



**APPENDIX A**

**SELECTED SPECIAL PROVISIONS**

**1.0 DESCRIPTION**

This item shall consist of the supply and application of approved compost material as shown on the plans or as directed by the Project Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification makes reference to the following standards, specifications or publications:

- CCME "Guidelines for Compost Quality"
- NSDEL "Composting Facility Guidelines"
- Canada Fertilizers Act and Regulations
- TMECC: "Test Methods for the Examination of Composting and Compost"
- AASHTO Standard Specification: Compost for Erosion/Sediment Control (Compost Blankets); AASHTO Designation MP 10
- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

Prior to delivery of compost to the site, the Contractor shall provide the Project Engineer with the following information:

- A list of the feedstock by percentage used in producing the compost material
- A certification statement verifying that the compost meets NSDEL requirements for Class A Compost
- A copy of the laboratory analysis for the compost material showing major plant nutrients, pH, CEC and mineral (metal) concentrations.
- A certification statement verifying that the compost material meets the physical requirements in Table 1.

The Project Engineer may require the Contractor to provide a sample of the compost for confirmatory purposes.

**4.0 MATERIALS**

The compost material shall be an organic substance produced from the aerobic decomposition of organic matter. The compost material shall not contain any visible refuse material nor any material toxic to plant establishment or growth. The composted material may be derived from, but not limited to, leaves, yard trimmings, food scraps, food processing residues, manure and other agricultural residues, bark and other forest residues, soiled or un-recycled paper and biosolids.

Compost materials shall meet all applicable provincial and federal regulations and guidelines for compost production. Compost material shall meet the time and temperature requirements to control pathogens, noxious weeds and rodent attraction. Compost material shall meet the CCME Classification for Category A. Category B may be used at the discretion of the Project Engineer and approval from NSDEL. Compost material shall meet the physical requirements shown in Table 1 or meet requirements designated by the Project Engineer.

**Table 1**

<b>Compost for Manufactured Topsoil</b>	<b>Erosion Control Compost</b>	<b>General Use Compost</b>
Organic Matter Content: 30% dry mass	Organic Matter Content: 40-60% dry mass	Organic Matter Content: 40-60% dry mass
Moisture Content: 40-60%	Moisture Content: 40-60%	Moisture Content: 40-60%
Particle Size: 100% passing 28 000 µm sieve	Particle Size: 100% passing 80 000 µm and <70% passing 25 000 µm sieve	Particle Size: 100% passing 20 000 µm and 70% passing 850 µm sieve
Soluble Salts: 5.0 max. dS/m	Soluble Salts: 5.0 max. dS/m	Soluble Salts: 5.0 max. dS/m
pH: 5.5 - 8.5	pH: 5.5 - 8.5	pH: 5.5 - 8.5

## **5.0 CONSTRUCTION METHODS**

After the designated areas have been graded according to the lines and grades approved by the Project Engineer, compost of the specified type shall be placed according to the following descriptions. Compost materials shall be loose and friable and be free of dust at the time of application. No compost materials shall be stored on site within 30 m of a watercourse.

**5.1 Compost Manufactured Topsoil.** Compost manufactured topsoil shall consist of soil material amended with 10 - 30% compost by volume. The soil material shall be free from trash, stumps and other objectionable materials, and shall be approved by the Project Engineer, prior to beginning the mixing process.

**5.1.1 Blended On Site.** Compost shall be evenly spread in a uniform layer over the previously prepared slope and thoroughly mixed to the depths shown on the plans or as directed by the Project Engineer.

**5.1.2 Pre-Blended.** Topsoil manufactured off-site shall be spread over the prepared slope in a uniform layer to a depth of 10 -20 cm. The topsoil shall be free of objectionable materials.

**5.2 Erosion Control Compost.** Compost materials shall be spread evenly over the prepared subgrade or slopes to form a uniform layer of a thickness of 50 - 75 mm or as shown on the plans. Compost shall not be used for erosion control on slopes  $\geq$  steeper than 2:1.

**5.3 General Use Compost.** General use compost shall be applied as a top dressing over established areas of turf, grass or other ground cover to the depth specified on the plans or as directed by the Project Engineer.

## **6.0 QUALITY CONTROL / QUALITY ASSURANCE**

### **7.0 METHOD OF MEASUREMENT**

Measurement for compost shall be the area in square metres where erosion control compost, general use compost, on-site blended compost, and manufactured topsoil has been acceptably applied and in place, measured along the slope of the ground.

### **8.0 BASIS OF PAYMENT**

- Blended On-Site Compost
- Pre-Blended Compost
- Erosion Control Compost
- General Use Compost

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material necessary to perform the work.

Slope preparation prior to use of compost materials and removal of objectionable materials will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

### **9.0 WARRANTY**

## **1.0 DESCRIPTION**

This item shall consist of the supply and application of approved bark material as shown on the plans or as directed by the Project Engineer.

## **2.0 REFERENCES**

- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

## **3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

### **4.0 MATERIALS**

**4.1 General.** The bark (wood waste) material shall be derived from weed free bark and conform to the following requirements:

- pH: 4.0-8.5
- Particle size: 100% passing a 80 000  $\mu\text{m}$  sieve and 50% passing a 28 000  $\mu\text{m}$  sieve
- Organic matter: no less than 70% by dry weight basis
- Moisture content: less than 60%
- The material shall not contain any visible refuse material nor any material toxic to plant establishment or growth.

**4.2 Documentation.** Prior to delivery of bark mulch to the site, the Contractor shall provide the Project Engineer with certification that the bark material conforms to the above requirements. The Project Engineer may also request the Contractor to provide a sample of the compost for confirmatory testing purposes.

### **5.0 CONSTRUCTION METHODS**

After the designated areas have been graded according to the lines and grades approved by the Project Engineer, the bark shall be spread evenly over the prepared slopes to a uniform thickness as follows:

- 50 - 75 mm on slopes  $\leq 3:1$ ,
- 75 - 100 mm on slopes between 3:1 and 2:1,
- or as shown on the tender drawings,
- or as directed by the Project Engineer.

Bark, for erosion control, shall not be used on slopes steeper than 2:1. Bark materials shall be loose and friable and be free of dust at the time of application. No bark materials shall be stored on site within 30 m of a watercourse.

### **6.0 QUALITY CONTROL / QUALITY ASSURANCE**

#### **7.0 METHOD OF MEASUREMENT**

Measurement for bark material shall be the area in square metres where bark material has been acceptably applied and in place, measured along the slope of the ground.

#### **8.0 BASIS OF PAYMENT**

Payment for bark materials at the contract unit price shall be full compensation for all labour, equipment and material necessary to perform the work.

Slope preparation prior to the placement of bark materials and the removal of objectionable materials will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

#### **9.0 WARRANTY**

## **1.0 DESCRIPTION**

This item shall consist of supplying, installing, maintaining and dispersing (if necessary) a water permeable windrow or berm of approved compost or bark material to contain soil erosion by removing suspended soil particles from water moving through or off the construction site.

## **2.0 REFERENCES**

- AASHTO Designation MP 9; AASHTO Standard Specification: Compost for Erosion / Sediment Control (Filter Berms)
- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

## **3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

Prior to delivery of the bark or compost to the site, the Contractor shall provide the Project Engineer with certification that the bark or compost conforms to the above requirements. The Project Engineer may also request the Contractor to provide a sample of the bark or compost for confirmatory testing.

## **4.0 MATERIALS**

**4.1 Bark Filter Berm.** The bark material shall consist of weed free bark/wood waste that conforms to the following requirements:

- pH: 4.0 - 8.5
- Particle size: 98% passing a 28 000 µm sieve, 90% passing a 20 000 µm sieve, and not more than 30% passing a 5 000 µm sieve. Material shall not exceed ten (10) cm in length.
- Moisture content less than 60% by wet weight basis.
- Organic matter more than 70% by dry weight basis.
- No visible refuse material nor any material toxic to plant establishment or growth.

**4.2 Compost Filter Berm.** Compost material must be derived from aerobic decomposition of organic materials as described in *Special Provision, Supplying and Placing Compost*. It shall meet the same physical requirements as the bark filter berm. The compost filter berm material may be used on its own or in combination with the bark filter berm material to a maximum of 50%.

## **5.0 CONSTRUCTION METHODS**

The erosion control berm shall be placed, un-compacted in a windrow at locations shown on the plans or as directed by the Project Engineer. The berms shall follow the contour or be perpendicular to the slope. Berms shall not be used on slopes steeper than 1.5:1. The minimum dimensions of the berm shall be 60 cm wide at the top, 120 cm wide at the bottom and 60 cm in height. After initial construction, the Contractor shall inspect berms to ensure they are in functioning condition and properly located for effectiveness.

Smaller berms may be used across slopes, perpendicular to the slope, to decrease the length of the slope in order to slow runoff water. The dimension of these berms will be as per the contract drawings.

Filter berms may be removed when they are no longer required. At the discretion of the Project Engineer, the berm material may be distributed over an adjacent area for use as a soil amendment or soil cover. Berms, retained as part of the landscape, may be hydroseeded.

## **6.0 QUALITY CONTROL/QUALITY ASSURANCE**

### **7.0 METHOD OF MEASUREMENT**

Measurement shall be by the linear metre, acceptably applied and in place, measured from end to end along the contour of the ground.

### **8.0 BASIS OF PAYMENT**

- Bark Filter Berm
- Compost Filter Berm
- Bark/Compost Filter Berm

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material necessary to complete the work.

The Contractor shall, at their own expense, repair any berms damaged as a result of improper installation, as determined by the Project Engineer.

Payment will be made as per Division 7 Section 4 for berms requiring repair if the original berms had been properly installed and approved by the Project Engineer and failure was not attributable to the Contractor.

Payment will be made as per Division 7 Section 4 for the maintenance and removal and management of sediment that is accumulated by berms as directed by the Project Engineer.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

**9.0 WARRANTY**

**1.0 DESCRIPTION**

Wire Backed Silt Fence Barrier, also known as 'Type 2 Silt Fence,' is typically specified for use near watercourses. Construction shall include the supply and installation of a fence composed of steel tee-rails or rebar (reinforcing bar), steel wire mesh (100mm x 50mm mesh or 'page wire' fencing), and geotextile fabric as described below and in accordance with the Department plan contained in Figure 1 (see below). The geotextile shall completely cover the wire fence. The barrier shall be installed with minimum disruption to the existing ground and additional sections shall be lapped a minimum of 300 mm. The geotextile fabric shall be keyed into the ground a minimum of 150 mm and a minimum 150 mm layer of Clear Stone (C5; 19 mm) added to the trench to secure the geotextile.

**2.0 REFERENCES**

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

The Contractor shall first receive approval from the Project Engineer, prior to ordering geotextiles, or commercially-available Wire Backed Silt Fence Barrier, for delivery to the site. The Contractor shall provide the Project Engineer with a Manufacturer certificate indicating that the proposed material meets the minimum requirements specified herein.

**4.0 MATERIALS**

**Posts:** Fence posts shall be steel tee-rails of not less than 32 mm by 32 mm by 2 m in dimension and 2 kg/m in mass, or 2 m lengths of 19 mm ( 3/4") rebar. All wire fasteners and other hardware shall be in accordance with manufacturer's recommendations.

**Wire Mesh for Fencing:** Wire mesh shall be 14 gauge or heavier steel wire mesh in 50 mm x 100 mm weave or page wire pattern, and at least 0.9 m high.

**Geotextile Fabric:** The geotextile fabric shall be slit film woven synthetic fibre fabric with sewn seams and with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days. The geotextile fabric shall comply with the following minimum specifications and physical properties:

Grab Tensile Strength, N	600
Mullen Burst, KPa	1800
Permittivity, s <sup>-1</sup>	0.25
Apparent Opening Size, mm	0.35

**Clear Stone (C5; 19 mm):** Clean, hard, durable, non-acid-producing stone particles as per Division 3, Section 4 of the Standard Specifications shall be used as shown on Figure 1, or as directed by the Project Engineer.

**5.0 CONSTRUCTION METHODS**

The Contractor shall carry out the work according to the Environmental Control Plans (ECPs) and Culvert Mitigation Plans (CMPs) as directed by the Project Engineer. All fence grades shall be subject to approval of the Project Engineer.

Prior to construction of the Wire Backed Silt Fence Barrier, the Contractor shall remove any debris and correct minor ground undulations (greater than 0.3 m vertical in a 3 m length) that would interfere with the proper construction and operation of the fence in the required location.

All posts shall be embedded vertically a minimum of 1.1 m into the ground and in line at a minimum 5.0 m spacing.

Corner posts shall be installed whenever the fence line changes direction by more than 20°, and additional (straining) post at changes in elevation of more than 30°.

The geotextile material shall be fastened to the wire fence in an approved fashion, and shall be keyed into the ground at least 150 mm according to the ECPs/CMPs (or as directed by the Project Engineer). A minimum 150 mm layer of Clear Stone shall be added to the up-gradient side of the trench to secure the geotextile.

The Contractor shall inspect the fence daily, and before and after each rain event, to ensure that the fence is in good repair and properly functioning. Note the nature of any runoff water passing through /around the installations. Necessary repairs or deterioration shall be made immediately, or operations ceased until repairs are completed.

If significant volumes of silt (one half of the barrier height) have accumulated against the barrier fence, or silt depths of 300 mm are observed immediately upgradient of the barrier, the silt shall be removed or a second line of barrier installed. Inform the Project Engineer in either case.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**7.0 METHOD OF MEASUREMENT**

The quantity to be measured for payment shall be the number of metres of Wire Backed Silt Fence Barrier satisfactorily installed where directed by the Engineer as described herein.

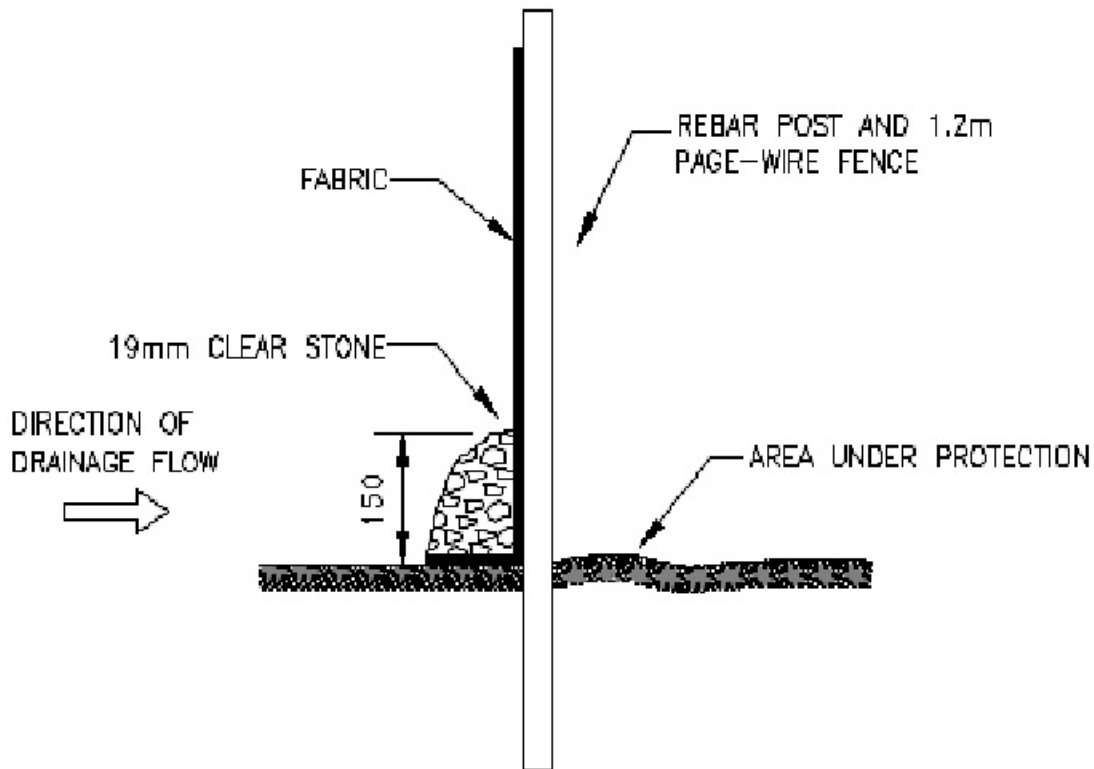
**8.0 BASIS OF PAYMENT**

Payment for work under this item shall be at the Contract unit bid price per metre.

**9.0 WARRANTY**

**FIGURE 1**

**WIRE BACKED SILT FENCE BARRIER (TYPE 2 SILT FENCE)**





## **1.0 DESCRIPTION**

The Contractor shall prepare a site specific Erosion and Sediment Control (ESC) Plan for any borrow pit, outside the highway right-of-way and larger than 0.5 ha, for the purpose of supplying “common” material on a highway construction project.

## **2.0 REFERENCES**

The environmental control measures and procedures contained in the ESC Plans for borrow pits must comply with the terms and practices referred to in the following documents:

- Nova Scotia Department of Transportation and Public Works **Standard Specification** for Highway Construction and Maintenance; and
- Nova Scotia Department of Transportation and Public Works **Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways (latest version)**.

## **3.0 SUBMISSION AND DESIGN REQUIREMENTS**

The ESC Plan should be an independent entity from the working or construction drawings for the project. The Plan should include a written portion and an illustrative portion. The Plan should describe the potential for erosion and sedimentation and explain and illustrate the measures that will be put into place to control these problems.

The **narrative portion** of the Plan must provide enough information so that the Project Engineer (and regulatory authority) can adequately inspect the site and ensure that the Plan is being properly implemented. It should describe where and when the various ESC measures should be installed.

The **illustrative portion** must contain enough information to satisfy the Project Engineer (and regulatory authority) that the problems of erosion and sedimentation have adequately been addressed. The complexity of the illustrations should be appropriate for the size of the borrow pit, the severity of conditions, range in weather conditions, and the potential for off-site sedimentation.

### **3.1 Narrative Checklist**

The narrative portion of the ESC Plan shall include:

- **Project description** - A brief description of the location of the borrow pit, the area (in hectares) expected to be disturbed, and the anticipated period(s) of operation;
- **Existing site conditions** - A brief description of the existing topography, vegetation and drainage (include photographs as appropriate);
- **Adjacent areas** - A description of adjacent areas of concern such as streams, lakes, residential areas which could be impacted by land disturbance (include photographs);
- **Critical Areas** - A description of areas on the borrow pit site that will be disturbed and that have a high potential for erosion, *i.e.* steep slopes, channels, underground springs, etc.
- **Water Control** - A description of how water will be controlled: flowing onto the site, through the site, and leaving the site;
- **ESC measures** - A description of the methods and types of environmental controls that will be used to control erosion and sediment on the site;
- **Sequencing of environmental controls** - A description of when and the sequence in which the environmental controls will be installed on the site;
- **Permanent stabilization** - A description of the method in which the site will be stabilized after excavation has been completed;
- **Contingency Plan** - This plan deals with typical responses to extreme and long duration rainfall events and the failure of ESC measures. Further details are given below; and

- **Monitoring and Maintenance** - A description of the regular inspections and repair of ESC measures that will be carried out on this site.

### **3.2 Illustrative Checklist**

The illustrative portion of the ESC Plan shall include:

- A site plan locating the site in relation to the surrounding area;
- Direction of north in relation to the site;
- Existing contours of the site;
- Limits of clearing and grubbing;
- Direction of groundwater flow onto site;
- Any channelization of flow through the site;
- If required, areas that will be utilized to retain water temporarily on the site;
- Any areas of a high erosion potential; and
- Locations where ESC measures will be installed.

### **3.3 General Requirements**

- The ESC Plan must be submitted to the Project Engineer a minimum of 10 working days in advance of any ground disturbing activity;
- All perimeter ESC measures must be installed prior to any excavation;
- All groundwater flowing onto the site must be controlled and directed through the site by means of stabilized channels;
- If the peak runoff velocity of the water leaving the borrow pit site is greater than pre-construction conditions, then downstream channels will have to be stabilized. The preferred option is to maintain existing runoff velocities through temporary retention of water on-site;
- Post-construction runoff velocities from the site should not exceed pre-construction runoff velocities. This may require permanent retention structures being left in place;
- Between the dates of August 30<sup>th</sup> and April 1<sup>st</sup> each year, the establishment of vegetative cover through seeding should not be relied upon to protect exposed soil. During this period alternative cover types should be utilized such as a clean rock, erosion control blanket, mulching or in some cases sodding for permanent cover, or mulching with weed-free hay in temporary situations; and
- Work in or near a watercourse is not normally permitted between September 30<sup>th</sup> and June 1<sup>st</sup>. However, excavation work in adjacent areas still has the potential to cause siltation. With respect to such work, between the dates of November 30<sup>th</sup> and May 1<sup>st</sup> each year, existing vegetation should not be relied upon as a filtering medium for silt laden water. Alternatives include settling ponds and geotextile silt bags.

### **3.4 Contingency Plan**

Essential components of the plan shall include the following:

- Staff training (*e.g.*, tailgate/toolbox safety and environmental meetings to inform/educate staff of potential problems and hazards);
- Storm preparedness (conditions for work stoppages, pre-storm staff meetings, inspection of all ESC measures, preventative maintenance of ESC measures, cover applied to exposed soil, clean-out of any settling ponds and check dams, and proactive measures that the Contractor shall implement to ensure critical ESC measures will withstand storm runoff, snow melt and wind/ice conditions);
- Confirmed availability of equipment and operators that can be mobilized on short notice to create/repair berms, dams, diversion ditches, and settling ponds;
- Stockpiles of ESC materials (include quantities and locations for strategic placements);
  - straw/hay bales, compost, and/or bark (to be used as mulch/cover material)
  - ESC blankets/matting and staples (or tarps/plastic sheeting)
  - Sandbags, clear stone
  - Water pumps, hoses and fuel (the latter to be stored in a 'safe' location)

- Typical approaches for temporary control of water flow and erosion until new ESC measures can be implemented (e.g., excavation of cross ditches to divert runoff into settling ponds or vegetated areas, excavation of temporary water storage areas, berm construction, and bank stabilization). Note that approaches will vary depending upon season, and the Contractor shall indicate approaches for (a) summer, low flow periods, (b) spring-fall, high flow periods, and (c) frozen ground, high-flow periods;
- Standard protocols for notification of ESC failure to the Project Engineer (and NSEL/DFO inspectors depending upon the magnitude); and
- Incident and 'Near Miss' reporting to the Project Engineer and Environmental Services Section to provide documentation of ESC failure (a *Near Miss Report* details failures that did not result in the loss/release of sediment; the intention is identify the cause and help prevent future occurrences).

## **INTRODUCTION**

Riparian buffer zones act as "strategic" buffers between roadways and the aquatic ecosystems of streams and lakes. Their most important functions include filtering and retaining sediment, immobilizing, storing, and transforming chemical inputs from roadways, maintaining stream bank stability, modifying aquatic environments for fish habitat and providing water storage and recharge of subsurface aquifers. The effectiveness of these processes will depend on the vegetation, soil characteristics such as porosity, aeration, pH and organic matter content, the depth to shallow groundwater and the rate surface and subsurface waters move through the buffer strip. Buffers also contribute to landscape biodiversity by providing diverse habitats and corridors for animals and plants. Further information about the design of buffers is given in an *Attachment* at the end of this document.

## **1.0 DESCRIPTION**

This item shall consist of the supply and placement of a topsoil over a neutral to alkaline pH subsoil in a riparian buffer area which is to be stabilized by establishing a dense permanent vegetated cover capable of filtering and retaining sediment and chemical inputs.

## **2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This special provision refers to the following standards, specifications and publications:

- ASTM D 4972, Test Method for pH of Soil
- ASTM 2974, Test Method for Moisture, Ash and Organic Matter of Peat and other Organic Materials
- *Standard Specifications* Division 7, Sections 5, 6, 7 and 16
- *Standard Specifications* Division 3, Section 2
- Landscape Nova Scotia Horticultural Trades Association: Topsoil Specifications and the Soil and Compost Use Guidelines
- TPW, Environmental Services: *Background for the Design of Vegetated Buffer Zones*

## **3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

**3.1 Soil Analysis.** The Contractor shall take soil samples of all soils to be seeded, prior to spreading, and shall submit them to the Nova Scotia Department of Agriculture and Fisheries, Quality Evaluation Division, Laboratory Services Section, at 176 College Road (or Box 550), Harlow Institute in Truro, NS, B2N 5E3 (or other approved laboratory) for a "Standard Test" soil analysis and resulting recommendations based on growing "Coarse Turf". Soils samples for laboratory testing shall consist of approximately 500 ml of material that is a composite of a minimum of 20 individual samples taken randomly from soils that appear uniform in colour and texture. Each type of soil proposed to be mixed into the final blend shall be analyzed. The results of the laboratory analysis shall be submitted to the Project Engineer and Vegetation Specialist for recommendations of amendments and final approval.

**3.2 Soil Texture.** The Contractor shall manually determine the soil texture of soils to be mixed or seeded (see Table 1). A handful of soil can be rubbed between the fingers to feel the amount of 'grittiness' to it. Sand has the largest particles, which feel "gritty". Silt has medium sized particles that feel soft, silky or "floury". Clay has the smallest particles and feels "sticky".

**Cast Test:** A moist soil sample is to be squeezed in the hand. If the soil forms a cast, then toss it from hand to hand to test strength of cast. A more durable cast indicates more clay is present.

**Ribbon Test:** Moist soil is to be rolled into a cigarette-shape between palms of hands, then rolled out between thumb and forefinger to form the longest, thinnest ribbon possible. The longer the ribbon, the more clay it contains.

The Contractor shall submit a plan to the Project Engineer and Vegetation Specialist for using available on-site soils and intended mixing of those soils to achieve a suitable growing media for the establishment of dense, thick vegetative cover, as shown on the vegetation plan.

Table 1. Field Testing Soil Texture.

Class	Visual	Reaction When Squeezed in the Hand		
		Dry Soil	Moist Soil	Ability to Form a Ribbon
Sand soils	Granular with easily seen particles	Will not form a cast, or cast easily falls apart	Forms a cast that falls apart easily	Cannot form a ribbon
Loam soils	Low to moderately granular  Can form clumps when dry	Forms a cast that can be handled some what easily	Forms a cast that can be easily handled	Pure loam cannot form a ribbon  Loam with more silt and clay will form fragile ribbon
Clay soils	Fine texture with very few large particles  When dry, forms hard clumps	Forms a cast that can be handled freely	Forms a cast that can be worked and sticks together	Forms a long, flexible ribbon

**3.3 Subsoils.** The Contractor shall determine the pH of the subsoil material and submit that value to the Project Engineer for approval prior to application.

**4.0 MATERIALS**

**4.1 Subsoil Material**

The subsoil media shall be free draining and composed of crushed rock, gravel or limestone. It shall have a pH of 7.0 or higher. It shall be free from flat, elongated or objectionable pieces. The subsoil media shall be approved by the Project Engineer prior to utilization.

**4.2 Topsoil**

The topsoil media shall be free draining and consist of a loam, silt loam, clay loam, loamy sand or sandy loam texture capable of supporting a healthy vegetative cover. In situ soils may be amended with sand and compost to provide appropriate texture and organic content. The topsoil media shall have a pH of 6 to 7.5, an organic matter content of greater than 8% and less than 20% and shall be free of stones, lumps or objects greater than 60 mm. It shall be free from noxious weeds and free of any material toxic to plant growth. The topsoil media shall be approved by the Project Engineer and Vegetation Specialist prior to utilization.

**4.3 Compost**

Compost is the preferred soil amendment and shall meet the requirements of *Standard Specifications, Division 7 Section 16*. It may be used up to 30% by volume to soils low in organic matter and/or soils with high quantities of sand or clay.

**4.4 Hydroseed Seed Mix**

The seed mixture shall be applied hydraulically according to *Standard Specifications Division 7 Section 5*. This specification covers the seed mix, the rate of seed and fertilizer applications, cellulose hydro-mulch and liming requirements.

#### **4.5 Mulch**

Mulch, if required in the vegetation plan, is to be applied after shrubs and trees are planted and shall be of aged hardwood or comparable wood-based product.

#### **5.0 CONSTRUCTION METHODS**

When the surface to be vegetated consists of rock fill or rip rap, a subsoil media shall be evenly distributed over the rock to a minimum depth of 125 mm on top of the rock fill and compacted into the spaces between rocks. It shall be tilled to a depth of 75 mm prior to spreading of topsoil to properly bond the topsoil to the subsoil.

The topsoil media shall be uniformly distributed over the subsoil base to a compacted minimum depth of 200 mm. There shall be no bare areas of rocks, gravel or hardpan at the surface. The surface soil shall be tilled or loosened to a depth of 50 mm to leave the soil surface in a loose, friable condition. Bulldozers or other tracked machinery which are used to loosen the soil surface shall leave the surface with track ridges running parallel to the slope of the site. The surface shall meet the contours and elevations indicated on the drawings, or as directed by the Project Engineer.

The topsoil shall not be placed and distributed while frozen or muddy or when the subgrade is frozen or excessively wet.

The prepared area shall be immediately hydroseeded, according to *Standard Specifications Division 7 Section 5*, and if on a slope of greater than 4:1, subsequently covered with a suitable erosion control blanket. On more shallow slopes, the seeded area may be mulched with chopped hay according to *Standard Specifications Division 7 Section 6*.

#### **6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The Contractor shall accomplish the work in an orderly progression to minimize the time topsoil is stockpiled before re-use.

The Contractor or sub contractor shall demonstrate knowledge of basic horticultural and erosion control principles for establishing vegetation, and be trained and experienced in the skills necessary to meet the performance requirements of the Contract.

Use of topsoil and recommended amendments to grow quality coarse turf shall be based on the soil analysis results from a qualified laboratory and from field testing soil texture.

#### **7.0 METHOD OF MEASUREMENT**

Where topsoil is to be drawn from stockpiles built by the Contractor or from existing stockpiles designated in the contract and placed, measurement shall be made in square metres of surface covered, measured along the slope of the ground.

#### **8.0 BASIS OF PAYMENT**

Payment for topsoil will be at the contract unit price per square metre which shall be full compensation for all labour, equipment and materials (including pulverized limestone and compost) necessary to do the work.

The salvaging and stockpiling of topsoil obtained on site will not be measured for payment but shall be considered as incidental to *Standard Specifications Division 2 Section 3*.

The costs incurred by the Contractor for handling, stockpiling and transporting topsoil will be considered as incidental to the work.

## **9.0 WARRANTY**

During the duration of the Contract any areas showing erosion or poor seed mix establishment shall be repaired and re-seeded to prevent the loss of sediment from the construction site.

### **ATTACHMENT**

#### **Background for the Design of Vegetated Buffer Zones**

Riparian buffer zones will be designed to act as "strategic" buffers between roadways and the aquatic ecosystems of streams and lakes. Their most important functions include filtering and retaining sediment, immobilizing, storing, and transforming chemical inputs from roadways, maintaining stream bank or lake shore stability, modifying aquatic environments for fish habitat and providing water storage and recharge of subsurface aquifers. The more riparian zones can perform natural functions the more diverse, productive and resilient the aquatic ecosystem will be. The effectiveness of these processes will depend on the vegetation, the soil characteristics, the depth to shallow groundwater and the rate surface and subsurface waters move through the buffer strip. Soil characteristics such as porosity, aeration, pH and organic matter are important not only for the type of vegetation, but also for drainage, moisture availability, the retention of metal contaminants and degradation of organic pollutants. Alkaline soils and subsoils promote metal removal, which may also be enhanced by spreading a layer of organic matter such as compost on the soil surface. Buffers also contribute to landscape biodiversity by providing diverse habitats and travel corridors for animals and plants.

#### **Riparian Vegetation**

Riparian vegetation consists of woody, herbaceous and grass-like plant species. The woody and fibrous roots provide strength to hold slopes and stream banks in place. The roots increase soil stability by mechanically reinforcing soil. The deep rooting habit of woody plants extract more water from greater soil depths than shallow rooted plants and provide superior soil stabilization when compared to herbaceous plants. They also provide protection against the hydraulic pressures of high flows while fibrous roots bind the finer soil particles. Taller growing, woody plants control the quantity and quality of solar radiation reaching the water surface and provide small organic matter inputs to the water. Organic matter input into the watercourse from riparian vegetation serves as an energy source for aquatic organisms. Large woody debris in stream channels influence the physical structure by creating pools, which store and detain sediments, and riffles which help oxygenate the water.

Grasses and grass like plants provide a high density of stems needed to dissipate the energy of surface runoff. The deep and dense annual root systems increase soil infiltration capacities and provide organic matter for large microbial populations. Microbes contribute to the degradation of organic compounds such as pesticides. However, this is dependent on having readily available organic matter in the soil.

#### **Design of Vegetation Zones**

Typically, in highway construction projects, there is minimal width available to construct a vegetated buffer area, and the area is typically on a slope. Since most chemical transformation and retention occurs at or near substrates of sediments or plant litter, vegetation and decaying plant litter has a much greater capacity for pollutant removal than poorly vegetated soil. Consequently, topsoils will be of suitable quality with high organic matter to accelerate vegetation establishment and litter buildup (organic substrate) to improve chemical retention. Natural topsoils with native plant propagules will facilitate active natural regeneration; salvaging of in situ soils and vegetation will be utilized in site-specific plans.

Wherever possible, site-specific vegetation plans will include the following vegetation zones:

Zone 1 consists of a strip of trees or large shrubs that begins at the edge of the water. It provides the final buffer for materials moving through the buffer strip and directly provides shade, habitat for insects and birds, and organic matter input to aquatic systems. The trees provide perennial root systems and long-term nutrient storage close to the watercourse. These tree species should include fast-growing, riparian species such as Willow (*Salix spp*) and Poplar (*Populus spp*) species. Other slower growing deciduous (Birch, Maple) and conifer (Larch, Spruce) trees may also be used.

Zone 2 is a minimum of 4 m wide and consists primarily of shrubs with herbaceous plants that are tolerant of differing degrees of soil moisture. It provides an area of maximum infiltration of surface runoff, nutrient uptake and storage while also providing organic matter for microbial processing of organic pollutants. More woody stems near the ground slow water flows during high flow conditions and provide wildlife habitat.

Zone 3 is a minimum 6 m wide zone of grasses and wild flowers which dissipates surface runoff and filters sediment from sheet flow generated from highway runoff. Large quantities of water and runoff compounds infiltrate into the biologically active rooting zone where nutrient uptake and microbial processing occur. The deep and dense annual root systems increase soil infiltration capacities and provide organic matter for large microbial populations.

#### **Planting Techniques**

Planting techniques and plant species will be included in site-specific vegetation plans. Salvaging of in situ plant communities with their soils will be conducted as part of the construction process when possible. The three basic planting techniques will be (1) Hydroseeding a mix of grasses and legumes; (2) Planting individual trees and shrubs from plant material propagated from the site; and, (3) Bioengineering techniques using dormant woody species:

#### **Zone 1: Shoreline**

To accelerate tree establishment dormant Willow and Poplar posts (>8 cm in diameter) and stakes (3-8 cm in diameter) can be driven into the stream or lake shore substrate in a row at the edge of the water at a spacing of 1.0 - 1.5 m. Several rows, spaced at 0.5 to 1.5 m, can be installed moving away from the shoreline.

Where bank stability is a problem along flowing streams, willow posts can be inserted with anchored dead tree revetments to absorb stream energy and trap sediment before grown enough to provide shade and organic matter for aquatic biota. Another technique is to tie 3 - 4 m long bundles of maple, birch, willow and/or alder together and lay them along the bottom row of posts with the butt ends facing upstream, and the bundles tied to the posts.

#### **Zone 2 - Shrub Zone**

Shrub species such as Meadowsweet (*Spiraea latifolia*), Red Osier Dogwood (*Cornus sericea*), Elderberry (*Sambucus*), Wild Rose (*Rosa virginiana*) and Pussy Willow (*Salix spp*) can be introduced as dormant cuttings in Brush Layers, Stakes and Wattles. Other shrub species that are found on specific sites may be introduced this way, when research indicates their suitability for establishment from cuttings.

#### **Zone 3 - Grassy Zone**

This zone will be established through seeding a suitable seed mix.