In the matter of a written Review by

the Natural Resources Conservation Board

under section 25 of the *Agricultural Operation Practices Act*, RSA 2000, c A-7

of a decision by an Approval Officer set out in

Decision Summary RA19016

WRITTEN SUBMISSION OF THE APPROVAL OFFICER

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On behalf of the Approval Officer

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I. INTRODUCTION

1. I make this submission on behalf of the Approval Officer, Jeff Froese, who issued Authorization RA19016 on November 20, 2019.

2. In Decision RFR 2019-07, the NRCB Board determined that a written review was warranted to consider whether condition #10 in Authorization RA19016 "is appropriate, having regard for the potential environmental risk posed by the EMS."

RFR 2019-07 Kramer Dairy Ltd. issued December 17, 2019 at page 5 ("RFR Decision")

3. The Approval Officer takes no position on the outcome of this Review – that is, whether the Board upholds condition #10 or not. Rather, this submission is intended to provide information to assist the Board in conducting its Review.

4. In the first part of this submission, "Clarification of Facts," the Approval Officer presents a factual foundation for the Approval Officer's responses to the questions that the Board posed in its RFR Decision.

5. In the second part of this submission, "Responses to the Board's Questions," the Approval Officer responds to the areas that the Board asked him to address at pages 3-4 of the RFR Decision.

II. CLARIFICATION OF FACTS

6. The issue in this Review is whether the Approval Officer "adequately considered the information that resulted in a finding that the EMS poses a risk to groundwater" (RFR Decision at page 2). Tied closely to that issue is the manner in which the Approval Officer used the Environmental Risk Screening Tool to inform his finding of a potential risk.

Background to Environmental Risk Assessment

7. The genesis of the NRCB's Environmental Risk Screening Tool ("ERST") was a working group[1] tasked in 2007 with developing "a tool that could be used by NRCB staff to assess environmental risk at confined feeding operations and manure storage facilities." Since then the ERST has evolved, with the latest version being 1.2 dated September 2011. The ERST does not replace the legislated requirements of AOPA.

See pages 1-3 of the Environmental Risk Screening Tool Version 1.2 guide (September 2011) [Document 4] ("ERST Guide")

See Slide 4 of PowerPoint slides for NRCB training on ERST dated September 26, 2018 – excerpted [Document 2]

8. Approval officers use the ERST to assess risk to environment at both existing and proposed facilities, in accordance with the NRCB's risk-based approach to exercising its regulatory functions under AOPA. In the context of the ERST, the NRCB Operational Policy 2016-7: *Approvals* provides this guidance to approval officers:

> 2.1 ....Approval officers base their decisions, including which conditions will be attached to a permit, on AOPA standards and requirements, and the results of their assessment of potential risks to groundwater and surface water identified for the site.
>
> 8.13 .... When assessing the risks posed by an existing confined feeding operation, approval officers will start by considering, based on their professional judgement and discretion, whether any facility or facilities clearly pose a higher risk to groundwater or surface water than the other facilities.

See parts 2.1 and 8.13 of the NRCB Operational Policy 2016-7: Approvals (updated May 8, 2018) – excerpted [Document 6]

9. The base set of information for any ERST is the Site Information Form. In this Review, two Site Information Forms are included in Documents 7 and 11. The approval officer fills in the Site Information Form, and then uses that information to complete individual assessments of facilities using the ERST. Facilities' potential risks to surface water and groundwater are

[1] The working group was established by the Policy Advisory Group in 2007. The technical committee included stakeholders from the NRCB, the department of Environment, the department of Agriculture and industry. See Slide 4 of the PowerPoint slides for NRCB training on ERST dated September 26, 2018 – excerpted [Document 2].

assessed separately to allow for "focusing corrective action on the specific pathway at risk or facility causing the risk." (ERST Guide page 2).

10. Liquid manure tends to have greater environmental risk than solid manure. The likelihood of manure from a liquid storage reaching the uppermost groundwater resource decreases as the depth to the uppermost groundwater resource increases (ERST Guide pages 14-15).

11. A "high" potential risk score on the ERST for groundwater is 90 and above. A "moderate" potential risk score is between 70 and 90. A "low" potential risk score is less than 70.

See also page 6 of Appendix 3, ERST Guide [Document 4]

12. Protective layers are not always the geologic unit found at the surface. Layers of similar geology are lumped together when determining protective layer thickness (ERST Guide page 11). In the *Standards and Administration Regulation* under AOPA, a "protective layer" is,

> with respect to a manure storage facility or manure collection area, one or more layers of naturally occurring materials that, individually or in the aggregate, restrict the migration of the contents of the manure storage facility or manure collection area
>
> *Standards and Administration Regulation, AR 267/2001 at section 1(1)(l.1)*

<u>Events in this Application</u>

13. On April 26, 2019, Reinder Kramer submitted a Part 1 application to the NRCB on behalf of Kramer Dairy Ltd. The application proposed to build a dairy barn addition and a lean-to for calves.

14. After gathering information during a site inspection and meeting with Mr. Kramer on June 24, 2019 the Approval Officer assessed the existing and proposed facilities with the NRCB Environmental Risk Screening Tool ("First ERST"). He scored the First ERST on July 2, 2019. The assessed facilities included the existing earthen liquid manure storage ("EMS").

15. For this First ERST in relation to the EMS, the Approval Officer determined protective layer and uppermost groundwater resource depths by referring to the available water well logs for SE 2-43-25 W4M.[2] He selected Water Well ID 297975 [Document 24] as the reference for determining the protective layer and uppermost groundwater resource depths as it represented the worst case of these water wells. He used the drilling log for Well ID 297975[3] (2001) as the silage pit well as it matched the date of the silage pit well supplied by Mr. Kramer. The Approval Officer concluded that there was a shallow clay till layer from about 1.8-3.4 m below ground level, a sandstone and sand layer below that, and the uppermost groundwater resource at 17.7 m depth below ground level. The Approval Officer treated the shallow till as the "protective layer." Since the shallow till existed, however, at a depth shallower than the EMS floor (estimated to be 3.6 m deep), the shallow till did not function as a protective layer for the EMS at all. In the First ERST for the EMS,

a. the protective layer thickness is entered as 0, and

b. the potential risk to groundwater from the EMS is "moderate" with a score of 70.8.

Water Well Drilling Report for Well ID 297975 [Document 24]

Site Information Form printed on July 5, 2019 [Document 7]

ERST result for EMS scored on July 2, 2019 [Document 8]

16. In a site visit on July 12, 2019 the Approval Officer learned from the Kramers that

a. the EMS was approximately 12 feet deep[4] when the equipment had excavated as far as it could dig;

b. there was no compacted or synthetic liner present; and

c. the silage pit's water well log was Well ID 298704 *[Document 25]*, not Well ID 297975.

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[2] Water well logs 154215, 196584, 297975, 98046, 98047, 98048, 98049, and 98050 [Documents 22-24 and 26-30, respectively].

[3] See references to well ID 297975 at page 1 of 13 (list of wells); page 2 (reference for PL); page 3 (reference for UGR beneath EMS), in Site Information Form printed on July 5, 2019 [Document 7].

[4] 3.28 feet = 1 metre
12 feet = 3.6 metres

In a follow-up e-mail on July 15, 2019, the Approval Officer identified to the Kramers that their neighbours could be using the relatively shallow sandstone as a water resource.

NRCB database entry screenshot for July 12, 2019 [Document 9]

Email from J. Froese to R. Kramer dated July 15, 2019 [Document 10]

17. The Approval Officer also chatted with the NRCB Red Deer office's Environmental Specialist, Scott Cunningham, and recalled training on the ERST that Mr. Cunningham provided in 2015 and 2018. As illustration, in the 2015 PowerPoint, slide 19 relating to uppermost groundwater resource was a situation with a protective layer and uppermost groundwater resource as a scenario. In the 2018 PowerPoint, slide 8 reminded approval officers that the ERST is a "screening tool only – not a quantitative risk assessment."

See slide 19 of PowerPoint slides for NRCB training on ERST dated May 2015 – excerpted [Document 1]

See slide 8 of PowerPoint slides for NRCB training on ERST dated September 26, 2018 – excerpted [Document 2]

18. The Approval Officer concluded that the sand/sandstone layer was a protective layer. Though porous, the sand/sandstone layer was suspected to be the only material located between the uppermost groundwater resource and the EMS based on the available information. It was more accurate to treat the sand/sandstone layer as a protective layer below the EMS, rather than treating the EMS as having no protective layer at all. The Approval Officer ran the ERST again ("Second ERST"), using the sandstone/sand layer as a protective layer. For the Second ERST,

a. the protective layer thickness is entered as 10.1 m, and

b. the potential risk to groundwater from the EMS is "low" with a score of 67.2.

Site Information Form printed August 23, 2019 [Document 11]

Environmental Risk Screening Tool result for EMS scored on August 21, 2019 [Document 12][5]

[5] The protective layer information may appear inconsistent as between the Site Info Form (clay till; medium texture; depth 1.8-3.4 m) and the ERST Results (sandstone; coarse texture; depth 3.6-13.7 m) for August 21. As explanation, the CFO-wide protective layer was the clay till, but the EMS-specific protective layer was the sandstone because the clay till had been excavated through for the EMS.

19. The ERST Guide [Document 4] at page 4 states that approval officers are expected to have access to professional advice. In this case, the Approval Officer reached out to the NRCB Monitoring Review Team ("MRT"). The Terms of Reference of the MRT include the following statements:

> The MRT reviews file information on confined feeding operation (CFO) facilities that have been scored as potential moderate or high risk using the risk screening tool and/or that have monitoring conditions (e.g., leak detection monitoring and/or water well monitoring), and makes recommendations to the responsible File Manager [the Approval Officer in this case]. The recommendations include monitoring requirements, data interpretation, and potential follow-up action to address any potential environmental risks to groundwater and surface water quality. With the input and recommendations from the MRT, the File Manager decides on appropriate follow-up actions.

Monitoring Review Team Terms of Reference [Document 3]

See also Responses to ERST risk levels, flowcharts (February 2012) [Document 5]

20. The Monitoring Review Team ("MRT") met with the Approval Officer for the first time on September 3, 2019. In discussion that day, the MRT agreed that there was a possibility of a moderate potential risk to groundwater, "regardless of final outcome of RST scoring." They also noted it would be beneficial to gather further information such as the depth of the EMS, depth of the shallow water table (if present) and the geologic layers located around and below the EMS, through a borehole.

Email from MRT Chair to J. Froese dated September 3, 2019 [Document 15]

21. On September 5, 2019, the Approval Officer met with Mr. Kramer and requested the information that the MRT had recommended gathering. A letter followed.

Letter from J. Froese to Kramer Dairy Ltd. dated September 5, 2019 [Document 16]

22. On October 15, 2019, Kramer Dairy Ltd. provided the Approval Officer with a report from Envirowest Engineering. The report showed data from three boreholes that were completed as monitoring wells. Among other information, the report "predicted" the depth of the EMS at 3.75-4.5 m below grade northeast of the EMS.

Letter from Envirowest to J. Froese dated October 15, 2019, enclosing on-site assessment completed September 26, 2019 [Document 17]

23. On October 18, 2019, the Approval Officer e-mailed Mr. Kramer. The Approval Officer noted that, as the report from the engineer provided only an estimated depth of the EMS, he still needed to know the depth of the EMS.

Email from J. Froese to R. Kramer dated October 18, 2019 [Document 18]

24. On October 23, 2019, the Approval Officer met for the second time with the MRT. The MRT agreed the best plan of action was for the Approval Officer to issue a decision that required submission of a plan to address the risk posed by the EMS.

Screenshot of NRCB CFO database entry for October 23, 2019 [Document 19]

25. On October 29, 2019, the Approval Officer advised Mr. Kramer of the MRT's direction by telephone. The Approval Officer also advised Mr. Kramer that actual depth of the EMS could indicate if there is a protective layer between the bottom of the EMS and the sand/sandstone below it.

Screenshot of NRCB CFO database entry for October 29, 2019 [Document 20]

26. On November 20, 2019, the Approval Officer issued the decision documents. He delivered them to the Kramers and explained, among other things, how the EMS appeared to present a risk to groundwater despite the "low" ERST score. The decision documents set out how evidence and advice led him to the conclusion that condition #10 was necessary.

Screenshot of NRCB CFO database entry for November 20, 2019 [Document 21]

Technical Document RA19016 at page 7 of 23

III. RESPONSES TO THE BOARD'S QUESTIONS

AO 1. At page 7 of Technical Document RA19016, you stated ". . . the ERST is a tool with some limitations that may not perform well in every situation. In this case, the ERST results for the earthen liquid manure storage (EMS) indicate that it poses a low potential risk to groundwater and surface water. I am of the opinion that despite the tools low screening result to groundwater (67.2 points, a relatively high low risk score), the EMS still poses a risk to groundwater that warrants discussion and actions being taken . . . "

AO 1.(a): Please provide the details of the ERST component scores for the Kramer EMS and an explanation of why the particular component scores were chosen.

27. For details of the ERST component scores, please see the ERST result for the EMS scored on August 21, 2019 [Document 12]. The information in the ERST of August 21, 2019 was generated from the accompanying Site Information Form [Document 11].

28. At the end of the ERST results for groundwater for the EMS (pages 3-4), there are scores for Hazard Potential and Groundwater Pathway. The Hazard Potential score is generated from the manure type (here, liquid) and the annual amount. In the August 21, 2019 ERST, the Hazard Potential score was 21. The Groundwater Pathway score is generated from information relating to uppermost groundwater resource, depth, thickness and texture of any protective layer or liner, proximity of water wells and infiltration potential. In the August 21, 2019 ERST, the Groundwater Pathway score was 35.

29. As part of the Groundwater Pathway assessment, "Storage Specifications" feed into scores further on in the Tool. Under Storage Specifications, at the top of the second page:

a. Depth of storage below grade is 3.6 m based on Mr. Kramer's initial estimate that the EMS was 12 feet deep (12 feet = 3.6 metres).[6]

b. Depth to top of protective layer below grade (not beneath the EMS) is 3.4 m. This is based on information in AEP well ID #s 98049, 98050, 297975 and 298704,[7] where sandstone or brown sand starts as shallow as 3.4 m (well 297975). (Note: the depth to

[6] Estimate provided by Mr. Kramer during site visit on July 12, 2019, and reflected in email from J. Froese to Mr. Kramer on July 15, 2019 [Document 10].

[7] The Water Well Drilling Reports for these wells are at Document 29 (for 98049), Document 30 (for 98050), Document 24 (for 297975), and Document 25 (for 298704).

the top of protective layer beneath the EMS is shown at 3.6 m as the storage below grade was estimated at 3.6 m depth).

c. Depth to bottom of protective layer below grade is 13.7 m. This is based on information in AEP well ID #s 98049, 98050 and 298704, where the static water level is at 13.7 m depth in sandstone (well 98049).

d. Thickness of protective layer is 10.1 m[8] based on the depth to storage and the depth to the bottom of the protective layer.[9]

e. The bottom of the protective layer is at the same depth as the top of the uppermost groundwater resource (UGR): 13.7 m.

30. Under "Protective Layer(s) (PL) Between Bottom of Facility and UGR" on the second page:

a. the thickness of the protective layer has categories of >2 m, 2-<5 m, 5-10 m and >10 m. As the thickness of the protective layer under Storage Specifications was 10.1 m, the >10 m was used.

b. the subsoil texture is "coarse" which covers both sandstone and sand.[10]

31. The Protective Layer entries generated a score of 8 and, in turn, a groundwater pathway score of 35.

32. The Approval Officer applied an exposure potential modifier of 1.2 because there was one or more water wells located within 100 metres of the EMS.

See page 20 of Environmental Risk Screening Tool Version 1.2 guide (September 2011) [Document 4]

See third page of ERST result for EMS scored on August 21, 2019 [Document 12]

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[8] 13.7 – 3.4 = 10.3 would suggest the protective layer is 10.3 m thick, not 10.1 m thick. However, since the storage is 3.6 below grade, the calculation is actually 13.7-3.6 because the storage is built partway into the protective layer.

[9] For an explanation of how this works, please see ERST version 1.2 guide (September 2011) [Document 4] at page 15, third paragraph under PATHWAY: 1. Groundwater.

[10] The estimated subsoil texture for sandstone is medium to coarse, and for clean sand is coarse to very coarse (ERST Guide [Document 4] at Appendix 4, third page).

AO 1.(b): Provide your evaluation of any limitations that may have caused the ERST to "not perform well" in evaluating the Kramer EMS.

33. For context, the Approval Officer made this observation in the Technical Document RA19016 at page 7 of 23:

> I note that the ERST is a tool with some limitations that may not perform well in every situation. In this case, the ERST results for the earthen liquid manure storage (EMS) indicate that it poses a low potential risk to groundwater and surface water. I am of the opinion that despite the tools low screening result to groundwater (67.2 points, a relatively high low risk score), the EMS still poses a risk to groundwater that warrants discussion and actions being taken....

34. The ERST depends on dropdown choices and numbers. For example, because the protective layer dropdown menu splits at 10.0 m, a protective layer thickness of 9.9 m will generate a different score than a thickness of 10.1 m.[11] Similarly, the numerical threshold between "low" and "moderate" potential risk is necessarily arbitrary. In version 1.2 of the ERST, that threshold is 70. The ERST score that the Approval Officer used was 67.2.

35. In addition, the ERST defines the thickness of a protective layer in relation to the uppermost groundwater resource, not in relation to layers that may bear water or may easily transport aqueous liquid manure. "Groundwater resource" under AOPA's regulations[12] is narrower than simply being an aquifer.

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[11] As illustration, for coarse – very coarse texture, a protective layer thickness of 5-10 m scores 12 for protective layer, while a protective layer thickness of >10 m scores 8.

[12] See the definition of "groundwater resource" in *Standards and Administration Regulation*, AR 267/2001 section 1(1)(g.1).

AO 2. Further, at page 7 of Technical Document RA19016, you stated, "The sand and sandstone were used as protective layers for the ERST which resulted in the low numeric risk result for groundwater. However, I also realize that these layers are potential pathways for liquid manure in the EMS to impact groundwater".

AO 2.(a): Having regard for estimated depth of the Kramer EMS and the available information on the sand and sandstone layers, explain why the sand and sandstone (identified as an aquifer) produce a low numeric ERST value.

36. The response to Question AO1.(b), above, may assist.

37. The ERST that the Approval Officer used for scoring the risk of the EMS to groundwater indicated a "low" potential risk. The score was 67.2 and the threshold for a "moderate" potential risk is 70. Three more points would push the score into the "moderate" zone.[13]

38. Under AOPA, a "protective layer" is defined as "one or more layers of naturally occurring materials that, individually or in the aggregate, restrict the migration of the contents of the manure storage facility ...."[14] As a result, sandstone or sand can be considered to be a protective layer in the ERST in the absence of other protective layers.

39. In addition, protective layer in the ERST is delineated by the distance between the EMS and the uppermost groundwater resource. It is possible to have a layer such as sand or sandstone that is considered to be a "protective layer" despite its potential to also act as a pathway for transporting liquid manure.

40. In the ERST, a sand/sandstone protective layer thickness of 10.1 m requires a choice of a >10 m thickness for the protective layer dropdown menu.

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[13] Which it did for the First ERST (July 2, 2019) with a score of 70.8 [Document 8].

[14] *Standards and Administration Regulation* under AOPA, AR 267/2001 at section 1(1)(l.1).

AO 3. You stated that you relied on two factors in concluding that condition #10 was necessary. The first of those factors is identified above as the potential pathways for liquid manure in the EMS to impact groundwater. The second factor is the direction provided by the NRCB's monitoring review team.

AO 3.(a): Provide any assessment that was provided to you by the monitoring review team.

41. The Approval Officer met with the monitoring review team twice: on September 3 and October 23, 2019.

42. Following the first meeting on September 3, 2019, the MRT agreed that there was a possibility of a moderate potential risk to groundwater, "regardless of final outcome of [E]RST scoring." They also noted it would be beneficial to gather further information such as the depth of the EMS, the depth of water table (if any), and the geologic conditions under and around the EMS.

Email from MRT Chair to J. Froese dated September 3, 2019 [Document 15]

43. At the second meeting on October 23, 2019, the MRT agreed the best plan of action was to proceed with issuing a decision that required submission of a plan to address the risk posed by the EMS. The plan should have a five-year timeline to address the environmental concerns.

Screenshot of NRCB CFO database entry for October 23, 2019 [Document 19]

AO 3.(b): Describe any direct contribution or participation the approval officer had in the monitoring team's review work.

44. Prior to the first meeting with the MRT on September 3, 2019, the Approval Officer provided the MRT with:

a. Water Well Drilling Reports for Well IDs 98049, 98050 and 298704 [Documents 29, 30 and 25];

b. Close up sketch of the CFO and related infrastructure on an aerial photo [Document 13];

c. July 2, 2019 ERST results for the EMS [Document 8]; and

d. August 21, 2019 ERST results for the EMS [Document 12].

See MRT Conference Call information dated September 3, 2019 [Document 14]

45. Prior to the meeting with the MRT on October 23, 2019, the Approval Officer provided the MRT with the letter from Envirowest Engineering dated October 15, 2019, enclosing the on-site assessment completed September 26, 2019 [Document 17].

AO 3.(c): Provide the names and roles for each member of the monitoring review team that contributed to the direction provided.

46. The monitoring review team that met with the Approval Officer on September 3 and on October 23 consisted of:

a. Mike Iwanyshyn: Chair of MRT and Senior Environmental Specialist (NRCB)

b. Walter Ceroici: Director, Science and Technology (NRCB)

c. Andy Cumming: Director, Field Services – Applications (NRCB)

d. Kevin Seward: Compliance Manager (NRCB)

e. Stephanie Fleck: Environmental Technical Specialist (NRCB)

In addition, NRCB Inspector Kari Lisowski was in attendance. The Approval Officer requested Ms. Lisowski's attendance as she is the Inspector for this confined feeding operation and would potentially be dealing with any conditions attached to the permit. Ms. Lisowski was an observer for the discussion related to the technical concerns, and a participant with finding solutions to those concerns.

AO 3.(d): Provide the evidence and advice you relied on, as well as an explanation of how this evidence and advice led you to the conclusion that condition #10 was necessary.

47. The Approval Officer used professional judgment to assess all the information before him and to conclude that the existing EMS presented a potential risk to groundwater that required action.

48. The Approval Officer relied in part on advice provided by the MRT, reproduced below:

> [September 3] Based on the discussion with the MRT this morning, it was generally suggested and agreed that based on the available information:
> - There is the possibility that there is a moderate potential risk to groundwater (regardless of final outcome of RST scoring);
> - It would be beneficial to have more information. It was suggested that a way to obtain more information would be for the operator to:
>   - determine the depth of the EMS.
>   - advance a borehole on the downgradient side of the EMS (with respect to expected direction of shallow groundwater flow). The hole should be advanced to at least the top of bedrock and/or past the determined depth of the EMS. The hole should be logged properly, including determining depth to water table, and could also be completed as a groundwater monitoring well.
>   - The NRCB and/or AF may be able to help with some of the information collection, and provide some advice.
> - Collected information could be used to re-assess the site and possible as mitigation to potential risk; and
> - The process will generally follow the applications steps right now.
>
> *Email from MRT Chair to J. Froese dated September 3, 2019 [Document 15]*

> [October 23] It was agreed that the best plan of action is to proceed with issuing a decision on the proposed facilities, but to require the submission of a plan to address the risk posed by the EMS. That plan should have a five year timeline for the environmental concerns to be addressed.
>
> *Screenshot of NRCB CFO database entry for October 23, 2019 [Document 19]*

49. In addition to advice from the MRT, the Approval Officer also relied on the following evidence to determine that condition #10 was necessary:

a. Site visits on April 26, June 24, July 12 and August 5, 2019 [TD RA19016 page 11 of 23]

b. Water Well Drilling Report for well ID 154215 [Document 22]

c. Water Well Drilling Report for well ID 196584 [Document 23]

d. Water Well Drilling Report for well ID 297975 [Document24]

e. Water Well Drilling Report for well ID 298704 [Document 25]

f. Water Well Drilling Report for well ID 98046 [Document 26]

g. Water Well Drilling Report for well ID 98047 [Document 27]

h. Water Well Drilling Report for well ID 98048 [Document 28]

i. Water Well Drilling Report for well ID 98049 [Document 29]

j. Water Well Drilling Report for well ID 98050 [Document 30]

k. Conversation with Scott Cunningham, Environmental Specialist (NRCB) in summer 2019 as reflected in the MRT conference call information dated September 3, 2019 [Document 14]

l. Site Information Form printed on August 23, 2019 [Document 11]

m. ERST result for EMS groundwater scored on August 21, 2019, which scored 67.2 [Document 12]

n. Letter from Envirowest to J. Froese dated October 15, 2019, enclosing on-site soil and limited geologic assessment completed September 26, 2019 [Document 17]

50. Based on this information, the Approval Officer concluded that condition #10 was necessary for the following reasons.

51. First, the sand/sandstone layer is porous. Its upper portion (at depths above 13.7 m) could function as a protective layer. Despite this, the uppermost groundwater resource is located in its lower portion (at a depth of 13.7 m). The sand/sandstone layer may provide some protection to the uppermost groundwater resource within it. However, the production rates in the sand/sandstone layer ranging from 13.6 L/min (well ID 98049) to 113.6 L/min (well ID 298704) indicate there is variability within the layer. There is potential that the materials could be porous and not represent much, if any, of a functioning protective layer.

Water Well Drilling Report for Well ID 98049 [Document 29]

Water Well Drilling Report for Well ID 298704 [Document 25]

52. Second, even after additional information from the engineering consultant, there are still some unknowns at the site of the EMS. The engineering consultant drilled three boreholes around the EMS, which show the following beneath the topsoil and shallow sand layer:

a. Two of the three borehole logs (borehole logs 19BH01 and 19BH02) indicate that there is a sandy clay layer from about 1.2-4.5 m depth. The third borehole log, 19BH03, shows the sandy clay layer from about 1.5-6.0 m depth, the maximum depth drilled in 19BH03.

b. Below the sandy clay is a sand layer that extends to 11.3 m depth.

c. Below the sand layer is weathered sandstone (bedrock) starting at 11.3 m.

Letter from Envirowest Engineering to J. Froese dated October 15, 2019, enclosing on-site assessment completed September 26, 2019 [Document 17]

53. As the maximum depth drilled for borehole log 19BH03 was 6.0 m, information about the underlying sand and weathered sandstone (bedrock) layers is missing for that area. Also, the engineering consultant did not measure the depth of the EMS, but rather predicted it at 3.75-4.5 m (see page 2 of the letter). Without this information, it is difficult to get a full picture of the interaction between the EMS and the sand and bedrock layers.

54. In addition, in one of the three boreholes (log 19BH03), a water table was observed within the sandy clay layer at 3.26 m below ground. That same water table was not observed in the other two boreholes (logs 19BH01 and 19BH02). The screens in the monitoring wells may explain this difference. The screen allows materials to move in and out of the monitoring well. Borehole log 19BH03 was screened from 2-5 m, entirely within sandy clay. Boreholes 19BH01 and 19BH02 were also screened at the same depth interval (2-5 m), but their screens extended into the sand layer, which started at a depth of 4.5 m. Where the screen extended beyond the sandy clay layer into the sand, water was not observed. This may indicate that the well screens in boreholes 19BH01 and 19BH02 acted as a kind of drain from the sandy clay into the sand layer below. For borehole 19BH03, an intact sand layer retained its shallow groundwater (a

water table within the sandy clay, not the uppermost groundwater resource in the sand/sandstone).

55. If the floor of the EMS is at 4.5 m, and since the sand layer starts at 4.5 m, the EMS could be acting the way that boreholes 19BH01 and 19BH02 did. Without more accurate information, it is possible that shallow groundwater, including manure and manure-impacted groundwater, is moving from the EMS into the sand layer and towards the uppermost groundwater resource below.

56. Third, the way the EMS was reported to be constructed may indicate that the sand layer starts at 3.75-4.5 m. During the site inspection on July 12, Mr. Kramer confirmed that the EMS was excavated likely either to the maximum achievable depth of that equipment or until the material was too hard to remove with the equipment present. In the Approval Officer's experience, compacted sand or sandstone can be a challenging medium for excavation equipment to dig through, opposed to sandy clay. This suggests that the layer of sandy clay beneath the EMS was likely either very thin or non-existent.

57. Fourth, the engineering consultant predicted the depth of the EMS to be between 3.75-4.5 m. If the EMS is in fact excavated to that depth, it is possible that its floor meets the sand noted in borehole logs 19BH01 and 19BH02 where sand is observed to occur at a depth of 4.5 m. This is consistent with the observed sand or sandstone depths noted in water well logs 98049 (4.6 m), 98050 (3.7 m) and 298704 (6.7 m), (respectively Documents 29, 30, and 25).

58. A written plan could resolve the uncertainty. The plan could, for instance:

a. ascertain the depth of the EMS, and what materials surround and underlay the EMS. A study might show the EMS with a more substantive protective layer around and below it;

Screenshot of NRCB CFO database entry for October 29, 2019 [Document 20]

b. propose to re-line the EMS; or

c. show that the groundwater conditions up- and down-gradient of the EMS do not differ.

Email from Approval Officer Jeff Froese to Reinder Kramer dated July 15, 2019 [Document 10]

Screenshot of NRCB CFO database entry for November 20, 2019 [Document 21]

59. Finally, with all the information, the MRT's advice on October 23 was that the EMS still presents an environmental risk that should be addressed, despite the low ERST result.

Screenshot of NRCB CFO database entry for October 23, 2019 [Document 19]

IV. CONCLUSION

60. The Approval Officer provides this submission upon request of the Board, and provides the listed records to support an informed determination of the issue under Review. The Approval Officer does not take a position on the outcome of the Review.

RESPECTFULLY SUBMITTED THIS 23rd DAY OF JANUARY, 2020

Fiona N. Vance

Chief Legal Officer – Operations

Natural Resources Conservation Board

V. LIST OF DOCUMENTS

1. PowerPoint slides for NRCB training on ERST dated May 2015 – excerpts
2. PowerPoint slides for NRCB training on ERST dated September 26, 2018 – excerpts
3. Monitoring Review Team (MRT) Terms of Reference (undated)
4. Environmental Risk Screening Tool Version 1.2 guide (September 2011)
5. Responses to ERST risk levels, flowcharts (February 2012)
6. Operational Policy 2016-7: *Approvals* (updated May 8, 2018) – excerpts
7. Site Information Form printed on July 5, 2019
8. Environmental Risk Screening Tool result for earthen liquid manure storage (EMS) scored on July 2, 2019
9. Screenshot of NRCB CFO database entry for July 12, 2019
10. Email from Approval Officer Jeff Froese to Reinder Kramer dated July 15, 2019
11. Site Information Form printed on August 23, 2019
12. Environmental Risk Screening Tool result for EMS scored on August 21, 2019
13. Close up sketch on an aerial photo, by J. Froese
14. MRT Conference Call information dated September 3, 2019
15. Email from MRT Chair Mike Iwanyshyn to Approval Officer Jeff Froese summarizing MRT discussion, dated September 3, 2019
16. Letter from Approval Officer Jeff Froese to Kramer Dairy Ltd. dated September 5, 2019
17. Letter from Envirowest Engineering to Approval Officer Jeff Froese dated October 15, 2019, enclosing on-site assessment completed September 26, 2019
18. Email from Approval Officer Jeff Froese to Reinder Kramer dated October 18, 2019
19. Screenshot of NRCB CFO database entry for October 23, 2019
20. Screenshot of NRCB CFO database entry for October 29, 2019
21. Screenshot of NRCB CFO database entry for November 20, 2019
22. Water Well Drilling Report for Well ID 154215
23. Water Well Drilling Report for Well ID 196584

24. Water Well Drilling Report for Well ID 297975
25. Water Well Drilling Report for Well ID 298704
26. Water Well Drilling Report for Well ID 98046
27. Water Well Drilling Report for Well ID 98047
28. Water Well Drilling Report for Well ID 98048
29. Water Well Drilling Report for Well ID 98049
30. Water Well Drilling Report for Well ID 98050