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October 6, 2014

Via: Email

Mr. Stan Denhoed, M.Sc., P.Eng.
Harden Environmental Services Ltd.
4622 Nassagewaya-Puslinch Townline Road
RR 1
Moffatt ON N0P 1J0

Dear Mr. Denhoed:

Re: Harden Letter of June 10, 2014
Project No.: 300032475.0000

Thank you for your June 10, 2014 letter which provided a response to the following two R.J. Burnside & Associates Limited (Burnside) letters:

- Harden Environmental Services Limited January 14, 2014 Letter-Response to Burnside Review of Summary of Drilling and Testing of New Well M15 at Hidden Quarry Site, (Burnside letter dated April 8, 2014).
- Harden Response to Burnside Review of Hydrogeological Summary Report, (Burnside letter dated April 9, 2014).

These letters were prepared by Burnside in response to the January 14, 2014 Harden letters.

As indicated by Harden in their June 10, 2014 letter, the primary concerns that Burnside has with the Hidden Quarry application are the following:

1. Water levels in the up-gradient domestic wells
2. Water quality in the down-gradient domestic wells
3. Rockwood Well Number 4

Harden indicates that the largest water level decline in up-gradient wells will be in the order of 1.6 m and it is their opinion that a water change of this magnitude will not adversely affect the availability of water for any domestic wells. Harden indicates that a rigorous on-site monitoring program will be initiated to confirm their opinion. Also, Harden indicates that James Dick Construction Limited (JDCL) has agreed to conduct a voluntary private well survey commencing well in advance of any below water table extraction. Harden suggests that the combination of these two programs will allow for the early detection of possible changes in the potentiometric elevation on the site and in neighbouring wells. Harden indicates that water quality in the down-gradient wells will be discussed at length in their June 10, 2014 submission. They also state that the Quarry will not affect the GUDI status of Rockwood Well Number 4 and that JDCL has agreed to provide the use of multi-level well M15 for monitoring during the pumping test of

Rockwood Well Number 4. Harden then categorizes the concerns into eight areas of interest. These are:

1. Karst
2. Groundwater Parameters-Hydraulic Connectivity-M15 intervals
3. Nitrate Balance
4. Deeper Water Sources and Water Quality
5. Local Well Survey
6. Quarry Depth Limitation
7. Brydson Spring and Blue Springs Creek
8. Sinking Cut-Monitoring and Historical Low Water Level

The information provided by Harden on each of the 8 issues will be summarized below followed by the Burnside response.

1.0 Karst

Tributary B is a small stream which enters the Hidden Quarry site near the northeast property boundary and proceeds in a generally southerly direction exiting near the southeast corner of the site. The tributary runs between the two portions of the site that are proposed to be quarried. There are a number of monitoring stations along the tributary with SW4 located at the point where the tributary enters the property near the north boundary and SW3 situated where the creek passes beneath Highway 7 to the south of the site. The tributary has been monitored fairly regularly since 2005. Harden notes that Tributary B loses all of its water, i.e., no flow at SW3 when the incoming flow at SW4 is less than approximately 20 L/s. As a result, the stream loses all of its water before it leaves the south end of the site. The loss of water from Tributary B has led to concerns that the stream could be influenced by underlying karstic bedrock. Harden suggests that the stream is not influenced by karstic bedrock due to the following observations:

a) Tributary B is not in direct contact with the underlying bedrock anywhere on the site.
b) Tributary B is physically separated from the underlying bedrock by several meters of permeable unconsolidated sediments. Jim Baxter of R.J. Burnside & Associates Limited was present for the drilling of M15 (within 30 m of Tributary B) where there was approximately 10 m of unconsolidated sediments comprised mainly of coarse aggregate.
c) The water table is found to be several meters below the tributary streambed.

Harden proposes to instrument two locations on the stream (SW4 and SW8) with continuous water level monitoring devices. Harden concludes that there is no indication of large contiguous karst features underlying the site and further more given the fact that the site will not be dewatered, karst geology is not an operational, water supply or safety issue at this site.

Burnside Response

Burnside has reviewed the borehole logs for the numerous wells on-site that penetrate the bedrock. Although there is evidence of fracturing in the bedrock, there is no evidence of karstic features such as caverns, large fractures etc. M15 was cored and a detailed examination of the bedrock and a down hole video did not reveal any karstic features. However, considering the fact that karstic features are common in the Rockwood area, including at Rockwood Well 3, it would not be unexpected to encounter occasional karstic features in the area of excavation.

The installation of continuous water level devices will assist in confirming the relationship between flow rates less than 20 L/s at SW4 and cessation of flow before the SW3 station. The water table is found to be several meters below the tributary streambed confirming that a downward gradient or losing stream condition exists.

2.0 Groundwater Parameter – Hydraulic Connectivity

Well M15 was reconstructed as a multi-level monitoring station on May 1 and 2, 2014 with 4 monitoring intervals. The screened intervals are summarized in Table 2 of the Harden letter and shown graphically in Figure 3 which was attached to the letter.

Burnside Response

Burnside reviewed the original proposal by Harden as to how to reconstruct M15 and is in agreement with the intervals selected to be screened.

2.1 Groundwater Elevation Multi-Level M15

Harden collected water levels from M15 on four occasions in May 2014. The water level data indicates that the water levels are found within a narrow range with the lowest water levels observed in M15-II which is an interval across a known fracture. The highest water levels were found in the upper 2 intervals which suggest a downward gradient between M15-II and M15-III and an upward gradient from M15-I (the deepest well) and M15-II. It appears that water movement in the well is both upwards and downwards towards the fractures located at approximately 36 m below ground surface (bgs). Harden indicates that the vertical profile gives no suggestion of a significant connection to lower hydraulic potential areas such as Brydson Spring or higher potential areas up-gradient of the site and that the data shows that significant water level changes will not occur as a result of making vertical hydraulic connections within the quarry.

Burnside Response

Well M15 was retrofitted on May 1 and 2, 2014 and water level data was collected on May 1, 2, 5 and 6, 2014. Ideally additional water level data will be collected to confirm that the water levels were not influenced by the water that was already in place in the open hole M15. Since water levels in M15-III and M15-IV are almost identical, it suggests that the fracture systems are connected. Collection of additional water level and water quality data should assist in improving the understanding of the vertical movement of groundwater in the bedrock.

2.2 Hydraulic Testing in Multi-Level M15

Hydraulic testing of M15 was conducted on May 6, 2014. The testing was conducted both by adding a slug of water to the test interval (falling head test) and recording the response and by removing a physical slug from the test interval (rising head test) and recording the response. The highest values for hydraulic connectivity were found in M15-I and M15-II, both of which are below the proposed level of the quarry. Harden indicates that approximately 75% of the flow to the well comes from the aquifer represented by test intervals M15-I and m15-II.

Burnside Response

The use of a variety of methods to obtain values for hydraulic conductivity has resulted in similar estimates of hydraulic conductivity. Harden should provide some commentary on how the hydraulic connectivity found at M15-II relates to the high connectivity zone used in layer 1 of the original modeling. It appears that this higher connectivity zone found in M15-II is below the base of the quarry and it is not clear how this may impact the interpretation of the geology that was used to create the original model.

Since the water levels at M15-IV and M15-III are so similar, it would have been helpful to monitor water levels in both wells when the rising and falling head tests were completed in order to see whether there was any connectivity between the wells. This would also help confirm the integrity of the well seal. This data likely exists and if so should be reported.

2.3 Combined Impact of Future Rockwood Well Number 4 and Hidden Quarry

Harden indicates that hydrogeologic work presented by both Gartner Lee and Aqua Resource and their modeling of the capture zone of future Well 4 indicate that the primary source area for the new well will be north and east of the well which does not include the area of Hidden Quarry. Harden also indicates that the Quarry will become a large reservoir of water and therefore will become a positive boundary condition for the expanding cone of influence of the well and for local wells. This will end up resulting in a lessening of the impact on Well Number 4 on aquifer levels local to the quarry.

Burnside Response

Burnside concurs with Harden that the Hidden Quarry site should likely not have a negative impact on Rockwood Well Number 4. Monitoring of wells within the quarry during the pumping test for Well 4 will be used to assess the degree of connection (if any) between the new well and the bedrock aquifer in the area of the proposed quarry.

2.4 Water Quality Testing in Multi-Level M15

Water quality samples were collected by Harden for each of the test intervals in new multi-level M15. Harden indicates that a minimum of 6 well volumes were removed from each of the test intervals prior to water quality samples being collected. The highest concentration of nitrate (3.17 mg/L) were found in M15-III with the lowest concentration (1.62 mg/L) found in the sample from M15-I. Nitrate was also present in M15-II (2.19 mg/L) and in M15-IV (1.96 mg/L). Highest values of TKN (0.9 mg/L) were found in M15-III with concentrations much lower (0.19 to 0.28 mg/L) in the other 3 intervals. Harden concludes that the fact that the highest TKN, DOC

and nitrate concentrations occur in M15-III suggests that this intermediate depth fracture set interacts with shallow fracture sets resulting in the movement of chemicals lower within the aquifer. The lower concentrations seen in M15-I and M15-II suggest that there is some degree of isolation between the fracture sets although the mere presence of TKN, DOC and nitrate within these lower fractures suggest interconnectivity between the lower and upper fracture sets.

Burnside Response

The water quality sampling indicated the greatest anthropogenic effects occur in well M15-III with concentrations of nitrate, DOC and TKN lowest in the deepest screen (M15-I). Additional water quality sampling undertaken concurrently with sampling of other monitors on site will assist in establishing the pre quarry water quality at the site. Monitoring of water levels in M15-IV while pumping M15-III will assist in assessing the degree of connection between fractures. Water levels should be recorded at all monitoring well locations during the next round of sampling to further confirm the extent of vertical connection and confirm well integrity.

3.0 Nitrate Balance M15 Results and Re-testing of Guelph Limestone Quarry

3.1 Guelph Limestone Quarry Water Quality Sampling

Harden collected four additional water samples from the Guelph Limestone Quarry (formerly Dolime Quarry) in order to evaluate the water quality impact following blasting at the site. Samples were collected on April 28, 2014 12 min 78 min and 15 hr after the blast and analyzed for nitrate, nitrite, TKN and ammonia. Total ammonia and nitrite were not detected in any of the samples. Concentrations of TKN increased immediately after the blast in samples collected at 12 min and 78 min, but then returned to below pre-blast concentrations in the 78 hr sample. Concentrations of nitrate remained relatively stable between 0.44 and 0.47 mg/L in all samples. Harden indicates that the elevated TKN in samples following the blast is likely related to organic nitrogen being stirred up from organic material in the pond. Once this material settled the TKN concentrations returned to normal. Harden also indicates that a sample collected on an occasion in 2012 from the Guelph Limestone Quarry was analyzed for other parameters including volatile organic compounds, petroleum hydrocarbons and polyaromatic hydrocarbons. This previous sample met all of the Ontario Drinking Water Quality Standards.

Burnside Response

The data presented by Harden indicates that subaqueous blasting at the Guelph Limestone Quarry did not result in any appreciable increase in nitrate concentration. It would appear that background levels in the quarry are about 0.5 mg/L. Harden should clarify the following to provide assurance that the results are directly applicable to the Hidden Quarry:

- How does the active dewatering in the quarry impact the background nitrate concentrations?
- Is the mass of nitrate in the explosive and the volume of water in the quarry comparable to what will be seen at Hidden quarry? It would appear that the volume of water at the Guelph Limestone quarry is much greater than what will be seen at the Hidden Quarry thereby diluting the mass of nitrogen in the explosives.

3.2 Nitrogen Compounds in Groundwater and Surface Water

Harden has collected 16 groundwater and surface water samples since February 2012 at the Guelph Limestone Quarry Pond. Results indicate that the pond quality is generally better than either the groundwater flowing into the Hidden Quarry site or surface water flowing into the Hidden Quarry site. In all circumstances, the Ontario Drinking Water Quality Standards for nitrate or nitrite are not exceeded, however their operational guideline for organic nitrogen was exceeded in every water type.

Burnside Response

Nitrate in groundwater samples from wells at the Hidden Quarry site range in concentration from 0.9 mg/L at M13D to as high as 5.2 mg/L at M3. Nitrate concentrations are 4.64 mg/L at SW4 and 4.53 mg/L at SW8. The nitrate concentrations in all samples collected from the Guelph Limestone Quarry are below the laboratory detection limit. The low levels of nitrate at the Guelph Limestone Quarry pond appear to confirm Harden's assertion that blasting at the Hidden Quarry site will not result in adverse levels of nitrate in the surface water. However, the amount of nitrate should be converted from mg/L to a mass that can then be applied to the anticipated volume of water in the proposed quarry to allow for a concentration in mg/L to be calculated. This is mentioned in the notes associated with Table 7, however details are not provided.

3.3 Revised Nitrate Prediction

Harden previously provided a water quality balance for nitrate in their January 14, 2014 letter. This has been revised based on the recent testing of the Guelph Limestone Quarry and the water quality testing of the multiple wells at M15. Revisions include:

- Distributing the nitrogen concentration evenly throughout the aquifer.
- Allowing mixing in the upper middle portions of the aquifer due to the revised quarry elevation 327 m asl.
- Reducing the introduction of nitrogen to the quarry pond by blasting activities as indicated by the recent Guelph Limestone Quarry sampling.
- Including dilution from infiltrating precipitation as suggested by R.J. Burnside & Associates Limited.
- Revised mass balance as a presented in Table 7 of the letter and the resultant change is a reduction in nitrate from 4.38 mg/L where it enters the property to 3.67 mg/L where it leaves the property.

Harden indicates that the observed reduction in nitrate across the site is already more significant than presented in Table 7 suggesting that de-nitrification is already occurring in the aquifer. Harden also indicates that biological activity in the future quarry ponds will also utilize nitrogen and therefore the nitrogen concentration down-gradient of the quarry boundary will continue to be less than that entering the quarry property.

Burnside Response

The previous nitrogen balance was provided by Harden in their letter (Response to Burnside review of Drilling and Testing of new well M15 at Hidden Quarry Site) of January 14, 2014. The rationale presented in the letter indicates that 894 kg of nitrogen residue will be available for dissolution in the water. Although it appears that no nitrate was added to the Guelph Limestone quarry following blasting, some additional detail on the fate of the nitrogen should be provided.

4.0 Deeper Water Sources and Water Quality

JDCL has agreed to limit the depth of the Quarry to an elevation of 327 m asl. Harden indicates that the drilling of M15 has confirmed a significant water bearing fractures occur beneath the depth of the proposed quarry and that Rockwood Well Number 3 obtains water from fractures below this elevation.

Burnside Response

The reduced depth of the quarry provides an additional level of opportunity for any domestic wells that may be impacted from a quality/quantity perspective due to quarrying operations. This will allow wells that are shallow to be drilled into the deeper fracture system thus providing a better opportunity of maintaining a good water supply. The detailed domestic well survey to be completed by JDCL should include confirmation of existing well depths so that the potential for drilling a deeper well on a specific lot can be established.

4.1 Current State of Local Water Supplies and Vulnerability of the Aquifer

Samples collected by Harden on April 8, 2014 had significant levels of both E.coli and total coliform in Tributaries A, B and C. Samples collected on the same day from the Guelph Limestone Quarry did not contain giardia, cryptosporidium or E.coli, however total coliform was detected.

Harden attributes the E.coli in the streams to farming activities such as cattle yards and manure spreading. Harden suggests that although the Hidden Quarry is closer to the five down-gradient wells than the farm fields, cattle yards and horse facilities, Tributaries A, B and C will deliver contaminants to the lands just north of Highway 7 where these contaminants infiltrate and enter the bedrock aquifer underlying the sand and gravel. Harden also indicates that samples collected from proxy sites demonstrates that the water quality in quarries is generally far better than that found in tributaries A, B and C at the Hidden Quarry site that the stored volume of water in the quarry offers at least 20 times more dilution than the existing bedrock aquifer. Based on this evidence Harden concludes that the Hidden Quarry will not be a major source of potential bacteriological contamination in this area.

Burnside Response

The location of the Guelph Limestone Quarry does not lend itself to being a recipient of significant E.coli since it is located largely within an urbanized area. Although there are some agricultural uses on the land to the northwest, any run off from these lands will likely enter the Speed River prior to impacting the quarry lands. In addition there is active dewatering in the Guelph Limestone Quarry which will draw water from the surrounding aquifer into the quarry. It

is not known how this may impact the water quality in the quarry. Although the west quarry pond may have significant dilution potential,

To date water quality samples have been collected from monitoring wells on the Hidden quarry site and no samples have been collected from nearby domestic wells. The current water quality in down-gradient wells should be assessed as part of the quarry application process since it appears likely that they may already have elevated nitrate levels. This will allow for existing impacts from current land uses to be quantified and will provide baseline water quality data so that future impacts (if any) from the quarry can be quantified and remediated if necessary.

4.2 Recent Research and Susceptibility of Local Wells to Contamination

Harden indicates that recent work at the University of Guelph Arkell Research Station suggests that there is significant bacteriological contamination of the underlying bedrock aquifer despite being overlain by over 12 m of glacial sediments. Harden indicates that this suggests that the aquifer down-gradient of Tributary A, B, or C or where glacial sediments are known to be less than 10 m thick are already susceptible to contamination originating from surface water infiltration. Other recent research cited by Harden indicates that a recent study found that 97 % of wells tested in southern Wellington County have some indication of sewage derived contamination. The conclusion of this investigation was that "*all well types completed in the fractured bedrock aquifers of southern Wellington County are susceptible to contamination with at least one type of organic waste water contaminant regardless of the wells construction, depth, surrounding land use, overburden thickness"*. Harden concludes that groundwater contamination from human activities is already occurring in this area. However, Harden also suggests that other mechanisms such as sunlight, biological activity and the dilution potential of the quarry will result in improved water quality in the aquifer.

Burnside Response

It is not clear whether comparison with the Arkell site is appropriate given that the research station is an intensive chick and swine research facility and as a result likely produces significant amounts of manure in comparison to some of the agricultural activities currently in the area of the Hidden Quarry. The fact that all wells in the area are deemed to be susceptible to contamination reinforces the fact that a comprehensive pre-quarrying baseline study needs to be undertaken in order to establish the current water quality and capacity. This is important as it will protect both the proponent and homeowner from any quality claims that may occur in the future. This study should be undertaken prior to approval in order to quantify how many wells (if any) have current water quality issues and which wells may be adversely impacted by any water quality changes that result from quarry operations.

4.3 Waterfowl Use of Hidden Quarry Pond

Harden indicates that the use of the east and west pond by waterfowl will be limited by characteristics of the pond such as deep water, rocky shoreline and dense shoreline vegetation as discussed by GWS Ecological Research and Forestry Services. Harden also indicates that waterfowl were observed in the Guelph Limestone Pond at the time of the water quality sampling for E.coli, cryptosporidium and giardia. None of these bacteria were detected in the water. Harden concludes that the natural introduction of nutrients and bacteria by water fowl and wild mammals will not occur at a significant level.

Burnside Response

JDCL should configure the ponds and adjacent shoreline to discourage the use of the ponds by waterfowl.. However, it is still possible that the quarry pond will become home to a number of animals following the end of extraction activities. This may increase the potential for giardia and cryptosporidium to enter the water system. This should be considered as part of the monitoring program.

4.4 Water Quality Early Warning and Mitigation

Harden indicates that there are a number of on-site monitoring wells that will be utilized to provide an assessment of water quality changes well in advance of any water moving off site. Harden indicates that even after 4 years of quarrying north and west of Tributary B the only private wells down-gradient of the extraction are W10 and W16. The drilling of well M16 will not occur until after the quarry license has been approved. However there will be several years of activity on the west side of Tributary B before the quarry on the east side is commenced which will allow ample time for baseline conditions to be established. Harden indicates that water well surveys immediately down gradient of the site have been undertaken at various times since 1995 and that none of the 5 wells immediately down-gradient of the site meet current O. Reg. 903 standards. However Harden indicates that although the wells do not comply with O. Reg. 903, they do not need to be accessed for water quality assessment since the water will be taken from plumbing fixtures. Baseline water quality and quantity assessments of wells W10, W16, W17, W18 and W19 will be undertaken as part of the overall private wells survey. Proactive modifications or retrofitting of these down-gradient wells such that they are only taking water from the deeper fracture sets will be undertaken at the request of the landowner. Harden also recommends that UV systems be installed at no cost to the landowners. Harden concludes that there will remain access to abundant high quality domestic water supplies at all receptors.

Burnside Comment

It is Burnside's opinion that it is preferable for residents to refrain from the need to use water treatment systems if possible. As a result Burnside recommends that the condition of the closest down gradient wells be investigated as part of the on-going studies in support of the quarry application. The assessment should include detailed documentation of the surface condition of the well, the depth of the pump, a brief pumping test to quantify the well yield and collection of water quality samples. The potential to deepen the well to access the deeper fracture system below 327 m asl should be evaluated. The survey should also identify the repairs needed in order to bring all wells in compliance to O. Reg. 903. Compliance with O. Reg. 903 decreases the chances that water quality impairment is being caused by the condition of the well which will make future evaluation of water quality easier. If the quarry application is approved, then the necessary repairs/retrofits to these wells should be undertaken within one month of license approval. Burnside also suggests that drilling of well M16 be undertaken as part of the approval process as it will provide additional data on the eastern portion of the property where there are limited deep monitoring wells.

5.0 Local Well Survey

JDCL agreed to undertake a voluntary detailed well survey and water quality assessment of wells within 500 m of the quarry. This will be conducted to establish baseline water quality and quantity conditions. Harden Environmental indicates they have already undertaken 3 such studies as summarized in the current letter. JDCL has agreed to upgrade wells, those in pits or buried to facilitate water level monitoring of up-gradient wells, if agreed to by the homeowner. Harden indicates that based on previous surveys, this will include well W5, W8 and possibly W7. Down-gradient wells and those distant from the quarry are not expected to experience any significant water level change, or have a higher water level, and thus regular water level monitoring is not needed and water quality can be obtained from the existing plumbing system. Harden indicates there will be minimum period of 2 years after the quarry is given approval before below water table extraction can commence. This provides ample opportunity to obtain seasonal water quality data as recommended by R.J. Burnside & Associates Limited.

Burnside Response

Burnside recommends that all wells to be monitored be upgraded as required. Burnside recommends that water level and water quality samples be collected from those wells immediately down-gradient of the pit. We also recommend that the well heads be retrofitted to bring them in compliance with O. Reg. 903. This will ensure that any water quality issues in the future are not a result of well construction and will make it easier to resolve any future interference claims if they arise.

6.0 Quarry Depth Limitation

JDCL has agreed to limit the depth of the quarry to a minimum elevation of 327 amsl.

Burnside Response

The original proposal was for extraction to 320 m asl. The revised extraction depth will provide a greater opportunity to deepen domestic wells in the event of a change in water quality/quantity.

7.0 Brydson Spring and Blue Springs Creek

Harden indicates that the quarry will not result in any reduction in flow in the Brydson Spring and that it is likely that the infiltration of waters of Tributary B and C contribute significantly to the Brydson Spring discharge. Since the flow in Tributary B and C will not be affected by the quarry operation, no change in the outflow from Brydson Spring will occur. JDCL has agreed, providing that permission is given by the owner, to conduct flow and water quality testing of the spring to establish baseline conditions.

Burnside Response

Conducting baseline flow and quality monitoring of the Brydson Spring will help to address concerns raised by both the GRCA and Halton Region.

8.0 Rock Extraction Water Level Change Monitoring

JDCL has agreed to limit the depth of the quarry to an elevation of 327 m asl. The elevation of the water table in the sinking cut is approximately 350 m asl. Harden proposes to use M3 as a reference elevation resulting in a minimum allowable water level in the sinking cut of 346.83 AMSL. JDCL proposes to hang a buoy from a tether with the buoy floating in the water until the water level falls below an elevation of 346.83 amsl at which point extraction will stop until water levels recover. JDCL has agreed to install a dedicated monitoring well as an open hole to 327 AMSL in the quarry limits. This well will be installed as M17.

Burnside Response

Information in the original Harden submission indicates that well M3 is only screened to a depth of 350 amsl which is indicated to be the elevation of the water table in the sinking cut. As a result it is not clear whether this well is an appropriate monitor to use to establish the low water level in the sinking cuts as it is completed within the upper portion of the bedrock at the water table elevation and there is still 23 m of bedrock to the base of the pit. Burnside recommends that a hole at the site be extended down to a depth of 327 amsl and be completed as an open hole in order to mimic the conditions within the quarry. Burnside concurs that the installation of M17 is an appropriate idea however it does not appear on Figure 2 as indicated by Harden.

8.1 Historic Low Water Level

Harden expects that there will be a maximum water level change at the quarry edge of 2.45 m and 1.6 m at the nearest private well. This quarry induced change is in addition to the natural variation in water levels. Therefore when water levels are at their natural low (as obtained from historic water level data) an additional 1.6 m of water level change is anticipated at the nearest well. JDCL has agreed to conduct a voluntary detailed private well survey to determine if any well could be impacted by the predicated change in water level, either modify the well or decrease the level of drawdown in the quarry as necessary. Harden includes a detailed monitoring plan in Appendix E of the letter.

Burnside Response

Burnside recommends that the well survey be done as part of the quarry approval process with a short term test designed to mimic typical domestic use completed. This will allow an assessment of typical water level declines under normal use. The current pump settings should also be confirmed so that assurances can be provided to homeowners that the 1.6 m change in low water levels will not impact the ability of the well to meet their normal domestic needs. If necessary the pump should be lowered to provide an appropriate margin of safety. An individual well construction drawing should be prepared for each well. A rating system should be developed that can be used to calculate the likelihood and type of impact (if any) from the quarry for each well. A detailed contingency plan is needed so that a formalized method to respond to well interference complaints is in place.

8.2 Monitoring Plan Revisions

A variety of changes to the monitoring plan have been made by Harden, primarily in accordance with requests from the GRCA to provide more rigorous monitoring of surface water features. Harden indicates they have provided the location of the well M17 on Figure C1.

Burnside Response

Burnside could not locate well M17 on Figure C1. The comments below pertain to the monitoring program provided in Appendix E of the Harden letter:

- Burnside recommends that well M3 be deepened to 327 m asl and completed as an open hole which will allow it to monitor water levels in the sinking cut. Currently this well is completed to a depth of 350 m asl with approximately 23 m of bedrock between the bottom of the well and the bottom of the sinking cut. As a result, it is possible that this well does not provide a true indication of water levels throughout the entire bedrock sequence. The table on page 2 of the monitoring program should include a section on domestic wells. At this point the domestic wells to be monitored should include the closest wells both up-gradient and down-gradient of the pit with semi-annual water quality monitoring and daily water level monitoring with dataloggers. The table should include a notation that the program will be modified following the baseline survey.
- Section 2.1 of the monitoring program includes the trigger levels for the bedrock aquifer and with the levels for M15 and M16 to be determined. Burnside recommends that monitoring begin at M15 as soon as possible in order to establish water levels for a number of seasons so that a reliable true historical low water level can be established. Similarly, M16 should be installed as soon as possible so that a meaningful pre-extraction water level database can be established.
- Protection of water quality/quantity in domestic wells should be a primary objective of the monitoring program. Since fractures in bedrock are heterogeneous, water levels on the site may not be representative of levels in domestic wells completed at similar depths. Rather than expanding the on-site monitoring network, Burnside recommends that a rigorous domestic well monitoring program be set up with trigger levels for each well and a well specific contingency plan.

2.3 Trigger Levels for Sinking Cut

Harden proposes to use a floating buoy as a visual indicator that the water level is being maintained above 346.83 amsl. Burnside recommends that a logger be installed with internet based access so that the water level in the sinking cut can be verified by authorized users who are independent of JDCL. It is recommended that the Township of Guelph/Eramosa be one of these authorized users. Provisions should be detailed in the monitoring program for notification of interested parties in the event that extraction needs to stop due to a decline of water levels below 346.83 amsl.

3.0 Contingency Measures

Harden provides protocols to be followed in the event that a trigger level for groundwater levels and the northwest wetland water levels are exceeded.

Burnside Response

Harden should provide a timeline for notification of the Township and GRCA following the investigation of the trigger level breach. We also suggest under item 2 that the wording be changed from “within 7 days conduct an evaluation” to “within 7 days complete an evaluation”.

Each of the recommended actions under item 3) are appropriate, but a decreased rate (or stopping) extraction should occur while the other options are investigated or put in place. As an example, it is anticipated that increasing the length and/or width of the barrier may take some time to implement and impacts will need to be reduced to below trigger levels while the work is completed.

3.2 Water Quality

Harden indicates that if the Quarry is found to be responsible for a water quality change then semi-annual testing of water quality of private wells that could be potentially impacted by the quarry will occur. In addition Harden indicates that in the event that a water quality issue related to the quarry occurs, JDCL will remedy the issue by providing the appropriate treatment, drilling a new well or isolating the water supply to the deeper aquifer.

Burnside Response

There needs to be clarification provided for the term "*A water quality issue related to the quarry occurs*". As with water levels, there is likely to be variation in water quality over time which will not necessarily be due to quarrying activities. As a result, baseline seasonal water quality must be established in all domestic wells within 500 m of the quarry prior to commencement of quarrying activities. Once the baseline is established then it is important that the parameters to be assessed and the limits allowed be established prior to the beginning of any extraction activities. The water quality data should be used in conjunction with the well information collected (as discussed in response 8.1) to identify wells to be included in the long term monitoring program.

4.0 Pre-Bedrock Extraction Water Well Survey

Details are provided regarding the information to be collected as part of the pre-extraction well survey. Wells that are identified for inclusion in the monitoring program will be modified as necessary by JDCL to permit continued monitoring.

Burnside Response

The condition of the well casing (visual inspection only) and lid should be documented as part of the well survey. Similarly the drainage around the well head should be delineated

5.0 Annual Monitoring Report and Interpretation

Harden indicates an annual report will be prepared and submitted to the Ministry of Environment and the Ministry of Natural Resources on or before March 31 of the following calendar year.

Burnside Response

The Township of Guelph/Eramosa should also be provided with a copy of this report.

9.0 Additional Work

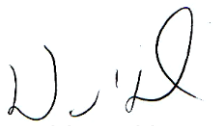
The proposed quarry has the potential to impact water levels and water quality in nearby domestic wells. There is also the potential that changes in flow could be observed in the Brydson Spring. Although many of the domestic wells have been visited, there has been no detailed data collected. Burnside recommends that the following additional data be provided as part of the application:

- A detailed well survey needs to be completed for all domestic wells within 500 m of the proposed quarry (and wells along 7th line to the East). The survey should include measurement of well depth, static water level, pump setting along with descriptions and photographs of well condition and accessibility for monitoring. Water quality samples should be collected. The results of the survey should be used to prepare a contingency plan for each well in the event water quality/quantity is impacted by the quarry. In particular, wells that could be deepened to access fractures below 327 amsl should be identified. Wells that require repairs to allow for monitoring or to prevent surface water intrusion should be identified.
- New wells M16 and M17 should be drilled and evaluated in the same fashion as M15.
- The Brydson spring should be investigated with a flow monitoring program implemented so that the pre-quarry base flow relationship between the spring and Tributary B can be established.
- Water quality samples should be collected from the on-site monitors and surface water features at the same time as the domestic well samples to allow for water quality to be compared.

If you have any questions regarding these comments please contact the undersigned.

Yours truly,

R.J. Burnside & Associates Limited



David Hopkins, P.Geo.
Senior Hydrogeologist
DH:sd

cc: Ms. Kim Wingrove, Township of Guelph/Eramosa (Via: Email)
cc: Mr. Greg Sweetnam, B.Sc., James Dick Construction (Via: Email)