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Developing Better Technical Specifications for Topsoil Use in Construction Projects

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1. Introduction

Currently, topsoil specifications in Atlantic Canada recommend the use of naturally occurring topsoil which has been stripped from fields or do not specify the use of quality topsoil. With these specifications, poor quality topsoil is often being used by contractors for landscaping. This can result in expensive post-construction maintenance. The use of quality compost manufactured topsoil can play an important role in reducing these expenses. As well, it is important to note, that it takes over 2000 years to naturally regenerate a 150mm thickness of native topsoil/humus layer, while using current engineered compost production methods can achieve the equivalent within a 6-month period (verbal communication – Envirem Organics Inc.). The objective of this report is to examine the benefits and promote the use of compost manufactured topsoil as an alternative to the lessor environmentally sustainable farmland and floodplain stripping practices.

1.1 Topsoil Definition

Topsoil is defined by the New Brunswick Department of Transportation as “the surface layer of the soil profile and is responsible for supplying water and nutrients to plants” (NBDOT, 2011).

1.2 Compost Manufactured Topsoil Definition

Compost manufactured topsoil is a combination of both natural soil and organic compost, typically with a split of 70-30% (by weight), respectively, or 50-50 (by volume). Compost manufactured topsoil presents an environmentally friendly alternative to field stripping. Compost manufactured topsoil is composed of many readily available ingredients such as low organic matter sub-soils, sand, and compost (Alexander, 2001).

2. Current Topsoil Specifications

The following section outlines the regulations and programs which may influence the use of compost manufactured. Current municipal specifications are also discussed.

2.1 Topsoil Preservation Act

The Topsoil Preservation Act came into effect on May 1st 1995 (NB Legislative Assembly, 2006). The goal of the act was to regulate the stripping of topsoil in the province of New Brunswick, thereby protecting the environmental integrity of soil in the province which prevents

excessive erosion and sediment transport. The Topsoil Preservation Act states the following in its legislation:

- No person shall remove topsoil from a site or move topsoil from a parcel unless the person is the holder of a permit,
- No person who owns a parcel shall permit topsoil to be removed from any site within the parcel or moved from the parcel by any other person unless the person who owns the parcel is the holder of a permit.
- No person shall transport topsoil in, on or by a vehicle on a highway except in accordance with the regulations. (NB Legislative Assembly, 2006)

In summary, the act prohibits the sale or removal of topsoil without a government permit. This act gives the government the power to regulate the removal of topsoil (NB Legislative Assembly, 2006).

The act also gives power to the minister to designate inspectors to topsoil removal projects, to insure compliance with the topsoil preservation act. The minister then can give a ministerial order to cease or suspend production, to alter the manner of removal, or to carry out rehabilitation of the removal site (NB Legislative Assembly, 2006).

The act grants the lieutenant governor general the power to regulate the number of permits issued, thereby preventing persons from obtaining permits, and exempting any persons from the act. Lieutenant governors ruling can overrule that of the minister (NB Legislative Assembly, 2006).

It is important to note that this particular piece of legislation has never been properly enforced within New Brunswick and topsoil stripping activities have been allowed to continue without restriction within our provincial floodplains and farmland (verbal communication – Envirem Organics Inc.).

2.2 Leadership in Energy and Environmental Design (LEED) Canada

2.2.1 LEED Canada Background

LEED Canada is an internationally recognized, third-party certification program. Its objective is to promote human and environmental health through a series of rating systems for the design, construction, and operation of high performance green buildings, homes, and neighbourhoods (CaGBC, n.d). LEED Canada currently has six rating systems: New Construction, Core and Shell, Commercial Interiors, Existing Buildings, Homes, and Neighbourhood Development (Ottawa Government, n.d.). Neighbourhood development focuses primarily on site selection, design, and construction while the other five rating systems focus on green building practices (CaGBC, 2011; CaGBC, 2009). Since the focus of this report is on the use of topsoil in construction projects, the report will focus on the first five categories of LEED Canada.

The LEED Canada points-based systems are tailored to Canadian climates, construction practices, and regulations. Point allocation among the categories is based on environmental impact and human benefits (CaGBC, 2009). The five building practice categories award points based on five principal environmental categories and a sixth secondary category. These categories include: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation in Design (or Operations) (CaGBC, 2009). For the purposes of this report, only the Materials and Resources (MR) category will be considered as it is the sole category which encourages design strategies to reduce and reuse resources and construction waste while encouraging the selection of building materials that contain recycled content (Ottawa Government, n.d.).

2.2.2 LEED and Compost Manufactured Topsoil

Current LEED specifications encourage the use of materials manufactured with recycled content for the construction of new buildings and the refurbishment of existing buildings and commercial interiors (CaGBC, 2009). The criterion does not however, promote the use of recycled materials such as compost manufactured topsoil for land restoration and development. Section 3 of this report discusses the various benefits of using this product.

2.3 Sustainable Technologies Evaluation Program

The Sustainable Technologies Evaluation Program (STEP) is a multi-agency initiative led by the Toronto and Region Conservation Authority aimed at broadening the application of sustainable technologies. STEP recommends using composted materials to remediate disturbed natural soils in order to restore soils natural function and increase soil fertility. Compost manufactured topsoil achieves these benefits and remediates disturbed natural soils, such as those on construction sites, by decreasing the density of the soil and increasing the organic content. In addition to increased soil integrity, more surface runoff is also absorbed by the soil minimizing the impact of soil compaction and flooding.

2.4 Municipal Topsoil Specifications

Topsoil specifications obtained from municipal and provincial specification documents for selected Atlantic, Central, and Western Canadian cities can be found in Appendix I of this report.

3. Benefits of using Compost Manufactured Topsoil

The use of compost manufactured topsoil can result in improved vegetation growth, and environmental and economic benefits. These benefits are outlined below.

3.1 Increased Vegetation Growth

The compost component of compost manufactured topsoil (about 50 percent by volume on average) provides the soil with superior chemical, biological, and physical characteristics. The high concentration of nitrogen within the compost allows the topsoil to sustain thicker and healthier plant growth. This characteristic alone has many positive environmental side effects, and consequently is also a very economical alternative to traditional topsoil. Topsoil possesses several other characteristics to support the growth of vegetation as well. These include providing an anchorage for plant roots, slowly releasing nutrients, providing oxygen, and draining excess water while also retaining moisture to sustain plant growth during dry periods (British Standards, 2007). In addition, the mixing of compost with a sandy soil which possesses a specific aggregate distribution will prevent compaction of the soil, thereby producing greater plant growth by facilitating root expansion (Agresource, n.d.). Due to the fragility of natural topsoil, intensive handling through excavation, loading, transportation, and distribution can result in a dramatic

deterioration in the functions provided by the topsoil. However, the careful production and handling of compost manufactured topsoil ensures that the soil retains the beneficial characteristics needed to sustain plant growth (British Standards, 2007).

3.2 Environmental Benefits

The use of compost manufactured topsoil offers a variety of environmental benefits. The increased root mass associated with improved plant growth, allows for greater water absorption which in turn decreases the amount of runoff and erosion (Alexander, 2001). Compost Manufactured topsoil can also help prevent plant disease due to the high concentration of microorganisms, thus helping to promote and preserve the ecosystem (EPA, 2012). Other environmental benefits would be the reduced amount of field stripping needed to keep up with topsoil demand. Since the current unregulated practice of stripping natural topsoil has become a common trend in the construction industry, the development of specifications which utilize compost manufactured topsoil will ultimately prevent the loss of this non-renewable natural resource.

3.3 Economic Benefits

The thicker healthier vegetation creates cost saving as well. Once an area has been covered and seeded, there is generally no need to return in the future to re-work areas that may not have produced sufficient vegetation (McCoy and Barrie, 2001). In addition to the economic benefits associated with thicker and healthier plant growth, the use of compost manufactured topsoil can also reduce the need for future maintenance costs. As discussed above, the reduction of erosion can also result in significant cost savings for a contractor working in an environmentally sensitive area (Alexander, 2001). This decrease in erosion further decreases post-construction costs as there is no need to return and fill in any eroded areas on site. This concept is discussed further in section 4.3 below.

4. Past Projects

The following sections describe the outcomes of past projects which used compost manufactured topsoil. The Merrimack Valley Transportation Centre, Gagetown Reclamation Project, and

Texas Highway Project are examples of successful use of compost manufactured topsoil. The Sidney Tar Ponds example shows the employment of insufficient topsoil specifications.

4.1 The Merrimack Valley Transportation Centre

The Merrimack Valley Transportation Centre in Massachusetts was recently constructed near Amesbury, MA. During the spring of 2012, landscaping was taking place. Topsoil, trees, and shrubs were already on site, waiting to be planted.

The landscaping contractor was the Green Company, and the company owner noticed that the topsoil on site was a low grade natural loam and would likely not result in good vegetation growth. Although the topsoil chosen may have fit the specification, it was not well suited for this application. Instead, the owner requested additional funds and purchased a compost manufactured topsoil and mulch. The topsoil was a sandy loam which contained eight percent organic matter. The mulch had a balanced carbon to nitrogen ratio and provided an organic layer. The long term performance of the topsoil was taken into account to better fit the needs of the client and the extra investment may result in lower maintenance costs over time.

4.2 CFB Gagetown – Training land reclamation project.

Canadian Forces Base Gagetown is a large military training base located in central New Brunswick. Land clearing and military practice operations have resulted in the severe degradation of wet lands in the practice area, shown in Figure 1. About 1100 square kilometers of land have been impacted (Downe, 2012).

The destruction of wetlands resulted in increased sedimentation, erosion and destruction of wildlife habitat. In 2008, the Land Forces Atlantic Area division of the Canadian Forces undertook reclamation activities for the damaged wetlands. The goal of the project was to reclaim lost wetlands and enhance existing wetlands. This was done by constructing earthen berms which encouraged the development of wetlands.

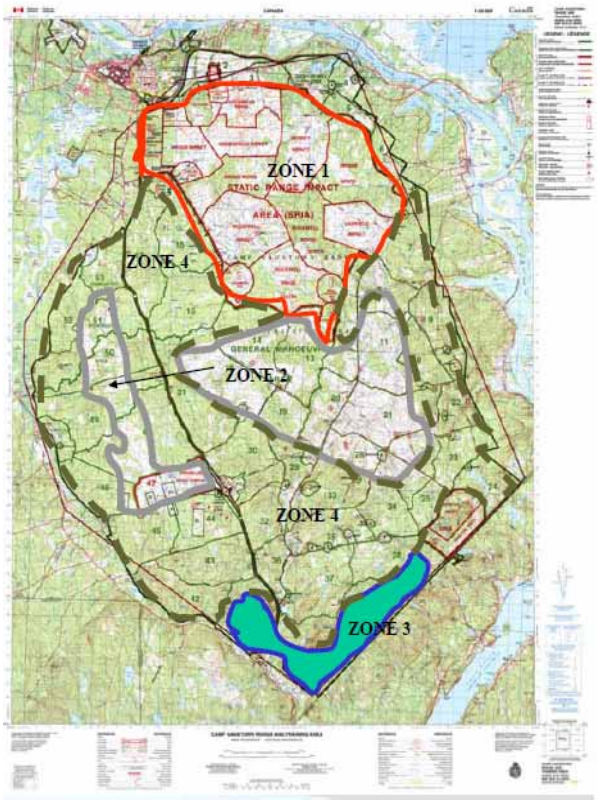

Figure 1: CFB Gagetown Training Area

The project brought in the expertise of several external groups including Ducks Unlimited, University of New Brunswick Saint John, and the province of New Brunswick.

Compost manufactured topsoil was used in the construction of the berms. It was chosen because it would support vegetation in the natural environment.

The project was successful. Visual inspections took place after one and two years and the outcome was positive. Two years after construction, the wetlands were well vegetated and maintained (Downe, 2012).

The following benefits resulted from the reclamation project:

- Water retention
- Water quality improvements
- Increased habitat for wetland dependent species
- Ground water recharge

- Sediment capture
- Flood abatement

4.3 Texas Highway Project

In the late 1990s, the town of Stephenville Texas had problems managing manure from their thriving dairy industry. To this problem the Texas Natural Resources Conservation Commission (TNRCC) approached the Texas Department of Transportation (TxDOT) and proposed using the manure to vegetate the slopes on either side of the highway. The TxDOT responded positively as they had difficulties in vegetating slopes that had very few nutrients left in the soil. Thus the slopes were prone to erosion because of the lack of vegetation. (McCoy, 2001)

To test the concept, the TxDOT and the TNRCC held a demonstration on a steep slope in Big Spring, TX in 1999. The TxDOT had attempted to vegetate this particular slope five times in the past unsuccessfully and erosion was a problem at this site. A mixture of manure, wood chips and yard clippings was composted and mixed with soil. The compost manufactured topsoil was applied mixed with grass seed. Within a month the slope had a layer of grass growing for the first time since its construction.

For the Big Spring demonstration, using compost manufactured topsoil also provided cost savings of about 20 percent in addition to conserving water. For new construction, it is estimated that cost savings can be as high as 60 percent compared to a traditional seed-soil-erosion blanket. (McCoy, 2001)

After the initial success in Big Spring, several more trials were initiated with similar, often remarkable results. In writing specifications for topsoil, the TxDOT has specific specifications for Compost Manufactured Topsoil. These specifications are on a three tiered scale. 1) Compost Manufactured Topsoil, 2) Erosion Control Topsoil and 3) General Use Compost. (McCoy, 2001)

4.4 Sydney Tar Ponds

The Sydney Tar Ponds is a hazardous waste site in Cape Breton Nova Scotia. The site is located on the eastern shore of the Sydney Harbour. Almost 100 years of steel and coke production left behind more than a million tonnes of contaminated soil when the Sydney Steel Mill was decommissioned. A stream transported these contaminants to the tidal estuary known as the Tar

Ponds. The clean-up of the tar ponds has long been a political issue and in 2007 an official clean-up effort was begun as a partnership between the Federal and Provincial governments. The group responsible for the clean-up is the Sydney Tar Ponds Agency (SPTA 2013).

The strategy of the remediation was to stabilize, solidify, and contain contaminated materials. This was done by combining contaminated sediment with Portland cement powder to solidify it and trap the contaminants in the cement. The cement was then covered with sand and soil to create a cap in order to isolate the contaminants.

The eventual plan for the tar ponds area is to construct a public park. This will require extensive landscaping work, and thus a large quantity of topsoil, to be able to grow grass, shrubs and eventually trees in the area (SPTA, 2013).

The topsoil specification for the surface cap and grading at the site of the former Coke Oven is shown in Appendix I. This is a general specification and would allow the stripping of nearby land such as farms or floodplains. It also does not mention the potential benefits of using compost manufactured topsoil in this project where growing conditions will be difficult. Since the long term plan for the land is recreational use, it is particularly important that the topsoil be nutrient rich. It is possible that using compost manufactured topsoil could reduce future maintenance costs of the facility.

5. Proposed Compost Manufactured Topsoil Specifications

5.1 Recommended Changes to Current Specifications

5.1.1 Recommendations to Municipalities

A number of municipal specifications do not promote the use of compost manufactured topsoil. However as previously mentioned in this report, the use of compost manufactured topsoil in landscaping has both environmental as well as economic benefits.

Therefore, it is necessary to make modifications to current municipal specifications to promote the use of compost manufactured topsoil. A complete topsoil specification can be found in Appendix II.

5.1.2 Recommendations to LEED

To promote the use of this beneficial product in independent land restoration and land development projects, four recommendations for future LEED Canada rating systems have been suggested.

5.1.2.1 Modification of existing credits

A modification of existing credits in the Materials and Resources (MR) environmental category to include the granting of credits for the use of compost manufactured topsoil may promote the use of this beneficial product. For example, MR Credit 4 could be modified to include the use of compost manufactured topsoil as a product manufactured from recycled material instead of simply awarding the credit for the use of building products which incorporate recycled content materials (CaGBC, 2009). The modification suggested would expand the materials referred to in these categories to include both building construction and post-construction landscaping materials.

5.1.2.2 Additional credit in MR environmental category

An additional credit could be integrated into the existing MR environmental category. This additional credit would promote the use of recycled materials for materials used in post-construction landscaping. This might include the use of compost-manufactured topsoil.

5.1.2.3 Additional environmental category in rating systems

An additional environmental category could be added to the five rating systems under consideration to address the environmentally friendly design and practices of post-construction landscaping. This category could include credits awarded for the use of topsoil manufactured using recycled materials. Furthermore, landscaping design and plant layout which promotes increased water absorption to decrease erosion and the loss of surrounding native soils could be credited.

5.1.2.4 Additional rating system

Finally, in addition to the existing six rating systems, a new rating system could be introduced for Land Reclamation and Development. Environmental categories could include: Sustainable Sites (SS), Materials and Resources (MR), and Innovation in Design (ID).

Credits in the SS category might include “Site development: Protect and Restore Habitat” which would involve conserving existing natural areas and restoring damaged areas to pre-existing habitats. Credits in the MR category might be similar to the MR credits of the existing five green building rating systems: Storage and Collection of Recyclables, Recycled Content, Regional Materials, and Rapidly Renewable Materials (CaGBC, 2009). These credits would be tailored to the materials used in land restoration and development and would promote the use of quality compost manufactured topsoil. The ID category would be composed of the existing credits of ID-Credit 1: Innovation in Design and ID- Credit 2: LEED Accredited Professional (CaGBC, 2009).

5.1.2.5 Benefits of Implementing Recommendations to LEED

There are several benefits associated with obtaining LEED certification for a project. Contractors and designers who meet the criteria of these rating systems have the opportunity to create a healthier and cleaner environment, gain the advantage of third party verification, and earn a competitive advantage in a growing eco-friendly construction market (CaGBC, n.d.). There are financial benefits to the owner associated with the green building design. These benefits encourage the construction on LEED approved green buildings. Since the use of compost manufactured topsoil produces a quality landscaped environment while using a material produced from recycled materials, it would be beneficial to integrate the use of compost manufactured topsoil into the LEED rating systems. Implementing these recommendations would ultimately expand LEED’s existing internationally recognized mark of excellence to include building construction and post-construction landscaping, as well as land restoration and development projects.

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APPENDICES

Appendix I – Current Specifications

Current Specifications

The following section briefly outlines the current specifications of major cities in the Atlantic Provinces. Additional specifications from central and western Canada are also discussed.

Atlantic Canada

City of Saint John

Topsoil shall be free from rock, roots or other foreign matter, with a minimum of 4% organic matter. Topsoil to be approved and depth to which is to be stripped to be specified before carrying to the Site.

Sample tests may be ordered to determine pH, NPK, and organic matter levels. Sufficient lime shall be added to bring topsoil to a pH range of 5.9 - 7.0. Topsoil shall meet the sieve analysis in Table 26.2.

Newfoundland and Labrador

The topsoil shall be obtained from approved areas off the site. The soil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds and other litter, and shall be free from stones, stumps and other objects larger than 50 mm in diameter, from roots, toxic substances and from any other material or substances that might harm growth or be a hindrance to grading, planting, or maintenance operation

Landscape Nova Scotia

Topsoil – imported, manufactured or site prepared: friable loam, neither heavy clay nor of very light sandy nature containing minimum of 4% organic matter for clay loams and 2% for sandy loams to maximum of 20% by volume; free from subsoil, debris, vegetation, toxic materials, and stones and roots over 50 mm maximum dimension. Topsoil to be rated to **Landscape Nova Scotia Horticultural Trades Association Standard Topsoil Triangle, 1990**, or latest revision,

rating B. Manufactured topsoil or topsoil derived from site sources is to be improved as necessary to meet topsoil qualifications above.

City of Miramichi

2.1 TOPSOIL

Friable, loam containing a minimum of 20% by volume and having a ph of 6-7. Free from subsoil, roots, vegetation, debris, toxic materials, stones over 20mm. dia. Topsoil shall be sandy texture soil. Contractor to supply topsoil analysis.

City of Moncton

13.1.2.2. Topsoil

Friable loam shall contain a minimum of 4% organic matter for clay loams and 2% for sandy loams to a maximum of 20% by volume, and having a pH of 6.0 to 7.0. Topsoil shall be free of admixture of subsoil, refuse, roots, stumps, sod, and stones larger than 20mm.

Central and Western Canada

City of Stratford, Ontario (Ontario Provincial Standard Specification)

802.05.01 Topsoil

Topsoil shall be a fertile loam material that is free of roots, vegetation, or other debris of a size and quantity that prevents proper placement of the topsoil. The topsoil shall not contain material greater than 25 mm in size, such as stones and clods.

Imported topsoil shall not have contaminants that adversely affect plant growth.
Soil from swamps or muskeg areas may be used in place of topsoil, when approved by the Contract Administrator.

City of Mississauga, Ontario

2.1 Materials

1 Topsoil texture to consist of 20% to 70% sand and will have a minimum of 5% organic matter for clay loams and 2% organic matter for sandy loams to a maximum of 20% by volume.

Topsoil will be free of subsoil, roots, grass, weeds, toxic materials, stones in excess of 25 mm, and foreign objects.

Topsoil will have an acidity range (pH) of 6.0 to 7.5.
Soil nutrients shall be present in the following ratios:
Nitrogen (N): 20 - 40 micrograms of available N/gram of topsoil
Phosphorous (P):10-20 micrograms of phosphate/gram of topsoil
Potassium (K): 80-120 mirograms of potash/gram of topsoil
Calcium, magnesium, and micro-nutrients including iron, zinc, boron, sulphur, copper, and molybdenum present in balanced ratios to support germination and establishment of intended vegetation.

The contractor shall submit independent soil tests to Community Services prior to acceptance of topsoil. Should the native topsoil not meet these requirements, imported topsoil will be used or the native topsoil will be amended, prior to planting, to the meet the above specifications and in accordance with the soils analysis.

2 Native Topsoil: Available from the excavated and stockpiled topsoil from grading operations. Topsoil is subject to inspection and testing by the contractor. **Do not commence work until topsoil is accepted by the Community Services Department**.

3 Imported Topsoil: Should the native topsoil not meet the requirements of this specification or should additional topsoil be required, imported topsoil shall be used. Imported topsoil is subject to inspection and testing by the contractor. **Do not commence work until topsoil is accepted by the Community Services Department.**

City of Winnipeg, Manitoba

5.2 <u>Topsoil</u>

All topsoil required shall consist of a screened clay-textured or loam-textured dark topsoil, a fertile, friable material neither of heavy clay nor of very light sandy nature containing by volume, a minimum of four (4%) percent for clay loams and two (2%) percent for sandy loams

to a maximum twenty-five (25%) percent organic matter (peat, rotted manure or composted material) and capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil contamination, roots, stones over 25mm in diameter, baler twine or subsoil clay lumps over 25mm in diameter and other extraneous matter. Topsoil shall not contain quackgrass rhizomes, Canada thistle roots or other noxious weeds. Upon delivery or thirty (30) days following delivery, salinity rating shall be less than 4.0mm hos/cm on a saturated paste basis. The pH range shall be between 6.0 - 8.0.

Topsoil may be either on-site topsoil or imported topsoil.

On-site topsoil which has been stockpiled, can be reused providing that it is shredded or screened prior to being re-spread and that it meets the requirements specified above for topsoil.

Topsoil shall not be blow-in dirt taken from wind erosion sites and topsoil shall not be taken from fields abandoned to corn production where such soil may contain soil incorporated herbicides, such as eradicane and atrazine with lasting residual effects.

The Contractor shall inform the Contract Administrator of proposed source of topsoil to be supplied. The Contract Administrator reserves the right to reject topsoil not conforming to the requirements of this Specification.

Topsoil Specifications for the Sidney Tar Ponds Project

The topsoil specification for the surface cap and grading at the site of the former Coke Oven is as follows:

Remediation of Tar Ponds & Topsoil Placement and Section 32 91 21

Coke Ovens Sites - CO6 Grading

Coke Ovens Surface Cap

Tender No. August 6, 2008

PART 2 - PRODUCTS

2.1 Topsoil

.1 Topsoil: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture to consist of 20 to 70 % sand, minimum 7 % clay, and contain 5 to 15 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Finished surface free from:

- .1 Debris and stones over 50 mm diameter.
- .2 Course vegetative material, 10 mm diameter
- and 100 mm length, occupying more than 2% of soil volume.

.4 Consistence: friable when moist.

2.2 Soil Amendments .1 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

3.2 Sand: washed coarse silica sand, medium to course textured.

.3 Organic matter: compost Category A, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.4 Limestone:

4.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test. (Fry, 2013)

Appendix II – Recommended Topsoil Specification

Description: This section describes the materials used in the preparation of compost-manufactured topsoil for use in planting. The specification for compost manufactured topsoil lists the parameters needed to be met for high quality compost manufactured topsoil.

1. Materials

1.1 Compost

Compost shall be derived from organic residues including forestry barks, fisheries/agriculture manures and/or municipal Class A bio-solids that meet criteria of the Canadian CSA/BNQ Compost Standard. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

The compost shall have a loose and granular texture with the following properties:

a) PH in the range of 5.5 to 8.0

b) Moisture content in the range of 35%-55%

c) Soluble salts shall be less than 4 mmhos (ds), as determined by an approved laboratory

d) C:N ratio 15-30:1

e) Maximum particle size: less than 20 mm

f) Organic matter content: greater than 20%

g) The acceptable range for Bulk Density is 1.2 g/cubic cm to 1.4 g/cubic cm

h) Shall be fully mature, and no less than 7 on the Solvita scale or other comparable measure

i) Metal content: Should meet the requirements of the Canadian Food Inspection Agency and Environmental Protection Agency

(Agresource, n.d.) (City of Bellingham, Washington, Parks Department. n.d.)

1.2 Inorganic Soil Component

Soil shall consist of loose and friable particles of parent material (broken rock), free of ice, snow and rubbish, construction debris, concrete, boulders, stones larger than 50 mm, hydrocarbons, petroleum materials or chemicals toxic to plants, herbicides, contaminants or other extraneous material harmful to plant growth (City of Bellingham, Washington, Parks Department. n.d.).

1.2.1 Additional soil parameters

a) PH 5.5 to PH 7.5, as determined by an approved laboratory

b) Moisture content in the range of 35%-55%

c) Soluble salts shall be less than 2.5 mmhos (ds), as determined by an approved laboratory

d) C:N Ration 20-25:1

e) Organic matter content not less than 4 percent and not more than 20 percent, as determined by a laboratory

f) Free of pests and pest larvae

g) Bulk Density shall be 1.2 – 1.4 g/cubic cm

h) Total petroleum hydrocarbons shall not exceed 150 ppm.

i) Clay content of material passing #200 sieve not greater than 15 percent, as determined by hydrometer tests.

j) Stone and Debris shall be less than 5 %

k) Metal content, as determined by an approved laboratory, shall meet the provincial guidelines for metal content in soil.

(Agresource, n.d.)

1.2.2 Particle Size

• 100% by volume must pass a 2 inch screen.

• 95% by volume must pass a 3/4 inch screen.

• Not more than 60% of the soil by weight shall be less than .05 mm (very fine sand) of which no more than 25% by weight shall consist of particles less than .002 mm (clay)

(Agresource, n.d.)

2. Compost Manufactured Topsoil

2.1 General

Compost manufactured topsoil shall contain at least a 1:1 mixture (by volume) of friable loam and composted materials. It should be free from debris, boulders, stones larger than 2", and hydrocarbons or petroleum products. The source soil and compost used in the mixture shall meet Canadian Food Inspection Agency (CFIA), Canadian Council of Ministers of the Environment (CCME), and United States Environmental Protection Agency (US EPA) standards.

2.2 Mechanical Specifications

Compost manufactured topsoil shall meet the following specification 100% by volume must pass a 2 inch screen. 95% by volume must pass a 3/4 inch screen. Not more than 60% of the compost manufactured topsoil by weight shall be less than .05 mm (very fine sand) of which no more than 25% by weight shall consist of particles less than .002 mm (clay).

2.3 Environmental Specifications

Compost manufactured topsoil shall meet safety standards noted above before it can be used. Topsoil shall retain between 35%-55% moisture content and contain at least 5% organic content (by weight) as determined by a recognized laboratory. Nitrogen content must be between 15-25 ppm in order to support vigorous plant growth.

Source soil for use in manufactured topsoil must not be stripped or removed from any environmentally sensitive site. All compost material that meets safety standards noted above is acceptable for use in manufactured topsoil.

3 Use of Compost Manufactured Topsoil

3.1 General

Compost manufactured topsoil shall be spread evenly upon previously prepared subgrade in uniform layers not exceeding 150 mm.

Compost manufactured topsoil must be spread to the following minimum depths after settlement:

1. Seeded areas- 150 mm
2. Sodded areas- 135 mm
3. Flower beds- 300 mm
4. Shrub beds- 500 mm

3.2 Turf Requirements

Compost manufactured topsoil shall be spread in such a manner as to establish a loose, friable seedbed. Measures should be taken on steep grades to slow run-off.

3.3 Planting Requirements

For all woody plant material, compost manufactured topsoil shall be placed around rootball to even the base of the plants main leader with the soil grade. All Compost manufactured topsoil shall be firmly dressed into place to prevent settling and provide support. Compost manufactured topsoil used for planting beds of herbaceous plants needs to be spread and remain loose and friable for installation of plant material.