HALIFAX
REGIONAL MUNICIPALITY

P.O. Box 1749
Halifax, Nova Scotia
B3J 3A5 Canada

Item No. 12.2.1
Halifax Regional Council
February 5, 2013
In Camera

TO: Mayor Savage and Members of Halifax Regional Council

SUBMITTED BY: Original signed by
Richard Butts, Chief Administrative Officer

Original Signed by
Mike Labrecque, Deputy Chief Administrative Officer

DATE: January 6, 2013

SUBJECT: Solid Waste Strategy Review – Otter Lake Analysis

PRIVATE & CONFIDENTIAL

ORIGIN

- Transportation and Public Works FY 2012/13 Business Plan – Solid Waste Resources Priorities;
- Regional Council Report - Solid Waste Resource Management Strategy System Review - Project Budget Allocation, 10 July, 2012

LEGISLATIVE AUTHORITY

HRM Charter, Part III, Section 60, Power to make policies, Item (b)

RECOMMENDATION

It is recommended that Halifax Regional Council:

1. Release the Stantec Waste Resource Strategy Report, January 2013.
2. Direct staff to initiate public consultation on the Stantec Report options and recommendations beginning with the Community Monitoring Committee concerning recommendations A1 and A3 that:
   i. The Front End Processor (FEP) and Waste Stabilization Facility (WSF) be closed by the end of 2013; and
   ii. The life of the Otter Lake Landfill be extended through vertical expansion.
3. Direct staff to initiate consultation with the operator of the Otter Lake Landfill concerning recommendation A1 and A3 of the Stantec Report and report back to Council.

BACKGROUND

In 1996, Regional Council adopted, in principle, the Citizens Stakeholder Committee (CSC) vision for a new Integrated Solid Waste/Resource Management System (the "Strategy"). The Strategy evolved from a public process to develop a framework for the implementation of an environmentally and fiscally sustainable waste management system for the Region that would be "acceptable for the next 100 years..."[1] The CSC vision for processing the residual {garbage} waste stream was intended to divert materials from landfill and produce marketable compost and recover marketable recyclables. HRM's integrated waste management system also included two composting facilities and an upgrade of the municipality's Materials Recovery Facility (MRF).

The Strategy, as envisioned by the CSC, relied on education and communication to achieve behavioural change and enshrined source separation as the foundation of citizen diversion efforts. The CSC vision introduced green carts which would enable residents and businesses to separate organics from their waste and recyclable materials. These new streams, organics and recyclables, would be resource streams. Resource streams would be collected separately and processed at appropriate facilities other than the landfill. The introduction of the green cart and source separated organics collection was a revolutionary Halifax innovation which has changed the municipal waste stream and been replicated across North America (NA).

As part of CSC's vision for a 100-year solution and maximized diversion from landfill, the Strategy committed to process compostable organics or recyclable materials out of the residual waste stream that had not been properly separated at source. This was to divert valuable resources from landfill, significantly reducing what actually ended up in the landfill and the resulting financial burden landfill operations placed on the municipality. This pre-processing of materials before they were placed in the landfill (RDF) was the origin of the Front End Processor (FEP) and Waste Stabilization Facility (WSF). This concept evolved into what became a different operational model at the Otter Lake site. The consultant was unable to identify another site in NA utilizing an FEP/WSF processing operation as employed at Otter Lake.

The CSC established an ambitious Strategy goal in 1995 of 88% diversion from landfill within two years. Resident and private sector buy-in, participation through behavioural change and effective source separation were critical factors in achieving the 100 year solution. The environmental objective was to dramatically reduce waste delivered to the landfill and achieve significant reductions and long-term sustainability of landfill costs and site life.

The community and environmental impacts resulting from the Sackville Landfill were the catalyst for the resulting public process to identify a new model for HRM. A critical objective of the CSC Strategy was minimizing the negative impacts from gases, odours, leachate and vectors resulting from organic and putrescible materials decomposing in the landfill[2]. CSC envisioned

[1] An Integrated ~~Waste~~/Resource Management Strategy for Halifax County/Halifax/Dartmouth/Bedford, Prepared by The Community Stakeholder Committee (CSC) and Adopted in Principle, page 2, March 25, 1995.

[2] An Integrated ~~Waste~~/Resource Management Strategy, page ii, 1995 ł

Redacted – direct contract reference

that ultimately, in a mature system, source separation would result in organics being sent to compost processing plants. Source separation and green carts were the innovative keys to practically and sustainably minimizing organic materials in the landfill and the negative environmental impact of odorous Greenhouse gases they produce.

The CSC recognized that behavioral change for effective source separation, at home and at work places, would not happen overnight. The FEP/WSF model was intended to bridge the gap while behaviour changed. This new system would address the objective of minimizing the negative impacts from gases, odours, leachate and vectors. It was envisioned that the system would then be "scaled down in a planned manner as source separated centralized composting scaled up."[3]

The existing Otter Lake operating model evolved from the original CSC Strategy vision. Processing of materials to divert organic and recyclable materials from landfill was changed to processing of all materials prior to them being placed in the landfill. Analysis at the time suggested that no marketable compost could be produced through the waste stream. This is an important distinction. The original intent of the FEP/WSF was to increase diversion from landfill, justifying the additional system costs. The implemented operating model at Otter Lake maintained diversion as an objective but was more focused on the environmental and community objectives of minimizing the negative impacts from gases, odours, leachate and vectors. The intent was to create a dry landfill by processing everything through the FEP prior to the RDF.

Council approved the contract with MIRROR on July 15, 1997. The "Agreement For The Design, Construction And Operation Of Components Of The Halifax Regional Municipality's Solid Waste Facilities" dated July 25, 1997. Key considerations for the contract included:

- A 25 year operating contract with MIRROR, with operations to commence no later than January 1, 1999, and expiring December 31, 2024, or when the facility reached capacity, whichever came earlier;
- The contract included the design, construction and operation of the Otter Lake facilities as detailed in the agreement and operating plan;
- The site required a Provincial Operating Approval which currently includes the processing of materials through the Front End Processor (FEP) and Waste Stabilization Facility (WSF). However, there is no legislative requirement for the FEP or WSF and the operating approval can be modified upon submission of a revised operating plan;
- Landfill cells were required to be built to Provincial cell design specifications as per the Nova Scotia Landfill Guidelines. These specifications can be modified upon submission of validating analysis to support design changes which maintain environmental protection;
- Upon completion of construction, all new cells require a Provincial Operating Approval, which is updated as each new cell is developed;
- The MIRROR agreement has subsequently been amended 15 times through supplemental agreements as new price agreements were negotiated and new cells were constructed and closed;

[3] An Integrated ~~Waste~~/Resource Management Strategy, page 7, 1995.

- The last pricing agreement was negotiated and approved by Regional Council September 20, 2011, expiring March 31, 2016; and,
- Cell 6, approved for construction September 20, 2011, commenced operations October 18, 2012. Cell 6 is forecasted to reach capacity in the summer of 2016. Staff are projecting a request of approval for construction of cell 7 from Council in the FY 2015/16 capital budget.

Duration of Operations at the Otter Lake Site

The Regional Plan, approved in 2006, outlines the following in terms of planning for the future at the Otter Lake landfill site and alternative options:

- SU-22 states HRM shall, through a public consultation process as defined by Council, consider all options for a new regional waste processing and disposal facility, including siting a new facility, extending the life of the existing facility, and exploring waste diversion initiatives.

The MIRROR contract outlines details of the process and work which would be undertaken if Council decided to close the Otter Lake site on completion of the contract term, either 2024 or when the site reaches capacity in the original planned nine (9) cells whichever occurs first.

Redacted – direct contract
Reference

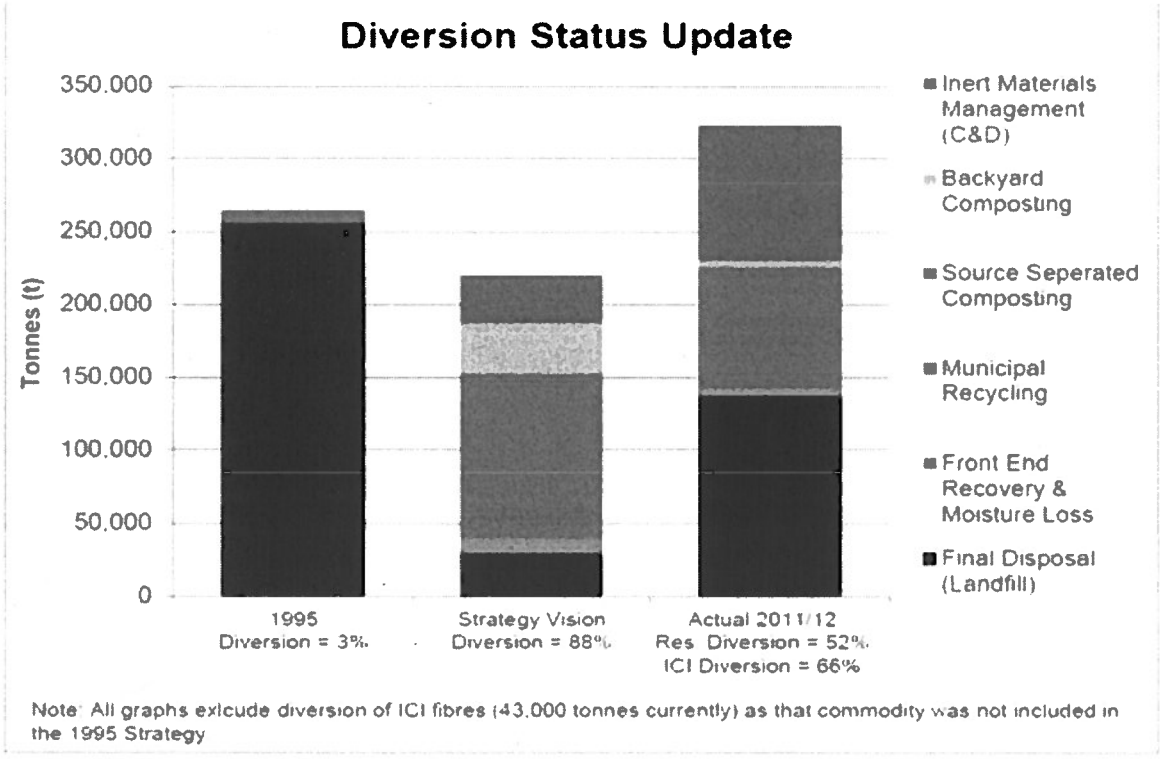
HRM's diversion is comprised of two separate and distinct components. Materials generated within the residential sector, for which HRM has responsibility for collection and disposal, and the Institutional Commercial Industrial (ICI) sector, for which private companies are responsible for collection and disposal. The ICI sector diversion calculation includes materials processed at private facilities including paper and construction and demolition materials. Since the adoption of the Strategy in 1997, HRM has achieved an overall blended diversion rate of 62% (2012). HRM's residential diversion of 52% is one of the highest in the country for similar sized cities. HRM's ICI diversion of 66% is also a significant achievement.

The Province calculates diversion based on a formula using kg/capita and the baseline year of actual tonnage per capita placed in the landfill in 1989. At that time, HRM was over 800kg/capita. In 1996, Nova Scotia established a target of 50% diversion of the total solid waste stream flows in an amendment of the *Environment Act.* In 2006, this target was updated under the Environmental Goals and Sustainable Prosperity Act {EGSPA} to 300kg/capita. HRM is now at 396 kg/capita which is also a significant achievement.

In 2011/12 HRM sent 142,500 tonnes of material to the landfill. This equates to the 396kg/capita. In order for HRM to achieve the Nova Scotia target of 300kg/capita it needs to reduce its total by 96kg/capita. This equates to reducing annual tonnage of materials sent to landfill to 104,832 tonnes. That is a total of 37,668 tonnes of additional diversion needed to reach the Nova Scotia EGSPA target of 300 kg/capita. This would translate into a 70 % blended (residential / ICI) diversion rate.

The following Mass Balance graph (Figure 1) shows three columns. The first illustrates diversion prior to implementation of the current system. The second depicts the CSC's original envisioned target for two years into the Strategy and how the 88% diversion would breakdown by material stream. The third column shows a comparative breakdown of waste and resource stream diversion as it exists today.

Figure 1



[4]

The current integrated waste system established several key objectives for the future of waste management in HRM. The existing system model, including the operating plan at Otter Lake, evolved from the CSC Strategy vision. Figure 2, below, outlines key system objectives in accordance with the plan implemented through the MIRROR agreement, July 1997, and their current status:

[4] Stantec, Waste Resource Strategy Update, page 1.7, January 2013.

The CSC vision identified three strategy objectives:

1. Maximize the 3Rs (reduction, reuse and recycling);
2. Maximize environmental sustainability and minimize costs; and
3. Foster stewardship and conserver society values.[5]

The following table (Figure 2) provides a staff review and status update on the CSC objectives in terms of diversion, education, environmental sustainability, minimizing costs, and the CSC 100-year solution.

Figure 2

HRM Waste System Objectives Status		
Objective	**Status**	**Remarks**
A system based on stewardship and citizens playing the primary role in diverting resources from landfill through source separation. HRM's target was to achieve greater than 60% diversion at Otter Lake.	HRM has a current combined overall diversion rate of 62%. This achievement is noteworthy and reflects the success of the citizen envisioned innovation of source separation. HRM's organics diversion is one of the highest in the country.	HRM has achieved the overall strategy target of over 60% diversion. However, there are still opportunities to improve diversion of organics and recyclables (50,000 tonnes) from the landfill.
A system which used education, communications and monitoring to effect behavioural change.	Since 2006, when diversion was at 53%, HRM's 4 educators and 2 diversion program officers have made formal contact with 23% of businesses across HRM.	Proactive outreach and education have proven the most effective means of gaining increased diversion through implementation of effective source separation programs within the ICI sector.
A system that protected the environment and community from the adverse effects of traditional landfill operations.	Environmental ground and surface water monitoring confirm there have been no adverse environmental impacts in the water table around Otter Lake. There is not a large flock of vectors living off the landfill. Conversely, analysis suggests	In response to odours which presented while still working in cells 1&2 in December of 2002, MIRROR developed a temporary gas management process. This involved plastic

[5] An Integrated ~~Waste~~/Resource Management Strategy, page 4, March 1995.

	that the current FEP/WSF processing model {The shredding of all materials passing through the FEP} generates gas much more rapidly than traditional landfill operations. This outcome is currently managed by a temporary gas management system.	piping installed in the waste and on top of the active cell which drew the gases to a flame to be burned off. This temporary system is then replaced with a permanent gas management system once the cell was sealed as intended in the operating plan.
A system which was economically sustainable and efficient.	The Otter Lake landfill operation is projected to be delivered at $170.00/tonne as of construction and operation of cell 6. This includes operations of the FEP/WSF and RDF, plus gas management, leachate processing and all capital expenditures for cell construction, closure and equipment. When the system costs were originally assessed, analysis indicated that the system would have a projected cost of $67.00/tonne (FY96). This equates to $90/tonne (FY12) based on Canada CPI Inflation.	The projected Otter Lake facility cost per tonne is substantially higher than the inflated system model cost originally assessed as fiscally sustainable.
A long term waste system solution for the Municipality. The CSC strategy envisioned a 100 year solution. Otter Lake site agreement contemplates a 25 year term. However Regional Council has sole discretion to extend operations at the site beyond the current contract with MIRROR.	To be clear, the Strategy is working. Residents have embraced source separation and diversion is at 62% overall. Source separation is a part of behavioural awareness. However, without a system model change, Regional Council will need to direct staff to initiate a project to identify a new landfill site or waste system alternative.	The entire process to site a new landfill at Otter Lake took over 15 years to accomplish before the site became operational. The issue of what the plan is for closing the landfill was previously raised at Regional Council, a motion for public consultation RE: Closure of Otter Lake Landfill, January 11, 2011.

Figures 1 and 2 illustrate that HRM has achieved its 1997 integrated waste system objective of over 60% diversion. HRM's current residential diversion rate is 52% which is among the highest compared to similar sized municipalities in Canada. When measured against the 12 largest municipalities in Ontario, HRM's diversion rate would rank fourth highest. In terms of waste per capita, at 396kg/capita, HRM's waste per resident is less than half the national average of over 800kg/capita. This is a significant achievement in terms of HRM's program goals.

Waste stream content analysis data and system oversight findings indicate there remains an opportunity to increase diversion from landfill through greater participation. HRM needs new programs and system changes to increase adherence to the source separation guidelines.

System data shows the Otter Lake operating model has evolved into a much more costly program than anticipated. The consultant report confirms that the all-inclusive cost per tonne of the Otter Lake landfill is well above industry norms. The analysis identifies that the higher than normal operating cost is directly attributable to the costs associated with the FEP/WSF. As a result of HRM's success with source separation, the FEP/WSF provides a negligible opportunity for diversion. Contrary to the CSC envisioned outcome, the FEP/WSF processing system results in the accelerated production of gases and odours which require a temporary gas management and odour control system which further increases operating costs.

In addition, a situation exists where the cost per tonne for landfill operations is increasing at the same time that diversion in HRM is reducing the annual tonnage being delivered to the landfill. Since 2006, when Otter Lake received 169,000 tonnes and diversion was at 55.3%, waste materials received at the landfill have steadily decreased to the current total of 142,500 (FY2011/12) tonnes at 62% diversion. Given the overall increase in cost and the continuing decline in tonnage, staff developed preliminary system cost comparison data through 2011.

In September 2011, Regional Council approved the latest MIRROR operating agreement. At that time, Regional Council also directed staff to formally review the Strategy. The Solid Waste Resources (SWR) FY2012/13 Business Plan Key Deliverables are noted in Figure 3 below.

Figure 3

5.1	Expand education efforts and develop program initiatives to increase diversion rate.
5.2	Conduct a comprehensive Waste Strategy Review including assessment of alternative options to improve the fiscal sustainability of the program through system enhancements.
5.3	Review and validate cell design specifications with the Province to reduce capital costs.
5.4	Development of a business case assessment for a transfer station to reduce overall residential collection costs and provide strategy contingency options.

On July 10, 2012, Regional Council approved an overarching system performance and industry bench mark analysis study contracted to Stantec, which resulted in the consultant report accompanying this report. {Waste Resource Strategy Update, January, 2013.}

DISCUSSION

Redacted – legal advice

The implementation of some or all of the consultant recommendations enables HRM to maintain or enhance focus on environmental stewardship throughout the integrated waste management system and remain true to the CSC's vision. Equally true and important is that the consultant report recommendations enable achievement of the envisioned fiscally-sustainable solid waste solution for many decades to come.

A fundamental criterion for the consultant's system review was the requirement that all recommendations maintained the focus on environmental stewardship. The consultant's review identified several key findings that have the potential to enhance the system's environmental stewardship through increased diversion and reduced negative environmental impacts from fugitive landfill gases.

In addition, the consultant identified opportunities to significantly increase the cost effectiveness of the integrated waste management system without impacting environmental protection or deviating from the objectives of the Strategy. The review of operations at Otter Lake was conducted in terms of the Regional Council approved MIRROR implementation plan of 1997. The analysis was divided into three specific assessments:

- Is the existing Otter Lake operation performing as designed/intended by the implementation plan and are there any negative outcomes?
- How does HRM's Otter Lake operation compare to industry standards and norms, especially in terms of the Key Performance Indicator (KPI) of cost per tonne?
- Are there opportunities to evolve HRM's system to better achieve the system objectives of environmental stewardship, fiscal sustainability and a long-term solution?

The consultant report provides a number of findings and options. The report outlines recommendations for an updated integrated waste management system to guide program and service implementation over the next 10-20 years. The recommended options introduce some fundamental waste system changes. These recommended changes have interdependencies. Therefore, the following option recommendations cannot necessarily be addressed in isolation:

- Closure of the FEP and WSF;

- Petition Nova Scotia Environment for modifications to the Nova Scotia Landfill Liner Specifications;
- Extend the life of the Otter Lake Landfill site through improved compaction and adding height to the cells;
- Create a centralized waste resource campus to support new infrastructure development;
- When developing the next MRF, move it to the campus site;
- Introduce new organics processing technology and capacity and include final curing processing;
- Increase staff resources dedicated to improving diversion of recyclables and organics through system oversight and education;
- Establish a mechanism of control over the sale of finished compost; and,
- Improve curbside collection and recovery efficiency through model/program changes as the system evolves.

What follows next in this report are the recommendations on increasing cell height as well as the disposition of the FEP and WSF. Once Regional Council has provided their direction, staff will finalize planning for the community engagement process to address these recommendations and the balance of recommendations from the consultant's report. As noted, staff will begin consultation with the CMC on these recommendations. Staff will then return to the Environment & Sustainability Standing Committee with a report incorporating community engagement feedback on the recommendations and options resulting from the strategy review project.

Landfill Cell Height

The current cell height protocol is consistent with original site planning. The nine cell plan for Otter Lake will reach capacity in 2024. However, the existing nine cell plan at Otter Lake could be extended by almost 25 years with an addition of 15 meters in height to each cell. This analysis includes adding additional materials on top of closed cells (1-5) once the current active cell, 6, reaches capacity. Cells 7-9 would subsequently be developed to the new height protocol. Staff is working on a digital representation of what this height increase would look like from various angles.

Industry standard is to build landfill cells as high as practical to realize maximum return on the capital investment in the cell liner construction cost. The vast majority of cost for a landfill cell is in the construction of the cell liner mold. Cell 6 cost $16.1 million as approved by Regional Council. This figure does not include the cost of the Borrow Pit Road ($ 944 K) project associated with the construction of cell 6.

Programmed capacity for cell 6 is approximately 500,000 tonnes for a $32.20/tonne capital investment expense. Increasing cell 6 height by 15m doubles the cell's capacity to approximately one million tonnes. This results in a reduced capital investment cost of $16.10/tonne. Current amortization is based on a cell life of 3.5 years on a projection of approximately 140,000 tonnes/year. The additional cell height doubles the cell life and doubles the amortization period to 7 years.

The only Provincial legislative criterion for siting cells at the Otter Lake site relates to distance from a well servicing a residence. According to Provincial legislation, cells must be a minimum of 1000m from the nearest well servicing a residence. The cells at Otter Lake exceed this Provincial regulation by over 2000m as per the CSC strategy recommendation that cells be no closer than 3000m from the nearest well servicing a residence. This is depicted in Appendix B.

The environmental consideration of the recommended increase in cell height would be a drumlin mound 15m higher than the existing drumlin mound at the site. The current site plan requires remedial restoration through the planting of trees, shrubs and other local vegetation. The intent of the remedial work would be to return the site topography to be consistent with local surroundings. Given the topography of the area and the existence of hills and ridges, the increased height of the resulting drumlin mound is assessed to have limited impact on this objective.

The consultant assesses that current cell height protocols impose higher than industry standard capital cost/tonne investment on HRM with no quantifiable environmental benefit. There are no identified environmental impacts resulting from increasing cell height. Based on current industry practices, and the effectiveness of remedial site restoration practices employed today, the consultant recommends that an increase in height across all existing and future cells be implemented at the Otter Lake site.

The recommendation to increase cell height is further supported when the capital investment already made in the existing cells on site is taken into consideration. Cells 1 through 5 are already built and paid for. Each cell which is added to in terms of 15m of additional materials has the ability to push out the requirement to build the next cell by several years. Each extension of time before the next cell is required also extends the life of the site, should Regional Council so choose.

Implementation of these operational site model changes will require development of a new operating plan to build on existing closed cell. Preliminary analysis from the consultant in terms of a draft operating plan indicates that this option is entirely practical when compared to existing and ongoing site management.

The addition of added height on cells with no identifiable environmental impact increases the economic sustainability of the development of cells at Otter Lake. This change also introduces over 20 years of projected annual capital budget savings as noted below in Figure 4. The key point in this representation is that these are not discretionary potential budget avoidance savings. These capital dollars would have to be spent to fund future cells which are already in the long range forecast budget to support cells 7-9.

Figure 4

Cell Height Scenario's Projected Capital Budget Cost Avoidance		
Cell Height Increase	**Resulting Year The Next Cell Would Need to be Built**	**Projected Budget Savings / Cost Avoidance**
15m	2034 - 2036	$ 114M - $ 117M
10m	2029 - 2031	$ 74M - $ 82M
5m	2023 - 2024	$ 36M - $ 43M
Current	2016	$0

In addition, using a conservative range of 145,000/tonnes/year to 160,000/tonnes/year, {which represents Regional growth} at the new cell height, with an additional nine cells adjacent to the current planned nine cells, the Otter Lake site represents an opportunity to achieve the CSC vision of a 100 year solution. As illustrated in Figure 4, increased cell height allows for maximizing the cost benefit of capital investment for landfill cells. The addition of another nine cells, which are easily accommodated within the site footprint and distance from residence criterion, can extend the life of the site into the 22nd century. A projection of a cell development timeline is detailed in Appendix C.

It should be noted that this site extension is based on the technological situation as it exists today. The waste management industry is evolving very quickly with new technologies. The implementation of this option to extend cell height and site capacity gives Regional Council the opportunity to have a secure, fiscally sustainable solution well beyond the planning horizon when other waste industry technology options may dictate alternatives to landfilling.

The site extension discussion was included in order to explain the order of magnitude of the opportunity the Otter Lake site represents to the region for HRM's waste management system. Regional Council is the sole authority in terms of approving cell height. The current protocol is a product of the initial site plan. As previously noted, there are no Provincial legislative or regulatory restrictions on cell height. The recommended height change poses no increased risk to the environment. The increase in height supports the achievement of the original CSC vision objective of a fiscally sustainable 100 year waste management solution for the region.

Operation of the FEP and WSF

The following bullet point summary outlines the rationale to close down FEP/WSF processing at Otter Lake. This is followed by a more comprehensive explanation of each assessment. The closure of the FEP/WSF represents an opportunity related to environmental stewardship, system functionality and a financial capability to save funds which more than represents the assessed costs to evolve the integrated waste management system as outlined in the consultant report.

FEP/WSF Discussion Summary

- The FEP/WSF process introduces an unintended environmental/community impact at the Otter Lake site in terms of the rapidity of gas/odour generation;

- Previous extended closure of the WSF produced no impacts to the environment, community or site;
- The FEP/WSF provides only limited recovery of otherwise more practically recoverable recyclable materials;
- The cost of recovered materials processed through the FEP and diverted from landfill, 300 tonnes of recyclables plus special handling materials, is $26,700/tonne which is unsupportable or justifiable; and
- The FEP/WSF cost/tonne is a negative system KPI.

The Otter Lake landfill system was intended to be a "dry" landfill rather than a "wet" landfill. As previously noted, the consultants were unable to identify a similar process anywhere in NA. In accordance with the strategy, "wet" organics, putrescible materials and materials contaminated with putrescible material were to be processed and then stabilized {dried} and then sent to the landfill. The designation of the Otter Lake landfill as a "dry" landfill is important. It speaks to the intended purpose of the Otter Lake FEP/WSF as it was originally envisioned by the CSC.

The municipality, based on the CSC vision, agreed to develop the more costly system incorporating the FEP/WSF to increase diversion and minimize the negative impacts from gases, odours, leachate and vectors.[6] All materials would pass through the FEP. The intended uncontaminated materials would then be sent directly to the RDF. {This includes materials that break down, decompose and generate methane gases.} The FEP process would screen, shred and prepare materials, either organic or contaminated with putrescible and/or organic matter, for the WSF bio-stabilizing or "drying" process. This preparation was essentially to shred materials to less than 2 inches in size.

The objective of the FEP processing and the WSF bio-stabilization was to avoid the negative environmental outcomes of the "wet" Sackville Landfill site. Unexpectedly, as previously noted, odours became an issue in late 2002 while cells 1 and 2 were still active. MIRROR quickly responded with the current and ongoing temporary gas/odour management process.

In addition to facilitating a "dry" landfill operation, the FEP/WSF operation, as Redacted – direct contract reference, was designed to achieve the following in terms of the site's operational plan:

- Manually and mechanically separate, sort and process Solid Waste delivered to Otter Lake
- Non-recyclable Inert Materials will be separated and disposed of in the landfill;
- Recyclable Materials will be extracted and stored separately on site for recovery for market;
- Materials capable of being rendered into Stable Materials through bio-stabilization will be processed through the WSF; and

[6] An Integrated ~~Waste~~/Resource Management Strategy , page ii, 1995.

- Hazardous substances and other Prohibited Materials will be extracted and temporarily sorted on the Site pending removal by HRM.[7]

The consultants assessed that the processing, shredding and stabilizing of the residual waste stream through the FEP/WSF unintentionally introduces a negative impact to the environment by generating increased volumes of landfill gas {Methane or Greenhouse Gases} in the early years of cell operation before optimized gas collection systems can be installed. Environment Canada's website states:

- Methane is 21 times more potent than carbon dioxide in terms of its global warming potential.
- Emissions from Canadian landfills account for 20% of national methane emissions.
- Estimates have shown that approximately 27 Mega tonnes (Mt) of carbon dioxide equivalent (eCO_2) are generated annually from Canadian landfills, of which 20 Mt eCO2 are being emitted annually.[8]

This unavoidable environmental impact is compounded at Otter Lake where landfill gases present earlier than occurs at traditional landfill operations as a result of the ongoing processing or shredding of materials through the FEP.

Landfill gas and corresponding odours presented at Otter Lake far earlier than was anticipated by MIRROR and HRM. Redacted – direct contract reference s. During the winter 2003, MIRROR developed an effective but labour intensive pro-active temporary gas management system. This system remains an ongoing and constant operation on the active landfill cell with temporary collection and piping installations in the waste and on top of the active cell.

This temporary gas management system is in essence an odour management system. The gases that are captured in the temporary piping systems are burnt off in a perpetual flame system. As a result of their early development from rapidly decomposing shredded materials, not all gases can be captured and some will escape into the atmosphere. Once a cell reaches planned capacity and is sealed, the permanent gas management system is installed as per the operating plan.

In terms of the science of this position, the analysis indicates that the current practice of processing and stabilizing the putrescible and organics contaminated materials through the FEP and WSF is, in fact, the reason for the more rapid generation of gas which exists at the Otter Lake site. Once a landfill cell is properly capped and sealed, gases are captured in permanent systems. This captured and managed gas can then be potentially used in the generation of electricity as is currently the practice at the closed Sackville site.

The following is an excerpt from the consultant's report in relation to the current negative environmental impact of the FEP/WSF process:

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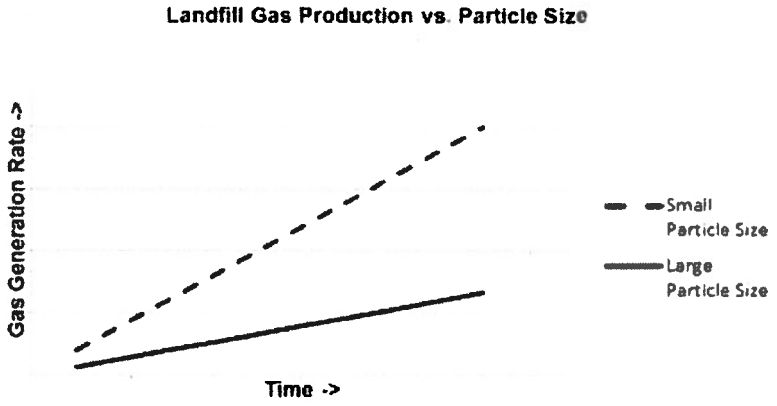
F Redacted – direct contract reference

8 http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=6F92E701-1, January 24, 2013.

"The only significant deviation from that contemplated in the 1995 Strategy is that all output from the WSF is sent to landfill. A potential unintended negative environmental consequence of this change is increased production of landfill gas in the immediate months and years after the WSF product is placed. The multiple shredding and mixing of organic waste in the FEP/WSF combination have in fact increased the potential for community odour impacts compared to a scenario where the FEP/WSF did not exist and all material was sent directly to landfill. This is due to the homogeneity and significant reduction in particle size of the waste which increases the surface area available for anaerobic bacteria (gas producing) to thrive as shown on the following graph[9]*.*



An analogy which may assist in the explanation of this phenomenon is the difference in time for a tree trunk to decompose, compared to an equivalent mass of wood chips created from the tree trunk. An intact trunk has a limited surface area for microorganisms to process the wood, whereas the wood chips offer a significant increase in surface area which increases the opportunities for bacterial decomposition."[10]

In terms of this discussion, a clear understanding and awareness of the impact of shutting down the WSF process already exists from both an environmental and community impact perspective. The WSF was previously shut down for over six months while operations continued at Otter Lake. In 2008-09, it was determined that the WSF roof required replacing. The roof replacement project was undertaken in 2010. Prior to the operational change, HRM obtained approval for the amended operational plan from Nova Scotia Environment and consulted with the Community Monitoring Committee.

The WSF was shut down from May through December, 2010. During the WSF closure, MIRROR undertook greater vigilance in monitoring RDF operations. Upon completion of the project, the site returned to full FEP/WSF operations. MIRROR reported no events or issues resulting from the WSF shutdown. It is recognized that modifications to the existing operating model would require development in terms of this option.

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[9] McBean, Edward A. et al, Solid Waste Landfill Engineering and Design, page 80, 1995
[10] Stantec, Waste Resource Strategy Update, page 3.7, January 2013.

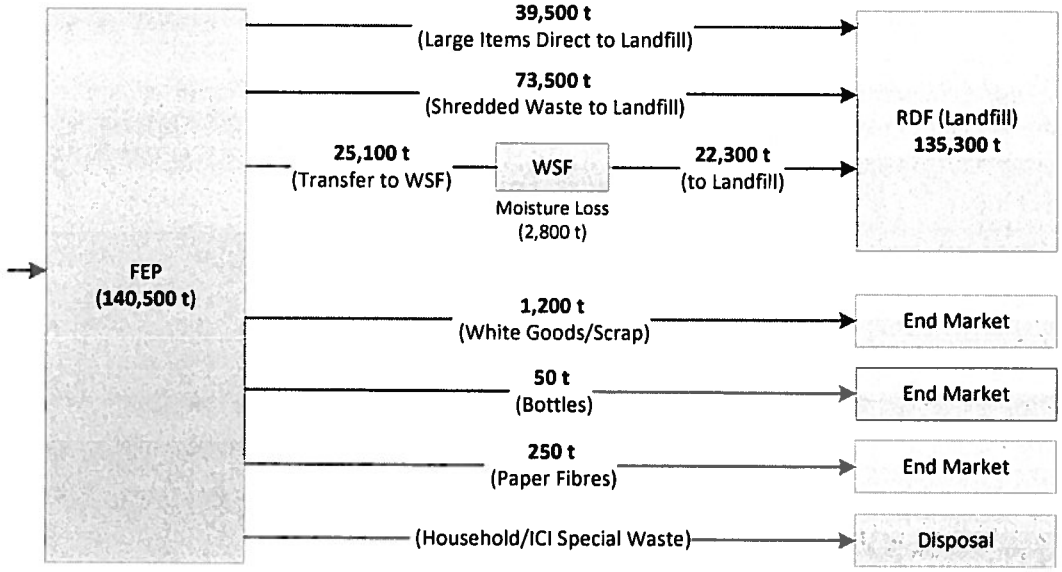
In addition to introducing the environmental impacts of early gas generation, the consultant assessed that the FEP/WSF was providing no real functional waste management system benefit in terms of the system KPI of diversion.

The mass balance graph below (Figure 5) shows the tonnage of materials received at Otter Lake. Key outcomes to note are:

- tonnage received from both residential and ICI sector which is transferred directly or indirectly to RDF (84%) without passing through the WSF;
- limited moisture loss and mineralization of organic materials from the bio-stabilization of materials processed through the WSF{outcome of source separation}; and,
- limited volume of marketable materials recovered through FEP processing (1%) {outcome of source separation}.

Figure 5

Mass Balance Graphic



The following bullets describe how materials that arrive at the Otter Lake tipping floor are handled/processed prior to being placed in the landfill (RDF):

- As depicted above in the mass balance graphic, the tip floor of the FEP receives 140,500 tonnes delivered by both residential and ICI collections (FY12-13). Of this tonnage, 39,500 tonnes are mechanically and manually transferred into trailers and sent directly to the RDF. This material is not processed in the FEP.
- A further 73,500 tonnes is processed through the FEP conveyer sorting and shredding system and then loaded into trailers and sent to the RDF.

- 25,100 tonnes of materials assessed contaminated with organic or putrescible matter is processed through the FEP conveyer sorting and shredding system and then sent through to the WSF facility. This 25,100 tonnes is then subjected to 18 plus days of "bio-stabilization" prior to it being loaded into trailers and sent to the RDF. This process results in a reduction of 2,800 tonnes in moisture loss and mineralization.
- The vast majority of marketable materials, 1200 tonnes {fridges and stoves or "white goods" and large salvageable pieces of metal} are also not processed through the FEP but are manually pulled out of the waste and come directly off the tip floor. In other regions, white goods are more practically and efficiently dealt with through a separate contracted collection system. Isolating this resource stream from the waste stream could enhance the collection system efficiency for these resources and bring the program more in line with its focus on stewardship;
- The FEP processing and screening system captures a very limited quantity of materials requiring special handling or banned materials. Again, savings realised by the closure of the FEP/WSF could support expansion of the current special handling depot operations and annual mobile events. Increasing accessibility should increase diversion of materials through increased participation;
- The FEP/WSF was originally envisioned to support diversion from landfill. The plan evolved to deal with processing materials prior to landfill with a limited objective of recovering marketable resources and materials banned from landfill. As noted in Figure 6, HRM is recovering minimal diversion of recyclables from the FEP; and
- Program data indicates that diversion through source separation is more effectively enhanced through education and communication and site inspections.

In addition to the negative environmental impacts and functional inefficiency in terms of diversion resulting from the FEP/WSF, there is a significant financial impact on annual operating costs for Otter Lake. The following table (Figure 6), details the KPI of cost/tonne for the current FEP/WSF process based on two FY bench marks, 2004 and 2011. The cost/tonne has significantly increased as diversion has correspondingly increased over the past half-decade.

As envisioned by the CSC, the FEP/WSF has steadily declined in functional effectiveness as the waste stream evolved through source separation. The FEP/WSF functional cost to the system has correspondingly increased. Out of 140,500 tonnes delivered to Otter Lake, 135,300 are placed in the landfill. The FEP/WSF process only accounts for diversion of 300 tonnes of recovered fibre and refundable containers and limited HHW/special handling materials. Further, 1200 tonnes of white goods are pulled off before the FEP processing system.

Figure 6

FEP/WSF System Performance & Cost				
Year/Overall HRM Diversion	Isolated FEP/WSF Operating Cost	Recyclable Materials Diverted	Percentage of Diversion From RDF	Cost Per Tonne of Diverted Material
2004/54%	$ 7,200,000	525	0.5%	$ 13,700
2011/61%	$ 8,000,000	300	0.3%	$ 26,700

Figure 6 shows the actual cost per tonne of diverting materials through FEP processing in 2004 and 2011. Over that period, tonnage diverted by the FEP process has decreased by 57%. Over the same period, FEP/WSF cost per tonne has increased significantly.

Figure 7 illustrates the KPI analysis from a projected budgetary perspective in terms of both annual equipment capital and operating costs of sustaining the FEP/WSF operation at Otter Lake. The closure of the FEP/WSF represents a significant projected savings in terms of the Solid Waste Resources annual operating and capital budget. This cost avoidance represents sufficient funding for the potential development of the integrated waste system infrastructure outlined in the report.

Figure 7

Projected Isolated FEP/WSF Capital Equipment and Annual Operating Cost Estimates			
Year	Operating	Capital	Total
13/14	$8,500,000	$2,100,000	$10,600,000
14/15	$8,700,000	$1,300,000	$10,000,000
15/16	$9,000,000	$900,000	$9,900,000
16/17	$9,200,000	$1,600,000	$10,800,000
17/18	$9,400,000	$1,800,000	$11,200,000
18/19	$9,700,000	$2,000,000	$11,700,000
19/20	$9,900,000	$2,700,000	$12,600,000
20/21	$10,100,000	$2,300,000	$12,400,000
21/22	$10,400,000	$1,400,000	$11,800,000
22/23	$10,700,000	$1,300,000	$12,000,000
23/24	$10,900,000	$1,300,000	$12,200,000
24/25	$11,200,000	$1,300,000	$12,500,000
Total	**$117,700,000**	**$20,000,000**	**$137,700,000**

Figure 7 represents the projected annual cost of operating the FEP/WSF along with the associated capital expenditures that are required within that facility.

The adoption of this recommended change will result in new integrated waste system program costs from the implementation of alternative approaches to capture marketable or banned materials. These would include a white goods curbside collection program, enhancement of the existing HHW/Special Handling depot program and operational adjustments at the RDF itself to accommodate collection vehicles delivering directly to the active cell. These costs and others would be fully developed as decisions are made based on the completion of the Strategy Review Project and Regional Council approved changes are implemented.

Financial Summary

Figure 8

Projected Overall System Financial Summary			
Year	FEP/WSF Operating and Capital Equipment Budget	Increasing Cell Height by 15M Annual Capital Cost Avoidance	Total Combined System Cost Avoidance of the Decisions
13/14	$10,600,000	$5,100,000	$15,700,000
14/15	$10,000,000	$5,100,000	$15,100,000
15/16	$9,900,000	$4,600,000	$14,500,000
16/17	$10,800,000	$4,800,000	$15,600,000
17/18	$11,200,000	$4,800,000	$16,000,000
18/19	$11,700,000	$4,800,000	$16,500,000
19/20	$12,600,000	$5,900,000	$18,500,000
20/21	$12,400,000	$7,000,000	$19,400,000
21/22	$11,800,000	$7,000,000	$18,800,000
22/23	$12,000,000	$6,400,000	$18,400,000
23/24	$12,200,000	$5,800,000	$18,000,000
24/25	$12,500,000	$5,800,000	$18,300,000
Total	**$137,700,000**	**$67,100,000**	**$204,800,000**

Projected FEP/WSF budget figures represent the total annual operating and capital expenses associated with this operation. Projected cell height cost avoidance savings refer to the estimated average annual reserve appropriations required to fund the sequential construction of Otter Lake cells based on the current development plan and the range of 135k-150k tonnes per year. Cell funding methodology used in this calculation is the same as current cell capital funding methodology whereby appropriations are made annually based on the asset's useful life.

Municipal Authority

Regional Council has full authority to change the operating model at Otter Lake and close down FEP/WSF processing. There is no legislative or regulatory requirement to operate either the FEP or the WSF prior to sending materials to the RDF. Changes to the operating approval and site operating plan will require a written submission to Nova Scotia Environment detailing changes to the operational plan.

Gas to Electricity Opportunity

The changes to the operating plan and extension of the term of the landfill site present an opportunity for HRM to potentially implement a gas to energy/electricity project. The consultants have identified that the current generation and forecast generation of gases have reached the point of supporting the investment in a system to generate electricity from the captured gas, rather than just burning it off. This would create an additional revenue opportunity and the potential to further reduce site operating costs. This type of project is already operating at the Sackville Landfill.

Maintenance of Existing Cell Height Protocol

The FEP/WSF discussion recommendation is based on the operational inefficiency, system cost savings and negative impact on the environment. The cell height discussion is more far reaching in terms of HRM's waste program. As previously noted, the Regional Plan contemplates the extension of operations at Otter Lake as an option. Regional Council may determine that adjusting the existing cell height protocol is not practical. It is important for Regional Council to remember that Otter Lake is programmed to close in 2024. Efforts to replace the previous Sackville Landfill commenced over 15 years before Otter Lake became operational.

If Regional Council determines to maintain the current cell height protocol and not investigate extending the life of the planned cells and site, staff will seek approval to commence planning to site a new landfill or identify an alternative waste program solution for HRM.

Peer Review

Stantec's analysis of the operations at Otter Lake and specifically that of the FEP/WSF and cell height option, is the subject of an independent professional peer review conducted by SNC Lavalin, commissioned by HRM in December 2012. SNC Lavalin confirms "agreement in principle," with the consultant recommendations on the cell height and closure of the FEP/WSF. The final report will be made available when complete.

LEGAL IMPLICATIONS

Redacted – legal advice

Redacted – legal advice

Redacted – legal advice

Redacted – legal advice

Redacted – legal advice

FINANCIAL IMPLICATIONS

The closure of the FEP/WSF will, on average, produce projected savings of approximately $11.5 million per year for the remaining 12 years of the current MIRROR contract. This totals $137.7 million.

The potential effect on the budget would be ceasing reserve funding for capital expenditures on the FEP/WSF. This will save $4.2 million. The 2012/13 and prior years funding of $2.1 million is currently within a reserve or operating account. The 2013/14 amount is currently in this year's budget envelope.

Figure 9

Projected Effect on 2013/14 Budget

2012/13 Reserve Funding For FEP/WSF Capital	$ 2,100,000
2013/14 Reserve Funding For FEP/WSF Capital	$ 2,100,000
Subtotal	**$ 4,200,000**

Increasing the cell height has the potential to avoid a projection of approximately $114 - $117 million of cell construction costs over the next 20 years. In addition, through this increase in cell capacity volume, the useful life of cells will be doubled. As a result, the cost can be spread over twice the original timeframe resulting in additional budgetary savings.

The potential effect on the budget would be ceasing reserve funding for capital expenditures on cell construction. This will save $10.7 million. The 2012/13 funding of $5.5 million is currently within a reserve or operating account. The 2013/14 amount is in this year's budget envelope.

These above potential savings will be subject to Council's approved changes to the system and operating model going forward.

Figure 10

Projected Effect on 2013/14 Budget

2012/13 Reserve Funding For Cell Not Required	$ 5,500,000
2013/14 Reserve Funding For Cell Not Required	$ 5,200,000
Subtotal	**$ 10,700,000**
Total	**$ 14,900,000**

Cell funding in 2013/14 is slightly lower than 2012/13 in order to create a stable reserve funding approach whereby approximately $8million per year is allocated to Q123. In 2014/15 the planned reserve funding that is associated with Cell 7 is $6.5million. Total funding to the reserve over the three year period is planned to be $17.2million.

COMMUNITY ENGAGEMENT

As directed by Regional Council, once clear understanding of the desired context and approach for the community engagement process is determined, staff will develop and execute a comprehensive community/stakeholder engagement process to explain the broad scope recommendations identified in the consultant report. Feedback from the consultation will then be brought back to Regional Council through Committee.

ENVIRONMENTAL IMPLICATIONS

- The recommended actions have no assessed environmental impact and are assessed to decrease the environmental impact of residual waste materials destined for landfill by reducing the early generation of landfill gases prior to the installation of landfill gas management systems.
- The recommendations will provide HRM with a long-term waste management solution within the existing landfill site plan which has a comprehensive environmental monitoring regime and is permitted as such by Nova Scotia Environment.

ALTERNATIVES

Option 2: Council could maintain the status quo operating model. This is not the recommended course of action. In addition, if this is the determined course of action, staff will require Council direction on commencing a project to locate a new landfill site or identify a new alternative option solution for the Municipality's waste management program.

Option3: Council can immediately close the landfill and send all residual materials to alternative landfills. This is not the recommended course of action. Council would still have to deal with the contract with MIRROR NS Ltd. In addition, HRM does not currently have a transfer station to support efficient consolidation of waste loads for transfer to alternative landfill sites. This option is only viable with an operational transfer station.

ATTACHMENTS

Appendix A – Stantec Report, Waste Resource Strategy Update, January 2013
Appendix B - Diagram of the range of houses from landfill cells
Appendix C - Time line graphs on cell development extending site life

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If the report is released to the public, a copy can be obtained by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

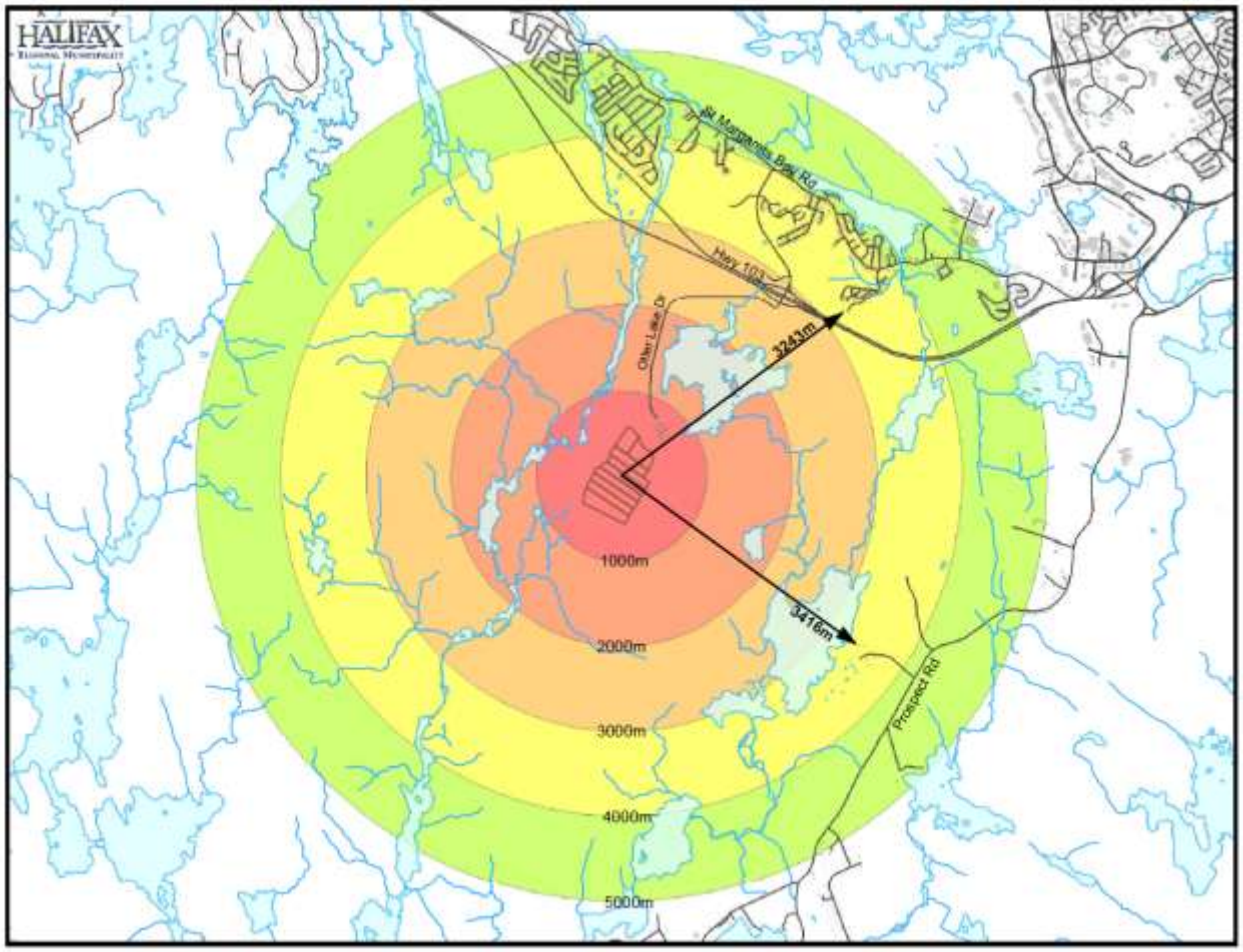
Report Prepared by: Gord Helm/Manager, Solid Waste Resources, 490-6606

Report Prepared by: Martin Ward, General Counsel, Legal Services, 490-6532

Financial Approval by: Original Signed
Greg Keefe, Director of Finance & Information Technology/CFO, 490-6308

Report Approved by: Ken Reashor, Director, Transportation & Public Works, 490-4855

Appendix B – Illustration of distances from wells servicing residences



Appendix C

The following two graphs show the calculated time line to develop the Otter Lake site if an additional nine cells were added, and the corresponding time line changes based on cell height increases of 5, 10 and 15 metres.