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October 8, 2025 Project No. 250015

Patrick Townes
MHBC Planning, Urban Design and Landscape Architecture
113 Collier Street
Barrie, ON L4M 1H2

Dear Mr. Townes:

Re: **Eagle Lake Lakeshore Capacity Assessment and Peer Review**

Stephanie Apollonio and Bob Hoang have proposed the development of a Tourist Commercial Camp on Eagle Lake. The proposed development includes 12 new elevated tent platforms, 16 parking spaces on a gravel driveway, one new camp centre, one new kitchen facility, two new accessory buildings with outhouse, one new maintenance office, and one new septic system. The proposal has been supported by a *Planning Rationale Report* (Biglieri Group, 2024) and a *Scoped Environmental Impact Study* ([EIS] Oakridge Environmental Ltd., 2024). Eagle Lake was determined to be at capacity according to the *Lakeshore Capacity Assessment for Eagle Lake, Township of Machar* (Hutchinson Environmental Sciences Ltd., 2013). As described in Policy B4.10 of the Township of Machar's Official Plan (MHBC, 2015), "*New development may be permitted within 300 metres of Eagle Lake only under one of the following special circumstances:*

D) The proposed new use, has a scale and density that is less than or equal to that which currently exists on site, and shall demonstrate a net reduction of the phosphorus loading to the lake."

Hutchison Environmental Sciences Ltd. (HESL) was retained to complete a Lakeshore Capacity Assessment update to determine if Eagle Lake is still at capacity and by extension the relevance of related Official Plan policies such as B4.10 (d) listed above. The Province of Ontario recommends the use of their Lakeshore Capacity Model (LCM) to determine the interim Provincial Water Quality Objective for phosphorus and the amount of shoreline development that can occur while maintaining phosphorus levels below the phosphorus threshold of Background + 50% (Ministry of Environment 2010). The Lakeshore Capacity Model is a steady-state, mass-balance model that estimates hydrologic and phosphorus loading from natural (watershed runoff and atmospheric deposition) and human (septic systems and land disturbance) sources and links them together considering lake dynamics to predict total phosphorus concentration in lakes.

The EIS was also peer reviewed to determine if it:

- provides sufficient information on the natural environment of the area to fully characterize the ecological setting, including detailed documentation of natural features, ecological functions, environmental sensitivities and constraints;
- uses methodologies to gather the information that follow industry standards and apply appropriate scientific approaches;
- identifies potential impacts of the proposed development on the natural features;
- makes sound conclusions and recommendations based on the best available information, so that the development proposal avoids negative impacts on significant natural heritage features and their ecological functions and conforms with applicable environmental policies and legislation; and
- determines whether the EIS conforms to applicable policies and legislation (e.g., Township of Machar Official Plan, Provincial Planning Statement, Endangered Species Act).

1. Lakeshore Capacity Assessment

The methodology utilized in *Lakeshore Capacity Assessment for Eagle Lake, Township of Machar* (HESL 2013) remains relevant as the methodology for Lakeshore Capacity Assessment as outlined in *Lakeshore Capacity Assessment Handbook – Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield* (Ministry of Environment [MOE] 2010) remains unchanged. The Lakeshore Capacity Model was however updated with new inputs and updated water quality data as follows:

- Lake surface areas, catchment areas, including % wetland and % cleared land were calculated using the Ontario Watershed Information Tool (OWIT).
- Measured total phosphorus concentrations were updated using 20 years of spring-overturn Lake Partner Program (2002 – 2022) and compared to modelled phosphorus concentrations to determine the accuracy and by extension, utility of the model.

1.1 Results

The modelled spring overturn phosphorus concentration in the north and south basins are 7.04 µg/L and 6.18 µg/L, respectively (Table 1). The measured spring overturn phosphorus concentrations in the north and south basins are 8.53 µg/L and 7.09 µg/L, respectively. The differences between the modelled and measured concentrations are less than 20%, indicating that the Lakeshore Capacity Model is sufficiently accurate to use (MOE 2010).

Table 1. Modelled Versus Measured Total Phosphorus Concentrations

Scenario	North Basin	South Basin
Existing Spring Overturn Modelled Total Phosphorus (µg/L)	7.04	6.18
Existing Spring Overturn Measured Total Phosphorus (µg/L)	8.53	7.09
% Difference between Measured and Modelled	17.5	12.9

The modelled background total phosphorus concentration in the north and south basins is 2.96 µg/L and 2.29 µg/L, respectively (Table 2). The Provincial Water Quality Objectives (PWQO), which are the background total phosphorus concentration + 50%, are 4.45 µg/L and 3.44 µg/L, respectively. The modelled ice-free total phosphorus concentrations of 6.42 µg/L (North Basin) and 5.57 µg/L (South Basin) are higher

than the Provincial Water Quality Objectives indicating that the lake is over-capacity for development following provincial guidance.

Table 2. Lakeshore Capacity Model Outputs

Scenario	North Basin	South Basin
Background Total Phosphorus (µg/L)	2.96	2.29
PWQO (Background + 50%) (µg/L)	4.45	3.44
Modelled Ice-Free Total Phosphorus Concentration	6.42	5.57

It should be noted that decades of research have shown that septic system phosphorus is immobilized in Precambrian Shield soils. Mechanistic evidence (Stumm and Morgan 1970; Jenkins et al. 1971; Isenbeck-Schroter et al. 1993) and direct observations (Willman et al. 1981; Zanini et al., 1998; Robertson et al. 1998; Robertson 2003) show strong adsorption of phosphate on charged soil surfaces and mineralization of phosphate with iron and aluminum. Mineralization reactions appear to be favoured in acidic and mineral-rich groundwater in Precambrian Shield settings (Robertson et al. 1998; Robertson 2003), typically resulting in over 90% immobilization of septic-system phosphorus. The mineralization reactions appear to be permanent (Isenbeck-Schroter et al. 1993) and many studies conclude that most septic phosphorus is stable within 0.5–1 m of the tile drains in a septic field (Robertson et al. 1998; Robertson 2003; Robertson 2012). A recent review (Robertson et al. 2018) reported average phosphorus attenuation of 97% and 69% within 10 m of the tile field in non-calcareous soils and calcareous soils, respectively, regardless of site age or loading rate.

The Lakeshore Capacity Assessment was completed with no septic phosphorus retention per provincial guidance but since the report was completed in 2013 additional scientific proof of phosphorus attenuation has emerged, notably the findings in Robertson et al. (2018). If a phosphorus retention coefficient is utilized however, the model does not predict measured total phosphorus concentrations within the allowable error range (±20%) defined by the Ministry of Environment, Conservation and Parks.

1.2 Other Measures of Capacity

Phosphorus attenuation complicates the utility of the Lakeshore Capacity Assessment. In HESL (2013), lake sensitivity was used which is the degree to which a lake will respond to the addition of phosphorus and is a function of such attributes as the lake size, shape, surface area and flow of water. Use of a standard loading of phosphorus for a lake allows lake sensitivities to be classified and compared between lakes. Both basins proved to be highly responsive to total phosphorus, indicating that Eagle Lake is sensitive to increased phosphorus loadings, including stormwater loadings, and will respond to them and should be managed accordingly.

The offshore lake areas (i.e., that beyond a 30-m-wide nearshore zone) are 292 ha for the north basin and 544 ha for the south basin. The offshore lakes areas are smaller than the minimum areas required for recreation on the north (306 ha) and south basin (580 ha), respectively, for the current level of development if the Seguin Township criteria which is based on 1 residential unit per 1.6 ha and 1 tourist accommodation unit per 0.8 ha. Therefore, there is no recreational capacity to support additional development on Eagle Lake (Table 3).

Table 3. Recreational density data for Eagle Lake.

	North Basin	South Basin
Lake Area (ha)	335	608
Offshore Area (ha)	292	544
Residences (#)	191	227
Residential Area (ha)	306	363
Tourist Units (#)	0	271
Tourist Area (ha)	0	217
Used Recreational Area (ha)	306	580

1.3 Conclusions

Shoreline development leads to a wide variety of stressors beyond nutrient loading from septics which has been the primary stressor used to dictate development capacity in Ontario. Other stressors include stormwater runoff including chloride inputs from road salt, impacts to fish habitat, increased fishing pressure, sedimentation caused by boat wakes, and alteration to shoreline buffers and riparian areas, that can negatively impact lakes and are not easily quantified through lake management or capacity models.

Lakes are subject to multiple stressors, including additive, complicating interactions that are not easily understood or managed, or that simply can't be directly managed (e.g., climate change causing more algal blooms in low-nutrient lakes). Lake management approaches are not available that consider lake characteristics and the myriad of stressors to develop a specific and accurate amount of development or type of development that is appropriate or sustainable. A holistic and conservative approach to lake management is required that recognizes those shortcomings to ensure that lakes are resilient to both anthropogenic and natural stressors moving forward.

Eagle Lake is over capacity according to Lakeshore Capacity Assessment and provincial guidance. It is also highly responsive to phosphorus loadings and is overcapacity from a recreational perspective. Algal blooms have also been reported in Eagle Lake recently in June 2024 and October 2024 (blue-green algae; https://townshipofmachar.ca/en/our-community/community-news-alerts/show/blue-green-algal-bloom-eagle-lake-1). Despite shortcomings in the capacity approaches, Official Plan policies such as B4.10 (d) should be implemented as part of conservative approach to lake management.

2. Peer Review of Scoped Environmental Impact Study

HESL Comment #1 – Winter Site Visit

Oakridge Environmental Ltd. (ORE) states, "*ORE staff completed a single site inspection in the winter period whereby the site was blanketed with snow. The ELC communities were therefore identified using a best effort approach based on the tree and shrub cover without the majority of the groundcover and soils data being available. ORE staff notes there were some test pits that were excavated about the site that did aid with the soils determination.*"

Winter is an inappropriate time to complete the sole field investigation used to inform an Environmental Impact Study (EIS). No information could be collected regarding low-lying vegetation, wetlands, fish habitat, watercourse features, or the majority of species-at-risk which are hibernating or have migrated south in the winter. Therefore, the EIS relies on limited information and contains too many assumptions. The EIS should be updated following field investigations completed in the growing season (e.g., summer) when natural heritage features and functions can be properly characterized. A Terms of Reference detailing the proposed approach should be provided to the Township for approval so that the landowner can be assured that the project proceeds in a manner that meets industry standards.

HESL Comment #2 – Beach Creation

The proposed development includes augmentation to the existing beach through placement of sand overtop the existing footprint. Placement of sand below the high-water mark would require approval from Ministry of Natural Resources (Public Lands Act) and Fisheries and Oceans Canada (Fisheries Act), and is generally discouraged. Ministry of Municipal Affairs and Housing (MMAH) was specifically concerned about how imported sand would impact phosphorus loading to Eagle Lake as stated in *One Window Provincial Review Comments – Draft Official Plan Amendment – Official Plan for the Township of Machar MMAH File No. 49-OP-242249.*

HESL Comment #3 – Net Phosphorus Reduction

Eagle Lake was determined to be at-capacity following provincial guidance and utilization of the Lakeshore Capacity Model, highly responsive to phosphorus loading and over capacity from a recreational perspective. Municipal policy requires that there be a net reduction in phosphorus from the subject property post-development. ORE mentions that "*there is potential for the proposed new septic system to increase the phosphorus loading to nearby waterbodies due to the potentially high infiltration rates on the property*". Phosphorus loading is to be mitigated through setbacks >50 m for the proposed buildings and septic, construction-based mitigation (e.g., silt fencing and reseeding). ORE also discuss phosphorus attenuation of septic effluent by soils, including the findings of W. Robertson, and state, "*In the event that the materials encountered are not similar to the conditions observed by Robertson (2003), the proponent should consider having tile bed materials utilized for the construction of the sewage system be composed of soils that are verified to have a phosphorus retention capacity of at least 6 mg/100 mg."*

The EIS focuses on how phosphorus loading can be mitigated, not how a reduction can occur. The report provides limited on the existing phosphorus load on-site, both in terms of phosphorus derived from stormwater and wastewater. Quantification of stormwater and wastewater phosphorus loads pre-and post-development, including a net reduction through implementation of mitigation measures and potentially improvements to the subject property are required to meet OP Policy B4.10 (d).The Lakeshore Capacity Model provides phosphorus loading and usage rates that should be reviewed, while phosphorus budget tools such as *Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed* (HESL 2012) contain concepts such as export coefficients that could be utilized to quantify phosphorus loads.

We agree that phosphorus can be attenuated in soils, but little information is provided to guide the proponent in the implementation of phosphorus reduction in wastewater. For example, no recommendations are provided to perform a soils assessment in order to see if the materials are similar as

those observed by Robertson (2003), nor what those similarities should be. It is also not clear what the basis is for the recommendation for soils with a phosphorus retention capacity of at least 6 mg/100 mg during mantle construction. MMAH have recommended that the development explicitly follow recommendations found in the Lakeshore Capacity Assessment Handbook for at-capacity lakes:

Development may occur where municipal planning tools or agreements are in place, such as site plan control under the Planning Act and a site-specific soils investigation prepared by a Qualified Professional documents the following:

- *the site where the septic tile-bed is to be located, and the region below and 15 metres down-gradient of this site, toward the lakeshore or a permanently-flowing tributary, across the full width of the tile bed, consist of deep (more than three metres), native and undisturbed, non-calcareous (<1% CaCO3 equivalent by\ weight) overburden with acid-extractable concentrations of iron and aluminum of >1% equivalent by weight (following Robertson 2005, 2006, Appendix B). Soil depth shall be assessed with test pits and/or boreholes at several sites. Samples for soils chemistry should be taken at a depth adjacent to, or below, the proposed tile bed; and*
- *an unsaturated zone of at least 1 ½ metres depth exists between the tile bed and the shallowest depth (maximum) extent of the water table. The position of the water table shall be assessed with test pits during the periods of maximum soils saturation (e.g., in the spring, following snowmelt, or late fall).*

We agree that a soils assessment should be completed following MMAH's recommendation. If conditions do not align exactly with those prescribed in the Lakeshore Capacity Handbook, alternative methods to sewage-related phosphorus attenuation should be discussed such as importation of acidic, iron and aluminum rich soils, or utilization of tertiary treatment systems, such as Ecoflo or Waterloo Bioflter systems. A thorough description of on-site soil conditions should allow for the development of a sewage servicing plan that attenuates a large proportion of sewage-related phosphorus.

3. Conclusions

The Scoped EIS was based on a singular site visit in the winter which is an inappropriate time to characterize natural heritage features and functions on a property in central Ontario. Site visits should be completed in the growing season to properly characterize the subject property and update the EIS. We recommend that a Terms of Reference be submitted by the proponent's consultants to ensure that the updated Scoped EIS is properly designed to meet OP policies focused on natural heritage features.

Eagle Lake was determined to be at-capacity following provincial guidance and utilization of the Lakeshore Capacity Model, highly responsive to phosphorus loading and over capacity from a recreational perspective. Municipal policy requires that there be a net reduction in phosphorus from the subject property post-development. The Scoped EIS does not provide a detailed accounting of pre-or post-development stormwater or wastewater phosphorus loads which is required to meet relevant OP policy.

Sincerely,
Per. Hutchinson Environmental Sciences Ltd.

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4. References

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