

**BITTER ROOT IRRIGATION DISTRICT
MAIN CANAL**

**CANAL LINING DEMONSTRATION PROJECT
Exposed 20-mil Geocomposite
(8-oz geotextile with carbon black - 20-mil Ethyl Vinyl Acetate - 8-oz geotextile)
OCTOBER 15 - 19, 2001**

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Bitter Root Irrigation District

GeoComp, Inc.

Bureau of Reclamation

Test Section BI-1.—

Material: Exposed 20-mil EVA with 8-oz geotextile bonded to both sides

Date Installed: October 2001

*Location: Bitter Root Irrigation District, near Hamilton MT (figure 1)
(900 linear feet, 4,500 square feet)*

Description: The membrane is GeoComp Canal³ (Canal-Cubed) geocomposite. It is composed of a gray 8-oz geotextile cushion; 20-mil EVA; and a black, 8-oz, geotextile cover. Both polyester geotextiles and the EVA geomembrane are made from recycled polymer. The geomembrane composite is installed with the black geotextile facing up for UV protection.

GeoComp also supplied some 12-30-12 geocomposite for this job. The 12-30-12 is composed of a black 12-oz geotextile cushion, 30-mil EVA membrane, and a black 12-oz geotextile UV cover. The 12-30-12 costs \$0.53 per square foot, and is probably better suited for exposed applications.

Prime Contractor: Bitter Root Irrigation District

Material Supplier: GeoComp Inc.

Surface Preparation: The irrigation district performed extensive subgrade preparation by removing vegetation to 1 foot above the waterline, removing large rocks, restoring the approximately 1½:1 side slopes, and cutting a 2- to 3-foot-wide bench for anchoring on each bank. The cost of subgrade preparation is estimated at \$0.26 per ft², based on the subgrade preparation costs of previous similar test sections. The finished canal prism measures 40 to 45 feet across. The invert is 12- to 15-feet and 7- to 8-ft deep. This section of canal typically carries about 300 cfs and runs about 6 feet deep. The finished subgrade is quite rocky, with rounded cobbles up to 6 inches in diameter. Seepage from the canal has been flooding fields and a house located immediately to the north of the canal. The only access road is on the north side of the canal.

Construction: The geomembrane was provided in 24-foot-wide rolls that are 275 feet long. A four to six man crew (including a trackhoe operator) installed the geomembrane. Because the canal was accessible only from one side, the geomembrane was unrolled across the canal by a trackhoe operating in the canal invert. After the geomembrane panel was cut from the roll to fit to the canal width (45 to 50 ft), the trackhoe would unhook the lifting bar and use its bucket to place cover material on the far anchor berm. The

trackhoe would then back up 24 feet, re-attach to the lifting bar, and unroll the next panel. Panels were shingled downstream and overlapped a minimum of 1 foot. Overlaps of 3 to 4 feet were typical because of the uneven subgrade and bends in canal alignment. At the end of each day, the trackhoe would drive out of the canal and backfill the near anchor berm. Lining started at the bridge and proceeded upstream. The District placed and seamed about 900 linear feet of geomembrane liner in 3 days. The geomembrane was placed into a 2-foot-wide cut-off trench at the upstream and downstream ends. Another 1,300-foot section downstream from the bridge was too wet for lining at this time. As weather permitted, this downstream section was lined during the winter of 2001-2002, bringing the total test section to 2,100 linear feet.

Seaming was performed by a one to four man crew using an air-powered hot-glue gun provided by the geomembrane manufacturer. The hot-glue gun consisted of an air compressor, an air accumulator chamber, and the hot-glue gun. A generator powered the air compressor and the hot-glue gun. Glue was provided in hockey-puck-sized pellets. The pucks were loaded into a supply chamber and heated to 450 °F. The gun extruded a 1/4- to 1/2-inch bead of hot glue into the seam. The seam was pressed together and held closed for several minutes to allow the hot glue to cool and set. Occasional geomembrane wrinkles and fishmouths were simply folded over and glued down. Inspection of the seams found a few unbonded areas (typically 6 to 12 inches long) where the seam was not pressed (held) together long enough for the glue to cool and set.

Difficulties:

Seaming was quite slow, and the seams were inconsistent (unbonded areas) and relatively weak. The geomembrane manufacturer has a larger gun that places a 1-inch wide bead that would be more suitable for this material. The district switched over to hot roofing tar later in the week. The tar was supplied in a 100-gallon kettle. Hot-tar seaming was more labor intensive and relatively slow because of the time needed for the hot tar to cool and set. A hot-air welder may be another alternative for seaming this material.

Unit Cost Estimate:

*Exposed 20-mil EVA-geotextile geocomposite = \$0.83 per ft²
(\$0.35 geocomposite + 0.26 surface prep + 0.10 installation +17% OH and profit).*

Advantages:

Installation was simplified by providing the geotextile cushion, EVA geomembrane, and geotextile cover in a single geocomposite.

Disadvantages:

Lots of seaming was required because of the 24-ft roll width. The seaming crew had trouble keeping pace with the installation crew.

Photographs:

1 through 24

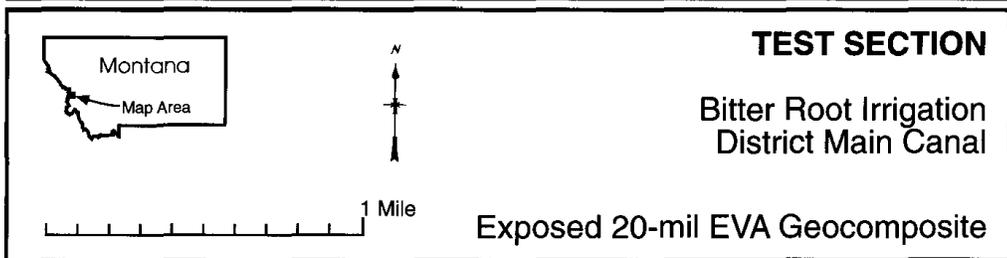
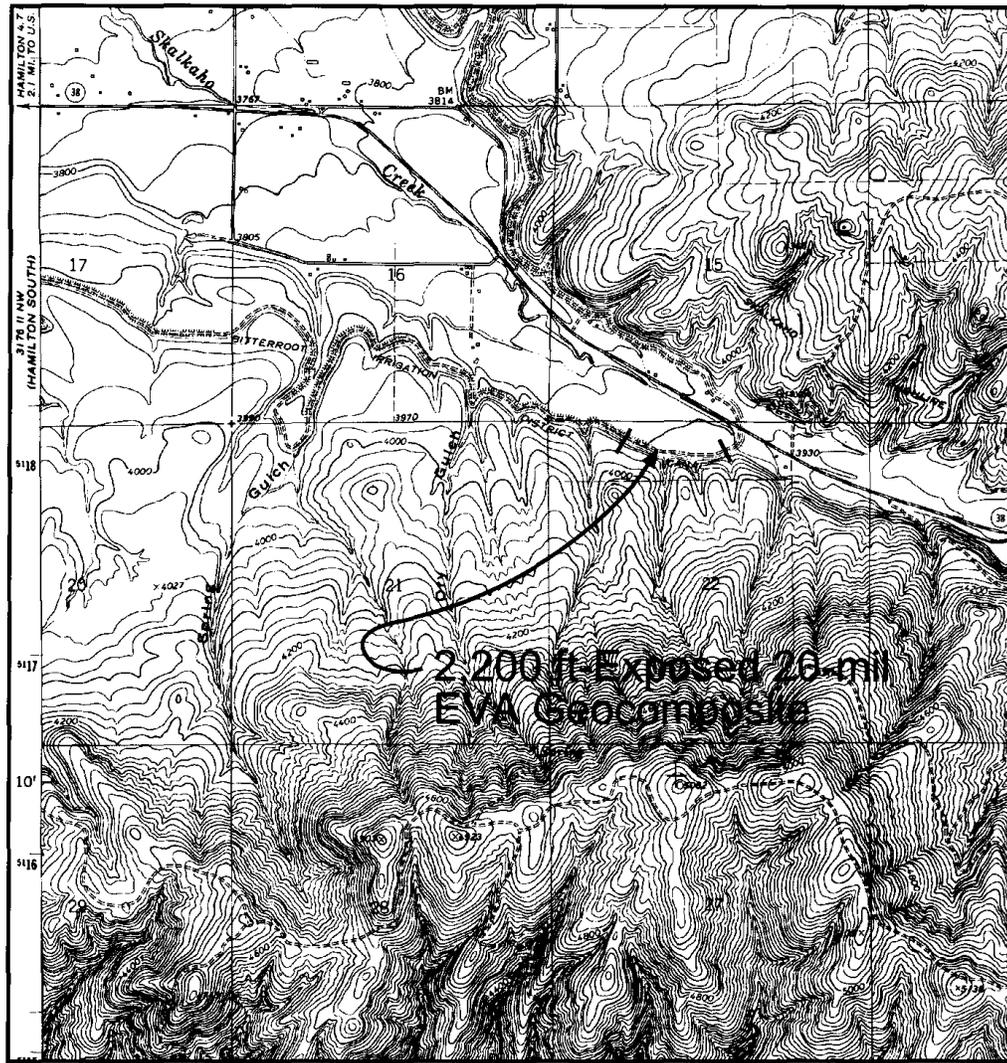


Figure 1.—Location map.

*Bitter Root Irrigation District – Test Section BI-1
Exposed 20-mil EVA with 8-oz Geotextile Bonded to Both Sides*



Photo 1.—The District performed extensive subgrade preparation by removing vegetation to 1 foot above the waterline, restoring the 1½:1 side slopes, and cutting a 2- to 3-foot anchor berm on each bank. The downstream section was too wet and was not lined at the time of the photograph.



Photograph 2.—Upstream section ready for installation of lining.

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Photograph 3.—The prepared subgrade has large cobbles of up to 6 inches in diameter.



Photograph 4.—Trackhoe operating in the canal invert using a lifting bar to unroll geomembrane across the canal.

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Photograph 5.—Trackhoe pulls down the far bank to cover geomembrane in the anchor berm.



Photograph 6.—At the end of the day, the trackhoe drives up the side slope and out of the canal.

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Photograph 7.—Trackhoe prepares to backfill the near anchor berm.



Photograph 8.—Laborers help backfill the near anchor berm.

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Photograph 9.—Backfill on near anchor berm is complete.



Photograph 10.—Overlapped seams are ready to be sealed. The trackhoe continues to lay geomembrane in the background.

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Photograph 11.—Three-man crew removes dirt from the seam and seals it with hot glue. Seams need to be held shut until the hot glue cools and sets.



Photograph 12.—Seaming continues.

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Photograph 13.—Closeup of the industrial hot-glue machine.



Photograph 14.—Closeup of seam with hot glue. Rock is placed on the seam to hold it together until the hot glue cools and sets.

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Photograph 15.—Hot glue is extruded into the seam in a ½-inch bead.



Photograph 16.—Three-man crew cleans the seam (removes loose dirt), applies hot glue, and holds seam shut until the glue cools and sets.

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Photograph 17.—Lower portion of Photograph shows factory seam in the upper geotextile. Fishmouth in the seam has been folded over and glued shut.



Photograph 18.—Hot tar was also used for seaming. Hot tar was supplied in a 100-gallon propane-fired kettle.

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Photograph 19.—Geotextile is folded back, and hot tar is mopped onto both geotextile surfaces.

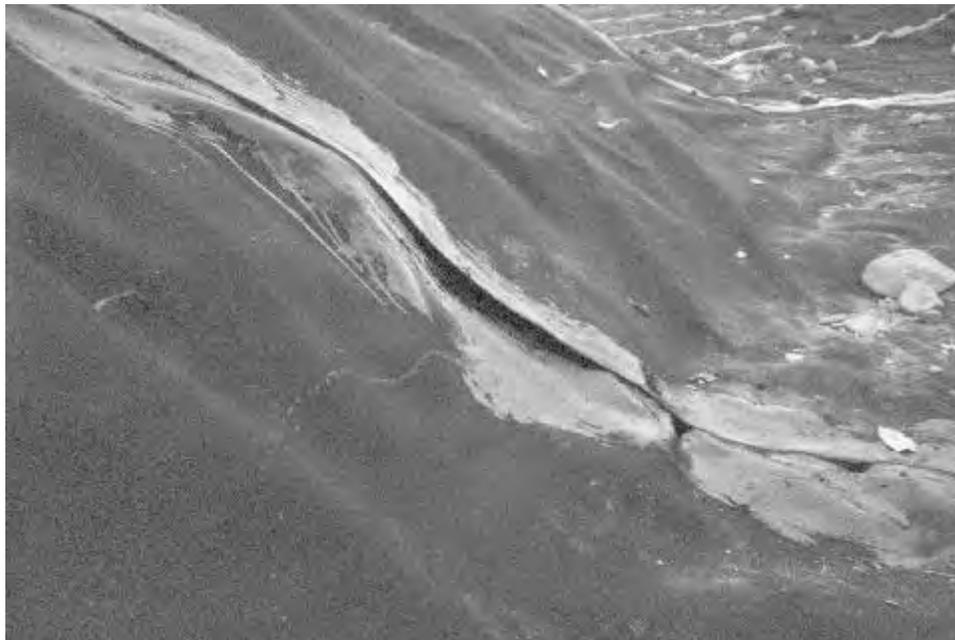


Photograph 20.—Upper geotextile is folded back into position, and the seam edge is buttered with hot tar.

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Photograph 21.—Laborer on right uses hoe to hold seam closed while hot tar cools and sets.



Photograph 22.—Seam with hot tar pops open if not held closed for sufficient time.

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Photograph 23.—Finished installation.



Photograph 24.—Finished installation.