

April 4, 2023

FILE: 22-092-02VC

Cowichan Bay Waterworks District
1760 Pavenham Rd
Cowichan Bay, BC V0R 1N1

Attention: Cheryl Wirsz, District Administrator

Re: Review of Draft Hydrogeological Assessment of Impact of Sewerage Effluent Dispersal Basins on Local Aquifer at Valleyview Shopping Centre, Cobble Hill, B.C.

Dear Cheryl:

Further to your request, Western Water Associates Ltd. (WWAL) provides this letter summarizing our review of a draft report prepared by Elanco Enterprises Ltd. assessing the impact of sewerage effluent dispersal basins on the local aquifer at the Valleyview Shopping Centre located at 1440 Cowichan Bay Road, Cobble Hill, B.C.

BACKGROUND

The Valleyview Shopping Centre is proposing an expansion to their facility located within the service area of the Cowichan Bay Waterworks District (CBWD). WWAL previously developed a Source Water Protection Plan (SWPP) for the CBWD (final report dated January 12, 2023) that identified potential threats to the delivery of safe drinking water, defined groundwater protection areas and established a framework and strategies for source water protection. The Centre is located within a groundwater protection area outlined in the SWPP (WWAL, 2023), therefore any potentially harmful activities at the Centre should be controlled where practical through planning and regulatory measures.

The primary production wells used by the CBWD are Valleyview Wells 1 and 2 (Well Plate Identification Number's (WPID's) 38473 and 13088). The Valleyview Wells are located in the northwestern corner of the Centre, downslope of the existing effluent disposal field operated by the Centre. Both wells are completed in Cherry Point Aquifer 197, a confined glacio-fluvial sand and gravel aquifer formed in the Quadra Sands stratified drift deposit. As part of the proposed expansion to the Centre, plans call for the construction of rapid infiltration basins (RIBs) to replace the current effluent ground dispersal field. The distance between the proposed RIBs and the nearest well (Valleyview Well 1) would be approximately 150 m. The owners of the Centre have retained MSR Solutions Inc. (MSR) to assist with effluent design modifications and permitting.

MSR requested that Elanco Enterprises Ltd. (Elanco) complete a hydrogeological assessment of the area around the Centre for the potential impacts that the proposed new in-ground wastewater disposal system may have on the local aquifer and, in particular, the two nearby water supply wells. Elanco's draft report is dated February 13, 2023 and entitled: *Hydrogeological Assessment of Impact of Sewerage Effluent Dispersal Basins on Location Aquifer, at Valleyview Shopping Centre, Cobble Hill, B.C.*

This letter provides our review of the draft Elanco report with respect to potential impacts to the nearby CBWD supply wells.

REVIEW COMMENTS

Background

In the background section of the Elanco report it is stated that, with the expansion of the Centre: the maximum daily effluent flow is anticipated to increase from 65 m³/day to 86 m³/day, the effluent quality will reduce from Class B to Class C, and rapid infiltration basins will replace the current ground dispersal field. We note that by increasing the volume and infiltration rate of lower quality effluent in the vicinity increases the potential for a negative water quality impact to the local aquifer and the existing CBWD well field.

Local Aquifer

The horizontal groundwater flow direction estimated by Elanco is similar to that of WWAL (2023) (toward the north-northwest), however the methodology used by Elanco results in a steeper gradient than the one estimated by WWAL (2023). Based on Figure 5 of the Elanco report (Hydrogeological Section B – B'), the flow gradient from southeast to northeast of the site (towards Dougan Lake) ranges between 11 to 14 m per km (0.011 to 0.014). This is steeper than the gradient of 0.004 estimated by WWAL (2023). A steeper flow gradient results in a smaller area required to contribute water to the pumping well to sustain a desired pumping rate (i.e., a smaller, less conservative capture zone area).

Test Pumping of Valleyview Well 1

Elanco's estimated transmissivity (T) value of 1728 m²/day from analysis of 2012 constant rate pumping test data of Valleyview Well 1 is roughly five times less than the T value of 7776 m²/day estimated by Thurber (2013). A smaller T value is more conservative for estimation of the size of the capture zone of a pumping well as it indicates that the aquifer cannot transmit groundwater as readily, therefore a larger area is required to contribute water to the well to sustain a desired pumping rate (i.e., a larger, more conservative capture zone area).

A lower T value is less conservative for estimates of travel time, however, as it results in a slower horizontal groundwater flow velocity and therefore longer travel times between contaminant source(s) and wells.

Capture Zone Analysis

As the project site is located within the Valleyview Wells source water protection area, the existing capture zones as identified in the SWPP should form the basis of any assessment. However, Elanco chose to delineate their own capture zones which differ slightly from the ones established in the SWPP. We have the following comments regarding Elanco's capture zone analysis:

- For the pumping rate, Elanco used the 2021 Average Daily Demand (ADD) of 8.2 L/s, as outlined in the CBWD Master Plan (AE, 2022), to delineate the capture zone of the CBWD wells. Selecting

the 2021 ADD as the pumping rate was a less conservative approach than that of WWAL (2023), as the Master Plan recommended a future increase in the well pumping rates. For the purpose of delineating a conservative groundwater protection area for the SWPP, WWAL (2023) assumed that Valleyview Well 1 will be pumped at its rated capacity of 38 L/s.

- Elanco's analytical capture zone calculations resulted in widths of 37.3 m (for a pumping rate of 8.2 L/s) and 51.4 m (for a pumping rate of 11.3 L/s). The estimated capture zone (as seen in Figure 3 of the Elanco report) is approximately half the width of WWAL's (2023), which is 84 m, due to a lower pumping rate and higher gradient. Neither the analytical capture zone estimates by Elanco, nor the one by WWAL (2023) intercept the effluent dispersal field, however.
- Near the end of the first paragraph on page 7, Elanco incorrectly referenced WTN 85452 (Valleyview Well 2), indicating that there is limited information available for this well and no decommissioning record. The WTN that should be referenced in this section is 85453.
- WWAL agrees that WTN 40670 and WTN 85453 have not yet been located at the Centre. As discussed previously with CBWD, efforts should be made to locate these wells and either utilize them for monitoring or decommission them.

Travel Times

Although the effluent disposal area is not located within the inferred capture zone for the CBWD supply wells, Elanco determined travel time estimates between the two as it is required by the Municipal Wastewater Regulation (MWR). This was done by first estimating the vertical travel time from the bottom of the disposal area to the water table and then the horizontal travel time to the wells. Using this methodology, Elanco estimated a travel time of 235 days. We have the following comments regarding Elanco's travel time estimate:

- A transmissivity of 518 m²/day was used by Elanco. It is not clear where this value comes from, but we note it is ~15 times less than that estimated by Thurber (2013) from pumping test analysis of Valleyview Well 1. Keeping the other variables constant, using the higher transmissivity of 7776 m²/day estimated by Thurber (2013) would result in a travel time of ~16 days.
- Elanco compared the travel time estimate to the 6 days required in the MWR for Class B effluent dispersal, however it is stated by Elanco in the background section of the report that effluent quality will only meet Class C effluent criteria and therefore a 10 day travel time would apply. The estimate of 16 days indicated above is close to the regulatory limit for Class C, and as such, suggests downgrading the effluent quality from B to C should be carefully considered by the regulator.
- Mounding of the water table beneath the dispersal field appears to have been considered by Elanco as being less than 1 m in height (Figure 3 of the Elanco report), however it was not indicated how this was determined (no mound height data analysis provided) nor whether it was considered in the travel time estimate. We note that localized mounding at the water table beneath the

disposal area could change the direction and magnitude of local groundwater flow and thereby have a significant effect on velocity and travel times.

- In consideration of a potential higher aquifer transmissivity, longer required travel time for Class C effluent, and water table mounding, we note that actual subsurface travel times may be much closer to the MWR minima than the Elanco estimate.

Water Quality

Elanco notes that historical nitrate concentrations in the Valleyview Wells are indicative of there being no water quality impacts from the existing dispersal field. WWAL agrees that there is currently no evidence of the effluent dispersal field negatively impacting the groundwater quality in the wells.

In addition to sampling recommendations provided in the SWPP (WWAL, 2023), we recommend annually sampling the Valleyview Wells for additional chemical tracers which could indicate potential wastewater contamination. Parameters associated with domestic wastewater contamination could include caffeine, artificial sweeteners, and/or pharmaceuticals, as they are commonly consumed and excreted by humans.

Recommendations

We have the following comments regarding Elanco's recommendations:

- WWAL agrees that a data-logging transducer should be installed in WTN 63623.
- Elanco recommended that the monitoring wells for water quality testing required by the MWR include the Valleyview Wells and two wells located up/cross gradient of the dispersal field (WTN 63623 and WTN 65065). In addition to monitoring these wells, WWAL recommends installing a monitoring well located between the Valleyview Wells and the dispersal field, so any water quality impacts can be detected prior to reaching the water supply.

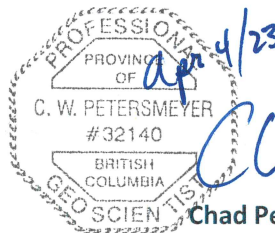
CLOSURE

We trust this letter provides the information you require. If you have any questions, please contact us.

Western Water Associates Ltd.
(EGBC Permit to Practice number 1001419)



Natasha Neweduk, B.Sc., GIT
Junior Hydrogeologist



Chad Petersmeyer, M.Sc., P. Geo.
Senior Hydrogeologist

REFERENCES

Associated Engineering (AE), 2022. *Cowichan Bay Waterworks District 2021 Water System Master Plan Update*.

Thurber Engineering Ltd. (Thurber), 2013. *Cowichan Bay Waterworks District Well 38473 Hydrogeological Assessment*.

Western Water Associates Ltd. (WWAL), 2023. *Cowichan Bay Waterworks District Source Water Protection Plan*.

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