Soil Builders: Compost-Based Best Management Practices for Erosion Prevention & Sediment Control

Vermont Organics Recycling Summit

May 6th, 2021

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Natasha Duarte, Composting Association of Vermont
Chuck Duprey, Naturcycle
Jack Eaton, Filtrexx Northeast Systems
Heather Voisin, VTrans

Today's Workshop

- Overview of **Soil Builders - Education in Action**
- Compost-Based BMPs for Erosion Prevention & Sediment Control
- CAV Demonstration Site, Jamaica, VT
- Panelists share their experience

Goals:

1. Better understand challenges for implementing compost-based BMPs
2. Identify next steps for collectively moving towards broader adoption of these BMPs

Project Partners

- Athena Lee Bradley, Compost Consultant, CAV Board Member
- Marc Companion, Lake Champlain Sea Grant
- Chuck Duprey, Naturcycle
- Brian Jerose, Agrilab Technologies Inc., CAV Board Member
- Deb Neher, UVM
- Elly Ventura, Lamoille Regional Solid Waste Management District, CAV Board Member

Additional Thanks

- Guest Panelists
- CAV Board of Directors

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Soil Builders Workshops

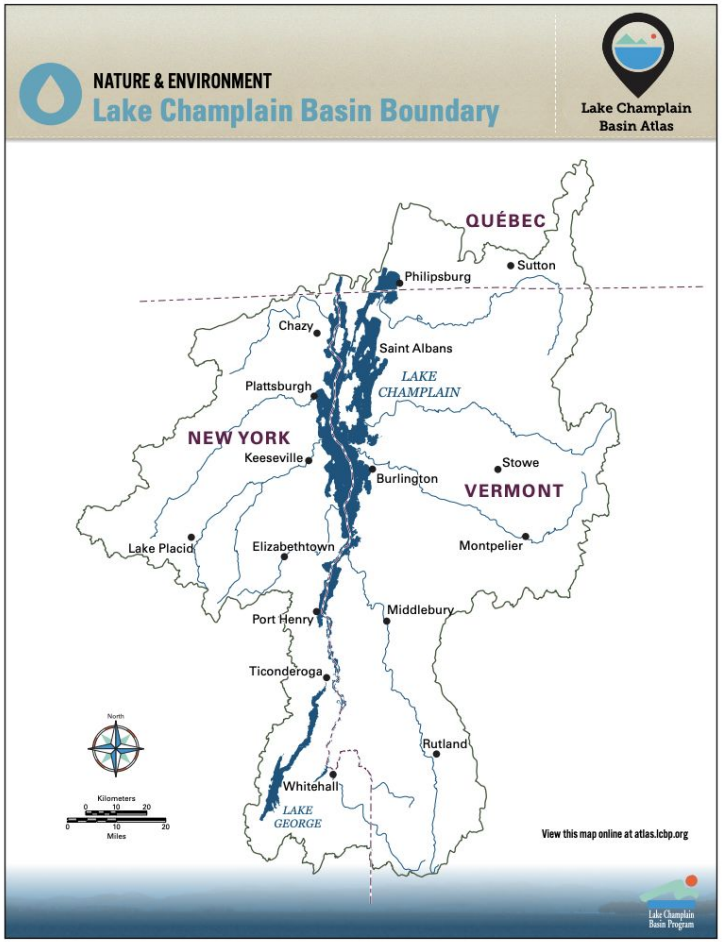
Compost-related eco-literacy for Lake Champlain Basin decision-makers, professionals & advocates

- Specific benefits from using compost
- How to modify current practices to produce those benefits

Soil Builders Workshop Topics

- ✔ Soil health & water quality
- ✔ Drivers for clean water & healthy soil
- ✔ **Best Management Practices for compost & compost-based products**
- ✔ Education in action – next steps

CompostingVermont.org/soil-builders



Upcoming Webinars

- ★ **May 20th: Compost Specifications for Landscape Architects with Chuck Duprey (LEED & LA CE available)**

Still to be scheduled:

- Education in Action - Watershed Groups
- Compost BMPs for Agricultural Applications
- Compost Top Dressing for Residential Lawn Care
- Deep Dive into Soil Function
- Deep Dive for Compost & Engineered Soil Producers
- Soil Builders Education in Action Advocacy workshops

Erosion Prevention & Sediment Control

Goals:

- Capture/filter runoff – perimeter & inlet control
- Runoff reduction – site stabilization
- Stabilize road drainage systems

✔ Increase infiltration, water holding capacity, revegetation rates

Background Concepts

- Understanding soil properties is critical to understanding soil erosion and reducing soil loss
- Soil can be a massive reservoir for moisture, carbon and nutrients when in native or restored condition
- Soil can’t retain water and nutrients when degraded
- Use of local compost supports organics diversion from landfills and supports maintaining these materials as a resource for soil improvement and fertility

3 Critical Uses of Compost

- Erosion control blankets
- Compost berms
- Filter socks

✔ Coarse material is best

Jamaica, VT Demonstration

A project coordinated by the

Composting Association of Vermont, 2012

Stabilizing Storm-Damaged Roadside Banks With Compost Products, Jamaica, Vermont (2012)

- Stabilized a 6,000 sq ft area of sidehill on old Route 8
- Seeded/netted compost blanket and compost filter sock
- Goals:
  - Demonstrate compost-based BMPS to remediate heavily eroded sidehills
  - Show improvements in flood resiliency of fragile and/or depleted soils & avoid future catastrophic failure

Jamaica Site Before Our Project

Demonstration Site: Jamaica, VT

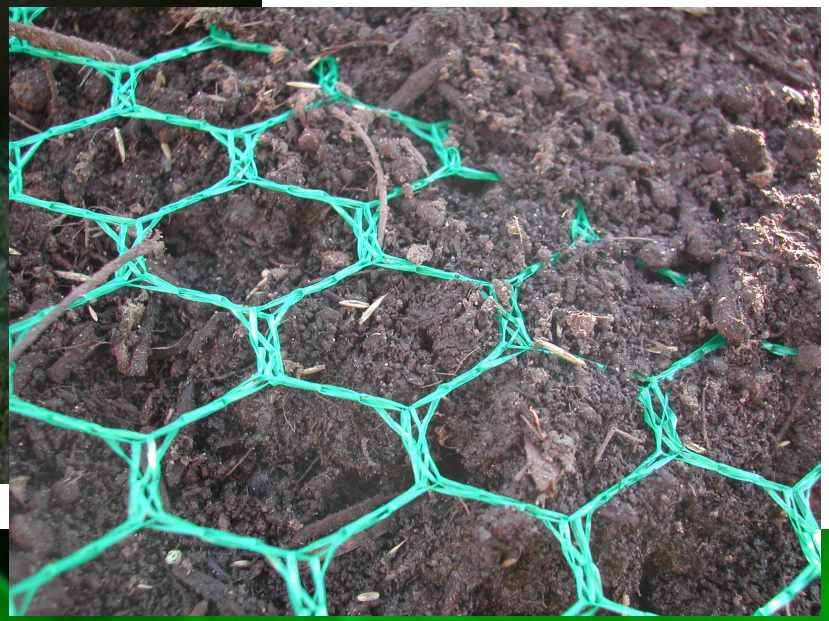
More Case Studies

Sharon, on the White River

Rte 4, near the Killington Gondola entrance

Rte 4 near the Killington Gondola entrance

2 to 1 hard clay slope
Stabilized with a compost blanket



2 to 1 hard clay slope
Stabilized with a compost blanket

Returning to the Phosphorus Question

Considerations when thinking about phosphorus loading

- Phosphorus moves off site
  - Attached to soil particles, in water
- Effect of increased infiltration rates & soil water holding capacity on runoff volumes
  - 1% increase in organic matter in the top 6” can hold approximately 27,000 gallons of water per acre (NRCS)
  - Healthy soils can hold up to 20x its weight in water; more drought resistant
- What forms of phosphorus are we looking at:
  - Total P vs. Water Extractable P (WEP)

Compost Analysis Comparing Water Extractable Phosphorus

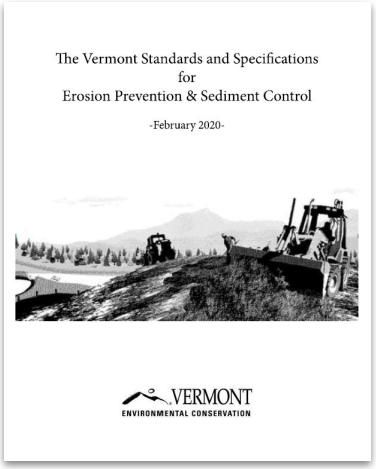
- Medway = leaf and yard waste
- Ipswich All Natural = leaf and yard waste with 10% food waste
- Ipswich Bio = biosolid compost utilizing leaf and yard waste as amendment
- Merrimack = biosolid compost utilizing wood shavings as amendment

Incorporating into Projects

Is it in the Specs?

Currently component of other items:

- Sod installations
- Topsoil amendment
- Erosion log filler
- Landscape Backfill – 50% topsoil, 25% compost, 25% native material



Compost included as "Mulch" material.

Compost Blanket as Mulch or RECP Alternative?

Contact Information

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Learn more at CompostingVermont.org/soil-builders

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The following slides from the last webinar are just for reference

Please drop in any slides in front of this one.

Natasha will work on formatting and smoothing everything out.

Changing Our Way of Thinking

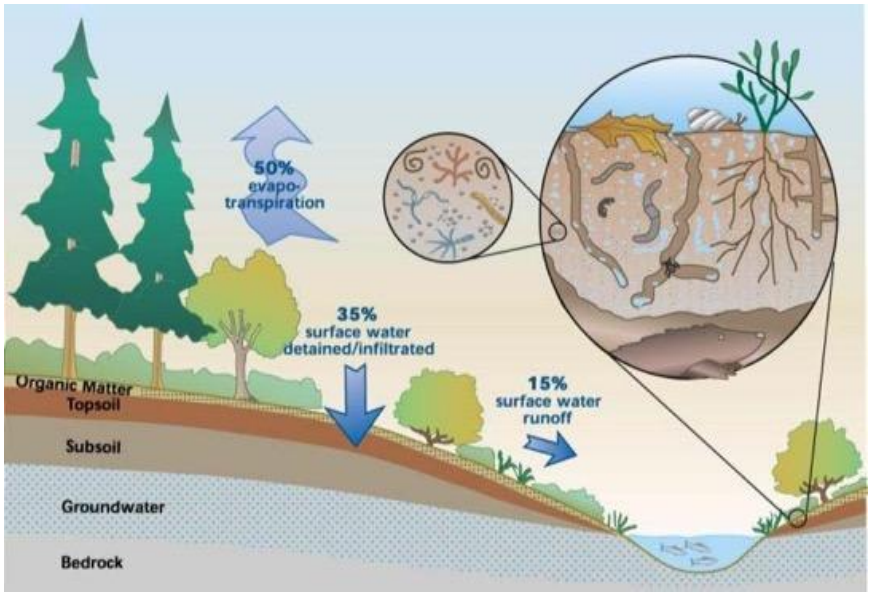
- Impact of changing climate (larger rain events mixed with extended drought conditions)
- Urgent need to rethink landscape management practices
- Compliance mindset → restoration/regenerative mindset

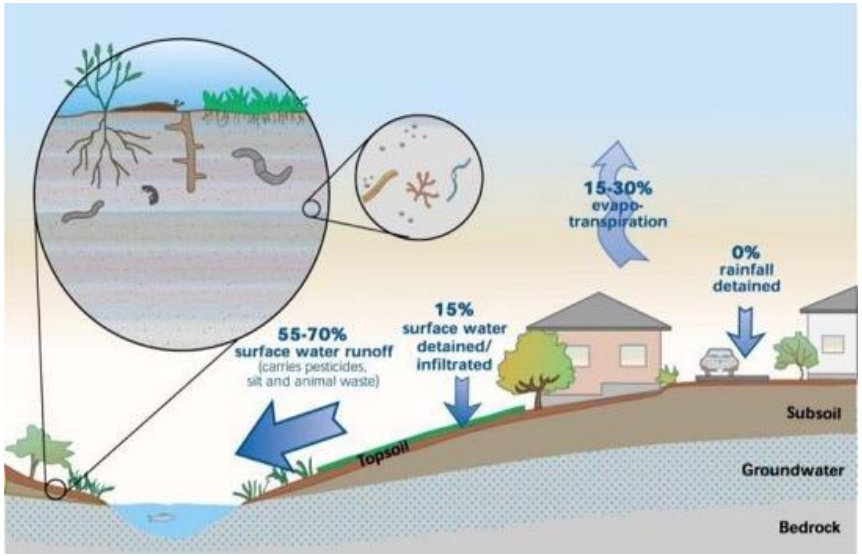
Soil Builders – Education in Action
Best Management Practices for Compost & Compost-Based Products

Best Management Practices for Erosion Control

Stormwater Management

- Practices are evolving
  - Decline in ecosystem functions
  - From simply managing quantity (retention basins) to quality AND quantity
- Mimicking nature: focus on <u>infiltration</u>, <u>evaporation</u>, & <u>transpiration</u>





VT Stormwater Permit Requirements

Erosion Prevention & Sediment Control

- Capture/filter runoff – perimeter & inlet control
- Runoff Reduction – site stabilization is required

Post-construction soil quality requirement

- Amend disturbed soil to 4+% OM content

Municipal Roads General Permit Requirements

- Stabilize road drainage systems
- Reduce potential road pollutants (excess nutrients, sediment, trace heavy metals, hydrocarbons, road salt)

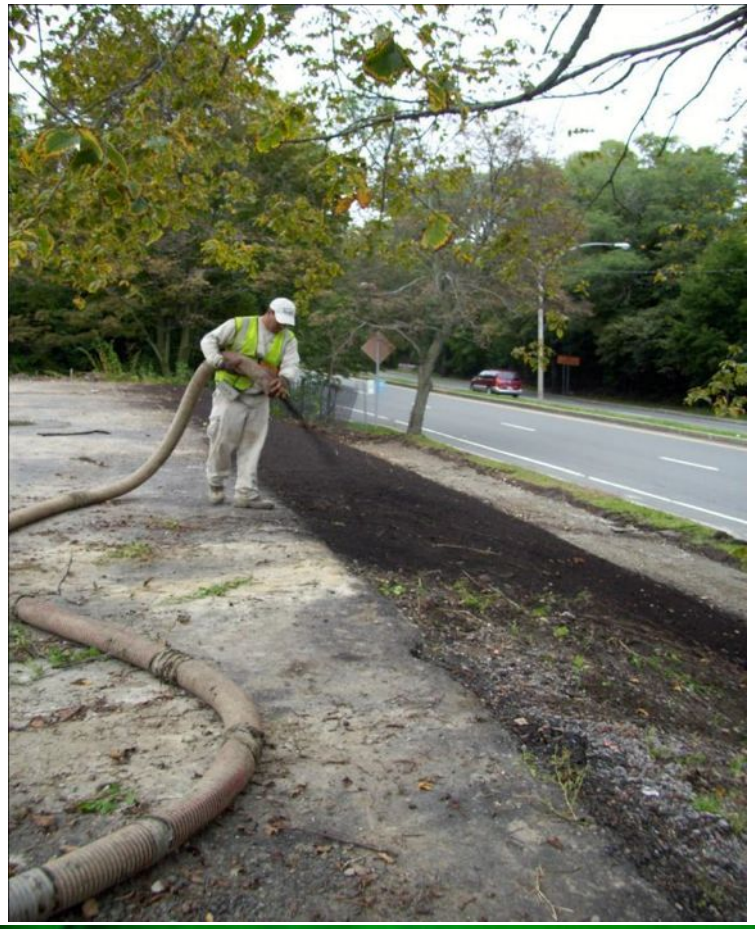
Road Construction Remediation

- Stabilization of cuts and banks from highways, local roads or on-site driveways and access lanes
- Compost added to topsoil improves speed of revegetation and density of growth
- Compost as surface cover (blanket) acts as temporary surface mulch to protect surface prior to revegetation
- Capacity of soils to infiltrate and then retain moisture improves with higher organic matter content
- VTrans used compost blanket on Rt.15 trial

Direct Erosion Control for Construction or Roadside

- Three critical uses of compost:
  - Erosion control blankets
  - Compost berms
  - Filter socks

✔ Coarse material is best for these applications



Erosion Control: Overview of BMPs

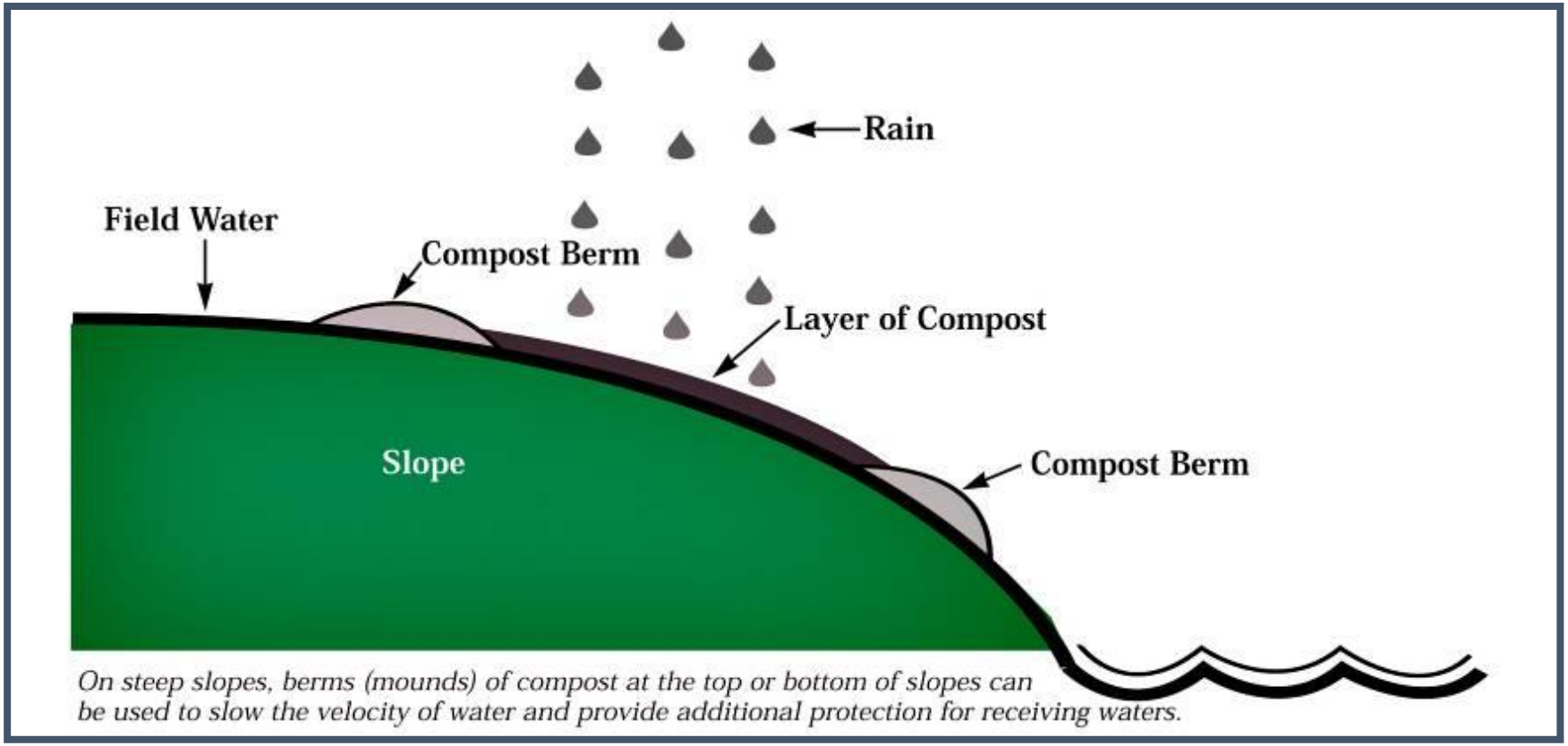
- Compost blankets are 2-part specifications
  - Blanket
  - Berm (or sock) for edges

- Compost filter socks have multiple uses
  - Silt fence alternative
  - Ditch check
  - Part of a compost blanket system
  - Stream bank restoration
  - Protection for stockpiles of soil (on construction sites)
  - DOT and commercial construction applications abound!

Compost-Based Erosion & Sediment BMPs

- Compost Berm and Sock: Pollutant removal
- Compost Blanket: Pollution prevention
- AASHTO Specifications MP-9 and 10
- Need coarse particle size to allow flow, resist movement
  - Composted mulch or screened “middles”
  - 30-60% (by wt) passing ¼” screen

Compost Blankets & Berms



American Society of State Highway and Transportation Officials Specs – CompostforLAs.com

Table 1 – Compost Blanket Parameters

Parameters[1,4]	Reported as (units of measure)	Surface Mulch to be Vegetated	Surface Mulch to be left Un-vegetated
pH[2]	pH units	5.0 - 8.5	N/A
Soluble Salt Concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	Maximum 5
Moisture Content	%, wet weight basis	30 – 60	30 – 60
Organic Matter Content	%, dry weight basis	25 – 65	25-100
Particle Size	% passing a selected mesh size, dry weight basis	• 3" (75 mm), 100% passing • 1" (25mm), 90% to 100% passing • 3/4" (19mm), 65% to 100%passing • 1/4" (6.4 mm), 0% to 75% passing • Maximum particle length of 6" (152mm)	• 3" (75 mm), 100% passing • 1" (25mm), 90% to 100% passing • 3/4" (19mm), 65% to 100%passing • 1/4" (6.4 mm), 0% to 75% passing • Maximum particle length of 6" (152mm)
Stability[3] Carbon Dioxide Evolution Rate	mg CO_2-C per g OM per day	< 8	N/A
Physical Contaminants (man-made inerts)	%, dry weight basis	< 1	< 1

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council)

[2] Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum

The following steps shall be taken for the proper installation of compost as a soil blanket for erosion/sediment control on sloped areas.

Slightly roughen (scarify) slopes and remove large clods, rocks, stumps, roots larger than 2 inches in diameter and debris on slopes where vegetation is to be established. This soil preparation step may be eliminated where approved by the Project Engineer or Landscape Architect/Designer, or where seeding or planting is not planned.

Where practical, track (compact) perpendicular to contours on the s using a bulldoze fore applying compost as soil blanket.

Apply compost at the rates specified in Table 2.

Table 2 – Compost Blanket Application Rates

Annual Rainfall/Flow Rate	Total Precipitation & Rainfall Erosivity Index	Application Rate For Vegetated* Compost Surface Mulch	Application Rate For Unvegetated Compost Surface Mulch
Low	1-25", 20-90	½ - ¾ " (12.5 mm - 19 mm)	1" – 1 ½" (25 mm – 37.5mm)
Average	26-50", 91-200	¾ - 1" (19 mm - 25 mm)	1 ½" – 2" (37 mm – 50 mm)
High	51" and above, 201 and above	1-2" (25 mm - 50 mm)	2-4" (50mm – 100mm)

*these lower application rates should only be used in conjunction with seeding, and for compost blankets applied during the prescribed planting season for the particular region.

Compost blanket application rates should be modified based on specific site (e.g., soil characteristics, existing vegetation) and climatic conditions, as well as particular project related requirements. The severity of slope grade, as well as slope length, will also influence compost application rates.

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In regions subjected to higher rates of precipitation and/or rainfall intensity, higher compost application rates should be used. In these regions, as well as those with spring snow melt, and on sites possessing severe grades or long slope lengths, the compost blanket may be used in conjunction with a compost filter berm. The filter berm may be 1-2 feet high (30 cm – 60 cm), by 2-4 feet wide (60 cm – 120 cm), and may be placed at the top or base (or both) of the slope. In these particular regions, as well as regions subject to wind erosion, coarser compost products are also preferred.

In regions subject to lower rates of precipitation and/or rainfall intensity, lower compost application rates may be used. Specific regions may receive higher rainfall rates, but this rainfall is received through low intensity rainfall events (e.g., the Northwestern U.S.). These regions may use lower compost application rates.

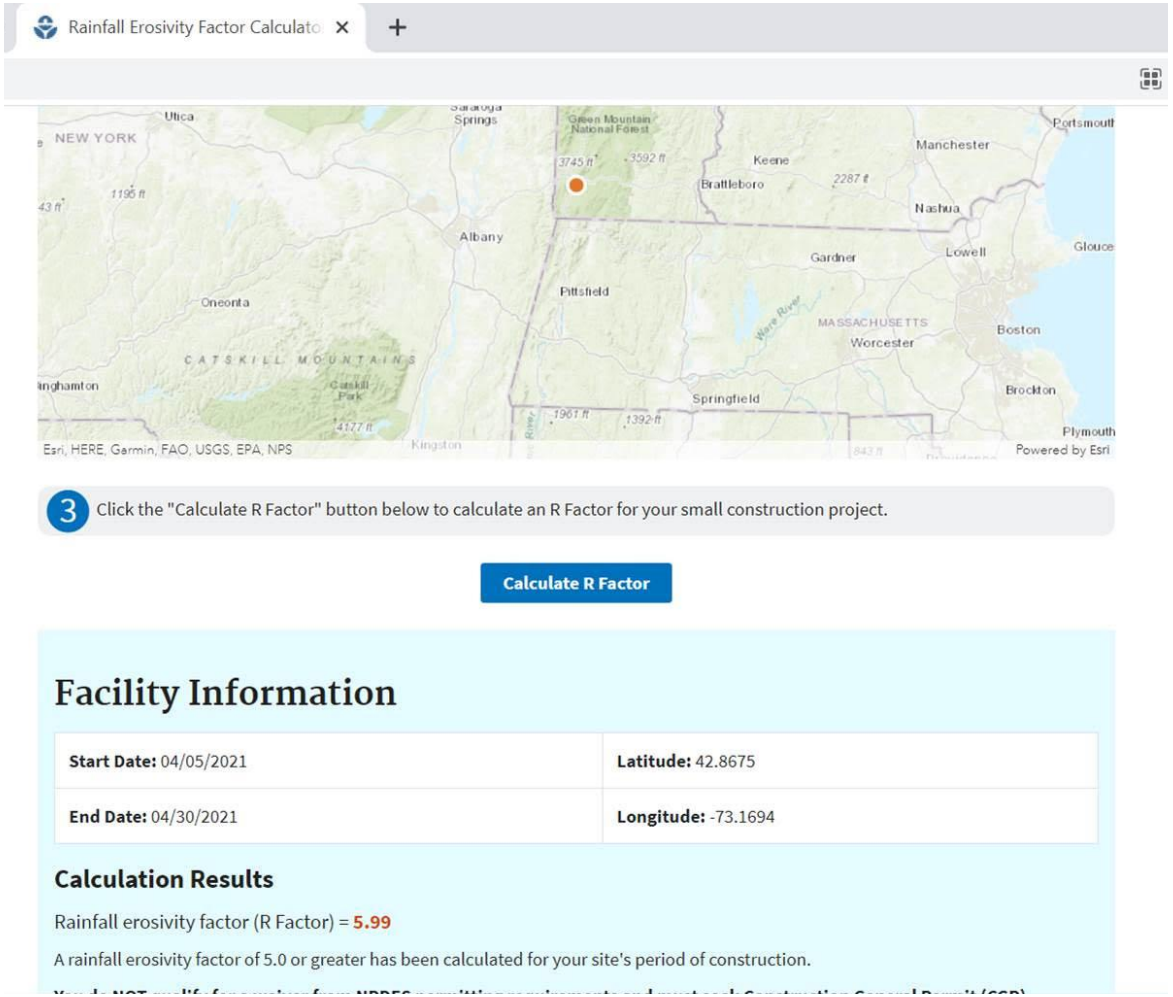
Compost shall be uniformly applied using an approved spreader unit, including bulldozers, side discharge manure spreaders, etc. Alternatively, apply compost using a pneumatic (blower) unit, or other unit that propels the product directly at the soil surface, thereby preventing water from moving between the soil-compost interface. Thorough watering may be used to improve settling of the compost. Apply compost layer approximately 3 feet (90 cm) over the top of the slope, or overlap it into existing vegetation.

On highly unstable soils, use compost in conjunction with appropriate structural measures.

Dry or hydraulic seeding may be completed following compost application, as required, or during the compost application itself, where a pneumatic unit is used to apply the compost.

Rainfall Erosivity Factor Calculator

- Based on kinetic energy considerations of falling rain
- A measure of erosive force & intensity of rain in a normal year
- [lew.epa.gov](lew.epa.gov)
  - Start & end date of construction
  - Address



How Compost Blankets Work

Slopes with soil

- Rolls downhill
- Speed/mass displaces other soil particles
- Rills are formed
- Speed increases due to channeling of water
- Channels are formed
- Gully erosion

Slopes with compost

- Compost is flat, flexible and mesh-like
- 'Knits' together on slopes
- Softer, does not roll
- Similar to a 'wet deck of cards' on the slope
- Porous enough to allow water to pass through slowly

How to Install a Compost Blanket

- Spread with dozer on moderate slopes
- Slinger truck
- Blower truck
- Applies more like mulch
- Can hydroseed over it

Compost Blanket Installation

Compost Berms

Berms at Windham SWMD Solar Project

Compost Filter Berm

FIELD APPLICATION

The following steps shall be taken for the proper installation of compost as a filter berm for erosion/sediment control on both level and sloped areas.

Parallel to the base of the slope, or around the perimeter of affected areas, construct a trapezoidal berm at the dimensions specified in Table 2. In general, when compost filter berms are used to control erosion/sediment near, or on a slope, the base of the berm should be twice the height of the berm.

Compost shall be applied to the dimensions specified in Table 2.

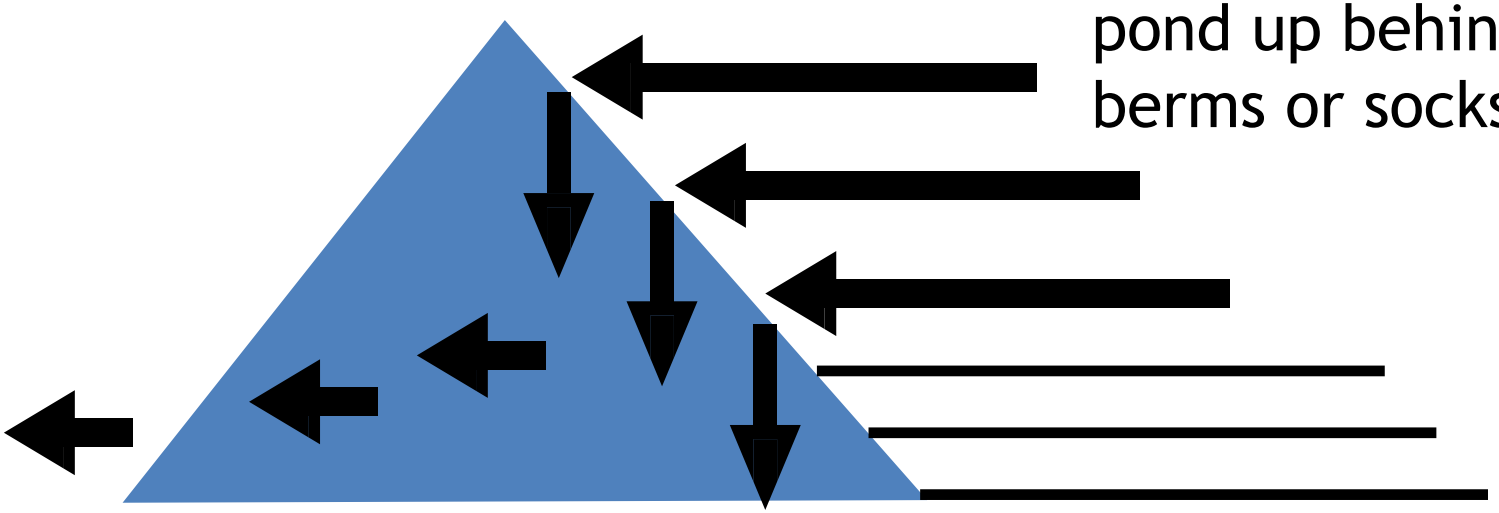
Table 2 ± Compost Filter Berm Dimensions

Annual Rainfall/Flow Rate	Total Precipitation & Rainfall Erosivity Index	Dimensions for the Compost Filter Berm (height x width)
Low	1-25',	1,x 2, ± 1.5, x 3,
	20-90	(30 cm x 60 cm ± 45 cm x 90 cm)
Average	26-50',	1,x 2, - 1.5, x 3,
	91-200	(30 cm x 60 cm ± 45 cm x 90 cm)
High	51' and above, 201 and above	1.5,x 3, ± 2, x 4, (45 cm x 90 cm ± 60cm x 120 cm)

Compost filter berm dimensions should be modified based on specific site (e.g., soil characteristics, existing vegetation) and climatic conditions, as well as particular project related requirements. The severity of slope grade, as well as slope length will also influence the size of the berm.

In regions subjected to higher rates of precipitation and/or rainfall intensity, as well as spring snow melt, larger berms

Berms: 'Geometrically Superior'



High runoff flows pond up behind berms or socks

Berms are three-dimensional filters

Sediment fills up behind berm

Filter Berm in Pennsylvania

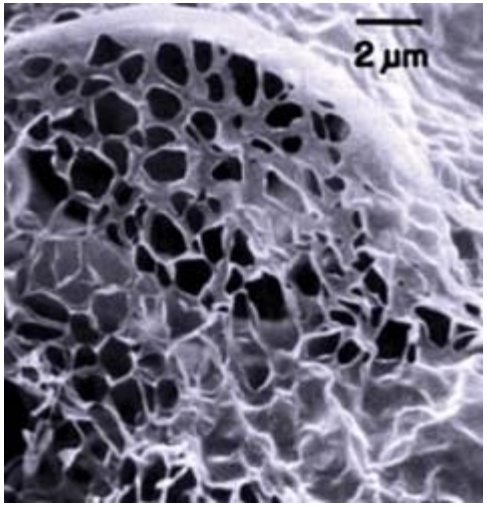
Cost Estimates: Compost Berms

- Material: $2.61 - $3.15/linear foot
- All-in: $7.50 - $8.12/linear foot (includes materials and installation, inspection and sediment removal, repair and replacement)

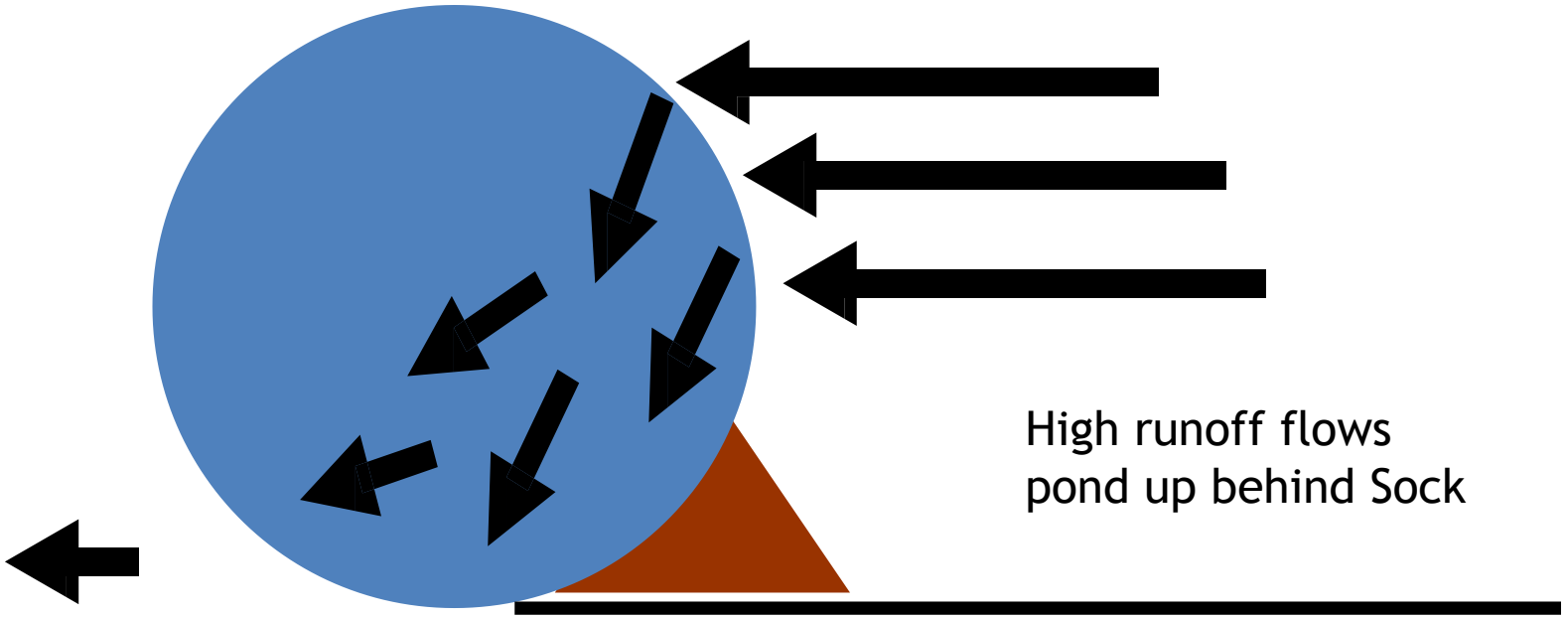
- Source: US EPA's Greenscapes Environmentally Beneficial Landscaping Program (2006)

Compost Filter Socks

- Several different kinds of compost socks, engineered for different purposes
- Many contain proprietary materials
- Coarse compost allows filtration



Compost Socks Don’t Fall Over & Can Be Used in Direct Flows



Compost Blanket & Filter Sock Application

The UNIVERSITY of VERMONT

January 2020

Ways to Source

- Contractors
  - Blower truck operators
  - More standard applications like slinger trucks

- Filter Sock distributors
  - Blower trucks can direct install
  - Companies like EJ Prescott sell palletized socks or Filtrexx distributors

Silt Fence Vs. Compost Products

- Have been in use for decades as sediment control practice for disturbed areas
- Mixed results – requires precise installation, maintenance & post-construction removal

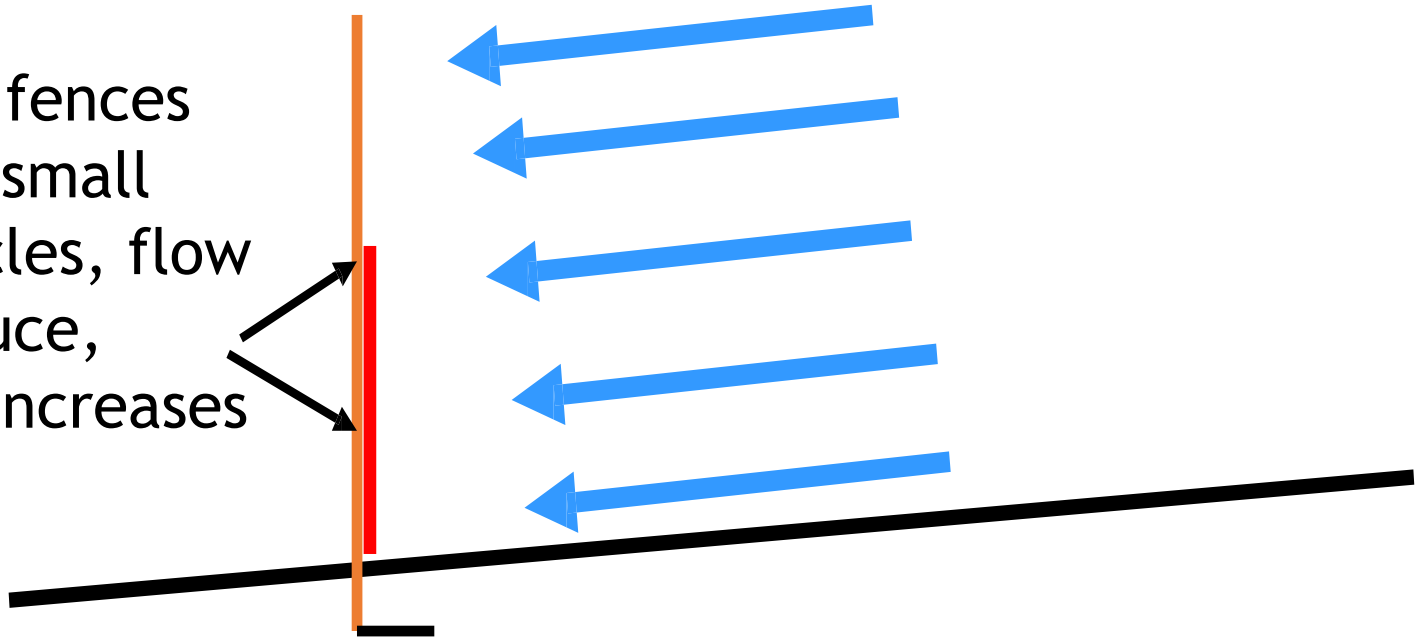
- Increasing in use as sediment control BMP
- Tested in multiple settings


Failed silt fence. Image cr: Filtrexx

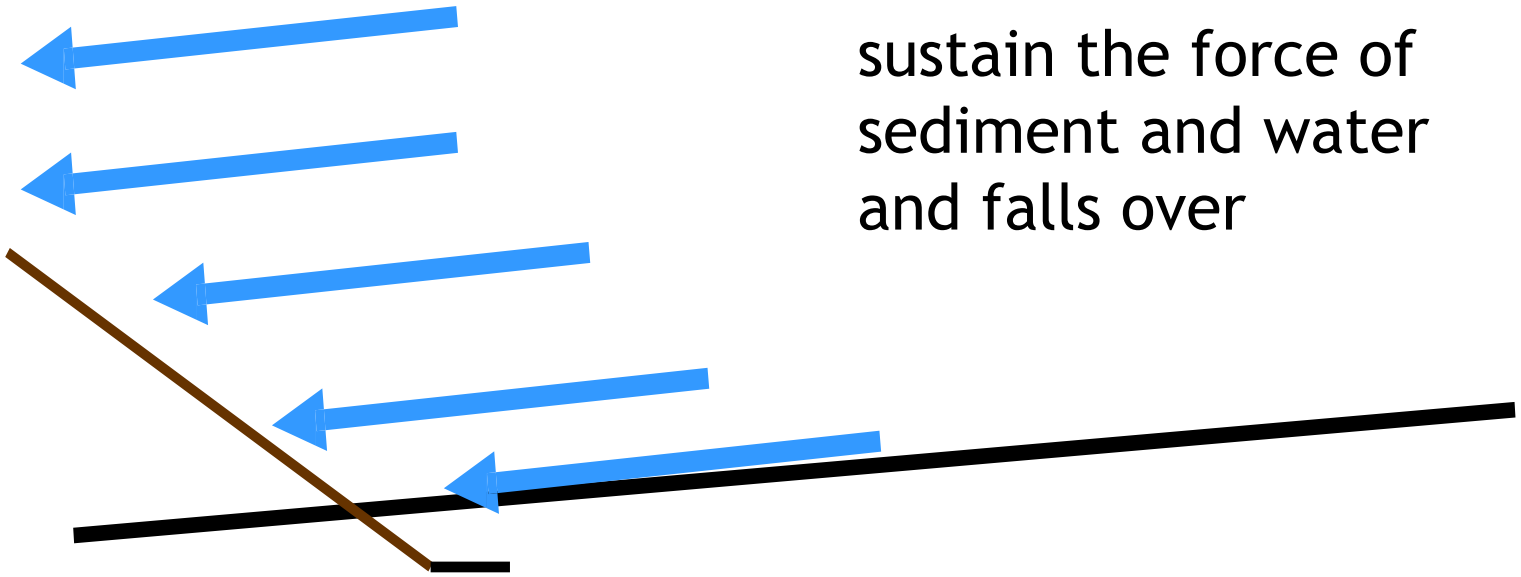
Eroded Sediments Knock Over Silt Fence

Silt Fences: Single Dimensional & A Problem When Clogged

When silt fences clog with small soil particles, flow rates reduce, ponding increases



The Number One Problem With Silt Fences (Besides Improper Installation)



Silt fence cannot sustain the force of sediment and water and falls over

Cost Estimates (2006): Filter Socks Vs. Silt Fences

	Filter Sock	**Silt Fence**
Materials (linear foot):	$3.00-3.50	$2.09-2.89
All-in Cost* (linear foot):	$7.68-8.18	$8.00-9.64

An 18-inch diameter sock used as a check dam ranges from $2.75 to $4.75 per linear foot.

*include materials and installation, inspection and sediment removal, repair and replacement, and fence removal and disposal cost

Timing of Application

- Most successful when planned for in design phase of a project
- Lead time for finding installers

Sourcing

- Erosion control businesses a good place to start

Tips and Tricks

- Get compost sample to verify it's the right coarseness
- Hydroseeding over compost may combine best of both worlds

Operation & Maintenance

- Location of compost availability drives a lot of the cost

Other Benefits of Filter Socks

- More natural solution
- Reduces chances of returning to site to fix wash outs
- Better at trapping soil particulate onsite to reduce run off
- Compost can be left and/or spread out after use

Detailed Resources

- Corey Poland – A comparison of DOT Erosion control blankets and specs

- Cal Trans – Improving Stormwater Quality with Compost Webinar 3:30hrs https://www.youtube.com/watch?v=CEZHnyEOQ8M

- Cornell's Compost Use for Improved Soil Poster Series https://ecommons.cornell.edu/handle/1813/45901