

Compost Use



GREEN INFRASTRUCTURE

Green Infrastructure



- *Green infrastructure is the physical environment within and between our cities, towns and villages. It is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, wetlands, forest, and open countryside. It comprises all environmental resources.*

Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

Green Infrastructure



- **Successful land conservation in the future will have to be:**
 - More proactive and less reactive
 - More systematic and less haphazard
 - Multifunctional, not single purpose
 - Large scale, not small scale, and
 - Better integrated with other efforts to manage growth and development. The key to accomplishing this is “*green infrastructure*”.

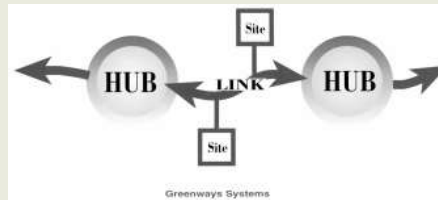
Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

Hubs



HUBS anchor green infrastructure networks and provide an origin or destination for wildlife and ecological processes moving to or through it. Hubs come in all shapes and sizes, including:

- **RESERVES** — Large protected areas, such as national and state parks and wildlife refuges;
- **MANAGED NATIVE LANDSCAPES** — Large publicly owned lands, such as national and state forests, managed for resource extraction as well as natural and recreational values;
- **WORKING LANDS** — Private farms, forests, and ranches that are managed for commodity production yet remain in a predominantly open and undeveloped state;
- **REGIONAL PARKS AND PRESERVES** — Less extensive hubs of regional ecological significance; and
- **COMMUNITY PARKS AND NATURAL AREAS** — Smaller parks and other sites at the community level where natural features and ecological processes



Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

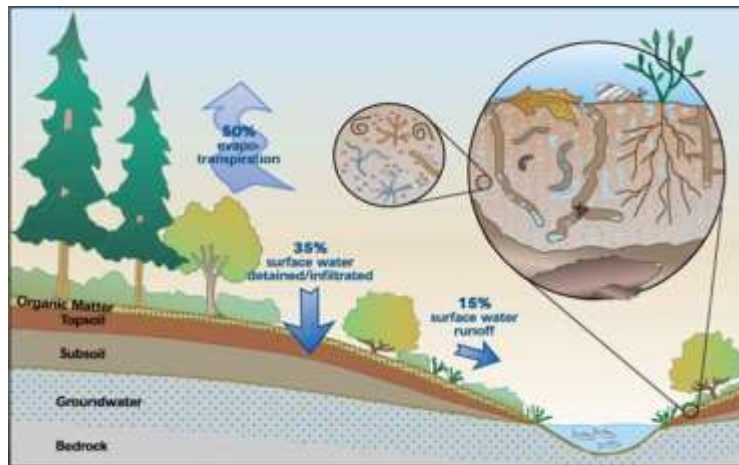
Links



LINKS are the connections that tie the system together and enable green infrastructure networks to work. They range in size, function and ownership, including:

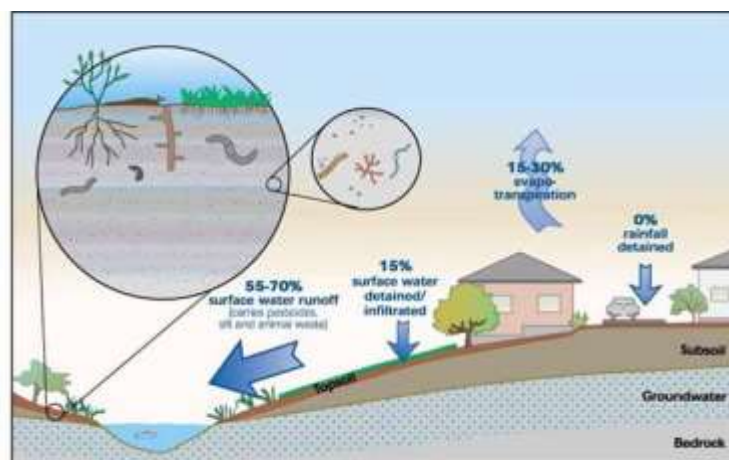
- **LANDSCAPE LINKAGES** — Large protected natural areas that connect existing parks, preserves, or natural areas and provide sufficient space for native plants and animals to flourish while serving as corridors connecting ecosystems and landscapes. Landscape linkages may also provide space for the protection of historic sites and opportunities for recreational use;
- **CONSERVATION CORRIDORS** — Less extensive linear protected areas, such as river and stream corridors that serve as biological conduits for wildlife and may provide recreational opportunities;
- **GREENWAYS** — Protected corridors of land managed for resource conservation and/or recreational use;
- **GREENBELTS** — Protected natural lands or working lands that serve as a framework for development while also preserving native ecosystems and/or farms or ranchland; and
- **ECOBELTS** — Linear woody buffers that can ease the zone of tension between urban and rural land uses while providing ecological and social benefits for urban and rural residents.

The Natural Cycle



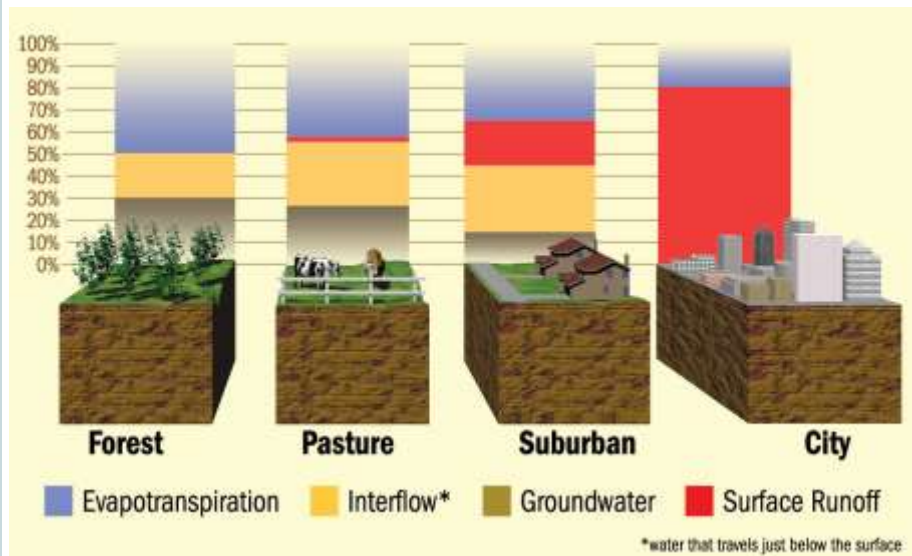
Native Soil

The Urban Environment



Disturbed Soil

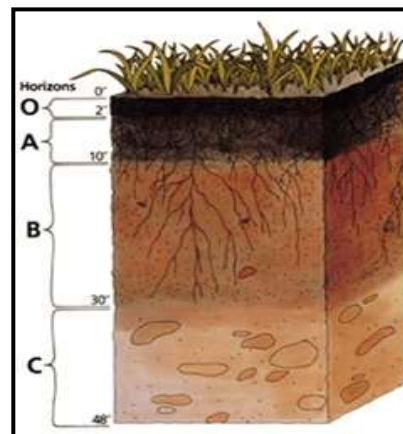
Stormwater Hydrology



Source: Sego Jackson -2001

The Soil Profile

- Topsoil (“O” and “A” Horizons)
 - Major zone of root development for plants
- Subsoil (“B” Horizon)
 - Harder for plant roots to penetrate
- Less reservoir of nutrients and moisture
- Often less drainage (wetness)
- Plant growth defined by “Law of the Minimum”
 - Constrained by most limiting nutrient (water, N, P, K, microelements, organic matter)





Native NC Soils

- These soils are called Ultisols.
- They are strongly leached, acid forest soils with low native fertility.
- Most have low percentages of SOM. (less than 1%)
- Our nation's most fertile soils have SOM readings in the 5-7% range
- A soil with insufficient organic matter may not hold water adequately or supply an environment for beneficial microbes
- These soils become quickly dependent on high levels of watering and multiple fertilizer applications and pesticides to maintain the appearance that our society expects

Soil Organic Matter-(SOM)

- Organic matter is the key to healthy soil and hence healthy plants.
- SOM is critical for the soil to function properly to support plant life naturally
- It provides structure and a place for water, air, and biological life to exist in soil

Soil Organic Matter

- The percentage of organic content directly relates to water holding capacity
- Each 1% of Organic Matter adds about 1.5% to available water capacity
- For every 1% of Organic Matter content, the soil can hold 16,500 gallons of plant available water per acre of soil down to one foot in depth

Source: National Sustainable Agriculture Information Service-(ATTRA)

Promoting Deep Rooted Vegetation

Improving soil health to encourage deep rooting by providing:

- Good soil tilth
- Sufficient depth
- Sufficient, but not excessive, nutrient supply
- Good soil drainage
- Large population of beneficial organisms



Compost Defined

- A humus-rich soil amendment made by the controlled biological decomposition of organic materials
- Made from organic wastes like yard trimmings, organic by-products, industrial residuals, food scraps, animal manures, biosolids
- Must go through an aerobic heating process to be biologically stable and mature
- Can improve biological, physical and chemical characteristics of soils

Compost – How is it made?

- Raw materials (feedstocks) are mixed together
 - Balance Carbon:Nitrogen ratio to 25-30:1
 - Balance moisture content to 50-60%
 - Balance structural porosity to 35-50%
- Primary composting – 21-120 days, depending on technology
 - Achieve time-temperature requirements of “Process To Further Reduce Pathogens” (40 CFR Part 503)
 - 131o F. for 3 consecutive days if aerated static pile
 - 131o F. for 14 cons. days if windrows
- Curing (aging) – 2-6 months or longer

Benefits of Compost Use

Physical

- Provides organic matter
- Improves structure
- Provides moisture management

Chemical

- Modifies and stabilizes pH
- Increases CEC
- Provides nutrients

Biological

- Provides soil microorganisms
- Suppresses plant diseases

Environmental

- Binds/degrades contaminants
- Binds nutrients
- Sequesters air-borne carbon



Compost Quality





Novozymes NA, Inc.
 Frank Francisco
 P.O. Box 176
 Franklinton
 NC 27525-0576 0

Product Identification: Compost
 Name: GREEN-RELEASE Compost

Date Sampled/Received: 02 Sep. 14 / 03 Sep. 14

COMPOST TECHNICAL DATA SHEET

Laboratory: Soil Control Labs 42 Hanger Way, Watsonville, CA 95076 tel: 831.724.2422 fax: 831.724.1188			
Compost Parameters	Reported at time of assessment	Test Results	Test Results
Plant Nutrients	% weight basis	Not reported	Not reported
Moisture Content	% wet weight basis	40.7	
Organic Matter Content	% dry weight basis	54.5	
pH	none	7.52	
Soluble Salts (electrical conductivity 25°C)	dl/lw (milliMhos/cm)	2.3	
Particle Size or Sieve Size	maximum aggregate size, inches	0.64	
Stability Indicators (representative)		Stability Rating	
CO ₂ Evolution	mg CO ₂ -C/g DM/day	1.4	stable
	mg CO ₂ -C/g DM/day	1.4	
Maturity Indicators (representative)			
Percent Emergence	average % of count	100.0	
Relative Seedling Vigor	average % of count	100.0	
Select Pathogens	PAS5-PAIL, per US EPA Class A standard, 48 CFR § 193.52(a)	Pass	Fecal coliform
		Pass	Salmonella
Trace Metals	PAS5-PAIL, per US EPA Class A standard, 48 CFR § 193.11, table 1 and 2	Pass	As, Cd, Cr, Cu, Pb, Hg, Mo, Ni, Se, Zn

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

Laboratory Group: Sep. 14 A Laboratory Number: 400009-113
 Analyst: Arad Smith *Arad Smith* www.compostlab.com

Directions for Product Use:

Type of Application Use Recommended Rate:

- Landscaping: Excellent for Tree Plantings - 10-50% by volume mixed in with native soil
- Landscaping: Mid-Range - 1 inch evenly applied
- Landscaping: Ornamental Beds - 3-5 inches filled into raised bed
- Turf: New Turf Establishment - 1-2 inches filled in to a depth of 3 inches
- Turf Topdressing - 1/2-1 inch evenly applied and raked in
- Nurseries: Container Mixes - 5-50% by volume
- Nurseries: Field Application - 1 inch applied to 24 inch
- Vegetable Gardens - 2-3 inches filled in to a depth of 7 inches

Cubic Yards of Compost Required to Cover - 1,000 square feet

1/2 inch layer	Approximately 9.75 cubic yards
3/4 inch layer	Approximately 1.7 cubic yards
1 inch layer	Approximately 1.0 cubic yards
1 1/2 inch layer	Approximately 0.7 cubic yards
2 inch layer	Approximately 0.5 cubic yards

Novozymes has tested this product to the recommended uses above and takes no liability for the actual or improper application of this product. We always recommend testing your soil before use.

(Note: The USCC will not assume whether or not, or in what amount, these directions are appropriate. It is the Participant's responsibility alone to ensure that they are.)

Compost Ingredients:

This compost is made from food grade enzyme residuals derived from corn, sugar and potato starch potatoes, sweetpot, ground yard trimmings and pre-consumer food residuals.

This compost product has been analyzed and tested as required by the Seal of Testing Assurance Program of the United States Composting Council (USCC). Test results are available upon request by calling Novozymes North America, Inc. at 919-494-1489. The USCC makes no warranties regarding this product or its contents, quality, or suitability for any particular use.

For additional information pertaining to compost use, the specific compost parameters listed for within the Seal of Testing Assurance Program, or the Program in general, log on to the US Composting Council's web site at www.compostingcouncil.org.

What is good compost?

- **Stable** – low biological activity level
- **Mature** – aged for optimum plant growth
- Nutrient content – 0.5-2.5% N, 0.2-2.0% P and 0.3-1.5% K
- **Organic matter content** – 50-60%
- Moisture content – 40-50%
- **Water holding capacity** - > 100%
- pH – 6.0-7.5
- **Soluble Salts** - < 6 mmhos/cm
- Bulk density – 800-1,000 lbs/cy

Why Use Compost?

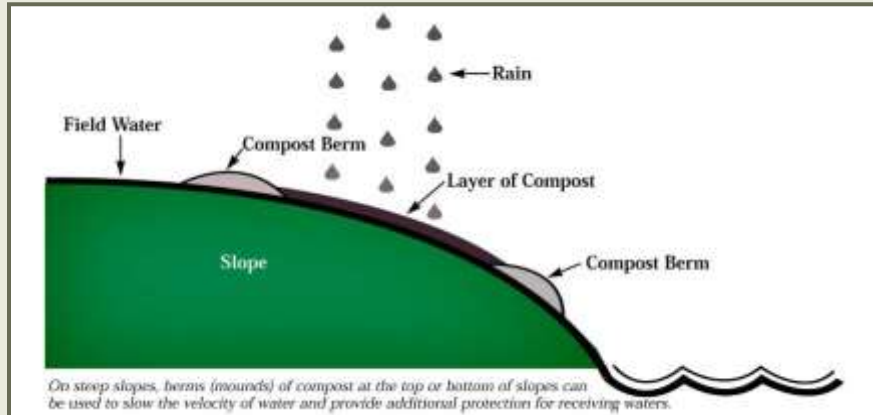
- Increase water infiltration into soil surface
- Increase water-holding capacity of soil
- Reduce soil particle dislodging
- Reduce runoff and soil particle transport in runoff
- Establish new vegetation directly into compost
- Increase plant growth and soil cover
- Buffer soil pH – improve vegetation growth

EROSION/SEDIMENT CONTROL

Compost Erosion Control Blankets

- **Advantages**
 - Intimate contact allows nearly 100% ground contact, eliminating puckering of other blankets
 - Intimate contact reduces sediment loss
 - Water infiltration increases, increasing germination from seed
 - Water discharge from slopes decreases, reduces potential sediment loss (Iowa State Study 2003)
 - Addition of organic matter improves slope ability to revegetate and establish a permanent erosion system

How is it used for Erosion Control?



Soil Contact



Compost Blanket Applied



Temporary Stabilization



Vegetative Permanent Stabilization



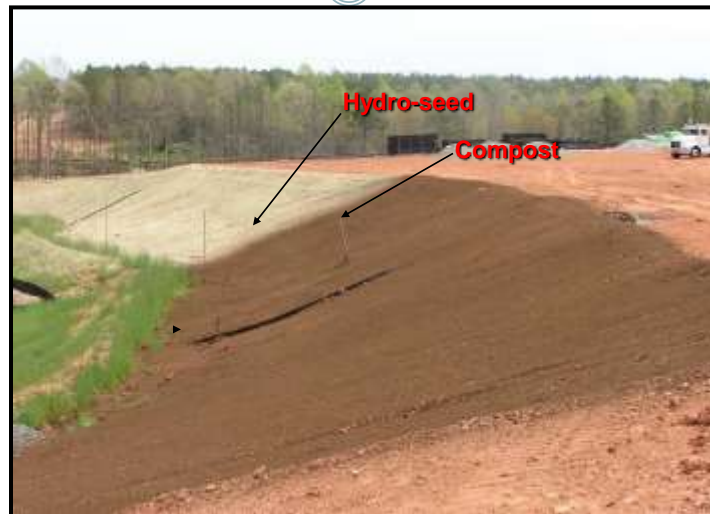
Before Application



After Application



Compost Blanket vs. Hydro-seeding



Compost Blanket vs. Hydro-seeding



One week later-One 3 inch rain event

Hydroseed Components Move with Sediment (seed, nutrients & chemicals)



Total Solids Lost



Britt Faucette, PhD University of Georgia

Lock Down Netting

- **Advantages:**
 - Adds shear strength to slippery slopes
 - Adds extra holding power to depths of compost
 - Biodegradable option 'goes away'
 - Easy to install
 - Made from 100% cotton, recycled materials
 - Replaces similar products from \$3-10/cy

Used in Combination



Compost Sock & Blanket



Compost Sock-Blanket-Lock Down Net



Federal Hwy Admin – Blue Ridge Pkwy



Installed



Established



Compost Filter Socks



- **Advantages:**
 - Contained material reduces wash out
 - Weight of compost filter sock resist movement
 - Guaranteed volume/size from compost filter sock
 - Continuous Lengths means unbroken perimeter control
 - Three dimensional Filtration

What are Compost Filter Socks?

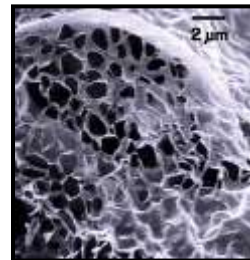


- A mesh tubular product which is filled on site with a compost or composted media
- The product has the capability to be a continuous length, or cut to fit the application
- **Only 2 Manufacturers**
 - Filtrex International
 - Envirotech Biosolutions

Compost Filter Socks



Compost Filter Media



Compost Filter Media Specifications

Compost Filter Media is a specially manufactured composted product which meets the following Specifications:

- 99% < 2", 90% < 1", 60-70% > 3/8"
- optimized Flow Rate of between 12 and 18 GPM
- 90+% Filtration of Total Solids and 50+% TSS
- 98% filtration of hydrocarbons and motor oil

Compost Filter Socks vs. Silt Fence



Silt Fence



Filter Sock #1

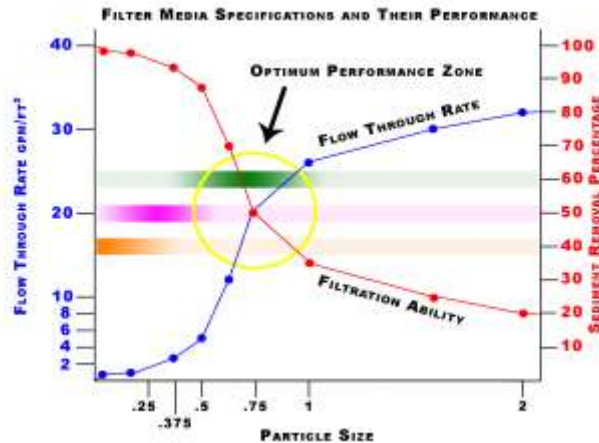


Filter Sock #2



Filter Sock #3

Customize Flow Rate & Sediment Removal for Site Conditions



Unique Features of Compost Filter Media

- Three dimensional Filtration
 - NOT a single membrane or piece of cloth
 - Compost Particles form a Filtration 'Matrix'
- Three way filtration
 - Chemical
 - Binding – a chemical reaction over time
 - Physical
 - Blocking/trapping soil gets caught in openings
 - Biological
 - Compounds degraded via reactions/

How the Product is Installed



Palletized onsite solutions

- Quick Patchwork
- Emergency Containment
- Replace when needed
- Can be moved



Industry Approval



US EPA	National Menu of BMPs
US EPA - NPDES Phase II	National Stormwater BMP list - Construction Activities
US EPA	GreenScapes
US EPA - Dallas	Region 6
US EPA	Regions 5
US EPA	Innovative Technology Inventory
US EPA	Stormwater Tradeshow
Federal Highway Admin	Blue Ridge
AASHTO	MP9-05 Berms/Socks

Industry Approval

Minnesota	DOT
Montana	DOT
Nebraska	DOR
New Hampshire	DOT
New Mexico	DOT
North Carolina	DOT/NC-NRCS/NCDENR-Energy, Mineral and Land Resources
OHIO	EPA
Oregon	DOT
Pennsylvania	DEP
South Carolina	DOT
Tennessee	DOT
Texas	DOT / TNRCC / TCEQ

Perimeter Protection



Inlet Protection

- Advantages:
 - True 3 way filtration
 - × Physical, chemical and biological
 - × Testing is currently being done for removal rates, etc.
 - Easy to install, maintain and remove
 - × Simple construction – maintenance is easy because it is outside the Compost Filter Sock on hard surface
 - No Domino effect
 - × Hi flow rates exceeding design capacity go over top of Compost Filter Sock into the drain, without flooding road surface or going over curbs

1 hour after a 2-inch rainfall event



Sediment Trap



Compost Naturally Filters Hydrocarbons!



Ditch Checks



- **Advantages:**
 - Replace straw bales and silt fence in drainage channels to increase total sediment removal
 - Can create 'terraces' as sediment and vegetation fills in behind sock
 - Easy to remove compared to rip rap
 - More effective filtration for sediment and other contaminants than rock checks or silt fence
 - Can be left in place or removed



Filter Rings



- **Advantages:**
 - Customizable filter size to treat any discharge
 - Easy cleanup and disposal
 - Additional rings can be added for continued filtration
 - Vertical Layers can be added for additional filtration

Temporary Sediment Filtration



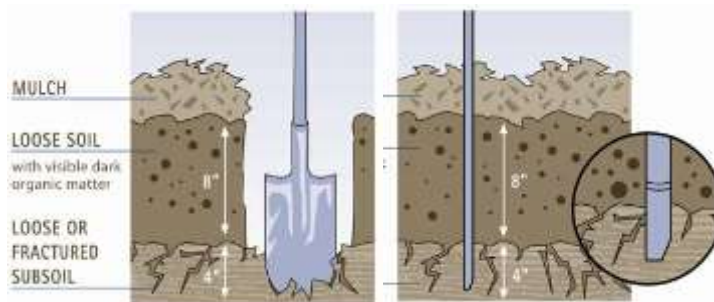
STORMWATER MANAGEMENT

Soil Restoration



- Soil quality is directly related to stormwater detention capacity, and so to the health of streams and aquatic resources. Soil quality also determines landscape success: plant survival, growth, disease resistance, and maintenance needs.
- **Soil retention** – preserving existing site vegetation and soil, un-compacted by equipment, or
- **Soil restoration** – correcting compaction to a 12-inch depth, and amending soils with compost or bringing in/reusing an amended topsoil to an 8-inch depth, plus
- **Soil protection** – protecting restored soils from re-compaction, and mulching after planting to prevent erosion and support healthy plant growth.

Soil Restoration



Soil BMP Requirements



Washington

DOE Stormwater Manual BMP t 5.13 --Soil Quality and Depth

- Building permit requires achieving a post-construction soil standard to preserve and restore soil quality and meet new code requirements
- Four options
 - Leave native soil undisturbed and protect from compaction
 - Amend existing soil in place (pre-approved amendment rate of 2.5 " to a depth of 8 inches
 - Import topsoil mix with 8-13% organic matter content
 - Stockpile site duff and topsoil and reapply after grading and construction 8" minimum depth

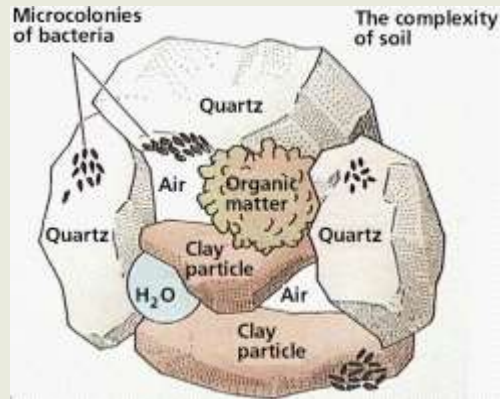
Soil Restoration



- Amending soils with compost can restore soil functions:
 - Decreases surface water runoff
 - Increases water infiltration
 - Traps sediments, heavy metals and excess nutrients; and biodegrades chemical contaminants
 - Rebuilds the beneficial soil life
 - Improves plant health, with reduced need for additional water, fertilizer and pesticides
 - Aids deep plant root growth

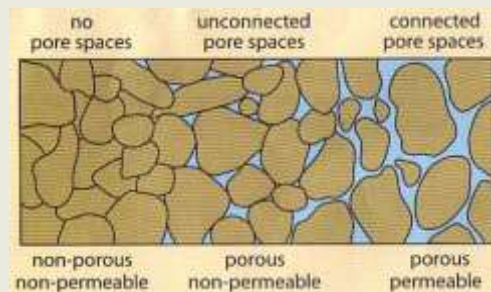
Factors That Influence Soil Water Movement

- Gravity
- Capillary action
- Soil porosity & permeability
- Soil layering
- Organic matter
- Deep rooted vegetation



Factors That Influence Soil Water Movement

- Soil porosity
- Porosity is a measure of the open space within soil or rock
 - Pore spaces represent the reservoir for holding water.



Factors That Influence Soil Water Movement

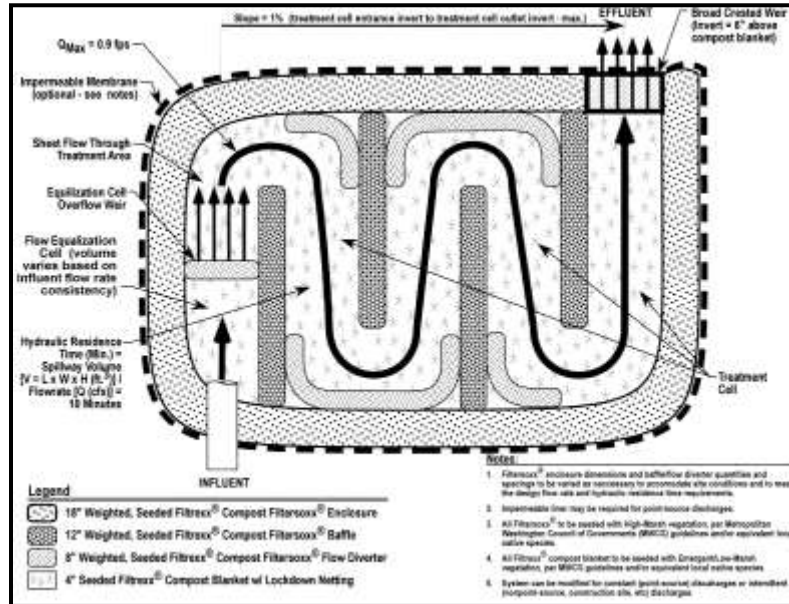


- Permeability is a function of the sizes of particles, pores, and the way they are arranged.
- Permeability is how quickly water will flow through the soil
- The straighter and larger the pores, the faster the permeability.
- **Clays** tend to **reduce** the porosity and permeability of soil material due to the small pores.
- Generally, surface horizons have a larger porosity and subsoils have smaller porosity and reduced permeability

Filter Cell



- **Advantages:**
 - Increased filtering capacity compared to traditional sediment ponds
 - Ideal for sensitive areas
 - Small Plot can treat large areas
 - Each Cell Section can treat a different contaminant – through varying of specified compost and/or polymer treatments



Installed



Working In Transition



Established






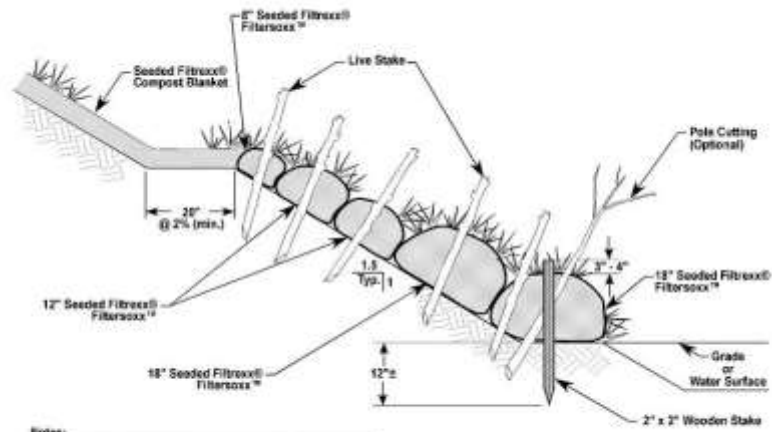
RESTORATION/REMEDICATION & STABILIZATION



Living Walls

- **Advantages**
 - One of the only tools to establish vegetation in steep slope situations – ½:1
 - Easy to install and roots help establish bank stability for the long term
 - Low cost compared to block walls or other retaining structures
 - Resists erosion and prevents bank slippage
 - Customizable vegetation makes it an attractive landscape option
- 

Filtrex® Living Wall™ Slope/Bank Stabilization System



- Notes:
1. All material to meet Filtrex® specifications.
 2. Filtrex® compost/sol/rock/seed fill to meet application requirements.
 3. Typical Filtrex® illustrated. Modify to meet application requirements.

Slope Failure



Established Living Wall



Residential Grade Change



Installed



Inter-coastal Waterway-SC



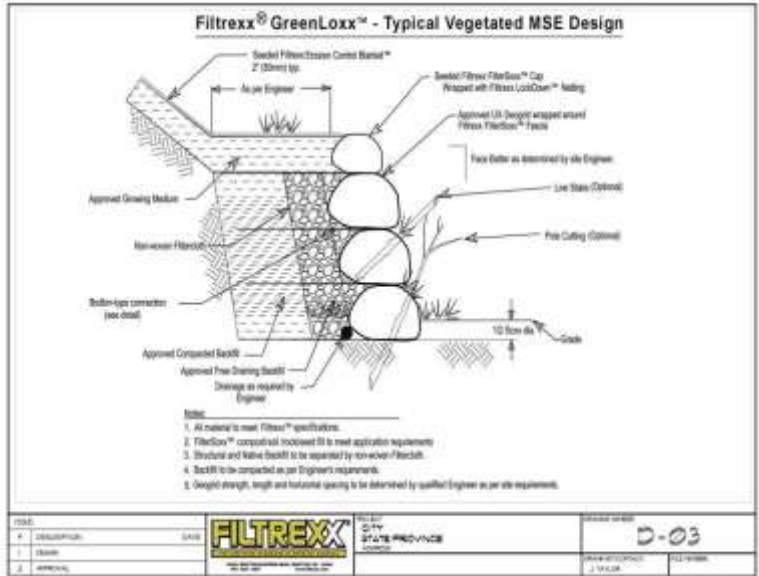
Established



Living Walls



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Geo Grid Slope Tie In



Geo Grid Sock Tie In



Installed



Growing



Stabilize



Pulte Homes – NJ



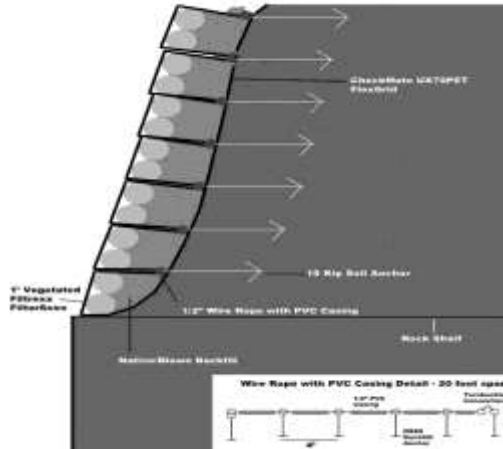
Living Wall Installed



Cross Diagram



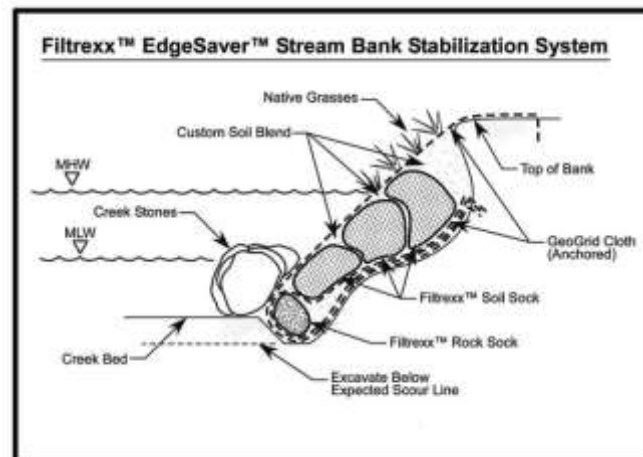
1/4:1 Batter for 14' - Not drawn to scale



Stream & Lake Bank Stabilization

- Advantages:
 - Only technology which combines immediate bank protection with vegetation establishment for the long term
 - Can seed in the sock – no other technology can do this
 - Live stakes or plugs planted directly into the sock provide customization to the site
 - Can reach remote areas without disturbance
 - Continuous sock offer unbroken protection
 - ✦ This is a huge benefit in streambank stabilization where forces of water catch edges of other competing products = erosion

Cross Diagram



Root Anchors to Bank



Installed & Staked



5 Days Later



20 Days Later



18 Months Later



Extreme Slop Failure







How much does it cost?

- STA Compost (3/8 inch) \$10.00-\$15.00/CY
- Compost blankets - \$0.18 - \$0.35/SF (square ft)
- Compost berms - \$2.00 - \$4.00/LF (linear ft)
- Compost socks - \$2.50- \$4.50/LF
- Living Walls-priced by job
- Streambank Restoration-priced by job

LEED Credits



Products and Practices

1. Sustainable Sites (potential credits=14)
2. Water Efficiency (potential credits=5)
3. Energy and Atmosphere (potential credits=11)
4. Materials and Resources (potential credits=13)
5. Indoor Environmental Quality (potential credits=15)
6. Innovation and Design Process (potential credits=3)

Filtrex Design Manual



Filtrex® Design Manual “Online” Access:

Filtrex offers FREE specifications and CADs for over 25 applications. Downloads are available in PDF, DWG, and DXF. Request free access at:
www.Filtrex.com/specifications

Questions



"A nation that destroys its soils, destroys itself"
- Franklin D. Roosevelt



2015
International
Year of Soils