



Soil Profile Rebuilding Specification

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Specification for Restoration of Graded and Compacted Soils that will be Vegetated

Based on Specifications developed At Virginia Polytechnic Institute- Department of Horticulture

1. PURPOSE AND DESCRIPTION

1.1 Purpose

Soil Profile Rebuilding is an appropriate soil restoration technique for sites where topsoil has been completely or partially removed and subsoil layers have been compacted (graded and/or trafficked by equipment). It may also be used with some modifications if topsoil is present. This is not an appropriate technique in sites with surface compaction only (6 inches or less), although this situation is rare on construction sites. This technique is not appropriate within the root zones of trees that are to be protected. Soil Profile Rebuilding can improve physical and biological characteristics of soil to allow for revegetation. Soil chemical problems, soil contamination from heavy metals, pathogens, or excessive debris or gravel shall be addressed separately.

1.2 Description of Procedure

The procedure includes a subsoiling procedure, addition of organic matter in the form of compost, replacement or addition of topsoil, and subsequent planting with woody plants. The soil preparation portion of Soil Profile Rebuilding puts the components in place for restoration to characteristics similar to undisturbed soils, however, the complete restoration process requires root activity and occurs over many years. This technique may be appropriate for restoration of disturbed soils as defined by SITES™.

1.3 Expected Outcomes

Soil Profile Rebuilding may improve vegetation establishment, increase tree growth rates, increase soil permeability, enhance formation of aggregates in the subsoil, and enhance long-term soil carbon storage.

2. PROCEDURE

2.1 Location

Profile Rebuilding shall occur on all soil areas that are to be vegetated that have been disturbed by trafficking or grading during construction or prior to construction. Soil areas that are not to be treated should be protected by permanent fencing during the construction period, and all access to these areas prohibited. A soil map delineating protected areas and areas to be treated shall be approved by the forestry inspector before grading or construction begins.

2.2 Sequencing

Profile Rebuilding shall occur after site disturbance is complete, including all vehicle and equipment trafficking, but before replacement of topsoil. Once profile rebuilding is complete, all traffic and equipment or materials storage on treated areas is prohibited, with the exception of foot traffic, for the purposes of planting or mulching. If topsoil is already present and is 4 inches or greater in depth, use the "modifications for pre-existing topsoil (2.62)."

2.3 Remove foreign materials

Remove all foreign materials resulting from construction operations, including oil drippings, stone, gravel, and other construction materials from the existing soil surface.

2.4 Application of Compost

Spread mature, stable compost to a 4 inch depth over compacted subsoil (see Section 3. Definitions for definition of compost).

2.5 Subsoiling

Subsoiling may be performed when soil is neither wet nor dry. If a shovel cannot be forced into the soil, it is too dry. If the surface is sticky or muddy, it is too wet. Use a mini-backhoe or similar equipment with a narrow (less than 24"), tined bucket to break up the compacted soil and incorporate the compost. Work backwards away from excavated soils so that treated soil is not trafficked by the equipment. Insert the bucket through the compost layer and into the subsoil to a depth of thirty-inches (36"), and raise a bucket of soil at least twenty-four inches above the soil surface.

Tip the bucket and allow soil to fall. Repeat this procedure until no clumps of compacted soil larger than 12 inches in diameter remain. The tines of the bucket can be used to break apart larger clumps if necessary. 50% of the soil shall be in clumps 6 inches or smaller. No clumps shall be greater than 18" in diameter. The subsoiling is not intended to homogenize the compost and soil, but rather loosen the soil to a thirty-six inch depth and create veins of compost down to that depth as well. To ensure that subsoiling reached the appropriate depth, a push tube soil sampler shall be used to verify compost is present at thirty-six inch depth.

2.6 Replacement of topsoil

2.6.1 Standard procedure

Stockpiled topsoil, or additional topsoil if none is available from the site, shall be returned to the site to a four (4) inch minimum depth (see *Section 3.3 Definitions* for definition of topsoil). If soil was severely disturbed (see definitions), a six (6) to eight (8) inch minimum shall be replaced with topsoil that meets city standards.

2.6.2 Modification if significant topsoil is already present before Profile Rebuilding is initiated

Case 1:

At least four inches of topsoil is present on the site after construction activities are completed AND soil is not severely disturbed (see *Section 3.3 Definitions* for description of severely disturbed).

Case 2:

Less than four inches of topsoil is present on site after construction activities were completed but before Profile Rebuilding is initiated, OR soil is severely disturbed (see *Section 3.3 Definitions* for description of severely disturbed).

For Case 1: A minimum of three inches additional topsoil shall be placed over the subsoiled layer before tilling.

For Case 2: Follow *Section 2.6.1 Standard procedure*, as if no topsoil had been present.

2.7 Tilling

Rototill topsoil to a depth of six to eight inches when soil is neither dry nor very moist. Rototilling depth should cross the interface with the subsoiled layer by a minimum of one (1) inch and can be verified with a random sampling with a push tube soil sampler.

2.8 Planting

Plant the site with woody plants, trees or shrubs, at a density that insure a minimum of 50% of the site will be occupied with roots within 10 years. Planting of at least one large stature tree (e.g., one that will mature at approximately 60-70 feet in height) or 20 medium stature shrubs per 5,000 sq. ft. shall be considered to achieve this.

3. DEFINITIONS

3.1 Topsoil

Soil can be considered topsoil if it originates from an A horizon of a natural soil or is a mineral soil with 4-6% organic matter content, and a NRCS textural class similar to pre-development conditions A horizon soils for the site, or as specified by the City Forestry Division. The city Forestry Division will specify a LOAM texture in the absence of native conditions listed above. Blended soils shall not be used unless specified by the City Forestry Division. In addition, topsoil shall:

1. Be friable and well drained
2. Have a pH between 5.5-7.
3. Have an organic matter content between 4-6%.
4. Have low salinity as indicated by a soluble salt content which is less than 3 dS/m
5. Be free of debris, stone, gravel, trash, large sticks, heavy metals, and other deleterious contaminants, (if screening is used to remove debris, screen size must be ¾ inch or larger).
6. Have a nutrient profile such that it has an adequate rating, per current industry standards.
7. Be free of noxious weed seeds

3.2 Compost

Compost shall be composed of leaves, yard waste, or food waste. Biosolid-based composts shall not be used. A compost sample with analysis shall be submitted for approval to the City Forestry Division before application.

Stability refers to the rate of biological breakdown, measured by carbon dioxide release. Maturity refers to completeness of the aerobic composting process and suitability (lack of plant toxicity) as a plant growth media, often measured by ammonia release and by plant growth tests. Compost manufacturers that subscribe to the US Composting Council's testing program may document stability as compost testing 7 or below in accordance with TMECC 05.08-B, "Carbon Dioxide Evolution Rate". Maturity (suitability for plant growth) may be documented as compost testing greater than 80% in accordance with TMECC 05.05-A, "Germination and Vigor". Compost is considered mature and stable if it tests at 6.0 or higher on the Solvita Compost Maturity Index Rating, which is a combination of Carbon Dioxide and Ammonia Maturity Tests (test information and equipment available at www.solvita.com).

Compost shall also:

1. Free of weed seeds.
2. Free of heavy metals or other deleterious contaminants.
3. Have a soluble salt content which is less than 3 dS/m.

3.3 Severely Degraded Soil

Soil shall be considered *severely degraded* if grade was lowered or raised more than 14 inches OR soil was compacted in lifts regardless of the final grade OR was used as a staging area for construction materials, equipment or processes.

4. SUBMITTALS

4.1 Soil Map

A soil map indicating soil areas to be protected and those to be restored via Soil Profile Rebuilding shall be submitted by the contractor for approval to the City Forestry Division before construction begins.

4.2 Compost

A compost sample with analysis certifying it is stable, mature, from acceptable feedstocks and free of contaminants and weed seeds shall be submitted for approval to the City Forestry Division before compost is applied to the soil.

4.3 Topsoil

A topsoil sample with analysis from a certified testing laboratory and verification of source shall be submitted for approval to by the City Forestry Division before application. Separate documentation is required for each 100 cubic yards of topsoil unless otherwise approved by the City Forestry Division.

5. REFERENCES & PERMISSIONS

Use of this specification has been documented to increase tree canopy and soil carbon stores compared with typical practices. See www.urbanforestry.frec.vt.edu/SRES for more information.

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