

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 Model Calibration Report - Appendix D

Strada Appendix D Model Calibration Report (August 2024)

An earlier version of the Strada Appendix D Model Calibration Report was Peer Reviewed with comments submitted on July 31, 2024. This Peer Review does not replace this earlier Peer Review as Strada does not appear to have addressed these comments. This current Peer Review has had regard for the Strada Matrix comments.

A. OVERVIEW

The Strada Groundwater Model Centric Reports appear to be authored by multiple authors without an overall logical editorial control. The reports are nearly incomprehensible and contained repeated Text and Figure Blocks in duplicate or triplicate but omit key information required to inform the reader. This Peer Review follows the information as presented and therefore is also repetitive and unfriendly to the reader.

The Village of Honeywood is again incorrectly located on most Figures in this Report as in others.

This Model-Centric Appendix, as are the others, is full of technical jargon and myopia. A glossary is needed.

B. SPECIFICS (page by page)

Peer Review comments follow 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 prior Matrix comments. Indeed, the comments frequently are not understood.

pg D-8 to D-20	Only need this text once.
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Fig 3.4 (pg D-21)	Appears elsewhere, only need this once in the Real Baseline Appendix AB.
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Local catchment boundaries in Strada Pit Environment based on WSC are in error.
Please don't show.

pg D-22 to D-25	The model needs to be subset to the Pine River at Honeywood line (Mulmur 2nd Line WHS) to provide closer to proposed quarry closure to Pine River headwater springs and stream flow and to reduce local model grid cell size for improved calibration. Stream flow monitoring is required. Delete the wrong WSC local catchment boundaries or update.
pg D-27 to D-30	These pages are repeated elsewhere in similar form. Only need once. As stated many times (see Matrix), this Peer Reviewer does not agree that the surficial geology is more descriptive than the Dufferin County Soils Map (pg D-27 para). Also as stated elsewhere, this Peer Reviewer does not agree that Tavistock Till (Glaciolacustrine derived silty clay till (Table 3.1) is present in the Old Survey of Melancthon north of 15th SR. The Tills are not correctly mapped by the legacy Quaternary Geologists and as adopted by the modelers' geologists. The authors of these report have at best no local, and at worst, no agricultural experience and need to talk to the Melancthon farmers who have far more knowledge of Melancthon soil and drainage (recharge) conditions than the modelers. The authors should also pay attention to the Soil Series Parent Materials and to the Strada Geotechnical Report (to be updated) as well as Genivar (2011) Appendix H, pg 19.
pg D-30 to D-32	Fig 3.9 demonstrates the difference between the imperfectly drained 'rubber boot country' of the New Survey versus the internally well drained Old Survey of Melancthon.
Fig 3.1.11 (pg D-33)	As a result of the modelers' 'ill-advised' dependence on surficial geology mapping, the hydraulic conductivities on the Melancthon uplands are incorrectly mapped in the Melancthon Old Survey. Therefore, the Model is not properly calibrated with respect to Hydraulic Conductivity (Groundwater seepage rates) and Recharge.
pg D-34 to D-39	This report section appears elsewhere in a similar form. Please consolidate into one location to the degree relevant. I am not aware of local bare (or fallow) fields except at spring planting and fall potato harvest. Winter wheat is frequently planted immediately after earlier potato harvests (Lundy on the Prince Farm).
pg D-40 to D-55	To the degree relevant, please consolidate all the Climate Data into one Report Section rather than scattering it all over. Fig 3.19 and Fig 3.20 appear reasonable with the exception of the erroneous WSC catchments in the local Strada pit areas.

pg D-56 to D-73

Please consolidate this section. Table 3.6 is repeated in many reports. Why is the Genivar data relevant here? Was this information actually used in the calibration? If it was, where are the hydrographs and if not, where is the virtual model baseline validation. Furthermore, we know the catchment boundaries are in error.

As already discussed, the Genivar mean flow of 350 L/s at SW-8 must be an error.

Why all the concern about the remote Riverview gauge (Fig 3.36) when the modelers do not even seem to be aware of Dundalk sewage treatment lagoon disposal practices? What does this far away data add to the already overloaded report?

pg D-74 to D-80

Few, if any, will understand or read this report section filled with the technical jargon and myopia. Perhaps this is the intent? Who understands 'Hortonian' and 'Cascading Runoff', except perhaps the writers?

A glossary and simplified rewrite with removal of overlap between sections is needed to assist.

What is the real difference between Fig 3.19 and Fig 3.42?

pg D-81 to D-83

All maps keep showing the incorrect WSC boundaries and Honeywood incorrectly located. Why?

Fig 3.47 and Fig 3.48 What do these Figures contribute? Are these really necessary?

Fig 3.49 illustrates similar net recharge in the Old Survey and New Survey of Melancthon. This is simply not credible and will not be credible to the NDACT community and Melancthon farmers. This assumption is rooted in the modelers lack of agricultural experience and incorrect assumptions of Tavistock Till and uniform hydraulic conductivity and recharge throughout Melancthon. Annual average net groundwater recharge is likely closer to 250 to 300 mm/yr in the Melancthon Old Survey. Have you asked the farmers (Lundy/ Prince Pit)?

Strada consultants have not provided any new 2024 stream flow data to validate the 'calibrated' model virtual baseline conditions. Similarly, the model has not been directly validated at the Genivar Sites. However, Genivar streamflow information near the MECP Permitted Newell / Funston Aquaculture fish hatchery and rearing ponds indicate an unacceptable calibration. Should we base our conclusion on this one site?

Notes:

- 1) *Genivar (2011) Table H-27 reported simulated Groundwater Discharge Rate at SW8/STR2 at 3,520 m³/day (40.7 L/s) and calculated observed low baseflow at 3,575 m³/day (41.4 L/s).*
- 2) *Newell / Funston Commercial Aquaculture (Fish Hatchery / Rearing Ponds) MECP Permit PTTW #7121-9Y7HP7 total is 741 m³/day (8.6 L/s) (Earthfx Aug 2024, pg D-102) immediately downstream of SW8/STR2.*

- 3) Genivar DP-SW8 reported Mean Flow at 0.35 m³/sec (350 L/s) in Earthfx Aug 2024 Table 3.6, pg D-57. This flow is an obvious error.
- 4) Earthfx (August 2024) Fig 3.22 pg 37 Simulated Virtual Model Baseline Condition Dry Weather Flow at SW8/STR2 is at 0.0 L/s.

The Earthfx Model Calibration for Baseline Conditions is obviously not validated for assessment prediction purposes.

The Model ‘dry flows’ at STR2 suggest the model is not recognizing the underlying and stream supporting Goat Island Aquitard.

Fig 3.50 (pg D-84)

Again, the recharge is underestimated in the Old Survey north of 15th Sideroad and in an outlier immediately north of Shelburne (Montgomery Farm) due to incorrect model glacial till assumptions. The WSC boundary again contradicts Strada detailed site data. Furthermore, there is not high net recharge in the Strada southern pit area. This Figure is misleading.

pg D-85 to D-87

Table 3.10 demonstrates average recharge for watershed and confirms recharge differences for the WSC catchments even if incorrect. The Grand River watershed near Dundalk and Riverview (New Survey of Melancthon) has lower recharge than the Boyne River at Earl Rowe and the Pine River at Everett.

The Pine River upland Old Survey of Melancthon likely has annual recharge in the order of 250 to 300 mm. Pine River 2024 stream flow monitoring at Honeywood Line (2nd Line Mulmur WHS) or Genivar DP-SW10 and calibrated model baseline validation is required.

Fig 3.5.2 (pg D-87)

The continued showing of the WSC boundary is ridiculous at this scale.

Conclusions (pg D-88)

Although the model perhaps may be well calibrated for use in estimation of long-term average recharge and baseflow at far away Earl Rowe and Everett Stations on a watershed basis, the only information currently available indicates the model is poorly calibrated to Horning’s Mills Pine River Valley headwater stream conditions.

pg D-89 to D-102

The model theory should be consolidated and appear in only one section of the Model-centric reports. **This Peer Review, despite the modelers’ accolades to their process, is focused on the bottom line calibration and validation results.**

Honeywood is in the wrong location again on many Figures.

Again, incorrect WSC boundaries should be deleted, especially on Fig 4.2 (also ridiculous).

Shelburne Golf Course irrigation water takings not shown on Fig 4.1 or Fig 4.7. Tavistock Till is incorrect in Table 4.1

Glossary required for Technical jargon.

Show this information only once in Model-centric Reports.

Karst network in s4.5 and Fig 4.6 attributed to Hunter (April 2010) needs to be updated to reflect Strada current real site data (Peer Review July 12, 2024 Fig H.1 and H.2) and new boreholes / groundwater monitors. There is no equivalent spatial water level analysis presented in the Strada document stack.

Simulated groundwater takings appear excessive in Table 4.2.

s4.8 (pg D-102)

This section appears elsewhere (but never easy to find) in the Strada document stack. We only need to see it once as part of the Real Baseline reporting.

This is the one location where stream flow information (Genivar) may be used to validate the model virtual stream base flow condition in the five recent Model Centric Reports provided. **The modellers have not ‘connected the dots’ in their Model Centric Reports or provided new Peer Review requested local stream flow observations to perform this validation.** This Peer Review indirect data correlation again indicates that the current model calibration is not acceptable.

- Notes:
- 1) Genivar (2011) Table H-27 reported simulated Groundwater Discharge Rate at SW8/STR2 at 3,520 m³/day (40.7 L/s) and calculated observed low baseflow at 3,575 m³/day (41.4 L/s).
 - 2) Newell / Funston Commercial Aquaculture (Fish Hatchery / Rearing Ponds) MECP Permit PTTW #7121-9Y7HP7 total is 741 m³/day (8.6 L/s) (Earthfx Aug 2024, pg D-102) immediately downstream of SW8/STR2.
 - 3) Genivar DP-SW8 reported Mean Flow at 0.35 m³/sec (350 L/s) in Earthfx Aug 2024 Table 3.6, pg D-57. This flow is an obvious error.
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The Earthfx Model Calibration for Baseline Conditions is obviously not validated for assessment prediction purposes.

The NDACT community, the MECP / MNRF agencies and Social Media will intuitively understand this unsatisfactory Groundwater Model situation very clearly if the model is predicting zero to near zero dry weather flows at the Newell / Funston Aquaculture Centre.

This may lead to non-confidence and failure of the Strada quarry licence application on this issue alone.

pg D-104 to D-105

Table 3 only contains Tavistock Till. There needs to be an entry for the Melancthon Old Survey Tills (Catfish / Newmarket?) or perhaps Weathered Till is a more appropriate class as this more pervious Till typically occurs at less than 2 m depth.

Hydraulic Conductivity in Layers 1 and 2 are required.

Layer 3 Increased Hydraulic Conductivity Zone may be expected to extend through the Strada Pits to the McTaggart Farm infiltration basin.

pg D-106 to D-115

The calibration statistics summarized in Table 4.1 are not suitable for assessment of stream flow as indicated by comparison of Model Predicted Baseline Conditions to Genivar stream gauging data near the Newell / Funston Aquaculture Centre at 3rd Line and 15th Sideroad about one kilometer northeast of the proposed Strada Quarry Northeast Infiltration Area.

If Strada does not agree with this conclusion then it should disclose for further validation, new stream flow data undertaken at sites as recommended by this Peer Reviewer on March 11, 2024 (see Figure).

The Strada consultants have dumped the potpourri of high quality 10 to 20 cm accuracy site water level data observations converted to CGVD2013, all at significant expense to Strada, into the model blender. This high quality site monitor data has been degraded to about 5 m accuracy notwithstanding the 3 m broken (not smooth) contours plotted as shown in Fig 4.9 Layer 1.

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 and Mitigation purposes.**

The high residuals in Layer 1 appear to reflect static levels in local perched aquifers (Fig 4.12) as well as real anomalies.

No 3D spatial data mining has been undertaken to identify real versus observation error anomalies including hydraulic connections between Model Layers across aquitards.

The high residuals 10 m ± in Model Layer 4 and Model Layer 6 are the direct result of the modelers avoiding investment in sweat equity to edit the MECP water well geographic locations and related ground elevations. This issue cannot be resolved with sophisticated modeling processing concepts and theories.

Where are the TPA private well surveys required to address this issue?

The Regional Figures with 20 m contours are not very useful.

pg D-116 to D-120

These scatter plots also occur in other Model-centric Reports. Why? We only need to see them once.

Once again, the 3 to 5 m errors are not acceptable for impact assessment, especially when improvements may be made to input data.

No scatter plots are provided for the previously high quality real site data degraded by the model.

No data mining is provided in Appendix AB.

pg D-121 to D-129

This whole section appears in similar form in other parts of these Model-Centric Reports. Why do we need to see and read it more than once? Please prepare one consolidated section. This information is real baseline data and should appear in Appendix AB so it doesn't need to be repeated in CDE.

No borehole and groundwater monitor screen information is provided for the Bonnefield and Shelburne Pump Tests.

Fig 4.22 continues to have mislabeled directions in the upper corners of the Figure window compared to the title. (Repeated in Matrix).

pg D-130 to D-133

Similar versions appear elsewhere in the Model-Centric Reports. Why do we need to see and read it more than once? **Have respect for the reader.**

These model-inferred 3D zones of Multi-Layer increased Hydraulic Conductivity are poorly documented on-site by the existing groundwater monitor network. Additional nested groundwater monitors are required to further confirm the location of this zone for Site Plan mitigation and development purposes.

We do agree that this Groundwater model inferred zone is real (Peer Review Groundwater Flow Convergence Trough on Fig H.1 and H.2). **There is also hydraulic evidence in the Strada water level database that the separating Layer 4 / Layer 6 intervening aquitard near the 4th Line may be discontinuous. Further nested water level and chemistry sampling data is required for confirmation.**

pg D-134 to D-138

The word 'local' in this section more or less equates with the TPA.

Again, there are multiple pages of sophisticated error discussions apparently to substitute for, or avoid editing the MECP WWIS database. This Peer Reviewer already initiated this process but set this task aside until the TPA data became available. Where is this TPA data?

These 'local' plots (Fig 4.31, 4.32 and 4.33) revert to 5 m contours from the 3 m shown on previous examples. These are confusing and of limited use except to show the data validation inaccuracy even at 5 m contour intervals.

pg D-139 to D-142

Versions of these scatter plots just appeared on pages D-116 to 119. What is the practical difference of these nuanced plots? All indicate Mean Absolute Errors in the 3 to 5 m range, similar to the contour plots. **Why all the nearly incomprehensible discussion to nuance the obvious.**
