Project #: 18037

May 23rd, 2018

ENGINEERING

PLANNING

URBAN DESIGN

Owners of Strata Plan LMS 3080
100 Blackberry Drive,
Anmore, British Columbia V3H 5B4

Attention: Ms. Brandie Roberts, Strata VP

Ministry of Environment and Climate Change Strategy
200 – 10470 152 Street
Surrey, British Columbia V3R 0Y3

Attention: Mr. Daniel P. Bings
for Director, Environmental Management Act
Environmental Protection Division, Regional Operations Branch
Compliance Section

Re: Pollution Abatement Order (109390)
Owners of Strata Plan LMS 3080 (Known as Anmore Green Estates)

Executive Summary

CTQ Consultants Ltd. (CTQ) has been retained to assist the Owners, LMS3080 by providing this independent engineering review and assessment of certain matters to be addressed in Abatement Order: 109390 issued by the Ministry of Environment and Climate Change Strategy (MOE) dated April 18th, 2018. A reference copy of the Abatement Order is enclosed with our report.

We were provided documentation for our review from Associated Environmental Consultants Inc. (AE). Any information that was relied upon for this review is listed within this report.

Our report is based upon our independent review of relevant documentation given to us by Associated Environmental Consultants Inc. (AE), and we have listed such documentation that we consider reliable in preparation of our report.

While there usually exists more than one solution to a particular challenge, we must complete a litmus test before making our Professional recommendation. Optimising the solution so that it is sustainable is the goal of every solution. Sustainability can be assessed in terms of the social, environmental and financial parameters:

1. The duty to uphold and protect the public interest is paramount; (Social)
2. Protection of the Environment; (Environmental)
3. Is it a practical, financially sound solution (Financial)?

This is not the first time that this system has not met the requirements of the Waste Discharge Permit (4606) and a detailed summary of events can be found in the Action Plan for Pollution Abatement Order 109192 dated January 19th, 2018 prepared by AE.

This report is based on sound Engineering judgement, Best Management Practices and an acceptable level of risk.

Solutions reviewed were as follows:

1. Reconstruction of the existing system;
2. Mounded System;
3. Tertiary Treatment (on-site and off-site discharge);
4. Pump and Haul; and
5. Tie into the existing Municipal Sanitary Sewer System.

CTQ and the writer of this report are not willing to Professionally sign off on any solution other than abandoning the existing disposal system and tying AGE's sanitary sewer system into the municipal sanitary sewer system to eliminate the risk to the Public and the Environment. The reasons for this recommendation are outline within this report.

1. Introduction and Scope of this Report

This report focusses on the most recent Abatement Order (109390) which states that the Director of the Environmental Management Act is satisfied that there is breakout causing pollution on the school District property. The Owners of Strata Plan LMS 3080 are ordered to comply with;

1. Retain a Professional Engineer to address options for continued on-site disposal under the Waste Discharge Permit 4606; (This report)
2. Retain a second Professional Engineer, approved by MOE, to review this report; (Completed by Mr. C. Jeffery Oland, P.Eng. Approved by MOE on May 10th, 2018 via email)

3. Submit the peer review assessment by May 23rd, 2018;
4. Continue to take actions to mitigate the risk of Human contact. (AE – Responsible).

This report is the deliverable under item 1. Of the Abatement Order which will be peer reviewed as required under item 2. Of the Abatement Order.

This report reviews, historical documentation, regulations relating to the design of the effluent disposal systems, the evidence of failure and possible solutions. From this, recommendations are provided.

2. Information Reviewed and Relied Upon

The following documents were provided to CTQ and were relied upon in preparation of this review report.

1. Abatement Order 109390, dated April 8th, 2018;
2. Action Plan for Pollution Abatement Order 109192 (PE 4606) dated January 19th, 2018;
3. The follow up Formal Report – Pollution Abatement Order 109192 (PE-4606) (Authored by AE, dated April 5th, 2018);
4. Technical Memorandum from AE dated October 16th, 2017 (Results of September 2017 Soil Testing), and
5. Assessment of the Ability to Repair or Replace the Septic Treatment Plant Effluent Disposal Fields at Anmore Green Estates, Anmore, BC prepared by S. Graham Engineering and Geology Inc., (GEG) dated January 15th, 2018.

Material facts from the above are not repeated in this report except where necessary to summarize findings or recommendations.

3. Regulation Relating to the Design.

While it was stated in the Abatement Order that…"Under a permitting regime, the statutory decision maker is not bound by the restrictions within the Municipal Wastewater Regulation and may approve anything which is sufficiently protective of the environment and human health…" as designers of systems we take these regulations as minimums. As regulations change from time to time, Best Management Practices dictate that we should design to the most up to date requirements when it comes to Public Health and Safety.

Understanding the responsibilities and duties of a Professional Engineer is key to how recommendations in this report are derived. The people of British Columbia, through an Act of Parliament, have given Professional Engineers and Geoscientists responsibilities and the right of self governance. The "Engineers and Geoscientists Act" states that "…the Association in it's duties is to uphold and protect the public interest respecting the practice of Professional Engineering..."

The Engineers and Geoscientists of British Columbia (The Association) in its Code of Ethics states as the number one tenet, "Hold paramount the safety, health and welfare of the public, the protection of the environment and promote health and safety within the workplace."

Therefore while the Waste Discharge Permit 4606 was approved under different regulations than the Municipal Wastewater Regulations of today it is our belief that the most current regulations should govern our recommendation.

4. Evidence of Failure

We do not think there is any question to the evidence of failure of the Anmore Green Estates effluent ground disposal system. As stated in the report prepared by GEG, there are numerous reasons why the disposal fields cannot be reconstructed, from geometric requirements such as pipe length, required setbacks, depth to unsaturated soils and required distances for down gradient breakout. Therefore if a suitable treatment process was installed the likelihood of breakout still exists and as such the risk to the Public Health still exists as it is unlikely that the treatment process is fail-proof.

5. Possible Solutions Reviewed

The Abatement Order states…"Retain a professional engineer to prepare a detailed report which addresses options for continued on-site disposal of Anmore Green Estates sewage flows under the authority of waste discharge permit 4606. This report must address all possible options and discuss their viability."

While the order only requires review of on-site disposal options we have also reviewed other options that do not include on-site disposal.

Many of the following systems have been reviewed by previous reports and information from these reports have been utilized in our review. The results of our review have been tabulated herein Table 5.1.

1. **Re and Re the existing Disposal Fields**; The original design utilised aggressive percolation rates in the calculations for the field size and since the down gradient conditions have changed there is evidence of Breakout. This unfortunately means that no ground disposal system will be acceptable due to the possibility of Breakout no matter what the quality of effluent.
2. **Mounded Disposal Field**; In the mounded system there is the ability to have evapotranspiration as well as infiltration and as such due to site geometric restrictions and infiltration rates this is not a viable option.
3. **Tertiary Treatment system**; While this will treat the effluent to a higher standard the issue becomes disposing of the effluent flows and volume. There are various types of Tertiary Treatment plants and they all involve some form of nutrient and solids removal as well as disinfection. These systems are very costly and require advanced operator experience to run and

maintain the system. While this type of treatment can produce effluent to Class A or B they are not failsafe and in the writer's opinion well above the capabilities of a Strata of this size.

a. **Disposal to Ground**; This option has been reviewed and rejected as indicated in items 1 and 2 above.

b. **Disposal to Surface Water**; While this option is a possible solution there are other factors that need to be considered. The local watercourses dry up during the dry months and therefore the dilution factor is not achieved. This would mean that if there was a disturbance in the treatment system and the effluent quality was reduced the risk of pollution would be increased.

c. **Disposal to deep with injection wells**. We have seen this procedure work well with geothermal systems however it greatly relies on, the permeability of the receiving ground, the chemical and biological conditions of the receiving medium. Chemical and biological fouling of the injection screens can occur rapidly causing a large reduction in flow to the point of failure. Rehabilitation of these plugged wells is time consuming and expensive. It is usually completed using either chemical and/or mechanical means to return them to their optimal flow.

4. **Pump and Haul**; This method is usually used as a temporary measure until a permanent solution is found. This is because it is expensive and very dependent on trucking and disposal costs.

5. **Disposal to the Municipal Sanitary Sewer System**. This system is the standard of modern Urban communities and is by far the most reliable method of sewage collection and treatment. The fact of scale makes this option sustainable in all the three factors.

Table 5.1 – Summary of Findings.

Treatment/Disposal Method	Order of Cost	Risk of Failure	Reason
1. Re and Re existing disposal Fields	Low to Medium Cost	Very High	Breakout of existing Ground Water in the wet season.
2. Mounded Disposal Field	Medium Cost	Very High	Same as Item 1.
3. Tertiary Treatment			
a. To Ground Disposal	High Cost	Very High	Same as Item 1.
b. To Surface Water	High Cost	High	Dilution requirements and reliability.
c. To Deep Injection Wells	Extremely High	High	Chemical & Biological Fouling.
4. Pump and Haul	Very High Cost	Low	Basically, an expensive option to 5 below.
5. Connect to Municipal Sewer	Low Cost	Negligible	Meets all requirements.

To expand on the table above:

1. Items 1, 2 and 3.a. above utilise the reuse of the ground disposal area and will still have risks of effluent breakout down gradient to the disposal fields especially in the wet season and therefore is not acceptable;
2. For item 3. - Tertiary Treatment has its own complexities and sophistication that may not be best suited for a private Strata Group;
3. Respecting item 3.b. utilizing disposal to surface waters will fail to meet the requirements for sufficient dilution in the receiving waters at certain times of the year and as such cannot be considered viable;
4. Item 4, Pump and Haul is typically used as a temporary measure as it is not economically viable long term.
5. Item 5, disposal to the existing Municipal Sewer System will meet all the engineering and environmental requirements.

6. Recommendations

Upon review of the available data supplied to CTQ it is evident that without somehow changing the groundwater regime, which we are **NOT** proposing, as that will possibly just transfer the problem somewhere else, the ground disposal method in the existing fields is a non-starter.

While the Abatement Order only requires the review of "on-site disposal" we must bring to the attention that, from a purely Engineering perspective the only solution that is sustainable in all three areas, Social, Environmental and Financial is to tie into the existing Municipal Sewer Collection System adjacent to the development.

Sincerely,
CTQ CONSULTANTS LTD.

Matt Cameron, P.Eng., FEC
Managing Partner

Copy to: C. Jeffrey Oland, P.Eng – Oland Engineering
Ms Fawn Ross, B.Sc., R.P.Bio – Associated Environmental Consultants Inc.
Mr. Dan Bings – Ministry of Environment and Climate Change Strategy.

Attached: Abatement Order 109390, dated April 8th, 2018;
Formal Report – Pollution Abatement Order 109192 (PE-4606) (Authored by AE, dated April 5th, 2018)
Assessment of the Ability to Repair or Replace the Septic Treatment Plant Effluent Disposal Fields at Anmore Green Estates, Anmore, BC (Prepared by S. Graham Engineering and Geology Inc., (GEG) dated January 15th, 2018)
Approval email for peer review.

OLAND
ENGINEERING
LIMITED

CTQ Consultants Ltd
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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.

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