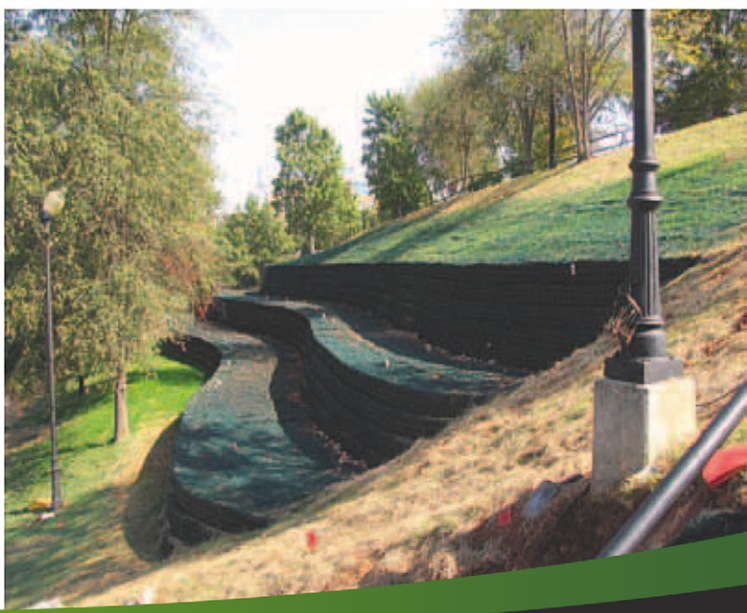
Erosion Control Solutions

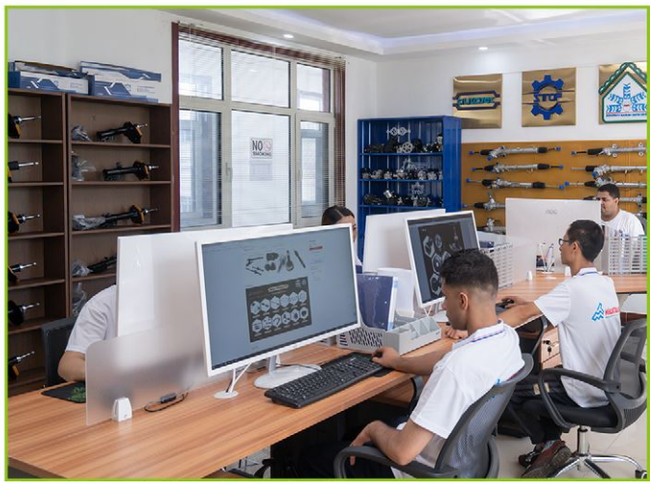


BIOARCTIC

SHANDONG BIOARCTIC COOLING EQUIPMENTS CO., LTD

WHO WE ARE

Shandong Bioarctic Cooling Equipment Co. Ltd is a manufacturer located in Jinan city, Shandong province, China. We produce all types of Erosion Control Blanket in high quality 100%. As well as we have 15 years of exporting Erosion Control Blanket to the Middle East, the Americas and the European countries.



WHAT IS EROSION CONTROL BLANKET

Control blankets, or anti-erosion blankets, are temporary blankets made from biodegradable materials such as straw, coir or wood fibers. They provide immediate protection to bare areas of soil against erosion caused by rain or wind. Also ECBs support for establishing vegetation, hold soil and seed in place until the vegetative establishment. The blankets degrade over time as the permanent vegetative cover establishes itself.

STRAW

COIR FIBERS

WOOD FIBERS

FOR WHAT USING THE ECBs

The primary purpose of Erosion Control Blankets is to keep soil from shifting or moving. They help stabilize soil particles and sediments, holding them in place to prevent sliding due to water, wind or other natural causes. They also enhance vegetation performance. Resist erosion and tearing of vegetation under the highest water velocities.

WHAT ARE THE ADVANTAGES OF OUR PRODUCT

●Our products are in high quality. We made them from biodegradable materials (straw, coir or wood fibers)

●Our product can withstand any weather

●The main advantage of our Erosion Control Blankets is effective, easy to install

●Erosion control mats or blanket qualify as an EPA Phase II Best Management Practice, serving as part of an overall storm water management plan.

●Prevent sediment runoff

●Promote ground water recharge

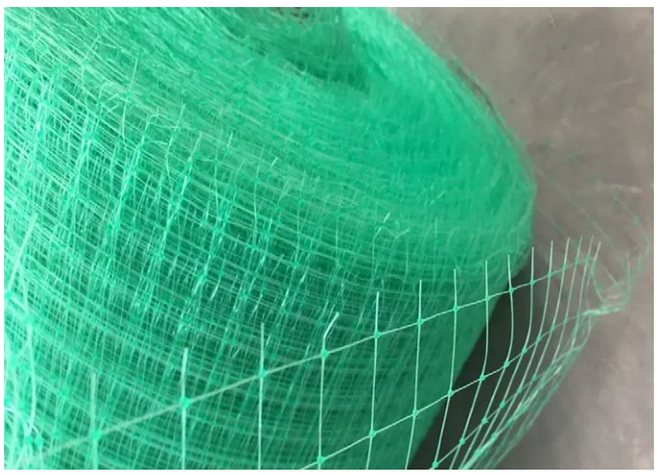
●Reduce peak flows and runoff velocities

●Easy inspection and maintenance

●Safer and less costly than hard armor solutions

MATERIALS

- Straw/Coconut fiber
- Wood fiber
- Polypropylene netting



DESCRIPTION

ECBs Erosion control blankets are manufactured from natural fibrous materials such as wood, and coconut, which are the cleanest, toughest and most consistent fiber available, held together by synthetic or biodegradable netting. ECBs Erosion control blankets come in wide variety of sizes. The product will be manufactured in China.

Size	Available in 4’ & 8’ widths; varied lenghts
Netting	1 layer of .5” × .5” opening, approximately 15 lbs/1000 yd² photodegradable, green polypropylene plastic.
Thread	600 denier degradable split yarn
Matrix	100% Excelsior wood fiber,. 73 lbs/yd²
Packaging	All rolls are wrapped tightly with stretch wrap to protect the rolled erosion control product from the weather and elements.
Special Features	4” folded edge on both sides of the 4’ &8’ folded and 1 cut on the 8’ creating a stronger blanket and a cleaner edge

Test Method-Description	Parameters	Test Result
ASTM D 6475-Mass per Unit Area	Index Test	8.33 oz/sq.yd.
ASTM D 6818-Ultimate Tensile Strength/Strain-TD	Index Test	10.3 lb/in @28.1%
		4.9 lb/in @23.0%
ASTM D 6525 - Thickness	Index Test	334 mils
ASTM D 6567- Ground cover / Light Penetration	Index Test	72.8% / 27.2%
ASTM D 1117 & ECTC-TASC 00197- Water Absorption	Index Test	152%
ASTM D 7101- Determination of Unvegetaded RECP ability to protect soil from rain splash and associated runoff under Bench-scale conditions	50mm(2 in.)/ hr for 30 min	Soil loss Ratio*= 7.71
	100mm(4in.)/ hr for 30 min	Soil loss Ratio*= 6.43
	150mm(6in.)/ hr for 30 min	Soil loss Ratio*= 5.37
ASTM D 7207- Determination of unvegetated RECP ability to protect soil from hydraulically-induced shear stresses under Bench-scale conditions	Shear: 0.88 psf for 30 min	Soil loss= 191.7 g
	Shear: 1.68 psf for 30 min	Soil loss= 565.0 g
	Shear: 3.27 psf for 30 min	Soil loss= 1280.0 g
	Soil loss curve intercept =	1.76 psf @ 1/2 in soil loss
ASTM D 7322- Determination of temporary degradable RECP performance in encouraging seed germination and plant growth	Top soil ; Fescue (Kentucky 31); 21 day incubation; 27±2° & approximately 45±5% RH	% of control
		= 406%
		(increased biomass)
*Soil loss Ratio = Soil Loss Bare Soil / Soil Loss with RECP = 1 / C- Factor (Note: soil loss is based on regression analysis)		

CHANNEL INSTALLATION

Step1-Site Preparation

Pepare sie to design profileand grde. Remove debris, rocks, clods, ete. Ground surface should be smooth prior to installation to ensure blanket remains in contact with slope.

Step2-Seeding

Seeding of site should be conducted to design requirements or to follow local or state seeding requirements as necessary.

Stap3-Staple Selection

At a minimum, 6in. long by 1 in. crown,11 gage staples are to be used to secure the blanket to the
ground surface. Installation in rocky,sandy or other loose soil may require longer staples

Step4-Excavate Anchor Trench and Secure Blanket

Excavate a trench along the top of the channelside slopes and the upstream temminal end of the channelto secure the edges of the blanket. The trench should run along the length and width of the installaton,be6in. wide and 6 in. deep. Staple blanketalong botom of rench, fill with compacted soil, overlap blanket owards toe of slope and secure with row of staples (shownin Figures A,EandF).

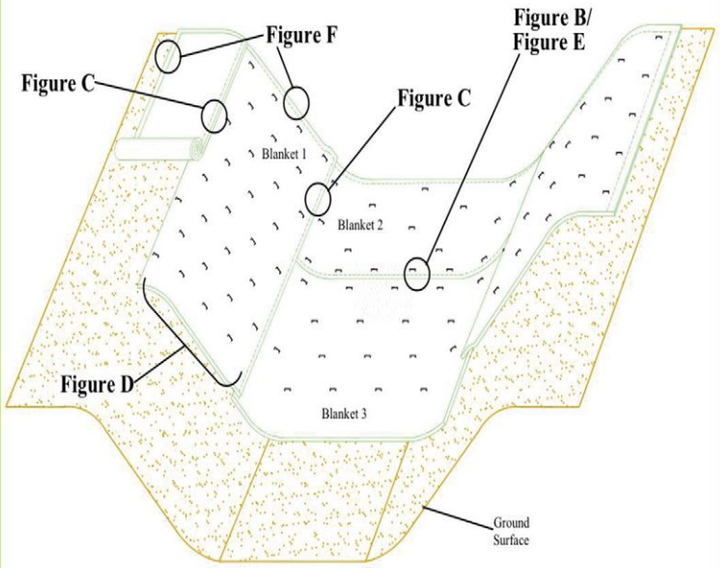
Step 5-Secure Body of Blanket

Roll blanket down slope from anchor trench. Staple body of blanket following the pattemn shown in Figure D. Leave end of blanket unstapled to allow for overlap shown in Figure B. Place downstream blanket underneath upstream blanket to form shingle pattern. Staple seam as shown in Figure E.Secure downstream blanket with stapling pattern shown in Figure D. Stapling patter shown in Figure D reflects minimum staples to be used. More staples may be required to ensure blanket is sufficiently secured to resist mowers and foot traffic and to ensure blanket is in contact with soil surface over the entire area of blanket. Furher, critical points require additional staples. Crtical points are identified in Figure G.

Step 6-Continue Along Slope-Complete Installation

Overlapadjacnt blankets as shown in FigureC and repeat Step 5. Secure toe of slope using stapling pattemn shown in Figure E.Secure edges of installation by stapling at 1.5 intervals along the terminal edge.

*Drawings Not to Scale



FigureA

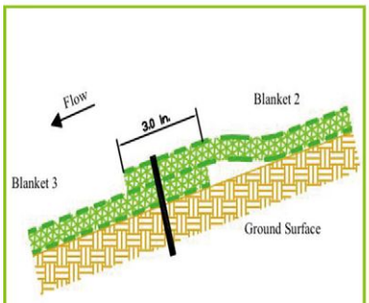


Figure B-Profile View

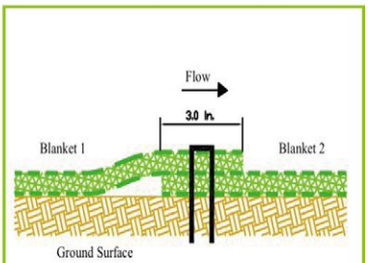


Figure C-Cross Section View

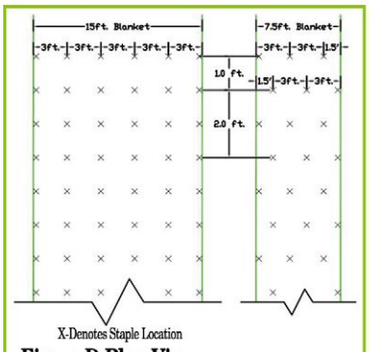


Figure D-Plan View

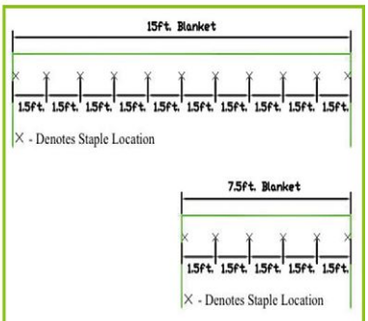


Figure E-Plan View

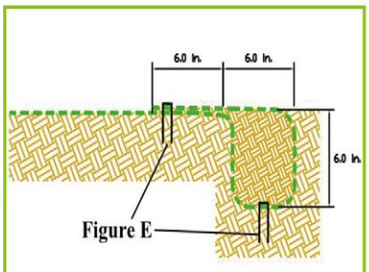


Figure F-Profile View

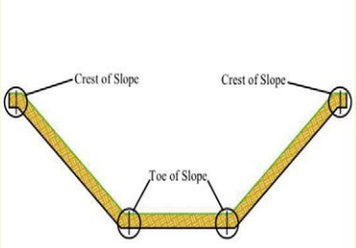


Figure G-Critical Point Securing

SLOPE INSTALLATION

Step1-Site Preparation

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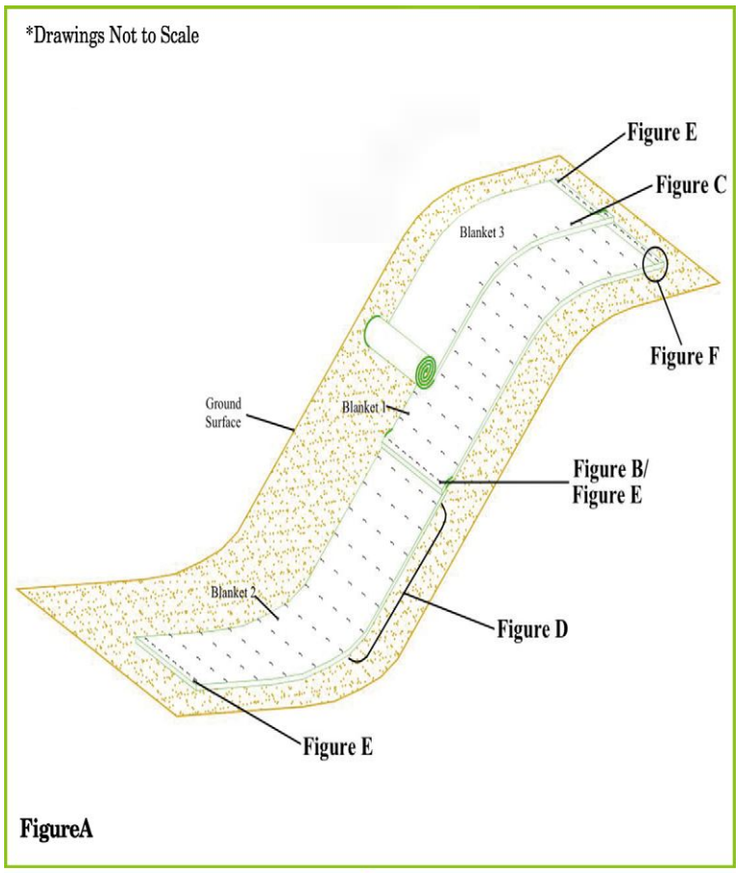


FigureA

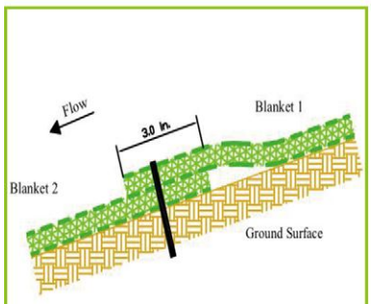


Figure B-Profile View

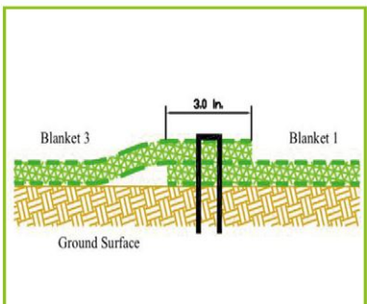


Figure C-Cross Section View

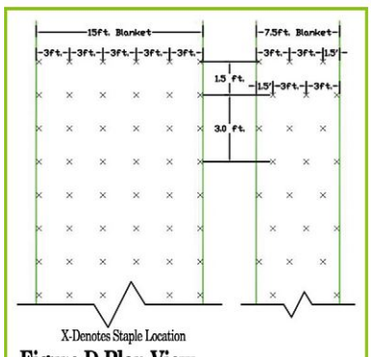


Figure D-Plan View

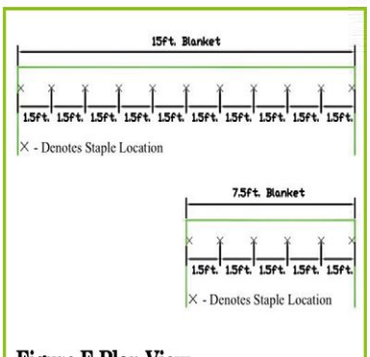


Figure E-Plan View

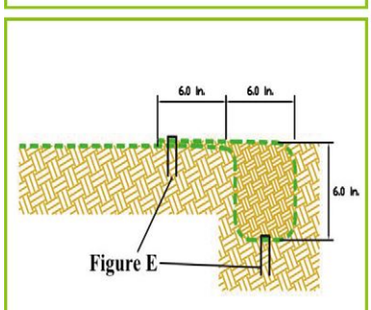


Figure F-Profile View

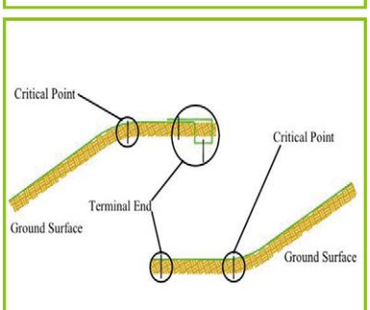


Figure G-Critical Point Securing

PRODUCT APPLICATION /EQUIVALENCY SPECIFICATIONS

Excel PP5-8 is produced by Wester Excelsior and consists of an permanent Rolled Erosion Control Product(RECP) comprised of a synthetic fiber blend matrix mechanically (stitch) bound between two,UV stable heavy duty synthetic nets (top and bottom). The expected longevity of Excel PP5-8 is greater han 36 months(actual longevity dependent on field and climatic conditions). Excel PP5-8is designed and manufactured to provide immediate erosion control and permanent turf reinforcement and is comprised of physical properties sufficient to provide the intended longevity and performance. Product specifications may be found on document WE EXCEL PP58 SPECand performance inforation may be found on document WE EXCEL PP58 PERF. All documents are available from Westerm Excelsior Technical Support or www.westemexcelsior.com. Additionalto above, equivalent products to Excel PP5-8 must meet identical criteria as Excel PP5-8 as follows□

1. Consist of synthetic fiber matrix confined between two UV stable, heavy duty sythetic nets.
2. Sufficient tensile strength, thickness and coverage to maintain integrity during installation and ensure material performance. Provide permanent turf reinforcement with longevity greate han three years, immune from moisture damage or chemical conditions within the soil.
3. Listing within AASHTO NTPEP database.
4. Mee ECTC specification for category 5A product.

DESIGN INFORMATION

Fabric-based Erosion Control Blankets (ECBs), Erosion Control Meshes, and Erosion Control Mats (ECMs) all fall under the general category of 'Rolled Erosion Control Products' (RECPs). Erosion control blankets are generally applied to soils subject only to sheet flow such as road batters. Erosion control mats and meshes are generally applied to soils subject to concentrated flow such as within drainage channels.

When selecting an erosion control blanket it is important to determine what performance features and attributes (Table 1a & b) are required. Some of these features can be performed by both natural and synthetic materials. Synthetic (plastic) materials can cause environmental concerns, but natural materials often have a shorter design life.

It is noted that hydraulic functionality is just one of many issues requiring consideration when selecting the preferred product.

Jute blanket (thick)

Wood shaving blanket with temporary synthetic netting

Coconut fibre blanket with temporary synthetic netting

Wool blanket with synthetic weed control backing

Table 1a - Desirable features and requirements of erosion control mats and blankets for various operational conditions

Operational conditions	Desirable features and requirements
Design life	Synthetic products generally have a longer service life; however, coirbased products can survive longer than some non UV-treated polymers.
	Permanent, UV-stabilised synthetics are general darker in colour (e.g. black) as a result of the carbon stabilisation.
	Coir-based (coconut fibre) products generally last longer than jutebased materials.
Flow velocity or shear stress	As a general indicator, the longer the product's service life, then usually the greater the allowable flow velocity and shear stress.
	Allowable flow velocity can be increased by using a synthetic mulch layer, or increasing the strength of the mat reinforcing.
	The allowable shear stress of 100% organic-based fabrics can be improved by anchoring the mat with a reinforcing mesh (such as jute mesh), or stabilising the fabric with a bitumen spray or other suitable tackifier.
Strong winds	Resistance to damage by wind is related to the spacing of anchor pins and the strength of the mulch and/or root reinforcing.
	High wind resistance can be achieved in a 100% biodegradable form by anchoring a jute/coir blanket with a jute/coir mesh.
Raindrop impact	Open weave fabrics, such as jute/coir mesh, provide only limited protection against raindrop impact erosion, unless supported by a bitumen emulsion over-spray, or placing the mesh over a suitable blanket of loose mulch.
	A UV-stabilised, synthetic mulch layer can continue to provide erosion protection even during periods of low vegetation cover.
Integration with separate mulch layer	Fabrics that have a high friction surface will aid in the retention of loose mulch placed on fabrics installed on steep slopes.
	Products such as nets, geonets and geogrids can be used to anchor loose mulch to steep slopes.
Integration with vegetation	Grass seeding can be placed below "thin' jute/coir blankets, or on top of 'thick' jute/coir blankets. The use of 'thick' blankets aids in the suppression of weed seed contained within the underlying soil.
	The synthetic mesh within UV-stabilised TRMs can damage tree and shrub roots.
Short-term use without vegetation	Most products can be used for short-term erosion control or channel lining even if the product was originally designed to function in association with a vegetative cover.
	Filter cloth and weed control fabrics can often be used as short-term channel linings on temporary batter chutes.
	In semi-arid environments where 100% vegetation cover is unlikely to occur, and/or the establishment of vegetation is considered unreliable, then coir-based organic products or synthetic mulch blankets may be preferred.
Weed control	'Thick' organic-based blankets and woven synthetic blankets can be used to suppress weed growth.

Table 1b - Desirable features and requirements of erosion control mats and blankets for various operational conditions

Operational conditions	Desirable features and requirements
Steep slopes	Most 100% organic-based blankets can experience significant distortion (slip) when placed on steep slopes unless plant establishment is quickly achieved. It should be noted that this distortion does not necessarily mean that the blanket has failed.
	On steep sites, consideration should also be given to hydraulically applied blankets, such as Bonded Fibre Matrices and Compost Blankets.
	Some weed control fabrics incorporate a high-friction upper surface to aid in the retention of loose surface mulch. For example, some blankets incorporate a needle-punch wool upper surface layer. Of course this particular feature will have a limited service life.
Temporary batter chutes	Non-woven fabrics generally have a lower allowable flow velocity, but generally bond better to the underlying earth than woven fabrics, thus there is usually a lower risk of erosion under the blanket.
	Woven fabrics have a higher allowable flow velocity, but can be more susceptible to water flow passing between the fabric and the soil.
Impact on future reuse of topsoil	The use of blankets and mats reinforced with UV-stabilised synthetics can interfere with the effective future re-use of any affected topsoil.
	Appropriate consideration must always be given the long-term sustainability of a given product before it is selected for use on a site.
Site access	On steep sites or sites with poor access, consideration should be given to hydraulically applied blankets, such as Bonded Fibre Matrices and Compost Blankets.
Wildlife	Synthetic-based blankets should generally not be use within bushland areas. Small ground-dwelling fauna, such as lizards and snakes, can become entangled in the netting. Ground-fossicking, granivorous (seed-eating) birds are also at risk of entanglement within the mesh.
	The use of organic-based, 100% biodegradable fabrics is preferred in within and adjacent to wildlife areas such as bushland.
Grazing animals	Synthetic-based blankets should be used with extreme caution in areas used by grazing animals.
Pedestrian traffic	Some low strength blankets can experience significant disturbance when subjected to pedestrian traffic.
	Biodegradable (non-metal) anchorage pins/staples may be required in order to minimise safety risks to humans. It is noted rusty steel staples can become exposed by surface erosion.
Mowing	Turf reinforcement mats that are topped with a light covering of soil are less susceptible to damage from mowing.
Risk of grass fires	The susceptibility of permanent mats to fire damage varies depending on the type of fire and the degree of earth cover.
	If the mats are used on permanent batter drains and catch drains, then appropriate maintenance access may be required to allow repairs and/or replacement of damaged matting.
Airports	Restriction may be placed on the choice of anchoring (stapling) system typically within 9m of an airport runway. Generally the use of metallic pegs and staples should be avoided to prevent damage to aircraft tyres.

In circumstances where reliable data (i.e. confirmed by laboratory testing) exists, selection and design can be based on manufacturer's design specifications. In circumstances where such data does not exist, then selection of erosion control blanket should be based on Table 2.

Table 2 - Default selection guide for erosion control blankets

Class	1						2			3			
Type	A	B	C	AX	BX	CX	A	B	C	A	B	C	D
Typical location	Embankments			Embankments			Embankments, chutes & drainage channels						
Maximum bank slope (X:1)	4.0	2.5	2.0	4.0	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0
Permissible shear stress (Pa)	N/A	50	70	N/A	50	70	N/A	95	95	95	95	170	240
Allowable 'sheet' flow velocity (m/s)	<1	1.1	1.3	<1	1.1	1.3	1.3	1.5	1.5	1.5	N/A		
Allowable concentrated' flow velocity (m/s)	<1	2.2	2.6	1.4	2.2	2.6	1.7	3.0	3.0	3.0	3.0	3.7	3.9
Mowing required during plant establishment				√	√	√				√	√	√	√
Pedestrian traffic likely to occur during plant establishment				√	√	√				√	√	√	√
Wildlife friendly	√			√			√						
Within 9m of airport runways				√	√	√							

Erosion control blanket/mat classification system

A classification system for erosion control blankets and mats (e.g. Class 1, Type A) is provided in Table 3. In general terms, this classification system is based on the following distinctions.

Class 1 blankets:

Class 1 includes those temporary, light-duty Rolled Erosion Control Products (RECPs) that are primarily used in areas of 'sheet' flow, and thus are termed Erosion Control Blankets. A further division is made by separating those products best used away from pedestrian areas (Type A, B & C), and those products used in areas where the blankets could be subject to foot traffic or are likely required to experience mowing during the service life of the blanket (Type AX, BX & CX).

Class 2 blankets/mats:

Class 2 includes those temporary, heavy-duty Rolled Erosion Control Products (RECPs) that are primarily used in areas of medium shear stress such as embankment higher than 3m in tropical areas, and drainage channels. These products are termed Erosion Control Blankets or Erosion Control Mats depending on their use.

Class 3 mats:

Class 3 comprises permanent, heavy-duty Rolled Erosion Control Products (RECPs), including turf reinforcement mats, that are primarily used in areas of high shear stress such as drainage channels and spillways/chutes. These products are typically termed Erosion Control Mats.

Note: The classification system presented in Table 3 is **not** comprehensive. Not all erosion control blankets can be classified under this system. Specifically, Table 3 does not identify those blankets with weed control properties.

Table 3 should not be used to prevent or limit the appropriate application of those unclassified products. In all cases, the application of best practice erosion control requires the selection of the technique or procedure most appropriate for the given site conditions.

Table 3 - Classification of erosion control blankets and mats

Class	1						2			3			
Type	A	B	C	AX	BX	CX	A	B	C	A	B	C	D
Typical location [1]	Embankments			Embankments			Embankments, chutes & drainage channels						
Permissible shear stress (Pa) [2]	N/A	50	70	N/A	50	70	N/A	95	95	95	95	170	240
Maximum slope [3](X:1)	4	2.5	2	4	2.5	2	2	2	2	2	2	2	1
RUSLE C-factor (maximum)	0.2			0.2			N/A			N/A			
Used in drainage channels	No	[4]	[4]	No	[4]	[4]	Yes			Yes			
Turf reinforcement mat (TRM)	No			No			No			No	Yes		
Minimum service life	3 months [5]			3 months [5]			1 years [6]			Permanent matting			
Thickness (mm)	N/A			N/A	9	9	N/A			N/A			
Able to withstand mowing [7]	N/A			Yes			Yes			Yes			
Able to withstand foot traffic [8]	N/A			Yes			Yes			Yes			
Wildlife friendly [9]	Yes	N/A		Yes	N/A		Yes	N/A		[10]			
Anchor pins	Any			Biodegradable [11]			Any			Any			
Primary blanket or matting component													
Primary material	Organic			Organic			[12]	Organic [13]		Synthetic			
Manufacture	Non-woven			Non-woven			[14]	[15]	[16]	N/A	Woven/welded		
Netting component													
Netting	No	Allowed		No	Allowed		No	[17]	Yes	Yes			
Type	N/A	Any		N/A	Organic		N/A	[18]	[19]	Synthetic			
% of weight (max)	N/A	15%		N/A	15%		N/A	15%		N/A			
Photodegradable	Allowable			Allowable			N/A		Yes	No			
Biodegradable	Allowable			100%			100%		Yes	No			
Stitching properties	N/A	As for netting		N/A	As for netting		N/A	As for netting		As for netting			

Notes:

[1] 'Typical location' is a general classification. The primary objective of the Type AX, BX & CX is to ensure ongoing safety to pedestrian traffic potentially affected by rusty, metallic anchoring pins/staples. Note; galvanised pins/staples are generally not acceptable due to limited anchorage of the blanket/mat.

[2] Failure in shear is defined by either, separation of 10% of the blanket from the soil surface, and/or the equivalent loss of 12mm of soil from the treated area (as per ASTM D6460-99 or equivalent).

[3] Maximum slope applied only when significant rainfall is possible prior to plant establishment.

[4] Blankets/mats can be used within minor (low velocity) drainage channels or on the banks of waterways in locations where revegetation is expected to occur before subject to high flow velocity.

[5] Service life defined by the maintenance of a maximum Cover Factor (C) of 0.20 based on the Revised Universal Soil Loss Equation (RUSLE) prior to establishment of the required vegetation cover. A minimum 6 months service life may be required in locations where vegetation establishment is known to be slow, such as during winter months.

[6] Service life defined by either the maintenance of a maximum Cover Factor (C) of 0.20 based on the Revised Universal Soil Loss Equation (RUSLE) prior to establishment of the required vegetation cover, or separation of 10% of the blanket from the soil surface, and/or the equivalent loss of 12mm of soil from the treated area (as per ASTM D6460-99 or equivalent).

[7] Requirement to allow for mowing of the treated surface without causing damage to the blanket applies to those areas where mowing of the emerging grass will likely be required prior to establishment of the required (e.g 70% cover) vegetation cover.

[8] Requirement to allow for occasional foot traffic without causing damage to the blanket applies to those areas where occasional

foot traffic is anticipated prior to establishment of the required (e.g 70% cover) vegetation cover.

[9] Requirement for the blanket to accommodate potential ground-dwelling wildlife is typically required when the blanket is placed adjacent to wildlife areas such as bushland, wildlife corridors, waterways, and land containing grazing animals.

[10] Turf reinforcement mats can potentially affect and/or be damaged by grazing animals.

[11] Anchorage pins/staples may be required to be biodegradable (e.g not metal) in order to minimise the risk of injury to humans, domestic animals, or wildlife following the long-term exposure of rusty or otherwise dangerous obstacles buried in the soil. Biodegradable anchorage pins/staples are also required on all blanket/mat installations within 9m of an airport runway. Note; it is the "rusting' of metal staples that provides much of their anchorage properties.

[12] Manufactured from 100% jute or coir fibres, or combination there of.

[13] The parent material of Class 2 Type B & C blankets/mats must have a maximum water absorption rate of 300%, by weight (ASTM D1117 or equivalent); and a maximum swell (wet thickness change) of 30% (as per ASTM D1777 or equivalent). The lignin content must be greater than 38% (as per Technical Assoc of the Pulp and Paper Industry test method T222 or equivalent).

[14] Jute and coir products may be non-woven (thick blankets), or woven (mesh). Warning, jute mesh may not be able to achieve the 1-year service life if located within a moist environment.

[15] Woven mats allowed with a maximum opening of 12mm.

[16] Woven or non-woven material allowed.

[17] Blanket can be reinforced with netting made from organic fibres only (e.g. jute or coir).

[18] Only organic fibres are allowed to avoid wildlife being trapped within the netting.

[19] Non-organic, photodegradable or biodegradable netting allowed.

Table 3 presents the flow stability properties of erosion control blankets and mats in terms of permissible shear stress measured in units of Pascals (Pa). Permissible shear stress is considered a more reliable measure of blanket's resistance to damage by water flow and is the measure typically used within Europe and USA; however, allowable flow velocity is more commonly used within Australia.

Table 4 defines the relationship between permissible shear stress (Pa) and allowable flow velocity (m/s) for various values of hydraulic radius (R). Table 3 is only appropriate for nonvegetated erosion control blankets and mats based on the assumed Manning's n roughness presented within the table. The table is therefore appropriate for Class 1 and 2 erosion control blankets.

Table 4 - Equivalent allowable flow velocity (m/s) for a given permissible shear stress (Pa) for non-vegetated **erosion control blankets**

Assumed Manning's roughness	Hydraulic radius (m)	Permissible shear stress (Pa)						
		40	**50**	**60**	**70**	**80**	**90**	**100**
0.1	**0.05**	0.39	0.43	0.47	0.51	0.55	0.58	0.61
0.08	**0.1**	0.54	0.61	0.67	0.72	0.77	0.82	0.86
0.06	**0.15**	0.78	0.87	0.95	1.03	1.1	1.16	1.23
0.05	**0.2**	0.98	1.09	1.2	1.29	1.38	1.47	1.54
0.045	**0.25**	1.13	1.26	1.38	1.49	1.59	1.69	1.78
0.04	**0.3**	1.31	1.46	1.6	1.73	1.85	1.96	2.07
0.035	**0.4**	1.57	1.75	1.92	2.07	2.22	2.35	2.48
0.03	**0.5**	1.9	2.12	2.32	2.51	2.68	2.85	3
0.03	**0.6**	1.96	2.19	2.4	2.59	2.77	2.93	3.09
0.03	**0.7**	2.01	2.24	2.46	2.65	2.84	3.01	3.17
0.03	**0.8**	2.05	2.29	2.51	2.71	2.9	3.08	3.24
0.03	**1**	2.13	2.38	2.61	2.82	3.01	3.19	3.37

Table 5 - Examples of Class 1, Type A erosion control blankets [1]

Products	Manufacturer
Jutemaster FM [2]	Landplan Engineering Supplies
Jutemaster TM [2]	Landplan Engineering Supplies
Coconut fibre mat [2]	Sure Gro
Surejute (various thicknesses) [2]	Sure Gro
Max J ute Fine [2]	Tree max
Max J ute Thick [2]	Tree max
Fibremaster (recycled textile) [2]	United Bonded Fabrics
Geomaster (jute textile) [2]	United Bonded Fabrics

[1] Not all of the above products are available in Australia. The data is supplied simple as a guide to assist people in finding an equivalent local product.

[2] Preliminary classification (independent test results not observed).

Table 6 - Examples of Class 1, Type B erosion control blankets [1]

Products	Manufacturer
Curlex 1 WH	American Excelsior
Curlex 1	American Excelsior
AEC Premier Straw SN	American Excelsior
ECX-1	East Coast Erosion Systems
ECM S1000	Enviroscape
S31	Erosion Control Blanket.com
S31UVD	Erosion Control Blanket.com
SS (formerly Proguard, S1 or Standard)	Erosion Control Systems
Enviromat [2]	Geofabrics Australasia
S75	North American Green
DS75	North American Green
DS150	North American Green
SC150	North American Green
Landlok S1	Propex
LandlokSIRD	Propex
SNS	SoilTex
Erosion King	Rhino Seed and Turf Supply
V75 S	Verdyol
V 75 S FD	Verdyol
Excel SR-1	Western Excelsior
Winters Straw *SNW	Western Excelsior
Winters Straw SNG	Western Excelsior

[1] Not all of the above products are available in Australia. The data is supplied simple as a guide to assist people in finding an equivalent local product.

[2] Preliminary classification (independent test results not observed).

Table 7 - Examples of Class 1, Type C erosion control blankets [1]

Products	Manufacturer
Curlex High Velocity	American Excelsior
AEC Premier Straw DN	American Excelsior
Curlex II	American Excelsior
Curlex LT	American Excelsior
AEC Premier Straw/Coconut	American Excelsior
S32	Erosion Control Blanket.com
ProGaurd DS	Erosion Control Systems
ECM S2000	Enviroscape
EG-2S	Ero-Guard
S150	North American Green
DS150	North American Green
SC 150	North American Green
Landlok CS2	Propex
Landlok S2	Propex
DNS	SoilTex
V150S	Verdyol
Excel SS-2	Western Excelsior
Excel SS-2 Rapid Grow	Western Excelsior
Winters Straw HVW	Western Excelsior
Winters Straw HVG	Western Excelsior
Winters Choice HV	Western Excelsior
Erosion King II	Rhino Seed and Turf Supply

Table 8 - Examples of Class 1, Type AX erosion control blankets [1]

Products	Manufacturer
Jutemaster TM [2]	Landplan Engineering Supplies
Coconut fibre mat [2]	Sure Gro
Surejute (various thicknesses) [2]	Sure Gro
Max J ute Thick [2]	Tree max
Fibremaster (recycled textile) [2]	United Bonded Fabrics
Geomaster (jute textile) [2]	United Bonded Fabrics

[1] Not all of the above products are available in Australia. The data is supplied simple as a guide to assist people in finding an equivalent local product.

[2] Preliminary classification (independent test results not observed).

Table 9 - Examples of Class 1, Type BX erosion control blankets [1]

Products	Manufacturer
Curlex I Fibrenet	American Excelsior
Curlex II Fibrenet	American Excelsior
AEC Premier Straw Fibrenet	American Excelsior
S31 BD	Erosion Control Blanket.com
S 75 BN	North American Green
S 150 BN	North American Green
SC 150 BN	North American Green
C 125 BN	North American Green
Excel SR-1 All Natural	Western Excelsior
Excel R-1 All Natural	Western Excelsior
WintersStraw Bio	Winters Excelsior

Table 10 - Examples of Class 1, Type CX erosion control blankets [1]

Products	Manufacturer
Curlex NetFree	American Excelsior
S32 BD	Erosion Control Blanket.com
SC 32 BD	Erosion Control Blanket.com
EXCEL SS-2	Western Excelsior

Table 11 - Examples of Class 2, Type A erosion control blankets/mats

Products	Manufacturer
Soil-Saver Jute Mesh [2]	Landplan Engineering Supplies

Table 12 - Examples of Class 2, Type B erosion control blankets/mats [1]

Products	Manufacturer
Dekowe 700	Belton Industries
Dekowe 900	Belton Industries
BioD-Mat	RoLanka

Table 13 - Examples of Class 2, Type C erosion control blankets/mats [1]

Products	Manufacturer
AEC Premier Coconut	American Excelsior
C32	Erosion Control Blanket.com
C 125	North American Green
C 125 BN	North American Green
C 350	North American Green
LandLock C 2	SI Geosolutions
DNC	SoilTex
V125C	Verdyol
WintersCoir HV	Winters Excelsior

[1] Not all of the above products are available in Australia. The data is supplied simple as a guide to assist people in finding an equivalent local product.

[2] Preliminary classification (independent test results not observed).

For examples of Class 3 erosion control mats, refer to the fact sheet for Erosion Control Mats located within the channel/chute linings section.

Description

A biodegradable or synthetic blanket placed (rolled) on the surface of an erodible material. Blankets form part of the generic product range termed 'Rolled Erosion Control product' (RECP).

A wide range of geotextiles are available for erosion control, each product having specific features that make that product suitable for a specified surface condition, environment or task.

Temporary Blankets:

The product can be 100% biodegradable or a composite geotextile incorporating UV- sensitive netting for improved short-term stability. Commonly used materials include jute (plant product), recycled fibre (cotton waste), coir (coconut fibre), excelsior (wood shavings), straw and wool. They have a useful life span of around three to six months, but some produces can last for more than a year under light rainfall/dry conditions.

Weed Control Blankets:

Similar in content to normal erosion control blankets, but are usually thicker. An increasing number of synthetic-based products are becoming available that are 100% biodegradable, even though the break-down process may take several years.

Hydraulically-Applied or Spray-On Blankets: These products include Bonded Fibre Matrix (BFM) and Compost Blankets. They are hydraulically sprayed onto the soil surface where they dry to form a flexible or semi-flexible blanket. The spray-on material may consist of seed, fertiliser, tackifier and mulch contained in a water-based slurry. They are typically used as a one-step process for erosion control and revegetation.

Purpose

The primary purpose of erosion control blankets is to protect exposed soils, primarily on slopes, from the erosive forces of raindrop impact. Most blankets have limited shear strength and thus are generally not suited to areas of significant (high shear stress) concentrated flow.

Erosion control blankets can also be used to protect stockpiles from the erosive effects of wind and raindrop impact.

Some blankets can be used to suppress in- situ plant (weed) growth, while others act as a mulch layer to promote seed germination and plant growth.

When used as a weed control blanket, seeding can (in some cases) be applied to the surface of the blanket (usually in the form of a hydromulch or BFM) to allow establishment of the preferred plant species.

Limitations

Synthetic-based blankets generally should not be use in bushland areas. Small ground-dwelling fauna, such as lizards and snakes, can become entangled in the netting. Ground-fossicking, granivorous (seed-eating) birds are also at risk of entanglement within the blankets.

Synthetic-based blankets should also be used with extreme caution in areas used by grazing animals.

Most biodegradable blankets have very limited shear strength and their resistant to concentrated flow can deteriorate rapidly over a period of a few months.

Adequate erosion control is generally not achieved if placed directly on a dispersive soil.

Advantages

From the wide range of commercial products available, a specific blanket can be chosen to manage the effects of raindrop impact, sheet erosion, weed growth, soil temperature fluctuations and/or soil moisture loss.

Most blankets are quick to install, and provide instant protection.

Disadvantages

Generally should not be placed directly over dispersive soils. The exception may be Compost Blankets (depending on the degree of dispersion, slope and hydraulic conditions).

Intimate soil contact is critical for blanket success and therefore extensive soil preparation is required before application to an irregular (eroded) surface.

Most natural fabrics have a very limited working life and low shear strength.

Synthetic-based blankets can be damaging to local wildlife.

Common Problems

'Tenting' caused by blankets being placed over irregular surfaces (i.e. as a result of poor surface preparation or blanket placement).

Failure of the blankets when place directly over dispersible soils. Such ■failures' may result in displacement of the blanket, or severe rilling under the blanket.

Blankets are often overlapped in the wrong direction causing the blankets to be displaced by water flow.

Poorly anchored blankets are often displaced by strong winds.

Special Requirements

Four general requirements exist for effective protection against erosion:

•intimate contact must be achieved;

•seepage flow should be discouraged;

•surface irregularities removed; and

•good anchorage must be provided.

The method of installation varies with the type of material used and the purpose being performed by the blanket.

Surface-laid blankets are generally laid over at least 75mm of topsoil that is seeded, fertilised, watered, and raked to remove any large irregularities.

Site Inspection

Check that the blankets are adequately anchored/ trenched along their outer edges.

Check for erosion along the edge of the blankets.

Check that the blankets overlap in the direction of flow, and/or strongest wind.

If vegetation is expected to grow (emerge) through the blanket, check that the blanket has good contact with the soil. The blanket may need to be rolled after placement to achieve good surface contact.

Materials

Unless otherwise specified, the following material specifications should apply.

Geotextile blankets:

•Woven polypropylene fabric.

•Minimum thickness of 1.5mm.

•Minimum width of 3.6m.

Staples:

•Minimum 11 gauge steel wire.

•U-shaped with 200mm leg length and 50mm crown.

Excelsior blankets:

•Curled wood fibre blanket with 80% of fibres longer than 150mm.

•Minimum roll width of 1200mm.

•Average weight of 0.43kg/m2 +/-10%.

Straw blankets:

•Minimum roll width of 2m.

•Minimum weight of 0.27kg/m2.

Coconut fibre blankets:

•Minimum roll width of 2m.

•Minimum weight of 0.27kg/m2.

Installation

The method of installation varies with the type of material used and the task being performed by the blanket. Installation procedures should be supplied by the manufacturer or distributor of the product. A typical installation procedure for rolled erosion control products is described below.

Application of rolled blankets on slopes not subjected to concentrated flow:

1.Refer to approved plans for location, extent, and installation details. If there are questions or problems with the location, extent, or method of installation contact the engineer or responsible on-site officer for assistance.

2.Clear away trash and large stones, and grade smoothly to eliminate footprints, tracks and ruts.

3.Prepare a smooth seedbed of approximately 75mm of topsoil.

4.Apply seed, soil ameliorants and water as specified, then rake to remove any remaining surface irregularities.

5.Commence placement of the blankets at the top of the slope. Bury the upper edge of the blanket within a 300mm deep trench and staple at 200 to 250mm centres.

6.The blankets can be placed lengthwise either along the slope (parallel to the contours) or down the slope (transverse to the contours), but not diagonally across the slope.

7.Overlap the sides of each blanket by at least 100mm.

8.Bury the edge of the blanket located along the outer most edge of the treated area within a 300mm deep trench and staple the blanket within the trench at 200 to 250mm centres.

9.Where more than one blanket is used down the slope, overlap each blanket by at least 300mm with the upper blanket placed over the lower blanket (shingle style).

10.When spreading the blankets, avoid stretching the fabric. The blankets should remain in good contact with the soil.

11.Staple the exposed fabric surface at 1 m centres.

12.Blankets, once fixed, may be rolled with a roller weighing 60 to 90kg/m length, then watered.

13.The installation procedure must ensure that the blanket achieves and retains intimate contact with the soil.

14.Damaged fabric shall be repaired or replaced.

15.Where directed, an additional mesh (jute or coir) anchor may need to be placed over the blankets to minimise displacement by strong winds.

Additional requirements associated with use near airport pavements:

1.Only blankets that are double netted shall be allowed within 3m of any airport pavement used by aircraft with the exception of airports classified as air carrier or corporate/transport. If the airport is classified as an air carrier or corporate/transport, there will be no blankets allowed within 9m of pavement used by aircraft.

2.Only biodegradable anchoring devices shall be allowed in the installation of any blanket for airport applications. No metal staples will be allowed.

Maintenance

1.During the active construction period, inspect the treated area fortnightly and after runoff-producing storm events and make repairs as needed.

2.The treated area should be inspected at least fortnightly for the first 3 months.

3.Inspect the treated area to see if:

(i)construction activity or falling debris have damaged the blankets;

(ii)runoff is undermining the fabric;

(iii)the blankets are in good contact with the soil; and

(iv)the blankets maintain adequate overlap.

4.If damaged, repair or replace the damaged section. If water is undermining the fabric, repair any holes or joints or re-bury the upper ends of the damaged sections.

INSTALLATION NOTES

Erosion control blankets should always be installed such that the up-slope blanket overlaps the down-slope blanket in the direction of surface water flow as shown in Figure 1.

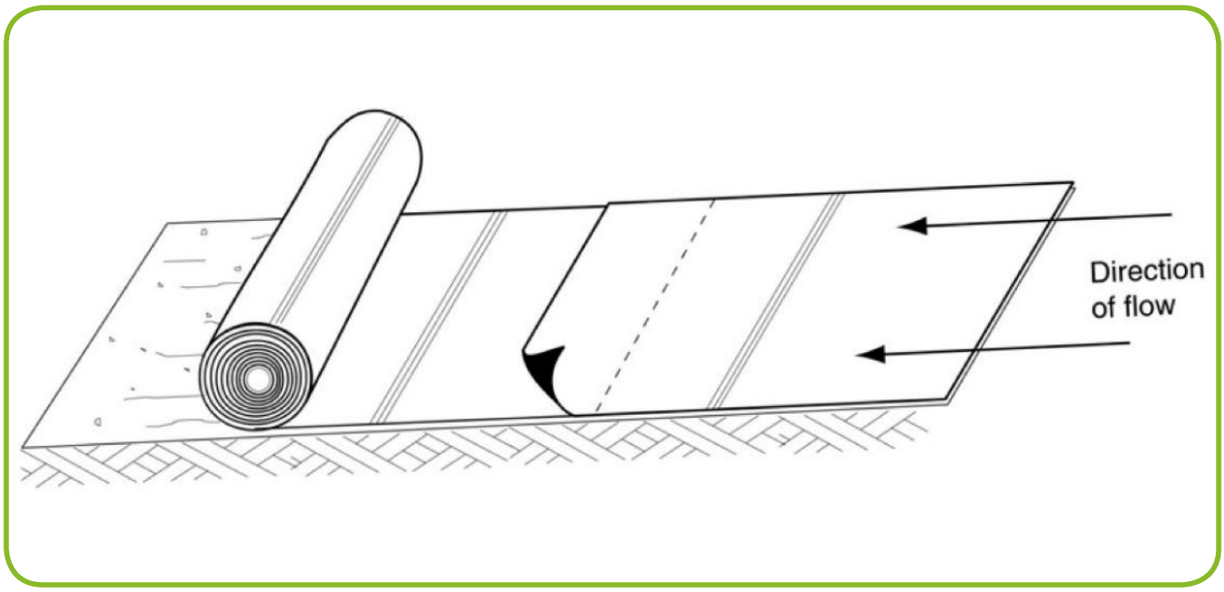


Figure 1- Placement of erosion control blankets

In circumstances where significant run-on water enters the upper edge of the treated area, this up-slope edge of the blanket should be suitably trenched (as shown in Photo 1) to prevent water passing under the blanket. The intent here is to prevent the displacement of the blanket, and to prevent the separation of the blanket from the ground surface, thus maintaining ideal conditions for the emergence of recently germinated seedlings.

APPLICATIONS

High-volume and high-velocity storm water runoff can erode soil within open channels, drainage ditches, swales and on steep exposed slopes increasing the transport of sediments into receiving waters that can severely affect water storage capacity and increase flooding potential. Water quality impacts of increased sediment load include the conveyance of nutrients and pesticide pollutants, disruption of fish spawning and impairment of aquatic habitat. Advanced Drainage Systems, Inc. is able to provide the products needed to protect against soil loss. In addition, BCE products are able to save the end user money and time.

BCE erosion control products are able to protect newly seeded soils from raindrop impact, minimize soil loss and promote infiltration to accelerate the development of the seeds.

On slopes, BCE products are more effective than hydraulic mulch and blown straw and more economical than concrete slope paving or riprap.

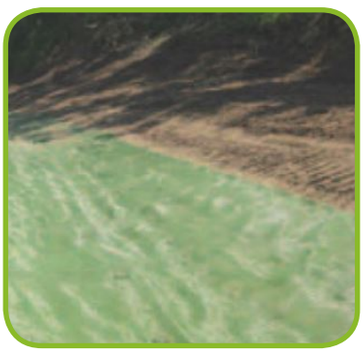
BCE erosion control products also help to capture sediment and other contaminants from storm water. Permanent turf reinforcement mats enhance vegetation performance, resist erosion and tearing of vegetation under the highest water velocities.

Slopes

Turf Reinforcment Mat with three weeks vegetative establishment.

Slope stabilization project utilizing an armor system.

Channels



Second generation woven turf reinforcement matting used for steep slope channel stabilization.

First generation turf reinforcement mat used for channel stabilization.

Semi-arid channel stabilization project.

High-Performance turf reinforcement mat with superior ultra-violet resistance for up to a 50-year design life in semi-arid conditions.

EROSION CONTROL BLANKETS (ECBS)

Erosion control blankets are available in numerous varieties, including excelsior, straw, straw/coconut and coconut which are confined by nettings stitched together. ECBs hold soil and seed in place until the vegetative establishment. The blankets degrade over time as the permanent vegetative cover establishes itself.

OOS1TT
Weed-free agriculture straw that is bonded by a single synthetic, photodegradable top netting. It is an ideal solution for rainfall/ rainsplash protection on shallow slopes.

OOS2TT
A single synthetic, photodegradable top and bottom netting is utilized in the OOS2TT. The blanket may be used in low-flow channels and moderate slopes.

OCS2TT
A combination of straw and coconut fibers with a polypropylene netting on the bottom and top has a two-year life span and can be utilized where long-term protection is needed and in medium runoff conditions.

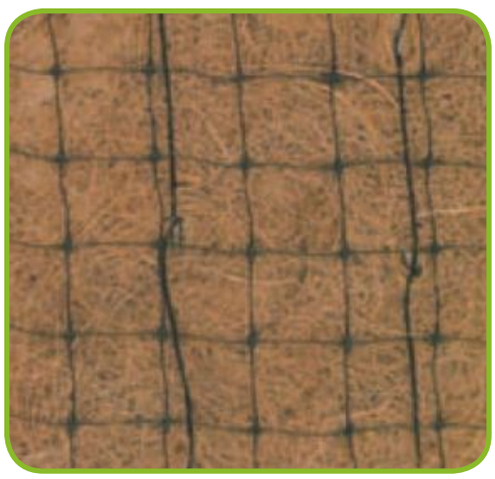
OOC2TT
For use on steeper slopes and moderate flow runoff, the slow degrading coconut fibers are stitched on the top and bottom with polypropylene nets. Provides erosion protection and mulching between a 2-3 year period.

ALL NATURAL
All erosion control blankets are available with an all-natural netting created from Jute/Scrim Biodegradable for sensitive applications. These ECBs are ideal for environmental restoration with light to moderate water runoff conditions.

RAPID GO
Rapid Go blankets are utilized where vegetation will grow rapidly and then is followed by mowing or other maintenance activities. The netting has special additives to accelerate the photodegradation process. Typical applications for Rapid Go are parks and golf courses.

00S1TT

00S1TT



00S1TT

TURF REINFORCEMENT MATS (TRMS)

When a permanent rolled erosion control product is needed to provide vegetation with two to three times its normal erosion protection, a turf reinforcement mat is used. TRMs are composed of permanent synthetic materials to provide immediate erosion protection, rapid vegetation growth and long-term erosion protection. TRMs are preferred environmental alternatives to hard armor in the protection of drainage ditches, open channels, steep slopes and detention basins.

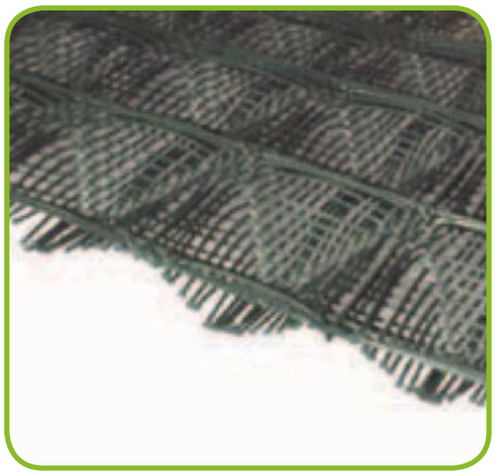
PP510GTR
Generally placed above a seeded surface and the first- generation TRM reinforces the vegetated root structure to resist higher hydraulic conditions. Two nets bond the web of green and tan polyolefin fibers and provides maximum erosion protection and vegetation growth through the mat. May be utilized for low flow swales, moderate slopes and ponds.

PP512GTR
A first-generation TRM, the PP512GTR allows soil filling and/ or retention as well as plant emergence beneath or within the matrix of the green or tan polyolefin fibers. Two high- strength, biaxial-oriented nets hold the fibers in place.

PP5HPTRM
A second-generation HPTRM, the PP5 high-performance woven turf reinforcement mat, features both high tensile strength and a high tensile modulus to provide superior erosion protection from accelerated hydraulic forces and stands up to non-hydraulic stress conditions (maintenance activity). Offering a 50-year design life, it may be applied to channels, slopes, ponds and canal/river banks.

PP5 ARMOR SYSTEM
An Anchored Reinforced Vegetation System (ARVS) consisting of the High Performance Turf Reinforcement Mat (HPTRM) in combination with Percussion Driven Earth Anchors (PDEAs). Installing the PDEAs with the HPTRM as a system allows for the strength of the HPTRM to be more effectively transferred to the ground surface reducing the potential for shallow plane failures due to poor in-situ soil conditions and/or strength loss due to seepage. Application consist of steep slopes, channels, river/ canal banks, retention/detention facilities, levee overtopping and/or where greater factors of safety are required.

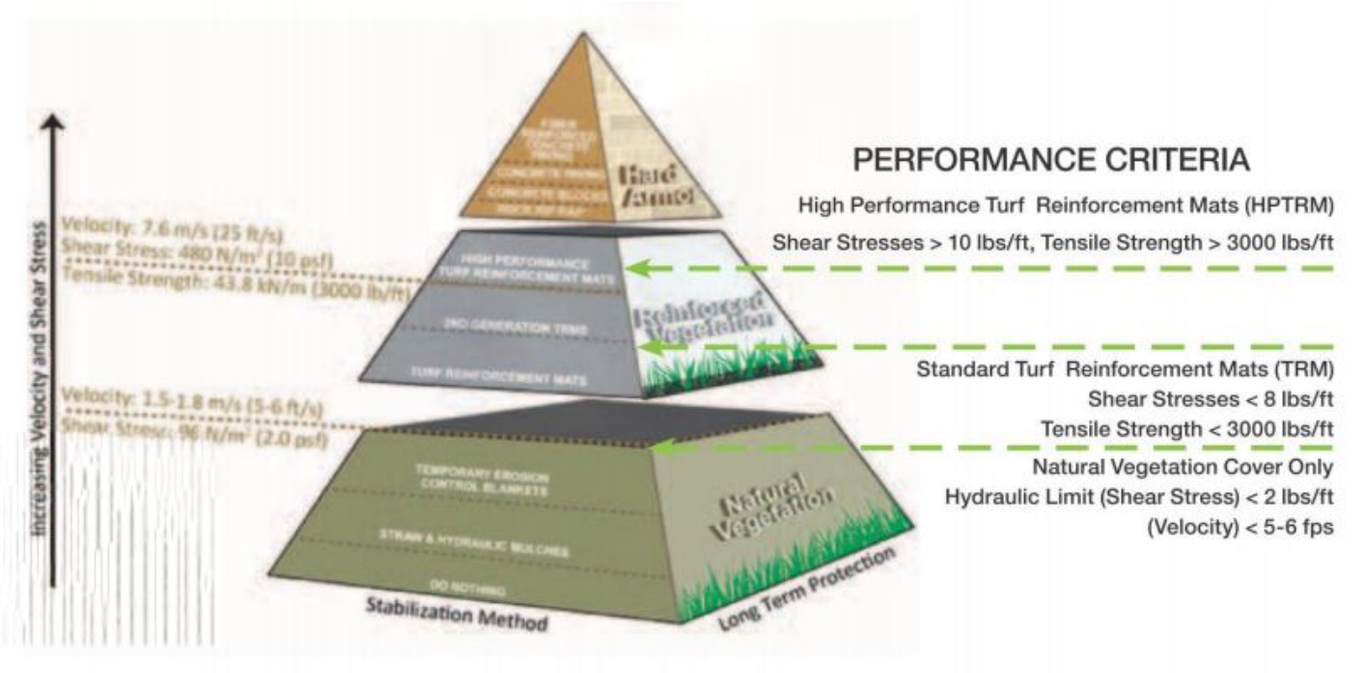
PP510GTR



PP5HPTRM

PP5 ARMOR SYSTEM

MEASURABLE BENEFITS



Benefits

- Erosion control mats qualify as an EPA Phase II Best Management Practice, serving as part of an overall storm water management plan.
- Prevent sediment runoff
- Promote ground water recharge
- Reduce peak flows and runoff velocities
- Easy inspection and maintenance
- Safer and less costly than hard armor solutions

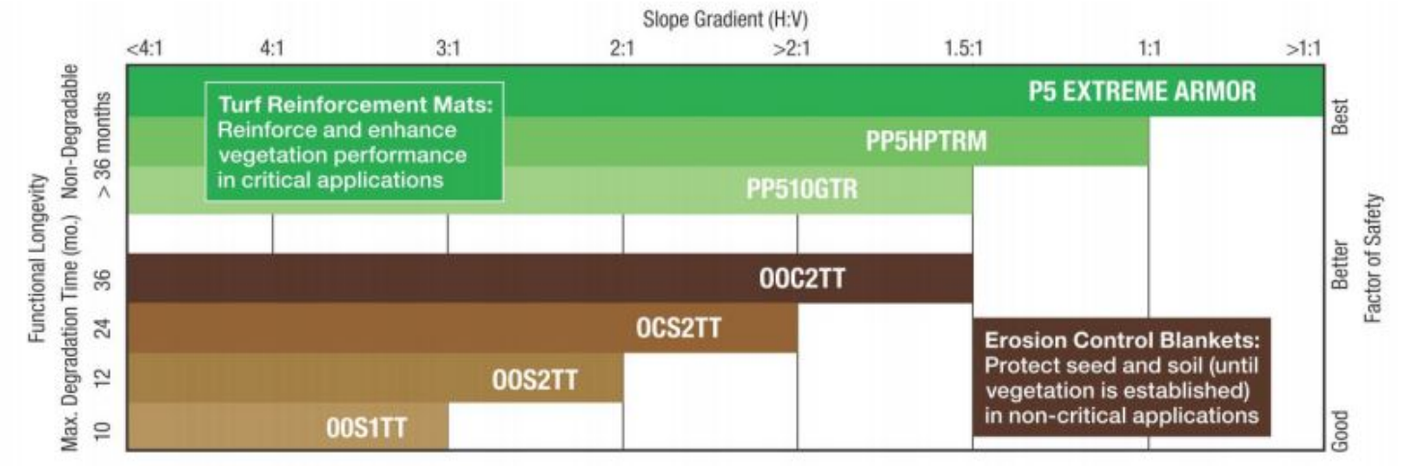
EFFECTIVENESS OF DESIGN SWALES	
Pollutant	Median Percent Removal
Total Suspended Solids	81%
Oxygen Demanding Substances	67%
Nitrate	38%
Total Phosphorous	9%
Hydrocarbons	62%
Cadmium	42%
Copper	51%
Lead	67%
Zinc	71%

Pollutant Removal

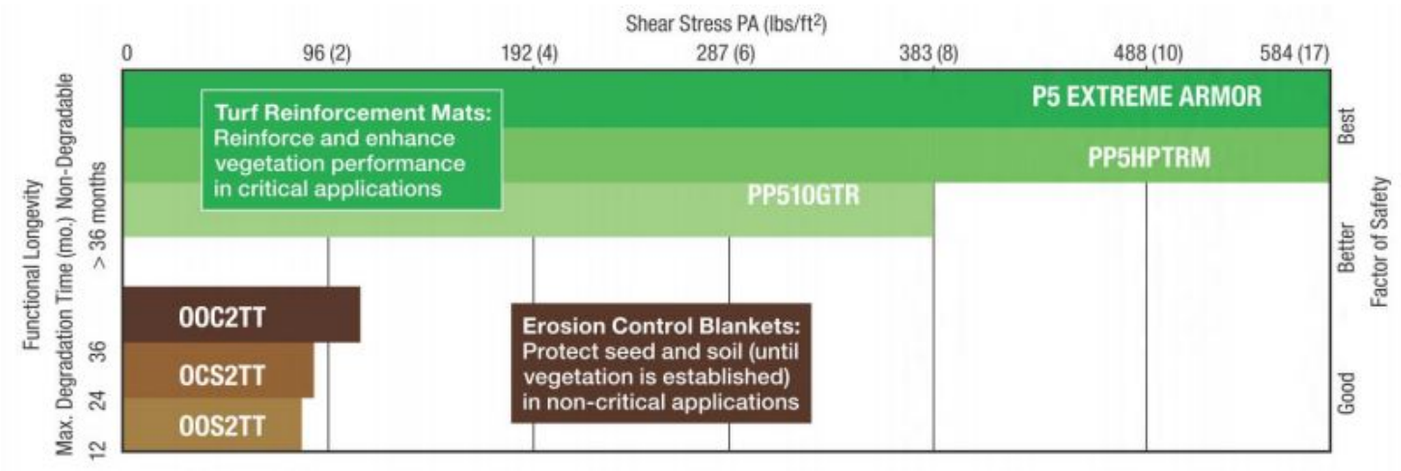
Studies done by the EPA show that grass swales and slopes with vegetation are effective in removing particulate pollutants. Conservative estimates are 25 to 50% pollutant removal efficiencies, but values ranging from 70-95% have been achieved on many sites.

PRODUCT SELECTION

Soil Slope Protection[1,2,3,6]



Channel Lining Systems[1,4,5,6]



NOTES:

1. Product suggestions shown are for initial selection of erosion control materials only. An experienced designer familiar with slope stability or channel design and lining material selection should make the final selection of the appropriate product. Consideration should be given to soil, geometry, vegetation selection, climate and irrigation conditions.
2. An important factor in erosion control material selection is slope length. For more information, please refer to the BCE EXCEL Erosion Design software or consult an BCE technical representative.
3. Where severe conditions are encountered and a long-term non-degradable material is needed, Xtreme Woven Technology Turf Reinforcement Mats should be selected. This selection chart is only applicable if soil slope is stable and upland surface water is not concentrated down slope.
4. An important component in channel lining is vegetation. Consult the Federal Highway Administration's Hydraulic Engineering Circular -15 (FHWA HEC-15) classification of vegetative covers or a local authority on appropriate species selection for more information.
5. Where the maximum shear stress is less than the permissible shear stress of the vegetation alone (i.e., <2lbs/ft2 or 5 ft/sec) is the only instance where degradable erosion control blankets should be utilized. The listed maximum shear stress for vegetation is from FHWA's11 Design of Roadside Channels with Flexible Linings" (HEC-15), Table 2.
6. Choose a material with higher functional longevity and tensile strength characteristics for an increased factor of safety. For more information see uStorm Water Technology Fact Sheet: Turf Reinforcement Mats", EPA 832-F-99-002, September, 1999.

PRODUCT SPECIFICATIONS

Erosion Control Blanket Specifications

Property	Test Method	Units	OOS1TT	00S2TT	OCS2TT	OOC2TT	OOS2AN	OCS2AN
Thickness	ASTM D6525	in mm	.28 in 7 mm	.28 7	.34 9	.26 7	.28 7	.34 9
Tensile Strength	ASTM D6818	lb/in kN/m	4.8 .8	10 1.8	13 2.3	18.4 3.2	16 2.8	16 2.8
Elongation	ASTM D6818	%	15 md 20 td	20 md 26 td	31 md 29 td	25 md 25 td		
Mass per Unit Area	ASTM D6475	oz/yd g/m	8 271	8 271	8.9 302	9.5 322	8 271	8.9 302
Functional Longevity	ASTM	months	12	12	24	36	12	24

NOTES:

Standard roll size for these styles is 2.4 m x 34.3 m (8‘ x 112.5') with 84 m2 (100 yd2) per roll.

Erosion Control Blanket Specifications

Property	Test Method	Units	PP58GTR	PP510GTR	PP512GTR	PP5HD	PP5-XTREME
Thickness	ASTM D6525	in mm	0.34 0	0.36 9	0.38 10	0.3 8	0.3 8
Tensile Strength	ASTM D6818	lb/ft kN/m	20.8x17.7 3.6 x 3.1	20.8x17.7 3.6 x 3.1	20.8x17.7 3.6 x 3.1	2,500x2,250 36x33	4,000 x 3,000 59x44
Elongation	ASTM D6818	%	25x24	25x25	25x25	25x20	25x22
Mass Per Unit Area	ASTM D6566	oz/yd g/m^2	8 271	10 339	12 407	9.2 312	9.2 312
Light Penetration	ASTM D6567	$\%^2$	35% open	25% open	20% open	25-30% open	25-30% open
Water Absorption	ASTM D1117	%	N/A	N/A	N/A	N/A	N/A
Resiliency	ASTM D6524	%	89%	87%	88%	95%	95%
Porosity	Computed	%	97%	96%	96%	96%	96%
UV Stability	ASTM D4355	%	100% (500 hr) 90% (1,000 hr)	100% (500 hr) 90% (1,000 hr)	100% (500 hr) 90% (1,000 hr)	100% (500 hr) 90% (3,000 hr)	100% (500 hr) 90% (6,000 hr)

NOTES:

1. Values for machine and cross machine, respectively, under dry or saturated conditions. Minimum average roll values are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported. Typical indicates mean or average of all test data.

2. Resiliency defined as percent of original thickness retained after 3 cycles of a 100 psi load for 60 seconds followed by 60 seconds without load.

3. Porosity calculation based upon mass per unit area, thickness and specific gravity.

4. Ground Cover Factor represents '*% shade" from Lumite Light Projection Test.

CONTACT US

CALL US

+8653187482137 +8653187481137 008618503117132 008618560035772

OUR EMAIL

sales@bioarctic.cn.com

OUR LOCATION

Shandong Bioarctic Cooling Equipment Co., Ltd. No. 21-1, Wuzhuang county, Zhangxia street, Changqing District, Jinan City, Shandong Province, China.