



November 16, 2015

Reference No. 088605-10

Mr. Matthew Keliher MBA, MPS, CHRP, CMA
Manager
Solid Waste Resources
Transportation & Public Works
Halifax Regional Municipality

Via Email: keliherm@halifax.ca

Dear Mr. Keliher:

**Re: Peer Review Summary and Response to Concerns from the Halifax Waste Resource Society - Vertical Expansion of the Residual Disposal Facility, Otter Lake Facility
600 Otter Lake Drive, Halifax, Nova Scotia**

1. Introduction

Mirror Nova Scotia (Mirror NS) was retained by Halifax Regional Municipality (Halifax) to complete technical studies and design plans (Plans) in support of an application to amend the Approval to Operate (No. 2008-065580-A01) to permit vertical expansion of the Residual Disposal Facility (RDF) located at the Otter Lake Facility in Halifax, Nova Scotia.

GHD Limited (GHD) was retained by Halifax to complete a peer review of the Plans completed by Mirror NS to ensure that vertical expansion of the RDF could be implemented while maintaining or improving the current level of environmental protection; and that the supporting information examined all major aspects of landfill design and operations necessary to successfully amend the Site's Approval to Operate by Nova Scotia Environment (NSE).

Overall GHD is of opinion that the Plans submitted by Mirror NS are comprehensive, technically sound, and demonstrate that vertical expansion can be implemented while maintaining the current level of environmental protection and in some instances the implementation of the proposed plans will improve the level of environmental protection (e.g., improved landfill gas management approach). The Plans do not identify any technical reason why vertical expansion cannot be implemented.

This letter provides a summary of the Plans completed in support of vertical expansion and demonstrates how the Plans have considered the specific concerns raised by the Halifax Waste Resources Society (HWRS) with regards to vertical expansion of the RDF.

2. Technical Studies and Design Plans

The Plans were generally prepared by Dillon Consulting (Dillon) (or sub-consultants) on behalf of Mirror NS in support of an application to amend the Approval to Operate to permit vertical expansion of the RDF (Cells 1 to 6). The following Plans were completed and peer reviewed by GHD:

- Daily Cover Material Options Analysis (Dillon, dated October 15, 2015)
- Geotechnical Investigation Report (Conquest Engineering, dated October 22, 2015)
- Leachate Collection System Assessment (Dillon, dated October 28, 2015)
- Cell Design and Sequencing Plan (Dillon, dated October 15, 2015)
- Landfill Gas (LFG) Management Plan (SCS Engineers, dated November 9, 2015)
- Stormwater Management and Erosion and Sedimentation Control Plan (Dillon, dated October 29, 2015)
- Updated Operations Plan for Residual Disposal Facility (RDF) (Dillon, dated September 2015).

3. Halifax Waste Resource Society Comments and Responses

The following specific concerns were raised by the HWRS in correspondence to Halifax dated December 3, 2014. The following summarizes the concerns raised and outlines how the concerns were addressed through the completion of the Plans.

1. Landfill Cell Development Scope and Sequencing:

- a. What is the most satisfactory height increase and based on what rationale (e.g., is it 15 m versus 10 m, 20 m or some other value?)
- b. Based on the selected height increase, confirmation of the required fill/long term construction sequence that best deals with vehicle access for waste placement, the original cover and gas collection system, and final cap installation. This evaluation must include selection of a preferred start point (ex., Cell 1 or Cell 6) of the vertical expansion effort.
- c. Forecast of a revised closing date and overall fill capacity of the RDF.

Response:

The height of the RDF has been proposed to be increased by 15 m. The basis for the 15 m height increase is based on there being no significant area view plane concerns (see balloon study completed by SNC Lavalin, 2013) and based on landfill design consideration (e.g., slope stability, surface water management).

As shown in the Cell Design and Sequencing Plan, vertical expansion has been designed in 5 areas above Cells 1-6 to accommodate approximately 1,497,450 MT of waste; for a site life of approximately 15 years based on 100,000 MT of annual incoming wastes to the Otter Lake Facility. Site life calculations have not been developed for the future development of Cells 7-9. Vertical expansion will commence over Cells 1 and 2 followed by Cells 3, 4, 5, and 6. This sequencing results in new waste

being placed over waste that is well consolidated and that has substantially less potential for LFG generation and associated odours.

2. Landfill Stability:

- a. Confirmation that establishing new disposal areas on top of previously completed portions of the landfill will not create issues related to potential sinking of the present ground level of the closed cells and/or side slope failure.

Response:

The Geotechnical Investigation Report demonstrated that the slope stability for the vertically expanded waste mound achieved an acceptable factor of safety; and that settlement in native foundation soils due to increased loads from vertical expansion will be negligible.

3. Area View Plane:

- a. With reference to Dillon's September 2012 conclusion that the top of Cell 5 was visible to area residents, completion of a view plane study to determine the visibility of the RDF during/following vertical expansion including consideration of ongoing/planned area developments.

Response:

A visual assessment was completed by SNC Lavalin in 2013 demonstrating that it is unlikely that the proposed vertical expansion will cause a visual impact to the local communities. In the event of any visual concerns, practical options exist to mitigate visual impacts such as the installation of planting beds or visual screening berms on the top of the landfill or the side slopes to break-up the skyline view in select areas.

Further visual assessment work was not completed with the preparation of the Plans.

4. Odour Management:

- a. Confirmation of potential odour impacts and approaches for lessening the potential impact of:
a) the removal of the cap system from previously completed cells, and b)
excavation/inspection and potential upgrade of the original leachate collection system.
- b. Identification of a preferred daily/interim cover material to enhance the control of landfill gas and odours.
- c. The evaluation of potential odour impacts associated with vertical expansion must acknowledge stipulation included in Section 10 (Air Emissions) of site's Approval to Operate.

Response:

Odours will be controlled through the minimization of the active areas/face, placement of daily and interim cover soils, and active LFG collection. As noted in response to Comment 1 above, vertical expansion is planned to commence over Cells 1 and 2 where LFG generation has declined substantially compared to recently filled cells. As part of vertical expansion, horizontal collectors in

addition to vertical wells are proposed to recover LFG as documented in the LFG Management Plan. The horizontal collectors will be installed in the existing waste shortly following cap removal and before new waste is placed to facilitate the early capture of LFG and minimize the potential for odours.

A revised Odour Control Procedure has been included in the Operations Plan for RDF (see Section 10.4) and LFG Management Plan (see Appendix C) which includes odour management procedures during final cover removal operations.

The Daily Cover Material Options Analysis deemed that the use of Construction and Demolition (C&D) matrix (Scenario 2a) or soil (Scenario 3a) as daily cover to be suitable along with the placement of interim cover soil for areas that will remain inactive for 6 months or more.

As part of the Leachate Collection System Assessment, the existing leachate collection system was determined to be in good condition and will facilitate leachate collection under vertical expansion. Minor upgrades to the conveyance system from the landfill to the leachate holding tank will be required, however, this will not result in landfill related odour impacts.

5. Landfill Gas Management:

- a. Evaluation of landfill gas management needs for the new vertical expansion areas including connecting existing site systems and the potential requirements for new collection and flaring infrastructure.
- b. Evaluation of potential impacts to surface/sub-surface gas system infrastructure in the close cells, including buried collection piping.

Response:

Please see response to #4.

As part of the LFG Management Plan (see Appendix B), the LFG recovery potential during vertical expansions was estimated to be between approximately 920 and 1,100 scfm at 50 percent methane (i.e., maximum forecasted LFG generation). Current flaring capacity at the site can accommodate approximately 2,950 scfm of LFG and is therefore adequate.

As shown in the LFG Management Plan (see Section 3.4 and Drawings in Appendix D), the LFG header system will be extended around the entire perimeter of the RDF creating a continuous perimeter header loop. This perimeter header loop will enable connection of LFG horizontal collectors and vertical wells on all sides of the RDF, while allowing optimal piping grades, optimized distribution of LFG flows through the header system, and system redundancy.

Buried LFG system components that will be not used as part of the vertical expansion will be progressively decommissioned (e.g., vertical wells decommissioned, buried collection piping cut and capped). This is shown on the Drawings in Appendix D of the LFG Management Plan.

6. Leachate Management:

- a. Confirmation that leachate from the new vertical expansion areas will move down through the closed disposal cells and to the original collection system without flow barriers (including soil cover in Cell 1); blockages ; or exceedance of the 300 mm head limit on the RDF liner system.
- b. Inspection of original cell leachate collection sumps to assess their capability to manage increased quantities of leachate from the new vertical expansion areas. Due to biofouling (i.e., material deposits) and design improvements carried out over the years, it is anticipated that some sumps and pumping systems will require excavation and replacement.
- c. Inspection and possible upgrading of the leachate transmission piping outside of the cells to assess the capability to manage increased quantities of leachate.

Response:

The following were key findings of the Leachate Collection System Assessment:

- The leachate collection and conveyance infrastructure can accommodate quantities of leachate associated with the development of the proposed vertical expansion area.
- There are no concerns associated with the vertical passage of leachate to the leachate collection system during the development of the vertical expansion area.
- No significant concerns in the leachate collection and conveyance infrastructure were identified based on video inspection results.
- Sumps in Cell 1 and Cell 3 were not observed to be clogged due to biofouling based on test pit results.
- Forcemain F1 (between Cell 1 sump and leachate holding tank, i.e., outside of landfill footprint) has been reported to be blocked by Mirror personnel (the location of the blockage was beyond the extent of the video inspection) and has been recommended to be replaced and increased in size from 100 mm to 150 mm to accommodate a larger pump.
- New dedicated pumps have been recommended for sumps in Cell 1 and Cell 3.

7. Surface Water Management:

- a. Determining drainage features (including terracing) necessary to accommodate runoff volumes and velocities down extended landfill site slopes.
- b. Confirmation of upgrade requirements to surface water management infrastructure (e.g., ditching, culverts and ponds) to manage runoff from new vertical expansion areas.

Response:

As per the Stormwater Management and Erosion and Sedimentation Control Plan, the existing conveyance system (ditches, culverts, etc.) is expected to provide adequate conveyance capacity for vertical expansion. Runoff velocities from vertically expanded side slopes were evaluated and determined to be acceptable based on vegetated side slopes or erosion protection for bare side

slopes (e.g., erosion control blankets and/or coir mats). The need for terracing or side slope interceptor swales is not needed.

Under vertical expansion conditions, upgrades to the North Pond will be required to retain the 25-year, 24-hour rainfall event. Upgrade options include increasing the storage pond capacity, creating in-line ditch storage capacity, diversion of flows to the South Pond, or increasing treatment capacity. The South Pond has the capacity to store the 25-year, 24-hour rainfall event.

8. Litter Management:

- a. Assessment of the adequacy of existing litter management procedures due to the increased elevation/exposure of the working disposal face.

Response:

Under vertical expansion, wind-blown litter will continue to be managed by maintaining control of the active face of the landfill by utilizing fixed and portable litter fencing, and by utilizing personnel to pick litter as outlined in the Operations Plan for RDF (see Section 5.1).

Sincerely,

GHD


Andrew Philopoulos, P.Eng., M.Sc.


Christine Skirth, C.E.T., PMP

AP/mb/10