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MEMO

To:	Alicia Kimberley
From:	Garry T. Hunter, M.A.Sc., P.Eng.
Date:	September 12, 2024
File:	21-407
Subject	**Peer Review of Strada Real Baseline Report August 15, 2024 – Appendix A & B**

Peer Review Strada Appendix A and B v August 15, 2024

A. PEER REVIEW CONCLUSIONS

Most of the outstanding Peer Review Matrix comments have not been addressed. Promising later delivery does not equal closure.

The authors of A/B do not appear to understand the difference between Real Baseline Data and Model Virtual Baseline data. This is reflected throughout the Matrix and elsewhere in the use of 'Baseline (Virtual) & Impact Assessment' terminology.

This report takes real high quality (also see last page) monitoring data with water level vertical accuracy in the 10 to 20 cm range capable of one meter or better actual base line contouring and blends it into a degraded virtual base line model environment with errors in the more or less 5 m (16 ft) range and even higher residuals as demonstrated by the August 2024 Draft Impact Assessment Figures utilizing 5 m water level contours.

The Strada consultants have been able to create 2 m on-site spatial contours of geological formations top and bottom (and thickness) plots from irregular bedrock formation surface 'picks'. Why can't these same consultants prepare one (1) meter water level contour plots by Model Layers from the higher precision '20 cm' downhole static water levels? The current Groundwater Model plots are not acceptable for Site Analysis purposes.

The monitor screens in Table 1 are classified in accordance with legacy gravel pit compliance A, B and C criteria. These criteria do not recognize the considerable work and expense incurred by Strada in construction of deep boreholes to the base of the Gasport Formation, quality bedrock core classifications, precise geodetic elevation surveys, and in some cases, nested monitor construction. Monitor screens need to be reclassified consistent with geological formation and Model Layers.

Strada legacy boreholes were logged to incorrect and /or later revised bedrock formations. On site glacial till is logged using well drillers 'clay' designations rather than the 'sandy silt with some gravel' as described by Strada's Geotechnical consultant on its Berm Slope Stability diagrams. See also Genivar Appendix H Vol 4 pg 19 Report. Explanatory or revised red flag notes are required on the Appendix A.11 Site Borehole Logs.

There is very little real baseline data analysis in these Appendices. There is no water quality assessment by Model Layers or by stream flow (see Genivar, 2011).

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Borehole logs are incomplete and do not include the Melancthon Mega Quarry, Shelburne or Bonnefield Groundwater Monitors and Geotechnical Boreholes as referenced in these Appendices and within 1 or 2 km of the Strada Site.

No legacy manual static water level observations have been provided to facilitate reinforcement of equivalent Model Layer screen plots, i.e., filling in the 'monitoring spatial data gaps'.

The Strada groundwater monitor distribution is insufficient to define the Groundwater modeller's inferred zone of enhanced hydraulic conductivity as required to further inform the Site Plan mitigation process.

There is no geographic spatial analysis and stratification of the nested groundwater level data collected. There is no database mining of the extensive water level database to define hydraulic anomalies.

The only analysis (visual) is of disconnected single point ground monitor hydrographs.

Strada is left to rely on the Peer Reviewer's exhibits, including Fig H.1, H.2 and Table H.1 for Site Plan development.

Appendix A/B should be the repository for all on-site and off-site real baseline data, not the Model Reports C, D and E or equivalent. This repository would also include the high quality site geological information, including profiles and sections.

Currently, the report seems to be trying to be Model-centric rather than Baseline-centric. It is very difficult to find the real site specific information scattered throughout the Model-centric Appendices C, D and E Documents.

B. SPECIFICS (page by page)

This Peer Review comments follow (and the Matrix) the flawed organization and extreme repetition within these documents. Updates will be required in due course as dialogue continues. There is little evidence of regard for the Peer Review Matrix comments. Indeed, the comments frequently are not understood.

sA.1 (pg A-1)	Appendix A does not document static water level much before 2014. Appendix B does not include any water chemistry data other than a Piper Diagram (Fig B.37 pg B-91) without a legend or indication of where the samples come from.
Fig A.2 (pg A-3)	No source date. Recent orthophotos should be used throughout the report to illustrate recent extraction.
sA.2.2 (pg A-4)	All Project Figures with m asl need to carry CGVD2013 designation.

	For historic, inactive and destroyed monitors assume CGVD28 and convert to CGVD2013 utilizing the NRCAN tool.
Fig A-3 (pg A-5)	For convenience, I have previously assigned the following names based on historic farmland owners etc. to 15th Sideroad Streams from west to east – Marshall Brook, Campbell Brook and Honeywood Brook. Also show SR 280, Dufferin County Rd 2 and 15th SR, an area of high water tables (NRSI wetlands?).
Fig A.4 (pg A-6)	Add LiDAR acquisition date for reference to pit extractions. Show Duivenvoorden and CBM Licenced Pit outlines. Also Duivenvoorden application expansion area.
sA.3 (pg A-7)	ABC Monitor labelling are legacy terms from Pit History (prior to circa 2016) and do not reflect screens in the updated Bedrock Formations and Model Layers described elsewhere in the Strada Appendices. Monitor screens must be reclassified by the Groundwater Model Layers with Open Hole designations as appropriate (See Peer Review Matrix and Table H.1). Strada's Geotechnical Consultant, based on off-site borehole investigations and particle size Distribution Charts by the Mega Quarry proponents, classified the Strada site tills as 'sandy silt with some gravel'. See also Genivar (2011) Appendix H (pg 19). This geotechnical description is preferred by this Peer Review. However, it would also be strongly preferred if actual geotechnical engineering descriptions of the on-site tills were undertaken. These are not Tavistock Tills typically described on legacy Surficial Geology maps as glaciolacustrine derived silty to clayey silt till (stonefree). Are borehole logs provided for all monitor wells? Section B also needs to contain legacy post-2000 manual static water levels to assist with precision synthetic Model Layer site water level plotting where data gaps exist.
sA.4 (pg A-7)	The well locations need to be edited to actual sites not just lot fronts. Where are the TPA well results from the spring and summer of 2024. Do these actually exist? **This Peer Review does not agree, for reasons cited below, that there is an exceptional network of data and monitoring for the purpose of a deep quarry application 60 to 70 m below ground and 50 to 60 m below the water table.**

Fig A.5 (pg A-8)	This Figure is not complete and all labels are not visible. A more recent orthophoto would be more appropriate. Where are surface monitoring points SW1 and SW2 Table A-3 pg A-10? Are surface water monitor points complete?
Table A.1 (pg A-1?)	Why new page numbering here? This Table now seems to be free of known errors as previously identified by this Peer Review through GIS error trapping procedures. **The Report should note that approximately one third of these monitor wells are non functional – destroyed, pulled, not observed or dry.** More are located within proposed quarry extraction areas and are not suitable as long term base line monitor wells. The Current Well Monitor Terminology follows legacy Strada Gravel Pit Compliance Reporting Terminology. Monitor screen terminology needs to be revised to reflect the significant work by Strada to establish Groundwater Model Layers and Bedrock Formation classifications as determined for this Quarry application.
Fig A.6 (pg A-3)	Well sites incomplete and labels overprinted (not readable). Drinking Water Monitoring should be included in this or a Separate Appendix. There is no reference as to where to find the well logs and monitoring history. TPA wells need to be plotted in actual locations.
sA.5 (pg A-5, para 3 last sentence)	**This is a nothing sentence. As evidenced by the Bedrock Formations encountered and documented on-site, not all the rock is high quality for all aggregate purposes.** The Public will want to know why Strada is proposing to excavate up to 60 m (200 ft) below ground and 50 m below the water table. Why not tell them so they understand? What is Strada going to do with the soft limestones of the Guelph Formation? What about the Chert of Goat Island Ancaster?
sA.6 (pg A-5)	Why isn't the legacy Pump Test data included in this Base Line Report?
sA.6.3, Table A.2 (pg A-6 to A-9)	Why aren't Lugeon tests provided for all seven deep test holes to the Cabot Head shales? Why isn't the Lugeon test data included in this Baseline Report?

	Does dilatancy also occur in the exposed extracted quarry rock walls? Does void filling also occur in overburden and bedrock infiltration areas?
Table A.2	There is a gap in the Lugeon 20 to 50 Range but not in the Hydraulic Conductivity Range, please correct.
sA.6.4 (pg A-8)	Why aren't the Highland 'Genivar' boreholes, logs and monitor data history included in this Baseline Report say within two km of the Strada site? Why aren't the adjacent Duivenvoorden borehole logs and monitoring data included in this Baseline Report? Why hasn't Strada arranged for new simultaneous monitoring at these nearby groundwater monitors?
sA.8.1 (pg A-10)	**The reader should be advised that most of the 22 groundwater monitor nests are screened in the Sand and Gravel, Overburden, Epikarst intervals for prior pit licencing purposes.** Most of these upper monitor nests show very little vertical gradient. Only about 7 or 8 monitors are screened across the very important (to the Quarry application) Goat Island Aquitard between the upper Guelph / Eramosa and the deeper Gasport Aquifers.
sA.8.2 (pg A-10)	Where is the off-site water level monitoring data?
sA.8.3 (pg A-10 and A-11)	Where is the on site and off site surface water level monitoring data for the surrounding areas? Where is there a plot of the surrounding area monitored sites including those listed in Table A-4?
Table A.5 (pg A-13)	Where are these permits on a map? Where is the Commercial Aquaculture Permit?
sA11.1 (pg A-14)	Not all C Series Monitors are deep? Many are in Model Layer 4. Please clarify.
Fig A.8, A.10 and A.12 (pg A-15, A-19 and A-22)	The Screen colouring reads 'Open Hole' on these Figures. Please adjust. Where are the 'H' static water levels vs the later installed screened static water levels? These 'H' monitors also show important vertical gradient information. Where are the unique baseline plots of static water level differences across the Goat Island aquitards for these three nested monitors and for the other open hole deep monitors that may be closely adjacent to legacy upper bedrock monitors?

	The modellers frequently talk about 20 – 25 m hydraulic heads across the Goat Island aquitards at Shelburne. Where do we find a spatial validation of this condition for the Strada site? This Peer Review has prepared an initial hydraulic head plot.
Table A.6 (pg 17)	Gradational change to underlying Eramosa must occur above the Eramosa Formation at 60 ft depth (prior Peer Review comment).
sA.11.2 (pg A-33)	All legacy on site borehole logs and high quality off-site logs within two km of the Strada site should be included in this section (Mega Quarry and Duivenvoorden). Please confirm that logs are included for all monitors reported in Table A.1 on pg A-1. Strada needs to acknowledge that its earlier hydrogeologist, as well as the Mega Quarry hydrogeologists, did not know the difference between Guelph and Amabel bedrock. Strada's consultants, after 2014 to early 2023, were not aware of the OGS reclassification of Mega Quarry Borehole core as reported, in part, in the MHBC / OGS 2014 revised ARIP mapping and available directly on request from F. Brunton, OGS. This circa 2014 reclassification was also performed on the deep Mega Quarry borehole core on the rear of the Duivenvoorden property. Likely the presence of extensive thick Guelph / Eramosa / Goat Island Formation rock above the Gasport was the real reason for withdrawal of this Mega Quarry application. Strada's geotechnical consultant based on off site Mega Quarry geotechnical information reported the Tills on the Strada site to be sandy silt with some gravel. These are not glaciolacustrine derived silty to clayey silt till. These tills may be misclassified by Strada's earlier consultants, perhaps based on 'drillers clay', as Tavistock Till. This misclassification carries into the Groundwater Model Reports.
Appendix B (pg B-65)	Why do we now start off at pg B-65? Is this report section duplicated somewhere else, why repeat it? Much of Appendix B appears in other groundwater Modelling Reports, likely it logically all fits here as real Base Line. Brunton revised the bedrock stratigraphy circa 2012 and a revised ARIP Mapping was released about 2014 by Strada's MHBC consultant with OGS.
Fig B.4 (pg B-67)	These Figures confirm that the Eramosa and higher Guelph were not typically part of the Ambel. Most of the upper bedrock described in Strada boreholes / monitor wells was not Amabel. Former Amabel terminology did include Goat Island and Gasport Formation.

Table B.1 (pg B-68)	This Table is upside down compared to most other Tables and Figures presented in the Base Line and Groundwater Model Reports. Similarly, the following descriptions are 'bottom up'.
sB.4.3, Fig B.14	The Tills in the potato growing specialty crop areas of Melancthon Old Survey north of the proposed Strada Quarry are not Glaciolacustrine derived silty to clayey silt till (Tavistock). The green 'till' colours on Fig B.14 are not easily correlated to the legend. Why is there no difference between the 'Old' and 'New' Surveys of Melancthon?
sB.5 (pg B-76)	This section needs to be integrated with the earlier sections. It appears these report sections are being multi-sourced by multiple authors just to meet imposed deadlines? Do they think no one will read this?
sB.6 (pg B-77)	Again, there are only about 7 or 8 Model monitor nest equivalents screened across the important Goat Island Aquitard Layer 5. Most of the other shallow overburden/ epikarst nests would seem to have little relevance to the quarry application except perhaps to inform the Model Layer 1 Water Table. This report makes little specific attempt to plot this important across the Goat Island aquitard 'nested' monitoring data. Similarly, the H-series open hole monitor data is not plotted compared to the subsequent lower installed monitor screen. There needs to be a monitor Well location map near the Monitor Well Hydrographs, or alternatively, a separate Figure Book to reduce Figure repetition (preferred) and assist 'finding'.
OW2 Well Nest (pg B-79)	Fig A-5 shows upward vertical gradients from deeper OW2C to OW2B but downward gradients from OW2A to OW2B.
OW3 Well Nest (pg B-79)	The quoted hydrograph low of 489.8 m asl appears to be an error.
OW4 Well Nest Fig B.19 (pg B-79)	This well nest needs the OW29C hydrograph to demonstrate the gradients between the Lower Bedrock (Gasport) and the Upper Bedrock (Guelph / Eramosa).
OW5 Well Nest Fig B.20 (pg B-80)	OW5 Well Nest demonstrates upward gradients from the upper bedrock into the overburden, therefore there is no recharge capability, except by mound surcharging.
OW7 (pg B-81)	OW7 Hydrograph shows declining water levels from about 2016 to 2024 likely because of local downgradient aggregate extraction into the water table.
OW9 Nest (pg B-82)	The OW9B Monitor level at 485 to 487 m asl is anomalous and suggests direct upper bedrock hydraulic connection to the locally lower pressure Gasport Aquifer (ineffective Goat Island Aquitard).

OW10 Nest (pg B.25)	OW10B is indicative of recharge towards the Pine River. Water levels are declining from 2016 to 2024.
OW14, Fig B.29 (pg B-85)	OW 14C in the Upper Bedrock Hydrograph varies seasonally from about 480 to 483 m asl and is under the obvious influence of the Pine River headwater groundwater flow convergence zone towards Horning's Mills. Water levels are declining (model zone of inferred lower hydraulic conductivity).
OW16C, Fig B.30 (pg B-86)	The low static water level in this screened Upper Bedrock (Guelph Eramosa) monitor well indicates direct hydraulic connection through the Goat Island Aquitards to the Gasport Aquifers (see Peer Review Fig H.2)
OW17C, Fig B-31 (pg B-86)	The low static water level in this Upper Bedrock (Guelph Eramosa) water well also indicates direct hydraulic connection to the Gasport Aquifers.
OW19 to 23, Fig B.33 (pg B-87)	OW22C and OW23C reflect tight low hydraulic conductivity upper bedrock (Guelph Eramosa). Upper bedrock OW21C and 20C are in the influence zone of the Groundwater Flow convergence trough flowing towards Horning's Mills. OW19C adjacent to the 4th Line has anomalous lower static water levels and may indicate direct hydraulic connection of the Upper Bedrock Aquifers through the Goat Island Aquitard to the Gasport Aquifers (see Peer Review Fig H.2).
Fig B.34 (pg B-88)	Fig B.34 does little more than scatter plot the bedrock hydrographs. Hydrographs need monitor labels in the graphic window to assist the reader (prior Peer Review request). More graphic visualization work is required. To be meaningful, the Hydrographs need to be separated by Bedrock Aquifers Model Layers 4 and 6. The reader may not be aware that OW24C to OW30C are all screened in the Gasport Aquifer. A longer monitoring period is required, at least to August 2024 to assist visual comparison. These hydrographs need to be moved to a separate page. Lowest static water level OW14C and OW16C in the Upper Bedrock are located near the east boundary of the Melancthon Pit. Anomalous Upper Bedrock OW19C (colour ?) on the 4th Line shows declining water levels but at more or less similar level to OW14C.
Fig B.35 (pg B-89)	Fig B.35 shows that the highest water table is at OW4B and the lowest water level at OW9B.

Fig B.36 (pg B-89)

Fig B.36 shows the highest water Table (mounding) is at OW2A just east of the 4th Line and downgradient of the McTaggart Farm natural infiltration basin west of the 4th Line.

The lowest water table at OW18A is at the Lot 13/14 east boundary in the influence area of the convergence flow trough leading to Horning's Mills.

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sB.7, Fig B.37 (pg B.90)

This Report Section has no supporting water quality data. There are no legends for the Piper Diagram. There is no equivalent Model Layer coding. What is the point of including this Figure?

For the Quarry Application, simultaneous water quality data is required for the Water Table and Model Layer 4 and 6 to assist with aquitard continuity interpretations.

Spatial analysis of key water quality parameters is required to assist with groundwater flow interpretations and identify contaminant sources (see Peer Review Figures).

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sB.8 (pg B-92) Conclusions

This conclusion is little more than self-serving. The conclusion also demonstrates the model centric bias of the A/B authors. The authors of this report do not seem to recognize the difference between true baseline data and the site inferior model predicted virtual base line data.

Appendix A and B need to be site-centric to support the Applicant's Site Plan with precise water level and geological vertical picks base line data. This site water level data now has a precision vertical accuracy of 10 to 20 cm.

Spatial analysis is also required to identify both data errors and true hydraulic anomalies indicative of site conditions.

Precise site data exported into and blended into the groundwater model is degraded to 4 or 5 m vertical accuracy. True hydraulic anomalies are lost. What is the point?

As this Peer Review has advised from the beginning, the Site Plans must be based on Site not Virtual Data. Model data further reinforced with TPA water well data may be appropriate for the Target Participation Area predictions.

This Peer Review has provided the only Spatial Analysis (GIS) including 'patched' together water level potentials maps at one m contour intervals for Layers 4 and 6. The Applicant Consultants have ignored these Peer Review expert products and provided little in substitute except promises (see Matrix).

The Peer Review Spatial Analysis of the Applicant data has independently identified a 3D Groundwater Flow Convergence through the Applicant Site and likely on-site recharge windows through the Goat Island Aquitards. This Flow convergence zone is somewhat coincidental with the inferred higher permeability zone incorporated into the groundwater model.

Additional deep multi-level groundwater monitors (say four) are required to further define this feature for the development of Site Plans Mitigation infrastructure.

All true baseline Figures should be assembled into a separate Figure Book(s) without repetition. Separate plots of active monitor screen locations by Geological Formation / Model Layer to visualize the true distribution of monitors by Layer. The consolidated recent and legacy monitor location maps without plotting screens by Model Layers are misleading.
