



November 27, 2009

Lynn Carter
Regulatory Officer
Mackenzie Valley Land and Water Board
7th Floor – 4910 50th Avenue
P.O. Box 2130
Yellowknife, NT
X1A 2P6

Dear Ms. Carter,

**Re: City of Yellowknife
Water Licence Renewal
MV2009L3-0007
Submission of Written Intervention**

The Department of Environment and Natural Resources (ENR) has reviewed the above noted project based on its mandated responsibilities under the *Environmental Protection Act*, the *Forest Management Act*, the *Forest Protection Act* and the *Wildlife Act* and provides the following written intervention and recommendations for consideration by the Board.

Should you have any questions or concerns with regards to ENR's comments and recommendations, please do not hesitate to contact me at (867) 920-6591 or patrick.clancy@gov.nt.ca.

Sincerely,

Patrick Clancy
Environmental Assessment Analyst
Environmental Assessment and Monitoring
Department of Environment and Natural Resources

ENR staff met with City of Yellowknife staff on Nov 24, 2009 to discuss ENR's Letter of Comment and Recommendations dated Sept 30, 2009 and the City's response to the Mackenzie Valley Land and Water Board (MVLWB). The purpose of the meeting was to elaborate on the intent of ENR's recommendations, and to reach an agreement on a consolidated list of the recommendations to the MVLWB. ENR and the City of Yellowknife have agreed to the following recommendations and the City committed to their implementation. ENR submits the following recommendations to the MVLWB for its inclusion in the Terms and Conditions of the Water Licence.

1. Leachate Modelling and Monitoring

ENR has outstanding concerns regarding adverse environmental impacts stemming from leachate originating from the current Solid Waste Disposal Facility (SWDF). Our concerns stem from the following points:

- Incomplete geotechnical and hydrologic information;
- A lack of subsurface leachate monitoring;
- Reservations stemming from whether the current SNP stations are representative of surface runoff from the site; and
- Recommendations within the geophysical survey conducted by Dillon Consulting Ltd. for the Drainage Study¹ indicating further study is required on subsurface seepage patterns, bedrock integrity, and leachate characteristics.

There are a number of forces that affect the migration of contaminants from a landfill. These forces are physical (filtration, sorption, advection, and dispersion), chemical (oxidation-reduction, precipitation-dissolution, adsorption-desorption, hydrolysis, and ion exchange), and biological (microbial degradation). The extent of these reactions depends on the materials underlying the landfill, the hydraulics of the groundwater system, and the chemistry of the leachate². As such, it is important to study these facets of the YK landfill site; including the terrain and subsurface, the water balance, and the characterization of the leachate.

a) ENR recommends and the City of Yellowknife has committed to the following:

That subsurface water/leachate seepage patterns, preliminary leachate characterisation, and integrity of the bedrock (fracturing) be investigated further as recommended in the Drainage Study by Dillon Consulting Ltd. Specifically, ENR recommends that subsurface water infiltration and outflow patterns from the SWDF should be determined. The specific purpose of the Study is as follows:

- i. Determine subsurface topography at the SWDF;
- ii. Enable future modeling of the bedrock "bowl" in which the SWF is located;

¹ City of Yellowknife Solid Waste Facility – Drainage Study", December 2006

² Landfills: Impact on Groundwater – Water Encyclopedia, Science and issues ,
<http://www.waterencyclopedia.com/La-Mi/Landfills-Impact-on-Groundwater.html>

- iii. Characterize the bedrock integrity and identify permeability or fracturing;
- iv. Determine a water inflow and outflow budget;
- v. Determine applicability of existing SNP stations, and recommend new stations if the study determines existing stations are not adequately placed to monitor quality and quantity of all surface water out points; and
- vi. Establish a general understanding of the composition of leachate across the YK landfill.

Establishing the general composition of leachate across the YK landfill is an important component in the overall study of water and contaminant movement onsite. Typical parameters of concern in municipal landfill leachate are generally established and include a host of specific measures and expected ranges of concentrations. However, it is understood that the uncertainty of historical practices at the subject site may broaden the extent of contaminants produced in the leaching process and present in the leachate. As such, a broad spectrum of analyses should be conducted on leachate samples collected from the YK landfill to ensure that the parameters of concern at this site are established (please see Appendix 1 for a list of typical parameters associated with municipal landfill leachate). This will assist in refining the indicator parameters used in a sampling program for future surface and groundwater monitoring plans, receptor monitoring, and ultimately, assist in the risk assessment of the landfill in terms of migrating contaminants. In the absence of known leachate composition, future sampling programs may not be representative or cost effective from a site monitoring perspective. The specific number and locations of leachate samples to be collected from the landfill, as well as the analytical parameters of focus, can be established by technical experts at a future date.

ENR recommends and the City commits to undertake these additional studies and submit a final report to the MVWLB by the fall of 2011.

b) ENR recommends and the City commit to developing a Water and Leachate Modelling and Monitoring Plan (the Plan) for the SWDF. The Plan shall be developed using information obtained from studies as described in 1.a). The Plan should include but not be limited to:

- A conceptual model of leachate generation from the SWDF. The model should include leachate volume and characteristics (Please Reference Recommendation 1. a) and Appendix 1). This includes pinpointing and installing devices necessary to monitor key locations (SNP stations and monitoring wells respectively) of surface and subsurface water infiltration and exit points from the SWDF.
- A validation of the conceptual model of subsurface water outflow using data from the SNP stations and monitoring wells. (This is important as conceptual leachate models do not always effectively reproduce observed patterns of landfill leachate production.)
- Plans for Reporting.

ENR recommends and the City commit to submitting the Plan to the MVLWB and technical experts for review and approval prior to implementation.

2. Abandonment and Closure

In its letter of comment dated Sept 30, 2009, ENR recommended the following:

“ENR recommends that a Closure and Reclamation Plan for the existing Solid Waste Facility should be developed and submitted for review and approval as soon as possible. The current timeframe of 6 months prior to facility abandonment is insufficient to provide the appropriate technical review prior to implementation. This plan should address current outstanding items, including but not limited to:

- Leachate monitoring (refer to 1.0) and reporting
- A landfill gas assessment.”

At the ENR/YK meeting, City staff informed ENR staff that a landfill gas assessment had been performed and a report submitted to the MVLWB in 2007. However, the landfill gas assessment was not included in the City of YK Water Licence Application package.

ENR has not had opportunity to review this report with the current Water Licence application. ENR reserves the right to comment on this assessment, in the context of its applicability to the management of the SWDS, at a future date.

At the Nov 24 meeting, ENR and the City agreed to the following rewording of the ENR recommendation:

Final Recommendation

ENR recommends and the City commits that an Abandonment and Closure Plan (A&C) for the Solid Waste Facility include the following components:

- Leachate Modelling and Monitoring Plan (Recommendation 1.b)
- Landfill Gas Monitoring Plan
- Annual reporting of the findings of the Landfill Gas Monitoring Plan and Leachate Modelling and Monitoring Plan

3. Management Plans

ENR noted in the letter of comment of Sept 30, 2009, that various Plans contained dated or missing information.

Final Recommendation:

ENR met with the City on Nov 24, 2009 where the City committed to updating all Management Plans by Feb 2010 and to submit these Plans to the MVLWB. Additionally, the City agreed to annually assess the Management Plans, update accordingly, and submit any updated plans to the MVLWB.

Further, the City committed to updating the Operations and Maintenance Manual by Feb 2010 to include and address Bear Fence Maintenance and operations.

4. Hazardous Waste

ENR, in its comment letter dated September 10 2009, recommends that the Proponent develop a site specific hazardous waste management plan that identifies hazardous materials accepted at the SWF and their management.

Final Recommendation:

The City has accepted this recommendation and committed to developing and submitting a final site specific Hazardous Waste Management Plan from 12 months of issuance of the WL, and the use of the ENR document Developing a Community Hazardous Waste Management Plan, and to develop the Plan in consultation with ENR throughout the time period.

5. Adaptive Management

ENR recognizes the Proponent submits Annual Reports to the MVLWB that include the quantities of all waste accepted and generated.

Final Recommendation

ENR recommends and the City commits that these reports also provide a comparison of this annual data to the projected lifespan of the SWDF and as such, ENR recommends and the City commits to modify/update future projections and operations and maintenance requirements accordingly.

Appendix 1

Typical parameters of concern in municipal landfill leachate are generally established and include a host of specific measures and expected ranges of concentrations, as presented in the following table. However, it is understood that the uncertainty of historical practices at the Yellowknife landfill may broaden the extent of contaminants produced in the leaching process. As such, a broader spectrum of analyses, in addition to those presented below, should be conducted on leachate samples collected from the YK landfill to ensure that the parameters of concern at this site are established.

Parameter	Typical Range (mg/L)	Upper Limit (mg/L)
Total Alkalinity (as CaCO ₃)	730–15,050	20,850
Calcium	240–2,330	4,080
Chloride	47–2,400	11,375
Magnesium	4–780	1,400
Sodium	85–3,800	7,700
Sulfate	20–730	1,826
Specific Conductance	2,000–8,000 µmhos/cm	9,000 µmhos/cm
Total Dissolved Solids	1,000–20,000	55,000
Chemical Oxygen Demand	100–51,000	99,000
Biological Oxygen Demand	1,000–30,300	195,000
Iron	0.1–1,700	5,500
Total Nitrogen	2.6–945	1,416
Potassium	28–1,700	3,770
Chromium	0.5–1.0	5.6
Manganese	Not detected – 400	1,400
Copper	0.1–9.0	9.9
Lead	Not detected – 1.0	14.2
Nickel	0.1–1.0	7.5

SOURCE : Based on Canter et al. (1988), McGinley and Kmet (1984), and Lee and Jones (1991)

Rob Dobson

From: Lynn Carter - MVLWB [lcarter@mvlwb.com]
Sent: Monday, November 30, 2009 3:40 PM
To: 'Rob Dobson'
Subject: FW: City of YK Written Intervention MV2009L3-0007
Attachments: 11-27-09 - ENR Letter to Board - City of Yellowknife - MV2009L3-0007 - Submission of Written Intervention.docx

From: Patrick Clancy [mailto:Patrick_Clancy@gov.nt.ca]
Sent: Friday, November 27, 2009 4:54 PM
To: Lynn Carter - MVLWB
Cc: walexander@yellowknife.ca; cgreencorn@yellowknife.ca; dkefaldas@yellowknife.ca; Todd Paget; Ken Hall
Subject: City of YK Written Intervention MV2009L3-0007

Hello,

Please disregard the previously sent intervention document as a mistake was detected and a new version is attached as the official intervention document.

Again, please find attached ENR's written intervention on the subject application. As contained in the intervention document the City of Yellowknife has committed to all ENR recommendations. For the Board's records, it is ENR's understanding that the City of Yellowknife staff will respond to this email to the MVLWB to confirm these commitments.

Thank you,

Patrick Clancy
Environmental Regulatory Analyst
Environmental Assessment and Monitoring
Environment and Natural Resources
GNWT
Work: (867) 920-6591
Fax: (867) 873-4021