



## EXTERNAL MEMORANDUM

**To:** Adam Wendland, MCIP, RPP  
Acting Manager, Development  
Business, Planning & Development Department  
Town of Caledon  
6311 Old Church Road  
Caledon, ON L7C 1J6  
CANADA

**cc:** Project Central File M2924.24028  
Genevieve Scott  
Senior Planner  
Cuesta Planning Consultants

**From:** Daykin Schnell  
Explosives Engineer, Manager  
RESPEC  
P.O. Box 888  
Lexington, KY 40588

Cam Thomas, P. Eng.  
Explosives Engineer

**Date:** July 23, 2024

**Subject:** RESPEC Peer Review of Documents for Proposed Canada Building Materials Pit/Quarry

RESPEC Consulting, Inc. (RESPEC) was contracted by the Town of Caledon in Ontario, Canada, to complete a peer review of the Blast Impact Assessment for the proposed Caledon Quarry. This memorandum details the work and findings from RESPEC's peer review of the Blast Impact Assessment of the proposed Caledon Quarry. RESPEC's findings from reviewing the material provided by the Town of Caledon and Cuesta Planning Consultants are included herein.

### REVIEW PROCESS

RESPEC completed the following tasks as part of the peer review of the Blast Impact Assessment of the proposed Caledon Quarry:

- / Reviewed plan documents provided by MacNaughton Hermesen Britton Clarkson Planning Limited (MHBC) Drawings A001, A002, A003, and A004
  - » Site Existing Features, Operation Plan, Rehabilitation Plan, and Detailed Notes
  - » Proposed mine plan sequence and mine plan limitations
- / Reviewed the Blast Impact Assessment completed by Golder Associates Ltd. (Golder)
  - » General review

146 EAST THIRD STREET  
LEXINGTON, KY 40508  
P.O. BOX 888 // LEXINGTON, KY 40588  
859.259.0959



- » Pattern design considerations
- » Blast vibration, air overpressure, and maximum flyrock range predictions
- » Considerations of nearby structures
- » Limitations on blasting
- / Reviewed the Air Quality and Noise Impact Assessments completed by Golder
  - » All issues related to drilling and blasting
- / Completed a site visit of the proposed quarry site on Wednesday, June 14, 2024.
  - » Cam Thomas of RESPEC toured the proposed site and nearby communities and had discussions with Dan Corkery of Golder
  - » General review of the site
  - » A summary of the site visit can be provided by RESPEC upon request

## SUMMARY OF FINDINGS

RESPEC has completed a detailed review of all the documents supplied as requested by the Town of Caledon. A summary of the findings, including recommended clarifications and adjustments identified during the peer review, are as follows.

### REVIEW OF THE FOUR SITE PLANS PREPARED BY MHBC

RESPEC has gone through everything on these site plans. The plans are thorough and accurate and an excellent representation of the existing features, proposed operations, and rehabilitation of the site; they also provide detailed operational notes.

- / RESPEC recommends considering adding the following information and references to the site plans:
  - » Discuss creating and implementing a planned approach for completing pre- and post-blast inspections of residential structures as the site develops.
  - » Include consideration of pre-blast processes (i.e. reviewing drill logs, checking hole deviation, and inspecting any open faces) to help ensure blasting is safe and effective.
  - » The site plans mention an independent third-party will perform blast vibration monitoring services for the site. RESPEC recommends discussing the roles and responsibilities of the site reporting any potential exceedances.

### REVIEW OF THE BLAST IMPACT ASSESSMENT PREPARED BY GOLDER

RESPEC's comments on recommended clarifications and adjustments follow (note: the page numbers quoted are from the downloaded document, which do not match the document Dan Corkery had during the site visit).

- / Overall, this is a very good assessment of the potential impacts from blasting operations at this site.
- / **Page 4, Paragraph 3:** The paragraph references a tunnel under Regional Road 136 to access the north area from the main quarry after approximately 10 years of operation and another tunnel under Charleston Sideroad to access the south area after approximately 30 years of operation. The document does not note the required blasting for this tunnel. In both cases, the tunnel must go below the buried Enbridge natural gas pipeline. The tunnel excavations may

result in some very restrictive blasting practices. RESPEC recommends noting this item in the report.

- / **Page 6, Paragraphs 1 and 2:** The paragraphs are a duplicate of one another. One paragraph should be eliminated.
- / **Page 7, Section 2.0, Paragraph 2:** The section notes, “the pit walls above the water table will slope at 3:1 and the pit walls below the water table will slope at 2:1.” This comment requires clarification on whether blasting the final walls down to these slopes will be required after completion of operations in the area (i.e., completion of mining in a particular area) or if the final production blasts in these areas are to be angled to produce the required results.
- / **Page 9, Figure 5:** The drawing shows the best estimate of the area where the depth of rock excavation would exceed 25 meters. This should be clarified in the report text. RESPEC recommends splitting the bench into two benches of approximately equal height as the pit wall approaches 25 meters in height to allow recovery of all resources. Having a bench of 25 meters and a secondary bench of 3 meters where the final wall height is 28 meters would not be economical or practical. This proposed split would also reduce the explosive loading per delay for each blast, lowering potential vibration levels (see bullet on page 5 [Page 24, Table 2]).
- / **Page 10, Section 3.0:** The blast pattern, hole size, stemming, subdrill depth, explosive weight per delay, and powder factor all appear to be very reasonable and equivalent to many operations in southern Ontario blasting in similar limestone rock formations. The explosive type is shown as a chemically sensitized, gassed bulk emulsion. RESPEC recommends showing this as an ammonium nitrate/fuel oil (ANFO) or gassed emulsion blend, which is most common in these types of operations.
  - » RESPEC recommends adding a 3-dimensional drawing or illustration of an example blast pattern.
- / **Page 11, Bullet Point 1:** The first bullet point describing the initiation of explosives in a borehole notes that “the bedrock behind the borehole is fractured.” As noted in Section 4.0, the rock immediately around the borehole is pulverized by the explosive, but outside the immediate area and behind the borehole (i.e., away from the open face), some cracking and micro fracturing extends for a very short distance into the final wall. The description of fracturing behind the borehole is very limited. RESPEC recommends expanding this explanation.
- / **Page 11, Paragraph 2:** The term “Air vibrations or airblast” is used. RESPEC recommends defining and using the term “air overpressure” consistently throughout the report. Different terminology is used throughout the industry, causing a degree of confusion about the meaning of the terms.
- / **Page 11, Paragraph 2:** The cause of air overpressure is described as “the indirect action of a confining material subjected to explosive loading.” This description is unclear. One cause of air overpressure is the face movement of the rock when an insufficient burden is in front of the face or openings in the rock, insufficiently confining and allowing the escape of high-pressure gases. This gas release pulse is responsible for some of the air overpressure and should be explained in more detail.
- / **Page 13, Section 4.2, Paragraph 1:** The description of flyrock uses the term “wild flyrock.” Although this does appear in some of the literature, RESPEC recommends not using this terminology as “wild flyrock” implies some sort of extreme event. In RESPEC’s opinion, flyrock should be defined as rock that is outside the controlled blast area or blast zone.
- / **Page 16, Sections 4.3 and 4.4:** The potential impacts on fisheries, pets, and livestock are well summarized and accurate. RESPEC agrees with the conclusions in these sections.



- / **Page 17, Section 5.2:** The summary is very comprehensive. RESPEC has reviewed all the blast reports and vibration monitoring information from CBM's Osprey Quarry near Collingwood (in a similar rock formation) for 3 years and produced a site attenuation forecast for ground vibrations. RESPEC's results are very similar to Golder's results. RESPEC believes the 95 percent confidence interval represents an excellent starting point to predict ground vibrations. As noted in the report, on-site monitoring at the proposed Caledon Quarry will be required to produce an attenuation relationship for the specific site. RESPEC is confident that the resulting site-specific equation will be similar to the prediction in Golder's report. RESPEC's data review and model are available upon request.
- / **Page 18, Section 5.3:** The data supplied from the Osprey Quarry consisted of air overpressure readings at different ranges insufficient to generate an air overpressure attenuation model. Air overpressure regression curves are difficult to generate with high accuracy as weather conditions make a significant difference in readings. However, Figure 9 presents industry standard equations to use as a starting point for quarry development. RESPEC verified these equations by reviewing supporting documentation and performing validation checks. A more accurate site-specific model will be developed as ongoing monitoring occurs throughout the quarry development.
- / **Page 18, Section 5.3, Paragraph 2:** The paragraph notes that cloud ceilings and temperature inversions can contribute to the air overpressure propagating further than expected. RESPEC's experience is that this is a common occurrence with air overpressure when a temperature inversion or low cloud cover causes the shock wave to be reflected back to ground and creates a higher level of air overpressure in an area that normally experiences little or no air overpressure. This only occurs in a very local area and is not likely repeated in subsequent blasts. The result of these incidents are that people who typically have limited or no knowledge of the blasting occurring may be startled and complain; however, the levels will be well below that which could cause any potential damage. RESPEC recommends expanding the explanation of the air overpressure in this section.
- / **Page 19:** The report discusses air overpressure models in front of and behind the face. In an operating quarry, the air overpressure wave will travel out from the face and may be reflected from an adjacent pit wall, resulting in an almost similar level behind the blast as in front of the blast. RESPEC recommends mentioning this possibility and focusing the analysis on the higher predicted levels in front of the face.
- / **Page 19:** RESPEC recommends emphasizing that proper control of face burdens and inspection of the face before shot loading should be done to minimize the potential for face bursting and higher air overpressure levels.
- / **General:** RESPEC recommends explaining that air over pressure may be noticeable, but far below damage thresholds and that the effect of significant air overpressure on nearby residences will result in potential vibrations in the mid-wall sections of the house, potentially causing dishes to rattle or wall hangings to shift. Such air overpressure levels are far below what would cause any damage. Air overpressure would have to be as high as 148 to 150 dBL to have the potential to crack windows (which is the first damage noted from air overpressure).
- / **Page 20, Paragraph 2:** The paragraph notes that "the blasting operation will progress toward the extraction perimeter with the nearest sensitive receptors located behind the face." This is generally true, but as the quarry is developed, there will be many situations where quarry faces will not be oriented this way (e.g., open corners). RESPEC recommends adding text to address these alternate situations.



- / **Page 20, Section 6.0:** The section on flyrock is very thorough and covers this subject clearly; however, RESPEC recommends two changes related to flyrock.
  - » **Page 22:** The equation for rifling shows  $\sin 2\theta DH$  with no reference to what DH represents, though it may be the launch angle noted in the list of terms. This should be updated or corrected in the report.
  - » **Page 22, Paragraph 4 (starting with McKenzie [2009]):** RESPEC suggests Golder add a paragraph recommending specifically what should be done with respect to flyrock control and blast area size.
  - » RESPEC has reviewed the flyrock prediction equations and supporting documents and completed validation checks, and supports the conclusions in the report.
- / **Page 21, Section 7.0:** Ground vibration and air overpressure predictions are provided in this section. The standoff distances for the nearest receptors provided in Appendix D were closer than the minimum distances calculated from the vibration prediction model. The report does not specifically address how the blast designs will be adjusted to ensure the quarry will be able to be excavated to its designed limits. RESPEC reviewed alternative blast designs and determined that achieving the designed quarry limits by adjusting the blast designs is possible. RESPEC recommends that the report discuss and add specific alternative design considerations that will allow the quarry to be excavated to the designed limits.
- / **Page 24, Table 2:** The estimated ground vibrations are listed for varying ranges and face heights. RESPEC notes that splitting the bench height would be best in areas where the face is more than 25 meters in height. Splitting the bench height would be a good practice as the bench height gets higher than 20 meters to help reduce the potential for air overpressure and reduce vibration levels behind the blast. RESPEC suggests adding a fifth column to this table showing the predicted vibration level if a 25-meter bench was split in half or two decks were used for benches between 15 and 25 meters in height (assuming delayed timing between explosive decks).
- / **Page 25, Table 3:** RESPEC recommends the same changes recommended for Table 2 are made for the maximum air overpressure estimates in front of the blast in Table 3.
- / **Page 27:** Three distances are noted for different bench heights indicating the estimated standoff distances to adjacent receptor residences based on estimated air overpressure levels. These calculations are correct. RESPEC recommends adding a note stating that these readings will depend on weather conditions.
- / **Page 29, Section 7.2:** Three points provide suggestions for techniques to reduce vibration levels. RESPEC recommends adding a fourth point that suggests considering the use of electronic detonators to improve timing accuracy. Numerous studies have shown that improved timing accuracies can reduce ground vibration levels in sensitive areas.
- / **Page 30, Section 7.3:** Enbridge's specification notes that they may require a daily leak test when blasting occurs near a pipeline. Providing the notifications and approvals are completed correctly, it is up to Enbridge to determine the need for testing while CBM would be financially responsible for the testing.
- / **Pages 30 and 31, Sections 7.4, 7.5, and 7.6:** The sections on heritage attributes, water wells, and repeated low level vibration effects on structures are well written and correct. RESPEC agrees with these sections.
- / **Page 33, Table 7:** RESPEC verified the minimum separation required based on the estimated maximum flyrock range calculations and provided data. However, Row 1, Column 6 appears to be incorrect and should show 230 meters instead of 330 meters.



- / **General:** RESPEC recommends adding the following information and references to the blast impact assessment.
  - » Discuss creating and implementing a planned approach for completing pre- and post-blast inspections of residential structures as the site develops.
  - » Include consideration of pre-blast processes (i.e. reviewing drill logs, checking hole deviation, and inspecting any open faces) to help ensure blasting is safe and effective.
- / **Page 34, Section 8.0:** The report mentions an independent third-party will perform blast vibration monitoring services for the site. RESPEC recommends expanding on this role earlier in Section 7.0. It is also recommended this section discusses the roles and responsibilities of reporting and maintaining accountability for any potential exceedances.
- / **Page 34, Section 8.0:** RESPEC recommends adding that the contractor should attempt to blast at approximately the same time frame each day blasting is scheduled. Neighbors will better expect and understand what is happening when a blast goes if there is more regularity and consistency around the blast events.
- / **Page 35, Section 8.0:** The last point suggests monitoring the first five production blasts with multiple seismographs. RESPEC agrees with this suggestion; however, several sinking shots will be required to open up the ramps and start development before production blasting. Sinking shots tend to be heavily loaded (because they are more confined than a regular face shot) and produce higher vibrations. RESPEC recommends stating that the location of the sinking shots and ramp development should be done with this in mind and be monitored at five locations.
- / **Appendix B:** RESPEC recommends updating the glossary as follows:
  - » Add the definition of "air overpressure."
  - » Use the term "flyrock" instead of "rock missile" in the definition of blast area.
  - » Update the definition for "blast area" to reflect how it is used in the report and define it as an area where controlled blast effects, such as controlled and intended rock movement, take place.
  - » Clarify the definition of "deck." A deck can be referenced as inert (stemming deck) material or explosive material (explosive deck).
  - » Update the definition of "flyrock." RESPEC assumes flyrock is being defined as uncontrolled and unintended rock movement using the current definition.
  - » RESPEC recommends adding an illustration to help define the blast zone and to differentiate between controlled and intended rock movement and flyrock.
- / **Pages 35 and 36, Section 9.0:** RESPEC agrees with Golder's view that blasting can be done within the current quarry blasting guidelines (NPC-119) at all surrounding sensitive land uses. RESPEC recommends the clarifications and additions previously outlined be added to the report, but overall Golder has done a thorough job of assessing the impacts of blasting.

#### REVIEW OF THE AIR QUALITY AND NOISE IMPACT ASSESSMENTS COMPLETED BY GOLDER

Both the Air Quality and Noise Impact Assessments are thorough, conservative, and accurate assessments of potential drilling and blasting impacts.

- / The noise impact assessment referenced noise limitation from blasting in NPC-119 but did not consider blasting noise in the analysis.



## CONCLUSION

Overall, RESPEC is satisfied that the air quality, dust control, and site plans are accurate and adequately cover all items related to drilling and blasting. RESPEC determined the blast assessment completed by Golder is thorough and covered all the relevant issues related to drilling and blasting. RESPEC recommends the clarifications and adjustments detailed in this summary. When these recommendations are addressed, RESPEC can perform a final review and issue an updated peer review letter and summary. Supporting documentation, data, equations, and comments can be provided by RESPEC upon request.