

2. Groundwater Levels

A groundwater contour map for the site was presented on Figure 4 by Waters Environmental Geoscience Ltd. (2016), hereinafter referred to as Waters. A detail of Figure 4 is shown on the appended Figure B.

On Figure 4 of the statement, water levels are sketchily presented with 10 m interval contours, which according to Waters are interpreted to represent the highest groundwater conditions onsite. So far, the site lacks field evidence to characterize it properly, as there are no onsite monitoring wells. To EXP's knowledge, groundwater levels were not measured onsite by Waters and no monitoring program of water levels has been implemented, and no well water well records are reported within 1 km of the study area. Therefore, the claim that Figure 4 of the Waters report is representative of highest groundwater levels cannot be supported. To provide such information, onsite monitoring wells are required, and multi-year seasonal groundwater level monitoring is needed.

For that reason, EXP disagrees with the stated interpretation (representation of highest groundwater conditions), as seasonal groundwater fluctuations and especially high-water levels during spring thaw (freshet) are yet unknown. The document by Waters (2016) rightly claims to be a "Groundwater Summary Statement", which is not a detailed hydrogeological report.

The groundwater contours shown on Figure B suggest discharging conditions to creeks #1 (south) and #3 (center) and recharging conditions between these streams. The assumed horizontal water table in cross-section A-A1 of the final Site Plan by Timber Craft Consultation Inc. (2019), as depicted on Figure C, is inconsistent with the interpretation made by Waters (2016). Generally, under current recharge conditions, the groundwater surface would somewhat mirror the surface topography for low hydraulic conductivity soils/rocks, and it would flatten, if the hydraulic conductivities are high.

EXP, following the water levels interpretation made by Waters (2016), observes that the water table has relief (as depicted in Figure B) and accordingly, the proposed quarry floor is predicted to be below the water table, as shown on Figure D.

3. Distance between Groundwater Surface and Pit/Quarry Floor

According to policy No. A.R.4.01.04, a minimum spacing of 2.0 m (and 1.5 m) needs to be maintained between the projected quarry (pit) floor and any static water level including seasonal high for bedrock (and overburden), respectively. Waters (2016) states that Bacher Construction Ltd. should avoid extracting bedrock below 382.0 masl in the northwest and 370.0 masl in the east. The elevation limit of 370.0 masl in the east is deemed as too low by EXP, based on surrounding elevation of surface water features, subject to actual field investigations.

EXP has the opinion that the proposed Site Plan by Timber Craft Consultation Inc. (2019) does not conform to the description "as above groundwater extraction of pit or quarry operation", and consequently, cannot be approved for a Category 9 or 11 application under the Aggregate Resources Act.

4. Potential Impacts

According to cross-section A-A1 presented on page # 2 of the Final Site Plan by Timber Craft Consultation Inc., there are no anticipated potential impacts shown on the horizontal water table. EXP's view on this prediction is that this seems a very unlikely and unrealistic scenario. EXP would expect an alteration of recharge areas and contribution to surface water features, potential effects on water quality (surface and groundwater), disruption of discharge areas and potential impacts on natural features, lowering of water table and changes in flow regime as likely outcomes of the extracting activity. Potential impacts due to the proposed pit/quarry development can be assessed with a detailed hydrogeological investigation.

5. Data Gaps

Without any claim of completeness, the following information would be required to evaluate the site hydrogeology in detail:

1. Characterization of groundwater surface and recharge/discharge areas;
2. Continuous monitoring of surface and groundwater water levels;
3. Characterization of overburden and bedrock (overburden thickness bedrock, bedrock surface elevation, hydraulic conductivity and specific yield);
4. Surveyed elevations of surface water features (Lake Harvey, creeks, springs and wetlands);
5. Locations of private groundwater wells (cottages);
6. Site-specific water balance for pre-quarrying and during quarrying conditions;
7. Surface flow measurements in surrounding creeks;
8. Floodplain delineation;
9. Groundwater and surface water chemistry baseline;
10. Quarry/pit floor elevations of Phases 1, 1a, 1b, 2 (north), 2 (south) and 3;
11. Comparison of quarry/pit floor elevations with creek bottom elevations;
12. Estimation of soil/rock volumes to be mined in Phases 1, 1a, 1b, 2 (north), 2 (south) and 3;
13. Erosion and sediment control plan; and
14. Additional site information by Timber Craft Consultation Inc., as quoted in Section 2.1 in Waters (2016).

6. Limitations

This preliminary hydrogeological review is based on limited investigations made by third parties and designed to provide an expert opinion regarding soil/rock extraction activities within the study area. The opinion presented here reflects existing site conditions at the time of writing this letter. EXP must be contacted immediately to review its present expert opinion, if any new findings become available.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this letter.

This letter was prepared for the exclusive use of Harvey Lake Area Residents. Any use which a third party makes of this letter, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this letter.

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Hydrogeological Review - Bacher Construction Pit and Quarry
Township of Algonquin Highlands, Haliburton County, Ontario
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We trust that this preliminary hydrogeological review is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,
EXP Services Inc.



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Attachments

- Figures

Figures

Figure A. Site Location Map

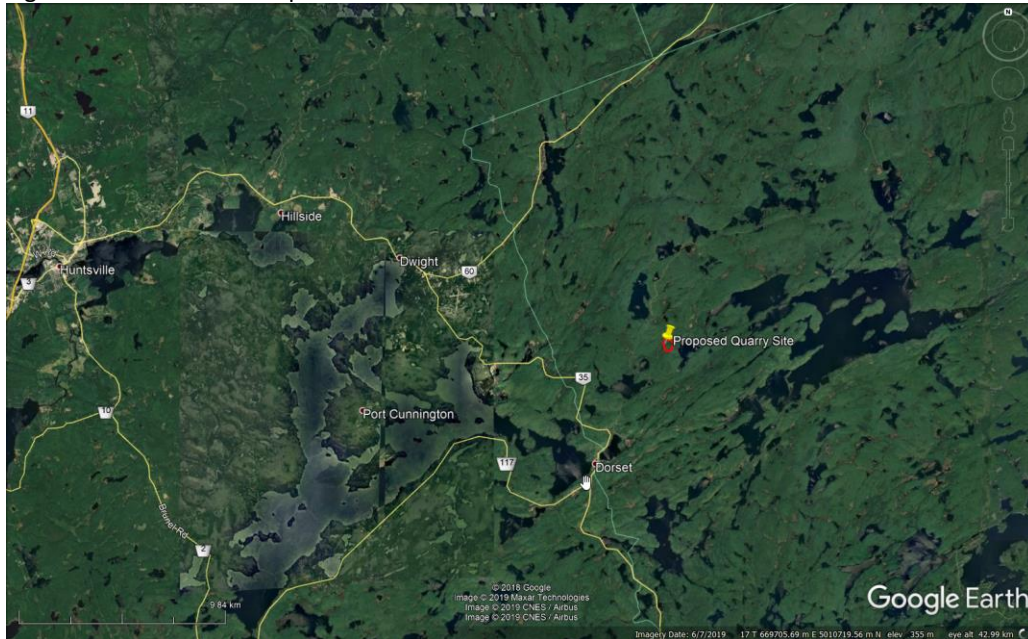
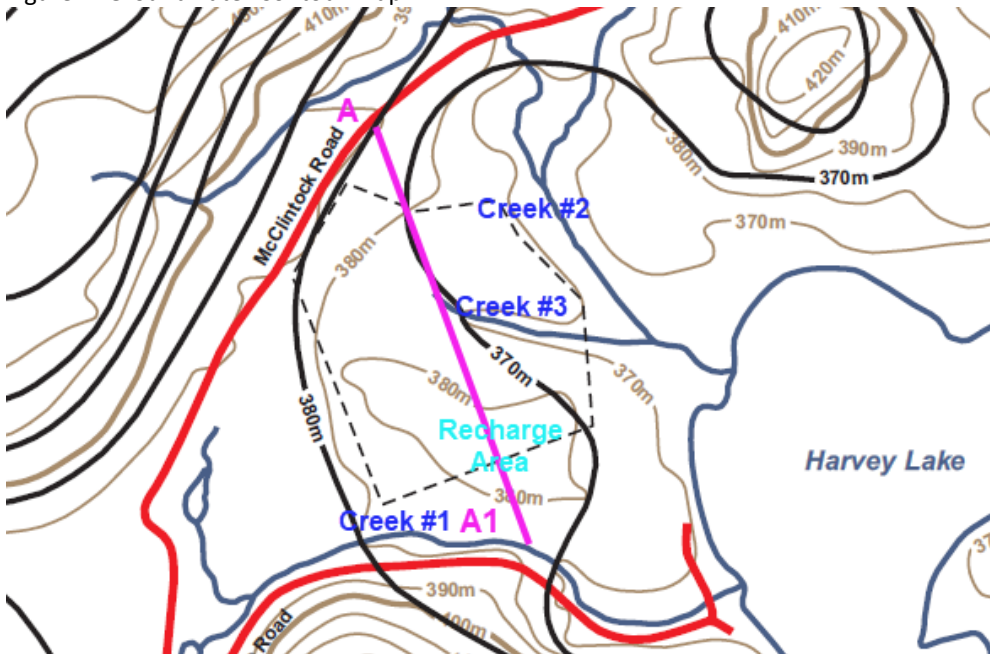
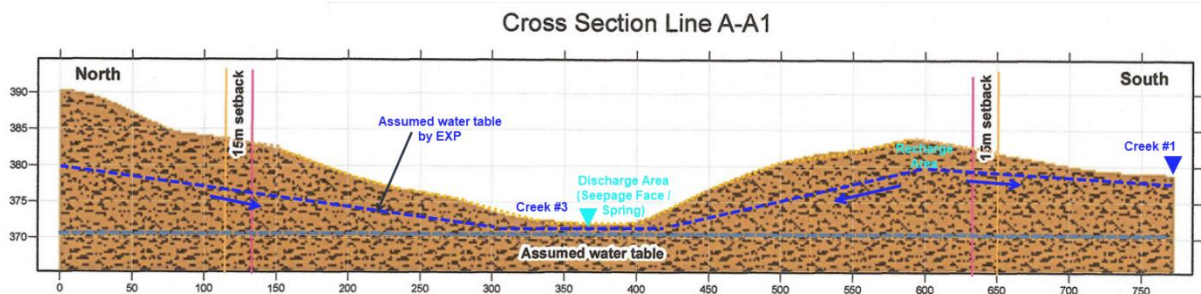


Figure B. Groundwater Contour Map



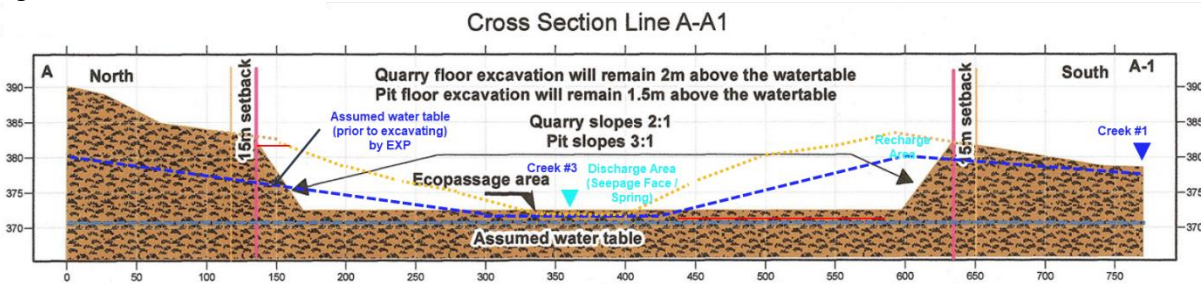
Detail from Figure 4 in Waters Environmental Geoscience Ltd. (2016)

Figure C. Assumed Water Table in Cross-Section A-A1



Cross section from page # 1 Timber Craft Consultation Inc.
Final Site Plan under the Aggregate Resources Act, dated 2019

Figure D Assumed Excavation below the Water Table in Cross-Section A-A1



Cross section from page # 2 Timber Craft Consultation Inc.
Final Site Plan under the Aggregate Resources Act, dated 2019