

# Soil Profile Rebuilding

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

### CSI Div 2

### CSICode-02910-Plant Preparation-Soil Preparation

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### 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 owner, arborist, or landscape architect 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.”

### **2.3 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 (see Section 3. Definitions for definition of compost) to a 4 inch depth over compacted subsoil.

### **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 backhoe rearbucket or similar equipment with a 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 24 inches and raise a bucket of soil at least 24 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 24-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 24 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 4 inch minimum depth (see *Section 3.3 Definitions* for definition of topsoil). If soil was severely disturbed (see definitions), a 6-8 inch minimum shall be replaced.

### 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 4 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 3 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 6-8 inches when soil is neither dry nor very moist. Rototilling depth should cross the interface with the subsoiled layer by a minimum of 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 3% or greater organic matter content and a NRCS textural class similar to pre-development A horizon soils for the site or as specified by the owner, arborist, or landscape architect. Blended soils shall not be used unless specified by the owner, arborist, or landscape architect. In addition topsoil shall:

1. Be friable and well drained

2. have a pH between 5.2 and 7.5 (a narrower range may be specified for particular plant material)
3. have an organic matter content not less than 3%
4. have low salinity as indicated by an electrical conductivity of less than 4.0 mmhos/cm
5. be free of debris, stones, 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 is able to support plant growth
7. be free of noxious weed seeds

### **3.2 Compost**

Compost feedstock shall be leaves, yardwaste, or foodwaste. Biosolid-based composts shall not be used. A compost sample with analysis shall be submitted for approval to the client 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](http://www.solvita.com)).

Compost shall also:

1. Free of weed seeds
2. Free of heavy metals or other deleterious contaminants
3. Have an EC of less than 4.0 mmhos/cm

### **3.3 Severely Disturbed Soil**

Soil shall be considered *severely disturbed* if grade was lowered more than 14 inches OR soil was compacted in lifts regardless of the final grade.

## **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 by the owner, arborist, or landscape architect 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 landscape architect or owner 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 the landscape architect or owner before application. Separate documentation is required for each 100 cubic yards of topsoil unless otherwise approved by the landscape architect or owner.

## **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](http://www.urbanforestry.frec.vt.edu/SRES) for more information.

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