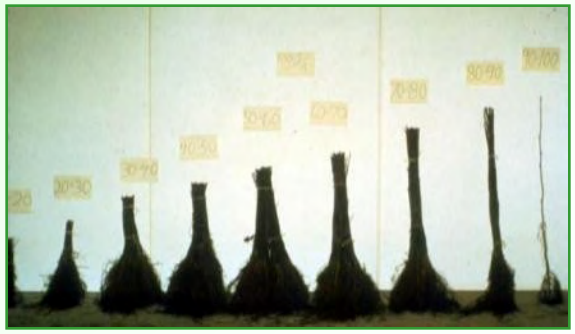
Landscaping/Environmental Applications for Compost, Caltrans Compost Specifications & Creative Specifying for Cost Savings

By: Ron Alexander

Principal, R. Alexander Associates, Inc. **6/18/09**

Compost as a Horticultural and Agricultural Product

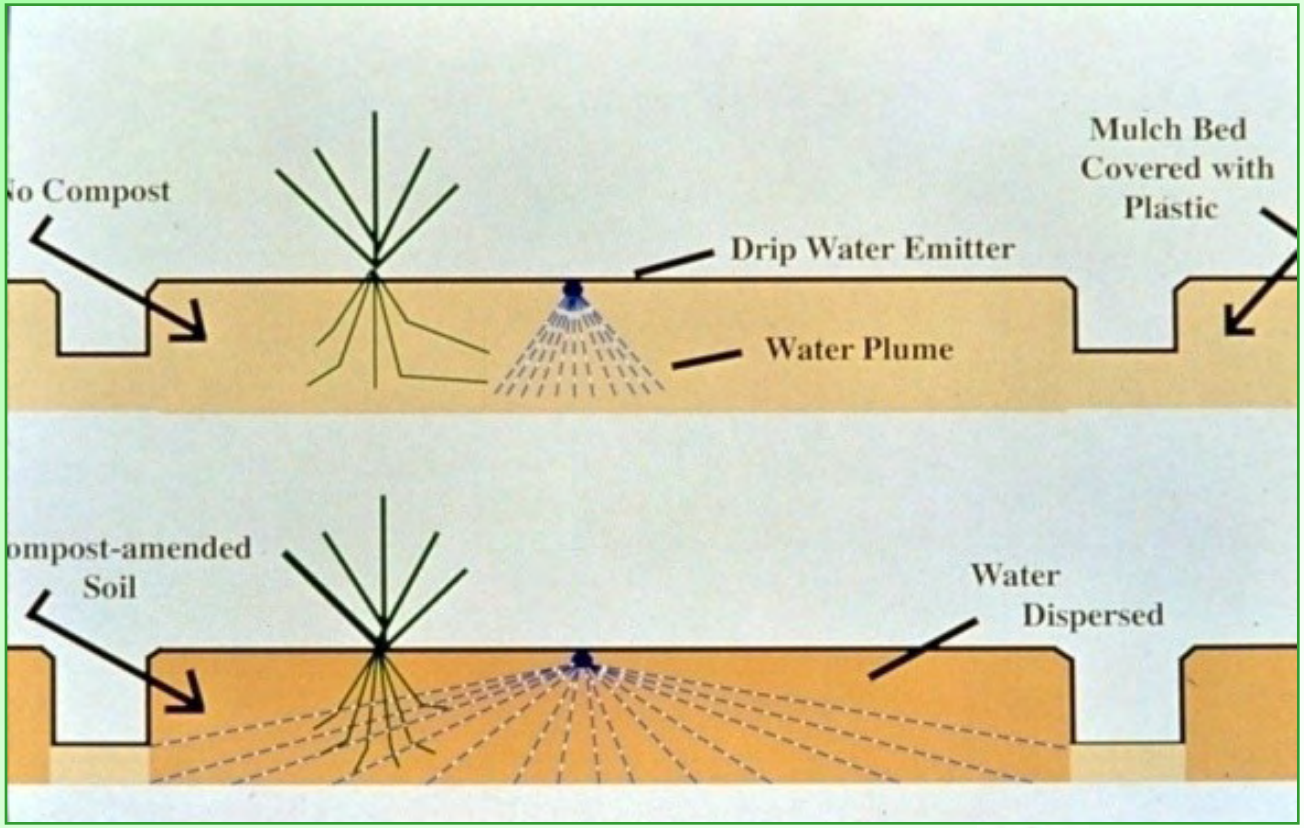
- **We understand how to produce quality product**
- **We understand benefits and primary applications**



..often are lower impact, safer products

Comparison of Drip Irrigation With and Without Soil Amended With Compost

Top: No compost in soil – water from drip emitter goes mostly down and misses root zone
Bottom: Compost amended soil – water from drip emitter spreads out over wide root zone



Compost Application

Soil Incorporant

- Turf establishment
- Garden bed preparation
- Reclamation/remediation
- Nursery production
- Roadside Vegetation

Surface Applied

- Garden bed mulch
- Erosion control media
- Turf topdressing

Growing Media Component

- Container/potting substrates
- Landscape (e.g. rooftop, raised planters)
- Backfill mixes (tree and shrub plantings)
- Golf course (e.g. tee, green, divot mixes)
- Manufactured topsoil

Lots of applications,
Staple of landscape industry

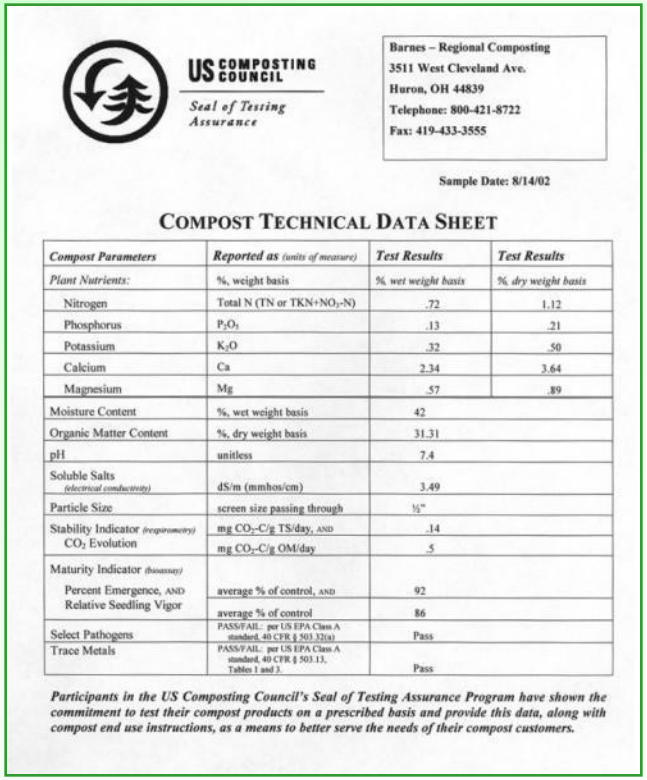
If It's Not STA Compost...

US COMPOSTING COUNCIL

Seal of Testing Assurance

What Is It?

Specifications and certification helps with confidence in purchasing and specifying



US COMPOSTING COUNCIL
Seal of Testing Assurance

Barnes – Regional Composting
3511 West Cleveland Ave.
Huron, OH 44839
Telephone: 800-421-8722
Fax: 419-433-3555

Sample Date: 8/14/02

COMPOST TECHNICAL DATA SHEET

Compost Parameters	*Reported as (units of measure)*	*Test Results*	*Test Results*
Plant Nutrients:	%, weight basis	*%, wet weight basis*	*%, dry weight basis*
Nitrogen	Total N (TN or TKN+NO_3-N)	.72	1.12
Phosphorus	P_2O_5	.13	.21
Potassium	K_2O	.32	.50
Calcium	Ca	2.34	3.64
Magnesium	Mg	.57	.89
Moisture Content	%, wet weight basis	42	
Organic Matter Content	%, dry weight basis	31.31	
pH	unitless	7.4	
Soluble Salts *(electrical conductivity)*	dS/m (mmhos/cm)	3.49	
Particle Size	screen size passing through	½"	
Stability Indicator *(respirometry)* CO_2 Evolution	mg CO_2-C/g TS/day, AND	.14	
	mg CO_2-C/g OM/day	.5	
Maturity Indicator *(bioassay)* Percent Emergence, AND Relative Seedling Vigor	average % of control, AND	92	
	average % of control	86	
Select Pathogens	PASS/FAIL: per US EPA Class A standard, 40 CFR § 503.32(a)	Pass	
Trace Metals	PASS/FAIL: per US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3.	Pass	

Participants in the US Composting Council's Seal of Testing Assurance Program have shown the commitment to test their compost products on a prescribed basis and provide this data, along with compost end use instructions, as a means to better serve the needs of their compost customers.

Nutrient and no nutrient versions to meet regulatory requirements >

R. Alexander Associates, Inc.©

General Landscape Applications

- Planting Beds
- Backfill Mixes
- Turf Establishment

Soil Amendment (Compost)

Apply 1-2” layer *(specify within spec)*
Incorporate to a 6-8” depth

Remove clods, stones, etc. over 2”

Smooth planting area

Plant as specified

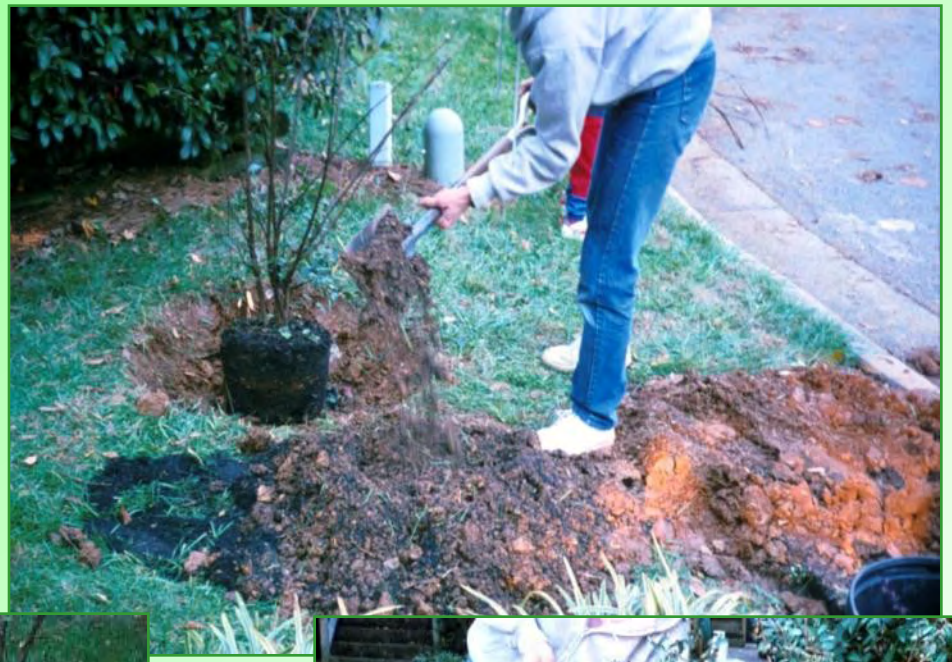
Water plants in well

Reforestation project by
the Presidio Trust

Not in the specs, but custom soil blending industry has grown

Excavate planting hole 2-3 width of rootball

Blend compost and existing soil – typically 2 : 1 by volume



Place plant

Backfill hole with soil blend

Firm occasionally

Water

Apply 1-2” layer (sometimes more)

(specify within spec)

Remove clods, stones, etc. over 2”

Incorporate to 6-8” depth

Smooth prior to seeding or laying sod

Water and fertilize

Fix the soil, don't cover it by laying sod

Soil Amendment (compost) - Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor, % Relative to Positive Control Seed Emergence Seedling Vigor	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	Inches % Passing 5/8 95% 3/8 70% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	<1000 (Pass)
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	<3 (Pass)
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps % > 4mm fraction (Sewing needles, hypodermic needles)	None Detected

NOTE: TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

In handout…

General Landscape Applications

- Mulching

Mulch > compost based

Apply uniform 2-3” layer

(specify within spec)

Smooth evenly and water

- Specify and use coarser, woody fraction for best results
- Avoid tree/shrub/plant trucks/stems, don’t apply within 4’ of drainage ditches

Mulch - Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.5
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	N/A
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–100
Maturity	TMECC 05.05-A Germination and Vigor, % Relative to Positive Control Seed Emergence Seedling Vigor	 N/A N/A
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	 N/A
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	Inches % Passing 3 99% 3/8 <25% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	 <1000 (Pass)
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Landscape / Restoration Application

- Site Restoration / Natives

Compost (incorporate)

Apply 4” coarse, compost

Typically used on hot, dry sites where natives are established (low nutrient requirements)

Incorporate to a depth of 12-18”

Avoid pavement edges (within 2’)

Rake and compact, as required

Seed/Vegetate

Apply erosion control measures

Brockway Summit Water Quality Improvement Project-2004

(near Lake Tahoe)

R. Alexander Associates, Inc. ©

Deep incorporation of compost improves soil characteristics including:

- Infiltration and permeability
- Water holding capacity
- Texture
- Nutrient levels and cycling
- Micro-organism populations
- Rooting depth
- Oxygen exchange and air space
- Vegetation Coverage

Caltrans Applications

- **Cut and Fill slopes**
- **Infiltration Basins**
- **Bio-swales and Strips**
- **Denuded Roadside Areas**

  (soft cover)
- **Environmental Restoration Sites**

Compost (Incorporate) - Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
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Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor, % Relative to Positive Control Seed Emergence Seedling Vigor	 80 or above 80 or above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	 80 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	Inches % Passing 3 99% 3/8 <25% Max. Length 4 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	 <1000 (Pass)
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Erosion/Sediment Control

- **Erosion Control (Compost blanket)**
- **Compost Sock**

Sheet vs. concentrated flow

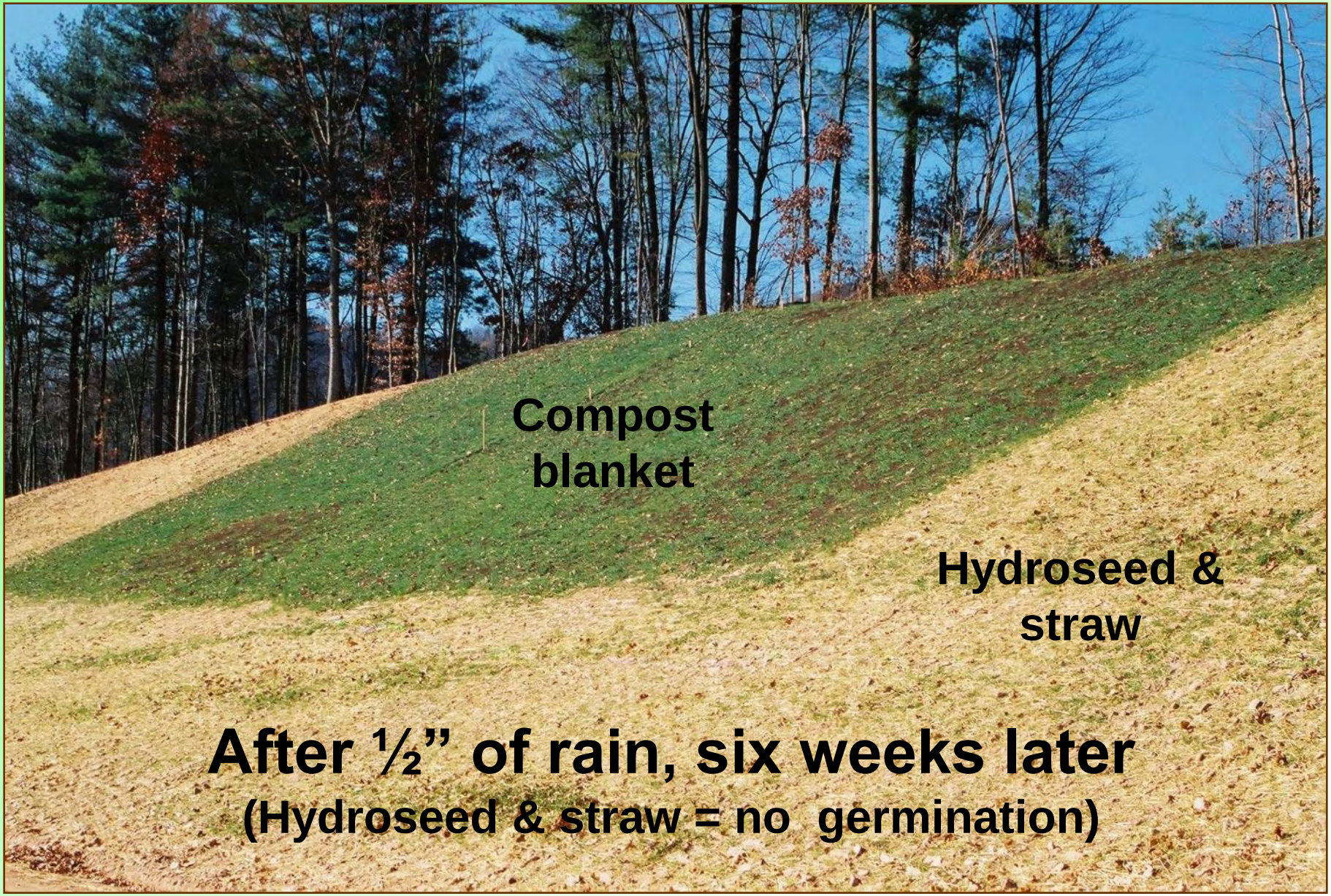
Typical installation and use scenarios

Silt fence with wash out under fence.

Erosion next to silt fence.

Source: Filtrexx

Source: Filtrexx International, LLC



Source: Filtrexx International, LLC

Source: Filtrexx International, LLC

Compost blanket, with seed blown in at same time

(Note no leaves on trees – it's too cold for seed germination without the blanket.)

Two months later.

Source: Rexius Forest by-Products

How Compost Blankets Work

Slopes with soil

- Some soil is round, it rolls downhill with the energy of the raindrops
- Its speed/mass displaces other soil particles
- Rills are formed
- Speed increases due to channeling of water
- Channels are formed, creating gully erosion

Slopes with compost

- Compost is flat, flexible and mesh-like
- ‘Knits’ together on slopes
- Softer, does not roll
- Porous enough to allow water to pass through slowly (percolate)
- Compost absorbs water
- Coarse vs. fine particles

Modified from: Filtrexx International, LLC

Compost Blankets

Advantages

- Intimate contact allows nearly 100% ground contact, eliminating puckering associated with other blankets
- Intimate contact reduces sediment movement
- Water infiltration increases, increasing germination of seed
- Water discharge from slopes decreases, reduces potential sediment loss
  - Often, very little water is actually discharged from the slope
- Addition of organic matter improves a slope's ability to re-vegetate and establish a permanent erosion system (extensive rooting which stabilizes the soil)
- Compost can bind heavy metals and degrade petroleum hydrocarbons in the water absorbed in the blanket

Modified from: Filtrexx International, LLC

Compost Blankets

1-2” depth *(specify within spec)*,

onto up to 2:1 slopes, apply 3’ above the top of the slope and into existing vegetation

Apply any necessary erosion control techniques

Source: TxDOT and TECQ

Compost Blankets

1-2” depth *(specify within spec)*,

onto up to 2:1 slopes, apply 3’ above the top of the slope and into existing vegetation

Apply any necessary erosion control techniques

Source: TxDOT and TECQ

Coarse compost

Compost blanket

Main Street Materials – 1:1 slope, 4” compost
Project near Lompoc

Plants using erosion control rolled blankets.

Compost blanket application on 1:1 Rock Slope: Barton Creek Country Club - Austin, TX

Source: TCEQ

Compost is being applied to a slope.

On the top of photo, no compost was used, and there is no vegetation. On the bottom portion of the photo, compost was used, and vegetation is present.

Chelan Site

Source: WS DOT

Compost Blanket - Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor, % Relative to Positive Control Seed Emergence Seedling Vigor	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inch 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	<1000 (Pass)
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	<3 (Pass)
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
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How Compost Filter Socks (& Berms) Work

Sediment fences

- Are one dimensional, and often get clogged with sediment
  - Then fall over from weight of the sediment
- Fine particles flow Its speed/mass displaces other soil particles
- Are often installed improperly
- Must be collected and disposed of
- Are not ‘green’ products

Socks (& berms)

- Are three dimensional, sediment is caught in the organic mass (pore spaces)
  - Mass slows flow velocity
- Coarse particles allow water to flow through, while finer particles trap sediment
- Have large sediment capacities
- Organic matter can bind and remove contaminants in the water

Filter Socks

Advantages:

- Resists movement much more than loose compost
  - Can be staked into place to allow use in concentrated flows of water
- Generally accepted better by regulators than berms
- Guaranteed volume/size from socks
- When filled, socks are very heavy and have good soil contact
- Continuous socks can be created, unlimited length

Modified from: Filtrexx International, LLC

Like a self-contained berm – can be used in concentrated water flows

Source: Filtrexx International, LLC

Compost socks

12” diameter sock,
1 year durability

Filter socks

Compost Sock - Physical and Chemical Requirements

Property	Test Method	Requirement
pH	TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.5
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	<60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–100
Maturity	TMECC 05.05-A Germination and Vigor, % Relative to Positive Control Seed Emergence Seedling Vigor	 N/A N/A
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	N/A
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	Inches % Passing 3 99% 3/8 30-50% Max. Length 2 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	<1000 (Pass)
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Other Applications

Not outlined in the Caltrans specifications

Compost Filter Berms

Advantages:

- Easy to install, maintain and remove
  - Removal is basically spreading the compost on the site
  - Move compost to planting areas for best results
  - Long term filtering capacity of compost can be achieved if left onsite (e.g., near roads)
- Proven in the field and the lab
  - Berm test results illustrate a scientifically significant improvement over solit fences for capturing sediment (especially fine particles, which would pass through a silt fence)
  - Hundreds of field projects show compost works better than silt fence

Modified from: Filtrexx International, LLC

Compost Filter Berms Act Like a Giant Coffee Filter (3-D)

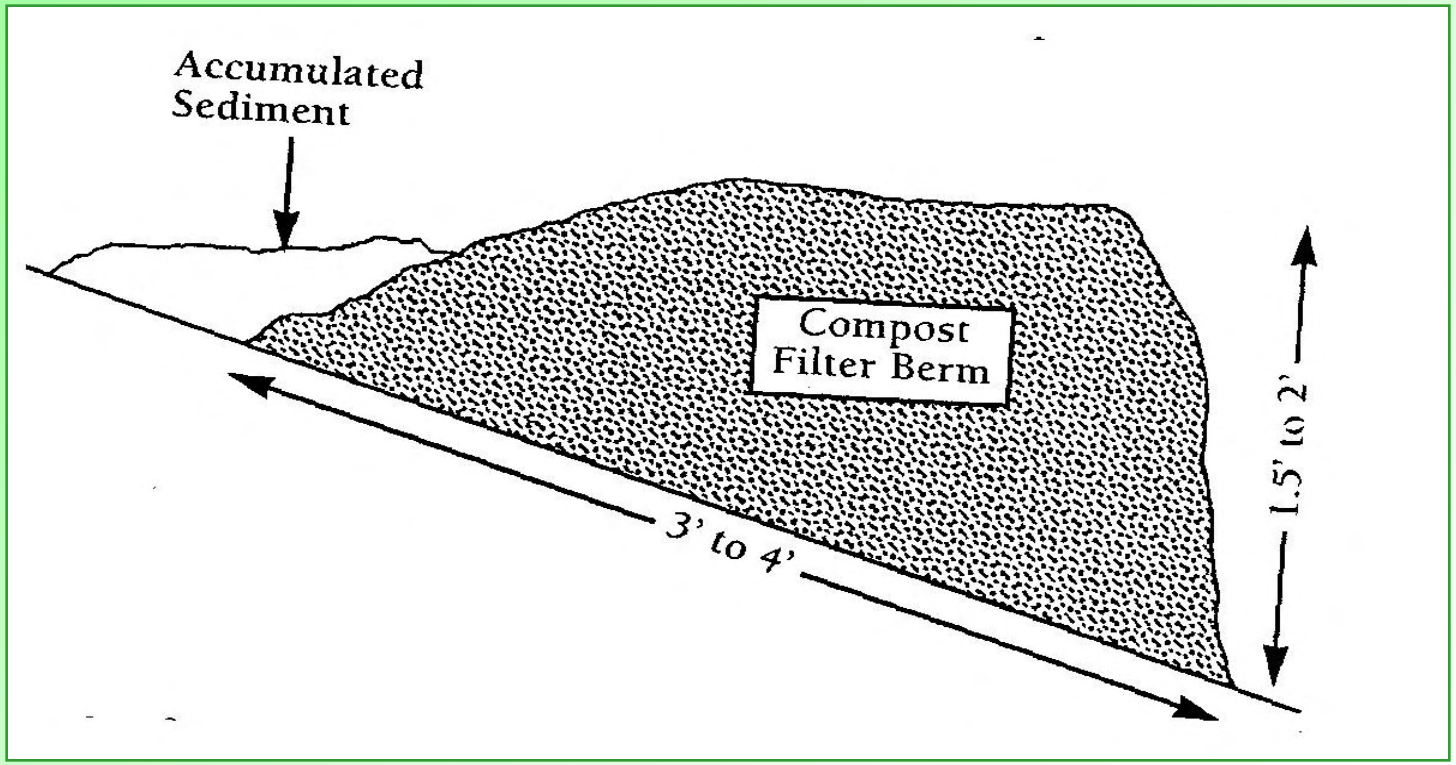


Diagram showing accumulated sediment is held upstream of the compost filter berm

Source: Filtrexx International, LLC

Vegetation being placed on top of berm.

Vegetated berm

Application and vegetation
(more permanent if vegetated)

Source: TCEQ

Vegetated berm

Vegetated berm controlling surface water flow.

Sediment build up, water percolation

Source: TCEQ

Combining blankets and berms

More effective, aesthetically more appealing, competitively priced

Source: TCEQ

Other Stormwater Management Applications for Compost

Green roofs

Source: IDNR, R. Alexander Associates, Inc., Erth Products, LLC

Rain gardens

Source: SOCCRA

Living or green walls

Source: Filtrexx International, LLC

Turf Topdressing

- Turf Maintenance

- Partial Renovation

- Aerate turf area
- Apply 1/4-1/2” layer of compost
- Rake into core holes

Seeding

R. Alexander Associates, Inc.©

Media and Media Component

- Sports Turf Construction

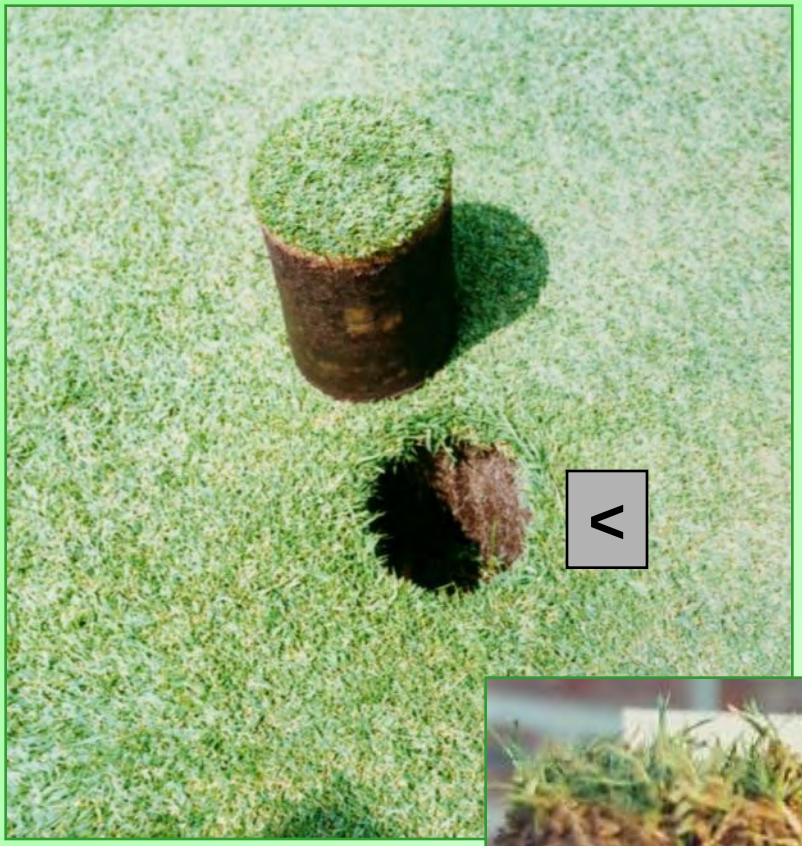
Compost is used
as organic matter

source in sand
based media

85:15 v/v sand to compost
blend can meet
STRI/USGA standards

1987

Same green
18 years
later



<

With > compost

< Without compost

Topsoil Manufacturing

On-site soil blending/ improvement

Incorporating compost into soil.

Leveling field.

After planting seed in soil with compost mixed in.

Soil and compost piles.

Off-site soil blending

Mixing soil and compost piles.

Adding compost to soil pile.

Mixing soil and compost together.

Blend ratio depends on initial soil quality and goals

- Typically 20-30% inclusion rate (compost/soil mix by volume)

Soil and compost being mixed together.

Finished pile of soil and compost mix.

Reclamation, Revegetation, Brownfields

Polkemmet Case Study

Construction of two 18-hole golf courses using in situ materials which consist of colliery waste and compost to a ratio of 70% colliery waste and 30% compost.

The colliery waste is crushed to 10mm and the compost is added after the waste has been applied.

Polkemmet Case Study
Large Scale Trial

Sewing Date: September 05

September 06

Creative Specifying for Cost Savings

It doesn't have to cost more to be 'green'

Soil creation: Former Royal Ordnance Site, Chorley, UK

Plan view of community.

Aerial view of community.

-7000t of compost

-7000t of unsuitable geotechnical subsoil

Blended 2:1 by volume to produce

Economy grade topsoil

2. Import 14,000t topsoil and landfill subsoil

Activity	**Cost**
Landfill gate fee (guide price £6/t + £2 landfill tax)	£56,000
Subsoil (7,000t) Haulage to landfill (approx £3/t)	£21,000
Importation of 14,000t topsoil. This costing is based on 'made' economy grade topsoil at £8/t including haulage	£112,000
Total costs **Includes final topsoil importation and subsoil disposal** **Based on 14,000t of topsoil brought to site ready for use**	**£189,000**
Total cost per tonne **Topsoil (14,000t estimate) ready to use** Note handling costs not included	**£13.50**

Financial case for BAE systems to use compost

1. Creation of soil using in situ subsoils and compost

Activity	**Cost**
7,036t of PAS 100 compost	£49,252
7,036t of subsoil to landfill	£0
Handling costs for receiving compost and mixing compost/subsoils	£36,909.50
Total costs to date for compost mixed with subsoil and ready for use	**£86,161.50**
Total cost per tonne of made soil (14,072t of 'made' soil in total)	**£6.12**

Benefits of compost

- Significant cost savings
- Soil generated will be closer to native soil than imported soil
- Source of nutrients for grass, plants and trees
- Compost is free from weed seeds, soil pathogens and roots
- Soil mix can be tailored to meet the specific needs of a site

Topdressings

- **Example**
  - **Topdressing** (sand-based)
    - 1/4” application rate = 33 CY/A
    - $30.00 ton (del’d) = $1,020.00
  - **Compost**
    - 1/4” application rate = 33 CY/A
    - $15.00 CY (del’d) = $502.50/A

That’s over $500 cost saving for the topdressing alone!

Economic Comparison

COSTS (Per 1,000SF)	Sand-Based Topdressing	Compost Topdressing
Topdressing	$23.42	$11.54
Fertilizer	$5.61	$0
Fungicide	$6.07	$0
TOTAL COST	**$35.09**	**$11.54**

Maine DOT

Compost and seed on slope, instead of soil, finished grading, seed

Landscaping

Planting bed establishment (no lime or fertilizer, reduced irrigation, reduced plant loss)

QUESTIONS