



20-069

December 23, 2020

Mike and Wendy Reid
779664 Concession 2 NCD
Georgian Bluffs, Ontario
N0H 2T0

**Re: Groundwater Quality Impact Assessment, Proposed Residential Sewage Systems
340175 Stone School Road
Township of Georgian Bluffs, Grey County**

Dear Mr. and Mrs. Reid,

As requested, this letter provides the results of an assessment of potential impacts on groundwater quality as a result of nitrate loading from the construction of individual on-site sewage systems on two residential lots that are proposed to be severed from your 40.6-hectare (100.2-acre) agricultural property located at 340175 Stone School Road in the Township of Georgian Bluffs (hereafter referred to as the Site). The Site is located in Part of Lot 31, Concession 1 South of Centre Diagonal (SCD), in the geographic Township of Keppel

Background

GSS previously carried out an environmental evaluation of the Site in accordance with Ministry of the Environment, Conservation and Parks (MECP) Guideline D-4 to assess the potential for environmental impacts from the presence of a closed waste disposal site located south of the Site. The results of that evaluation were provided to you in our December 7, 2020. At the time of that evaluation, GSS understood that you were proposing to create two residential lots in the south half of the Site, within the portion of the Site currently zoned as Rural (RU), although the size and configuration of the lots was still to be determined.

Following the issuance of the report, a preliminary site plan indicating the approximate size and location of the two proposed lots to be severed was provided to GSS via email on December 8, 2020. The preliminary plan showed a smaller lot with approximate dimensions of 80 m north-south by 150 m east-west (area of 1.2 ha) to be created in the southeast corner of the Site. A much larger lot with an area of approximately 23 ha was shown to occupy the remainder of approximately the south half of the Site.

Site Description

A description of the Site was provided in the December 2020 Guideline D-4 report. Topographic mapping indicated that the ground surface in the vicinity of the Site generally sloped toward the west-southwest. On the Site, two areas of higher ground at approximate elevation 235 m were indicated along the west-central boundary and in the southwest portion of the Site. The southeast corner was at approximate elevation 222 m, which was the lowest portion of the Site. A small, localized depression at approximate elevation 224 m was shown in the central portion of the Site near the edge of a treed area. South of that depression, it appeared that surface drainage in the southeast portion of the Site was primarily in a south-southwesterly direction.

Quaternary (near-surface overburden) geology in the vicinity of the Site was shown on Ontario Geological Survey (OGS) Map P.2559 (Sharpe and Jamieson, 1982). The southeast corner of the Site was shown to be located within an extensive deposit of glaciolacustrine (shallow water) sand. Most of the remainder of the Site was mapped as Bruce till (stoney, sandy silt). A relatively small area of higher ground extending into the west-central portion of the Site from the west was mapped as ice-contact stratified drift: sand, gravel, flow-till associated with moraines, deltas, or eskers.

The provincial records for two water wells shown to be located east of the south half of the Site, on the east side of Stone School Road, indicated that the overburden thickness at the well locations was 4.6 m and 7.0 m.

Assessment of Potential Impacts on Groundwater Quality from On-Site Sewage Systems

An evaluation of the potential impacts on groundwater quality from the sewage systems at the two proposed lots was carried out in general accordance with the method identified in MECP Procedure D-5-4 (1996) for individual on-site sewage systems: water quality impact risk assessment. That document provided technical guidance for assessing the potential of unacceptable groundwater impacts resulting from the use of individual on-site sewage systems through a prediction of the development's nitrate impact on the groundwater at the development boundary. The Procedure D-5-4 guideline was intended to assess the combined impact on groundwater of a development proposal of more than five units; however, the evaluation approach outlined in the guideline was considered to be reasonable for this assessment.

An evaluation of contaminant attenuation considerations was used to assess the risk that the proposed on-site sewage systems will cause the concentration of nitrate-nitrogen in groundwater to exceed 10 mg/L at the downgradient property boundary. A predictive assessment was made in general accordance with the considerations and assumptions identified in Procedure D-5-4.

For the purpose of predicting the potential for groundwater impacts, an estimated nitrate concentration of 40 mg/L in the sewage effluent was used. Dilution from infiltrating precipitation

at the Site was estimated using information from geological mapping and the Tier 1 Surface Water Budget and Stress Assessment Report prepared for the Saugeen Valley, Grey Sauble, and Northern Bruce Peninsula Source Protection Region (AquaResource, 2008). In that report, the Site was shown to be located within the Sauble River/Hepworth subwatershed. The selected study period for climate data was from 1985 to 2005. The average water budget model results for the relevant subwatershed were summarized by AquaResource (2008) as follows:

ID	Subwatershed	Area (km ²)	Precipitation (mm)	Evapotranspiration (ET) (mm)	Runoff (mm)	Recharge (mm)
22	Sauble River / Hepworth	215	1,141	552	329	260

The estimated evapotranspiration for the subwatershed was 552 mm, leaving 589 mm of precipitation as potential recharge, without the effects of runoff. Within the subwatershed, there were variations in the estimated evapotranspiration, runoff, and recharge values based on differences in surface topography, surface cover, and soil conditions. Using information in the MECP Stormwater Management Planning and Design Manual (2003), GSS identified an infiltration factor of 0.6 for the Site, based on the presence of hilly land, relatively permeable sandy soils, and cultivated land. Applying this infiltration factor to the potential recharge resulted in an estimated infiltration of 353 mm, substantially higher than the estimated infiltration rate from the 2008 Tier 1 Water Budget. For comparison, the MECP Design Guidelines for Sewage Works (2008) identified a constant quantity of dilution of 250 mm of water per year for assessing impacts of effluent on groundwater quality, which was identified to be approximately the rate of infiltration of precipitation into a sand unit. Based on the available information and the conditions at the Site, an estimated average infiltration of 260 mm per year (0.71 mm/day) was considered to be reasonable for this assessment.

Consistent with Procedure D-5-4, the nitrate loading was assumed to be 40 grams/lot/day for a single dwelling unit per lot and the volume of sewage effluent was estimated to be 1,000 L/day/lot, which corresponded to an average nitrate concentration in the effluent of 40 mg/L.

Using these input parameters in a mass-balance equation, a minimum lot size of 0.42 ha was identified in order for the estimated nitrate concentration in groundwater at the downgradient property boundary to be 10 mg/L or less. For a lot size of 1.2 ha, which was the approximate area of the smaller of the two lots proposed for the Site, the estimated nitrate concentration at the downgradient property boundary was 4.2 mg/L. This was well below the Ontario Drinking Water Quality Standard maximum acceptable concentration of 10 mg/L.

Summary

An evaluation of the potential groundwater quality impacts in general accordance with MECP Procedure D-5-4 indicated that the south half of the Site could be developed with two residential lots with a minimum area of 0.42 ha without causing nitrate-nitrogen concentrations in groundwater at the downgradient property boundary to exceed 10 mg/L.

We trust that this letter meets your present requirements. If we can be of additional assistance in this regard, please contact this office.

Yours truly,

GSS Engineering Consultants Ltd.



W. Brad Benson, P.Eng.
Senior Hydrogeologist

WBB/RS/bb

cc Beverly Nicolson, B.A. Nicolson Services

References

AquaResource, Inc. (2008). *Saugeen Valley, Grey Sauble, and Northern Bruce Peninsula Tier 1 Surface Water Budget and Stress Assessment Report*.

Ontario Ministry of the Environment (2008). *Design Guidelines for Sewage Works*.

Ontario Ministry of the Environment (2003). *Stormwater Management Planning and Design Manual*.

Ontario Ministry of the Environment and Energy (1996). *Procedure D-5-4, Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment*.

Sharpe, D.R., and Jamieson, G.R. (1982). *Quaternary Geology of the Warton Area, Southern Ontario*, Ontario Geological Survey Preliminary Map P.2559, Scale 1:50,000, Geology 1977.