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File: UA Hullcar Aquifer
AMS#108432

VIA EMAIL AND REGISTERED MAIL

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(email only)

Attention: Ken Regehr, Owner
Marta Green, P. Geo, Senior Hydrogeologist

RE: Ministry of Environment Review of the Environmental Impact Assessment Report
Prepared for Ken Regehr pursuant to Pollution Prevention Order #108432

This letter acknowledges receipt of the Comprehensive Monitoring Program and Environmental Impact Assessment Report (the Report) for Ken Regehr farm which was prepared by Associated Environmental Consultants Inc. dated December 2016 and submitted under Pollution Prevention Order 108432.

The September 23, 2016 approval letter for the Terms of Reference and Workplan required the “assess[ment] of the impact the...operations have on nitrates and other nitrogen compounds entering surface or groundwater”. The Report was reviewed by several government staff with varying expertise from the Ministries of Environment, Agriculture and Forests, Lands and Natural Resource Operations, and the Interior Health Authority. This letter and attachment are meant to provide government’s assessment of the Report.

In general, there are information gaps to support the environmental impact assessment of your operation. This report only considers nitrate in Aquifer 103 and not the potential environmental impact for other aspects of this agricultural operation. Examples include: the impact of infiltration from the feedlot operation (Section 2.1.4); the leachate from the wood chips (Section 2.5.5) and the stormwater runoff into the engineered wetland were acknowledged but were not included in the impact assessment (Section 2.5.4). Evaluation of these items must be included in the Action Plan.

The reviewers had difficulty determining the impacts to the aquifer considering information for the well screens and well lithology’s were not included in the report. This information would identify the depth below the water table that groundwater would be entering the well, and the geology surrounding the well which would assist in identifying if the well were in the confined or

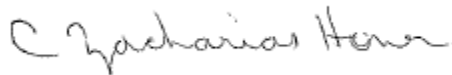
unconfined aquifers. Attachment 1 includes detailed comments and questions from the reviewers. Per the Information and Privacy Commissioner's report "[Clearly in the public interest: The disclosure of information related to water quality in Spallumcheen](#)", the Report has been made publicly available on the Ministry's website.

The Parties are notified that the Province intends to publish on the Ministry of Environment website the entirety of any Regulatory Document provided that:

- a) the Province will provide written notice to the parties of its intent to publish the Regulatory Documents at least [14] days prior to publication,
- b) the Province will not publish any information what could not, if it were subject to a request under section 5 of FOIPPA, be disclosed under the Freedom of Information and Protection of Privacy Act, R.S.B.C. 1996, c. 165 as amended from time to time.

If you have any questions, please contact me at (250) 356-8185, or Devan Oldfield at (250) 490-2222 or Devan.Oldfield@gov.bc.ca.

Sincerely,



Christa Zacharias-Homer
Deputy Director

Enclosure (1)

- cc. Devan Oldfield, P. Ag., Environmental Protection Officer, Ministry of Environment
Dennis Einarson, R.P.Bio, Environmental Impact Assessment Biologist, Ministry of Environment
Dave Thomson, P.Geo, Regional Hydrogeologist, Ministry of Forests, Lands and Natural Resource Operations
Dave Poon, P. Ag., Provincial Soil Specialist, Ministry of Agriculture
Rob Birtles, B Tech, CPHI(C), Team Leader-Infrastructure Programs, Interior Health Authority

Attachment 1

Inter-Ministry Working Group Comments and Questions on the Comprehensive Monitoring Program and Environmental Impact Assessment for Ken Regehr Farms, December 2016.

- 1) Section 2.1.3 Surficial Geology and Soils
 - a) It is noted that the description of hydraulic conductivity of mapped surficial geology deposits are considered high-level estimates, and the estimate for 'till' has a given estimated hydraulic conductivity ranging 6 orders of magnitude.
 - b) Page 2-3 states “the compacted surface acts to minimize infiltration and prevent seepage of nutrients into the soil and groundwater underneath. A silty soil underneath a feedlot...will compact and seal well.” What verification was completed at the Regehr feedlot to verify this statement?
- 2) Tables 2-4, 2-5 and 2-10
 - a) Task 6b requires “...include an assessment of the well logs, including suitability of length and placement of screen for assessing water quality in Hullcar 103, when completing our assessment of water quality results.” How was a discussion of suitability of screen lengths and placement included in this report?
 - b) What are the screen depths for the industrial and domestic wells listed in these tables? How was the interpretation of the water quality data completed considering this information?
 - c) Depth to water is reported as ‘na’ in these tables for wells 6 and 22, but there is a value given in Table 2-8. Which is correct?
 - d) How was the well information utilized to determine if each well was in Aquifer 102 or 103? How does this impact the interpretation of water elevation and flow direction?
 - e) The Project Well 7 log shows clay from 3 to 16 feet, and wet sands and gravels from 16-70 feet. The reported static level was 12 feet. The fact that the static water pressure resides within a confining layer above an aquifer suggests it is a confined aquifer. As well, the 'depth to water' listed in the table is not 54' according to the log. Include an explanatory note describing the reason for the difference.
 - f) Well 20 does indicate a log is available, however it is not clearly labelled in the appendix. Please provide.
 - g) Water quality data interpretation for Aquifer 103 is limited to Project wells 13, 17, 20 and 21, since well log lithology is not available for the other wells.
- 3) Section 2.5.4 Stormwater Management

The Report states on p 2-29 to 2-30 that “the reeds, cattails, and other vegetation likely reduce nutrient concentrations in the pond/wetland through the process of plant uptake, and some nitrogen is likely lost to the atmosphere through denitrification.” What analysis was done to confirm this statement considering the report also noted “there may be some seepage through to the underlying aquifer”?

- 4) Section 2.5.5 Wood Chip Storage
 - a) What sampling was completed to determine toxicity of woodchip leachate? This would assist to determine if the leachate needs to be treated separately prior to being directed into the constructed wetland.
 - b) Was woodwaste decomposition considered in the nitrogen calculations?
- 5) Section 2-2 Groundwater Flow Direction and Gradient, Figure 2-6 Measured Groundwater Levels and Groundwater Flow Direction and Table 2-8 Groundwater elevations
 - a) The Reports states on p 2-16 “To the west of this groundwater divide, the water flows west towards Salmon River.” What information was utilized to determine the groundwater divide? If additional groundwater information utilized was collected on a different date, how might the difference in sampling dates impact your findings?
 - b) In reviewing the data, it appears the Project 18 well shows the point of highest groundwater elevation in the southwest portion of the aquifer for December, and along the main valley axis, the gradient consistently is toward the north east. How was this considered in your analysis?
 - c) It appears that the flow is interpreted to occur along the valley walls orthogonal to the main axis of aquifer 103. How were these contours derived in the areas where there are no known measurements? For example, how were the contours derived for northwest of Project 21 well? And for southeast of the Purple Springs well field cluster?
 - d) How does the distance between Project 18 and Project 21 wells support the equipotential groundwater flow elevations shown parallel to the long axis of the valley? What were the assumptions in making this determination?
 - e) Tables 2-4 and 2-5 indicate that eight of the 19 wells in Table 2-8 do not have well logs associated with them. How were these wells used to infer groundwater flow direction if the lithology and depths are not known?
 - f) Groundwater levels at MW1 were not taken as part of this study and this well was sampled on a different date than the other wells in this study. In order to ascertain a baseline groundwater flow direction, all groundwater elevation measurements need to be made within a day or two of one another, and sometimes correlated to temporal changes in barometric pressure. To complete the workplan as approved, groundwater elevations need to be measured again during a period in which groundwater flow directions will not be influenced by the irrigation uses in the valley.
 - g) The Report states on p2-16 “Groundwater flows east towards Parkinson Lake. A gradient of 0.0008 was measured from between Project 13 well and Parkinson Lake.” What is the gradient using measured groundwater elevations as opposed to surface and groundwater elevations?
 - h) What is the evidence that support the statement on p 2-16: “There may be a second groundwater divide in the region of Parkinson Lake and near Project 37 well”?

- 6) Table 2-9 Nitrogen concentrations in groundwater
 - a) What is the assessment of the presence of Nitrite-N as it is a short-term intermediate product between ammonia and nitrate? As well, what is the assessment for the widespread presence of ammonia?
 - b) The use of piper plots of the wells would be useful to compare the various well samples.
- 7) Section 3.4.4 Discussion of Effects
 - a) How are the findings of Project Well 20 relevant if there is no log available and the screens are too far below the water table to provide useful information? How does this information support the summary in section 4.1?
 - b) How are the findings able to determine that known drinking water and irrigation wells in the vicinity of the study area are installed in the same portion of the aquifer as the wells that were sampled if you do not have the well logs or lithologies?
 - c) How does the pumping period of Project 13 well, which is located in the middle of a high-capacity well field, impact the samples provided they were obtained on September 27, 2016? Based on reported driller estimated yields, this well is capable of producing a substantial drawdown cone in the vicinity. Is it possible that sampling a high-capacity well that has not been running for a period of time will not be representative of the water quality in that well after a period of irrigation, given the ability to draw down a constantly supplied source of nitrogen.
- 8) Section 4.1 Monitoring and Environmental Assessment Results Summary
 - a) First line of evidence: section 3.4.1.1 states “A limitation in defining the magnitude of an effect on groundwater is that most of the wells that were sampled have the screen (water intake) set between 6 and 15 m below the water table...and not at the water table, where any leaching from surface would first enter the aquifer”(p 3-3). How are you able to state that Regehr Farm operations have a negligible effect? Project well 13 is installed to 62.5 feet which is 30.68 feet below the water table. This well measured 2.51 mg/L of nitrate at 30 feet below the water table, what is the concentration of this nitrate plume at the water table?
- 9) Table 2-13 Estimated nitrogen inputs and outputs
 - a) The calculations in the table are incorrect.
 - b) What is the nitrogen decomposition percentage per year for the solid manure mixtures?
- 10) Table 2-15 nitrogen Balance Calculations

The report stated in Section 2.5.7 that “no actual crop yield or protein content information was available for this operation...manure application rates recommended by the crop advisor are being followed by Regehr Farms, although no records were available.” How are the nitrogen balances in Table 2-15 determined if there are no records available?
- 11) General:
 - a) Workplan Task 3A: “Collect samples per the BC Field Sampling Manual”. The field measurements and other observations should be provided on the laboratory requisition forms Chain of Custody (COC). COC paper work is standard procedure used to transmit

samples as part of the QA/QC chain. COC were not provided for groundwater or surface water samples as found in Appendix C. Please provide documentation or explain why it is missing.

- b) This Report should have a QA/QC section that reports on the general data quality, and in particular on the field duplicate sample. Work Order 6091999 notes samples were received at 8 degrees Celsius. How does this affect the quality of data analysis and where is it discussed in the report?
- c) Lab results for post-harvest nitrate sampling must be included in the appendices.

12) Terms of Reference

- a) Task 6b requires “Calculate descriptive statistics for water and soil quality...” How was descriptive statistics included in this report?
- b) Task 6c states “assess the likelihood that current agricultural operations...” How was the potential to introduce nitrate to lower portions of the aquifer via pumping of irrigation wells considered?