

Loyalhanna Watershed Association Upper Latrobe Passive Treatment Project

Addendum #3

August 7, 2009

Project Specifications Update

This addendum clarifies the acceptable clay liners used in the wetland system. As a result of a reconsideration of the minimal amount of water depth in the wetland, the specification for the clay liner has changed. The following clay liners are suitable for use in the wetland system.

- CETCO's Bentomat ST
- GSE's Bentoliner NSL

Alternative materials that have similar properties are acceptable.



The Pioneer Of Geosynthetics

S I N C E 1 9 7 2

GSE BentoLiner NSL Geosynthetic Clay Liner

GSE BentoLiner "NSL" is a needlepunched reinforced composite geosynthetic clay liner (GCL) comprised of a uniform layer of granular sodium bentonite encapsulated between a woven and a nonwoven geotextile. The product is intended for moderate to steep slopes and moderate to high load applications where increased internal shear strength is required.

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	VALUE (ENGLISH)	VALUE (SI)
GEOTEXTILE PROPERTY				
Cap Nonwoven, Mass/Unit Area	ASTM D 5261	1/200,000 ft ² (1/20,000 m ²)	6.0 oz/yd ² MARV ⁽¹⁾	200 g/m ² MARV ⁽¹⁾
Carrier Woven, Mass/Unit Area	ASTM D 5261	1/200,000 ft ² (1/20,000 m ²)	3.1 oz/yd ² MARV	105 g/m ² MARV
BENTONITE PROPERTY				
Swell Index	ASTM D 5890	1/100,000 lb (50,000 kg)	24 ml/2 g min	24 ml/2 g min
Moisture Content	ASTM D 4643	1/100,000 lb (50,000 kg)	12% max	12% max
Fluid Loss	ASTM D 5891	1/100,000 lb (50,000 kg)	18 ml max	18 ml max
FINISHED GCL PROPERTY				
Bentonite, Mass/Unit Area ⁽²⁾	ASTM D 5993	1/40,000 ft ² (1/4,000 m ²)	0.75 lb/ft ² MARV	3.66 kg/m ² MARV
Tensile Strength ⁽³⁾	ASTM D 6768	1/40,000 ft ² (1/4,000 m ²)	30 lb/in MARV	5 kN/m MARV
Peel Strength	ASTM D 6496 ASTM D 4632 ⁽⁴⁾	1/40,000 ft ² (1/4,000 m ²)	3.5 lb/in MARV 21 lb MARV	610 N/m MARV 93 N MARV
Hydraulic Conductivity ⁽⁵⁾	ASTM D 5887	1/Week	5 x 10 ⁻¹¹ m/sec max	5 x 10 ⁻¹¹ m/sec max
Index Flux ⁽⁵⁾	ASTM D 5887	1/Week	1 x 10 ⁻⁸ m ³ /m ² /sec max	1 x 10 ⁻⁸ m ³ /m ² /sec max
Internal Shear Strength ⁽⁶⁾	ASTM D 6243	Periodically	500 psf Typical	24 kPa Typical
ROLL DIMENSIONS				
Width x Length ⁽⁷⁾	Typical	Every Roll	15.5 ft x 150 ft	4.7 m x 45.7 m
Area per Roll	Typical	Every Roll	2,325 ft ²	216 m ²
Packaged Weight	Typical	Every Roll	2,600 lb	1,179 kg

NOTES:

- ⁽¹⁾Minimum Average Roll Value.
- ⁽²⁾Oven-dried measurement. Equates to 0.84 lb/ft² (4.1 kg/m²) when indexed to a 12% moisture content.
- ⁽³⁾Tested in machine direction.
- ⁽⁴⁾Modified ASTM D 4632 to use a 4 in (100 mm) wide grip. The maximum peak of five specimens averaged in machine direction.
- ⁽⁵⁾Deaired, deionized water @ 5 psi (34.5 kPa) maximum effective confining stress and 2 psi (13.8 kPa) head pressure.
- ⁽⁶⁾Typical peak value for specimen hydrated for 24 hours and sheared under a 200 psf (9.6 kPa) normal stress.
- ⁽⁷⁾Roll widths and lengths have a tolerance of ±1%.

BENTOMAT® ST CERTIFIED PROPERTIES

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY ft ² (m ²)	REQUIRED VALUES
Bentonite Swell Index ¹	ASTM D 5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss ¹	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Mass/Area ²	ASTM D 5993	40,000 ft ² (4,000 m ²)	0.75 lb/ft ² (3.6 kg/m ²) min
GCL Grab Strength ³	ASTM D 6768	200,000 ft ² (20,000 m ²)	30 lbs/in (53 N/cm) MARV
GCL Peel Strength ³	ASTM D 6496	40,000 ft ² (4,000 m ²)	3.5 lbs/in (6.1 N/cm) min
GCL Index Flux ⁴	ASTM D 5887	Weekly	1 x 10 ⁻⁸ m ³ /m ² /sec max
GCL Hydraulic Conductivity ⁴	ASTM D 5887	Weekly	5 x 10 ⁻⁹ cm/sec max
GCL Hydrated Internal Shear Strength ⁵	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf

Bentomat ST is a reinforced GCL consisting of a layer of sodium bentonite between a woven and a nonwoven geotextiles, which are needlepunched together.

Notes

¹ Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

² Bentonite mass/area reported at 0 percent moisture content.

³ All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

⁴ Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10⁻⁹ cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

⁵ Peak values measured at 200 psf (10 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

CETCO has developed an edge enhancement system that eliminates the need to use additional granular sodium bentonite within the overlap area of the seams. We call this edge enhancement, SuperGroove™, and it comes standard on both longitudinal edges of Bentomat® ST. It should be noted that SuperGroove™ does not appear on the end-of-roll overlaps and recommend the continued use of supplemental bentonite for all end-of-roll seams.