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RE: PEER REVIEW OF REPORT ENTITLED: HYDROGEOLOGICAL INVESTIGATION AND TERRAIN EVALUATION PROPOSED RESIDENTIAL SUBDIVISION 819 BURRITTS RAPIDS ROAD MERRICKVILLE-WOLFORD ONTARIO

Dear Ms. Mallory,

This letter provides my peer review of the report Entitled: “Hydrogeological Investigation and Terrain Evaluation Proposed Residential Subdivision, 819 Burritts Rapids Road, Merrickville-Wolford Ontario”, dated January 20, 2025 by Kollard and Associates. The report provides an assessment of the quantity and quality of the groundwater supply, a groundwater quality nitrate impact assessment, septic system design considerations, and related conclusions and recommendations for the proposed development.

Proposed Development

The hydrogeological report indicates that the site consists of an area of approximately 22.7 hectares (56 acres) located on the west side of Burritts Rapids Road on the Rideau River within the village boundary of Merrickville-Wolford, Ontario. According to the report, the site is bordered on the west and north by the Rideau River, on the south by Burritts Rapids Road, and on the east by farmland and forest and is currently mostly treed with the exception of an existing house with a detached garage. The west and north sides of the subject property border the Rideau River and there is an unevaluated wetland within the south portion of the property. The report indicates that the proposed development involves subdividing the site property into ‘some 29 lots’, with an average size of 0.65 hectare lots with a minimum lot size of 0.4 hectare for single family residences purposes. The proposed residences are to be serviced by private septic systems and wells and does not provide details about proposed basement depths and drains.

Terrain Evaluation

The field work for the terrain evaluation included a total of ten test pits (TP1 to TP10) were put down across the site. The test pits were put down throughout the site. The test pits were advanced to depths of approximately 3.1 mbgs (metres below ground surface) to 3.6 mbgs. The soil types, depths to strata changes, and groundwater conditions at each test pit location were recorded at the time of excavation. Soil samples were obtained from test pits TP4 and TP9 for laboratory grain size distribution analysis for the soil encountered at the site.

The soil horizons encountered in the test pits, as indicated the hydrogeological report, are summarized below:

- Topsoil - all ten test pits encountered 0.30 to 0.60 metres of native topsoil, which consisted of a combination of sand, silt, organic material (humus).
- Silty Clay – native deposits of red brown silty clay were encountered at all test pits. With depth, silty clay transitions to grey-brown at depths of between approximately 0.6 mbgs and 1.2 mbgs.
- Glacial Till - a one test pit (TP9), the soil consisted of red brown silty sand, some gravel, cobbles, boulders, trace clay (glacial till). The glacial till becomes grey-brown at about 1.2 metres, then grey at a depth of about 2.3 mbgs. The till sample obtained for hydrometer analysis consists of a coarse-grained soil with some approximately 48% of particles passing the #200 sieve. The soil is coarse grained with less than 10% clay and approximately 39% silt content, the soil is considered to be of medium permeability.

Two representative samples were obtained from test pits TP4 and TP9 from depths of 1.6 mbgs and 2.5 mbgs and submitted to a laboratory for grain size analyses. The results of hydrometer testing on the two soil samples indicate the grain size distribution:

Sample	Depth (metres)	% Gravel	% Sand	% Silt	% Clay
TP4	1.6 – 2.5 m	0.0	1.6	44.4	54.0
TP9	1.6 – 2.5 m	10.6	41.6	38.8	9.0

The report indicates that charts in the MMAH *Supplementary Guidelines to the 1997 OBC* were used to correlate the soil type to hydraulic conductivity estimates of the soil and report and indicates that the saturated hydraulic conductivity of the soil is between 1.0×10^{-6} cm/s and 1.0×10^{-7} cm/s. The report indicates that the silty clay is considered to have a low permeability with approximately 54% clay sized particles and approximately 44% silt sized particles. The report indicates that this that this is considered to be low permeability. The estimated hydraulic conductivity of the till based on the grain size distribution is 1.3×10^{-5} cm/s. I agree that the analytical results indicate that the silty clay has low hydraulic conductivity, and that the till has a moderate hydraulic conductivity.

The report indicates that the site is not considered to be hydrogeologically sensitive since the surficial soils at the site are of low to very low permeability and there is a sufficient thickness of soils that are not highly permeable overlying the bedrock. I agree with the that site is not hydrogeological sensitive for these I also note that any septic design should take into the consideration the low permeability of the silty clay deposits.

Monitoring Well Installations

Four monitoring wells were installed using hand augering equipment adjacent to four test pits (TP1, TP2, TP5 and TP10) and designated as AH1, AH2, AH5, AH10.These wells were used groundwater level measurements and collection of groundwater samples for analysis of nitrogen compounds for use in the nitrate impact assessment for septic systems. The depths of the augered holes were approximately 3m deep based on the logs and they were completed in silty clay material. The report indicates that annular space around the screened interval and for

approximately 30 cm above the screen at each auger hole was filled with silica sand, with the remainder of the annular space to ground surface filled with bentonite pellets.

Test Wells

The report indicates that three test wells (TW1, TW2, andTW3) were drilled and TW4 is an existing residential well that was used for the testing. The purpose of the wells was to assess the groundwater supply quantity and quality for the proposed development and were utilized for pumping tests. The water well records for the test wells supplied by the well drilling contractor indicate that nominal 15 centimetre inside diameter steel casings were installed through the overburden and were set well into the bedrock and grouted in place. Test wells TW1, TW2 and TW3 were cased 1.8 metres into the bedrock with casing lengths ranging between 12.2 m (40 feet) and 13.1 metres (43 feet) below ground surface. The test wells were drilled to final depths using a 15 cm diameter bit and completed as an open hole in the carbonate bedrock of the Oxford Formation. TW1, TW2, and TW3 were drilled into the bedrock to final depths of 33.5mbgs, 42.7mgs, and 25 mbgs, respectively. TW4 is of unknown depth and construction.

Groundwater Levels

The groundwater elevations in the monitoring wells were measured during April 2023 and February 2024, and the results presented below in in the following table from the report.

Measured Groundwater Levels in Monitoring Wells – Elevations

Monitoring Well	Ground Surface Elevations	Groundwater Elevations (masl)	
		Apr. 18, 2023	Feb. 20, 2024
AH1	95.33	95.19	94.75
AH2	95.89	95.82	95.22
AH5	91.41	90.77	89.71
AH10	98.08	97.23	96.06

I have used the data in the report to create the following table to express the data as depth below ground surface below.

Measured Groundwater Levels in Monitoring Wells – Depth Below Ground Surface

Monitoring Well	Ground Surface Elevations (masl)	Groundwater Elevations (mbgs)	
		Apr. 18, 2023	Feb. 20, 2024
AH1	95.33	0.14	0.58
AH2	95.89	0.07	0.67

Monitoring Well	Ground Surface Elevations (masl)	Groundwater Elevations (mbgs)	
		Apr. 18, 2023	Feb. 20, 2024
AH5	91.41	0.64	1.7
AH10	98.08	0.85	2.02

As can been seen in the above table the groundwater levels are shallow and close to ground surface at all locations, as follows.

- AH1: 0.14 mbgs and 0.58 mbgs
- AH2: 0.07 mbgs and 0.67 mbgs
- AH5: 0.64 mbgs and 1.7 mbgs
- AH10: 0.85 mbgs and 2.02 mbgs

It is not clear from the report why the measured water levels were deeper in the second set of measurements at AH5 and AH10. Based on the water level measurements the groundwater levels at the monitoring wells are shallow and near ground surface. In my opinion, the high groundwater levels should be taken into account in the design of septic systems and related impact assessment, in addition to the low hydraulic conductivity of the silty clay deposits. My concern is whether there is sufficient capacity for infiltration into the clay to prevent breakout of leakage from the septic system along the top of the clay.

The report indicates that interpreted groundwater flow directions in the ‘sewage effluent receiving aquifer’ are expected to be to the northwest towards the Rideau River (as shown on Figure 6 in the report). I agree that the groundwater flow directions appear to be toward the Rideau based on the groundwater level measurements and the interpreted groundwater flow (shown on Figure 6 of the report).

The report indicates that water levels in the water supply wells at the site were measured during 2022 as follows.

Measured Groundwater Levels in Test Wells

Test Well	Top of Casing Elevations (masl)	Ground Surface Elevations (masl)	Groundwater Elevations (masl)
			June 28, 2022
TW1	98.25	97.33	94.03
TW2	95.85	94.89	94.03
TW3	100.65	99.72	94.14
TW4	96.80	96.38	89.68

The report notes that TW4 had groundwater elevations that were lower than the other wells, becausethis well is servicing the existing dwelling, and is of older construction, and that the water elevation in that well was not used to estimate groundwater flow direction. I note that this test well was not able to be used for determining the direction of groundwater flow. In my opinion, it would have been better to have drilled a new test well than to rely on the existing residential well considering that it could not be used for the well interference testing or determining groundwater flow directions. I am not recommending that a new test well be drilled and used instead of the residential well, at this stage, since I don't think that this information is critical for the application considering the low degree of well interference and the clear direction of shallow groundwater flow toward the river. In addition, the report indicates that deeper bedrock water aquifer groundwater flows are expected to be to the northwest (as shown on Figure 7 of the report). I agree with this interpretation based on the information provided in the report.

Nitrate Impact Assessment

The nitrate impact assessment in the report follows the three-step process in the MECP (formerly MOE) Procedure D-5-4 Individual On-site Sewage Systems: Water Quality Impact Risk Assessment. The report notes that the minimum lot size is 0.40 hectares and as a result Step 1 does not apply. The Step 2 – this approach was not utilized since, as noted in the report, that hydrogeological isolation from potential water supply aquifers was not evaluated. The report used the Step 3 methodology for the impact assessment which involves assessing whether the nitrate levels will be below the threshold limit of 10 mg/L at the downgradient property.

Groundwater samples were collected from the monitoring wells and were analyzed for nitrogen species nitrates, nitrites, Total Kjeldahl Nitrogen (TKN) and ammonia. The analytical results summarized in the report in the following table.

Analyte (Mg/L)	AH1	AH2	AH5	AH10
Sample Date (yy-mm-dd)	23-04-18	23-04-18	23-04-18	23-04-18
$N\text{-}NO_2$	<0.10	<0.10	<0.10	<0.10
$N\text{-}NO_3$	<0.10	<0.10	<0.10	<0.10
$N\text{-}NH_3$	0.031	<0.020	<0.02	0.043
Total Kjeldahl Nitrogen (TKN)	0.178	0.196	<0.10	0.244
Total Nitrogen = NO2+NO3+TKN	0.209	0.196	<0.1	0.287

The report indicates that based on that testing, the background nitrate levels in all four test wells indicate minimal levels (>0.3 mg/L) of nitrates. In my view, the analytical results indicate that the that nitrate levels (as $N\text{-}NO_{3)}$ are all non detect at <0.10 (mg/L). In my opinion, it is appropriate to use this value as the background concentration for the nitrate impact assessment for the septic systems. This calculation does include the existing background concentration of less 0.10 mg/L.

The results of the sewage dilution calculations presented in the report indicate that the expected concentration of nitrate at the site boundary for the proposed 29 sewage systems is approximately 9.7 mg/L (with supporting information provided in Attachment E of the report). This is below the Ministry of the Environment acceptable nitrate threshold limit of 10 mg/L and hence it is acceptable.

I agree that this is an appropriate approach and methodology for the impact assessment. In addition, I reviewed the approach and the calculation, and this appears to have been done using the appropriate calculation with the appropriate input parameters based on the information in the site investigation. The nitrate concentrations were based on only a single sample, but I am not recommending that additional sample be taken since the concentrations were all not detected at the laboratory detection limit. Should additional information be encountered during subsequent phases of the proposed development, such as areas with high existing background nitrate levels, then this information should be considered in a revised impact assessment.

Groundwater Supply Quantity Assessment

The assessment of groundwater supply follows the approach provided in MECP (formerly MOE) Procedure D-5-5 Private Wells: Water Supply Assessment. Pumping tests were conducted at TW3, TW1, TW2, and TW4 on four dates in 2022. A second pumping test was carried out at TW3 in December 2024. The testing consisted of 6-hour duration constant discharge rate pumping tests. During the pumping tests, water level measurements were made to monitor the drawdown of the water level in the wells in response to pumping. Following pumping, the pump was shut off and the recovery of the water level in the test well was monitored. During the pumping tests, water levels at adjacent test wells were monitored, using pressure transducers, to determine the potential interference effects between the wells.

The pumping test data for the test wells were analyzed using the method of Cooper and Jacob (1946), although the report notes that while the assumptions on which these equations are based are not strictly met, this method provides a reasonable estimate of the aquifer transmissivity. It is not clear from the report whether alternate analyses were performed and whether these more appropriate than the Cooper and Jacob method. I am not requesting additional analyses by a different method at this stage. The results of the pump testing are summarized below based on the information provided in the report.

- **Test Well TW1**

A six-hour pumping test was completed at a discharge rate of 72 L/min (litres per minute) with a total drawdown of 0.35 m (4.22 m at the beginning of pumping compared to 4.57m at the end of pumping). The transmissivity of the aquifer is estimated to be 43 m^2/day based on the pumping test drawdown data, and 19 m^2/day based on the recovery data.

- **Test Well TW2**

A six-hour pumping test was carried out at a discharge rate of 47 L/min. The total drawdown was 7.0 m from a static water level prior to testing of about 1.70 m below the top of casing reference point to 8.66 m at the completion of pumping. Based on the pumping test drawdown data, the transmissivity of the aquifer is estimated to be 41 m^2/day, while based on the recovery data, the transmissivity of the aquifer is estimated to be 62 m^2/day.

- **Test Well TW3**

A six-hour pumping test was conducted (as a second pumping test at this location) at a discharge rate of 33 L\min. The total drawdown at the end of pumping was 0.31 m from a static level of 7.50 m below the top of the well casing reference point at the beginning of the test to 7.81 m at the completion of the test. The transmissivity of the aquifer is estimated to be 55 m^2/day based on the pumping test drawdown data, while based on the pumping test recovery data, the transmissivity of the aquifer is estimated to be 16 m^2/day.

- **Test Well TW4**

A six-hour pumping test was completed out at a discharge rate of 32 L/min. The total drawdown at the end of pumping of was 9.2 metres, from an initial static water level of 6.36 m, to 15.58 m below the top of the well casing reference point. The report indicates that, based on the pumping test drawdown data, the transmissivity of the aquifer is estimated to be 8.0 m^2/day, while the transmissivity of the aquifer is estimated to be 3.0 m^2/day based on the pumping test recovery data.

The following measurements were made during the pumping tests to assess the potential for well interference.

- **Pumping of TW1**

The total drawdown observed at TW2 located 250 m from the pumping well was 0.25 m, and was 0.50 m at TW4 located 500m from the pumping well.

- **Pumping of TW2**

The total drawdown observed at TW1 was 0.20 m located at 250 m from the pumping well and 0.33 m at Observation Well OW1 located 650 m from the pumping well.

- **Pumping of TW3**

The total drawdown observed at TW4, located at 375 m from the pumping well, was 1.45 m but this well was also being used by the residence of the property which may have also been causing drawdown as noted in the report. I consider this well interference assessment to be problematic due to the potential drawdown associated with the use of the residential well during the test. From my perspective it would have been better to conduct the test either with use of the residential well temporarily suspended during the test, or to have drilled a new test well to use for the well interference testing. However, since the interference with the other wells was low I am not recommending a repeat test with the residential well not pumping, or the installation of a new test well.

- **Pumping of TW4**

During the pumping of TW4, pressure transducer logging was carried out at TW1, TW2, TW3, and the Observation Well (OW1) at the existing residence with the following results: the observed drawdown at TW1 located 500m from the pumping well was 0.0 m (no drawdown). The observed drawdown at TW2 located 660 m from the pumping well was 0.0m (no drawdown) m; The total drawdown at TW3 was 0.00 m (no drawdown) located at 375 m from the pumping well; and, the total drawdown at OW1 at the existing residence was 4.74 m, which as noted in the report, may have been influenced by the use of the well.

The report provides a calculation to predict the cumulative thirty-year drawdown at a central well in the proposed subdivision for the proposed 29 domestic wells. The cumulative drawdown at the test wells was calculated for a pumping rate of 1,100 L/day for four persons per household. The result of the calculation indicates that the thirty-year drawdown at a centrally located well due to the interference from the other 28 wells in the subdivision is approximately 0.94 metres. The cumulative well interference at the property boundary due to the 29 proposed wells was also estimated in the report to determine the impact of the proposed development on water supply outside of the site. The expected thirty-year drawdown at the site boundary was calculated to be 0.96 m.

In my opinion, the calculation and the input parameters are appropriate, and the results indicate a low degree of potential for mutual well interference in the proposed development. While the calculation appears to be adequate approximation there are other methods that could be used to estimate this using computer software. I am not, however, recommending that this be done since the calculated well interference impacts and those during the pumping tests are low. In my opinion, the results of the pump testing and thirty-year drawdown calculation indicate a low potential degree of mutual well interference. I note, however, that the actual well interference may differ due to the inherent variability in a fractured rock environment, such as a fracture that is interconnected between multiple wells.

Groundwater Supply Quality

The report notes that that the groundwater quality in the bedrock aquifer, based on sampling of the test wells, meets the ODWS (Ontario Drinking Water Standards) concentrations for all health-related chemical, physical and bacteriological parameters tested except for the following.

- **Iron**

Iron was measured above the aesthetic objective of 0.3 mg/L at TW2 and TW3. As noted in the report, iron filters may be used to remove iron from the water supply using conventional ion exchange water softeners, depending on the form that iron is in (reduced or oxidized) as well and other factors. I note that the water wells that have iron above the aesthetic objective may require treatment by conventional water softeners and/or iron filters.

- **Turbidity**

The laboratory results for samples from TW2 and TW3 exceeded the aesthetic objective 5 NTU for turbidity which is attributed in the report to elevated iron levels. The turbidity was less than the aesthetic objective of 5 NTU at all test wells after the pumping tests were completed, indicating that turbidity is within the aesthetic limit for all wells at the point of consumption. The report notes that treatment to reduce iron will be effective in reducing turbidity for water if required.

- **Organic Nitrogen**

The organic nitrogen concentrations at TW1 and TW3 ranged from 0.17 mg/L to 0.20 mg/L in comparison to the operational guideline of 0.15 mg/l. As noted in the report the operational guideline for organic nitrogen relates to its potential interaction with chlorine when used in water treatment that may cause taste problems in the treated water. The report notes that since groundwater at individual water supply wells is typically not treated using chlorine, the potential presence of organic nitrogen should not require treatment.

- **Sodium**

The Sodium levels were between 20 mg/L and 33 mg/L at TW2 and TW3. As noted in the report, the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets. The report recommends that if water softeners are used to treat hardness and TDS levels, that an untreated drinking water tap is installed in the kitchen to ensure that excessive sodium levels in treated water are not consumed.

- **Hardness**

The hardness levels of all samples at all wells ranged between about 268 mg/L to 400 mg/L and are considered to be hard from a standpoint of requiring water treatment. The report notes that recommended water treatment consists of ion exchange water softeners and maintaining a separate unsoftened water supply for drinking and culinary purposes.

In my opinion the groundwater quality is adequate to supply the proposed development recognising that the exceedances of the water quality guidelines based on the groundwater samples, as noted in the report. I recommend that the groundwater analyses in the report be provided to prospective home buyers such that they are aware of potential health implications and treatment requirements.

Septic System Design Considerations

The report indicates that future sewage systems on the property are expected to be fully raised conventional Class IV sewage systems with minimum 15 metre mantles and that all sewage systems should be constructed of imported sand with specification percolation time of between 6 and 8 minutes per centimetre with less than 5 percent passing the #200 (0.074 mm) sieve. The report also recommends that gradation analyses be carried out on any potential sand fill prior to leaching bed construction in order to verify that the percolation time of the fill material is acceptable. The design must ensure that the bottom of the absorption trenches is at least 0.9 metres above bedrock or soils that are unsuitable for treatment of septic effluent (those with excessively low permeability), and at least 0.9 metres above the seasonally high groundwater table. The report indicates that seepage from the septic systems will migrate slowly in the surficial deposits. The hydrogeological report indicates low surficial low permeability silty clay deposit over the majority of the site with high water table conditions.

My concern is that the septic water will not infiltrate into the low permeability glacial deposits. As a result, I recommend that this should be considered in the final design of the septic system to ensure adequate infiltration and prevent ‘break out’ of septic system water at the top of the underlying low permeability clay deposit with the shallow water table. From my perspective this can be addressed as part of the design of the septic systems and does not require a revised hydrogeological report. I agree with the findings of the report that downgradient well users will not be at risk due to the low hydraulic conductivity of the glacial materials. While I agree with this interpretation my concerns is the potential management of effluent from the base of the septic system and related surface water impacts. I agree with the statement in the report that the construction of individual septic disposal systems on the proposed lots should be carried out in accordance with the specifications set out in the Ontario Building Code.

The report indicates that Lot Development Plan shows fully raised conventional Class IV sewage systems with mantles based on sewage design flows of 2,800 L/day on most lots (21 of the proposed 29 lots). The report

indicates that there are seven lots that either have development constraints due to limited frontage on corner lots or to maximize separation distance from adjacent wetland or slopes. The report indicates that these exceptions are to ensure that each property can be serviced adequately with sewage systems in the front yards, down gradient of wells on these lots and maximize separation distances between sewage systems and adjacent surface water. As indicated in the report, these lots are proposed to have current OBC Level IV treatment units and alternative leaching beds (filter beds, Type A Beds, Type B Beds or shallow buried trenches) or other approved sewage systems.

The report recommendations that future owners of these lots should be made aware of this by appropriate means, such as being included in the title or deed that these additional constraints apply to the development of these parcels. While I agree in general with an approach involving the placement of the septic beds downgradient of the wells, I note that the County and Municipality should consider whether they are prepared to accept these types of systems on theses lots and whether they would accept an agreement with the landowner to operate and maintain these systems.

The report recommends that the general layout shown on the Lot Development Plan shall be maintained on each proposed lot, which means that sewage systems are generally to be kept in the front yards on most lots with mantles having an outlet to front yard roadside ditches (except for Lots 2 and 22 that have back yard sewage systems). I agree with these recommendations in the hydrogeological report that the general layout shown on the Lot Development Plan shall be maintained on each proposed lot, so that sewage systems are generally to be kept in the front yards on most lots with mantles having an outlet to front yard roadside ditches (except for Lots 2 and 22 that have back yard sewage systems).

The report indicates that any proposed alteration to the lot layout such as changing the location of a front yard to a back yard, would require a qualified hydrogeologist to review and approve the proposed lot grading and drainage plan. The report further indicates that the hydrogeologist must, at a minimum, ensure that any such change does not encroach upon any other lots from following the approved Lot Development Plan or affect the development setbacks that are protective of the natural habitat and surface water. The report further recommends subsequent report and Lot Grading and Drainage Plan should be approved by the Merrickville-Wolford Township building department prior to building permit issuance. I agree with the recommendation in the report that a hydrogeologist must ensure that any changes to the lot does not encroach upon any other lots from following the approved Lot Development Plan or affect the development setbacks that are protective of the natural habitat and surface water.

Conclusions and Recommendations

1) The investigation of groundwater supply followed the accepted approach of MECP (formerly MOE) D-5-5 Private Wells: Water Supply Assessment. Based on the results of the water supply investigation, there is sufficient groundwater supply for the proposed development to provide for single family dwelling domestic use. I agree that the levels of well interference between the wells are low and acceptable based on the pumping test and calculation of future demand. I note that the actual quantities of groundwater at the private well locations, and well interference, may vary due to the inherent variability in the fractured bedrock aquifer.

2) The quality of the groundwater is adequate to supply the proposed development recognizing the exceedances of the water quality guidelines of some natural groundwater samples as noted in the report. I

recommend that the groundwater analyses in the report be provided to prospective home buyers such that they are aware of potential treatment requirements.

3) The report recommends that future well owners are advised to obtain water samples and have the bacteriological water analyses performed through the Leeds, Grenville and Lanark Health Unit prior to first use of the water and twice annually thereafter typically in the Spring and Fall. I agree with this recommendation for bacteriological water analyses.

4) The report indicates that Homeowners should be aware of their obligations with regards to well maintenance and water and energy conservation. The report indicates that Homeowners are referred to the MECP publication Water Supply Wells – Requirements and Best Management Practices manual, April 2015. Additional information and links on water conservation measures are offered at the wellaware.ca website link. I agree with this recommendation and note that since homeowners may not read the hydrogeological report, I recommend that a mechanism be put in place to refer this publication to purchasers of the properties.

5) The nitrate impact assessment followed the accepted approach of MECP (formerly MOE) Guideline D-5-4 Individual On-site Sewage Systems: Water Quality Impact Risk Assessment. The results of the nitrate impact calculation are 9.7 mg/L which is close to but below the MECP (formerly MOE) threshold limit of 10mg/L and hence is acceptable. The nitrate concentrations were based on only a single sample, but I am not recommending that additional sample be taken since the concentrations were all not detected at the laboratory detection limit. Should additional information be encountered during subsequent phases of the proposed development, such as areas with high existing background nitrate levels, then this information should be considered in a revised impact assessment.

6) I agree that a post development monitoring program for groundwater quality at the site related to potential nitrate impacts is not warranted since the nitrate impact assessment meets the applicable guidelines. However, if nitrate impacts are encountered then a nitrate impact monitoring program should be developed.

7) I agree with the recommendation in the report that future wells drilled on this property shall be constructed in accordance with Ontario Well Regulation 903 and its well construction methodology, including setting the casing a minimum of 1.8m into sound bedrock.

8) The report recommends that existing on-site monitoring wells, including the boreholes AH1, AH2, AH5, and AH10 should be properly abandoned in accordance with Ontario Well Regulation 903. A record of well abandonment should be produced for each well prior to development approval. I agree with this recommendation for proper well abandonment.

9) The hydrogeological report indicates that future sewage systems on the property are expected to be fully raised conventional Class IV sewage systems with minimum 15 metre mantles and that all sewage systems should be constructed of imported sand with less than 5 percent passing the #200 (0.074 mm) sieve and percolation time of between 6 and 8 minutes per centimetre. The report also recommends that gradation analyses be carried out on any potential sand fill prior to leaching bed construction to verify that the percolation time of the fill material is acceptable. The hydrogeological report indicates low surficial low permeability silty clay deposit over the majority of the site with high water table conditions. As a result, I

recommend that this should be considered in the final design of the septic system to ensure adequate infiltration and minimize and/or prevent the potential 'break out' of septic system water at the top of the low permeability clay deposit with a water table that is close to ground surface. I recommend that the low permeability soil and shallow water table be considered in the design of the individual septic systems in accordance with the specifications of the Ontario Building Code.

10) I agree with the report recommendation that the general layout shown on the Lot Development Plan shall be maintained on each proposed lot, with the sewage systems are generally to be kept in the front yards on most lots with mantles having an outlet to front yard roadside ditches (except for Lots 2 and 22 that have back yard sewage systems as noted in the report).

11) I agree with the report recommendation that any proposed alteration to the lot layout, such as changing location of front and back yards, would require a qualified hydrogeologist to review and approve the proposed lot grading and drainage plan who should ensure that any such change does not affect the development setbacks that are protective of the natural habitat and surface water.

12) The report indicates there seven lots are proposed to have OBC Level IV treatment units and alternative leaching beds (filter beds, Type A Beds, Type B Beds or shallow buried trenches) or other approved sewage systems. I agree with the recommendation in the report that future owners of these lots should be made aware of this by appropriate means, such as being included in the title or deed that these additional constraints apply to the development of these parcels. I further recommend that that the County and Municipality should consider whether they are prepared to accept these types of systems on these lots and whether they would accept an agreement with the landowner to operate and maintain these systems.

13) The report indicates that it is understood that Merrickville-Wolford Township allows secondary dwelling units on all residential properties. The report indicates that the well yields that were tested are sufficient to provide for larger single-family dwellings, and if additional water demand is needed for secondary dwelling units, future property owners are responsible to do further well assessment at the time of well construction to ensure an adequate water supply is present. I agree with this recommendation in the hydrogeological report that further well testing would be required for a secondary dwelling unit.

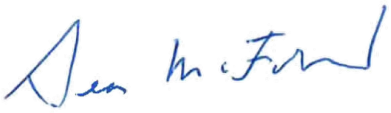
14) The report indicates that any private well that extends beyond the assessed depths of the test wells they may encounter different water quality and quantity and should have additional water quantity and quality testing performed in accordance with MECP Procedure D-5-5 and ensure that interference with adjacent well owners is minimized. The report recommends that a Hydrogeologist with related experience, such as a P. Geo or P. Eng., should be engaged to do this assessment. I agree with this recommendation that additional studies are required by a qualified hydrogeologist with related experience if the water supply wells for the residences are to be deeper than those tested in the hydrogeological report.

15) This peer review is based on the findings and recommendations of the hydrogeological investigation. If any of the site development conditions were to change from those assessed, then additional hydrogeological work may be required to be updated to assess the revised development conditions. The planning approvals should then be based on the revised hydrogeological study to reflect the revised development application and this peer review process repeated on the new report findings.

Closure

I trust that this peer review meets your requirements and if you have any questions, please contact the undersigned.

WSP Canada Inc.



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SM/PM/rk