filtrexx® SUSTAINABLE TECHNOLOGIES

Filtrexx® GroSoxx® Gabion (GroSoxx®)

PURPOSE & DESCRIPTION

The Filtrexx® GroSoxx® Gabion vegetated system combines soft and hard armor technology and is designed to stabilize and prevent erosion of waterway and shoreline banks. The GroSoxx Gabion system is composed of a heavy duty tubular mesh netting matrix used to contain and stabilize Filrexx® GrowingMedia™ and vegetation. This soft armor component can be used solely or as a green fascia within the rock gabion basket. The GroSoxx Gabion technology provides structural protection, erosion control, vegetation growth, and vegetation reinforcement in one system. The weight and anchoring system of GroSoxx Gabion can withstand flow velocities and hydraulic shear stresses similar to traditional soft armoring devices (brush mattresses, coconut fiber logs, turf reinforcement mats) and hard armoring devices (rip rap, rock gabion baskets), while the injected GrowingMedia ensures establishment and sustainability of both seeded and live stake plantings. This system is ideal for biotechnical engineering, wildlife habitat restoration, riparian and ecological restoration, and/or aesthetic enhancement applications as the organic GrowingMedia is ideal for establishing and sustaining most types of vegetation.

The GroSoxx Gabion vegetated armoring system is specifically designed to establish and reinforce vegetation under intense hydraulic pressure. Once permanent vegetation is established in the GroSoxx Gabion system the following management parameters are enhanced:

- Structural stability and protection from toe-cutting and sloughing of waterway bank
- Structural stability and protection from mass wasting and sloughing of shoreline from wave action
- Control of erosion from overland runoff, wave action, and shear stress from concentrated flows
- Control of runoff velocity flowing to receiving water
- Dissipation of runoff energy flowing to receiving water
- Sustained vegetation health
- Sediment, soluble pollutant, and pathogen removal efficiency of runoff flowing to receiving water

APPLICATION

The GroSoxx® Gabion armoring system is used where waterway and shoreline banks are eroding, have become unstable, or cannot sustain vegetation. GroSoxx® Gabions can be used to establish, sustain, and reinforce vegetation in areas of flow and intense hydraulic pressure that typically undermine vegetation growth, such as creeks and streams. Applications where the GroSoxx® Gabion system is typically required include:

- Creek, stream, and riparian bank stabilization
- Pond and lake shoreline stabilization
- Sediment and storm water retention/detention pond bank slope stabilization
- Riparian, stream bank, tidal creek, and salt marsh restoration, habitat and ecological restoration, and aesthetic revitalization

GroSoxx Gabion can also be used to reduce runoff velocity flowing into surface waters. Reducing runoff velocity will decrease soil erosion and increase pollutant removal through trapping, sediment deposition, and plant uptake.

ADVANTAGES AND DISADVANTAGES

Advantages

- GroSoxx Gabion is a vegetated armoring system that stabilizes and prevents erosion of waterway banks and shorelines.
- GroSoxx Gabion can be used on vertical bank slopes and shorelines.
- GroSoxx Gabion system includes GrowingMedia which establishes and sustains vegetation, unlike rip rap and other hard armoring devices.
- GroSoxx Gabion increases aesthetic value of land area due to increased vegetation relative to rock gabion basket or rip rap.
- GroSoxx Gabion increases wildlife habitat and ecosystem restoration due to increased vegetation relative to rock gabion basket or rip rap.
- GroSoxx Gabion can be direct seeded at the time of installation.

- GroSoxx Gabion stability and bank protection/ erosion prevention are increased when vegetation is established within the system.
- GroSoxx Gabion filters sediment, soluble nutrients, heavy metals, petroleum hydrocarbons, pesticides, and pathogens from storm runoff flowing toward surface waters.
- GroSoxx Gabion slows runoff velocity, which can reduce erosion, and increase sediment deposition and pollutant removal efficiency prior to reaching surface water.
- GroSoxx Gabion removes pollutants from storm water by plant uptake (phytoremediation).
- GrowingMedia in GroSoxx Gabion has the ability to bind and adsorb soluble nutrients, metals, and hydrocarbons that may be in storm water runoff, thereby reducing loads to adjacent receiving waters.
- Microorganisms in GrowingMedia have the ability to degrade organic pollutants and cycle captured nutrients into beneficial and/or less toxic forms (bioremediation).
- Contained GrowingMedia within GroSoxx Gabion Soxx™ creates an ideal system for biotechnical engineering projects.
- Humus colloids and organic matter in GrowingMedia™ provide physical structure for seed, seedlings, and live stakes.
- Humus colloids and organic matter in GrowingMedia™ provide increased water holding capacity and reduced water evaporation to aid in seed germination, plant sustainability, and the potential for reduced irrigation.
- Low volume, low pressure drip tape irrigation systems can be installed within the GroSoxx Gabion Soxx™ to promote vegetation establishment.
- GroSoxx Gabion is a good option for arid and semi-arid regions where germination, moisture management, and irrigation can be difficult.
- GrowingMedia provides organic nutrients that slow release for optimum efficiency to establishing vegetation.
- GrowingMedia provides organic nutrients that are less prone to runoff transport and pollution of surface waters, relative to mineral nutrients supplied by fertilizers.
- GroSoxx Gabion is comprised of GrowingMedia which is organic, all natural and locally manufactured.
- GroSoxx® Gabion can be easily designed and incorporated as one treatment in a treatment train approach to site or watershed storm water management.
- GroSoxx Gabion may assist in qualification for LEED® Green Building Rating and Certification credits under LEED Building Design & Construction (BD+C), New Construction v4. Awarded credits may be possible from the categories of Sustainable Sites, Water Efficiency, Materials & Resources, and Innovation. *Note: LEED is an independent program offered through the U.S. Green Building Council. LEED credits are determined on a per project basis by an independent auditing committee. Filtrexx neither guarantees nor assures LEED credits from the use of its products. LEED is a trademark of the U.S. Green Building Council.*

ADVANTAGES

	LOW	MED	HIGH
Installation Difficulty	✓		
Durability		✓	
Vegetation Establishment			✓
Runoff Flow Control			✓
Erosion Control		✓	
Pollution Control		✓	

Disadvantages

- If GroSoxx Gabion does not use Filtrexx® GrowingMedia™, performance may be diminished.
- If not installed correctly, maintained or used for a purpose or intention that does not meet specifications, performance may be diminished.
- If vegetation does not establish or cover density is low, performance may be diminished.
- GroSoxx Gabion should not be the only form of site or watershed storm water management.
- GroSoxx Gabion may need to be reseeded or live stakes replaced if significant storm flow occurs prior to vegetation establishment or where vegetation fails.
- GroSoxx Gabion performance may be lower prior to vegetation establishment and maturity.
- GroSoxx Gabion installation is a land disturbing activity and can increase sediment loading to

surface waters if appropriate sediment control measures are not established during construction phase.

MATERIAL SPECIFICATIONS

GroSoxx Gabion uses only Filtrexx® Soxx™, photodegradable netting materials available from Filtrexx International, and are the only mesh materials accepted in creating GroSoxx Gabion for any purpose. For Soxx Material Specifications see Table 1.1.

GROWINGMEDIA™ CHARACTERISTICS

GroSoxx Gabion uses only Filtrexx GrowingMedia which is a composted material that is specifically designed for stability within the system and establishment and sustainability of vegetation growth. GrowingMedia should be third party tested and certified to meet minimum performance criteria defined by Filtrexx International. Performance parameters include: percent cover of vegetation, water holding capacity, pH, organic matter, soluble salts, moisture content, biological stability, maturity bioassay, percent inert material, bulk density and particle size distribution. For information on the physical, chemical, and biological properties of GrowingMedia refer to Specification 5.2 Filtrexx® GrowingMedia™. *Note: the Contractor is responsible for establishing a working riparian, hydrologic, and/or storm water management system and may, with approval of the Engineer, work outside the minimum construction requirements as needed. Where GroSoxx Gabion fails, it shall be repaired or replaced with an effective alternative.*

PERFORMANCE

QA/QC material testing of GrowingMedia to ensure specifications are met is conducted by the Soil Control Lab, Inc. Scientific research on vegetated filter strips, Filtrexx® Compost Erosion Control Blankets™, and Filtrexx® Sediment Control (SiltSoxx™) has been conducted in recent years. Conservative assumptions can be made regarding GroSoxx Gabion in light of performance associated with applied field research and previously mentioned practices. For performance on these practices see Filtrexx® Compost Erosion Control Blankets™, Filtrexx® Sediment Control , and supporting technical and research reports in the Appendices. See Table 1.2 for a summary of material specifications and Table 10.2 for a summary of performance testing results and design specifications.

DESIGN CRITERIA

Function

The primary functions of the GroSoxx Gabion vegetated armoring system are: to stabilize and prevent erosion of waterway and shoreline banks prior to vegetation establishment, to structurally reinforce seeded and planted vegetation against intense hydraulic pressures and wave action, provide a long-term living and natural filter, and to provide an optimum medium for vegetation establishment and sustainability. The GroSoxx Gabion system is specifically designed to dissipate the energy from moving water, and establish, reinforce, and sustain vegetation under high velocity flows and shear stresses in concentrated flow applications. The GroSoxx Gabion system is unique in that GrowingMedia and seed are injected and contained within the structural armoring system to combine soft and hard armor technology. The Filtrexx Soxx mesh allow grass to establish through the matrix, while live plantings (live stakes, plugs, sprigs) can be manually inserted into the system without compromising its structural stability. Established roots increase the stability, anchor capacity, and sustainability of the system on the bank or shoreline slope. This system is ideal for biotechnical engineering, wildlife habitat restoration, riparian and ecological restoration, and aesthetic enhancement system because the organic GrowingMedia is ideal for establishing and sustaining most types of vegetation. The GroSoxx Gabion system is specifically designed to make contact with 100% of the soil interface of the waterway or shoreline bank, thereby increasing the structural integrity and preventing erosion of the slope. See Figure 10.1 for design drawing details and requirements.

The GroSoxx Gabion system is effective at filtering storm water pollutants potentially entering surface waters due to physical trapping and runoff velocity reduction by the vegetation. Vegetation can increase surface roughness (Manning's n), which can reduce runoff velocity. Large particles are typically removed in greater efficiencies than suspended particles through reducing runoff velocity and constructing/maintaining vegetated buffers. Maintenance is a key consideration, as sediment build-up will significantly reduce the ability of a vegetated GroSoxx Gabion to remove pollutants from storm runoff; however, unless sediment accumulation is extreme, GroSoxx Gabion vegetation will continue to grow in and through deposited sediment.

Humus content within the GrowingMedia has the ability to chemically adsorb and bind soluble

pollutants such as phosphorus, ammonium-nitrogen, heavy metals, and petroleum hydrocarbons, making them unavailable for plant or animal uptake (Filtrexx Tech Link #3307 and #3308). Additionally, many plants have the ability to take up excess nutrients and pollutants trapped in the vegetation, while microorganisms can decompose and/or incorporate these pollutants into their biomass, making them less toxic to aquatic ecosystems. Organic matter supplied in GrowingMedia increases the diversity and population of microorganisms that can decompose and incorporate captured pollutants.

Planning Considerations

GroSoxx Gabion should be used as one treatment in a treatment train approach to storm water management.

Dense stands of native vegetation, vegetated buffers, trees, shrubs, and their root masses should be conserved if they are functionally stabilizing the bank and are healthy. Equipment and soil disturbing activities should avoid contact with above and below ground plant material described above.

Infiltration and runoff velocity reduction practices may be installed upslope from the bank stabilization project to reduce storm flows that cause erosion and sediment and soluble pollutant transport to receiving waters.

Surface waters and their banks typically support a diversity of wildlife and often human recreation. Planning should include design for wildlife habitat, aesthetics, and potential human and pet recreation. *Note: any natural (not man-made) waterway or channel stabilization and vegetation project requires permit and approval by the US Army Corp of Engineers, and all defined waterways are regulated through the US Clean Water Act by US EPA. A defined waterway may only have flow during rainfall events, be sure to check with jurisdictional zoning and regulating authorities during planning phase.*

Vegetation Selection

Vegetation selection is a key item for success of any system, and the following variables should be considered: soil type, soil porosity, water holding capacity, drainage of site, rainfall amount, slope of site, maintenance considerations, zone hardiness of plants selected, and irrigation availability (Tyler, 1996).

Fast establishing annual grasses and legumes should be specified for temporary and nurse crop applications. Native, perennial grasses should be specified for permanent applications (USDA-NRCS, 2004), as these will be better adapted to local climate, native soil, and hydrology. If the GroSoxx Gabion system will be exposed to prolonged moisture, wetland species may be required. Generally, tall and sturdy grasses are better at reducing runoff velocity and increasing sediment removal than low growing, flexible grasses and legumes (Grismer et al., 2006; USDA-NRCS, 2004) as they generally increase surface roughness values (Manning's n). Additionally, deep rooted grasses will be more stable under high storm runoff, high concentrated flow velocity and shear stress, and high energy wave action.

GroSoxx Gabion is specifically designed for biotechnical engineering applications. GrowingMedia fill within the Soxx system creates an optimum fertile and structural environment for establishing and sustaining live stakes, tubers, rhizomes, and plugs. A live stake is a 1 to 3 ft (300-900mm) long cutting from a live hardwood tree or shrub and planted vertically into a growing media (KYTC, 2006). Typical live stake species include, willow, poplar, maple, cottonwood, dogwood, sycamore, and oak (KYTC, 2006). Drip tape irrigation installed within the GroSoxx Gabion system can maintain moisture for plants used in biotechnical engineering projects, particularly in drought prone regions and seasons.

Local landscape architects, USDA-NRCS, or cooperative extension should be consulted and used as resources for seed and plant selection. Many state erosion and sediment control and storm water management manuals have specifications for seed and plant selection, seeding rates, and planting requirements. PLANTS, a database created by the USDA-NRCS, may be a helpful tool for seed and plant selection. It can be accessed at http://plants.usda.gov

The hydraulic properties of grasses commonly used in channels have been characterized and grouped. Each class, A through E, is determined by height, density and stiffness of the vegetative stand. These properties effect the vegetation's surface roughness (Manning's n) and its ability to withstand hydraulic pressure from concentrated flows (ECTC, 2006). Grass retardance classes and their corresponding permissible shear stress values are defined in the Federal Highway Administration HEC 15: (See Table 13.1).

Establishing & Sustaining Vegetation
GroSoxx Gabion is seeded at the time of application by mixing with GrowingMedia during GroSoxx Gabion construction. Nurse crops, such as annual rye, may be considered to establish a quick vegetative cover and root anchor until perennial grasses and/or live stakes are established. Grasses should be mowed and maintained between 4 and 10 inches (100-250mm) high, unless otherwise specified. Taller grasses may have higher sediment removal efficiency and sediment storage capacity, and a greater ability to dissipate runoff energy and reduce storm flow velocity relative to low growing or low maintained grasses. Live stakes should be 1 to 3 feet (300-900mm) long and planted vertically with at least 2 in (50mm) of one end planted into a growing media, and spaced 3 to 5 ft (1-1.5m) apart (KYTC, 2006).

Although GrowingMedia typically has a higher water holding capacity than topsoil, irrigation may be required to ensure successful establishment. In arid and semi-arid regions or hot and dry weather regular irrigation may be required. Drip tape irrigation may be installed within the GroSoxx Gabion Soxx to maintain moisture within GrowingMedia to ensure vegetation establishment.

GrowingMedia can supply humus, organic matter, beneficial microbes, and slow release organic nutrients that can contribute to increased fertility, plant health and sustainability.

Organic vs. Fertilizer Nutrients:
Although most specification and design manuals include fertilizer recommendations or requirements for vegetation, mineral nutrients from fertilizers may not be preferable where vegetation sustainability and water quality are a concern. GroSoxx Gabion provides organic nutrients which are slow release, provide plant micronutrients, and are less likely to be transported in storm runoff to receiving water – which can lead to pollution and eutrophication of waterways (Faucette et al, 2005).

Weed Establishment
Invasive weed growth has been more closely associated with mineral fertilizer than organic fertilizer fertility practices (Faucette et al, 2004). Vegetation practices should always be inspected for invasive and noxious weeds.

Slope Degree
GroSoxx Gabion can be used effectively on vertical slopes; however, constructed banks typically do not exceed a 2:1 slope.

Runoff Velocity & Shear Stress
GroSoxx Gabion should not be used in areas where runoff velocity or shear stresses will damage or undermine the system. For most grasses a maximum velocity of 4 ft/sec (1.2 m/sec) or a maximum hydraulic shear stress of 2 lbs/ft2 (10 kg/m2) is recommended (MD Storm Water Design Manual, 2000) – unless vegetation reinforcement is utilized. Filtrexx® Bank Stabilization (similar to GroSoxx Gabion) provides bank protection for a maximum shear stress of 12 lbs/square ft (59 kg/square m).

Traditionally, concentrated flow velocity (ft/sec, m/sec) has been used to design for bank protection and stabilization. However, velocity does not account for the pressure and stress created by depth of concentrated flow within the channel. Pressure created by flow depth is an important variable in bank erosion, whereas designing based only on

Table 10.1. FHWA HEC 15 Retardance Class, Stand Height, and Permissible Shear Stress for Grasses used in Channels, Ditches, and Concentrated Flow Applications.

Class	Example of Vegetation	Stand Density	Average Stand Height	Permissible Shear Stress
A	Weeping Lovegrass, yellow bluestem	Excellent	>=76.2 cm (>= 30 in)	177 Pascal (PA) (3.7 lbs/ft2, 18 kg/m2)
B	Bermuda, blue grama , and native grass mixtures	Good	30.5 - 61 cm (12 - 24 in)	100 Pascal (PA) (2.1 lbs/ft2, 10 kg/m2)
C	Bermuda, Kentucky blue grass, centipede grass	Good	15 — 30.5 cm (6 - 12 in)	48 Pascal (PA) (1.0 lbs/ft2, 5 kg/m2)
D	Bermuda, buffalo, grass-legume mixture	Good	5 — 15 cm (2 - 6 in)	28 Pascal (PA) (0.60 lbs/ft2, 3 kg/m2)
E	Bermuda, native grass mixture	Good	<5 cm (< 2 in)	16 Pascal (PA) (0.35 lbs/ft2, 2 kg/m2)

flow velocity does not account for these variables. Permissible shear stress (tractive or frictional force) on channel lining practices is a more suitable design criteria, as it includes depth of flow variables. Because shear stress of a channel or bank can be variable, the maximum shear stress is used as the preferred design parameter. The area of concentrated flow where shear stress is greatest is where the depth of flow is greatest (and tractive/frictional force) – the channel bed. Therefore, the maximum shear stress of a bank or channel protection device reflects its performance and design limit in the channel bed, which is sufficient for shear stress along the banks within the same channel.

To determine the maximum shear stress in a stream, creek, channel, or river, use:

$$T_{max} = y \times Y \times S$$

Where:
T_{max} = maximum shear stress (lb/sq ft, kg/sq m)
y = density of water (62.4 lb/cu ft, 1011 kg/cu m)
Y = depth of water (ft, m)
S = slope of gradient (ft/ft, m/m)

To determine the mean shear stress in a channel, use:

$$T_{mean} = (y \times A \times S)/P$$

Where:
T_{mean} = mean shear stress (lb/sq ft, kg/sq m)
y = density of water (62.4 lb/cu ft, 1011 kg/cu m)
A = cross-sectional area (sq ft, sq m)
S = slope of gradient (ft/ft, m/m)
P = wetted perimeter

To determine velocity of flow in a channel, use Manning's Equation:

$$V = (\alpha_1/n) \times R^{2/3} \times S^{1/2}$$

Where:
V = mean velocity of flow (ft/sec, m/sec)
R = hydraulic radius = A/P (ft, m)
A = cross-sectional area (sq ft, sq m)
P = wetted perimeter (ft, m)
S = slope of gradient (ft/ft, m/m)
n = roughness coefficient
α_1 = 1.0 for SI units, 1.496 for English units

INSTALLATION

1. GroSoxx Gabion shall meet Filtrexx Specifications and use Filtrexx® GrowingMedia™.
2. Contractor is required to be a Filtrexx® Certified℠ Installer as determined by Filtrexx International (877-542-7699). Certification shall be considered current if appropriate identification is shown during time of bid or at time of application. Look for the Filtrexx® Certified℠ Installer Seal.
3. GroSoxx Gabion will be placed at locations indicated on plans as directed by the Engineer.
4. GroSoxx Gabion shall be placed in a manner that protects the entire bank or shoreline from erosion and destabilization.
5. GroSoxx Gabion Soxx shall be placed within the rock gabion basket in complete horizontal lifts before placement of next lift. Adjacent Soxx shall fit tightly within the basket. Soxx shall fill the entire volume of the basket.
6. Alternatively, Soxx used in combination with rip rap shall be placed in the rock gabion basket in complete horizontal lifts with the rip rap. Soxx and rip rap should fit tightly together within the basket. Soxx are placed along the entire fascia (outward facing side) of the rock gabion basket.
7. Once in place, GroSoxx Gabion Soxx shall be lightly compacted to tighten seal between Soxx layers and encourage even water flow over the surface of the system.
8. GroSoxx Gabion must be installed and stabilized before concentrated flow is allowed to contact bank or slope area.
9. Sediment control devices (such as Soxx) shall be installed if construction requires land disturbance or earth moving.
10. Land surface shall be cleared of debris, including rocks, roots, large clods, and sticks prior to installation.
11. Waterway bank or shoreline shall be made smooth prior to installation.
12. Soil bed may be compacted and graded prior to installation.
13. If toe-cutting is an issue at the waterway bed and slope interface, excavation should be performed at the interface below creek bed level to allow placement of GroSoxx Gabion.
14. Excavation should be to a minimum of 1 foot (300mm) below scour line for waterways with flow depths of 6 inches (150mm) or greater.

15. GroSoxx Gabion shall be placed parallel to concentrated water flow and perpendicular to wave action.
16. Applications below the waterline will use pea gravel and small rock in the GroSoxx Gabion Soxx at the base of the system and GrowingMedia in the Soxx where vegetation will be established above the waterline.
17. In areas where waterline fluctuates below and above the system, custom soil blends may be used, as directed by the Engineer. Custom soil blends may include GrowingMedia, topsoil, sand, pea gravel, or other small aggregate.
18. For GroSoxx Gabion terrace applications, areas between GroSoxx Gabion should be on a level grade, and backfilled with seeded GrowingMedia. Waterline should be below terraced areas receiving backfill.
19. GroSoxx Gabion shall be seeded at the time of application, seed selection will be determined by the Engineer.
20. Seeded GroSoxx Gabion should not be installed prior to seasons where growing vegetation is difficult.
21. Seed shall be thoroughly mixed with the GrowingMedia prior to construction or at time of application.
22. Biotechnical engineering with live stakes, tubers, seedlings, or plugs should be conducted after staking is complete.
23. Live stakes should be from a live species, and cuttings should be 1 to 3 feet (300-900mm) long.
24. Live stakes should be spaced 5-7 feet (1.5-2.1m) apart, and planted vertically with one end planted through the GroSoxx Gabion and at least 2 inches (50mm) into native soil.
25. Seeded and/or live staked GroSoxx Gabion shall be thoroughly watered after installation and allowed to settle for 1 week.
26. Drip tape may be installed within the GroSoxx Gabion Soxx during construction to provide irrigation for establishing vegetation.
27. If drip irrigation system is installed, a reliable water source should be located and secured.
28. If drip irrigation system is installed and municipal water or a pump will be utilized, a pressure reducer may be required to manage flow and prevent drip tape from bursting.

INSPECTION

Routine inspection should be conducted within 24 hours of a runoff event for the first year after installation, until permanent vegetation has established, or as designated by the regulating authority. If product dislodgement occurs, or vegetation does not establish, GroSoxx Gabion should be repaired, reseeded, and/or replanted. If bank or shoreline erosion occurs, the area should be repaired immediately. Vegetation practices should always be inspected for noxious or invasive weeds. If sediment accumulation is 25% of the height of the vegetation, sediment removal is recommended. Storm debris and trash should be removed immediately.

MAINTENANCE

1. The Contractor shall maintain the GroSoxx Gabion in a functional condition at all times and it shall be routinely inspected.
2. GroSoxx Gabion shall be maintained until a minimum uniform 70% cover of the applied area has been vegetated, permanent vegetation has established, or as required by the jurisdictional agency.
3. GroSoxx Gabion may need to be irrigated in hot and dry weather and seasons, or arid and semi-arid climates to ensure vegetation establishment.
4. Where a GroSoxx Gabion fails or becomes dislodged, the contractor will ensure the practice is in good contact with the soil and backfill media, repair, and use additional staking or anchoring if necessary.
5. Where bank or shoreline erosion occurs, the contractor will regrade the soil if necessary and repair or replace the GroSoxx Gabion.
6. Where vegetation does not establish, the contractor will reseed, replant, replace live stakes, or provide an approved and functioning alternative.
7. If GroSoxx Gabion is only seeded at time of installation, live stakes may be added to increase stability, aesthetics, wildlife habitat, and ecological succession.
8. No additional fertilizer or lime is required for vegetation establishment and maintenance.
9. No disposal is required for this product/practice.
10. GroSoxx Gabion shall become part of the permanent landscape.
11. Maintenance of grass vegetation on seeded GroSoxx Gabion to a minimum height of 4 inches (100mm) and a maximum height of 10 inches (250mm) will deter invasive weeds, allow sunlight to kill captured pathogens from storm water, and provide maximum sediment removal efficiency and sediment storage capacity in the vegetation.
12. Storm debris and trash deposited on GroSoxx

Gabion should be removed immediately.

13. Sediment shall be removed if it reaches 25% of the height of the vegetation (mowed) to prevent diversion of storm runoff and reduction of vegetation health and cover.
14. If drip tape irrigation system is installed, once vegetation is fully established, connections to drip tape irrigation system may be removed, leaving the drip tape inside the GroSoxx Gabion Soxx. Cut ends of drip tape and discard in approved waste receptacle.

METHOD OF MEASUREMENT

Bid items shalls show measurement as Filtrexx GroSoxx® Gabion installed, per linear foot or linear meter installed, as specified by the engineer. Backfill media shall show measurement as GrowingMedia™, per cubic yard or cubic meter of material installed.

ADDITIONAL INFORMATION

For other references on this topic, including additional research reports and trade magazine and press coverage, visit the Filtrexx website at www.filtrexx.com

Filtrexx International, Technical Support
61 N Clev-Mass Rd, Ste E, Akron, OH 44333
877-542-7699 | 234-466-0810 (fax)
www.filtrexx.com | info@filtrexx.com
Call for complete list of international installers.

REFERENCES CITED & ADDITIONAL RESOURCES

ECTC, 2006. FHWA HEC 15 Maximum Permissible Shear Stress Approach. Erosion Control Technology Council.http://www.ectc.org/products/channel_hec15.html

Faucette L.B., C.F. Jordan, L.M. Risse, M. Cabrera, D.C. Coleman, and L.T. West. 2006. Vegetation and soil quality effects from hydroseed and compost blankets used for erosion control in construction activities. Journal of Soil and Water Conservation. 61:6:355-362.

Faucette, L.B., C.F. Jordan, L.M. Risse, M. Cabrera, D.C. Coleman, and L.T. West. 2005.
Evaluation of storm water from compost and conventional erosion control practices in construction activities. Journal of Soil and Water Conservation. 60:6:288-297.

Grismer, M., A. T. O'Green, and D. Lewis. 2006. Vegetative Filter Strips for Nonpoint Source Pollution Control in Agriculture. University of California Division of Agriculture and Natural Resources. Publication 8195.

KY TC, 2006. Kentucky Erosion Prevention and Sediment Control Field Guide. Kentucky Transportation Cabinet.

Maryland Storm Water Design Manual Vol I and II. 2000. Appendix D.12. Critical erosive velocity for grasses and soil. Maryland Deparent of Environment and the Center for Watershed Protection.

Mukhtar, S., M. McFarland, C. Gerngross, and F. Mazac. 2004. Efficacy of using dairy manure compost as erosion control and revegetation material. 2004 American Society of Agricultural Engineers/Canadian Society of Agricultural Engineers Annual International Meeting, Ontario, CA. Paper # 44079.

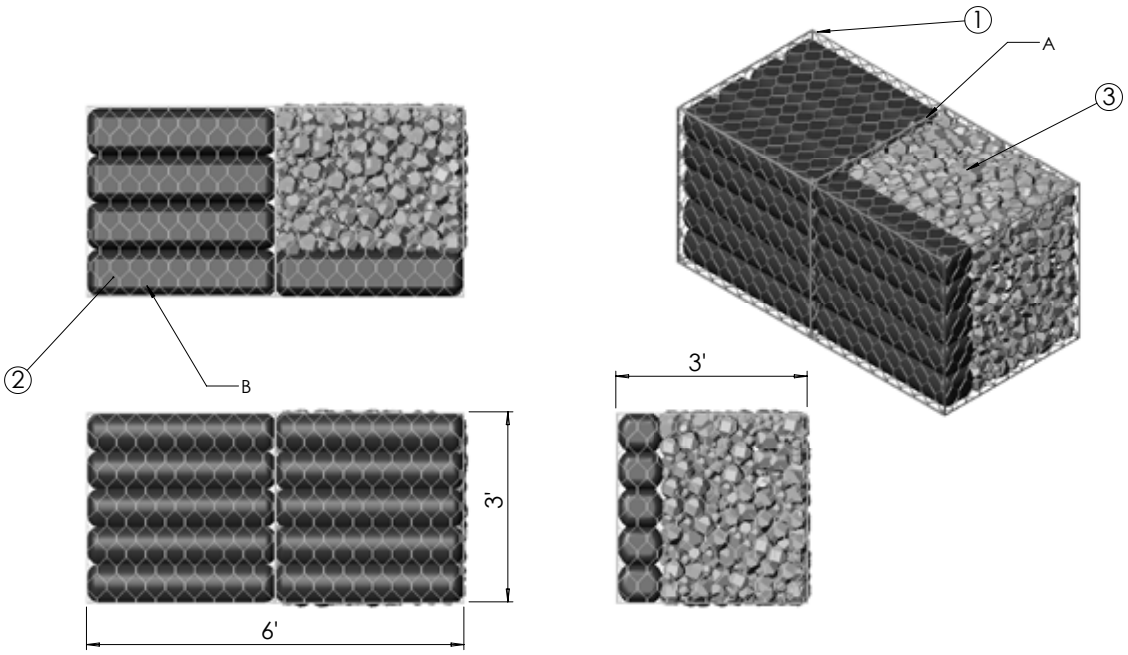
Tyler, R.W. 1996. Winning the Organics Game – The Compost Marketers Handbook. ASHS Press, Alexandria, VA

USDA-NRCS. 2004. Standards and Specifications No. 393, USDA-NRCS Field Office Technical Guide.

TABLES & FIGURES:

Figure 10.1. Engineering Design Drawing for GroSoxx® Gabion

Filtrexx® GroSoxx® Gabion



NOTES:
A. 3' X 3' PEICE OF GABION WIRE CREATES CENTRAL DIVIDER.
B. SOXX™ MAY BE FILLED WITH FILTER OR GROWING MEDIA, DEPENDING ON THE APPLICATION.
C. THE TWO CHAMBERS CAN BE FILLED WITH ALL SOXX™ OR PART SOCK AND PART ROCK DEPENDING ON THE APPLICATION.

ITEM NO.	DESCRIPTION	QTY.
1	STANDARD GABION CAGE	~100 FT^2
2	8" FILLED SOXX™ 36"L	25
3	ROCK, #1S AND 2S (PER CHAMBER)	~1 YD^3

DIMENSIONS ARE IN INCHES
ANGULAR: BEND ± 2°
TWO PLACE DECIMAL ± .015
THREE PLACE DECIMAL ± .005
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ECO		

filtrexx
FILTREXX INTERNATIONAL
61 CLEV-MASS RD. STE E
AKRON, OH 44333
877-542-7699
WWW.FILTREXX.COM

SIZE A | TITLE: GREEN GABION | REV.
DWG./PART NO. | SHEET 1 OF 1

Table 10.2. Filtrexx® Soxx™ for GroSoxx® Gabion Performance and Design Specifications Summary

Design Diameter / Design & Performance	8 in (200mm)	12 in (300mm)	18 in (450mm)	24 in (600mm)	32 in (800mm)
Effective Height	6.5 in (160mm)	9.5 in (240mm)	14.5 in (360mm)	19 in (480mm)	26 in (650mm)
Effective Circumference	25 in (630mm)	38 in (960mm)	57 in (1450mm)	75 in (1900mm)	100 in (2500mm)
Density	20 lbs/ft (30 kg/m)	48 lbs/ft (73 kg/m)	110 lbs/ft (167 kg/m)	200 lbs/ft (300 kg/m)	300 lbs/ft (450 kg/m)
Maximum continuous length	unlimited	unlimited	unlimited	unlimited	unlimited
Staking Requirement	10 ft (3m)	10 ft (3m)	10 ft (3m)	10 ft (3m)	10 ft (3m)
Maintenance Requirement (sediment removal at X height)	3.25 in (80mm)	4.75 in (120mm)	7.25 in (180mm)	9.5 in (240mm)	13 in (325mm)
Functional Longevity*	6 mo – 5 yr	6 mo – 5 yr	6 mo – 5 yr	6 mo – 5 yr	6 mo – 5 yr
Hydraulic Flow Through Rate (sediment-laden water)	< 1 gpm /linear ft (<1 L /min/m)	< 1 gpm /linear ft (<1L/min/m)	< 1 gpm /linear ft (<1L /min/m)	< 1 gpm /linear ft (<1L /min/m)	< 1 gpm /linear ft (<1L /min/m)
Max Runoff Flow Height	3 in (75mm)	6 in (150mm)	11 in (275mm)	15 in (375mm)	22 in (550mm)

* Functional Longevity is dependent on mesh material type, UV exposure, freeze/thaw frequency, region of US/Canada, runoff-sediment frequency/duration/loading, and adherence to specified maintenance requirement. Functional longevity ranges are estimates only. Site specific environmental conditions may result in significantly shorter or longer time periods.