

## Review Comment Table

<b>Board:</b>	MVLWB
<b>Review Item:</b>	Hay River Final Landfill Fire Sampling Report (MV2009L3-0005 and MV2019L3-0010)
<b>File(s):</b>	<a href="#">MV2009L3-0005</a> <a href="#">MV2019L3-0010</a>
<b>Proponent:</b>	Town of Hay River
<b>Document(s):</b>	<a href="#">MV2019L3-0010 - Hay River - Final Landfill Fire Sampling Report - Feb10-20</a> (67.78 MB) <a href="#">MV2009L3-0005 - Town of HR - Inspector requirements for post-freshet water monitoring after landfull fire - Jun6-19</a> (2.23 MB)
<b>Item For Review Distributed On:</b>	Feb 25 at 11:38 <a href="#">Distribution List</a>
<b>Reviewer Comments Due By:</b>	Mar 17, 2020
<b>Proponent Responses Due By:</b>	Apr 15, 2020
<b>Item Description:</b>	<p><b>June 12, 2020 Update:</b> As noted below, Board staff had intended to use the outcomes of this review in both the ongoing proceeding for the Town’s application for Licence MV2019L3-0010, as well as to revise the SNP for the Town’s existing Licence MV2009L3-0005. However, Board staff were unable to utilize this review to make changes to the SNP for MV2009L3-0005, and are now focusing efforts on integrating the outcomes of this review into the renewal proceeding for MV2019L3-0010. Please refer to the <a href="#">Work Plan Version 4</a> for the MV2019L3-0010 proceeding.</p> <p><b>March 19, 2020 Update:</b> The Town of Hay River has <a href="#">requested</a> and been granted an extension to respond to reviewer comments. The new response deadline is April 15, 2020. At this point, revisions to</p>

**the timeline for the MV2019L3-0010 renewal proceeding are being considered, and will be distributed at a later date.**

The Town of Hay River (Town) has submitted a Post-Fire Monitoring Report for their Solid Waste Disposal Facilities, as part of their [Application for Water Licence MV2019L3-0010](#). Board staff are distributing the Post-Fire Monitoring Report for public review under the current Licence MV2009L3-0005 because of its immediate relevance to upcoming sampling, and the possibility of associated changes to the Surveillance Network Program (SNP) annexed to MV2009L3-0005.

Reviewers are requested to take note that Board staff intend to use the comments and recommendations posted by reviewers on the Post-Fire Monitoring Report, along with responses from the Town, in the ongoing proceedings for the Town's application for Licence MV2019L3-0010, as any changes to monitoring under the current Licence MV2009L3-0005 can inform draft Licence conditions and/or the SNP annexed to the renewal Licence MV2019L3-0010.

Reviewers are further requested to note the June 6, 2019 direction provided to the Town by the Water Resources Officer (Inspector) for post-fire monitoring. Additional documents and monitoring results related to the March 2019 SWDF fire are available on the public registry page for MV2009L3-0005 (keyword search: "fire").

If you have questions or comments regarding this review or the Online Review System, please contact Board staff identified below.

**General Reviewer Information:**

This information was also faxed to the following:

- Fort Simpson Métis Local #52 - Marie Lafferty President (867)695-2040; and



		<p>SW8/River 3.</p> <p><b>Recommendation</b> An additional surface water monitoring station should be added between SW8/River3 and River 2.</p>		
2	Additional information on Drinking Water Sample	<p><b>Comment</b> SW4 is a drinking water sample which results are provided for but more information on where this sample was taken is required. Was it taken at the source of the drinking water for the town? Was it taken at end of pipe for the municipal system? Was it taken from water the is delivered by truck</p> <p><b>Recommendation</b> Provide Details on Drinking Water Source</p>	<p><b>Apr 15:</b> The water treatment plant is located near the confluence with Great Slave Lake, and a sample of the raw water was taken at that location (SW4).&amp;nbsp; GPS Coordinates 564566.768 (easting) 6747177.406 (northing).</p>	
3	Providing Context on Exceedances	<p><b>Comment</b> Some of the surface water samples had exceedances for various parameters. Some context should be provided on these exceedances for their potential source and potential impacts. Are they just minor exceedances due to the natural features of the Hay River? Could these exceedances impact many of the homeowners that live along the river and use the river to water their gardens and lawns or the drinking water source for the town? The exceedances are presented in detail in technical tables but some more general context on the potential sources and impacts would helpful for analysis of the results</p>	<p><b>Apr 15:</b> While the levels of various parameters were detected in the Hay River near the landfill during and shortly after the landfill fire, the levels of many of the parameters that exceeded the applied regulatory guideline limits were only in the order of micrograms per litre which is parts per billion.&amp;nbsp; As such, the concentrations of contaminates that were detected at SW2 were relatively low.&amp;nbsp; It should also be taken into account that, according to the Northwest Territories Government, 115,000 litres of water flows past the town of Hay River every second.&amp;nbsp; (&lt;a href="https://www.enr.gov.nt.ca/sites/enr/files/hay_river_report_2013.pdf"&gt;https://www.enr.gov.nt.ca/sites/enr/files/hay_river_report_2013.pdf&lt;/a&gt;).&amp;nbsp; That translates to a flow rate of</p>	

	<p><b>Recommendation</b> Provide more context on exceedances</p>	<p>6,900 m<sup>3</sup>/minute going past the town. &amp;nbsp;As the special fire sampling program established that the concentrations of those chemicals were undetectable at sampling sites upriver from the landfill, it is easy to see how the trace amounts of these chemicals getting into the river adjacent to the landfill would be nearly infinitely diluted as they are mixed into the 6,900 m<sup>3</sup> (6,900,000 litres) of fresh uncontaminated water going past the landfill each and every minute.&amp;nbsp; By the time these chemicals are transported a few hundred meters downstream of the landfill, it is almost certain they would be diluted to the point where they would be completely undetectable by any analytical technology available.&amp;nbsp; Further, many of the compounds such as PHC constituent's benzene, toluene, ethylbenzene, xylene (BTEX), PHC Fraction F1 and the VOCs are volatile and would most likely flash off (volatilize) to atmosphere quickly and are unlikely to have persisted in the Hay River water for long. The above analysis is corroborated by the sample data collected at sampling location SW8 which was located downstream in the Town of Hay River.&amp;nbsp; All samples collected at SW8 during and after the landfill fire reported non-detect for all PHC, VOC, and PAH parameters indicating that the compounds detected in the Hay River at SW2 were not reaching the Town of Hay River in detectable concentrations, even when the detection limits of the analyses were</p>	
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			<p>way down in the parts per billion.&amp;nbsp; Given the sizable dilution factor that would have occurred by the time these chemicals would have reached the town, the amounts of these chemicals that were detected in levels exceeding regulatory guideline limits at SW2 should not be a concern for downstream landowners who may have drawn water from the Hay River to water their lawns and gardens during and after the landfill fire.&amp;nbsp; It should also be pointed out that the exceedances detected at SW2 were largely only detected there in March of 2019 and were not detected afterwards in April and May.&amp;nbsp; This is not true of all chemicals detected at SW2 but it is of most.&amp;nbsp; As such, the amount of time many of the chemicals were appearing in detectable amounts in the Hay River at SW was limited to just a few weeks in 2019.</p>	
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**GNWT - ENR - EAM (Environmental Assessment and Monitoring): Central Email GNWT**

<b>ID</b>	<b>Topic</b>	<b>Reviewer Comment/Recommendation</b>	<b>Proponent Response</b>	<b>Board Staff Response</b>
1 4	General File	<b>Comment</b> <a href="#">(doc)</a> GNWT-ENR cover letter <b>Recommendation</b>		
1	Topic 1: Post Fire Surface & River Water Monitoring	<b>Comment</b> The report states that it was not possible to sample ponded surface water resulting from the fire after May 2019. In a June 6, 2019 e-mail to the Town, the ENR Inspector recommended that opportunistic post-fire surface water samples at the landfill site be collected after any major	<b>Apr 15:</b> <p style="margin-left: 36.0pt;">The Town has gone through staff changes during 2019 which resulted in the surface water samples not being taken after May 2019.&amp;nbsp;</p>	

	<p>rain events, most specifically of ponded water at/near the SW1, SW7 and SW13 locations. A full suite of parameters such as those monitored during the fire were to be monitored, including total cyanide, toluene, PAHs, VOCs and 2,3,7,8-TCDD. Was there no ponding surface water in these low lying areas at the landfill after major rain events in 2019? How frequently did Town staff monitor these areas as requested after major rain events? ENR requests the Town provide further rationale as to why these areas were not sampled as requested after May 2019. To assess potential impacts of the fire on surface water in the river, the ENR Inspector also requested that samples be collected at SW2 &amp; SW14, twice during the remaining 2019 open water season (summer &amp; fall). A full suite of parameters such as those monitored during the fire were to be monitored, including PAHs and 2,3,7,8-TCDD. Why were SW2 &amp; SW14 not sampled twice during the 2019 season as requested by the ENR Inspector? ENR requests the Town provide further rationale as to why these areas were not sampled at the frequency requested after May 2019. The Inspector also recommended groundwater quality monitoring for a full suite of parameters</p>		
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		<p>required in August and again before fall freeze-up (as already required yearly under water licence SNP groundwater monitoring requirements), in order to maintain a temporal record. A full suite of parameters such as (but not limited to) monitored during the fire should be monitored, including benzene, ethylbenzene, PAHs, VOCs, OCDD [45.4], OCDF[2.36], Total Hepta-Dioxins [16.4]. The ground water monitoring wells were not sampled in August 2019 as requested. ENR requests the Town provide further rationale as to why these wells were not sampled at the frequency requested by ENR?</p> <p><b>Recommendation 1)</b> ENR requests the Town provide further rationale as to why surface water samples at the landfill site at/near the SW1, SW7 and SW13 locations were not sampled after May 2019 as requested by ENR.</p>		
2	None	<p><b>Comment</b> None</p> <p><b>Recommendation 2)</b> ENR requests the Town provide further rationale as to why surface river water samples at locations SW2 &amp; SW14 were not sampled at the frequency requested after May 2019.</p>	<p><b>Apr 15:</b> &lt;p style="margin-left:36.0pt"&gt;The Town has gone through staff changes during 2019 and budget constraints were why the sampling was not completed as requested.</p>	
3	None	<p><b>Comment</b> None</p> <p><b>Recommendation 3)</b> ENR requests the Town provide further rationale as to why 0053-5 series ground water monitoring</p>	<p><b>Apr 15:</b> &lt;p style="margin-left:36.0pt"&gt;The 0053-5 series wells, while sampled twice since the spring (September and November) which the Town understands was not at the exact frequency</p>	

		wells at the landfill were not sampled at the frequency requested by ENR?	requested by ENR (August).&nbsp; However, the Town did complete the additional sample event to meet the intent of ENRs request.	
4	Topic 2: Landfill Fire Impacts Water Quality Monitoring to Occur on a Timely and Continuous Basis	<p><b>Comment</b> The report recommends that a one-time surface water sampling program at the landfill be conducted during the upcoming 2020 spring freshet. ENR supports this recommendation, but has concerns about a one-time sampling event setting precedent on whether or not certain parameters should be sampled in future. The report notes that during this one time sampling event, any sampled parameters that do not exceed guidelines will not require further sampling, or monitoring. ENR suggests there should be more consistency and regularity in terms of monitoring for fire related contaminants at the landfill, given the number of fires in the past, and given the potential for future fires. The 2019 fire was not an isolated event, or likely the last fire to occur at the landfill. Thus, one- time sampling is not adequate. The Town needs to show due diligence by providing more vigilance and continuity in terms of monitoring for landfill fire related contaminants. ENR recommends that the new Water Licence SNP should include monitoring of fire related contaminants for the next five years at various landfill and river sites;</p>	<p><b>Apr 15:</b> &lt;p style="margin-left:1.0cm"&gt;The Town would like to maintain the recommended timing of sampling and based on the one-time sampling event results determine the next steps.&amp;nbsp; The Town would like to manage the fire monitoring as part of a study rather than as part of the SNP.&amp;nbsp; The 2020 Landfill Fire Monitoring Study will inform the next steps of continued/long-term testing.&amp;nbsp;</p>	

		<p>even if it's just on an annual basis. In addition, Section 5.2 of the report (River Water Results and Recommendations) notes that a one-time sampling event be conducted for river water samples at three locations (one upstream of the landfill, one at the level of the landfill and one downstream of the landfill). The report indicates that this sampling should occur 'in the upcoming summer or fall (or as soon as funding allows), after snowmelt run-off or any precipitation events'. ENR recommends that this sampling occur at spring 2020 freshet (snowmelt) as potential contaminants need to be detected and identified now. Time is of the essence if any residual contaminants of the 2019 fire are to be detected in landfill surface run-off, soil and river water samples.</p> <p><b>Recommendation 1)</b> ENR suggests there should be more consistency and regularity in terms of monitoring for fire related contaminants at the landfill in 2020 and beyond.</p>		
5	None	<p><b>Comment</b> None</p> <p><b>Recommendation 2)</b> ENR recommends that the new Water Licence SNP should include monitoring of fire related contaminants for the next five years at</p>	<p><b>Apr 15:</b> <p style="margin-left:1.0cm">The Town would like to manage the fire monitoring as part of a study.This would enable the Town to modify the fire monitoring as required without having to change the Water Licence. As a study, the fire</p></p>	

		various landfill and river sites; even if just on an annual basis.	monitoring would still be required to report as part of the Annual Report.	
6	None	<p><b>Comment</b> None</p> <p><b>Recommendation</b> 3) ENR recommends that water quality monitoring at the landfill and noted river sites occur at spring freshet 2020 in order to capture and detect residual contaminants of the 2019 fire.</p>	<p><b>Apr 15:</b> &lt;p style="margin-left:1.0cm"&gt;The Town agrees with this recommendation, although timing may depend of how quickly the fire monitoring plan/study is approved.</p>	
7	Topic 3: Improperly Installed Ground Water Monitoring Wells and Ensuring Quality and Representative Data Moving Forward.	<p><b>Comment</b> In section 5.4 of the report (Groundwater Results and Recommendations) it notes that the 0053-5 series ground water monitoring wells were constructed improperly. Given this information, how can the Town have confidence in the quality of data being reported at these wells, and ensure accurate and representative results at these locations moving forward? ENR requests that the Town indicate how it will work to ensure accurate and representative results at these landfill monitoring well sites now and in future. Does the Town have a contingency plan to address this issue? Will these wells be re-drilled at some point in a phased approach, or when the proposed two new monitoring wells will be installed? ENR suggests that the Town develop a contingency plan and allot budget funding to address this issue.</p> <p><b>Recommendation</b> 1) Until the improper</p>	<p><b>Apr 15:</b> &lt;p style="margin-left:1.0cm"&gt;The Town will ensure that a low flow sampling method is used and that sampling is not done if surface water is pooling around the wells.</p>	

		well installment issue is addressed, ENR requests that the Town indicate how it will work to ensure the most accurate and representative results at these existing 0053-5 series well locations now and in future?		
8	None	<b>Comment</b> None <b>Recommendation</b> 2) ENR recommends that the Town develop a contingency plan and allot budget funding to address this issue.	<b>Apr 15:</b> <p style="margin-left:1.0cm">The funding is anticipated to be available in 2021 to upgrade the 5 series monitoring wells.This plan is based on current information that the Town has.	
9	Topic 4: River Water Monitoring “ Upstream Background	<b>Comment</b> The Final Landfill Fire Sampling Report specifies, p. 4, that: "River samples collected upstream of the landfill contained elevated concentrations of total metals (aluminum and zinc) and routine parameters such as sulfates, dissolved iron, and TSS. Exceedances found at upstream river samples illustrate concentrations that were either caused by the 2019 landfill fire via smoke and ash blown upstream by the wind, or by conditions existing prior to this fire. Since the concentrations of many fire related contaminants such as dioxins and furans, PCBs, PAHs, VOCs, and petroleum hydrocarbons were below guidelines or below detection limits, it is likely that the exceedances at upstream river samples SW5 and SW9 were pre-existing." The Draft Guidelines for Developing Baseline	<b>Apr 15:</b> <p style="margin-left:1.0cm">The Town feels that this recommendation is not in relation to the fire monitoring.&nbsp; The Town would like to note that is has been collecting data at River 1, River 2, and River 3 since 2017.	

		<p>Water Quality Monitoring Programs in the NWT posted on the MVLWB Online Review System, recommends the following temporal sampling frequency for river systems (p. 18): "Minimum three (3) years with at least four (4) sampling events per year (1 high water, 1 low water, 2 under ice). Also includes at least once each year, a five (5) samples-in-30 day sampling event needs to be conducted at each station."</p> <p><b>Recommendation 1)</b> ENR recommends that a minimum of 3 years of monitoring data be collected (as per above), to inform background water quality upstream from the Hay River SWDF. Using guidance from the above mentioned guidelines will help confirm the water quality concentrations upstream from the landfill, as well as the background contribution to water quality samples collected near the SWDF (River 2), and further downstream (River 3).</p>		
10	None	<p><b>Comment</b> None</p> <p><b>Recommendation 2)</b> ENR recommends the Town of Hay River consult the Draft (or Final) Guidelines for Developing Baseline Water Quality Monitoring Programs in the NWT, in the process of developing or finalizing River monitoring details within the Water Monitoring Plan, if/as necessary.</p>	<p><b>Apr 15:</b> <p style="margin-left:1.0cm">The Town feels that this recommendation is not in relation to the fire monitoring.</p></p>	

1	Topic 5: River 1 Water Monitoring “ River 2	<p><b>Comment</b> Exceedances measured during the 2019 fire monitoring at SW2 (near/at River 2) included PAHs, PHCs, dissolved sulphate, nitrate, iron and TSS. During the February Technical session, the Town agreed to include the river monitoring site River 2 located immediately downstream from the landfill, in the SNP requirements of their water licence. The current Final Landfill Fire Report for review specifies, section 2.5, that "uncontrolled burning often takes place at the Hay River dump" (Dillon, 1991) with other mentions of fires occurring prior to May 2010, as well as in 2014. Considering the unmanaged persistent large pile of unsegregated waste that remains at the landfill site which significantly increases the risks of fire (and from which the fire was burning in 2019), there is potential for future fires at the site. The River 2 monitoring location should therefore analyze for parameters that were measured as exceedances at SW2 during the 2019 fire, such as PAHs, PHCs and nitrate, in addition to other typical routine parameters (metals, major ions, etc.). May future trends for these parameters clearly indicate a correlation with fire events; the Town may present these evidences to the Board when suggesting to adapt monitoring</p>	<p><b>Apr 15:</b> <p style="margin-left:1.0cm">The Town has historically monitored the Hay River for the same parameters as listed in the current Water Licence for the 0053-5x series groundwater wells. Specifically, for the Landfill Fire Monitoring study the Town plans to sample (in addition to the parameters that are sampled as part of the regular monitoring) for PAHs, dioxins and furans, VOCs, and PCBs in accordance with the recommendations in the Beckingham report.</p></p>	
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		<p>requirement at River 2 for these parameters (eg. possibly in time of fire occurrences only).</p> <p><b>Recommendation</b> 1) Considering the landfill fire history and fire-prone risks current present at the site, ENR recommends that PAHs, PHCs and nitrate be added to surface water quality parameters monitored at River 2.</p>		
1 2	<p>Topic 6: Groundwater Monitoring Parameters</p>	<p><b>Comment</b> Page 7 of the Final Landfill Fire Sampling Report, specifies that: "One possibility that has to be considered is that the dioxins and furans detected in the groundwater across the Site in 2019 are pre-existing and the dioxins and furans deposited on the ground surface from smoke, ashes, dust and runoff as a result of the 2019 landfill fire have not had sufficient time to migrate downwards into the water table or infiltrate the 5 series monitoring wells .. (Beckingham 2019)." ENR notes that according to the 'Groundwater Monitoring Program Review' by Beckingham (January 2020), it would take an estimated minimum of 4 years for groundwater to travel from the active current landfill cell area, to the groundwater monitoring well 0053-5e.</p> <p><b>Recommendation</b> 1) ENR recommends that dioxins and furans be added to the water licence SNP monitoring parameter</p>	<p><b>Apr 15:</b> The Town proposes to follow the recommendations (see Beckingham &lt;em&gt;Hay River Landfill Fire &amp;ndash; Environmental Monitoring Report&lt;/em&gt;) regarding the groundwater monitoring sampling for dioxin and furans.&amp;nbsp; According to the recommendation, dioxin and furan sampling should be completed in the spring when an annual groundwater monitoring event takes place.&amp;nbsp; The spring should occur after freshet so the effects of any recharge to the aquifer that may occur in the spring may be reflected in the spring samples.&amp;nbsp; Additional groundwater dioxin and furan sampling should also take place in the fall.&amp;nbsp; The need for any additional groundwater dioxin and furan sampling can be assessed after the fall 2020 dioxin and furan groundwater data has been reviewed.&amp;nbsp; This goes to the Towns recommendation that the fire monitoring be managed through a study.</p>	

		requirements for 0053-5e, 0053-5c, as well as any additional groundwater wells that may be added downstream from the active current landfill cell area (see 2013 Landfill Drainage Study, Fig. 2).		
1 3	None	<b>Comment</b> None <b>Recommendation</b> 2) ENR recommends that past groundwater monitoring results compiled within ENR Tables 6 to 11 (submitted with the Groundwater Monitoring Plan Proposal) may be used to inform on trend analyses for various parameters throughout the site (eg. TPH Fractions, BTEX, etc.) in relation to monitoring requirements'™ relevance.	<b>Apr 15:</b> <p style="margin-left:1.0cm">The Town has provided tables as part of the Annual Reports and provided tables in response to the MVLWB Information Request coming out of the Technical Sessions.&nbsp; Trending has also been provided as part of Annual Reports.	

**Katlochee First Nation: Patrick Riley**

<b>ID</b>	<b>Topic</b>	<b>Reviewer Comment/Recommendation</b>	<b>Proponent Response</b>	<b>Board Staff Response</b>
1	Parameter	<b>Comment</b> On page 26, the TOHR states, "In order to confirm this decrease of fire related contaminants in the river water, it is recommended to conduct a one-time river sampling program at these three river location, after snowmelt runoff and any precipitation events and to include dioxins and furans, total metals and routine parameters in the water analysis. <b>Recommendation</b> KFN recommends that the TOHR explicitly list the parameters that	<b>Apr 15:</b> The Town has provided the list of parameters to be sampled with regards to the three river locations: Routine Parameters: Alkalinity; pH, Hardness; Calcium Carbonate (CO3); Electrical Conductivity (EC); Hydroxide (OH); Potassium (K) Calcium (Ca); Magnesium (Mg); Sodium (Na); Bicarbonate (HCO3); Sulphate (SO4); and Chloride (Cl); Nitrate (NO3) and Nitrite (NO2), dissolved Iron (Fe); dissolved Manganese (Mn); and calculated TDS.&nbsp; Total Metals: Aluminum (Al); Arsenic (As); Barium (Ba);	

		will be tested (in this section of the report) or the TOHR reference where in the document that the tested parameters are listed.	Beryllium (Be); Boron (B); Cadmium (Cd); Chromium (Cr); Cobalt (Co); Copper (Cu); Iron (Fe); Lead (Pb); Lithium (Li); Magnesium (Mg), Manganese (Mn); Molybdenum (Mo); Nickel (Ni); Phosphorous (P); Selenium (Se); Strontium (St); Silver (Ag); Sulphur (S); Tin (Sb); Titanium (Ti); Thallium (Tl); Uranium (U); Vanadium (V); Zinc (n). Dioxins and Furans VOCs PAHs PCBs PHCs (Fractions F1-F4 and BTEX)	
2	Parameter	<p><b>Comment</b> On page 25, the TOHR states "It is recommended to conduct a confirmatory upstream river sampling program to confirm that the elevated concentration are indeed background concentrations.</p> <p><b>Recommendation</b> KFN recommends that the parameters being tested are explicitly stated in this section of the report or that the TOHR explicitly states where in the documents that the tested parameters are listed. KFN also recommends that background samples are taken at the same time as downstream samples to allow for a robust comparison.</p>	<p><b>Apr 15:</b> The Town provided the list of parameters in response to the previous recommendation.&amp;nbsp; The Town will be sampling that background samples at the same time as the downstream samples to allow for a good comparison.</p>	
3	Parameter	<p><b>Comment</b> On page 25, the TOHR states, "It is recommended to conduct a one-time soil sampling at locations SW13, SW1 and SW7..Recommended analyses includes dioxins, furans, total metals, PAHs, VOCs and routine parameters."</p> <p><b>Recommendation</b> KFN recommends that</p>	<p><b>Apr 15:</b> The Town has provided the list of parameters to be sampled with regards to the soil sampling below: Routine (Salinity) Parameters: Calcium (Ca), Magnesium (Mn), Potassium (K), Sodium, Chloride (NaCl), Sulphate (SO4), pH by CaCl2, Electrical Conductivity by Saturated Paste (EC), Saturation %, Calculations including Sodium</p>	

		<p>the TOHR explicitly list the parameters that will be tested (in this section of the report) or the TOHR reference where in the document that the tested parameters are listed.</p>	<p>Adsorption Ratio (SAR), TGR.&amp;nbsp; Total Metals: Aluminum (Al); Arsenic (As); Barium (Ba); Beryllium (Be); Boron (B); Cadmium (Cd); Chromium (Cr); Cobalt (Co); Copper (Cu); Iron (Fe); Lead (Pb); Lithium (Li); Magnesium (Mg), Manganese (Mn); Molybdenum (Mo); Nickel (Ni); Phosphorous (P); Selenium (Se); Strontium (St); Silver (Ag); Sulphur (S); Tin (Sb); Titanium (Ti); Thallium (Tl); Uranium (U); Vanadium (V); Zinc (n). Dioxins and Furans VOCs PAHs PCBs PHCs (Fractions F1-F4 and BTEX). &amp;nbsp;</p>	
4	Parameter	<p><b>Comment</b> On page 24, the TOHR states, "In order to find out whether the landfill is still a source of contaminants in surface water. parameters to include in the analysis are dioxins and furans, total metals, PAHs, VOCs and routine parameters.</p> <p><b>Recommendation</b> KFN recommends that the TOHR explicitly list the parameters that will be tested (in this section of the report) or the TOHR reference where in the document that the tested parameters are listed.</p>	<p><b>Apr 15:</b> The Town has provided the list of parameters to be sampled with regards to the three river locations: Routine Parameters: Alkalinity; pH, Hardness; Calcium Carbonate (CO3); Electrical Conductivity (EC); Hydroxide (OH); Potassium (K) Calcium (Ca); Magnesium (Mg); Sodium (Na); Bicarbonate (HCO3); Sulphate (SO4); and Chloride (Cl); Nitrate (NO3) and Nitrite (NO2), dissolved Iron (Fe); dissolved Manganese (Mn); and calculated TDS.&amp;nbsp; Total Metals: Aluminum (Al); Arsenic (As); Barium (Ba); Beryllium (Be); Boron (B); Cadmium (Cd); Chromium (Cr); Cobalt (Co); Copper (Cu); Iron (Fe); Lead (Pb); Lithium (Li); Magnesium (Mg), Manganese (Mn); Molybdenum (Mo); Nickel (Ni); Phosphorous (P); Selenium (Se); Strontium (St); Silver (Ag); Sulphur (S); Tin (Sb); Titanium (Ti); Thallium (Tl); Uranium (U); Vanadium (V); Zinc (n). Dioxins and Furans VOCs PAHs PCBs PHCs (Fractions F1-F4 and BTEX)</p>	

5	Reporting of results	<p><b>Comment</b> In the Landfill Fire - Environmental Monitoring Report, it does not state when the results of the Landfill Fire will be reported and how they will be reported.</p> <p><b>Recommendation</b> KFN recommends that the results of the Landfill Fire be reported as part of the Annual Report.</p>	<p><b>Apr 15:</b> The Town would like to manage the monitoring and reporting of the Landfill Fire as a study which would be reported in the Study section of the Annual Report.</p>	
6	Surveillance Network Protocol	<p><b>Comment</b> N/A</p> <p><b>Recommendation</b> KFN recommends that the additional monitoring sites and monitoring schedule be added to the upcoming Water License renewal as SNP sites.</p>	<p><b>Apr 15:</b> The Town proposes to submit the Landfill Fire Monitoring as a separate Study rather than under the Surveillance Network Program.&amp;nbsp; This will allow for the monitoring to begin prior to the receipt of the new Water Licence and to be more responsive and agile to monitoring results and recommendations.</p>	
7	Guidelines	<p><b>Comment</b> In sections 5.1.1., 5.2, 5.3, 5.4, in the Recommendation Section the TOHR states that the "If parameters do not exceed the guidelines, there is no need for further sampling." In Section 2.6 of the document, specific guidelines are referred to and the TOHR does reference Appendix B as a supporting document for guidelines recommendations.</p> <p><b>Recommendation</b> KFN recommends that the TOHR explicitly states the guidelines that they are referring to in sections 5.1.1., 5.2, 5.3 and 5.4 or specifically reference where the guidelines are found within the document.</p>	<p><b>Apr 15:</b> The guidelines are found in Section 2.6 Regulatory Framework of the report.&amp;nbsp; A summary is listed below: Surface Water &amp;ndash; Environmental Quality Guidelines for Alberta Surface Waters (AEP 2018) River Water &amp;ndash; Environmental Quality Guidelines for Alberta Surface Waters (AEP 2018) &lt;p style="margin-left:78.0pt"&gt;Groundwater &amp;ndash; Federal Contaminated Sites Assessment Program Interim Groundwater Quality Guidelines (GOC, 2016a and 2016b), Coarse grained criteria (Direct Contact Ecological and Freshwater Aquatic Life)</p>	

8	Action levels	<p><b>Comment</b> In sections 5.1.1., 5.2, 5.3, 5.4, in the Recommendation Section the TOHR states that the "If parameters do not exceed the guidelines, there is no need for further sampling." There are no clear recommendations on what future activities will occur if parameters are exceeded.</p> <p><b>Recommendation</b> KFN recommends that the TOHR explicitly state what remedial action planning will take place if parameters exceed the recommended guidelines.</p>	<p><b>Apr 15:</b> In Section <em>5.0 Conclusions and Recommendations</em> if fire related parameters exceed the guidelines a Remedial Action Plan (or called an environmental management plan in the report) will be developed to contain these parameters.</p>	
9	Soil sampling and analysis	<p><b>Comment</b> On page 16, the TOHR states "The soils at the landfill site can be a source of contaminants eroding off the soil surface and into the river via wind and water. It is therefore recommended to conduct a soil sampling program at the locations of SW13, SW1 and SW7 at 0-15 cm depth to assess potential residual soil contaminations resulting from the landfill fire. Recommended analyses include dioxins and furans, total metals, PAH, VOCs and routine parameters.</p> <p><b>Recommendation</b> KFN recommends that the TOHR explain what specific parameters they will be testing for or where that information is referred to in the report. What guidelines the TOHR will be comparing these parameters against?</p>	<p><b>Apr 15:</b> The Town has listed the specific soil parameters in response to KFN Topic 3 above.  The TOHR would use the Government of the Northwest Territories Environmental Guideline for Contaminated Site Remediation to compare these parameters against.  A Remedial Action Plan would be developed if the fire related parameters exceed the guidelines to contain the parameters.</p>	

		What remedial action will be taken if these parameters are exceeding the guidelines?		
MVLWB: Erica Janes				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Response
1	Overall approach	<p><b>Comment</b> Board staff have reviewed the Town's Final Landfill Fire Sampling Report and are of the opinion that while it is somewhat encouraging to have these sampling results presented, they are limited in the extent to which they can effectively address the monitoring requirements in the Town's current Licence and/or potential future Licence due to fundamental and inherent challenges surrounding the integrity of existing monitoring stations (i.e. improperly installed wells) and the effectiveness of the overall monitoring program design, including suitability of parameters analyzed and consistency in sampling procedures.</p> <p><b>Recommendation</b> None</p>	<p><b>Apr 15:</b> The &lt;em&gt;Hay River Landfill Fire &amp;ndash; Environmental Monitoring Report&lt;/em&gt; (Beckingham 2020) was not intended to address the current and/or future monitoring requirements at the SWDF.&amp;nbsp; The reports intent was to present the monitoring results that were done in response to the 2019 fire and to inform recommendations for a study to continue monitoring the specific fire related impacts at the landfill.</p>	
2	General Comment	<p><b>Comment</b> In the Northwest Territories, professional engineering and professional geoscience are governed by the Engineering and Geoscience Professions Act, which is administered by NAPEG. Board staff note that Beckingham Environmental Ltd. does not hold a Permit</p>	<p><b>Apr 15:</b> The Town is aware of the requirement and Beckingham Environmental is in the process of registering with NAPEG as is their senior engineer.&amp;nbsp; Both the firm and the senior engineer have been approved by NAPEG as of April 15th, 2020.</p>	

		<p>to Practice in the Northwest Territories. Board staff also note that neither the Professional Engineer nor the Professional Geoscientist who stamped this Report are registered with NAPEG. Board staff remind the Town of Hay River that it is a statutory requirement that professional engineering and professional geoscience only be practiced in the Northwest Territories by registrants of NAPEG.</p> <p><b>Recommendation</b> The Town of Hay River is reminded that engineers, geoscientists, and firms practicing engineering and geoscience in the Northwest Territories must be registered with NAPEG.</p>		
3	Executive Summary	<p><b>Comment</b> Board staff note that there is reference to elevated concentrations of a number of parameters (e.g., petroleum hydrocarbons, VOCs, dioxins, furans) that were observed downgradient of the landfill, but there is uncertainty whether these elevated concentrations are due to the 2019 or past landfill fires. While the monitoring being reported on was done in relation to the 2019 fire, elevated concentrations of fire-related parameters may have potential to influence the Hay River receiving environment, regardless of when they originated (i.e., 2019 or earlier), and will need to be accounted for in closure planning for the site.</p>	<p><b>Apr 15:</b> The <em>Hay River Landfill Fire &amp; Environmental Monitoring Report</em> (Beckingham 2020) was intended to specifically present the results of the monitoring done in response to the 2019 fire and provide recommendations to inform a study going forward. The Town recognizes that any monitoring done related to the landfill fire will also inform and be considered during closure planning.</p>	

		<p><b>Recommendation</b> Please provide further explanation to support why determining the impacts specifically from the 2019 landfill fire is relevant, rather than simply identifying fire-related parameters of concern that should continue to be monitored in the receiving environment, and considered in closure planning.</p>		
4	<p>Executive Summary and Section 2.4.2 Hydrogeology and Hydrochemistry</p>	<p><b>Comment</b> Board staff note that there is reference to elevated chloride concentrations in groundwater well SNP0053-5e, but there is uncertainty regarding how these concentrations increased (i.e., subsurface aquifer migration, surface water recharge) yet there is no mention of the structural issues related to the groundwater wells and how they were installed as explained in the Groundwater Monitoring Program Proposal submitted January 30, 2020. In addition, the overview of the groundwater well monitoring network discusses variability in chemistry across the site, but does not mention the structural issues with the wells identified in the Groundwater Monitoring Program Proposal submitted January 30, 2020. As a result, it is unclear what the potential implications on the water quality in the groundwater wells and what limitations in data interpretation arise as a result of</p>	<p><b>Apr 15:</b> In the Executive Summary of the report Beckingham states “Due to the improper construction of the 5 series wells (Beckingham, 2020), it is also possible that fire related surface water could’ve reached sentinel well 5e and then either infiltrated the well directly from the ground surface and/or through vadose zone and biased the results of the September and November groundwater samples. As such, it is not possible to determine what caused the sudden increase in groundwater Cl levels reported at sentinel monitoring well 5e in the fall of 2019 and if that increase was in any way fire related.” The improperly constructed 5 series wells are also addressed in further detail in throughout section 4.4.</p>	

		<p>these structural deficiencies.</p> <p><b>Recommendation</b> Please provide further explanation as to the broader implications of the groundwater well structural deficiencies and potential implications to the interpretation of the monitoring results.</p>		
5	Section 2.4.2 Hydrogeology and Hydrochemistry	<p><b>Comment</b> None</p> <p><b>Recommendation</b> Please also explain in detail the limitations or caveats on data interpretation of site-wide trends or patterns.</p>	<p><b>Apr 15:</b> The Town believes the report provides an explanation of any limitations or caveats on data interpretation that exist throughout the report.&amp;nbsp; Additionally, this recommendation is vague and does not provide specific details that can be commented on by the Town.&amp;nbsp; The Town recommends that the Board rephrase this recommendation if they feel that the report does not explain what exactly what they are looking for with respect to limitations or caveats.</p>	
6	Section 1.1	<p><b>Comment</b> Board staff note that certain samples from the the Hay River have been defined as 'surface water' while others are defined as 'river', but no clear rationale defining this difference in classification is provided. Board staff assume that the RIVER sampling locations and SW sampling locations in the Hay River were established at different times (as part of the Water Monitoring Plan and post-landfill-fire sampling, respectively); however, the two sets of locations are now being used in combination. Technically all samples collected from the river are considered</p>	<p><b>Apr 15:</b> The RIVER samples (River 1, River 2, and River 3) are the sample locations which have been sampled since 2017 and reported on in the Annual Reports.&amp;nbsp; SW locations were developed specifically as part of the monitoring in response to the 2019 landfill fire.&amp;nbsp; While both locations are surface water keeping the naming convention that has been used since 2017 for the three locations along the Hay River helps with continuity.&amp;nbsp; The SW locations include pooled surface water locations as well as some locations along the river.&amp;nbsp; Keeping the fire specific locations separate allow for</p>	

		<p>surface water and the difference appears related to the timing of the sample collection. By splitting samples into artificially separate groups there could be bias in the interpretation of results.</p> <p><b>Recommendation</b> Please clarify how the SW and RIVER samples are different, and provide an explanation and cross-reference for the two sets of locations, with clear rationale supporting splitting river samples into two categories.</p>	<p>continuity in when the locations began to be sampled and why.&amp;nbsp;  </p>	
7	Section 1.1	<p><b>Comment</b> None</p> <p><b>Recommendation</b> Please include suggestions for how to align the two sets of sampling locations in the new Licence SNP.</p>	<p><b>Apr 15:</b> The Town would like to recommend that the fire related sampling be addressed as a Study which would provide updates and reporting as part of the Study section within the annual report.&amp;nbsp;   This way the fire monitoring is kept together and is able to be addressed and updated as monitoring data is collected and analyzed.</p>	
8	Section 5.2 River Water Results and Recommendations; pg. 26	<p><b>Comment</b> The location of River 3 is 4 km downstream of the landfill. As there are other developments between this location and the landfill, it will be impossible to identify any contaminants to the river emanating from the landfill versus from other sources.</p> <p><b>Recommendation</b> Please consider relocating sampling location River 3 to further upstream to avoid ambiguity in the data that results from the current location.</p>	<p><b>Apr 15:</b> The Town agrees with this recommendation.</p>	



	<p>the biotreatment pad that is adjacent to the 7-series wells.</p>	<p>saline groundwater produced at monitoring wells 5b and 7d appears to be consistent with what would be expected to be produced from an aquifer containing a lot of evaporite minerals and also minerals from the Canadian Shield. It is known that during a certain era, the Hay River area was glaciated by glaciers that moved westward from the shield area east of Hay River and over an area in between the Shield and Hay River where an evaporate rich layer is known to form the bedrock surface. As such, it is entirely possible that a glacial clay till containing both Shield and evaporite minerals could be underlying the area surrounding the Site and this would completely explain the solute rich, saline groundwater chemistry observed at monitoring wells 5b and 7d. As we move eastward from 7d to monitoring wells 7c, b, and a, a rapid transition towards a very solute poor non-saline groundwater is observed indicating those wells are not intersecting or completed in the same lower till layer that 7d is reported to intersect. As mentioned above, the soil treated within the bio-treatment pad is hydrocarbon impacted, not salt impacted. If it were highly salt impacted, the hydrocarbon in the soil would not break down naturally as the high salt content would inhibit or prohibit the microbes from multiplying and digesting the hydrocarbons. Also, if soil being treated within the bio-treatment pad was salty enough to</p>	
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			<p>make the groundwater produced at 7d as saline as it is, the other 7 series wells would likely also reflect this high level of salinity. &amp;nbsp;Those wells are also completed along the down-gradient side of the bio-treatment pad so it is logical to assume they would be affected in the same way.&amp;nbsp; Therefore, Beckingham has not identified any evidence to suggest that groundwater produced from the 7 series wells have been impacted by soil remediation activities in the bio-treatment pad.&amp;nbsp; Instead, the great variation in groundwater chemistry observed across those four wells appears to be fully attributable to the naturally occurring surficial geology and hydrogeology of the Site.</p>	
1 2	<p>Section 2.6: Regulatory Framework</p>	<p><b>Comment</b> Board staff note that Alberta Surface Water Quality Guidelines have been applied to all surface water and river stations. Application of these guidelines makes sense for surface water locations located off the landfill site (i.e. in the Hay River), but it is not clear why guidelines for industrial sites (e.g. GNWT's Guideline for Industrial Waste Discharges in the NWT) were not considered for ponded water located on the landfill site proper as elevated concentrations in would not be unexpected regardless of the 2019 fire. <b>Recommendation</b> Please provide rationale for the use of Alberta Surface Water Quality Guidelines for ponded water</p>	<p><b>Apr 15:</b> The Alberta Surface Water Quality Guidelines were use as they are more conservative and due to the landfill's proximity Hay River. &amp;nbsp;</p>	





		rationale supporting the decision to not analyze PHCs in all samples.		
1 8	Section 3.1.1: Sampling Events and Section 4.1.2 At Landfill Site: Samples SW13, SW1 and SW7, pg. 15 3rd paragraph	<p><b>Comment</b> Board staff note that the schedule of sampling events seems somewhat random. Further information explaining how sampling dates were selected as well as why some sites were not sampled (e.g. station was dry) would be helpful. In addition, the report states that "it was not possible to sample it after May 2019." but does explain why.</p> <p><b>Recommendation</b> Please provide further information to explain scheduling of sampling events, including an explanation as to why some locations could not be sampled after May 2019.</p>	<p><b>Apr 15:</b> The scheduling of sampling events from March to May was determined in conjunction with ENR. Sampling done after May was to accommodate ENR's request for an additional sampling event along with the required fall SNP sampling event. As noted in Section 4.1.2 pg. 15, 3rd paragraph some surface water locations could not be sampled after May 2019 because there was no longer any ponded water in those locations.</p>	
1 9	Section 3.1.2 Surface and River Water Samples, pg. 8	<p><b>Comment</b> The term "industry standard sampling protocols" is too ambiguous in describing the procedure for sample collection. Knowing the distance from shore and the depth of sampling in the Hay River would assist in understanding the efficacy of sampling done.</p> <p><b>Recommendation</b> Please specify the procedure used to collect the surface water and river water samples, including confirmation of the exact locations (i.e., distance from shore) and depths of sampling conducted in the Hay River.</p>	<p><b>Apr 15:</b> Surface water and river water samples collected during the fire varied from near the shore to middle of the river. All samples were collected at a depth of 3 – 5 centimeters while facing upstream.</p>	





	<p>Sampling Methodology</p>	<p>information regarding which laboratory this was is included in the report or appendices. Typically for compliance-related sampling, the laboratory-issued Certificate of Analyses (COA) is provided as an appendix to the report. This enables regulators to verify analytical methods and results directly from the laboratory rather than from only a summary table, which may contain errors. These reports also contain laboratory qualifiers and temperature of the samples upon receipt - all of which is important information for completing a proper QA/QC assessment of the results. This sampling was completed under a directive from the GNWT Inspector and does qualify as compliance monitoring. Board staff also note that there is an Appendix C: Laboratory Analytical Results, but it contains no information.</p> <p><b>Recommendation</b> Please specify which analytical laboratory was used and provide the certificates of analysis.</p>	<p>sampling.&amp;nbsp; A copy of the analysis is attached as Attachment C. &amp;nbsp;&amp;nbsp; </p>	
<p>2 5</p>	<p>Section 3.2.1 Trip Blanks, pg. 9</p>	<p><b>Comment</b> There is no reason given why the trip blank was only analyzed for BTEX and PHC fractions F1 and F2. Dioxins and furans, with their very low detection limits, are highly susceptible to cross-contamination.</p> <p><b>Recommendation</b> Please specify why only</p>	<p><b>Apr 15:</b> KBL Environmental (KBL) was contracted by the Town to complete the field sampling during the post-fire landfill monitoring.&amp;nbsp;   The people who did all that field work are no longer with KBL at the time the reports were written; therefore, they could not be asked what their field procedures were.&amp;nbsp;   Copies of the</p>	

		a limited analysis was performed only on the trip blanks for BTEX, F1 and F2 and not for other parameters	field notes left behind by those former employees were reviewed but they did not contain any information on why limited analysis was performed on the trip blanks. A copy of all the post-fire monitoring analytical completed on behalf of the Town is attached as Appendix C.	
2 6	Section 3.2.1 Trip Blanks, pg. 9	<b>Comment</b> None <b>Recommendation</b> Please specify whether or not trip blanks were analyzed for parameters in addition to BTEX, F1 and F2.	<b>Apr 15:</b> KBL Environmental (KBL) was contracted by the Town to complete the field sampling during the post-fire landfill monitoring.&nbsp; The people who did all that field work are no longer with KBL at the time the reports were written; therefore, they could not be asked what their field procedures were.&nbsp; Copies of the field notes left behind by those former employees were reviewed but they did not contain any information on whether trip blanks were analyzed for parameters in addition to BTEX, F1 and F2 were completed.&nbsp; A copy of all the post-fire monitoring analytical completed on behalf of the Town is attached as Appendix C.	
2 7	Section 3.2: Quality Assurance/Quality Control	<b>Comment</b> Board staff note that trip blanks and duplicate samples were included, but field blanks were not included as QC samples. Field blank samples provide verification that contamination didn't occur during sample collection. <b>Recommendation</b> Please provide rationale for not including field blank samples.	<b>Apr 15:</b> KBL Environmental (KBL) was contracted by the Town to complete the field sampling during the post-fire landfill monitoring.&nbsp; The people who did all that field work are no longer with KBL at the time the reports were written; therefore, they could not be asked what their rationale was for not including field blanks samples.	

2 8	Section 3.2: Quality Assurance/Quality Control	<p><b>Comment</b> Board staff note that it is not possible to verify if the proportion of QC samples for each sampling event was reasonable (e.g., 10% of field samples collected) as this information is not provided in the report.</p> <p><b>Recommendation</b> Please clarify the proportion of samples that were QC per sampling event.</p>	<p><b>Apr 15:</b> KBL Environmental (KBL) was contracted by the Town to complete the field sampling during the post-fire landfill monitoring.&amp;nbsp; The people who did all that field work are no longer with KBL at the time the reports were written; therefore, they could not be asked what their field procedures were.&amp;nbsp; Copies of the field notes left behind by those former employees were reviewed but they did not contain any information on the proportion of samples that were QC per sampling event. A copy of all the post-fire monitoring analytical completed on behalf of the Town is attached as Appendix C.</p>	
2 9	Section 3.2: Quality Assurance/Quality Control	<p><b>Comment</b> Board staff note that the QA/QC section contains no explanation of methods applied to this monitoring program such as calibration of the multi-meter, equipment cleaning protocols to minimize cross-contamination, protocols applied to the laboratory results (e.g., review of laboratory qualifiers, proportion of relative percent differences between duplicates deemed acceptable, proportion of detectable concentrations in trip blanks deemed acceptable).</p> <p><b>Recommendation</b> Please provide additional information outlining QA/QC methods applied to the monitoring program.</p>	<p><b>Apr 15:</b> KBL Environmental (KBL) was contracted by the Town to complete the field sampling during the post-fire landfill monitoring.&amp;nbsp; The people who did all that field work are no longer with KBL at the time the reports were written; therefore, they could not be asked what their field procedures were.&amp;nbsp; Copies of the field notes left behind by those former employees were reviewed but they did not contain any information regarding what exact procedures and protocols were used with respect to meter calibrations, equipment cleaning to prevent cross-contamination, etc. when the field work was done. Beckingham gave priority to focusing on those aspects of the report which are of primary importance such as documenting the field methodologies and sequence of events and</p>	

			presenting the data/results, conclusions and recommendations.  Beckingham did complete quick visual comparisons of duplicate sample results to determine if there were any glaring discrepancies in the duplicate sample results.  Has Beckingham seen any significant discrepancies it would've reported them, but none were identified.  It is Beckingham's opinion, however, that going through such an exercise at this point would not be a worthwhile use of the TOHR's funds as it is mainly just an academic exercise and will not likely result in any substantive changes to the conclusions and recommendations of the report.	
30	Section 3.2.2 Duplicate Samples, pg. 9	<b>Comment</b> This section states that ". did not identify any unacceptable disparities between duplicate samples", but provides information as to how this was assessed. <b>Recommendation</b> Please specify which criteria were used to judge the reliability of duplicate samples, and reference the source of the criteria.	<b>Apr 15:</b> Beckingham did complete quick visual comparisons of duplicate sample results to determine if there were any glaring discrepancies in the duplicate sample results.  Has Beckingham seen any significant discrepancies it would've reported them, but none were identified.	
31	Section 4.0 Results and Discussion	<b>Comment</b> Board staff note reference to guidelines is inconsistent and sometimes confusing. For example, under sub-section 4.1.1.1 Routine Parameters, bullet 2 refers to 'ASWQG' and 'CCME'; however, the ASWQG are a compilation of guidelines from a variety of sources that includes CCME as well as others (e.g., USEPA,	<b>Apr 15:</b> Should this information be used in future reports, the Town will update the text.  However, no revisions are planned to the report. &nbsp;&nbsp;	







		site are not unexpected. The report should also present the range of concentrations observed so that comparison can be made to subsequent groundwater samples for identifying potential source locations.		
3 6	Section 4.1.2 At Landfill Site: Samples SW13, SW1 and SW7, pg. 15 3rd paragraph	<b>Comment</b> There is a series of questions posed in this paragraph. These questions do not add value in this section of the report. They are the objectives of the study and should be included in Section 1. <b>Recommendation</b> Please remove the questions listed in the referenced paragraph.	<b>Apr 15:</b> The Town believes that the questions presented in this section do add value to the report.&nbsp; Whether or not they add value to this section is very subjective.&nbsp; While the questions may not add value to the Board, they may add value to a different reader.&nbsp; In either case, they do not detract from the content in the section, and as such removing the questions should not be necessary.&nbsp;	
3 7	Section 4.1.2 At Landfill Site: Samples SW13, SW1 and SW7, pg. 15 4th paragraph	<b>Comment</b> The last sentence in this paragraph states "Parameters to include in the analysis are the contaminants listed in the previous paragraph." but the previous paragraph does not list any parameters. <b>Recommendation</b> Please revise the paragraph to reference the correct location of the listed parameters.	<b>Apr 15:</b> Should this information be used in future reports, the Town will update the text.&nbsp; However, no revisions are planned to the report.&nbsp;	
3 8	Section 4.1.3 Downstream of the Landfill Fire, pgs. 16 to 17.	<b>Comment</b> This section lists exceedances of the applied guideline but does not provide an indication whether the landfill and fire have contributed deleterious parameters to the river. As such this section is of little value. <b>Recommendation</b> Please revise this section to present a comparison between	<b>Apr 15:</b> The Town would like to note that the report was designed to discuss the specifics around the monitoring completed in relation to the 2019 Landfill Fire.&nbsp; &nbsp;The Town disagrees that this section is of little value and considers this comment to be subjective.&nbsp; &nbsp;&nbsp;	

		the upstream and downstream data and highlight any concentrations that are elevated compared to the upstream values.		
3 9	Section 4.4.2 Routine Water, pg. 20 2nd paragraph.	<p><b>Comment</b> Beckingham concludes that even though there was an over 300% increase in the chloride concentration in well SNP0053-5e in the fall monitoring events compared to the spring events and events dating back to 2009, there is no concern because the concentration is less than the concentration seen in the background well. This is a false conclusion as the background well is likely being influenced by road de-icing or dust suppression compounds used in its vicinity. Well SNP0053-5e is further to the south of the groundwater flowpath that is affected by these compounds, thus the low chloride concentrations likely reflect the true background for this portion of the landfill. Thus, the 300% increase would represent a concern that landfill leachate has reached the groundwater table and is being detected at this location.</p> <p><b>Recommendation</b> Please review the conclusion based on the hypothesis presented and revise it accordingly or provide evidence that the hypothesis is valid.</p>	<p><b>Apr 15:</b> The average Chloride (Cl) level reported at sentinel well SNP 0053-5e (5e) from 2009 to Spring 2019 was 64 mg/L thus the increase to 180 mg/L in the Fall of 2019 represents an approximate 180% increase in Cl levels from the previous average, not 300%. The actual amount of increase from normal average levels at 5e is only in the order of 120 mg/L of a common naturally occurring anion which is not a significant amount. The Report pointed out that for a number of reasons, it is not possible to determine the cause(s) of the sudden increase of groundwater Cl levels identified at 5e during the Fall of 2019. One possibility is that it is a results of runoff water from firefighting activities pooling in the vicinity of 5e and either recharging groundwater in the vicinity of the well or runoff water infiltrating the well directly from the surface due to the substandard/improper construction. As Cl is highly soluble, mobile and persistent in groundwater it is regarded as an indicator species so the question is correct in pointing out that the sudden rise in Cl levels at 5e is an indication of a leachate plume reaching that well. This is not likely to be fire related water recharging groundwater in the vicinity of the well because, based on available data, any</p>	

			<p>water poured into the landfill during the 2019 fire would take several years to reach sentinel well 5e through the aquifer even under the most optimistic conditions. Therefore, if the chloride spike identified at 5e is due to a groundwater plume finally reaching sentinel well 5e from the landfill, those chlorides are most likely to have been migrating towards 5e for years. While the possibility that a leachate plume has reached sentinel 5e does exist, it is noteworthy to point out that there is a lack of other evidence to suggest this is the case. Just as Cl is considered a common indicator species of landfill leachate groundwater contamination due to its high solubility and mobility, so too are Nitrogen nutrient species Nitrate (NO<sub>3</sub>) and Nitrite (NO<sub>2</sub>). It might therefore be expected for both chloride and nitrogen nutrient species to arrive together at a down gradient sentinel well. To date, however, there has been no corresponding increase in nitrogen nutrient levels over normal background levels identified at well 5e. Other common landfill contaminants such as petroleum hydrocarbons and certain dissolved metals have not been detected at well 5e either; therefore, other than just the most two recently reported Cl levels, there appears to be no other evidence that suggests a leachate plume has reached well 5e. With regards to whether the elevated Cl levels at background monitoring well</p>	
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			<p>SNP 0053-5b (5b) and SNP 0053-7d (7d) are representative of normal background levels and whether the chloride levels reported at those wells are likely influenced by the use of road salt on the nearby Fort Smith Highway and possibly also by the use of chloride based dust suppressants in the vicinity of those wells, Beckingham reviewed the available evidence and dismissed the idea for the reasons outlined below:</p> <ul style="list-style-type: none"><li>The groundwater chemistry consistently reported at monitoring wells 5b and 7d is thoroughly consistent with a groundwater derived from an aquifer rich in evaporite minerals and also minerals derived from the Canadian Shield and is inconsistent with that of a non-saline groundwater that has been impacted by salts commonly used in road salt and dust suppressants.</li><li>In brief, road salts and dust suppressants are not a potential source of sulphates (SO<sub>4</sub>) which are prevalent in the groundwater produced at monitoring wells 5b and 7d.</li><li>The presence of naturally occurring evaporative minerals in glacial tills dragged from areas further east of the Hay River area does, however, explain fully the presence of elevated Cl and SO<sub>4</sub> levels in the groundwater at those two wells.</li><li>Monitoring well 5b has consistently reported Cl levels in the 300 – 600 mg/l range since 2009.</li><li>Monitoring well 7d, which is located immediately downgradient of 5b, has consistently reported Cl</li></ul>	
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			<p>levels up to four times higher than those reported at 5b yet the Cl levels reported approximately 100m further east of 7d at monitoring well SNP 0053-7a (7a) are only in the range of 20 &amp;ndash; 30 mg/L.&amp;nbsp; Both monitoring wells 7d and 7a are located on the downgradient side of the bio-treatment area which has never been treated with dust suppressants and are both approximately the same distance from the Fort Smith Highway.&amp;nbsp; If the elevated Cl levels reported at 5b and 7d are supposedly influenced by the use of road salt on the highway then it would be expected that monitoring wells 7a &amp;ndash; 7d would be equally Cl impacted.&amp;nbsp; They are all located the same distance from and directly downgradient of the same potential anthropogenic source of Cl so intuitively, one would expect them to be equally impacted but they are definitely not.&lt;/li&gt; &lt;li&gt;There would have to be considerable quantities of salt being consistently poured on the highway to cause Cl concentrations at the monitoring wells 5b and 7d to be consistently reported in the 300 &amp;ndash; 600 mg/L and 1,000 &amp;ndash; 1,200 mg/L ranges (respectively) at all times of the year.&amp;nbsp; If that were the case, there should be a considerable amount of vegetation stress evident close to the highway and close to monitoring well 5b caused by salt impacted runoff from the highway.&amp;nbsp; A review of available aerial imagery of the Site indicates this is not the</p>	
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			<p>case. There is no visible evidence of any salt impacted vegetation proximal to the highway, monitoring well 5b or the bio-treatment pad.</p> <p>Monitoring well 7d is located along the downgradient side of the bio-treatment pad. Soil that is treated in that area is petroleum hydrocarbon (PHC) impacted, not salt impacted. If soils treated in that area were significantly salt impacted, they would be resistant to bio-remediation techniques because the salt would inhibit or prohibit the growth of PHC digesting biota in the soil. If the soils being treated aren't the source of elevated Cl reported in the groundwater at 7d and neither is the road salt used on the highway, then what is? And if soils treated in the bio-treatment pad were a potential source of elevated Cl's consistently detected at 7d then it would be expected that the other three 7 series wells would also be salt impacted.</p> <p>Based on the above, there is no evidence to suggest that the elevated Cl levels at monitoring wells 5b and 7d are related to any anthropogenic activities or sources such as road salting or the use of dust suppressants on the Site. The only plausible and possible explanation for the amount of nature of the salinity of the groundwater produced at those two wells is that it is naturally occurring. Beckingham has done a thorough review of the surficial geology of the Site and has concluded that saline</p>	
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			<p>groundwater at the Site most likely comes from lower lying glacial tills containing evaporite minerals ground up from the Devonian bedrock known to exist further east of the Hay River area and possibly also pyrite and fluoride bearing minerals transported from the Canadian Shield which exists slightly further to the east of where the evaporite rich Devonian bedrock is known to exist. Given that naturally occurring groundwater Cl levels of 500 - 1,200 mg/L are known to exist at the west end of the Site and that such Cl rich groundwater is constantly discharging into the Hay River, it does not make sense to consider a minor fluctuation of Cl levels from an average level of 64 mg/L to 180 mg/L at one downgradient sentinel well to be considered an area of potential environmental concern (APEC) for the Hay River or even for the Site. As discussed earlier, because Cl is recognized to be an indicator parameter for leachate plumes emanating from domestic landfills, it is recognized that the sudden albeit relatively small increase of Cl levels reported at sentinel well 5e may be an indication that a contaminant plume from the landfill has reached 5e but there has been almost no other evidence (e.g. elevated Nitrogen nutrient or PHC constituent levels at 5e) to corroborate that theory. Given the available data and circumstances, it is not possible to determine what has caused the sudden increase in Cl levels detected at sentinel well 5e in the Fall</p>	
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			of 2019 but it appears more likely to have been related to firefighting runoff pooling in the area proximal to 5e during the Spring of 2019 than anything else. As such, Beckingham stands by its recommendation to take no further action at sentinel well 5e other than to continue conducting routine groundwater monitoring activities and closely monitor what happens with groundwater Cl levels at that well in order to determine if any further actions are necessary.	
4 0	Section 4.4.8 Dioxins and Furans, pg. 23 2nd paragraph.	<b>Comment</b> The last two sentences in this paragraph are contradictory. The first of the two sentences says that smoke may be a source of the dioxins detected in SNP0053-5e and perhaps SNP0053-5d, while the next sentence states that the consultant cannot offer explanation why these parameters were reported in SNP0053-5d and -5e but not -5c. <b>Recommendation</b> Please revise this paragraph to clarify the statement about dioxins and furans.	<b>Apr 15:</b> The two sentences in the referenced paragraph are not contradictory.  The first sentence refers to the reason for the presence of dioxins in wells 5e and 5d.  The second sentence refers to the lack of an explanation regarding the lack of presence of dioxins in well 5c.  Since the two statements make sense and do not contradict each other, they will not be changed.	
4 1	Section 5.1.1 At the Landfill Site, Recommendation, pgs. 24 to 25	<b>Comment</b> It is stated "If these parameters exceed guidelines, the landfill is continuing to release contaminants to the river and groundwater". As stated in the MVLWB comment ID-38, the direct application of the surface water guidelines should be limited because of the nature of the landfill area. Therefore, additional information regarding the range of concentrations over	<b>Apr 15:</b> Should this information be used in future reports, the Town will update the text.  However, no revisions are planned to the report.  The Town will develop an environmental management plan which can include an assessment of whether the contaminant loading will affect the concentrations seen in the groundwater, including possible contingencies for the	





	Recommendation, pg. 28			
4 6	General Comment: References	<p><b>Comment</b> Board staff note that the Alberta Surface Water Quality Guidelines are cited two different ways: (1) "AEP (Alberta Environment and Parks).2019. "Alberta Soil and Groundwater Remediation Guidelines", Land Policy Branch, AEP, Edmonton, Alberta, Canada, January 10, 2019, ISBN 978-7-4601-2695-0" in the report from Beckingham, and (2) "GOA (Government of Alberta). 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta." in the memorandum from Intrinsic (Appendix B). Board staff also note a discrepancy between the information cited in Section 2.6 (i.e., AEP, 2018) vs the reference listed in Section 9.0 (i.e., listed as AEP, 2019). It is also unclear why the ISBN number in the full citation provided in Section 9.0 is highlighted yellow.</p> <p><b>Recommendation</b> Please verify which citation for the Alberta Surface Water Quality Guidelines is correct and update relevant sections in the next version. At a minimum, please verify dates for the same reference are consistent within the main report.</p>	<p><b>Apr 15:</b> The Town would like to note that the "Alberta Soil and Groundwater Remediation Guidelines" are as separate guideline document from the "Environmental Quality Guidelines for Alberta Surface Waters". The first is the guideline relating to soil and groundwater and the second is in relation to surface waters. Should this information be used in future reports, the Town will update the text to provide more clarity. However, no revisions are planned to the report.</p>	

