Safety Codes Council

COUNCIL ORDER NO. 2024-03

BEFORE THE ADMINISTRATIVE TRIBUNAL OF THE PRIVATE SEWAGE SUB-COUNCIL

(the "Tribunal")

ON October 28, 2024

IN THE MATTER OF the *Safety Codes Act*, Revised Statutes of Alberta 2000, Chapter S-1 (the "*Act*");

AND IN THE MATTER OF the stop work order issued by the Inspections Group Inc (the "Respondent") to Lexon Projects Inc. (the "Appellant") regarding [redacted] (the "Property") on April 25, 2024 (the "Order") and the variance application refused by the Respondent on June 17, 2024, (the "Variance Refusal") for the Property;

UPON REVIEWING AND CONSIDERING the evidence named in **The Record**, including written submissions of the Appellant and Respondent; and **UPON HEARING** the testimony of the parties at the hearing;

IT IS HEREBY ORDERED THAT the stop work order is **UPHELD** and the written refusal of the variance is **VARIED**.

<u>Appearances, Preliminary, Evidentiary, or Procedural Matters:</u>

1. The hearing for this matter was conducted by virtual means.

2. At the commencement of the hearing, the Coordinator of Appeals confirmed the subject of the appeal as the Order and the Variance Refusal and confirmed the names of those in attendance:

a. Appearing for the Appellant, the Tribunal heard from:

i. [redacted], Professional Engineer;

ii. [redacted], Professional Geologist;

iii. [redacted], Ph.D. Microbial Ecology;

iv. [redacted], Project Manager;

b. Appearing for the Respondent, the Tribunal heard from:

i. [redacted], Private Sewage Safety Codes Officer;

c. Facilitating the hearing on behalf of the Safety Codes Council:

i. [redacted], Associate Vice President, Policy and Engagement.

3. The Coordinator of Appeals then introduced the Chair of the Tribunal (the "Chair"), [redacted], nominated by the Alberta Onsite Wastewater Association, and turned the hearing over to them.

4. The Chair called the hearing to order and introduced the other Tribunal members: [redacted], public member nominated by Ministerial Order, and [redacted], member nominated by Alberta Health Services.

5. The Chair then confirmed the parties were aware that the Respondent is a member of the Safety Codes Council sub-council for Private Sewage. The Chair and the Tribunal members acknowledged his membership and confirmed that they believe themselves to be able to consider the evidence presented and make a decision without bias.

6. The Chair asked each party if there were objections to the members of the Tribunal and their ability to hear the appeal. Appellant and Respondent confirmed there were no objections to any members of the Tribunal, and that the Safety Codes Council in general and the Tribunal in particular had jurisdiction to hear and decide the appeal. The Tribunal also confirmed they had jurisdiction to hear and decide this appeal.

7. The Chair then explained the process of the hearing and advised of the list of the written material before the Tribunal, consisting of the documents listed below in **The Record** (see paragraph 8). The Appellant and Respondent confirmed that there were no objections to any of the material submitted to the Tribunal.

The Record:

8. The Tribunal considered, or had available for reference, the following documentation:

Item	*Description*	*Date*
1	Notice of Appeal	May 28, 2024
2	Acknowledgement of Appeal Application	May 29, 2024
3	Notification of Hearing	June 20, 2024
4	Appellant's Brief Submission	August 12, 2024
5	Respondent's Brief Submission	August 8, 2024
6	Attendance Sheet	August 14, 2024

Issue:

9. This appeal concerns a stop work order issued by the Respondent to the Appellant regarding the construction of a private sewage treatment system (the "Project") on the Property for non-compliance with the requirements of the Alberta Private Sewage Standard of Practice 2015 (the "SOP") and the *Safety Codes Act,* RSA 2000, c S-1 (the "Act").

10. This appeal also concerns the subsequent application for a variance that was refused on June 17, 2024, wherein the application was refused for non-compliance with sections 8.4.1.6, 8.1.1.4(2), and 8.2.2.11(2); for shallow restrictive layers, and for the potential for the geotextile fabric used plugging due to the percentage of fines being present in the material used in the Project.

Positions of the Parties:

Appellant

From the Appellant's submissions and testimony, the Appellant's position is summarized as follows:

11. It is the Appellant's position that the Project was designed to meet objectives rather than prescriptive requirements of the SOP and that the Project should be evaluated based on those objectives.

Respondent

From the Respondent's submissions and testimony, the Respondent's position is summarized as follows:

12. It is the Respondent's position that the Project does not meet the requirements of the SOP and that the Appellant has not provided sufficient evidence to satisfy the safety concerns identified by the Respondent in his evaluation of the Project.

Summary of the Evidence Provided On Behalf of the Appellant:

Written Submissions on behalf of the Appellant:

13. The Property is one of three fish hatcheries owned and operated by Alberta Environment and Protection, constructed in the 1980s, which includes a hatchery and two residences. The Property is currently being upgraded to modernize the hatchery and supporting infrastructure.[1]

14. The current wastewater treatment site at the Property has three septic tanks which discharge primary treated effluent into a lift station which is pumped to a treatment field located 700 meters south of the hatchery building.[2]

15. The upgraded treatment field is being built on top of the existing treatment field and includes a full replacement of the three septic tanks, lift station, force main and treatment field. The septic tanks are dual chamber tanks and are fitted with effluent discharge filters and equipped with monitoring and control devices.[3]

16. Additionally, the new lift station includes dual pumps, heated ventilation of the wet well, and controls. Low level aeration is included in the wet well of the lift station to prevent continued anaerobic digestion of the effluent between pumping cycles while in the force main between

[1] The Record, page 14
[2] The Record, page 14
[3] The Record, page 14

the lift station and the treatment area.[4]

17. The Appellant applied for a permit on August 31, 2023[5]. On September 14, 2023, the Appellant received comments from the authority having jurisdiction at the time on their design. The comments describe the project as the installation of a 7,950 gallon septic tank/lift tank with a working capacity of 5,300 gallons and a pressure treatment field. The field is described as being 2025 square meters. The system design "based on medium sand layer at 450 min[imum] depth add depth to level base. Provide geotextile fabric at base of washed rock above base sand layer."[6] The base sand minimum depth is required to be 475mm and the existing *in situ* topsoil is to be preserved. The geotextile fabric is to cover lateral and trench media to prevent the migration of soil. It states that the installation depth must be in accordance with 8.1.1.14.1.a, and the minimum setbacks are to be maintained as required in section 8.2.2. The comments also state that it is expected that all work and materials comply with the appropriate codes and standards.[7] The permit was issued to the Appellant by the previous agency on October 6, 2023.[8]

18. On March 6, 2023, a request for a variance was submitted by [redacted] requesting that the AHJ approve use of the current drum filter process for fish treatment connected to the treatment and septic field discharge for the fish treatment process.[9] The variance was approved because the contents of this process are primarily fecal matter and fish solid waste with a low BOD, which does not require different treatment than is required under the Alberta Private Sewage Standard of Practice.[10] Included in support of this approved variance was an academic journal on the aerobic bioconversion of aquaculture solid waste[11] and water testing analysis conducted by CARO Analytical Services.[12]

19. The Respondent took over as the agency with jurisdiction for the Property in 2024. An inspection report dated April 11, 2024, was issued from the Respondent to the Appellant (the "Inspection Report") recommending that work on the project stop until the design information requested was supplied and reviewed.[13] The Inspection Report included the following requests:

a) Requested sieve analysis of gravel used to ensure it meets requirements under the SOP section 8.2.3.1(1)

b) Requested sieve analysis of sand used in the field to ensure it meets the requirements of the SOP section 8.2.3.1(2)

c) Provide engineers approval of conduit elbows used in pressure distribution system under the SOP section 2.5.3.1

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[4] The Record, page 14
[5] The Record, page 929
[6] The Record, page 532
[7] The Record, page 532
[8] The Record, pages 565, 887
[9] The Record, page 464
[10] The Record, page 464
[11] The Record, pages 465-472
[12] The Record, pages 474-477
[13] The Record, 565

d) Provide video of a compliant squirt test showing compliance with the SOP section 2.6.1.5(1)(d)

e) Provide soil test pit information including lab results for each excavate test pit, with a minimum of 2 at the field location, in accordance with the SOP section 7.1.1.2

f) Provide a site evaluation report that meets all requirements of the SOP section 7.1.1.4 including strength and volume of wastewater

g) Provide linear loading information in support of the field layout on the slope shown on drawing 303 to be in accordance with the SOP section 8.2.1.12

h) Provide documentation showing 30% or more void space volume, as sand was compacted as a dump truck was driven on the sand, as shown in the provided pictures, to ensure compliance with the SOP section 8.2.2.3(1)(e).[14]

20. The Inspection Report also included the following non-compliant items:

a) Install monitoring ports within fifteen feet of the end of each lateral in accordance with the SOP section 8.2.2.10

b) Low point drains must be capable of draining the entire piping system under the SOP section 2.5.1.2

c) Piping of the system must be fully supported under the SOP section 2.5.1.4.[15]

21. There was an error in communication and the Inspection Report was not provided to the Appellant until April 19, 2024.[16]

22. The Appellant issued a stop work order on April 22, 2024, requiring the Appellant stop work for being in contravention of section 2.1.1.4(1) of the SOP. The Order requires all work by the Appellant stop until a sieve analysis of the sand and gravel used are provided, the complete soil information from two test pits are provided, a site evaluation report is provided, and soil compaction results for the sand layer in the field are provided.[17]

23. On April 25, 2024, the Respondent informed the Appellant that the order issued on April 22, 2024, had been partially complied with, and issued a new order (the "Order") reflecting the action that had been taken. The Order requires that a design be provided that is compliant with the SOP and that all non-compliant sand and gravel products currently installed be removed or abandoned, as the design was in contravention of section 2.1.1.4(1) of the SOP.[18]

24. The Appellant submitted a second variance request to the Respondent via email on May 27, 2024.[19] In support of their design and the variance request, the Appellant provided a variance memorandum detailing the Appellant's design with reference to their variance request (the "Variance Memo").

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[14] The Record, pages 565-568
[15] The Record, pages 565-568
[16] The Record, page 889
[17] The Record, page 569
[18] The Record, pages 688-689
[19] The Record, pages 692, 922

25. The Variance Memo states that the separation distance reported in the soil investigations identify the restrictive layer (the "C Soil Horizon") as being 450mm, which is an insufficient vertical separation space for the treatment methods in the SOP.[20] The SOP requires a vertical separation between the soil infiltration surface and a restricting layer of at least 1500mm when receiving primary treated effluent (Level 1) or 900mm when receiving secondary treated effluent (level 2 or better), under the SOP sections 8.1.1.1.4(1).

26. The Variance Memo states that a literature review was undertaken regarding the removal of bacteria through soil-based treatment as a result of the shallow restrictive layer. The literature review (summarized below starting at paragraph 63) indicates that between 90 and 95 percent of effluent-borne bacteria are removed within 500mm of entering the treatment media and no further additional bacteria removal occurred when treatment bed thickness was increased to 1000mm, that higher rates of removal occur when effluent enters unsaturated soil than if it enters saturated soil, that smaller particle size of sand creates a greater surface area for microbial action and more micro-pores for effluent movement, and providing good aeration onto the effluent infiltration surface improves performance.[21]

27. Based on the literature review, the Appellant requested a variance approving the site with an in-situ soil thickness of 450mm, rather than the 600mm required by section 8.2.2.11.2 of the SOP.[22] The Appellant states that the variance is requested is that there has been an existing soil treatment system on the property for 40 years already which was designed by registered professionals, that there is no other site on property that is sufficiently level or separated from a natural flowing water course. The basis upon which the variance is requested is:

a) that the restrictive layer is highly permeable and therefore has the capacity to receive treated media at the effluent loading rate;

b) the design has added 20% to the calculated surface infiltration area to offset for stones and roots found in the soil and added 10% for the design margin to the area calculation, by ensuring that the media depth of the raised treatment field exceeds the depth needed for the removal of bacteria;

c) to set the pump to deliver no more than 20% of the daily effluent loading volume to a dosing zone;

d) Dividing the treatment field into eight dosing zones to enhance aeration of treatment media between dosing events;

e) installing a geotextile between the treatment field media and washed rock to enhance uniform effluent distribution during dosing events;

f) install washed rock across the treatment field to enhance air movements across the bed to enhance aerobic conditions within treatment media;

g) use washed, medium sand with maximum allowable small particles;

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[20] The Record, page 695

[21] The Record, page 695-696

[22] The Record, page 696

h) install aeration at the lift station to initiate aerobic breakdown of the effluent and limit stagnation in the force main piping between pump cycles.[23]

28. The Variance Memo states that the wastewater will receive primary treatment with three septic tanks each with an effluent filter. The discharge from the septic tanks will then be piped to a lift station.

29. The Variance memo details the Appellant's calculations for the effluent loading and infiltration area. The calculations are based on a daily wastewater volume of 21,250L/day. Their calculation states that the soil, which is a mix of loam and sandy loam, can absorb 22L/day/meter square, which means that the infiltration surface required is 965 square meters. The Appellant then adds the 20% allowance for rocks in the topsoil layer and 10% for a design margin, which equals the total surface area of the field to be 1,221 square meters.[24] Further in the Variance Memo, under the summary of the treatment bed design, the Appellant states that the as-built infiltration surface area is 1,764 square metres.[25]

30. The summary of the treatment bed in the Variance Memo states that the material used for the treatment field is a medium washed sand with a high gradation of smaller particles but still within the gradation limits. The medium washed sand has an average depth of 895mm, with the minimum depth measured at 505mm, and the *in situ* soil is measured at 450mm. The Variance Memo states that the depth of the primary treatment media was determined "following a review of published scientific data regarding the effective removal of coliform bacteria within soil-based media.[26]

31. The Variance Memo also states that the design has enhanced performance by ensuring there is sufficient air in the system to promote aerobic conditions in the effluent distribution layer which is achieved by using washed rock for the trench walls instead of a less permeable material, reducing the topsoil covering layer from 300mm to 150mm, installing aeration equipment in the lift station wet well to initiate aerobic breakdown before the effluent is discharged, and installing geotextile below the washed rock layer to prevent intermingling into the sand layer.[27]

32. The Appellant had, after receiving the stop work order, also provided the Respondent with a memorandum outlining the design approach to the project dated May 7, 2024 (the "Design Memorandum").

33. The Design Memorandum states that the Appellant used an objective based approach to the design of the treatment field as the site presented challenges for soil-based treatment due to the high permeability of the soil.[28]

34. In the Design Memorandum, the Appellant states that the strength of the effluent discharged from the septic tanks is "assumed to meet" the requirements under the SOP.[29] They then detail

[23] The Record, pages 697-698
[24] The Record, page 701
[25] The Record, page 702
[26] The Record, page 702
[27] The Record, page 703
[28] The Record, page 577
[29] The Record, page 577

that the wastewater will receive primary treatment with three septic tanks, each with an effluent filter. All effluent discharged from the septic tanks is then piped into a lift station, designed to accumulate incoming raw wastewater and periodically pumping it to a higher elevation in accordance with section 6.3.1.1.1 of the SOP. Small doses of wastewater are supplied downstream periodically to avoid overloading the system's capacity, as per section 6.3.1.2 of the SOP.[30]

35. The Design Memorandum indicates that of the recommended treatment systems, the treatment mound is the only one capable of accepting primary effluent.[31]

36. The Appellant states that ensuring adequate depth for bacterial removal under a prescriptive method would require an increase in the depth of the sand in the treatment mound, which would significantly increase the footprint of the mound.[32] The Appellant therefore designed the system with "an alternate mound geometry, distribution lateral layout and revised sand depth" to create the Appellant's current design.[33] The design includes the following:

a) The design of the system's infiltration area was based on vertical infiltration without an allowance for lateral infiltration. The Appellant references section B-8.1.1.4 of the SOP as the corresponding code section;

b) Increase of the calculated infiltration surface area into the *in-situ* soil by 20% to offset for stones and roots found in the topsoil and 10% for design margin;

c) Placing a 475mm deep medium sand layer onto the *in situ* topsoil layer of the infiltration area to provide adequate depth for the removal of pathogenic bacteria, as per objective 2.1.1.2 of the SOP;

d) Providing aeration of the effluent at the lift station to initiate aerobic digestion, reduce stagnation in the force main piping between pump cycles and enhance aeration in the washed rock layer, to meet the objectives of SOP section B-8.1.1.11;

e) Placing a layer of washed rock above the sand layer for effluent distribution and movement of air into the treatment bed, to meet the objectives of SOP section B-8.1.1.11;

f) Installation of pressure distribution laterals in washed rock above the sand layer. This includes 150mm of washed rock below the laterals and 100mm above the laterals, to provide protection of laterals while placing the cover layer and to enhance entry of air into the washed rock layer, to meet objectives of section B-8.1.1.11 of the SOP;

g) Having alternating pump control of effluent into 8 different, non-adjacent dosing zones during each pumping cycle. Each pump will apply 530 litres onto a dosing zone, representing 20% of the allowable daily effluent loading allotment into the underlying in-situ soil. The soil will de-saturate between doses due to the permeability of the sand layer

[30] The Record, page 578
[31] The Record, page 579
[32] The Record, page 582
[33] The Record, page 582

thus increasing retention time of effluent movement through the soil.[34]

37. In support of the Memorandum, the Appellant included three academic articles and the testing reports, which are summarized further starting at paragraph 63.

38. The Appellant had field tests taken on the Property on August 6, 2024, specifically to determine if the soil on the Property would "provide property hydraulic conductivity and effluent loading rates to treat the effluent from the facility" on the Property.[35] Four tests were conducted by [redacted], a professional geologist, on the soil on this date, and the results "show that the soil meets the effluent loading rates from the Alberta Private Sewage Systems Standard of Practice"[36], as the coarse sandy loams had a loading rate of 14.9 litres per day per square meter and states that the SOP states at table 8.1.1.10 that an effluent loading rate of 14.7 litres per day per square meter is appropriate for a coarse and medium sand, loamy coarse sand, or loamy medium sand.[37]

39. The Appellant's documents also included the executed construction contract, the request for bids documents provided by Alberta Infrastructure, and the approved permit application form.[38]

Wood Geotechnical Investigation Report

40. In November, 2018, Wood Environment & Infrastructure Solutions ("Wood") conducted a geotechnical investigation of the Property to support the construction design of the upgraded treatment field project, which is described in their investigation letter as having "…a buried tank extending to a depth of about 2.4 meters below the existing grade."[39] To do this assessment, Wood drilled three boreholes and collected soil samples of the property for review by a geotechnical engineer and laboratory testing.

41. The subsurface conditions identified by Wood include:

a) organic clay was noted from the surface to depths ranging between 0.3m and 0.5m and was silty and sandy with rootlets, black and damp to moist;

b) the upper natural mineral soil from two of the three bore holes had clay till which was low to medium plastic, silty, sandy, trace gravel, coal and oxide inclusions and soft to stiff with SPT N-values of 12 blows per 300mm at the test depth of 1.5m, and the *in situ* water content of the clay till ranged between 16 and 20 percent indicating moist soil conditions;

c) the third bore hole's upper natural mineral soil included silty sand described as fine to coarse grained with intermittent clayey lenses, loose to compact with an SPT N-value of 10 blows with *in situ* water content of the silty sand ranging between 15 and 20 percent indicating moist soil conditions;

d) gravelly stratum was encountered at each borehole at depths of 2.4 to 2.6 meters below

[34] The Record, pages 582-583
[35] The Record, page 884
[36] The Record, page 884
[37] The Record, page 885
[38] The Record, pages 527-529
[39] The Record, page 112

grade. The gravel was fine to coarse grained, sandy with cobbles and suspected boulders, compact to dense and moist to wet;

e) the gravel layers were moist to wet, however no groundwater accumulation was observed in the boreholes;

f) Refusal to the auger occurred at depths ranging between 2.7 and 3.1 meters below existing grade.[40]

42. Wood's report states that the soils are generally suitable for supporting building loads, but that pile installation will be difficult given the auger refusal in the shallow gravel layer and suspected shallow bedrock conditions at the site.[41]

The GRIT Report

43. Groundwater Resources Information Technologies Ltd ("GRIT") produced a Private Sewage Treatment System Assessment for the Property on June 1, 2023, (the "GRIT Report"). The Report was prepared by Alanna Felske, Geologist in Training, and was reviewed and certified by Professional Engineer [redacted] Hugo.[42]

44. The GRIT Report states that GRIT's assessment was for a commercial development exceeding 9 cubic meters of septic effluent generation per day and following the 2021 Alberta Private Sewage Systems Standard of Practice (the "SOP"). In conducting the assessment, GRIT dug four test pits near the existing septic field "to log the soil, collect soil samples for grain size analysis, and determine if a shallow water table is present."[43]

45. The GRIT Report states that the shallow soil types identified were either silt clay loam, sandy loam, silt loam, loam or clay loam textures. Below 0.3-0.5 meters was predominantly clast supported cobbles not supported by the sandy matrix[44] and boulders in a "medium to coarse grained sand matrix."[45] The cobbles and boulders "represent a restrictive layer, limiting soil-based treatment of septic effluent."[46] These cobble and boulder deposits are "at least 18 meters thick" and bedrock was not encountered in the test holes.[47] No impervious soil conditions were encountered either.[48]

46. GRIT's drilling investigations indicated a high proportion of coarse-grained gravel which "allows for relatively rapid migration of septic effluent through the subsurface."[49] The report states that during the drilling investigations a "sewage odor was detected in drill cuttings up to a depth of 6 meters below surface, indicating the potential for untreated septic effluent infiltrating to this

[40] The Record, page 113
[41] The Record, page 114
[42] The Record, page 126
[43] The Record, page 127
[44] The Record, page 135
[45] The Record, page 127
[46] The Record, page 127
[47] The Record, page 132
[48] The Record, page 135
[49] The Record, page 132

depth and septic effluent is not being properly treated."[50] The GRIT Report states that the soil texture at 0.2-0.4 meters depth indicated a sandy loam or a sandy loam with a "moderate blocky structure" and states that under the Alberta Private Sewage Systems Standard of Practice, section 8.1.1.3(2), "effluent should not be applied to coarse gravel soils unless a suitable soil horizon is present (such as a sand lens) within the soil that will allow for treatment of effluent."[51]

47. The GRIT Report also states that the Property is "acceptable for a mounded septic field with primary, secondary or greater treated effluent" or a litter fermented and humanic soil at-grade system (an "LFH System") with secondary treated effluent.[52] It states that the C horizon of clast supported cobble and boulder deposits represent a restrictive layer that would limit vertical soil-based treatment of septic effluent and prevent the installation of traditional below grade septic treatment trenches.[53] It states that the LFH at-grade system would utilize the forested area to treat septic effluent within the shallow organic soil horizons present, whereas a mounded system would "require extensive tree removal" and require "washed sand and gravel material" to be brought in to construct the mound.[54] Due to the heavily forested nature of the site, the GRIT Report recommends an LFH at-grade system as being ideally suited for the existing site conditions.[55]

48. The water table for the Property is reported to be at a depth of 17.8 meters, below a thick unsaturated zone that separates the water table from the base of the current septic field. No impact to the groundwater by septic field effluent was detected.[56]

49. GRIT did a cumulative impact assessment which had baseline nitrate levels in the water table measured at 0.77mg/L. It is anticipated that the additional effluent from the new septic system would provide an average of 30,000 litres per day with a nitrate concentration of 4mg/L, which would result in a concentration of 1mg/L nitrate loading to the subsurface.[57]

50. There is also additional nitrate concentration in the overburden layer of 0.95mg/L that is to be added to the existing 0.77mg/L in the water table, which results in a total nitrate concentration of 1.72mg/L.[58] The maximum nitrate concentration for drinking water allowed is 10mg/L. No adverse impact on the drinking water aquifer quality in the area is expected due to septic field effluent disposal from the new system.[59]

51. The water sample collected by GRIT was analyzed and shows relatively low concentrations of nutrient parameters, nitrate, and ammonia concentrations, indicating no adverse impacts to

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[50] The Record, page 132
[51] The Record, page 136
[52] The Record, page 127
[53] The Record, page 137
[54] The Record, page 128
[55] The Record, page 137
[56] The Record, page 128
[57] The Record, page 128
[58] The Record, page 128
[59] The Record, page 128

the water table.[60] The GRIT Report provided the following septic field effluent parameters:

a) Nitrate: 0.77 mg/L

b) Nitrite: 0.074 mg/L

c) Sulfate: 22 mg/L

d) Ammonia – N: less than 0.025 mg/L

e) Kjeldahl Nitrogen: 0.5 mg/L

f) Total dissolved solids; 237 mg/L

g) Sodium: 14.2 mg/L

h) Potassium: 5.2 mg/L

i) E. Coli: less than 100 mg/L

j) Total Coliforms: less than 100 MPN/100mL.[61]

52. The GRIT Report states that due to the high permeability of the soil and the deep depth to groundwater, breakout to the surface should not occur with the mounding of the septic effluent.[62]

Back To Earth Septics Report

53. Back To Earth Septics ("BTES") conducted a field evaluation for septic field suitability on March 23, 2023. The report of this field evaluation (the "BTES Report") was provided to the Appellant on an unknown date.

54. BTES dug four test pits on the Property. The BTES Report states that there were lots of rocks visible on the surface of the Property and within the four test pits. The soil was damp on the top due to melting snow and then dry through the rest of the soil in the test pits.[63]

55. The key soil characteristics for test pit 1 indicate that the soil had high coarse fragments, that the depth to the restrictive soil layer was 40cm and the depth to the highly permeable layer limiting design was 30cm. The comments regarding the system design regarding the soil characteristics state that the area needs a mound or LFH at grade due to the coarse fragments present at the depth of 40cm.[64]

56. The key soil characteristics for test pit 2 indicate that the oil had high coarse fragments, that the depth to the restrictive soil layer was 50cm and the depth to the highly permeable layer limiting design was 35cm. The comments regarding the system design regarding the soil characteristics state that the area needs a mound or LFH at grade due to the coarse fragments present at the depth of 50cm.[65]

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[60] The Record, page 139
[61] The Record, page 138
[62] The Record, page 128
[63] The Record, page 149
[64] The Record, page 150
[65] The Record, page 151

57. The key soil characteristics for test pit 3 indicate that the oil had high coarse fragments, that the depth to the restrictive soil layer was 45cm and the depth to the highly permeable layer limiting design was 30cm. The comments regarding the system design regarding the soil characteristics state that the area needs a mound or LFH at grade due to the coarse fragments present at the depth of 45cm.[66]

58. The key soil characteristics for test pit 4 indicate that the oil had high coarse fragments, that the depth to the restrictive soil layer was 37cm and the depth to the highly permeable layer limiting design was 27cm. The comments regarding the system design regarding the soil characteristics state that the area needs a mound or LFH at grade due to the coarse fragments present at the depth of 37cm.[67]

59. The soil analysis done by BTES, through the Down To Earth Labs Inc, indicate that in test pits 1, 3 and 4, very fine sand (characterized as 53-106 µm) made up between 0.1 and 10% of the soil sample, fine sand (characterized as 106-250µm) made up between 5.5-11.5% of the soil sample, medium sand (characterized as 250-500 µm) made up between 7 and 17.2% of the soil sample, and then coarse sand (characterized as 0.5-1mm) and very coarse sand (characterized as 1-2mm) made up between 17 and 20.8% and 16 and 35.4% of the soil sample, respectively.[68] Test pit 2 had loam textures, no sand.

60. The BTES Report states that these types of fields are suited for a septic mound, an LFH at grade system, a holding tank or a secondary treatment system. It also states that it is recommended the designer make the field at least 10% larger than the minimum required to account for soil irregularities not encountered in the test pits.[69]

61. The map of the test pits indicate that test pits 1 and 2 are on the north side of the road and test pits 3 and 4 are on the south side of the road.[70]

Study of Slow Sand Filtration in Removing Total Coliforms and E. Coli

62. As support for the Variance Memo, the Appellant included the study "Study of Slow Sand Filtration in Removing Total Coliforms and E. Coli", June 2014, conducted by the Department of Environmental Engineering and the Faculty of Mineral Technology with the University of Pembangunan Nasional Yogyakarta Indonesia, the Institut für Wasser und Gewässerentwicklung and the Institut für Funktionelle Grenzflächen in the Karlsrusher Institut für Technologie in Germany (the "Study"). The study evaluated the performance of slow sand filtration systems regarding bacteria removal considering grain size distribution and grain shape.[71]

63. In the Study, the test columns were made up of a 5cm (50mm) gravel layer at the bottom, a 50cm (500mm) supporting sand bed and an additional 5cm (50mm) gravel layer on the surface.

64. The Study found that bacterial removal was between 97.7%-99.998% in the columns, with the

[66] The Record, page 152
[67] The Record, page 153
[68] The Record, pages 154-155
[69] The Record, page 156
[70] The Record, page 157
[71] The Record, page 722

best and most consistent performance achieved by the filter column consisting of lava sand with the configuration C2(d10=0.07mm and Cu=4.2),[72] which is a small grain size sand with a medium amount of size variety in the grains themselves.[73]

65. The Study references previous academic studies that found that a decrease in grain size leads to an increase in treatment efficiency and states that their study supports this trend – being that the highest bacteria removal corresponded to the finest grain size.[74] The Study goes on to explain that adsorption is the most important mechanism in retaining bacteria (compared to straining): "An increase in sand surface area leads to an increase in adsorption spots on sand and biofilm attached to the sand grains", so the finer the sand or smaller the grain size the larger sand surface area that exists compared to coarse sand, therefore providing more adhesion or adsorption spots.[75]

66. In addition to grain size distribution, grain shape is also important in removing bacteria, according to the Study. In the Study, the lava sand, as opposed to the rhine sand, provided a better result in both total coliforms and E. coli, which is "likely caused by the different grain shape" as the lava sand is angular and the rhine sand is circular.[76] The Study references another paper which found that more angular sand grains could filter out more particles in a wider range of sizes.[77]

67. The summary of the Study states that the results that can be concluded are that a smaller grain size leads to an increase in bacteria removal, a higher bacterial removal was achieved by sand with an angular shape as compared to a spherical shape.[78] The Study also has suggestions for improving the findings of the study, which include subsequent experiments should be carried out to assure the effect of intermittent operation to the development of the biofilm on the sand surface, an additional study should be conducted to know the clogging time or running period of the sand filter, and research of slow sand filtration using the local material regarding bacterial removal should be carried out to acquire the real implementation of this study in the case area.[79]

68. The Study also suggests that good performance of the sand was achieved under the specific condition of hydraulic loading rate 0.03m/h.[80]

Vertical Separation Scientific Literature Review

69. The Appellant included the literature review paper "Vertical Separation: A review of available scientific literature and a listing from fifteen other states" by Selden Hall, Washington State

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[72] The Record, page 724

[73] Author's note: "d10" refers to the grain size for which 10% of the sand particles are small. A smaller d10 means finer sand. "Cu" is the uniformity coefficient, which indicates how varied the grain sizes are – a higher Cu number means more variety in size. In engineering and filtration, a Cu of 6-10 is considered high.

[74] The Record, page 724

[75] The Record, page 725

[76] The Record, page 726

[77] The Record, page 726

[78] The Record, page 728

[79] The Record, page 728

[80] The Record, page 729

Department of Health Office of Environmental Health and Safety, 1990 (the "Literature Review"), in support of the Variance Memo.

70. The Literature Review summary states that vertical separation is essential for effective treatment, as it affects degradation of organic nutrients and the removal of bacteria and viruses, as well as converting nitrogen into soluble nitrate ions "which can migrate into the groundwater unless denitrifying conditions are present".[81] It goes on to say that in order to achieve vertical separation there is a "certain necessary distance that wastewater must travel under unsaturated conditions in order to provide adequate treatment"[82] and states that vertical separation has been shown to be more effective in removing contaminants than horizontal separation "because horizontal flow usually requires saturated conditions."[83] Studies found that horizontal movement resulted in significant removals of bacteria only after effluent had travelled a minimum horizontal distance of 6.1-12 meters.[84] It references a study that "reported a 3000-fold reduction in bacteria levels 38[cm]… below the trench bottom and 30[cm]… laterally."[85]

71. The Literature Review states that if the groundwater table or other barrier layer is too close to the bottom of the trench there will be saturated flow. Under saturated flow conditions, water flows through the "macropores" which can "result in the short circuiting of the soil purification process."[86] This can be influenced by complex factors, such as wet and dry weather which results in the rise and fall of ground water, the length of each of these periods and the rate of groundwater flow which is dependent on rainfall.[87] It states that shallow soils over creviced bedrock or excessively permeable soils, shallow soil over high groundwater tables, and impermeable soils, prevent safe soil treatment and disposal.[88]

72. In contrast, the Literature Review states that unsaturated flow through small pores increases the efficiency of bacterial and viral removal due to "slower average pore water velocities" and increased surface contact.[89] One of the keys to a functioning septic system, it says, is ensuring that there is a large enough vertical separation between the bottom of the drain field and the water table to maintain unsaturated conditions during wet seasons.[90]

73. The Literature Review states that there is wide variance across the United States for what is considered adequate separation. However, it states that studies show that viral deactivation occurs within 40 centimeters and that bacteria can adequately be removed between 0.9 to 1.2 meters of effluent travel through soils, and another that shows that fecal coliforms were

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[81] The Record, page 733
[82] The Record, page 734
[83] The Record, page 735
[84] The Record, page 735
[85] The Record, page 736
[86] The Record, page 735
[87] The Record, page 735
[88] The Record, page 735
[89] The Record, page 736
[90] The Record, page 736

"reduced to background levels within 61[cm] of the trench bottom."[91]

74. The Literature Review states that low pressure distribution where site conditions have minimal vertical separation can be used to provide equal distribution over the drainfield. It notes one study that found most fecal coliform bacteria and coliphage virus were removed within the first 30cm of unsaturated soil, and occasionally a few coliforms were observed at 120cm.[92] It notes another study that found total removal of fecal coliforms at 90cm containing sand and silt loam, and another study that found substantial but incomplete coliform removal in a series of 60cm columns with a variety of sand and clay mixtures.[93] The Literature Review then states that the indication is that substantial bacterial and viral removal occur "within the first foot" of unsaturated soil and almost complete removal within 60 to 120cm.[94]

75. Finally, the Literature Review concludes that the research shows that 0.61 to 1.2 meters of vertical separation will remove more than 200 fecal coliforms per 100 milliliters, depending on the soil type and conditions, but that to achieve the unsaturated zone of two feet it is usually necessary to construct a system with even greater separation in order to account for groundwater mounding.[95] The scientific literature is therefore strongly indicated a final vertical separation that is greater than 2 feet.[96]

Improving Septic Tank Performance by Enhancing Anaerobic Digestion

76. The Appellant included the report "Improving Septic Tank Performance by Enhancing Anaerobic Digestion" by Jowett, *et al.*, undated, through the Waterloo Biofilter Systems Inc. and Fleming College in Lindsay Ontario (the "Septic Report").[97] The Septic Report focuses on the basics of anaerobic microbiology and why directing sewage flow and inducing a more methanogenic anaerobic environment improves sewage treatment. [98]

77. The Septic Report states that while there have been significant improvements in understanding of anaerobic microorganisms and development of "high-rate anaerobic technologies" this knowledge has not been applied to improving the septic tank.[99] The Septic Report discusses improvements that can be made to septic tank design, which include: closed-conduit flow, removal of airspace and avoidance of stagnant space by directed flow, warm anaerobic digestion, and use of high rate design features such as granular sludge.[100]

78. The Septic Report then describes the workings of the InnerTube™ Anaerobic Digester developed by the Waterloo Biofilter Systems Inc.[101]

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[91] The Record, page 736
[92] The Record, page 737
[93] The Record, page 737
[94] The Record, page 737
[95] The Record, page 739
[96] The Record, page 739
[97] The Record, page 749
[98] The Record, page 750
[99] The Record, page 750
[100] The Record, page 754
[101] The Record, page 754

79. The Septic Report describes that a warm environment facilitates increased methanogenic activity and increases microbial diversity and activity which will result in a better digestion of sludge and needing less frequent pump-outs of waste.[102]

Aerobic vs Anaerobic Wastewater Treatment

80. The Appellant included the report "Aerobic vs Anaerobic Wastewater Treatment", updated June 2023, by Greentumble Water Pollution (the "Treatment Report"), in support of their appeal.

81. The Treatment Report differentiates aerobic and anaerobic treatment. Aerobic treatment involves treating wastewater with oxygen, which is essential for the growth and activity of aerobic microorganisms. The oxygen facilitates the efficient breakdown of organic compounds and removal of nitrogen, phosphorus and other nutrients. The aerobic process promotes rapid degradation and therefore is effective in treating wastewater with high organic loads.[103] Anaerobic treatment operates without oxygen, and relives on those microorganisms that can thrive in low or zero-oxygen conditions. Anaerobic treatment allows microorganisms to break down organic compounds in the wastewater and is effective in treating wastewater with high concentrations of solid organic matter.[104] Anaerobic treatment can be used as a pre-treatment prior to aerobic treatment in municipal wastewater systems.[105]

82. The Treatment Report states that aerobic treatment is used when site conditions are not supportive for anaerobic systems or when the water table is too high for effective septic use. Anaerobic systems are used because the no-air input generates less sludge, the sludge created is safe to use as a soil enrichment, and the process uses less energy and fewer chemicals than the aerobic treatment.

83. The Treatment Report states that the aerobic process is more effective in removing high organic loads from wastewater and reducing biochemical oxygen demand. Whereas the anaerobic process is highly effective in treating high concentrations of organic matter in wastewater and is particularly useful for treating sewage sludge or industrial wastewater with high organic content.[106] [107]

<u>Evidence on behalf of [redacted]:</u>

84. [redacted] ("[redacted] Professional Engineer for MPE, is the lead engineer on the Appellant's project.

85. [redacted] submit to the Tribunal that the Order issued by the Respondent had inconsistencies that have been corrected by supporting documents. He states that the reasons for the Order and

[102] The Record, page 755
[103] The Record, page 762
[104] The Record, page 762
[105] The Record, page 763
[106] The Record, page 765
[107] Author's note: "Organic Load" refers to the quantity or total amount of organic material and is measured in terms of biochemical oxygen demand; "Organic Content" refers to the concentration or proportion of organic material present and is typically measured as a percentage or concentration, such as milligrams per liter.

the Variance Refusal are qualitative opinions that are not supported by quantitative evidence.

86. [redacted] informed the Tribunal that it is his opinion that the Variance Application was incorrectly refused, as the Appellant's design follows an objective standard and the refusal was based on the prescriptive standard found in the SOP which is not an appropriate justification. [redacted] submitted to the Tribunal that the correct standard is that the design needs to provide equivalent or greater safety as the prescriptive requirements.

87. [redacted] suggests that soil and hydrogeology reports were submitted to support the objective of the standards set in section 2.2.1.4.1(a) of the SOP. He also states that the determination of the volumes for the effluent flow were determined by the SOP and that the volume calculations were provided alongside a biological demand for wastewater strength, to support the design under the requirements in section 2.2 of the SOP.

88. [redacted] suggests that under section 2.1.1.4.1(f) of the SOP, the Appellant was required to consider other objectives and prescriptive requirements of the SOP that may impact system design and performance, but that consideration under this section does not require those prescriptive requirements be followed, but rather included in determining the system design. [redacted] submitted that this subsection, where there "may" be impacts to the system and performance, is being ignored by the Respondent.

89. [redacted] also submitted to the Tribunal that the SOP is referenced by the Alberta Building Code, and as such is subject to the Alberta Building Code's paramountcy clause, therefore allowing for objective interpretations and alternative solutions that do not strictly follow prescriptive environments.

90. Finally, [redacted] also suggested that the previous approval of a different variance regarding fish effluent is contradictory to the Respondent's requirement that the system adhere to prescriptive requirements.

91. In response to a Tribunal question, [redacted] confirmed that the design on the Property had the following layering (from top down): layer of top soil, then the geotextile fabric, then a layer of washed rock, then a layer of geotextile fabric, and then sand.

<u>Evidence on behalf of [redacted]:</u>

92. [redacted] ("[redacted] is a Professional Geologist and hydrogeologist with GRIT and was the reviewing and signing professional on the GRIT Report. The GRIT Report was produced by a geologist in training, at the time, with approximately seven years of experience. She is now a professional geologist and was an intermediate GIT at the time of producing the GRIT Report. [redacted] informed the Tribunal that he has done site assessments like the assessment done for the Appellant for many other fields.

93. [redacted] confirmed for the Tribunal that the GRIT Report includes data from a monitoring well on the Property which confirmed no mounding at the site. He also informed the Tribunal that field data from a monitoring well is more reliable than mound calculations. He states that he did not have the hydraulic connectivity data to be able to do accurate mound calculations but that having actual field data is a more reliable method for determining the conditions of the site.

94. [redacted] stated that based on GRIT's review there are no hydrogeological conditions which would prevent the use of the site, as the setbacks from the surface water and the slope of the property are suitable. The Property has a deep water table at over 15 meters.

95. When asked if the Appellant's modified treatment bed would perform differently from a treatment mound, as defined under the SOP, [redacted] stated that in terms of the impact to the subsurface the effect would be the same.

96. [redacted] stated that four tests were conducted: the infaltromer for measuring vertical drainage, a percolation test which measures horizontal drainage, a glob permeameter test which is a spherical test, and then grain size distribution test. He stated that all tests came back with similar numbers which were within the acceptable range as specified within the design guidelines. He confirmed that the Appellant's Property did not have a stratified system. He also confirmed that it was his opinion that the site was suitable for an effluent drainage site.

97. [redacted] informed the Tribunal that he did not believe the washed rock would restrict water movement in the system. He does not believe the effluent would have a significant amount of suspended materials and therefore does not believe there would be significant movement of the sand and rock fines that would lead to plugging the geotextile fabric. He did state, however, that he is not a geotechnical engineer and therefore cannot comment on whether the geotechnical fabric would plug excessively.

98. Upon a question from the Respondent, [redacted] confirmed that the sandy loam present on the Property is coarse sandy loam. [redacted] also confirmed that to get a distribution average across an area where discharge will be abnormally distributed he used a geometric average calculation rather than an arithmetic average calculation, which scientific literature states should be used unless the area is stratified, which is not the case for the Property.

99. When asked whether there is potential for the fines in the washed rock to settle at the bottom to create stratification, [redacted] stated that this is a geotechnical engineering question and therefore he cannot say whether this was a possibility. However, he states that he is unsure whether there is enough velocity in the discharge to mobilize the fines. [redacted] also states that the geotextile fabric is not preventing vines from migrating and that the fines would continue to migrate when they hit the gravel. [redacted] stated that if the Property had a marginal soil and added more fines this could be a problem but the soil on the Property is quite permeable and coarse enough that he did not believe fine migration would be a problem.

100. [redacted] also answered that the restrictive layer identified on the Property is not a fixed line layer. He states that the sand and silt layers come and go throughout the property.

<u>Evidence on behalf of Dr. Abimbola Biola:</u>

101. [redacted] ("[redacted]") has a PhD in Microbial Ecology from the University of Regina. He currently works with the Water Institute in Regina with biofilms on surfaces, including geotextiles and rocks, and how that impacts the cleaning of water. [redacted] confirmed that he is familiar with soil based treatment of effluent wastewater and had a chance to review the design and reference documents included in the Record.

102. [redacted] stated that the level noted of biochemical oxygen demand ("BOD") in the

Appellant’s testing of the effluent being discharged, which is 36.8mg/L,[108] is not a level of BOD, as in much of waste water the BOD levels can be as high as 150mg/L.

103. [redacted] informed the Tribunal that most harmful chemicals and microorganisms, such as E. coli and nitrogen, have the majority removed within the first 30 to 50cm, and that the proposed system allows for aeration which helps microbes to further break down the contaminants. When asked by the Respondent how far down into the gravel of the system will have enough oxygen for the microbes to break down the contaminants [redacted] stated that it would depend on the type of soil and the amount of moisture in the soil, but that the current system achieves close to the required levels.

104. The hydrology report also show that the existing septic field is already treating the water system effectively as testing from the current site shows that levels of biological coliforms are below the acceptable level standard. [redacted] stated that because there is already an operational field and the new system is going on top it will likely be more effective as they have effectively increased the treatment zone between the surface and the groundwater.

105. [redacted] informed the Tribunal that the presence of smaller particles or fines in the sand is seen as beneficial as they increase the surface area for microbial activity, enhancing the biofilm that treats the wastewater. [redacted] explained that in the Regina Study, the microbia on rocks and sand retained close to 95% of the organisms, nitrate and nitrite in the gel created by the microbes.

Evidence on behalf of [redacted]:

106. [redacted] ([redacted]) is a project manager for Lexon Inc. and was the supervising manager for the Appellant project on the Property.

107. [redacted] informed the Tribunal that the superintendent for the Property is no longer with Lexon Inc. and therefore was not available to attend the hearing.

108. [redacted] confirmed for the Tribunal that his experience with the superintendent for the Property was that this superintendent’s regular practice to attempt to comply within the code rules and approved permit documents. He stated that there was pressure to complete the project and when the situation of non-compliance with the SOP arose they were surprised because they were working under an approved permit. It was suggested that work stop but it was [redacted] understanding that there could be a difference of opinions because they had done the work as per the issued permit.

109. [redacted] agreed that the installation instructions for installing the field specifies only tracked equipment is to be used to place and shape that material and stated that it was his understanding that this instruction was followed by construction crews. In response to the Respondent’s question regarding a tri-axel truck on the Property seen in a submitted photo [redacted] stated that he has not seen the photo but recalled that at the time the truck was on site the sand was frozen so there would not be compaction.

110. [redacted] informed the Tribunal that the squirt test was done in two portions. The first squirt test required some remedial work, which was done, and then the second test confirmed the

[108] The Record, page 474

system was working properly. However, in answering the Respondent's question, [redacted] stated that he was not aware of the results from the second squirt test being provided to the Respondent.

111. Finally, [redacted] informed the Tribunal that the geotextile fabric was put in place before the gravel because there was a concern that the sand would mix with the gravel as the sand was somewhat saturated due to the inclement weather and they wanted to ensure that the two layers would remain separate.

Summary of the Evidence Provided On Behalf of the Respondent:

Written submissions made on behalf of the Respondent:

112. The Appellant applied for a plumbing permit on August 31, 2023, for a septic replacement and upgrade and field for a nine-bedroom residence at a fish hatchery. The plans were reviewed by a safety codes officer who represented the Crowsnest Pass municipality at the time.[109] The application included an engineer's drawings of the site and the design.[110]

113. Included in the engineer's drawings was a diagram of the system which shows 20mm of washed rock above the pressure distribution lateral, followed by 20mm of washed gravel below the pressure distribution lateral, and then 475mm of medium sand below the gravel above the existing ground. A note is included beside the diagram, highlighted by the Respondent, that states "medium sand layer at 450 min depth. Add depth to level bed. Provide geotextile fabric at base of washed rock above base sand layer. Base sand medium will very based on existing grades. Minimum depth to be 475mm."[111]

114. The Appellant was the successful party in the request for bids for the Project. The request for bids package for the sanitary sewage disposal field includes, at section 1.4.1 that the fields must be designed in accordance with the Alberta Private Sewage Systems Standard of Practice 2021. It also states at section 2.2 that the fill material shall include medium sand, 25mm washed crush gravel, and an infiltration bed cover.[112]

115. The Appellant started working as the agency representing the Crowsnest Pass on January 1, 2024, and began reviewing and following up on previously issued permits alongside issuing new permits.[113]

116. The Respondent SCO, [redacted] ([redacted] attended the Property on April 11, 2024, with a new SCO to provide some training for the new SCO and to perform an interim inspection. On this date, a contractor on site introduced himself to [redacted] and invited him to witness the squirt test they were going to perform. On this date, the squirt test was not successful as the piping had clogged orifice because they had not previously been flushed out. At this time, [redacted] told the

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[109] The Record, page 929
[110] The Record, pages 931-955
[111] The Record, page 946
[112] The Record, page 1027
[113] The Record, page 958

contractor that he would need to have a good squirt test video submitted to his office.[114] He also informed the contractor that he would need a sieve analysis of the gravel and sand as it appeared upon his review that there were too many fines in the material being used.[115]

117. In an email to the superintendent of the Project dated April 16, 2024, [redacted] wrote that he has concerns with the issuance of the permit given that there are "key components that are not reflected in the permit documentation that was provided".[116] Based on what was missing, the permit should not have been issued because the design could not be fully verified as being compliant with the SOP. [redacted] then requested that, if the superintendent had the documents, that he provide him with the following information missing from the design information:

a) soil logs;

b) effluent flows;

c) sewage strength;

d) soil texture lab results; and

e) pressure distribution information.[117]

118. In this email, [redacted] also recommended the Appellant address the design portions and concerns prior to continuing with the installation to avoid potential issues.[118]

119. On April 18, 2024, the superintendent for the Project responded to [redacted] requesting a copy of the inspection permit, as it had not yet been received. In this email he also informed [redacted] that he did not believe that [redacted] had jurisdiction to inspect, as it was provincial land, and that he was trespassing on the Property. He also stated that [redacted] could not make comments because the system is an engineered design. Finally, he states that the work on the Project would continue.[119]

120. The Inspection Report was provided to the Appellant on April 19, 2024. The contents of the report are described in paragraph 19 and 20 above.

121. The Appellant provided the Respondent with an aggregate gradation report (the "2022 Gradation Report") that was done on September 15, 2022. The test results showed that 7% of the sample passed through an 80um (0.08mm) sieve, 9.4% passing rate through a 160um (0.16mm) sieve, 17% passing rate through a 630um (0.63mm) sieve, and 23% passing rate through a 1,250um (1.25mm) sieve.[120]

122. The Appellant also provided a sand sieve report from August 23, 2023 (the "2023 Gradation Report"). This test showed that 12.5% of the sample passed through an 80um (0.08mm) sieve, 20% passing rate through a 160um (0.16mm) sieve, 52% passing rate through

[114] The Record, page 957
[115] The Record, page 958
[116] The Record, page 958
[117] The Record, page 958
[118] The Record, page 958
[119] The Record, page 956
[120] The Record, page 968

a 630um (0.63mm) sieve, and 68% passing rate through a 1,250um (1.25mm) sieve.[121] The engineer's notes on the review of the 2023 Gradation Report, dated September 12, 2023, states "The specified sand has slightly more fines than specified, which is acceptable. Engineers approval of improper sand."[122]

123. The Respondent included notes on the GRIT Report. The GRIT Report states that the test holes show "surficial cobble and boulder deposits" at least 18 meters thick to which the Respondent notes that there are no lower soils found in the holes that would allow for the slowing of effluent.[123] He also notes that the high coarse grain content of the C horizon making the C horizons a restrictive layer, as identified in the GRIT Report, are restrictive at different depths.[124]

124. The GRIT Report states that the depth to groundwater exceeds 3 meters, indicating that a shallow water table would not be a consideration when installing a septic system. The Respondent notes that despite this, the gravels used would allow under-treated effluent to impact the groundwater. The Respondent notes this later where the water table was below 17.3 meters, but states that the gravels will allow effluent to reach the water.[125]

125. The Respondent comments on the Back to Earth Report that Back To Earth is the second professional to recommend a Treatment Mound design.[126]

126. The Respondent also includes notes on the description requirements for the Project as set out in the Request for Proposal. Specifically, the notes include that a tri-axel dump truck was used for delivery and placement of gravel on the sand layer which is contrary to the requirement that "only low ground pressure tracked equipment" be used to place and shape fill materials.[127] The Request for Proposal also states that the sand needs to be a medium sand layer and his notes state that there are many fines in the sand.[128] The Request for Proposal also outlines that the valves need to achieve the "specified discharge pressure of 1,525 millimeter head, which the Respondent notes was not achieved during his site visit. He notes that a video was requested but was not provided.[129]

127. The Respondent also notes that the Project is installed on top of the existing, failed system on the Property. The Respondent's note states that the system does not address the existing piping below the ground.[130] The Respondent notes later that the existing system is failed and that soils are "not conducive to failing upwards".[131]

<u>Evidence on behalf of [redacted]:</u>

[121] The Record, page 971
[122] The Record, page 969
[123] The Record, page 991
[124] The Record, page 994
[125] The Record, page 1052
[126] The Record, page 1015
[127] The Record, page 1029
[128] The Record, page 1029
[129] The Record, page 1029
[130] The Record, page 1042
[131] The Record, page 1052

128. [redacted] confirmed for the Tribunal that he inherited the file from the previous agency in 2024. The permit was issued to the Appellant was issued by the previous agency that had been contracted by the municipality.

129. [redacted] informed the Tribunal that his office received some inspection reports and photos from engineers doing site visits to the Property and that [redacted] started his review of the file in April. When he started to review the file in April the permit file did not contain many of the design documents. Specifically, the file had the permit application, the permit, and the IFC documents. There was no soil information, design information, or other types of supporting documents that would be included in the spec book for the project. [redacted] stated that he did reach out to the SCO that issued the original permit to ask for the information they had when reviewing the permit application and was informed that they issued the permit based on the application itself and the ISC drawings because they were stamped and they believed that having the stamped drawings was sufficient to issue the permit.

130. On April 11, 2024, [redacted] was in the area for another project and so he, and an SCO that he was training, attended the Property. When he arrived, he was informed by some of the workers on site that a squirt test was about to be conducted and invited him to attend. The squirt test failed on this date. He also noted a few other aspects of the Project that were not currently in compliance and informed the professional on site of those things, including laterals extending past the sand layer and unsupported distribution piping. [redacted] informed the Tribunal that he took some sand on this date for a jar test as he had concerns about the gravel and sands because it was evident there were a lot of fines present. He also advised that he would need a video or photos of a successful squirt test.

131. [redacted] shared that he wrote the Inspection Report, but due to a typographical error from the original documents it was not sent to the Appellant until April 17, 2024. The Inspection Report requested an analysis on the materials being used.

132. [redacted] did have a sieve analysis (jar test) done on the sand and gravel [redacted] from the Property on April 11, 2024, and the test confirmed there were too many fines present in the material being used. [redacted] states that the lab results provided were close to what he found with this test.

133. [redacted] also stated that there were two different companies (GRIT and Down to Earth) that did site investigations and both identified very thin restrictive lenses or layers in the soil. He also states that you need 600mm from the raised bed field to the restrictive layers under the SOP and that was not present. He did state that they have enough in situ soil that they could add sand to create a thicker sand layer and install septic mounds to align with the SOP.

134. When the Variance was received to allow the Project in its current state, the information that was provided to the Tribunal for the Hearing was not provided to the Respondent. And based on the information received his opinion is that there was not enough information and evidence to prove that the Project would provide equal or greater safety performance.

135. [redacted] also informed the Tribunal that he had concerns about the compaction of the soil as the pictures received from engineers who had done site visits to the Property showed a tri-axel truck on the sand. In the project requirement documents under the Appellant's contract to do the work with the Government of Alberta it states that only tracked vehicles are to be used to place and shape fill materials,[132] so this is a requirement that is known and was a contractual requirement. While the Appellant countered on questioning that the photo shows snow, [redacted] stated that the snow does not guarantee the ground was frozen and that there was no compaction. The presence of the truck is supportive of a reasonable suspicion that there was compaction of the ground, which is why he asked for documentation showing 30% or more void space volume in the Inspection Report.[133] When asked by the Appellant if he believes it reasonable to say that the ground might not be compacted and just frozen given the updated information received during the hearing, [redacted] maintained that he cannot be certain there was no compaction.

Reasons for Decision:

136. On an appeal such as this, the powers of the Tribunal are set out in subsection 52(2) of the *Act*, the relevant excerpts are reproduced below:

> 52(2) The Council may by order
>
> (a) confirm, revoke or vary an order, suspension or cancellation appealed to it and as a term of its order may issue a written variance with respect to any thing, process or activity related to the subject-matter of the order if in its opinion the variance provides approximately equivalent or greater safety performance with respect to persons and property as that provided for by this Act;
>
> (b.1) confirm the refusal by a safety codes officer to issue a written variance or revoke the refusal by a safety codes officer to issue a written variance and issue a written variance on the terms and conditions that the Council considers appropriate

137. This appeal has two distinct issues, the appeal of the Order issued April 22, 2024, and the refused variance application for the Project. This decision will address each issue separately.

The Order

138. The Appellant has submit to this Tribunal that the Order was incorrectly issued because the design of the Project meets the objectives of the SOP.

139. The Appellant submits in the appeal application that the soil evaluation report and hydrogeological study that were completed for the project are sufficient to meet section 2.1.1.4(1) of the SOP, which requires an onsite wastewater treatment system design to consider (a) the soil conditions determined by a complete site evaluation as required in Part 7, and (b) the project volume of wastewater, flow variation and wastewater strength as required in

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[132] The Record, page 326
[133] The Record, page 975

section 2.2 of the SOP. The Appellant submits that the strength of the effluent was tested to confirm that it was not in excess of the standard treatment requirements.[134] The Appellant also submits that the incorrect standard is being used for evaluation of the Project, as the Project was designed as a raised bed and the standards being used by the SCO are for a mound design, and therefore prescriptive compliance as a mound is not feasible.[135]

140. Section 8.2 of the SOP sets out the requirements of a treatment field. As the Appellant has submit to the Tribunal that the Project was designed as a treatment field and not as a mound, the requirements for the treatment field will be evaluated first.

141. Section 8.2.2.12 requires that a raised treatment field's fill material use coarse sand, medium sand, fine sand, loamy medium sand or loamy coarse sand. As the Property has coarse sand, this requirement is met.

142. Section 8.2.2.11(2) states that a raised treatment field shall not be used unless there is a minimum of 600mm of *in situ* soil that is assigned an effluent loading rate in Table 8.1.1.10 below the raised treatment field. The Project's *in situ* soil layer is an average of 450mm.[136] This requirement is not met and therefore under the SOP the Project cannot use a raised treatment field as their treatment system.

143. As the requirements for a raised treatment field has not been met, the Project must then be evaluated as a treatment mound.

144. Section 8.4 of the SOP sets out the requirements for a treatment mound.

145. Section 8.4.1.4 sets out the requirements for the sand layer for primary treated effluent in a treatment mound. Sentence 1(c) requires that the sand layer of a mound shall not exceed 3 meters in width, when measured at the top of the sand layer. The Project is 45 meters wide.[137] This is a prescriptive requirement and therefore the Project is not compliant with the SOP as a treatment mound.

146. Under section 49 of the *Safety Codes* Act, a safety codes officer "may issue an order if the safety codes officer believes, on reasonable and probable grounds that this Act is contravened." The design of the Project is not compliant with the SOP as either a treatment field or a treatment mound. Deviating from the requirements of the SOP is acceptable if there is an approved variance for that departure. No variance for the Project was issued allowing for deviation from the prescriptive requirements of the SOP. Therefore, in having a non-compliant design that was in the process of being built, and therefore existing as a non-compliant system, the safety codes officer had reasonable and probable grounds for believing that the Act was contravened and therefore the Order was properly issued.

147. As the Order has been determined to have been properly issued based on the system design, it is not necessary for the Tribunal to engage in a discussion regarding the soil conditions and wastewater conditions.

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[134] The Record, page 4
[135] The Record, page 5
[136] The Record, pages 150-153;
[137] The Record, page 947

148. The Tribunal upholds the Order.

Variance

149. Under section 38(1) of the *Safety Codes Act,* a safety codes officer may issue a written variance if that safety codes officer "is of the opinion that the variance provides approximately equivalent or greater safety performance with respect to persons and property as that provided for by this Act."

150. The Tribunal agrees with the Appellant that a variance can be issued for alternatives that do not meet the prescriptive requirements. However, for a variance to be issued, it is the obligation of the applicant (in this case, the Appellant) to provide sufficient proof that the proposed variance will provide equivalent or greater safety performance when compared to the prescribed requirement.

151. This section of the *Safety Codes Act* requires the Tribunal to partake in a 3-step analysis:

a) Identify what section of the applicable code applies;

b) Identify the purpose or objective of that code section;

c) Analyze and determine if the proposed variance meets or exceeds the safety objective identified for the applicable code section.

152. The Variance Refusal provides four reasons for the refusal. The first is: "the restrictive layers provided allow for a treatment mound to be installed with a thickened sand layer. 8.4.1.6 (see note) and 8.1.1.4(2).[138]

153. Section 8.1.1.4 of the SOP states the following:

> (1) Soil-based treatment systems shall maintain a vertical separation between the soil infiltration surface and a restricting layer of not less than (a) 1500mm (5 ft) when receiving primary treated effluent level 1…
>
> (2) If there is a very shallow restricting layer, fill material may be used if allowed and specified in the system-type selection of this standard to provide the required vertical separation, but in no case shall there be less than 300 mm (1 ft) of in situ soil that is assigned an effluent hydraulic loading rate within this standard below the fill material and above the restricting layer.

154. Based on the information provided by the Appellant, the treatment level of the effluent being discharged is level I under the SOP, and therefore the 1500mm under section 8.1.1.4(1)(a) is the appropriate requirement.

155. As discussed in the literature provided by the Appellant, vertical separation is essential to effective treatment of effluent in a soil based treatment system. The purpose of the 1500mm requirement under subsection (1) is threefold. The first purpose it achieves is to ensure that there is enough vertical distance and surface area the effluent must pass through for microbes to adequately filter and break down contaminants. The second purpose is to ensure that there

[138] The Record, page 791

is sufficient capacity in the soil to absorb and disperse the effluent without causing surface runoff or overloading the system. And finally, the third purpose is to make sure the *in situ* soil is deep enough to maintain aerobic conditions within the soil to facilitate adequate treatment of the effluent.

156. The Appellant's system has 450mm of *in situ* soil rather than the 600mm required. However, under section 8.1.1.4(2), fill material can be used to provide the required vertical separation as long as the *in situ* soil is not less than 300mm. 450mm is more than this minimum, so alternative fill can be used to make up the required 1500mm.

157. The Appellant's system has added between 450mm and 475mm of medium washed sand to *in situ* soil in the system. The Variance Memo states that the average depth is 895mm.[139] This is still significantly below the 1500mm required by the SOP for Level I treated effluent. The Appellant has requested the variance on the basis that the material of the restrictive layer is highly permeable and the material of medium coarse sand provides increased surface area, therefore allowing for more microbial activity than the prescribed material of fine sand. The Appellant's provided The Study which found that reduced grain size provided for greater surface area for microbial activity thus treatment efficiency of wastewater.[140] [redacted] informed the tribunal that the number of fines will increase the surface area for microbial activity.[141] The Tribunal was not provided with how much of an increase the number of fines would add for microbial activity and if the increase would equal approximately the surface area that would be achieved with the prescribed depth of 1500mm using the prescribed material. Stating that there will be an increase is not enough. The Appellant needs to provide testing which shows that the surface area has increased enough to be equal to the surface area that is achieved when the prescribed material is used at a depth of 1500mm.

158. The Appellant provided literature to the Tribunal that between 90 and 95% of effluent born bacteria are removed within 500mm of entering the treatment media.[142] It also states that the higher rates of removal occur when effluent enters unsaturated soil than if it enters saturated soil.[143] [redacted] also stated to the Tribunal that the most harmful chemicals have the majority removed within the first 30-50cm, it does depend on the type of soil and the amount of moisture in the soil for how far down into the soil there is enough oxygen for the microbes to break down the contaminants.[144] This brings us to the second objective of the code, which is to make sure the in situ soil is deep enough to maintain aerobic conditions within the soil to facilitate adequate treatment of the effluent. Saturated soil does not allow for the oxygen required for the aerobic microbial activity required to achieve this level of treatment. A shallow layer has an increased likelihood of becoming saturated and therefore not achieving the required level of effluent treatment.

159. The Appellant has provided the Tribunal with two aspects of their design that address the

[139] The Record, page 702
[140] The Record, page 724
[141] Paragraph 105
[142] The Record, page 695-696
[143] The Record, page 582
[144] Paragraph 103

need for sufficient oxygen availability for aerobic microbial activity. The first is dividing the treatment field into eight dosing zones wherein the wastewater will be discharged onto different dosing zones to allow for desaturation to occur. The Appellant has stated that the wastewater volume is anticipated to be 21,250 liters per day.[145] With eight dosing zones, each zone will receive 4,250 liters per day. The variance memo states that each dose applied to the dosing zones will occur every two hours, and each dose will be 531 liters.[146]

160. The Variance Memo states two different total surface area for the site – on page 701 of the Record, the total surface area is reported to be 1,221 square meters, and on the next page, the infiltration surface is said to be 1,764 square meters.[147] Using the smaller surface area, if the total area is 1,221 square meters, each of the eight dosing zones would be 152.625 square meters. The Appellant has calculated that the soil will be able to absorb 22 liters per day per square meter.[148] Using that absorption rate, each dosing zone can absorb 3,357.75 litres per day. The Appellant has stated that each zone would receive 4,250 litres per day, 892.25 litres higher than the absorption rate for each dosing zone. Using the higher surface area, if the total infiltration surface is 1,764 square meters, each dosing zone would be 220.5 square meters. Using the Appellant's absorption rate of 22 liters per day per square meter, each zone at this size would be able to absorb 4,851 litres per day. If this is the size of the infiltration surface, then the zones would be able to absorb the total effluent required, assuming that the soil is not saturated by other sources, such as precipitation or snow melt.

161. Based on the Tribunal's analysis, the second objective *could* be met by the Design, however the Appellant has provided inconsistent measurements of the area. The calculations are also based on the wastewater being the only source of saturation, which is not the reality in Alberta, wherein there is significant variance in precipitation and melt throughout the year. Therefore, in order for a variance to be provided, the Appellant will need to provide accurate measurements and calculations including any impact seasonal precipitation and melt could have on the field.

162. Additionally, the lab analysis of the studies referenced were not based on the effluent and material from the site in question. This therefore leaves the Tribunal without the assurance that the results found in these laboratory tests would be the actual result for the Project.

163. The third purpose of having a 1500mm restrictive layer depth is to ensure that the in situ soil has the capacity for absorption to prevent lateral runoff or overloading the system. As discussed above, it is possible that the makeup of the site could handle the effluent dosing, however there is information that is required from the Appellant to ensure that the site can actually absorb the anticipated effluent discharge of 21,250 liters per day considering the difference in reported size of the site and considering the impact that precipitation and melt will have on the saturation of the site.

164. The second section quoted in the refused variance is section 8.4.1.6, specifically the note,

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[145] The Record, page 701
[146] The Record, page 703
[147] The Record, pages 701 and 702.
[148] The Record, page 701

which states:

(1) A treatment mound may be used as a final treatment component where (a) the in-situ (original) soil has an assigned loading rate as determined by Table 8.1.1.10 to a depth of at least 300mm, and (b) a minimum vertical separation of 900mm is maintained between the bottom of the required depth of the sand layer and any restrictive layer below the treatment mound.

Note: Clause (1)(b) – The sand layer receiving the effluent may be increased in thickness to provide the vertical separation required. Using the same sand as is required for the 300mm sand layer is advised. The fill must have a textural classification not finer than fine sand. Sand with any significant percentage of silt or clay content should not be used, as it will cause excessive compaction and will be washed down over time through the fill material as the effluent is applied, resulting in the development of a restrictive layer.

165. This section quotes Table 8.1.1.10, which provides the effluent soil loading rates and linear loading rates for different types of soil. The applicable portions state:

Loamy Coarse Sand and Loamy Medium Sand with zero or low fine content particles with 30-150mg/L of BOD_5 has a loading rate of 14.7 litres per day per square meter, and requires pressure distribution;

Loam or Silt Loam with a grade of a sand, silt and clay composition, with 30-150mg/L of BOD_5 have a loading rate of 22 litres per day per square meter;

Coarse Sandy Loam with a very coarse and large particled sand with a 30-150mg/L of BOD_5 have a loading rate of 9.8 liters per day per square meter;

166. Again, this section 8.4.1.6 is in regards to a treatment mound, not a raised field. This section again requires a minimum of 300mm of *in situ* soil for a treatment mound. The Appellant does have a depth of 450mm of *in situ* soil, which is classified as loam to sandy loam in the Appellant's summary[149] and in the GRIT Report.[150] The infiltration loading rate for effluent at a level I treatment level is determined to be 22.0 litres per day per meter squared in the GRIT Report.[151] In the GRIT report, the A and B horizons are classified as either silt clay loam, sandy loam, silt loam, loam or clay loam with a moderate to strong blocky texture, and the C horizons are a medium to coarse grained sand. The GRIT Report states that the high coarse grain content of the C horizon makes it a restrictive layer "as septic effluent would pass through the soil too quickly for soil-based treatment of septic effluent to occur."[152]

167. Based on the GRIT Report, the infiltration rate of the sand installed in the Project does meet the infiltration rate required under section 8.4.1.6 for a treatment mound for level I

[149] The Record, page 15
[150] The Record, page 503
[151] The Record, page 503
[152] The Record, page 135.

effluent. Therefore, the first requirement of this section is met - the in situ soil does have an appropriate loading rate for level I treated effluent and is at a depth that is greater than the minimum of 300mm.

168. The second requirement of section 8.4.1.6(b) is that there must be a minimum of 900mm between the bottom of the sand layer and any restrictive layer below the mound. The Variance Memo again indicates that the average depth of the medium washed sand is 895mm with a minimum depth of 505mm depth.[153] 895mm is incredibly close to the minimum requirement set out in the section of the SOP, however the minimum depth is only slightly over half of the minimum required depth. Without knowing how prevalent these shallow sections of 505mm are, the Tribunal is not prepared to agree that this section has been met.

169. As discussed above, the minimum depth of the sand is required to ensure that there is adequate vertical separation between the effluent and any restrictive layers or groundwater. The sand layer in a sewage treatment mound helps to filter and treat the effluent as it percolates through the soil, and 900mm separation ensures that there is enough material to allow for the biological, chemical and physical processes to break down contaminants. The minimum also acts as a protective buffer to ensure that effluent does not reach groundwater or other water sources without being properly treated. Finally, it also ensures that the system adheres to the different effluent loading rates of various soil types.

170. As discussed above, the Appellant has provided sources that report between 90 and 95% of bacteria are removed within the first 500mm of soil, although this is dependent on soil type.[154] The Appellant has also explained that the design of the Project is such that the area is larger than needed for the infiltration rate of the material used in the Project. Therefore, as discussed above, it is possible that the Project could meet the objectives of section 8.4.1.6, however evidence would need to be provided demonstrating that the soil present at the Project does actually remove the bacteria and pathogens. The Tribunal has not been provided testing results showing that this level of pathogen removal will be the result of this particular Project.

171. The second point on the Variance Refusal states the rational for the refusal is that "Clause 8.2.2.11(2) is a prescriptive not an objective based clause."[155] Clause 8.2.2.11(2) states the following:

> A raised treatment field shall not be used unless there is a minimum of 600mm of in situ soil that is assigned an effluent hydraulic loading rate in 8.1.1.10 below the raised treatment field.

172. Differentiation between a raised treatment field and a treatment mound exist because there are natural conditions that preclude or prevent different types of systems to be used. A raised treatment field is a system that treats effluent within trenches where soil is imported to enable all or a portion of the treatment field trench to be located above the *in situ* soil surface.[156] Raised treatment fields rely on the natural soil conditions and site factors as part of

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[153] The Record, page 702
[154] The Record, pages 695-696
[155] The Record, page 791
[156] SOP, section 1.1.5.2, Defined Terms, "Treatment Field – Raised Treatment Field"

the system to treat and disperse effluent safely. In situ soil is used in the final stages of effluent treatment and disposal - meaning that by the time effluent reaches the *in situ* soil layer it needs to be level II treated. The *in situ* soil traps any remaining pathogens or contaminants and supports populations of aerobic and anaerobic bacteria, which break down the remaining organic matter or nutrients that were not treated in the sand layer. As determined above, the Appellant's Project would be for level I treated effluent. Because the natural soil is part of the system the site must have the ability to absorb, filter and break down the effluent before it reaches groundwater. When these natural conditions are not sufficient, the treatment field cannot provide adequate treatment.

173. A treatment mound, on the other hand, is a system where the effluent is distributed onto a sand layer and is built above grade to overcome limits imposed by depth to seasonally saturated soil or bedrock, or by highly permeable or impermeable soils.[157]Sand is used as a filtering medium when the in situ soil is insufficient on its own. The sand provides fine filtration which helps trap solids, pathogens, and contaminants due to the smaller particle size which prevents these contaminants from moving further in the soil too quickly. It also encourages slower percolation, which increases the contact time between the effluent and the filtering medium, allowing for better breakdown of contaminants. It also provides enhanced treatment as the aerobic conditions in the sand helps reduce harmful bacteria like E. coli and promote the breakdown of nitrogen compounds, contributing to improved effluent quality before it reaches the underlying in situ soil. Because of these processes, treatment level I effluent is appropriate because the sand provides enough filtration that the effluent becomes level II treated effluent by the time it exits the sand layer and enters the *in situ* soil layer.

174. Soil depth and permeability are required for a treatment field to work effectively. Soils with good permeability, such as sandy loam or loamy sand, allow for appropriate absorption and filtration of effluent. The requirement of 1500mm of in situ soil is a requirement because it provides proper filtration and breakdown of harmful pathogens and nutrients. A raised treatment field is selected when there is not sufficient vertical separation to support an actual trench system but there is a minimum of 600mm of suitable soil available. 600mm is suitable for a level II treated effluent to be applied to the area, as described above. This is because in situ soil is used in the final stages of effluent treatment and disposal.

175. Because the Appellant's system is for level I treated effluent, the effluent requires a sufficient sand layer before it reaches the in situ soil and therefore a treatment field is not sufficient. The sand needs to be present to facilitate the treatment process and therefore the Project requires a treatment mound.

176. Treatment mounds are used when there is less than the required vertical separation to support a treatment field, which is the case for the Appellant. Treatment mounds are systems that use sand in order to facilitate the processes described above. The reason for the refusal is because the Appellants have made the argument that the Project was designed as a field, not a mound, and therefore should be evaluated based on the requirements for a field.

177. The Appellant provided two professional reports on surveys and testing of the Property.

[157] SOP, section 1.1.5.2, Defined Terms, "Treatment Mound"

Both professional reports state that the Property was well suited for a treatment mound or an LFH at grade.[158] The Appellant also includes these findings in their report on their selection of the treatment system.[159] Given that these are materials relied upon by the Appellant, and quoted by the Appellant in their brief, it is unclear why the Appellant decided to design a system that was not recommended by the professionals they hired to survey.

178. Given the reasons why this section exists, and that the expert reports provided by the Appellants also recommend a treatment mound, the Tribunal agrees that a treatment mound is the appropriate standard for evaluation, as the Project requires treatment of level I effluent and uses sand in its treatment method.

179. The third point on the Variance Refusal states that the rational for the refusal is that "the shallowest restrictive layer on the side of the road where the system is being installed is at 400mm (TP#1)."[160]

180. The Appellant provided literature that states that 90-95% bacteria and matter is removed within the first 500mm of treatment media.[161] As described above, they have used this as support for having a restrictive layer that is less than 1500mm. The Appellant has not provided any evidence for how much bacteria is removed at 400mm, which is the measurement in certain areas of the site. Therefore, even with the Appellant's own numbers the Appellant has not met this reduced measurement that they are asking the Tribunal to accept as permissible.

181. The final point on the Variance Refusal states that "the geotextile fabric used between the rock and sand will plug based on the current percentage of fines present preventing the full application of effluent to the sand layer."[162]

182. Geotechnical fabric is required under section 8.2.2.3(1)(f) of the SOP for the weeping lateral trench construction in a raised treatment field.

183. The Respondent stated during the Hearing that his concern is that the fines would filter through the coarse material of the gravel and settle at the bottom and become stratified, creating a plugging layer on the second geotextile layer before the sand layer. The Respondent states that the concern was that this plugging would then cause the effluent to move laterally outside the system and therefore creating a risk to the surrounding area. When asked about this possibility during his questioning, [redacted] responded that this would depend on the velocity of the effluent movement through the ground and that he was not sure whether there would be enough velocity in the Appellant's Project to mobilize the fines. However, [redacted] stated that this question was a geotechnical engineering question and therefore he was not qualified to speak to answer the question definitively.

184. [redacted] also stated in answering questions from the Respondent that the geotextile fabric does not prevent the fines from migrating and that it was his opinion that the soil is coarse enough that the fines should not form a layer in the gravel because of how permeable the soil

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[158] The Record,
[159] The Record, page 579
[160] The Record, page 791
[161] The Record, page 695-696
[162] The Record, page 791

is. He also stated that he is not qualified on the geotechnical aspects to state whether the fines would form an impermeable layer.

185. The Tribunal does find that this is a valid concern that has been raised by the Respondent. Soil requirements are included in the SOP to ensure that there is sufficient permeability throughout the system. The Appellant has shown that their soil is permeable, however ensuring that the excess fines in the present soil will not cause permeability issues after the Project has been in use is important in approving the material use. Therefore, given that the Appellant has not been able to provide evidence that the fines present will not cause the geotextile fabric to plug and create stratification, this is a consideration that needs to be addressed.

186. The Tribunal does acknowledge that [redacted] indicated that he did not believe that migration of fines would cause a plugging problem. However, as [redacted] did state that he was not necessarily qualified as this question was one that required a geotechnical engineer to answer, the Tribunal cannot accept this testimony as sufficient evidence to alleviate this concern.

187. Finally, the Respondent raised concerns about the presence of a tri-axle wheeled truck driving on the sand. The construction requirements for the project require the installation to only use "low ground pressure tracked equipment"[163] to prevent any damage or compaction to the site. The presence of a dump truck does raise legitimate concerns that there could be compaction. As discussed at length through this decision, the sand, and the space between the sand grains, is incredibly important to ensuring that the effluent is able to flow through the space for optimal filtration. It is also important to ensure that there was no compaction which could create a stratified layer, thus preventing the effluent from travelling through the system and causing pooling or spreading outside the system.

188. The Appellant did inform the Tribunal that the ground was frozen at the time the dump truck was on site as demonstrated by the snow shown in the photos. However, the presence of snow does not guarantee a completely frozen ground such that the presence of the dump truck would have no compaction impact. The Appellant did not provide any actual evidence that no compaction had occurred. Therefore, the Tribunal cannot be sure that there was no adverse impact from using a dump truck instead of a tracked vehicle.

Conclusion

189. The Tribunal agrees with the Appellant that a design that does not meet the prescriptive requirements under the SOP can be acceptable. However, the Tribunal does agree with the Respondent that the proof that the Appellant's particular design will meet the objectives of the SOP has not been sufficiently provided.

190. The Appellant will need to provide confirmation of the size of the Site and calculations demonstrating that the soil has the ability to absorb the proposed load when taking into consideration the impact snow melt and precipitation will have on the site.

191. The Appellant must provide proof to the Respondent that the number of fines actually present in the soil will increase the surface area enough to make up the difference for the shortfall in the Project's soil depth and the depth required under section 8.1.1.4 of the SOP. The

[163] The Record, page 326

proof needs to be actual testing and calculations of the Project itself, as the studies provided are supportive information but not actual data of the site.

192. The Appellant also must provide the Respondent with sufficient proof that the sand has not been compressed due to the use of the truck and still maintains enough space that the effluent will be able to flow through the sand as required to effectively remove the bacterial and physical makeup of the effluent.

193. The Appellant also needs to provide the Respondent with proof that the presence of the fines in the sand used will not migrate down to create a stratified layer and plug the geotextile fabric.

194. The Tribunal therefore has determined that the Variance Refusal is to be varied to reflect the following:

The Variance is refused until the Appellant can provide the Respondent, to the satisfaction of the Respondent, the following information:

a) Confirm the size of the suggested Site and calculations from a qualified professional that the site will be able to absorb the anticipated effluent load with consideration for the saturation impact of precipitation and snow melt;

b) Proof that the Project's fines provide enough surface area for microbial activity to sufficiently break down the effluent as would be achieved by having 1500mm of *in situ* soil as is required by section 8.1.1.4 of the SOP;

c) Proof that the Project's sand has not been compressed by the dump truck used during the course of construction; and

d) Proof that the presence of the fines in the sand will not migrate down to create a stratified layer and plug the geotextile fabric.

Signed at the City of Edmonton)
in the Province of Alberta)
this 28th day of October, 2024)

[redacted]

Chair, Private Sewage Sub-Council
Administrative Tribunal