



April 28, 2023  
Project Number: 230303

Ms. Theodhora Merepeza, MCP, MCIP, RPP  
Manager, Planning  
Municipality of Port Hope  
5 Mill Street South  
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Email: [tmerepeza@porthope.ca](mailto:tmerepeza@porthope.ca)

**Re: Peer Review of Hydrogeology Study  
Residential Development, Garden Hill**

Dear Ms. Merepeza:

BluMetric Environmental Inc. (BluMetric®) was retained by the Municipality of Port Hope to peer review hydrogeological studies prepared by others in support of the proposed Garden Hill residential development in Port Hope. The documents for review included:

- Geotechnical Report prepared by Terraspec Engineering Inc. on May 6<sup>th</sup>, 2021
- Hydrogeological and Servicing Assessment prepared by Greer Galloway Group Inc. in April 2021
- Submission Cover Letter and Comment Matrix prepared by Monument Geomatics on December 23<sup>rd</sup>, 2022
- GRCA Hydrogeology Comment Response prepared by The Greer Galloway Group Inc. on December 19<sup>th</sup>, 2022
- GRCA hydrogeology comments that are summarized in the December 2022 Greer Galloway report noted above

The overall work conducted by Greer Galloway and the reviews completed by the GRCA (Ganaraska Region Conservation Authority) is well done and of high quality. The comments that relate to hydrogeology from the GRCA and other agencies, along with mostly Greer Galloway, are summarized in the accompanying table. Points where additional work or items that should be considered as conditions of approval are summarized below.

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1. Theoretical calculations of potential cumulative interference effects should be completed to confirm that well interference is expected to be minimal, and that all wells can always meet the peak water demands.
2. We agree with the GRCA and Greer Galloway that a wellfield design be completed and that a “viable well be established on each lot before that lot can be made available for sale”. This should be considered as a condition of approval.
3. We agree with Greer Galloway’s recommendation that enhanced infiltration using soak away pits on lots in the areas around the two on-site wetland areas will help to offset the reduction in infiltration predicted based on modelling results. This should be considered as a condition of approval.
4. We also agree that a revised water balance should be conducted for these areas to ensure that post-development recharge rates match the pre-development rates especially during the summer months. This should be considered as a condition of approval.
5. Slab-on-grade home construction may need to be considered as a condition for development. Continued pre-construction monitoring will aid in determining seasonal groundwater fluctuations across the site but more detailed assessments may be required on a lot-by-lot basis.

BluMetric is of the opinion that two comments that are not covered in the attached summary matrix need to be considered. The Greer Galloway *GRCA Hydrogeology Comment Response* report provides a proposed groundwater monitoring program and a contingency plan complete with triggers. The proposed program is appropriate with a few additional recommendations provided. It is not clear from the report on which on-site wells would be included in the monitoring. Would it be the existing water supply wells, the existing shallow monitoring wells or a combination of both? Given the comment below, shallow monitoring wells both on-site and down gradient should be part of the monitoring program. The proposed frequency of groundwater chemistry monitoring includes three rounds during the pre-construction period. Approval for the development has currently not been obtained and it is not known when construction would start if approval were obtained. We suggest that this monitoring should include at least two rounds of sampling per year, in spring and fall, and be maintained until construction begins. Water levels would be obtained by data loggers so the continual monitoring proposed will be appropriate. The monitoring program and contingency plan should be a condition of approval.

BluMetric is also of the opinion that potential impacts to surface water have not been addressed with respect to potential nitrate loading from the septic systems. Calculations of estimated nitrate concentrations at down gradient property boundaries and at the edge of water bodies should be completed to determine potential impacts. The monitoring program above would then provide the necessary data to confirm or refute if any impacts from the proposed development are occurring.

## LIMITING CONDITIONS

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

BluMetric makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

Nothing in this report is intended to constitute or provide a legal opinion. BluMetric makes no representation as to compliance with environmental laws, rules, regulations, or policies established by regulatory agencies.


This report shall only be relied upon by the Municipality of Port Hope. No other reliance on this report, in whole or in part, shall be permitted without the written permission of BluMetric.

Please do not hesitate to contact the undersigned if you have any questions or concerns.

Sincerely yours,

BluMetric Environmental Inc.



  
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Encl.

*Ref: 230303 Port Hope Peer Review repf April 2023*

North South EIS Peer Review Comments				
Comment Number	Category	NSE Comment – June 2022	Cambium Response – September 2022	BluMetric Comments April 2023
14	Seeps and Springs	During the site walk on May 31, 2022, two seepage areas were observed along the lower slope of the valley associated with the coldwater creek within the Fresh-Moist White Cedar Coniferous Forest (FOM7-1). According to the SWH Criteria Schedules for Ecoregion 6E the presence of a site with two (2) or more seeps/springs should be considered SWH, whereby the ELC forest ecosite is the SWH. As such, the FOM7-1 ELC unit is confirmed SWH for Seeps and Springs and should be acknowledged and discussed where appropriate in the update to the EIS.	<p>Cambium did not observe the seepage areas noted by NSE on May 31, 2022, nor were they observed during our other field investigations. Seeps generally occur during periods of high groundwater elevation and may not be visible year-round, therefore it is possible that these seepage areas were not observable during our other investigations. The comment indicates that the seepage areas were noted in ELC Type FOM7-1, but the description of Fresh-Moist White Cedar Coniferous Forest applies to ELC Type FOC4-1 (Community 8). Based on topography, stream characteristics (coldwater creeks are generally presumed to be groundwater fed), and observations over the duration of study, it is probable that seeps occur in the vicinity of the watercourse on a periodic/intermittent basis. Based on topography and vegetation type, Cambium interprets NSE's comment to apply to Community 8 (FOC4-1).</p> <p>Based on the observations made by NSE, Cambium concurs that Community 8 should be designated SWH for Seeps and Springs, as per the criteria listed in the SWH Technical Guide (6e).</p>	The reports indicate that seeps may exist in some areas especially during the spring melt when groundwater levels are maximized. As discussed in the BluMetric letter, there is a potential for this shallow groundwater to be impacted by nitrates that could impact surface water quality.
Ganaraska Region Conservation Authority				
Comment Number	Category	November 2022 – 2 <sup>nd</sup> Round Comments	Greer Galloway Response – December 2022	BluMetric Comments April 2023
13	Hydrogeology	As stated previously, the hydrogeological report should speak in more detail to the potential impacts of the development site, including reduction in infiltration potentially leading to reduced interflow and baseflow discharge, raised or lowered water levels in shallow aquifers, changes in shallow groundwater flow direction, and creation of preferential pathways that may increase susceptibility of contamination in the subsurface. A figure or schematic indicating the movement of subsurface water would be beneficial to clearly show the difference between pre- and post development preferential pathways. This is especially important since the site contains a wetland, which is likely linked to the groundwater it receives. It is noted that the groundwater level within an aquifer fluctuates constantly in response to rainfall, evapotranspiration, barometric pressure, groundwater movement, and groundwater pumpage. As such calculating hydraulic gradients and groundwater velocity would quantify those changes. A description and figure of the proposed site alteration that clearly outlines groundwater elevations and change in subsurface drainage patterns should be addressed.	<p><b>BluMetric Comment</b> – The Greer Galloway Response is very detailed. Our conclusion of their work is provided below however the reader is urged to review the full response in the <i>Greer Galloway document GRCA Hydrogeology Comment Response, Garden Hill Subdivision, 3852 Ganaraska Road</i>, dated December 2022.</p> <p>The modelling indicates a slight increase (up to 5%) in the maximum slope along the internal roadways and a slight decrease in slope over the remainder of the site. The modelling also indicates a reduction of 10 to 60 mm/annually across the site. This does not include infiltration along roadside ditches, stormwater ponds (if not lined) and, if built, soak aways. Overall groundwater flow direction is not expected to change significantly.</p>	Greer Galloway's modelling of potential changes to infiltration reduction across the site is well done. We agree with Greer Galloway that infiltration at the site does not significantly recharge the deep overburden/bedrock water supply aquifer at the site. The roughly 30 m of fine grained (mostly clay) significantly reduces the amount of surface infiltration but this is what protected the aquifer from near surface contamination such as septic systems. We agree that no impacts to the groundwater supply aquifer at the site is anticipated by the predicated amount of infiltration reduction.

Ganaraska Region Conservation Authority				
Comment Number	Category	November 2022 – 2 <sup>nd</sup> Round Comments	Greer Galloway Response – December 2022	BluMetric Comments April 2023
14	Hydrogeology	The report should address the issue of whether the groundwater withdrawals in the proposed development will exceed the long-term safe yield of the aquifer or whether there is a significantly decrease of baseflow that may affect sensitive water features in more detail. Stress levels assessed by Source Water Protection do not represent a site-specific water balance that includes wetlands or individual wells.	<p>As noted by the GRCA, stress levels assessed by Source Water Protection do not represent a site- specific water balance. However, the modelled stress levels do cover the recharge and water balance for the confined aquifer system on the flanks of the Oak Ridges Moraine. The modelled stress levels do not include the potential for local effects on potentially sensitive ecological features such as wetlands.</p> <p>The planned level of development is equivalent to the residential water demand of about 45 homes within a 16-ha property. Average residential water demand in Ontario is approximately 675 L/day/home so the scale of development represents a total taking of about 30,000 L/day the most of which will be returned to the subsurface. This amount represents a water removal of a little under 2,000 L/day per ha: equivalent to a recharge rate of 73 mm even if we exclude recharge coming from upgradient areas (the main recharge area). We conclude that the long term safe yield for the confined aquifer system is greater than the proposed water takings either within the subject site or in the larger area.</p>	We agree with Greer Galloway that on the cumulative planned water requirements will not mine the water supply aquifer. As stipulated in comment 13, there is no apparent hydraulic connection between the deep, water supply aquifer and the shallow, water table aquifer and therefore no appreciable impacts are anticipated to surface water features such as wetlands. Potential impacts to the wetlands from changes in infiltration amounts are addressed in Comment 18.
15	Hydrogeology	Well interference reduces the available drawdown, it also reduces the maximum yield of a well. Well interference is, therefore, an important matter in the design of well fields where it is desirable for each well to be pumped at the largest possible rate. Since the wells are located on the proposed properties and somewhat resembles a grid pattern, considerations should be given to the minimum distance for the well location. Excessive well interference is avoided by increasing the spacing between wells. As pointed out within the report that “meeting regulatory setback distances plus a reserve area will limit the areas where wells can be drilled”. GRCA suggests a well field design prior to approval of the number of lots to determine the optimum distance between wells.	The recommendation to prepare a conceptual well-field layout is one that we agree with and one which will be helpful during the drilling of supply wells across the site. Such a layout should include both a preferred and an alternate well location for each lot in areas that meet OBC setback requirements from septic systems and which maximize the separation between wells.	Of the four test wells where Greer Galloway conducted aquifer test, two had more than the amount required for an individual dwelling, one barely meets the requirement, and another does not meet the requirement. We agree that the Greer Galloway conclusion that the cumulative well supply wells for the development have a minor risk of causing disruptive interference with offsite wells. We do not feel as certain about their conclusions with respect to cumulative interference between wells on the proposed development and the possibility that a well on any particular lot may not meet the required supply. We therefore feel that theoretical calculations of potential cumulative interference effects should be completed to confirm that well interference is minimal, and that all wells can always meet the peak demands. We agree with the GRCA and Greer Galloway that a wellfield design be completed and that a “viable well be established on each lot before that lot can be made available for sale” (Greer Galloway <i>Hydrogeology and Servicing Assessment Proposed Residential subdivision, 3852 Ganaraska Road, Campbellcroft, Ontario, April 2022</i> ).
16	Water Balance	The water balance within the storm water report on page 6 mentions an annual moisture surplus of 372mm. The water balance in appendix O however calculates a surplus of 342mm. Please clarify.	The hydrogeology study presented a water balance carried out in accordance with the Ministry of the Environment, Conservation and Parks (MECP) Procedure D-5-4 (Individual On-Site Sewage Systems). The water surplus was estimated to be 367 mm/a which was calculated by subtracting the actual evapotranspiration (AET) of 498 mm/a from the precipitation of 865 mm/a. Both these numbers were taken from the Trent Conservation Coalition Source Protection Committee (TCCSPC, 2018) report. The 372 mm/a number is an error, and it should read 367 mm/a. As we noted in our report, the water balance methodology used for the hydrogeology study was taken from MECP 1995 guidance and for the purposes of nitrate mass balance calculations. The methodology is crude and should not be used for stormwater management design. We therefore defer to the stormwater report for this purpose.	We acknowledge that the noted discrepancy was a typographical error. We agree with Greer’s Galloway’s approach for water balance.

Ganaraska Region Conservation Authority				
Comment Number	Category	November 2022 – 2 <sup>nd</sup> Round Comments	Greer Galloway Response – December 2022	BluMetric Comments April 2023
17	Water Balance	The second submission says that no adverse effects to water quantity are predicted, however page 39, last paragraph of the Servicing and Stormwater Management Report mentions that over time post development conditions would decrease the infiltration volume as recharge to regional groundwater flow system and interflow within the shallow unsaturated zone would be expected to decrease. Please clarify.	Our second submission stated that no adverse effects to water quantity are predicted. This statement was made in reference to the water supply aquifer and there is no contradiction with the Servicing and Stormwater Management Report which notes that changes in the site grading and the increase in impervious cover would decrease the infiltration volume and interflow within the shallow unsaturated zone would be expected to decrease. We note that the regional confined aquifer obtains most of its recharge from lands to the north of the site where permeable aquifer strata daylight at surface. Proximal recharge is dependent on the maintenance of saturated conditions in the base of the shallow overburden overlying the confining layers and would not be affected by development-related changes to infiltration. The potential impacts from such changes to local ecological features is discussed under Comments 1 and 6.	We agree with Greer Galloway that this is addressed by comments 13 and 18 of this document (Comments 1 and 6 of Greer Galloway document <i>GRCA Hydrogeology Comment Response, Garden Hill Subdivision, 3852 Ganaraska Road</i> , dated December 2022.)
18	Water Balance	As much as possible, calculations should estimate the amount of infiltration necessary to maintain pre- development conditions. Detailed information on the proposed mitigation measures should be provided to account the loss of infiltration. These details should include location of enhanced infiltration, the volume/rate and condition of the soils to support water being infiltrated. This is especially important as the site contains a wetland – Please demonstrate that there will be no negative impacts on the natural features or their ecological functions due to the development.	<p>Further to the Hydrogeological Response Letter the Servicing and Stormwater Management Report has provided verbiage in the Water Balance Section acknowledging the recommendations from the response letter that will be completed at the time of detailed design.</p> <p><b>BluMetric Comment</b> – The Greer Galloway Response is very detailed. Only portions of their reply are provided below however the reader is urged to review the full response in the Greer Galloway document <i>GRCA Hydrogeology Comment Response, Garden Hill Subdivision, 3852 Ganaraska Road</i>, dated December 2022.</p> <p>Groundwater flow directions are not predicted to change significantly however the reduction in recharge within lands that contribute to water levels in the two wetland areas could affect these features. In the absence of detailed information regarding the sensitivity of the wetland vegetation to such changes, we recommend following the precautionary principle and implementing at-source infiltration to match, as closely as possible the pre-development recharge.</p> <p>Within the identified areas [<i>BLM the two wetland areas</i>] we recommend the use of enhanced infiltration measures to infiltrate clean roof runoff for each lot. Direct infiltration avoids water losses to evapotranspiration and runoff and it is possible, in principle, for lot level infiltration to offset infiltration losses resulting from impervious paved areas. Direct infiltration of roof water would always be predicted to have its maximum benefit during the summer months when evapotranspiration losses are at their highest and when wetlands would be under the greatest stress.</p> <p>A revised water balance should be developed for identified priority areas. This should include the effects of enhanced infiltration measures and a more detailed treating of changes in grading and impervious covers. The resulting water balance should match pre-development recharge rates during the summer months.</p>	We agree with Greer Galloway's recommendation that enhanced infiltration using soak away pits on lots in the areas around the two on-site wetland areas will help to offset the predicted reduction in infiltration from modelling results. We also agree that a revised water balance should be conducted for these areas to ensure that post-development recharge rates match the pre-development rates especially during the summer months. We also feel that both recommendations should be a condition for approval of the development.
<b>Notes to the Municipality</b>			<b>Monument Acknowledgement</b>	<b>BluMetric Comments April 2023</b>
1	Hydrogeology	The geotechnical reports states that groundwater was encountered at depths of 1.5m to 3m "below the ground surface". The houses may be required to be slab-on-grade (no basements).	Noted	Slab-on-grade home construction may need to be considered a condition for development. Continued pre-construction monitoring will aid in determining season groundwater fluctuations across the site but more detailed assessments may be required on a lot-by-lot basis.