



# Topsoil Testing Procedure

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## Background

Topsoil quality is an important consideration during project design, construction and revegetation. Topsoil quality improves native plant establishment and reduces long-term roadside maintenance. Design decisions made in the development of the Stormwater Management Plan (SWMP) and during construction have long term impacts on vegetation establishment, erosion and sediment control. In Colorado's arid climate, an inch of topsoil takes over 100 years to develop. Topsoil supports native plant growth, suppresses weeds and decreases surface erosion by increasing infiltration. Additional topsoil functions include: storage of precipitation for resilient plant communities, breakdown of biomass and sustainable nutrient cycling, biological decomposition of pollutants, and moderation of peak stream flows after precipitation events.

## Purpose

This procedure provides SWMP designers with direction on how to plan, collect, and test topsoil for successful restoration. Inventory and testing provide critical data to determine the topsoil management strategy during the design phase.

For most projects, existing topsoil depth is shallow but present in sufficient volume to make topsoil management a top priority. It is beneficial to salvage, protect and redistribute topsoil stockpiles on site. Unfortunately, not all project sites will have topsoil of sufficient quantity and quality to justify a topsoil management strategy. Past factors such as environmental stressors and previous topsoil mismanagement have caused irreplaceable topsoil loss in some areas. The design team should carefully consider the benefit and feasibility of managing existing topsoils.

For projects that have existing topsoil, this inventory and analysis will enhance the success of revegetation through analytical laboratory analysis to select appropriate soil amendments and seed selections. With enhanced revegetation best practices, projects can successfully achieve 70% of the preexisting vegetation and be able to close out the project stormwater permits.

Refer to Chapter 4, Section 4.4 Roadside Revegetation for the detailed background on Topsoil sampling and revegetation.

## PRESAMPLING PLANNING

Topsoil inventory and field collection can occur year-round but requires pre-planning. The first step is to determine the number of revegetation units within the project's Limits of Disturbance Area (LDA) early in the design process. Revegetation units are areas within the LDA with distinctly different characteristics. Large projects with greater landscape diversity may have the potential to have a few revegetation units. SWMP Designers should consider the following to determining the amount and location of revegetation units for the project:

## Topsoil Testing Procedure

- significantly different soil types
- microclimates
- vegetation types
- slope gradient and aspect
- drainage patterns
- management needs

During the Field Investigation Review (FIR) meeting, the SWMP designer should discuss with regional environmental staff the proposed number revegetation unit(s) on the project. Each revegetation unit should be tested separately. If possible, conduct topsoil inventory and sampling at the time of the FIR meeting. Soil conditions should not be frozen or overly moist at the time of sampling.

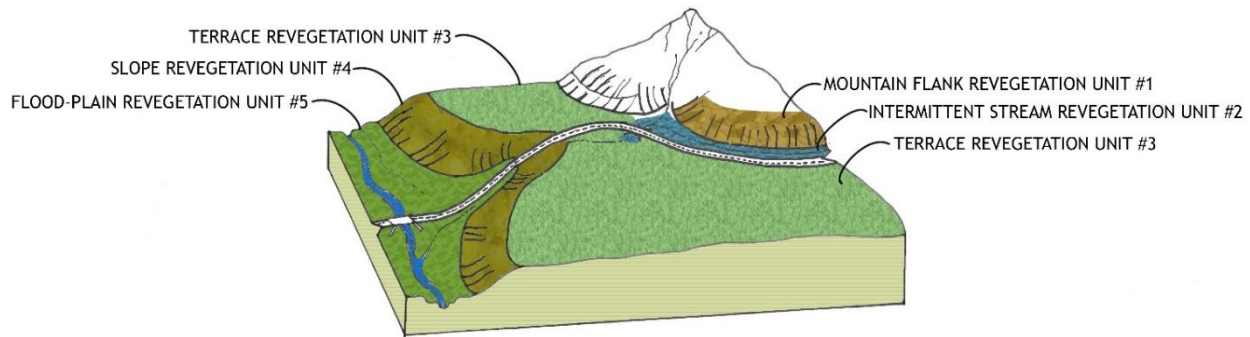


Illustration of Revegetation Units

For an inventory of existing topsoil depths, the SWMP designer will have to select locations for topsoil pits. The topsoil pits are used to determine the topsoil depths for salvage and stockpile during construction. For most projects, six topsoil pits in each revegetation unit will be sampled for an accurate representation of the site topsoil. A sample is taken from each pit within the revegetation unit, the soil is mixed and a composite sample is taken, minimizing testing costs.

If the determined soil management strategy is to salvage and stockpile on-site, the locations of the soil pits and depths of topsoil should be shown in the SWMP Initial Site Maps.

As part of inventorying topsoil depths for the revegetation unit, the designer should also identify and note if the topsoil surface contains areas of litter and duff. Litter and duff is the layer of fresh and decomposed needles and leaves covering the ground surface of forest and shrub plant communities. This organic material is a valuable source of seeds and nutrients. Based on the site assessment of desirable or problematic preexisting plant species, the direction should be given to either stockpile litter and duff with the topsoil or dispose of it offsite. Document the topsoil stockpiling strategy for each of the revegetation units on the SWMP site maps.



## Topsoil Testing Procedure

The laboratory soil analysis identifies problems such as high salinity or extreme pH, along with nutrient organic matter levels. If salvaging and stockpiling topsoil, the soil analysis will be used to specify soil amendments and assist with determining the appropriate plant species.

### SENDING SAMPLES TO LABORATORY FOR TESTING

Print out the form found on the LA webpage (link below table). Complete the form prior to shipping or dropping off sample. An example of a pre-filled form can also be found on the Landscape Architecture website.

All costs associated with shipment and testing will be the responsibility of the consultant developing the SWMP. If testing completed by CDOT, shipment and testing will be the responsibility of the project. Test results will be available in 1-2 weeks, allowing sufficient time to interpret the results and include recommendations on the Final Office Review (FOR) plans.

Soil samples should be hand delivered or shipped for overnight delivery on the same day as collected. Keeping samples in the shade or in a cooler with ice will help prevent excessive heating. It is important to keep samples cool during warm weather. The nitrogen results can change dramatically if the samples are allowed to overheat.

Laboratories accepting overnight samples:

<b>LABORATORY NAME</b>	Colorado State University Soil, Water and Plant Testing Laboratory	Colorado Analytical Laboratories, Inc.
<b>SHIPPING ADDRESS</b>	200 West Lake Street, A320 NESB 1120 Campus Delivery Fort Collins, CO 80523-1120	10411 Heinz Way Commerce City, CO 80640 <i>Or</i> 12860 W. Cedar Dr. #101 Lakewood, CO 80228
<b>VENDOR #</b>	2000008	1104973
<b>PHONE NUMBER</b>	970-491-5061	303-659-2313
<b>WEBSITE FOR ADDITIONAL INSTRUCTIONS**</b>	<a href="http://www.soiltestinglab.colostate.edu/documents/soilsample_horticulture.pdf">http://www.soiltestinglab.colostate.edu/documents/soilsample_horticulture.pdf</a>	<a href="http://coloradolab.com/services/soilanalysis/">http://coloradolab.com/services/soilanalysis/</a>
<b>REQUEST THE FOLLOWING TESTS</b>	Routine Garden and Landscape Soil Test (Reclamation Application), Add Sodium Evaluation, and Sulfate-Sulfur	Complete Nutrient Test
<b>ESTIMATED COST</b>	\$50	\$58

\*\*Examples of completed soil sample submitted forms for both CSU Lab and Colorado Analytical Lab can be found on the Landscape Architecture website:  
[www.codot.gov/programs/environmental/landscape-architecture](http://www.codot.gov/programs/environmental/landscape-architecture)



# Topsoil Testing Procedure

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## FIELD INVENTORY AND TESTING PROCEDURE

Prior to collection determine where you sending or dropping off samples and hours of laboratory or post office. Print form and complete. Have FedEx, UPS or USPS overnight box and mailing label ready. Place form in the box with the bagged soil samples. Do not put form in soil sample bags.

### Field supplies you will need for collection

- box for mailing/pre addressed label
- six (6) 1-gallon plastic bags
- sharpie
- clean, rust-free spade shovel (do not use galvanized or brass implements).
- 5 gallon bucket, clean
- cooler to keep samples cool
- notebook to note depth of topsoil at each revegetation unit and litter and duff

## TOPSOIL DEPTH INVENTORY

Conduct a topsoil depth inventory at each of the selected revegetation unit locations by digging a pit at each location. Using a clean rust-free spade or shovel, dig a pit. The sides of the pit should be straight down and not cut at an angle. Overall pit depth is based on the visual indicators of topsoil layer, but should range between 1" to 6" in depth.

Use the following four indicators to assist with inventorying topsoil depths:

1. **Color** - Brownish or darker colors near the surface. When tones or distinct color change occurs, it generally indicates topsoil has ended. Moisture darkens the soil, therefore conditions after precipitation may make identification more difficult.

## Topsoil Testing Procedure

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Picture of visually distinct color differences between topsoil and subsoil

2. **Native Grass Roots** - Fine dense mass of roots from native grasses is a useful visual indicator of topsoil. However, isolated roots from shrubs and trees can penetrate well beyond the Topsoil layer.



Picture showing fibrous roots identifying topsoil depth in a pit

3. **Topography Location** - Deeper topsoil depths are usually located in drainages and floodplain areas, especially on undeveloped sites. Steep slopes and previous roadway cut conditions usually have less topsoil.



## Topsoil Testing Procedure

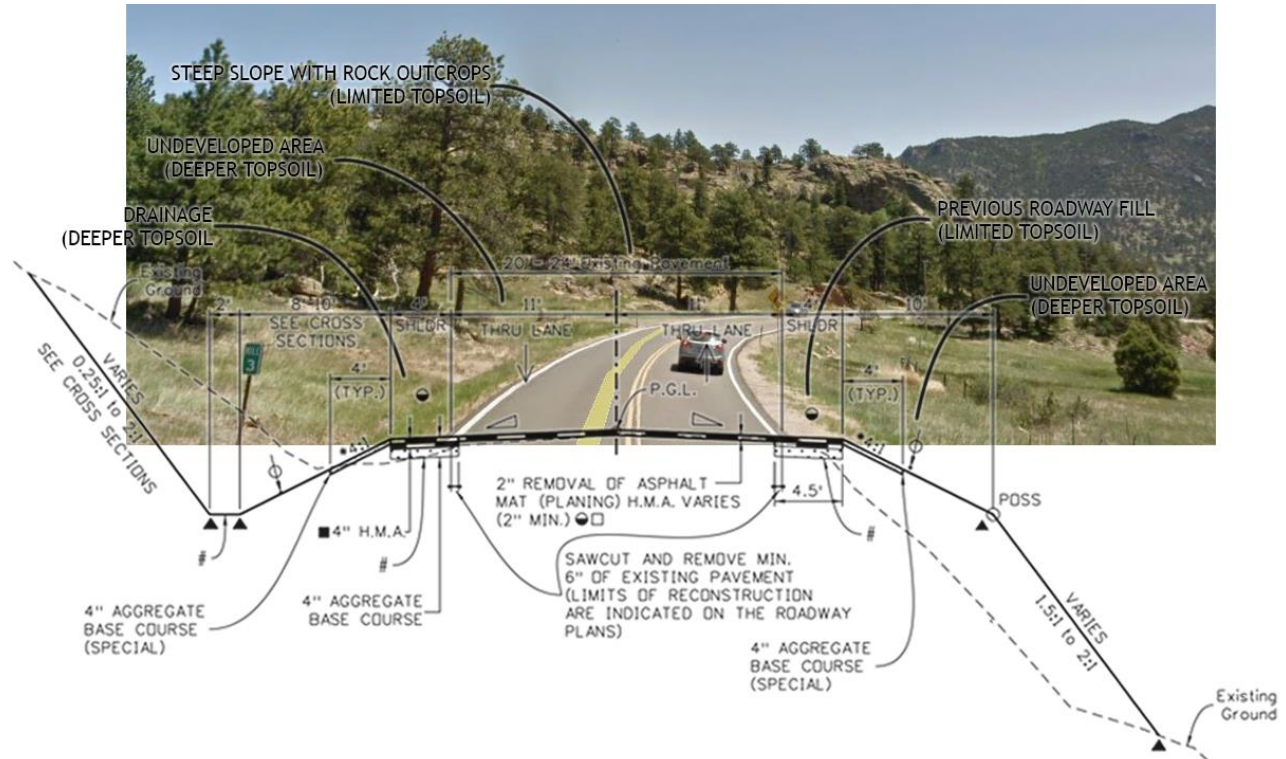


Illustration of how topography can effect topsoil depth

**4. Topsoil Structure and Texture** - Topsoil has a more balanced physical texture than the parent subsoil material. Topsoil layers have consistent texture s. Subsoils, especially in high clay conditions will have an irregular blocky appearance. Using the USDA textural classes, topsoil would be classified in the loam range.

## Topsoil Testing Procedure



Visually distinct texture and structure differences between topsoil and subsoil

Note the litter and duff layer.

### SAMPLE COLLECTION

- To collect a representative slice from each of the soil pits, use the spade and cut a ½" thick slice, straight down and not angled, from of the side of the soil pit. Evenly sample the topsoil based on the determined depth. For example, if the topsoil depth is 4", sample the entire 4" equally (see diagram).
- Remove any plant material (leaves, twigs, etc.) from the sample.
- Place the six (6) samples from each test pit into a bucket and thoroughly mix with the shovel, removing plant debris and breaking up clods. Remove approximately 3 cups of the sample and place into a one-gallon zipper-seal plastic bag. This is the composite sample from the six test pits for the revegetation unit.
- Label the plastic bag with the name and telephone number of SWMP designer/sample collector, revegetation unit #, project construction code and approximate Mile Marker Post.
- Repeat the inventory and soil sampling procedure for each vegetation unit. Use a separate plastic bag for each vegetation unit sampled.
- Keep samples cool by leaving in shade and/or place in a cooler with ice.

## Topsoil Testing Procedure

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Picture of collection from a soil pit.

Contact the landscape Architecture Section with any question on how to use the guidance, comments or suggestions.