



Jolly, Becky <becky.jolly@dnr.iowa.gov>

Fwd: 6th Street - GCL Installation Preconstruction Submittal and Preconstruction Meeting

1 message

Stobbe, Chad <chad.stobbe@dnr.iowa.gov>
To: "Jolly, Becky" <becky.jolly@dnr.iowa.gov>

Mon, Sep 25, 2017 at 1:26 PM

Becky - Please file this under #57-SDP-34-04C. No further action required. Thanks

**Chad A. Stobbe** | Environmental Specialist Senior
Iowa Department of Natural Resources
P 515-725-8351 | F 515-725-8202 | 502 E. 9th St., Des Moines, IA 50319
www.iowadnr.gov

----- Forwarded message -----

From: **Gearing, Phillip** <PGearing@scsengineers.com>
Date: Mon, Sep 25, 2017 at 1:17 PM
Subject: 6th Street - GCL Installation Preconstruction Submittal and Preconstruction Meeting
To: "joe.sanfilippo@dnr.iowa.gov" <joe.sanfilippo@dnr.iowa.gov>, "chad.stobbe@dnr.iowa.gov" <chad.stobbe@dnr.iowa.gov>
Cc: "Greene, Wendy (WendyGreene@alliantenergy.com)" <WendyGreene@alliantenergy.com>, "Nelson, Eric" <ENelson@scsengineers.com>, "Sankey, Eli" <ESankey@scsengineers.com>

Joe and Chad –

Per our CQA Plan for the 6th Street Closure project, we are submitting information on the GCL material that will be installed (this will also be included in the documentation report). The information includes the following:

- Information on the GCL product.
- Certification from the laminated GCL manufacturer that the laminated GCL product is free of broken-off needles from the needle punching process.
- Proposed panel layout.
- Certified product data for the material that will be used.

The contractor plans to potentially start placement of GCL soon. Also per our CQA plan, we will have a geosynthetic preconstruction meeting with the contractor to go over installation of material. The day and time of the meeting is TBD. Let us know if you would like to attend.

The submittal of the information and the meeting are not IDNR requirements, however we are filling you in due to the statements in our CQA plan text.

Let me know if you have any questions.

Thank you

Phillip Gearing, P.E.

Senior Project Engineer

SCS ENGINEERS

2830 Dairy Drive

Madison, WI 53718

608.224.2830

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6th Street_GCL Information.pdf
1306K

BENTOMAT® CLT CERTIFIED PROPERTIES

Prepared For: Interstate Power and Light Company, Coal Combustion Residue Settling Ponds 6th Street Generating Station.

CETCO® Bentomat® CLT is a reinforced geosynthetic clay liner (GCL) consisting of a layer of sodium bentonite between a polypropylene woven geotextile and a polypropylene nonwoven geotextile, which are needle-punched together and laminated to a double-sided textured polyethylene geomembrane.

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	CERTIFIED VALUES
Woven Base Geotextile Mass/Area ¹	ASTM D5261	200,000 ft ² (20,000 m ²)	3.2 oz/yd ² (108 g/m ²) min.
Nonwoven Cap Geotextile Mass/Area ¹	ASTM D5261	200,000 ft ² (20,000 m ²)	5.9 oz/yd ² (200 g/m ²) min.
Bentonite Moisture Content ²	ASTM D2216	1 per 50 tonnes	12% max.
Bentonite Swell Index ²	ASTM D5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss ²	ASTM D5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area ³	ASTM D5993	40,000 ft ² (4,000 m ²)	0.75 lb/ft ² (3.7 kg/m ²) min.
Geomembrane Density ¹	ASTM D1505	200,000 ft ² (20,000 m ²)	0.94 g/cm ³
Geomembrane Thickness ¹	ASTM D5994	200,000 ft ² (20,000 m ²)	20 mil (0.5 mm) min.
Geomembrane Break Strength ^{1,4}	ASTM D6993	200,000 ft ² (20,000 m ²)	14 lbs/in (2.5 kN/m) min.
GCL Moisture Content	ASTM D5993	40,000 ft ² (4,000 m ²)	35% max.
GCL Grab Strength ⁵	ASTM D6768	200,000 ft ² (20,000 m ²)	30 lbs/in (5.3 kN/m) min.
GCL Peel Strength	ASTM D6496	40,000 ft ² (4,000 m ²)	3.5 lbs/in (610 N/m) min.
GCL Hydraulic Conductivity ⁶	ASTM D5887	250,000 ft ² (25,000 m ²)	5 x 10 ⁻¹² m/s max.
GCL Index Flux ⁶	ASTM D5887	250,000 ft ² (25,000 m ²)	1 x 10 ⁻⁹ m ³ /m ² /s max.
GCL Hydrated Internal Shear Strength ⁷	ASTM D6243	1,000,000 ft ² (100,000 m ²)	500 psf (24 kPa) typ.@ 200 psf (9.6 kPa)

Notes:

¹ Geosynthetic property tests performed on the geosynthetic components before they are incorporated into the finished GCL product.

² Bentonite property tests performed before the bentonite is incorporated into the finished GCL product.

³ Reported at 0 percent moisture content.

⁴ Geomembrane tensile break strength performed in the machine and cross-machine directions using ASTM D6693, Type IV.

⁵ GCL tensile strength testing is performed in the machine direction using ASTM D6768.

⁶ ASTM D5887 is modified to include the laminated thin flexible membrane on the test specimen. Index flux and hydraulic conductivity testing with deaired distilled/deionized water at 80 psi (550 kPa) cell pressure, 77 psi (530 kPa) headwater pressure and 75 psi (515 kPa) tailwater pressure. ASTM D 5887(modified) testing is performed only on a periodic basis because the thin flexible membrane is essentially impermeable. The Bentomat® GCL core (without the flexible membrane) has a maximum hydraulic conductivity of 5 x 10⁻¹¹ m/s and corresponding maximum index flux of 1 x 10⁻⁸ m³/m²/s. For more information, see CETCO® Technical Reference (TR) Nos. 111 and 112.

⁷ Peak values measured at 200 psf (9.6 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.



July 21, 2017

RE: Settling Pond Closure-6th Street Generating Station, SCS Project #: 252122161.00, Submittal #12
MQA-QCA GCL Response
Geosynthetic Clay Liner

To whom it may concern:

CETCO® has reviewed the request for submittal response for the above referenced project and prepared by SCS Engineers dated July 7, 2017. Based upon our review of this request, CETCO® proposes to supply Bentomat® CLT as the geosynthetic clay liner (GCL) for this project. The Technical Data Sheet (TDS) for Bentomat® CLT is enclosed, and Bentomat® CLT will meet or exceed the project requirements as indicated by the aforementioned document with the exceptions and clarifications identified below.

- **Bentonite Adhering:** Paragraph 12.1.5 of the Construction Quality Assurance Plan requires that the bentonite be continuously adhered to the textiles to prevent the loss of bentonite in the event of the GCL being cut, torn, or transported. CETCO®'s needle-punching technology and use of granular bentonite prevent the loss of bentonite in the event our GCLs are cut or torn and during the transportation process. In the event of an unintentional cut or tear needing repair, CETCO® recommends that the repair be performed in accordance with our Bentomat® Installation Guidelines and/or the requirements of the Project Design Documents.
- **Certified Needle Free GCL:** CETCO® acknowledges the need for a certified needle free GCL. CETCO® manufactures and performs quality control testing for our GCLs in accordance with industry standards that conform to ASTM D5889, *Standard Practice for Quality Control of Geosynthetic Clay Liners*, and GRI-GCL-3, *Standard Specification for Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners*. As such GRI-GCL3, Section 6 Workmanship and Appearance, Paragraph 6.2 requires that GCLs are "essentially free of broken needles and fragments" and that "continuous needle detection and removal devices, e.g., metal detectors and magnets, are used during manufacture of GCL products". CETCO® performs continuous needle detection of our GCL products as described in the attached Technical Reference (TR-335).

Please find our Bentomat® CLT TDS and the Technical References attached. We appreciate your interest in CETCO® products. Please call Tom Hauck, CETCO® Technical Sales Manager, at (248) 652-9274 if you have any further questions.

Very truly yours,

John M. Allen, P.E.
Technical Services Manager
CETCO® Environmental Products

Enclosures (2)



CETCO's NEEDLE DETECTION SYSTEM FOR BENTOMAT® REINFORCED GCLs

The production of needlepunch-reinforced GCLs requires special procedures to prevent the presence of needle fragments in the finished product. This document describes CETCO's needle detection and removal system, which consists not only of metal detectors and magnets, but also includes special operating procedures to ensure needles are removed from the GCL to the maximum extent practicable.

The Needle punching Process. Needle punching is the process by which loosely laid fibers are entangled to form a continuous fabric. A loose layer of fibers is introduced across a needle loom, whose powerful reciprocating motors move a set of needles (often numbering 10,000 or more) mounted on a needle board (Figure 1). Each needle has a barbed shaft which snares fibers on the downstroke and releases them on the upstroke. With thousands of needles moving at hundreds of strokes per minute, the needle punching process can be used not only for manufacturing geotextiles but also for reinforcing GCLs. Significant forces are applied to the needles during this process. A few needles will inevitably break, and needle fragments must be removed.

CETCO's ISO-compliant quality plan involves a three-part strategy of *prevention, detection and removal*. By implementing a variety of procedures relating to the operation of the loom, needle breakage can be largely prevented. These procedures focus on loom operation and maintenance, optimization of bentonite particle size, needle type selection, and many other parameters that have been found with experience to influence the tendency for needles to break.

While CETCO strives to eliminate breakage, it should be realized that the act of needle punching through bentonite particles places extreme stress on the needles, and some breakage is inevitable. Therefore, a set of powerful magnets is arranged downstream from the loom, across the width of the GCL (Figure 2). Positioned just over the surface of the textiles, the magnets effectively remove needle fragments that break after striking a clay particle. Almost all needle fragments are removed by the magnets, but a few do remain in the product and must be detected and removed.

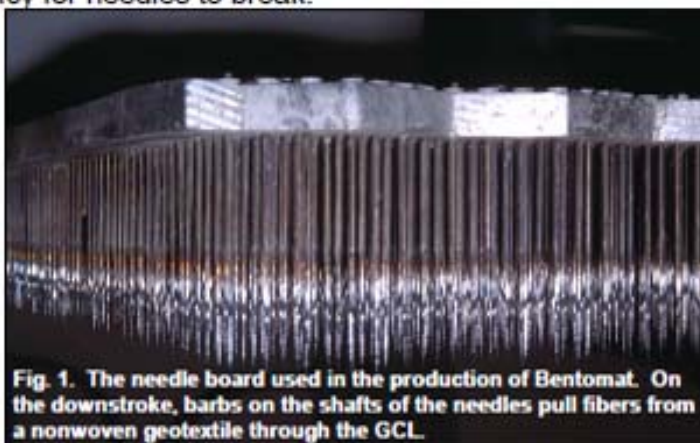


Fig. 1. The needle board used in the production of Bentomat. On the downstroke, barbs on the shafts of the needles pull fibers from a nonwoven geotextile through the GCL.

CETCO uses a state-of-the-art system of magnetic metal detectors distributed across the width of the GCL. Located after the magnets, the detectors divide the roll into discrete segments. If a needle fragment is detected in one of the segments, a production crewperson stops the material in-line and checks for needle fragment(s). Rolling of the material then resumes and it passes a second metal detector. If metal is still detected, a tag is placed on the outside edge of the roll. Flagged rolls are set aside for a secondary detection and removal process, where a "re-roll station" is used to unroll the GCL to the spot where the tag was placed. This section of the roll is scanned with a hand-held detector and visually inspected until the needle fragment is found. Protruding needle fragments are removed, and the rolls is then wound and packaged.

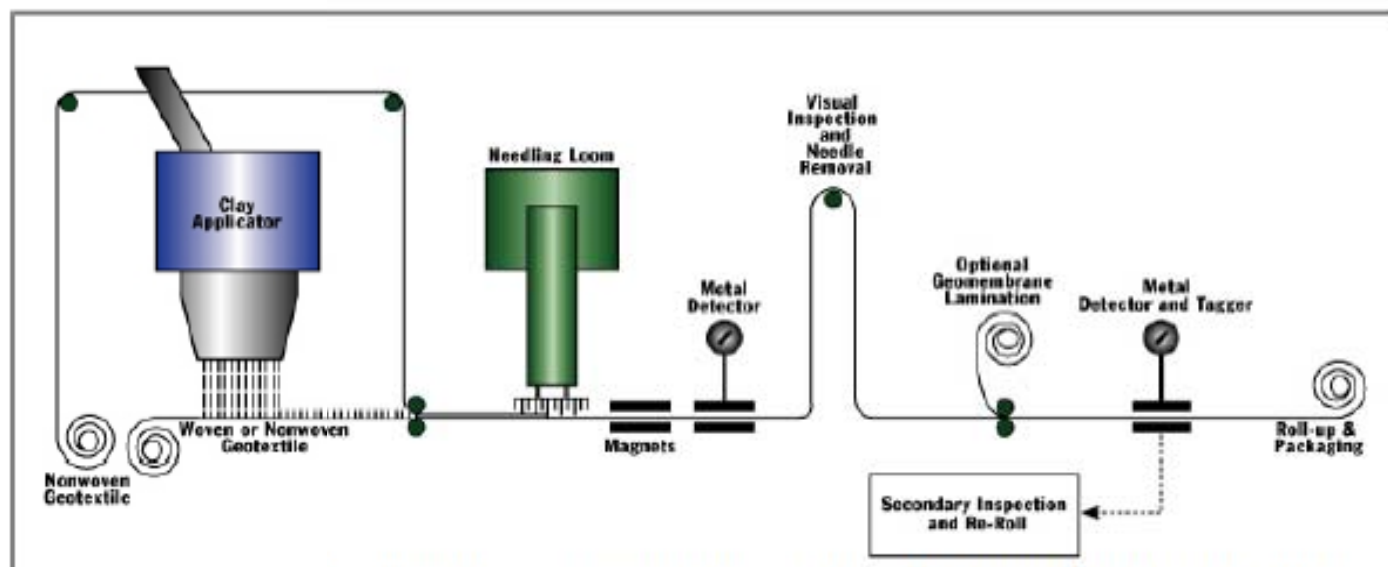
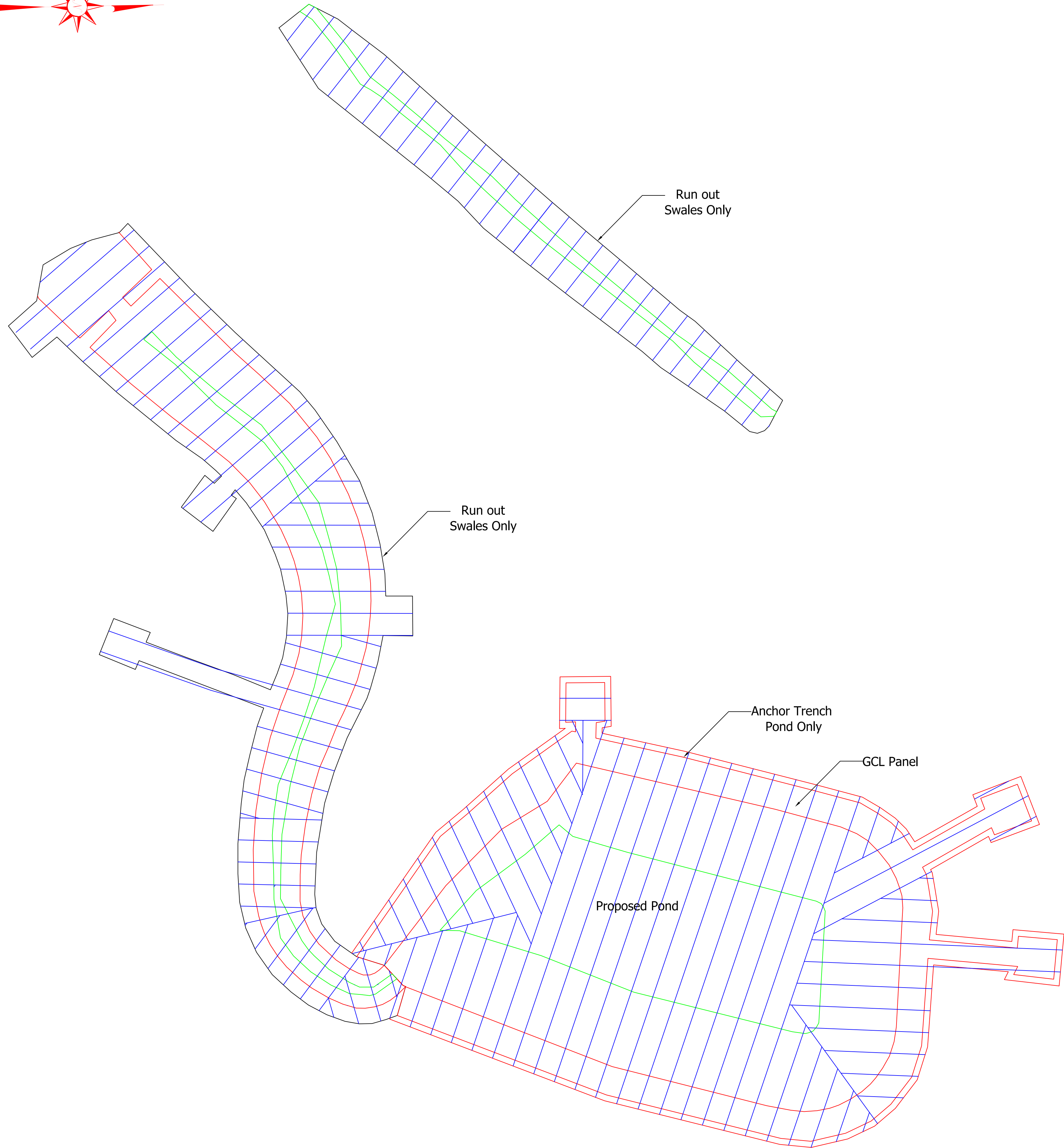
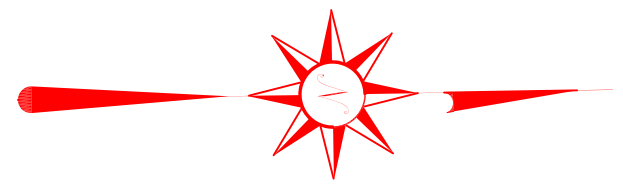


Figure 2. The Bentomat production process involves the use of magnets and metal detectors to ensure needle fragments are removed.

While it is impossible to guarantee that every roll of Bentomat will be needle-free, CETCO's needle prevention, detection and removal system results in the best possible quality reinforced GCL product available.



BENTOMAT® CLT CERTIFIED PROPERTIES

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY ft²(m²)	REQUIRED VALUES
Bentonite Swell Index¹	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss¹	ASTM D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area²	ASTM D 5993	40,000 ft² (4,000 m²)	0.75 lb/ft² (3.6 kg/m²) min.
GCL Grab Strength³	ASTM D 6788	200,000 ft² (20,000 m²)	45 lbs/in (70 N/cm) MARV
GCL Peel Strength³	ASTM D 6486	40,000 ft² (4,000 m²)	3.5 lbs/in (6.1 N/cm) min
GCL Index Flux⁴	ASTM D 5887	Periodic	1 x 10⁻⁹ m³/m²/sec max
GCL Hydraulic Conductivity⁴	ASTM D 5887	Periodic	5 x 10⁻¹⁰ cm/sec max
GCL Hydrated Internal Shear Strength⁵	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typical

Bentomat CLT is a reinforced GCL consisting of a layer of sodium bentonite between two geotextiles, which are needlepunched together and laminated to a 20-mil (0.5mm) textured HDPE geomembrane.

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 6788. All peel strength testing is performed using ASTM D 6486. Upon request, tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.
⁴ ASTM D5887 index flux and hydraulic conductivity testing with desired distilled/ionized water at 80 psi (551 kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 92 gal/acre/day. This flux value is equivalent to a permeability of 6x10⁻¹¹ cm/sec for typical GCL thickness. ASTM D 5887 testing is performed only on a periodic basis because the membrane is essentially impermeable.
⁵ Peak value 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.

TR 401-BNCLT
05/07

800.527.9948 Fax 847.577.5566
For the most up-to-date product information, please visit our website: www.cetco.com.
A wholly owned subsidiary of AMCOL International Corporation. The information and data contained herein are believed to be accurate and reliable. CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.



Global Designs

6 Diana Drive
Fairmont, WV 26554
(304) 281-8795

LEGEND:

- Panel
- Anchor Trench
- Toe of slope

MATERIAL INFO

GCL - CLT
Lined Area with slope gain and anchor trench.
LA = 143,075 SF

Material Required
MR = 157,500 SF
Rolls (15' x 150' ea.) = 70

NOTES:

- 1) Panel orientation may change in field based on site access, field conditions, material wastage, and safety considerations.
- 2) Cross seams not shown for clarity.
- 3) Corner panels will be field fit based on actual conditions.



Settling Pond Closure
6th Street
Generation Station
Cedar Rapids, Iowa

Proposed GCL
and Geotextile
Panel Layout

DWN BY: GE
DATE: 7/04/17
DRAWING NO.
1



Date: 18-Jul-2017 12:32
Purchase Order: 20874
ORDER NUMBER: 55015101

NORTHERN GEOSYSTEMS
4757 FAWN HILL COURT
ROCHESTER, MI, 48306

To Whom it May Concern:

Please find enclosed the MQA/MQC test data package for Geosynthetic Clay Liner shipments to NORTHERN GEOSYSTEMS

Questions regarding this information should be directed to CETCO Technical Services at eptechservices@cetco.com

Sincerely,

NICHOLLS, RYAN J
Quality Assurance Coordinator
CETCO Lovell Plant

**GEOSYNTHETIC CLAY LINER
MANUFACTURING QUALITY ASSURANCE DATA PACKAGE**

PROJECT NAME:
CUSTOMER P.O.: 20874
ORDER NUMBER: 55015101
PREPARED FOR: NORTHERN GEOSYSTEMS

CONTENTS:

- Product Certifications
- GCL Order Packing List and MQA Tracking Form
- GCL Manufacturing Quality control test data
- Bentonite clay certification
- Raw Material Test results

PREPARED BY: NICHOLLS, RYAN J
Quality Assurance Coordinator
CETCO
AMERICAN COLLOID COMPANY
92 HIGHWAY 37
LOVELL, 82431, WY
Telephone: 800-322-1159
Email: Ryan.Nicholls@mineralstech.com

PRODUCT CERTIFICATIONS

PROJECT NAME:
CUSTOMER P.O.: 20874
ORDER NUMBER: 55015101
PREPARED FOR: NORTHERN GEOSYSTEMS

The GCL Manufactured for the above-referenced order number is certified to meet the values listed in the tables below:

GCL PROPERTY SPECIFICATIONS FOR BENTOMAT CLT-SFT

Test Method	Test Method Property	Test Frequency	Certified Value
ASTM D5993	Bentonite Mass/Area	40,000 sq ft (4,000 sq m)	.75 - lbs/sq ft
ASTM D6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	45 - lbs/in
ASTM D6243	GCL Hydrated Internal Shear Strength	1,000,000 sq ft	500 - psf
ASTM D6496	GCL Peel Strength	40,000 sq ft (4,000 sq m)	3.5 - lbs/in
ASTM D5890	Bentonite Free Swell	50 tons	24 - ml
ASTM D5891	Bentonite Fluid Loss	50 tons	18 - ml
ASTM D5887	GCL-Index Flux	250,000 sq ft	1x10 ⁻⁹ - m ³ /m ² /s
ASTM D5887	GCL-Hydraulic Conductivity	250,000 sq ft	5x10 ⁻¹⁰ - cm/s

Bentonite property tests are performed at a bentonite processing facility before shipment to CETCO's production facility.
All tensile testing is 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.

NICHOLLS, RYAN J
Quality Assurance Coordinator
Colloid Environmental Technologies Co. (CETCO)

GCL PACKING LIST AND MQA TRACKING FORM

Listing of finished and raw materials used to produce certification package number 55015101

GCL								GEOTEXTILE			CLAY	LAMINATE
BENTOMAT CLT-SFT								01-9514	01-9865		CG 50-BLK	01-9445
Order	GCL Lot#	GCL Roll#	Length	Width	Weight	Sq. ft	Roll # Tested	Cap1 Roll #	Base1 Roll #		Clay Lot #	Plastic Lot #
55015101	LL-28-2017	34	150	15	3535	2250	34	2024992450	2024975256		L-191-17-E	8563945
55015101	LL-28-2017	35	150	15	3050	2250	34	2024992450	2024975256		L-191-17-E	8563945
55015101	LL-28-2017	36	150	15	3015	2250	34	2024992450	2024975256		L-191-17-E	8563945
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55015101	LL-28-2017	39	150	15	3040	2250	34	2024992450	2024975256		L-191-17-E	8563945
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55015101	LL-28-2017	41	150	15	3025	2250	34	2024992267	2024975256		L-192-17-A	8563945
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55015101	LL-28-2017	43	150	15	3025	2250	42	2024992288	2024978466		L-192-17-A	8563945
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55015101	LL-28-2017	45	150	15	3200	2250	42	J20406974	2024978466		L-192-17-A	9105527
55015101	LL-28-2017	46	150	15	3210	2250	42	J20406974	2024978466		L-192-17-A	9105527
55015101	LL-28-2017	47	150	15	3185	2250	42	J20406974	2024978466		L-192-17-A	9105527
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55015101	LL-28-2017	78	150	15	3165	2250	76	J20390933	2024979121		L-192-17-B	9105645
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55015101	LL-28-2017	83	150	15	3210	2250	76	J20390933	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	84	150	15	3335	2250	76	J20390933	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	85	150	15	3360	2250	76	J20390933	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	86	150	15	3340	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	87	150	15	3340	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	88	150	15	3295	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	89	150	15	3320	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	90	150	15	3265	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	91	150	15	3315	2250	76	J20390925	2024979121		L-192-17-B	9105367
55015101	LL-28-2017	92	150	15	3300	2250	76	J20390925	2024979121		L-192-17-B	8430370
55015101	LL-28-2017	93	150	15	3270	2250	93	J20390925	2024979121		L-192-17-B	8430370
55015101	LL-28-2017	94	150	15	3275	2250	93	J20390944	2024979121		L-192-17-B	8430370
55015101	LL-28-2017	95	150	15	3280	2250	93	J20390944	2024979121		L-192-17-B	8430370
55015101	LL-28-2017	96	150	15	3255	2250	93	J20390944	2024979122		L-192-17-B	8430370
55015101	LL-28-2017	97	150	15	3290	2250	93	J20390944	2024979122		L-192-17-B	8430370
55015101	LL-28-2017	98	150	15	3265	2250	93	J20390944	2024979122		L-192-17-C	8430370
55015101	LL-28-2017	99	150	15	3440	2250	93	J20390944	2024979122		L-192-17-C	8430370
55015101	LL-28-2017	100	150	15	3380	2250	93	J20390944	2024979122		L-192-17-C	8430370
55015101	LL-28-2017	101	150	15	3385	2250	93	J20390944	2024979122		L-192-17-C	8564504

55015101	LL-28-2017	102	150	15	3355	2250	93	J20390944	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	103	150	15	3385	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	104	150	15	3410	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	105	150	15	3390	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	106	150	15	3375	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	107	150	15	3370	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	108	150	15	3220	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	109	150	15	3335	2250	93	J20407003	2024979122		L-192-17-C	8564504
55015101	LL-28-2017	110	150	15	3335	2250	110	J20407003	2024979122		L-192-17-C	9106170
55015101	LL-28-2017	111	150	15	3325	2250	110	J20406994	2024979122		L-192-17-C	9106170
55015101	LL-28-2017	112	150	15	3325	2250	110	J20406994	2024979122		L-192-17-C	9106170
55015101	LL-28-2017	113	150	15	3235	2250	110	J20406994	2024979122		L-192-17-C	9106170
Total Sq Ft:						1800 00	Total Number of Rolls Certified: 80					

GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 55015101 have been tested in our production facility lab.

Product	Lot# Tested	Roll# Tested	Mass Area	Grab Strength	Peel Strength			
ASTM Test Method:			ASTM D5993	ASTM D6768	ASTM D6496			
Required Value:			.75 - lbs/sq ft	45 - lbs/in	3.5 - lbs/in			
BENTOMAT CLT-SFT	LL-28-2017	34	.81	98.7	5.1			
BENTOMAT CLT-SFT	LL-28-2017	42	.8	109	9.6			
BENTOMAT CLT-SFT	LL-28-2017	59	.81	109	10			
BENTOMAT CLT-SFT	LL-28-2017	76	.8	109	9.2			
BENTOMAT CLT-SFT	LL-28-2017	93	.86	109	9.8			
BENTOMAT CLT-SFT	LL-28-2017	110	.82	109	11			

BENTONITE CLAY CERTIFICATION

The Bentonite Clay used to produce package 55015101 has been tested by American Colloid Company and yielded the following results.

Clay Lot #	Moist	Swell	Fluid Loss
ASTM Test Method:	ASTM D2216	ASTM D5890	ASTM D5891
Required Value:	12 - %	24 - ml	18 - ml
L-191-17-E	10.03	29	12.6
L-192-17-A	10.37	28	13.8
L-192-17-B	10.27	33	10.4
L-192-17-C	10.16	30	13

GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 55015101 was manufactured with geotextiles which were tested with the following results.

BASE GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd ²	Grab Strength lbs
01-9865	2024975256	3.37	137.5
01-9865	2024978466	3.28	164.2
01-9865	2024979121	3.25	137
01-9865	2024979122	3.25	137

COVER GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd ²	Grab Strength lbs
01-9514	J20407003	6.8	83
01-9514	J20406994	6.6	78
01-9514	2024992450	7.39	145.31
01-9514	2024992267	6.88	109.87
01-9514	2024992288	7.07	110.9
01-9514	J20406974	6.5	78
01-9514	J20407001	6.8	83
01-9514	J20390937	6.3	68
01-9514	J20390914	6.9	78
01-9514	J20390933	7	78
01-9514	J20390925	6.5	71
01-9514	J20390944	6.3	68

Material	Roll Number	Mass Area g/m2	Grab Strength lb/in	Thickness mm
Laminate	8564504		75	28.33
Laminate	9106170		76	22.37
Laminate	8563945		80	24.12
Laminate	9105527		76	22.63
Laminate	8657164		85	20.71
Laminate	8565135		80	27.18
Laminate	9105645		76	20.55
Laminate	9105367		76	24.61
Laminate	8430370		86	26.25

Certifications from our suppliers are on file at our production facility.

An '*' or 'PT' indicates supplier certifications were unavailable prior to shipping so testing was performed at a CETCO lab.



Date: 30-Aug-2017 07:13
Purchase Order: 20874
ORDER NUMBER: 55016679

NORTHERN GEOSYSTEMS
4757 FAWN HILL COURT
ROCHESTER,MI,48306

To Whom it May Concern:

Please find enclosed the MQA/MQC test data package for Geosynthetic Clay Liner shipments to
NORTHERN GEOSYSTEMS

Questions regarding this information should be directed to CETCO Technical Services
at eptechservices@cetco.com

Sincerely,

NICHOLLS, RYAN J
Quality Assurance Coordinator
CETCO Lovell Plant



Colloid Environmental Technologies Company LLC

GEOSYNTHETIC CLAY LINER MANUFACTURING QUALITY ASSURANCE DATA PACKAGE

PROJECT NAME:
CUSTOMER P.O.: 20874
ORDER NUMBER: 55016679
PREPARED FOR: NORTHERN GEOSYSTEMS

CONTENTS:

- Product Certifications
- GCL Order Packing List and MQA Tracking Form
- GCL Manufacturing Quality control test data
- Bentonite clay certification
- Raw Material Test results

PREPARED BY: NICHOLLS, RYAN J
Quality Assurance Coordinator
CETCO
AMERICAN COLLOID COMPANY
92 HIGHWAY 37
LOVELL, 82431, WY
Telephone: 800-322-1159
Email: Ryan.Nicholls@mineralstech.com

PRODUCT CERTIFICATIONS

PROJECT NAME:
CUSTOMER P.O.: 20874
ORDER NUMBER: 55016679
PREPARED FOR: NORTHERN GEOSYSTEMS

The GCL Manufactured for the above-referenced order number is certified to meet the values listed in the tables below:

GCL PROPERTY SPECIFICATIONS FOR BENTOMAT CLT-SFT

Test Method	Test Method Property	Test Frequency	Certified Value
ASTM D5993	Bentonite Mass/Area	40,000 sq ft (4,000 sq m)	.75 - lbs/sq ft
ASTM D6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	45 - lbs/in
ASTM D6243	GCL Hydrated Internal Shear Strength	1,000,000 sq ft	500 - psf
ASTM D6496	GCL Peel Strength	40,000 sq ft (4,000 sq m)	3.5 - lbs/in
ASTM D5890	Bentonite Free Swell	50 tons	24 - ml
ASTM D5891	Bentonite Fluid Loss	50 tons	18 - ml
ASTM D5887	GCL-Index Flux	250,000 sq ft	1x10 ⁻⁹ - m ³ /m ² /s
ASTM D5887	GCL-Hydraulic Conductivity	250,000 sq ft	5x10 ⁻¹⁰ - cm/s

Bentonite property tests are performed at a bentonite processing facility before shipment to CETCO's production facility. All tensile testing is 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.

NICHOLLS, RYAN J
Quality Assurance Coordinator
Colloid Environmental Technologies Co. (CETCO)

GCL PACKING LIST AND MQA TRACKING FORM

Listing of finished and raw materials used to produce certification package number 55016679

GCL								GEOTEXTILE			CLAY	LAMINATE
BENTOMAT CLT-SFT								01-9514	01-9865		CG 50-BLK	01-9445
Order	GCL Lot#	GCL Roll#	Length	Width	Weight	Sq. ft	Roll # Tested	Cap1 Roll #	Base1 Roll #		Clay Lot #	Plastic Lot #
55016679	LL-32-2017	254	150	15	3120	2250	249	J20398310	2024880087		L-221-17-F	8655741
55016679	LL-32-2017	271	150	15	3075	2250	266	J20398293	2024914648		L-221-17-F	8657534
55016679	LL-32-2017	272	150	15	3090	2250	266	J20390954	2024914648		L-221-17-F	8657534
55016679	LL-32-2017	276	150	15	3045	2250	266	J20390954	2024976000		L-222-17-A	8657534
55016679	LL-32-2017	277	150	15	3150	2250	266	J20390954	2024976000		L-222-17-A	8657534
55016679	LL-32-2017	278	150	15	3090	2250	266	J20390954	2024976000		L-222-17-A	8657534
55016679	LL-32-2017	280	150	15	3110	2250	266	J20390954	2024976000		L-222-17-A	8655929
55016679	LL-32-2017	281	150	15	3110	2250	266	J20390954	2024976000		L-222-17-A	8655929
55016679	LL-32-2017	282	150	15	3085	2250	266	J20406949	2024976000		L-222-17-A	8655929
55016679	LL-32-2017	284	150	15	3135	2250	283	J20406949	2024976000		L-222-17-A	8655929
55016679	LL-34-2017	373	150	15	3480	2250	363	2025072572	2024630931		L-228-17-D	9232897
55016679	LL-34-2017	393	150	15	3430	2250	380	2025071602	2024930650		L-228-17-D	9233925
55016679	LL-34-2017	395	150	15	3415	2250	380	2025071602	2024930650		L-228-17-D	9233925
55016679	LL-34-2017	396	150	15	3420	2250	380	2025071602	2024930650		L-228-17-D	9233925
Total Sq Ft:						3150 0	Total Number of Rolls Certified: 14					

GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 55016679 have been tested in our production facility lab.

Product	Lot# Tested	Roll# Tested	Mass Area	Grab Strength	Peel Strength			
ASTM Test Method:			ASTM D5993	ASTM D6768	ASTM D6496			
Required Value:			.75 - lbs/sq ft	45 - lbs/in	3.5 - lbs/in			
BENTOMAT CLT-SFT	LL-32-2017	249	.83	131.3	7.6			
BENTOMAT CLT-SFT	LL-32-2017	266	.82	131.3	8.9			
BENTOMAT CLT-SFT	LL-32-2017	283	.82	131.3	6			
BENTOMAT CLT-SFT	LL-34-2017	363	.88	101.7	8.4			
BENTOMAT CLT-SFT	LL-34-2017	380	.9	101.7	10.6			

BENTONITE CLAY CERTIFICATION

The Bentonite Clay used to produce package 55016679 has been tested by American Colloid Company and yielded the following results.

Clay Lot #	Moist	Swell	Fluid Loss
ASTM Test Method:	ASTM D2216	ASTM D5890	ASTM D5891
Required Value:	12 - %	24 - ml	18 - ml
L-221-17-F	10.18	30	13.1
L-222-17-A	10.3	30	12.9
L-228-17-D	10.47	28	14.5

GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 55016679 was manufactured with geotextiles which were tested with the following results.

BASE GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd ²	Grab Strength lbs
01-9865	2024880087	3.37	194.27
01-9865	2024914648	3.56	191.11
01-9865	2024976000	3.37	160.6
01-9865	2024630931	3.53	175.76
01-9865	2024930650	3.5	225

COVER GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd ²	Grab Strength lbs
01-9514	J20398310	6.6	70
01-9514	J20398293	6.4	91
01-9514	J20390954	6.6	75
01-9514	J20406949	6.6	75
01-9514	2025071572	7.07	134.01
01-9514	2025071602	6.75	124.71

Material	Roll Number	Mass Area g/m ²	Grab Strength lb/in	Thickness mm
Laminate	8655741		77	23.73
Laminate	8657534		85	22.35
Laminate	8655929		77	20.5
Laminate	9232897		82	21.75
Laminate	9233925		60	23

Certifications from our suppliers are on file at our production facility.

An '*' or 'PT' indicates supplier certifications were unavailable prior to shipping so testing was performed at a CETCO lab.