Building Soil

Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13

in WDOE Stormwater Management Manual for Western Washington

2016 Edition

Summary

Soil quality is directly related to stormwater detention capacity, and so to the health of streams and aquatic resources in the Pacific Northwest. Soil quality also determines landscape success: plant survival, growth, disease resistance, and maintenance needs.

This publication provides guidance for landscape designers, builders, planners, and inspectors to implement soil quality "Best Management Practices" (or BMPs), in order to protect and restore soil functions. The guide describes techniques for construction site soil handling, reducing soil compaction, and amending site soils with compost to meet BMP T5.13 "Post Construction Soil Quality and Depth" in the WA Dept. of Ecology's *Stormwater Management Manual for Western Washington*. This guide also includes field inspection techniques, WA suppliers of compost and soil testing laboratories, and specification language in APWA and CSI formats.

Building Soil: Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington

1st edition 2003
2nd edition 2005
2nd edition, 2007 printing (web links updated – no other changes)
2nd edition, 2009 printing (web links, and compost suppliers and laboratories lists updated – no other changes)
2nd edition, 2010 printing (web links updated – no other changes)
3rd edition, 2012 (Ecology's 2012 revised BMP text, compost suppliers, and web links updated)
4th edition, 2016 (Ecology's 2014 revised BMP text, and web links updated)

This publication is provided to help professionals in the land development and landscape industries understand and implement the new Washington State Department of Ecology "Best Management Practice" (BMP) for soil quality, designed to improve stormwater retention and water quality.

The specifications, procedures and forms contained in this publication were developed by a team of landscape professionals, municipal inspectors, soil scientists and public agency staff. They are provided as examples of the tools needed to implement the State's soil quality BMP.

This manual, specifications, and resources are available online at

www.SoilsforSalmon.org

and along with factsheets for builders at

www.BuildingSoil.org

CONTENTS

SECTION ONE — **The Role of Soil Quality in Stormwater Management**

SECTION TWO — **BMP T5.13 "Post Construction Soil Quality and Depth"**
from the DOE Stormwater Management Manual for Western Washington

SECTION THREE — **Summary of Steps for Implementing BMP T5.13**

SECTION FOUR — **Amendment Options**

SECTION FIVE — **Developing a Soil Management Plan**

Model "Soil Management Plan" form (for permit applications)

SECTION SIX — **Field Guide to Verifying Soil Quality and Depth**

Model "Field Inspection" form

SECTION SEVEN — **Resources**

Calculating Custom Amendment Rates: Formula & Spreadsheet

Permitted Composting Facilities in Washington

Soil and Compost Analytical Labs Serving the Northwest

Additional Resources on Compost Quality and Use, and the Role of Soil Quality in Stormwater Management

Model Soil Amendment Specifications: APWA and CSI Formats

CREDITS

DEVELOPMENT AND FIRST EDITION FUNDING: Snohomish County Public Works Department

PROJECT MANAGER: Sego Jackson, Snohomish County Public Works Department

MANUAL LEAD AUTHOR: Howard Stenn, Stenn Design, Vashon, WA

TECHNICAL ASSISTANCE – AMENDMENT CALCULATIONS: Dr. Craig Cogger, Washington State University-Puyallup

TECHNICAL ASSISTANCE – SPECIFICATIONS: Jeff Girven, The Berger Partnership, Seattle, WA

TECHNICAL ASSISTANCE & EDITING – SECOND EDITION: David McDonald, Seattle Public Utilities

FIRST EDITION GRAPHIC DESIGN: Partners in Design, Seattle, WA

ILLUSTRATIONS/PHOTOS: Courtesy of King County Department of Natural Resources and Parks, and Seattle Public Utilities

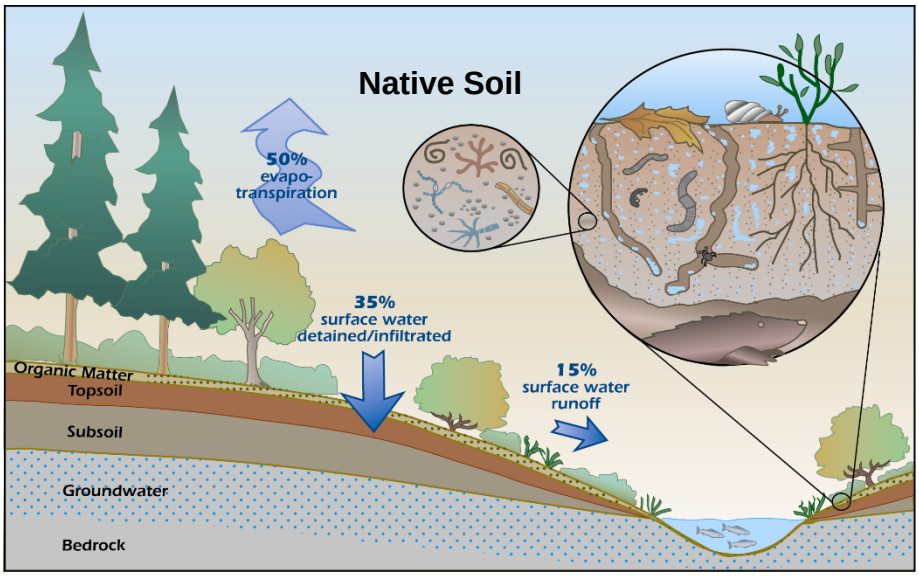
SECOND EDITION GRAPHIC DESIGN AND FUNDING: Seattle Public Utilities

THE ROLE OF SOIL QUALITY IN STORMWATER MANAGEMENT

The Benefits of Healthy Soil

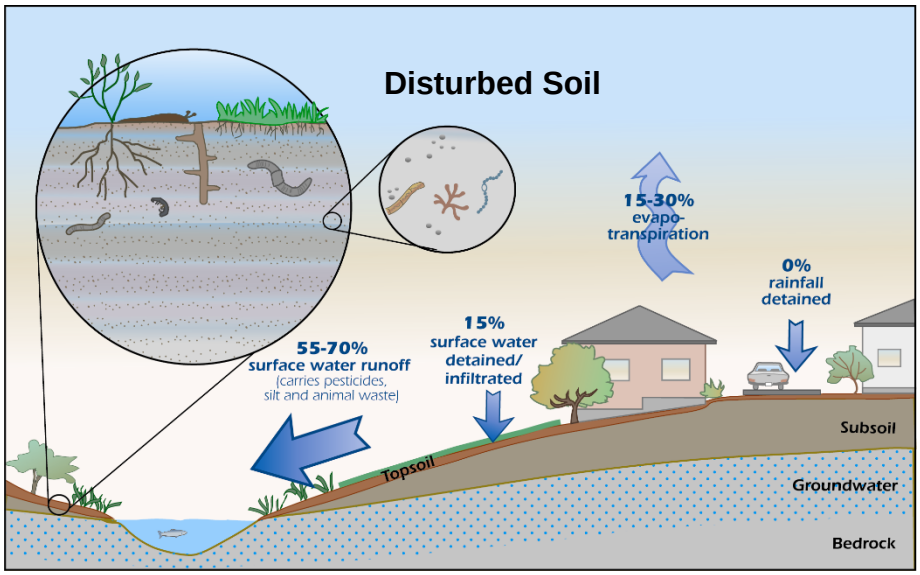
Healthy soil provides important stormwater management functions including efficient water infiltration and storage, adsorption of excess nutrients, filtration of sediments, biological decomposition of pollutants, and moderation of peak stream flows and temperatures. In addition, healthy soils support vigorous plant growth that intercepts rainfall, returning much of it to the sky through evaporation and transpiration.

Rapid urbanization of forest and farmland in the Puget Sound basin has severely degraded soil capacity to absorb, filter and store rainwater; and support vigorous plant growth. Common development practices include removal of topsoil during grading and clearing, compaction of remaining soil, and planting into unimproved soil or shallow depths of poor quality imported topsoil. These conditions typically produce unhealthy plants that require excessive fertilizers and pesticides, further contaminating runoff.



Stormwater management functions of healthy soils:

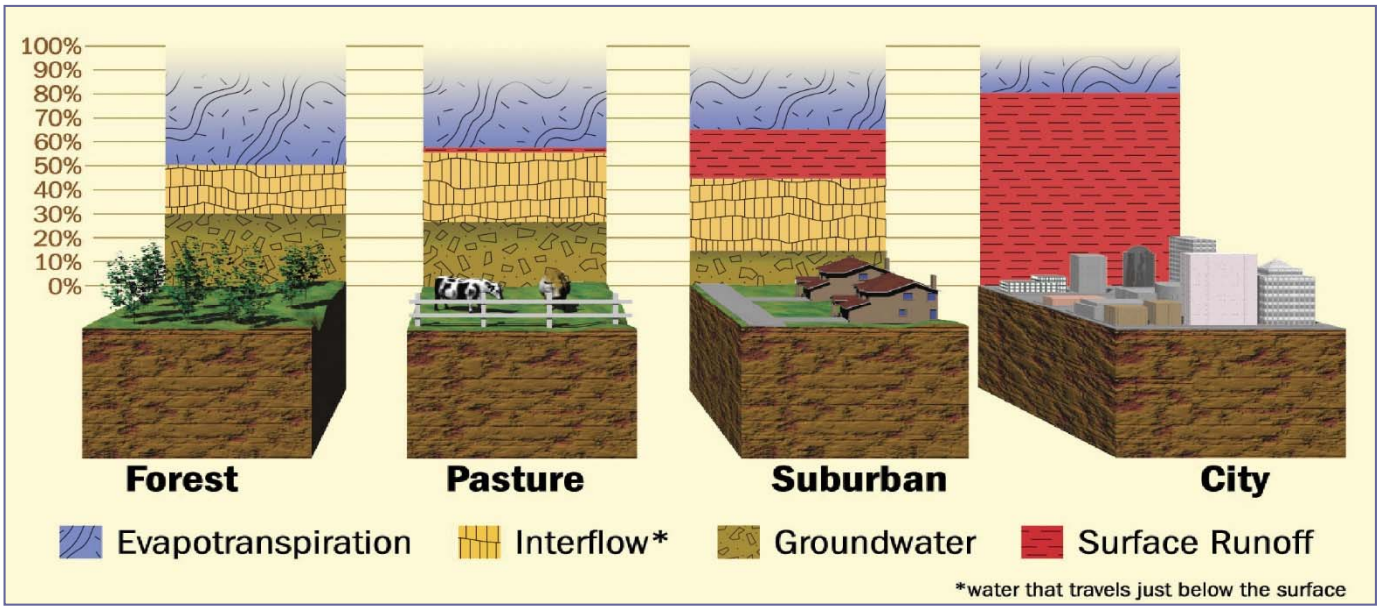
- Provides high rates of water infiltration and retention
- Minimizes surface water runoff and erosion
- Traps sediments, heavy metals and excess nutrients; and biodegrades chemical contaminants
- Encourages vigorous protective vegetative cover
- Supports beneficial soil life that fight pests and disease, and supply plant nutrients — reducing need for fertilizers and pesticides that may contaminate waterways.



During development, soil functions are often impaired by topsoil loss and compaction:

- Decreases surface water infiltration and storage
- Increases surface water runoff, including contamination from roadways and yards.
- Increases erosion and flooding.
- Reduces beneficial soil life
- Impairs plant growth, pest and disease resistance
- Increases landscape needs for irrigation, fertilizers, and pesticides, which further increases surface water pollution.

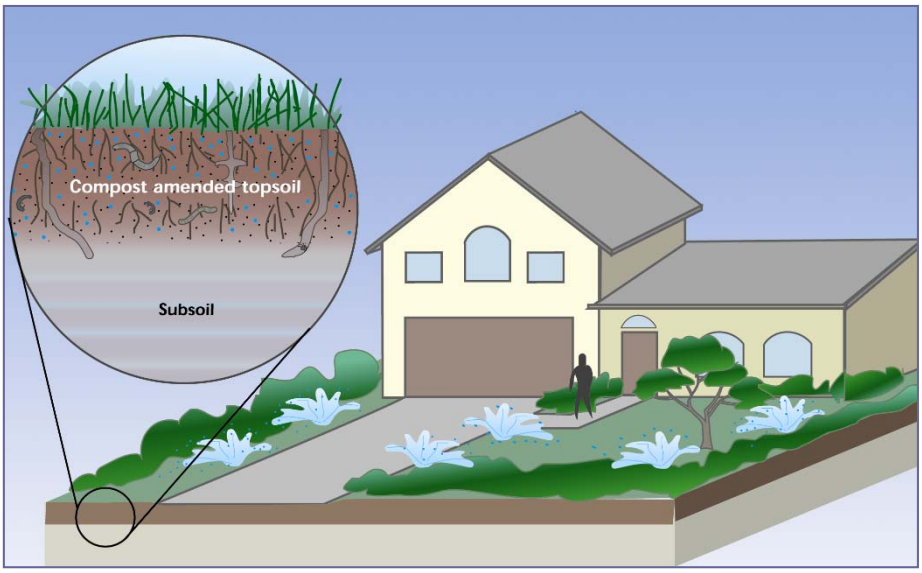
Where the Rain Goes – The Regional Impact of Urbanization on Stormwater Flows



These changes, plus the listing of some Puget Sound salmon runs as "threatened" under the Endangered Species Act, has stimulated examination of alternative practices to preserve and restore the soil's stormwater and water quality functions.

Low Impact Development (LID) practices that improve on-site management of storm water runoff include:

- Minimizing impervious surfaces,
- Preserving native soil and vegetation, and
- Establishing minimum soil quality and depth standards in landscaped areas.



Amending soils with compost or other organic materials can restore soil functions:

- Restores soil water infiltration and storage capacities
- Decreases surface water runoff and erosion
- Traps sediments, heavy metals and excess nutrients; and biodegrades chemical contaminants
- Rebuilds the beneficial soil life that fights pests and disease, and supplies plants with nutrients and water
- Improves plant health, with reduced need for additional water, fertilizers and pesticides
- Aids deep plant root growth and vigorous vegetative cover.

Illustrations for this section were created by the King County Department of Natural Resources and Parks

BMP T5.13 "POST CONSTRUCTION SOIL QUALITY AND DEPTH"

IN THE STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

Excerpted from the Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Vol. V: Runoff Treatment BMPs, Chapter 5, pages 5-8 to 5-11 (or pages 105 to 108 in the online PDF file) as revised December 2014. "BMP" means "Best Management Practice", a term used for techniques that are recommended or (in this case) required. The Manual can be found online at www.ecy.wa.gov/programs/wq/stormwater/manual.html

Purpose and Definition

Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. These functions are largely lost when development strips away native soil and vegetation and replaces it with minimal topsoil and sod. Not only are these important stormwater functions lost, but such landscapes themselves become pollution generating pervious surfaces due to increased use of pesticides, fertilizers and other landscaping and household/industrial chemicals, the concentration of pet wastes, and pollutants that accompany roadside litter.

Establishing soil quality and depth regains greater stormwater functions in the post development landscape, provides increased treatment of pollutants and sediments that result from development and habitation, and minimizes the need for some landscaping chemicals, thus reducing pollution through prevention.

Applications and Limitations

Establishing a minimum soil quality and depth is not the same as preservation of naturally occurring soil and vegetation. However, establishing a minimum soil quality and depth will provide improved on-site management of stormwater flow and water quality.

Soil organic matter can be attained through numerous materials such as compost, composted woody material, biosolids, and forest product residuals. It is important that the materials used to meet the soil quality and depth BMP be appropriate and beneficial to the plant cover to be established. Likewise, it is important that imported topsoils improve soil conditions and do not have an excessive percent of clay fines.

This BMP can be considered infeasible on till soil slopes greater than 33 percent.

Design Guidelines

Soil retention. Retain, in an undisturbed state, the duff layer and native topsoil to the maximum extent practicable. In any areas requiring grading remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas, to be reapplied to other portions of the site where feasible.

Soil quality. All areas subject to clearing and grading that have not been covered by impervious surface, incorporated into a drainage facility or engineered as structural fill or slope shall, at project completion, demonstrate the following:

1) A topsoil layer with a minimum organic matter content of 10% dry weight in planting beds, and 5% organic matter content in turf areas, and a pH from 6.0 to 8.0 or matching the pH of the undisturbed soil. The topsoil layer shall have a minimum depth of eight inches except where tree roots limit the depth of incorporation of amendments needed to meet the criteria. Subsoils below the topsoil layer should be scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible.
2) Mulch planting beds with 2 inches of organic material.
3) Use compost and other materials that meet these organic content requirements:
   a) The organic content for "pre-approved" amendment rates can be met only using compost meeting the compost specification for Bioretention (BMP T7.30), with the exception that the compost may have up to 35% biosolids or manure.
   The compost must also have an organic matter content of 40% to 65%, and a carbon to nitrogen ratio below 25:1.
   The carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.
   b) Calculated amendment rates may be met through use of composted material meeting (a.) above; or other organic materials amended to meet the carbon to nitrogen ratio requirements, and not exceeding the contaminant limits identified in Table 220-B, Testing Parameters, in WAC 173-350-220.

The resulting soil should be conducive to the type of vegetation to be established.

Editor's note: "other organic materials" includes other composts not meeting the stringent specification in BMP T5.30, which is designed for bioretention swales. Any mature, stable compost is appropriate for general soil amendment.

Implementation Options. The soil quality design guidelines listed above can be met by using one of the methods listed below:

1) Leave undisturbed native vegetation and soil, and protect from compaction during construction.
2) Amend existing site topsoil or subsoil either at default "pre-approved" rates, or at custom calculated rates based on tests of the soil and amendment.
3) Stockpile existing topsoil during grading, and replace it prior to planting. Stockpiled topsoil must also be amended if needed to meet the organic matter or depth requirements, either at a default "pre-approved" rate or at a custom calculated rate.
4) Import topsoil mix of sufficient organic content and depth to meet the requirements.

More than one method may be used on different portions of the same site. Soil that already meets the depth and organic matter quality standards, and is not compacted, does not need to be amended.

Planning/Permitting/Inspection/Verification Guidelines & Procedures

Local governments are encouraged to adopt guidelines and procedures similar to those recommended in *Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington*. This document is available at: http://www.soilsforsalmon.org/pdf/Soil_BMP_Manual.pdf

Maintenance

- Establish soil quality and depth toward the end of construction and once established, protect from compaction, such as from large machinery use, and from erosion.
- Plant vegetation and mulch the amended soil area after installation.
- Leave plant debris or its equivalent on the soil surface to replenish organic matter.
- Reduce and adjust, where possible, the use of irrigation, fertilizers, herbicides and pesticides, rather than continuing to implement formerly established practices.

Runoff Model Representation

Areas meeting the design guidelines may be entered into approved runoff models as "Pasture" rather than "Lawn."

Flow reduction credits can be taken in runoff modeling when BMP T5.13 is used as part of a dispersion design under the conditions described in:

BMP T5.10B Downspout Dispersion

BMP T5.11 Concentrated Flow Dispersion

BMP T5.12 Sheet Flow Dispersion

BMP T5.18 Reverse Slope Sidewalks

BMP T5.30 Full Dispersion (for public road projects)

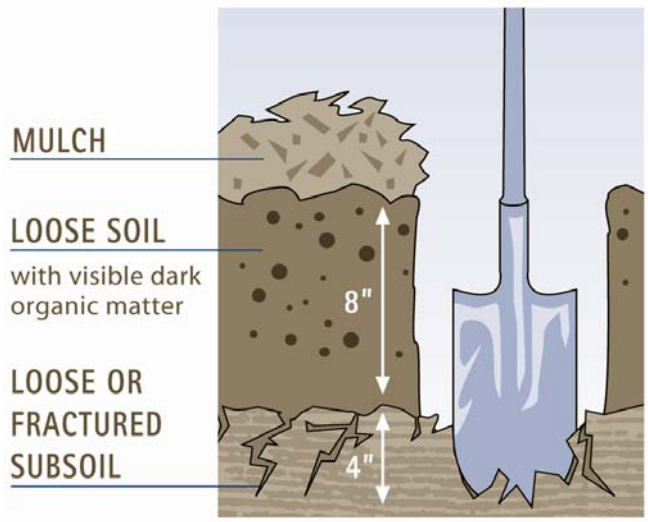


Figure 5.3.3 – Planting bed Cross-Section
(Reprinted from *Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington*, 2010, Washington Organic Recycling Council)

Related BMP's in the same volume (Vol. V, Ch. 5) of the Stormwater Management Manual for Western Washington
available online at
www.ecy.wa.gov/programs/wq/stormwater/manual.html

- **BMP T5.40 Preserving Natural Vegetation**
- **BMP T5.41 Better Site Design**

See also Chapters 7 and 9 in Volume V on Infiltration and Biofiltration/Bioretention BMPs
and see Volume III, Appendix C "Low Impact Development Flow Modeling Guidance"

SUMMARY OF STEPS FOR IMPLEMENTING BMP T5.13

PROPOSED SPECIFICATION FOR PERMITTING AND INSPECTION
TO IMPLEMENT BMP T5.13 "POST-CONSTRUCTION SOIL QUALITY AND DEPTH"

The following approach to implementation of BMP T5.13 *(BMP = Best Management Practice)* in the Department of Ecology's Stormwater Manual has been developed with expert input and review. It is proposed as a practical methodology to implement the State's BMP guidelines.

Proposed Soil Specifications

These specifications are designed to achieve an 8 inch depth of soil with 10% "Soil Organic Matter" (SOM) content in planting beds, and 5% organic content in turf areas.

Detailed amendment rates and procedures are described in Section 4 "Amendment Options," and in the specifications included in Section 7 "Resources".

Developers may select from the following four options to meet the requirements:

Option 1.
Leave undisturbed native vegetation and soil, and protect from compaction during construction.

Option 2.
Amend existing site topsoil or subsoil either at "pre-approved" default rates, or at custom calculated rates based on tests of the soil and amendment.

Option 3.
Stockpile existing topsoil during grading, and replace it prior to planting. Stockpiled topsoil must also be amended if needed to meet the organic matter or depth requirements, either at a "pre-approved" default rate or at a custom calculated rate.

Option 4.
Import topsoil mix of sufficient organic content and depth to meet the requirements.

Methods and Amendment Quality

More than one treatment may be used on different areas of the same site. Soil that already meets the depth and organic matter quality standards, and is not compacted, does not need to be amended.

- Compacted subsoils must be scarified at least 4 inches below the 8 inch deep amended layer (for a finished uncompacted depth of 12 inches).
- Planting beds must be mulched with 2 inches of organic material.
- Compost and other materials used to meet organic content must meet these standards:
  - The organic content for "pre-approved" amendment rates can be met only using compost that meets the definition for "composted materials" in WAC 173-350, section 220, available online at www.ecy.wa.gov/programs/swfa/organics/soil.html
    - The compost must also have an organic matter content of 35% to 65%, and a carbon to nitrogen ratio below 25:1.
    - The carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.
  - Calculated amendment rates may be met through use of composted materials as defined above; or other organic materials amended to meet the carbon to nitrogen ratio requirements, and meeting the contaminant standards for "composted materials" in WAC 173-350-section 220.

See Section 4 "Amendment Options," and Section 7 "Resources" for more on calculated amendment rates.

Note: In Ecology's 2014 update (see page 4) they changed this to require a more tightly specified compost for "pre-approved" amendment rates.

Planning and Permitting

A site specific Soil Management Plan (SMP – see Section Five "Guide to Developing a Soil Management Plan") must be approved as part of the clearing and grading or construction permit application.

The Soil Management Plan (SMP) includes:

- A scale-drawing (11" X 17" or larger) identifying area where native soil and vegetation will be retained undisturbed, and which soil treatments will applied in landscape areas.
- A completed SMP form identifying treatments and products to be used to meet the soil depth and organic content requirements for each area.
- Computations of compost or topsoil volumes to be imported (and/or site soil to be stockpiled) to meet "pre-approved" amendment rates; or calculations by a qualified professional to meet organic content requirements if using custom calculated rates. Qualified professionals include certified Agronomists, Soil Scientists or Crop Advisors; and licenced Landscape Architects, Civil Engineers or Geologists.
- Copies of laboratory analyses for compost and topsoil products to be used, documenting organic matter contents and carbon to nitrogen ratios.

Inspection and Verification Procedures

(See also Section Six "Field Guide to Verifying Soil Quality and Depth in New Landscapes.")

Inspection and verification should be performed by appropriate jurisdiction inspectors.

Some verification may be made by supervising Landscape Architects or Civil Engineers, who submit signed certification that the approved SMP had been implemented.

The following is an outline of a preferred inspection schedule and tasks:
Depending on local resources and procedures, the inspection tasks may be consolidated into fewer visits.

1) Pre-Grading Inspection

- Verify delineation and fencing off of native soils and vegetation to be left undisturbed, per the SMP.
- Review the SMP with the general contractor to ensure that topsoil stockpiling and other specified measures are incorporated into the work plan.

2) Grading Progress Inspection

- Verify that proper erosion control methods are being implemented.
- Verify that excavation and stockpiling of native soils follows the SMP.
- Verify that subgrades are consistent with the SMP.

3) Post-Construction Inspection

Preferably prior to planting, so that omissions can easily be corrected:

- Verify that compost, mulch, topsoil and amendment delivery tickets match volumes, types and sources approved in the SMP. If materials other than those approved in the SMP were delivered, submissions by the supplier should verify that they are equivalent to approved products.
- Check soil for compaction, scarification and amendment incorporation by digging at least one 12 inch deep test hole per acre for turf and at least one per acre for planting beds. Test holes must be excavated using only a garden spade driven solely by inspector's weight.
- Test 10 locations per landscaped acre (10 locations minimum) for compaction, using a simple "rod penetrometer" (a 4 foot long 3/8th inch diameter stainless steel rod, with and a 30 degree bevel cut into the side at that goes in 1/8 inch at the tip). Rod must penetrate to 12" depth driven solely by inspector's weight (see illustration in Section 6).
- Verify placement of two inches of organic mulch material on all planting beds.

Secondary Verification For Failing Sites

If inspector believes the installation does not meet the approved permit conditions, additional testing may be ordered to determine whether remediation steps are required prior to final occupancy and payment. An independent consultant (Certified Soil Scientist, Crop Advisor or Agronomist; or Licensed Landscape Architect, Civil Engineer or Geologist) should conduct the following additional sampling and analysis:

- Organic matter content should be verified by an independent soil testing service, using the Loss On Ignition method.
- If necessary, the percentage of fine particles (less than #200 mesh) should be confirmed by a certified Soil Laboratory using a wet sieve test.
- At present, an analytical method for verifying scarification has not been identified. Verification may be a matter of professional opinion.

AMENDMENT OPTIONS

Select the soil preparation options that best suit each area of the project site.
Either choose a pre-approved default amendment rate, or have a qualified professional calculate a custom rate based on soil and amendment tests described in Section 5, using the calculation method described in Section 7 “Resources”).

OPTION 1: Leave native vegetation and soil undisturbed, and protect from compaction during construction.

Identify areas of the site that will not be stripped, logged, graded or driven on, and fence off those areas to prevent impacts during construction. If neither soils nor vegetation are disturbed, these areas do not require amendment.

OPTION 2: Amend existing site topsoil or subsoil

either at default “pre-approved” rates, or at custom calculated rates based on specifier's tests of the soil and amendment.

Scarification. Scarify or till subgrade to 8 inches depth (or to depth needed to achieve a total depth of 12 inches of uncompacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained. Amend soil to meet required organic content.

A. Planting Beds

1. PRE-APPROVED RATE: Place 3 inches of composted material and rototill into 5 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches).
2. CALCULATED RATE: Place calculated amount of composted material or approved organic material and rototill into depth of soil needed to achieve 8 inches of settled soil at 10% organic content.

Rake beds to smooth and remove surface rocks larger than 2 inches diameter.

Mulch planting beds with 2 inches of organic mulch.

B. Turf Areas

1. PRE-APPROVED RATE: Place 1.75 inches of composted material and rototill into 6.25 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches).
2. CALCULATED RATE: Place calculated amount of composted material or approved organic material and rototill into depth of soil needed to achieve 8 inches of settled soil at 5% organic content.

Water or roll to compact to 85% of maximum dry density.

Rake to level, and remove surface woody debris and rocks larger than 1 inch diameter.

OPTION 3: Stockpile existing topsoil during grading. Replace it before planting.

Stockpiled topsoil must also be amended if needed to meet the organic matter or depth requirements, either at a pre-approved default rate or at a custom calculated rate.

Scarification. If placed topsoil plus compost or other organic material will amount to less than 12 inches:
Scarify or till subgrade to depth needed to achieve 12 inches of loosened soil after topsoil and amendment are placed.
Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.

Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission, in approved location, prior to grading.

Replace stockpiled topsoil prior to planting. Amend if needed to meet required organic content.

A. Planting Beds

1. PRE-APPROVED RATE: Place 3 inches of composted material and rototill into 5 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches).
2. CALCULATED RATE: Place calculated amount of composted material or approved organic material and rototill into depth of replaced soil needed to achieve 8 inches of settled soil at 10% organic content.

Rake beds to smooth and remove surface rocks larger than 2 inches diameter.

Mulch planting beds with 2 inches of organic mulch or stockpiled duff.

B. Turf Areas

1. PRE-APPROVED RATE: Place 1.75 inches of composted material and rototill into 6.25 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches).
2. CALCULATED RATE: Place calculated amount of composted material or approved organic material and rototill into depth of replaced soil needed to achieve 8 inches of settled soil at 5% organic content.

Water or roll to compact soil to 85% of maximum dry density.

Rake to level, and remove surface rocks larger than 1 inch diameter.

OPTION 4: Import topsoil mix of sufficient organic content and depth to meet the requirements.

Scarification. Scarify or till subgrade in two directions to 6 inches depth.
Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.

A. Planting Beds

Use imported topsoil mix containing 10% organic matter (typically around 40% compost). Soil portion must be sand or sandy loam as defined by the USDA.

Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.

Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.

Place second lift of 3 inches topsoil mix on surface.

Rake beds to smooth, and remove surface rocks over 2 inches diameter.

Mulch planting beds with 2 inches of organic mulch.

B. Turf Areas

Use imported topsoil mix containing 5% organic matter (typically around 25% compost). Soil portion must be sand or sandy loam as defined by the USDA.

Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.

Place second lift of 3 inches topsoil mix on surface.

Water or roll to compact soil to 85% of maximum.

Rake to level, and remove surface rocks larger than 1 inch diameter.

GUIDE TO DEVELOPING A SOIL MANAGEMENT PLAN

This section outlines steps for professional specifiers to prepare a Soil Management Plan (SMP) to meet the provisions of BMP T5.13 in the Department of Ecology's Stormwater Manual for Western Washington. The main steps to creating the SMP are:

Step 1: Review Site Landscape Plans and Grading Plans.

Examine all areas that will not be covered by structures, impervious surfaces, or stormwater detention / infiltration structures, to assess how grading will impact soil conditions and determine areas where different soil treatments may be applied.

Those allowed soil treatment options are:

Option 1: Areas where native soil and/or vegetation will be retained in place;
Option 2: Areas where topsoil or subsoil will be amended in place;
Option 3: Areas where topsoil will be stripped and stockpiled prior to grading for reapplication, and;
Option 4: Areas where imported topsoil will be applied.

Step 2: Visit Site to Determine Soil Conditions

Working with plans, check the soil in each area to identify information outlined in the chart below.
Identify compaction of subgrade in each area by digging down to a level that will be 12" below finished grade.
Use a shovel or "rod penetrometer" driven solely by the your weight, as described in Section 3, and illustrated in Section 6 "Field Guide to Verifying Soil Quality and Depth."

Areas	Assess Conditions	Include Information on SMP
Native vegetation / undisturbed soil to be preserved	✓ Established native plants. ✓ Undisturbed topsoil and duff layer.	✓ Identify those areas to be left undisturbed and fenced during construction.
Topsoil not requiring grading, but cleared of native vegetation	✓ Depth of compacted layers less than 12 inches deep. ✓ Presence of organic matter that may make amendment unnecessary, or allow calculation of reduced amendment rate. ✓ If planning to use calculated amendment rate, sample and test soil as described in Step 4.	✓ Will scarification be needed? What depth of scarification is required to allow compost incorporation and achieve 12 inches uncompacted depth? ✓ Will area be amended with compost or topsoil at "pre-approved" rate, or custom calculated rate? ✓ Can areas be protected from compaction during construction?
Areas to be cut during grading	✓ Quantity of topsoil that can pbe stockpiled and reapplied. ✓ Depth of any compacted layer less than 12 inches below ultimate finished grade. ✓ Presence of organic matter in subgrade or topsoil that may make amendment unnecessary, or allow calculation of reduced amendment rate. ✓ If planning to use calculated amendment rate, sample and test soil as described in Step 4.	✓ Will scarification be needed? What depth of scarification is required to allow compost incorporation and achieve 12 inches uncompacted depth? ✓ Will topsoil be stockpiled during grading and reapplied? Will it require supplemental topsoil or compost to achieve 8 inches depth at specified organic content? ✓ Will area be amended with compost or topsoil at "pre-approved" rate, or at custom calculated rate?
Areas to be filled during grading	✓ Estimate what subgrade conditions will be when fill is in place. ✓ Depth of any compacted layer less than 12 inches below ultimate finished grade. ✓ Presence of organic matter in fill soil that may make amendment unnecessary, or allow calculation of reduced amendment rate. ✓ If planning to use calculated amendment rate, sample and test soil as described in Step 4.	✓ What depth of scarification is required to allow compost incorporation and achieve 12 inches uncompacted depth? ✓ Will area be amended with compost or topsoil at "pre-approved" rate, or custom calculated rate?

Step 3: Select Amendment Options.

The most convenient and economic method for achieving the Soil Quality and Depth guidelines depends on: site soil conditions, grading, and resulting subgrade compaction; the practicality of stockpiling topsoil during grading; and site access issues.

"Pre-Approved" or custom calculated rates?
Use of "Pre-Approved" amendment rates may simplify planning, however custom calculated rates can save substantial effort and expense—easily repaying the expense of testing and calculations. (See testing required for custom rates at right and on next page, and calculation method in Section 7 "Resources".)

Often pasture or woodland soils have adequate organic matter if existing organic layers are preserved. Also, compost products will frequently provide the desired soil organic matter content at lower applications than the Pre-Approved rates (which are based on "average" conditions).

Identifying Options on the Site Plan and SMP form

- Identify the areas where each amendment option will be applied by outlining each area on the site plan with a dark, thick-line pen.
- Assign each area an identifying number or letter (A, B, C…) on the plan, and on the Soil Management Plan form.

Step 4: Identify Compost, Topsoils and Other Organic Materials for Amendment and Mulch.

Amendments for Pre-Approved rates must be compost meeting the definition for "Composted Materials" in WAC 173-350, section 220, (available online at www.ecy.wa.gov/programs/swfa/organics/soil.html) or topsoil manufactured from these composts plus clean sand or sandy loam soil. Products must be identified on the Soil Management Plan form, and recent product test results must be provided showing that they meet the additional requirements in this Guide for organic matter content and carbon to nitrogen ratio (see specification in Section 3).

For Custom Calculated amendment rates (see right, next page, and formula in Section 7 "Resources"), organic matter may be provided by:

- Compost (as defined above), or
- Other by organic materials with a carbon to nitrogen ratio under 25:1 (35:1 for native plantings), meeting the same contaminant standards as "Composted Materials" in WAC 173-350, section 220.

These products must be identified on the Soil Management Plan form, and recent test results provided showing that they meet these requirements.

Step 5: Calculate Amendment, Topsoil and Mulch Volumes on SMP form

- For Pre-Approved amendment rates, figure the square footage of each area and complete the simple calculation to convert inches of amendment into cubic yards.
- To compute custom calculated amendment rates, use soil and amendment test results and the *Model Amendment Rate Calculator Spreadsheet* and/or the *Equation for Calculating Compost Application Rates* (both are in Section 7 "Resources") to achieve the target Soil Organic Matter content (10% SOM for landscape beds, or 5% SOM for turf areas).

Site Assessment Supplies

- Copy of site grading plan
- Sturdy shovel
- Tape measure

If using custom calculated amendment rates requiring soil tests:

- Clean bucket or stainless steel bowl for mixing soil samples
- Sealable bags for soil samples, and indelible ink pen to label

Sampling and Testing for Custom Calculated Amendment Rates

Soil and amendments submitted for testing should be a composite of samples taken from several spots on a site or in a pile of amendment.

Soil:

Gather samples from soil that will be the subgrade after all grading operations are completed, before placement of imported topsoil or amendments.

- Take samples from 10-12 spots in each area. Imagine a line dividing the area in half lengthwise, then divide each half into five near equal sized widths. Take samples near the middle of each subsection.
- At each sampling spot dig a spades-width hole at least 8 inches deep, then shave a 1 inch slice from the side of the hole to use in the composite sample.
- Thoroughly mix the 10-12 samples from each turf or planting area together in a clean plastic bucket or bowl. Place 2 cups of the mix into a sealable plastic bag for testing (some tests may require more soil, ask laboratories).
- Label the bag with the site information, area of sample; plus your name, address and phone number.

Amendment:

Producers of composts and manufactured topsoils can usually provide test results for their products. If tests are

nonexistent or incomplete, conduct necessary tests on each proposed amendment.

- Take samples from 10-12 spots in pile of material. Imagine a line dividing the pile in half lengthwise, then gather samples from five spots equally spaced along the length of each side of the pile.
- At each sampling spot, dig a spades-width hole at least 8 inches deep. Use a clean cup or trowel to collect a cup of amendment from the bottom of each hole.
- Thoroughly mix the 10-12 samples from each pile together in a clean plastic bucket or bowl. Place 2 cups of the mix into a sealable plastic bag for testing (some tests may require more compost, ask laboratories).
- Label the bag with the product and supplier information; plus your name, address and phone number.

Tests to Conduct for Custom Calculated Amendment Rates:

Soil	**Compost Amendment**
- Bulk Density	- Bulk Density
- Percent Organic Matter (by "loss on ignition" method)	- Percent Organic Matter (by "loss on ignition" method)
	- Moisture Content as is
	- Carbon to Nitrogen Ratio (C:N)
	- Heavy Metals Analysis (per WAC 173-350, section 220)

Model SOIL MANAGEMENT PLAN for BMP T5.13

(available as MS Word file at www.SoilsforSalmon.org)

PROJECT INFORMATION **Page # ____ of ____ pages**

Complete all information on page 1; only site address and permit number on additional pages.

Site Address / Lot No.:_____	
Permit Type:	**Permit Number:**
Permit Holder:	**Phone:**
Mailing Address:_____	
Contact Person:	**Phone:**
Plan Prepared By:	

ATTACHMENTS REQUIRED (*Check off required items that are attached to this plan*)

___ **Site Plan showing, to scale:**	___ Areas of undisturbed native vegetation (no amendment required) ___ New planting beds and turf areas (amendment required) ___ Type of soil improvement proposed for each area
___ **Soil test results (required if proposing custom amendment rates)**	
___ **Product test results for proposed amendments**	

AREA #_____ (*should match Area # on Site Plan*)

PLANTING TYPE ___ Turf ___ Planting Beds	___ Undisturbed native vegetation ___ Other: _____	
SQUARE FOOTAGE OF THIS AREA: _____ square feet		
SCARIFICATION ___ Subsoil will be scarified	___ inches (depth) of scarification needed to achieve finished total 12" loosened depth.	
PRE-APPROVED AMENDMENT METHOD: ___ Topsoil import Amend with compost ___ Stockpile and amend (_____ cu. yds. stockpiled)	____inches of compost or imported topsoil applied X 3.1 (*conversion factor, inches to cubic yards*) _____ = cu. yards per 1,000 sq. ft. X ,000s sq.ft. in this area ____ = cubic yards of amendment → → → → → (*needed to cover this area to designated depth*)	PRODUCT:_____ _____ QUANTITY:_____CU. YDS.
CUSTOM AMENDMENT ___ Topsoil import ___ Topsoil & compost lift ___ Amend ___ Stockpile and amend (____ cu. yds. stockpiled)	**Attach test results and calculations.** ____ inches organic matter or topsoil import X 3.1 _____= cu. yards / 1,000 sq. ft. X ___ ,000s sq.ft. in this area ____ = cubic yards of amendment → → → → →	PRODUCT:_____ _____ QUANTITY:_____CU. YDS.
MULCH	___ ,000 sq.ft. X 6.2 (*conversion, to give 2 inch mulch depth*) ____ = cubic yards of mulch → → → → → →	PRODUCT:_____ QUANTITY:_____CU. YDS.

TOTAL AMENDMENT/TOPSOIL/MULCH FOR ALL AREAS (*complete on page 1 only, totaling all areas/pages in this Plan*)

❑ **Product #1:**_____	❑ **Quantity:** _____**cu. yds.**
❑ **Test Results:** ___ **% organic matter**	____**C:N ratio <25:1** (except mulch, or <35:1 for native plants) ____ **"stable"** (yes/no)
❑ **Product #2:**_____	❑ **Quantity:** _____**cu. yds.**
❑ **Test Results:** ___ **% organic matter**	____**C:N ratio <25:1** (except mulch, or <35:1 for native plants) ____ **"stable"** (yes/no)
❑ **Product #3:**_____	❑ **Quantity:** _____**cu. yds.**
❑ **Test Results:** ___ **% organic matter**	____**C:N ratio <25:1** (except mulch, or <35:1 for native plants) ____ **"stable"** (yes/no)

Date:	**Inspector:**	**Approved:**	**Revisions Required:**
Date:	**Inspector:**	**Approved:**	**Revisions Required:**

COMMENTS:_____

_____

FIELD GUIDE TO VERIFYING SOIL QUALITY AND DEPTH IN NEW LANDSCAPES

This guide is provided to help professional inspectors verify implementation of soil improvements to fulfill BMP T5.13 "Post Construction Soil Quality and Depth" in the Washington Department of Ecology's Stormwater Management Manual Western Washington.

The main conditions to be confirmed are:

1. Provision of eight inches of topsoil containing 10% organic matter in planting beds, or 5% in turf areas.
2. Scarification of compacted subsoil four inches below the topsoil layer (for a total uncompacted depth of 12 inches).
3. Placement of two inches of mulch on all planting beds.

Site Inspection Supplies

- A copy of the approved Soil Management Plan (SMP) for the site, with site drawing.
- A sturdy shovel
- Tape measure or 12" ruler
- 3/8 inch diameter 3-4 foot stainless steel "rod penetrometer" with a 1/8" bevel cut into the tip at 30 degrees from the side, and a 90 degree bend at top to form a handle (*see illustration, next page*).
- Field Verification Form to record results

The following steps may be completed at multiple visits as a project progresses or in one final project approval inspection, depending on local practices:

STEP 1: Compare site conditions with approved Soil Management Plan (SMP).

The SMP approved with the site permit describes soil treatments approved for each area. Make sure site conditions match these details in the SMP:

- Site location and permit holder.
- Turf and planting areas match approved drawings.
- Areas to remain as undisturbed native soil and vegetation have been fenced off during construction to prevent soil compaction or damage to plants.

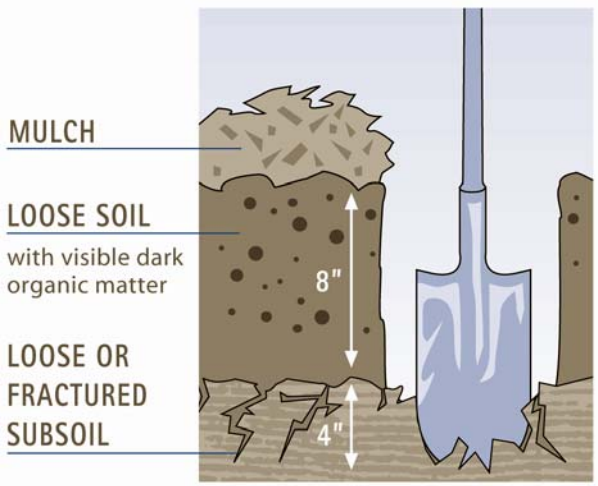
STEP 2: Inspect delivery tickets for compost, topsoil and mulches.

Permitee must provide original delivery tickets for all soil and mulch products. Compare delivery tickets with the SMP to match the following information:

- Delivery location.
- Total quantities for each soil product and mulch.
- Product descriptions and sources.
  If materials other than those listed in the SMP were delivered, laboratory test results must be provided to confirm that they are equivalent to approved products.

STEP 3: Verify depth of amended soil and scarification.

Use a shovel to dig at least one test hole per acre for turf and one per acre for planting beds to verify eight inch topsoil depth (below mulch layer), incorporation of amendments, and four inches of uncompacted subsoil.



Test holes should be about one foot deep (after first scraping away any mulch) and about one foot square.

Eight Inch Depth of Amended Soil. The top eight inches of soil should be easy to dig using a garden spade driven solely by your weight. The soil should be darker than the unamended soil below, and particles of added organic

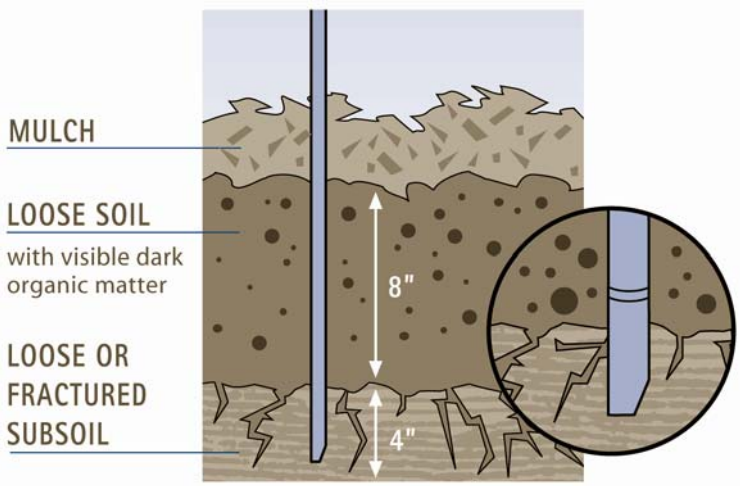
matter are likely to be visible. Clay soil that been saturated and then dried may require jumping on the shovel step to penetrate, but the soil should yield easily when moist. Soil that requires vigorous chipping with the shovel to penetrate probably does not meet the specification.

Four Inch Depth of Scarified Subsoil. The next four-inch depth of soil should be loose enough to penetrate with the shovel. It may be rocky, and the loosened depth may vary due to the pattern of scarifying equipment – but some sections of subsoil in a one foot square hole should be loose four inches deep into the subsoil (that is, to a total 12 inch depth from the soil surface).

STEP 4: Check soil depth in several spots.

Use a simple "rod penetrometer" (illustration below) to confirm that the soil is uncompacted twelve inches deep at ten locations per acre – with a minimum of ten on smaller sites. To locate test spots, imagine a line dividing the site (or each acre) in half lengthwise, then divide each half into five nearly equal sections. Conduct tests near the middle of each section. Additional test locations are encouraged.

The rod penetrometer should enter the soil twelve inches deep, driven solely by the inspector's weight. Irregular scarification or rocks in the lower layer may require probing a few spots at each location to reach the full depth.



A rod penetrometer is a 4 foot long, 3/8 inch or 10 mm diameter stainless steel rod with a 90 degree bend 5 inches form the top to make a handle, and a 30 degree bevel cut 1/8 inch or 3 mm into the side of the tip.

STEP 5: Check mulch depth.

Use a shovel to scrape away and reveal surface mulch thickness. A two inch layer of organic material (mulch) such as composted sawdust, wood chips, or ground bark should be distinguished from the underlying soil on all planting beds.

FINAL STEP: Record results on "Field Verification Form" or similar document *(see sample form on next page)*.

What should be attached to the Soil Management Plan?

- Scale drawings showing layout of turf and planting beds, and identifying where soil treatments described in the SMP will be applied.
- Copies of compost and topsoil test results demonstrating that products contain adequate organic matter, and meet carbon to nitrogen ratio and stability standards.
- Where custom calculated amendment rates are used, include laboratory analyses of the soil and organic matter sources plus calculations by a qualified professional showing that the organic matter requirement will be achieved.

What If A Site Does Not Meet the Soil Management Plan Requirements?

If inspection indicates that an installation does not fulfill the approved SMP, the permit holder or their agent should be notified of what steps are needed to comply. When results are unclear or disputed, an independent consultant should conduct sampling for analytical testing of organic matter as described in the project specifications.
Qualified consultants include: Certified Soil Scientists, Crop Advisors or Agronomists; or Licensed Landscape Architects, Civil Engineers or Geologists.

Model FIELD VERIFICATION FORM for BMP T5.13

(available as MS Word file at www.SoilsforSalmon.org)

PROJECT INFORMATION **Page # ____ of ____ pages**

Complete all information on page 1, only site address and permit number on additional pages.

Site Address:_____	
Permit Type:	**Permit Number:**
Permit Holder:	**Phone:**
Mailing Address:_____	
Customer Representative At Inspection:	**Phone:**
Plan Prepared By:	

VISIT RECORD

Date:	**Inspector:**	**Items Approved: __ Fencing off undisturbed areas __ Soil preparation __ Mulch __ Other:**
Date:	**Inspector:**	**Items Approved: __ Fencing off undisturbed areas __ Soil preparation __ Mulch __ Other:**
Date:	**Inspector:**	**Items Approved: __ Fencing off undisturbed areas __ Soil preparation __ Mulch __ Other:**

DELIVERY TICKETS FOR AMENDMENT, TOPSOIL & MULCH.

(*Check if tickets match Soil Management Plan (SMP). Total volumes for all areas should be on page 1 of the SMP*).

❑ **Product #1:**_____ ❑ **Test Results: ___ % organic matter ____C:N ratio <25:1 ____ "stable"** (Y/N) ❑ **Quantity: _____cu. yds.** (except mulch, or <35:1 for native plants)	**Comments:**
❑ **Product #2:**_____ ❑ **Test Results: ___ % organic matter ____C:N ratio <25:1 ____ "stable"** (Y/N) ❑ **Quantity: _____cu. yds.** (except mulch, or <35:1 for native plants)	
❑ **Product #3:**_____ ❑ **Test Results: ___ % organic matter ____C:N ratio <25:1 ____ "stable"** (Y/N) ❑ **Quantity: _____cu. yds.** (except mulch, or <35:1 for native plants)	

AREA #___ (*refer to Areas mapped on Site Plan and described on Soil Management Plan*)

PLANTING TYPE ___ Undisturbed vegetation ___ Turf ___ Planting Beds ___ Other: _____ **Square footage:_____**	**Test Holes** **Number Test Holes Required:____** (minimum 1 hole/acre) **Soil Amended 8 Inches Deep? Y / N** **Amendment Matches Soil Mgmt. Plan? Y / N** ❑ Topsoil Product ? ❑ Amendment Visible ? **Subsoil Loose/Scarified 12 Inches Deep? Y / N**	**Rod Test** **Number Rod Tests Required:____** (minimum 10 tests/acre) **Rod penetrates 12 inches deep in all areas? Y / N**
(*If Planting Bed, Mulch is Required After Planting*) **Mulch Product:** _____ **Mulch two inches deep? Y / N**	**Comments:**	

AREA #___

PLANTING TYPE ___ Undisturbed vegetation ___ Turf ___ Planting Beds ___ Other: _____ **Square footage:_____**	**Test Holes** **Number Test Holes Required:____** (minimum 1 hole/acre) **Soil Amended 8 Inches Deep? Y / N** **Amendment Matches Soil Mgmt. Plan? Y / N** ❑ Topsoil Product ? ❑ Amendment Visible ? **Subsoil Loose/Scarified 12 Inches Deep? Y / N**	**Rod Test** **Number Rod Tests Required:____** (minimum 10 tests/acre) **Rod penetrates 12 inches deep in all areas? Y / N**
(*If Planting Bed, Mulch is Required After Planting*) **Mulch Product:** _____ **Mulch two inches deep? Y / N**	**Comments:**	

Add additional sheets for additional Areas

RESOURCES

- Calculating Custom Amendment Rates: Formula & Spreadsheet

- Permitted Composting Facilities in Washington that Sell Bulk Compost

- Soil and Compost Analytical Labs Serving the Northwest

- Additional Resources on Compost Quality & Use, and the Role of Soil Quality in Stormwater Management

- **Model Soil Amendment Specifications, in APWA and CSI Formats,**
  located in back of this Guide, and available as MS WORD files for cut-and-paste at www.SoilsforSalmon.org

See more resources online at:

www.SoilsforSalmon.org – background science, low impact development and design resources

www.BuildingSoil.org – soil BMP information for builders – factsheets, erosion control, marketing benefits

CALCULATING CUSTOM AMENDMENT RATES
TO ACHIEVE A TARGET SOIL ORGANIC MATTER CONTENT

Where soils already have some organic content, it is often cost-effective to calculate the amount of compost amendment needed to achieve the target 10% soil organic matter for landscape beds or 5% for turf areas, rather than using the pre-approved rates (see Section Five).

Custom amendment rates can be calculated using either the Equation below, or the Model Spreadsheet on facing page (also available as an Excel spreadsheet online at www.SoilsforSalmon.org).

EQUATION FOR CALCULATING COMPOST APPLICATION RATES:

Use this equation to calculate compost application rates to achieve a target final soil organic matter content (FOM, which should be 10% for landscape beds or 5% for turf areas) for a soil with a given bulk density (SBD) and initial soil organic matter (SOM). The spreadsheet example on the next page illustrates how the equation is applied on typical soils using common composted materials.

$$\mathbf{CR = D \times \frac{SBD \times (SOM\% - FOM\%)}{SBD \times (SOM\% - FOM\%) - CBD \times (COM\% - FOM\%)}}$$

Where:

CR = Compost application rate (inches) calculated to achieve the target final organic matter (FOM)

D = Depth of finished incorporation (inches)

SBD = Soil bulk density (lb/cubic yard dry weight)*

SOM % = Initial soil organic matter(%)***

FOM% = Final target soil organic matter(%)***

CBD = Compost bulk density (lb/cubic yard dry weight)**

COM% = Compost organic matter (%)***

Assumption: This equation calculates compost rate using an additive approach. For example, a 3-inch compost rate incorporated to an 8-inch depth will be a final mix containing 3/8 compost and 5/8 soil by volume.

* SBD To convert Soil Bulk Density in g/cm3 units to lb/cubic yard, multiply by 1697.

** CBD To convert Compost Bulk Density from lb/cubic yard "as is" to lb/cubic yard dry weight, multiply by solids content.

*** OM All Organic Matter measurements are based on the commonly used "loss-on-combustion" method.

MODEL AMENDMENT RATE CALCULATOR SPREADSHEET WITH EXAMPLES

Example from an Excel spreadsheet that uses the equation on previous page.
This Excel file can be downloaded at www.SoilsforSalmon.org

This set of examples shows amendment rates in a typical sandy soil using a compost with a bulk density of 660 lb/cubic yard, compared with rates for a typical clay soil using compost with a BD of 550 lb/cubic yard.

It demonstrates that soils with a higher initial organic matter (SOM) require less compost amendment to achieve a desired target final organic matter (FOM – which is set at 10%, appropriate for landscape beds, in these examples).

	SBD	SOM%	FOM%	CBD	COM%	D	CR
	Soil bulk density (lb/cubic yard dry weight)	Soil organic matter (percent)	Final organic matter (percent)	Compost bulk density (lb/cubic yard dry weight)	Compost organic matter (percent)	Depth of incorpor-ation (inches)	**Calculated compost application rate (inches)**
Sandy Soil	2206	1%	10%	660	60%	8 inches	**3.0 inches**
Soil bulk density = 1.3 g/cm^3 or 2206 lb/cu yd	2206	2%	10%	660	60%	8 inches	**2.8 inches**
	2206	3%	10%	660	60%	8 inches	**2.6 inches**
	2206	4%	10%	660	60%	8 inches	**2.3 inches**
	2206	5%	10%	660	60%	8 inches	**2.0 inches**
	2206	6%	10%	660	60%	8 inches	**1.7 inches**
	2206	7%	10%	660	60%	8 inches	**1.3 inches**
	2206	8%	10%	660	60%	8 inches	**0.9 inches**
Clay Soil	1697	1%	10%	550	50%	8 inches	**3.3 inches**
Soil bulk density = 1.0 g/cm^3 or 1697 lb/cu yd	1697	2%	10%	550	50%	8 inches	**3.1 inches**
	1697	3%	10%	550	50%	8 inches	**2.8 inches**
	1697	4%	10%	550	50%	8 inches	**2.5 nches**
	1697	5%	10%	550	50%	8 inches	**2.2 inches**
	1697	6%	10%	550	50%	8 inches	**1.9 inches**
	1697	7%	10%	550	50%	8 inches	**1.5 inches**
	1697	8%	10%	550	50%	8 inches	**1.1 inches**

PERMITTED COMPOSTING FACILITIES IN WASHINGTON THAT SELL BULK COMPOST

Compost from many of these facilities is sold and mixed into topsoil products through numerous retail outlets – check with topsoil and nursery vendors too. Please note that some of these facilities are not open to the general public.

Information from the WA Department of Ecology website, current 2011. *Note: not updated for this 2016 print edition – see website below for a current list of suppliers.*
An annually updated list of Permitted Composting Facilities throughout Washington is available at the DOE website www.ecy.wa.gov/programs/swfa/organics/soil.html

County	Facility / Company	City	Phone
Benton	City of Richland Horn Rapids Composting Operation	Richland	509-942-7481
Chelan	Chelan County Compost Facility	Dryden	(509) 548-5592
	Stemilt World Famous Compost Facility	Wenatchee	509-662-3613
Clallam	City of Port Angeles Municipal Landfill Facility	Port Angeles	(360) 417-4874
Clark	H & H Wood Recyclers	Vancouver	(360) 892-2805
Columbia	Columbia Compost	Dayton	(509) 386-4748
Cowlitz	Cowlitz County Landfill	Longview	(360) 577-3125
Grant	Quincy Compost	Quincy	(509) 787-3523
	Royal Organic Products	Royal City	(509) 554-3885
Island	Mailliard's Landing Nursery	Oak Harbor	(360) 679 8554
Jefferson	Port Townsend Biosolids Compost Facility	Port Townsend	(360) 385-7908
King	Cedar Grove Composting Co. Maple Valley	Seattle	1-877-764-5748 or (425) 432-2395
	GroCo/ Steerco/ Sawdust Supply	Kent	(206) 622-5141
	Woodland Park Zoo	Seattle	(206) 548-3633
Kitsap	Emu Composting Facility	Kingston	360-638-0117

County	Facility / Company	City	Phone
	Kittitas County Compost Facility	Ellensburg	509-962-7542
Lincoln	Barr-Tech Composting Facility	Sprague	509-590-0437
Mason	North Mason Fiber Co.	Belfair	(360) 275-0228
Pierce	LRI compost Factory, Pierce County Recycling, Composting & Disposal	Puyallup	(253) 847-7555
	Pierce County Purdy Compost Facility	Gig Harbor	(253) 857-2075
Skagit	Dykstra Composting Facility	Burlington	(360) 767-6376
	Skagit Soils Inc	Mount Vernon	(360) 424-0199
Snohomish	Bailand Farms Yardwaste (Bailey) Compost	Snohomish	(360) 568-8826
	Cedar Grove Composting Co.	Everett	(425) 212-2515
	Pacific Topsoils - Maltby	Woodinville	1-800-884-7645 or (425) 337-2700
	Riverside Topsoil Inc.	Snohomish	(425) 379-9933
Thurston	Silver Springs Organics Composting LLC	Tenino	(360) 446-7645
Walla Walla	Boise Wallula Composting	Wallula	(509) 545-3318
	Sudbury Landfill Compost Facility	Walla Walla	509-527-4591
	WSP Correctional Industries Compost Facility	Walla Walla	509-526-6361
Whatcom	Green Earth Technology (Compost)	Lynden	(360) 354-4936
Yakima	Natural Selection Farms Composting Facility	Sunnyside	(509) 837-3501

NUTRIENT MANAGEMENT guide

EM 8677
Revised May 2008

Laboratories Serving Oregon

Soil, Water, Plant Tissue, and Feed Analysis

J. Hart

Soil testing and plant analysis aid commercial growers, gardeners, and homeowners in making decisions about fertilizing or applying soil amendments. This fertilizer guide lists a variety of laboratories serving Oregon, and provides specific information about laboratory services.

To compile this list, the OSU Extension Service requested information from labs providing services for Oregon and adjacent areas. OSU Extension Service makes no endorsement by listing a laboratory; conversely, omission of a laboratory does not indicate that it's unsuitable. Another source for locating commercial laboratories is the yellow pages of your local telephone directory.

Before submitting material to a lab, pay attention to the following guidelines:

- Be sure the test you request is the right one to answer your question. Nutrients aren't the only factor for successful crop production, so a soil test may not tell you why your plants don't grow. Ask a county Extension agent or other agriculture professional which tests you may need.
- The goal of a soil or tissue test is a fertilizer recommendation. Fertilizer recommendations are based on soil/tissue tests that follow a set procedure or recipe. For example, OSU fertilizer recommendations are based on procedures used in OSU's Central Analytical Laboratory. Many labs say they use "comparable" procedures, but they may not. A laboratory that uses a procedure different from OSU's most likely will give a different fertilizer recommendation.
- Before sending samples, call the lab to inquire about costs and shipping instructions. For example, soil samples to be tested for nitrate-nitrogen should be refrigerated or dried rather than sent moist at room temperature.
- Beware of low prices. Laboratory procedures cost money to perform. A lab quoting a low price usually analyzes a few elements and estimates the others. You do not want estimates—make sure you obtain results from analytical work.
- For information on taking soil samples, see EC 628, *Soil Sampling for Home Gardens and Small Acreages.*

This list is revised regularly. Laboratories wishing to be added to this list may contact:

John Hart, Extension soil science specialist
Department of Crop and Soil Science
Ag & Life Sciences Building 3017
Oregon State University
Corvallis, OR 97331-7306
541-737-5712

For a list of laboratories approved by the Oregon Health Division for drinking water analysis, contact the Oregon Health Division, Drinking Water Systems, P.O. Box 14450, Portland, OR 97214-0450, or call 503-731-4010 or 503-731-4009.

For additional copies of this publication, visit your local county office of the OSU Extension Service, or contact:

Publication Orders
Extension & Station Communications
Oregon State University
422 Kerr Administration
Corvallis, OR 97331-2119
Fax: 541-737-0817

This publication also is available on the OSU Extension Service website (**extension.oregonstate.edu/catalog/**). Choose Agriculture, followed by Soil and Water (or search within the catalog by the series number, EM 8677).

John Hart, Extension soil scientist, Oregon State University.
This publication replaces FG 74, *A List of Analytical Laboratories Serving Oregon.*

© 2008 Oregon State University

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Oregon State University Extension Service offers educational programs, activities, and materials without discrimination based on age, color, disability, gender identity or expression, marital status, national origin, race, religion, sex, sexual orientation, or veteran's status. Oregon State University Extension Service is an Equal Opportunity Employer.

Revised June 2006. Revised May 2008.

Analytical Laboratories Serving Oregon
EM 8677 • page 2 • Revised May 2008

Laboratory	Area Served				Analyses								Other Services	
					Soil			Water			Plant Tissue	Feed		
	Oregon (OR)	Idaho (ID)	Washington (WA)	California (CA)	Agricultural	Environmental (heavy metals)	Environmental (pesticides, chem. cont.)	Biological (total & fecal coliform)	Chemical (pesticides)	Chemical (nitrate in drinking water)	Plant tissue	Feed	Fertilizer recomm.	Consulting
A & L Western Agricultural Laboratories ..... 1311 Woodland Ave., Suite 1 Modesto, CA 95351-4732 209-529-4080 • FAX 209-529-4736 **Portland Office** 10220 SW Nimbus Ave., Bldg. K-9 Portland, OR 97223 503-968-9225 • FAX 503-598-7702 e-mail: rbutterf@al-labs-west.com Web: al-labs-west.com	●	●	●		●	●	●	●	●	●	●	●	●	●
Agri-Check, Inc. ..... 323 Sixth St. • P.O. Box 1350 Umatilla, OR 97882 541-922-4894 or 800-537-1129 FAX: 541-922-5496 e-mail: dara@agri-check.com	●	●	●	●	●						●	●	●	●
Alexin Analytical Laboratories ..... 13035 SW Pacific Hwy., Portland, OR 97223 503-639-9311 • FAX 503-684-1588 e-mail: mail@alexinlabs.com Web: www.alexinlabs.com	●					●		●		●				●
Analytical Laboratory and Consultants, Inc. ... 361 W Fifth Ave., Eugene, OR 97401 541-485-8404 or 800-262-5973 FAX 541-484-5995 e-mail: anlabinc@rio.com	●				SC	●	SC	●	SC	●				●
Basin Agri-Serve ..... 22109 Stateline Rd., P.O. Box R Merrill, OR 97633 541-798-5112 • FAX 541-798-5114 e-mail: basinagri@fireserve.net	●			●	●						●	●	●	
Best-Test Analytical Services..... 3394 Bell Rd. NE, Moses Lake, WA 98837 509-766-7701 • FAX 509-766-7705 e-mail: besttest@atnet.net	●	●	●		●	●	●			●	●			
Bodycote FPL, Inc. ..... 12003 NE Ainsworth Circle, Portland, OR 97220 503-253-9136 or 800-375-9555 FAX 503-253-9019 e-mail: fpltim@aol.com Web: www.fplabs.com	●	●	●			●	●	●	●			●		●
Brookside Laboratories, Inc. ..... 308 S Main St., New Knoxville, OH 45871 419-753-2448 • FAX 419-753-2949 e-mail: mflock@blinc.com Web: www.blinc.com	●	●	●		●	●	●	●	●	●	●	●		●
Cascade Analytical, Inc. ..... 3019 G.S. Center Rd., Wenatchee, WA 98801 509-662-1888 e-mail: cascade@nwi.net Web: www.cascadeanalytical.com	●	●	●		●	●		●	●	●	●			●

*SC indicates a service is subcontracted.

Analytical Laboratories Serving Oregon
EM 8677 • page 3 • Revised May 2008

Laboratory	Area Served				Analyses								Other Services	
					Soil			Water			Plant Tissue	Feed		
	Oregon (OR)	Idaho (ID)	Washington (WA)	California (CA)	Agricultural	Environmental (heavy metals)	Environmental (pesticides, chem. cont.)	Biological (total & fecal coliform)	Chemical (pesticides)	Chemical (nitrate in drinking water)	Plant tissue	Feed	Fertilizer recomm.	Consulting
Dairy One Forage Lab ..... 730 Warren Rd., Ithaca, NY 14850 607-257-1272 • FAX 607-257-1350 e-mail: forage@dairyone.com Web: www.dairyone.com	●	●	●									●		
Dellavalle Laboratory, Inc. ..... 1910 W McKinley, Suite 110 Fresno, CA 93728-1298 559-233-6129 • FAX 559-268-8174 e-mail: ndellavalle@dellavallelab.com Web: www.dellavallelab.com	●	●	●		●			●	●	●	●	●	●	●
Delta Environmental Services, Inc. ..... 36 Irving Rd., Eugene, OR 97404 541-689-3177 • FAX 541-689-5104 e-mail: contact@deltaesi.com Web: www.deltaesi.com	●	●	●	●				●	●	●				
Kuo Testing Laboratories, Inc. ..... 337 S First Ave., Othello, WA 99344 509-488-0112 • FAX 509-488-0118 e-mail: kuotest@atnet.net Web: www.kuotesting.com	●	●	●		●	●	●		●	●	●	●	●	●
Laucks Testing Laboratory ..... 940 S. Harney St., Seattle, WA 98108 206-767-5060 • FAX 206-767-5063	●	●	●			●	●	●	●	●		●		●
MDS Harris ..... 621 Rose St., P.O. Box 80837 Lincoln, NE 68501 402-476-2811 • FAX 402-476-7598 e-mail: steve.frack@mdsinc.com Web: www.mdsharris.com	●	●	●			●				●	●			
Northwest Agricultural Consultants ..... 2545 W Falls, Kennewick, WA 99336 509-783-7450 • FAX 509-783-5305 e-mail: bob@nwag.com Web: www.nwag.com	●	●	●		●					●	●	●	●	●
OMIC USA, Inc. ..... 3344 NW Industrial St., Portland, OR 97210 503-223-1497 • FAX 503-223-9436 e-mail: labmgr@omicusa.com Web: www.omicnet.com	●	●	●	●	●	●	●	●	●		●	●		
Oregon State University Central Analytical Laboratory ..... Ag & Life Sciences Bldg., Room 3079 Corvallis, OR 97331-7306 541-737-2187 • FAX 541-737-5725	●										●		●	
Pacific Agricultural Laboratory ..... 12505 NW Cornell Rd., Portland, OR 97229 503-626-7943 • FAX 503-641-0644 e-mail: sthun@pacaglab.com Web: www.pacaglab.com	●	●	●	●			●		●		●			●
Pacific Analytical Laboratory, Inc. ..... 540 SW Third, Corvallis, OR 97333 541-753-4946 • FAX 541-753-4994 e-mail: info@pacificanalytical.com	●	●	●	●				●	●	●				

Analytical Laboratories Serving Oregon
EM 8677 • page 4 • Revised May 2008

Laboratory	Area Served				Analyses								Other Services	
					Soil			Water			Plant Tissue	Feed		
	Oregon (OR)	Idaho (ID)	Washington (WA)	California (CA)	Agricultural	Environmental (heavy metals)	Environmental (pesticides, chem. cont.)	Biological (total & fecal coliform)	Chemical (pesticides)	Chemical (nitrate in drinking water)	Plant tissue	Feed	Fertilizer recomm.	Consulting
Soil & Plant Laboratory, Inc. ..... 13547 SE 27th Pl. Suite 3B, Bellevue, WA 98005; 425-746-6665 • FAX 425-562-9531; e-mail: splabnw@flash.net; Web: www.soilandplantlaboratory.com; **Oregon Office** 503-557-4959 • FAX 503-557-0713; e-mail: splabor@flash.net	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Soiltest Farm Consultants, Inc. ..... 2925 Driggs Dr., Moses Lake, WA 98837; 509-765-1622 • FAX 509-765-0314; e-mail: brent@soiltestlab.com; Web: www.soiltestlab.com	●	●	●		●	●				●	●	●	●	●
Specialty Analytical ..... 19761 SW 95th Ave., Tualatin, OR 97062; 503-612-9007 • FAX 503-612-8572; e-mail: marty@specialtyanalytical.com; Web: www.specialtyanalytical.com	●	●	●			●	●	●	●	●				
Stukenholtz Laboratory, Inc. ..... 2924 Addison Ave. E, P.O. Box 353; Twin Falls, ID 83303-0353; 208-734-3050, 800-759-3050 • FAX 208-734-3919; e-mail: stuklab@mindspring.com; Web: www.stukenholtz.com	●	●			●	●		●		●	●	●	●	●
Test America ..... 9405 SW Nimbus Ave., Beaverton, OR 97008; 503-906-9200 • FAX 503-906-9210	●	●	●	●	●	●	●	●	●	●				
Umpqua Research Company ..... P.O. Box 609, 626 NE Division; Myrtle Creek, OR 97457; 541-863-5201 • FAX 541-863-6199; e-mail: lab@urcmail.net; Web: www.chemlab.cc	●	●	●			●	●	●	●	●				
USAg Analytical Services, Inc. ..... 1320 E Spokane St., Pasco, WA 99301; 509-547-3838 • FAX 509-547-8645; certified NFTA	●	●	●		●					●	●	●	●	●
Utah State University Analytical Lab 4830 Old Main Hill, 166 Ag Science Bldg.; Logan, UT 84322-4830; 435-797-2217 • FAX 435-797-2117; Web: www.usual.usu.edu • e-mail: usual@usu.edu	●	●	●	●	●	●	●			●	●	●		
Waterlab Corp. ..... 2603 12th St. SE Salem, OR 97302; 503-363-0473 • FAX 503-363-8900	●							●		●				
Western Laboratories, Inc. ..... P.O. Box 1020, Parma, ID 83660; 208-722-6564, 800-658-3858 • FAX 208-722-6550; e-mail: john@westernlaboratories.com; Web: westernlaboratories.com	●	●	●		●	●	●	●	●	●	●	●	●	●
William F. Black Soil Testing ..... 503 Gardner, P.O. Box 317, Burlington, WA 98233; 360-757-6112 • e-mail: bjlblack@verizon.net	●	●	●		●	●				●			●	●

ADDITIONAL RESOURCES ON COMPOST QUALITY & USE, AND THE ROLE OF SOIL QUALITY IN STORMWATER MANAGEMENT

Background Science

University of Washington Center for Water and Watershed Studies https://digital.lib.washington.edu
Search publications database for:

- *Proceedings of 1998 Salmon in the City conference* – reports on a number of studies by University of WA and other scientists, includes source references for stormwater & water quality data presented in this Guide
- *The Relationship Between Soil and Water: How Soil Amendments and Compost Can Aid in Salmon Recovery*, a 1999 report by King and Snohomish Counties, City of Seattle, Washington Dept. of Ecology, and Washington State University
- *Guidelines for Landscaping with Compost-Amended Soils*, a 1998 report prepared for the City of Redmond which details trials, stormwater benefits, and 3-7 paybacks on compost amendment based on landscape water savings

This site also includes research on the effects of urbanization, stream restoration techniques, permeable paving , etc.

Soil Biology and Soil Functions: Why Soil Life Matters, and How it Works

US Dept. of Agriculture, NRCS Soil Quality Institute http://soils.usda.gov/sqi/
Download the excellent *Soil Biology Primer* at http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/biology/ and other soil quality and erosion prevention resources, or order print copies from 1-800-THE SOIL

Washington State University's Soil Management research site http://puyallup.wsu.edu/soils/
Of particular interest are the sections on Compost, Current Research, and Soils and Soil Testing

Soil Restoration, Compost Quality and Compost Use

Washington Organic Recycling Council www.compostwashington.org and Soils for Salmon www.SoilsforSalmon.org
Background and up to date information on Soils for Salmon initiative, this *Building Soil* guide online including calculations spreadsheet, and useful links on compost use and soil restoration. A new (2008) partner site, www.BuildingSoil.org carries this *Building Soil* guide too, along with factsheets on construction sequencing, erosion control, and customer information.

Washington State Department of Ecology's Solid Waste/Compost Program www.ecy.wa.gov/programs/swfa/organics/soil.html includes links to Washington State's Compost Facility Standards – WAC 173-350 section 220 – referred to in this Guide, as well as a current list of Permitted Composting Facilities, and other useful compost resources

U.S. Composting Council http://compostingcouncil.org/ The most authoritative source for information on compost specifications. Particularly useful to landscape professionals is the recently updated *Field Guide to Compost Use*.

USCC's "Seal of Testing Assurance" (STA) program is the state-of-the-art for verifying compost quality and specifications for a variety of uses. See http://compostingcouncil.org/tmecc/ and follow the "STA" link for complete information.

Penn State Turfgrass Extension http://plantscience.psu.edu/research/centers/turf/extension/factsheets/composts
Download Dr. Peter Landschoot's practical guide, *Using Composts to Improve Turfgrass Performance*

Ecologically Sound Lawn Care for the Pacific Northwest Seattle Public Utilities. See sections on soil preparation for turf, and compost use in turf topdressing. www.seattle.gov/util/landscapeprofessionals click on "Lawn"

Stormwater Management with Soil and Low Impact Development BMPs

Washington State Department of Ecology *Stormwater Management Manual for Western Washington*, (2001, revised 2005) used by local jurisdictions for stormwater design, contains soil improvement as a Best Management Practice (Volume V, Chapter 5, BMP T5.13) at www.ecy.wa.gov/programs/wq/stormwater/manual.html, and see the Soils for Salmon website below for the online version of this Guide to implementing that BMP.

Washington Stormwater Center http://www.wastormwatercenter.org/ has an array of Low Impact Development stormwater and site planning resources, incorporating soil BMPs, especially the *Low Impact Development Technical Guidance Manual for Puget Sound* and the *Rain Garden Handbook* http://www.wastormwatercenter.org/lid/

Master Builders Association's "Built Green" sustainable building program, developed with King and Snohomish Counties, includes soil strategies for home building. www.builtgreen.net

Homeowner resources www.700milliongallons.org

Soil and Compost Use Specifications and Design Guidelines

WA Dept. of Transportation soil bio-engineering page and *Roadside Manual* http://www.wsdot.wa.gov/Design/Roadside/ and WsDOT's compost specifications in their *Standard Specifications*

Seattle Public Utilities, Green Stormwater Infrastructure codes, specs & projects www.seattle.gov/util/GreenInfrastructure and best landscape practices (including soil) information for homeowners at www.seattle.gov/util/services/yard/ and for landscape design, construction, and maintenance professionals at www.seattle.gov/util/landscapeprofessionals

Low Impact Development Technical Guidance Manual for Puget Sound (see WA Stormwater Center above)

Texas DOT specs http://www.txdot.gov/ (search under "compost")

Iowa State University research & Iowa DNR specs www.eng.iastate.edu/compost/

A national version of the Washington soil BMP is now included in *The Sustainable Sites Initiative: Guidelines and Performance Benchmarks*, a LEED-like green building standard for sites, see www.sustainablesites.org

and see Specifications in APWA and CSI format at end of this Guide

Compost Berms and Blankets for Erosion Control

Compost Berm, Blanket and Sock specifications, approved BMPs for erosion control, on US EPA NPDES menu http://www.epa.gov/npdes (select "stormwater" then "construction") or search "compost blanket" on that site. For an introduction, see the "Erosion Control with Compost" factsheet on www.buildingsoil.org

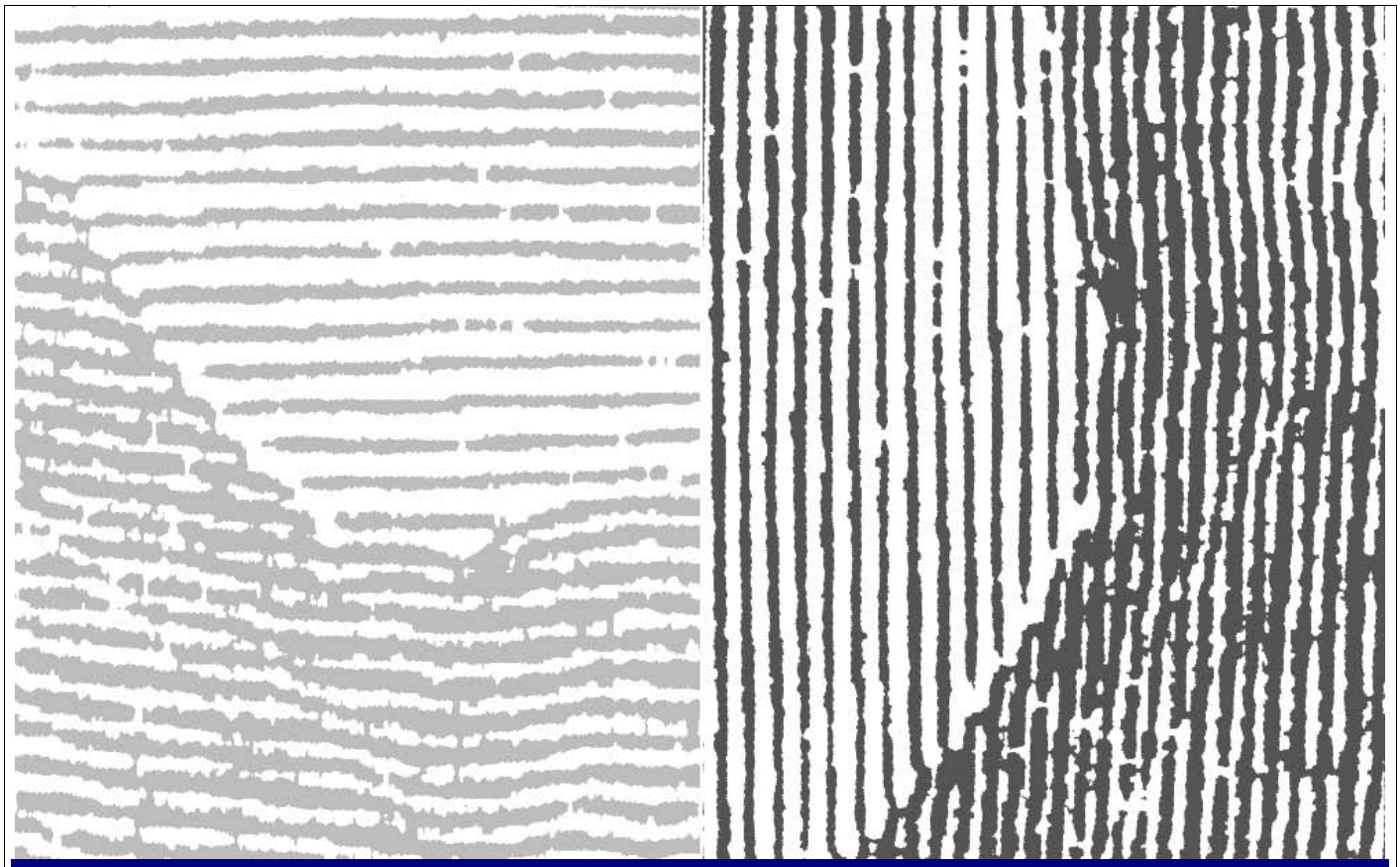
Search the internet for "compost berms" and "compost blankets" for current information. Good online articles include:

- *BioCycle* Journal www.biocycle.net/ Search the index for various articles, especially "Compost Filter Berms and Blankets Take on the Silt Fence" by Rod Tyler, Biocycle: Vol. 42; No. 1, January 2001
- "Erosion Control and Environmental Uses for Compost" by Rod Tyler et al http://www.p2pays.org/ref/11/10295.pdf
- Various articles in *Erosion Control* Journal (search under "compost") http://foresternetwork.com/magazines/erosion-control/
- "Restoring Soil Health To Urbanized Lands" Oregon DEQ, esp. pp14-19 on compost berm and blanket trials, and p. 26 for specifications http://www.deq.state.or.us/lq/pubs/docs/sw/compost/RestoringSoilHealth.pdf

For More Information Contact:

Washington Organic Recycling Council *info@compostwashington.org* www.compostwashington.org/
and see more resources at **www.soilsforsalmon.org** and **www.buildingsoil.org**

Notes

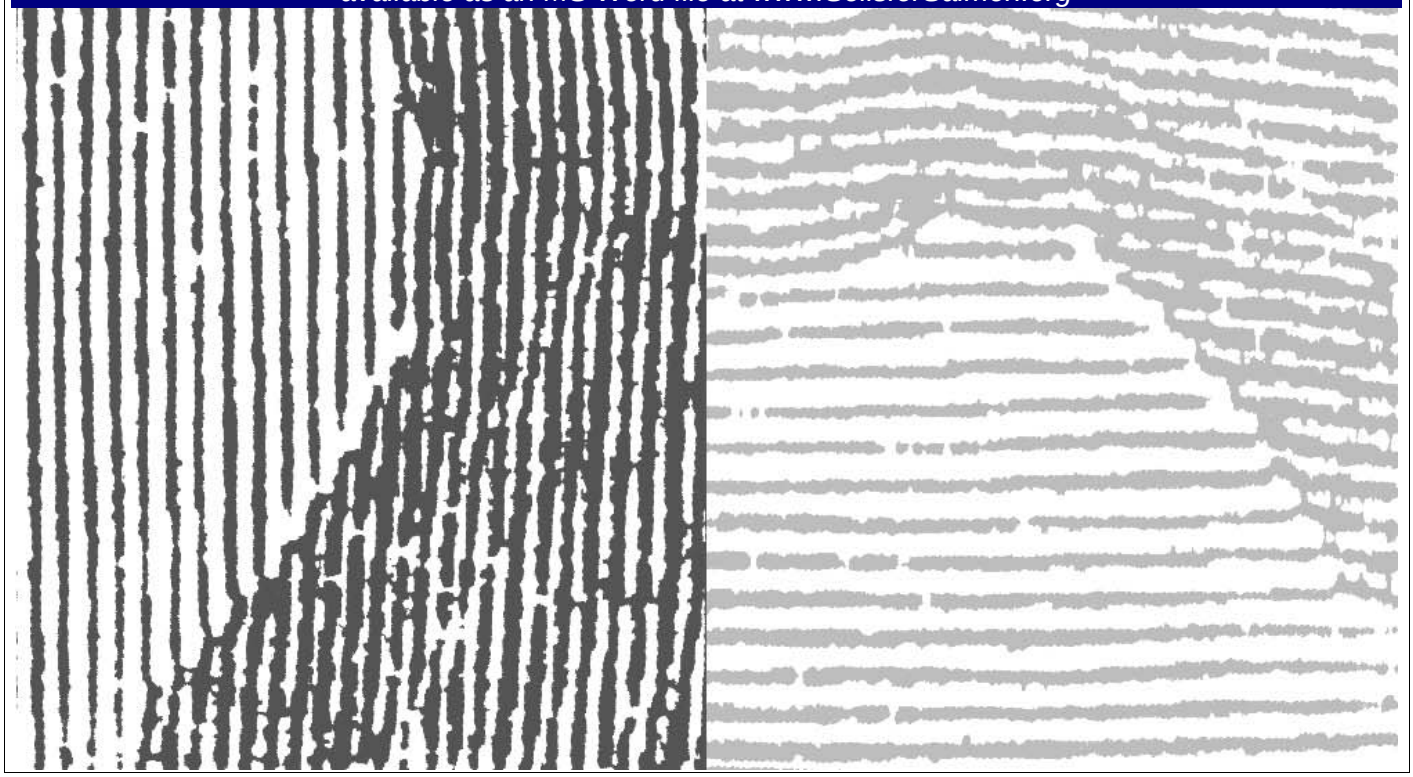


Model Soil Amendment Specification

to implement Soil Quality and Depth BMP T5.13

APWA FORMAT

available as an MS Word file at www.SoilsforSalmon.org



9.14.1 Soil (New Section)

9.14.1(1) Work in this Section

A. Section includes:
   1. Soil amendments.
   2. Soil preparation.
   3. Preparation and finish grading of planting and lawn areas.
   4. Mulching

9.14.1(2) References

A. Washington State Department of Ecology, Western Washington Stormwater Manual, BMP T5.13: Post-Construction Soil Quality and Depth

B. WAC Chapter 173-350, Definitions and Section 220

C. United States Department of Agriculture (USDA) Soil Texture System of Classification

9.14.1(3) Submittals

A. Soil Management Plan: Prior to commencement of site work, submit a copy of the project Soil Management Plant and an attached implementation schedule that have been approved by local jurisdiction for permit.

B. Samples: Submit samples of all soil amendments. Include a list of sources and certification as specified. Soil amendments shall be submitted in one-gallon containers.

C. At the time of Post-Construction Inspection, furnish copies of material verifications such as load tickets, invoices, sales slips, test results and similar items as specified.

9.14.1(4) Quality Assurance

A. Qualifications of Contractor: The Contractor shall be active and experienced in work of the type specified, and upon request by the Contracting Agency, be able to show evidence of successful completion of projects of similar scope.

B. Regulatory Requirements: Obtain and pay for all permits and testing related to the work of this section.

C. Pre-Grading Inspection: In conjunction with the soil preparation specified herein, meet with the Contracting Agency to discuss and verify requirements, schedule, and proposed soil preparation methods.

9.14.1(5) Guarantee

A. Guarantee: Guarantee materials and workmanship for a period of one-year following Owner's final acceptance.

9.14.1(6) Sequencing And Scheduling

A. Coordinate work of other trades specified elsewhere.

B. Do not perform soil preparation work in areas subject to the subsequent work of other sections, unless approved otherwise.

9.14.1(7) Maintenance

A. Maintain the work as specified in this section until final acceptance of the work.

9.14.1(8) Compost

A. Composted material must be in compliance with WAC Chapter 173-350 Section 220; plus the following additional requirements.

B. Additional Requirements

1. The carbon to nitrogen ratio of the compost shall be below 25:1, or below 35:1 if the proposed plantings are composed entirely of plants native to the Puget Sound Lowlands region.
2. The compost shall have an organic matter content of 35% to 65% as determined by "loss on ignition" test method.

C. Alternative organic materials may be used in lieu of the specified compost if they meet the criteria for carbon to nitrogen ratio, contaminants (as defined in WAC Chapter 173-350 Section 220), and when mixed with existing native soil can achieve a calculated organic content of 5% for turf areas or 10% for planting beds.

D. Submit one-gallon sample, source, and letter of certification from the supplier to the Contracting Agency for approval prior to installation.

9.14.1(9) Mulch

A. Specified compost, or fine ground freshwater bark, or stockpiled forest duff from the project site.

B. Submit one-gallon sample, source, and letter of certification from the supplier to the Contracting Agency for approval prior to installation

9.14.1(10) Imported Topsoil

A. A mixture of compost, meeting requirements of Section 2.1 above, and sand or sandy loam per USDA soil texture classification. The mixture shall contain a minimum of approximately 5% organic matter for turf areas or a minimum of approximately 10% organic matter for planting beds. The sand or sandy loam shall be free of weeds, deleterious materials, rocks, and debris. 100% of the imported topsoil shall pass through a 3/4" screen, less than 25% shall pass through a #200 sieve.

B. Submit one-gallon sample, source, and letter of certification from the supplier to the Contracting Agency for approval prior to installation.

9.14.1(11) Soil Management Plan

A. The Soil management Plan (SMP) will be submitted as part of site development / building permit application, and will include the following:

1. An 11" X 17" or larger site map indicating:
   Option 1. Areas where native soil and vegetation will be retained in place,
   Option 2. Areas where topsoil or subsoil will be amended in place,
   Option 3. Areas that will be stripped and stockpiled prior to grading for reapplication, and
   Option 4. Areas where imported topsoil will be applied.
2. Calculations for volumes of soil to be stockpiled, and amounts of amendment or topsoil to be imported to achieve specified minimum organic matter content.
3. Names and sources of specified organic amendments and topsoil products to be used, with copies of laboratory analyses documenting that organic matter content and carbon to nitrogen requirements will be achieved and that compost meets WAC Chapter 173-350 Section 220 definition of "Composted Material".
4. IF CALCULATED AMENDMENT RATES ARE TO BE USED, characterize site soils to be amended and compost or alternative organic material for the following properties:
   a. Soil- Bulk density, organic matter content and depth of compacted layers to a depth of 12 inches.
   b. Compost or alternative organic material- Bulk density, organic matter content, carbon to nitrogen ratio, moisture content/percent solids.

   Soil samples must be gathered following the distribution plan outlined in the Post-Construction Inspection below, and be composed of material from the entire depth to be amended, excluding any surface mulch layers. Calculations by a Qualified Professional must be provided showing that the organic content requirements will be met based on the organic contents and densities of both the site soil and amendments. Qualified Professionals include Certified Soil Scientists, Crop Advisors or Agronomists; and Licensed Landscape Architects, Civil Engineers or Geologists.

9.14.1(12) Preparation

A. Protect surrounding construction from damage caused by the work of this section.

9.14.1(13) Subgrades

A. Prepare subgrades as specified in paragraph 9.14.1(14) Amendment Options

9.14.1(14) Amendment Options

A. Select the soil preparation option which best suits the project site. Different options may be used in different areas of the project. Choose either the "default" pre-approved amendment rate, or a qualified professional may calculate a custom rate based on soil and amendment tests described in Section 9.14.1(11) A.4. The selected soil preparation option(s) shall be shown on the Soil Management Plan approved with site development permit.

OPTION 1: Leave Native Vegetation and Soil Undisturbed, and protect from compaction during construction
Identify areas of the site that will not be stripped, logged, graded or driven on, and fence those areas to prevent impacts during construction. If not impacted, either in soils or vegetation, these areas do not require amendment.

OPTION 2: Amend Existing Soil In-Place	
Scarification: Scarify or till subgrade to 8 inches depth (or to depth needed to achieve a total depth of 12 inches of uncompacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds	**B. Turf Areas**
i. PRE-APPROVED RATE: Place and rototill 3 inches of composted material into 5 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of soil needed to achieve 8 inches of settle soil at 10% organic content	**i.** PRE-APPROVED RATE: Place and rototill 1.75 inches of composted material into 6.25 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of soil needed to achieve 8 inches of settled soil at 5% organic content.
Rake beds to smooth and remove surface rocks larger than 2 inches diameter.	Water or roll to compact soil to 85% of maximum.
Mulch planting beds with 2 inches of organic mulch.	Rake to level, and remove surface woody debris and rocks larger than 1 inches diameter

OPTION 3: Stockpile site topsoils prior to grading for reapplication. Amend with organic matter or add topsoil if necessary to achieve required organic content to 8 inches depth.	
Scarification: If placed topsoil plus compost or other organic material will amount to less than 12 inches: Scarify or till subgrade to depth needed to achieve 12 inches of loosened soil after topsoil and amendment are placed. Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds	**B. Turf Areas**
Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission, in approved location, prior to grading.	Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission, in approved location, prior to grading.
Replace stockpiled topsoil prior to planting.	Replace stockpiled topsoil prior to planting.
i. PRE-APPROVED RATE: Place and rototill 3 inches of composted material into 5 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of replaced soil needed to achieve 8 inches of settled soil at 10% organic content	**i.** PRE-APPROVED RATE: Place and rototill 1.75 inches of composted material or into 6.25 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of replaced soil needed to achieve 8 inches of settled soil at 5% organic content.
Rake beds to smooth and remove surface rocks larger than 2 inches diameter.	Water or roll to compact soil to 85% of maximum
Mulch planting beds with 2 inches of organic mulch or stockpiled duff.	Rake to level, and remove surface rocks larger than 1 inches diameter.

OPTION 4: Import topsoil meeting organic matter content standards.	
Scarify or till subgrade in two directions to 6 inches depth. Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds: Use imported topsoil mix containing 10% organic matter (typically around 40% compost).	**B. Turf Areas:** Use imported topsoil mix containing 5% organic matter (typically around 25% compost).
Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.	Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.
Place 3 inches topsoil mix on surface.	Place 3 inches topsoil mix on surface.
Rake beds to smooth, and remove surface rocks over 2 inches diameter.	Water or roll to compact soil to 85% of maximum.
Mulch planting beds with 2 inches of organic mulch.	Rake to level, and remove surface rocks larger than 1 inches diameter.

9.14.1(15) Inspection And Verification

A. Pre-Grading Inspection: Prior to the commencement of site work, contact the Contracting Agency to provide an inspection to verify the delineation and protection of native soils and vegetation to remain undisturbed, and to verify the proposed location for topsoil and material stockpiling. Make corrections and adjustment as directed by the Inspector.

B. Interim Grading Inspection: Prior to the placement of soil amendments, contact the Contracting Agency to provide an inspection to verify that specified erosion control methods have been implemented, the location of stockpiled soil and materials, and that subgrades are consistent with the Soil Management Plan. Make corrections and adjustment as directed by the Inspector.

C Post-Installation Inspection: Prior to planting, contact the Contracting Agency to provide an inspection to verify that the placement of amendments and soil preparation is consistent with the Soil Management Plan. Provide delivery tickets for soil amendments to verify the quantity of material specified on the Soil Management Plan. Make corrections and adjustment as directed by the Inspector.

D. Mulch Placement Verification: At the completion of planting, contact the Contracting Agency to provide a review to verify that mulch has been installed as specified.

E. Secondary Verification for Failing Sites: If the Contracting Agency determines that the installation does not meet the conditions of the approved Soil Management Plan, additional testing by an independent certified soil consultant will be ordered by the Contracting Agency and paid for by the Contractor. Make corrections and adjustment as directed by the Contracting Agency.

9.14.1(16) Final Acceptance

A. Final acceptance by the Contracting Agency for soil preparation will be contingent on the approval of all inspections, and that the soil preparation is consistent with these specifications and with the approved Soil Management Plan.

9.14.1(17) Measurement

A. Soil amendments, soil preparation, and mulching will be measured along the ground slope and computed in square yards for the areas completed and accepted by the Contracting Agency.

9.14.1(18) Payment

A. Payment will be made in accordance with Section 1.04.1, for each of the following listed bid items that are included in the proposal:

Amendment Option One - Planting Beds, per square yard.
Amendment Option One - Turf Areas, per square yard.

Amendment Option Two - Planting Beds, per square yard.
Amendment Option Two - Turf Areas, per square yard.

Amendment Option Three - Planting Beds, per square yard.
Amendment Option Three - Turf Areas, per square yard.

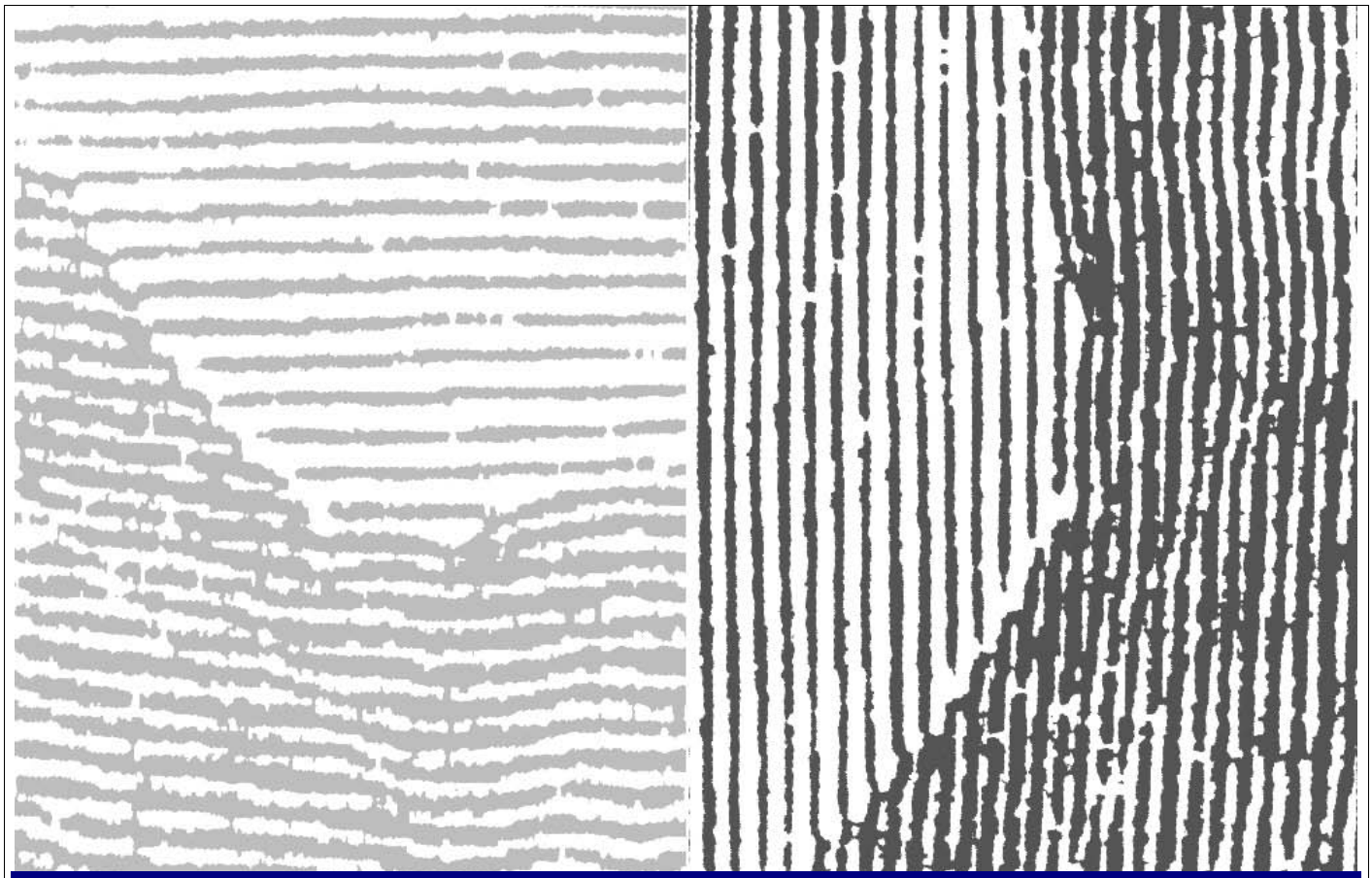
9.14.4(3) Bark or Wood Chips (DELETE PARAGRAPH)

9.14.4(4) Sawdust (DELETE PARAGRAPH)

9.14.4(8) Compost (DELETE PARAGRAPH)

END OF SECTION

Notes

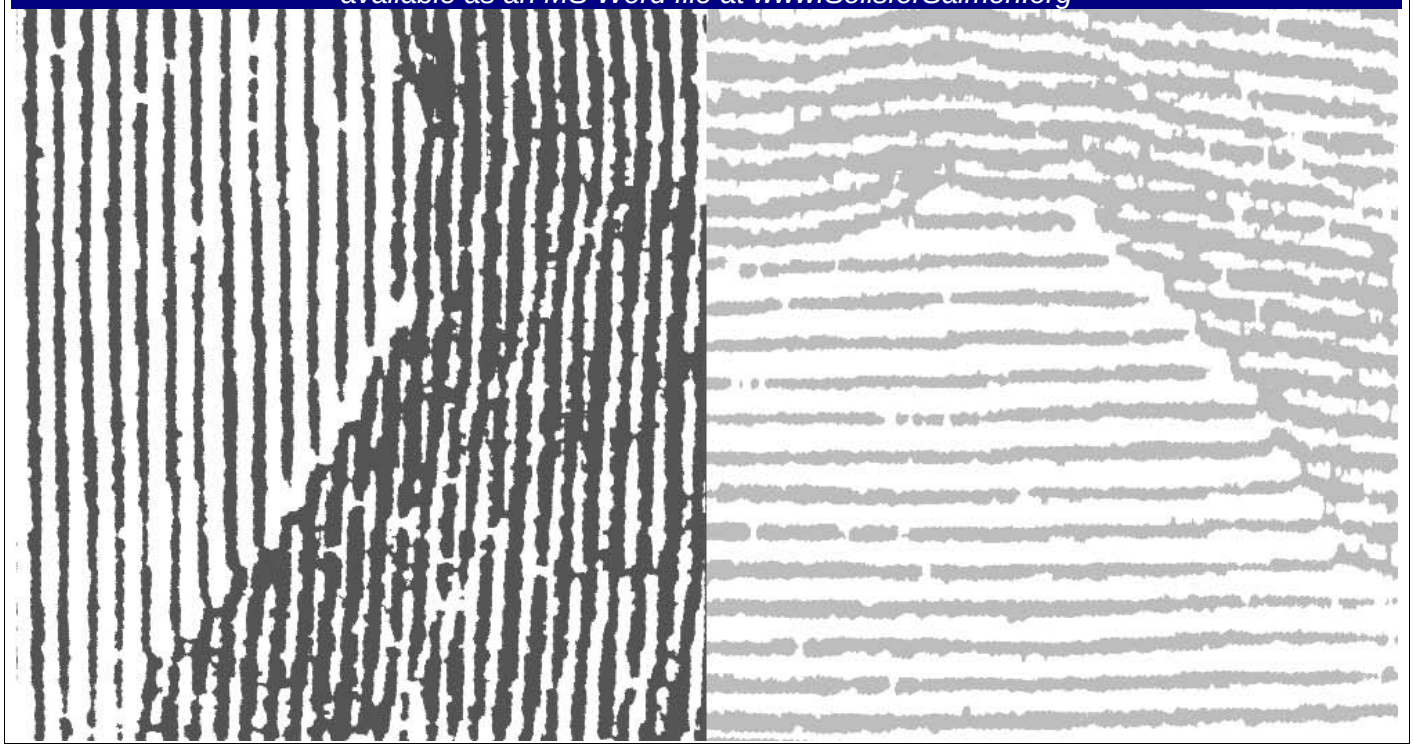


Model Soil Amendment Specification

to implement Soil Quality and Depth BMP T5.13

CSI FORMAT

available as an MS Word file at www.SoilsforSalmon.org



PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract and Division-1 Specifications sections, apply to this section.

1.2 WORK IN THIS SECTION

A. Section includes:
1. Soil amendments.
2. Soil preparation.
3. Preparation and finish grading of planting and lawn areas.
4. Mulching

B. Substitutions: Substitute products will be considered only under the terms and conditions of Section 01640.

1.3 RELATED WORK IN OTHER SECTIONS

A. The following Sections contain requirements that may relate to this Section:
1. Section 02200 -Earthwork
2. Section 02810 -Irrigation
3. Section 02900 -Planting
4. Section 02920 - Seeding

1.4 REFERENCES

A. Washington Department of Ecology, Western Washington Stormwater Manual, BMP T5.13: Post-Construction Soil Quality and Depth

B. WAC Chapter 173-350, Definitions and Section 220

C. United States Department of Agriculture (USDA) Soil Texture System of Classification

1.5 SUBMITTALS

A. Make submittals in accordance with Section _____ as applicable.

B. Soil Management Plan: Prior to commencement of site work, submit an approved copy of the project Soil Management Plant with an attached implementation schedule.

C. Samples: Submit samples of all soil amendments. Include a list of sources and certification as specified. Soil amendments shall be submitted in one-gallon containers.

D. At the time of Post-Construction Inspection, furnish copies of material verifications such as load tickets, invoices, sales slips, test results and similar items as specified.

1.6 QUALITY ASSURANCE

A. Qualifications of Contractor: The Contractor shall be active and experienced in work of the type specified, and upon request by the Owner and/or Owner's Representative, be able to show evidence of successful completion of projects of similar scope.

B. Regulatory Requirements: Obtain and pay for all permits and testing related to the work of this section.

C. Pre-Grading Inspection: In conjunction with the soil preparation specified herein, meet with the Owner and/or Owner's Representative to discuss and verify requirements, schedule, and proposed soil preparation methods.

1.7 GUARANTEE

A. Guarantee: Guarantee materials and workmanship for a period of one-year following Owner's final acceptance.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate work of other trades specified elsewhere.

B. Do not perform soil preparation work in areas subject to the subsequent work of other sections, unless approved otherwise.

C. Perform work in accordance with the approved schedule specified in paragraph 1.5 SUBMITTALS. If a schedule delay greater than three days occurs, immediately revise and resubmit schedule to reflect each schedule delay.

1.10 MAINTENANCE

A. Maintain the work as specified in this section until final acceptance of the work.

PART 2 - PRODUCTS

2.1 COMPOST

A. Composted material must be in compliance with WA Department of Ecology's specifications, which appear in WAC Chapter 173-350 Section 220; plus the following additional requirements.

B. Additional Requirements
1. The carbon to nitrogen ratio of the compost shall be below 25:1 or below 35:1 if the proposed plantings are composed entirely of plants native to the Puget Sound Lowlands region.
2. The compost shall have an organic matter content of 35% to 65%% as determined by "loss on ignition" test method.

C. Alternative organic materials may be used in lieu of the specified compost if they meet the criteria for carbon to nitrogen ratio, contaminants (as defined in WAC Chapter 173-350 Section 220), and when mixed with existing native soil can achieve a calculated organic content of 5% for turf areas or 10% for planting beds.

D. Submit one-gallon sample, source, and letter of certification from the supplier to the Owner and/or Owner's Representative for approval prior to installation.

2.2 MULCH

A. Specified compost, or fine ground freshwater bark, or stockpiled forest duff from the project site.

B. Submit one-gallon sample, source, and letter of certification from the supplier to the Owner and/or Owner's Representative for approval prior to installation.

2.3 IMPORTED TOPSOIL

A. A mixture of compost, meeting requirements of Section 2.1 above, and sand or sandy loam per USDA soil texture classification. The mixture shall contain a minimum of approximately 5% organic matter for turf areas or a minimum of approximately 10% organic matter for planting beds. The sand or sandy loam shall be free of weeds, deleterious materials, rocks, and debris. 100% of the imported topsoil shall pass through a 3/4" screen, less than 25% shall pass through a #200 sieve.

B. Submit one-gallon sample, source, and letter of certification from the supplier to the Owner and/or Owner's Representative for approval prior to installation.

PART 3 - EXECUTION

3.1 SOIL MANAGEMENT PLAN

A. The Soil management Plan (SMP) will be submitted as part of site development / building permit application, and will include the following:
1. An 11" X 17" or larger site map indicating:
Option 1. Areas where native soil and vegetation will be retained in place,
Option 2. Areas where topsoil or subsoil will be amended in place,
Option 3. Areas that will be stripped and stockpiled prior to grading for reapplication, and
Option 4. Areas where imported topsoil will be applied.
2. Calculations for volumes of soil to be stockpiled, and amounts of amendment or topsoil to be imported to achieve specified minimum organic matter content.
3. Specified organic amendments and topsoil products to be used, with organic matter content and carbon to nitrogen documented by producer supplied copies of laboratory analyses to demonstrate that requirements will be achieved and that compost meets WAC Chapter 173-350 Section 220 definition of "Composted Material").
4. IF CALCULATED AMENDMENT RATES ARE TO BE USED, site soils to be amended and compost or alternative organic material must be characterized for the following properties: Soil- Bulk density, organic matter content and depth of compacted layers to a depth of 12 inches. Compost or alternative organic material Bulk density, organic matter content, carbon to nitrogen ratio, moisture content. . Soil samples must be gathered following the distribution plan outlined in the Post-Construction Inspection below, and be composed of material from the entire depth to be amended, excluding any surface mulch layers. Calculations by a Certified Soil Scientist, Crop Advisor or Agronomist must be provided showing that the organic content requirements will be met based on the organic contents and densities of both the site soil and amendments.

3.2 PREPARATION

A. Protect surrounding construction from damage caused by the work of this section.

3.3 SUBGRADES

A. Prepare subgrades as specified in paragraph 3.4 AMENDMENT OPTIONS.

3.4 AMENDMENT OPTIONS

A. Select the soil preparation option which best suits the project site. Different options may be used in different areas of the project. Choose either the "default" pre-approved amendment rate, or a qualified professional may calculate a custom rate based on soil and amendment tests described in Section 3.1.A.4. The selected soil preparation option(s) shall be shown on the Soil Management Plan approved with site development permit.

OPTION 1: Leave Native Vegetation and Soil Undisturbed, and protect from compaction during construction
Identify areas of the site that will not be stripped, logged, graded or driven on, and fence those areas to prevent impacts during construction. If not impacted, either in soils or vegetation, these areas do not require amendment.

OPTION 2: Amend Existing Soil In-Place	
Scarification: Scarify or till subgrade to 8 inches depth (or to depth needed to achieve a total depth of 12 inches of uncompacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds	**B. Turf Areas**
i. PRE-APPROVED RATE: Place and rototill 3 inches of composted material into 5 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of soil needed to achieve 8 inches of settle soil at 10% organic content	**i.** PRE-APPROVED RATE: Place and rototill 1.75 inches of composted material into 6.25 inches of soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of soil needed to achieve 8 inches of settled soil at 5% organic content.
Rake beds to smooth and remove surface rocks larger than 2 inches diameter.	Water or roll to compact soil to 85% of maximum.
Mulch planting beds with 2 inches of organic mulch.	Rake to level, and remove surface woody debris and rocks larger than 1 inches diameter

OPTION 3: Stockpile site topsoils prior to grading for reapplication. Amend with organic matter or add topsoil if necessary to achieve required organic content to 8 inches depth.	
Scarification: If placed topsoil plus compost or other organic material will amount to less than 12 inches: Scarify or till subgrade to depth needed to achieve 12 inches of loosened soil after topsoil and amendment are placed. Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds	**B. Turf Areas**
Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission, in approved location, prior to grading.	
Replace stockpiled topsoil prior to planting.	
i. PRE-APPROVED RATE: Place and rototill 3 inches of composted material into 5 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of replaced soil needed to achieve 8 inches of settled soil at 10% organic content	**i.** PRE-APPROVED RATE: Place and rototill 1.75 inches of composted material or into 6.25 inches of replaced soil (a total amended depth of about 9.5 inches, for a settled depth of 8 inches); **ii.** CALCULATED RATE: Place and rototill calculated amount of composted material or approved organic material into depth of replaced soil needed to achieve 8 inches of settled soil at 5% organic content.
Rake beds to smooth and remove surface rocks larger than 2 inches diameter.	Water or roll to compact soil to 85% of maximum
Mulch planting beds with 2 inches of organic mulch or stockpiled duff.	Rake to level, and remove surface rocks larger than 1 inches diameter.

OPTION 4: Import topsoil meeting organic matter content standards.	
Scarify or till subgrade in two directions to 6 inches depth. Entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.	
A. Planting Beds: Use imported topsoil mix containing 10% organic matter (typically around 40% compost).	**B. Turf Areas:** Use imported topsoil mix containing 5% organic matter (typically around 25% compost).
Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.	Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.
Place 3 inches topsoil mix on surface.	Place 3 inches topsoil mix on surface.
Rake beds to smooth, and remove surface rocks over 2 inches diameter.	Water or roll to compact soil to 85% of maximum.
Mulch planting beds with 2 inches of organic mulch.	Rake to level, and remove surface rocks larger than 1 inches diameter.

3.5 INSPECTION AND VERIFICATION

A. Pre-Grading Inspection: Prior to the commencement of site work, contact the Owner and/or Owner's Representative to provide an inspection to verify the delineation and protection of native soils and vegetation to remain in place, and to verify the proposed location for topsoil and material stockpiling. Make corrections and adjustment as directed by the Inspector.

B. Interim Grading Inspection: Prior to the placement of soil amendments, contact the Owner and/or Owner's Representative to provide an inspection to verify that specified erosion control methods have been implemented, the location of stockpiled soil and materials, and that subgrades are consistent with the Soil Management Plan. Make corrections and adjustment as directed by the Inspector.

B. C. Post-Installation Inspection: Prior to planting, contact the Owner and/or Owner's Representative to provide an inspection to verify that the placement of amendments and soil preparation is consistent with the Soil Management Plan. Provide delivery tickets for soil amendments to verify the quantity of material specified on the Soil Management Plan. Make corrections and adjustment as directed by the Inspector.

D. Mulch Placement Verification: At the completion of planting, contact the Owner and/or Owner's Representative to provide a review to verify that mulch has been installed as specified.

E. Secondary Verification for Failing Sites: If the Inspector determines that the installation does not meet the conditions of the approved Soil Management Plan, additional testing by an independent certified soil consultant will be ordered by the Inspector and paid for by the contractor. Make corrections and adjustment as directed by the Inspector.

3.10 FINAL ACCEPTANCE AND PAYMENT

A. Final acceptance and payment for soil preparation will be contingent on the approval of all inspections, and that the soil preparation is consistent with these specifications and with the approved Soil Management Plan.

END OF SECTION

Notes

Learn more at

www.SoilsforSalmon.org

and see additional factsheets for
builders and construction managers at
www.BuildingSoil.org