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From: Wilf Ruland (P.Geo.)  
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Date: February 23, 2022

Re: Various Reports Pertaining to Contamination Issues at the Richmond Landfill

## **1) Introduction**

This memorandum has been prepared in order to respond to a request from my clients (the Concerned Citizens Committee of Tyendinaga and Environs, or CCCTE). The CCCTE asked me to review various recently issued documents circulated by Waste Management of Canada Corporation (WM) or the Ministry of Environment, Conservation and Parks (MECP) pertaining to the Richmond Landfill, including the following:

- a memorandum dated May 19, 2021 from Mr. Kyle Stephenson of the MECP regarding the leaky North (Leachate) Lagoon on the Richmond Landfill property;
- a second memorandum (dated August 11, 2021 from Mr. Stephenson (MECP) regarding the purported delineation of the off-site groundwater contamination plume emanating from the Richmond Landfill property;
- the November 23, 2021 Application by WM to amend its Certificate of Approval for the Richmond Landfill;
- the January 7, 2022 Addendum to the above Application, to allow for operation of a Hydraulic Control System (HCS) near the southeast corner of the landfill property.
- a second January 7, 2022 document which is an application to allow for discharge of leachate-impacted effluent from the HCS into the landfill's stormwater management system.

In reviewing these documents and preparing my comments I am taking a somewhat different approach to previous reviews that I have done for the CCCTE. In the past the CCCTE have of necessity been very heavily involved in the review of proposals coming from WM - because so many of the landfill-related proposals coming from the Company have been ill-advised and potentially harmful to the local environment and to neighbours of the site.

It would normally be the job of the MECP to oversee and regulate site operations and make sure that the local environment and site neighbours are protected from harmful impacts, but historically the MECP has often not been up to the task.

For example the MECP permitted the expansion of the landfill and the recirculation of leachate which led to many of the current off-site contamination problems, including the contamination of several neighbouring properties and domestic wells.

It is high time for the MECP to rise to the task of properly regulating the Richmond Landfill. In preparing my comments and recommendations I have at times deliberately chosen brevity over the level of detail provided in previous reviews, because I have come to the conclusion that the CCCTE and I need to stop “doing the MECP’s job for them”.

In my review comments in this memorandum I will occasionally be referencing my last report for the CCCTE (dated October 31, 2019) - and the full text of that prior report is attached for convenience.

My review comments on the documents listed on page 1 of this memo follow below.

## **2) May 19, 2021 Memo from Mr. Stephenson regarding the leaky North (Leachate) Lagoon**

Starting in 2017 WM was engaged in the years-long practice of dumping surplus leachate into a leaky storage lagoon (the North Lagoon). I expressed my grave concerns about this practice in Section 6 of my Oct. 31, 2019 report, and I stand by everything said in that report.

The North Lagoon was only to be used for temporary leachate storage during high-flow periods and to be emptied thereafter - instead WM misused the North Lagoon by dumping leachate into the lagoon and leaving it there until it “evaporated” (ie. leaked out).

The following volumes of leachate were dumped into the lagoon:

- 2.9 million Litres were dumped in 2017, and were said to have “evaporated”;
- 3.5 million Litres were dumped in 2018, and were said to have “evaporated”;
- a net total of 4.4 million Litres were dumped in 2019;
- at least 0.3 million Litres were dumped in January 2020, after which the MECP ordered a stop to the dumping.

Starting in May 2020 liquid (a mix of leachate plus precipitation) was removed from the North Lagoon - by year-end a total of 8.8 million Litres. The MECP’s hydrogeologist also required water balance modelling to be done to assess whether the pond was leaking. This modelling showed that there was a 40% discrepancy between the amount of liquid left in the lagoon vs. the amount that the model predicted should be in the lagoon. I have not seen the modelling results, but it is my professional opinion based on the available evidence that the missing 40% liquid leaked into the groundwater flow system.

Mr. Stephenson commented on two wells (M217 and M218) which were installed near the lagoon to check for leachate impacts, and in which leachate indicators were not detected. It is my position that millions of Litres of leachate leaked from the North Lagoon between 2017 and 2020, and the fact that it was not detected in two wells only means that the two wells were situated in the wrong locations.

The leachate from the North Lagoon is somewhere in the groundwater flow system - location unknown. But it will be contributing to the contaminant load of the groundwater flow system, which is already burdened by ongoing and uncontrolled leakage from the unlined 40% of the Richmond Landfill.

Further contributions to the contaminant load of the groundwater system came from 3 leachate spills in 2020 - one of which was intentional. In the intentional spill (on Jan 14, 2020), a truck driver was directed to dump his entire load of 13,000 Litres of leachate on the ground when there were challenges in finding a location to dispose of the leachate. In the second spill a couple of days earlier there was an overflow of the South Chamber of the leachate collection system, with an undetermined amount of leachate having spilled into a ditch near Stormwater Pond 3.

There was also a third leachate overflow of the South Chamber of the leachate collection system, starting on January 2, 2020. The amount of leachate which overflowed from the South Chamber in the two overflow spill events is unknown.

The MECP was not notified by WM of the spills until 2 days after the intentional leachate spill, and this delay was in contravention of the requirements of the Environmental Protection Act. The public were not notified by WM until over two weeks later, in contravention of the requirements of the landfill's Public Notification Plan.

These unacceptable leachate management practices appear to have finally gotten the attention of the MECP, which took some long overdue action. A Provincial Officer's Report and a related Provincial Officer's Order (dated Jan. 23, 2020) were prepared by MECP Officer David Arnott, which detailed these leachate spills and required that:

- a leachate management Action Plan (with both short-term and long-term components) be prepared;
- further dumping of leachate into the North Lagoon was to be discontinued;
- surface water and groundwater samples be taken to investigate the leachate spills, and a report be submitted to the MECP outlining the results of that investigation.

Since that time new leachate storage tanks have been and/or are being constructed at the site, WM has indicated that it is not using the North Lagoon, and the lagoon is being emptied of liquid. WM's consultants were unable to detect any impacts on groundwater or surface water quality from the various spills - but that does not mean that impacts were not occurring.

The MECP's hydrogeologist (Mr. Stephenson) is concerned that these various leachate management issues may have resulted in increasing 1,4-dioxane levels in several wells at and beyond the eastern property boundary of the landfill site. In this he is echoing my concerns brought to him 1 1/2 years earlier in Section 6 of my Oct. 31, 2019 report for the CCCTE.

### **3) August 11, 2021 Memo from Mr. Stephenson regarding Contaminant Plume Delineation**

At this point, Mr. Stephenson considers the Richmond Landfill's offsite groundwater contamination plumes to have been reasonably delineated.

I disagree, for reasons set out in my Oct. 31, 2019 report for the CCCTE. **Therefore I recommend that the CCCTE should formally register its disagreement that the off-site plumes have been delineated.** This leaves the long-term responsibility for protection of off-site groundwater resources where it should be - with the MECP.

In years past there was good reason for the CCCTE to be actively involved on this issue as there were impacts and threats to private domestic well water supplies, however the area around the landfill has been effectively depopulated due to a variety of landfill impacts and there are no domestic wells in use south of Beechwood Road. North of Beechwood Road and east of the landfill is a private property with 2 shallow dug wells. These wells are completed in the overburden and as such are not vulnerable to impacts from the leachate plume on that property.

The proposed Contaminant Attenuation Zone (CAZ) encompasses all off-site lands on which contaminant plumes emanating from the Richmond Landfill have been detected. It remains the responsibility of the MECP to ensure that the reasonable use of groundwater on lands outside of the CAZ boundaries is secured. In order for the MECP to do so, a comprehensive and proactive long-term groundwater monitoring program is needed. This issue is discussed further in the next section below.

#### **4) Nov. 23, 2021 Application to amend Landfill's Environmental Compliance Approval**

##### **a) Introduction**

The only substantive technical document in this Application is in Attachment F, which contains the Nov. 23, 2021 proposed **Post-Closure Environmental Monitoring Plan** for the landfill (hereafter referred to as the "Proposed EMP").

I have briefly compared the current site monitoring programs (as set out in the Spring 2021 Semi-Annual Monitoring Report) with the Proposed EMP. Following that comparison, **I recommend that the Proposed EMP should be rejected by the MECP and CCCTE**, for the reasons set out below:

- The Proposed EMP fails to disclose which changes are actually being proposed to the landfill's various monitoring programs.
- The Proposed EMP if approved would reduce key aspects of the site monitoring programs with no justification or rationale.
- The Proposed EMP does not make provision for PFAS sampling or for sampling of several off-site wells near a karst feature, even though such sampling was recommended by the MECP.
- The Proposed EMP does not make provision for reporting of leachate seeps, springs, spills, overflows or other upset events at the landfill.

I will deal with each of these issues in turn below.

##### **b) Proposed EMP Fails to Disclose Changes being Made**

The proposed EMP is a lengthy document with 12 tables outlining various aspects of the proposed landfill monitoring programs. The proposed new monitoring program is presented in the document as a "fait accompli" - there is no disclosure of which parts of the proposed monitoring programs are the same, and which parts have been changed. This is unreasonable.

In effect the MECP, First Nations, local municipalities, the CCCTE, and members of the public have been left with the onerous task of trying to discern what is staying the same and what is being changed. This is inappropriate - it should be up to WM and its consultants to carefully and transparently document which changes are proposed.

It is not a good use of my time or the CCCTE's funds to be combing through the Proposed EMP trying to find changes which have been surreptitiously introduced. **A revised draft of the EMP is required which transparently documents the proposed changes.**

c) Proposed EMP Reduces Key Aspects of Site Monitoring Programs with no Justification

As indicated above it is not a good use of my time or the CCCTE's funds for me to be combing through the Proposed EMP trying to find changes introduced by WM and/or its consultants. However a simple count of monitoring wells in the program reveals that WM is proposing to sample 47 wells going forward, down from 63 currently - a 25% reduction.

As outlined above, there is no disclosure of which wells are proposed to be dropped from the sampling program. There is also no justification or rationale provided regarding the dropping of wells - the Proposed EMP simply presents a new (25% shorter) list of wells to be sampled in Table 2.

Focussing in on one key area (north of the landfill, between the landfill and Marysville Creek) the number of shallow wells to be sampled as per the Proposed EMP is one (1), down from 8 currently. No rationale is provided - the reviewer is left to guess at what might be behind such a severe reduction in sampling locations.

Maybe WM is planning to do more frequent surface water quality sampling (in lieu of shallow well sampling)? However my review of Table 7 of the Proposed EMP indicates that surface water sampling is proposed to be reduced to twice yearly from 3 times yearly at present - again with no justification or rationale provided for the reduction in surface water quality sampling.

**A revised draft of the EMP is required which provides the justification/rationale for all proposed reductions in site monitoring.**

d) MECP's Recommended PFAS and Well Sampling is not Included in Proposed EMP.

Mr. Stephenson (MECP hydrogeologist) has recommended several lines of monitoring which have not been included in the Proposed EMP.

i) On page 5, paragraph 3 of his Aug. 11, 2021 Memorandum, the MECP's Mr. Stephenson stated that:

*".. ongoing PFAS sampling should be incorporated into the updated EMP for the site".*

I support this recommendation. PFAS parameters have emerged as a very useful potential addition to the site monitoring programs, and can be used together with 1,4-dioxane and alkalinity to help determine the presence of landfill leachate.

For example, in **Section 2** of this report I discussed WM's dumping of leachate into the North Lagoon. During an investigation of the lagoon, 1,4-dioxane was not found to be present in the lagoon. Mr. Stephenson attributed this to dilution from rainfall - I believe it was more likely volatilization that led to 1,4-dioxane not being detected. In any event, PFAS were found to be present at high levels in the lagoon and were then useful in assessing whether leachate had impacted nearby monitoring wells.

**A revised draft of the EMP is required which makes provision for PFAS sampling in critical areas of the site including selected monitoring wells as well as Marysville Creek, Stormwater Pond 3, the Beechwood Road ditch, and the off-site karst feature.**

ii) On page 4, paragraph 3 of his Aug. 11, 2021 Memorandum, the Mr. Stephenson also stated the following in regard to his recommendation for monitoring of a complex pathway for leachate migration to a karst feature:

*“Monitoring well locations that are interpreted to be influenced by the karst system such as wells at locations M194, M195, M187, and M173 should also be considered for inclusion in the updated EMP.”*

Only one of the 4 wells recommended by Mr. Stephenson is included in Table 2 of the Proposed EMP. I support Mr. Stephenson’s recommendation.

WM’s prior consultants had long denied that there could be karst features in the landfill area in response to my raising that possibility. The karst feature in question receives leachate-impacted surface water under certain flow conditions, and it is not known where the water disappearing down the karst feature goes from there.

**A revised draft of the EMP is required which makes provision for sampling of wells M173, M194, and M195 near the off-site karst feature.**

#### e) No Reporting of Leachate Seeps, Spills, Overflows or Other Upset Events at the Landfill

The most recent (2020) Annual Operations Report for the site provides numerous details regarding the various leachate spills, seeps, overflows and other upset events at the Richmond Landfill in 2020. Information can be found in Sections 3.1.5, 3.11, 3.15, 3.23 of the 2020 Annual Report as well as in Appendices E, H, I, J, and K.

Such information provides important contextual background information for interpretation of environmental monitoring program results, and a summary of such events needs to also be provided in the Annual Monitoring Reports for the landfill.

**A revised draft of the EMP is required which makes provision for summary reporting of leachate seeps, springs, spills, overflows or other upset events at the landfill (in Section 8 of the Annual Monitoring Reports for the site).**

### **5) January 7, 2022 ECA Application Addendum for Hydraulic Control System (HCS)**

#### a) Introduction

This document is an Addendum to the ECA Amendment Application discussed previously. The only substantive technical document in this Addendum is in Attachment C, which contains the January 6, 2022 report entitled **Conceptual Design for Southeast Hydraulic Control System** (hereafter referred to as the “HCS Report”).

The Hydraulic Control System (HCS) is being proposed in order to try to hydraulically contain the southeastern corner of the Richmond Landfill property. At present one of the landfill’s groundwater contamination plumes crosses the southeast property boundary and contaminates groundwater on a neighbouring property. The off-site area which is being contaminated by the landfill is not precisely defined, which is one of the reasons I don’t consider the plumes to be fully delineated.

In any event, the HCS has been developed in order to contain the plume to the landfill property in this area. Work done to date includes the following:

- 4 prospective pumping wells (M212-PW through M215-PW) were installed;
- well yields were established through testing;
- several pumping tests were run (the longest for 57 hours) in order to assess hydraulic parameters and to establish whether there was a hydraulic connection to nearby site monitoring wells;
- groundwater modelling was done to establish which constellation of pumping wells and pumping rates might work best;
- groundwater quality testing was done on samples taken from the wells.

Based on this work it is proposed that three of the wells together be used as a hydraulic control system (HCS), with a combined pumping rate of 7.6 Litres/minute. It is assumed that the HCS will be able to permanently cut off the flow of contaminants to the neighbouring property - but this is by no means a sure thing.

The contaminated HCS effluent is proposed to be fed into a forcemain which would discharge the effluent to Stormwater Pond 3 on the south side of the landfill. In turn, Stormwater Pond 3 discharges into the off-site environment via the Beechwood Road ditch. This is a very questionable proposal.

My comments on a prior 2018 report regarding the HCS were provided in Section 5c) of my (attached) Memorandum dated October 31, 2019. The chief concerns which I raised at that time have not been addressed, and are reprinted here:

*“It can be anticipated that any purge well system would see progressively evolving and deteriorating groundwater quality conditions, as the pumping of a purge well system would establish a new low point in the local groundwater flow system. Increasing leachate impacts, the upwelling of briny water from depth, and safe disposal of the leachate/brine impacted groundwater all need to be accounted for.”*

I will deal with these issues in turn below.

#### b) Deteriorating Groundwater Quality in HCS Effluent

The pumping of the proposed HCS will result in a contaminated effluent which needs to be disposed of. The HCS Report reported on the sampling results obtained during one of the pumping tests, and projected that this effluent water quality was suitable for discharge to Stormwater Pond 3, and from there into the off-site environment via the Beechwood Road ditch.

I see no sign in the HCS Report (or the attached HCS Evaluation Memorandum) that any consideration has been given to the possibility that conditions might change from those observed during the pumping tests (in late August and early September 2021).

Instead, the authors appear to be assuming that one particular pumping rate for the HCS (10,900 Litres/day) and the groundwater chemistry conditions which prevailed at the time of the pumping test can be extrapolated into the long term. I anticipate that these assumptions will prove to be incorrect.

In my opinion, a 57-hour pumping test is not long enough to ascertain what long term groundwater quality in the HCS effluent will be. The proposed continuous pumping of the 3 HCS wells will establish a new low point in the local groundwater flow system, and inward hydraulic gradients will induce inward flow to the system.

Increasing leachate parameter concentrations in the HCS effluent may result from continuous long-term pumping, as increasing amounts of the leachate leaking from the unlined 40% of the landfill footprint are drawn into the HCS wells.

There is also a very real possibility that the ongoing pumping of the HCS wells will create upward hydraulic gradients, that would induce the upwelling of briny water from depth. The Richmond Landfill is underlain by very saline groundwater at depth, and past history has shown that ongoing pumping of groundwater can induce upwelling of that very saline (briny) deep groundwater. The briny deep groundwater is in many respects a worse liquid than landfill leachate, but the possibility of upwelling brine is not discussed in the HCS Report.

### c) Is it Appropriate to Dump Contaminated HCS Effluent into the Surface Water System?

From my perspective the main concern associated with the HCS proposal is the fact that WM is proposing to dump the contaminated HCS effluent into the landfill stormwater system (Stormwater Pond No. 3), from where it will flow unimpeded into the off-site downstream natural environment.

This proposal is unique in my experience - normally leachate-contaminated groundwater being pumped for containment purposes would be diverted to a landfill's leachate collection system, from where it would be taken off-site for proper treatment and disposal.

The HCS report does not present a selection of options for dealing with the HCS effluent - it simply presents the dumping of effluent into Stormwater Pond No. 3 as the only option. As discussed below in **Section 5d** of this report, WM has other options. The HCS does not explain why this option (which brings with it the greatest potential for negative effects on the natural environment) was selected.

I have prepared a table (**Table 1**) on the following page, which provides a comparison of leachate strength from the North Chamber to the HCS effluent sampling results from the HCS Report.

The data presented in **Table 1** were taken from the HCS Report (Table 5) and the Spring 2021 Semi-Annual Monitoring Report (Table 6).

**Table 1** shows that the raw landfill leachate is certainly stronger, perhaps by an average overall factor of about 3 for the parameters listed. But the HCS effluent did not meet the Provincial Water Quality Objectives for 3 parameters (boron, zinc and toluene) - with toluene detected in the HCS effluent but not the raw leachate!

In effect the WM proposal to dump 10,900 Litres/day of HCS effluent into the surface water system is the rough equivalent (in terms of mass loading) of dumping 1000s of Litres/day (365 days per year) of North Chamber leachate into the surface water system. The latter would never be approved, and the former shouldn't be either.

It is extremely disappointing that WM is bringing this objectionable proposal (to dump HCS effluent into the surface water system) forward at this time. There are indications that the proposal has the tacit support of local MECP staff - who should really know better.

**Under no circumstances should the MECP Approvals Branch approve the proposed dumping of HCS effluent into Stormwater Pond No. 3. Any such approval should be vigorously challenged by the CCCTE and its allies.**



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**Table 1 - Comparison of Strength of Leachate vs. HCS Effluent**

<u>Parameter</u>	<u>PWQO</u>	<u>North Chamber (NC) Leachate</u>	<u>HCS Effluent</u>	<u>Difference in Strength (NC vs HCS)</u>
alkalinity	NL	1200	540	2.2 times stronger
sodium	NL	290	250	1.2 times stronger
chloride	NL	320	252	1.3 times stronger
TDS	NL	1580	879	1.8 times stronger
phosphorous	0.03	<b><i>0.42</i></b>	0.03	14 times stronger
boron	0.2	<b><i>1.3</i></b>	<b><i>1.0</i></b>	1.3 times stronger
nickel	0.025	<b><i>0.027</i></b>	0.003	9 times stronger
zinc	0.02	<b><i>0.06</i></b>	<b><i>0.03</i></b>	2 times stronger
1,4-dioxane	0.02	<b><i>0.038</i></b>	0.008	4.5 times stronger
toluene	0.0008	<b><i>&lt;0.004</i></b>	<b><i>0.0013</i></b>	HCS is stronger!

**Notes:**

- all concentrations are in mg/L
  - data taken from HCS Report and Spring 2021 Semi-Annual Monitoring Report
  - concentration in bold italics (eg. ***0.038***) means PWQO exceeded
  - HCS means Hydraulic Control System
  - NC means North Chamber of landfill leachate collection system
  - PWQO means Provincial Water Quality Objective
  - NL means no PWQO for this parameter
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## d) Other Considerations

### i) Other Options

The only option for disposal of the HCS effluent that is presented in the HCS Report is to dump the contaminated effluent into the surface water system. But WM has other options for dealing with the issue of off-site contamination to the east of the landfill property which the HCS is intended to address.

Firstly and most obviously, WM could purchase the property to the east of the landfill which is being contaminated. Alternatively WM could purchase the water rights for that property. Once WM owns the property (or the water rights for the property) it can expand the Contaminant Attenuation Zone (CAZ) to include the property and the issue is resolved.

Secondly, WM could make arrangements to have the HCS effluent taken to the same sewage treatment plants which are receiving the landfill's leachate. This is what would normally be done at any other landfill that I am familiar with.

As I have stated previously, I consider the dumping of HCS effluent into the surface water system to be an unacceptable approach for WM to be taking. The two options presented above demonstrate that WM has other options.

These other options may be more expensive than the proposed HCS effluent dumping - however I would argue that for a company of WM's size, properly dealing with contaminated liquids should simply be seen as a cost of doing business.

### ii) Annual Volume of HCS Effluent which is Recommended to be Properly Treated.

The annual volume of effluent from the proposed HCS is projected to be about 4 million Litres per year. By comparison, the volume of leachate generated at the landfill in 2020 was about 21 million Litres.

The 21 million Litres of leachate generated by the landfill in 2020 went to sewage treatment plants for proper treatment and disposal - there is no reason that the projected 4 million Litres/year of HCS effluent can't be treated in the same way.

### iii) No Assurance the Hydraulic Control System Will Work as Intended

The field investigations, calculations and modelling carried out in support of the HCS have demonstrated the following:

- the pumping wells are drawing leachate-contaminated groundwater from one of the landfill's contaminant plumes;
- taking water from the pumping wells leads to observable water level drops in some nearby monitoring wells.

What has not yet been demonstrated is that the operation of the HCS will accomplish the goal of cutting off the flow of contaminated groundwater to the neighbouring property.

Interestingly, the HCS “Performance Monitoring” proposed in Section 5 of the HCS Report does not include any proposal to test groundwater quality in the critical impacted wells on the east property boundary and on the adjacent private property.

As discussed previously, I am strongly recommending against MECP approval of the HCS proposal in its current form. **If WM intends to pursue this proposal, then any revised application should address this issue as well as the other issues and recommendations made in this report.**

#### **6) Jan. 7, 2022 Sewage ECA Amendment Application to Allow Dumping of HCS Effluent**

This document is an ECA Amendment Application, which if approved would allow WM to dump about 10,900 Litres/day of contaminated HCS effluent into Stormwater Pond No. 3 at the Richmond Landfill.

The only substantive technical document in this Application is in Attachment C, which contains the January 6, 2022 HCS Report which I have discussed previously in **Section 5** of this memorandum.

Attachment D of this ECA Amendment Application includes correspondence between WM and the MECP which suggests that local MECP staff are at least tacitly supporting WM’s proposal - as stated previously, I am disappointed in the MECP staff for not insisting on a proper treatment proposal.

#### **7) Discussion**

The Richmond Landfill has a long and checkered history. Unnecessary environmental impacts caused by poor leachate management practices are a recurring theme at this site, as are ill-advised new proposals for leachate management.

It is with a certain sense of deja vu that I have undertaken the current review of documents pertaining to this site - which again document incidents of unacceptable leachate management in the form of spills and overflows, and which feature a new, objectionable proposal to dump contaminated groundwater pumped from the HCS into the surface water system.

The CCCTE have been in existence for a long time, and over their history have done the public and the environment a very good service by shining a spotlight on what is happening at the landfill and by vigorously challenging unpalatable new proposals.

I regret to have to inform the group that another ill-advised proposal has been put forward and needs to be challenged. The proposal to dump contaminated groundwater pumped from the HCS into the surface water system should never have made it past the initial reviews by local MECP staff. Instead of telling WM to come back with a more reasonable option, local MECP staff seem to be tacitly supporting the ECA Amendment applications which I have reviewed.

## **8) Conclusions**

1) The reports I reviewed indicate that there were unacceptable leachate management practices at the Richmond Landfill in January 2020, which culminated in the issuance of a MECP Provincial Officer's Order against WM. Detailed discussion of this matter is provided in **Section 2** of this report.

2) The MECP have indicated that they consider the off-site groundwater contamination plumes from the Richmond Landfill to be delineated. I disagree with the MECP on this issue. My discussion of this matter is provided in **Section 3** of this report.

3) **Section 4** of my report discusses the proposed Post-Closure Environmental Monitoring Plan, which is inadequate and requires further work because:

- it fails to disclose which changes are actually being proposed to the landfill's various monitoring programs;
- if approved it would reduce key aspects of the site monitoring programs with no justification or rationale;
- it does not make provision for PFAS sampling or the sampling of wells near a karst feature, even though such sampling has been recommended by the MECP;
- it does not make provision for reporting (in the Annual Monitoring Reports) of leachate seeps, springs, spills, overflows or other upset events at the landfill
- it does not make provision for the monitoring of the proposed Hydraulic Control System (HCS).

4) My concerns about the WM proposal to dump contaminated groundwater pumped from the HCS into the surface water system (via Stormwater Pond No. 3) are outlined in **Sections 5 and 6** of this report.

In its current form I consider the HCS proposal to be ill-advised and objectionable.

## **9) Recommendations**

### **Recommendation 1**

**The CCCTE should formally inform the MECP of its disagreement that the Richmond Landfill's off-site groundwater contamination plumes have been delineated.**

### **Recommendation 2**

**a) The Proposed Environmental Monitoring Plan (EMP) should be rejected by the MECP and CCCTE.**

**b) A revised draft of the EMP is required, which:**

- transparently documents the proposed changes to the site monitoring plans;**
- provides the justification/rationale for all proposed reductions in site monitoring;**
- makes provision for PFAS sampling in critical areas of the site including selected monitoring wells as well as Marysville Creek, Stormwater Pond No. 3, the Beechwood Road ditch, and the off-site karst feature;**
- makes provision for sampling of wells M173, M194, and M195 near the off-site karst feature;**
- makes provision for summary reporting of leachate seeps, springs, spills, overflows or other upset events at the landfill (in Section 8 of the Annual Monitoring Reports);**
- makes provision for the monitoring of the proposed Hydraulic Control System (HCS), in the event that WM chooses to pursue that proposal.**

### **Recommendation 3**

**a) Under no circumstances should the MECP Approvals Branch approve the proposed dumping of contaminated HCS effluent into Stormwater Pond No. 3 at the Richmond Landfill Site.**

**b) Any such approval should be vigorously challenged by the CCCTE and its allies.**

**c) Any revised HCS application should address the issues raised in this report.**

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Please feel free to contact me if there are any questions about any of the issues raised or recommendations made in this memorandum.

Yours sincerely,



*WRuland*

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Date: October 31, 2019

Re: Various Reports Pertaining to Contaminant Plume Delineation and CAZ  
Boundaries for the Richmond Landfill

## **1) Introduction**

This Memorandum has been prepared in order to respond to a request from Mr. Trevor Dagilis (Ministry of the Environment, Conservation and Parks, or MECP) for my clients (the CCCTE) to review two recent reports circulated by Waste Management of Canada Corporation (WM) pertaining to the Richmond Landfill.

These two recent reports detail the company's attempts to delineate the off-property leachate contamination plumes in the downgradient groundwater flow system:

- The first is a report prepared for WM by Blue Metric Environmental in on October 15, 2018 which is entitled "Site Conceptual Model Update and Contaminant Attenuation Zone Delineation" (hereafter referred to by me as the "**2018 SCM and CAZ Update Report**").
- The second is a follow up document prepared for WM by Blue Metric Environmental in May 2019 which is entitled "Addendum to Site Conceptual Model Update and Contaminant Attenuation Zone Delineation" (hereafter referred to by me as the "**2019 SCM and CAZ Update Report Addendum**").

In reviewing these WM reports I have also considered other relevant reports including the following:

- two Technical Memoranda from the MECP dated November 29, 2018 and July 16, 2019;
- the Fall 2018 and Spring 2019 Semi-Annual Monitoring Reports for the Richmond Landfill site;
- a memorandum entitled "PFAS Sampling Summary, Waste Management";

- a memorandum entitled “Preliminary Purge Well System Evaluation, Waste Management”;
- an e-mail regarding 1,4-Dioxane Trend Analyses by XCG Consultants.

## **2) 2018 SCM and CAZ Update Report**

The 2018 SCM and CAZ Update Report is a flawed document. In order to not be wasting my time or the funds of our clients more than is absolutely necessary, I am only providing a brief overview regarding issues of concern arising from the 2018 SCM and CAZ Update Report at this time.

### **a) Shallow Plume in Central CAZ Needs Further Investigation**

The shallow plume in the central CAZ requires further delineation. It has been shown to be present at M206, M178R-5, and M205. The detection of the 1,4-dioxane at M205 flies in the face of the claim in the report that there is a shallow groundwater flow divide present to the north of M205.

If there were a flow divide north of M205 (as shown on Figures 4a and 4b), then contamination shouldn't be able to make it past the divide to M205. A conceptual model which puts a contaminated well on the far side of a flow boundary from a contaminant source - and then fails to explain how contamination has gotten from the source to past the flow boundary is inadequate and requires revision.

I should note that what I am seeing when I look at the locations of M206, M178R-5, and M205 is that they fall in a straight line running NNW to SSE. There are several linear features in the area around the landfill, likely linked to vertical fractures - this may be another. Further investigation is needed to see if this shallow leachate plume extends further SSE beyond M205, and if there are other leachate impacts south of the “flow divide” - fortunately there are lots of unsampled drivepoints which could first be tested (see below).

### **b) Over Half the New Monitors in Central CAZ Not Tested**

I noted in my review of the report that none of the 11 new drivepoint piezometers were sampled, nor was new monitoring well M202 (despite a claim to the contrary on page 22, paragraph 2). Given the problems with shallow plume delineation in the central CAZ area, the drivepoints and M202 should be sampled as soon as possible.

### **c) Inconsistencies between Water Level Data and Flownets**

As evidence of the shallow flow divide discussed above, flow nets provided in Figures 4a and 4b of the report (which are based on water level data from Table 6 of the report) are cited. Comparison of the water level data in Table 6 of the report with the data on Figures 4a and 4b (for the same dates) reveals massive inconsistencies - the data simply don't match. These inconsistencies must be corrected and a new report issued.



#### d) Contamination in Surface Water Course in Central CAZ

The 2018 SCM and CAZ Update Report claims on page page 22, paragraph 2 that:  
“..no landfill impacts have been detected in the local surface water course sampled ... (which corresponds to a local flow divide for shallow groundwater..”

This section of the report appears to have been very carefully worded, and is misleading.

I will cite some known facts about this water course:

- as indicated above, shallow groundwater contamination has been shown to be present at M206, M178R-5, and M205 and hydraulic gradients are strongly upward (meaning this contamination will be discharging at the ground surface);
- during an initial investigation of the area, the MECP found leachate contamination in several leachate seeps which were discharging to the ground surface immediately upstream of the surface water course;
- the MECP (in recent surface water sampling (discussed in the MECP Technical Memorandum of July 16, 2019) found trace levels of 1,4-dioxane at the downstream end of this surface water course, where it drains into a sinkhole.

If WM’s consultants are unable to find surface water contamination in this area where groundwater contamination is discharging to the area of the surface water feature, then I would suggest that they try harder. WM’s current monitoring of the feature is obviously inadequate, and the MECP should require more frequent testing under a variety of flow conditions.

The downstream end of the water course terminates in a sinkhole, so there is significant potential for contaminants to be transported downstream with little attenuation. Where the water disappearing down the sinkhole ends up has not been delineated.

#### e) Contaminant Plume Off-site to East of Landfill Property is Not Delineated

There is a neighbouring property (to the east of the landfill and north of Beechwood Road) which has been impacted by the Richmond Landfill’s groundwater contamination plume.

Test results for well M170 (which is situated on the property line) are shown in **Table 1** of this report below, and will be briefly discussed. 1,4-dioxane was first detected in Well M170 in 2013, and levels increased to the 6 to 9 ug/L range through 2015 and 2016. There was a further jump in 1,4-dioxane levels to 11 ug/L in 2017 (after WM began leachate dumping in a leaky lagoon on the northeast side of the landfill), and the most recent spring 2019 results are 12 ug/L - far above the Reasonable Use Limit of 1 ug/L. The other primary leachate indicator (alkalinity) has shown a similar progression, with alkalinity levels in the 400 to 500 mg/L range in 2013 and considerably higher (in the 650 to 800 mg/L range) at present.

What these results indicate is a progressive worsening of water quality on the boundary of the neighbouring property. Since groundwater is flowing from the landfill property toward the neighbouring property, it follows that the neighbouring property is also impacted.

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**Table 1 - Contamination at Well M170 on Martin Farm (East of Richmond Landfill)**

<u>Date</u>	<u>1,4-Dioxane (ug/L)</u>	<u>Alkalinity (mg/L)</u>	<u>DOC (mg/L)</u>
13/08/2013	< 1	<b>430</b>	2.8
21/10/2013	<b>1.37</b>	<b>500</b>	3.4
05/09/2014	<b>1.97</b>	<b>460</b>	2.6
26/11/2015	<b>6.3</b>	<b>620</b>	<b>5.0</b>
08/03/2016	<b>8.1</b>	<b>700</b>	<b>4.9</b>
21/03/2016	<b>8.7</b>	<b>690</b>	<b>6.9</b>
05/04/2016	<b>9.0</b>	<b>700</b>	<b>5.3</b>
19/10/2016	<b>6.4</b>	<b>600</b>	<b>3.8</b>
<i>spring 2017</i>	<i>WM begins dumping millions of litres of leachate into a leaky lagoon, and this leachate dumping continued in 2018 and 2019..</i>		
01/05/2017	<b>11.0</b>	<b>740</b>	<b>4.4</b>
10/18/2017	<b>9.0</b>	<b>670</b>	<b>4.2</b>
05/15/2018	<b>12.0</b>	<b>780</b>	<b>4.2</b>
10/15/2018	<b>12.0</b>	<b>740</b>	<b>4.6</b>
01/05/2019	<b>12.0</b>	<b>690</b>	<b>4.9</b>
----- Reasonable Use Limit (RUL)	<b>1.0</b>	<b>400</b>	<b>3.5</b>

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What Table 1 shows quite conclusively is that the Richmond Landfill is impacting the M170 well, and given that groundwater is flowing from the landfill onto the neighbouring property it follows that the neighbouring property is impacted as well.

Hard evidence to support this inference is provided by the test results for well M192, which is well inside the neighbouring property (to the east) and which is also contaminated by leachate from the Richmond Landfill.

The data available to me for 1,4-dioxane tests on well M192 are shown in **Table 2** below. Note the major changes which coincided with the start of WM's leachate dumping.

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**Table 2 - Contamination at Well M192 on Martin Farm (East of Richmond Landfill)**

<u>Date</u>	<u>1,4-Dioxane (ug/L)</u>
March 8, 2016	< 1 ug/L
March 21, 2016	< 1 ug/L
May 6, 2016	< 1 ug/L
October 18, 2016	< 1 ug/L
<i>spring 2017 - WM begins dumping millions of litres of leachate into a leaky lagoon, with leachate dumping continuing in 2018 and 2019</i>	
May 4, 2017	<b>1 ug/L</b>
fall 2017	not tested
May 15, 2018	<b>3.6 ug/L</b>
October 17, 2018	<b>3.6 ug/L</b>
April 10, 2019	<b>5.6 ug/L</b>

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Note: the Reasonable Use Limit (RUL) for 1,4-dioxane is 1 ug/L

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M192 is not at the margin of the landfill's leachate plume as has been claimed by WM - it is inside the plume, and there are no wells further into the neighbouring property which could be used to define the real-world boundaries of the plume.

In the absence of such wells, there is no merit to any claim that the Richmond Landfill's leachate plumes are delineated. Further delineation work is needed in this area.

Moreover and even more problematic, it is my professional opinion that WM has fundamentally changed local groundwater conditions - through the high-risk practice of dumping millions of litres of leachate into a leaking lagoon on the northeast side of the landfill. This leachate dumping commenced in 2017 and continued in 2018 and 2019.

The leachate dumping has introduced a new leachate source on the landfill property, and new leachate plumes will be developing from this new leachate source. Past delineation efforts are now being rendered moot, given that there is a new leachate source whose impacts have started working their way through the groundwater flow system.

This issue is discussed in more detail in Section 6 below.

f) The 2018 SCM and CAZ Update Report includes an Intermediate Bedrock Zone groundwater contour map which ignores the presence of the karst features on the CAZ, and the profound effect they have on groundwater levels in their vicinity.

The map becomes absurd in the vicinity of M64-2, where the well's water level of 118.96 is contoured while ignoring the 14 meter lower water level in well M189 (which is immediately adjacent to M64-2). The karst sinkhole near M187 is also not marked on the map, and the map equally absurdly shows a 115 masl contour running right through M187 - even though the actual M187 water level is over 20 meters lower (94.69 masl).

### **3) 2019 SCM and CAZ Update Report Addendum**

There is little to say about the Addendum Report. For the most part, it just provides a reshuffling and reformatting of the content of the 2018 SCM and CAZ Update Report - minus the figures and tables which provided some context to the points being made in the earlier report.

The only new materials introduced in the 2019 SCM and CAZ Update Report Addendum are the following:

- One new well (M216) was drilled and abandoned, after being found unsuitable for monitoring purposes.
- A new figure (Figure 3) has been introduced, which shows the area on the southeast side of the landfill property where impacts have gone onto the neighbouring property in the vicinity of wells M170 and M192 (as discussed above). The figure is misleading, in that it shows M192 at the outside margin of the 1,4-dioxane impacted area. The most recent test results at M192 show 5.6 ug/L of 1,4-dioxane in the well - this is not a well at the margins of the plume. The figure needs to be updated.

- Figure 4 of the report is a figure seen previously (which outlines the proposed CAZ properties and boundaries), but the figure has been updated to show a 20 acre parcel in the vicinity of M170 and M192 which WM hopes to acquire from the neighbouring property owner. I will be discussing this issue in more detail subsequently, but it seems pointless for WM to be proposing acquisition of only a 20-acre parcel, given that the proposal is based on a now-outdated understanding of groundwater conditions at the Richmond Landfill. The high-risk dumping of leachate into the leaky lagoon on the northeast side of the landfill has fundamentally changed things. WM is likely to need more of the property east of the landfill for plume delineation and attenuation.

#### **4) MECP Technical Memorandum of November 29, 2018**

Items of interest in the memorandum include the following:

a) The MECP did precautionary sampling of wells on Callaghan Road within 750 meters of Deseronto Road in the spring/summer of 2018. I had requested such sampling, and very much appreciate the MECP taking this initiative. All sampling results showed non-detectable levels of 1,4-dioxane - which is great news.

b) The MECP did surface water sampling in February 2018, and found trace levels of 1,4-dioxane in the surface water course which runs from east to west across the center of the proposed CAZ area. The source of the 1,4-dioxane will be the upstream area where leachate-impacted shallow groundwater is discharging in the vicinity of M206, M178R-5, and M205 which was discussed earlier. This surface water was observed draining down into the sinkhole which is found at the western end of the surface water course.

Trace levels of 1,4-dioxane were also found in Marysville Creek. It is possible that this is related to the leachate-dumping into the leaking lagoon, which is situated near the creek.

c) The memorandum concludes that plume delineation is not yet completed, because additional delineation work is required in the vicinity of M170 and M192.

#### **5) MECP Technical Memorandum of July 16, 2019**

Items of interest in the memorandum include the following:

##### **a) Plume Delineation**

The MECP has changed its position, and indicates the extent of leachate-impacted groundwater has been reasonably delineated. I disagree with this position. No new work was done in the vicinity of M170 and M192, and the plume in that area is no closer to being delineated - in fact it is probably further away from being delineated.

This is because of the ongoing dumping of leachate into the leaking lagoon on the nearby northeast side of the landfill. I should note that 1,4-dioxane levels rose from 3.6 ug/L to 5.6 ug/L in the time period between the issuance of the two MECP memoranda.

#### b) Proposed Purge Well System

The MECP discuss WM's proposed purge well system (set out in an October 15, 2018 memorandum), which the company is suggesting may be deployed in the southeast corner of the landfill property near M170 and M192. The MECP concludes that further work would be needed to proceed with such a system.

I certainly agree. The purge well memorandum is deficient in a variety of ways:

- Firstly there are no water quality test results for the 4 wells which were installed (M212-PW through M215-PW). Water quality testing should have been done before, during, and after the pumping test. This will be required for any future test.
- A pump test was carried out, but it appears to have escaped the notice of those doing the test that drawdowns in 2 of the observation wells were greater than the drawdown in the pumping well. This is theoretically impossible, and the pumping test will need to be redone.
- The modelling which was based on the pump test results will likewise need to be redone.
- It can be anticipated that any purge well system would see progressively evolving and deteriorating groundwater quality conditions, as the pumping of a purge well system would establish a new low point in the local groundwater flow system. Increasing leachate impacts, the upwelling of briny water from depth, and safe disposal of the leachate/brine impacted groundwater all need to be accounted for.

Extensive investigations and testing and modelling will be required before this proposal is ready for serious evaluation.

#### c) PFAS Sampling

This had been requested by the MECP. PFAS is an abbreviation for Per- and Polyfluoralkyl Substances, a group of compounds which are manmade and which have no natural source. They are also compounds of emerging regulatory concern, due to their undesirable human health effects.

The results of the PFAS sampling included the following:

- the landfill leachate was shown to be high in PFAS;
- PFAS were generally found to be elevated in groundwater wells previously determined to be leachate-impacted;
- PFAS levels were generally low or not present in wells previously believed to not have been impacted by leachate;
- PFAS were found in Marysville Creek (just upstream of Deseronto Road), and in the Beechwood Road ditch - both locations are downstream of the landfill, and the Marysville Creek location is downstream of the lagoon which WM is dumping leachate into.

Based on the results obtained, the MECP concluded that PFAS levels are a good additional indicator of Richmond Landfill leachate impacts.

The MECP has requested that PFAS sampling should become an ongoing feature at the landfill, with sampling of leachate and selected wells. I agree with the general recommendation, but note that it is short on specifics.

d) 1,4-Dioxane Trend Analyses by XCG Consultants

The MECP indicates that trend analyses provided by XCG are a useful tool, and requests that this sort of trend analysis should be included in the landfill semi-annual monitoring reports. I agree with the MECP reviewer in this regard.

While we're on the topic of improving the semi-annual monitoring reports, I would request that the table(s) of groundwater monitoring data should be reformatted so that the data are clearly legible. One way of doing this would be to group inorganic and organic parameters into separate tables.

e) 1,4-Dioxane Detection in M185-1

The MECP has requested two extra rounds of sampling in the 12-month period following the 1,4-Dioxane detection (at 5.4 ug/L) at M185-1. I concur.

f) Environmental Monitoring Program (EMP)

The MECP has rightly requested that the EMP should be updated to include the following:

- recently installed monitoring locations including monitoring wells in the central area of the proposed CAZ in the wetland / groundwater discharge area;
- the quality of groundwater and surface water moving towards the Karst feature that drains the wetland area;
- groundwater monitoring associated with the additional CAZ to the east (if obtained) or the purge well system;
- an ongoing PFAS monitoring program;
- the need for repair / replacement or decommissioning of damaged monitoring wells.

I agree that an update of the EMP is badly needed. I also note that WM needs to work to meet prior commitments.

i) WM has failed to update the landfill groundwater database as they are required to under Condition 14.1 e. of their ECA. The most recent update of the database is current only up to the data for 2017. A 2018 update of the database should be posted immediately.

ii) The Environmental Review Tribunal Decision of December 24, 2015 requires that *“any new monitoring wells will be tested at least four times within the first year, on a quarterly basis, after being established..”* It appears that this directive is not always being followed.

For example, new monitoring well M202 and all of the drivepoint piezometers in the central CAZ do not appear to have been tested at all after installation. Likewise 2 rounds of test results for the remaining new wells in the central CAZ (M199, M200, M201, M203, M204, M205, M206 and M207) appear to be outstanding. Once the updated database (up to the end of 2018) is available it will be worth checking if the required 4x testing has been done for other newly installed monitoring wells at the site such as M189, M191, M193, M194-1, M195, M212, M213, M214, and M215.

g) The MECP memorandum provided a disappointing response to my concerns about WM's new practice (since 2017) of dumping millions of litres of leachate in a lagoon on the northeast side of the site, and then having that leachate "evaporate" (ie. leak) from the lagoon. The MECP response is provided below:

*"WM has been diverting leachate to the lined lagoon north of Marysville Creek during 2017, 2018 and 2019. The concern from CCCTE, CELA and Mr. Ruland is that the leachate diverted to the lagoon may be leaking into groundwater and then potentially impacting water quality in the creek.*

*The ministry has had discussions with WM regarding leachate management at the site. WM has indicated that leachate volumes have been increasing since 2017. These increases may be related to periods of higher precipitation since that time. WM has indicated to the ministry that they are assessing leachate management options and contingency actions at the site.*

*This includes assessment of approaches to decrease leachate volumes (e.g. the need for landfill cap improvements) and assessment of leachate management during periods of higher precipitation (including periodic use of the approved lagoon, tank storage of leachate at the site and / or on-site leachate treatment). Leachate management has become an issue at the site because at times when periods of higher precipitation occur there is often difficulty discharging to Sewage Treatment Plants because the plants are also dealing with higher than normal flows.*

*Further assessment of the lagoon has also been discussed including the determination of accurate leachate flows to the lagoon, installation of a staff gauge in the lagoon, determination of lagoon liner integrity, and installation of groundwater monitoring wells between the lagoon and Marysville Creek. Discussions are ongoing to determine acceptable leachate management for the site."*

This response is unacceptable. But it clarifies the MECP's position, which appears once again to be one of aiding and abetting WM in another high-risk endeavour which puts local groundwater supplies at risk.

There is no indication that the MECP is doing what it should be doing as regulator, namely taking all necessary steps to stop this unapproved high-risk practice. There is no provision in the landfill's Environmental Compliance Approval (ECA) which would allow leachate to be disposed of in the lagoon on the northeast side of the landfill.

My more detailed concerns regarding the unauthorized dumping of leachate into the lagoon are provided in the next and final section of this memorandum.



## **6) High-Risk Dumping of Leachate in Lagoon Northeast of Landfill**

### **a) Introduction**

Commencing in 2017, WM has been carrying out a high-risk and poorly thought out leachate disposal practice at the Richmond Landfill. Instead of carrying out the approved leachate disposal method for this landfill (trucking leachate off-site for treatment), since 2017 massive quantities of leachate have been diverted from the leachate collection system to the on-site leachate contingency storage lagoon and left there indefinitely until they “evaporated” (ie. disappeared).

**It is my professional opinion that the “evaporating” leachate is leaking into the groundwater flow system from the lagoon.** The water budget of Southern Ontario is such that there is what is known as a water surplus – which means that any impermeably lined lagoon will accumulate water from precipitation over the course of a year, with more coming in from rainfall than can evaporate out. If liquid is disappearing from the lagoon, then it is because it is leaking from the lagoon.

### **b) Approved Use of Leachate Lagoon**

The following paragraph is taken from the 2018 Annual Report for the Richmond Landfill, prepared by WSP Canada:

*“If leachate cannot be hauled from the site due to conditions at the Town of Greater Napanee or Cobourg plants, leachate or leachate-impacted water will be temporarily stored in the leachate-holding lagoon located to the north of the site. Once leachate treatment resumes at the receiving plant, this liquid would then be hauled to the plant for treatment and disposal. Storage of leachate in the holding lagoon is a temporary, last resort measure, and is outlined in the leachate management plan submitted to the MECP.”*

Leaving leachate in the leachate lagoon for an indefinite period is a misuse of the lagoon, which should only be used to provide emergency storage at times of peak leachate generation in spring or after heavy rains – when the leachate trucks or local wastewater treatment plants cannot keep up with the flows. But the goal should be to pump out and clear the leachate lagoon of leachate as quickly as possible.

However WM has been using the lagoon in a different way since 2017 - in fact, misusing the lagoon would be a better way to describe what is happening. WM has been disposing of leachate in the lagoon, by dumping it for an indefinite period and waiting for it to “evaporate”. And the leachate has been disappearing from the pond, which is a matter of urgent concern.

As outlined above, Southern Ontario has a water surplus and any impermeably lined pond or lagoon will progressively accumulate water over time. If liquid is disappearing from a pond or lagoon, then the only way this can be happening is if it is leaking out. And this is what is happening at the Richmond Landfill - WM is improperly disposing of millions of litres of leachate by dumping the leachate into a leaky lagoon. The inexorable result will be steadily worsening groundwater contamination.

### c) Scale of the Unauthorized Leachate Dumping

The scale of WM's leachate diversions to the lagoon since 2017 are massive and concerning, and are described below.

#### 2017

The 2017 Annual Monitoring Report for the Richmond Landfill (issued March 26, 2018) states the following on page 17:

*“As described under **Section 3.1.5** and **Section 3.11**, the leachate holding lagoon was utilized for temporary leachate storage during late winter and early spring 2017 due to high flows experienced at the site. There were no issues with the operation of the lagoon during this time, nor were any complaints received by the site from the general public during this period. The leachate eventually evaporated from the lagoon.”*

I would estimate that at least 2-3 million litres of leachate were dumped in the lagoon over the 3-week period referred to on page 17. I firmly believe that these millions of litres of leachate did not evaporate – instead they leaked into the underlying groundwater flow system.

#### 2018

The 2018 Annual Monitoring Report for the Richmond Landfill (issued March 22, 2019) states the following on page 16:

*“Overall for 2018, approximately 1,386,000 gallons of leachate was pumped to the leachate holding lagoon over a period of 77 hours. An estimated pumping rate of 300 gallons per minute was used to determine volumes of leachate removed from the landfill. Using a conversion factor of 1 gallon = 3.785 litres, a total of 5,246,581 litres of leachate (5,247 m<sup>3</sup>) was moved to the lagoon in 2018.*

*There were no issues with the operation of the lagoon during this time, nor were any complaints received by the site from the general public during this period. The leachate from the April 2018 events eventually evaporated from the lagoon. The leachate from the November 2018 event remained in the lagoon and is expected to evaporate throughout the winter.”*

I firmly believe that the estimated 5.2 million litres of leachate which were dumped in the lagoon in 2018 did not evaporate – instead they leaked into the underlying groundwater flow system.

#### 2019

I am concerned that during the wet spring of 2019 millions of litres more of leachate were dumped in the lagoon. The MECP memorandum of July 16, 2019 confirms that leachate dumping continued in 2019. No estimates of how much leachate was dumped to date in 2019 are available, however I am assuming that WM is taking advantage of MECP inaction on this issue and that it has dumped at least several million more liters of leachate in 2019.

**I strongly recommend that the MECP order an immediate suspension of WM's practice of dumping leachate into the lagoon and leaving it there indefinitely.**

#### d) Failure of the MECP to Act

The MECP has failed to take the necessary actions to put a halt to the leachate dumping at the Richmond Landfill.

The MECP memorandum of July 16, 2019 indicates that:

- the MECP has had discussions with WM regarding leachate management at the site
- that further assessment of the lagoon and increased monitoring have been discussed
- that discussions are ongoing to determine acceptable leachate management options for the site.

Leachate dumping commenced at the site 2 1/2 years ago, and the MECP is still discussing the matter with WM. This is hugely disappointing to myself and my clients. We had hoped that after the ERT Hearing the MECP would have learned its lesson, and on a go-forward basis implemented careful and environmentally protective supervision over WM's activities at the site.

#### e) Potential Impacts of Unauthorized Leachate Dumping

The leachate dumping/disposal in the leachate lagoon which has been carried out by WM is a high-risk activity which threatens to exacerbate the Richmond Landfill's groundwater contamination problems and threatens Marysville Creek – and the MECP should not be allowing this.

Given that the leachate is disappearing from the pond, leakage into the groundwater flow system is a given. In light of the quantities involved, the leachate dumping will be creating a temporary, local high point in the groundwater flow system every time it occurs. Outward and/or downward flow of leachate into the shallow and/or intermediate groundwater system followed by the spread of leachate contaminants will be result of the leachate dumping.

In essence, WM has created a new groundwater contaminant source on its Richmond Landfill property - and at present there is no way of knowing in which direction(s) leachate is moving from the new contaminant source. The result is a new, changed condition - the dynamic equilibrium of the groundwater flow system will be shifting in light of the massive inputs of contaminated liquid. Groundwater flow velocities and directions will change, and new contaminant plumes will develop.

As a consequence, the work which has been done on leachate plume delineation to date is being rendered moot - because the delineation work which has been done pertains to a (pre-dumping) groundwater condition which no longer exists.

An interesting possible first detection of impacts of the leachate dumping is being provided by wells M170 and M192, as can be seen from the water quality trends in those wells (in Tables 1 and 2 respectively). 1,4-dioxane levels in both wells have gotten distinctly worse since leachate dumping began in 2017.

#### f) Increased Monitoring is Urgently Required

I had hoped (obviously in vain) that after receiving my clients' letter of June 14, 2019 that the MECP would have ordered an immediate halt to the leachate dumping in the lagoon, or that WM would have voluntarily put a halt to the activity.

Not only has the MECP failed to halt the leachate dumping, but it has also failed to require the substantial increase in monitoring which is needed to assess the impacts of the dumping. WM has likewise failed to halt the dumping, or to take any measures to properly monitor the impacts of this new high-risk activity.

At present it appears that there is virtually no monitoring of shallow or intermediate depth groundwater quality anywhere near the lagoon where leachate is being dumped.

Up to date groundwater quality and groundwater level information is urgently needed from all existing wells within 500 meters of the lagoon (which should be sampled immediately), and many new shallow and intermediate monitoring wells are required.

All further dumping of leachate needs to be strictly controlled. Liquid volumes being dumped in the lagoon need to be accurately metered (just as they are when leachate is brought to the wastewater treatment plant for disposal).

The lagoon itself also requires stringent monitoring. A staff gauge needs to be installed immediately, with weekly measurements taken any time there is liquid in the lagoon.

Surface water quality monitoring of Marysville Creek also should be increased to weekly when there is liquid in the lagoon and monthly otherwise to ensure that downstream surface water supplies and users are not being put at risk.

#### g) Discussion

The MECP and WM have been distracted by a focus on leachate plume delineation at a time when groundwater and surface water flow and contamination conditions at the Richmond Landfill are in the process of changing.

The changes will be resulting from WM's new (since 2017) high-risk practice of dumping millions of litres of leachate from the landfill into a lagoon on its northeast side for an indefinite period, and then waiting for it to disappear (ie. leak into the groundwater flow system).

A moratorium on the leachate dumping is urgently required, and it is incumbent on WM and/or the MECP to act in this regard.

In the meantime, I see no point in my clients' continuing discussions on plume delineation at the Richmond Landfill. Delineation work done to date is being rendered moot by the input of millions of litres of leachate into the groundwater flow system - and work on assessing the impacts of the dumping takes highest priority at this time.

## **7) Recommendations**

### **Recommendation 1**

All of the new central CAZ drivepoints and well M202 should be sampled immediately, with a total of at least 4 sampling rounds over the coming year.

### **Recommendation 2**

Figure 4a and Figure 4b and Table 6 of the 2018 SCM and CAZ Update Report should be carefully reviewed and revised, such that the groundwater level data in the tables and figures are consistent with one another.

### **Recommendation 3**

Surface water quality monitoring of the central CAZ water course should be increased to weekly (throughout the time when there is flowing water present).

### **Recommendation 4**

Future intermediate zone groundwater level maps should show the location of the karst sinkhole, and need to be properly contoured in areas where karst features are affecting groundwater levels.

### **Recommendation 5**

Figure 3 in the 2018 SCM and CAZ Update Report Addendum needs to be updated to reflect the fact the M192 well is not at the margin of the Richmond Landfill's leachate plume on the neighbouring property.

### **Recommendation 6**

Extensive investigations and testing and modelling will be required before the proposed purge well system is ready for serious evaluation. The comments provided in Section 5b) of this report should be addressed.

### **Recommendation 7**

PFAS sampling should be incorporated into the Richmond Landfill's monitoring programs, by implementing PFAS sampling for all surface water stations and any time sampling for 1,4-dioxane and/or alkalinity is being conducted on wells near the margins of contaminant plumes.

## **7) Recommendations - continued**

### **Recommendation 8**

- a) Trend analysis graphs should be included in the Semi-Annual Monitoring Reports for key monitoring wells such as M114-1, M178R-3, M178R-4, M178R-5, M170 and M192.**
- b) Table 5a of the Semi-Annual Monitoring Reports should be made more legible, by grouping the parameters into Inorganic and Organic groups and having a separate page for each.**
- c) The groundwater database on the WM website should be updated to include data for 2018.**
- d) The Semi-Annual and Annual Monitoring Reports which are currently missing from the WM website should be added.**

### **Recommendation 9**

**The MECP should ensure that the required sampling (4 times in the year after installation) is being done on all new monitoring wells as required by the ERT Decision.**

### **Recommendation 10**

**The MECP should require or WM should voluntarily impose an immediate moratorium on the practice of dumping/disposing of leachate in the lagoon on the northeast side of the landfill.**

### **Recommendation 11**

**Increased monitoring of groundwater quality and levels, Marysville Creek surface water quality, lagoon liquid levels, and leachate dumping volumes are all urgently required - as is the installation of many new monitoring wells. Guidance is provided in Section 6e of this report.**

### **Recommendation 12**

**I recommend to my clients (and the MBQ) that there is no point in continuing discussions on plume delineation at the Richmond Landfill. Delineation work done to date is being rendered moot by the input of millions of litres of leachate into the groundwater flow system - and work on assessing the impacts of the dumping takes highest priority at this time.**

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Please feel free to contact me if there are any questions about any of the issues raised or recommendations made in this review.

Yours sincerely,



*WRuland*

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