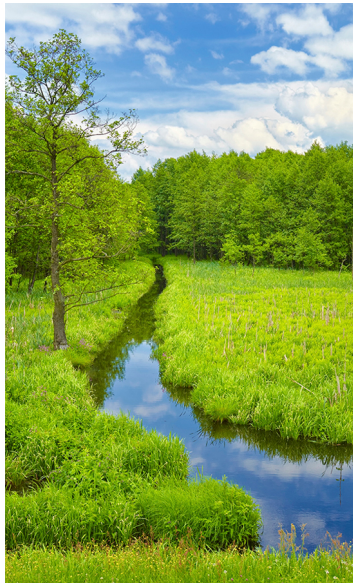




Process Review of New Era Technologies Limited Compost Facility

Prepared for: Halifax Regional Municipality

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Executive Summary

Conestoga-Rovers & Associates (CRA) completed a compliance and process review of the New Era Technologies Limited (NETL) compost facility located at 61 Evergreen Place Goodwood, Nova Scotia. The facility is operated under a long-term design-build-operate contract with Halifax Regional Municipality (Halifax). In 2019, the 20-year contract term will be completed, with Halifax taking ownership of the facility and terminating the lease of the property and having multiple options for the succession of the facility including entering into a new long-term arrangement to operate and upgrade the facility (including increasing or decreasing capacity) or shutting down the facility.

The objectives of the process review were therefore to:

- Identify requirements to bring the NETL facility into compliance with the 2010 Nova Scotia Environment (NSE) Composting Facility Guidelines (2010 NSE Guidelines)
- Identify facility process improvement opportunities
- Evaluate options to both increase and decrease the capacity of the facility

Following a site visit and review of historical reports, it was found that to generate compost from the NETL facility that is fully compliant with the 2010 NSE Guidelines will require, at a minimum:

- Continued practice of no recirculation of leachate (zero capital cost, net operational savings with respect to leachate management).
- Additional bulking amendment (zero capital cost item, potential of \$8-16 per tonne of source separated organics increase in operating costs).
- Additional curing area and/or frequent turning (i.e., increased aeration) of the curing pile (\$400,000 - \$1,500,000 of capital for additional curing area and/or new windrow turning equipment).
- Elmsdale Landscaping Ltd. is not an approved composting facility and therefore would not be able to act as a secondary curing facility for the NETL facility, if required, unless it obtains approval.
- The NETL facility will require additional signage to provide normal operating hours, emergency contact information and the types of acceptable materials at the site entrance.
- Foreign matter levels in the compost are a concern and may require new or additional screening equipment. The screen size can likely be reduced if the compost maturity is improved. The efficacy of the existing equipment will need to be re-evaluated when the compost maturity has improved to an acceptable level (it was difficult to evaluate this from the material present during CRA's site visit).

- The NETL facility must increase the frequency of compost sampling as they are currently not in compliance with their Approval to Operate (NSE Approval #2008-062534). For the years 2012-2014 the operator was just short of this requirement. Testing is required for every 1,000 tonnes of compost or every 3 months; see Table 3.1. The 2010 NSE Guideline requirement is the same as the sampling frequency in the Approval to Operate.
- Condition 13(b) of the Approval to Operate requires overs to be disposed of at an approved landfill site unless written permission for an alternative is received from the NSE. This condition should be clarified by consulting with NSE to ensure that New Era is meeting the requirements of the Approval to Operate. Currently, New Era tests larger size compost material (coarse compost) prior to shipping according to the CCME Guidelines for every 1,000 tonnes generated and ships the material to Elmsdale Landscaping for further processing and curing.

The NETL facility is not ideal for considering further investment to upgrade operations to bring into compliance with the 2010 NSE Guidelines or to increase or decrease capacity. In 2019, when the 2010 NSE Guidelines will apply to the NETL facility, it is recommended that Halifax replace the existing facility with alternate organics processing capacity to meet Halifax's organics processing needs for the subsequent 20-year period. With respect to process improvements or modifying the capacity of the facility, the primary constraints are:

- Age and condition of existing equipment and buildings
- Porosity, moisture, pH and C:N ratios of feedstock materials and challenges in sourcing suitable bulking amendment
- Incompatibility between the existing organics processing technology (static aerated floor/container) with Halifax source separated organics (particularly Institutional, Commercial and Industrial materials). This is related to the feedstock issues identified above and the inability to easily address this incompatibility through changes to feedstock materials or composition. Thus, a different technology is recommended for the long-term organics processing needs of Halifax past 2019.

To continue operating the existing NETL facility for the first 5 years of operation past 2019, as compared to more efficient organic processing capacity, will cost Halifax \$5-17 million of capital and operating costs or approximately \$1.0-3.4 million annually. This assumes that the existing composting system (static aerated floor/container) will last until 2025.

Potential wastewater volume and disposal cost fluctuations are the primary reason for the large variation in potential savings. Under a worst case scenario, where the existing system is maintained and leachate and process water volumes are not significantly reduced and the

current disposal option is no longer able to accept the NETL wastewater, the additional cost in wastewater treatment could exceed \$1.4 million annually.

Section 1.0 Introduction

Conestoga-Rovers & Associates (CRA) has prepared this compliance and process review of the New Era Technologies Limited (NETL) compost facility located at 61 Evergreen Place, Goodwood, Nova Scotia. The facility is operated under a long-term design-build-operate contract with Halifax Regional Municipality (Halifax). In 2019, the 20-year contract term will be completed, with Halifax taking ownership of the facility and terminating the lease of the property and having multiple options for the succession of the facility including entering into a new long-term arrangement to operate and upgrade the facility (including increasing or decreasing capacity) or shutting down the facility. In reviewing these options, Halifax must consider the financial investment needed to continue operating the facility. The objectives of the process review were therefore to:

- Identify requirements to bring the NETL facility into compliance with the 2010 Nova Scotia Environment (NSE) Composting Facility Guidelines (2010 NSE Guidelines)
- Identify facility process improvement opportunities
- Evaluate options to both increase and decrease the capacity of the facility

The NETL facility was designed in the late 1990s in accordance with NSE requirements that specified meeting compost quality in accordance with the 1996 Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality. Since that time, NSE has adopted the most recent 2005 CCME Guidelines for Compost Quality (2005 CCME Guidelines) and has required composting facilities in Nova Scotia be in compliance by the fall of 2015. CRA understands that NSE may grant Halifax permission to meet this requirement by 2019 for the NETL facility to coincide with the end of the 20-year contract term.

In addition to the current study, CRA recently completed a building assessment of the NETL facility (submitted under separate cover in April 2015). Overall, the facility was found to be in fair to poor condition with capital expenditures of \$698,000 required over a five year investment horizon to maintain the facility for a remaining useful life of 10-15 years.

Section 2.0 NETL Compost Process

Mr. Andrew Philopolous and Mr. Mike Muffels of CRA toured the site on April 28, 2015 and met with the Plant Manager, Mr. Darren Evans. Observations documented from the site visit are incorporated into the appropriate sections below.

The NETL facility consists of a receiving hall, office, Stinnes-Enerco containerized composting system, curing building, and a screening building. It is located at 61 Evergreen Place in

Goodwood, Nova Scotia on a piece of property owned by Halifax. The NETL facility site layout is shown on Figure 2.1. The NETL facility composting process flow is illustrated on Figure 2.2.

Feedstock is received in the receiving hall, where it is loaded onto a conveyor belt. The feedstock passes through a manual sort station staffed with 3-4 people on a part-time basis with a large magnet to remove metal for recycling. Recyclable materials collected are sold. The conveyor belt drops the sorted feedstock material into a shredder or grinder with an 8 inch screen size. The ground feedstock is mixed with screening overs and any other available bulking amendment in the receiving hall using a front end loader.

The facility is based on the Stinnes-Enerco containerized composting process. The primary composting stage is completed in one of 24 aerated and sealed containers. The composting containers are located outdoors. Material is typically left in the container for 7-10 days. The containers are controlled by a central control system that monitors air temperature and air flow. The primary compost process can be controlled by adjusting the air flow rate and the recirculation of leachate. No leachate is currently recirculated due to high moisture levels in the feedstock materials.

The containers are tipped in the curing building and the material placed onto the aerated curing floor. The compost remains in the curing building for 2.5 to 3.0 months. The material in the curing hall is only turned when it is moved down the curing floor using front end loaders towards the screening building as it matures.

The matured compost is screened (25 mm openings) and stored in the screening building. The screening equipment includes a vacuum blower to collect light film plastic. Roughly 40 percent of incoming organics are converted into compost at the NETL facility. Screening overs (>25 mm) are used as bulking amendment for the composting process. Overs not used back in the composting process are sent to Elmsdale Landscaping.

The fines or compost are transported in bulk to Elmsdale Landscaping for little revenue. Elmsdale Landscaping further cures the material and uses it for their landscaping products. The compost exported from the NETL facility does not have the quality or consistency to generate a higher price due to low maturity level (high moisture, low pH).

All process and building air is mechanically ventilated and treated through biofilters located either behind the receiving hall or beside the curing building. The facility does receive occasional odour complaints.

All process water and leachate is collected, stored and trucked off-site to a wastewater treatment facility. The leachate storage pump is located between the biofilters and compost

containers behind the receiving hall. Approximately 5 million liters of leachate are generated annually. The process water storage tank and pump out is located in the northeast corner of the paved area. Approximately 3.8 million litres of process water are transported off-site each year for treatment.

Section 3.0 Compliance with 2010 NSE Composting Facility Guidelines

CRA completed a review of the NETL facility and the 2010 NSE Guidelines to identify compliance concerns. CRA understands that the NETL facility will not be required to comply with the 2010 NSE Guidelines until the end of the current contract with NETL in 2019. The results of this review are summarized in Table 3.1 following the text. It has been well documented that the primary challenge for source-separated organics (SSO) compost facilities, including the NETL facility, to achieve compliance with the 2010 NSE Guidelines is the more stringent maturity requirement. The compost maturity guideline is the primary non-compliance concern. This is discussed in more detail in Sections 3.1 and 3.2 below.

Other 2010 NSE Guideline non-compliance and potential non-compliance items include:

- Elmsdale Landscaping Ltd. is not an approved composting facility and therefore would not be able to act as a secondary curing facility for the NETL facility, if required, unless it obtains approval.
- The NETL facility will require additional signage to provide normal operating hours, emergency contact information and the types of acceptable materials at the site entrance.
- Foreign matter levels in the compost are a concern and may require new or additional screening equipment to meet Section 3.3 the 2005 CCME Guidelines. The screen size of 25 mm is relatively large for a screening a finished compost and this will have an impact on the level of contamination in the compost. The screen size can likely be reduced if the compost maturity is improved as discussed in Section 3.2 below. The efficacy of the existing equipment will need to be re-evaluated when the compost maturity has improved to an acceptable level (it was difficult to evaluate this from the material present during CRA's site visit).
- The NETL facility must increase the frequency of compost sampling as they are currently not in compliance with their Approval to Operate (NSE Approval #2008-062534). The 2010 NSE Guideline requirement is the same as the sampling frequency in the Approval to Operate.
- Condition 13(b) of the Approval to Operate requires overs to be disposed of at an approved landfill site unless written permission for an alternative is received from the NSE. This condition should be clarified by consulting with NSE to ensure that New Era is meeting the requirements of the Approval to Operate. Currently, New Era tests larger size compost

material (coarse compost) prior to shipping according to the CCME Guidelines for every 1,000 tonnes generated and ships the material to Elmsdale Landscaping for further processing and curing.

3.1 Current Compliance with Maturity Requirement

Mature compost is material in which biological activity has slowed after most of the easily degraded molecules have been broken down into humus, leaving the complex organic material behind. In this state, it is difficult to identify the original feedstock materials. A fine texture, dark colour, and a rich earthy smell characterize mature composts.

The 2010 NSE Guidelines require that the resulting compost meet the 2005 CCME Guidelines. The compost maturity requirements in Section 3.4 of the 2005 CCME Guidelines are as follows:

Compost shall be mature and stable at the time of sale and distribution. To be considered mature and stable, a compost shall be cured for a minimum of 21 days and meet one of the following three requirements:

- a. *the respiration rate is less than, or equal to, 400 milligrams of oxygen per kilogram of volatile solids (or organic matter) per hour [400 mg O₂/kg VS/h]; or,*
- b. *the carbon dioxide evolution rate is less than, or equal to, 4 milligrams of carbon in the form of carbon dioxide per gram of organic matter per day [4 mg CO₂/g OM/d]; or,*
- c. *the temperature rise of the compost above ambient temperature is less than 8°C.*

Dr. Paul Arnold of Bio-Logic Environmental Systems completed a technical memorandum, dated May 11, 2014 for New Era Technologies evaluating the process performance and respiration rate (2014 Bio-Logic Study). The measured respiration rates, after 80-90 days, reported in this memorandum were approximately an order of magnitude higher (3,500 - >10,000 mg O₂/kg VS/h) than the 2010 NSE Guideline limit of 400 mg O₂/kg VS/h. Full-scale trials involving no leachate recirculation and increased bulking amendment were not able to reduce the measured respiration result significantly.

Over 2010 and 2011, CBCL Limited (CBCL Study) collected 4 batches of compost samples from the NETL facility (as well as the Miller and Elmsdale facilities). While the respiration rates, after 120 days, were significantly lower (409 – 2,830 mg O₂/kg VS/h) than the results measured in the 2014 Bio-Logic Study, they were still above the 2005 CCME Guideline threshold.

Section IV.4(d)&(e) of the 2010 NSE Guidelines allows for immature compost to be transferred to an approved composting facility in order to complete the maturation process. In addition:

For immature compost to be transported to a secondary curing area, it must achieve one of the following requirements:

- i. cured for at least 21 days and must not reheat above 20°C;*
- ii. cured for at least 21 days and organic matter is reduced by at least 60% by weight;*
or
- iii. able to germinate 90% of cress seed vs control and has a plant growth rate of compost/soil at least 50% of control.*

The 2014 NETL Annual Report confirms that the compost generated at the NETL facility is currently able to consistently meet the cress seed germination and plant growth rate requirement. Thus, utilization of a secondary curing facility at an approved composting facility will be an option following the implementation of the 2010 NSE Guidelines for the NETL facility in 2019.

3.2 Feedstock and Process Considerations to Achieve Maturity Requirement

The rate at which maturity is attained is dependent primarily on how well the material is aerated during both the compost and curing stages. For a facility that relies on static aeration for both the compost and curing stages, this is ultimately dependent upon the structure and porosity of the feedstock. Manipulating air flow rates through a compost heap will only have a significant impact if the compost has adequate porosity or free air space to permit the air to flow through the heap. Porosity is a function of the range of particle sizes in the material, moisture content and homogeneity of the material (i.e., well mixed). Achieving maturity in a timely fashion also requires other material quality parameters such as C:N ratio, nutrients and pH to be maintained within certain bounds.

Process change options in 2019 to increase aeration include:

- Increased bulking amendment
- Increased turning/aeration at the primary and/or curing stages
- Increased curing times (requires additional capacity)

Previous work has been completed to improve the maturity of the compost at the NETL facility. The 2014 Bio-Logic Study separately measured the impact of additional bulking amendment (and cessation of leachate recirculation) and the impact of increased turning/aeration during

the curing phase. In the study, Dr. Arnold was able to demonstrate, in a bench-scale test, that increased aeration during curing could achieve a respiration rate of below 1,000 mg O₂/kg VS/h in as little as 40 days despite the fact that the curing material was wetter than optimal curing conditions (60 percent actual vs 45-55 percent optimal). This was the best respiration result achieved in the study.

The study also demonstrated that only ceasing leachate recirculation or combining no leachate recirculation with a drier bulking agent (with no changes to curing process) was not sufficient to achieve the new maturity requirement on its own. The study did not examine the combined impact of no leachate recirculation, additional bulker and increased curing aeration.

At the time the 2014 Bio-Logic Study was completed leachate was still being recirculated back into the compost process; a practice which was terminated in May 2014 largely as a result of the 2014 Bio-Logic Study. Mr. Evans noted during the site visit that the compost quality has improved noticeably in the year since as a result.

Table 3.2, attached, summarizes the compost quality data from the 2012-2014 Annual Reports. There have been only two compost maturity samples collected since August 2014 and these results are within the range of values measured prior to August 2014. Thus, the cessation of leachate recirculation does not appear to have had any immediately measurable impact on compost maturity; but it is still too premature to draw any conclusions. It could take a number of compost cycles to progressively dry out the overs, in turn drying out the feedstock mixture, until a new seasonal process equilibrium is reached.

Figure 3.1, attached, illustrates the available compost C:N ratio, pH and moisture data compiled from the 2012-2014 Annual Reports. If leachate recirculation was terminated in May 2014, the first batches of compost generated without leachate addition would be screened in early August 2014 (grey dashed vertical line). There is not enough data yet available to draw any firm conclusions, but qualitatively comparing the compost moisture data before and after August 2014, it does appear that the moisture content in the compost may have dropped somewhat as a result of not adding leachate back to the composting process. This supports Mr. Evans' initial observations. There are no readily apparent trends in the available pH or C:N data.

Table 3.3, below, summarizes available moisture, pH and C:N ratio levels in the feedstock and compost compared against industry standard optimal ranges. From Table 3.3, the NETL facility compost C:N ratio was within the recommended range, however the moisture content and pH were not. C:N ratio data was not available for the feedstock materials, it is suspected that the C:N ratio of the mixed feedstock materials entering the compost containers is below 25:1. Typical values for municipal organics have been provided for reference. The NETL facility uses

very little external bulking amendment and relies heavily on screening overs to bulk up the material. The low pH is also retarding the rate of composting and curing. The data in Table 3.3 suggests that the compost process is incomplete and ineffective based on current lack of external bulking amendment and compost and curing processes.

Table 0.3

Available Compost Quality Parameters

Parameter	Feedstock		Compost	
	NETL¹	Optimal²	NETL³	Optimal²
Moisture (%)	56-61	55-65	50 (45-59)	40-45
C:N Ratio	Food Waste: 15:1 Green Grass: 10:1 Leaves: 55:1 Wood Chips: 200:1	25:1 – 30:1	16:1 (12:1-19:1)	15:1 – 20:1
pH	4.3-6.0	6.5-8.0	5.3 (4.5-6.1)	6.5-8.0
Bulk Density (kg/m³)		475-590	Not available	
Nutrients	Not available		Not available	

Notes:

1. Source: Moisture and pH values from 2014 Bio-Logics Study. Measured feedstock C:N ratio data not available; typical values taken from Environment Canada 2013 Technical Document on Municipal Solid Waste Organics Processing.
2. Source: Average, minimum and maximum values taken from Environment Canada 2013 Technical Document on Municipal Solid Waste Organics Processing.
3. Source: 2012-2014 NETL Annual Reports – see Table 3.1.

The material exported from the NETL facility does consistently meet previous cress seed germination and plant growth rate maturity requirements. This indicates that some level of treatment or composting is occurring but is likely limited due to a limiting factor such as low pH, high moisture, a nutrient deficiency or time; or a combination thereof.

The retention time of the primary compost containers is considered to be insufficient, particularly given the moisture content of the material and lack of suitable bulking amendment. This is a primary capacity constraint of the NETL facility. The containers must first dry the material before proper composting can begin. Seven to ten days is not considered enough time to dry, pasteurize and compost the wet, low pH SSO materials being received at the site, particularly given the lack of suitable bulking amendment. Thus, in effect, the curing area is also performing the function of a secondary composting area; which impacts that available curing capacity of the facility.

In 2019, the composting containers will be 20 years old and this is considered the end of their remaining useful life. The containers appear to have been reasonably well maintained and repaired over the past 15 years considering that they have been moved, tipped, lifted, dropped 25-30 times per year. They are however starting to exhibit signs of their age. The container walls are developing new holes at an increasing rate and an increasing number of patches are required according to Mr. Evans. The containers are expected to need replacing in 5-10 years to ensure reliable operation past 2019.

New containers can no longer be purchased from Stinnes-Enerco to expand the existing system as they are no longer in business. An alternate composting system would be required to expand or replace the existing container system. Adding additional capacity via another composting system, for example another compost container supplier or an in-vessel system (similar to HotRot system), would result with a facility that employs two different composting systems of two different vintages. As the existing system will be at or very near the end of its remaining useful life in 2019, it is recommended that it be replaced with a new organics processing system that is better suited to the quantity and quality of feedstocks anticipated to be received in the future.

To extend the life of the existing containers, without expansion, as long as possible past 2019, it is possible to utilize a portion of the curing area as a secondary composting area. This is essentially what is already occurring but should be done with more active management, including increased turning of the materials in the first part of the hall where active composting is occurring. Use of curing area for secondary composting will therefore require additional curing area (as a result of the reduced area available due to the secondary composting).

Additional bulking amendment material would improve the porosity, pH, moisture and C:N ratio of the feedstock material. Procurement of wood chips, a common and effective bulking agent, has been a challenge for the NETL facility. There is a strong local demand for wood chips for power generation driving up the price. Mr. Evans indicated that the local price for bulk mulch is too expensive at \$15-18 per yard to utilize at the facility. Assuming a bulk density of approximately 250 kg/m³ and a bulker:organics ratio of between 1:5 and 1:3 (volume basis), the cost of purchasing a mulch amendment could range between \$8 and over \$16 per tonne of SSO processed. At a bulker:organics ratio of 1:4 (volume basis), approximately 9,000 m³ or 2,500 tonnes of well-structured bulking amendment would be required to process 25,000 tonnes of SSO.

The NETL does occasionally receive mulch from smaller suppliers as it is available. This is primarily used to replenish the biofilters on-site. Spent mulch from the biofilters is used as an amendment in the composting process as it becomes available (not continual).

Compounding the problem of the lack of bulking amendment is the increase in the amount of ICI organics being delivered to the facility. As with all municipal organics processing facilities, the quantity and quality of the material is dependent on the program participants and varies seasonally and over time. Table 3.4 summarizes the amounts of residential and ICI material received at the NETL facility from 2012 to 2014.

Table 0.4

Summary of ICI and Residential Tonnages Received at NETL Facility

<i>Year</i>	<i>Residential</i>	<i>ICI</i>	<i>Total</i>	<i>Percent ICI</i>
2012	15,900	8,159	24,059	33.9%
2013	15,684	8,659	24,343	35.6%
2014	14,873	9,354	24,227	38.6%

Source: 2012-2014 NETL Annual Reports

This increase in the relative amount of ICI SSO received at the facility increases the amount of bulking amendment required for adequate composting in a static aerated container composting system. The lack of bulking amendment availability compounds the unsuitability of the static aerated containers for this type of material. It is very difficult to first dry and then compost the material in this style of composting.

3.2.1 Increased Curing Area

The 2012 CBCL Study demonstrated that only the compost from the Elmsdale facility that had cured for 12 months consistently met the maturity and other compost quality criteria, including pathogen reduction. Thus, without any other significant improvements to the quality of fines exported from the NETL facility, an option to meet the 2010 NSE Guidelines would be to provide sufficient area for an additional 12 months of passive windrow curing. Table 3.5 summarizes the calculations for the approximate additional curing area required.

Table 0.1

Estimate of Additional Curing Area

<i>Item</i>	<i>Value</i>	<i>Units</i>
Mass to be Cured (110% of 2014 annual compost quantity)	12,500	tonne
Assumed Bulk Density of Immature Compost	500	kg/m ³
Volume to Cured	25,000	m ³
Stockpile Width	16	m
Stockpile Height	8	m

<i>Item</i>	<i>Value</i>	<i>Units</i>
Stockpile Cross-Sectional Area (triangle)	64	m ²
Stockpile Length	400	m
Stockpile Footprint	6,400	m ²
Allowance for Equipment Access and Work Areas (100%)	6,400	m ²
Allowance for Water Management (50%)	3,200	m ²
Approximate Total Additional Curing Area (-50%/+25%)	16,000	m ²
	1.6	hectares
	4.0	acres

It is not clear how effective the existing curing hall is with the existing quality of material being cured. The air channels in the floor become completely clogged and must be cleaned each time material is moved down the curing hall. Therefore, it is not recommended that a new aerated curing hall be constructed as it would be required to be covered with mechanical ventilation and odour treatment.

The cost to develop an additional 1.6 hectares (4.0 acres) for a curing pad will depend on a number of factors but could vary from several hundred thousand dollars to over a million dollars depending on the site. Locating the additional curing pad at an existing serviced facility with an existing scale, a loader, staff and surface water management will greatly reduce the required capital investment and ongoing operational costs. The site may require NSE approval or an amendment to an existing approval to operate.

Increasing the curing area/time does nothing to address the quality of the compost currently produced at the NETL facility, the effectiveness of the existing composting equipment, or condition of existing infrastructure, which will be 20 years old in 2019.

3.2.2 Increased Aeration

Simply forcing more air through the existing feedstock materials or curing piles will not be successful in increasing aeration without suitable external bulking amendment. This approach has been attempted with little to no success multiple times by the operator within the bounds of the current blower fan capacities. For the NETL facility, increased aeration effectively implies additional turning of the curing pile, as additional turning of the primary compost containers is not possible. Additional turning of the curing pile will require additional labour, additional equipment and/or additional space.

The interior dimensions of the curing building are approximately 135 m long by 20 m. The aerated floor is approximately 120 m (container tipper is located at front of curing building) by 14 m. On the day of the site visit the curing pile spilled over at least 2 m past the end of the aerated floor making the pile approximately 16 m wide at its base. On the day of the site visit

the curing pile was approximately 3.1 m (10 feet) high, but Mr. Evans indicated that normally he would prefer to keep it at approximately 2.4 m (8 feet) high. Based on these dimensions and the shape of the curing pile, it was calculated to have a cross sectional area that varied between 35 and 45 m².

The length of the floor is almost never entirely covered as space is always needed to add new material. It is estimated that currently the floor is approximately 80 percent full on average. On the day of the site visit the curing area was 50-67 percent full, but Mr. Evans indicated that he was clearing some space in the curing building to facilitate an inspection and possible repairs to the tipping floor area. Thus, on average the curing building contains roughly 3,400 – 4,300 m³ of unscreened material for curing.

Additional turning using a front end loader could be accomplished with minimal additional space (if any) but with significant additional labour. In order for a front end loader to move and turn approximately 3,400 – 4,300 m³ of material twice per week, allowing for at least three days before a material is turned and working on a 5-day work schedule, would require the turning to be completed in approximately 1.5 working days (Monday to Tuesday morning, and Thursday afternoon to Friday) or 11 hours. This implies moving 300 - 390 m³/hr or 60 to 195 bucket loads per hour (1-3 bucket loads per minute) depending on the size of the bucket. This will likely require 2-3 loaders to complete depending on the amount of material and size of bucket. Operating three loaders in this tight and foggy space in a safe manner would need to be evaluated. This is very labour intensive regardless of the number of loaders required and may require an additional loader and operator to what currently exists at the facility.

Alternatively, a specialized compost turner could be utilized. It could be used to both turn the piles and move the piles down the hall towards the screening building if well planned. A single compost turner could potentially turn 4,300 m³ in less than half a day.

Most compost turners are designed for outdoor windrow use and as such require a prohibitive amount of space for turning and between windrows. This space would result in significant reductions in the capacity of the curing building. As compost turners generally move the pile backwards during the turning process, they would need to move in the same direction for the majority of turns in the curing building, generally from back to front (oldest to newest material) to ensure the material is continually moved towards the screening building. This would require a dedicated extra wide aisle to move the machine from one end of the building to the other between rows. Most large self-propelled turners also do not fit through doors that are less than 6 m wide. Smaller turners would result in much smaller windrows and curing capacity.

CRA found one potential suitable compost turner: the ECO 5003 model from neuson ecotec; an Austrian firm with a distributor in Quebec (Agritibi R.H. Inc.). It can process up to 2,800 m³/hr. The website link is:

<http://www.neuson-ecotec.com/index.php?id=40&L=1>

The ECO 5003 is specifically designed for tight spaces and indoor use. It does not require space between windrows and requires minimal turning area at the end of each windrow. The front rotor unit, which comes in 4 or 5 m widths, is attached with a quick-hitch system and with the front rotor unit removed; the machine is 3.65 m (12 feet) wide. This may allow the machine to enter and exit the building for maintenance without modifications to the doors (to be confirmed).



Figure 0.2: Photo of neuson-ecotec ECO 5003 (Source: neuson-ecotec website)

The 5 m wide rotor can manage a 10 m² trapezoidal – triangle pile that is 5 m (16 feet) at its base and 2.5 m (8 feet) high. No space is required between windrows; in fact they can be overlapped by 1.5 m, so three windrows would require as little as 12-15 m. The curing building is approximately 20 m wide. Three windrows would provide room for the machine to travel from one end of the building to the other to move all three windrows in the same direction. Three windrows provides approximately 30 m² total cross sectional area (less if the windrows are overlapped).

This type of compost turner would result in drier material at the NETL facility. The aeration channels would require less frequent cleaning, at least in the back half of the building. This would allow less of the area to be kept offline at any one time for cleaning. However, this is offset by the additional turning area required for the machine, roughly 6 m at each end of the building. It was assumed that with this machine, the curing hall would remain approximately 80 percent full on average. Thus, the total curing volume capacity would be approximately 2,800 m³ or 65-82 percent of the current capacity.

Use of a compost turner of this type, combined with forced aeration, would reduce the amount of curing time required. Material is currently cured for 75-90 days (2.5 – 3.0 months). It is reasonable to expect that with the effective use of a turner such as this (turning 2-3 times per week), that the maturity requirement under the 2005 CCME Guidelines can be achieved in less than 65 percent of the current curing time (i.e., in less than 50 days) from a material generated from 7-10 days in the primary compost containers (without leachate recirculation and without additional amendment). This will need to be confirmed with a field trial as outlined in Section 3.2.3.

CRA is not aware of any facilities in Canada using the ECO 5003. This unit is expected to cost several hundred thousand dollars but would replace at least one front end loader and possibly one laborer as much less time will be spent in the curing hall moving materials around.

3.2.3 2010 NSE Guidelines Compliance Summary

To generate compost from the NETL facility that is fully compliant with the 2010 NSE Guidelines and applicable 2005 CCME Guidelines on compost quality will require, at a minimum:

- Continued practice of no recirculation of leachate (unless required to maintain minimum moisture requirements if a compost turner is utilized, for example) (zero capital cost, net operational savings with respect to leachate management)
- Additional bulking amendment (zero capital cost item, \$8-16/tonne SSO received)
- Additional curing area and/or frequent turning (i.e., increased aeration) of the curing pile (several hundred thousand dollars to over a million dollars of capital for additional curing area or new windrow turning equipment)
- Potentially new or additional screening equipment (not fully operational during site visit therefore could not fully assess)

This is in addition to the approximately \$698,000 in building repairs required over the next 5 years identified in the building assessment completed by CRA, submitted under separate

cover (CRA, April 2015). This does not account for the age of the existing equipment and the expected requirement to replace the existing composting system within 5 years past 2019.

Given that the existing containers will be at the end of their remaining useful life in 2019, their unsuitability for the type of wet, low pH SSO material being received at the NETL facility, and the lack of suitable bulking amendment, it is not recommended to purchase additional primary composting capacity to improve the retention time of the existing containers to achieve the maturity requirement. If the existing composting system is operated past 2019, it is recommended that a portion of the curing area be utilized for the additional composting capacity as it is unknown how long past 2019 the existing containers will be serviceable.

If the decision is made to continue operating the existing composting system past 2019, it is recommended to complete a pilot-scale trial in the curing building (on the aerated floor) of the impact of increased turning of the curing pile. If possible a small windrow turner should be rented to complete the trial. An area at the back-end of the curing building (adjacent to the screening building) should be used for the trial to ensure that any of the leachate from the other compost does not impact the trial.

Section 4.0 Process Improvement Assessment

As part of CRA's operational review, a process improvement assessment was to be completed. The assessment was to identify process improvements that could result in better compost quality, throughput, and use of space in addition to process improvements required to meet the 2010 NSE Guidelines. Based on the findings outlined in Section 3.0 and the building condition assessment completed previously, investing in further process improvements to the existing Stinnes-Enerco containerized composting system is not recommended as it will need to be replaced by 2019 or shortly thereafter. In 2019, when the 2010 NSE Guidelines will apply to the NETL facility, it is recommended that Halifax replace the existing facility with alternate organics processing capacity to meet Halifax's organics processing needs for the subsequent 20-year period.

Based on the findings to bring the facility into compliance with the 2010 NSE Guidelines, the cost to implement these upgrades are in the order of several hundred thousand dollars (for a new turner) to over a million (for a new secondary curing area). This is in addition to the approximately \$698,000 in building repairs required over the next 5 years identified in the building assessment completed by CRA, submitted under separate cover (CRA, April 2015).

This is also in addition to replacement costs for the existing compost containers with new composting equipment. If the compost equipment is replaced, it is not clear based on the characteristics of the SSO being received at the facility, namely it's high moisture content, low

C:N ratio and low pH, that composting the material is the most cost effective processing option. It is recommended that Halifax explore multiple organics processing options when considering replacement of the existing composting system at the NETL facility.

In addition to these capital expenditure upgrades, the following operational considerations are significant:

1. Due to the increased amounts of ICI organics to the feedstock material, the static aerated container composting technology is no longer ideal for composting the material currently being received at the facility. This is addressed in Section 3.2.
2. The process is labour intensive. The NETL facility employs 10-11 staff. Other more modern SSO composting facilities of a similar scale can operate with less full time staff; the number depends on the type of technology used but as few as 7 full time staff. Many composting facilities do not include a manual sorting step, apart from separation of large items observed by tip floor loader operator. This is an area for potential process improvement.
3. Halifax is paying to truck 5.0 million liters of leachate and 3.8 million litres of process water per year. Currently, this is costing Halifax approximately \$0.08/litre for trucking and disposal, however, in the past it has been over \$0.22/litre. The wastewater had been permitted to be trucked to a nearby Halifax Water sanitary sewer inlet, at a cost of \$0.165/litre; however Halifax Water encountered difficulty processing the wastewater and could no longer accept the material. At the current price of \$0.08/litre, Halifax is paying \$704,000 annually to manage the leachate and process water at the site. Measures have been taken to minimize the amount of leachate generated at the facility (no leachate recirculation) and therefore the quantity is expected to decrease. No plans have been identified to cover the outdoor biofilters (further discussed below) to reduce the quantity of process water.

The uncovered outdoor biofilters could be covered to reduce the amount of process water generated at the NETL facility. The curing building biofilter is approximately 1,760 m². Halifax has an average annual rainfall of approximately 1,400 mm. Assuming that 50 percent of the precipitation that falls on the biofilter will eventually pass through it to be collected and stored, covering the biofilter will result in a reduction of approximately 1.2 million litres of process water per year or an approximate savings of \$100,000 per year in disposal costs at the current price of \$0.08/litre. Installing a fixed cover over the biofilter would cost between \$0.8-1.5 million and would require disruption to existing operations to install as space is limited around the biofilter. Assuming the facility will only remain operational for 5 years, it is not recommended to cover the biofilters as the capital upgrade and disruption of operations is not justified based on the potential savings.

A temporary biofilter cover is an alternate option. However, assuming the facility will only remain operational for 5 years, the additional capital and operating costs are not justified. Managing exhaust air from the biofilter and the media moisture levels will be more difficult. If not managed properly, a temporary cover could result in increased odours. Additional costs considerations include the temporary cover system and labour and equipment to roll the cover on and off the biofilter to refresh the media and control the moisture levels.

In summary, the following costs, summarized in Table 4.1 attached, will be incurred by Halifax to keep the NETL facility operating past 2019 using the existing composting system:

- \$698,000 in building repairs are required to continue to operate the existing facility.
- \$400,000 - \$1,500,000 for additional curing area and/or equipment.
- Potential costs associated with new screening equipment.
- Reduced tip fees from \$200/tonne (which includes leachate and process water disposal costs): CRA's April 1, 2015 memorandum to Mr. Matthew Keliher at Halifax's Solid Waste Resources estimates tip fees for a composting facility to currently be approximately \$175/tonne based on fees at other existing facilities. The Miller facility currently charges HRM \$146/tonne. A new, more efficient facility with reduced tip fees and reduced wastewater disposal costs would save Halifax \$0.6-1.4 million annually.
- Wastewater disposal costs included in the above \$200 tip fee are currently lower than they have been in the past several years. Historically, leachate and process water disposal costs have been up to 3 times higher than the current cost of \$704,000 annually; or approximately \$2 million.
- Additional bulking amendment at \$8-16 per tonne of SSO received. Taking a conservative assumption that a new composting system will still require some bulking amendment, the savings to Halifax is estimated to be \$100,000 annually in additional bulking material.

In total, to continue operating the existing NETL facility for the first 5 years of operation past 2019, as compared to more efficient organic processing capacity, will cost Halifax approximately \$5-17 million more in capital and operating costs or approximately \$1.0-3.4 million annually. This assumes that the existing composting container system will last until 2025.

Potential wastewater volume and disposal cost fluctuations are the primary reason for the large variation in potential savings. Under a worst case scenario, where the existing system is maintained and leachate and process water volumes are not significantly reduced, and the

current disposal option is no longer able to accept the NETL wastewater, the additional cost in wastewater treatment could exceed \$1.4 million annually.

Section 5.0 Future Operational Capacity Scenarios

Halifax requested CRA evaluate three future capacity scenarios, namely:

1. Status Quo: 25,000 tonnes per year
2. Capacity increase: 40,000-45,000 tonnes per year
3. Capacity reduction: 10,000-15,000 tonnes per year

As discussed in Sections 3.0 and 4.0, the NETL facility, CRA does not recommend operating the NETL facility at its current capacity beyond 2019. The same rationale applies to both the capacity increase and decrease scenarios. The existing Stinnes-Enerco composting containers and associated ancillary equipment are expected to need replacing in 2019 or shortly thereafter. The system cannot be relied upon for another 15-20 years of operation past 2019. In addition, the static aerated container/floor system is not ideally suited for the nature of Halifax's organics due to the challenge in procuring a cost effective bulking amendment.

For both the status quo and capacity increase scenarios, scenarios 1 and 2 above, CRA recommends replacement of the existing composting system with alternate organics processing capacity. The existing system is not expected to be able to meet the 2005 CCME Guidelines for maturity at the existing or any increased material throughput without significant upgrades to infrastructure and/or equipment.

With respect to scenario 3, decreased capacity, for long-term robust organics processing capacity, CRA does not recommend relying on continuing operation of the NETL facility well past 2019; even at a reduced throughput. However, CRA expects that at a reduced throughput of roughly half the current throughput of 25,000 tonnes annually, that no further investment (beyond investment in building repairs to reach 2019) in the NETL facility would be required to achieve the 2010 NSE Guidelines, including the 2005 CCME Guidelines for maturity. Operating at a reduced capacity will reduce the labour required (7-8 staff), reduce the leachate and process water generated significantly and generate a finished saleable compost. Halifax should not rely on operating the NETL facility at half capacity past 2019 for an extended period of time but it could be operated in this manner possibly for a number of years if it is operated with some care.

Section 6.0 Conclusions and Recommendations

To generate compost from the NETL facility that is fully compliant with the 2010 NSE Guidelines and applicable 2005 CCME Guidelines on compost quality will require, at a minimum:

- Continued practice of no recirculation of leachate (unless required to maintain minimum moisture requirements if a compost turner is utilized, for example) (zero capital cost, net operational savings with respect to leachate management).
- Additional bulking amendment (zero capital cost item, potential of \$8-16 per tonne of source separated organics increase in operating costs).
- Additional curing area and/or frequent turning (i.e., increased aeration) of the curing pile (several hundred thousand dollars to over one million of capital for additional curing area or new windrow turning equipment).
- Elmsdale Landscaping Ltd. is not an approved composting facility and therefore would not be able to act as a secondary curing facility for the NETL facility, if required, unless it obtains approval.
- The NETL facility will require additional signage to provide normal operating hours, emergency contact information and the types of acceptable materials at the site entrance.
- Foreign matter levels in the compost are a concern and may require new or additional screening equipment to meet Section 3.3 the 2005 CCME Guidelines. The screen size can likely be reduced if the compost maturity is improved as discussed in Section 3.2 above. The efficacy of the existing equipment will need to be re-evaluated when the compost maturity has improved to an acceptable level (it was difficult to evaluate this from the material present during CRA's site visit).
- The NETL facility must increase the frequency of compost sampling as they are currently not in compliance with their approval to operate from NSE. For the years 2012-2014 the operator was just short of this requirement. Testing is required for every 1,000 tonnes of compost or every 3 months; see Table 3.1. The 2010 NSE Guideline requirement is the same as the sampling frequency in NSE Approval #2008-062534.
- Condition 13(b) of the Approval to Operate requires overs to be disposed of at an approved landfill site unless written permission for an alternative is received from the NSE. This condition should be clarified by consulting with NSE to ensure that New Era is meeting the requirements of the Approval to Operate. Currently, New Era tests larger size compost material (coarse compost) prior to shipping according to the CCME Guidelines for every 1,000 tonnes generated and ships the material to Elmsdale Landscaping for further processing and curing.

The NETL facility is not ideal for considering further investment to upgrade operations to bring into compliance with the 2010 NSE Guidelines or to increase or decrease capacity. In 2019, when the 2010 NSE Guidelines will apply to the NETL facility, it is recommended that Halifax replace the existing facility with alternate organics processing capacity to meet Halifax's organics processing needs for the subsequent 20-year period. With respect to process improvements or modifying the capacity of the facility, the primary constraints are:

- Age and condition of existing equipment and buildings
- Porosity, moisture, pH and C:N ratios of feedstock materials and challenges in sourcing suitable bulking amendment
- Incompatibility between the existing organics processing technology (static aerated floor/container) with Halifax SSO (particularly the Institutional, Commercial and Industrial source separated organics). This is related to the feedstock issues identified above and the inability to easily address this incompatibility through changes to feedstock materials or composition. Thus, a different technology is recommended for the long-term organics processing needs of Halifax past 2019.

To continue operating the existing NETL facility for the first 5 years of operation past 2019, as compared to more efficient organic processing capacity, will cost Halifax \$5-17 million of capital and operating costs or approximately \$1.0-3.4 million annually. This assumes that the existing composting container system will last until 2025.

The 61 Evergreen Place property is zoned for processing of solid waste (organics) and is owned by Halifax. The site is 33 acres with approximately 20 acres undeveloped. There is sufficient space to construct a new facility around the existing facility while maintaining its operations.

Section 7.0 Closure

We trust that this report meets your present requirements. Please do not hesitate to contact us, if any questions arise.

Mike Muffels, M.Sc., P. Eng.

Tej Gidda, Ph.D., P. Eng.

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



Aerial Imagery Source: DigitalGlobe, Halifax_CA_V2, captured 8/6/2011, accessed via ESRI World Imagery service.
 Coordinate System: NAD 1983 UTM Zone 17N

figure 2.1

SITE LAYOUT
NEW ERA TECHNOLOGIES LTD. FACILITY
61 EVERGREEN PLACE, GOODWOOD
Halifax Regional Municipality



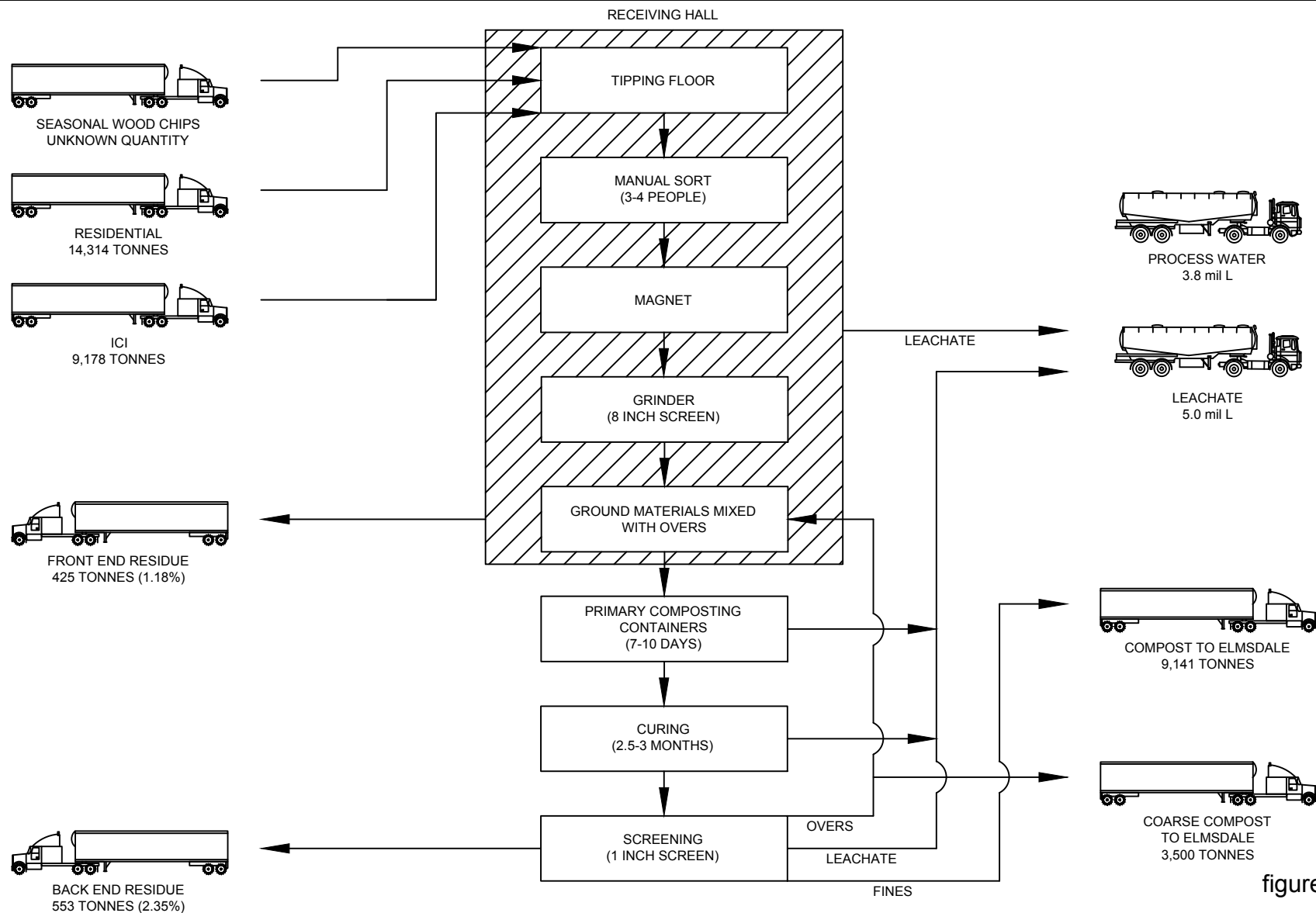


figure 2.2

PROCESS FLOW DIAGRAM
NEW ERA TECHNOLOGIES LTD. FACILITY
61 EVERGREEN PLACE, GOODWOOD
Halifax Regional Municipality



NOTE:
TONNAGES FROM HRM FISCAL 2014

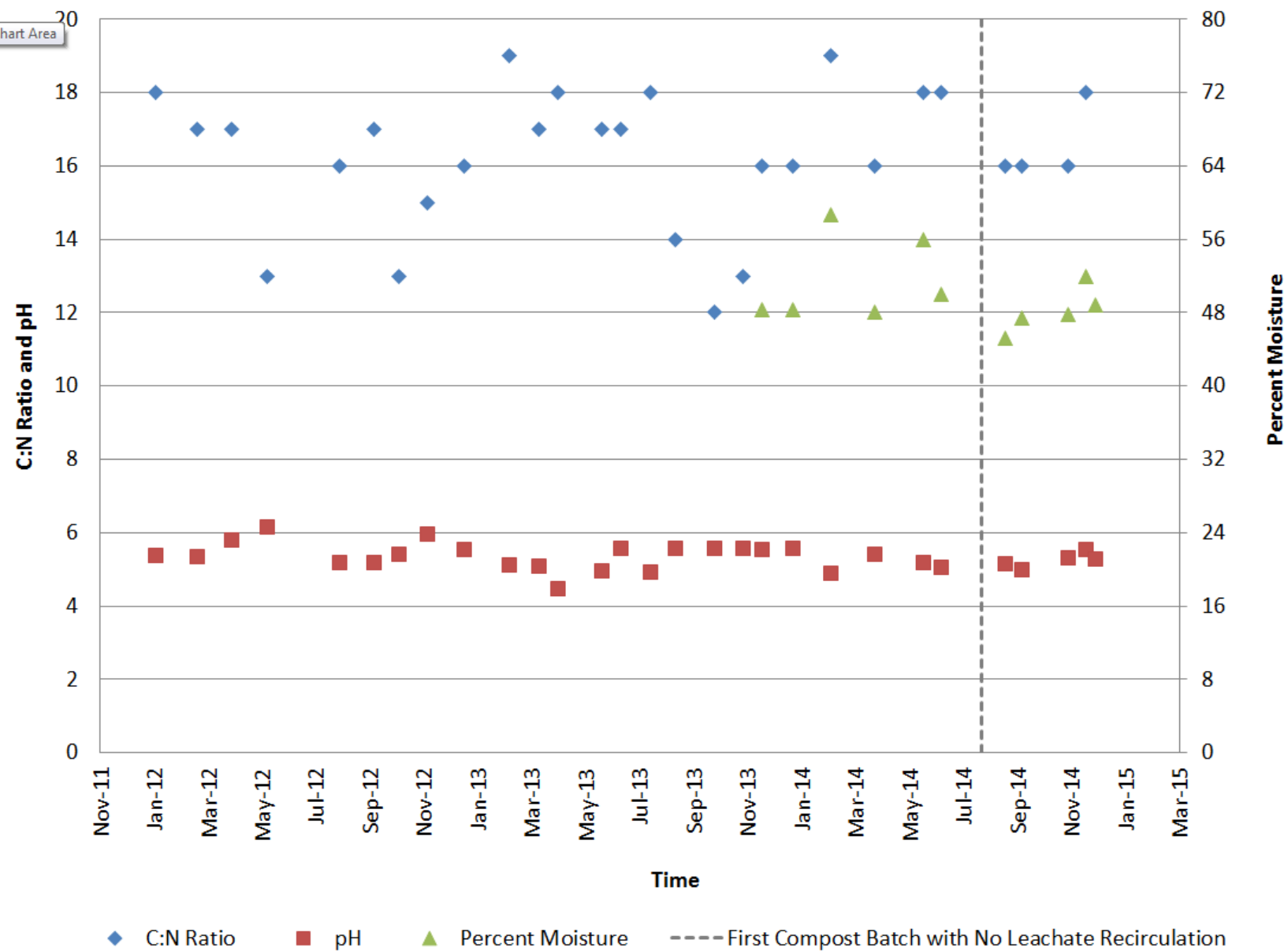


figure 3.1
COMPOST QUALITY
NEW ERA TECHNOLOGIES LTD. FACILITY
61 EVERGREEN PLACE, GOODWOOD
Halifax Regional Municipality

TABLE 3.1

2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY

<i>Section</i>	<i>Guideline Requirement</i>	<i>Compliant (Y/N)</i>	<i>Notes</i>
I & II	<i>General & Application for Approvals</i>		
I.3.(a) II.1.(a)	No person shall construct, operate, expand or modify a facility which can process compost without obtaining approval from the Minister.	Y	NSE Approval #2008-062534 Expires June 19, 2019
III	<i>Leaf and Yard Waste Composting Facilities under 10 000 tonnes</i>	NA	
IV.	<i>In-Vessel Composting Facilities</i>		
IV.2.(a)	The receiving and tipping area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.	Y	Receiving and tipping areas have concrete floor. Leachate collected and transported off-site for treatment. Leachate recirculation to process discontinued in May 2014.
IV.2.(b)	The receiving and tipping area shall be in an enclosed structure.	Y	
IV.3.(a)	The composting area shall be designed to fully contain the compostable organic material and all leachate which may be generated.	Y	Composting conducted in enclosed containers on outdoor concrete pad.
IV.3.(b)	The containment system shall be impermeable, the surface of which shall be constructed of concrete, asphalt, steel or other material as approved by the Department.	Y	Composting containers are steel on outdoor concrete pad.
IV.3.(c)	All drainage from the composting area shall be collected for treatment or for return to the process.	Y	Leachate collected from composting containers and transported off-site for treatment. Leachate recirculation to process discontinued in May 2014.
IV.4.(a)	The curing area shall be underlain by an impermeable pad, the surface of which shall be concrete, asphalt or other material as approved by the Department.	Y	Curing area has concrete floor.
IV.4.(b)	All drainage from the impermeable pad shall be collected for treatment or for return to the process.	Y	Leachate collected and transported off-site for treatment. Leachate recirculation to process discontinued in May 2014.
IV.4.(c)	All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and minimize odour and leachate generation.	Y	Curing area enclosed in cover-all type building.

TABLE 3.1

2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY

<i>Section</i>	<i>Guideline Requirement</i>	<i>Compliant (Y/N)</i>	<i>Notes</i>
IV.4.(d)	Where space limitations prevent the production of mature finished compost at in-vessel composting facilities, immature compost may be transferred to an approved composting facility in order to complete the maturation process.	N	Immature (per 2010 NSE Guidelines) compost is currently transferred to Elmsdale Landscaping Ltd. Elmsdale is not listed on the NSE list of Organic Composting Facilities in Nova Scotia.
IV.4.(e)	For immature compost to be transported to a secondary curing area (i.e. secondary site), it must achieve one of the following requirements: i) cured for at least 21 days and must not reheat above 20°C; ii) cured for at least 21 days and organic matter is reduced by at least 60% by weight; or iii) able to germinate 90% of cress seed vs control and has a plant growth rate of compost/soil at least 50% of control.	Y	Refer to NETL facility Annual Reports. The fines or compost generated at the NETL complies with requirement iii).
IV.5	A leachate management system shall be developed which consists of infrastructure and monitoring systems designed to collect, monitor, control, and treat leachate prior to being discharged into the surrounding environment. The system shall: (i) have a leachate collection and removal network in the active area; (ii) function year round; and (iii) have a means of monitoring all treated leachate discharges.	Y	Leachate collected, stored and transported off-site for treatment.
IV.6	The applicant shall submit for approval from the Department, a surface water monitoring program.	Y	Compliance documented in annual reports reviewed by NSE.
IV.7	The applicant shall submit for approval from the Department, a groundwater monitoring program.	Y	Compliance documented in annual reports reviewed by NSE.
IV.8.(a)	Mechanical ventilation shall be provided for the composting area, areas for the storage of compostable organic feedstock and any other area containing readily putrescible materials such as the storage room for residuals.	Y	Mechanical ventilation is provided for all active areas.
IV.8.(b)	All areas referred to in clause (a) shall be under negative atmospheric pressure in order to avoid the escape of odours.	Y	On the day of CRA's site visit (April 28, 2015), inward air flow through open overhead and man doors was observed.
IV.8.(c)	All ventilation air shall be subject to a treatment system designed to remove odours prior to release into the environment.	Y	Ventilation air treated through organic media biofilters.

TABLE 3.1

2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY

<i>Section</i>	<i>Guideline Requirement</i>	<i>Compliant (Y/N)</i>	<i>Notes</i>
IV.9	Separation distance ² between active area and: Nearest residential or institutional building is at least 500 metres Nearest commercial or industrial building is at least 250 metres	Y Y	~860 metres ~225 metres, approved by NSE as permitted by IV.9.(f)
IV.9 (cont.)	Nearest property boundary is at least 100 metres, or 30 metres where it can be demonstrated that particular equipment will not release odours generated from the composting process Nearest watercourse or water body, including salt water, be at least 30 metres	Y Y	~10 metres, approved by NSE as permitted by IV.9.(f) 135 metres
V.	<i>Open Windrow Composting Facilities</i>	NA	
VI.	<i>Secondary Curing Areas</i>	NA	
VII.	<i>Composting Facility Operation</i>		
VII.1.(b)	The objective of all composting facilities shall be to incorporate all compostable organic feedstock into the composting process the same day that it is delivered to the site. If some feedstock is not incorporated into the process in the same day, except leaf and yard waste feedstocks only, then it shall be stored in an enclosed area with a mechanical ventilation system for the capture and treatment of odorous emissions.	Y	Mr. Evans confirmed that feedstock is generally processed and loaded into composting containers on the same day it arrives. On the day of CRA's site visit (April 28, 2015), it was observed that some of the SSO feedstock on the tipping floor looked as if it had been stored longer than 1 day, but unable to confirm. Receiving area and tipping floor is an enclosed area with mechanical ventilation for the capture and treatment of odorous emissions.
VII.1.(c)	The composting facility shall have constant supervision during the hours that the facility is open.	Y	On the day of CRA's site visit (April 28, 2015), Mr. Evans indicated that the facility is staffed with 10-11 full-time staff.
VII.1.(d)	The composting facility shall accept only feedstock identified in the approval.	Y	Not raised by HRM staff as a known issue. On the day of CRA's site visit (April 28, 2015), CRA did not observe any unapproved feedstock materials.

TABLE 3.1

**2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY**

<i>Section</i>	<i>Guideline Requirement</i>	<i>Compliant (Y/N)</i>	<i>Notes</i>
VII.1.(e)	Any residual products associated with the composting operation shall be disposed of in a manner acceptable to the Department.	Y	Compost residuals are taken to an approved landfill for disposal in accordance with Condition 13.c) of NSE Approval #2008-062534.
VII.1.(f)	Litter shall be controlled on the entire site.	Y	On the day of CRA's site visit (April 28, 2015), no litter was observed.
VII.1.(g)	Exposed areas shall be stabilized to prevent erosion and sedimentation.	Not Assessed	On the day of CRA's site visit (April 28, 2015), snow still covered areas of the site not under concrete. Not a significant concern for the purposes of this study.
VII.1.(h)	Dust shall be controlled to Department requirements for particulate emissions.	Not Assessed	It rained and snowed on the day of CRA's site visit (April 28, 2015). Dust is not specifically addressed in NSE Approval #2008-062534. Not a significant concern for the purposes of this study.
VII.1.(i)	Vectors shall be controlled in accordance with a control plan approved by the Department.	Y	NSE Approval #2008-062534
VII.1.(j)	Signs shall be placed at the entrance to the site indicating the name of the facility, hours of operation, emergency contact, and the materials acceptable at the site.	N	Sign at front entrance does not indicate hours of operation, emergency contact and materials acceptable at the site
VII.2	An Operation and Maintenance Manual shall be submitted for review from the Department. The Operation and Maintenance Manual shall be left on site at all times and shall be available for inspection during operating hours.	Y	Operation and Maintenance Manual reviewed by NSE as part of NSE Approval #2008-062534
VII.3	The applicant shall provide contingency plans addressing problems associated with vectors, groundwater contamination, equipment failure, and odour generation and complaints.	Y	Contingency Plan prepared as part of NSE Approval #2008-062534
VII.4	Reports and Records	Y	Reports and records provided to NSE as required in NSE Approval #2008-062534. CRA received copies of 2012-2014 Annual Reports.

TABLE 3.1

**2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
 NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
 61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
 HALIFAX REGIONAL MUNICIPALITY**

<i>Section</i>	<i>Guideline Requirement</i>	<i>Compliant (Y/N)</i>	<i>Notes</i>
<i>VIII.</i>	<i>Compost Classification and Use</i>		
VIII.1.(a)	All compost will be classified in accordance with the criteria identified in the 2005 CCME Guidelines. The compost must meet all criteria as established for foreign matter, maturity, pathogens and trace elements.	N	Regular testing compiled in Annual Reports and CBCL Study demonstrate that NETL compost consistently meets trace elements and pathogen reduction requirements. A significant amount of foreign matter >25mm was visible during CRA's site visit on April 28, 2015. This appeared to be primarily film plastic. The plastics vacuum on the screening equipment was disconnected at the time of CRA's site visit. Mr. Evans indicated that due to the high moisture content in the compost this winter, the film plastic was too heavy for the vacuum blower. Screening equipment upgrades, including a smaller screen opening to 10 mm, may be required to meet 2005 CCME Guidelines for A and B compost for foreign matter. NETL compost has been consistently unable to meet 2005 CCME Maturity requirements. Refer to Section 4.1 of this report for detailed discussion on maturity.

TABLE 3.1

2010 NOVA SCOTIA ENVIRONMENT COMPOSTING FACILITY GUIDELINES COMPLIANCE SUMMARY
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY

Section	Guideline Requirement	Compliant (Y/N)	Notes																							
VIII.1.(b)	Testing of the compost quality shall be completed for every 1000 tonnes of compost produced or every three months and conducted in accordance with the minimum testing procedures identified in Section 4 of the 2005 CCME Guidelines.	N	<table><tr><th></th><th>Compost (tonnes)</th><th>No. of Samples</th><th>No. per 1000 tonnes</th></tr><tr><td>'12</td><td>8,723</td><td>8</td><td>0.92</td></tr><tr><td>'13</td><td>10,890</td><td>11</td><td>1.01</td></tr><tr><td>'14</td><td>11,226</td><td>10</td><td>0.89</td></tr><tr><td>Sum</td><td>30,839</td><td>29</td><td>0.94</td></tr></table> Note: This is a non-compliance with condition of 11.b).(iii) of the NSE Approval #2008-062534.					Compost (tonnes)	No. of Samples	No. per 1000 tonnes	'12	8,723	8	0.92	'13	10,890	11	1.01	'14	11,226	10	0.89	Sum	30,839	29	0.94
	Compost (tonnes)	No. of Samples	No. per 1000 tonnes																							
'12	8,723	8	0.92																							
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Sum	30,839	29	0.94																							

Notes:

1. Condition or efficacy of infrastructure or systems such as concrete pads, containment systems, tanks, etc. not inspected or assessed as part of this compliance review. Scope restricted to a presence/absence determination.
2. Separation distances confirmed using exploreHRM online mapping tool. Printouts from exploreHRM included as Appendix A.
3. List of Organic Compost Facilities in Nova Scotia found at: <http://www.novascotia.ca/nse/waste.facilities/facilities.organic.composting.php>

TABLE 3.2

COMPOST QUALITY DATA
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY

<i>Date</i>	<i>C:N</i>	<i>pH</i>	<i>Moisture</i>	<i>Dewar (Heating Test)</i>	<i>Compost Stability Index</i>	<i>Respiration CO₂-C/g OM/day</i>	<i>Respiration CO₂-C/g TS/day</i>
25-Jan-12	18	5.39		IV	8	0.10	<0.01
12-Mar-12	17	5.34					
19-Apr-12	17	5.80		V	8	0.70	0.50
30-May-12	13	6.14					
20-Aug-12	16	5.18		IV	3	11.40	6.60
27-Sep-12	17	5.19					
25-Oct-12	13	5.42		IV	4	8.50	5.30
27-Nov-12	15	5.95					
8-Jan-13	16	5.53		IV	3	11.70	8.20
28-Feb-13	19	5.12		IV	5	7.90	6.10
2-Apr-13	17	5.10		V	8	<0.01	<0.01
23-Apr-13	18	4.47		IV	8	1.50	1.30
12-Jun-13	17	4.97		IV	5	6.30	5.10
4-Jul-13	17	5.58		V	8	0.60	0.40
6-Aug-13	18	4.94					
3-Sep-13	14	5.57		V	8	0.90	0.90
17-Oct-13	12	5.58					
19-Nov-13	13	5.58					
10-Dec-13	16	5.54	48.3	V	5	7.00	4.80
14-Jan-14	16	5.57	48.3				
26-Feb-14	19	4.90	58.7				
16-Apr-14	16	5.42	48.0	IV	5	7.60	6.10
11-Jun-14	18	5.18	56.0				
30-Jun-14	18	5.04	50.0	III	7	3.90	2.60
11-Sep-14	16	5.15	45.2	IV	6	4.50	2.90
30-Sep-14	16	4.99	47.4				
21-Nov-14	16	5.32	47.8	IV	4	8.40	5.60
11-Dec-14	18	5.54	51.9				
22-Dec-14	17	5.29	48.9				
Mean	16	5.34	50.0				
Minimum	12	4.47	45.2				
Maximum	19	6.14	58.7				

Notes:**Maturity Index**

3	Active compost; fresh ingredients, requires intensive oversight and management
4	Compost in medium or moderately active stage of decomposition; needs on-going management
5	Compost is moving past the active phase of decomposition and ready for curing; reduced need for intensive handling
6	Curing; aeration requirement reduced; compost ready for piling; significantly reduced management requirements
7	Well matured, aged compost, cured; few limitations for usage
8	Inactive, highly mature compost, very well aged, possibly over-aged, like soil; no limitations on usage

Stability Index

III	Material still decomposing; active compost
IV	Maturing; Moderately stable; Curing compost
V	Very mature stable, well-aged compost, Finished compost

TABLE 4.1

**SUMMARY OF COSTS TO KEEP NEW ERA FACILITY OPERATIONAL FOR 5 YEARS
NEW ERA TECHNOLOGIES LIMITED (NETL) FACILITY PROCESS REVIEW
61 EVERGREEN PLACE, GOODWOOD, NOVA SCOTIA
HALIFAX REGIONAL MUNICIPALITY**

	<i>Quantity</i>	<i>Years</i>	<i>Annual Costs</i>		<i>5-Year Window (2019-2024)</i>	
			<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
Building repairs ¹					698,000	698,000
Additional curing pad off-site or additional curing equipment ²					400,000	1,500,000
Screening Equipment (unknown, assume zero)					-	-
Risk of additional wastewater costs if price increases ³	8,800,000 litres	5	-	1,232,000	-	6,160,000
Additional bulking amendment ⁴	12,500 tonnes	5	100,000	200,000	500,000	1,000,000
Difference in Tip Fees						
New Era Tip Fees (\$200/tonne)	25,000 tonnes	5	5,000,000	5,000,000	25,000,000	25,000,000
Alternate Facility Tip Fees (\$146-175/tonne)	25,000 tonnes	5	3,650,000	4,375,000	18,250,000	21,875,000
Difference		5	625,000	1,350,000	3,125,000	6,750,000
Total					4,723,000	16,108,000
Corrected for 2019 dollars (2%, 4 years)		5	\$ 1,000,000	\$ 3,400,000	\$ 5,000,000	\$ 17,000,000

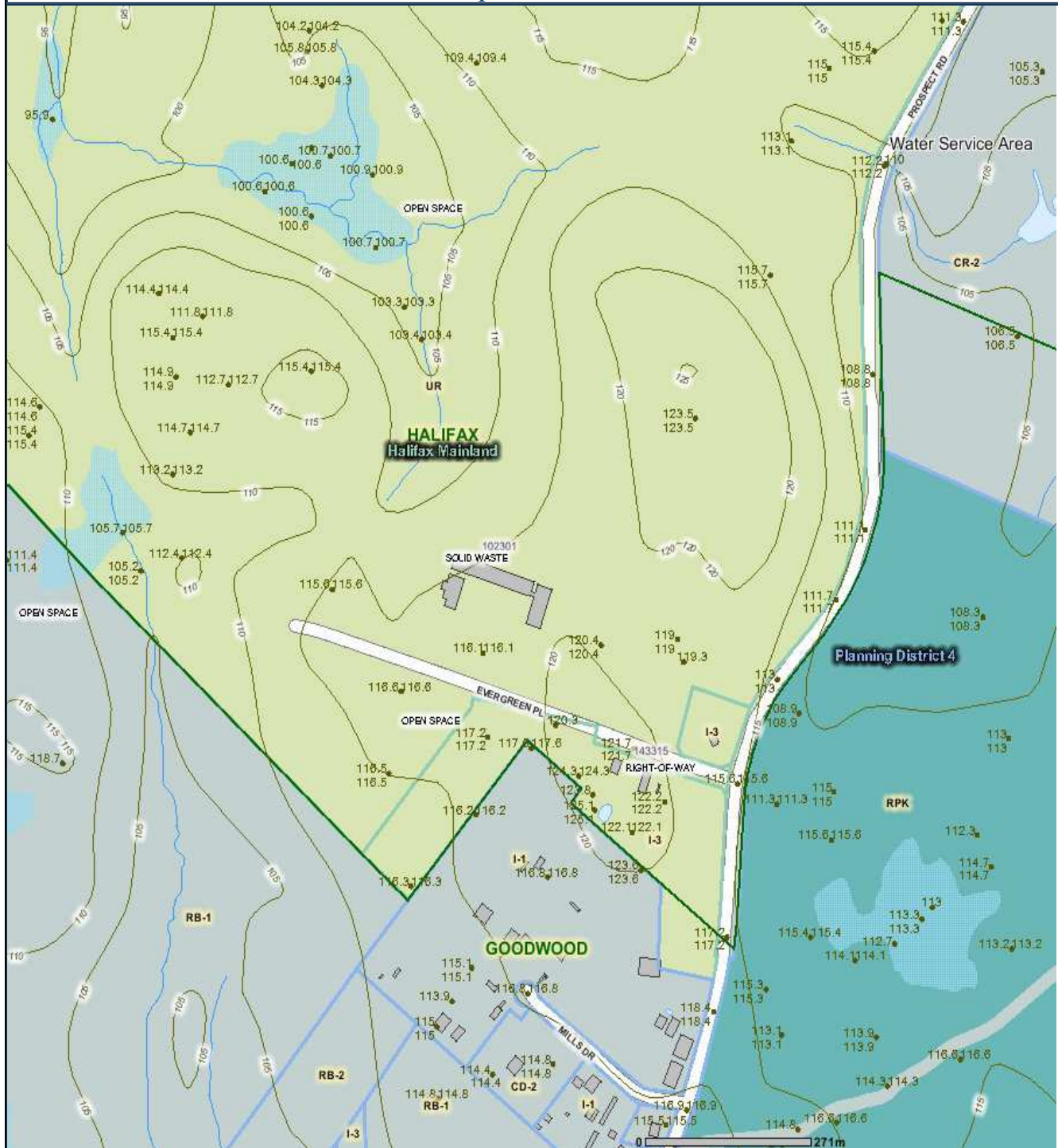
Notes:

1. Building repair cost estimate taken from New Era building assessment
2. Curing pad costs estimated from similar previous projects CRA is familiar with. Worst case costs assumes significant site development costs including electrical servicing.
3. Wastewater costs ranged from 0-14 cents per litre based on historical ranges of wastewater surplus costs from agreement with New Era Technologies Limited.
4. Additional bulking amendment based on \$8-16/tonne for mulch.

Appendix A

Halifax Regional Municipality Maps

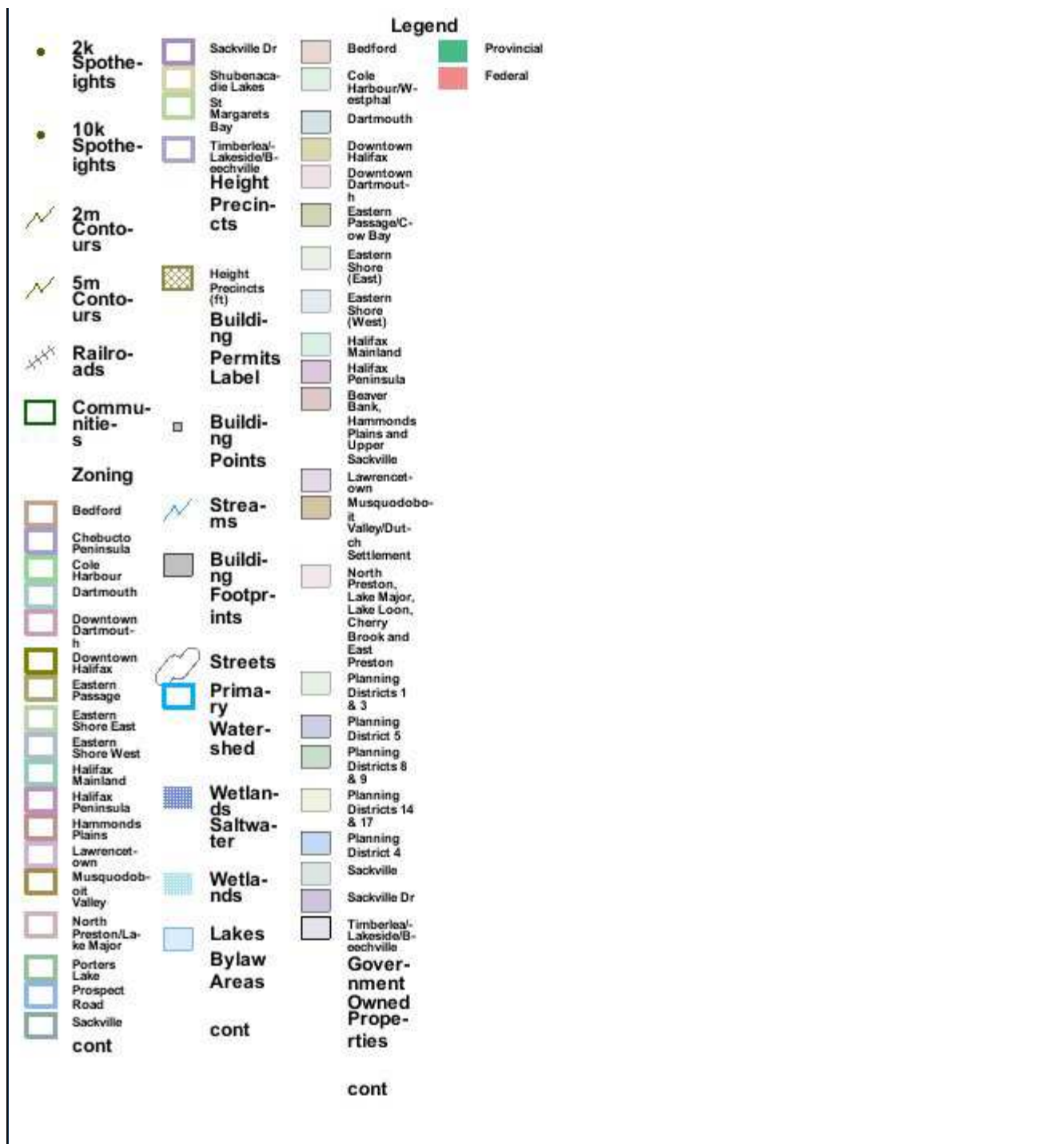
Explore HRM!



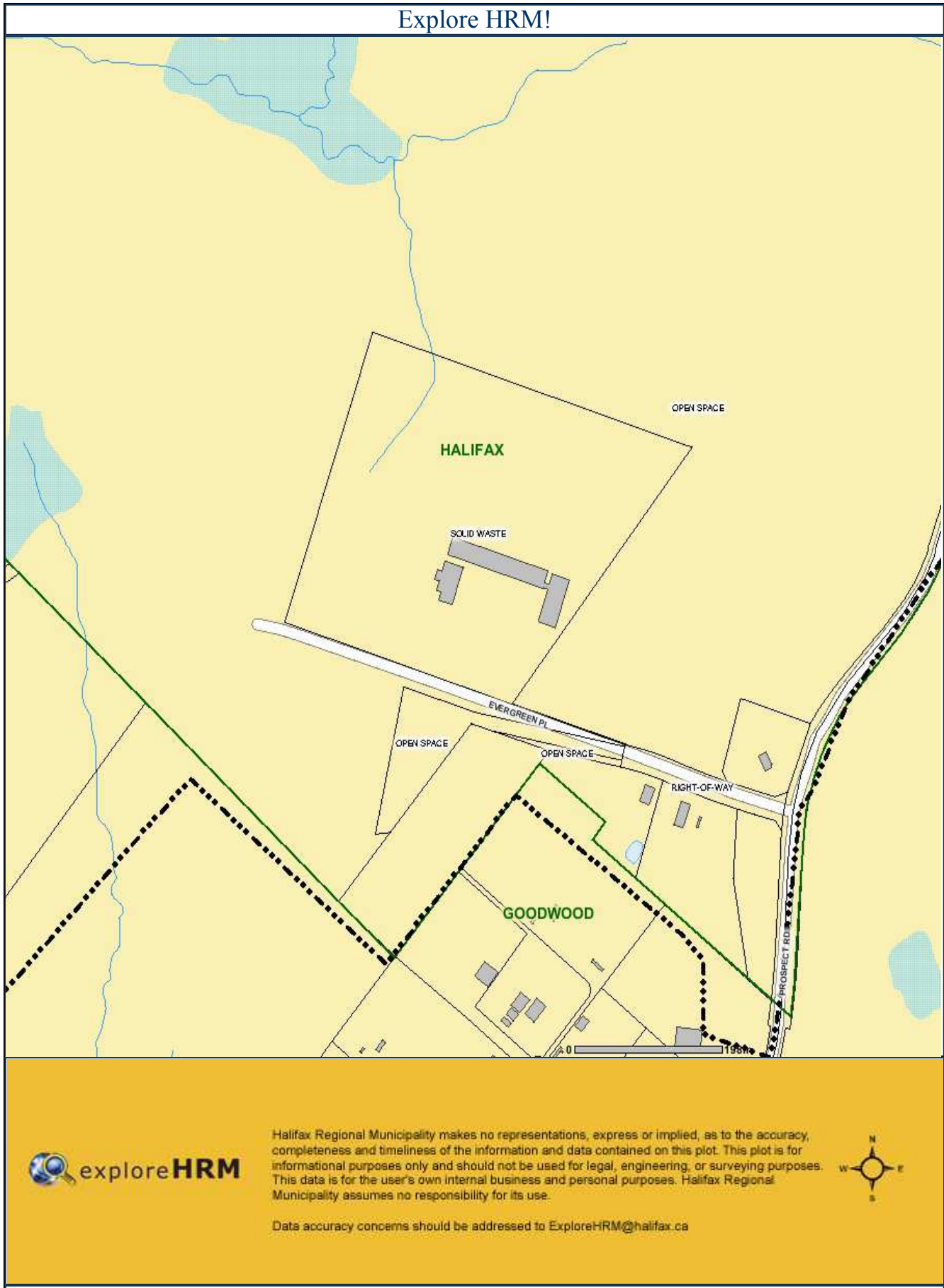
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Data accuracy concerns should be addressed to ExploreHRM@halifax.ca





Explore HRM!



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Data accuracy concerns should be addressed to ExploreHRM@halifax.ca





UR (URBAN RESERVE) ZONE (RC-Jun 25/14;E-Oct 18/14)

- 61AA(1) The following uses shall be permitted in any UR Zone:**
- (a) Single family dwellings, on existing lots or lots approved pursuant to Section 38 of the Subdivision By-law provided that a private on-site sewage disposal system and well are provided on the lot**
 - (b) Passive recreation uses**
 - (c) Uses accessory to the foregoing uses**
- 61AA(2) No person shall in any UR Zone use or permit to be carried out, any development for any purpose other than one or more of the uses set out in subsection (1).**
- 61AA(3) No person shall in any UR Zone use or permit to be used any land or building in whole or in part for any purpose other than one or more of the uses set out in subsection (1).**

REQUIREMENTS

- 61AA(4) Buildings erected, altered or used for UR uses in a UR Zone shall comply with the following requirements:**

Minimum Front or Flankage Yard:	9.1m
Minimum Side Yard:	2.5m
Minimum Rear Yard:	2.5m
Maximum Lot Coverage:	35%
Maximum Height of Main Building:	11m