CREDIT VALLEY CONSERVATION

November 20, 2008

Mary Hall
Planning Director
Town of Caledon
P.O. Box 1000
Caledon East, Ontario
L0N 1E0

Dear Ms. Hall:

Re: Rockfort Quarry Application
James Dick Construction Limited
Pt. Lots 1, 2 and 3, Concession 6 W.H.S.
Town of Caledon Region of Peel

This letter will provide the Town of Caledon with comments from Credit Valley Conservation staff (CVC) in regards to an application to amend the Official Plan and Zoning By-law to permit a quarry by James Dick Construction Ltd. (JDCL). CVC's comments, along with other peer reviews provided by consultants retained by the Town and Region, will be released through the Town on November 21, 2008 as prescribed in the schedule of key milestones established for the Ontario Municipal Board (OMB) hearing which is to commence on May 25, 2009.

CVC has been involved in providing environmental advice and technical review of the application since its original submission in 1998. Since 2003, CVC has been involved in review of a Comprehensive Broader Scale Environmental Study (CBSES) prepared by JDCL for Aggregate Resource Area 9-A and a recent review of studies supporting the revised site specific application submitted in July, 2008. CVC is to take a position on the matter on January 23, 2009.

These comments will be provided by discipline in two categories, the first being related to the site specific application and the second related to the Adaptive Management Plan (AMP).

CVC retained a number of experts to review the applications and their comments are contained in the Appendices: Appendix A: Ray Blackport, hydrogeological review of the site specific application and the AMP; Appendix B: Roger Phillips, fluvial geomorphological review of the AMP and Appendix C: Donald G. Weatherbe, Water Resources Engineer, review of Temperature Model.

To provide the context for CVC's review, the following provides a brief characterization of the general area and its environmental features and functions. The quarry is proposed on 220 acres at the north-east corner of Olde Base Line and Winston Churchill Boulevard. JDCL has applied for a Category 2 License for a quarry below water table.

The property is adjacent to two Areas of Natural and Scientific Interest (ANSI), one known as the Caledon Mountain Slope Provincially Significant Life Science ANSI and the second known as the Terra Cotta Forest Provincially Significant Life Science ANSI.

The property is also adjacent to the Caledon Mountain Environmentally Significant Area (ESA) and the Terra Cotta Woods ESA as designated by CVC.

There are two Provincially Significant Wetlands (PSW) in the immediate vicinity known as the Caledon Mountain Provincially Significant Wetland and the Ballinafad Ridge Provincially Significant Wetland. Two other non PSWs are located adjacent to the property known as the Erin Town Woods Non-Provincially Significant Wetland and the Belfountain Non-Provincially Significant Wetland.
There are tributaries of Rogers Creek and Second Creek adjacent to the property with associated flood plains and erosion hazards. The watercourses are managed as a coldwater fishery.

The watercourses and associated hazards, wetlands and adjacent other areas are regulated by CVC pursuant to Section 28 of the Conservation Authorities Act with only a small portion of the property being regulated. It should be noted this regulation does not apply to activities approved under the Aggregate Resources Act.

A number of species at risk that are identified for the area including Jefferson Salamander, Western Chorus Frog, Blandings Turtle and Butternut.

1) Site Specific Application

a) Fisheries/Fish Habitat

New sources of information and assessment tools since the original submission e.g. Credit River Water Management Strategy Update (2007), Credit River Fisheries Management 2002 Plan, Evaluation, Classification and Management of Headwater Drainage Features Interim Guidelines March, 2007 should be utilized to identify the fishery and potential impacts.

The addendum adds new data surrounding the site but does not integrate it in a cumulative and ecosystem approach. Integrative concepts such as RCC and Stream Order should be applied and interpreted at the site scale. There is also a lack of integration of new data that was collected as part of CBSES.

Mapping or clear descriptions of the warm, cool and coldwater reaches, potential and management zones needs to be provided. This would enable clear depictions of isolated populations and their critical refuge habitats. This would also provide an overall picture of the fishery that is too often lost by the reach by reach breakdown and provide ability to understand the functions of the watercourses particularly the reaches adjacent to the quarry and how they contribute to the downstream fishery. It could also assist to identify a system of monitoring sites.

The functions of the Rockfort Drain functions are not well documented. For example, the catchment area for Rockfort Drain is approximately 60 ha which provides 10% of the catchment sustaining Reach 12 (seasonal fishery), which represents 50% of the flow to Reach 13 (brook trout fishery). The Classification and

Management of Headwater Drainage Features Interim Guidelines could be utilized to assess the functions of the Rockfort Drain and other headwater features (e.g. Hutchinson Swale). The assessment should include all phases of the quarry.

The modelling appears to indicate that portions of the Second Creek tributary north and west of Shaws Creek Road (part of Reach 12) will be impacted by a drawdown of groundwater levels; although this area is indicated to be within the "limit of competent Eramosa". This fishery and its connection to the groundwater system needs to be more clearly characterized and predicted impacts addressed.

The Ecoplans 2000 Report Executive Summary identifies a minor reduction in the spring/early summer duration of flow and associated bait/forage fish use. Reduction of flows in Reach 2, 6 and 8 could reduce or exclude seasonal reproduction. This should be further discussed and assessed utilizing DFO's (Department of Fisheries and Oceans) Risk Management Framework (RMF). Furthermore, there is potential for losses to baseflow to perennial Reach 7. Although flows may be supplemented to this reach by pumping. It is not clear if this pumping provides the functions of a natural spring to a coldwater managed fishery.

CVC has entered into an Agreement with DFO, which has established a streamlined approach to addressing issues pertaining to the Federal Fisheries Act. CVC staff, in consultation with DFO staff, are responsible for co-ordinating the review of proposed works that may result in a harmful alteration, disruption or destruction of fish habitat (HADD). DFO has previously determined that if the Adaptive Management Plan works as designed there would be no HADD. Since that determination was made, extensive data has been collected and analyzed around the site, (i.e. CBSES), and within the Credit River watershed (i.e. CRFMP). In addition, several tools have developed to assess fish habitat and potential impacts (i.e. DFO's Risk Management Framework and Classification and Management of Headwater Drainage Features Interim Guidelines). CVC has analyzed the new information that has been collected and applied RMF to the project. DFO has been asked to review our analysis and to provide further direction.

b) Water Quality

There is a lack of integration of information collected through CBSES with respect to the benthic community.

There is a lack of assessment of potential impacts on the benthic community and water quality. Any identified changes in the benthic community should include further investigation of other water resources especially water chemistry and flow.

c) Water Temperature

There is no assessment of warming on the nearest reaches that are warm or coolwater. A thermal contour map should be overlayed with the stream network.

A 1°C increase in critical coldwater habitat could be a significant impact given the degree of error and variability involved. Also over a 30-50 year period the cumulative effects of climate change must now be considered.

d) Terrestrial

Rockfort Quarry Report (2000) states "wetlands smaller than 2 ha are too small to be evaluated". The Ontario Wetland Evaluation states, "In general, wetlands smaller than 2 ha (5 acres) will not be evaluated. However, very small wetlands can sometimes provide important habitat for wildlife or be important for other reasons. This is particularly true in wetland complexes. Wetlands smaller than 2 ha can be evaluated and the rationale for including them attached to the data record." The Ontario Ministry of Natural Resources (MNR) has provided examples of the rationale for evaluating wetland units under 2.0 hectares and wetland communities under 0.5 hectares. Some of these smaller wetlands likely match the rationale provided by MNR and subsequently may be evaluated and could be complexed with existing Provincially Significant Wetlands.

Wetland complex boundaries in the area have been changed since the Rockfort Quarry Report (2000). MNR is currently working in the area to update and reassess the wetlands of the surrounding landscape. New PSW in the vicinity is likely.

The submitted documents should use the most up to date wetland mapping and evaluations from the Ministry of Natural Resources. Impact analysis should be based upon the updated information.

There is a lack of recognition of connectivity functions and the area functioning as a system. There is also a lack of recongition of all wetland functions including fish habitat, base flow and flood storage.

Impacts on biological features and functions have not been appropriately addressed including loss of potential restoration opportunities. The impacts to Species at Risk have not been appropriately addressed. The report needs to address breeding habitats, foraging habitats and migration of these species. Assessment needs to address both the actual quarry, operation of the quarry (i.e. noise and dust) and other impacts such as road widenings and increases traffic. The impacts of the loss of the plantations the fucntions of the eastern woodland and the connectivity to the Niagara Escarpment have not been addressed.

The proposed restoration plan for the quarry is a lake which has limited biological value (i.e. lack of structure or biological diversity. A more complex diverse restoration plan should be proposed which will mitigate some of the impacts resulting from the loss of the multiple terrestrial habitats.

Mitigation measures do not address hyroperiod and discharge rates of groundwater to wetlands.

Impacts of noise on sensitive species have not been addressed.

There is a lack of identification of local or regionally rare species.

e) Hydrogeology

see Appendix A

2) Adaptive Management Plan

a) Fisheries

There may be offsite mitigation/compensation measures that may not be acceptable to landowners or approved by agencies such as deepening of existing ponds and pumping to ponds and springs. These mitigation measures should not be proposed for impacts resulting from the quarry since they may not be achievable. Furthermore, pumping is not a sustainable substitute for the maintenance or restoration of natural functions.

There are also insufficient details with respect to mitigation measures (e.g. stormwater management pond) to ensure that these features do not result in negative impacts.

Additional monitoring information is required. For example, the plan should not assume a linear relationship or depend on early warning indicators but consider sudden threshold changes in stream ecology. There appears a focus on monitoring ponds but no reasons are provided for this focus. Further consideration should be given to utilizing up and downstream/gradient control sites.

Although spawning surveys may be repeated, piezometers provide the best monitoring indicator in such critical habitats. CVC prefers using piezometers in ponds as they can infill over time and have temperatures affected in other ways.

CVC defends the MNR protocol for fish biomass sampling over the use of spawning surveys to quantitatively monitor fish populations. Annual surveys can be decreased over time as already demonstrated at other CVC IWMP sites. Comparative biomass data watershed wide is available and should be utilized.

Consider TRCA/CVC Headwater monitoring/research. Intermittent and warm/cool communities require more attention in the monitoring plan.

CVC needs to consider a more concentrated, frequent and updated sampling (missed the wettest year 2008) at the site level and suggests monitoring a minimum of 15 sites to represent most stream reaches that are unique/isolated plus additional landowners as requested. Monitoring below each confluence as a systems approach would also be appropriate and should include for each stream type e.g.

Ephemeral hydroperiods (days of flow)
Intermittent hydroperiods, weekly rates, flow peaks and annual fish species presence.
Permanent reach temps, monthly baseflows and piezometer, annual fish biomass.
Associated wetland watertables.

The plan states target levels are to be set. CVC would appreciate further discussion (using CRWMSU targets for all disciplines) but cannot endorse the plan prior to this.

Also note that DFO and MNR are also promoting and have trained CVC staff on alternative Instream Flow Needs assessments for fish. This may also require additional baseline data.

b) Hydrogeology

See appendix A

c) Fluvial Geomorphology

See Appendix B

d) Water Quality

Additional information and discussion is required on identifying the water chemistry parameters of concern (not general categories) and a detailed list of target concentration/levels. Comparison with Canadian Water Quality Objectives should be undertaken to identify potential concerns with off-site discharge of water. This is especially important where no PWQO exists.

More detail is required with respect to isolating the water quality impacts associated with the quarry operations from other sources.

What is the location, length and frequency of monitoring that will be used to determine background conditions?

Monitoring Frequency – at what point will the monitoring program be assessed to determine if monitoring frequencies can be reduced? How will the assessment be done?

The report identifies that water quality monitoring and protection programs are documented in Section 3.6. There is no Section 3.6.

e) Water Temperature

Surface water temperature monitoring should be undertaken using continuous temperature loggers rather than spot measurements. This will provide the ability to capture the critical maximum/minimum temperatures.

There appears to be no background temperature data. What is the location, length and frequency of monitoring that will be used to determine background conditions?

There is insufficient detail with respect to temperature monitoring to determine potential impacts to the termal regime (e.g specific target, baseline, location, length and frequency). Specific triggers with respect to temperature changes during critical seasons are required.

How will mitigation measures be implemented and how long will it take place?

Thermal impacts from the proposed quarry lakes on near reaches have not been adequately addressed.

See Appendix C for comments on temperature modelling.

Please do not hesitate to contact me, if you have any additional questions.

Yours truly,

Liam Marray
Senior Planner/Ecologist
Credit Valley Conservation

cc Kagan Shastri
Attention: Paul DeMelo

Department of Fisheries and Oceans
Attention: Cynthia Mitton-Wilkie, Senior Biologist

APPENDIX A

Hydrogeology

Comments – Updated Adaptive Management Plan, Water Resources Protection, July 2008

Comments prepared by Ray Blackport September 16, 2008.

Attached: January 2003 memo from Ray Blackport to DFO that summarizes concerns with site characterization and suggests ways in which monitoring and AMP could be expanded to address some of the major deficiencies in characterization and previous AMP. Ray's major points appear to have been incorporated into revised July 2008 AMP, although further clarification is required, as described below.

Note: comments in italics intended to clarify information requested by these comments.

Section 1.2 Mitigation Strategy and Adaptive Management Plan

Page 6 second paragraph – It states that the primary component of mitigation measures during active quarrying conditions is the interim recharge system. It is noted that the "interim" recharge system may be required for more than 70 years, which means that there will be considerable maintenance and monitoring during and after active extraction.

Page 7 – first full paragraph - there is a general discussion of the comprehensive monitoring program and when appropriate mitigation measures would be initiated. Details are presented throughout the AMP report.

As a general comment there is little discussion of the time required to initiate the large scale mitigation measures. There should be some discussion related to the monitoring and trigger thresholds in relation to the timelines for the mitigation measures. For example, an issue with a water supply well can be addressed very quickly, so there is little lead time necessary in order to respond effectively. If there are problems with sustaining water levels in a particular area and the grout curtain is required or a modification to the grout curtain is required, how much time is required to install or upgrade large portions of the grout curtain? Could this dictate some of the threshold levels, if for example it could take 8 months to properly install and test an appropriate mitigation system?

Section 2.1 – Phase 1 – North Reservoir

There will be an impact on the groundwater regime as a result of water infilling the void by aggregate extraction. It was previously indicated in the original Water Resources Evaluation Report (2000) that additional water will be required to supplement the inflow of groundwater. This is assumed to be about 40 Igpm. This pumping would be in addition to the groundwater infilling the void. This water taking will take place assuming there are no adverse effects (see second bullet from the bottom of page 11).

What constitutes an adverse effect? If there are adverse effects, how will they be mitigated and how will this be decided?

First bullet, page 12 – ***What does it mean that although no further mitigation measures are anticipated other measures may be implemented, such as local grouting, as appropriate? As per the question above (re North Reservoir) how is this decided?***

Second bullet, page 12 – complete the detailed design and initiate construction of the groundwater recharge system as required for Phase 2.

A description of the development and demonstration of the recharge system is presented in the footnote. Monitoring of a number of wells, during this testing, is also described in the footnote. It is not clear if the nested wells for vertical response distribution along site perimeter locations, as described in Appendix F, will be installed prior to this testing and how the

demonstration testing will be conducted on these wells. This was discussed in the DFO Memo from Blackport Hydrogeology Inc. as included in Appendix B2. These proposed monitoring wells were also discussed in an earlier Memo to DFO by Blackport Hydrogeology Inc., dated January 15, 2003 (see attached).

Could you confirm whether these site perimeter wells will be installed prior to the testing of the recharge system and whether appropriate testing will be conducted to assess vertical hydraulic response? If there are distinct hydraulic responses in specific vertical zones, could you confirm that there will be sufficient testing to verify that water can be recharged to different hydraulic zones, through recharging selective hydraulic zones, to maintain water levels/hydraulic heads in these zones, if necessary?

Section 2.2. – Phase 2 – Plant Area

The groundwater recharge system will be completed prior to Phase 2 including construction and testing as well as confirmation that the minimum water storage is available.

- ***Will this testing and confirmation of sufficient water storage be reviewed by agencies prior to implementation or proceeding with below water extraction?***
- ***At what point will permitting and a C of A be required related to water taking and "recharge" of the water back into the aquifer?***
- ***When the groundwater recharge system is operating what if you need more water, but additional water taking to supplement the recharge system causes and unacceptable impact? Is extraction halted until water there is a sufficient water balance restored? If this scenario was to trigger the installation of a grout curtain how fast could the installation testing and implementation be done, assuming best case and worst case scenarios?***
- ***Under what scenarios would additional recharge wells be required? And would this require additional water to be recharged or will the same amount of water be recharged but the injection volume spread out in a different manner?***
- ***What is necessary to "complete the design of the grout curtain for Phase 3 (3rd last bullet, page 13). Will the design be reviewed by any agencies and what approvals will be required?***
- ***In the same bullet it states "initiate grout curtain installation along recharge perimeter if required based on design. What does this mean? How will the decision be made, based on the design?***
- ***If further mitigation measures are required to the east of the site (bullet 7, page 14) how fast can the implementation be done?***

Section 2.3 – Phase 3

Page 15, 3rd bullet - ***If there are unacceptable changes in temperature, what mitigation would be implemented and how quickly would this take place*?**

Page 15, 2nd last bullet – It is indicated that at a minimum a portion of the alignment adjacent to Phase 3 will have a grout curtain installed to limit recirculation. *What is the expected time frame for this installation and when will this commence?*

If, for whatever reason, (e.g. cost) the grout curtain is not feasible, what mitigation options would be pursued at this point? And could the extraction continue without potentially impacting water resources?

What is meant by "as feasible" in the last sentence?

Section 2.5 – Phase 5

Page 19, 7th bullet – there is the potential for further grout curtain development that may include grouting along the rock pillar between Phase 3 and Phase 5A/B.

How will it be determined if this is required and when would it be implemented if it was required?

Section 2.6 – Rehabilitation

Will the operation of the recharge system and pumping from the two lakes be automated? Will the system be tied into water levels for example, similar to a SCADA system for monitoring water levels and pumping?

Page 21, 2nd bullet – ***What is the anticipated range of timing (in years) of the decommissioning, based on the current 30 year extraction plan and current water balance assessment?***

Section 3 - Performance Monitoring and Response Procedure

Page 23, last full paragraph – ***Can general timeframes be discussed somewhere with respect to how long it will take to implement each of the various mitigation measures to provide some sense of response time to addressing non-maintenance of target levels?***

Section 4 – Water Resources Protection Monitoring

Perimeter Sentry wells- ***Why is there such a large gap between sentry wells along the south side just north of spring 34 (see Figure 4.1)?*** Nested wells are also proposed as discussed in Appendix F, and to be located near some of the sentry wells all the south side. ***Have these locations been selected and when will these installations occur?***

Target Levels and historic Water Levels (pages 30-32) - The approach to target levels appears to be reasonable. Water levels have been monitored for a number of years, as shown by the example in Figure 4.4. Protocols are calculations of target water levels are presented in detail in Appendix C. Could the following questions be addressed to further clarify the approach:

What were the climatic conditions during the time of monitoring? Are they reflective of "average" climatic conditions or have there been extremes and will this be taken into account in setting target levels? Are there monitoring wells or areas that show large fluctuations in water levels and if so, should these areas be looked at more closely to ensure there are no concerns, taking the approach chosen for target water levels?

Section 4.1.4.2 – Available Mitigation Measures

As discussed elsewhere – ***Where will the water come from for increased flow to the recharge wells? In particular, if the water has to come from storage or pumping wells, what mechanisms are in place to ensure that this water can mitigate the situation without creating another impact elsewhere? What time frames are anticipated for the mitigation measures that will require considerable work to implement i.e. Page 38 i) – d) and e)?***

Section 4.4 Water Quality

Has there been any pre-consultation with MOE with respect to the recharge wells and water quality of water to be re-injected into the aquifer system? This is an important aspect of the mitigation, and a "buy-in" from MOE on the feasibility of the recharge system is needed.

Monitoring Frequency and Target Concentrations – page 48
It is unclear what analyses will be conducted.

Will analyses be completed for all ODWQS (as indicated in the Target Concentrations) will the ODWQS target concentrations only be related to the analyses described in the monitoring frequency (i.e. general chemistry, metals, hydrocarbon parameters)?

If there are water quality issues during the active quarrying, with respect to the recharge water, will the recharge system be shut down until an appropriate mitigation measure is assessed and implemented? Will there be monitoring of water quality at the sentry wells it is determined that there are water quality issues with the recharge water?

Section 4.6 Chemical Quality of Imported Fill

Has there been any pre-consultation with MNR or MOE with respect to importing fill into the quarry lakes?

Section 4.7 Water Temperatures

At what depth will the water be pumped, from the reservoir, for use in the recharge wells? It would seem that with continuous pumping from the reservoir that there will be a constant inflow of groundwater at a relatively low temperature, within the lower part of the reservoir and the water temperature at depth would be much lower than the temperatures used in the model simulations in Appendix G of the Water Resources Evaluation report in 2000. If water were pumped from depth in the summer and from the upper zone in the winter the recharge water would be always be cool.

Section 5 – Supplemental Mitigation Monitoring

5.2 – Recharge wells (page 60)

In Section 5.2.1 - ***What is meant by "an adjacent control well as appropriate"*****?**

- ***How will the monitoring be conducted, manually or electronically?***
- ***Will there be any mechanism in place to determine if the recharge wells are functioning properly, other then routine monitoring?***
- ***If the monitoring is electronic how and when is the data downloaded?***
- ***During start up operations for specific recharge wells are pumping rates chosen based on design from the performance testing? Can water level threshold be set in sentry wells and pumping rates adjusted or rebalanced to try to maintain the threshold water levels?***

Section 5.4 – Water Budget Monitoring

Page 67 – Note 14

- ***How was the recirculation rate of 95% determined?***
- ***How much variation is there in the predicted recirculation rate for the different phases, specifically comparing phases before and after a grout curtain?***
- ***Was the 5% of the water that moves offsite compared to the current "flow through" on the site to determine whether this volume of water would be a reasonable approximation of the current groundwater flow that would be cut off by the quarry dewatering?***

Under Section 5.4.4 - Response Actions it states that when there is insufficient water available a response action may be the installation of additional recharge and/or sentry wells. *Please explain how this will work.*

Blackport Hydrogeology Inc
192 King Street South,
Waterloo, Ontario
N2J 1P9

Memo

To: Joey Crocker, DFO

From: Ray Blackport
Blackport Hydrogeology Inc.

CC: Richard Murphy, CRA

Date: 15/01/03

Re: Rockfort Quarry Review

Further to our meeting and discussions regarding the revised Adaptive Management Plan and hydrogeologically related issues I offer the following comments. A number of issues and concerns have been previously raised with respect to the hydrogeology of the Rockfort Quarry, the interpretation of the site features and the potential implications of this assessment. Some of these issues have been addressed, some are unresolved and some will likely never be resolved given the nature of fractured bedrock. This is why an adaptive management plan is developed in a setting such as the proposed Rockfort Quarry.

An important aspect of an adaptive management plan is the ability of a monitoring program to collect the type of data necessary to determine if potential detrimental impacts are going to occur, related to specific ecological features. Mitigation measures can then theoretically be implemented to prevent these impacts from occurring.

In order for an adaptive management plan to work, in this case to ensure there is no impact on adjacent fisheries due to changes in groundwater discharge conditions, the appropriate data must be collected. The linkage of the groundwater system and the fisheries must also be understood with sufficient confidence to ensure that any potential mitigation options will in fact perform as predicted. Again, given the nature of fractured rock this can be difficult.
As I indicated above, I do not believe we are in technical agreement on several groundwater related issues. One of the issues is the proposed groundwater monitoring program. However, in spite of some of these unresolved issues, if certain monitoring programs are developed, my "comfort level" will

increase substantially, with respect to assessing potential changes to groundwater conditions in areas of fisheries concerns, and the ability to mitigate these potential impacts.
I have concerns with two areas of groundwater monitoring. The first is the proposed groundwater level monitoring at the boundary of the proposed quarry operation. The second is the proposed groundwater level monitoring in areas of fisheries concerns. In both cases, groundwater monitoring is proposed over long vertical areas of on boreholes (i.e. large distances across the fractured Amabel Formation.). In my opinion, this monitoring would not determine if water level impacts were occurring in discreet levels of the Amabel Formation. It is my opinion that there are discreet fracture zones throughout the Amabel Formation. The proponent's interpretation is that these fractures are well connected and the Amabel Formation acts as one large unconfined aquifer unit throughout much of the study area.

It is unknown how these higher permeability zones are connected throughout the site and whether they are laterally continuous to areas of fisheries concerns. In other words, we do not know if they are even linked to the fisheries area. Without extensive testing, it would be difficult to assess this. However, if it was the case that there was some form of hydraulic connection and an impact on groundwater conditions in a fisheries area were to occur, it is unlikely that monitoring water levels over large vertical distances in the Amabel Formation would see this. It would also be difficult to mitigate any changes in the groundwater system, as the actual linkage between the site and the fisheries would be unknown. As a result, the appropriate mitigation method would be unknown.

To provide a higher level of assurance that this type of impact will not occur, without conducting extensive hydraulic testing between the site and areas of fisheries concerns, the following additional monitoring or modification to the monitoring program is proposed:

- Add to or modify the current proposed monitoring locations along the southern boundary of the site, to incorporate 2-4 multi-level monitoring locations. It is recommended that three discreet vertical levels be monitored. The vertical locations should be based on packer testing, with installations in a shallow high permeability zone and a deep high permeability zone and in an intermediate high permeability, if one is found. If there are no major differences throughout the borehole, shallow, intermediate and deep monitoring wells should be installed to determine if the water level responses are similar throughout the Amabel Formation. If this is proven, than the long-term monitoring program can be modified accordingly. In my opinion, the results to date have not proven this.

- Monitoring proposed in the areas of fisheries concerns should also have multi-level monitoring installations. The vertical gradient can be determined and insight gained into whether groundwater is discharging to these areas from local lateral groundwater flow, based on topographical conditions, or from deeper intermediate groundwater flow. Monitoring of water levels at different depths will determine whether the hydraulic vertical hydraulic gradient is changing, possibly in response to activities at the quarry. If water level declines are also noted in discreet zones along the property boundary then mitigation methods can be tailored to specific zones in the Amabel Formation, in order to maintain appropriate hydraulic gradients, without affecting the operation of the quarry

APPENDIX B

Fluvial Geomorphologist Consultant Comments (Roger Phillips, Aquafor Beech)

The issues and gaps identified to-date include, but are not necessary limited to, the following:

- **Hydrology Considerations**
  - **General –** Conclusions of Fluvial Geomorphology assessment are strongly dependant on vague expectations of hydrology changes. Detailed expectations based on storm-water management plans and hydrologic modeling are not well outlined to provide substantive justification of conclusions.

  - **Hydrographs** – The **CBSES 2008** report suggests that quarry activities will decrease peak flows resulting in aggradation and a shift in "channel-forming" flows. Modeled hydrographs presented in the **WRED Addendum 2008 – Attachment 5** indicate a possible 25 to 30 % reduction in peak flow rates. While the conclusions of the detailed fluvial geomorphology report by Geomorphic Solutions suggest that this hydrology change will not result in significant channel adjustments from an erosion threshold perspective, the report has not adequately addressed the **CBSES 2008** issue of the geomorphic effects of potential deposition/siltation, including channel capacity, flow redirection, and fish habitat.

  - **Stormwater Management / Dewatering –** The fluvial geomorphology assessment does not address how the stormwater management pond design or dewatering plans will avoid negative impacts to downstream watercourses. Detailed plans should be summarized or clearly referenced in the fluvial geomorphology assessment to demonstrate adequate consideration of this issue in report conclusions.
  - **Baseflow** – The **WRED Addendum 2008 – Attachment 5** report states "[they] do not agree with the CBSES" in that "[f]rom a geomorphic perspective, minor reductions, minor modifications to base flow should not impact channel form and function." Channel process and function are intertwined with biophysical conditions. Further, minor physical channel changes do not imply insignificant ecological implications. This assessment does not consider the geomorphic and ecological implications of potential vegetation encroachment (e.g., grasses) due to lower flow levels during dry periods. The possibility of such impacts should be recognized in the fluvial geomorphology report and documented in the monitoring plans.

- **Geomorphic Field Assessments**
  - **General –** Reports, including the fluvial geomorphology assessment, generally lack clear justification for the selected "zone of influence."
  - **Reach Sensitivity Criteria** – Field sites selected for detailed fluvial geomorphology analysis and monitoring have been selected primarily based on geography, accessibility, and channel definition. It is not clear if these criteria are adequate to assess potential changes and impacts based on a "weakest link" approach. At the general level, the field sites selected do not appear to adequately consider Channel Form Sensitivity Analysis provide in the **CBSES 2008 Report – Part B, Figure 6.8**. At the detailed level, issues of reach slope, dominant boundary material, vegetation conditions, and existing erosion conditions (for example) should also be clearly considered/confirmed in the monitoring site selection and justification.

- **Stream Ecogeomorphology** – An overriding premise in the **WRED Addendum 2008 – Attachment 5** report is the assessment of fluvial geomorphic impacts in isolation of the biological systems. Specifically, the conclusions are based on the unlikelihood of "exacerbat[ing] erosion" and that any potential negative aspects of other minor adjustments need to be considered within "the context of the other disciplines, such as terrestrial and aquatic ecology." While it is agreed that any value statements or assessments of negative impact with respect to geomorphic processes are generally incorporated from the health of associated biological systems, it is not convincing that geomorphologists can detach their physical conclusions, specifically within an integrated study.
    - **Integrated Monitoring** – Specifically, the fluvial geomorphic monitoring plans/fieldsites have not been integrated with fish habitat and benthic habitat monitoring sites. As commented above, geomorphic considerations should integrate both physical and biological implications; and detailed monitoring plans from the proponent's consultant team should outline how observations from the various disciplines will be coordinated to provide an integrated understanding of the natural systems.

Geomorphic Significance – This review recognises the "state-of-the-art" challenges associated with scientific measurability and predictability of adjustments in small vegetation controlled / altered watercourses due to possible changes in hydrology. This limitation emphasizes the need to better integrate geomorphic monitoring and interpretations into the subtle implications for biological impact assessments and the identification of off-site.

APPENDIX C

Rockfort Quarries – Discussion Notes – at CVC - November 13, 2008
Donald Weatherbe, P.Eng.

Review of Appendix G – Thermal Effects Calculations – Water Resources Evaluation, Rockfort Quarry, Town of Caledon, Ont., Conestoga-Rovers, August 2000.

Model documentation

The model is described for groundwater flow in a porous media, which is then modified by the consultants in some way to handle the worst case - a fissure in the rock. To review the model suitability I need to see the basic assumptions described by the original authors or an interpretation provided by the consultants. The referenced sources are needed to comment on the theory and the choice of parameter values.

- The primary references for the model are two papers in German (Soll, 1988) and French (Grima 1984) – Could they be provided in English. Another reference (Domenico and Schwartz 1990 "Physical and Chemical Hydrogeology", John Wiley & Sons.) has been purchased (1998 edition).

Model Formulation

In order to test the formulation, the Heat Transfer Model equations (equations 2 and 3, page G-4) were set up in and Excel spreadsheet. Comments:

- The summation symbol shown in equation 3 appears to be incorrect. There should be 12 separate calculations to show the monthly variations, not a summation.
- The findings could not be reproduced. Only the worst case examples were calculated. For these cases - Rogers Creek at 350 m. Unsaturated thickness 5 m. Groundwater base temperature 9 Deg C.

Case	CRA Max-Min Deg C	DGW Max-Min Deg C	Comment
Porous rock	9.5 – 9.0 Table G-4	9.82 – 8.78	
Fractured rock	9.5 – 9.0 Table G-5	12.68 – 8.08	

- The model formulations should be compared to see if an error has been introduced by this author or if there is an error in the CRA model implementation.
- The equations seem consistent. The results are significantly different that those found in the CRA report. For example, the fractured rock case has the Darcy flow velocity as 0.01894 m/s which is equivalent to 68 m/hr. With only 350 m to the Rogers Creek, it would take 5 hours for flow to reach the Creek.

No data on receiving streams – flow, temperature – is given, There is no calculation of temperature effect on streams. This is probably because the predicted temperature range in the CRA report would give a negligible impact