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May 28, 2018

Attention: **Mr. Matt Cameron, P.Eng, FEC**
CC: **Ms. Brandie Roberts, AGE Strata VIP**
Mr. Danial P. Bings, Ministry of Environment and Climate Change Strategy.

Re: **Peer review of May 23, 2018 report by Matt Cameron regarding Pollution Abatement Order (109390).**

Introduction and Scope

On November 23, 2017, a Ministry of Environment Abatement Order (109192) was delivered to the owners of the Strata Plan LMS 3080, known as Anmore Green Estates (AGE).

The Order, in summary, required AGE to retain qualified professional to:

1. Develop an action plan to implement pollution abatement.
2. Engage with school district 43 (SD43) and Port Moody to implement actions to mitigate risk to human health by restricting access to the effluent breakout hazard.
3. Following actions taken in Item 2 above:
   a) Describe the actions implemented.
   b) Provide recommendations for on-going restoration, mitigation and monitoring along with a long-term plan.
   c) A list of professional contributing to the report.

The abatement order 109390 issued on April 18, 2018 has requires additional requirements.

In summary

1. Retain a professional to prepare a report addressing options for on-site disposal of AGE sewage. (The CTQ report).
2. Retain a second engineer to peer review the CTQ report. (This review).
3. Submit peer review by May 23, 2018.
4. Continue to take actions to mitigate risks to Human Health.

Oland Engineering Limited (OEL) has been retained to conduct a peer review of the report submitted by Matt Cameron, P.Eng., FEC of CTQ Consultants Ltd. The CTQ report is to address options for continued on-site disposal under the Waste Discharge Permit # 4606.

CTQ provided OEL the following documents to prepare a review and comment on the options presented.

1. The Abatement Orders 109192 and 109390.
2. Action plan presented by Associated Environmental Consultants Inc. January 19, 2018.
3. S. Graham Engineering and Geology Inc. (GEG) report January 15, 2018.
4. Report by Arden Consulting Engineers Ltd (AGE) July 31, 2008.
5. Drawings, photos and test results associated with above listed reports.

In addition to the above-mentioned documents, I the writer, have 26 years of experience in the discipline of on-site sewerage treatment and ground disposal of effluent. I am very familiar with the Municipal Sewage Regulation (MSR), the Municipal Wastewater Regulation (MWR) and Ministry of Health Sewerage System Regulation (SSR).

I did not visit and conduct an inspection of the subject site.

Comments:

Regulation related to the design.

Under the permitting regime, looking back to the 1978 date of permit issue and amended in 2002, the approving authority is the Ministry of Environment Waste Manager, as I understand it. The design and construction as presented to the waste manager, is approved by the engineer of record on the permit. The statutory decision maker, the waste manager, may not be bound by the municipal wastewater regulation (MWR) or at the time, the Municipal Sewage Regulation (MSR). I concur with Mr. Cameron in stating that we, as Professional Engineers, must follow best management practices. Best management practices include following, as a minimum, accepted and recognized standards of practice. In this case the recognized standard is the MWR. It maybe necessary, in some site situations, to divert from the MWR standard, but keeping the MWR expected performance as a minimum. In this case the performance standard is not being met.

As pointed out by Mr. Cameron, it would be in every engineer's best interest and ethics, to follow the MWR as a minimum standard.

Evidence of failure.

I agree, based on the evidence presented, that the subject treatment and dispersal system has failed and is creating potential risk to human health and the environment. Regardless of the quality of treatment, the volume of effluent flow will not change, and breakout will continue.

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Possible Solutions Reviewed.

1. **Re and Re the existing disposal fields:**
   A new disposal field would not alter the ultimate course of effluent and ground water unless relocated to another area. The only available area is the reserve area, which places the field even closer to potential breakout points.

2. **Mounded disposal field:**
   A mounded disposal field may improve effluent quality by increasing the vertical separation to ground water and filtering out more of the organics and suspended solids in the elevated unsaturated zone. The quantity of effluent remains the same unfortunately and evapotranspiration may actually decrease due to faster vertical travel to below the evaporation zone. I agree that this is not a viable option.

3. **Tertiary treatment system. (on-site and off-site discharge)**
   I agree with Mr. Cameron that we can theoretically remove nutrients and pathogens using a higher level of treatment but based on my experience, this is not a sustainable affordable option for a small development due to the initial capital investment, the ongoing operational cost, a requirement for a skilled operator and frequent monitoring.
   a) Disposal to ground will still result in breakout, leaving at the very best, a negative perception of a health hazard.
   b) Disposal to surface water is not an option due to the nonexistence of an acceptable dilution factor as well as a lack of confidence in the quality as suggested by Mr. Cameron.
   c) Disposal to deep injection wells.
      I am not experienced with using this method of disposal. An extensive hydrogeological study would be required to begin with and there would be a risk of aquifer contamination. I do not feel qualified to comment further on the cost or technical aspects of deep well injection.

4. **Pump and haul.**
   I agree with Mr. Cameron that pump and haul is a temporary measure in an emergency only. Assuming an average of 25 to 35 m^3/day of sewage flow, more than two truck loads per day would be required at a typical cost of more than $800.00 per truck load depending on dumping fees in the area.

5. **Disposal to the municipal sewer system.**
   No one can argue that connecting the AGE Strata to the Municipal Sewer System, is the option that meets all the engineering and environmental requirements as pointed out by Mr. Cameron. This has always been in the long-term plan. As I understand from the Associated Engineering time line, in 1997 the sewerage system was designed with a future municipal sewer connection in mind and was included as part of the MOE Permit (PE-4606) should sewer become available.

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Alternatives

In Mr. Cameron's recommendations, he briefly mentions, but discounts changing the groundwater regime.
It occurred to me there is little or no formal hydrogeological evaluation of the groundwater, which I believe to be a major contributor to the breakout. I do not know what the standards were in 1978, but since my first experience with the MSR, in the early 1990's, an Environmental Impact Study (EIS) would be required. The EIS would have required monitoring wells and a model of groundwater flow. I understand there may have been a groundwater interception system prior to the downstream development, that was likely cut off by the school development.
(GEG Report Page 20)
I believe the possibility of groundwater diversion needs further explanation and/or examination. I am not qualified as a Hydrogeologist to make expert comment on groundwater modeling. If the groundwater diversion system did exist, then the question should be answered. "Did cutting off the groundwater diversion system contribute to the breakout? "and is reconstructing such a system a feasible option.

Conclusion

In general, I agree with Mr. Cameron's report. The ideal solution, providing the least risk to public health and environment, is connection to the Municipal Sewer System. I encourage the political decision makers to do the right thing and find a way to make this happen.

My comments regarding groundwater diversion, are directed to the previous reports and studies. I am simply suggesting that more examination of ground water would have been prudent, since it leaves some unanswered questions. Ground water diversion is the only option I see outside of community sewer connection. As Mr. Cameron pointed out, redirecting groundwater can produce problems elsewhere and may not be sustainable. I would not be willing to sign off on a groundwater diversion design without an extensive and conclusive hydrogeological study providing unquestionable evidence that the design would eliminate the risk of breakout.

Sincerely,

C. Jeffrey Oland, P.Eng.
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