

# *Engineers Construction, Inc.*

P.O. Box 2187, South Burlington, VT 05407

Phone: (802) 863-6389

Fax: (802) 862-9703

www.engineersconstruction.com

## **SUBMITTAL COVER SHEET HIGHGATE STP 0297 (8) ECI Project Number 130546**

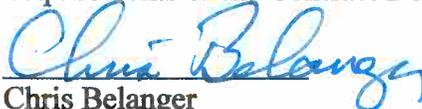
**Date:** 6/18/2013  
**ECI Submittal Reference No:** 605.13-01  
**Revision Number:** 0  
**Submittal Title:** Underdrain Perforated Pipe  
**Manufacturer Name:** HANCOR  
**Specification Section/Paragraph No:** 710.03  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 5 OF 20  
**Submittal Notes:**

**Revision No:**  
**Revision Date:**

This Submittal Prepared By: Chris Belanger, Project Manager  
Indicate one of the following:

- This submission is not a proposed substitution or deviation from the Contract Documents.
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By:   
Chris Belanger  
Project Manager

**END OF SUBMITTAL COVER SHEET**

## AASHTO Class I Perforation

The following terminology is derived from the applicable AASHTO specification. Hancor manufactures 12- through 24-inch (300 – 600 mm) Class I perforation as a standard product (Hancor designation 'C' perforation), however, other sizes may be ordered as a made to order with sufficient lead time. Please contact your local Hancor representative when ordering 4- through 10-inch and 30- through 60-inch Class I perforated pipe. The perforations shall be approximately circular and arranged in rows parallel to the axis of the pipe. The locations of the perforations shall be in the valley of the outside corrugation and also in each corrugation. The perforations shall be arranged in two equal groups placed symmetrically on either side of the lower half of the pipe. Please note that certain perforation patterns are not available in various parts of the United States. Please contact your local Hancor representative for availability and ordering of Class I perforations.

Nominal I.D.		Min. No. of Rows of Perforations	Maximum Perforation Hole Diameter		Minimum Perforation Hole Diameter		"H" Maximum		"L" Minimum		Nominal Inlet Area	
in	mm		in	mm	in	mm	in	mm	mm	mm	in <sup>2</sup> /ft	cm <sup>2</sup> /m
12	300	8	0.40	10	0.20	5	5.4	138	7.0	192	2.65	56
15	375	8	0.40	10	0.20	5	7.2	184	10.1	256	1.97	42
18	450	8	0.40	10	0.20	5	8.1	207	11.3	288	1.90	40
24	600	8	0.40	10	0.20	5	10.9	276	15.1	384	2.15	46
*30	750	8	0.40	10	0.20	5	13.6	345	18.9	480	1.85	35
*36	900	8	0.40	10	0.20	5	16.3	414	22.7	576	1.37	28
*42	1050	8	0.40	10	0.20	5	19.0	483	26.5	672	1.31	28
*48	1200	8	0.40	10	0.20	5	21.7	552	30.2	768	1.29	27
*60	1500	12	0.40	10	0.20	5	27.2	690	37.8	960	1.70	36

\* Denotes perforation pattern made to order

Figure 2  
AASHTO Class I Perforation Patterns



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## **SUBMITTAL COVER SHEET HIGHGATE STP 0297 (8) ECI Project Number 130546**

**Date:** 6/18/2013  
**ECI Submittal Reference No:** 605.23-01  
**Revision Number:** 0  
**Submittal Title:** Underdrain Carrier Pipe  
**Manufacturer Name:** HANCOR  
**Specification Section/Paragraph No:** 710.03  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 5 OF 20  
**Submittal Notes:**

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By:   
Chris Belanger  
Project Manager

**END OF SUBMITTAL COVER SHEET**

## HANCOR SURE-LOK® ST PIPE SPECIFICATIONS

### Scope

This specification describes 4- through 60-inch (100 to 1500 mm) Hancor Sure-Lok ST pipe for use in gravity flow drainage applications.

### Pipe Requirements

Sure-Lok pipe shall have a smooth interior and annular exterior corrugations.

- 4- through 10-inch (100 to 250mm) shall meet AASHTO M252, Type S.
- 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or ASTM F2306.
- Manning’s “n” value for use in design shall be 0.012.

### Joint Performance

Pipe shall be joined using a bell & spigot joint meeting AASHTO M252, AASHTO M294 or ASTM F2306. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.

### Fittings

Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

### Material Properties

Virgin material for pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250mm) diameters, or 435400C for 12- through 60-inch (300 to 1500mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500mm) virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Section 9.5 and 5.1 of AASHTO M294 and ASTM F2306, respectively.

### Installation

Installation shall be in accordance with ASTM D2321 and Hancor’s published installation guidelines with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) and for 54- and 60-inch (1350 and 1500 mm) diameters shall be 2 ft (0.6 m) in single run applications. Contact your local Hancor representative or visit our website at [www.hancor.com](http://www.hancor.com) for a copy of the latest installation guidelines.

### Pipe Dimensions

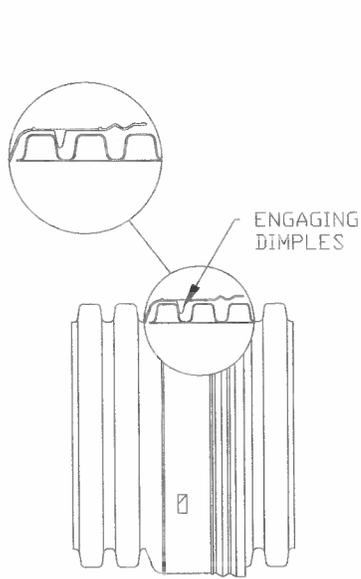
		Nominal Diameter, in (mm)													
Pipe I.D. (mm)	in	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	54* (1350)	60 (1500)
Pipe O.D.** (mm)	in	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28 (711)	36 (914)	42 (1067)	48 (1219)	54 (1372)	61 (1549)	67 (1702)
Perforations		All diameters available with or without perforations													

\*Check with sales representative for availability by region.

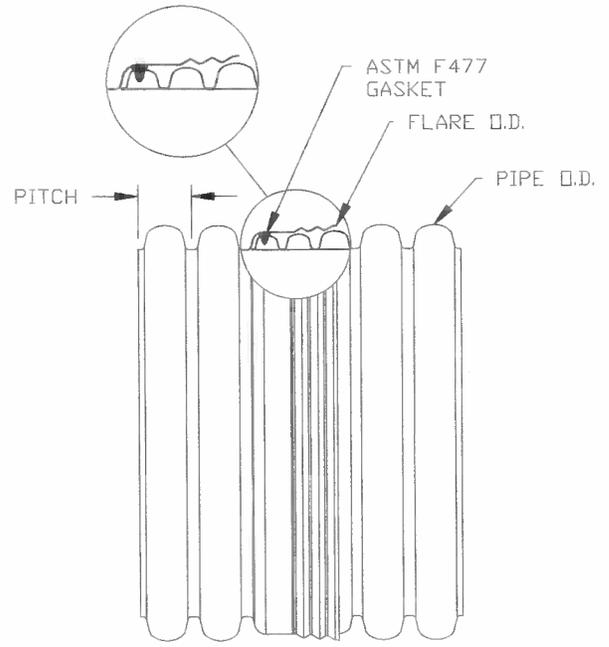
\*\*Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ± 1 inch. Contact a sales representative for exact values.

## SURE-LOK® ST PIPE JOINING SYSTEM

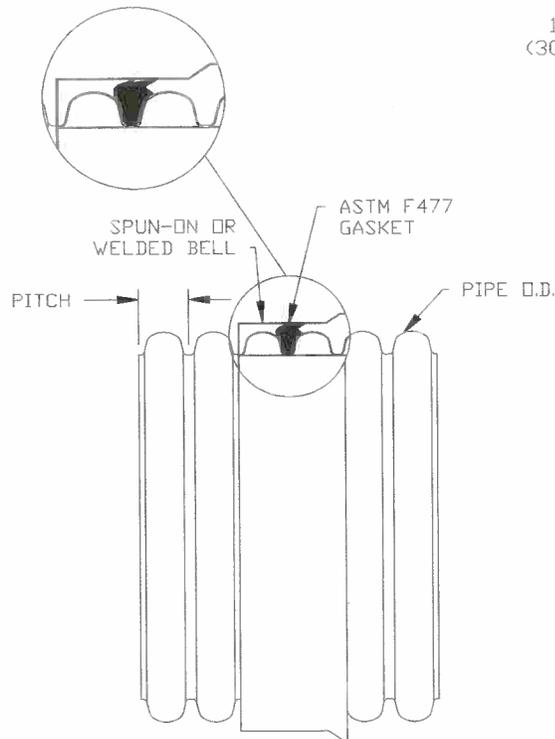
(Joint configuration & availability subject to change without notice. Product detail may differ slightly from actual product appearance.)



4" - 10"  
(100-250 MM)



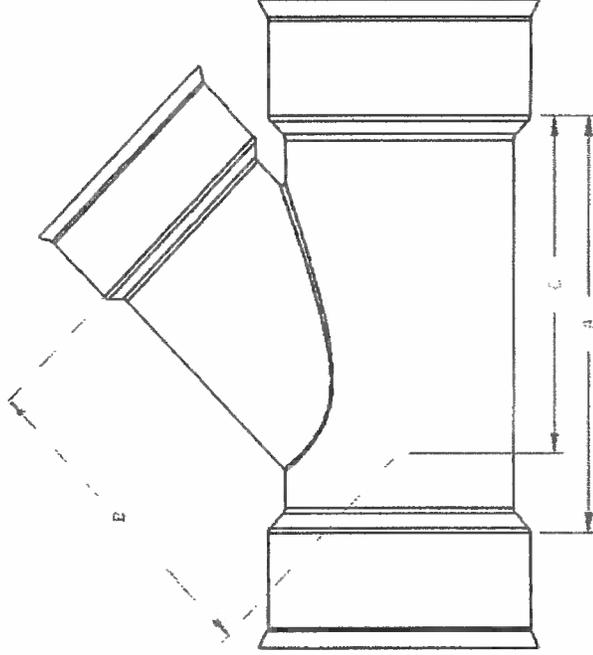
12" - 60"  
(300-1500 MM)



4" - 60"  
(100-1500 MM)

**INJECTION MOLDED 45° REDUCING WYE**  
**6" x 4" - 8" x 4" - 8" x 6" - 10" x 8" - 12" x 6" - 12" x 8" DIAMETER**

PART #	PIPE SIZE	A	B	C	JOINT
0680ST	6 x 4 in (150 x 100 mm)	6.3 in (160 mm)	8.3 in (211 mm)	4.8 in (122 mm)	ST
0680WT	6 x 4 in (150 x 100 mm)	6.3 in (160 mm)	8.3 in (211 mm)	4.8 in (122 mm)	WT
0880ST	8 x 4 in (200 x 100 mm)	10.7 in (272 mm)	10.0 in (254 mm)	9.2 in (234 mm)	ST
0880WT	8 x 4 in (200 x 100 mm)	10.7 in (272 mm)	10.0 in (254 mm)	9.2 in (234 mm)	WT
0881ST	8 x 6 in (200 x 150 mm)	12.6 in (320 mm)	11.3 in (287 mm)	10.8 in (274 mm)	ST
0881WT	8 x 6 in (200 x 150 mm)	12.6 in (320 mm)	11.3 in (287 mm)	10.8 in (274 mm)	WT
1082ST	10 x 8 in (250 x 200 mm)	17.9 in (455 mm)	14.3 in (363 mm)	13.9 in (353 mm)	ST
1082WT	10 x 8 in (250 x 200 mm)	17.9 in (454 mm)	14.3 in (363 mm)	13.9 in (353 mm)	WT
1281WT	12 x 6 in (300 x 150 mm)	17.1 in (434 mm)	15.8 in (401 mm)	14.5 in (368 mm)	WT
1282WT	12 x 8 in (300 x 200 mm)	22.5 in (572 mm)	18.7 in (475 mm)	18.1 in (461 mm)	WT



**NOTE:**  
 FITTINGS WHOSE PART NUMBERS END WITH "WT"  
 HAVE WATER TIGHT BELL CONNECTIONS. WATER  
 TIGHT BELLS ARE SHOWN HERE IN THIS DRAWING AND  
 REQUIRE GASKETS TO BE FITTED TO DUAL WALL PIPE  
 TO FORM A WATER TIGHT JOINT. (GASKETS INCLUDED)

FITTINGS WHOSE PART NUMBERS END WITH "ST"  
 HAVE SOIL TIGHT BELL CONNECTIONS. SOIL TIGHT  
 BELLS HAVE MOLDED CLEATS AND REQUIRE NO  
 GASKET TO MAKE CONNECTION TO DUAL WALL PIPE.

NOTE: ALL FITTINGS DIMENSIONS ARE FOR REFERENCE ONLY



DRAWING #:	3110	04.24.07
DRAWN BY:	JCB	
APPROVED BY:		
REVISIONS:	TJR	10.17.07

INJECTION MOLDED 45° BEND  
4" - 12" DIAMETER

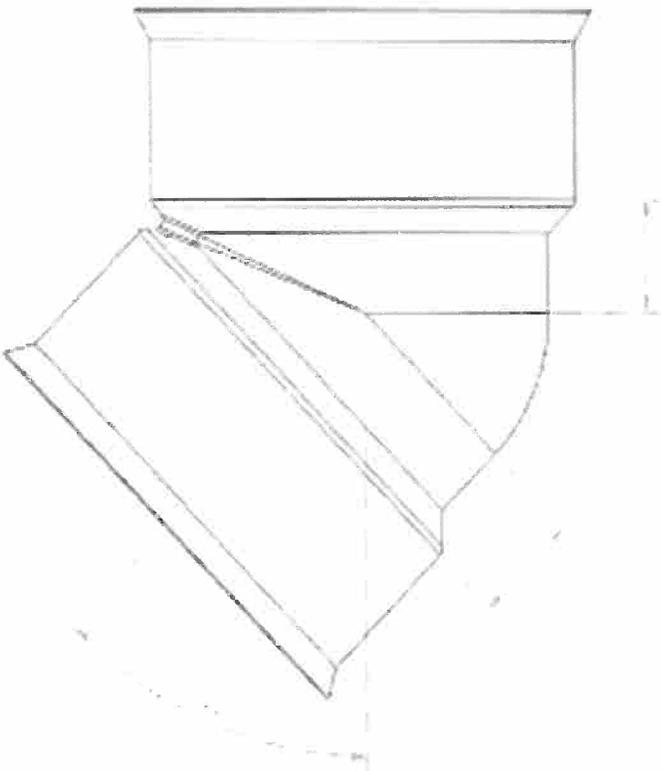
PART #	PIPE SIZE	A	JOINT
0494ST	4 in (1100 mm)	1.3 in (33 mm)	ST
0494WT	4 in (1100 mm)	1.3 in (33 mm)	WT
0694ST	6 in (150 mm)	1.9 in (46 mm)	ST
0694WT	6 in (150 mm)	1.8 in (46 mm)	WT
0894ST	8 in (200 mm)	2.4 in (60 mm)	ST
0894WT	8 in (200 mm)	2.4 in (60 mm)	WT
1094ST	10 in (250 mm)	3.4 in (87 mm)	ST
1094WT	10 in (250 mm)	3.4 in (87 mm)	WT
1294ST	12 in (300 mm)	4.4 in (112 mm)	ST
1294WT	12 in (300 mm)	4.4 in (112 mm)	WT

NOTE:

FITTINGS WHOSE PART NUMBERS END WITH "WT" HAVE WATER TIGHT BELL CONNECTIONS. WATER TIGHT BELLS ARE SHOWN HERE IN THIS DRAWING AND REQUIRE GASKETS TO BE FITTED TO DUAL WALL PIPE TO FORM A WATER TIGHT JOINT. (GASKETS INCLUDED)

FITTINGS WHOSE PART NUMBERS END WITH "ST" HAVE SOIL TIGHT BELL CONNECTIONS. SOIL TIGHT BELLS HAVE WOLDED GLEATS AND REQUIRE NO GASKET TO MAKE CONNECTION TO DUAL WALL PIPE.

NOTE: ALL FITTINGS DIMENSIONS ARE FOR REFERENCE ONLY



**Hancor**

DRAWING # 3200

DRAWN BY JCB 07/31/06

APPROVED BY

REVISIONS MJP 05/15/07

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## **SUBMITTAL COVER SHEET HIGHGATE STP 0297 (8) ECI Project Number 130546**

**Date** 6/18/2013  
**ECI Submittal Reference No:** 613.25-01  
**Revision Number:** 0  
**Submittal Title:** Gabion Basket Wall  
**Manufacturer Name:** MACCAFERRI, INC  
**Specification Section/Paragraph No:** 712.04  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 7 OF 20  
**Submittal Notes:**

**Revision No:**  
**Revision Date:**

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By:   
Chris Belanger  
Project Manager

**END OF SUBMITTAL COVER SHEET**

American Units

### GABION GALVANIZED & PVC COATED

#### Product Description

Gabions are baskets manufactured from 8x10 double twisted hexagonal woven steel wire mesh, as per ASTM A975 (Figures 1, 2). Gabions are filled with stones at the project site to form flexible, permeable, monolithic structures such as retaining walls, channel linings, and weirs for erosion control projects.

The steel wire used in the manufacture of the gabion is heavily zinc coated soft temper steel. A PVC coating is then applied to provide additional protection for use in polluted, contaminated or aggressive environments: in salt, fresh water, acid soil or wherever the risk of corrosion is present. The PVC coating has a nominal thickness of 0.02 in. (0.50 mm). The standard specifications of the mesh-wire are shown in Table 2.

The gabion is divided into cells by diaphragms positioned at approximately 3 ft (0.9 m) centers (Figure 1).

To reinforce the structure, all mesh panel edges are selvaged with a wire having a greater diameter (Table 3). Dimensions and sizes of PVC coated gabions are shown in Table 1.

Gabions shall be manufactured and shipped with all components mechanically connected at the production facility.

#### Wire

All tests on wire must be performed prior to manufacturing the mesh. All wire should comply with ASTM A975, style 3 coating, galvanized and PVC coated steel wire. Wire used for the manufacture of gabions and the lacing wire, shall have a maximum tensile strength of 75 000 psi (515 MPa) as per ASTM A641/A641M-03, soft temper steel.

#### Woven Wire Mesh Type 8x10

The mesh and wire characteristics shall be in accordance with ASTM A975 Table 1, Mesh type 8x10 and PVC coated. The nominal mesh opening,  $D = 3.25$  in. (83 mm) as per Figure 2.

The minimum mesh properties for strength and flexibility should be in accordance with the following:

- **Mesh Tensile Strength** shall be a minimum of 2900 lb/ft (42.3 kN/m) when tested in accordance with ASTM A975 section 13.1.1.
- **Punch Test** resistance shall be a minimum of 5300 lb (23.6 kN) when tested in compliance with ASTM A975 section 13.1.4.
- **Connection to Selvedges** shall be 1200 lb/ft (17.5 kN/m) when tested in accordance with ASTM A975.

#### P.V.C. (Polyvinyl Chloride) Coating

The technical characteristics and the resistance of the PVC to aging should meet the relevant standards. The main values for the PVC material are as follows:

- The initial property of the PVC coating shall be in compliance with ASTM A975 section 8.2.
- Prior to UV and abrasion degradation, the PVC polymer coating shall have a projected minimum durability of 60 years when tested in accordance with *UL 746B Polymeric Material-Long Term Property Evaluation* for heat aging test.

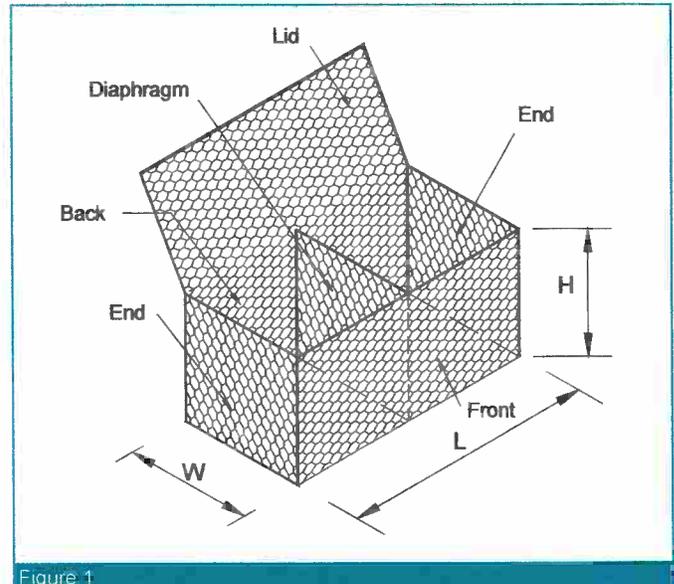
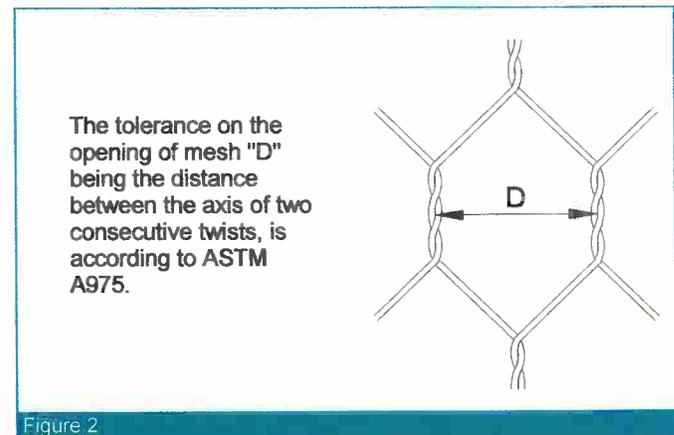


Figure 1



The tolerance on the opening of mesh "D" being the distance between the axis of two consecutive twists, is according to ASTM A975.

Figure 2

#### Lacing, Assembly and Installation

Gabion units are assembled and connected to one another using lacing wire specified in Table 3 and described in Figure 3. MacTie preformed stiffeners or lacing wire can be used as internal connecting wires when a structure requires more than one layer of gabions to be stacked on top of each other. Internal connecting wires with lacing wire shall connect the exposed face of a cell to the opposite side of the cell. Internal connecting preformed stiffeners shall connect the exposed face of a cell to the adjacent side of the cell. Preformed stiffeners are installed at 45° to the face/side of the unit, extending an equal distance along each side to be braced (approximately 1 ft. (300 mm)). An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed.

Stainless steel ring fasteners can be used instead of, or to complement, the lacing wire (Figure 4).

# MACCAFERRI

Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

Table 1 - Sizes for gabions

L=Length ft (m)	W=Width ft (m)	H=Height ft (m)	# of cells
6 (1.8)	3 (0.9)	3 (0.9)	2
9 (2.7)	3 (0.9)	3 (0.9)	3
12 (3.6)	3 (0.9)	3 (0.9)	4
6 (1.8)	3 (0.9)	1.5 (0.45)	2
9 (2.7)	3 (0.9)	1.5 (0.45)	3
12 (3.6)	3 (0.9)	1.5 (0.45)	4
6 (1.8)	3 (0.9)	1 (0.3)	2
9 (2.7)	3 (0.9)	1 (0.3)	3
12 (3.6)	3 (0.9)	1 (0.3)	4
9 (2.7)**	6 (1.8)	1(0.3)	3

\*\*This Gabion has 6' X 3' cells.

All sizes and dimensions are nominal. Tolerances of  $\pm 5\%$  of the length, width, and height of the gabions shall be permitted.

Stainless steel rings for PVC coated gabions shall be in accordance with ASTM A975 section 6.3. Spacing of the rings shall be in accordance with ASTM A975 Table 2, Panel to Panel connection, Pull-Apart Resistance. In any case, ring fasteners spacing shall not exceed 6 in. (150 mm) (Figure 3). The rings can be installed using pneumatic or manual tools (Figure 5). For full details, please see the Gabion Product Installation Guide. The average maximum resistance of the fasteners from the field shall not be lower than 90% of the resistance provided in the certification.

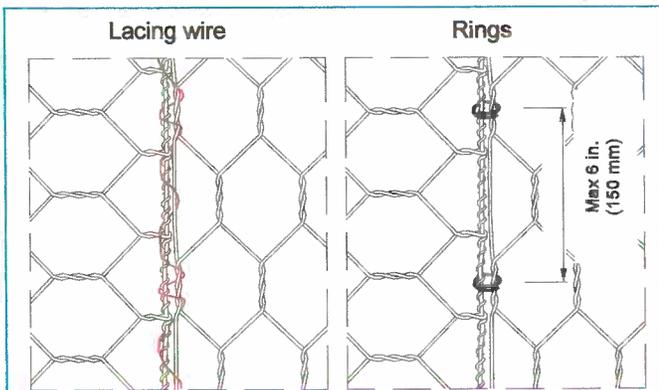


Figure 3

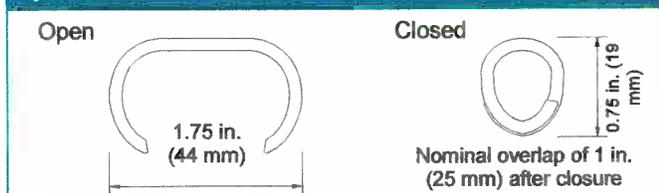


Figure 4

Table 2 - Standard mesh-wire

Type	D in. (mm)	Tolerance	Internal Wire Dia in. (mm)	External Wire Dia in. (mm)
8x10/ ZN+PVC	3.25 (83)	$\pm 10\%$	0.106 (2.70)	0.146 (3.70)

Table 3 - Standard wire diameters

	Lacing Wire	Mesh Wire	Selvedge Wire / Preformed
PVC Mesh Diameter $\phi$ in. (mm)	0.087/0.127 (2.2/3.2)	0.106/0.146 (2.7/3.7)	0.134/0.174 (3.4/4.4)
Wire Tolerance ( $\pm \phi$ in. (mm))	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)
Minimum Quantity/Zinc oz/ft <sup>2</sup> (g/m <sup>2</sup> )	0.70 (214)	0.80 (244)	0.85 (259)
Wire+PVC diameter in. (mm)	0.127 (3.20)	0.146 (3.70)	0.174 (4.40)

### Quantity Request

When requesting a quotation, please specify:

- number of units,
- size of units (length x width x height, see Table 1),
- type of mesh,
- type of coating.

EXAMPLE: No. 100 gabions, 6x3x3, Mesh type 8x10, Wire diameter 0.106 in. (2.70 mm), Galvanized + PVC coated.

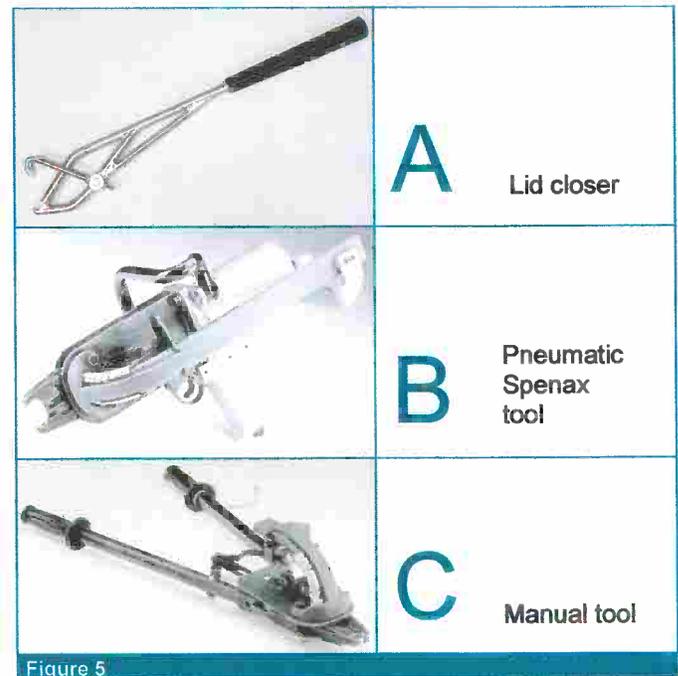


Figure 5

## MACCAFERRI

www.maccaferri-usa.com

Headquarters:  
10303 Governor Lane Boulevard  
Williamsport, MD 21795-3116  
Tel: 800-638-7744  
Fax: 301-223-6134  
info@maccaferri-usa.com

### MACCAFERRI, INC.

AZ, Phoenix	MO, St. Louis	PR, Caguas
CA, Sacramento	NJ, Iselin	TX, Lewisville
FL, Coral Gables	NM, Albuquerque	WA, Seattle
MD, Williamsport	OH, Columbus	

### Area Offices:

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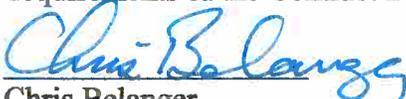
**Date** 6/18/2013  
**ECI Submittal Reference No:** 649.51-01  
**Revision Number:** 0  
**Submittal Title:** Geotextile for Silt Fence  
**Manufacturer Name:** DGI Industries  
**Specification Section/Paragraph No:** 720.04A  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 12 OF 20  
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Chris Belanger  
Project Manager

**END OF SUBMITTAL COVER SHEET**

# Silt Fence

DOT - Series

## VT21303617

### State of Vermont DOT Silt Fence

\*\*\* Coforms to VT DOT Specifications \*\*\*

#### Specifications:

Physical Properties	Test Method	Minimum Value
Grab Tensile, lbs.	ASTM-D-4632	124
Grab Elongation, %	ASTM-D-4632	15/20
Mullen Burst, psi	ASTM-D-3786	300
Puncture, lbs.	ASTM-D-4833	65
Trapezoidal Tear, lbs.	ASTM-D-4533	65
UV Resistance <sup>2</sup> , % <sup>3</sup>	ASTM-D-4355	80
AOS, US Sieve Number	ASTM-D-4751	#30 or 0.60(mm)
Permittivity	ASTM-D-4491	.10 sec-1
Flow Rate	ASTM-D-4491	10 gal/min/ft <sup>2</sup>

#### Packaging:

	VT21303617
Fabric Width	36"
Roll Length	100'
Post Size	1 1/8" x 1 3/8" x 60"
Post Space	6.25' O.C.
Roll Weight	60 lbs.
Pallet Qty.	25
Pallet Weight	1500 lbs.

DGI VT21303617 Silt Fence is the result of our consultation with the Vermont Department of Transportation to insure compliance with Vermont rules and regulations pertaining to erosion control. DGI VT21303617 Silt Fence conforms to State of Vermont DOT specifications for Silt Fence. For additional information, please call (603) 641-2850 or fax your request to our 24 Hour Fax Inquiry Line listed below.

Tel: (603) 641-2850 24 Hour Fax Inquiry Line: (603) 669-6991  
Toll Free: 1-888-SILT-DGI (745-8344)



# DGI

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**ECI Submittal Reference No:** 649.51-01  
**Revision Number:** 0  
**Submittal Title:** Geotextile for Under Stone Fill  
**Manufacturer Name:** SKAPS Industries  
**Specification Section/Paragraph No:** 720.04A  
**Contract Drawing/Detail Reference:**  
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Project Manager

**END OF SUBMITTAL COVER SHEET**



Sales Office:  
 Engineered Synthetic Products, Inc.  
 Tel (770) 564-1857  
 Fax (770) 564-1818  
 www.espgeosynthetics.com

## Geotextile Product Description Sheet

### SKAPS GT-180 Nonwoven Geotextile

SKAPS GT-180 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. SKAPS GT-180 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT-180 conforms to the physical property values listed below:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd <sup>2</sup> (g/m <sup>2</sup> )	8.0 (271)
Grab Tensile	ASTM D 4632	lbs (kN)	205 (0.911)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	85 (0.378)
Puncture Resistance	ASTM D 4833	lbs (kN)	120 (0.533)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	535 (2.38)
Mullen Burst	ASTM D 3786	psi (kPa)	350 (2413)
Permittivity*	ASTM D 4491	sec <sup>-1</sup>	1.35
Water Flow*	ASTM D 4491	gpm/ft <sup>2</sup> (l/min/m <sup>2</sup> )	90 (3657)
AOS*	ASTM D 4751	US Sieve (mm)	80 (0.180)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING	
Roll Dimensions (W x L) – ft	12.5 x 360 / 15 x 300
Square Yards Per Roll	500
Estimated Roll Weight - lbs	250

\* At the time of manufacturing. Handling may change these properties.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.

**SKAPS Industries,**  
 335 Athena Drive, Athens GA 30601  
 Phone:(706)-354-3700, Fax(706)-354-3737,  
 www.skaps.com

**Made in U.S.A.**

# Engineers Construction, Inc.

P.O. Box 2187, South Burlington, VT 05407

Phone: (802) 863-6389

Fax: (802) 862-9703

www.engineersconstruction.com

## SUBMITTAL COVER SHEET HIGHGATE STP 0297 (8) ECI Project Number 130546

**Date** 6/18/2013  
**ECI Submittal Reference No:** 653.20-01  
**Revision Number:** 0  
**Submittal Title:** Temporary Erosion Control Matting  
**Manufacturer Name:** North American Green  
**Specification Section/Paragraph No:** 710.03  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 5 OF 20  
**Submittal Notes:** S75BN FOR STAGING AREA WHERE SLOPE IS LESS  
THAN 3:1  
SC150BN FOR ALL OTHER AREAS WHERE SLOPE ARE  
LESS THAN 1:1

**Revision No:**

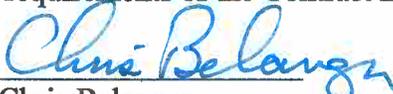
**Revision Date:**

This Submittal Prepared By: Chris Belanger, Project Manager

Indicate one of the following:

- This submission is not a proposed substitution or deviation from the Contract Documents.
- This submission includes a proposed deviation from the Contract Documents as clearly identified in this submittal.

The undersigned attests that the undersigned has carefully examined this entire submission, and that the requirements of the Contract Documents have been met.

By:   
Chris Belanger  
Project Manager

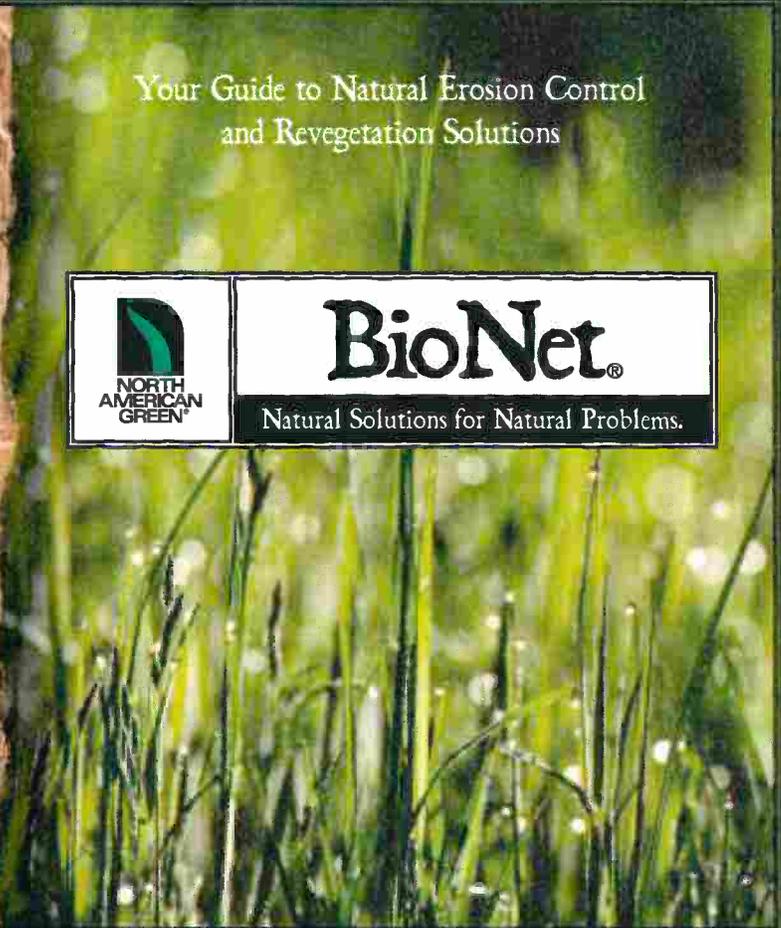
**END OF SUBMITTAL COVER SHEET**

Your Guide to Natural Erosion Control  
and Revegetation Solutions



**BioNet<sup>®</sup>**

Natural Solutions for Natural Problems.



B I O D E G R A D A B L E E R O S I

# BioNet®

## Natural Solutions for Natural Problems.

BioNet® 100% biodegradable erosion control blankets from North American Green provide effective and all-natural erosion control and vegetation establishment in an environmentally and wildlife friendly manner. All products in the BioNet series – S75BN™ Single Net Straw Blanket, S150BN™ Double Net Straw Blanket, SC150BN™ Double Net Straw-Coconut Blanket and C125BN™ Double Net Coconut Blanket – are composed of 100% organic, biodegradable materials.

North American Green BioNet products offer the following features and benefits to guarantee the “*natural*” success of your project.

### Woven Net Structure

- Little to no risk of wildlife entrapment
- Easy to sprig or plant through

### Leno-Weave Top Net

- High durability, fiber retention & mechanical stability

### Flexible Jute Netting

- Increased water absorption
- Improved blanket conformance & adherence to soil
- Enhanced erosion protection and mulching capabilities

### Stitched on 1.5-inch Centers

- Biodegradable thread
- Excellent durability & flexibility

### Patented DOT System®

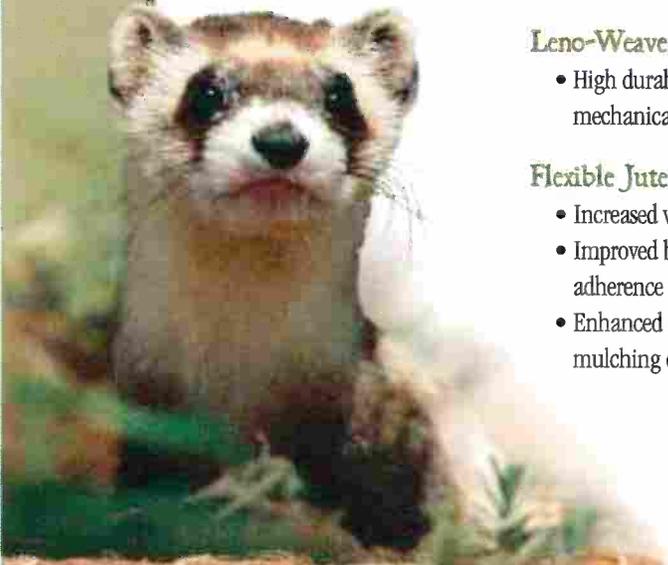
- Standard on most products
- Simplifies proper installation

### Performance Guaranteed

- Backed by North American Green's Ultimate Assurance Guarantee

### Ideal Applications Include

- Bioengineering applications
- Environmentally sensitive sites
- Shaded areas
- Streambanks/shorelines



# D N C O N T R O L B L A N K E T S

### Guaranteed Complete Degradability

Unlike erosion control blankets with photodegradable plastic netting and yarn that depends on sunlight to degrade, BioNet blankets are completely biodegradable. Leaving absolutely no synthetic residues on site after vegetation is established, BioNet blankets are ideal for use in bioengineering projects, wetland mitigation, riparian area protection, shaded areas, streambank restorations and environmentally-sensitive areas where synthetic products may pose a threat to wildlife.

### Increased Erosion Control & Mulching Capabilities

With a dense mulch layer, BioNet blankets offer much greater erosion control and mulching capabilities than jute or coir netting alone. BioNet blankets also exhibit increased erosion control and mulching capabilities versus their synthetic-netted counterparts. The jute netting on these products increases their water absorption capacity, which helps weigh the blanket down and conform the fiber matrix to the soil surface (upon saturation). This conformance and adherence to the soil surface aids in effective erosion control, soil temperature regulation and moisture retention to promote seed germination and early plant growth.

### Increased Strength & Structural Integrity

The jute top netting on all BioNet products is constructed using the leno weave method (Fig. 1) to ensure superior mechanical stability and fiber retention under severe conditions. By intertwining and securing the cross directional netting strands, leno weaving affords BioNet blankets higher tensile strength, greater durability and better erosion protection than many other "biodegradable" blankets which use easily distorted cross-lay netting (Fig. 2) only.

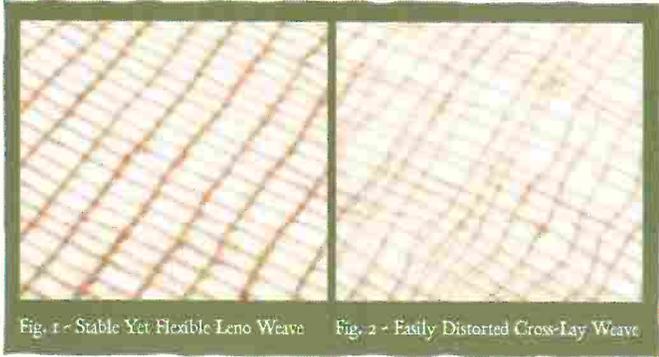
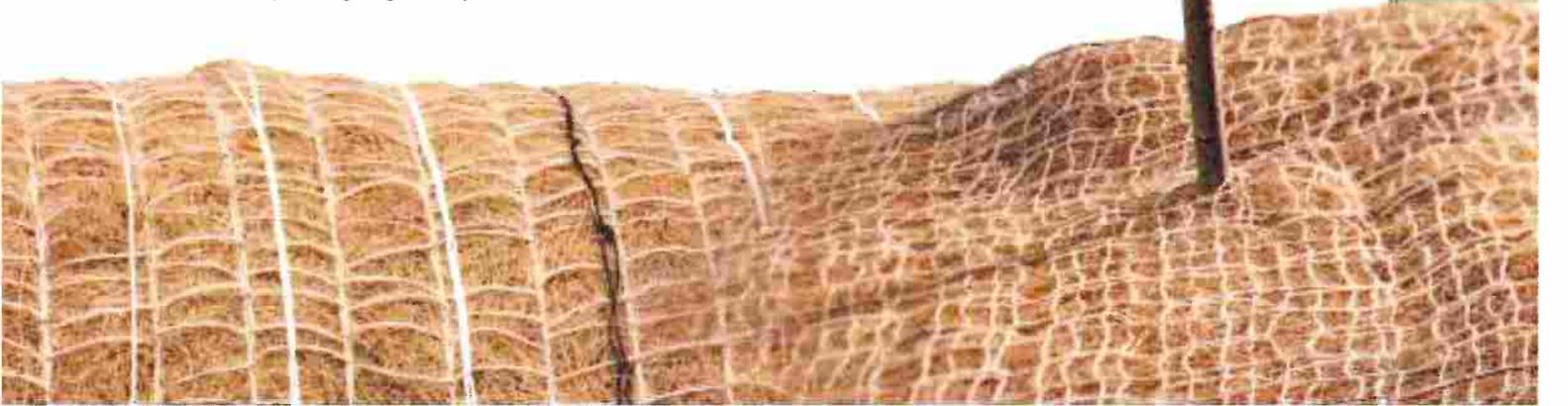


Fig. 1 - Stable Yet Flexible Leno Weave      Fig. 2 - Easily Distorted Cross-Lay Weave

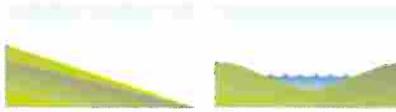
### Less Risk To Wildlife & Easy To Plant Through

The interwoven strands of the BioNet netting can move independently of each other. This flexibility minimizes the risk of accidental wildlife entrapment; and enables the use of live stakes and the installation of trees, shrubs and other plantings through the blanket without compromising erosion control performance.



## S75BN™ Single Net Straw Blanket

S75BN™ features a 100% agricultural straw matrix stitched with biodegradable thread to a leno woven jute top netting. Designed to provide erosion protection and vegetation establishment assistance for up to 12 months. S75BN is much more effective than loose straw, hydro-mulch or conventional jute netting. The S75BN is generally recommended for use on moderate slope and low-flow channel lining applications.



4:1 – 3:1 Slopes\*

Low-Flow Channels\*  
1.60 lbs/ft² (76 Pa)  
Max. Shear Stress

### Netting

Leno woven, 100% biodegradable,  
natural jute fiber  
9.30 lbs/1,000 ft² (4.53 kg/100 m²)  
approximate weight

### Matrix Material

100% agricultural straw  
0.50 lbs/yd² (0.27 kg/m²)

### Stitching

Biodegradable thread on 1.5-inch centers

### Standard Roll Specifications

Width: 6.67 ft (2.03 m)  
Length: 108 ft (32.92 m)  
Weight: 46 lbs (21.05 kg) approx.  
Area: 80 yd² (66.89 m²)



*S75BN is often applied to shallow slopes or flat areas where disturbance has taken place. In this role, the BioNet blankets will protect seed, retain soil moisture and enhance seed germination while posing little risk of wildlife entanglement.*



# SC150BN™ Double Net Straw-Coconut Blanket

SC150BN™ is comprised of a 70% agricultural straw / 30% coconut fiber matrix stitched with biodegradable thread between a leno woven jute top netting and a woven jute bottom netting. The double netting structure and the integration of coconut (coir) fiber in the matrix afford increased durability, longevity and erosion control effectiveness. The SC150BN is ideal for use in applications where vegetation will require up to 18 months for establishment, in medium-flow channels, streambanks and severe slopes.



## Netting – Top

Leno woven, 100% biodegradable,  
natural jute fiber  
9.30 lbs/1,000 ft<sup>2</sup> (4.53 kg/100 m<sup>2</sup>)  
approximate weight

## Matrix Material

70% agricultural straw  
0.35 lbs/yd<sup>2</sup> (0.19 kg/m<sup>2</sup>)  
30% coconut fiber  
0.15 lbs/yd<sup>2</sup> (0.08 kg/m<sup>2</sup>)

## Netting – Bottom

100% biodegradable,  
natural jute fiber  
7.70 lbs/1,000 ft<sup>2</sup> (3.76 kg/100 m<sup>2</sup>)  
approximate weight

## Stitching

Biodegradable thread on 1.5-inch centers

## Standard Roll Specifications

Width: 6.67 ft (2.03 m)  
Length: 108 ft (32.92 m)  
Weight: 52 lbs (23.69 kg) approx.  
Area: 80 yd<sup>2</sup> (66.89 m<sup>2</sup>)



2:1 – 1:1 Slopes\*



Medium-Flow Channels\*  
2.10 lbs/ft<sup>2</sup> (100 Pa)  
Max. Shear Stress



Streambanks\*

\*NOTE: This guide is for general purposes only. Actual project design and product selection should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®). Visit [www.nagreen.com](http://www.nagreen.com) for more information about ECMDS®.



*Steep slopes and drainage channels in wildlife sensitive areas, like this roadside application near Yellowstone National Park, naturally benefit from the increased longevity and erosion protection of the SC150BN.*



# BioNet® Product Application Guide

Product	Description	Longevity	Applications	Permissible Shear Stress	Maximum Flow Velocity	FHWA FP-03 Category
S75BN	Single Net Straw Blanket	Up To 12 Months	4:1 - 3:1 Slopes Low-Flow Channels	1.60 lbs/ft <sup>2</sup> (76 Pa)	5 ft/s (1.52 m/s)	Type 2.C
S150BN	Double Net Straw Blanket	Up To 12 Months	3:1 - 2:1 Slopes Moderate-Flow Channels	1.85 lbs/ft <sup>2</sup> (88 Pa)	6 ft/s (1.83 m/s)	Type 2.D
SC150BN	Double Net Straw-Coconut Blanket	Up To 18 Months	2:1 - 1:1 Slopes Medium-Flow Channels	2.10 lbs/ft <sup>2</sup> (100 Pa)	8 ft/s (2.44 m/s)	Type 3.B
C125BN	Double Net Coconut Blanket	Up To 24 Months	1:1 & Greater Slopes High-Flow Channels	2.35 lbs/ft <sup>2</sup> (112 Pa)	10 ft/s (3.05 m/s)	Type 4

NOTE: This guide is for general purposes only. Actual project design and product selection should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®). Visit [www.nagreen.com](http://www.nagreen.com) for more information about ECMDS®.

## BioNet Fastener and Installation Options

### SureLock® II

#### Convertible Staple Gun

Efficiently and effectively install 4" (10.16 cm) or 6" (15.24 cm) BioSTAKES® or 6" (15.24 cm) wire cartridge staples with the SureLock® II Convertible Staple Gun. Available in manual and pneumatic-drive models, the SureLock II can be easily converted from one drive system to the other. Features all composite metal components for reduced wear and easy cleaning and maintenance.



### BioSTAKES®

Our BioSTAKES® are available in 4" (10.16 cm) and 6" (15.24 cm) lengths, and provide an environmentally friendly alternative to metal staples. Sturdy and rigid when used, BioSTAKES will break down over a period of one to three years after being driven into the ground.



### EcoSTAKES®

Our wooden EcoSTAKES® are available in 6" (15.24 cm), 12" (30.48 cm), 18" (45.72 cm) and 24" (60.96 cm) lengths. They are ideal for use in bioengineering, streambank and other critical applications requiring greater anchoring capability of longer stakes.



North American Green is a leading erosion control solution provider with a worldwide network of qualified distributors with trained Erosion Control *Specialists*. In addition to offering a full line of rolled erosion control products, North American Green's Erosion Control *Specialists* are trained to provide site-specific project design and product specification assistance using North American Green's Erosion Control Materials Design Software (ECMDS®); and offer the most comprehensive guarantee in the industry, the Ultimate Assurance Guarantee. More information about North American Green products and services is available at [www.nagreen.com](http://www.nagreen.com) or by calling (800) 772-2040.

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1.812.867.6632 • 1.800.772.2040 • [www.nagreen.com](http://www.nagreen.com)



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P.O. Box 2187, South Burlington, VT 05407

Phone: (802) 863-6389

Fax: (802) 862-9703

www.engineersconstruction.com

## **SUBMITTAL COVER SHEET HIGHGATE STP 0297 (8) ECI Project Number 130546**

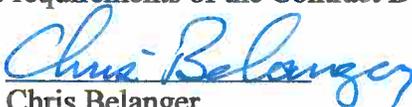
**Date** 6/18/2013  
**ECI Submittal Reference No:** 900.675-01  
**Revision Number:** 0  
**Submittal Title:** Geomembrane Liner  
**Manufacturer Name:** RAVEN Industries  
**Specification Section/Paragraph No:** 712.04  
**Contract Drawing/Detail Reference:**  
**Plan Sheet:** 6 OF 20  
**Submittal Notes:**

**Revision No:**  
**Revision Date:**

This Submittal Prepared By: Chris Belanger, Project Manager  
Indicate one of the following:

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By:   
Chris Belanger  
Project Manager

**END OF SUBMITTAL COVER SHEET**

# RUFECO® 2000B, 3000B & 4000B

Meets GRI-GM17 Standard Specification



PROPERTIES	TEST METHOD	RUFECO 2000B		RUFECO 3000B		RUFECO 4000B	
		Min. Roll Averages	Typical Roll Averages	Min. Roll Averages	Typical Roll Averages	Min. Roll Averages	Typical Roll Averages
THICKNESS mils, (mm)	ASTM D5199	20.0 (0.50)	21.0 (0.53)	30.0 (0.75)	31.2 (0.78)	40.0 (1.00)	41.5 (1.04)
DENSITY g/cm <sup>3</sup>	ASTM D792 or ASTM D1505			0.939 Max.			
*TENSILE STRENGTH lb/in. width, (N/mm width)	ASTM D6693 1. Tensile Strength at Break 2. % Elongation at Break	76 (13) 800	120 (27) 950	125 (22) 800	165 (29) 1000	180 (32) 800	220 (39) 1000
*TEAR RESISTANCE lb, (N)	ASTM D1004	11 (49)	14 (62)	16 (71)	20 (89)	22 (98)	27 (120)
PUNCTURE RESISTANCE lb, (N)	ASTM D4833	30 (133)	45 (200)	45 (200)	60 (267)	60 (267)	80 (356)
CARBON BLACK %	ASTM D1603 D4218			2-3			
CARBON BLACK DISPERSION	ASTM D5596			Pass			
OXIDATIVE INDUCTION TIME (OIT) or HIGH PRESSURE OIT	ASTM D3895 ASTM D5885			>100 min. >400 min.			
OVEN AGING AT 85°C (90 Days)	ASTM D5721/D5885		Pass		Pass		Pass
UV RESISTANCE (1600 Hours)	GRI GM11		Pass		Pass		Pass
MAXIMUM USE TEMPERATURE			180°F 82°C		180°F 82°C		180°F 82°C
LOW TEMP. IMPACT FAILURE TEMP F, (C)	ASTM D746		<-70 (-57)		-70 (-57)		-70 (-57)
DIMENSIONAL STABILITY % CHANGE	ASTM D1204				<2		
MULTIAXIAL TENSION % ELONGATION	ASTM D5617	>90	>120	>90	>120	>90	>120
ENVIRONMENTAL STRESS CRACK RESISTANCE HOURS TO FAILURE	ASTM D5397 Appendix A				>400		
PERMS grains/ft <sup>2</sup> /hr/in. Hg (grams/m <sup>2</sup> /day/mm Hg)	ASTM E96 Method 73 F, 50% RH		0.045 (0.030)		0.029 (0.019)		0.022 (0.014)
<b>FACTORY SEAM REQUIREMENTS</b>							
BONDED SEAM STRENGTH lb/in width, (N/cm width)	ASTM D4545 Mod.**	40 (70)	45 (79)	60 (105)	70 (119)	75 (131)	80 (140)
SEAM PEEL ADHESION lb/in width, (N/cm width)	ASTM D4545 Mod.**	30 (53)	40 (63)	45 (63)	60 (93)	70 (105)	85 (121)

Nominal Weight /Thousand Square Feet: RUFECO 2000B - 100 lbs., RUFECO 3000B - 150 lbs., RUFECO 4000B - 200 lbs.

\* Tests are an average of MD and TD directions.

\*\* Raven Industries performs seam testing at 12" per minute.



RUFECO® 2000B, 3000B and 4000B are membranes consisting of a very flexible, linear low-density polyethylene (LLDPE). LLDPE provides high elongation, tremendous tear resistance and bursting strength. A minimum carbon black content of 2.0% provides excellent protection from UV rays and harsh weather conditions. Manufactured from virgin resins, RUFECO 2000B, 3000B and 4000B do not contain plasticizers which can migrate to the surface, causing premature aging.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at [www.RavenEFD.com](http://www.RavenEFD.com)



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**Engineered Films Division**  
P.O. Box 5107  
Sioux Falls, SD 57117-5107  
Ph: (605) 335-0174 • Fx: (605) 331-0333

Toll Free: 800-635-3456  
Email: [efdsales@ravenind.com](mailto:efdsales@ravenind.com)  
[www.ravenefd.com](http://www.ravenefd.com)  
1/12 EFD 1155

## Product Description

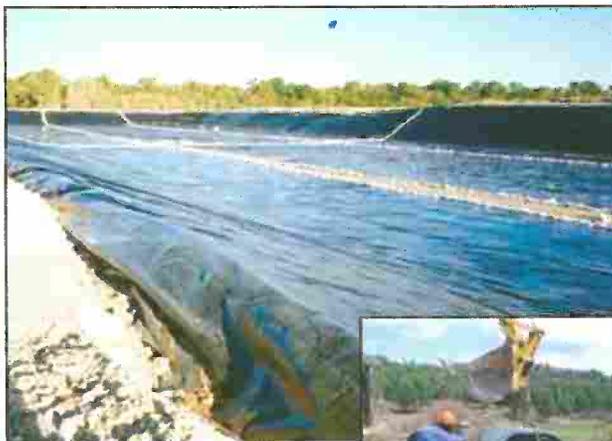
RUF<sup>CO</sup>® 2000B, 3000B and 4000B are membranes consisting of a very flexible, linear low-density polyethylene (LLDPE). LLDPE provides high elongation, tremendous tear resistance and bursting strength. A minimum carbon black content of 2.0% provides excellent protection from UV rays and harsh weather conditions. Manufactured from virgin resins, RUF<sup>CO</sup>® 2000B, 3000B and 4000B do not contain plasticizers which can migrate to the surface, causing premature aging.

## Product Use

RUF<sup>CO</sup>® 2000B, 3000B and 4000B are used in applications that require excellent outdoor longevity and chemical resistance. These are very flexible materials that will conform to uneven surfaces. RUF<sup>CO</sup>® 2000B, 3000B and 4000B meet the GRI-GM17 Standard Specification.

## Size & Packaging

RUF<sup>CO</sup>® 2000B is available in 50,000 square foot panels and RUF<sup>CO</sup>® 3000B in up to 35,000 square foot panels. RUF<sup>CO</sup>® 4000B is available in up to 25,000 square foot panels. All panels are accordion folded and tightly rolled onto a heavy duty core for ease of handling and time saving installation.



Holding Pond



Large Factory Welded Panel

Product	Part #
RUF <sup>CO</sup> .....	2000B
RUF <sup>CO</sup> .....	3000B
RUF <sup>CO</sup> .....	4000B

## APPLICATIONS

- |                    |                           |
|--------------------|---------------------------|
| Decorative Ponds   | Oil Field Pit Liners      |
| Pond/Canal Liners  | Mine Tailing Ponds        |
| Outdoor Covers     | Interim Landfill Caps     |
| Fire Ponds         | Waste Water Ponds         |
| Remediation Liners | Golf Course Pond Liners   |
| Vapor Retarders    | Farm Ponds                |
| Brine Ponds        | Leachate Collection Ponds |