

DATE July 20, 2016**PROJECT No.** 1211250045/14000**TO** Andrew Evers
MOECC**CC****FROM** Paul Smolkin**EMAIL****RESPONSE TO COMMENTS ON GEOLOGICAL ASPECTS OF MOECC'S REVIEW OF THE CRRRC ENVIRONMENTAL ASSESSMENT, J.L. WALLACH, MAY 18, 2016**

This memo provides responses to the May 18, 2016 comments from Dr. J. Wallach on the geological aspects of the MOECC review of the CRRRC EA, which was released for public comments on April 18, 2016.

Dr. Wallach has submitted comments on these matters to the MOECC previously and responses have been provided by the Golder Associates Ltd. (Golder) team on behalf of Taggart Miller Environmental Services (TMES or Taggart Miller). In addition, the MOECC engaged the expertise of the Ontario Geological Survey (OGS) and Natural Resources Canada (NRCan) to review the geologic and seismic aspects, including the comment and response documents by Dr. Wallach and Golder that have been prepared. The chronology of documents referred to in this memorandum is provided below:

1. Wallach 2014 - Paper published in the Canadian Journal of Earth Sciences – A low-relief hill in eastern Ontario, Canada, covered by the easily erodible Queenston Formation and derived sediments- probably the result of Quaternary tectonic uplift, published September 2014
2. Final EA - Taggart Miller EA for the Proposed CRRRC - Final EA, December 2014
3. Wallach 2015 – Critical Review of Geoscientific Component of TMES EA, Final Version, February 2, 2015, submitted to MOECC
4. Golder June 2015 – Response to Wallach 2015
5. Wallach January 2016 – Post-EAR Report to Defend Omission of Information- An Indefensible Undertaking by Golder Associates, January 15, 2016, submitted to MOECC
6. Wallach February 2016 – Golder Associates' Lack of Objectivity dated February 2, 2016 and Attached figures & explanation for you! dated February 5, 2016, both submitted to MOECC
7. Golder March 2016 – Response to Wallach January and February 2016 dated March 7, 2016, submitted to MOECC
8. OGS/NRCan April 2016 – Review of Geological and Seismic Aspects of the Proposed CRRRC and Associated Documentation, submitted to MOECC April 14, 2016
9. MOECC April 2016 – Ministry Review of the CRRRC EA, released for comment April 18, 2016
10. Wallach May 2016 – Geological Aspects of MOECC's Review of the CRRRC EA, May 18, 2016, submitted to MOECC



The comments in Wallach May 2016 include many of the same ones as he submitted previously in Wallach January and February 2016, as well as some others that Dr. Wallach has previously submitted. The comments are basically arguments to support his interpretation of faults and possible geologically recent tectonic activity on Cholowski Hill, and to question, discredit and urge the MOECC to not accept the Golder interpretation. Also, a number of the comments are repeated several times in various sections of the May 2016 submission.

The main technical comments in Wallach May 2016 have been assembled into the attached table:

- Wallach May 18, 2016 Comment Summary Table – Taggart Miller Responses: in this table, Golder has provided a response and/or provided reference to where a response to the comment has been previously provided.
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There are also several comments in Wallach May 2016 that are directed specifically at the MOECC.

Attachments: Table

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Comment(s)	Proponent’s Response	Ministry Status
<p>In Golder Associates June 2015 report they carefully located their cross-section shown on Figure 5 because there is only one borehole (90-7) along that line near the North Russell escarpment, shown as the North Russell fault in Figure P-1. Also, only two boreholes along that line, OGS-01-06 and BH 09-4 were drilled deep enough to encounter the Queenston/Carlsbad contact. The section does not show the displaced formational contacts that exist across the North Russell and East Ridge faults.</p>	<p>The section line was not ‘carefully located’ to avoid or downplay any geologic feature. It was selected to illustrate the bedrock formations present from east to west across Cholowski Hill based on reliable borehole information. The Queenston/Carlsbad contact elevation at locations where the boreholes terminated before encountering the contact correspond to the inferred contact elevation shown on Golder Figure 3-8 in the Volume III report and reproduced in the Golder June 2015 response document. The high quality borehole information on Cholowski Hill does not suggest the presence of the displaced formational contacts inferred by Dr. Wallach that he has named the North Russell and East Ridge faults.</p>	
<p>Golder’s two boreholes BH 09-7 and 09-3, which have a difference in Queenston/Carlsbad contact elevation of 26 m, are located on opposite sides of the North Russell fault. These two boreholes confirm the presence of the North Russell fault.</p>	<p>This same comment was previously submitted by Dr. Wallach on February 5, 2016, and addressed in Golder’s March 7, 2016 response, Appendix A, comment 6. The interpretation using all the Golder borehole information on Cholowski Hill, as presented in the EA, does not indicate the presence of the North Russell fault.</p>	
<p>Golder withheld information in the EA, in particular the paper published by Wallach (2014) in the Canadian Journal of Earth Sciences. Golder should have fully discussed this paper and its findings in the EA, but they didn’t. The MOECC required Golder, or Taggart Miller, to address the matters raised in the paper, which they did in the Golder June 2015 post-EA report.</p>	<p>The reasons that Wallach (2014) was not specifically discussed in the EA are described in the June 2015 response. The June 2015 post-EA report by Golder was prepared to respond to Dr. Wallach’s February 2015 submission of comments on the Final EA. Because Dr. Wallach’s February 2015 comments centered on the interpretations in his 2014 paper, the Golder June 2015 response provided a detailed critical review of the paper.</p>	
<p>Golder deliberately left out of the EA certain geological information pertinent to assessing the safety of the proposed</p>	<p>The geologic, seismic hazard and landfill seismic stability assessment provided in the EA, and in</p>	

<p>landfill at the Boundary Road site. This information relates to faults and seismicity uncomfortably close to that site, specifically Cholowski Hill, the North Russell and East Ridge faults, interpreted as described in Wallach (2014) to possibly be related to geologically recent tectonics. MOECC should not have accepted Golder’s June 2015 response on these matters.</p>	<p>supplemental submissions to address comments received (primarily from Dr. Wallach), considered the geological and seismic aspects of the proposed CRRRC project. An independent review of these matters carried out by OGS and NRCan for the MOECC was generally supportive of Golder’s work and interpretations to describe the geologic setting and earthquake hazard in the area of the proposed CRRRC. These agencies also question various aspects of Dr. Wallach’s work and interpretations.</p>	
<p>Dr. Wallach’s interpretation of faults and Quaternary uplift are not just based on water well records. They are based on morphology, supported by the magnetic survey patterns. The breaks in the gentle slopes on the west and east sides of Cholowski Hill, together with the presence of the easily erodible Queenston shale on the slopes above the lower lying adjacent terrain and the shape of the total field magnetic survey pattern support the presence of the North Russell and East Ridge faults and the possibility of geologically recent activity along the faults.</p>	<p>The submissions by Dr. Wallach were assessed and responded to by Golder in their June 2015 and March 7, 2016 documents. Golder’s interpretation is that when the high quality bedrock information from the drilling program on the North Russell Road site is integrated with other reliable data, there is no evidence to support the presence of the faults or fault activity. Consistent with the opinion provided by Golder in its June 2015 response, the May 2016 review by Desmond Rainsford, Senior Science Leader for Geophysics at the OGS questions Dr. Wallach’s use of the magnetics data to interpret faults that displace the sedimentary bedrock on Cholowski Hill.</p> <p>Golder’s interpretation of the origin of the scarps that form Cholowski Hill as shoreline erosional features is provided in the Golder June 2015 response. The review by Dr. Andy Bajc of the OGS describes the many shoreline features associated with the Champlain Sea in this area, and notes the many drumlinoid ridges that cross the inferred locations of the North Russell and East Ridge faults with no apparent vertical displacement (which should have occurred if there was geologically recent movement along the faults).</p>	

<p>A number of examples of the use of specific water well records as related to the inference of the presence of faults on Cholowski Hill are provided by Dr. Wallach.</p>	<p>These specifics were considered and responded to by Golder in its March 7, 2016 document, Appendix A, comments 5a, 5b, 6.</p>	
<p>A number of examples of where Dr. Wallach’s use of specific water well records and information from certain OGSL boreholes was criticized or dismissed by Golder are discussed. Dr. Wallach notes that Golder’s views have no effect on his interpretation of the North Russell and East Ridge faults.</p> <p>On Figure 10f, Dr. Wallach presents modifications to his previous geological cross-sections across Cholowski Hill after removing water wells that Golder identified as having unacceptable location accuracy codes, and states that they still support the morphology-based interpretation of the faults.</p>	<p>These are examples of what Golder considers the continued inappropriate use of water well records by Dr. Wallach to interpret structural geology, as well as the importance of interpreting the bedrock stratigraphy from the OGSL borehole geophysics and not just relying on the written descriptions on the well cards. These were each discussed in Golder’s June 2015 response (sections 2.1.2.1 and 2.1.2.3).</p> <p>Wallach cross-section C-D on Figure 10f, constructed based on water well records, infers the North Russell and East Ridge faults because of the reported presence of Carlsbad limestone at shallow depth in the central portion of Cholowski Hill. It is noted that cross-section C-D is located just north of Golder’s cross-section A-A’ on Figure 5 in Golder’s June 2015 response. Golder’s cross-section A-A’ is based on high quality borehole data that shows the continuous presence of Queenston shale to depth in the area of this cross-section, very different than the interpretation on Dr. Wallach’s cross-section C-D that is based on far less accurate or reliable water well data.</p>	
<p>“On page 6 of Golder’s June 2015 report it is stated, “As described later in this Section and in Section 2.1.5, the results of drilling investigations at the North Russell Road Site (quarry) demonstrate that the bedrock ridge is continuously underlain by Queenston shale bedrock and the limestone referred to by Dr. Wallach to exist near surface within the ridge associated with the presence of the inferred North Russell and East Ridge faults is not present.” To begin in the section of the [Wallach] published paper entitled “General</p>	<p>The sentence quoted by Dr. Wallach from Golder’s June 2015 report is taken out of context. This sentence was specifically with referring to cross-section C-D in Wallach (2014), which is in the southern part of Cholowski Hill. The above response regarding cross-section C-D describes the basis for the discrepancy between Golder’s cross-section A-A’ and cross-section C-D in both Wallach (2014) and as modified in Figure 10f of Dr. Wallach’s May 18, 2016 submission.</p>	

<p>Stratigraphy”, p. 863, it was very clearly written that the Queenston overlies the Carlsbad.” It is noted that there is no Queenston in the northern part of Cholowski Hill; the uppermost bedrock unit there is the Carlsbad.</p>	<p>Golder agrees that the Carlsbad limestone is the uppermost bedrock unit in the northern part of Cholowski Hill, as shown on Figure 3-6 of the Volume III report.</p>	
<p>In Golder’s thorough review of the OGSL boreholes, they “missed” the faulting documented in the log of borehole T002580.</p>	<p>This was previously raised by Dr. Wallach and responded to in Golder’s March 7, 2016 report in Appendix A comment 3. These were part of the documents provided by MOECC to OGS and NRCan for their independent review.</p>	
<p>In their June 2015 report, Golder criticized the suggestion in Wallach (2014) that Cholowski Hill may be a roche moutonnee. A response was submitted to MOECC by Dr. Wallach on January 15, 2016. This does not affect Dr. Wallach’s interpretation of the presence of the North Russell and East Ridge faults.</p>	<p>Golder provided a response to this in its March 7, 2106 report, which was part of the documents provided by MOECC to OGS and NRCan for their independent review. Golder’s opinion on Dr. Wallach’s interpretation of the faults is provided in previous reports and in this summary table.</p>	
<p>In their June 2015 report, to support their position on the inappropriate use of water well records for interpretation of structural geology, Golder uses the example from Wallach (2104) of two water well records in the WWIS with identical location coordinates but different descriptions of subsurface conditions. Wallach (2014) did include this information, but did not use this conflicting information in his interpretation; rather he used it as an example to illustrate the problems geologists have in interpreting information from the well records.</p> <p>In their June 2015 report, Golder wrote that Wallach (2014) claimed to have identified the first Quaternary or younger fault scarp in eastern North America, when Wallach (2014) states that fault scarps are not known in eastern North America other than the Lac Turquoise fault on the Ungava Peninsula in northern Quebec.</p>	<p>Golder agrees with Dr. Wallach on both points.</p>	

<p>Golder’s June 2015 report incorrectly states that “<i>topography and inferred morphology (or any surface features) are not a basis on which to document faulting.</i>” Dr. Wallach provides a number of examples where these have been used to document faulting.</p>	<p>This point was also raised by Greg Brooks of NRCan in his independent May 2016 review on behalf of the MOECC. Golder’s statement that “topography and morphology cannot be used to identify faults” (page 17 of Golder’s June 2015 response) needs to be taken within the context in which it was presented. Golder concurs completely with Mr. Brooks that the interpretation of large and small-scale geomorphic features is a major element in any paleoseismic investigation and interpretation. The statement in question was intended simply to point out that in the absence of any other supporting data, the <i>only</i> evidence for the so-called North Russell and East Ridge faults provided by Dr. Wallach were photographs of topographic scarps. We were suggesting that topography and morphology alone cannot be used to identify faults.</p>	
<p>Although not addressed in Wallach (2014), “<i>the topographically evident Gloucester Fault is very nearby and it, too, may have been rejuvenated in that area [of Cooper’s Hill Road to the west]</i>”</p>	<p>To Golder’s knowledge, all the information on the well-known Gloucester Fault describes it as inactive.</p>	
<p>In Table 1 of the MOECC review, under GRT comments it states that the proposed landfill is acceptable from a hydrogeological perspective because of favourable geologic conditions and negligible potential for impact to off-site water wells. Dr. Wallach questions this conclusion by the MOECC hydrogeologist and if the reviewer considered the potential effects of earthquakes</p>	<p>The MOECC hydrogeologist reviewed the draft EASR, asked for clarifications and additional information, and required additional measures to be incorporated into the perimeter containment design and groundwater monitoring program as described in the final EASR. NRCan provided an independent review of the geological and seismic aspects of the draft EA.</p>	
<p>From Table 1 of the MOECC review, South Nation Conservation noted that a Headwater Drainage Assessment (HDA) will need to be completed for the on-site drainage courses. Taggart Miller responded that this will be further discussed with SNC as part of future approvals/permits for the CRRRC project, and the MOECC states it is satisfied this will</p>	<p>The completion of this assessment, which is now a requirement of SNC on all development projects within their watershed, is listed as a commitment in the EA and progress on fulfilling it will be tracked by the EA monitoring program that will be a condition of EA approval.</p>	

<p>occur. Dr. Wallach states his distrust that this will happen and asks why MOECC do not require this assessment to be completed prior to EA approval.</p>		
<p>MOECC should require Taggart Miller / Golder to complete a drilling investigation program on Cholowski Hill at the interpreted North Russell and East Ridge faults to prove or disprove their existence prior to considering EA approval for the proposed CRRRC on the Boundary Road site.</p>	<p>Golder’s conclusion is that there is no technical basis to infer faults at these locations. Dr. Wallach has made his case as to why he believes the faults to be present and Golder has fully addressed and, in our view, refuted his assessment. Our responses have been reviewed by OGS/NRCan. These additional investigations would, in our view, be irrelevant to the performance of the proposed CRRRC on the Boundary Road site.</p>	