DILLON CONSULTING

MUNICIPALITY OF EAST HANTS

Update of Organics Processing Options Review

Draft Report

November 2023 – 23-6951-1000

November 17, 2023

Municipality of East Hants
230 – 15 Commerce Court
Elmsdale, Nova Scotia
B2S 3K5

Attention: Ms. Andrea Trask
Manager of Solid Waste

Update of Organics Processing Options Review (Draft Report)

Dillon Consulting Limited is pleased to submit the draft version of the Update of Organics Processing Review for the Municipality of East Hants (MEH). As described in our work plan letter of September 15, 2023, we have updated the findings of an analysis completed in June 2014 with a focus on the projected source separated organics (SSO) processing requirements for MEH.

We look forward to discussing your comments on this draft document.

Sincerely,

DILLON CONSULTING LIMITED

Scott Kyle, P.Eng.
Partner, Project Manager

SDK:jes

Our file: 23-6951

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Executive Summary

In June 2014, Dillon Consulting Limited (Dillon) issued a report entitled *Evaluation of Organics Processing Options* to the Municipality of East Hants (MEH). The project had been completed as a collaborative effort of MEH and Halifax Regional Municipality (HRM) and involved the evaluation of a number of scenarios to process source separated organic (SSO) materials generated within the two municipalities.

MEH are currently transporting collected SSO materials from a Transfer Station at the East Hants Waste Management Centre (EHWMC) to processing facilities operated by GFL Environmental Ltd. at the Guysborough Landfill near Boylston, NS. Previously, these materials were transported and processed at a privately operated facility (Fundy Compost) in Brookfield, NS.

Acknowledging the significant transport distance to the GFL facility, the current compromised condition of the SSO Transfer Station and anticipated population growth within the current MEH service area, there has been renewed interest in the potential of establishing a compost processing facility at the EHWMC, as presented in the June 2014 options evaluation report.

In September 2023, Dillon was contacted by MEH requesting an update to the June 2014 report with a focus on forecasted SSO management requirements specifically for the MEH service area. Following the preparation of a work plan letter in collaboration with MEH, Dillon was retained to develop an update to the 2014 document.

Key assumptions used to guide the update of the 2014 options report are summarized as follows:

- Consideration of requirements to accommodate the SSO processing requirements for the MEH service area only;
- Proposed organics processing/management infrastructure to be situated at the same location at the EHWMC site identified in the June 2014 report. Existing site components, including leachate/runoff management infrastructure, are to be incorporated into the proposed management systems where practical;
- Continued assumption of the processing technologies and facility layouts (in-building windrows, with and without in-floor aeration) recommended for the MEH-only scenarios in the 2014 report;
- Siting/design of all infrastructure to be consistent with applicable provincial and municipal requirements;
- Processed/cured end product to meet the Category A requirements of CCME Guidelines for Compost Quality (2005); and
- Design requirements to consider a 10-year planning period (2024-2034).

As organics are the focus of this study, the project team was only concerned with the compostable organics material in the overall waste stream. Organics are materials that can be decomposed by microbiological processes (e.g., composting) and transformed into a material that is sufficiently stable for nuisance-free storage and safe used in land applications. The organics stream for a given area can be

characterized by defining a percentage breakdown of specific material types, including food waste, leaf and yard (L&Y) waste, indoor plant waste, boxboard, food-soiled OCC, paper towel and select "other" organics.

In order to revise processing facility size requirements from those assumed for the 2014 evaluation, a SSO tonnage projection had to be prepared. The projection effort incorporated the following components:

- Identification of the current (2023) annual SSO tonnage arriving at the EHWMC site; and
- Development of a service area population estimate and projection for 2023 through to 2034 acknowledging:
  - Statistics Canada data and growth rates from the 2016 and 2021 censuses.
  - Forecasted residential development growth acknowledging Municipal approval of 5000 new lots in 2021/22.

MEH staff reported that the annual SSO tonnage arriving at EHWMC in 2022 was 1900 tonnes. As similar value was anticipated by the end of 2023. With regards to population, projections based on both Statistics Canada census trends and anticipated residential growth were developed. Using Statistics Canada trend information, a forecasted 2034 population of 27,187 was determined. Based on forecasted residential development, the estimated 2034 value was 37,003.

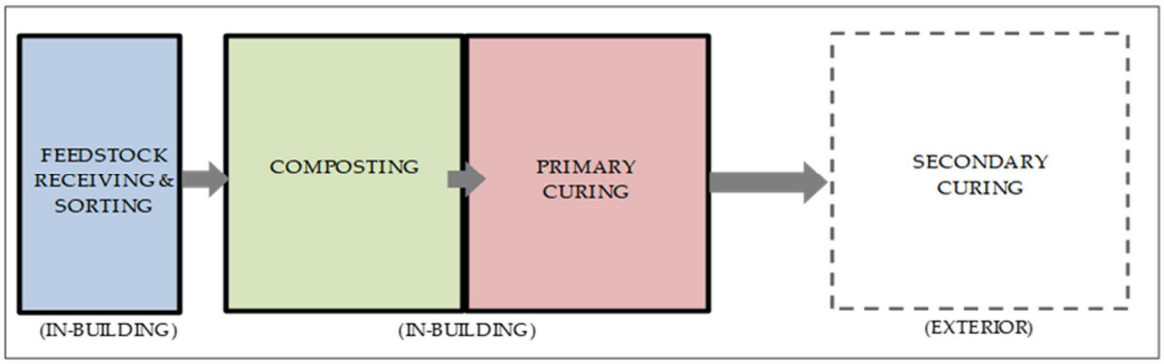
Following discussions with MEH staff, it was recommended to select 37,003 as basis for the projection of the design year SSO tonnage. Founded on this 2034 population and an annual SSO generation rate of 75.4 kg/person (based on recent MEH data), a SSO processing value of 2,800 tonnes/year (tpy) was calculated. To achieve the proper moisture and carbon/nitrogen balance in the compost feedstock, the SSO must be augmented by a 50% proportion of leaf and yard (L&Y) materials; thus bringing the facility design value to 2800 tpy + 0.5*(2800 tpy) = 4200 tpy.

Based on the experience of the project team, the successful composting of food waste organics using a windrow-based technology incorporates the following considerations:

- Feedstock reception/preparation, composting and primary curing should be conducted within a weather protected area in order to control moisture and other operational parameters;
- Mechanical turning is accomplished with specialized mobile equipment; and
- Beyond mechanical turning, aeration requirements can be augmented with in-floor blower systems.

Acknowledging these requirements, a typical windrow process flow diagram for organics processing for this project is presented in Figure E-1.

Figure E- 1: Basic System Components



Founded on these basic components, and with reference to the 2014 report, the two technology options for the revised evaluation were: Option 1A – Windrow (non-aerated floor) and Option 1B – Windrow (aerated floor).

Site-specific conceptual facility designs, complete with conceptual cost estimates and descriptions of operational requirements, were prepared for the two options. Table E-1 presents a summary of the conceptual capital cost estimates. It is noted that the additional cost to bring three phase power to the EHWMC for the aeration system blowers required under Option 1B represents and additional estimated capital cost of approximately $2 million.

Table E-1: Conceptual Cost Estimate Summary Table

Item	Description	Option 1A	Option 1B
1	Site Development	$175,000	$2,035,000
2	Primary Composting	$2,777,000	$3,576,000
3	Primary Curing	$1,353,000	$2,451,000
4	Secondary Curing	$652,000	$565,000
5	Bulking Agent Storage Pad	$46,000	$46,000
6	Mobile Equipment	$400,000	$400,000
	Subtotal	$5,403,000	$9,073,000
	Contingency @ 10%	$540,000	$907,000
	Engineering @ 8%	$432,000	$726,000
	Conceptual Capital Cost Estimate	$6,375,000	$10,706,000

1.0 Introduction

In June 2014, Dillon Consulting Limited (Dillon) issued a report entitled *Evaluation of Organics Processing Options* to the Municipality of East Hants (MEH). The project had been completed as a collaborative effort of MEH and Halifax Regional Municipality (HRM) and involved the evaluation of a number of scenarios to process source separated organic (SSO) materials generated within the two municipalities. In September 2023, Dillon was contacted by MEH requesting an update to the June 2014 report with a focus on forecasted SSO management requirements specifically for the MEH service area.

Following the preparation of a work plan letter in collaboration with MEH, Dillon was retained to develop an update to the 2014 document.

The remainder of the attached document consists of the following sections:

- Section 2 – Project Methodology
  - assignment objectives, assumptions and tasks
- Section 3 – Background Information and Performance Requirements
  - summary description of key attributes of the EHWMC site
  - organic material quality and quantity characteristics for each proposed management option
  - regulations and guidelines relevant to the design and operation of organics processing/composting facilities
- Section 4 – Organics Processing Technologies
  - review of 2014 screening of candidate processing technologies
  - review of characteristics of windrow processing systems
- Section 5 – Conceptual Processing Systems
  - conceptual designs of two organics processing systems
- Section 6 – Conclusions
  - suggested next steps for MEH in light of assessment findings

For convenience and continuity, it is acknowledged that select information from the June 2014 has been incorporated into this report.

2.0 Project Management

2.1 Objectives

MEH are currently transporting collected SSO materials from a Transfer Station at the East Hants Waste Management Centre (EHWMC) to processing facilities operated by GFL Environmental Ltd. at the Guysborough Landfill near Boylston, NS. Previously, these materials were transported and processed at a privately operated facility (Fundy Compost) in Brookfield, NS.

Acknowledging the significant transport distance to the GFL facility, the current compromised condition of the SSO Transfer Station and anticipated population growth within the current MEH service area, there has been renewed interest in the potential of establishing a compost processing facility at the EHWMC, as presented in the June 2014 options evaluation report.

With reference to the project assumptions presented in Section 2.2, the objective of this report is to prepare an updated conceptual design and cost estimate for a SSO processing facility at the EHWMC, founded on relevant findings and recommendations from the June 2014 report.

2.2 Key Assumptions

Key assumptions used to guide the update of the 2014 options report are summarized as follows:

- Consideration of requirements to accommodate the SSO processing requirements for the MEH service area only;
- Proposed organics processing/management infrastructure to be situated at the same location at the EHWMC site identified in the June 2014 report. Existing site components, including leachate/runoff management infrastructure, are to be incorporated into the proposed management systems where practical;
- Continued assumption of the processing technologies and facility layouts (in-building windrows, with and without in-floor aeration) recommended for the MEH-only scenarios in the 2014 report;
- Siting/design of all infrastructure to be consistent with applicable provincial and municipal requirements;
- Processed/cured end product to meet the Category A requirements of CCME Guidelines for Compost Quality (2005); and
- Design requirements to consider a 10-year planning period (2024-2034).

2.3 Project Tasks

The work program for this assignment consisted of the completion of the following three tasks.

Task 1 – Assemble Background Information and Define Performance Requirements

- In direct collaboration with MEH, assembled/updated relevant background information related to existing EHWMC site conditions and current/future organic material quality and quantity, including seasonality issues;
- Confirmed facility siting, design and operational requirements through a review of the *Nova Scotia Environment Composting Facility Guidelines* (2010), the *CCME Guidelines for Compost Quality* (2005), the current EHWMC NSE Approval to Operate and MEH bylaws; and
- Prepared a 10-year forecast (2024-2034) of annual compostable organics tonnage for MEH to serve as a basis for the updating of approximate facility costs.

Task 2 – Update Facility Capital and Operational Cost Estimates

- With reference to processing facility design and operational components described under Scenarios 1A and 1B in the 2014 report, reviewed and revised facility infrastructure and operational elements to accommodate Task 1 findings; and
- Developed revised 2023 planning level capital and operational cost estimates (including staffing requirements), acknowledging updated processing facility requirements.

Task 3 - Reporting

- The outcomes of Tasks 1 and 2 were consolidated into a concise Project Report;
- An electronic (PDF) draft version of the Project Report will be submitted to MEH. Within a week of submission, it is recommended that a virtual meeting be held to review the document and discuss comments; and
- Within a week of the confirmation of required revisions to the draft, a finalized PDF version of the Project Report will be prepared and provided to MEH.

3.0 Background Information and Performance Requirements

3.1 East Hants Waste Management Centre Overview

The EHWMC, located at 1306 Georgefield Road, Hants County, is an active waste management facility with an overall total area of 61.3 hectares. The MEH revised the operations of the EHWMC in 2005, consistent with Provincial regulations, to discontinue municipal solid waste (MSW) landfilling and subsequently closed the first generation landfill area. On January 1, 2006, the MEH began transferring municipal solid waste generated within its boundaries to a new second-generation landfill in the Municipality of East Hants.

Currently, the EHWMC property includes the following features:

- A closed/capped 1st generation landfill;
- An active C&D processing and landfilling area;
- An asbestos disposal facility;
- A waste and recyclables transfer station;
- An organics transfer station;
- A residential Household Hazardous Waste depot;
- Drop off facilities for E-waste;
- Metal, tire and clean wood piles;
- Sedimentation/effluent control ponds;
- An administration/maintenance building;
- Scale house and two scales; and
- A series of groundwater monitoring wells.

An aerial photograph of the EHWMC is presented in Figure 3-1.

ORGANICS
TRANSFER STATION

WASTE/RECYCLABLES
TRANSFER STATION

ADMINISTRATION
BUILDING

SCALE

HHW DEPOT

C&D AREA/LANDFILL

SEDIMENTATION
CONTROL PONDS

GEORGEFIELD ROAD

50 0 50
SCALE 1:3,000 METRES

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DILLON CONSULTING

DATE	NOVEMBER 2023	PROJECT	UPDATE OF ORGANICS PROCESSING OPTIONS REVIEW
		TITLE	**AERIAL PHOTOGRAPH OF EHWMC (2023)**
		PROJECT NO.	23-6951
		FIGURE NO.	3-1

Organic materials are currently transported from the transfer station at the EHWMC to GFL's Guysborough Landfill for processing. Recyclables are delivered by contract to a processing facility in HRM (Bayers Lake).

3.2 Material Characteristics

3.2.1 SSO Quality

As organics are the focus of this study, the project team was only concerned with the compostable organics material in the overall waste stream. Organics are materials that can be decomposed by microbiological processes (e.g., composting) and transformed into a material that is sufficiently stable for nuisance-free storage and safe used in land applications. The organics stream for a given area can be characterized by defining a percentage breakdown of specific material types, including food waste, leaf and yard (L&Y) waste, indoor plant waste, boxboard, food-soiled OCC, paper towel and select "other" organics.

With reference to the 2014 report, the assumed breakdown of the residential SSO waste stream (as determined in a 2003 HRM audit program) was as follows:

Table 3-1: Residential SSO Waste Stream Percentage Breakdown by Weight

Material	Weight %
Food organics	43.7
Yard organics	29.6
Boxboard	11.4
Compostable bags/Kraft paper	8.9
Paper towel/tissue/soiled paper	2.9
Acceptable Wood	2.3
Pizza boxes	1.3

For this project, the feedstock for primary composting will consist of material from East Hants (93% residential, 7% ICI). Commentary on the assumed moisture content of incoming SSO material as well as the amount of leaf and yard material required to optimize overall moisture levels is provided in Section 4.2.

3.2.2 SSO Quantity

In order to revise processing facility size requirements from those assumed for the 2014 evaluation, a SSO tonnage projection had to be prepared. The projection effort incorporated the following components:

- Identification of the current (2023) annual SSO tonnage arriving at the EHWMC site; and
- Development of a service area population estimate and projection for 2023 through to 2034 acknowledging:
  - Statistics Canada data and growth rates from the 2016 and 2021 censuses.
  - Forecasted residential development growth acknowledging Municipal approval of 5000 new lots in 2021/22.

MEH staff reported that the annual SSO tonnage arriving at EHWMC in 2022 was 1900 tonnes. As similar value was anticipated by the end of 2023.

With regards to population, projections based on both Statistics Canada census trends and anticipated residential growth were developed.

Table 3-2 presents the forecast prepared based on census information for the two jurisdictions included in SSO collection service area; MEH and Indian Brook. Estimates for 2022 through to 2034 (the selected design year assuming facility commissioning in 2024) were founded on growth rates between the 2011 and 2021 censuses.

Table 3-2: MEH Service Area Population Forecast Based on Census Growth Rates

Year	Population[1]			Comments
	MEH	Indian Brook	Total	
2011	22,111	1.84	23,195	
2016	22,453	1,089	23,542	
2021	23,734	1,119	24,853	See Note 2
2022	23,903	1,123	25,025	
2023	24,073	1,126	25,199	
2024	24,244	1,130	25,373	Assumed commissioning of new facility
2025	24,416	1,133	25,549	
2026	24,590	1,137	25,726	
2027	24,764	1,141	25,904	
2028	24,940	1,144	26,084	
2029	25,118	1,148	26,264	
2030	25,296	1,151	26,446	
2032	25,657	1,159	26,814	
2033	25,840	1,162	27,000	
2034	26,023	1,166	27,187	Design year for new facility

Notes:
1. 2011-2021 population data from statcan.gc.ca unless otherwise noted.
2. StatsCan provided revised 2021 population values for MEH and Indian Brook in Oct 2022.

Table 3-3 presents a projection based on anticipated residential development growth within the MEH service area, using 2021 census data as a starting point. The projection also assumes 2.43 persons per residential unit, as reported in MEH's 2021 census information.

Table 3-3: MEH Service Area Population Based on Forecasted Residential Development

Projected MEH Residential Unit Increase	Assumed Persons Per Dwelling	Estimated Population Increase from 2021	Estimated 2034 Population
5,000	2.43	12,150	37,003

Following discussions with MEH staff, it was recommended to select the higher 2034 population estimate (37,003) as a basis for the projection of the design year SSO tonnage. It was concluded that the higher value could serve to accommodate growth in industrial, commercial and institutional (ICI) activity (as a result of the residential growth) within the service area, leading to increases in SSO generated from that sector.

Definition of a per capita SSO generation rate for the design year (2034) was then developed as follows:

- 2023 Service Area Population Estimate = 25,199 persons
- 2023 SSO Tonnage = 1,900 tonnes
- 2023 Per Capita SSO Generation Rate = 1,900 tonnes/25,199 persons
  = 0.0754 tonnes/person
  = 75.4 kg/person

While there is a potential that generators may continue to improve their "segregation performance" to divert organic materials from mixed waste to their green cart (and thus an increased per capita SSO generation rate over time), we have assumed this would be offset by improved efforts to reduce food wastage. Therefore, an annual SSO per capita generation rate of 75.4 kg/person was selected for design purposes.

Thus, the 2034 SSO design tonnage for the proposed organics processing facility is:

- Estimated 2034 population x Assumed per capita SSO generation rate
- 37,003 persons x 75.4 kg/person/year = 2,790,026 kg
  = 2,800 tonnes (rounded)

3.3 Applicable Regulations and Guidelines

The following section presents a summary of regulations and guidelines relevant to the development of a composting facility at the EHWMC.

3.3.1 Provincial Approvals and Guidance Documents

EHWMC NSE Approval to Operate

A Certificate of Approval, issued by the Nova Scotia Department of Environment and Climate Change (NSECC), is required for the construction and operation of a composting facility. The EHWMC is currently operating under Approval 2007-2535041-01 which is valid until December 21, 2027. The approval covers the operation of the EHWMC's current facilities, including the C&D disposal facility, the household hazardous waste handling facility, the municipal solid waste transfer station and the organic waste transfer station.

An amendment to this approval is likely to be required if organic processing operations are initiated at the facility. Section 3 (g) of the Approval states that "The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Facility, including the operating area, process changes or waste disposal practices which are granted under this Approval".

Nova Scotia Environment Composting Facility Guidelines (2010)

This Guidance Document presents guidelines for the design and operation of composting facilities. It is to be used in conjunction with the Nova Scotia Solid Waste Resource Management Strategy (1995). The guidelines apply to all composting facilities requiring approval under Section 27 of the Solid Waste-Resource Management Regulations.

Section V of the guidelines present requirements for Open Windrow Composting Facilities, including, but not limited to:

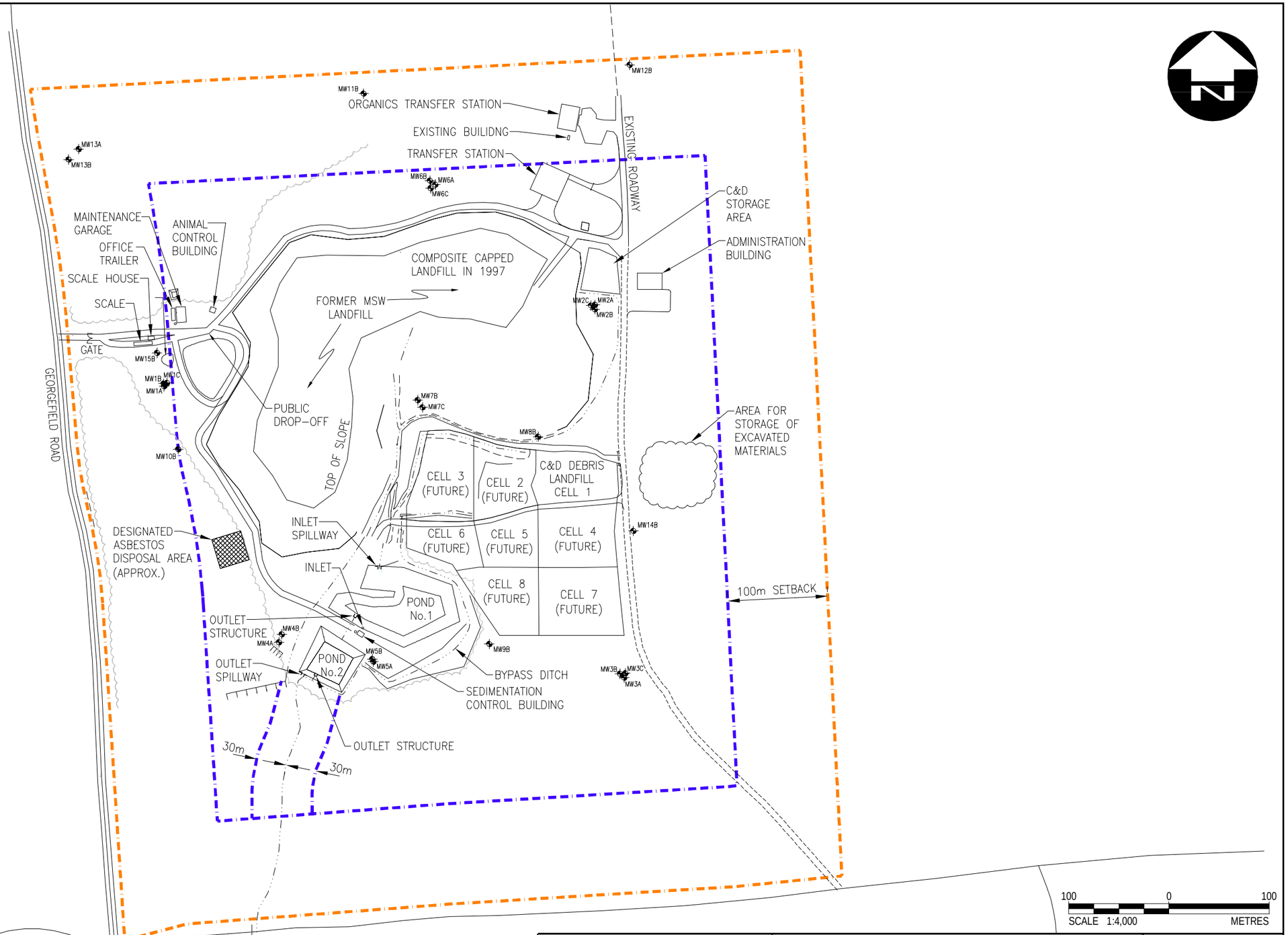
- Receiving and tipping area;
- Composting area;
- Curing area;
- Leachate management system;
- Surface water management;
- Groundwater management;
- Odour control; and
- Separation distances.

Section VI presents requirements for Secondary Curing Areas. The guidelines are presented in Appendix A of this report. Relevant items from the guidelines, as they relate to this project, are presented in Table 3-4.

Table 3-4: Guidelines for Open Windrow Composting Facilities and Secondary Curing Areas

	Requirements – Open Windrow Composting Facilities	Requirement – Secondary Curing Areas
Receiving and Tipping Areas	Underlain by an impermeable pad with a concrete or asphalt surface In an enclosed structure	Not applicable
Composting Area	Underlain by an impermeable pad with a concrete or asphalt surface Permanent roof structures and/or proven management techniques to control moisture/minimize odour and leachate Underlain by an impermeable pad with a concrete or asphalt surface Drainage shall be collected for treatment or return to the process Permanent roof structures and/or proven management techniques to control moisture/minimize odour and leachate	Not applicable
Curing Area	To be transferred to a secondary curing area, it must achieve one of the following maturity requirements: • Cured for at least 21 days and must not reheat above 20C • Cured for at least 21 days and organic matter is reduced by at least 60% weight; or • Able to germinate 90% of cress seed versus control and has a plant growth rate of compost/soil at least 50% of control	Underlain by native clay till, imported clay or other approved material
Odour Control	Atmospheric dispersion modeling to determine the potential for odour at the property boundary and other receptors near the facility	Detailed management techniques
Separation Distance	Distance between active area and nearest building or structure: 1,000 m Distance between active area and nearest property boundary: 100 m Distance between active area and nearest watercourse or water body: 30 m	

The required separation distances for the active area from the property boundary are shown on Figure 3-2. It is noted that the existing organics transfer station is outside of the 100 m setback area. It will not be included in considerations for organics processing options.



SOURCE:
NOVA SCOTIA GEOMATICS CENTRE, ONLINE DATA LOCATOR 1:10,000 TOPOGRAPHIC MAPPING AND IN HOUSE RESOURCES.

LEGEND:
SETBACK
PROPERTY BOUNDARY

DILLON CONSULTING

DATE NOVEMBER 2023

PROJECT UPDATE OF ORGANICS PROCESSING OPTIONS REVIEW

PROJECT NO. 23-6951

TITLE SEPARATION DISTANCES FOR THE ACTIVE AREA OF EHWMC

FIGURE NO. 3-2

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3.3.2 CCME Guidelines for Compost Quality (2005)

Two compost categories (A and B) have been developed for trace element concentrations and foreign matter, based on the end use of the compost material. Category A compost is considered suitable for "unrestricted use" and can be used in any application, such as agriculture lands, residential gardens, horticultural operations, the nursery industry, and other businesses. Category A criteria is typically met when the organic feedstock consists of source separated organic food waste, municipal biosolids, pulp and paper mill biosolids, or manure. Category B has restricted use due to the presence of sharp foreign matter or higher trace element content.

With reference to Section 2.2, all finished compost for the proposed EHWMC facility will be required to meet "Category A" requirements. Additionally, compost must meet all criteria established for foreign matter, maturity, pathogens and trace elements. The criterion is presented in the CCME Guidelines for Compost Quality in Appendix A of this report.

Recommended practices are indicated to assess compost product quality and for the development of a sampling program. Finished compost must be tested for quality on a regular basis; at least every 1,000 tonnes of production every three months and prior to marketing any product.

4.0 Organics Processing Technologies

4.1 2014 Candidate Technology Screening

As part of the evaluation completed in 2014, a screening process was undertaken to identify a preferred SSO processing technology to address primary and secondary composting requirements. It is noted that only windrow-based processing technologies (deemed appropriate for range of operational tonnages being assessed and the site characteristics of the EHWMC) were considered as part of the 2014 assessment.

For the purposes of this evaluation, and consistent with the NS Composting Facility Guidelines, the term "secondary composting" was considered equivalent to "primary curing". With reference to Section V.4.(e) of the guidelines, specific maturity criteria must be achieved at the primary curing stage to allow the material to proceed to the final step in the process, the secondary curing area.

In 2014, acknowledging a wide range of potential SSO processing tonnages, two aerobic processing technologies were identified as being appropriate for consideration at the EHWMC site; 1) windrow, and 2) turned mass bed.

Table 4-1 describes the basic attributes of each technology, as presented in a 2013 Environment Canada publication entitled *Technical Document on Municipal Solid Waste Organics Processing*.

Table 4-1: Windrow and Turned Mass Bed Processing Technologies

Organic Waste Processing Technology	Overview of Technology	Typical Scale of Installations (tonnes per year of organic waste)
Windrow	Formation of large windrows outdoors, which are mechanically agitated (turned). This method relies on passive aeration and is differentiated from Static Pile based on the windrow agitation. The large area requirement for the development of windrows for higher design tonnages (e.g., >20k tpy) typically makes the use of an indoor facility impractical.	<50,000
Turned Mass Bed	Outdoor or indoor process that uses "beds" that are larger than windrows, with mechanical agitation. Process relies on passive aeration of material. Specialized equipment is used to allow for material turning.	8,000 to 50,000

Additional information on these two technologies is provided in Appendix B, including the following:

- Overview of the process;
- Infrastructure requirements;
- Applicable feedstocks;
- Feedstock preparation requirements;
- Typical capacity;
- Composting time;
- Flexibility/seasonality;
- Process control features;
- Level of odour control;
- Level of moisture control;
- Fuel consumption;
- Effluent treatment requirements; and
- End product characteristics.

Secondary Curing

With regard to secondary curing, Section 3.3.1 of the Nova Scotia Composting Facility Guidelines specifies that "…area shall be underlain by native clay till, imported clay, or other material as approved by the Department." Roof structures or cover systems are not required for secondary curing areas provided that a groundwater management system is established.

Based on the experience of the project team and practices utilized at other processing facilities in Atlantic Canada, it is recommended that the secondary curing area (for all options under consideration) consist of:

- 450 mm compacted aggregate base overlain by a 125 mm asphalt layer;
- Materials being placed in the same configuration as in the composting facility; and
- A perimeter drainage collection system to allow for runoff quality monitoring and management.

4.2 Use of Leaf and Yard Material in SSO Processing

Based on the experience of the project team, a noted performance challenge of many SSO composting operations in Nova Scotia is achieving an optimal moisture content in the feedstock mix. Typically, 55% moisture content (by weight) is the objective, with materials from cart-based collection programs typically presenting values in the range of 60 to 70%, and sometimes higher. If the moisture content is too high, water displaces air from the interstices between the feedstock particles resulting in anaerobic conditions.

In order to get the moisture content down to the optimal 55% value, dryer organic materials must be added to the mix. Generally, leaf and yard organics, with moisture contents in the 30 to 40% range, are utilized to address this requirement. In addition, "overs" (oversized organic items screened out of the final cured product) are typically utilized to support moisture level reduction requirements. It is noted that since this evaluation focuses on capital costs, the specifics on how this moisture content adjustment requirement is addressed (e.g., the amount of L&Y material versus the amount of overs) is not relevant to the analysis.

To address the moisture content adjustment issue for the purposes of the East Hants assessment, and to support the appropriate sizing of the candidate processing operations, the project team made the following assumptions:

- Average moisture content of incoming SSO cart program organics; 65%.
- Average moisture content of available leaf and year organics; 35%.
- Target feedstock adjusted moisture content; 55%.

To determine the amount of leaf and yard material to be added to the SSO feedstock to achieve the 55% moisture content, the following relationship was developed:

x = Leaf and Yard tonnage
y = SSO tonnage

Using a weighted relationship and the objective of reaching a 55% combined moisture content, we have;

$$\frac{0.35x}{(x+y)} + \frac{0.65y}{(x+y)} = 0.55$$

$0.35x + 0.65y = 0.55x + 0.55y$
$0.35x - 0.55x = 0.55y - 0.65y$
$-0.2x = -0.1y$
$X = 0.5y$

In other words, the amount of leaf and yard material (x) that needs to be added to the cart-generated organics (y) is equal to 50% of the tonnage of the incoming SSO material.

Carrying this assumption forward, we arrive at the following overall throughput design tonnage for the proposed processing facility:

- Total annual throughput design tonnage = SSO tonnage + required L&Y tonnage
  = SSO tonnage + 0.5 SSO tonnage
  = 2800 + 0.5*(2800)
  = 4,200 tonnes/year

It is acknowledged that operation of the proposed facility will require some degree of leaf and yard and/or overs addition to achieve the moisture content objectives. This issue is discussed further in Section 5.

As a component of the 2014 evaluation, it was determined that a minimum organics throughput (SSO plus any additional bulking/carbon rich materials – see Section 4.2) of 8,000 tpy was required to justify the selection (acknowledging additional mobile equipment costs) of the turned mass bed technology. Therefore, with an estimated annual throughput design tonnage of 4,200 tonnes/year, only windrow-based processing technologies are being carried forward for further assessment as part of this report. Specifically, and with reference to the 2014 report, the two technology options for the revised evaluation are:

- **Option 1A** – Windrow (non-aerated floor); and
- **Option 1B** – Windrow (aerated floor)

5.0 Conceptual Processing System Design

5.1 Basic System Components

Based on the experience of the project team, the successful composting of food waste organics using a windrow-based technology incorporates the following considerations:

- Feedstock reception/preparation, composting and primary curing should be conducted within a weather protected area in order to control moisture and other operational parameters;
- Mechanical turning is accomplished with specialized mobile equipment; and
- Beyond mechanical turning, aeration requirements can be augmented with in-floor blower systems.

Acknowledging these requirements, a typical windrow process flow diagram for organics processing for this project is presented in Figure 5-1.

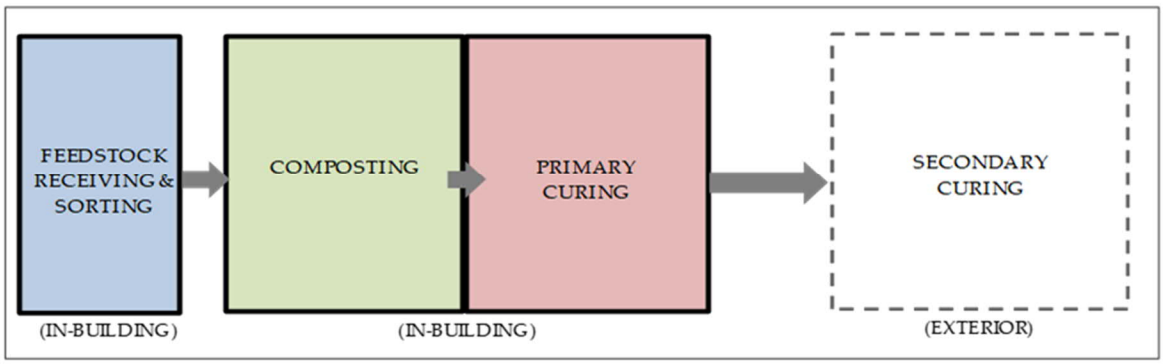


Figure 5-1: Basic System Components

5.2 Key Conceptual Design Assumptions

For Options 1A and 1B, the conceptual design for the material (SSO, L&Y) delivered to the site for composting and curing is based on the following assumptions:

- General Process Description
  - Materials are delivered to the site and after initial inspection/weighing/recording at the scale house, proceed to the primary composting processing facility.
  - Inspection on the sort line, shredding and preparation - then directed to compost building for aerobic primary composting and primary curing.
  - Outside to the secondary curing area.
  - Periodic turning and monitoring.
  - Trommel screening to remove overs (directed back to the front end).
- Composting/Curing Timeline

  - Option 1A (non-aerated floor)
    - Primary Composting (in building) – 3.0 months
    - Primary Curing (in building) – 3.0 months
    - Secondary Curing (exterior pad) – 10.0 months
  - Option 1B (aerated floor)
    - Primary Composting (in building) – 2.0 months
    - Primary Curing (in building) – 2.0 months
    - Secondary Curing (exterior pad) – 8.0 months
- Material Turning Time
  - The primary composting windrow is turned on average once per week.
  - The primary curing windrow is turned on average once every two weeks.
  - The secondary curing windrow is turned on average once every eight weeks.
  - The ALLU screening bucket can process approximately 125 m^3/hr.
- Aeration system
  - For Option 1B, an in floor aeration system is included for the Primary Composting and Primary Curing areas.
- Building
  - Buildings consists of a concrete floor, 1.0 m high perimeter walls, unheated, fabric covered wall/roof, open span.
  - In the case of Option 1A, the floor of all identified buildings will be asphalt.
- Existing compost transfer building
  - Not incorporated into the facility design due to its limited size and inadequate separation distance from the property line.
- Exterior Curing Pad
  - Asphalt surface, sloped to existing or new stormwater management system.
- Surface Water Management
  - Utilization of the existing two pond system, with potential for flocculation addition.
- Leachate Management
  - Moisture generated during primary composting or curing will be collected and directed to a holding tank for re-usage.
- Electrical Power
  - For Option 1A, an on-site generator will be used to provide three phase power for feedstock sorting and preparation requirements.
  - For Option 1B, the existing single phase power supply will be upgraded to three phase.
- Odour Control
  - As outlined in the NS Guidelines, atmospheric modeling would be conducted to determine potential odours.
- Sprinkler
  - Not included in the conceptual design. To be reviewed at detailed design phase.
- Biofilter

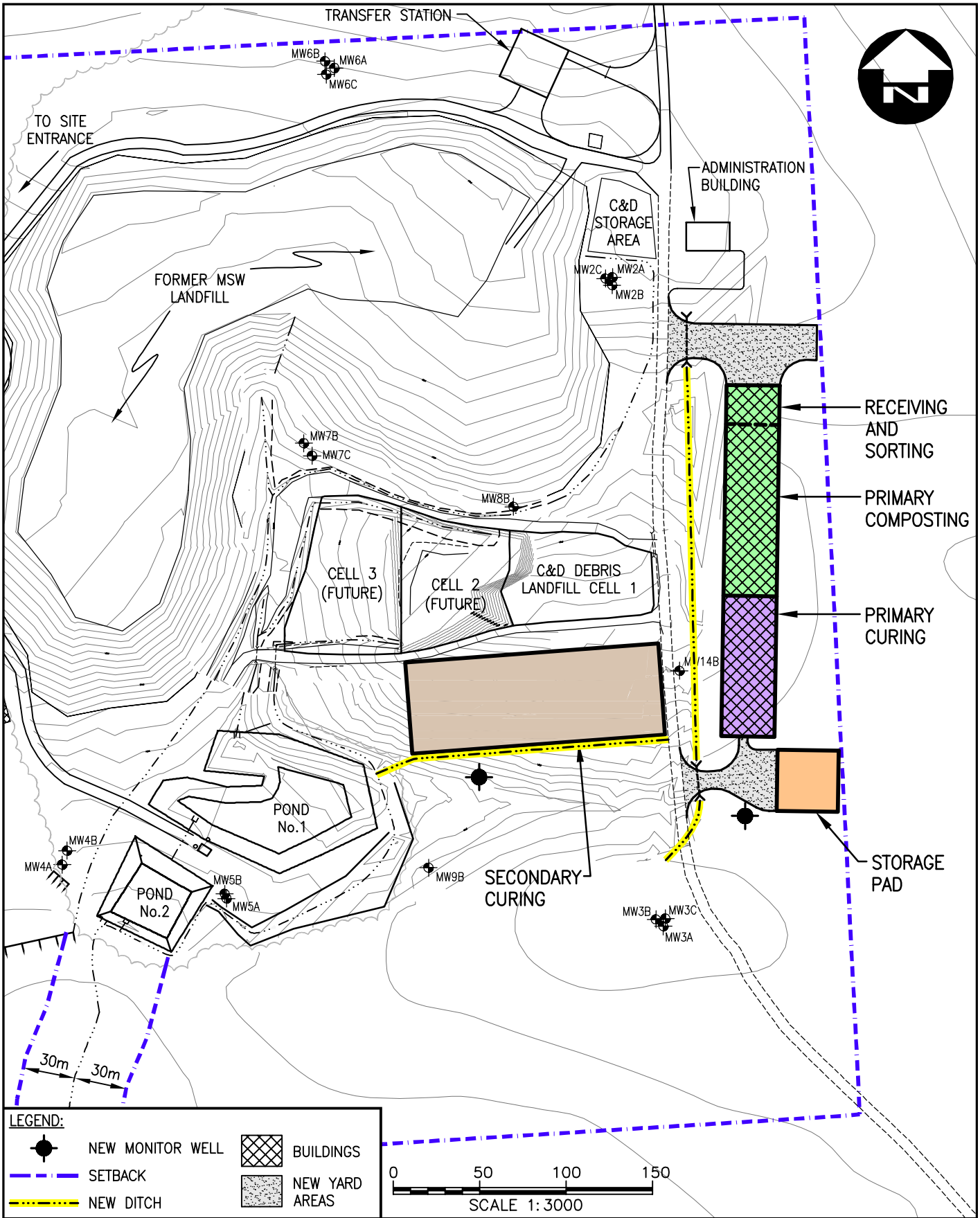
- Not included in the design due to remoteness of the site.
- Groundwater Management
  - Additional groundwater wells/nests have been identified.
- Administration Building
  - The existing building has sufficient space/resources for an additional staff and/or equipment requirements.
- Conceptual Capital Costing
  - Reference unit costing information provided from the 2014 Colchester compost facility tender (adjusted for inflation with 2023 consumer price index (CPI) data), along with various recent Nova Scotia construction tenders, Toromont Cat Maritimes and Dillon's historical costing data archive.

5.3 Option 1A – Windrow (non-aerated floor)

5.3.1 System Description and Conceptual Capital Cost Estimate

For this option, the existing staff would record the delivered SSO material from East Hants and direct the haulage vehicle to the front of the primary composting building. The material would be inspected, sorted, shredded and transported to the windrows. Periodically, the material would be turned, using a dedicated ALLU screening bucket attached to the existing front end loader, in the primary compost windrows, the primary curing windrows and the exterior secondary curing area. There will be no in-floor aeration systems in the primary composting and primary curing buildings. Three phase power will be necessary only for feedstock preparation requirements and will be provided by an on-site generator.

This option is depicted in Figure 5-2. A detailed cost breakdown based on the identified assumptions is presented in Appendix C. A summary of the costing for this option is presented in Table 5-1.



DILLON CONSULTING	PROJECT: UPDATE OF ORGANICS PROCESSING OPTIONS REVIEW	PROJECT NO.: 23-6951
DATE: NOVEMBER 2023	TITLE: OPTION 1A CONCEPTUAL LAYOUT	FIGURE NO.: 5-2

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Table 5-1: Option 1A Capital Cost Estimate

Item	Description	Amount
1	Site Development	$175,000
2	Primary Composting	$2,777,000
3	Primary Curing	$1,353,000
4	Secondary Curing	$652,000
5	Bulking Agent Storage Pad	$46,000
6	Mobile Equipment	$400,000
	Subtotal	$5,403,000
	Contingency @ 10%	$540,000
	Engineering @ 8%	$432,000
	Conceptual Capital Cost Estimate	$6,375,000

5.3.2 Operational Considerations

Staff roles and responsibilities would include a labourer to receive and inspect the delivered SSO. During sorting operations, a minimum of two people would be required, for safety considerations and to sort, shred and transport the material to the windrows. During the primary and secondary phases, a dedicated equipment operator would be required to turn the windrows.

Annual staffing requirements would include:

- Labourer – 1 staff position;
- Equipment operator – ½ staff position;
- Compost Supervisor – 1/12 staff position; and
- Surface and groundwater monitoring – incorporated into existing monitoring program.

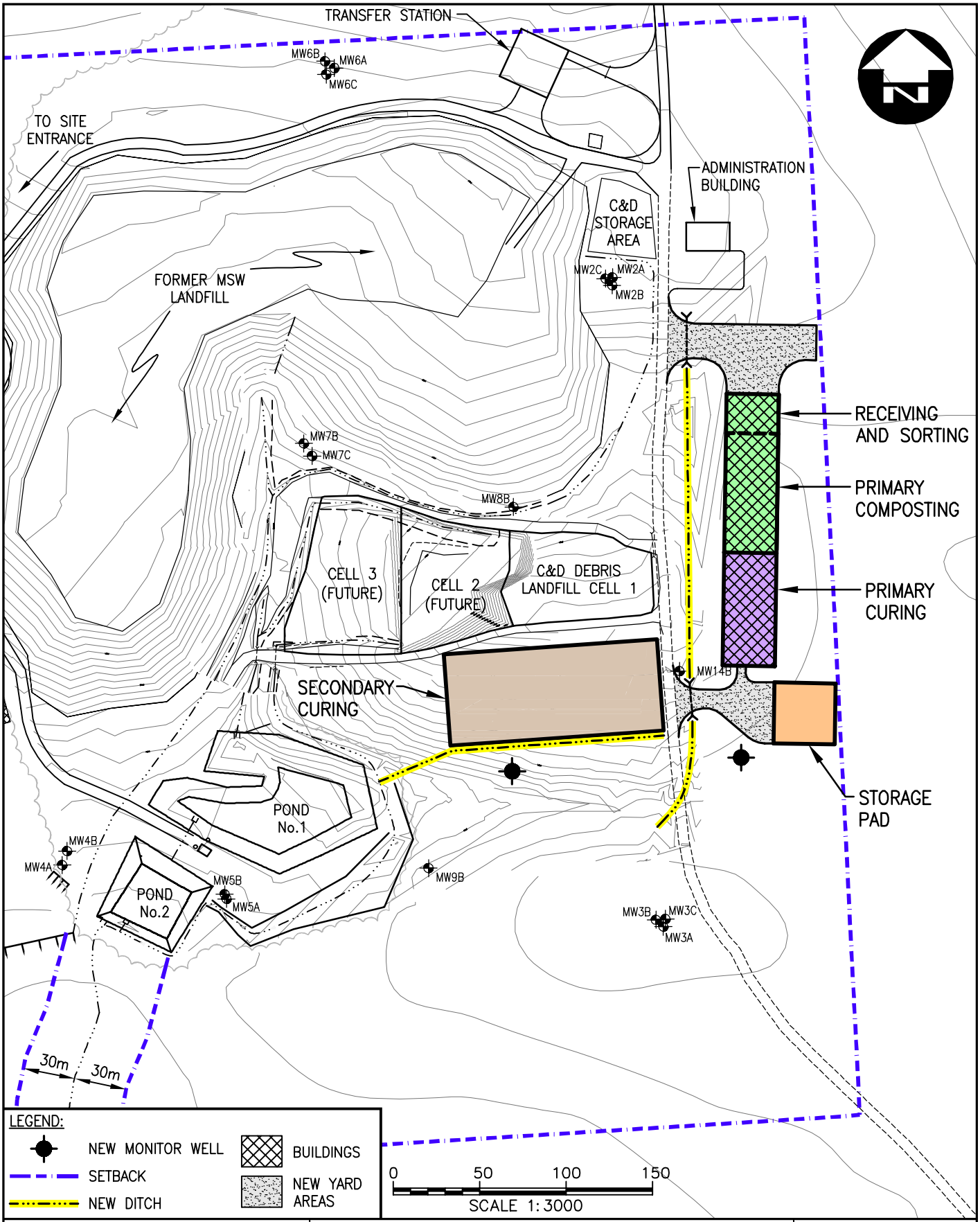
Periodically, a dedicated trained compost supervisor would be required to assess/oversee the operations.

5.4 Option 1B - Windrow (aerated floor)

5.4.1 System Description and Conceptual Capital Cost Estimate

For this option, the existing staff would record the delivered SSO material from East Hants and direct the haulage vehicle to the front of the primary composting building. The material would be inspected, sorted, shredded and transported to the windrows. Periodically, the material would be turned, using a dedicated ALLU screening bucket attached to the existing front end loader, in the primary compost windrows, the primary curing windrows and the exterior secondary curing area.

This option is depicted in Figure 5-3 with a detailed cost breakdown for the scenarios based on the identified assumptions presented in Appendix C with a summary of the costing for this scenario in Table 5-2.



DILLON CONSULTING	PROJECT: UPDATE OF ORGANICS PROCESSING OPTIONS REVIEW	PROJECT NO.: 23-6951
DATE: NOVEMBER 2023	TITLE: OPTION 1B CONCEPTUAL LAYOUT	FIGURE NO.: 5-3

FileName:c:\pw working directory\projects 2023\dillon_50ttr\dms48606\236951_fig 5-2.dwg

Table 5-2: Option 1B Capital Cost Estimate

Item	Description	Amount
1	Site Development*	$2,035,000
2	Primary Composting	$3,576,000
3	Primary Curing	$2,451,000
4	Secondary Curing	$565,000
5	Bulking Agent Storage Pad	$46,000
6	Mobile Equipment	$400,000
	Subtotal	$9,073,000
	Contingency @ 10%	$907,000
	Engineering @ 8%	$726,000
	Conceptual Capital Cost Estimate	$10,706,000

*: Including three phase power connection

5.4.2 Operational Considerations

Staff roles and responsibilities would include a labourer to receive and inspect the delivered SSO. During sorting operations, a minimum of two people would be required, for safety considerations and to sort, shred and transport the material to the windrows. During the primary and secondary phases, a dedicated equipment operator would be required to turn the windrows.

Annual staffing requirements would include:

- Labourer – 1 staff position
- Equipment operator – ½ staff position
- Compost Supervisor – 1/12 staff position
- Surface and groundwater monitoring – incorporated into existing monitoring program

Periodically, a dedicated trained compost supervisor would be required to assess/oversee the operations. A further operational consideration associated with Option 1B is the maintenance of the aerated floor within the composting and primary curing areas. Aerated concrete floors are subject to clogging and require regular inspection and (somewhat difficult) maintenance. Further, the aeration system blowers would require that three phase power be brought into the site. With the nearest existing three phase connection being approximately 19 km from the EHWMC, this represents an additional estimated capital cost of $2 million.

5.5 Conceptual Implementation Schedule

A conceptual implementation schedule (applicable at a preliminary level of analysis for both windrow options) is presented in Figure 5-4. If construction were to occur entirely/partially during winter months, the proposed completion period would need to be increased.

Figure 5-4: Conceptual Implementation Schedule

		Months																
Task No.	Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Project Initiation																	
2	Topographic Survey																	
3	Geotechnical Investigation																	
4	Preliminary Design																	
5	Detailed Design																	
6	MEH Review																	
7	NSE Review/Approval																	
8	Equipment Pre-purchase																	
9	Tendering/Review/Award																	
10	Construction*																	
11	Commissioning																	

6.0 Conclusions

Founded on two scenarios originally developed as part of an analysis completed in 2014, updated conceptual SSO processing designs were developed for this evaluation. Both options were developed and based on site information reviewed as part of this assignment, can be accommodated within the existing EHWMC property.

Appendix A

Provincial and CCME Guidelines

COMPOSTING FACILITY GUIDELINES

Approval Date: September 21, 2010 **Effective Date:** September 21, 2010

Approved By: Kim MacNeil

Version Control:	Replaces the document entitled *Composting Guidelines* issued March 23, 1998; revised January 31, 2006. Latest revision, 2010 (technical amendments).

I. GENERAL

1. Purpose

(a) The purpose of these guidelines is to provide for the proper environmental management of composting facilities.

(b) These guidelines also provide guidance as to the requirements to obtain an approval to construct and operate a composting facility.

(c) Refer to Schedule "A" for the definition of terms used in these guidelines.

(d) Final assessment of applications for the construction and operation of a composting facility will be made on a case by case basis.

(e) For further information respecting these guidelines, contact Nova Scotia Environment's Regional/District office where the site is located.

2. Applicable Documentation

These guidelines should be used in conjunction with the following:

(a) *Solid Waste Resource Management Strategy (1995)*;
(b) *Environment Act*,
(c) *Solid Waste-Resource Management Regulations*;
(d) *Activities Designation Regulations*; and
(e) *Approvals Procedure Regulations.*

3. Applicability

(a) These guidelines apply to all composting facilities requiring approval under Section 27 of the *Solid Waste-Resource Management Regulations*, which states:

> No person shall construct, operate, expand or modify a facility which can process compost without obtaining approval from the Minister.

(b) These guidelines do not apply to:

(I) backyard composting;
(ii) generally accepted farming activities; and
(iii) the composting of leaf and yard waste where not more than 100 m^3 is produced annually.

II. APPLICATION FOR APPROVALS

1. Application

(a) Prior to construction of a composting facility, an approval must be granted by the Department pursuant to Section 27 of the Nova Scotia *Solid Waste-Resource Management Regulations.*

(b) Applications for approval to construct, operate, expand or modify a composting facility must be accompanied by a letter from the municipal unit where the facility is to be located stating that the facility meets zoning, planning restrictions and such other by-laws as may exist.

(c) Unless specifically exempted by the administrator, the applicant is to provide all information necessary to satisfy the requirements of each of the following sections in these guidelines.

III. LEAF AND YARD WASTE COMPOSTING FACILITIES UNDER 10 000 TONNES

1. General

Section III applies to composting facilities which process only leaf and yard waste and utilize up to a maximum of 10 000 tonnes annually of feedstock.

2. Facility Design and Construction

(a) The composting facility shall incorporate the following requirements:

(I) systems shall be designed to minimize odour generation;
(ii) measures shall be taken to control/treat leachate and storm runoff and prevent groundwater contamination;
(iii) a groundwater and surface water monitoring plan shall be approved by the Department; and,
(iv) by-products, including residuals, must be removed from the site in a timely manner and disposed of in a manner acceptable to the Department. The storage of these by-products shall not result in any vector, odour or litter problems.

(b) The composting facility shall have the following separation distances:

(I) the distance between the active area and the nearest foundation of an off-site structure used for commercial, industrial, residential or institutional purposes shall be a minimum of 100 metres;
(ii) the distance between the active area and the nearest property boundary shall be a minimum of 30 metres;

(iii) the distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres;
(iv) under certain circumstances, separation distances may be increased or decreased after consultation with the Department depending on factors such as environmental controls and local conditions; and,
(v) a separation distance may be decreased by the Department pursuant to clause (iv) provided that written consent is obtained by the applicant from all the property owners within the affected area.

IV. IN-VESSEL COMPOSTING FACILITIES

1. General

Section IV applies to all in-vessel composting facilities.

2. Receiving and Tipping Area

(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.

(b) The receiving and tipping area shall be in an enclosed structure.

3. Composting Area

(a) The composting area shall be designed to fully contain the compostable organic material and all leachate which may be generated.

(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.

(c) All drainage from the composting area shall be collected for treatment or for return to the process.

4. Curing Area

(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.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and minimize odour and leachate generation.

(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.

(e) 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 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.

If the compost achieves one of the above requirements, it may be accepted at a secondary curing site as specified in Section VI of these guidelines.

5. Leachate Management Systems

(a) 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.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

6. Surface Water Management

(a) The applicant shall submit for approval from the Department, a surface water monitoring program. The extent of surface water monitoring requirements will be based on the design of the facility.

(b) The surface water monitoring program shall be designed to do the following:

(I) divert surface and storm water from the active areas;
(ii) control run-off discharge from the facility;
(iii) control erosion, sedimentation, siltation, and flooding; and
(iv) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

7. Groundwater Management

(a) The applicant shall submit for approval from the Department a groundwater monitoring program. The extent of groundwater monitoring requirements will be based on the design of the facility. Should any of the active area not be protected from precipitation with permanently constructed roof structures,

then the groundwater monitoring program shall consist of the following minimum requirements:

(I) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;
(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;
(iii) locations of the monitoring well(s) shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and
(iv) the monitoring well(s) are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program)

8. Odour Control Systems

(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.

(b) All areas referred to in clause (a) shall be under a negative atmospheric pressure in order to avoid the escape of odours.

(c) All ventilation air shall be subject to a treatment system designed to remove odours prior to release into the environment.

9. Separation Distances

(a) The distance between the active area and the nearest residential or institutional building shall be a minimum of 500 metres.

(b) The distance between the active area and the nearest commercial or industrial building shall be a minimum of 250 metres.

(c) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(d) Where it can be demonstrated that particular equipment will not release odours generated from the composting process into the surrounding environment, the distance between the equipment and the nearest property boundary shall be a minimum of 30 metres.

(e) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(f) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(g) A separation distance may be decreased by the Department pursuant to clause (f) provided that written consent is obtained by the applicant from all property owners within the required separation distances.

V. OPEN WINDROW COMPOSTING FACILITIES

1. General

Section V applies to all open windrow composting facilities except leaf and yard waste composting facilities covered under Section III.

2. Receiving and Tipping Area

(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.

(b) The receiving and tipping area shall be in an enclosed structure.

3. Composting Area

(a) The composting area shall be underlain by an impermeable pad, the surface of which shall be concrete, asphalt, or other material as approved by the Department. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) All composting areas shall utilize permanent roof structures and/or proven management techniques in order to control moisture and to minimize odour and leachate generation.

4. Curing Area

(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.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and to minimize odour and leachate generation.

(d) Where space limitations prevent the production of mature finished compost at open windrow composting facilities, immature compost may be transferred to an approved composting facility in order to complete the maturation process.

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

l) cured for at least 21 days and must not reheat above 20^{o}C;
ii) cured for 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.

If the compost achieves one of the above requirements, it may be accepted at an open windrow composting site as specified in Section VI of these guidelines.

5. Leachate Management Systems

(a) 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;
(iii) have a means of monitoring all treated leachate discharges; and
(iv) the system must record both instantaneous and total flow volumes.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

6. Surface Water Management

Surface water management systems shall be designed to do the following:

(a) divert surface and storm water from the active areas;
(b) control run-off discharge from the facility;
(c) control erosion, sedimentation, siltation, and flooding; and
(d) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

7. Groundwater Management

(a) To ensure that groundwater is adequately protected, each facility shall include a groundwater monitoring program.

(b) The groundwater monitoring program shall consist of the following:

(I) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;
(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;
(iii) locations of the monitoring wells shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and,

(iv) the monitoring wells are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program.)

8. Odour Control

(a) Facilities shall provide to the Department detailed management techniques for the control of odours from the composting process.

(b) All open windrow facilities which include more than 1000 tonnes annually of food waste in their feedstock or exceed 10 000 tonnes annually of total feedstock, shall provide atmospheric dispersion modelling to determine the potential for odour at the property boundary and other receptors near the facility.

(c) The modelling shall categorize the compounds which could result in odour and shall establish odour concentrations at the property boundaries and other receptors. These baseline odour concentrations shall meet the satisfaction of the Department and shall be used in testing for odours after the facility is in operation.

9. Separation Distances

(a) The distance between the active area and the nearest structure, including residential, institutional, commercial or industrial buildings, shall be a minimum of 500 metres. Where the facility includes more than 1000 tonnes annually of food waste in its feedstock, or exceeds 10 000 tonnes annually of total feedstock, then the separation distance shall be a minimum of 1000 metres.

(b) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(c) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(d) Where a facility was operational prior to the adoption of this provincial guideline, and whose tonnage of received feedstock has increased over time to exceed 10,000 tonnes, separation distances will not be increased.

(e) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(f) A separation distance may be decreased by the Department pursuant to clause (d) provided that written consent is obtained by the applicant from all property owners within the affected area.

VI. Secondary Curing Areas

1. General

Section VI applies to all open windrow composting facilities, which operate for the purpose of producing mature finished compost from immature compost received from a composting facility. Feedstock that can be accepted includes immature compost and bulking material.

2. Curing Area

(a) The curing area shall be underlain by native clay till, imported clay, or other material as approved by the Department.

(b) Permanent roof structures, tarps, or other approved cover systems may be used for secondary curing sites receiving less than 1000 tonnes of immature compost per calendar year in place of groundwater management systems as specified in subsection VI(5).

3. Leachate Management

(a) The Approval holder shall operate the facility to prevent the generation of significant quantities of leachate.

(b) Should leachate be generated that results in adverse effects upon the environment, the Approval Holder shall, at the request of the Department, prepare and implement leachate management and groundwater monitoring programs that meet the requirements of the Department.

4. Surface Water Management

Surface water management systems shall be designed to do the following:

(a) divert surface and storm water from the active areas
(b) control run-off discharge from the facility
(c)control erosion, sedimentation, siltation, and flooding
(d) minimize the generation of leachate

(See Appendix 1 for an example of a typical surface water monitoring program)

5. Groundwater Management

(a) To ensure that groundwater is adequately protected, each facility shall include a groundwater monitoring program.

(b) The groundwater monitoring program shall consist of the following:

(I) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;
(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;

(iii) locations of the monitoring wells shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and

(iv) the monitoring wells are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program.)

6. Odor Control

(a) Facilities shall provide to the Department detailed management techniques for the control of odours from the curing process.

7. Separation Distances

(a) The distance between the active area and the nearest structure, including residential, institutional, commercial or industrial buildings, shall be a minimum of 500 meters. Where the facility includes more than 10000 tonnes of total feedstock, then the separation distance shall be a minimum of 1000 meters.

(b) The distance between the active area and the nearest property boundary shall be a minimum of 100 meters.

(c) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 meters.

(d) Under certain circumstances, separation distances may be increased or decreased after consultation with the department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(e) A separation distance may be decreased by the department pursuant to clause (d) provided that written consent is obtained by the applicant from all property owners within the affected area.

VII. COMPOSTING FACILITY OPERATION

1. General Requirements

(a) Section VII of the guidelines applies to all composting facilities regardless of the size and type of feedstock processed.

(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 system for the capture and treatment of odorous emissions.

(i) With regard to secondary curing areas, no incorporation of any material, other than bulking agent, is permitted.

(c) The composting facility shall have constant supervision during the hours that the facility is open.

(i) Constant supervision during operational hours is not required for secondary curing areas if they are not located on the same site as the composting facility from which the immature compost has originated.

(d) The composting facility shall accept only the feedstock identified in the approval.

(e) Any residual products associated with the composting operation shall be disposed of in a manner acceptable to the Department.

(f) Litter shall be controlled on the entire site.

(g) Exposed areas shall be stabilized to prevent erosion and sedimentation.

(h) Dust shall be controlled to Departmental requirements for particulate emissions.

(I) Vectors shall be controlled in accordance with a control plan approved by the Department.

(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.

*(*I) Signs for secondary curing areas that are not located on the same site as the composting facility from which the immature compost originated shall include name of facility operator and emergency contact.

2. Operation and Maintenance Manual

(a) An Operation and Maintenance Manual shall be submitted for review from the Department and shall include the following:

(I) record drawings and specifications for the composting facility;
(ii) a copy of the approval including Terms and Conditions of the approval for the composting facility;
(iii) a complete description of the operational practices and procedures;
(iv) measures to control and monitor the aeration of the compost to ensure that the oxygen content in the compost material is sufficient to prevent the composting mass from becoming anaerobic;
(v) measures to control the aeration, blending and mixing of the compost to minimize odorous emissions from the composting operation as well as raw material and compost storage;

(vii) monitoring programs including sampling protocols, locations and frequency for monitoring wells, leachate treatment and storm water management systems; and
(viii) contingency plans.

(b) The Operation and Maintenance Manual shall be left on site at all times and shall be available for inspection during operating hours.

3. Contingency Plans

(a) Contingency plans shall identify all reasonably foreseeable emergencies including a fire, explosion, leachate leakage or spills and shall describe appropriate response to prevent an adverse affect on the surrounding environment.

(b) The applicant shall provide contingency plans addressing problems associated with vectors, groundwater contamination, equipment failure, and odour generation and complaints.

4. Reports and Records

(a) The type and frequency of monitoring and reporting requirements shall be specified in the terms and conditions of the approval.

(b) The applicant shall submit for review from the Department an annual report which shall include the following information:

(I) liquid effluent (leachate) monitoring both pre-treatment and post-treatment including:
  (a) flow volumes; and
  (b) leachate quality;
(ii) surface water monitoring and groundwater monitoring quality data;
(iii) feedstock flow including:
  (a) types of materials accepted at the composting facility for the period;
  (b) quantities of materials accepted at the composting facility for the period;
  (c) quantities of materials composted; and
  (d) quantities of materials rejected and sent for disposal;
(iv) compost quality testing results; and,
(v) complaint records.

(c) The applicant shall record and respond to complaints regarding the composting operation from the neighbouring public. Each complaint and associated measures shall be recorded in a log book including:

(I) a description of the complaint and the date and time it was received by the applicant;
(ii) wind direction, wind speed, temperature, humidity and other atmospheric conditions at the time of the occurrence which resulted in a complaint; and

(iii) a description of the measures taken to address the cause of the complaint.

VIII. COMPOST CLASSIFICATION AND USE

1. Compost Classification

(a) All compost will be classified in accordance with the criteria identified in the Canadian Council of Ministers of the Environment (CCME) document "Guidelines for Compost Quality" dated October 2005 as amended from time to time. The compost must meet all criteria as established for foreign matter, maturity, pathogens and trace elements. See Schedule “B” for table of trace elements.

(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 CCME Guidelines.

(c) Compost which meets the criteria established in the CCME Guidelines as Category B shall be classified in accordance with metal concentrations, product maturity, amount of foreign matter, organic matter content, pH and salinity.

(d) Compost which is tested and classified as a hazardous or special waste shall be handled and treated in accordance with the requirements of the *Act.*

2. Compost Use

(a) Compost which meets the criteria established in the CCME Guidelines as Category A may be used in accordance with the uses stated in the CCME Guidelines for Category A.

(b) Use of compost which meets the criteria established in the CCME Guidelines as Category B will be related to the sensitivity of the proposed receiving environment, the various feedstock used to produce the compost and the quality of the final product. Approval for the use of this compost shall include use on forest lands, landfills, highway medians and land reclamation projects such as quarries and disposal site restorations. This compost cannot be used on food crops.

Dated at Halifax, Nova Scotia, this _____day of _____, 2010.

Original signed by
Kim MacNeil
Acting Deputy Minister

Schedule "A"

Definitions:

(a) "*Act*" means the *Environment Act*, S.N.S. 1994-95, c.1;

(b) "active area" means any area used for transfer, storage, disposal, separation, processing or treatment of compostable material including the tipping area, the composting area and the curing pad;

(c) "administrator" means a person appointed by the Minister pursuant to Section 21 of the *Act*;

(d) "approval" means an approval pursuant to Section 27 of the *Solid Waste-Resource Management Regulations*;

(e) "backyard composting" means composting at a residential dwelling unit of organic solid waste, including grass clippings, leaves or food waste, where

(I) the waste is generated by the residents of the dwelling unit or neighbouring dwelling units or both; and,
(ii) not more than 10 m^3 is processed annually

(f) "biosolids" means organic materials which originated as settled matter in facilities treating municipal or industrial liquid wastes and may be used as feedstock for composting operations;

(g) "compost" means a product of composting which is used or sold for use as a soil amendment, artificial topsoil or growing medium or for some other application to land;

(h) "compostable organic material" means vegetative matter, food processing waste, landscaping, garden and horticultural wastes, kitchen scraps, feed processing wastes, and other organic wastes which can be readily composted in composting facilities;

(i) "composting" means the biological decomposition of organic materials, substances or objects under controlled circumstances to a condition sufficiently stable for nuisance-free storage and for safe use in land applications;

(j) "composting area" means an area where organic material undergoes the rapid initial stage of composting;

(k) "composting facility" means a solid waste-resource management facility where composting occurs;

(l) "curing area" means an area where organic material that has undergone the rapid initial stage of composting is further stabilized into a mature finished compost;

(m) “Department” means the Nova Scotia Environment;

(n) “food waste” means any residual vegetative waste other than leaf and yard materials or woody materials and residual waste of animal origin including meat, fish, bones, carcasses or shells other than manure or biosolids from residential, industrial, commercial or institutional sources;

(o) "foreign matter" means any matter resulting from human intervention and made of organic or inorganic components including metal, glass, synthetic polymers (e.g., plastic and rubber) that may be present in compost but foreign matter does not include mineral soils, woody material, and rocks;

(p) "in-vessel composting" means any composting method in which composting materials are contained in an enclosed reactor, vessel or building and which utilizes forced ventilation with treatment of ventilation air for odour reduction;

(q) "leaf and yard waste" means vegetative matter resulting from gardening, horticulture, landscaping or land clearing operation, including materials such as tree and shrub trimmings, plant remains, grass clippings, leaves, trees and stumps, but excludes construction and demolition debris or contaminated organic matter;

(r) “Minister” means Minister of Environment;

(s) "open windrow composting" means composting in which compostable organic material is open to the atmosphere during the composting process and includes windrow composting in a building but where there is no treatment of ventilation air for odour reduction;

(t) “secondary curing site” means a curing area at an approved off-site location where the product, having met intermediate standards, is placed for further stabilization into mature finished compost.

(u) "vector" means a carrier organism that is capable of transmitting a pathogen from one facility or waste source to another source, facility, product or organism including rodents, insects and birds.

Schedule "B"

Concentrations of trace elements in compost*:

	CATEGORY A	CATEGORY B
Trace Elements	**Maximum Concentration within Product (mg/kg dry weight)**	**Maximum Concentration within Product (mg/kg dry weight)**
Arsenic (As)	13	75
Cadmium (Cd)	3	20
Cobalt (Co)	34	150
Chromium (Cr)	210	1060**
Copper (Cu)	400	760**
Mercury (Hg)	0.8	5
Molybdenum (Mo)	5	20
Nickel (Ni)	62	180
Lead (Pb)	150	500
Selenium (Se)	2	14
Zinc (Zn)	700	1850

*See CCME Guideline for maximum cumulative additions to soil.
** See CCME Guideline for further description of these values.

APPENDIX 1

TYPICAL SURFACE AND GROUNDWATER MONITORING PROGRAM

1.0 SITE ASSESSMENT AND DESIGN

1.1 Hydrogeologic Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the hydrogeologic conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following;

.1 a general description of geologic and hydrogeologic conditions occurring at the site, and adjacent and other properties within 1000 m of the site. This description should identify any unstable soils or bedrock, indicate the location and nature of any boundaries to groundwater movement, and characterize the significance of groundwater resources and the use made of these resources;

.2 a detailed hydrogeologic investigation of the site which establishes soil, rock, and groundwater conditions;

.3 an interpretation of the results of the detailed hydrogeologic investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific hydrogeologic conditions, the design of the site, and the contingency plans for the control of leachate.

1.2 Surface Water Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the surface water conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following:

.1 a description of the local surface water features occurring at the site, and adjacent and other properties within 1000 m of the site. This description shall include, but not be limited to, flood plains, natural watercourses, waterbodies (including salt water) drainage paths and boundaries, streamflows, surface water quality, and sources of water supply. The description shall also extend further than 1000 m to be sufficiently large to assess the range and extent of potential effects;

.2 a detailed surface water investigation of the site to assess water quality, quantity, and habitat conditions of the surface water features identified on site, including existing and potential surface water uses;

.3 an interpretation of the results of the detailed surface water investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific surface water conditions, the design of the site, and the contingency plan for the control of leachate.

2.0 OPERATION AND MONITORING

2.1 Groundwater Monitoring

A program for monitoring groundwater quality and quantity shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of groundwater within the site shall be:

a) obtained annually from groundwater monitoring facilities and be analyzed for the parameters listed in column 1 of Schedule 1; and

b) obtained quarterly from groundwater monitoring facilities and be analyzed for the parameters listed in column 2 of Schedule 1.

.2 Where requested by property owners or occupants, representative samples of groundwater shall be obtained from domestic wells located within 500 m of the site at a frequency of 1 sample per well per year and these groundwater samples shall be analyzed for the parameters listed in column 2 of Schedule 1.

.3 The results of analysis of a water sample collected under Subsection 2.1.2 shall be provided to the Department and the owner or occupant of the property with the domestic well from which the sample was obtained, within 60 days of obtaining the sample.

.4 The results of analysis of all water samples collected in the groundwater monitoring program, together with an assessment of these results shall be provided to the Department in an annual report, and where the assessment indicates a significant increase in contaminant concentrations, within 60 days of obtaining the sample and 5 days of making the assessment.

.5 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

2.2 Surface Water Monitoring

A program for monitoring surface water quality, quantity, and biological features shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of surface water being discharged from the site and of any waterbody, including upstream control locations, which may be

affected by leachate, stormwater runoff, or sediment from the site , shall be:

a) obtained semi-annually, and be analyzed for the parameters listed in column 3 of Schedule 1 and for other parameters of concern identified in the surface water assessment; and

b) obtained quarterly and be analyzed for the parameters listed in column 4 of Schedule 1.

.2 Annual monitoring of biological features to assess the composition and any changes to the benthic community present in any waterbody, located downstream of storm water discharges, that may be affected by leachate, stormwater runoff, or sediment from the site.

.3 The results and assessment of the results of the surface water monitoring shall be provided to the Department in an annual report, and where the assessment indicates an increase in contaminant concentrations exceeding the natural variability exhibited by baseline and operational monitoring data, within 60 days of obtaining the sample and 5 days of making the assessment.

.4 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

Schedule 1
Groundwater, Leachate and Surface Water Monitoring Parameters

Parameter				
Parameter Group	Column 1	Column 2	Column 3	Column 4
	Comprehensive List for Groundwater and Leachate	Indicator List for Groundwater and Leachate	Comprehensive List for Surface Water	Indicator List for Surface Water
	Alkalinity	Alkalinity	Alkalinity	Alkalinity
	Ammonia		Ammonia	Ammonia
	Arsenic		Arsenic	
	Barium		Barium	
	Boron		Boron	
	Cadmium	Cadmium	Cadmium	
	Calcium	Calcium		
	Chloride	Chloride	Chloride	Chloride
	Chromium		Chromium	
	Conductivity	Conductivity	Conductivity	Conductivity
	Copper		Copper	
	Iron	Iron	Iron	
	Lead	Lead	Lead	
	Magnesium	Magnesium		
	Manganese			
	Mercury		Mercury	
	Nitrate	Nitrate	Nitrate	Nitrate

Parameter				
Parameter Group	Column 1	Column 2	Column 3	Column 4
	Comprehensive List for Groundwater and Leachate	Indicator List for Groundwater and Leachate	Comprehensive List for Surface Water	Indicator List for Surface Water
	Nitrite		Nitrite	Nitrite
	Total Kjeldahl Nitrogen		Total Kjeldahl Nitrogen	Total Kjeldahl Nitrogen
	pH	pH	pH	pH
	Total Phosphorus		Total Phosphorus	Total Phosphorus
	Potassium	Potassium		
	Sodium	Sodium		
	Suspended Solids	Suspended Solids	Suspended Solids	Suspended Solids
	Total Dissolved Solids	Total Dissolved Solids	Total Dissolved Solids	Total Dissolved Solids
	Sulphate	Sulphate	Sulphate	Sulphate
	Zinc		Zinc	
Volatile Organics				
	Benzene		Benzene	
	1, 4 Dichlorobenzene		1, 4 Dichlorobenzene	
	Dichloromethane		Dichloromethane	
	Toluene		Toluene	
	Vinyl Chloride			

Parameter				
Parameter Group	Column 1	Column 2	Column 3	Column 4
	Comprehensive List for Groundwater and Leachate	Indicator List for Groundwater and Leachate	Comprehensive List for Surface Water	Indicator List for Surface Water
Other Organics				
			Biochemical Oxygen Demand (BOD_5)	Biochemical Oxygen Demand (BOD_5)
	Chemical Oxygen Demand	Chemical Oxygen Demand	Chemical Oxygen Demand	Chemical Oxygen Demand
	Dissolved Organic Carbon	Dissolved Organic Carbon	Total Organic Carbon	
	Phenol		Phenol	Phenol
			Tannins/Lignins	
Field Parameters				
			Temperature	Temperature
	pH	pH	pH	pH
	Conductivity	Conductivity	Conductivity	Conductivity
			Dissolved Oxygen	Dissolved Oxygen
			Flow	Flow

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GUIDELINES FOR COMPOST QUALITY

PN 1340

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Guidelines for Compost Quality

PN 1340

Canadian Council of Ministers of the Environment

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Abstract

The benefits of compost to aid plant growth and add stability and fertility to soils are well demonstrated. Based on these attributes, the composting industry in Canada has become a vibrant industry that continues to grow in size and strength.

In order to ensure a consistent, high quality product that is safe for all uses, early in the 1990s CCME established a committee to develop quality guidelines for compost that is sold or given away. CCME, the Bureau de normalization du Québec (BNQ) and the Canadian Food Inspection Agency (CFIA) agreed to coordinate efforts and developed compost standards that provide a significant level of consistency, while being flexible enough to accommodate different (e.g. regional) interests and issues. This joint effort led to the development of the first edition of the CCME Compost Quality Guidelines in 1996.

Since 1996, the industry has grown to what it is today. During that growth, new science and technologies have improved our understanding of composting and compost. Thus, a revision to the 1996 guidelines was necessary. These revised guidelines reflect our new understanding while still providing the same level of protection that was intended in the first version.

The CCME Guidelines for Compost Quality are based on the following four criteria for product safety and quality: foreign matter, maturity, pathogens, and trace elements. The guidelines attempt to integrate the concept that exposure is an integral part of risk by establishing two grades of material (Category A - unrestricted and Category B - restricted). The guidelines will help protect public health and the environment and help composting continue to develop as an important resource/waste management solution.

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Glossary

aerated static pile: a heap of compostable materials formed to promote the aerobic decomposition of the organic matter. Ventilation is either provided by passive or forced aeration, rather than through frequent agitation (turning). French: ***tas statique aéré***

biosolids: organic product obtained from the physico-chemical and/or biological treatment of wastewater. Biosolids result from primary wastewater treatment (primary biosolids), or from secondary wastewater treatment (secondary biosolids), and these two types of biosolids are often combined (mixed biosolids). These biosolids can be derived from the treatment of either municipal wastewater or industrial wastewater. French: ***biosolides***

compost: solid mature product resulting from composting. French: ***compost***

composting: managed process of bio-oxidation of a solid heterogeneous organic substrate including a thermophilic phase. French: ***compostage***

contaminant: element, compound, substance, organism, or form of energy which through its presence or concentration causes an adverse effect on the natural environment or impairs human use of the environment. French: ***contaminant***

foreign matter: any matter over 2 mm in dimension that results from human intervention and has organic or inorganic components such as metal, glass, synthetic polymers (for example plastic and rubber) and that may be present in the compost but excluding mineral soil, woody material and pieces of rock. French: ***corps étranger***

in-vessel composting: diverse group of composting methods in which composting materials are contained in a reactor vessel; the purpose is to maintain optimal conditions for composting. French: ***compostage en milieu fermé***

mature: term used to designate a compost that, when used as an organic soil conditioner, does not have phytotoxic effects arising from, for example, nitrogen immobilization or anaerobioses. NOTE — The opposite of "mature" is immature. French: ***mature***

micronutrient: plant nutrient (for example boron, copper, molybdenum, manganese, iron and zinc) required in lesser quantities than major (for example nitrogen, phosphorus and potassium) and secondary (for example calcium and magnesium) plant nutrients, having essential physiological functions in plant metabolism. French: ***oligoélément***

municipal biosolids: biosolids obtained from municipal wastewater pretreated to remove gravel and coarse solid waste. French: ***biosolides municipaux***

municipal solid waste (MSW): solid non-hazardous refuse that originates from residential, industrial, commercial, institutional, demolition, land clearing, or construction sources. French: ***déchets solides municipaux***

pathogens: organisms, including some bacteria, viruses, fungi, and parasites, that are capable of producing an infection or disease in a susceptible human, animal, or plant host. French: ***organismes pathogènes***

sharp foreign matter: any foreign matter over a 3 mm dimension that may cause damage or injury to humans and animals during or resulting from its intended use. NOTE — Sharp foreign matter may consist of, but is not limited to, the following: metallic objects or pieces of metallic objects, for example utensils, fixtures, electrical wiring, pins, needles, staples, nails, bottle caps; glass and porcelain or pieces of glass and porcelain, for example, containers, dishes, glass panes, electric light bulbs and tubes, mirrors. French: ***corps étranger tranchant***

source separation: separation of wastes into specific types of material at the point of generation. French: ***tri à la source***

thermophilic phase: biological phase in the composting process characterized by the presence of micro-organisms which grow optimally in a temperature range of 45˚C to 75˚C. French: ***phase thermophilic***

trace element: chemical element present in compost at a very low concentration. French: ***élément trace***

volatile solids: solids in water or other liquids that are lost on ignition of dry solids, generally above 500˚C. French: ***solides volatils***

windrow: elongated piles of triangular or trapezoidal cross-section that are turned in order to aerate and blend the material. French: ***andain***

yard waste: vegetative matter resulting from gardening, horticulture, landscaping, or land clearing operations and includes materials such as tree and shrub trimmings, plant remains, grass clippings, and chipped trees. French: ***résidus de jardin***

Acronyms

AAFC	Agriculture and Agri-Food Canada
BNQ	Bureau de normalisation du Québec
CCC	Composting Council of Canada
CCME	Canadian Council of Ministers of the Environment
CFIA	Canadian Food Inspection Agency
CRIQ	Centre de recherche industrielle du Québec
MPN	most probable number
MSW	municipal solid waste
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
SCC	Standards Council of Canada

Preface

Guidelines for Compost Quality, 2005, is published by the Canadian Council of Ministers of the Environment (CCME) and replaces the previous version – *Guidelines for Compost Quality*, 1996.

This document was prepared by the CCME Compost Guidelines Task Group. Membership of the Task Group was representative of provincial, territorial, and federal governments.

Compost Guidelines Task Group

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Section 1

Introduction

Canadians have long understood that organic matter, when composted, is a valuable product. Compost provides many benefits, returning nutrients and organic matter to the soil, making it a valuable amendment for landscaping, horticulture, and agriculture.

In 1996, CCME developed guidelines for compost products, at a time when the composting industry was still relatively young. Since then, many industries and municipalities have implemented large-scale composting operations.

By setting standards for the quality of compost material, the guidelines helped protect public health and the environment, as well as ensured that compost products were used beneficially. The composting industry also benefited since the guidelines helped secure compost as a beneficial soil amendment, increased the demand for organic materials, and encouraged source separation of organic wastes. In short, the guidelines helped organic materials to be regarded as a resource.

As is often necessary, updates to guidelines and standards are necessary in order to recognize advances in new technologies and science. This 2005 revision is meant to reflect these advances and to provide even better use of organic resources in Canada and to protect the environment and human health.

1.1 Background

Several standard-setting organizations across Canada are mandated to regulate compost and write standards concerning compost. These include the federal government, provincial and territorial governments, and the Bureau de normalisation du Québec (BNQ), acting on behalf of the Standards Council of Canada (SCC)[1].

Within the federal government, the Canadian Food Inspection Agency (CFIA) regulates compost when it is sold either as a soil amendment or as a product with plant nutrient claims under the *Fertilizers Act*. The provinces and territories regulate the disposal and beneficial use of wastes on land, and therefore, the production and use of compost. In its role, acting on behalf of the SCC, the BNQ establishes voluntary industry standards for adoption by the SCC and endorses products that meet their standards.

Since 1993, CCME, BNQ and CFIA have aimed to coordinate efforts in an attempt to develop compost standards that provide a significant level of national consistency, while being flexible enough to accommodate different interest (e.g., regional) and issues.

[1] The SCC coordinates voluntary industry standardization activities in Canada and represents Canada in the International Organization for Standardization (ISO). Four standard-development organizations are accredited by the SCC, one of which is the BNQ. Within the SCC, BNQ is primarily responsible for standardizing fertilization, organic fertilizers, and soil supplements. As such, the BNQ is the only standard-writing organization of the SCC accredited to write industry standards for compost.

CCME produced its first Guidelines for Compost Quality in 1996. In 2003, CCME directed the Compost Guidelines Task Group to review the 1996 CCME Compost Guidelines since the Canadian voluntary standard (BNQ) was also being revised. The BNQ public consultations and standard revisions have led to the development of these revised CCME Guidelines for Compost Quality.

1.2 Objectives

The objectives of *Guidelines for Compost Quality* are to:

- Protect public health and the environment across the country;
- Promote harmonization with the Canadian Food Inspection Agency (CFIA) and Bureau de normalisation du Québec (BNQ);
- Encourage source separation of municipal solid waste (MSW) to produce a high quality compost product;
- Produce compost standards that are consistent across the country, while accommodating different interests and issues;
- Incorporate the experience of industry and regulators in applying the guidelines and to ensure that the national guidelines reflect new science and technology advances;
- Discourage the application of untreated organic wastes to land; and,
- Ensure consumer confidence through consistent nationwide product quality standards.

1.3 Scope and Applicability

These guidelines apply to compost produced from any organic feedstock as determined by regulatory agencies. They apply to compost that is sold, given away or used on-site. Specific definitions and regulatory information on on-site composting can be obtained from federal, provincial and territorial authorities.

These guidelines do not apply to compost-based products, e.g., potting soil mixes, although jurisdictions may wish to apply or modify the guidelines for these products.

Due to the diversity of regulatory approaches that exists in Canada, these guidelines generally apply to the quality of compost rather than the composting process. Jurisdictions will develop individual siting and operating guidelines to accommodate jurisdictional needs.

In response to special concerns, a jurisdiction may decrease or increase the number of parameters to be analyzed based on monitoring data, changes in the waste stream or

processing techniques, effectiveness of source separation programs, or the potential presence of toxic substances.

These guidelines only come into effect if adopted, in whole or in part, by an authority having jurisdiction. Where this guideline has been adopted, in whole or in part, by an authority having jurisdiction, it is subject to any restrictions or conditions added by the regulatory authority.

Readers of this guideline are advised to check with the federal, provincial, or territorial authority having jurisdiction to establish whether this guideline applies in their area of interest.

Section 2

Product Safety and Exposure

Products must be safe for sale or use. However, by the same token, “safety” (or “risk”) is the function of exposure. When assessing the safety of a product, exposure must also be considered; if there is no exposure there can be no “risk”. Ultimately, exposure is a function of the quantity, the intended use, and the users of a product. The question then becomes whether a product is “safe enough” for “use as intended”. It should be recognized that a product may be safe for one type of use and user, but not for another use in which the product may be further exposed to the public, water, environment, or plants in the food chain. These guidelines attempt to integrate the concept that exposure is an integral part of the risk by establishing different grades of material (Category A - unrestricted and Category B - restricted) on the basis of safety.

Section 3

Compost Product Guidelines

These compost guidelines are based on the following four criteria for product safety: foreign matter, maturity, pathogens and trace elements.

The standards for compost quality are summarized in this section. For additional information on the limits recommended, please refer to the "Support Document for Compost Quality Criteria [National Standard of Canada CAN/BNQ 0413-200, Canadian Council of Ministers of the Environment (CCME) Guidelines and Agriculture and Agri-Food Canada (AAFC) Criteria]".

3.1 Categories

Two compost categories have been developed for trace element concentrations and sharp foreign matter. These categories (A and B) are based on the end use of the compost material.

Unrestricted Use

Category A – Compost that can be used in any application, such as agricultural lands, residential gardens, horticultural operations, the nursery industry, and other businesses.

Category A criteria for trace elements are achievable using best source separated MSW feedstock or municipal biosolids, or pulp and paper mill biosolids, or manure.

Restricted Use

Category B – Compost that has a restricted use because of the presence of sharp foreign matter or higher trace element content. Category B compost may require additional control when deemed necessary by a province or territory.

Please note that for a compost to meet the unrestricted use category, it must meet the unrestricted (Category A) requirements for all trace elements and sharp foreign matter. If the compost fails one criterion of the guideline for unrestricted use but meets the criteria for restricted (Category B) use, then it is classified as a Category B product. Products that do not meet the criteria for either Category A or B must be used or disposed of appropriately.

3.2 Trace Elements

Trace elements, for example, mercury, cadmium, lead, may be present in raw materials from which compost products are produced. Excessive accumulation in soils over the long term may result in toxicity to plants, animals and humans. However, copper, cobalt, molybdenum and zinc (and possibly nickel and selenium) are plant micronutrients, and

their presence may be useful in compost. Also arsenic, cobalt, chromium, copper, molybdenum, nickel, selenium, and zinc are micronutrients required by animals and humans (Webber and Singh, 1995). Cadmium, mercury and lead are of no known value to either plants or animals. Compost applied repeatedly in large quantities to land without monitoring trace element concentrations could theoretically cause adverse effects on human health or the environment over the long term.

The concentrations of trace elements in finished compost (Category A and B) and the cumulative additions to soil (Category B) shall not exceed those levels provided in Table 1 as calculated on a dry weight basis.

Background information about trace elements are provided in Annexes A and B.

Table 1 Concentrations of Trace Elements in Compost and Cumulative Trace Element Additions to Soil

	CATEGORY A	CATEGORY B	
Trace Elements* **	Maximum Concentration within Product (mg/kg dry weight)	Maximum Concentration within Product* (mg/kg dry weight)	Maximum Cumulative Additions to Soil* (kg/ha)
Essential or beneficial to plants or animals			
Arsenic (As)	13	75	15
Cobalt (Co)	34	150	30
Chromium (Cr)	210	**	**
Copper (Cu)	400	**	**
Molybdenum (Mo)	5	20	4
Nickel (Ni)	62	180	36
Selenium (Se)	2	14	2.8
Zinc (Zn)	700	1850	370
Other			
Cadmium (Cd)	3	20	4
Mercury (Hg)	0.8	5	1
Lead (Pb)	150	500	100

* These concentrations are the existing standards under the Canadian Food Inspection Agency's Standards for Metals in Fertilizers and Supplements, September 1997 (Trade Memorandum T-4-93).

** Limits for copper and chromium are not established in the Trade Memorandum. Calculated in the same manner as limits for the other nine elements, the trace element additions to soil for chromium and copper would be: chromium = 210 kg/ha and copper = 150 kg/ha for the trace element concentrations within the compost product , chromium = 1060 mg/kg and copper = 757 mg/kg. Details of these calculations are in the "Support Document for Compost Quality Criteria [National Standard of Canada CAN/BNQ 0413-200, Canadian Council of Ministers of the Environment (CCME) Guidelines and Agriculture and Agri-Food Canada (AAFC) Criteria".

*** Concentrations of other elements may eventually be regulated in certain provinces to accommodate regional and national concerns.

3.3 Foreign Matter in Compost

Foreign matter detracts from good quality compost. As most compost feedstocks and products contain foreign matter, the following quality criteria are important to protect human health, and to be an incentive for source separation of residuals or sorting out of foreign matter in the final product.

a) Sharp Foreign Matter

Category A - Compost shall not contain any sharp foreign matter of dimension greater than 3 mm per 500 ml.

Category B - Compost shall have a sharp foreign matter content less than or equal to three (3) pieces of sharp foreign matter per 500 ml, and the maximum dimension of the sharp foreign matter shall be 12.5 mm. However, this compost shall not be used in pastures, parks or for residential purposes.

b) Other Foreign matter

Category A - Compost shall contain no more than one (1) piece of foreign matter greater than 25 mm in any dimension per 500 ml.

Category B - Compost shall contain no more than two (2) pieces of foreign matter greater than 25 mm in any dimension per 500 ml.

3.4 Maturity/Stability of Compost

Characteristics of mature and stable compost include biostabilization and humus formation. Guidelines for compost maturity are necessary as unstable/immature product has the potential to cause adverse effects on plants when applied in large amounts or attract vectors, such as flies, and to cause odours.

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; 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; or,

c) the temperature rise of the compost above ambient temperature is less than 8 °C .

3.5 Pathogens in Compost

As pathogenic organisms may be present in the compost feedstock, the compost itself may also contain pathogenic organisms and, as a result, may pose a risk to human health. To adequately reduce these health risks, the compost shall conform to the criteria outlined in either a) or b) depending on the feedstock source.

a) When compost contains ***only yard waste*** the following criteria shall be met:

1. The compost shall undergo the following treatment or other process recognized as equivalent by the relevant province or territory.

   Using in-vessel composting method, the material shall be maintained at operating conditions of 55°C or greater for three days.

   Using the windrow composting method, the material shall attain a temperature of 55°C or greater for at least 15 days during the composting period. Also, during the high temperature period, the windrow shall be turned at least five times.

   Using the aerated static pile composting method, the material will be maintained at operating conditions of 55°C or greater for three days. The preferable practice is to cover the pile with an insulating layer of material, such as cured compost or wood chips, to ensure that all areas of the feed material are exposed to the required temperature.

   OR

2. Organism content shall meet the following:

   Fecal coliforms[2] < 1000 most probable number (MPN)/g of total solids calculated on a dry weight basis,

   AND

   No *Salmonella* sp. with a detection level < 3 MPN/4g total solids calculated on a dry weight basis.

[2] Preliminary research suggests that some composts may have high fecal coliform counts due to bacteria of environmental origin and not of fecal origin. Thus, fecal coliforms may not be a reliable indicator of pathogen levels under all circumstances. In cases where high levels of fecal coliforms are suspected to be due to environmental contamination, additional analysis for *Escherichia coli* should be conducted. Use of *Escherichia coli* content as a direct indicator of pathogen levels is not yet supported by all regulatory agencies in Canada, but it may be used to help verify the reason for the high fecal coliform levels.

b) When compost contains ***other feedstock***, the following criteria shall be met:

1. Undergo a treatment (described in a),

   AND

2. Organism content shall meet the following:

   Fecal coliforms < 1000 MPN / g of total solids calculated on a dry weight basis,

   OR

   No *Salmonella* sp. with a detection level < 3 MPN / 4g total solids calculated on a dry weight basis.

3.6 Organic Contaminants in Compost

Organic chemicals enter waste streams from a variety of industrial and domestic sources. While many degrade or volatilize during waste collection, treatment (including composting) and storage, some of these organic chemicals persist.

Some compost feedstocks may contain trace amounts of persistent[3] or bio-accumulating organic contaminants, such as dioxins, furans, pesticides, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH) or herbicides (e.g. clopyralid). The manufacturer should pay special attention to raw materials that might contain such contaminants. To this effect, it is recommended that the composting of raw materials with high contents of these contaminants be avoided.

However, given the low content of dioxin and furans in compost feedstock (Webber, 1996) and in composts produced in Canada (Groeneveld and Hébert, 2004), routine analysis under the CCME Guidelines is not considered necessary. The same also applies to PCB and PAH. For specific sampling requirements in each province or territory, contact the provincial or territorial authority having jurisdiction.

[3] The term "persistent" is used to indicate resistance to transformation (i.e. breakdown or degradation) in the environment. A compound is considered persistent in soil or aquatic systems when its half-life (T ½) or its time for 50% decline or disappearance is greater than 180 days.

Section 4

Sampling and Analytical Methods for Testing Compost Quality

The following documents can be used as a basis for sampling and analytical test methods.

CAN/BNQ 0413-200-2005 – Organic Soil Conditioners – Composts. (Amendements organiques – Composts.)

CAN/BNQ 0413-210-2005 – Organic Soil Conditioners – Composts – Determination of Foreign Matter Content – Sieving Method. (Amendements organiques – Composts – Détermination de la teneur en corps étrangers – Méthode granulométrique.)

CAN/BNQ 0413-210-2005 – Organic Soil Conditioners – Composts – Determination of Respiration Rate – Respirometric Method. (Amendements organiques – Composts – Détermination du taux de respiration – Méthode respirométrique.)

These publications are available at the Bureau de normalisation du Québec (BNQ).

Bureau de normalisation du Québec
Customer Service
333, rue Franquet
Sainte-Foy (Québec) G1P 4C7
Telephone: (418) 652-2238
Toll-free: 1 800 386-5114
Fax: (418) 652-2292
E-mail: bnqinfo@bnq.qc.ca
http://www.bnq.qc.ca/

CENTRE D'EXPERTISE EN ANALYSE ENVIRONNEMENTALE DU QUÉBEC, Dénombrement des salmonelles ; méthode par tubes multiples. MA. 700 **–** Sal-tm 1.0, Ministère de l'Environnement du Québec, 2003, 19 p.
http://www.ceaeq.gouv.qc.ca/methodes/pdf/MA700Saltm10.pdf

Compost sampling and analysis protocols can also be found in *Test Methods for the Examination of Composting and Compost* (TMECC).

US COMPOSTING COUNCIL RESEARCH AND EDUCATION FOUNDATION (CCREF), and UNITED STATES DEPARTMENT OF AGRICULTURE (USDA), *Test Methods for the Examination of Composting and Compost*.
http://www.tmecc.org/tmecc/

Annex A

Maximum Acceptable Trace Element Contents in Category A Compost — No Net Degradation and Best Achievable Approach Concepts[4]

The **no net degradation** and the **best achievable approach** concepts are two different concepts that were considered for the determination of the maximum acceptable trace element contents in **Category A** compost.

The **no net degradation** concept referred to in *An International Survey of Composting Criteria* (Waste Conversion Incorporated, 1992) requires that the use of compost not change the regional background levels of trace elements in the receiving soils. In the *Review and recommendations for Canadian interim environmental quality criteria for contaminated sites* (1991), Environment Canada defines **background level** as "the concentration of a chemical substance occurring in a media removed from the influence of industrial activity at a specific site and in an area considered to be relatively unaffected by industrial activity."

The **no net degradation** concept generally recognizes that the maximum acceptable trace element contents in compost should be established by taking the arithmetic mean of measured background levels in a defined region and adding three standard deviations from the mean. For ***normal distributions***, 99 % of all trace element content results for samples from a region considered to be uninfluenced by industrial activities shall be below these maximum acceptable contents.

At the time of the first edition of this guideline (1996), measurements of background levels of trace elements were available only for the agricultural soils of Alberta, Ontario and Québec. Requirements based on the **no net degradation** concept were thus established using the highest values of background levels of soils obtained from these three provinces.

The **best achievable approach** concept favours the use of the best available technology to produce an end product. This concept is based on the fact that the best available technology (such as source separation) to produce the desired end product should be used to establish the requirements for maximum acceptable trace element contents in compost.

At the time of the first edition of this guideline (1996), data based on the **best achievable approach** concept was available in British Columbia's *Production and Use of Compost Regulation* (1993). The data specified in this regulation were derived from municipal solid waste residue and source separation management programs. In 2004, numbers for Cu and Zn were derived to allow composting of other feedstocks. For Cu, the value was raised from 100 to 400 mg/kg in order to allow composting of hog manure and municipal biosolids. Environmental justifications of trace element contents are found in Hébert and

[4] Adapted from Bureau de normalisation du Québec (2005)

Groeneveld (2003). For Zn, the concentration limit was raised from 500 to 700 mg/kg to allow composting of poultry and hog manure, and vermicomposting. The limits for poultry manure were based on CRIQ (1994) database values for manure and manure composts. It is important to note that both the **no net degradation** approach and the **best achievable technology** standards are policy-based criteria for compost products and are not based on risk assessment associated with local soil quality.

The following table presents maximum acceptable trace element contents for **Category A** compost established using the highest value derived from **no net degradation** and **best achievable approach** concepts.

Table 2 Maximum Acceptable Trace Element Contents for Category A Compost Using the Highest Value Derived from No Net Degradation and Best Achievable Approach Concepts.

Trace Element	Mean of Background Levels + 3 Standard Deviations			*No Net Degradation* Concept (1996)	*Best Achievable Approach* Concept	Maximum Acceptable Trace Element Content in Category A Compost
	Alberta	Ontario[1]	Québec[2]			
As		10		10	13[3]	13
Cd	1.6	3	2.5	3	2.6[3]	3
Co	14	25	34	34	26[3]	34
Cr	30	50	121	121	210[3]	210
Cu	29	60	48	60	400[4]	400
Hg	0.1	0.15	0.09	0.15	0.8[3]	0.8
Mo		2		2	5[3]	5
Ni	36	60	62	62	50[3]	62
Pb	20	150	68	150	150[3]	150
Se		2		2	2[3]	2
Zn	124	500	144	500	700[5]	700

NOTE — All results are expressed in milligrams per kilogram (dry weight basis).

1. Reference: Ontario Ministry of the Environment, 1989
2. Reference: Giroux, Rompré, Carrier, Audesse & Lemieux, 1992
3. Reference: British Columbia, 1993
4. Reference: Hébert and Groeneveld, 2003
5. Reference: Centre de recherche industrielle du Québec, 1994

Annex B

Maximum Acceptable Trace Element Contents in Category B Compost as outlined in Trade Memorandum T-4-93 [5]

Maximum acceptable trace element contents for **Category B** compost ensure that the cumulative trace element additions to soil will not exceed the requirements shown in the table below, assuming a wet basis annual application rate of 11,000 kg/hm² (1 hm^2 = 10,000 m^2 = 1 ha) of compost at 60% moisture content (equivalent to an oven-dried mass of 4,400 kg/hm^2 containing up to 5% total nitrogen) for a period of 45 years.

No maximum trace element content for Cu or Cr was retained for **Category B**, which corresponds to the absence of values indicated in "Trade Memorandum T-4-93" (CFIA, 1997).

Note that these values, except for As and Pb, are lower than «Exceptional quality» criteria derived by US EPA (1995) for municipal biosolids compost from a risk-based analysis.

Table 3 Maximum Acceptable Trace Element Contents for Category B Compost

Trace Element	**Maximum Cumulative Trace Element Addition to Soils* Based on *Table I* in "Trade Memorandum T-4-93",** kg/hm^2 (kg/ha)	**Maximum Acceptable Trace Element Content in Type *B* Compost Based on *Table II* in "Trade Memorandum T-4-93",** mg/kg (dry weight basis)
Arsenic (As)	15	75*
Cadmium (Cd)	4	20
Cobalt (Co)	30	150
Lead (Pb)	100	500
Mercury (Hg)	1	5
Molybdenum (Mo)	4	20
Nickel (Ni)	36	180
Selenium (Se)	2.8	14
Zinc (Zn)	370	1,850

* The maximum arsenic content in a compost in milligrams per kilogram is calculated as follows:

$$\frac{15\ \text{kg}/\text{hm}^2}{4400\ \text{kg}/\text{hm}^2\text{a} \times 45\ \text{a} \times 1\ \text{g}/1000\ \text{mg} \times 1\ \text{kg}/1000\ \text{g}}$$

[5] Adapted from Bureau de normalisation du Québec (2005)

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Appendix B

Windrow and Turned Mass Bed Processing Technologies

APPENDIX B

MUNICIPALITY OF EAST HANTS - Update of Organics Processing Options Review

Windrow and Turned Mass Bed Processing Technologies

Technology/Option	Windrow 	Turned Mass Bed 
Process Overview	Passive aeration and mechanical agitation, outdoor method. Suitable for a wide range of feedstock and facility capabilities. Method involves feedstock being formed into long, low, triangular piles (windrows). Windrows are regularly moved or turned. Composting time is reduced, and a greater quantity of material can be processed on a smaller footprint. Windrows are typically 1.5 to 3.5 m high and 3 to 6 m wide. Spacing between windrows ranges from 1 to 5 m depending on type of turning device.	Passive aeration and mechanical agitation, indoor (with or without an aerated floor) or outdoor method. Variation/ improvement on the traditional windrow method. A continuous-flow system that often relies on a specialized windrow turner. Windrows are larger than the "windrow composting method" (i.e., 15 to 40 m wide)
Infrastructure/Space Requirements	Medium to high space requirements, low infrastructure requirements, includes long low piles, an outdoor working pad, access roads, accompanying ditches and a detention pond. Windrows are situated on a firm working pad composed of concrete, asphalt, cement-treated base or compacted gravel. Turning is done using mobile equipment such as a front-end loader, a skid steer, or a farm tractor and manure spreader. Several styles and sizes of specially designed windrow "turners" have also been developed specifically for this task.	Medium space requirements. Infrastructure includes working pad, turning equipment. To create mass bed, a windrow turner is modified by adding a horizontal cross-conveyer which allows for more processing of material.
Applicable Feedstocks	L&Y, wood, food waste, high C:N ratio.	L&Y, suitable for materials with high oxygen demand such as food waste and biosolids if managed carefully.
Feedstock Preparation Requirements	Shredding	Shredding
Typical Capacity (tpy SSO)	< 50,000	10,000 to 50,000
Composting Time	12 to 16 months	10 to 14 months
Flexibility/ Seasonality	Depends on location and climate. Medium flexibility; outdoor method may be difficult to compost during winter months.	Medium flexibility, year-round operation
Process Control Features	Windrows are regularly moved or turned to re-establish porosity, break up and blend material, and introduce oxygen. Turning regularly (at least once per week during active composting), maintaining the pile size, and ensuring the FAS is maintained increases the rate of processing.	Less surface area exposure and lower level of passive aeration requires more turning (every two to four days if floor unaerated) and higher level of monitoring. In-floor aeration system can be installed to increase oxygen concentration and reduce turning frequency.
Level of Odour Control	Low to medium odour control; when windrow is turned, heat, water vapour and gases are released which can affect adjacent properties. Turn windrows during periods of low pressure or when the wind is blowing away from adjacent properties.	Low to medium, medium to high if enclosed in building.
Water/Moisture Control Requirements	Low to medium water requirements/no moisture control.	Low to medium water requirements/no moisture control unless covered.
Vector (animal/ bird) Access	High	High if outdoors
Electricity Consumption	Not needed	Only required with the aerated floor option (medium).
Fuel Consumption	Medium to high - to run turning equipment.	High - the cost of the specialized turning equipment is 50% to 100% higher than traditional windrow turner.
Quantity of Liquid Effluent Requiring Management	High quantity of effluent - if composting done outdoors on non-porous surface where exposure to precipitation can lead to runoff management problems. Leachate increases in quantity and potentcy with proportion of food waste. Runoff must be collected and treated, or added to a batch of incoming feedstock to increase moisture content.	Medium to high quantity of effluent if bed is exposed to precipiation, leading to runoff issues.
End Product Characteristics	Product is not stable compost after active management of 8-10 months, still needs a curing stage 4-6 months.	Product is not a stable compost product after active management of 6-8 months, still needs a curing stage 4-6 months.
Relative Cost	Low to medium construction and O&M cost.	Low to medium construction and O&M cost.
Example Operations	1. Fundy Compost Inc., Brookfield NS - 9,000 tpy 2. Envirem Organics, Clarendon NB - 150,000 tpy 3. City of Camrose, AB - 1500 tpy	1. Colchester County, Kemptown NS - 10,000 tpy

Notes:

C:N - carbon to nitrogen ratio
FAS - free air space
L&Y - leaf and yard waste
N/A - not applicable
O&M - operations and maintenance
Passive aeration requires free air space
SSO - source-separated organics
tpy - tonnes per year

Appendix C

Conceptual Capital Cost Estimates

Appendix C - Opinion of Probable Costs
Update of Organics Processing Options Review

Item	Description	Units	Unit Price	Option 1A Non-Aerated		Option 1B Aerated	
				Provisional Quantity	Amount	Provisional Quantity	Amount
1	**Site Development**						
a	Site Survey	lump sum	$ 20,000.00	1	$ 20,000	1	$ 20,000
b	Atmospheric Modelling	lump sum	$ 40,000.00	1	$ 40,000		
c	Geotechnial Investigation	lump sum	$ 30,000.00	1	$ 30,000	1	$ 30,000
d	Groundwater Monitoring Well	each	$ 10,000.00	6	$ 60,000	6	$ 60,000
e	Water Supply Well	lump sum	$ 25,000.00	1	$ 25,000	1	$ 25,000
f	3-Phase Power Extenstion	m	$ 100.00			19,000	$ 1,900,000
2	**Primary Composting**						
a	Clear and Grub	sq m	$ 12.00	4,100	$ 49,000	3,200	$ 38,000
b	Common Cut and Fill Allowance	cu m	$ 20.00	3,500	$ 70,000	3,500	$ 70,000
c	Site Grading	sq m	$ 3.00	4,100	$ 12,000	3,200	$ 10,000
d	Concrete	sq m	$ 750.00			2,800	$ 2,100,000
e	Concrete	sq m	$ 190.00	3,700	$ 703,000		
f	Aggregate	sq m	$ 40.00	3,700	$ 148,000		
g	Asphalt	sq m	$ 50.00	3,700	$ 185,000		
h	Fabric Building Structure	sq m	$ 240.00	3,700	$ 888,000	2,800	$ 672,000
i	Material Preparation	sq m	$ 125.00	3,700	$ 463,000	2,800	$ 350,000
j	Aeration System	sq m	$ 50.00			2,800	$ 140,000
k	Electrical	sq m	$ 40.00	3,700	$ 148,000	2,800	$ 112,000
l	Mechanical	sq m	$ 30.00	3,700	$ 111,000	2,800	$ 84,000
3	**Primary Curing**						
a	Clear and Grub	sq m	$ 12.00	2,500	$ 30,000	2,100	$ 25,000
b	Common Cut and Fill	cu m	$ 20.00	3,500	$ 70,000	3,500	$ 70,000
c	Site Grading	sq m	$ 3.00	4,400	$ 13,000	2,100	$ 6,000
d	Roadways	lump sum	$ 40,000.00	1	$ 40,000	1	$ 40,000
e	Concrete	sq m	$ 750.00			2,100	$ 1,575,000
f	Concrete	sq m	$ 190.00	2,500	$ 375,000		
g	Aggregate	sq m	$ 40.00	2,500	$ 100,000		
h	Asphalt	sq m	$ 50.00	2,500	$ 125,000		
i	Fabric Building Structure	sq m	$ 240.00	2,500	$ 600,000	2,100	$ 504,000
j	Aeration System	sq m	$ 40.00			2,100	$ 84,000
k	Electrical	sq m	$ 40.00			2,100	$ 84,000
l	Mechanical	sq m	$ 30.00			2,100	$ 63,000
4	**Secondary Curing**						
a	Clear and Grub	sq m	$ 12.00	4,600	$ 55,000	3,900	$ 47,000
b	Common Cut and Fill Allowance	cu m	$ 20.00	4,200	$ 84,000	3,500	$ 70,000
c	Site Grading	sq m	$ 3.00	4,600	$ 14,000	3,900	$ 12,000
d	Aggregate	sq m	$ 40.00	4,400	$ 176,000	3,700	$ 148,000
e	Asphalt	sq m	$ 50.00	4,400	$ 220,000	3,700	$ 185,000
g	Piping	m	$ 250.00	90	$ 23,000	90	$ 23,000
h	Manholes	each	$ 10,000.00	5	$ 50,000	5	$ 50,000
ii	Surface Water Management	lump sum	$ 30,000.00	1	$ 30,000	1	$ 30,000
5	**Bulking Agent Storage Pad**						
a	Clear and Grub	sq m	$ 12.00	700	$ 8,000	700	$ 8,000
f	Common Cut and Fill	cu m	$ 20.00	400	$ 8,000	400	$ 8,000
c	Site Grading	sq m	$ 3.00	700	$ 2,000	700	$ 2,000
e	Aggregate	sq m	$ 40.00	700	$ 28,000	700	$ 28,000
6	**Mobile Equipment**						
a	Allu Bucket Screener	lump sum	$ 100,000.00	1	$ 100,000	1	$ 100,000
b	Chipper	lump sum	$ 50,000.00	1	$ 50,000	1	$ 50,000
c	Trommel Screen	lump sum	$ 250,000.00	1	$ 250,000	1	$ 250,000
			Subtotal	$	5,403,000	$	9,073,000
			Contingency @ 10%	$	540,000	$	907,000
			Engineering @ 8%	$	432,000	$	726,000
			Conceptual Capital Budget (Excluding HST)	$	6,375,000	$	10,706,000

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