Sustainable Solutions for Bank and Slope Restoration

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Filtrexx International
Overview

- Issues
- Solutions
- Sustainability
- Our Story
- Filtrexx Solutions
- Projects
- System Benefits
- Impact
Issues: Banks and Slopes

What’s the problem here?
Cause
Movement of dislodged particles

- Wind, Water & Gravity
- Concentrated Flow
- Loss of vegetation
- Soil cohesion
- Soil loss
Solutions

What’s in your toolbox?
Traditional Solutions

- Rock – Rip Rap
- Concrete
- RECP’s – Blanket & TRM
- Cellular Confinement
- Gabion
- Wire Faced Systems
- Natural methods
Sustainability

What makes a solution sustainable?
Sustainable Solutions

- Do not add to the problem
- Repurpose / Reroute / Renew
- Duplicatable
- Native Vegetation
- Add value
February 14, 2018

'LIVING GREEN WALLS' LINED WITH TREES AND BUSHES COULD HELP REDUCE TOXIC POLLUTION
SUSTAINABLE RESIDENTIAL DESIGN: APPLYING ECOLOGICAL DESIGN

Over the four-year construction period, the addition of hundreds of mature trees and countless flowering shrubs, perennials, and groundcovers brought in a flood of nesting birds and insect pollinators. The transformation was evident to workers who had been at the site from start to finish. They went from seeing virtually no wildlife at the beginning to experiencing a cacophony of bird song at dusk and swarms of bees, butterflies, and moths bouncing from plant to plant as they came into bloom. The diverse plantings ensure staggered bloom times to keep pollinators busy year-round, and create niche habitats for many birds and small mammal species. The property is now a lush oasis for urban wildlife in an otherwise biologically monotonous neighborhood. ASLA 2016 Professional Residential Design Honor Award. Kronish House, Beverly Hills, California / Marmol Radziner

Plants are central to a functioning global ecosystem. Plants oxygenate the atmosphere and reduce atmospheric pollutants. Ecological restoration in both developed and developing countries is a primary strategy for mitigating the impacts of climate change. Native plant communities are not only key to the global ecosystem, but also crucial to environmental and human health at the residential and neighborhood scales.
Sustainability through Vegetation Landscape Design

This year's Earth Day, which was celebrated worldwide recently, put a strong emphasis on vegetation with its “Trees for the Earth” theme, as there has been growing concern in relation to the drastic reduction of green spaces across the urban areas in the world.

May 5, 2016
The Filtrexx Story:

1 part Compost – 1 part Mesh – 1 part Ingenuity
A simple recipe of recycled organics and biomimicry disrupts an industry through performance & environmental sustainability around the globe.
The Evolution of Filtrexx

Beneficial Reuse of Organics
- Filtrexx International Opens - 2002
- The Recipe = MESH + MEDIA + PATENT

Science
- Research, Testing, Engineering;
- Federal/State Approvals & Specs Developed for 25 Applications;
- Design Manual Published for Designers/Engineers;

Market Development
- In-House Marketing Drives National Attention;
- Training an International Network of 120+ Professional Installers;
- Creation of the Filtrexx Big Mac = The SiltSoxx™ Pallet;
- Rapid Growth of Manufacturing, Development, Distribution, and Sales.
High Performance SMP’s for all phases of development

http://ecopractices.com/industry
Compost Socks
Recycling and Low Impact Development Movement

WOOD
FOOD
LEAF Waste

CERTIFIED MEDIA

MESH
Compost Filter Socks
Compost Growing Socks
“Back to Nature”

Superior Results
Growing Media™
Filtrexx Solutions

Bank and Slope Restoration
GreenLoxx Applications

- **MSE** (Mechanically Stabilized)
  - Up to 80°
  - Slope instability
  - Reinforcement – FLW Geogrid
  - Variable Set back
  - Compacted Fill
  - Typical retaining wall design
  - Engineered
  - Customized Seed

- **Non MSE**
  - Up to 50°
  - Stable slope
  - Wrap Soxx – FLW Geogrid
  - Soil Anchor system
  - Methodology
  - Soils Report
  - Anchored vegetative facing
  - Customized Seed
GreenLoxx MSE
GREENLOXX MSE REINFORCED LIVING WALL DETAIL

SEEDED FILTREXX SLOPE PROTECTION, 2" DEPTH

APPRIOVED GROWING MEDIUM

FLW 20 GEOGRID WRAPPED AROUND FILTREXX GROSSOXX FASCIA OR OTHER STRENGTH (FLW 3S OR FLW 5S)

BATTER SET BY STEPPING BACK ROWS

BATTER DETERMINED BY DESIGNER

SEEDED FILTREXX GROSSOXX (8"-18" TYP.) OR LIVE PLANTED (SEE NOTE 5)

MINIMUM 6" EMBEDMENT

DRAIN PIPE: LOCATION AND DISCHARGE POINTS AS REQUIRED BY ENGINEER

4" SLOTTED AND WRAPPED PERFORATED PIPE, DRAIN THROUGH WALL FACE AT LOW POINT OF WALL AND AT MAXIMUM SOFT INTERVALS.

FILTER FABRIC BETWEEN DRAIN ROCK AND SELECT FILL

DRAINAGE AGGREGATE 12" THICK MIN.

NOTES:
1. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
2. GROSSOXX FILL TO MEET APPLICATION REQUIREMENTS.
3. ALL GROSSOXX TO BE SEEDED PER LANDSCAPE ARCHITECT'S SPECIFICATIONS.
4. BACKFILL TO BE PLACED PER ENGINEER'S REQUIREMENTS.
5. GEOGRID STRENGTH, LENGTH, AND VERTICAL SPACING TO BE DETERMINED BY ENGINEER. GEOGRID—NO STRANDS ARE TO BE CUT DURING PLANTING, ETC. WE RECOMMEND BI-DIRECTIONAL STRENGTH FOR CONSTRUCTION EASE.
6. NATIVE AND DRAINAGE BACKFILL TO BE SEPARATED BY NON-WOVEN FILTER FABRIC.
7. MAXIMUM HEIGHT RECOMMENDED: TEN FEET EXPOSED HEIGHT.

thes graphic representations are intended for preliminary design purposes only and are not to be used for construction without the signature of a registered professional engineer.
Streambank Project Profile
GreenLoxx Non MSE
FLW 20 GEOGRID OR OTHER DESIGN STRENGTH (FLW 35 OR FLW 55)

GRIPPLE SOIL ANCHOR 3' MIN DEPTH OR OTHER ANCHOR STRENGTH AS PER ENGINEER

DETAIL A

LIVE WILLOW STAKES OR OTHER PLANT MATERIAL FROM SEED OR FROM LIVE PLUGS

*NO GRID STRANDS ARE ALLOWED TO BE CUT IN ORDER TO INSERT PLANTS IN ANY CASE.

EXISTING GRADE

STONE SHELF

8"-18" SEEDED FILTREXX FILTERSOXX

DETAIL B

GREENLOXX NON-MSE REINFORCED LIVING WALL DETAIL [STYLE 1]
FLW 20 GEOGRID OR OTHER DESIGN STRENGTH (FLW 35 OR FLW 55)

GRIPPLE SOIL ANCHOR 3’ MIN DEPTH OR OTHER ANCHOR STRENGTH AS PER ENGINEER
Non MSE Components
Rocky River, Ohio
Lake Erie
Richland Co. SC
Project Profiles

GreenLoxx in action around the country
Harrisburg, PA
Springfield, MO
Phenix City, AL
Chattahoochee River
Shorewood, WI

Lake Michigan
St. Louis, MO
Gilroy, CA
System Benefits

Sustainable BMP’s and the impact
System Benefits: SBMP’s

- Redirecting Organics
- Carbon Impact
- Vegetation impact
- Heat Island Reduction
- Biodiversity and Habitat
- Native Pollinators
- Air Quality
- Stormwater Runoff Absorption
Role of vegetation in sustainability of infrastructure slopes

Authors: S. Glendinning, PhD, F. Loveridge, MSc, CEng, MICE, CGeol, FGS, R. E. Starr-Keddie, MSc, M. F. Eransby, MA, PhD, and P. N. Hughes, MSc, PhD

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Abstract

Many aspects of the performance of infrastructure slopes are affected by vegetation, but many are conventionally overlooked by engineers. This paper explores in detail the engineering aspects associated with vegetation on infrastructure slopes and the conflicts that must be managed in order to maintain safety and serviceability. It also examines the importance of roadside corridors as grassland habitats and the difficulties of managing and maintaining the diversity of species using safe and economic management practices. The biodiversity of roadside grassland habitats is discussed in this paper, but it is expected that these findings will offer general lessons for the vegetation management of infrastructure slopes.
Stormwater Absorption
The Impact
Sustainability by the numbers
Recycled Organics
Recycling organic wastes by diverting these materials from landfills helps to preserve landfill space, prevents pollution from landfill leachate, and reduces carbon intensive greenhouse gases. The amount of organics recycled/diverted from the landfill per linear ft of 12 inch diameter SiltSoxx with FilterMedia compost = 80 lbs; organics diverted from the landfill, while 1 linear ft of 12 inch diameter GroSoxx with GrowingMedia compost = 160 lbs; organics diverted from the landfill.

Water Absorption, Conservation, & Treatment
With approximately 50% organic matter, a high porosity, and high relative surface area, compost has the ability to absorb significant volumes of water. Data extrapolated from published University research shows that each linear ft of 12 inch diameter Soxx (which equates to 1 square foot of Living Wall) with GrowingMedia compost can absorb up to 4 gallons of water (Faucette et al., 2005; Faucette et al. 2007).

This information may be used to determine the potential volume of rainfall absorption and resulting storm water runoff reduction, or the volume of captured storm water that can be treated or used as irrigation if applied to the Filtrexx Compost-Based SMP. Each of these scenarios could be extremely beneficial in drought prone or water restricted areas, or where green infrastructure or green building programs have been implemented.

Carbon Footprint Reduction
Filtrexx Compost-Based SMPs can have a significant impact on a project or site’s carbon footprint. There are four key ways in which our products can significantly lower carbon footprint.

1. Methane Avoidance: this is the process in which methane gas is prevented from forming due to organic materials being recycled/diverted from the landfill through composting. Methane gas is 25 times more concentrated in carbon than carbon dioxide (e.g. 25 carbon dioxide equivalents or 25 CO₂e). For each linear ft of 12 inch GroSoxx with GrowingMedia compost we prevent 280 lbs of CO₂e from going into the atmosphere, for SiltSoxx with FilterMedia compost we prevent 140 lbs of CO₂e (Sakai, 2007).

2. Carbon Sequestration by Permanent Vegetation: this is the process of taking CO₂ out of the atmosphere when permanent/perennial vegetation is established in our system (not temporary vegetation). If the project is in the Eastern US the carbon removed from the atmosphere is 0.05 lbs/linear ft of 12 in vegetated GroSoxx, and if it’s in the Western US it is 0.02 lbs/linear ft of 12 in vegetated GroSoxx (Chicago Climate Exchange, 2008).

3. Carbon Sequestration by Storing Carbon in the Soil: this is the process of using the stable carbon in compost, returning it to the soil, and creating a carbon sink (rather than source) as long term soil carbon. When compost is returned to the soil, part of the carbon in compost is considered active...
## Sustainable Management Practices Quick Reference Guide

### Water Absorption/Conservation (max. per rainfall event)

<table>
<thead>
<tr>
<th>Depth (in)</th>
<th>GroSoxx</th>
<th>SiltSoxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.6 gal/ft</td>
<td>22 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<tr>
<td>8</td>
<td>1.7 gal/ft</td>
<td>59 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<tr>
<td>12</td>
<td>4 gal/ft</td>
<td>140 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
</tr>
<tr>
<td>18</td>
<td>8 gal/ft</td>
<td>280 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
</tr>
<tr>
<td>24</td>
<td>16 gal/ft</td>
<td>560 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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</tbody>
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### Carbon Footprint

#### 1. Methane Avoidance

<table>
<thead>
<tr>
<th>Depth (in)</th>
<th>GroSoxx</th>
<th>SiltSoxx</th>
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<tr>
<td>5</td>
<td>44 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<td>8</td>
<td>118 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<td>12</td>
<td>280 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<td>18</td>
<td>560 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
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<tr>
<td>24</td>
<td>1120 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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</tbody>
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#### 2. Carbon Sequestered in Vegetation: Western/Eastern US

<table>
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<tr>
<th>Depth (in)</th>
<th>GroSoxx</th>
<th>SiltSoxx</th>
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<tbody>
<tr>
<td>5</td>
<td>0.003/0.007 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
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<tr>
<td>8</td>
<td>0.008/0.02 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.02/0.05 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.04/0.1 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>0.08/0.2 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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</table>

#### 3. Carbon Sequestered in Soil

<table>
<thead>
<tr>
<th>Depth (in)</th>
<th>GroSoxx</th>
<th>SiltSoxx</th>
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<tbody>
<tr>
<td>5</td>
<td>4 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<tr>
<td>8</td>
<td>11 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>27 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<tr>
<td>18</td>
<td>54 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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<tr>
<td>24</td>
<td>108 lbs CO&lt;sub&gt;2&lt;/sub&gt;e/ft</td>
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Gilroy California

Project Environmental Impact - California Embankment

Wall Size: 90' long x 30' tall - filled with 12" Dia. GroSoxx / 2700 sf face / 40 courses x 90 lf = 3600 lf of Soxx permanently vegetated in the face

Organics Diverted from Landfills: 576,000 lbs

Potential Rainfall Absorption: 14,400 gallons

Methane Avoidance: 1,008,000 lbs of CO2e

Carbon Sequestration in Vegetation: 135 lbs of CO2

Carbon Sequestration in soil: 97,200 lbs of CO2
Pennsylvania Roadway

Project Environmental Impact - Penn Roadway

Wall Size: 300' long x 8' tall - filled with 12" Dia. GroSoxx / 2400 sf face / 11 courses x 300 lf = 3300 lf of Soxx permanently vegetated in the face

Organics Diverted from Landfills: 528,000 lbs

Potential Rainfall Absorption: 13,200 gallons

Methane Avoidance: 924,000 lbs of CO2e

Carbon Sequestration in Vegetation: 120 lbs of CO2

Carbon Sequestration in soil: 89,100 lbs of CO2
Wisconsin Residence

Project Environmental Impact - Wisconsin Lakefront

Wall Size: 100' long x 15' tall - filled with 12" Dia. GroSoxx / 1500 sf face / 20 courses x 100 ft = 2000 ft of Soxx permanently vegetated in the face

Organics Diverted from Landfills: 320,000 lbs

Potential Rainfall Absorption: 8,000 gallons

Methane Avoidance: 560,000 lbs of CO2e

Carbon Sequestration in Vegetation: 75 lbs of CO2

Carbon Sequestration in soil: 54,000 lbs of CO2
South Carolina Streambank

Project Environmental Impact - SC Creekbank

Wall Size: 1000' long x 4' tall x 2 sides - filled with 12" Dia. GroSoxx / 8000 sf face / 18 courses x 1000 lf = 18,000 lf of Soxx permanently vegetated in the face

Organics Diverted from Landfills: 2,888,000 lbs

Potential Rainfall Absorption: 72,000 gallons

Methane Avoidance: 5,040,000 lbs of CO2e

Carbon Sequestration in Vegetation: 400 lbs of CO2

Carbon Sequestration in soil: 486,000 lbs of CO2
“...an essential tool for engineers, designers, architects, regulators, planners, managers, contractors, consultants, policymakers, builders, and water resource managers.”

– Forester Press
• Mission: Management of organics for maximum, verifiable, documentable environmental services benefits for our customers and the communities they serve.
• 3rd Party Verification Partner for Filtrexx product environmental benefits;
• Corporate Accountability: Sustainability trends, documentable environmental benefits of product use choices;
• EcoPractices verifies, documents, and reports Filtrexx sustainability benefits: CO2e reduction, waste diverted from landfills/recycled.
Filtrexx by the numbers

A company with a mission
2017 Environmental Impact Through the Use of Filtrexx Products

- 775,731 tons of organic waste recycled/diverted from landfills
- 150,106 tons of sediment prevented from waterways
- 1,616,547 tons of CO$_2$ prevented from atmosphere
- 343,946 cars removed from highways/roadways
Questions?