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M E M O R A N D U M

June 02, 2023

TO: Phil White
Thomas Cavanaugh Construction Limited
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FROM: Brigitte Simmatis
Surface Water Specialist
Technical Support Section
Eastern Region

RE: MECP Surface Water Review Comments, Aggregate Resources Act
Proposed Highland Line Pit
Part Lot 15, Concession 10, Lanark County, Ontario

The Ministry of Natural Resources and Forestry (MNRF) administers the *Aggregate Resources Act* (ARA). The Ministry of the Environment, Conservation and Parks (MECP) may become involved if proposed activities overlap with the *Ontario Water Resources Act* and/or *Environmental Protection Act*. The role of the MECP surface water reviewer is to assess submitted report(s) and related material in order to assess potential impacts from proposed activities on surface water features including wetlands, ponds, lakes and rivers. The goal of the review is to ensure that detrimental impacts to water quality and quantity are mitigated.

I have reviewed the Level 1 and Level 2 Water Report, prepared by Golder Associates Ltd. ("Golder") and dated December 2022, and offer the following comments in relation to surface water resources. Comments in relation to hydrogeology and associated impacts have been provided by a regional hydrogeologist.

Background

Thomas Cavanagh Construction Limited ("Cavanagh") has applied for a Class 'A' licence (Pit Below the Groundwater Table) under the ARA. The proposed Highland Line Pit will be located on Part Lot 15, Concession 10 in the Township of Lanark Highlands (Geographic Township of Dalhousie).

Site Description

The proposed licensed property will comprise 50.6 ha. The extraction area is proposed to be 35.1 ha (exclusive of a 1.3 ha Natural Environment Exclusion Zone), separated by Anderson Lane into eastern and western extraction areas. Currently, the site surface elevation ranges from 184 to 216 masl with a ridge running east-west along the southern

aspect of the site.

Surrounding land use currently includes an existing sugarbush to the west; deciduous, mixed and coniferous forest to the south, east, and north; small patches of interspersed shallow-rooted agriculture; a sand extraction operation (owned by others) to the north on the opposite site of Highland Line; and residential dwellings along Highland Line, Leo Jay Lane and Anderson Lane. Golder estimated that eight private supply wells are located within 500 m of the proposed licence boundary based on an air photo review; MECP WWIS confirmed two domestic wells.

Unconsolidated material extraction will include the removal of overburden to a pit base elevation of approximately 176 masl. Bedrock is expected to remain intact and dewatering is not currently proposed. Golder reports that groundwater generally flows from southwest to east across the site, towards Barbers Lake.

The final rehabilitation plan includes a permanent pond located within the proposed extraction area, with a surface elevation of 186 masl. The pond would go to the edge of the proposed extraction area with a 30-m setback from the mixed mineral shallow marsh adjacent to Barbers Lake. From my understanding, the rehabilitated pit pond will have an intermittent outlet to Barbers Lake at an unspecified location.

Surface Water Features

Within the property boundary, unevaluated shallow swamps and marshes exist adjacent to Barbers Lake. Topographically low areas collect water (e.g., small forest pond in the eastern portion).

Adjacent to the property boundary, Barbers Lake lies 100 m southeast of the proposed extraction area; municipal drains lie to the north and east; two seepage areas feed an intermittent watercourse (connected to Barbers Lake and unevaluated wetlands); and, a series of unevaluated wetlands exist along the northern property boundary. I note that the main channel of Long Sault Creek lies within 300 m of the southern property boundary along the western portion of the site. Long Sault Creek is a cool-/cold-water stream with a naturally reproducing brook trout population.

Golder reports that the site can be divided into three catchments, separated by the topographic ridge and Anderson Lane. Less than one-half of the site (north of the ridge) flows north to the ditch along Highland Line Road. Approximately one-third of the site (roughly east of Anderson Lane) drains southeast to Barbers Lake. Approximately one quarter of the site (roughly west of Anderson Lane) drains southwest to an unevaluated wetland hydraulically connected to Long Sault Creek.

I note that Golder misidentified Long Sault Creek as a tributary of the Clyde River. Long Sault Creek flows to and from Barbers Lake adjacent to the site. Downstream of Barbers Lake, Long Sault Creek discharges to the Mississippi River after ~5 km. The Mississippi River eventually discharges to the Ottawa River.

Baseline Studies and Modelling

Baseline hydrology

Staff gauges (SG) and a well point (WP) were installed to measure water levels in the northern wetland and near the eastern marshes adjacent to Barbers Lake. Data loggers were installed at each point and measured water levels in 15-min increments. SG2 was installed along the northern site boundary near the corner of Highland Line Drive and Leo Jay Lane. SG1, SG3 and WP1 assessed water levels in the marshes adjacent to Barbers

Lake. SG2 recorded a daily average fluctuation of 0.59 m. The marshland adjacent to Barbers Lake had a daily average fluctuation of 0.23-0.49 m. Golder reports that water levels in the unevaluated wetland to the northeast responded to precipitation and melt events. Water levels in the marsh adjacent to Barbers Lake did not notably respond to precipitation and melt events. The consultants state that water levels were moderate to high in spring following freshet and low for the remainder of the year, except for high-water events in winter resulting from short melt events.

Water balance

Estimated water balance scenarios under operational and rehabilitated conditions were compared to existing conditions. Catchments were not separately assessed based on their on-site areas relative to the total catchment areas. Water balance was based on the equation, P = S + ET + Surplus, where P was precipitation, S was the change in soil water storage (assumed to be negligeable), ET was evapotranspiration, and Surplus was the amount of water available for runoff or infiltration.

A key assumption of the water balance scenarios was that the final pond would remain a closed depression and its entire volume could contribute to infiltration; based on my understanding, this would not entirely reflect the proposed rehabilitated conditions (i.e., intermittent connectivity with Barbers Lake).

Overall, Golder reports that surplus will decrease during the operational and rehabilitated phases compared to current conditions. Runoff will be reduced by approximately 48% (34,625 m^3/year) during the operational phase and reduced by 32% (23,100 m^3/year) during the rehabilitated phase compared to current conditions. Flooding of nearby wetlands would not be expected due to limited discharge from the pit during the operational phase. The consultants predict the runoff will flow away from the pit to Long Sault Creek, Barbers Lake, and the unevaluated northern wetland. Overall, an increase in evaporative losses is expected to decrease the annual surplus (i.e., water available for runoff or infiltration) from the site.

The consultants estimate that baseflow will slightly increase to Barbers Lake and Long Sault Creek based on expected infiltration in the rehabilitated pond and based on the direction of groundwater flow; potential changes in water quality were not assessed or discussed. Overall, Golder states that the impact of operations and development to surface water is expected to be marginal, as changes in the catchment is expected to be 2% and infiltration is expected to report to two of the three adjacent waterbodies as baseflow. Given that dewatering is not anticipated and predicted groundwater effects are localized, Golder states that no impacts to surface water features are anticipated.

Proposed Monitoring Program

I defer to the groundwater reviewer for further comments on groundwater considerations and the appropriateness of proposed groundwater monitoring.

The consultants propose to complete quarterly surface water level monitoring during pit operations (once below the water table) at SG-1, located at the edge of the marsh adjacent to Barbers Lake. Monitoring during the rehabilitated phase was not proposed. Monitoring of other adjacent waterbodies or wetlands have been proposed.

Conclusions and Recommendations

Based on my review, additional information is required to reduce uncertainty about potential impacts of operations to surface water quality:

1. Further clarification on the anticipated mechanism (including volume, location, etc.) of seasonal surface runoff from the rehabilitated pit lake to Barbers Lake is required to assess potential impacts to the lake and adjacent wetlands, including flooding, sedimentation and/or erosion.
2. Further clarification on the overall stormwater management plan for the site would be beneficial.
3. Based on available well records, I assume that some residences on Barbers Lake may use surface water for domestic use (including drinking water). The location and type (use, frequency) of surface water sources should be assessed to ensure monitoring is completed with sensitive uses and receptors in mind.
4. The proposed surface water monitoring regime consists of one water level monitoring site in the wetland adjacent to Barbers Lake. The average radius of influence as shown in Figure 2 demonstrates that the wetlands north of Highland Line Road and adjacent to Long Sault Creek southwest of the property may be influenced by pit operations, but monitoring was not conducted nor is future monitoring proposed.

   The proposed monitoring plan will not sufficiently assess or monitor potential impacts (quantity, quality, or temperature) to Long Sault Creek, Barbers Lake or the adjacent unevaluated wetlands. Further clarification on potential hydraulic, thermal, and chemical impacts of operations to surface water bodies would be beneficial.

   A revised monitoring plan should be considered, and I emphasize the following points for your consideration:

   - Chemical and physical parameters such as (but not limited to) temperature, pH, conductivity, total suspended solids, total dissolved solids, alkalinity, turbidity, and nutrients should be monitored upstream and downstream of operations; groundwater quality data may aid in refining the list of monitored parameters. Water quality at the outlet of the pit pond at Barbers Lake should also be monitored when connectivity occurs in the rehabilitated phase.
   - In cool-/cold-water streams, groundwater seeps act as thermal refugia for sensitive species and modulate water temperature extremes (e.g., summer or winter). Thermal refugia are vital to the perpetuation of sensitive species such as salmonids. The proposed setback may not be adequate for groundwater temperature to stabilize and not alter the cool-/cold-water regime of Long Sault Creek.

     For example, Markle and Schincariol (2007; DOI: https://doi.org/10.1016/j.hydrol.2007.02.031) examined the thermal impacts of below-water-table aggregate extraction on a nearby cool-water creek in the Tricks Creek watershed (southwestern Ontario). The geology of the studied region varies somewhat from the proposed extraction area; the study region was located in a glacial moraine outwash, forming an unconfined sand and gravel aquifer with heterogeneous hydraulic characteristics that connected the pit pond to Tricks Creek. Temperature was measured through a series of monitoring wells. The thermal groundwater plume in Markle and Schincariol (2007) was found to migrate 250 m downgradient of the rehabilitated pit pond. The hydraulic conductivity of the Markle and Schincariol (2007) study region was faster than the conductivity described for

the proposed extraction area, so the spatial extent of groundwater temperature change may vary.

- Groundwater (within the setback area) and/or stream temperatures upgradient and downgradient of the site should be monitored during the baseline and operational phases.

5. Further clarification on the source and fate of various operational uses for water that were not discussed in this report (e.g., wash water and dust suppression if needed) would be beneficial.

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