



## 3 Restore Disturbed Soils

Disturbed soils (i.e. any soil in a town, city, or other historically populated area) tend to get compacted by vehicular or, in the case of clayey soils, even foot traffic. Compaction reduces spaces in the soil where water can infiltrate, which has several impacts to water quality & availability<sup>1</sup>.

- Rain falling on compacted soil can no longer be absorbed and conveyed downhill in the soil, but instead runs off, carrying pollutants with it.
- Plant establishment depends on roots' access to air and water in spaces within the soil (voids).
- Landowners often respond to unhealthy plants by applying chemicals like pesticides, herbicides, and fertilizers and by watering more.

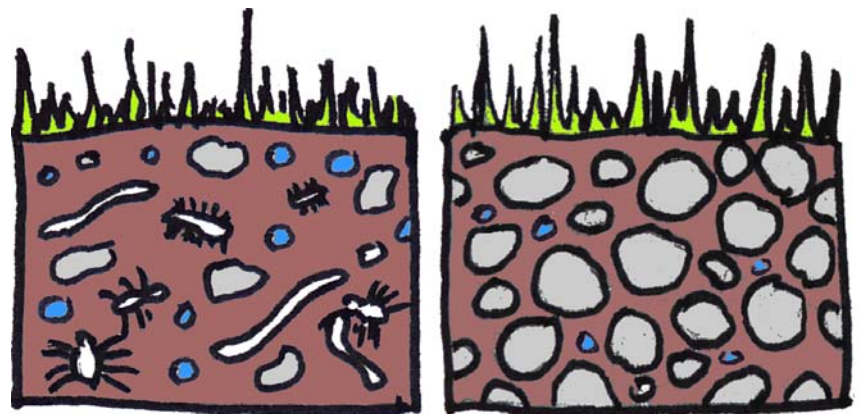
In studies done by Washington State University Extension Services, simply ripping/disturbing, without folding in compost, allows the soil to slump back into a compacted state. These studies found that when disturbed soils were properly amended with compost and finished in lawn or shrubs in a landscape area, the areas responded to rainfall events as if they were 50% - 80% forested, respectively, and remained permeable (allow water to soak in) over time. This method of soil restoration in developed areas is recommended to regain greater stormwater functions, provide increased treatment of pollutants and sediments, and minimize the need for some landscaping chemicals, thus reducing pollution through prevention<sup>2</sup>. The practice of amending these soils is a simple, cost-effective practice for restoring and preserving the long-term permeability of compacted soils. The practice is also a great way to conserve water.



**Figure 1. Compost amendment of disturbed soils reduces long-term maintenance and irrigation, reducing or eliminating the need for pesticides and herbicides.**

### Cost Benefits

Real estate agents estimate that the landscape is about 5-10% of the total sales price of a house. This practice can cost as little as \$1,000/lot during construction<sup>3</sup>. Long-term irrigation demand can be cut by 50% with a payback period of 3-7 years, which is a selling point for landowners. Stockpiling topsoil for use later as an ingredient in the compost amendment can save money in hauling costs.



**Figure 2. Left: Beneficial soil animals, from tiny microbes to beetles and larger fauna, chemically break down some pollutants and provide nutrition to plants. As they move through the soil, they protect long-term permeability and promote soil formation. Right: Compacted soils have fewer to no voids to store air and water needed to sustain soil animals.**



## Where to Amend

Compost amended soils should be used anywhere soils have been disturbed and where a future landscape area is proposed. Compost amendment should not be performed under tree canopies or other established landscape areas to be preserved since the tilling process will damage roots. Any kind of soil will benefit from compost amendment, but in particular, watersheds with clay will benefit the most.

## Design

For all proposed landscape areas inside the disturbed area (clearings, parking, roads, pathways, re-grading), till compost into the top few inches of native soils. The ideal organic content is 10% for landscaped beds. A lower target rate for turf areas of 5% is recommended since a higher organic content could make mowing more difficult. The document "Building Soil<sup>4</sup>" includes great detail on methods to calculate the appropriate depth of compost to use to achieve these percentages, but the following guidance is a method that can easily applied, without calculations or lab testing, to any kind of soil (sandy, clay, silty, etc).

To amend proposed landscaped beds:

- Till or scarify soil 12" deep.
- Place 3" of compost and till into 5" of soil (a total amended depth of about 9.5", for a settled depth of about 8").
- Rake beds to smooth and remove surface rocks larger than 2" in diameter.
- Mulch planting beds with 2 – 3" of organic mulch.



2-4" MULCH  
8" COMPOST AMENDED SOIL  
4" TILLED OR SCARIFIED SOIL

**Figure 3. For lawn or landscaped garden, the same cross section (layers) of loosened and amended soils apply.**

To amend proposed turf areas that will be mowed:

- Till or scarify 12" deep.
- Place 1.75" of composted material and roto-till into 6.25" of soil (a total amended depth of about 9.5", for a settled depth of about 8").
- Water or roll to compact to 85% of the maximum density there would be in dry conditions. Rake to a level surface and remove surface woody debris and rocks larger than 1" diameter.

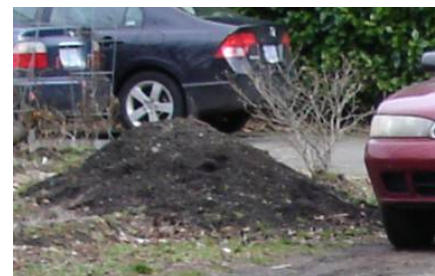
To amend native soils for rain gardens and vegetated filter strip areas, see "4 Build a Rain Garden" and "2 Disconnect Impervious Areas".

## Compost Specification

When amending soils, care should be taken to ensure that compost is clean and free of weeds, pollutants, or other harmful materials that may impact plant health and water quality.

Organic compost should have the following properties:

- Weed seed and pollutant free.
- 100% of material shall pass a 1/2" screen.
- pH between 5.5 and 7.0. If the pH isn't quite right, it may be lowered by adding iron sulfate and sulfur or raised by adding lime or recycled, ground gypsum board.



**Figure 3. Compost should be dark and fully composted (in other words, smell like earth, not ammonia).**

# 5C Program

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- Carbon nitrogen ratio of 35:1.
- Organic matter content between 40 and 50%.
- Fully decomposed. Earthy is good. Avoid compost that smells like ammonia.

Organic compost may consist of the following:

- Mushroom Compost. The used bedding material from commercial mushroom production.
- Local nursery or garden supply's stock of organic compost. There is US Compost Council Seal of Testing Assured (STA) compost. Visit <http://compostingcouncil.org/participants> to find a participating supplier near you. The STA program is no guarantee of quality, only that the compost has been tested and those test results are available for review.

Organic compost may NOT be:

- Composted Yard Debris. This is because excessive pollutants, mostly herbicides, pesticides, and fertilizers, have historically been found in these materials. "Cides" can kill beneficial soil life, reduce stormwater benefits, and increase maintenance.
- Peat Moss. Peat moss is extracted from wetlands; this has negative impacts on the watershed from which the peat moss was removed.

## Conveyance

Compost amended areas are considered self managing. Grading plans should show a 2% minimum slope away from buildings for a minimum

distance of 10' in landscape areas to ensure adequate drainage during large storms, which are expected to generate runoff. This is a common rule of thumb and shouldn't change the grading design from that of a conventional stormwater approach. If compost amended landscape areas drain to a structured outlet such as an area drain and pipe, size the infrastructure to adequately convey even the very large, perhaps infrequent, storm flows safely away.



**Figures 4 & 6. A range of construction equipment (tiller, cat mounted ripper, tractor-mounted disc, etc) or simply shovels and rakes may be used depending on the extent of the area to be amended.**

## Construction

Soils should be amended at the end of construction or at least at the completion of concrete work. Protect areas from compaction and erosion afterward with fencing and signage as needed<sup>5</sup>. Minimize erosion by covering soil with mulch and planting right away.



## Maintenance

Maintenance of compost amended soils is the same as any landscape area. It should be possible to irrigate less and reduce or eliminate the use of fertilizers, herbicides and pesticides. Keep soil in landscaped garden areas covered with 2-4" of compost by mulching once a year. Aerate turf areas and top-dress with fine mulch<sup>6</sup>.

<sup>1</sup> EPA Stormwater Menu of BMPs website

[http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=97&minmeasure=1](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=97&minmeasure=1) This references:

Center for Watershed Protection (CWP). 1999. Diazinon sources in runoff from the San Francisco Bay region. Technical Note 106. *Watershed Protection Techniques* 3(1): 613-616.

Schueler, T. 1995a. Nutrient movement from the lawn to the stream. *Watershed Protection Techniques* 2(1): 239-246.

<sup>2</sup> [http://www.soilsforsalmon.org/pdf/Soil\\_BMP\\_Manual.pdf](http://www.soilsforsalmon.org/pdf/Soil_BMP_Manual.pdf)

<sup>3</sup> In 2010 dollars

<sup>4</sup> [http://www.soilsforsalmon.org/pdf/Soil\\_BMP\\_Manual.pdf](http://www.soilsforsalmon.org/pdf/Soil_BMP_Manual.pdf)

<sup>5</sup> Stormwater Management Manual for Western Washington:

<http://www.ecy.wa.gov/programs/wq/stormwater/manual.html>

<sup>6</sup> [http://conferences.wsu.edu/conferences/lidworkshops/presentations/bioretenion/Soil\\_Improvement\\_for\\_Stormwater\\_Management\\_David\\_McDonald.pdf](http://conferences.wsu.edu/conferences/lidworkshops/presentations/bioretenion/Soil_Improvement_for_Stormwater_Management_David_McDonald.pdf)

## Bibliography

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Washington Organic Recycling Council. Soils for Salmon. <<http://www.soilsforsalmon.org/>>.

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