GENIVAR

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

(SECOND ROUND TECHNICAL REVIEW)

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

March 2013

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

PREPARED BY:
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PROJECT NO.: 111-53308-01

GENIVAR

March 20th, 2013

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 – Second Round Technical Review

File 111-53308-01

GENIVAR Inc. (GENIVAR) is pleased to present the enclosed report, which provides a summary and discussion of comments raised during our *Second Round Technical Review* of the following supplemental documents, as prepared by Golder Associates Ltd. (Golder) and/or Beacon Environmental (Beacon) on behalf of Brampton Brick Limited:

- Golder Associates Ltd., January 16th, 2012. *Memorandum: Formal Response to Peer Review Assessment of a Level 1/2 Hydrogeological Technical Report Submitted in Support of a Quarry Zoning Application review – Proposed Norval Quarry.* Project No. 07-1112-0100.
- Golder Associates Ltd. / Beacon Environmental, September 19th, 2012. *Adaptive Management Plan (AMP), Version 1.0 – Water Resources and Ecological Features, Proposed Norval Quarry Brampton, Ontario.* Report No. 07-1112-0100.

Based on this *Second Round Technical Review*, it is our opinion that the additional information provided by Brampton Brick continues to be insufficient to warrant approval by required legislation and therefore remains unacceptable to the City of Brampton. The major deficiencies identified in this peer review that do not satisfy Section 2.2 of the Provincial Policy Statement, nor Section 4.14 of the City of Brampton's Official Plan include the following:

- No contingencies to address immediate or short-term impacts to the groundwater or surface water resources that could negatively affect the Main Tributary and local wetlands.
- There is a reliance on the supply of a municipal water supply to residents with water wells within 5 years. While this contingency is reasonable to maintain a sufficient water supply well to the public, this is more a planning issue for consideration by the City of Brampton.
- Concern regarding the effectiveness of the Storage Pond for temperature and water quality control.

Detailed review comments are provided in the following document. 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 the undersigned if you have any questions or comments.

Respectfully submitted,
GENIVAR Inc.

Jason T. Balsdon, P.Eng., Consulting Engineer
Director, Environment

JAM:

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APPENDICES

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. 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.

In support of its Zoning By-law Amendment application, the Proponent 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.).

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.

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.

In June 2010, the City released a request for informal proposal (RFIP) for the *Hiring of a Peer Review Consultant to Provide a Peer Review Assessment on a technical Study Submitted in Support of a Quarry Zoning Application Review*. GENIVAR Inc. (GENIVAR) was successful in securing this contract with the City. According to the original 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."*

Fulfillment of the deliverables of the original assignment was achieved by GENIVAR through the submission of a formal peer review report to the City on May 25th, 2011. It is our understanding that a copy of our peer review report subsequently was forwarded by the City to the Proponent and their Consultant team for consideration.

In response to comments provided in our May 2011 peer review report, additional technical information was submitted to the City by Golder Associates Limited (Golder) on behalf of the Proponent in May 2012. Upon receipt of the response documentation, a request for proposal (RFP) subsequently was circulated by the City to GENIVAR via email on May 22nd, 2012. The purpose of the RFP was to undertake a *Second Round Peer Review* of the additional technical information provided in response to our original peer review comments. GENIVAR was successful in securing this contract extension with the City.

In August 2012, a draft copy of an Adaptive Management Plan (AMP) also was submitted to the City by Golder and Beacon Environmental (Beacon) on behalf of the Proponent. Upon receipt of the draft AMP, document a request for proposal (RFP) was forwarded by the City to GENIVAR via email on September 25th, 2012. The purpose of the RFP was to include a technical peer review of the draft AMP document as part of our *Second Round Peer Review* response. GENIVAR was successful in securing this contract extension with the City.

1.2 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 our hydrology, hydrogeology and design and operations peer review (including this Second Round Peer review Response). 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 used as a guide 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	→ 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	→ 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?
ITEM	QUESTIONS
Information	→ 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	→ 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	→ 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	→ 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	→ 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?

1.3 Available Documents

1.3.1 Documents Reviewed

The following documents represent the primary focus of this hydrology, hydrogeology and design and operations *Second Round Technical Peer Review* response.

→ Golder Associates Ltd., January 16th, 2012. *Memorandum: Formal Response to Peer Review Assessment of a Level 1/2 Hydrogeological Technical Report Submitted in Support of a Quarry Zoning Application review – Proposed Norval Quarry.* Project No. 07-1112-0100.

The following ten (10) attachments were included as part of the Consultants response memorandum.

1) Updated Figure D-5 (Hydrograph of Monitoring Well MW07-05);
2) Updated Table 3-1 (Summary of Water Level Monitoring and Well Installation Details);
3) Feature B Profile (Graph);
4) Updated Figure 5.2 (Groundwater Elevations in Overburden);
5) Updated Figure 5.3 (Groundwater Elevations in Shallow / Intermediate Bedrock);
6) Memorandum: November 25, 2011. *2011 Additional Field Work at the Proposed Norval Quarry Site to Investigate Potential Surface Water-Groundwater Interactions* (10pp. plus figures and 8 appendices);
7) Hydrograph of Monitoring Well SV08-2;
8) Memorandum: November 25, 2011. *2011 Additional Groundwater Modelling for the Proposed Norval Quarry* (10pp. plus tables and figures);
9) Memorandum: December 21, 2011. Proposed Norval Quarry – Wetland Water Balance Estimates (11pp. plus photographs and 2 appendices); and
10) Memorandum: November 25, 2011. *Proposed Norval Quarry – Quarry Water Management and Lake Filling Estimate* (25pp. plus tables and figures).

→ Golder Associates Ltd. / Beacon Environmental, September 19th, 2012. *Adaptive Management Plan (AMP), Version 1.0 – Water Resources and Ecological Features, Proposed Norval Quarry Brampton, Ontario.* Report No. 07-1112-0100. This report was provided in draft format.

1.3.2 Other Documents

Similar technical responses to initial peer review comments were provided by other disciplines included as part of the Proponent's consultant team. A summary listing of other technical response reports submitted in support of the Proponent's Zoning By-law Amendment application and ARA License application is not provided as part of this report.

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 Specific Comments

The following sections provide updated peer review comments based on a review of the technical response information (ref. Section 1.3.1) provided by Golder Associates on behalf of the Proponent in May 2012. Peer review comments pertaining specifically to the draft AMP are included in Appendix A. The comments provided herein should be read in conjunction with our preliminary peer review report, dated May 25th, 2011. A completed *Peer Review Results Chart* is also included for reference in Appendix B.

2.1.1 Executive Summary

COMMENT
→ Refer to response comments for Sections 1.0 to 11.0.

2.1.2 Section 1.0 (Introduction)

SUB-SECTION	COMMENT
1.1	→ RESOLVED.
	→ The monitoring program, trigger mechanisms, assessment process, and contingencies planned for the Adaptive Management Plan (AMP) are essential components for the hydrogeological assessment. Refer to Appendix A for further comments pertaining to the AMP.
1.3	→ REASONABLE RESPONSE. No further clarification required.
Figure 1.2	→ RESOLVED.

2.1.3 Section 2.0 (Regional Setting)

SUB-SECTION	COMMENT
2.1	→ RESOLVED.
2.6	→ Attachment #6 in the Proponent's response indicates that groundwater discharge into Wetland No. 42 and 44 occurs at certain times of the year. We concur with the findings. However, monitored surface water and groundwater levels at Wetland No. 46 indicate only recharge conditions in the wetland area south of Bovaird Drive. Additional analyses are recommended for the water balance per our peer review comments provided for Attachment #9 (Section 2.1.17). → Comments relating to modelling presented in Attachment #8 are provided in Section 2.1.16 of this review document.

2.1.4 Section 3.0 (Field Investigations)

SUB-SECTION	COMMENT
3.1.2	→ RESOLVED.
3.1.3	→ RESOLVED.

3.2.5	→ RESOLVED.
3.2.7	→ REASONABLE RESPONSE. The DO monitoring has been included in the AMP.

2.1.5 Section 4.0 (Site Geology)

SUB-SECTION	COMMENT
4.1	→ RESOLVED.
Figure 4.3	→ RESOLVED.
Figure 4.5	→ RESOLVED.

2.1.6 Section 5.0 (Baseline Site Hydrogeology)

SUB-SECTION	COMMENT
5.2.2	→ REASONABLE RESPONSE. The use of arithmetic mean hydraulic conductivity values as a starting point in model calibration is preferred, however use of a geometric mean in this application is considered adequate for the chosen steady state model approach.
5.3.1	→ Attachment #7 of the Proponent's response shows the period of surface water levels at a higher elevation than adjacent groundwater levels at SV08-2 during the summer months of 2009, 2010, and 2011. This is indicative of periods of recharge conditions as noted in our previous review comments. Findings presented in Attachment #6 for the surface water flow in the vicinity of CRT-2 also indicate summer (July 6th, 2011) recharge conditions per page 7/10, which states: *"a further 60 m downstream near the central site access road culvert the flow decreased to approximately 2.7 L/s apparently associated with stream infiltration into the silty and sandy alluvium in the vicinity of well SV08-02"* The use of average water levels in Attachment #3 obscures the periods of recharge conditions during the summer months. Plotting of groundwater levels at about 226 m ASL for SV08-2 A/B in Attachment #3 would also show the periodic occurrence of recharge conditions and possible perched surface water conditions for a distance of about 60 m in a downstream direction. We concur that during other periods of the year when groundwater pressures are greater, such as during the winter and spring, groundwater discharges to the MT and that perched surface water conditions do not occur.
	→ RESOLVED.
	→ Photographs and field notes from the November 2009 site visit do not indicate surface water flow within Feature E upslope of the interpreted seeps in the area of MW07-5. The potential for seeps in the area of SV08-01 is also supported by the more mineralized water detected within the Main Tributary at Station H (Main Tributary Flow Measurements, Attachment #6) in July 2011. The electrical conductivity of the surface water at this location was 19.8 mS/cm, as compared to less than 1 mS/cm at other surface water stations. Thus, groundwater seepage in the area of Feature E in November 2009 continues to be apparent; however based on the 2011 observations by Golder perhaps the seepage is periodic. Presentation of the 2009 through 2011 groundwater level information for MW07-2, MW07-5, and SV08-1 for review would be beneficial.
5.4.1	→ Comments pertaining to Attachment #8 and #9 are provided later sections of this document. → Predicted effects to water wells should be evaluated based on pump settings and available drawdown. It is noted that while the predicted drawdown from the quarry is within the baseline seasonal fluctuation range, the predicted drawdown should be considered as an

5.4.1 cont'd	additional (cumulative) drawdown effect. → Well 33 continues to show the greatest drawdown effect, which could affect both the quantity and quality of water available at the well. → Predicted drawdown effects were considered in development of the AMP. Refer to Appendix A for further comments pertaining to the AMP.
5.4.1 / 5.4.2	→ RESOLVED.
5.4.2	→ RESOLVED.
Figure 5.1	→ Comments pertaining to modelling presented in Attachment #8 are provided in Section 2.1.16 of this review document. → We concur with Golder that slug test results provide a more localized characterization of hydraulic conductivity values in the medium being tested. However, as commonly found in weathered and fractured bedrock, as the scale of the test increases (for example to pumping tests) the hydraulic conductivity determined for the medium typically increases. Therefore, it is recommended that the higher hydraulic conductivity results from the slug tests be considered as a starting point for the model calibration. This approach would not bias the modelling results provided that acceptable calibration statistics are achieved. Consideration of this approach would benefit a sensitivity assessment of the modelling results as other statistical tests were not completed per the Golder response to Subsection 4.5, Appendix H.
Figure 5.2	→ REASONABLE RESPONSE. No further clarification required.
Figure 5.3	→ RESOLVED.

2.1.7 Section 6.0 (Baseline Site Hydrology)

SUB-SECTION	COMMENT
6.1	→ REASONABLE RESPONSE, although flow may also be reduced along the reach of the watercourse by recharge per Attachment #6 for July 2011.
	→ As noted in our response for Subsection 5.3.1, groundwater seepage in the area of Feature E in November 2009 continues to be apparent; however based on the 2011 observations by Golder perhaps the seepage is periodic. Presentation of the 2009 through 2011 groundwater level information for MW07-2, MW07-5, and SV08-1 for review would be beneficial.
6.2	→ RESOLVED.
	→ Comments pertaining to modelling presented in Attachment 8 are provided in Section 2.1.16 of this review document. → As noted in our comments to Attachment #10, the recirculation of water between the MT and the quarry should be considered for potential water quality impacts.
6.3	→ RESOLVED.
6.4	→ Comments pertaining to Attachment #10 are presented in Section 2.1.18 of this document.
6.5	→ Comments pertaining to Attachment #10 are presented in Section 2.1.18 of this document.

2.1.8 Section 7.0 (Groundwater – Surface Water Interactions)

SUB-SECTION	COMMENT
7.1	→ At location WL42A the shallow groundwater levels within monitoring well MW10-8E are above grade and are representative of the staff gauge measurements shown in the hydrograph. Thus, the wetland appears to have a greater dependency on the upward

7.1 cont'd	hydraulic gradients within the till than is suggested in the report. The groundwater levels for P11-03, located about 50 m to the east, are lower and may be influenced by its proximity to GW Seep #2. It is noted that the hydrograph for P11-03 as presented in the Wetland 42 North Hydrograph does not match the preceding hydrograph for P11-03 only. → At location WL42B the shallow groundwater levels at P11-01 and P11-02 match the water level pattern observed for P11-03, including during the dry period of June 2011. A similar pattern is apparent for the manual water levels for the staff gauge. Thus, there is a good interaction between groundwater and surface water in this area of the wetland. → The Wetland 42 North Hydrograph suggests a different conceptual model for the wetland than is presented in the report. Groundwater pressures within the upper portion of the shale bedrock (MW08-08C) indicate upward hydraulic gradients into the overlying sand (MW08-08D). However, groundwater pressures within the overlying till (MW10-08E) are typically greater than observed within the sand (MW08-08D). Thus, the sand appears to function as a drainage layer. Groundwater pressures within the till discharge into the wetland and result in downward hydraulic gradients into the underlying sand. Southeast east of the wetland the groundwater within the upper bedrock, sand, and till provides baseflow to the seeps and the Main Tributary. Therefore, the constant heads considered for Wetland No. 42 in the model should consider the groundwater pressures for the sand unit (Layer 2). It appears that Layer 1 groundwater levels were used.
7.2	→ Attachment #7of the Proponents response shows the period of surface water levels at a higher elevation than adjacent groundwater levels at SV08-2 during the summer months of 2009, 2010, and 2011. This is indicative of periods of recharge conditions as noted in our previous review comments. Findings presented in Attachment #6 for surface water flow in the vicinity of CRT-2 also indicate summer (July 6, 2011) recharge conditions per page 7/10: *"a further 60 m downstream near the central site access road culvert the flow decreased to approximately 2.7 L/s apparently associated with stream infiltration into the silty and sandy alluvium in the vicinity of well SV08-02"* The use of average water levels in Attachment #3 obscures the periods of recharge conditions during the summer months. Plotting of groundwater levels of about 226 m ASL for SV08-2 A/B in Attachment #3 would also show the periodic occurrence of recharge conditions and possible perched surface water conditions for a distance of about 60 m in a downstream direction. We concur that during other periods of the year when groundwater pressures are greater, such as during the winter and spring, groundwater discharges to the MT and perched surface water conditions do not occur. For the steady-state model, placement of the surface water boundary nodes within the upper layer of the model, and the consideration of a lower vertical hydraulic conductivity provided a reasonable representation of average hydrogeologic conditions in the vicinity of the MT. Interpretation of the modelling results should consider the potential for different hydrogeologic conditions near CRT-2 during drier summer conditions.
7.3	→ CRT-3 water level records are not provided with the response as noted.

2.1.9 Section 8.0 (Groundwater Flow Modelling)

SUB-SECTION	COMMENT
8.1	→ The contingency for significant fracture flow is the stream baseflow management program, are considered within the AMP. Refer to Appendix A for further comments pertaining to the AMP. As noted in our comments pertaining to Attachment #10, recirculation of water between the MT and the quarry should be considered for potential water quality impacts.
	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.

8.1 cont'd	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
8.2	→ RESOLVED.
	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
8.3	→ The AMP notes that the fill material to be used will satisfy applicable criteria of the time. Refer to Appendix A for further comments pertaining to the AMP.
8.4	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
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8.4.5	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
8.5	→ RESOLVED.

2.1.10 Section 9.0 (Impact Assessment)

SUB-SECTION	COMMENT
9.1.1	→ REASONABLE RESPONSE. No further clarification required.
	→ RESOLVED.
9.1.3	→ RESOLVED.
	→ As noted in our comments pertaining to Attachment #10, continuous discharge from the Storage Pond during Stage 1 has the potential to affect water levels within the pond, which affects the impact assessment for temperature and water quality effects of the discharge water.
9.1.4	→ As noted in our comments pertaining to Attachment #10, continuous discharge from the Storage Pond during Stage 2 has the potential to affect water levels within the pond, which affects the impact assessment for temperature and water quality effects of the discharge water. → Trigger details for control of pumping from the storage pond on the quarry floor in Stage 2 should be included within the AMP. These details currently are not included in the draft AMP provided for review.
9.2	→ Comments for pertaining to Attachment #10 are provided in Section 2.1.18 of this review document.
9.2.5	→ Comments for pertaining to Attachment #10 are provided in Section 2.1.18 of this review document.

9.3	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
9.4.1	→ REASONABLE RESPONSE. While we disagree on certain specific details, the approach is acceptable for a steady state model approach.
9.4.2	→ The predicted drawdown to water wells should be considered as an addition to the seasonal water fluctuations (cumulative effect) as the steady-state model considers average conditions. Therefore, the impact assessment should consider the pump settings and the source (model layer) of fresh water. → The monitoring, trigger mechanisms, assessment process, and contingencies for protection of water wells are included as part of the AMP. Refer to Appendix A for further comments pertaining to the AMP.
9.6.1	→ We concur that the predicted reduction in baseflow within the MT upstream of the quarry should be considered in the Natural Environment assessment. As noted in our comments to Attachment #10, a similar assessment should be completed for the predicted reduction in baseflow between the quarry and the Credit River.
9.6.11	→ Comments for pertaining to Attachment #10 are provided in Section 2.1.18 of this review document.
9.6.2	→ Comments for pertaining to Attachment #10 are provided in Section 2.1.18 of this review document. We concur that the predictions should be considered in the Natural Environment assessment.

2.1.11 Section 10.0 (Recommended Monitoring Program)

SUB-SECTION	COMMENT
ALL	→ While our original peer review comments have been for the most part acknowledged by the consultant, these items are considered within the AMP. Refer to Appendix A for further comments pertaining to the AMP.

2.1.12 Section 11.0 (Potential Mitigation Requirements)

SUB-SECTION	COMMENT
ALL	→ While our original peer review comments have been for the most part acknowledged by the consultant, these items are considered within the AMP. Refer to Appendix A for further comments pertaining to the AMP.

2.1.13 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 additional review comments provided herein.

2.1.14 Report Appendices

2.1.14.1 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
ALL	→ It is noted that monitoring data collected to date for Wetland No. 46 indicates that the wetland is in an area of recharge, not discharge as indicated. The effect of this recharge condition on the groundwater model predictions should be assessed.

2.1.14.2 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
ALL	→ The updated steady-state model allows for a reasonable representation of average hydrogeological conditions and predictions. Comments pertaining to Attachment #8 are provided in Section 2.1.16 of this review document.

2.1.15 Peer Review Response Attachment #6

SUB-SECTION	COMMENT
Site Visit	→ It is concluded that the seeps are a result of the spring freshet raising the water table with discharge as a result of a lower hydraulic conductivity layer. What evidence is there that the seeps do not flow the remainder of the year, possibly further downslope at a lower elevation? The potential for a continual seepage point is suggested by the hydrographs in Appendix F that tend to show a minimum elevation for the shallow groundwater with no notable effects from dry weather during the summer months or from precipitation events. For example, at P11-01 a minimum elevation of about 232.62 m ASL is maintained during July and August 2011 Minimum groundwater elevations are also shown for P11-02 and P11-03 and may suggest a continual seepage point further downslope. It is noted however, that the Bottom of Hole indicated in the hydrographs does not correspond to the Bottom of Hole (or well) on the borehole logs. It is possible that the minimum elevation presented in the hydrographs actually represents standing water within the base of the monitoring well if the lower part of the pipe and/or cap was not slotted to allow for drainage. At location WL42A, the shallow groundwater levels within monitoring well MW10-8E are above grade and representative of the staff gauge measurements shown in the hydrograph. Thus, the wetland appears to have a greater dependency on the upward hydraulic gradients within the till than is suggested in the report. The groundwater levels for P11-03, located about 50 m to the east, are lower and may be influenced by its proximity to GW Seep #2. It is noted that the hydrograph for P11-03 as presented in the Wetland 42 North Hydrograph does not match the preceding hydrograph for P11-03 only. → At location WL42B, the shallow groundwater levels at P11-01 and P11-02 match the water level pattern observed for P11-03, including during the dry period of June 2011. A similar pattern is apparent for manual water levels at the staff gauge. Thus, there is a good interaction between groundwater and surface water in this area of the wetland.
Piezometer Soil Sampling and Testing	→ The use of a flexible wall permeameter to determine hydraulic conductivity of the shallow silty clay to clayey silt is a reasonable approach when larger-scale field testing cannot be completed. It should be recognized that soil weathering features, such as soil fractures, can result in a higher hydraulic conductivity than is determined by the laboratory tests.
Conceptual Model for On-Site Wetland No. 42	→ The Wetland 42 North Hydrograph suggests a different conceptual model for the wetland than is presented in the report. The groundwater pressures within the upper portion of the shale (MW08-08C) indicate upward hydraulic gradients into the overlying sand (MW08-08D). However, groundwater pressures within the overlying till (MW10-08E) are typically

<table>
<tr><td>Conceptual Model for On-Site Wetland No. 42 cont'd</td><td>greater than observed within the sand (MW08-08D). Thus, the sand appears to function as a drainage layer. Groundwater pressures within the till discharge into the wetland and result in downward hydraulic gradients into the underlying sand. Southeast east of the wetland the groundwater within the upper bedrock, sand, and till provides baseflow to the seeps and the Main Tributary. Therefore, the constant heads considered for Wetland No. 42 in the model should consider the groundwater pressures for the sand unit (Layer 2). It appears that Layer 1 groundwater levels were used.</td></tr>
<tr><td>Off-Site Wetland Investigations</td><td>→ It appears that the report interprets Wetland No. 44 to be influenced by the seasonal discharge of groundwater, while Wetland No. 46 is within a recharge area. These interpretations are reasonable.</td></tr>
<tr><td>Main Tributary Flow Measurement</td><td>→ The dry season flow rate measurements for July 11th, 2012, suggest the following pattern for recharge and discharge.
<table>
<tr><th>VERTICAL HYDRUALIC GRADIENTS</th><th>LOCATIONS</th><th>COMMENTS</th></tr>
<tr><td>Upward (Discharge)</td><td>Upstream site boundary A to B</td><td>Consistent with groundwater discharge interpretation southeast of the wetland. Therefore, groundwater discharge within northern reach of MT and where bedrock is at the base of MT.</td></tr>
<tr><td>Downward (Recharge)</td><td>B to C and C to D</td><td></td></tr>
<tr><td>Downward (Recharge)</td><td>F to G</td><td>Within Tributary B</td></tr>
<tr><td>Upward (Discharge)</td><td>C to E</td><td></td></tr>
<tr><td>Downward (Recharge)</td><td>E and D to H</td><td></td></tr>
<tr><td>Upward (Discharge)</td><td>H to I</td><td>Downstream of site. The surface water temperature and conductivity at H indicates an area of notable groundwater discharge into the MT</td></tr>
</table>
→ It is not clear if the morning (am) and afternoon (pm) flow rate data for location C were collected on the same date. If not, with a five (5) day separation in data collection the decrease in groundwater pressures apparent in the hydrographs could result in the observed flow rate decrease.</td></tr>
<tr><td>Water Quality Comparison</td><td>→ No data were provided to review the interpretation of the water quality comparison.</td></tr>
</table>

2.1.16 Peer Review Response Attachment #8

SUB-SECTION	COMMENT
2.3 (Boundary Conditions) & 2.4 (Hydraulic Conductivity)	→ The use of the constrained constant heads for the tributaries of the MT is considered reasonable. The representativeness of unconstrained constant heads for the MT will depend on the effectiveness of the quarry water management system to maintain surface water flow within the MT. In addition, the use of anisotropy (lower Kz) for Layers 1 through 4 also is a reasonable approach to average out the spring flow conditions with the periodic occurrence of baseline groundwater levels below the base of the MT in some areas (e.g. SV08-02) as discussed in our review comments for Attachment #6. → As also discussed in our review comments pertaining to Attachment #6, Wetland No. 46 is located within a recharge area based on the monitoring data provided for review.
2.5 (Recharge)	→ Clarity is required regarding the yearly average baseflow value for flow station CRT2. Does the value of 10.5 L/s represent the contribution of groundwater only, which typically occurs during the summer months, or does it represent an average of yearly flow rates that would also include contribution from runoff? For reference, the July 11th, 2011, baseflow value for

2.5 (Recharge) cont'd	CRT2 is about 2.2 to 2.7 L/s, per Figure 4 of Attachment #6. Similar to the effects of interflow, the contribution of runoff would result in a greater flow rate at CRT2 than results from groundwater baseflow only.
3.0 (Calibration)	→ The NRMS's of less than 10% suggest acceptable calibration of the steady state model. However, the residuals for the onsite wells (per Table 1) suggest a pattern near the central portion of the MT of simulated groundwater elevations levels being over 2 m higher than the observed elevations as noted below. • MW07-04C – 2.0681 m • SV08-02B – 2.80 m Modification of the model characteristics in this area should be considered owing to the sensitivity of the MT. → As discussed in our review comments for Attachment #6, Wetland No. 46 is located within a recharge area based on the monitoring data provided for review.
4.1 (Potential Groundwater Level Drawdown)	→ The influence of the MT as a hydraulic barrier to potential quarry drawdown effects to the west is apparent in the quarry simulations. These results highlight the importance of the quarry water management plan, proposed monitoring, and contingencies for the quarry. → The influence of Wetland No. 46 as a recharge area should be considered in the predicted drawdown assessment. → The predicted drawdown for the water wells was considered in the AMP. Refer to Appendix A for further comments pertaining to the AMP.
4.2 (Potential Impact to Surface Water Baseflow)	→ The predicted reduction in discharge to the MT will require replacement as part of quarry operations. Based on Table 2 of the attachment, it is apparent that the required average pumping of water into the MT to maintain baseline conditions will be as follows, with lower rates during drier months and higher rates during wetter months. • Stage 1 at 5 Years – 89 m^3/day • Stage 1 Full Excavation – 156 m^3/day • Stage 2 Maximum Excavation – 356 m^3/day • Final Rehabilitation – 22 m^3/day → The discharge of up an average of 356 m^3/day (about 4 L/s) into the MT is about 66% of the 6 L/s baseflow predicted for station CRT2. The effect of the recirculation of this water should be assessed as part of the quarry water management plan.

2.1.17 Peer Review Response Attachment #9

SUB-SECTION	COMMENT
1.1 (Background)	→ No Figure 1 provided for review. → Water level information for Wetland No. 46 that is provided in Attachment #6 indicates that the wetland is in a recharge area as surface water levels are higher in elevation than local groundwater levels.
2.1 (Wetland Specific Storage Volume Estimates)	→ The average storage depths presented are considered reasonable. While they are generally less than observed for the 2011 monitoring data, it is understood that the lower value considers non-ponded perimeter areas of the wetlands. However, it appears that the depths used for Wetlands No. 44 and 46 have been reversed. For example, at Wetland No. 44 the average depth for the Medium Volume Estimate should be 15 cm per Section 2.1.3 and the average depth at Wetland No. 46 should be 5 cm per Section 2.1.4. The low and high estimates for these two wetlands should also be switched accordingly.
2.2 (Long-Term, Average Groundwater Discharge)	→ Table 2 of the attachment denotes baseline fluxes that are considered reasonable for Wetlands No. 42, 43, and 44. However, monitoring data indicate that at Wetland No. 46 the elevation of the surface water level is higher than the adjacent groundwater level, which indicates recharge conditions. Thus, a negative value for groundwater flux to surface water for this wetland is required unless technical rationale is provided for the adjacent Wetland

2.2 (Long-Term, Average Groundwater Discharge) cont'd	No. 45 that was combined with Wetland No. 46. → The note for Table 2 in regard to the Stage 2 assessment is considered reasonable for Wetlands No. 44 and 46 as recharge rates for Wetland No. 44 will be minimal and the baseline recharge conditions at Wetland No.46 will continue.
2.2.1 (Groundwater – Surface Water Interaction: Wetland No. 42)	→ The Wetland 42 North Hydrograph suggests a different conceptual model for the wetland than is presented in the report. Groundwater pressures within the upper portion of the shale bedrock (MW08-08C) indicate upward hydraulic gradients into the overlying sand (MW08-08D). However, groundwater pressures within the overlying till (MW10-08E) are typically greater than observed within the sand (MW08-08D). Thus, the sand appears to function as a drainage layer. Groundwater pressures within the till discharge into the wetland and result in downward hydraulic gradients into the underlying sand. Southeast of the wetland the groundwater within the upper bedrock, sand, and till provides baseflow to the seeps and the Main Tributary. Therefore, the constant heads considered for Wetland No. 42 in the model should consider the groundwater pressures for the sand unit (Layer 2). It appears that Layer 1 groundwater levels were used.
2.2.3 (Groundwater – Surface Water Interaction: Wetland No. 46)	→ It appears that the report interprets Wetland No. 46 as a recharge area based on the provided monitoring data. This finding does not support the presentation of groundwater influx to surface water in Table 2.
3.2 (Hydroperiods During Baseline Conditions)	→ The use of 5 mm of standing water to define 'dry' conditions is considered reasonable for the hydrogeologic assessment. The reasonableness of 5 mm should also be evaluated by the Natural Environment peer reviewer.
3.3 (Effects of Stage 2 Full Extraction)	→ Attachment B is not provided. It is assumed that this information is provided in the last page of Appendix A. → Table 4 of the attachment should be reassessed with the correct average pond depths for Wetlands No. 44 and 46, and with Wetland No. 46 subject to recharge baseline conditions. It appears that using the average wetland depth of 15 cm for Wetland No. 44 the average year shows no 'dry' periods and no notable change for 'dry' periods based on dry year data. However, for Wetland No. 46 the average year shows a 4.5 cm drop in water levels for a 5 cm baseline condition in August and 6 'dry' months during a dry year instead of 8, with possible greater effect when recharge conditions are considered.
5.0 (Conclusions)	→ The conclusions for Wetlands No. 42, 43, and 44 are considered reasonable. Conclusions for Wetland No 46 should be reassessed to consider existing recharge conditions and an average water depth of 5 cm; it is apparent that during a dry year there is a potential for the wetland to be 'dry' from May through October (6 months) instead of no 'dry' months as presented for baseline conditions. These additional 'dry' conditions should be assessed for potential effects on the natural environment.

2.1.18 Peer Review Response Attachment #10

SUB-SECTION	COMMENT
1.1 (Background)	→ The noted stormwater management pond (SWM) pond is not shown in Figure 1 (Site Location Plan), or in Figure 2 for the Quarry Water Management (QWM). → The protection of the MT is contingent on effective QWM in regard to quantity and quality. → Monitoring, the assessment process, trigger mechanisms, and contingencies are required to provide the effective monitoring indicated in the introduction. The AMP considers regular updates to the groundwater model as part of the predictive modeling techniques for

1.1 (Background) cont'd	land where monitoring access is not granted. Refer to Appendix A for further comments pertaining to the AMP.
1.2 (Interpretation Results)	→ The 'conservative' findings repeatedly noted in the attachment may be somewhat misleading as some considerations in the assessment may not be conservative. For example, the periodic dry-season occurrence of recharge / perched conditions near CRT2 are not considered in the steady-state model. The uncertainty of the predictive modelling is recognized, but should not be used as rationale for allowing unacceptable effects to water resources on the natural environment. The uncertainty in using the steady-state model for predictions should be considered in establishing the monitoring program, trigger mechanisms, and contingencies to be provided in the AMP. Refer to Appendix A for further comments pertaining to the AMP.
2.0 (Quarry Water Management Concept)	→ The ability to consider alternative quarry water management (QWM) configurations is reasonable provided that the same objectives for protecting the water resources are achieved. Comments provided in this peer review focus on the proposed QWM and should also be considered for any proposed alternatives.
2.1 (Proposed Facility Layout and Operational Sequencing)	<u>Settling / Decanting Pond</u> → Monitoring, an assessment process, trigger mechanisms, and contingencies are required to provide for the effective operation of the Settling / Decanting Pond. <u>Storage Pond</u> → The Storage Pond is identified to provide between zero and several days attenuation, dependent of operational and climatic conditions. Use of the weir and orifice plate during gravity drainage will provide some control of discharge, but appear not to provide the ability to contain storage water. Continual discharge from the Storage Pond could result in periods of no storage during the drier summer months, which would affect the pond's ability to moderate water temperatures. → Placement of the Storage Pond on the quarry floor during Stage 2 will require pumping from the Storage Pond to the north swale. Conceptual information on the pumping equipment and ability to 'bottom-draw' during pumping without disturbing sediments within the 'dead storage zone' is required. → Conceptual design information should be provided on mechanisms to control sediment suspension and subsequent settlement after pumping from the Settling/Decanting Pond into the Storage Pond. → Monitoring, an assessment process, trigger mechanisms, and contingencies are required to provide for the effective operation of the Storage Pond. <u>North Swale</u> The gravity drainage scenario from the Storage Pond to the North Swale is considered reasonable. Additional details are required on the conceptual design for pumping from the Storage Pond to the swale. As discussed in the comments on the AMP (Appendix A), the AMP does not consider the use of the North Swale for discharge from the Storage Pond.
2.2 (Proposed Facility Dimensions and Storage Volumes)	→ Monitoring, an assessment process, trigger mechanisms, and contingencies are required to provide for the determination of sediment removal frequency and adequate TSS-treatment duration. Refer to Appendix A for further comments pertaining to the AMP.
3.1 (Effects of Seasonally Dry Meterological Conditions on Quarry Water Surpluses	→ Table 2 values do not consistently total to the correct value when rounded to three significant figures per note 3.

3.2 (Effects of Annual Average Meterological Conditions on Quarry Water Surpluses)	→ The indication of 5% initial evaporation for horizontal seepage is not consistent with note 1 in Table 3. → Table 3 values do not consistently total to the correct value when rounded to three significant figures per note 3.
5.0 (Hydro-geological Conditions)	→ It is not apparent if the water loss estimates for the QWM considered water losses for dust control, landscape irrigation, and adherence to the shale when the material is removed from quarry. These additional losses could result in a negative effect on the MT during the drier summer months and should be assessed.
6.0 (Water Quality Consideration)	→ The water quality analyses and mixing assessments are considered reasonable. However, a discussion on the potential water quality cumulative effects from the continual recirculation of water between the MT and the QWM system should be provided.
7.0 (Water Temperature Consideration)	→ A comparison of the temperature plots and trend lines presented in Figures 5 through 7 indicate that the surface water temperature within the MT decreases by about 1°C from CRT1 to CRT2, which is interpreted to be a result of groundwater discharge between the two stations as presented in Attachment #6. A similar pattern of decreasing concentrations between CRT2 and CRT3 is not apparent, likely as a result of recharge conditions and the contribution of surface water flow from adjacent tributaries. This cooling effect of groundwater discharge between CRT1 and CRT2 is an important consideration in the MT impact assessment for water temperature as this cooling effect will not be present both during and following quarry operation.
7.2 (Ambient Air Temperatures)	→ It is noted that the water level within the Storage Pond will fluctuate as the pond will allow for continuous discharge for Stage 1 of quarry operations per Section 2.1. Thus, the bottom-draw water temperature could approximate diurnal temperatures during periods of discharge. → Rational for the use of Pearson temperature data for the water temperature considerations in Section 7.0, but Georgetown WTP temperature data for Table 17 is required. It is recommended that a consistent climatic station be used for the impact assessment.
7.3 (Examined Water Temperature Mixing)	→ Potential temperature effects of the continual recirculation of water should be considered as one of the impact assessment scenarios.
8.0 (Quarry Water Balances)	→ The water balances should consider water loss / consumption as a result of dust control, landscape irrigation, and adherence to shale during off-site transport. → We were unable to replicate some of the numbers presented in Tables 19 through 22. In addition, some of the numbers appear to be orders of magnitude off, which may be transcription errors. For example, see the Stage 1 (5 year) value to Main Tributary in Table 19 and accumulation values in Table 22. It appears that corrections for calculations and transcription errors result in approximately the same baseflow augmentation values, but values should be checked to confirm the predictions.
10.0 (Water Quality Effects on Quarry Operations in the Main Tributary)	→ Recirculation of water between the MT and the quarry should be considered in the water quality impact assessment. → Potential sediment re-suspension effects of discharge (pumping) from the Settling / Decanting Pond into the Storage Pond during Stage 1 should be addressed. Turbidity in the discharge has the potential to increase the total metal concentrations within the surface water above concentrations predicted in Table 25. → Water quality discussions on elevated boron concentrations that are greater than the interim PWQO should be provided. It is noted that predicted boron concentrations are not influenced by elevated MDLs. → The predicted increase in chloride and sodium concentrations should be assessed as part of the Natural Environment assessment.

10.0 (Water Quality Effects on Quarry Operations in the Main Tributary) cont'd	→ The predicted concentration increases were considered as part of the AMP for the proposed quarry. Refer to Appendix A for further comments pertaining to the AMP.
11.0 (Water Temperature Effects on Quarry Operations in the Main Tributary)	→ The impact assessment should consider the temperature effects of: • Low water levels within the Storage Pond during Stage 1 as a result of continuous discharge that can prevent the benefits of bottom-draw. • Recirculation of water between the MT and the quarry. • Loss of the surface water cooling effect observed during baseline conditions between CRT1 and CRT2.
13.0 (Conclusions)	→ As presented in the preceding comments, technical aspects that should be assessed include: • Recirculation of water between the MT and quarry, and • Low water levels within the Storage Pond during Stage 1. → The predicted effects of the quarry on surface water should be considered as part of the Natural Environment impact assessment and for development of the monitoring plan, assessment process, trigger mechanisms, and contingencies. Refer to Appendix A for comments pertaining to the AMP. → Based on the results presented, there is the potential of a reduction in baseflow within the MT of about 30% upstream and downstream of the quarry when measured flow rates for July 2011 are considered. The effects of this predicted decrease in flow should be evaluated as part of the Natural Environment assessment. → Augmentation of water loss from the MT during quarry operations will occur at the upstream boundary of the quarry. Prior to the commencement of lake filling, flow augmentation will average about 3.1 L/s (Table 19) during dry conditions, which will double the observed value of 3.13 L/s observed at CRT1 in July 2011 (Attachment #6). Similarly, an approximate doubling of flow during average flow conditions is predicted. The effects of this localized increase in flow at the upstream location should be evaluated as part of the Natural Environment assessment. It is noted that the AMP documents direct discharge from the Storage Pond directly into the MT and that this discharge occurs about 75 m downstream of the upstream site boundary.

3. CLOSURE

Based on this *Second Round Technical Review*, it is our opinion that the additional information provided by Brampton Brick continues to be insufficient to warrant approval by required legislation and therefore remains unacceptable to the City of Brampton. The major deficiencies identified in this peer review that do not satisfy Section 2.2 of the Provincial Policy Statement, nor Section 4.14 of the City of Brampton's Official Plan include the following:

- → No contingencies to address immediate or short-term impacts to the groundwater or surface water resources that could negatively affect the Main Tributary and local wetlands.
- → There is a reliance on the supply of a municipal water supply to residents with water wells within 5 years. While this contingency is reasonable to maintain a sufficient water supply well to the public, this is more a planning issue for consideration by the City of Brampton.
- → Concern regarding the effectiveness of the Storage Pond for temperature and water quality control.

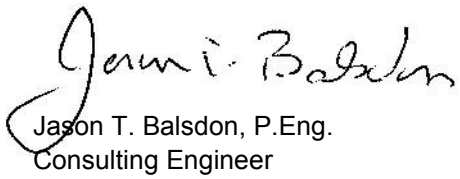
The opinions expressed in this peer review (including appendices) may be supplemented, reconsidered or otherwise revised by the author(s) due to new or previously unknown information.

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,
GENIVAR INC.

Report Prepared By:



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4. 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.

APPENDIX A

PEER REVIEW OF DRAFT ADAPTIVE MANAGEMENT PLAN

APPENDIX A

PEER REVIEW COMMENTS ON:
ADAPTIVE MANAGEMENT PLAN (AMP) VERSION 1.0 – DRAFT
Water Resources and Ecological Features
Proposed Norval Quarry, Brampton, Ontario
Dated September 19, 2012

1.0 INTRODUCTION

→ The two primary focus areas of the AMP are reasonable. These two areas include: 1) ecological receptors, such as watercourses and wetlands; and 2) local water supplies for human and agricultural use.

→ The monitoring programs and trigger mechanisms for both primary focus areas consider the impact assessment results as follows.

- For the ecological receptors, the AMP is designed to evaluate the predicted quarry effects on the groundwater and surface water resources, with responses/actions based on AMP findings that differ from the predictions.
- For the private well receptors, the AMP proposes three zones: 1) less than 800 m from the Stage 1 Excavation boundary for provision of a municipal water supply for any water use interference; 2) between 800 m and 1,200 m from the Stage 1 Excavation boundary for rectification of interference caused by the quarry; and 3) beyond 1,200 m from the Stage 1 Excavation boundary no monitoring, triggers, or complaint response process is proposed.

While both approaches are reasonable from a hydrogeological perspective and in consideration of the impact assessment results, some improvements to the AMP are suggested as detailed later in this Peer Review document.

1.1 OVERVIEW

→ We question the comment that quarry water surpluses will be discharged to the MT at the upstream property boundary in a controlled manner. The use of an orifice weir for the final water storage pond prior to discharge to the northern swale does not appear to allow for controlled discharge. No details on the operation of the discharge system have been provided, and the AMP references indicate that a feasibility study for the discharge system has not been completed.

→ It is noted that the predicted final lake level of 228 masl does not approximate water level conditions prior to quarry dewatering activities, which range between about 225 masl and 240 masl. The prediction that drawdown effects owing to final lake rehabilitation are mostly within the site boundaries is dominantly a result of the use of low permeability material for the rehabilitation slopes for the lake.

→ The AMP proposes that a municipal water supply will be available within five years of shale extraction. It is understood that the base of Stage 1 is predicted to be at an elevation of about 213 m ASL, which is below the groundwater table, and that water table drawdown effects are predicted to extend beyond the site boundary. Predictions are presented in Figure 10, Attachment 8, of the Response to Peer Review Assessment (Golder, 2012). A copy of this figure is attached.

Based on the predicted water table drawdown effects, the risk to water well use in the area appears low for the five-year period. Only Well 33 is located within the 1 m drawdown contour (between the 1 m and 5 m contours). It is understood per Section 2.3.1.3 of the AMP that extraction would be suspended at the five-year period if residents within 800 m of the Stage 1 Excavation are not connected to the municipal water supply. While this approach is reasonable, Genivar cannot comment on the Region of Peel's proposed schedule to extend its water distribution system.

1.2 PURPOSE OF THE AMP

→ The discussion on design principles for response actions notes that viable contingency measures will be confirmed prior to commencement of the excavation sequence (fourth bullet). As the use of the rehabilitated sideslopes of the quarry are identified as a contingency in the event of unexpected effects to water resources, the design principle indicates that the effectiveness of the sideslope rehabilitation in limiting off-site drawdown effects will be confirmed prior to extraction below the water table. An outline on how this testing will be completed should be provided. Similarly, a water balance assessment that incorporates the Contingency Pond should be completed to determine if a Contingency Pond could be filled and maintained while maintaining sufficient discharge to the MT.

1.3 HOW TO READ THE AMP

→ We have no comments pertaining to this section.

2.0 MONITORING, OPERATIONS AND MITIGATION

2.1 QUARRY DEVELOPMENT PHASES

→ We have no comments pertaining to this section.

2.2 PRE-EXCAVATION PHASE

→ We have no comments pertaining to this section.

2.2.1 OPERATIONAL REQUIREMENTS

→ We have no comments pertaining to this section.

2.2.1.1 Permit / Approvals Acquisition

→ We have no comments pertaining to this section.

2.2.1.2 Sediment and Erosion Controls

→ We have no comments pertaining to this section.

2.2.1.3 Redirection of Drainage Features

→ The potential need for regulatory approvals should be addressed by the Natural Environment peer reviewer.

2.2.1.4 Construction Stockpile Area Stormwater Management

→ We have no comments pertaining to this section.

2.2.1.5 Construction of Berms, Haulage Roads and Stockpile Area and Main Tributary Crossing

→ The potential need for regulatory approvals should be addressed by the Natural Environment peer reviewer.

2.2.1.6 Construction of Quarry Water Management System

→ We continue to have concerns regarding the proposed 'bottom-draw' structure on the outlet of the QWM system as noted in our comments provided in Section 2.1.18 of our DRAFT Second Round Technical Review Report (GENIVAR, August 2012).

→ The configuration of the QWM system, as shown on Figure 2-1 differs from that which was presented in Attachment #10 of Golder Associates' Technical Response Materials (November 2011). Specifically, discharge water from the 'Storage Pond' is now to be directed into the MT, instead of the north swale as was previously proposed.

2.2.1.7 Construction of Discharge Water Cooling System

→ Details of the proposed cooling system should be provided as this appears to be a new concept that has not previously been presented.

2.2.2 MONITORING AND MITIGATION REQUIREMENTS

→ We have no comments pertaining to this section.

2.2.2.1 Baseline Monitoring

→ We have no comments pertaining to this section.

2.2.2.2 Additional Groundwater Monitoring

→ The target zone / depth for each of the two (2) additional monitoring wells proposed should be identified.

2.2.2.3 Additional Surface Water Monitoring

→ Regular inspections and removal of accumulated sediment within the SWM Pond and the QWM ponds is a good recommendation. Trigger levels that would initiate sediment removal should be provided.

2.2.2.4 Additional Ecological Monitoring

→ We have no comments pertaining to this section.

2.2.2.5 Baseline Well Survey

→ The completion of the Baseline Water Well Survey within 800 m and 1,200 m of the Stage 2 Excavation boundary is a good recommendation to establish baseline conditions in the event of future water well complaints. We question if the AMP intent was to indicate that the survey be completed within 800 m and 1,200 m of the Stage 1 Excavation boundary for consistency with the water well complaint parameters. Both survey distances are reasonable.

→ It is recommended that the Baseline Water Well Survey also include private water wells within 800 m of the Stage 1 Excavation boundary, unless already completed.

→ It should be clarified that the water quality sample to be collected at each domestic well would be on the untreated (raw) water stream.

2.2.2.6 Final Design of Contingency Measures

→ Additional details regarding the proposed 'Contingency Pond' should be provided; including location, areal size, capacity and source of influent water.

2.3 RESOURCE EXCAVATION PHASE (STAGE 1 PARTIAL EXTRACTION)

2.3.1 OPERATIONAL REQUIREMENTS

→ We have no comments pertaining to this section.

2.3.1.1 Sediment and Erosional Controls

→ We have no comments pertaining to this section.

2.3.1.2 Mitigation Requirements

→ The AMP indicates that all quarry surpluses will be returned to the MT. The use of a Contingency Pond per Section 2.2.2.6 will affect the water balance and will require the diversion of some water intended for the MT. An impact assessment to consider the use of the Contingency Pond should be completed to ensure that sufficient water is available for the MT.

2.3.1.3 Connection of Properties to Municipal Water Supply

→ Clarification should be provided, indicating that BBL would assume the cost of construction and connection of the Municipal water supply to each residence within 800 m of the Stage 1 Excavation Boundary.

→ In conjunction with the above, the ongoing cost of water billing to each residence within 800 m of the Stage 1 Excavation Boundary should be addressed.

2.3.2 MONITORING AND MITIGATION REQUIREMENTS

→ We have no comments pertaining to this section.

2.3.2.1 Groundwater, Surface Water and Ecological Monitoring

→ We have no comments pertaining to this section.

2.3.2.2 Mitigation Requirements

→ The statement "…all quarry surpluses will be returned to the MT at the upstream property boundary" appear incorrect based on information previously provided in Section 2.2.2.6 regarding the construction of a "Contingency Pond" that would presumably retain a portion of the annual surplus within the quarry.

2.3.2.3 Target Level Adjustment

→ We have no comments pertaining to this section.

2.3.2.4 Interim Performance Assessment Study

→ Completion of the dedicated modeling study to correspond to Stage 1 Partial Excavation is a good component of the AMP. This study will allow for the consideration of: 1) updated water resource information and 2) the response of water resources to quarry operations. As a result, an improvement in the impact assessment predictions will be provided. It is recommended that the results of the study be presented in an annual report discussed in Section 5.2.

→ It is recommended that a second Interim Performance Assessment Study, including an update to the predictive model, be completed prior to commencement of Stage 2 to allow for an assessment of the hydrogeologic predictions at a full depth quarry excavation.

2.4 RESOURCE EXCAVATION PHASE (STAGES 1 AND 2 FULL EXTRACTION)

2.4.1 OPERATIONAL REQUIREMENTS

→ We have no comments pertaining to this section.

2.4.1.1 Sediment and Erosional Controls

→ We have no comments pertaining to this section.

2.4.1.2 Excavation Activities

→ We have no comments pertaining to this section.

2.4.1.3 Staged Relocation of Quarry Water Management Features

→ The configuration of the QWM system, as shown on Figure 2-1 of the AMP differs from that which was presented in Attachment #10 of Golder Associates' Technical Response Materials (November 2011). Specifically, discharge water from the 'Storage Pond' is now to be directed into the MT about 75 m downstream of the upstream site boundary, instead of the North Swale as was previously proposed.

2.4.2 MONITORING AND MITIGATION REQUIREMENTS

→ We have no comments pertaining to this section.

2.4.2.1 Groundwater, Surface Water and Ecological Monitoring

→ Initial sentence seems to exclude wells located between 800 m and 1,200 m from the quarry excavation area. Well receptors within this area should still be considered given BBL's commitment to investigate complaints in Section 3.1.

→ Section also assumes that residents within 800 m will be agreeable for connection to the Municipal water system.

2.4.2.2 QWM Dewatering and Main Tributary Baseflow Augmentation

→ We have no comments pertaining to this section.

2.4.2.3 Backfilling of Quarry Faces

→ We have no comments pertaining to this section.

2.4.2.4 Target Level Adjustment

→ We have no comments pertaining to this section.

2.5 POST-EXCAVATION PHASE

2.5.1 OPERATIONAL REQUIREMENTS

→ We have no comments pertaining to this section.

2.5.1.1 Site Rehabilitation

→ We have no comments pertaining to this section.

2.5.1.1.1 Sediment and Erosional Controls

→ We have no comments pertaining to this section.

2.5.1.1.2 Removal of Drainage B1 Culvert

→ The potential need for regulatory approvals should be addressed by the Natural Environment peer reviewer.

2.5.1.1.3 Sloping of Quarry Faces and Re-Vegetation

→ If importation of subsoil and topsoil is approved by the MNR, we concur that acceptance criteria should be based on criteria that are applicable at the time of rehabilitation. However, until the criteria are changed it is recommended that the criteria be Table 8 (agricultural property use) of the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (MOE, 2011). These criteria are applicable for generic site conditions for land within 30 m of a water body and potable groundwater conditions. The use of the agricultural property use criteria would be consistent with the indication of 'active agriculture' for the property.

→ To provide the low permeability of the sideslopes as considered in the impact assessment, triggers or criteria for the soil characteristics should be provided, including: particle size, moisture content, compaction effort, etc.

2.5.1.2 Installation of Floating Pump Platform

→ We have no comments pertaining to this section.

2.5.1.3 Installation of Passive Discharge Structure

→ Concerns remain regarding the viability of the proposed "bottom-draw" structure based on the elevation of the quarry floor during Stage 2 relative to the proposed discharge location within the MT.

2.5.2 MONITORING AND MITIGATION REQUIREMENT

→ Groundwater receptors (i.e., local water wells) should also be considered.

→ Re-assessment of monitoring programs after the five year period seems reasonable with the understanding that any proposed reduction in the monitoring programs would require approval by MNR.

3.0 OVERVIEW OF POTENTIAL FOR PREDICTED IMPACTS

→ We have no comments pertaining to this section.

3.1 PRIVATE WELL RECEPTORS

→ Refer to comments in Section 2.3.1.3 regarding connection of individual residences to a Municipal water supply.

3.2 ECOLOGICAL RECEPTORS

→ We have no comments pertaining to this section.

3.2.1 MAIN TRIBUTARY

→ We have no comments pertaining to this section.

3.2.1.1 Upstream Portion of the Main Tributary

→ We have no comments pertaining to this section.

3.2.1.1.1 Stream Flows

→ We have no comments pertaining to this section.

3.2.1.1.2 Water Temperatures

→ We have no comments pertaining to this section.

3.2.1.1.3 Water Quality

→ We have no comments pertaining to this section.

3.2.1.2 On-Site Portion of the Main Tributary

→ We have no comments pertaining to this section.

3.2.1.2.1 Stream Flows

→ We have no comments pertaining to this section.

3.2.1.2.2 Water Temperatures

→ Refer to comments in Section 2.2.1.7 regarding the proposed cooling system.

3.2.1.2.3 Water Quality

→ We have no comments pertaining to this section.

3.2.1.3 Downstream Portion of the Main Tributary

→ We have no comments pertaining to this section.

3.2.1.3.1 Stream Flows

→ We have no comments pertaining to this section.

3.2.1.3.2 Water Temperatures

→ Refer to comments in Section 2.2.1.7 regarding the proposed cooling system.

3.2.1.3.3 Water Quality

→ We have no comments pertaining to this section.

3.2.2 FISH COMMUNITY AND FISH HABITAT

→ We have no comments pertaining to this section.

3.2.3 WETLANDS

→ We have no comments pertaining to this section.

3.2.3.1 Wetland No. 42

→ We have no comments pertaining to this section.

3.2.3.2 Wetland No. 43

→ We have no comments pertaining to this section.

3.2.3.3 Wetland No. 44

→ We have no comments pertaining to this section.

3.2.3.4 Wetland No. 46

→ We have no comments pertaining to this section.

3.2.4 MT VALLEY VEGETATION COMMUNITY (FOD 7-4)

→ We have no comments pertaining to this section.

4.0 PERFORMANCE MONITORING AND RESPONSE PROGRAM

4.1 GROUNDWATER TRIGGER LOCATION MONITORING

→ We have no comments pertaining to this section.

4.1.1 GROUNDWATER MONITORING PRIOR TO EXTRACTION

→ We have no comments pertaining to this section.

4.1.2 GROUNDWATER MONITORING DURING OPERATIONS

4.1.2.1 Groundwater Monitoring Prior to Municipal Water Supply Connection

→ The proposed groundwater monitoring program is considered reasonable, with the following three recommendations.

- MW07-5C should be retained in the monitoring program until completion of Stage 1. Monitoring at this location will provide valuable input to assessing the predictive drawdown influence of the quarry at full depth and associated dewatering.

- In the event that a noted monitoring well at a monitoring nest goes dry, a deeper monitoring well at that location should be used for on-going water monitoring.
- The four selected private wells allow for a reasonable understanding of groundwater level changes near the limits of the predicted maximum drawdown extent. Therefore, it is recommended that monitoring at the four private wells be continued after connection to the municipal water supply, unless the well owner elects to have the well decommissioned.

4.1.2.2 Groundwater Monitoring After Municipal Water Supply Connection

→ Refer to comments provided in Section 4.1.2.1.

4.1.3 QUARRY DISCHARGE MONITORING

→ We have no comments pertaining to this section.

4.1.4 GROUNDWATER MONITORING AFTER FINAL SLOPING

→ The decision for reducing the monitoring program requirements should consider signs of water level recovery at monitoring locations that were affected by the quarry and associated dewatering. The proposed requirement that 'all' monitoring wells show signs of recovery may not be practical for wells not affected by the quarry.

4.1.5 GROUNDWATER MONITORING FREQUENCY

→ We have no comments pertaining to this section.

4.1.5.1 Normal Monitoring Frequency

→ Quarterly downloads of the dataloggers is reasonable. The Green Zone frequency in Table 4-1 should be revised from annually to quarterly.

→ The parameter list in Table 4-2 for groundwater (GW) should replace Total Suspended Solids (TSS) with Total Dissolved Solids (TDS) as groundwater analyses are for dissolved parameters and TSS can be artificially increased by purging and sampling from monitoring wells developed in shale.

4.1.5.2 Enhanced Monitoring

→ The second paragraph requires some additional clarity. As the monitoring wells will have transducers and dataloggers at the outset of the monitoring program, it appears that if a water level drops below the trigger level then transducers and dataloggers would be added to each well within the monitoring well nest. How is 'suitability' defined?

→ It is recommended that the monitoring (download) frequency be increased to weekly during the enhanced monitoring period, rather than monthly as is proposed given that the purpose of the enhanced monitoring is to further evaluate potential impacts and success of contingency measures, as appropriate.

→ The term 'satisfactorily addressed' in the final paragraph should be more clearly and quantitatively defined.

4.2 SURFACE WATER TRIGGER LOCATION MONITORING

→ It is recommended that surface water station CRT-2 be included as a trigger monitoring location as it is located near an area of MT recharge and thus would be susceptible to quarry drawdown effects. In addition, an assessment of potential quarry effects at CRT-2 and CRT-3 would allow for an improved effectiveness of the design and implementation of MT contingency measures, if required.

4.2.1 OTHER SURFACE WATER / ECOLOGICAL MONITORING LOCATIONS

→ We have no comments pertaining to this section.

4.2.2 SURFACE WATER/ECOLOGICAL MONITORING FREQUENCY

→ The data review frequency listed in Table 4-1 appears to be too infrequent for an effective AMP. For example, an annual review of the data could result in a trigger exceedance not being detected for several months. It is recommended for the Green Zone that the Data Review Frequency be increased to quarterly at a minimum. After several years of monitoring with no quarry effects, a reduced Data Review Frequency could be considered.

4.3 TARGET LEVELS

→ Refer to comments provided in Section 4.1.2.1.

4.3.1 GROUNDWATER TARGET LEVELS

→ The seasonal target levels presented in Table 4-3 are considered reasonable based on the information provided and the impact assessment results. It is recommended that the trigger levels be updated just prior to site preparation activities to allow for consideration of additional baseline data. The more current data would incorporate additional seasonal variations into the calculations.

→ Similar to the above recommendation, while the trigger levels for the two new monitoring wells (MW9 and MW10) should be based on a minimum of one year of data, more representative trigger levels could be determined if trigger levels are updated just prior to site preparation activities to allow for consideration of additional baseline data.

4.3.1.1 Rationale for Establishing Groundwater Target Levels

→ For a number of the monitors, target levels have been established that are less than 0.3 m below seasonal average levels, meaning that in a 'dry' year, groundwater target level exceedances could potentially be widespread. Therefore, the re-evaluation of target levels may be required during certain years.

→ The final sentence in the third paragraph should be revised to include "in consultation with the relevant review agencies".

4.3.1.2 Review of Groundwater Target Levels

→ We have no comments pertaining to this section.

4.3.2 SURFACE WATER TARGET LEVELS

→ We have no comments pertaining to this section.

4.3.2.1 Rationale for Establishing Surface Water Target Levels

→ We have no comments pertaining to this section.

4.3.2.2 Main Tributary Target Levels

→ The proposed target levels for temperature, TSS, dissolved oxygen, as well as oil and grease are considered reasonable. However, the following additions are recommended.

- Considering the potential for water recirculation and the contribution of mineralized groundwater to water managed as part of the QWM, PWQO's should also be set as trigger concentrations for QWM-ED and CRT3.
- A trigger level for temperature at CRT3 should be provided to allow for a cumulative assessment of quarry operations effects on the MT. A temperature less than or similar to that measured at CRT1 is suggested.
- Trigger values for CRT-2 should be established.

→ The database used and the calculations to obtain the proposed trigger flow rates should be provided for peer review.

→ The flow rate triggers are based on summer low flow conditions. Trigger flow rates should also be established for spring, fall, and winter conditions.

→ Considering the Golder (2012) assessment indicates that the MT is a gaining stream between CRT3 and CRT-CR, the 'minimum flow' provided on Table 4-6 for CRT-CR (0.4 L/s) appears too low relative to the value provided for CRT3 (1.1 L/s).

4.3.2.3 Wetland Target Levels

→ The targets provided on Table 4-7 denote hydroperiod duration (in months) rather than surface water target levels as noted in the text. It is recommended that surface water target levels be established for each trigger location to allow for a correlation between target water levels and wetland hydroperiods (e.g., water level above ground surface at each location).

→ Considerations such as monitoring and review frequencies should be addressed by the Natural Environment peer reviewer.

4.3.2.4 Vegetation Community Monitoring Activities

→ We have no comments pertaining to this section.

4.3.2.5 Review of Surface Water Target Levels

→ The term "unexpected" as it pertains to surface water target levels should be more clearly defined.

4.4 RESPONSE ACTIONS

→ The term "regular intervals" as it pertains to the review of response actions should be more clearly defined.

4.4.1 PRIVATE WELL AND GROUNDWATER TRIGGER MONITORING RESPONSE PROGRAM

→ The program for private wells within 800 m to 1,200 m of the Stage 1 Excavation boundary is considered reasonable. However, prior to connection to the municipal water supply (comments on this assumption provided in earlier sections) it is recommended that private wells within 800 m of the Stage 1 Excavation be included in the immediate response program.

4.4.1.1 Green Zone

→ We have no comments pertaining to this section.

4.4.1.2 Yellow Zone

→ We have no comments pertaining to this section.

4.4.1.2.1 Groundwater Target Level Exceedances

→ The response process appears reasonable, but would be easier to follow if co-ordinated with the process flow charts in Figures 4-2 and 4-3. Similarly, Figures 4-2 and 4-3 also should include the timeline from the date of the first trigger exceedance for each step of the process.

4.4.1.2.2 Private Well Complaints

→ Refer to previous comments relating to connection of residences to a municipal water supply.

4.4.1.3 Red Zone

→ We have no comments pertaining to this section.

4.4.2 SURFACE WATER/ECOLOGICAL RESPONSE PROGRAM

→ Figures 4-5 to 4-8 should include the timeline from the date of the first trigger exceedance for each step of the process.

4.4.2.1 Green Zone

→ We have no comments pertaining to this section.

4.4.2.2 Yellow Zone

→ We have no comments pertaining to this section.

4.4.2.3 Red Zone

→ We have no comments pertaining to this section.

4.5 CONTINGENCY MEASURES

4.5.1 CONTINGENCY MEASURE FOR PRIVATE WELLS

→ Refer to previous comments relating to connection of residences to a municipal water supply.

4.5.1.1 Private Well Complaints Response Program (CRP)

- → Item 3 should also include a statement that BBL will be responsible for all costs associated with the re-establishment of landscaped areas on a property associated with the installation of a buried cistern.
- → Refer to previous comments relating to connection of residences to a municipal water supply.

4.5.1.2 Water Supply Response Program (WSRP) for Private Well Complaints within 800 m and 1,200 m of the Stage 1 Excavation Boundary

- → A volume limit of 2,000 L/day/dwelling for hauled water is considered reasonable, provided water is not used for agricultural purposes (e.g. stock).
- → Considering that water well complaints must be reported to MOE, it is recommended that the resolution of a complaint be accepted by MOE prior to classification of the complaint as resolved. The use of an independent hydrogeologist to help resolve a disagreement is a methodology that could be used by the MOE.
- → Wording should be added to the final statement to address the cost of retaining an "independent hydrogeologist".

4.5.2 CONTINGENCY MEASURES FOR MAIN TRIBUTARY

- → We have no comments pertaining to this section.

4.5.2.1 Contingency Measure for Flows

- → The use of the qualifier "alone" in determining a response to a trigger exceedance is questionable owing to the difficulty in considering multiple variable / sources of changes to surface water conditions. If the trigger exceedance is attributed to an effect from the quarry, a contingency should be implemented. The type of contingency would be dependent on the cause(s) of the trigger exceedance.
- → As the QWM will discharge water collected (groundwater and precipitation) to the MT there will be sufficient water to maintain the expected natural conditions. Therefore, a trigger exceedance caused by the quarry would likely be a result of deficiencies in the system for discharging the water into the MT. Thus, short-term contingencies could include additional discharge locations and rates.
- → A water balance assessment should be completed to determine the viability of filling and maintaining a Contingency Pond while discharging to the MT.
- → In the final paragraph, it should be clarified that the secondary storage pond would be a "lined" feature as is noted in subsequent sections.

4.5.2.2 Contingency Measure for Water Quality

- → Short-term contingencies should be identified to address immediate water quality issues, such as increased pond storage, revised pond design, changes in operations.
- → A water balance assessment should be completed to determine the viability of filling and maintaining a Contingency Pond while discharging to the MT.

4.5.2.3 Contingency Measures for Water Temperature

→ Per Section 1.2, it is understood that pilot scale testing would be completed for the contingencies prior to implementation. Therefore, the potential effect of floating vegetation mats on the dissolved oxygen content of the water should be assessed.

4.5.3 CONTINGENCY MEASURE FOR WETLANDS

→ The use of berms to increase the storage capacity of wetlands should be assessed for viability based on potential effects to the natural environment. Alternative contingency measures may be required for protection of the wetlands.

4.5.4 CONTINGENCY MEASURE FOR FOD 7-4 COMMUNITY

→ We have no comments pertaining to this section.

4.5.5 INCREASED SETBACKS OR ACCELLERATED REHABILITATION

→ We have no comments pertaining to this section.

5.0 REPORTING AND MODIFICATIONS TO THE AMP

→ It is recommended that each AMP report also be posted on BBL's website for public viewing.

5.1 PRE-EXCAVATION REPORT (BASELINE CONDITIONS)

→ Target levels for groundwater and surface water should be updated based on additional monitoring data obtained prior to the commencement of site preparation activities.

5.2 ANNUAL REPORTING

→ A groundwater modeling update should also be prepared upon completion of Stage 1 Full Excavation, as well as any time that unexpected quarry impacts are detected that were not predicted in the previous modeling.

→ It is recommended that the City of Brampton be included as a commenting agency with respect to the annual AMP reports.

5.2.1 MODIFICATIONS TO AMP

→ It is recommended that the City of Brampton be included in the recipient list for any revised or consolidated AMP.

5.3 REPORTING FOR RESPONSE ACTION PROCESS

→ In addition to the notifications detailed in Section 4.4, all well complaints and target exceedances as well as resolutions should be documented in the annual reports for the year in which they occur.

5.3.1 GREEN ZONE REPORTING

→ We have no comments pertaining to this section.

5.3.2 YELLOW ZONE REPORTING

→ We have no comments pertaining to this section.

5.3.2.1 Private Well Complaints

→ We have no comments pertaining to this section.

5.3.2.1.1 Complaints Within the 800 m Stage 1 Excavation Boundary

→ For residents whom may not be amenable to the installation of a cistern and/or for connection to a municipal water supply (e.g., pump lowering and/or well deepening as possible alternatives), more frequent reporting to agencies is recommended. The reporting frequency should be similar to that recommended in Section 5.3.2.1.2 of the AMP. It is recognized that additional reporting requirements for MOE will also be included as part of a future PTTW for the quarry operation.

5.3.2.1.2 Complaints Between 800 m and 1,200 m of the Stage 1 Excavation Boundary

→ We have no comments pertaining to this section.

5.3.2.2 Target Level Exceedance in Groundwater Monitoring Location

→ The two week agency reporting shown on Figure 4-1 should be included. Also, for Item D, the implementation window is shown as x+4 weeks on Figure 4-1, not x-10 weeks as indicated.

5.3.2.3 Target Level Exceedance of Main Tributary Flows

→ We have no comments pertaining to this section.

5.3.2.4 Target Level Exceedance of Air Temperature Forecasts or Discharge Water Temperature

→ We have no comments pertaining to this section.

5.3.2.5 Target Level Exceedance of Discharge Water Quality

→ We have no comments pertaining to this section.

5.3.2.6 Target Level Exceedance of Wetland Hydroperiods

→ We have no comments pertaining to this section.

5.3.3 RED ZONE REPORTING

→ The process outlined does not correspond to the Red Zone reporting requirements detailed on Figure 4-1 or Figure 4-4.

5.4 REPORTING FOR RESPONSE ACTION PROCESS

→ We have no comments pertaining to this section.

5.4.1 ANNUAL

→ We have no comments pertaining to this section.

5.4.2 IMMEDIATE

→ We have no comments pertaining to this section.

5.5 INTERIM PERFORMANCE ASSESSMENT

→ The interim assessment should also update the predictive groundwater model based on the additional data collected and the observed water resource responses to the quarry operations.

6.0 REFERENCES

→ We have no comments pertaining to this section.

TABLES

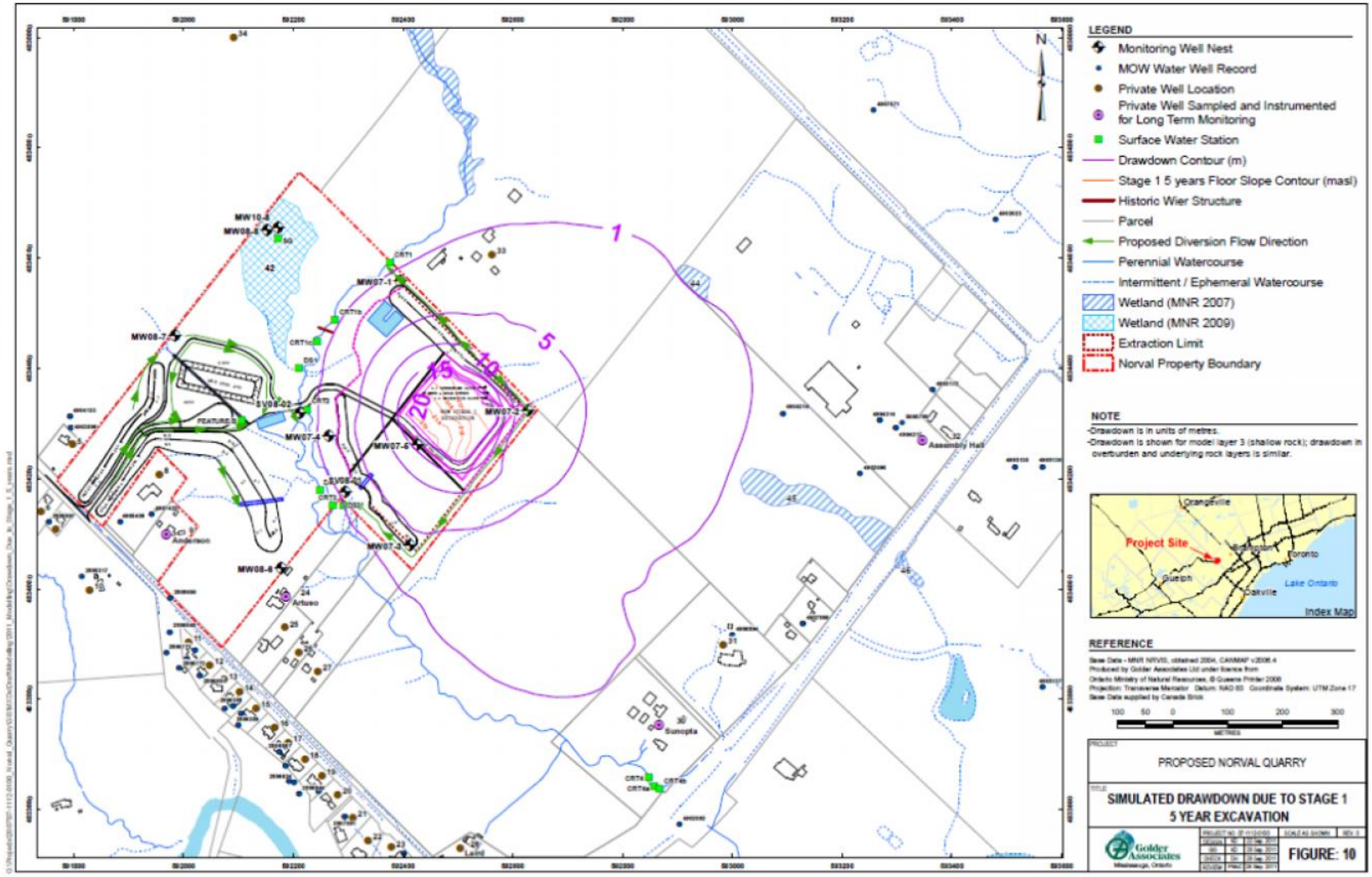
→ Revisions to several of the tables are required based on peer review comments provided for the AMP text. Examples include chemical parameters and monitoring / reporting intervals.

FIGURES

→ The configuration of the QWM system, as shown on Figure 2-1 differs from that which was presented in Attachment #10 of Golder Associates' Technical Response Materials (November 2011). Specifically, discharge water from the 'Storage Pond' is now to be directed into the MT, instead of the north swale as was previously proposed.

→ Figures 4-2, 4-3, 4-5, 4-6, 4-7 and 4-8 should be updated to include the required action timelines for clarity.

→ The title of Figure 4-4 should be revised to "Surface Water / Ecological Response Action Plan" to match the description provided in the text.


LEGEND
Monitoring Well Nest
MOW Water Well Record
Private Well Location
Private Well Sampled and Instrumented for Long Term Monitoring
Surface Water Station
Drawdown Contour (m)
Stage 1 5 years Floor Slope Contour (masl)
Historic Wier Structure
Parcel
Proposed Diversion Flow Direction
Perennial Watercourse
Intermittent / Ephemeral Watercourse
Wetland (MNR 2007)
Wetland (MNR 2009)
Extraction Limit
Norval Property Boundary
NOTE
-Drawdown is in units of metres.
-Drawdown is shown for model layer 3 (shallow rock); drawdown in overburden and underlying rock layers is similar.
Project Site
Orangeville
Toronto
Guelph
Oakville
Lake Ontario
Index Map
REFERENCE
PROPOSED NORVAL QUARRY
SIMULATED DRAWDOWN DUE TO STAGE 1 5 YEAR EXCAVATION
FIGURE: 10

APPENDIX B

PEER REVIEW RESULTS TABLE

GENIVAR

NORVAL QUARRY REZONING APPLICATION (BRAMPTON BRICK)

Peer Review Results Chart (Hydrogeology & Hydrology – Second Round Technical Review)

DATE: 4-Dec-2012
FILE: 111-53308-01

GUIDELINE QUESTION	FINDINGS REGARDING THE BRAMPTON BRICK REPORT	IMPLICATIONS IF THIS CONCERN / ISSUE IS NOT ADDRESSED IN THE TECHNICAL REPORT
PURPOSE		
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?	→ Yes.	→ n/a
METHODOLOGY		
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, and facts is generally considered to be objective and appropriate, although additional information is required in certain areas.	→ Due to the lack of sufficient detail, it is difficult to confirm some interpretations, conclusions and recommendations posed by the consultant in their report.
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
INFORMATION		
Are relevant data and facts clearly and consistently presented in the technical report?	→ Yes, in most cases. → In some instances data is missing or is presented incorrectly. → Some inconsistencies in the data interpretation provided are also noted.	→ 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.

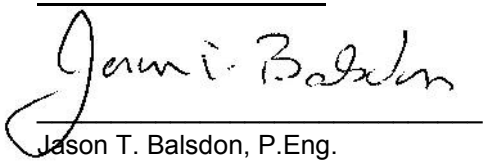
Is information gathered from appropriate sources? Is the information useful? Accurate? Are there concerns regarding their quality or validity?	→ Yes, information is gathered from appropriate sources and is useful to the interpretation provided in the report. → Information gathered generally is accurate, although some presentation errors have been identified. → Data quality and validity appears generally to be consistent with standard industry practice.	→ Where identified, those errata can be addressed through the peer review process.
Is the data used critical to the conclusions?	→ Yes.	→ n/a
Is the Brampton Brick Report thorough / comprehensive / complete? To respond to this question, peer reviewers must consider accuracy, appropriateness and timing / seasonality of the data collection (if applicable). 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.	→ The technical report, technical response materials and draft AMP, as presented, generally are thorough, comprehensive and complete. → A general notation is provided to establish a linkage to the Natural Environment report in Section 1.1 (“Overview”) of the technical response document. This described linkage needs to be clarified and discussed further with the Natural Environment peer review consultant.	→ n/a
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.	→ Mitigation and monitoring measures, as proposed (inclusive of both the original report and technical response), remain incomplete.	→ Impacts to groundwater levels in the bedrock are predicted to occur to the northeast and east of the proposed quarry. Reasonable contingencies are provided to address unacceptable effects to water wells. Long-term contingencies to protect ecological features are reasonable for groundwater and surface water controls, but require acceptance from the Natural Environment peer reviewer. Short-term contingencies are required to address immediate impacts if detected. → Additional assessment for the Contingency Pond is required.
The gap analysis will assess the relative importance of the data gaps and limitations to the project and identify potential options	→ Gaps identified include: (i) the absence of sufficient supporting information to justify trigger mechanisms proposed to asses quarry	→ Seasonal triggers for surface water are required to protect the MT.

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.	impact to surface water, and (ii) insufficient detail for contingency measures in the event of adverse impact(s).	→ The AMP indicates that the proposed contingencies would be proven prior to implementation. This should be completed either theoretically (e.g. water balance for Contingency Pond), with triggers (e.g. for the rehabilitation slopes), or with pilot testing.
CERTAINTY		
Are certainties and uncertainties of the proposal's success openly and objectively stated in the applicant's report / study?	→ Yes, although additional analyses are required to address some of those uncertainties which have been identified in the original report and technical response.	→ Unidentified impacts that have not been considered may occur. Additional contingencies may be required that affect the overall water balance.
Are all assumptions clearly stated? Are the assumptions reasonable? Analysis of assumptions and parameters.	→ Yes, the assumptions and limitations are identified in the appropriate sections of the report. Some assumptions utilized in the analysis (inclusive of technical response) should be assessed and re-visited.	→ Unidentified impacts that have not been considered may occur. Additional contingencies may be required that affect the overall water balance.
Are the standards or thresholds commonly accepted in this type of technical area identified and appropriately utilized? (i.e., transportation, soils, natural environment? Etc…)	→ Partially – Triggers are provided in the AMP, but some modifications are required.	→ Modified triggers are required to allow for a reasonable evaluation of predictions and assessment of quarry impacts.
ISSUE GAPS		
Are there issue gaps arising from the review?	→ The original report and technical response appear 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?	→ Yes, there are key issues that have not been considered in the report. Those issues include: • Impact assessment of Contingency Pond.	→ A water balance assessment of the Contingency Pond is required to ensure sufficient water for the QWM and other contingencies.

MITIGATION / MONITORING		
Are realistic mitigation measures / rehabilitation plans proposed in the applicant's report? Is there sufficient detail?	→ Yes, although there continues to be 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?	→ No, not for groundwater use. However, contingency to provide alternative water supply is reasonable. → Potentially for surface water, although additional input from Natural Environment is required.	→ n/a
Will the proposed measures be adequate to address outstanding concerns?	→ Yes for groundwater use provided that municipal water will be available. → Uncertain for surface water as additional assessments are required.	→ n/a
CONCLUSION		
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?	The major deficiencies identified in this peer review that do not satisfy Section 2.2 of the Provincial Policy Statement, nor Section 4.14 of the City of Brampton's Official Plan include the following: → No contingencies to address immediate or short-term impacts to the groundwater or surface water resources that could negatively affect the Main Tributary and local wetlands. → There is a reliance on the supply of a municipal water supply to residents with water wells within 5 years. While this contingency is reasonable to maintain a sufficient water supply well to the public, this is more a planning issue for consideration by the City of Brampton. → Concern regarding the effectiveness of the Storage Pond for temperature and water quality control.	→ n/a

Are the conclusions relevant to the purpose / objective and supported by the work undertaken by the report authors?	→ Yes, although insufficient technical justification is provided regarding proposed trigger mechanisms and details on contingency measures.	→ No process to identify an unacceptable impact (trigger mechanism) for the initiation of contingency measures.
Based on the peer review, would the same conclusions be determined?	→ No.	→ Additional information / detail pertaining to mitigation measures for surface water impacts is required.
ADEQUACY		
Does the applicant's report / study adequately address the stated purpose?	→ Report generally follows standard industry practice, although additional analyses, and information on proposed mitigation, trigger mechanisms, water budget, and contingency details are required.	→ n/a
Is there anything that should, in your opinion, have been done differently?	→ Report generally follows standard industry practice, although additional analyses, and information on proposed mitigation, trigger mechanisms, water budget, and contingency details are required.	→ n/a

TABLE PREPARED BY



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