Natural Drainage Practice Guidelines for Single Family Residential Development

Amended Soil and Post Construction Soil Quality and Depth

Applies to permits issued through December 31, 2012. **Revised March 16, 2012.**

This guideline is designed to help owners of single family homes meet the City of Bellevue requirements for on-site stormwater management (Minimum Requirement #5) using amended soil. This guideline provides design, construction, inspection, and maintenance guidelines for all projects on single family residential property where Minimum Requirements 1 through 5 only apply. Projects that are also subject to Minimum Requirements 6 and/or 7 must be designed by a licensed civil engineer.

City requirements for on-site stormwater management, including amended soils, are provided in Bellevue Storm and Surface Water Code 24.06.065, the current *City of Bellevue Storm and Surface Water Engineering Standards* (*Storm Engineering Standards*) and the current City of Bellevue *Clearing and Grading Development Standards*. See Figures 2.2 and 2.3 in the *Storm Engineering Standards* to determine which Minimum Requirements apply to the project.

This guideline provides hands-on information about:

- What is healthy soil and why does it matter?
- Requirements for "Post Construction Soil Quality and Depth"
- Options for Post Construction Soil Quality and Depth
- Selecting appropriate Post Construction Soil Quality and Depth options
- Testing native soils
- Pre-approved soil amendment rates
- Calculating custom amendment rates
- Preparing permit submittal documents
- Implementing the selected Soil Quality and Depth options
- Maintaining amended soils
- Finding material suppliers and installers
- Inspections required for Post Construction Soil Quality and Depth
- Scheduling inspections
- Resources and contacts

What is healthy soil and why does it matter?

Naturally occurring, undisturbed soil, soil organisms, and vegetation provide important stormwater management functions, including water infiltration and storage, as well as nutrient, sediment, and pollutant removal.

These functions are largely lost when native soils and vegetation are stripped and replaced with low quality soil and sod. Such landscaped areas create polluted runoff because they become compacted, have increased use of pesticides and fertilizers, and concentrate pet wastes and pollutants from adjacent roads and driveways. While restoring soil quality and depth is not as beneficial as preserving naturally occurring soil and vegetation, it does improve on-site stormwater management and water quality.

Questions?

Utilities Permit Center

utilityreview@bellevuewa.gov

425-452-4187

These Guidelines for storm drainage are strictly for use on single family residential projects where Minimum Requirements 1-5 only apply. Minimum Requirements are usually determined by the amount of impervious area (such as driveways or roofs) that will be new and/or replaced. Contact Bellevue's Utilities Permit Center to determine which Minimum Requirements apply to your project.

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Adding compost re-establishes a healthy soil ecosystem and provides increased treatment of pollutants and sediments. It also supports healthy plant growth, reduces the need for fertilizers and pesticides, and prevents pollution.

Requirements for "Post Construction Soil Quality and Depth"

City of Bellevue "Post Construction Soil Quality and Depth" requirements are based on the City's stormwater permit requirements, and are defined in Section D6-03.1(D) of the *Storm Engineering Standards*, and in BMP T5.13 provided in Appendix A2 of the *Clearing and Grading Development Standards.*

On all construction sites that trigger Minimum Requirement #5, at project completion, all areas must meet the Post Construction Soil Quality and Depth requirements if they are:

- Subject to soil or vegetation disturbance, clearing, grading, or compaction; and
- Not covered by impervious surface, incorporated into a drainage facility, or engineered as structural fill or slope.

At project completion, all areas where soil or vegetation has been disturbed must have at least 8 inches of soil containing 5-10 percent organic matter by volume. Because landscaped areas with large plants need richer underlying soil than turf (lawn) grasses, compost amendment requirements differ for turf and landscaped areas:

- 5 percent organic matter for turf or lawn areas.
- 10 percent organic matter for native plant or landscaped areas (such as flower beds or tree and shrub areas);

"Organic matter" is determined in a soil laboratory by measuring soil weight loss after burning (called the Loss-On-Ignition test, described below under "Testing native soils"). Organic matter is expressed as a percent by weight of soil material. If pre-approved compost amendment rates are used, as described below, laboratory tests are not needed.

Once amended, soil areas must be protected from re-compaction, and planting beds must be covered with 2 to 4 inches of mulch or stockpiled duff.

Options for Post Construction Soil Quality and Depth

Different soil treatments 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. The most convenient and economic method for achieving the Post Construction 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. Options for different areas of the site include:

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

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Option 2: Amend existing site topsoil or subsoil in place (see Option D-1 – AMEND below).

- Amend at either the default "pre-approved" rates, or at custom calculated rates based on soil tests.
- If soil tests show that existing soils already meet the requirements, compost may not be needed.

Option 3: Stockpile existing topsoil during grading and replace before planting (see Option D-1 - AMEND below).

- If the proposed site grading activities require that the existing topsoil be stripped and removed, and if construction site has space for it, stockpile the existing topsoil during construction and replace it before planting.
- Stockpiled topsoil must also be amended 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 (see Option D-2 - IMPORT below).

- If the proposed site grading activities require that the existing topsoil be stripped and removed, and if the construction site does not have space for stockpiling, imported topsoil with sufficient organic content and depth can be used to meet the requirements.

Selecting appropriate Post Construction Soil Quality and Depth options

On the site plan sheet, assign one of the following three labels to all areas that will not be covered by impervious surface:

1. **Non-disturbed Area (ND)**
   - Areas covered by vegetation that will not be subject to land disturbing activity or compaction (clearing, grading, storage, stockpiling, vehicles, etc) do not require soil amendment if they are fenced and continuously protected throughout the construction process.
2. **Disturbed Area Option 1 (D-1) – AMEND**
   - Amend existing topsoil to meet Post Construction Soil requirements. Amend existing soil in place or stockpile topsoil, amend, and replace. There are two methods for amending the existing soil in place:
     i. Method 1) Mix a pre-approved rate of compost (as described below). Compost must meet the definition of "Composted Materials" in WAC 173-350 section 220 (available at the Washington State Department of Ecology's website: www.ecy.wa.gov/swfa/compost/). See the section below on finding material suppliers.
     ii. Method 2) Add a custom-calculated amendment rate of compost to meet the organic matter requirement, based on tests of the existing site soil and compost amendment (See "Testing native soils" below). The compost must conform to the WAC 173-350 standards. The completed area must have 12 inches of uncompacted soil depth. (See "Calculating Custom Amendment Rates" below.)
3. **Disturbed Area Option 2 (D-2) – IMPORT**
   Import a topsoil mix that meets the organic matter content and depth requirements. Where the existing soil is too rocky, compacted or poorly drained to amend effectively, you can place 8 inches of topsoil on the surface. Organic matter requirements in topsoil for landscape areas and turf areas differ:

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- For turf areas: a soil mix including 20-25% compost by volume (or topsoil with a lab test showing 5% organic matter by loss-on-ignition test).
- For landscaped areas: a soil mix including 35-40% compost by volume (or topsoil with a lab test showing 10% organic matter by loss-on-ignition test).

Areas assigned to each of these soil management options will be shown on the permit site plan and/or on the Construction Stormwater Pollution Prevention Plan (CSWPPP) erosion and sediment control (ESC) plan, as described below.

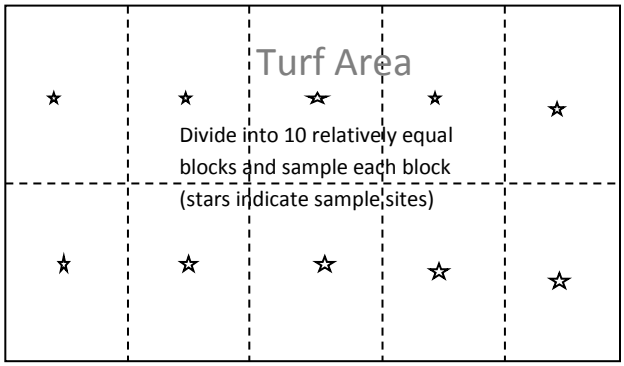
Soil Depth Requirements:
The subsoil must be scarified (tilled) four inches deep prior to placing the topsoil to provide the required 12 inches of un-compacted soil depth. (At project completion, a 3/8-inch diameter probe must penetrate 12 inches driven only by the inspector's weight.)

Where tree roots limit the depth of incorporation of amendments, those root areas are exempted from this requirement only if they are fenced and protected from stripping soil, grading, or compaction to the maximum extent practical.

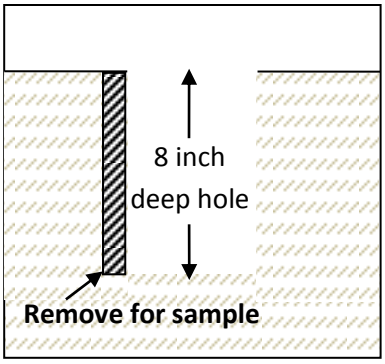
Testing native soils

Use of "Pre-Approved" amendment rates simplifies planning because soil tests are not needed. On sites with healthy soil, soil testing and using custom calculated rates can save substantial effort and expense – easily repaying the expense of testing and performing calculations. Sites with pasture or woodland soils often have adequate organic matter if existing organic layers are preserved. In order to calculate a custom amendment rate, the native soils on-site must be tested for bulk density and percent organic matter by a soil/compost analytical laboratory.

Soils submitted for testing should be a composite of samples taken from several spots on a site. **Gather samples from soil that will represent the final subgrade after all grading operations are completed, before placement of imported topsoil or amendments are added. Use the following sample protocols:**



- Take samples from 10-12 spots in each turf or landscaped area to be compost amended. To do this, 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. For areas smaller than 100 square feet, take only five samples from evenly spaced locations within the area.
- At each sampling spot dig a spades-width hole at least 8 inches deep, then dig out a 1-inch wide section from the side of the hole. Add this soil to a clean plastic sample bucket or bowl.
- Thoroughly mix all of the 10-12 samples from each turf or landscape area together in the 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 the soil/compost analytical laboratory for their requirements in advance.
- Label the bag with the site information, area of sample; plus your name, address, and phone number.
- Take or send it to the laboratory.



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Pre-approved soil amendment rates

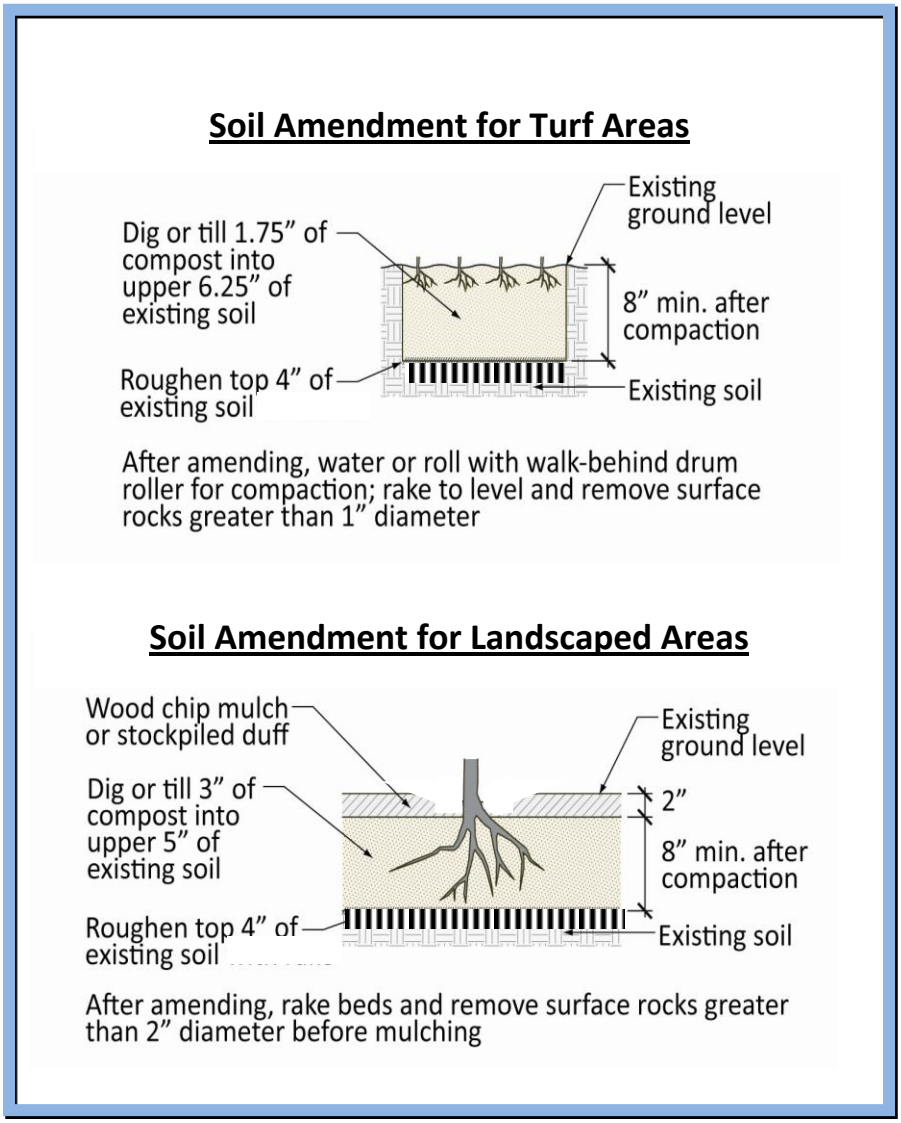
Use the existing site soils, till, and mix with compost at the following pre-approved rates to eliminate the need for testing soil organic matter percentages at a laboratory.

Soil Amendment for Turf Areas Requires:

- 4 inches of scarified subsoil (loosened by tilling).
- 8 inches (minimum depth) of organic-amended soil. The finished un-compacted depth must be 12 inches.
- Spread 1.75 inches of compost and rototill into 6.25 inches of native soil, or 20-25 percent compost by volume in a topsoil mix.
- pH of 6.0 to 8.0, or match the pH of the original undisturbed soil.

Soil Amendment for Landscaped Areas Requires:

- 4 inches of scarified subsoil (loosened by tilling).
- 8 inches (minimum depth) of organic-amended soil. The finished un-compacted depth must be 12 inches.
- Spread 3 inches of compost and till into 5 inches of native soil, or 35-40 percent compost by volume in a topsoil mix.
- pH of 6.0 to 8.0, or match the pH of the original undisturbed soil.



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Calculating custom amendment rates

Most applicants will find it easier to amend at the pre-approved rates described above. On larger sites with higher quality existing soil (higher initial organic matter), you may find it cost-effective to calculate a custom amendment rate to meet the organic matter (determined by laboratory loss-on-ignition test, see "Testing native soils" above) requirements:

- 5 percent organic matter for turf areas
- 10 percent organic matter for landscaped areas

Calculating a custom amendment rate requires laboratory tests of soil bulk density and organic matter, and compost bulk density and organic matter.*

**Acceptable test methods for determining loss-on-ignition soil organic matter (OM) include the most current version of ASTM D2874 "Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils," and TMECC 05.07A "Loss-On-Ignition Organic Matter Method." For a list of labs qualified to conduct these tests go to: http://www.puyallup.wsu.edu/soilmgmt/Pubs/Analyt_Labs_PNW_EB1578E.pdf*

The Washington Department of Ecology-approved method for calculating custom amendment rates is described on pages 18-19 of the guide, *Building Soil: Quality and Depth BMP T5.13* in the *Stormwater Management Manual for Western Washington*. The guide is available on two websites: www.buildingsoil.org (for builders) and www.soilsforsalmon.org (with more resources for designers). These websites also have a spreadsheet that will perform the custom amendment calculations, and other resources.

Preparing permit submittal documents

The Site Plan and Construction Stormwater Pollution Prevention Plan (CSWPPP) need to be prepared as part of the permit application prior to disturbing any soil or vegetation per the *Clearing and Grading Development Standards*. The *Clearing and Grading Development Standards* contain templates that can be used to develop a CSWPPP. Soil management areas, as described above, must be represented in the Erosion and Sediment Control (ESC) Plan Sheet or on the site plan, as well as other items. See the *Clearing and Grading Development Standards* for the permit submittal requirements.

Implementing the selected Soil Quality and Depth options

1. **Non-disturbed Area (ND)**
   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.
2. **Disturbed Area Option 1 (D-1) – AMEND**
   Till the subgrade to a depth of 8 inches (or to a depth needed to achieve a total depth of 12 inches of uncompacted soil after the calculated amendment amount is added). Till the entire surface. Do not till within a drip line of existing trees to be retained. Amend the soils to meet the required organic content for either landscape areas or turf areas using a pre-approved or custom calculated rate, as follows:

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Amend Existing Site Topsoil	Landscape Areas	Turf Areas
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).	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).
Custom Calculated Rate	Place the 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.	Place the 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.
Notes	Rake to smooth and remove surface rocks larger than 2 inches in diameter, and mulch with 2 inches minimum of organic mulch.	Settle or firm soil by watering using a lawn sprinkler for day before seeding, rake to level and remove surface woody debris and rocks larger than 1 inch in diameter

If amending stockpiled topsoil, and the placed topsoil plus compost or other organic material will amount to less than 12 inches, till the subgrade to the depth needed to achieve 12 inches of loosened soil after the topsoil and amendment are placed. Replace the stockpiled topsoil prior to planting and amend if needed to meet the required organic content.

3. Disturbed Area Option 2 (D-2) – IMPORT

Till the subgrade in two directions to a depth of 6 inches, disturbing the entire surface. Do not till within a drip line of an existing tree to be retained.

For landscape areas:

1. Use imported topsoil mix which contains sand or sandy loam and 10% organic matter (typically around 40% compost).
2. Place 3 inches of imported topsoil mix on the surface and till into 2 inches of soil.
3. Place second lift of 3 inches topsoil mix on surface.
4. Rake beds to smooth, and remove surface rocks over 2 inches diameter.
5. Mulch landscape area with 2 inches of organic mulch. Do not mulch closer than 2 inches to tree trunks.

For turf areas:

1. Use imported topsoil mix containing 5% organic matter (typically around 25% compost). The soil portion must be sand or sandy loam.
2. Place 3 inches of imported topsoil mix on the surface and till into 2 inches of soil.
3. Place second lift of 3 inches of topsoil mix on the surface.
4. Methods for settling and firming soil prior to seeding or placing sod include rolling with a water-filled lawn roller or watering using a lawn sprinkler for one hour the day before seeding. Mechanical compaction is not recommended.
5. Rake to level, and remove surface rocks larger than 1 inch diameter.

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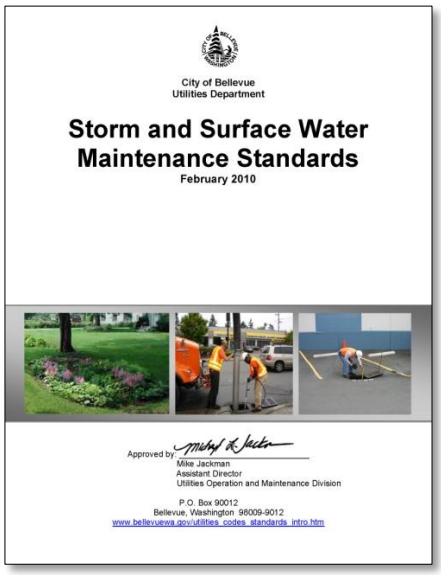
Maintaining amended soils

Toward the end of construction, you should establish the soil quality and depth as described above. Once placed, you should protect them from compaction, such as from large machinery use, and from erosion. Plant and mulch the soil after installation. Leave plant debris on the soil surface to replenish organic matter and limit the use of irrigation, fertilizers, and pesticides.

For more information on maintenance of amended soils, refer to the *Utilities Storm Maintenance Standards, City of Bellevue Utilities Department,* Section M3-06, page 58.
http://www.ci.bellevue.wa.us/doc_library.htm


City of Bellevue
Utilities Department

Storm and Surface Water Maintenance Standards
February 2010

Approved by: Mike Jackman
Assistant Director
Utilities Operation and Maintenance Division

P.O. Box 90012
Bellevue, Washington 98009-9012
www.bellevuewa.gov/utilities_codes_standards_intro.htm

Finding material suppliers and installers

"Compost" and "Topsoil" headings in phone directories list local suppliers. The Washington Department of Ecology (www.ecy.wa.gov/) also maintains a list of composting facilities and compost products that meet City requirements on its website. The list and other resources are also available in the Building Soil Guide, available at www.buildingsoil.org or www.soilsforsalmon.org.

Mulch can include any coarsely chopped woody vegetation, including trunks, branches, bark and leaves. Chipped wood from an arborist is commonly used, and can often be delivered free of charge by calling a local arborist. Be sure the material does not contain weed seeds, soil, roots, or other debris. Do not use chips containing English ivy or holly because they may spread these noxious weeds. Decorative bark is also not allowed.

Soil amendment or amended topsoil installation can be done by landscape contractors, other contractors with the appropriate equipment and experience, or by a property owner.

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Inspections required for Post Construction Soil Quality and Depth

First Inspection (Clearing and Grading Precon/Jobcon)
You must schedule this inspection prior to any earth disturbance. This table will help you prepare for the first inspection.

DO NOT BEGIN EARTH DISTURBANCE OR VEGETATION CLEARING PRIOR TO THIS INSPECTION

Builder Requirements:	Inspector Requirements:	Note:
Have the approved plan set on site.	Look over approved plan set.	If the approved set of plans is not on-site, the inspection cannot be conducted and must be rescheduled.
Have knowledge of the impervious material, details, areas, and quantities.	Verify allowed impervious surface per plans.	Changes to the approved square footage will require re-sizing the stormwater management plan and plan revision submittals may be required.
Carefully read the Construction Stormwater Pollution Prevention Plan (CSWPPP) narrative and review the site plan and the Erosion and Sediment Control (ESC) Plan.	Go over the CSWPPP narrative, the site plan, and ESC Plan with the Owner or Owner's Representative.	
Verify the property pins are in place and visible at lot corners.	Discuss setbacks of Natural Drainage Practice (NDP) facilities.	No setbacks required for amended soils.
Have a construction sequencing, staging and NDP protection plan prepared.	Discuss NDP protection strategy.	
Determine Non-disturbance (ND) areas to be protected from construction impacts.	Verify ND areas and square footage on Site Plan and ESC plan sheet.	
Identify Soil Management Options D1 or D2 for landscape areas and turf areas.	Discuss post construction soil management plan, verify D1, D2 square feet.	D1 is amending existing soil on-site with compost. D2 is importing a compost amended topsoil mix.
Areas identified as non-disturbance (ND) on the plan set must be protected during construction with sturdy fencing.	Look at areas identified as ND and discuss how they will be protected throughout construction.	If any ND areas are affected during construction, then they shall be amended and inspected as required for disturbed areas.
Install approved ESC measures including tree protection prior to start of work.	Discuss ESC requirement and expectations.	No tracking/dirt/debris allowed in the right of way (ROW). Use dust control at all times.

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Site Final Inspection

The final site inspection must occur prior to the building permit final approval. To help you prepare, the table below describes your responsibilities.

Builder Requirements:	Inspector Requirements:	Note:
Have the approved plan set on site.	Evaluate the permanent erosion control.	The inspection cannot be conducted without the approved site plan.
Measure and provide certification of the impervious square footage.	Verify the as-built impervious surface matches or is less than the design plan and assumptions.	Builder to certify impervious area (certification form).
Show how non-disturbed areas have been protected throughout construction.	Verify non-disturbed areas remained protected throughout construction.	No storage, vehicular traffic, clearing, grading or other impacts are allowed on ND areas.
Provide original delivery tags of compost, topsoil, and mulch showing supplier, quantity, type of material, and delivery location.	Verify compost, topsoil, and mulch came from an approved supplier. Make sure that total quantities meet or exceed the required amount shown on the approved site plan and CSWPPP.	
Based on the approved site plan and/or CSWPPP, ensure that the site has been properly amended and the planting beds/turf areas are planted. Be prepared to dig holes (one cubic foot in size) where the inspector designates, to verify mulch, topsoil/compost and scarified subgrade.	Choose location of test holes to be dug in both planting beds and turf areas. Verify profile of mulch, topsoil/compost and scarified subgrade. Test several locations with a probe rod to verify 12 inches of probe penetration. The probe should be driven easily solely by the weight of the inspector to a depth of 12 inches below the mulch layer.	The test holes and 12 inch probe test should verify 8 inches of top soil/compost soil mix, and 4 inches of scarified (loosened) subgrade. There shall be a minimum of 2 inches and a maximum of 4 inches of mulch on top of the topsoil/compost mix in landscape areas. Mulch shall be kept 1-2 inches away from all trunks of trees.
Follow the approved Site Plan and/or CSWPPP and provide a scaled redline of any changes made to the approved plan set.	Ensure the site plan and/or CWPPP has been followed and that any and all changes were approved and properly documented on the plan sheet.	
Schedule additional inspections as needed.	Assess the need for additional inspections.	

Scheduling inspections

To schedule an inspection, call 425-452-6875 and press 1, or go online to www.mybuildingpermit.com. Enter your Clearing & Grading permit number and use inspection code 100 for Precon/Jobcon and 124 for Final Inspection. You can schedule inspections up until 6:00 am the morning of the day of the inspection. The inspector will arrive between 8:00 am and 3:30 pm. To find out the estimated inspection time, contact the inspector at 425-452-4570 between 7:00 am and 8:00 am on the day of the inspection.

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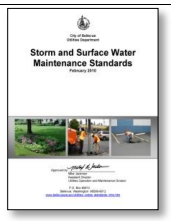
Resources and contacts

Applicants are encouraged to call or visit the City Hall permit desk to discuss their project prior to submittals.

Resources		Web Link
City of Bellevue Storm and Surface Water Engineering Standards		http://www.bellevuewa.gov/pdf/Utilities/2012_Surface_Water_Std.pdf
City of Bellevue Storm and Surface Water Utility Code		http://www.codepublishing.com/wa/bellevue/?/Bellevue24/Bellevue24.html
City of Bellevue Clearing and Grading Development Standards		http://www.ci.bellevue.wa.us/clearing-grading-standards.htm
City of Bellevue Clearing and Grading Code		http://www.codepublishing.com/wa/bellevue/?/Bellevue23/Bellevue2376.html#23.76
City of Bellevue Storm and Surface Water Maintenance Standards		http://www.ci.bellevue.wa.us/pdf/Utilities/Utilities_Storm_Maintenance_Standards_Feb_2010.pdf
Soil Management for Builders		www.buildingsoil.org
Soil Management for Designers		www.soilsforsalmon.org
Washington Department of Ecology Permitted Compost Facilities:		www.ecy.wa.gov/programs/swfa/compost

Key contacts:

Clearing & Grading Permit Center	clearandgradereview@bellevuewa.gov	425-452-4570
Utilities Permit Center	utilityreview@bellevuewa.gov	425-452-4187
Inspection Requests	http://www.bellevuewa.gov/schedule_an_inspection.htm	425-452-6875

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