) due to new or previously unknown information.

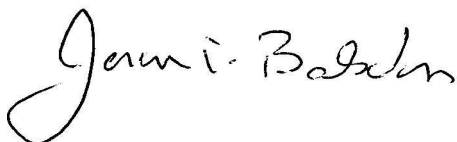
We trust that the peer review results and recommendations presented herein are sufficient for your needs at this time. Please contact the undersigned if you have any questions or comments.

We thank you for allowing GENIVAR to assist you with this assignment.

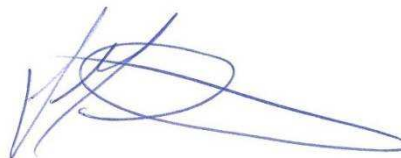
Respectfully Submitted,

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5. LIMITATIONS AND USE

This report has been prepared for the exclusive use of The Corporation of the City of Brampton and its assignees. GENIVAR Inc. (GENIVAR) will not be responsible for the use by others of any information contained within this report. GENIVAR also accepts no responsibility for any damages incurred by any third party as a result of decisions or actions made based upon the information contained within this report.

All background information reviewed in the preparation of this report has been relied upon in good faith, and GENIVAR does not accept any responsibility for any mis-statements, inaccuracies, or deficiencies contained in those documents. The information in this report should be evaluated, interpreted and implemented only in the context of the assignment.

The findings and conclusions included in this report are valid only at the date of issuance. If additional information is provided in the future, such as the results of additional site-specific testing or evaluation, GENIVAR will be pleased to re-evaluate its conclusions contained within this report and issue amendments, as required.