



MIRROR Nova Scotia
Reflecting Community Partnership

MUNICIPAL INTEGRATED RESOURCE
RECOVERY OPPORTUNITY REALIZATION

April 9, 2015

Mr. Matthew Kellher
Manager, Solid Waste Resources
Halifax Regional Municipality
P.O. Box 1749
Halifax, NS B3J 9A5

Dear Matt:

Re: Work Plan for Vertical Expansion of Landfill Cells

MIRROR Nova Scotia
600 Otter Lake Drive
P.O. Box 209
Lakeside, Nova Scotia
B3T 1M6

Tel: (902) 453-3490

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We are in receipt of your letter, dated March 13, 2015, wherein you requested that Mirror provide a lump sum proposal to complete a work plan regarding the vertical expansion of the Residual Disposal Facility within the scope specified within the Conestoga-Rovers & Associates' ("CRA") work plan, also dated March 13, 2015.

Please find attached the proposal developed by Dillon Consulting for your review and approval. Please note that the forecasted end date has been pushed out since the last schedule presented to you as a result of the later start date than previously proposed. However, it is still forecasted that the permit application can be presented to Nova Scotia Environment at the end of September 2015. We would be pleased to discuss the proposal at your convenience.

As an aside, I note that your letter asks that Mirror provide its proposal pursuant to Section 16.3 of the Operating Agreement (the "Agreement"), which pertains to Capital Improvements. Although there may be capital related aspects of the plan in the future, the proposed Vertical Expansion should not be characterized as "Capital" in our view, as it is essentially an "Operational" project. In any case, this difference of interpretation should not affect the initiation of the work plan.

Yours Sincerely,



J.D. Mann
Contract Administrator

April 8, 2015



MIRROR NOVA SCOTIA INC.
600 Otter Lake Road
Lakeside, Nova Scotia
B3T 1M6

ATTENTION: Joe Mann
Contract Administrator

***Otter Lake Solid Waste Management Facility – RDF – Revised Engineering Services
for the Proposed Vertical Expansion of Cells 1 to 6***

Further to our previous meetings with MIRROR NS, HRM and Conestoga Rovers & Associates (CRA) during December 2014 and January 2015, our proposal to provide engineering services for the proposed vertical expansion of Cells 1-6, dated February 10, 2015, and our response to CRA's questions relating to that proposal, we are pleased to respond to the scope of work presented by CRA in their letter dated March 13, 2015 by offering the following revised work plan and budget regarding the provision of engineering services that will support HRM's stated objective to achieve an amended permit from Nova Scotia Environment.

Contractor Data Requirements

Mirror NS has agreed to provide the data and opinions necessary for Dillon to perform the tasks outlined in the CRA scope of work.

Task 1 - Project Management

We have included an allowance for day to day management of the overall assignment, review of data collected by MIRROR, five meetings with HRM and CRA representatives, two project update meetings with NSE staff and a peer review by SCS Engineers.

Task 2 - Daily Cover Material Options Analysis

Based on discussions with MIRROR NS, HRM and CRA, the preparation of a cost-benefit evaluation of the change from a shredded construction and demolition material daily cover to a soil based daily cover or a combination of the two materials is to be assessed, based on the evaluation of the following three scenarios:

- Scenario 1
 - Use of the alternative cover material as daily cover up to a maximum lift of 150 mm, including the assessment of the potential cost implications associated with the temporary landfill gas collection system.

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- Scenario 2
 - Use of the alternative cover material as daily cover up to a maximum lift of 150 mm with 150 mm of soil cover used when a lift of residual material reached final design elevation. Two sub scenarios are to be addressed:
 - Soil cover material from an on-site borrow source.
 - Soil cover material from an off-site borrow source located within 100 km of the RDF.
 - To include the assessment of the potential cost implications associated with the temporary landfill gas collection system and the use of soil cover material.
- Scenario 3
 - Use of 150 mm of soil cover for daily cover. Two sub-scenarios are to be addressed:
 - Soil cover material from an on-site borrow source.
 - Soil cover material from an off-site borrow source located within 100 km of the RDF.
 - To include the assessment of the potential cost implications associated with the temporary landfill gas collection system and the use of soil cover material.

Output:

- A mass balance of daily cover requirements.
- Opinion of RDF airspace usage for alternative or soil based cover.
- Cost implications relating to the temporary landfill gas collection system and soil usage.
- Preparation of a Draft Daily Cover Material Options Analysis Report.
- Preparation of the Final Daily Cover Material Options Analysis Report.

Task 3 - Geotechnical Assessment

We propose to utilize Conquest Engineering Ltd. to perform the tasks associated with the geotechnical investigation.

Geotechnical Investigation

Two boreholes would be advanced within Cell 1 and two within Cell 3 near the toe to assess the status of the leachate collection system. Four boreholes will be advanced in Cell 4 to assess the settlement. Six will be advanced within the remaining cells for waste classification/characterization. The proposed methodology for the geotechnical investigation is as follows:

- Review local and regional background information, including available terrain and geological mapping for the site.

- The boreholes will be drilled to an average depth of 15 metres while remaining a minimum of 3 metres above the top of the collection stone in the liner system. The actual locations and depths required will be discussed prior to the work. The boreholes will be located in the field using GPS mapping units. Elevations of the borehole surface will be compared with known liner base elevations prior to drilling to keep boreholes depths a minimum of 3 metres above top of the collection stone in the liner system.
- Oversized Standard Penetration Testing (SPTs) and Shelby tube sampling will be conducted in all boreholes. The field investigation will be conducted in accordance with ASTM/CSA standards and standard geotechnical practice. Laboratory testing will be conducted to characterize the existing waste material and will be completed as per ASTM/CSA standards.
- The age of the waste and characteristics of materials placed in the RDF (including shredded and stabilized waste and shredded C&D matrix daily cover) will be confirmed with MIRROR NS.

Slope Stability Assessment and Settlement Review

A slope stability assessment will be undertaken for the proposed vertical expansion slopes using the SLOPE/W (GEO-SLOPE International) computer program. The material parameters used in the slope stability analysis will be chosen based on the borehole investigation, local knowledge and experience. The slope stability assessment will evaluate the final RDF slopes as well as the stability of Cell 4. Recommendations for slope stability improvements and rehabilitation will be provided as required. This will include verification that the native subgrade is able to support new loading for the expanded height landfill.

We will also review the existing settlement data for Cell 4 along with the data collected from the field investigation in this area. Evaluation and recommendations regarding the consolidation and settlement of the new and existing residual material, the foundations of Cells 1 to 6, and the impacts to structures and pipe cover will also be provided.

Although not included in the work, instrumentation such as slope inclinometers could be considered for monitoring lateral slope movements adjacent landfill cells during the placement of the vertical expansion, or settlement plates for monitoring settlement. We will add comments on these items in our report.

Output:

The Geotechnical Assessment report effort will include:

- Regional surface and bedrock geology.
- Information on existing conditions, including access, constraints to construction, and former land use.

- Field observations.
- Description of the investigation program including borehole records and location plan.
- Detailed soil and/or bedrock conditions and profile.
- Observed water table elevation and groundwater conditions.
- Description of field test results.
- Laboratory and field test results.
- Settlement assessment (including review of larger settlements in Cell 4).
- Slope stability assessment for the vertical expansion (including consideration of settlement in Cell 4).
- Geotechnical recommendations for potential work, including slopes, dewatering, fill placement and settlement.
- Preparation of a Draft Geotechnical Assessment Report.
- Preparation of the Final Geotechnical Assessment Report.

Task 5 - Leachate Collection System Assessment

Investigation

During the Task 3 field work, boreholes will be placed in the vicinity of the sumps (one in Cell 1 and one in Cell 3) with water levels taken over a three week period. Additionally, the video inspection (to be completed by MIRROR NS) results from the sump piping and the leachate collection piping near the sump and the forcemains from Cells 1 and 3 will be reviewed for existing conditions and potential performance issues.

The pumping systems in Cells 1 and 3 will also be reviewed.

Previously, forecasted leachate generation rates will be compared to actual generation rates for the period subsequent to the closure of Cells 1 and 3.

Output:

- Recommendations for potential future study or field work.
- Preparation of a Draft Leachate Collection System Assessment Report.
- Preparation of the Final Leachate Collection System Assessment Report.

Task 5 - Cell Design and Sequencing Plan

To allow for planning of cover removal, placement of residual material in lifts, daily and intermediate cover requirements, modification of the permanent and temporary landfill gas collection system, management of surface runoff and installation of a new final cap, the sequential placement of residual material will be determined. To achieve this, the

removal of the cover will be paced to support the annual placement of 100,000 tonnes as per HRM's forecast and deal with operational constraints while minimizing the area of cover removed at any one time in order to minimize the production of leachate and fugitive odour emissions.

Output:

- The deliverables from the exercise will be conceptual drawings cover removal, infrastructure requirements and new cover installation.
- Fill Plan.
- Site Life Estimates for the vertical expansion above Cells 1-6.
- Projected Costs.

Task 6 – Landfill Gas Management Plan

Background Review

Available information relating to the vertical expansion will be reviewed, including:

- Proposed vertical expansion construction and projected filling plans.
- Up-to-date as-built drawing of the landfill, including recent topography and LFG collection system (e.g., piping locations and sizes, well locations).
- RDF waste filling history for 2010-2014.
- RDF waste filling projections through to the year of anticipated closure of the vertical expansion of Cells 1-6.
- LFG gas generation reports, including recent (last three months) LFG system data for the existing LFG collection system).
- Well sounding data (i.e., depth to water and depth to bottom) for vertical LFG extraction wells over the past year, along with well installation records indicating depth to perforated portion of well.
- LFG operation reports for the blower/flare stations, including totalized flow and methane concentration data on a monthly basis since 2014.
- Odour control procedures in the existing Operation Plan.

LFG Recovery Assessment

The estimation of future LFG recovery rates will be based on current and historical LFG recovery rates and industry standard methods for performing LFG projections. The assessment will include preparation of LFG recovery projections using the USEPA LandGEM model, based on provided waste input data, current and historical LFG flow rates and SCS's experience with LFG modeling. A discussion regarding the potential

impacts on LFG recovery of continued filling of stabilized waste and processed C&D material in the RDF will also be included.

LFG Collection and Flaring Assessment

The assessment will summarize and evaluate the performance of existing permanent and temporary LFG collection and blower/flare systems. A site visit to the RDF will involve observation of the LFG collection and blower/flare systems and performing limited monitoring.

LFG Management Plan

The Management Plan will detail the means by which LFG can be managed in the short term, as well as during the vertical expansion of the RDF. This plan will include the following elements:

- Summary of Recovery Assessment and the Flaring Assessment.
- Conceptual design for the LFG collection system, including recommended changes to existing system in the short term and necessary changes to existing system as vertical expansion of RDF progresses and phased development of the LFG collection system.
- Proposed LFG collection system design, including discussion regarding LFG piping sizing and alignment, blower/flare system sizing, condensate management, future compatibility of the existing LFG collection system with the vertical expansion of the RDF and the need to continually manage LFG to prevent off-site migration and odours.
- Drawings are expected to include the following: - Existing Conditions Plan - LFG Collection System Changes (i.e., pre-vertical expansion) - Phased development of the LFG Collection System Expansions and Typical LFG Collection and Piping Details.
- Recommended changes in LFG system operation and maintenance (O&M) practices, including specific recommendations regarding the use of temporary LFG collection systems. The conceptual LFG collection system design will be prepared to be consistent with the vertical expansion cell design and sequencing plan, and will be sized to support future projected LFG recovery rates.
- A preliminary construction cost estimate for each phase of LFG collection system development.
- As per CRA's specified scope of work, an odour management model will not be developed.

Odour Control Procedures Revisions

The odour control procedures in the existing Operations Plan will be reviewed in accordance with Section 10 of the Approval to Operate (2008-065580-A01), to include the following:

- Odour inspection procedures including regular on- and off-site monitoring to ensure early detection of odour issues, using a field olfactometer.
- Contingency measures for odour management during normal operations and Landfill cover removal operations.
- Modification of operations including; utilization of cover soils - utilization of oxidizing misting agents, and installation of temporary LFG collection devices and piping.
- Preparation of proposed revisions to the odour control procedures for review and incorporation into Operating Plan.

Output:

- Preliminary design drawings.
- Cost implications relating to the temporary and permanent landfill gas collection system.
- Preparation of a Draft Landfill Gas Management Plan.
- Preparation of the Final Landfill Gas Management Plan.

Task 7 - Stormwater Management and Erosion and Sediment Control Plan

Hydrologic and hydraulic modelling will be completed to estimate the pre- and post-vertical expansion inflows to the North and South Sedimentation Ponds. It is proposed that the latest version of the Computational Hydraulics International (CHI) PCSWMM software be used for modelling of the Otter Lake stormwater management system. Modelling will consider the rainfall-runoff response within the stormwater management system watershed, including the routing of storm flows through the stormwater conveyance infrastructure and sedimentation ponds. The modelling will require a review of the existing size and configuration of the North and South Sedimentation Ponds to determine the existing stage-storage-discharge relationships for each pond.

Simulations will be completed for the both the North and South Sedimentation Pond watersheds for the 2, 10, 25, 50 and 100-year design rainfall events. The design storms will be derived from the intensity-duration-frequency relationships developed for the Environment Canada Halifax Weather Station (#8202251).

Modelling for historical rainfall events will also be completed as part of this assessment. Results from historical simulation will be compared with concurrent water level observations in the ponds, allowing for a high-level calibration of the pre-expansion hydrologic modelling scenario. The calibrated model parameters can then be applied to the post-expansion modelling scenario.

The hydrologic modelling described above will be completed to evaluate the possible impacts the proposed vertical expansion will have on the existing stormwater management system. Based on review of the model results, recommendations for potential stormwater management system upgrades will be provided, including:

- Preliminary design drawings.
- A review of potential constraints that may result from the proposed system upgrades.
- Development of temporary and permanent erosion and sedimentation control plans for the construction and operation phases of the project, respectively.

Both the temporary and permanent erosion and sediment control plans described above will be prepared in accordance with the Nova Scotia Environment Erosion and Sedimentation Control Handbook for Construction (NSE 1988).

Output:

- Preparation of a draft of the Stormwater Management and Temporary and Permanent Sediment and Erosion Control Plan.
- Preparation of the final Stormwater Management and Temporary and Permanent Sediment and Erosion Control Plan.
- Recommendations regarding associated expenditures.

Task 8 – Updated Design and Operations Plan

MIRROR will update the 2012 Operations Plan

Output:

- Prepare a Draft of the Design and Operations Plan
- Prepare the Final Design and Operations Plan.

Task 9 – Nova Scotia Environmental Consultation and Permit Application

Dillon will prepare the Application for Approval for the vertical expansion of Cell 1 to 6 for submission to Nova Scotia Environment (NSE) by HRM with associated fees being addressed by HRM. The task reports prepared as part of the overall work program along with supporting documents already prepared or to be prepared by others (i.e., property ownership, existing approvals) will be included in the draft application. We have included an allowance for three meetings with NSE and to provide responses to potential NSE comments, but have not included an allowance for the performance of any additional work or revisions to the outputs of this workplan.

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MIRROR NOVA SCOTIA INC.
April 8, 2015

Output:

- Prepare a Draft of the Application for Approval.
- Prepare the Final of the Application for Approval.

Schedule and Budget

With reference to Table No. 1, our proposed budget to conduct the overall work described in this letter, including identified field services is [REDACTED] (taxes extra). Chris Shortall, P.Eng. will serve as Project Manager for this assignment, with senior technical review being provided by Scott Kyle, P.Eng. As noted, SCS Engineers and Conquest Engineering Limited will serve as sub-consultants for this work.

If requested, work plans can be prepared for additional work.

Assuming receipt of direction to proceed by April 20, 2015 and assuming the timely review and approval of individual task deliverables by HRM, a draft version of the Application for Approval will be completed by September 28, 2015. A detailed schedule is provided in Figure No. 1.

Yours truly,

DILLON CONSULTING LIMITED



Christopher Shortall, P.Eng.
Project Manager

Scott Kyle, P.Eng.
Partner

CRS:jes
Attachments
Our File: 14-9875 1000