WITNESS STATEMENT

OF

Chris Helmer, B.Sc., P.Geo.

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In the matter of
Freymond Lumber Ltd Application License #626401 – Class "A"
Parts of Lots 51, 52 of Concession WHR, Upper Tier of Hastings, Township of Faraday

Case # PL190595
File # MM190020
Municipal File # 12-OP-175106

This Witness Statement outlines my qualifications and summarizes the issues and matters I will address in my evidence before the Local Planning Appeal Tribunal.

1.0 QUALIFICATIONS

1.1. I am a Professional Geoscientist licensed by the Professional Geoscientists of Ontario (PGO). I have been a member in good standing of the PGO since 2013.

1.2. I am a Hydrogeologist and sole proprietor (Chris F Helmer, operating as Hydrogeology Consulting Services), specializing in hydrogeological investigations. Hydrogeology related projects undertaken by Hydrogeology Consulting Services (HCS) include hydrogeology studies in support of land development applications and construction dewatering projects; Permit to Take Water (PTTW) and Environmental Activity Sector Registry (EASR) studies and applications; Environmental Compliance Approval (ECA) investigations and applications; groundwater flow, elevation, and chemistry monitoring; well pumping tests and slug tests for aquifer characterization; and nitrate and chloride impact assessments.

1.3. I have nineteen years of experience working in the field of groundwater science and hydrogeology specializing in hydrogeological investigations.

1.4. My Curriculum Vitae is attached as Appendix A to this witness statement.

2.0 RETAINER

2.1. HCS was retained by James Cunningham to review and provide independent comment on the Level 1 and Level 2 Hydrogeological Investigation Report (2016) and associated documents prepared by MTE Consultants Inc. (MTE). I am aware that a technical peer review of the MTE hydrogeological investigation report has previously been completed by Greer Galloway Consulting Engineers (August, 2017), with supporting information provided by MTE reviewed by Greer Galloway Consulting Engineers (August, 2018) and no further comments or recommendations provided at that time. As a result, my review and comments do not constitute a technical peer review per the Professional Geoscientists of Ontario (PGO) Reviewing Work Prepared by Another Professional Geoscientist guideline document (2019).

3.0 EVIDENCE

3.1. The MTE Level 1 and Level 2 Hydrogeological Investigation Report originally issued in 2016 provides an assessment of the potential impacts to water resources, water users, and the natural environment by the property quarry development. It is my opinion that the proposed quarry development may negatively impact groundwater resources and users of those groundwater resources, and/or surface water features dependent on groundwater resources, and that a more comprehensive and fulsome evaluation of the proposed quarry development is required in order to accurately assess the potential impacts that may be underestimated by the MTE report.

Additionally, it is my opinion that a more comprehensive and fulsome Private Well Monitoring Program should be developed to include collection of pre-development (baseline) data that can be used, along with more robust data collection from private water supply wells, to provide more pro-active and detailed assessment of potential impacts from the proposed development.

It is also my opinion that a more comprehensive and fulsome evaluation of the proposed mitigation measures (including stormwater/drainage management) is required in order to accurately assess the effectiveness of the proposed mitigation measures in maintaining groundwater resources during and after development of the proposed quarry.

I have identified hydrogeological issues of concern in Section 4.0 below based on my review of the MTE hydrogeological investigation report and based on the Issues List included in the Procedural Order.

4.0 ISSUES

4.1 *Will the Proposed Development negatively impact nearby water sources, including surface water, groundwater, and sources of drinking water relied on by residents living in and around the Township?*

AND

Does the Proposed Development conform with Water Goal 2.6.1 b) To eliminate or minimize negative land use impacts on water recharge and discharge areas, groundwater aquifers, producing wells, stream base flow and drainage patterns?

4.1.1 The MTE Technical Memorandum discussing the groundwater drawdown zone of influence (Appendix G of the 2016 hydrogeological investigation report) uses a hand-calculation method to assess the potential dewatering drawdown radius of influence. The MTE hydrogeological investigation report concludes no negative impacts to groundwater users or surface water features will result from the proposed dewatering required to support the proposed quarry on the basis of their technical memorandum.

The Theis Equation used in the technical memorandum, developed in 1935, has just a small number of variables that must be assumed and averaged for the entire 27.5 hectare proposed extraction area and the full depth of the proposed excavation. The technical memorandum assumes, among other variables, a geometric mean hydraulic conductivity (K) of 7.9×10^{-10} m/sec as an average for the entire bedrock aquifer thickness within the study area. This very low average K value, which when used in the Theis Equation results in a smaller calculated radius of influence, does not take into account the significantly higher K values that would be expected for the water-bearing fractures within the bedrock matrix which are anticipated to be the primary source of water supply for residential wells in the vicinity of the proposed quarry, and a potentially

significant source of recharge for Spurr Lake given the anecdotally identified cold-water springs emerging into the lake bed. As noted in the MTE report, a water-bearing bedrock zone encountered in one of their on-site monitoring wells (MW7) has K value of 10^{-6} m/sec, four orders of magnitude higher than the geometric mean K value.

The Theis equation is not able to account for preferential flowpaths (i.e. bedrock fractures) and the significantly higher K values they have. As K increases, so does the radius of influence of pumping/dewatering; therefore, it is reasonable to be concerned that the hand-calculations presented in the MTE report may underestimate the dewatering drawdown radius of influence. My initial review of publicly available Level 1 and Level 2 hydrogeological investigations for other quarry projects in Ontario noted that other hydrogeological investigations for quarry projects assumed a K value one to several orders of magnitude higher than the geometric mean as a conservative factor of safety.

It is important to note that for several decades hydrogeologists have been able to use 3-D computer simulations (models) to more effectively and accurately evaluate complex scenarios such as drawdown from quarry dewatering. In the last twenty years, modeling software has become increasingly sophisticated, and increasingly common in its application for assessment of potential impacts in complex environments. In particular, modeling software is able to account for a low permeability bedrock containing high permeability fracture matrices. MTE has applied 3-D modeling to other quarry projects where they have prepared a Level 1/2 hydrogeological investigation report (e.g. Proposed Cumberland Quarry Level 1 and 2 Hydrogeological Investigation, 2014).

Based on the relatively common practice of using the extremely robust capabilities of 3-D modeling to more accurately simulate and evaluate complex bedrock groundwater environments, and MTE's previous experience in using 3-D modeling to evaluate the impacts of a proposed quarry, it would seem beneficial for this proposed quarry project to re-evaluate the calculated drawdown radius of influence using 3-D modeling software (e.g. FEFLOW or Visual MODFLOW) capable of accounting for high permeability fractures and the preferential drawdown that could occur as a result of dewatering in a fractured bedrock environment. A more accurate assessment of the dewatering drawdown radius of influence would generate a better understanding of potential impacts to private water supply wells and surface water features dependent on groundwater discharge, and in turn help to generate a more effective monitoring and mitigation strategy to address the potential impacts.

4.1.2 The MTE hydrogeological investigation report describes a response procedure to address water quantity or quality impacts reported by private well owners. However, this reactive procedure does not include any proactive monitoring that could help to identify negative trends in groundwater quality or quantity prior to impacts occurring. The Private Well Monitoring Program described in the MTE hydrogeological investigation report includes only monitoring during operation of the quarry, without including pre-

development (i.e. background) monitoring to establish baseline water quantity/level and quality data that could be used to evaluate changes or trends in monitoring data. Additionally, the Private Well Monitoring Program specifies monthly monitoring of private wells; however, with only twelve datapoints per year (which could be impacted by residential well usage depending on the time of day monitoring is performed), identification of changes or trends would be challenging. A more effective monitoring method would be to install electronic pressure transducers (dataloggers) in participating wells for continuous recording (e.g. at hourly intervals) of water levels in the private water supply wells. The hydrographs generated from the continuously recorded data would provide a much more accurate assessment of potential changes or trends over time.

Without an effective monitoring program in place, the potential exists for impacts to private water supply wells that would result in significant disruption to the well owners. Where the potential for impacts to private water supply wells exists, it is advisable to create a monitoring and mitigation plan that includes assessment of pre-development conditions (i.e. background well water levels and chemistry), and during- and post-development monitoring of well water levels and chemistry to identify negative trends before they become impacts so that appropriate mitigation measures can be applied to reverse the negative trends

4.2 *Is the Proposed Development consistent with Policy 2.5.2.2 – Extractions shall be undertaken in a manner which minimizes social, economic, and environmental impacts?*

AND

Does the Proposed Development conform with Economic Objective 2.36.1 a): To ensure that the economic utilization of the natural resources by primary industry is achieved in a manner which preserves and rehabilitates the natural environment?

The MTE hydrogeological investigation report describes the proposed groundwater and precipitation management strategy to consist of gravity-based diversion via a drainage swale to a stormwater management (SWM) facility for eventual discharge to the York River, and to depressed storage areas for eventual evaporation. The proposed quarry rehabilitation plan includes permanent groundwater diversion to the SWM facility for eventual discharge to surface water.

Under pre-development conditions infiltrating precipitation would be expected to percolate vertically downwards through the overburden soils and into bedrock fracture matrices. The proposed stormwater/drainage management strategy would be expected to result in a deficit in infiltration (i.e. groundwater recharge) due to discharge of precipitation and pumped groundwater to off-site surface water features and

storage/evaporation areas, thereby negatively impacting the groundwater flow regime under during- and post-development conditions.

The MTE Technical Memorandum discussing drainage and water balance (Appendix F of the 2016 hydrogeological investigation report) assumes just 5% of precipitation that is not lost to evapotranspiration becomes groundwater recharge. The MTE water balance calculations suggest infiltration rates of less than 30 mm/yr for the majority of contemplated land uses and soil types. Based on the assumption these values are accurate, it is important to consider that with such small recharge rates contributing to the maintenance of groundwater resources utilized by private water supply wells, and which contribute recharge to area lakes via subterranean springs, a reduction in available recharge could reasonably be expected to result in negative impacts to groundwater resources. It is recommended the quarry proponent considers a method of stormwater and groundwater control that promotes reinfiltration of collected/pumped water rather than discharging to off-site surface water features in order to mitigate the anticipated infiltration deficit. The concept of using "groundwater recirculation trenches" to mitigate the effects of quarry dewatering is well documented, and is one option that can be considered to provide a means to reduce the impact of quarry dewatering and precipitation management while still achieving the dewatering and precipitation management goals.

5.0 CONCLUSIONS

It is my opinion that the Level 1 and Level 2 hydrogeological investigation report for the proposed quarry development does not provide a sufficiently accurate assessment of the potential impact of the proposed quarry dewatering on groundwater resources and the private water supply wells and surface water features that are dependent on them.

Additionally, the proposed Private Well Monitoring Program does not include collection of background data for use as a baseline, and does not include a sufficient monitoring frequency to provide a meaningful assessment of changes or trends over time.

Further, the stormwater/drainage management strategy proposed in the Level 1 and Level 2 hydrogeological investigation report would be expected to result in a reduction in infiltration of precipitation which supports groundwater resources, causing a negative impact to groundwater resources the private water supply wells and surface water features dependent on them. For these reasons it is suggested that approval of the proposed quarry project is premature.

I believe a more comprehensive investigation of the potential dewatering drawdown radius of influence should be completed via 3-D modeling of the bedrock fracture matrices; assessment of potential impacts to private water supply wells and surface water features should be updated based on the results of the 3-D modeling;

stormwater/drainage management should be redesigned to promote reinfiltration of collected groundwater/precipitation to help preserve groundwater resources; and, a more robust Private Well Monitoring Program should include collection of background data and use of dataloggers for continuous measurement of water levels in participating wells.

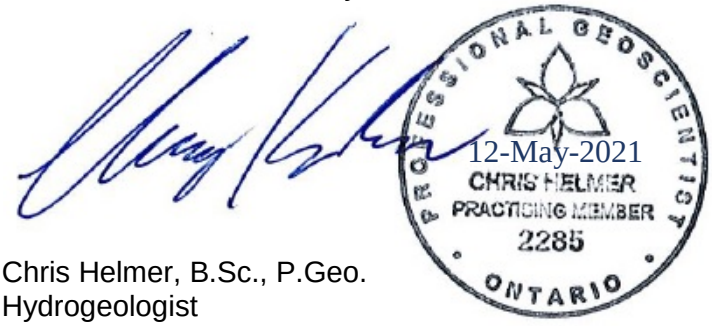
Please note that I reserve the right to respond to additional issues raised in the witness statements/replies of other witnesses.

6.0 REFERENCES

MTE Consultants Inc. *Proposed Freymond Quarry, Final Level 1 and Level 2 Hydrogeological Investigation Report*. File No. 33886-100, December 2016.

MTE Consultants Inc. *Proposed Cumberland Quarry, Level 1 and Level 2 Hydrogeological Investigation*. File No. 33876-200, November, 2014.

Dated at Kitchener, 12-May-2021:



Chris Helmer, B.Sc., P.Geo.
Hydrogeologist

APPENDIX A

CURRICULUM VITAE

CHRIS HELMER

B.Sc., P.Geo.
Senior Hydrogeologist
MECP Licensed Well Contractor

Senior Hydrogeologist and owner of HCS with more than 19 years of technical and administrative experience in hydrogeological investigations, project management, and department and staff leadership, for hydrogeological assignments throughout Southern Ontario.

Professional Experience

- Authoring of hydrogeological studies and groundwater investigations for residential and commercial developments, construction dewatering projects, nitrate impact assessments (including Reasonable Use assessments), salt (chloride) impact assessments, water supply pumping tests, and infiltration assessments.
- Permit to Take Water (PTTW) applications, including hydrogeology study preparation to support PTTW applications; Environmental Activity and Sector Registry (EASR) package preparation and submissions; Environmental Compliance Approval (ECA) application submissions; and municipal sewer discharge application submissions.
- Preparation and management of short and long-term groundwater and surface water monitoring programs for municipal and MECP mandated studies at sites up to 150 hectares.
- Project management services; including communication with clients and other stakeholders; meeting with regulatory agencies; cost and budget tracking; and invoicing.
- Hydrogeology group and field staff team coordination, scheduling, and management for small and large-scale hydrogeology projects; and coordination of staff and resources between inter-office and intra-office departments.
- Review of hydrogeology studies and reports prepared by colleagues and junior staff, and peer review services for municipal planning departments, to ensure accuracy of analyses and calculations, and validity of results.
- Preparation of work plans and fee estimates for small and large-scale hydrogeology project proposals, and collaborative proposal preparation for multi-discipline projects.

Career Path

2017-present	Owner, Hydrogeology Consulting Services (HCS). Kitchener
2017	Senior Hydrogeologist, Insitu Contractors Inc. Guelph
2015-2017	Senior Hydrogeologist, Morrison Hershfield Ltd. Markham
2007-2015	Hydrogeologist, Project Manager, EnGlobe Corp. Kitchener (formerly LVM Inc., Naylor Engineering Associates Inc.)
2006-2007	Groundwater Scientist, Gartner Lee Limited. Guelph
2006	Groundwater Technologist, Lotowater Technical Services Inc. Paris
2002-2005	Department Coordinator and Software Support, Waterloo Hydrogeologic. Waterloo

AREAS OF EXPERTISE

PTTW, EASR, ECA, and Sewer Discharge Applications

Hydrogeological Investigations for Land Development

Construction Dewatering

Open and Closed Loop Geothermal

Hydrogeology Project Management

Client Relationship Management

EDUCATION

1997 Bachelor of Science, Double Major
Acadia University

PROFESSIONAL ASSOCIATIONS

2013-present Association of Professional Geoscientists of Ontario - License No. 2285

CERTIFICATIONS AND PROFESSIONAL DEVELOPMENT

2007-present WHMIS/GHS

2019-present MECP Licensed Well Contractor

2020 Operation of Small Drinking Water Systems

2020 MOL Safety Awareness

2020 Self Contained Breathing Apparatus (SCBA)

2017 Lift Truck/Skid Steer Operation

2016 First Aid and CPR, Level C

2016 Working at Heights

2016 Contaminated and Hazardous Waste Site Management

2015 ATV Operation

2015 Groundwater Modeling with FEFLOW 6.2

2015 Aquifer Pumping Test Techniques

2014 No Purge Groundwater Sampling

2013 Groundwater Aspects of Underground Construction in the GTA

2013 Slug Testing for Site Characterization

HCS HYDROGEOLOGY CONSULTING SERVICES