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16. Abstract

A series of evaluation procedures to determine the field performance of flexible erosion control materials were conducted at the TTI/TxDOT Hydraulics and Erosion Control Laboratory. The objectives of the study were to determine the effect of flexible materials on the germination and growth of native grasses, as well as to determine the effectiveness of the materials to prevent erosion on typical steep, roadside slopes before the establishment of permanent vegetation. Researchers repeated the vegetation establishment and soil retention portions of the evaluations on two soil types with the option for two different slopes, according to the manufacturer's preference.

Researchers conducted the vegetation establishment evaluation by hydraulically applying the seed and fertilizer mixture on the plot, installing the erosion control product according to the manufacturer's published literature, and collecting data periodically throughout the growing season. The apparent vegetative cover of each plot is averaged for every round of data collection. Results include the four rounds of vegetation coverage data or the final round of vegetation data, depending on the analysis level. Researchers calculate the minimum amount of vegetation establishment from statistically analyzing the data set for significant difference ranges to the analysis level.

Researchers conducted the erosion control portion of the study by artificially simulating various rainfall events with the greatest probability of occurrence during highway construction periods. The total dry sediment weight is calculated to achieve the total sediment loss per one hundred square feet of plot area. The report averages the results of each series of simulated design storms for each round of data collection. The resultant of total sediment loss is established by averaging the totals of each round of design storm values. Researchers establish the maximum amount of sediment loss from statistically analyzing the data set for significant difference ranges according to the analysis level.

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PERFORMANCE OF FLEXIBLE EROSION CONTROL MATERIALS

April, 1993
1991-92 Cycle
Final Report

Prepared for
Texas Department of Transportation
Division of Maintenance and Operations
Austin, TX 78701

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I. INTRODUCTION

The Texas Department of Transportation rewrites all standard specifications every ten years. The revised Standard Specifications for Construction of Highways, Streets and Bridges is scheduled to be released during fiscal year 1993. The revision and standard specifications Item 169, "Soil Retention Blanket" will now contain the following requirements:

"Soil Retention Blanket" shall meet the requirements of and be approved by the Chief Engineer of Maintenance and Operations. A list of pretested and approved soil retention blankets will be maintained, and can be obtained by writing the Chief Engineer of Maintenance and Operations, 125 East 11th Street, Austin, Texas, 78701-2483.

Without a formal research program, it would be impossible to develop a defensible list of approved materials. Therefore, a cooperative effort between the Texas Department of Transportation, Division of Maintenance and Operations, Section 18-L and the Texas Transportation Institute was initiated in order to produce an approved materials list based upon demonstrated field performance.

An initial literature search of temporary erosion control materials and standard product and performance evaluation methods uncovered a variety of information.

The erosion control industry and the Federal Highway Administration recognize a wide range of generic materials which can be used as temporary erosion control for slope faces and flexible channel linings. The category under which these generic materials belong, and by which they will be referred, is geotextile-related products.[1] A partial list includes the following geotextile-related products: Woven Paper Net, Jute Net, Fiberglass Roving (single and double), Straw with Net, Curled Wood Mat, and Synthetic Mats. Each of these materials has an appropriate range of applications based on its strength and hydraulic properties. Laboratory tests and field observations suggest, however, that great variance in strength, durability, and vegetation response exists among the material classifications and between manufactured brands of similar materials.

To this point, a variety of laboratory tests exist to describe standard strength properties, such as tensile strength, shear strength, resistance to abrasion, cutting and tearing, heat resistance, etc.[2] These tests are conducted using very small samples in the laboratory and do not adequately describe or test the field performance. Further review of the literature also indicates that currently, no generally accepted methodology developed for in-situ testing of temporary geotextile-related products exists to determine their soil-fabric interaction properties or their ability to foster the development of vegetative cover.

The purpose of this document is to describe the design of the research facilities, to provide general background on the formulation of the evaluation methods, and to set forth the research program for field performance evaluation of temporary erosion control products.

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[1]The term geotextile-related product is approved by the International Standard Organization (ISO) and includes grids, nets, mats, webbing, and geocomposites.

[2]FHWA Geotextile Engineering Manual, March 1984, Revised March 1985, Chapter 2

II. FIELD LABORATORY FACILITIES

Location

The Hydraulics and Erosion Control Field Laboratory is part of the Texas Transportation Institute's proving ground and located at the Texas A&M University Riverside Campus, four miles (6.5 kilometers) west of Bryan, Texas. The Field Laboratory site is bounded on the north, east, and west sides by runways and an open field to the south. Because of the site's location on a ridge just above the Brazos River, it was originally a military airport facility, it is exposed to harsh climatic conditions. The soils are generally poor and highly compacted, and the heat energy stored in, or reflected from the surrounding pavement, influences the facility. These conditions are very similar to those experienced in typical highway roadside environments. Researchers deliberately selected these unique physical conditions to provide the most realistic conditions possible for conducting controlled experiments related to the highway roadside.

The first evaluation cycle occurred on the embankment located west of Runway 35 terminus (see Figure 1). The slope study plots were situated on a 22 feet (6.75 meters) high earth fill embankment structure with 2:1 and 3:1 sloped sides and sediment boxes at its base. The water supply system for the rain

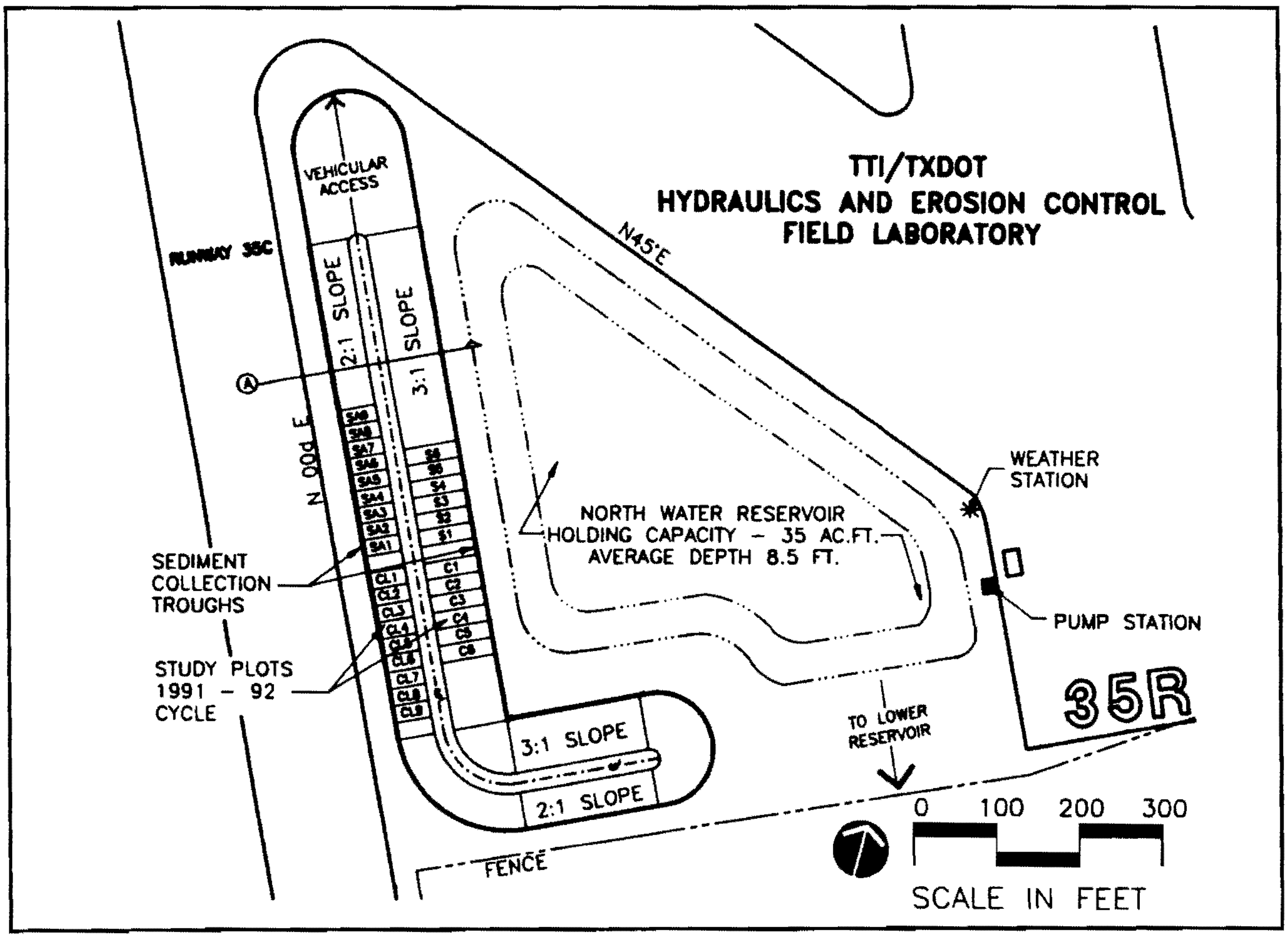


Figure 1. TxDOT/TTI Hydraulics and Erosion Control Field Laboratory

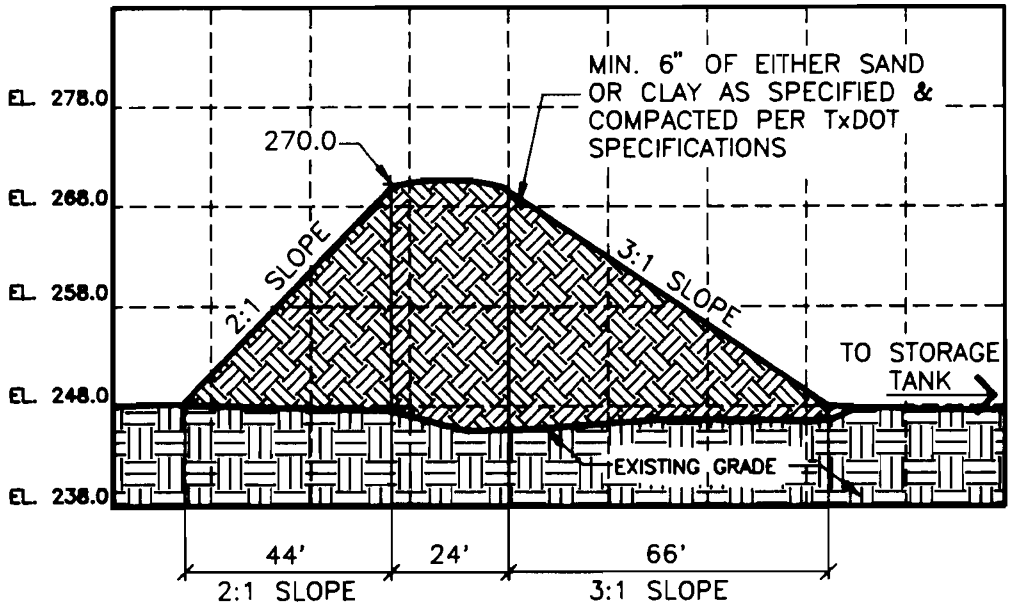


Figure 2. Typical Cross-section of the Embankment

simulators ran along the top of the embankment with access valves. The pump station for this water system sat beside the north water reservoir adjacent to the runway pavement. The weather station equipment was located on-site to provide continuous accurate climatic recording.

Earth Embankment

Researchers built the earth embankment from two types of soil found within the 12.5 acres (5 hectare) site. One half of the embankment was built and capped with a sandy loam soil (SL)[3](K=.05)[4]. and the remaining portion was built and capped with a clay soil (C)[5](K=.20)[6]. The physical properties of these two soils represent fairly the erosive properties frequently encountered in Texas highway construction sites.

The "L-shaped" embankment shown in Figure 1 has a total length of 876 feet (267 meters) at the crest and a vertical height of 22 feet (6.75 meters). The cross-section of the embankment was finished with a minimum 6 inch (15.24 centimeters) soil cap, with a 2:1 slope on the south and west facing slopes anda 3:1 slope on the north and east facing slopes. The top of the embankment measures 24 feet (7.31 meters)

---

[3]Post-construction soil sample analyzed by SASI, Inc., with reference made to the National Soils Handbook, July 1983, Figure 603-1, "Soil Texture Triangle."

[4]K value determined on post-construction soil sample following the SCS soil erodibility nomograph Predicting Rainfall Erosion Losses - A Guide to Conservation Planning.

[5]Post-construction soil sample analyzed by SASI, Inc. with reference made to the National Soils Handbook, July 1983, Figure 603-1, "Soil Texture Triangle"

[6]K value determined on post-construction soil sample following the SCS soil erodibility nomograph Predicting Rainfall Erosion Losses - A Guide to Conservation Planning.

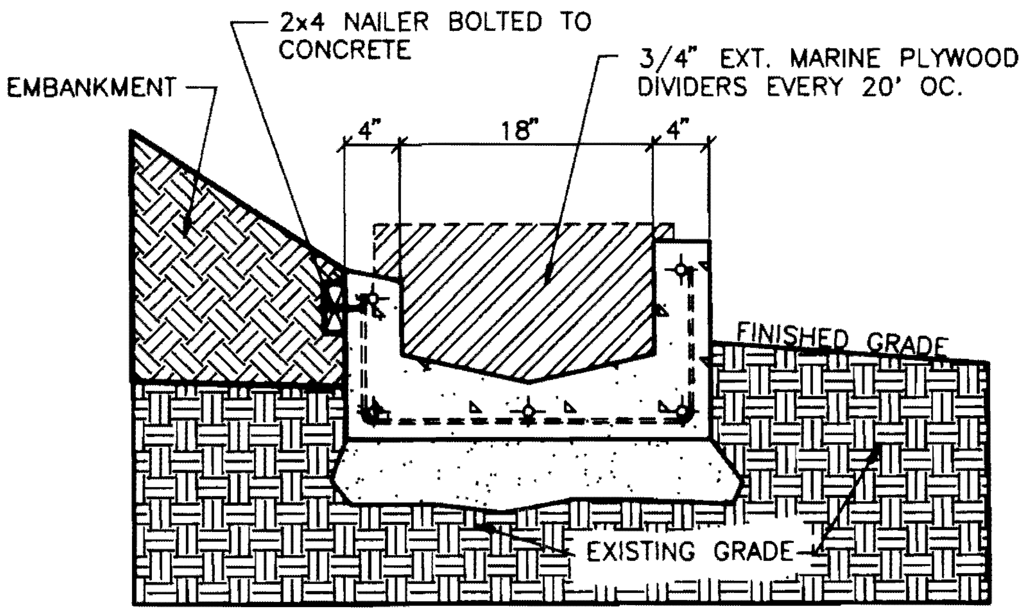


Figure 3. Typical Cross-section through the Sediment Trough

wide (see Figure 2.) Texas Department of Transportation (TxDOT) 1982 Standard Specifications for Construction of Highways, Streets and Bridges governed the construction. Density control method in accordance with test method Tex-114-E and test method Tex 115-E controlled compaction. The Tex-114-E test method was a two part test to determine the compaction ratio for the selection of the density of soils and base materials in place. The Tex-115-E test was a field method for determination of in-place density of soils and base materials. Field work and testing were performed by the TxDOT District 17 laboratory in Bryan and subsequently by the certified TTI Field Laboratory manager.

Slope Study Plots. The embankment, constructed of both sand and clay to repeat the product evaluations on two diverse soil types, provided a total of seventy-six sub-plots, each being 20 feet (6.2 meters) wide. A concrete sediment collection box was installed at the base of each plot. Figure 3 shows a typical cross-section of the sediment collection box.

Rainfall Simulators. Rainfall simulators were used to generate the primary data in the sediment retention performance evaluations. Natural rainfall was recorded, but no sediment was collected. The rainfall simulator units measured 20 feet (6.2 meters) wide and capable of covering the entire plot.

Each simulator unit consisted of a series of arms spaced 5 feet (1.5 meters) apart mounted on a steel frame and set approximately 2 feet (0.60 meters) above the ground plane. Each arm had pressure gauges at each end to control water flow through the coarse spray, adjustable, irrigation nozzles. The nozzles spray upward away from the slope face approximately 3-5 feet (1-1.5 meters) to provide a greater drop velocity. Each unit can be calibrated to provide 1-11.8 inches (25-300 millimeters) of precipitation per hour. Drop size generally represented natural rainfall.

Reservoirs and Pump Station

Two reservoirs were created as the result of the embankment construction with a natural vertical elevation difference of approximately 5 feet (1.5 meters). The upper reservoir has a surface area of 6.5 acres (2.43 hectares) and has a holding capacity of approximately thirty-five acre feet. This reservoir provided the primary water supply source for all the experimental work. A ten horsepower centrifugal pump supplied the rain simulators stationed on the embankment.

Weather Instrumentation

The Field Lab had an on-site suite of recording weather instruments. These included a tipping-bucket rain gauge, hygrothermograph, barograph, recording anemometer, and pyronometer. These instruments provided a detailed record of the climatic influences over the study period and were recorded with the results.

III. DESCRIPTION OF MATERIALS

The products were categorized into three varying degrees of definition for various levels of analysis. The left-hand column in Table A shows the broadest definition, *"organic"* or *"synthetic,"* while the next column further specifies the product by the overall material type. The third level of definition is the actual trade or brand name(s) evaluated. The last column documents steepness of slope evaluation conditions as requested by the manufacturer for the 1991-92 cycle:

Table A. Description of Materials in the 1991-92 Cycle

Generic Classification	Material Classification	Brand Name of Material Evaluated	Slope
Organic	Excelsior	American Excelsior Curlex®	2:1 & 3:1
		Xcel Regular®	3:1
		Xcel Superior®	2:1
	Jute	ANTI-WASH®/GEOJUTE® (Regular)	2:1
	Straw	North American Green® S75	3:1
		North Americn Green® S150	2:1
		Verdyol® ERO-MAT®	3:1
	Straw/Coconut	North American Green® SC150	2:1
Synthetic	Polyproplyene	POLYJUTE™ 407GT	2:1
	PVC	GREENSTREAK® PEC-MAT®	2:1 & 3:1

In addition to material plots, researchers replicated four bare ground (Control) plots on the 2:1 and 3:1 slopes, clay and sand soils. The Control plots were prepared and received the identical seeding mix and fertilizer as plots receiving an erosion control material. Also, researchers subjected the control plots to the identical rainfall simulations and vegetative density measurements as the material plots.

The following materials were selected for evaluation during the 1991-92 cycle as requested by the manufacturer. The general material specifications as well as the roll dimensions are shown for each material according to the manufacturer's published literature are presented on the following pages.

American Excelsior Curlex®

American Excelsior Curlex® is manufactured by American Excelsior Company based in Arlington, Texas. Curlex is made from curled and seasoned Aspen wood excelsior reinforced with polypropylene netting. A photodegradable extruded plastic mesh that is adhering to the wood excelsior covers the top side. The blanket is smolder-resistant without the use of chemical additives.

Table B. American Excelsior Curlex® Product Specifications

American Excelsior Curlex®	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Wood excelsior - 80% 6" or longer	Width - 4 ft.
Weight - 0.98 lbs./sy.	Lenght - 180 ft.
Mesh - black plastic	Weight - 78 lbs.
	Area - 80 sy.

Source: American Excelsior Curlex® Product Installation Guidelines, 1991.

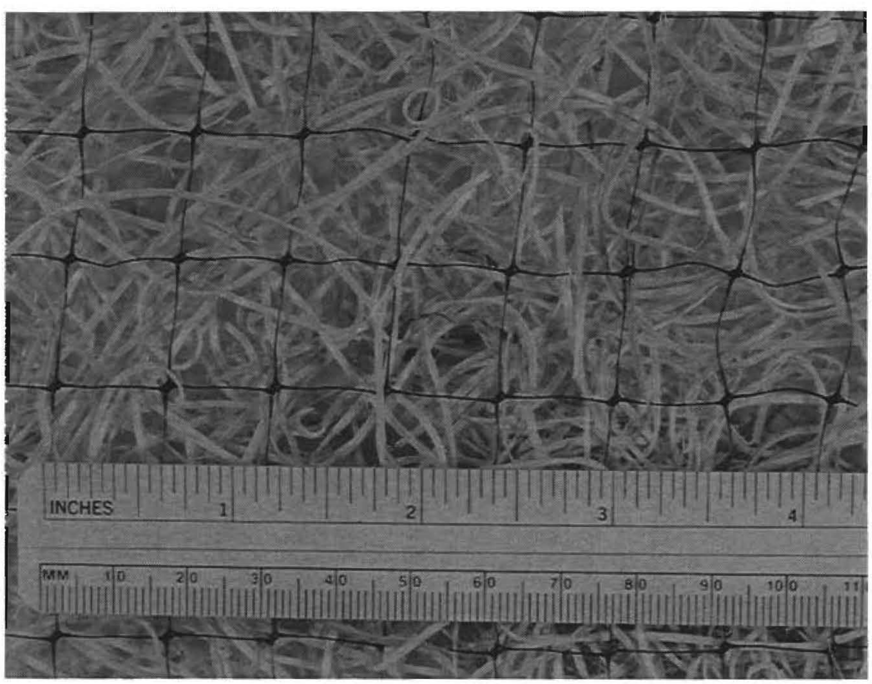


Figure 4. American Excelsior Curlex®

Xcel Regular®

Xcel Regular® is manufactured by PPS Packaging Company based in Fowler, California. Xcel Regular® is made from pure clean Colorado Aspen wood excelsior reinforced with polypropylene netting. A photodegradable synthetic mesh, adhering to the wood excelsior by their PLASTISTITCH® knitting process using degradable thread, covers the top side.

Table C. PPS Packaging Co., Xcel Regular® Product Specifications

Xcel Regular®	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Wood excelsior	Width - 4 ft.
Weight - 0.98 lbs./sy.	Lenght - 180 ft.
Mesh - 1"x1" green plastic	Weight - 78 lbs.
	Area - 80 sy.

Source: PPS Packaging Co. Product Installation Guidelines, 1991.

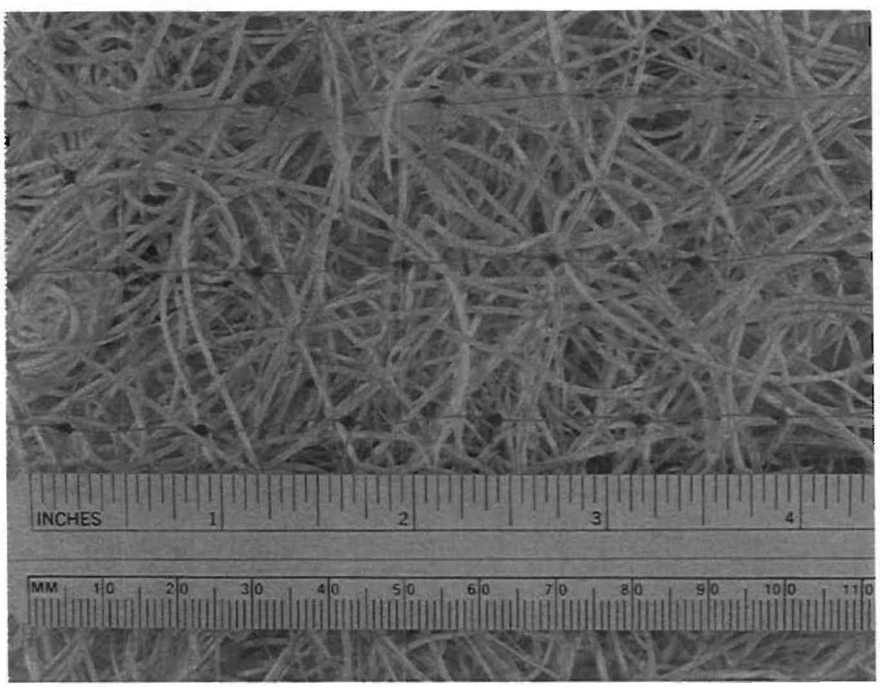


Figure 5. PPS Packaging Co., Xcel Regular®

Xcel Superior®

Xcel Superior® is manufactured by PPS Packaging Company based in Fowler, California. Xcel Superior® is made from pure clean Colorado Aspen wood excelsior reinforced with polypropylene netting. The top and bottom sides are covered with a photodegradable synthetic mesh that is adhered to the wood excelsior by their PLASTISTITCH® knitting process using degradable thread.

Table D. PPS Packaging Co., Xcel Superior® Product Specifications

Xcel Superior®	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Wood excelsior Weight - 1.0 lbs./sy. Mesh - 5/8"x 3/4" black plastic	Width - 4 ft. Lenght - 180 ft. Weight - 80 lbs. Area - 80 sy.

Source: PPS Packaging Co. Installation Guidelines, 1991.

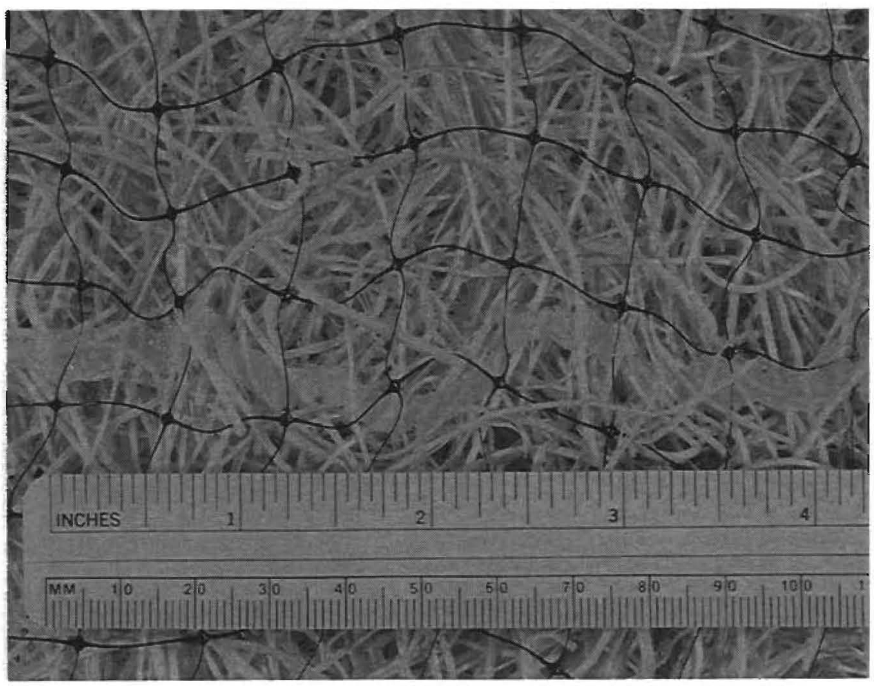


Figure 6. PPS Packaging Co., Xcel Superior®

ANTI-WASH®/GEOJUTE® (Regular)

ANTI-WASH®/GEOJUTE®, manufactured by Belton Industries, Inc. based in Atlanta, Georgia, is a woven bio-degradable natural jute mat with an open weave construction. It is highly absorbent and has no synthetic nettings.

Table E. Belton Industries, ANTI-WASH®/GEOJUTE® Product Specifications

ANTI-WASH®/GEOJUTE® (Regular)	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Yarn - Jute, undyed & unbleached	Width - 4 ft.
Yarn count - 78/width, min.	Lenght - 225 ft.
Weft - 42/linear yard	Weight - 92 lbs.
Water absorption - > 450% of fabric wt.	Area - 100 sy.

Source: Belton Industries Installation Guidelines, 1991.

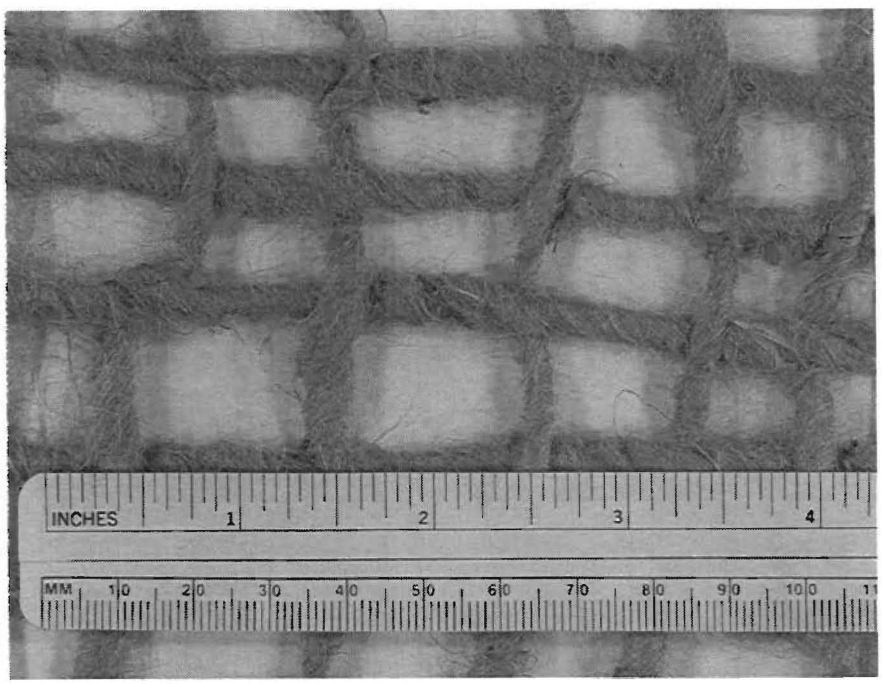


Figure 7. Belton Industries, ANTI-WASH®/GEOJUTE®

North American Green® S75

North American Green® S75, manufactured by North American Green, Inc. based in Evansville, Indiana, is a 100% wheat straw matrix sewn into a lightweight photo-degradable netting on the top side. The blanket is sewn together with a bio-degradable cotton thread.

Table F. North American Green® S75 Product Specifications

North American Green® S75	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Straw = 100%, 0.5 lb/sy (0.27 kg/sq m)	Width - 6.5 ft. (2m)
Net = Black synthetic, one side	Lenght - 83.5 ft. (25.5m)
Thread = biodegradable cotton	Weight - 30 lbs. (13.6kg)
	Area - 60 sy. (51sq m)

Source: North American Green Installation Guidelines, 1991.

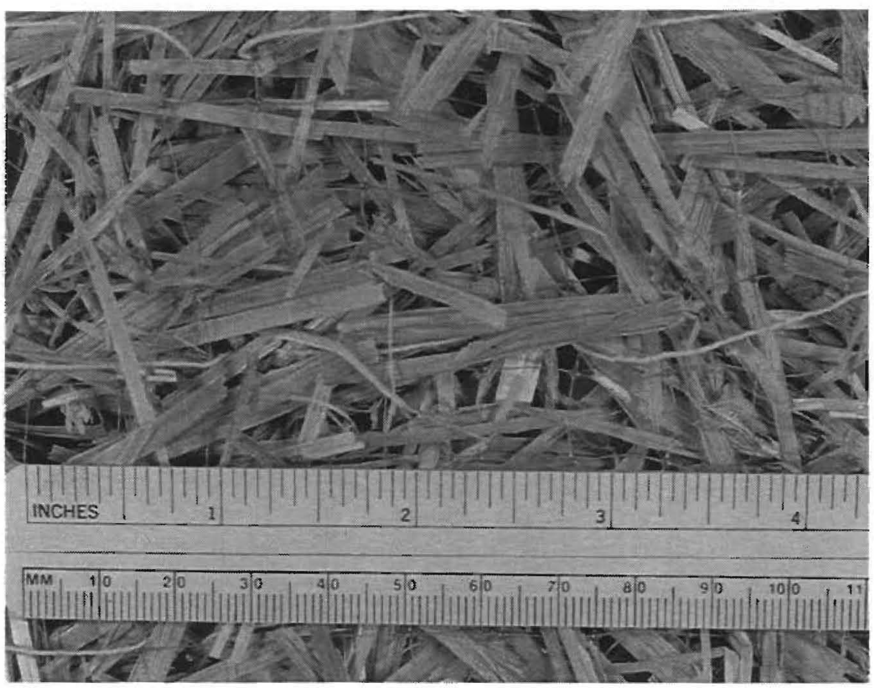


Figure 8. North American Green® S75

North American Green® S150

North American Green® S150, manufactured by North American Green, Inc. based in Evansville, Indiana, is made of a 100% biodegradable straw fiber matrix with photo-degradable netting on both sides. The blanket is sewn together with bio-degradable cotton thread.

Table G. North American Green® S150 Product Specifications

North American Green® S150	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Straw = 0.5 lbs./sy (0.27 kg/sq m)	Width - 6.5 ft. (2m)
Net = Black synthetic, both sides	Lenght - 83.5 ft.(25.5m)
Thread = biodegradable cotton	Weight - 30 lbs. (13.6 kg)
	Area - 60 sy. (51 sq m)

Source: North American Green Installation Guidelines, 1991.

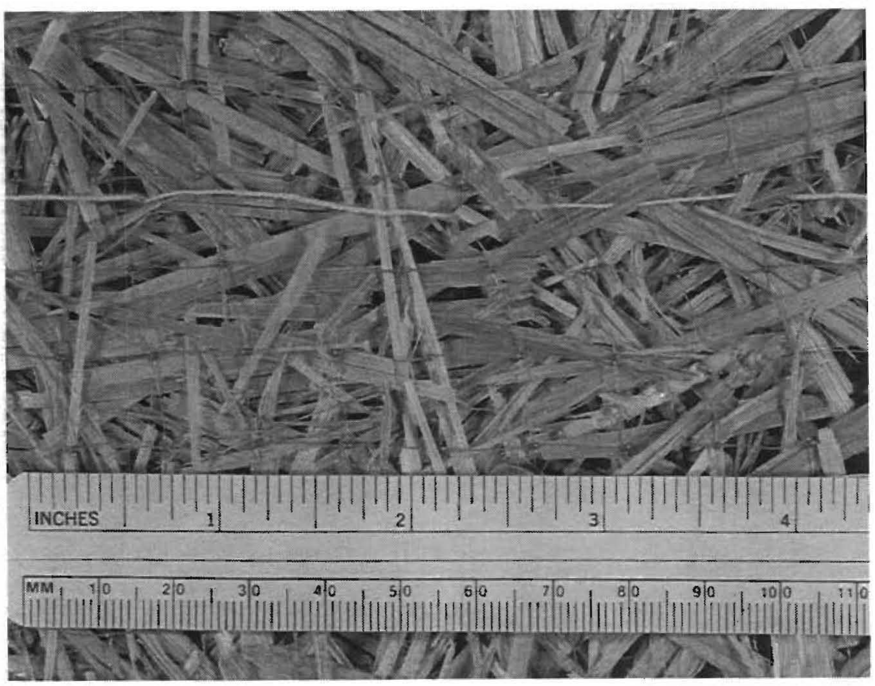


Figure 9. North American Green® S150

Verdyol® ERO-MAT®

Verdyol® ERO-MAT®, manufactured by Verdyol Alabama, Inc. based in Pell City, Alabama, is made from clean wheat straw from agricultural crops that is made into a machine assembled knitted straw blanket. The top side is covered with a photodegradable synthetic mesh that is adhered to the straw by a knitting process using degradable thread.

Table H. Verdyol® ERO-MAT® Product Specifications

Verdyol® ERO-MAT®	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Straw = wheat primary component	Width - 7.5 ft.
Thickness = 3/8" +/- 1/8"	Lenght - 120 ft.
Mesh - synthetic, 1/4"x 1/4"	Weight - 50 lbs.
Dry weight = > 0.55 lb./sy	Area - 100 sy.

Source: Verdyol Alabama Installation Guidelines, 1991.

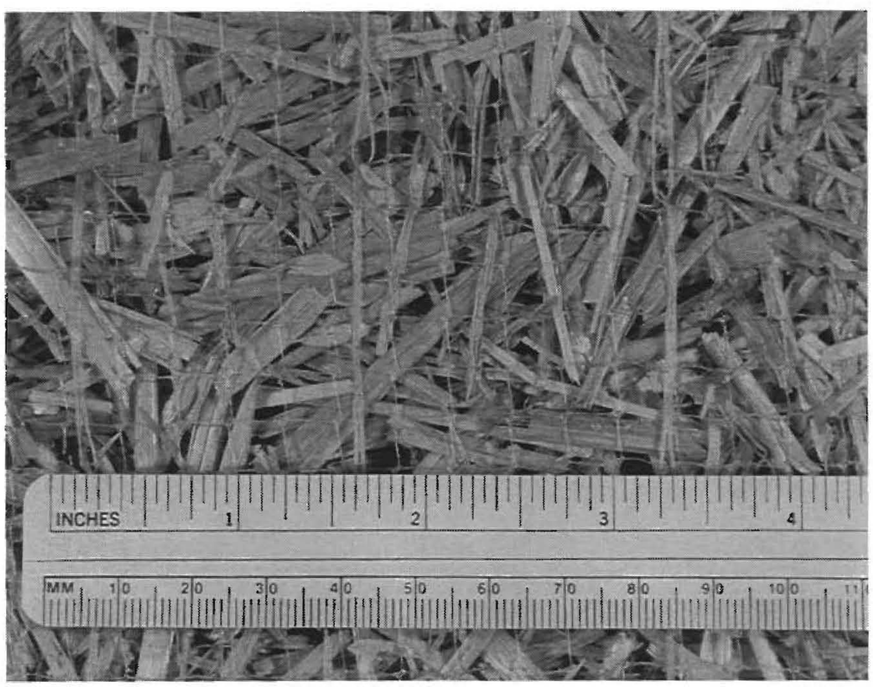


Figure 10. Verdyol® ERO-MAT®

North American Green® SC150

North American Green® SC150, manufactured by North American Green, Inc. based in Evansville, Indiana, is a 70% wheat straw and 30% coconut fiber matrix sewn between an ultra-violet (UV) stabilized black netting on the top side and a lightweight netting on the bottom. The blanket is sewn together with bio-degradable cotton thread.

Table I. North American Green® SC150 Product Specifications

North American Green® SC150	
MATERIAL SPECIFICATIONS	ROLL SPECIFICATIONS
Straw = 0.35 lb./sy (0.19 kg/sq m)	Width - 6.5 ft. (2m)
Coconut = 0.15 lb./sy (0.08 kg/sq m)	Length - 83.5 ft. (25.5m)
Net = heavyweight UV stabilized (top) lightweight net (bottom)	Weight - 30 lbs. (13.6kg) Area - 60 sy. (51 sq m)

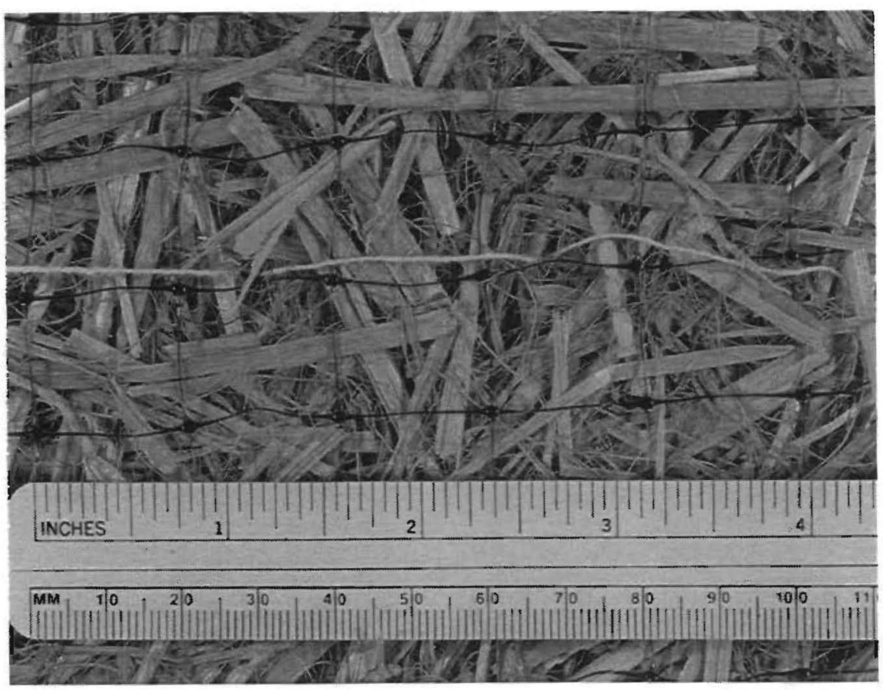


Figure 11. North American Green® SC150

Source: North American Green Installation Guidelines, 1991.

POLYJUTE™ 407GT

POLYJUTE™ 407GT, manufactured by Synthetic Industries, Construction Products Division based in Chattanooga, Tennessee, is a flexible, woven polypropylene photo-degradable mesh.

Table J. Synthetic Industries, POLYJUTE™ 407GT Product Specifications

POLYJUTE™ 407GT			
MATERIAL SPECIFICATIONS			ROLL SPECIFICATIONS
Physical Property	Test Method	Average Value	Width - 4 ft. 3 in., or 12 ft. 10 in.
Tensil strength (#/ft)	ASTMD-4602	225 x 120	Length - 432 ft.
Weight (oz/sy)	ASTMD-3776	2.25	Weight - 33 lbs. or 100 lbs.
Opening size	Measured	0.10 x 0.15"	Area - 204 sy. or 616 sy.
Color		Natural Beige	

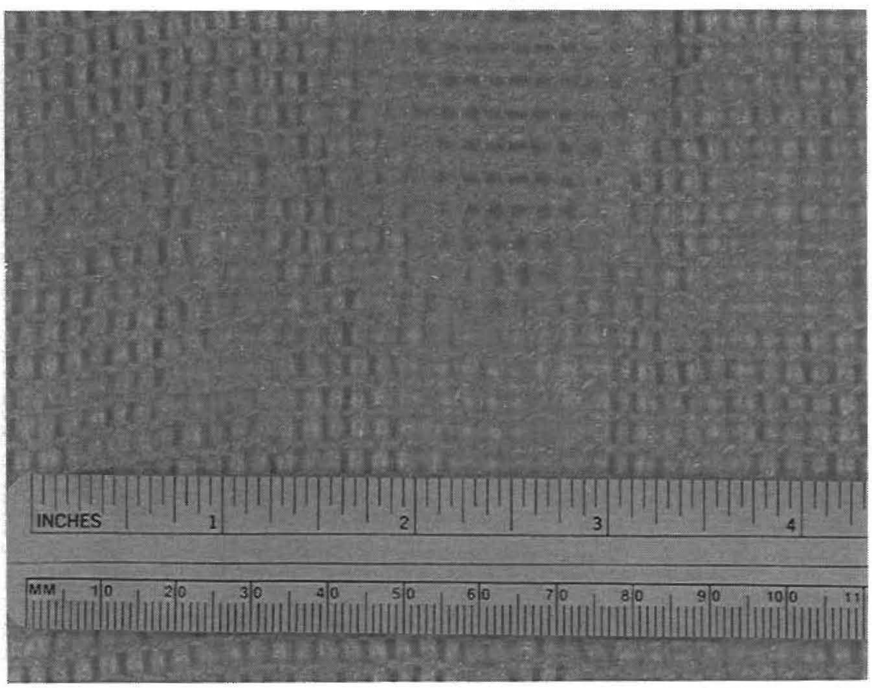


Figure 12. Synthetic Industries, POLYJUTE™ 407GT

Source: Synthetic Industries Installation Guidelines, 1991.
GREENSTREAK® PEC-MAT®

GREENSTREAK® PEC-MAT®, manufactured by Greenstreak, Inc. based in St. Louis, Missouri, is a flexible, non-woven mat of randomly oriented monofilaments thermally welded together into a three-dimensional porous web.

Table K. GREENSTREAK® PEC-MAT® Product Specifications

GREENSTREAK® PEC-MAT®			
MATERIAL SPECIFICATIONS			ROLL SPECIFICATIONS
Physical Property	Test Method	Average Value	Width - 6 ft.
Tensil strength (#/ft)	ASTMD-4595-86	12 x 7	Length - 150 ft.
Weight (oz/sy)	ASTMD-3776	28 +	Weight - 175 lbs.
Porosity (%)	CWD 02215-86	72	Area - 100 sy.
Color		Grass Green	

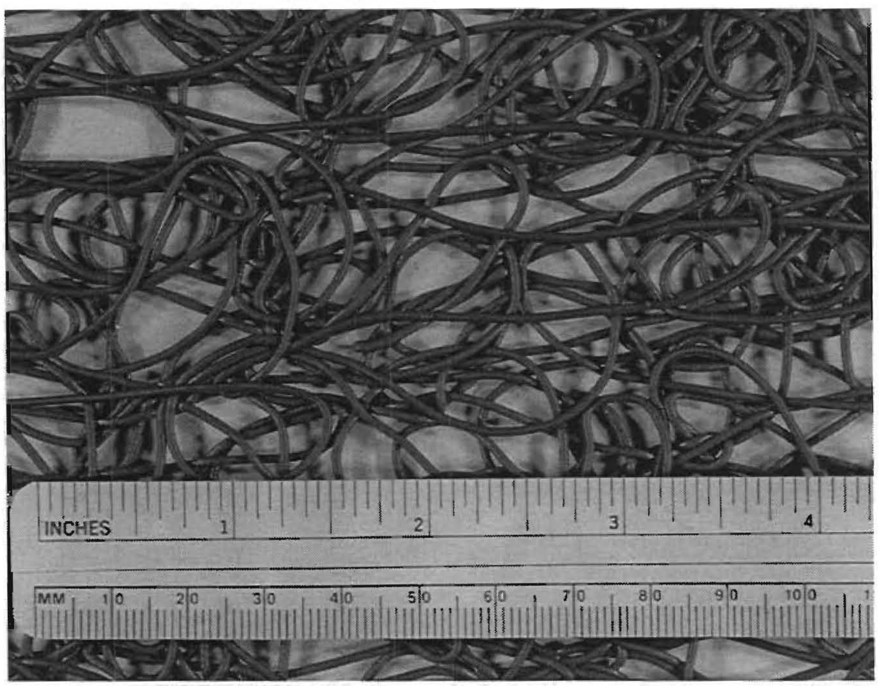


Figure 13. GREENSTREAK® PEC-MAT®

Source: GREENSTREAK® Installation Guidelines, 1991.

Polyfelt TS220

Polyfelt TS220[7], manufactured by Polyfelt, Inc. based in Evergreen, Colorado, is an ultra-violet stabilized, spunbonded, continuous filament, needlepunched, polypropylene, nonwoven geotextile with the following properties.

Table L. Polyfelt TS220 Product Specifications

POLYFELT TS220			
MATERIAL SPECIFICATIONS			ROLL SPECIFICATIONS
Physical Property	Test Method	Average Value	Width - 15 ft.
Grab strength (#/ft)	ASTMD-4632	90	Length - 360 ft.
Weight (oz/sy)	ASTMD-3776	3.3	Weight - 150 lbs.
Permeability (cm/sec)	ASTMD-4491	0.5	Area - 600 sy.
UV resistance	ASTMD-4355	> 70%	

Source: Polyfelt TS220 Installation Instructions, 1991.

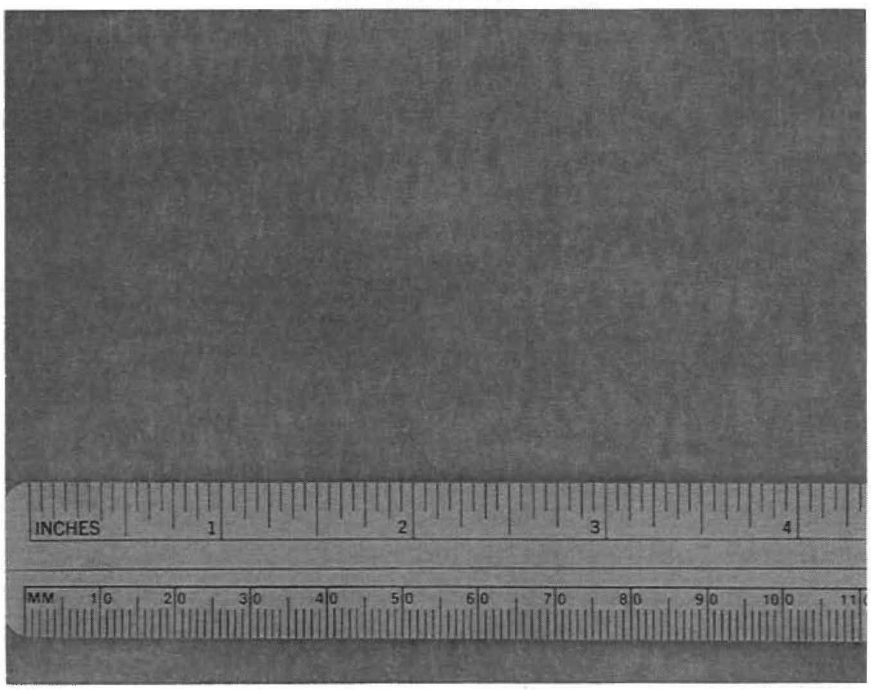


Figure 14. Polyfelt TS220

[7]The manufacturer has requested evaluation for performance data only. The material will not be included as a viable candidate for the approved materials list under Item 169, "Soil Retention Blanket".

IV. EVALUATION PROCEDURES FOR TEMPORARY EROSION CONTROL MATERIALS

Soil Preparation

Researchers cleared all slope plots of vegetation, as well as repaired and brought them back to a reasonably uniform grade. The soil on the plots was graded with a chain link drag and left in a loose condition. Hand raking the surface fine graded the soil.

Seeding

The seeding mixtures used came from the specification to be enacted in the 1992 TxDOT Standard Specifications for Construction of Highways, Streets and Bridges, ***Item 164, Seeding for Erosion Control***. The seeding mixtures used were for District 17-Bryan, as recommended by TxDOT, Operations and Maintenance Division, Landscape Section. Researchers applied fertilizer was integrally with the seed mixtures at the rate of 225 lbs/ac (102 kilograms per hectare). Seed and fertilizer were applied to each plot with a hydroseeder just prior to the installation of the blanket.

Material Installation

Researchers installed the selected erosion control materials in accordance with the manufacturer's **published** technical publications and recommendations. All work was performed under the supervision of the Hydraulics and Erosion Control Laboratory Manager. Individual manufacturer's technical representatives attended the installation of their materials to assure that all published recommendations and installation requirements had been met prior to initiating formal evaluation procedures. The following pages describe the installation of each of the materials replicated on the sand and clay soils.

American Excelsior Curlex® - 2:1 Sand Slope

The Curlex® blanket was installed according to the manufacturer's published literature on May 24, 1991. Researchers extended the material 3' (0.91-m) beyond the top of the slope and placed staples every 12" (0.30-m) on center. The blanket was rolled downhill in the direction of the water flow. Researchers butted together the edges of parallel blankets and stapled them with a common row of staples. The ends of blankets were butted snugly together and stapled with a common row of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the Curlex material, no visible signs of punctures, tears, or other physical damage existed. Figure 15 graphically depicts the installation of the Curlex® blanket on the 2:1 sand slope.

American Excelsior Curlex® - 2:1 Clay Slope

The Curlex® blanket was installed according to the manufacturer's published literature on May 24, 1991. The material was extended 3' (0.91-m) beyond the top of the slope and staples were placed every 12"

(0.30-m) on center. The blanket was rolled downhill in the direction of the water flow. The edges of parallel blankets were butted together and stapled with a common row of staples. Researchers butted the ends of blankets snugly together and stapled with a common row of staples. The staple pattern measured a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Curlex material, no visible signs of punctures, tears, or other physical damage existed. Figure 15 graphically depicts the installation of the Curlex blanket on the 2:1 clay slope.

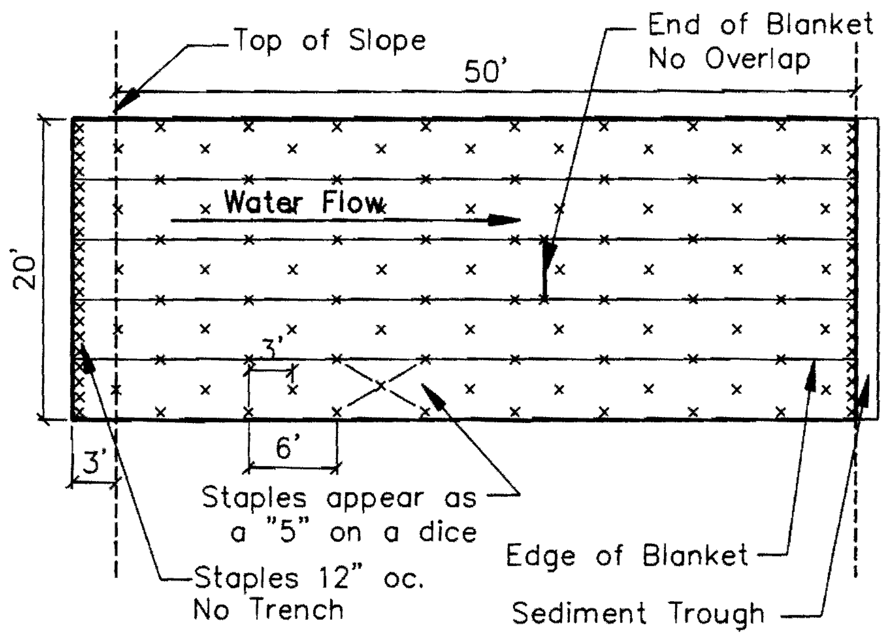


Figure 15. American Excelsior Curlex® - 2:1 Sand & Clay Installation Plan

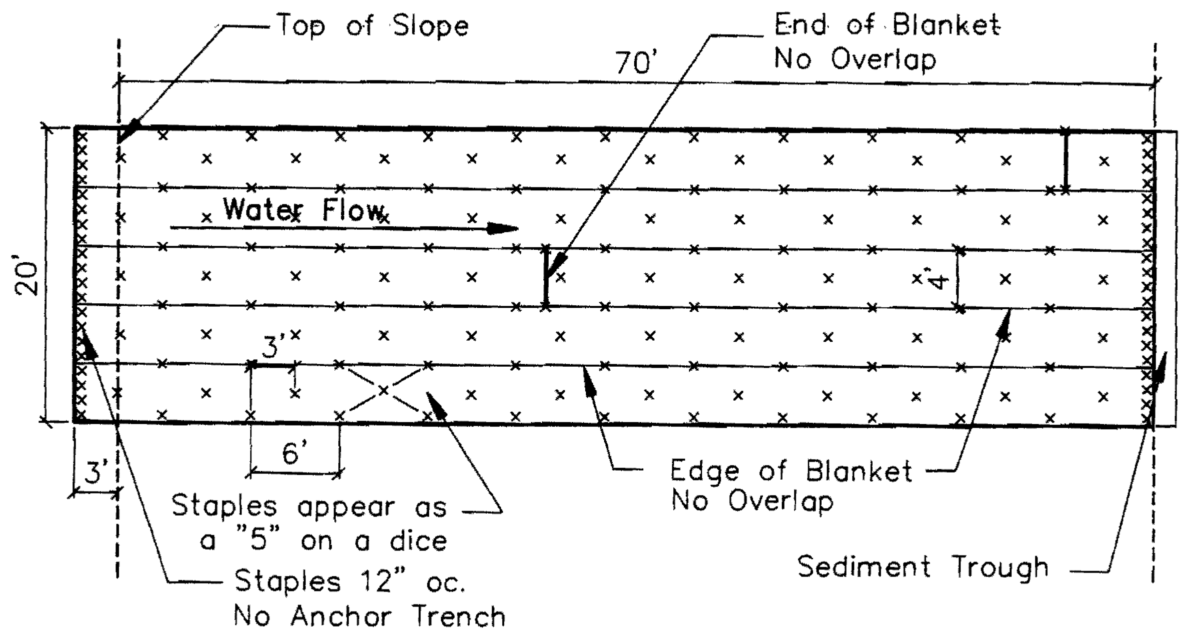


Figure 16. American Excelsior Curlex® - 3:1 Sand & Clay Installation Plan

American Excelsior Curlex® - 3:1 Sand Slope

The Curlex® blanket was installed according to the manufacturer's published literature on May 24, 1991. The material was extended 3' (0.91-m) beyond the top of the slope and staples were placed every 12" (0.30-m) on center. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were butted together and stapled with a common row of staples. Researchers butted the ends of blankets snugly together and stapled them with a common row of staples. The staple pattern was a 6' x 3' (1.83 x 0.91 m) pattern and the staple size was 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the Curlex material, no visible signs of punctures, tears, or other physical damage existed. Figure 16 graphically depicts the installation of the Curlex blanket on the 3:1 sand slope.

American Excelsior Curlex® - 3:1 Clay Slope

The Curlex® blanket was installed according to the manufacturer's published literature on May 24, 1991. Researchers extended the material 3' (0.91-m) beyond the top of the slope and placed staples every 12" (0.30-m) on center. The blanket was rolled downhill in the direction of the water flow. The edges of parallel blankets were butted together and stapled with a common row of staples. Researchers butted the ends of blankets snugly together and stapled them with a common row of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Curlex® material, no visible signs of punctures, tears, or other physical damage. Figure 16 graphically depicts the installation of the Curlex® blanket on the 3:1 clay slope.

Xcel Regular® - 3:1 Sand Slope

The Xcel Regular® blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. The blanket was rolled downhill in the direction of the water flow with the net on the topside. Researchers overlapped the edges of parallel blankets 2" (50-mm) with a common row of staples. The ends of blankets were spliced down the slope by placing blankets end of end (shingle style) with approximately 2" (50-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 5' x 2-1/2' (1.5 x 0.76 m) pattern, and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the Xcel Regular® material, no visible signs of punctures, tears, or other physical damage existed. Figure 17 graphically depicts the installation of the Xcel Regular® blanket on the 3:1 sand slope.

Xcel Regular® - 3:1 Clay Slope

The Xcel Regular® blanket was installed according to the manufacturer's published literature on May 18, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. The blanket was rolled downhill in the direction of the water flow with the net on the topside. Researchers overlapped the edges of parallel blankets 2" (50-mm) with a common row of staples. The ends of blankets were spliced down the slope by placing blankets end over end (shingle style) with approximately 2" (50-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 5' x 2-1/2' (1.5 x 0.76 m) pattern, and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Xcel Regular® material, there were no visible signs of punctures, tears, or other physical damage. Figure 17 graphically depicts the installation of the Xcel Regular® blanket on the 3:1 clay slope.

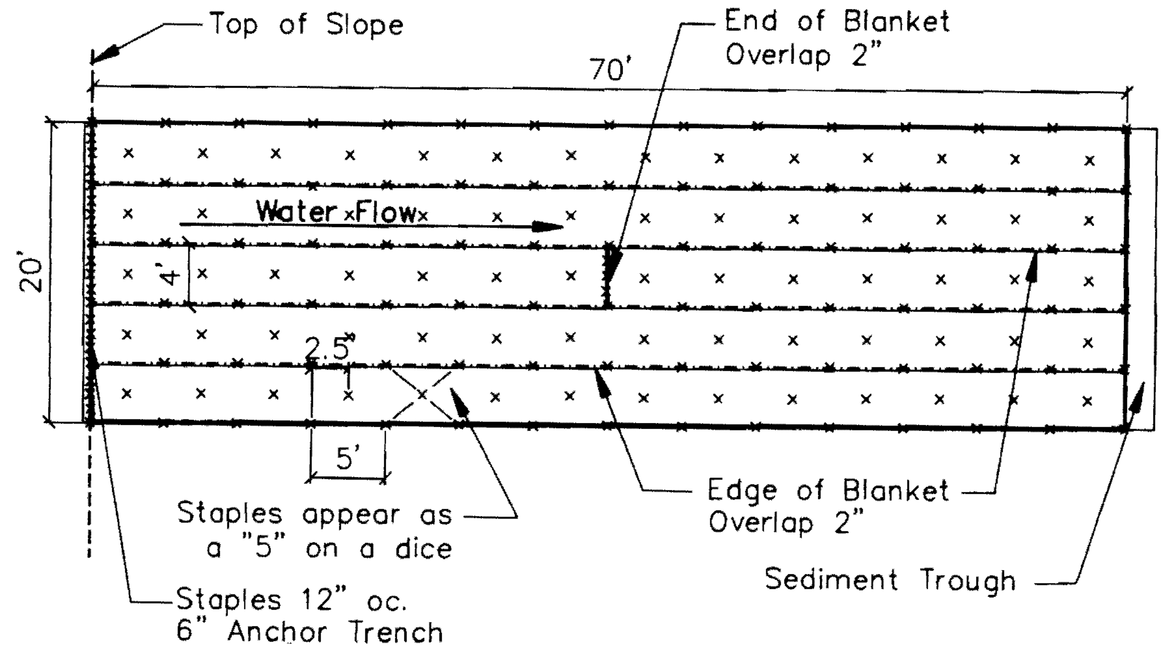


Figure 17. PPS Packaging Co., Xcel Regular® - 3:1 Sand & Clay Installation Plan

Xcel Superior® - 2:1 Sand Slope

The Xcel Superior® blanket was installed according to the manufacturer's published literature on May 18, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 2" (50-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 5' x 2-1/2' (1.5 x 0.76 m) pattern, and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the Xcel Superior® material, no visible signs of punctures, tears, or other physical damage existed. Figure 18 graphically depicts the installation of the Xcel Superior® blanket on the 2:1 sand slope.

Xcel Superior® - 2:1 Clay Slope

The Xcel Superior® blanket was installed according to the manufacturer's published literature on May 18, 1991. Researchers anchored the material in a 6" x 6" (1.83 x 1.83 m) anchor trench at the top of the slope with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 2" (50-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 5' x 2-1/2' (1.5 x 0.76 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x .02 x 0.15 m). During the installation of the Xcel Superior® material, no visible signs of punctures, tears, or other physical damage. Figure 18 graphically depicts the installation of the Xcel Superior® blanket on the 2:1 clay slope.

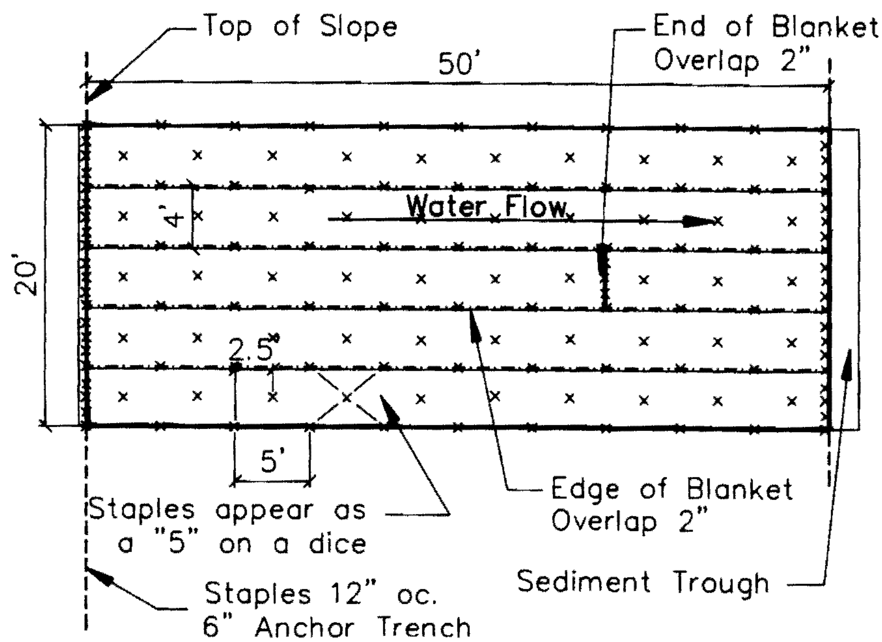


Figure 18. PPS Packaging Co., Xcel Superior® - 3:1 Sand & Clay Installation Plan

ANTI-WASH®/GEOJUTE® (Regular) - 2:1 Sand Slope

The ANTI-WASH®/GEOJUTE® blanket was installed according to the manufacturer's published literature on May 28, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical side of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped between 2 to 6 inches (50-mm to 150-mm) and stapled separately with staples placed side by side. Researchers spliced the blankets down the slope by overlapping the edges between 4 to 8 inches (100-mm to 200-mm) in a shingle style, with the overlapped area stapled every 12" (0.30-m) on center. The staple pattern was every 18 to 24 inches (0.46-m - 0.61-m) on center, and the staple size measured 8" x 2" x 8" (0.20x0.05x0.20m). During the installation of the ANTIWASH®/GEOJUTE® material, no visible signs of punctures, tears, or other physical damage existed. Figure 19 graphically depicts the installation of the ANTIWASH®/GEOJUTE® blanket on the 2:1 sand slope.

ANTIWASH®/GEOJUTE® (Regular) - 2:1 Clay Slope

The ANTIWASH®/GEOJUTE® blanket was installed according to the manufacturer's published literature on May 28, 1991. Researchers anchored the material in a 6" x 6" (1.83 x 1.83m) anchor trench at the top of the slope, with staples placed every 12" (0.30 m) on center on the vertical side of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped between 2 to 6 inches (50-mm to 150-mm) and stapled separately with staples placed side by side. The blankets were spliced down the slope by overlapping the edges between 4 to 8 inches (100-mm to 200-mm) in a shingle style, with the overlapped area stapled every 12" (0.30-m) on center. The staple pattern was every 18 to 24 inches on center, and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the ANTIWASH®/GEOJUTE® (Regular) material, no visible signs of punctures, tears, or other physical damage. Figure 19 graphically depicts the installation of the ANTIWASH®/GEOJUTE· blanket on the 2:1 clay slope.

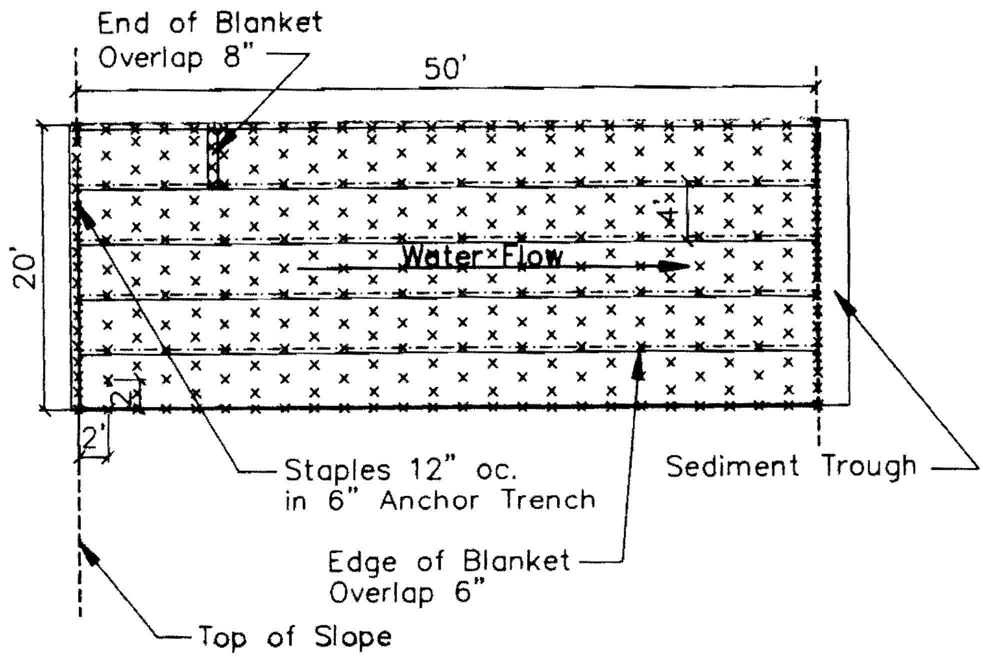


Figure 19. Belton Industries, ANITWASH®/GEOJUTE® (Regular) - 2:1 Sand & Clay Installation Plan

North American Green® S75 - 3:1 Sand Slope

The North American Green® S75 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 4' x 2' (1.22 x 0.60 m) pattern and the staple size measured 8" x 2" x 8" (0.2 x 0.05 x 0.20 m). During the installation of the North American Green® S75 material, no visible signs of punctures, tears, or other physical damage existed. Figure 20 graphically depicts the installation of the North American Green® S75 blanket on the 3:1 sand slope.

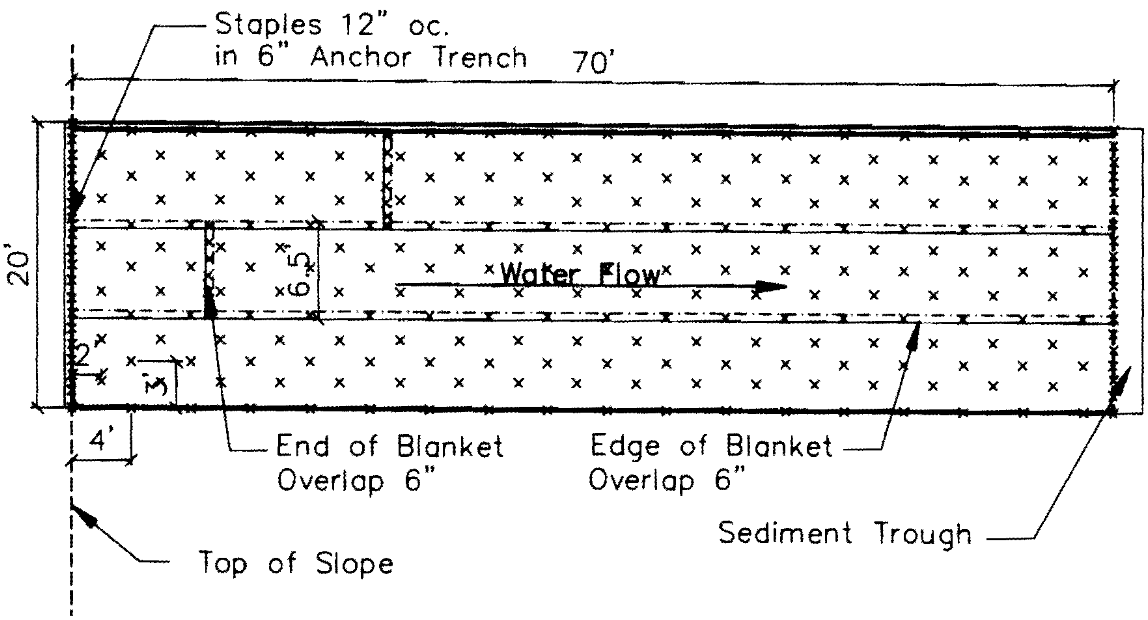


Figure 20. North American Green® S75 - 3:1 Sand Installation Plan

North American Green® S75 - 3:1 Clay Slope

The North American Green® S75 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope with staples placed every 12" on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the North American Green® S75 material, no visible signs of punctures, tears, or other physical damage. Figure 21 graphically depicts the installation of the North American Green® S75 blanket on the 3:1 clay slope.

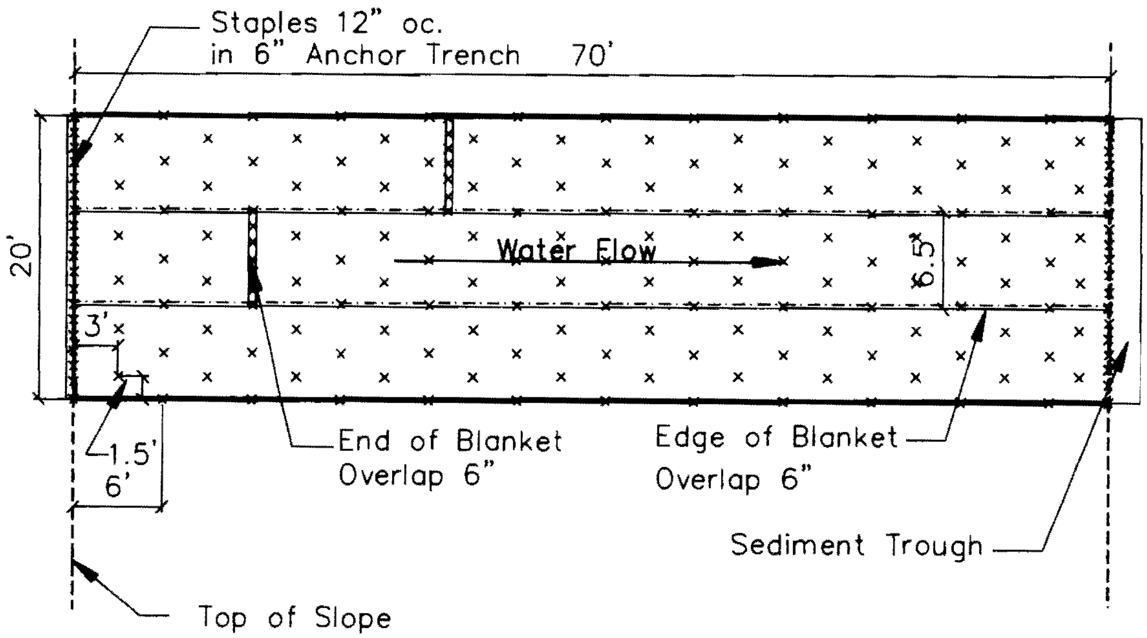


Figure 21. North American Green® S75 - 3:1 Clay Installation Plan

North American Green® S150 - 2:1 Sand Slope

The North American Green® S150 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled them with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 4' x 2' (1.22 x 0.60 m) pattern, and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m) During the installation of the North American Green® S150 material, no visible signs of punctures, tears, or other physical damage existed. Figure 22 graphically depicts the installation of the North American Green® S150 blanket on the 2:1 sand slope.

North American Green® S150 - 2:1 Clay Slope

The North American Green® S150 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled with a common row of staples every 12" (0.30-m) on center. The staple pattern, formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the North American Green® S150 material, no visible signs of punctures, tears, or other physical damage existed. Figure 23 graphically depicts the installation of the North American Green® S150 blanket on the 2:1 clay slope.

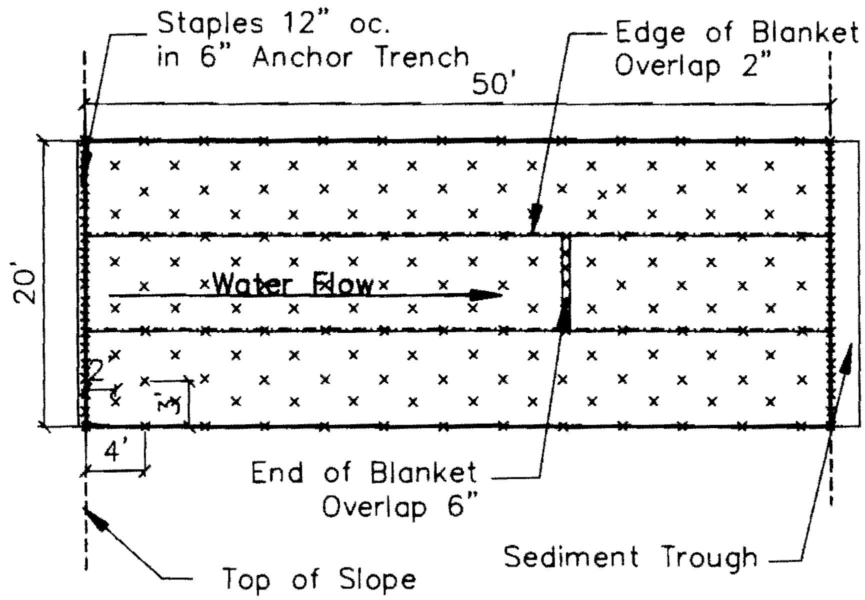


Figure 22. North American Green® S150 - 2:1 Sand Installation Plan

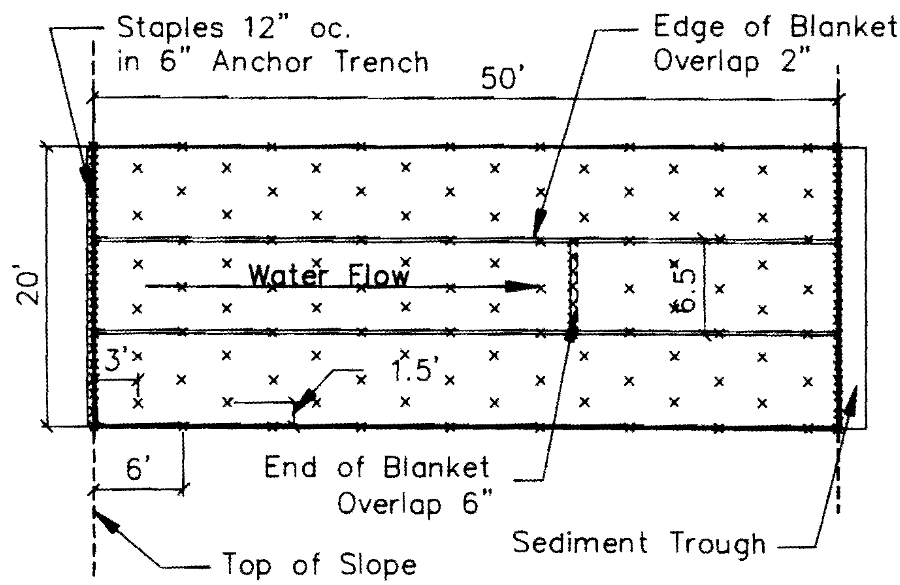


Figure 23. North American Green® S150 - 2:1 Clay Installation Plan

Verdyol® ERO-MAT® - 3:1 Sand Slope

The Verdyol® ERO-MAT® blanket was installed according to the manufacturer's published literature on May 22, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical side of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were snugly butted together with a common row of staples. Researchers butted the ends of blankets snugly together and stapled them with a common row of staples. The staple pattern formed a dice pattern that was 7-1/2' x 3-3/4' (2.29 x 1.14 m), and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the Verdyol® ERO-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 24 graphically depicts the installation of Verdyol® ERO-MAT® blanket on the 3:1 sand slope.

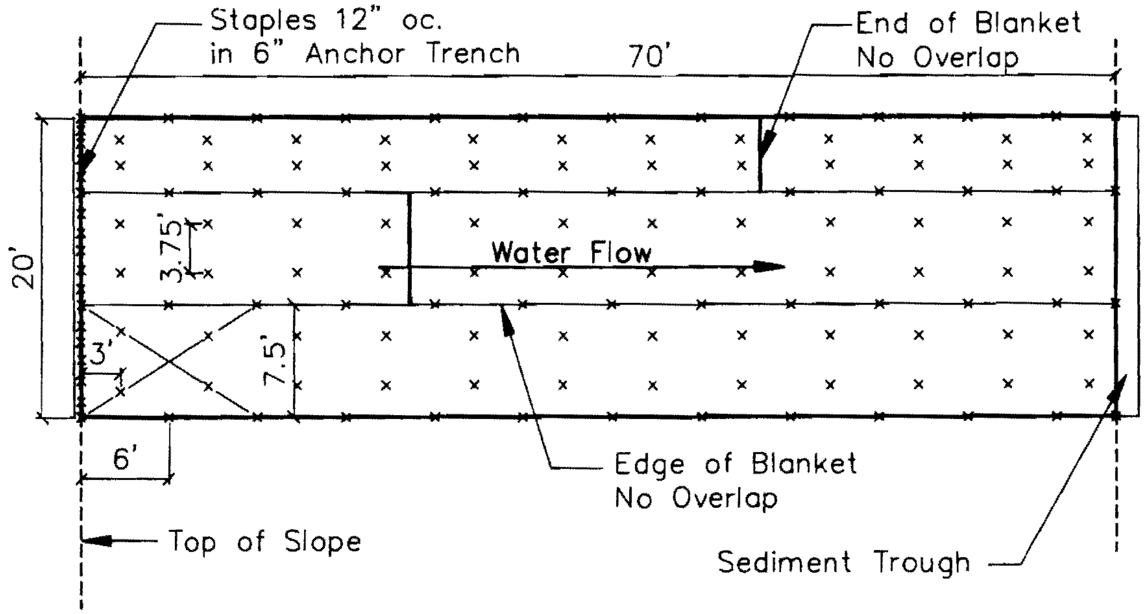


Figure 24. Verdyol® ERO-MAT® - 3:1 Sand & Clay Installation Plan

Verdyol® ERO-MAT® - 3:1 Clay Slope

The Verdyol® ERO-MAT® blanket was installed according to the manufacturer's published literature on May 22, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical side of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were snugly butted together with a common row of staples. Researchers butted the ends of blankets snugly together and stapled them with a common row of staples. The staple pattern formed a dice pattern that was 7-1/2' x 3-3/4' (2.29 x 1.14 m), and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Verdyol® ERO-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 24 graphically depicts the installation of Verdyol® ERO-MAT® blanket on the 3:1 clay slope.

North American Green® SC150 - 2:1 Sand Slope

The North American Green® SC150 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled them with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 4' x 2' (1.22 x 0.60 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the North American Green® SC150 material, no visible signs of punctures, tears, or other physical damage existed. Figure 25 graphically depicts the installation of North American Green® SC150 blanket on the 2:1 sand slope.

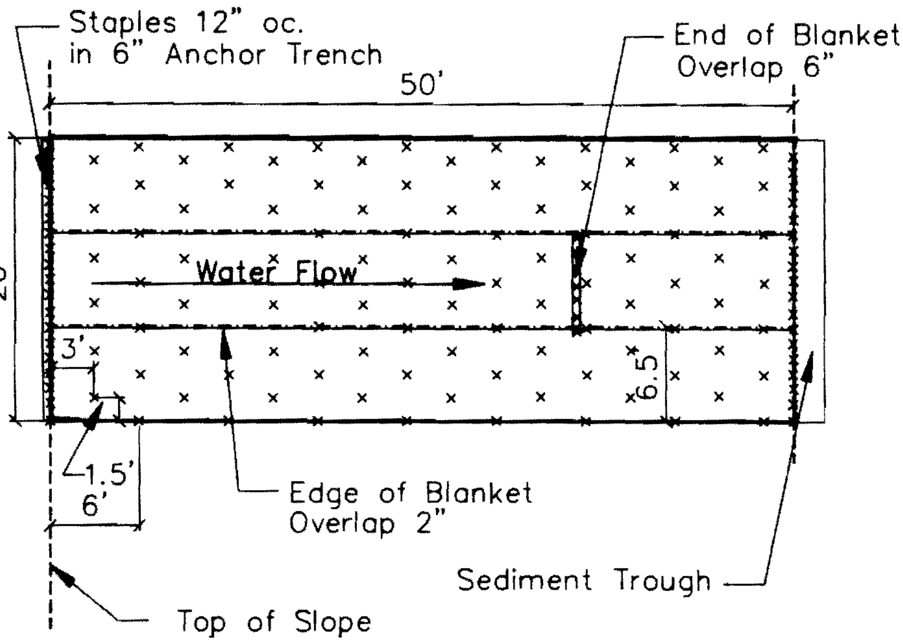


Figure 25. North American Green® SC150 - 2:1 Sand Installation Plan

North American Green® SC150 - 2:1 Clay Slope

The North American Green® SC150 blanket was installed according to the manufacturer's published literature on May 17, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the vertical wall of the anchor trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow with the net on the topside. The edges of parallel blankets were overlapped a minimum of 2" (50-mm) with a common row of staples. Researchers spliced the ends of blankets down the slope by placing blankets end over end (shingle style), with approximately 6" (150-mm) overlap and stapled them with a common row of staples every 12" (0.30-m) on center. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern, and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the North American Green® SC150 material, no visible signs of punctures, tears, or other physical damage existed. Figure 26 graphically depicts the installation of North American Green® SC150 blanket on the 2:1 clay slope.

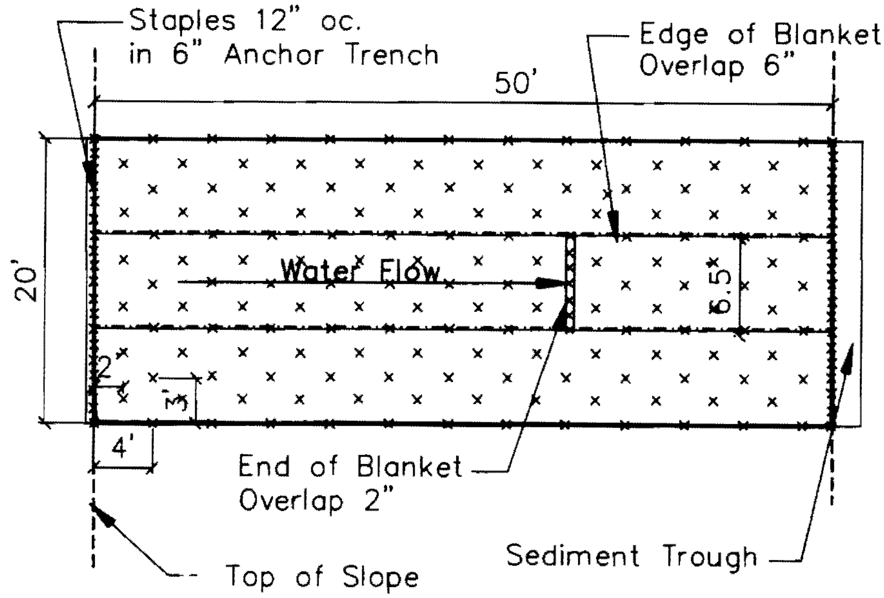


Figure 26. North American Green® SC150 - 2:1 Clay Installation Plan

POLYJUTE 407GT - 2:1 Sand Slope

POLYJUTE 407GT was installed according to the manufacturer's published literature on May 18, 1992. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench located 3' (0.91-m) beyond the top of the slope, with staples placed every 12" (0.30-m) on center in the bottom of the trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 4" (100-mm) and stapled with a common row of staples in the general stapling pattern. During the installation, the need to overlap the ends of the blanket on the slope face did not occur, but the installation detail specifies a 4" (100-mm) overlap in a shingle-style and stapled following the general staple pattern. The staple pattern formed a 3' x 1-1/2' (0.91 x 0.46 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the POLYJUTE 407GT material, no visible signs of punctures, tears, or other physical damage existed. Figure 27 graphically depicts the installation of POLYJUTE 407GT on the 2:1 sand slope.

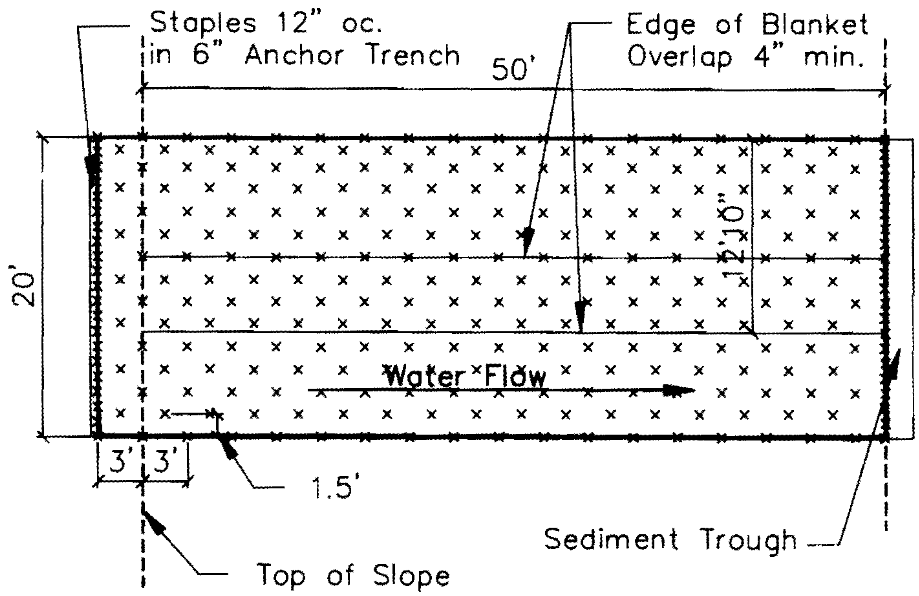


Figure 27. POLYJUTE 407GT - 2:1 Sand & Clay Installation Plan

POLYJUTE 407GT - 2:1 Clay Slope

POLYJUTE 407GT was installed according to the manufacturer's published literature on May 18, 1992. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) trench located 3' (0.91-m) beyond the top of the slope, with staples placed every 12" (0.30-m) on center in the bottom of the trench. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 3 to 6 inches (75-mm to 150-mm) and stapled with a common row of staples in the general stapling pattern. During the installation, the need to overlap the ends of the blanket on the slope face did not occur, but the installation detail specifies a 4" (100-mm) overlap in a shingle style and stapled following the general staple pattern. The staple pattern formed a 3' x 1-1/2' (0.91 x 0.46 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the POLYJUTE 407GT material, no visible signs of punctures, tears, or other physical damage existed. Figure 27 graphically depicts the installation of POLYJUTE 407GT on the 2:1 clay slope.

GREENSTREAK® PEC-MAT® - 2:1 Sand Slope

The GREENSTREAK® PEC-MAT® blanket was installed according to the manufacturer's published literature on May 21, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the bottom of the anchor trench and two rows of staples within 3' (0.91-m) of the anchor trench. The material was anchored in 6" x 6" (0.15 x 0.15 m) perimeter edge (transverse) slots and stapled every 12" (0.30-m) on center. There was one transverse check slot installed mid-way down the slope, which was 6" x 12" (0.20 x 0.30 m) with the material stapled three places on the bottom of the slot. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 3" to 6" (75-mm to150-mm). Researchers spliced the blankets down the slope by overlapping the edges 24" (0.61-m) in a shingle style with the overlapped area stapled with two rows of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the GREENSTREAK® PEC-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 28 graphically depicts the installation of GREENSTREAK® PEC-MAT® on the 2:1 sand slope.

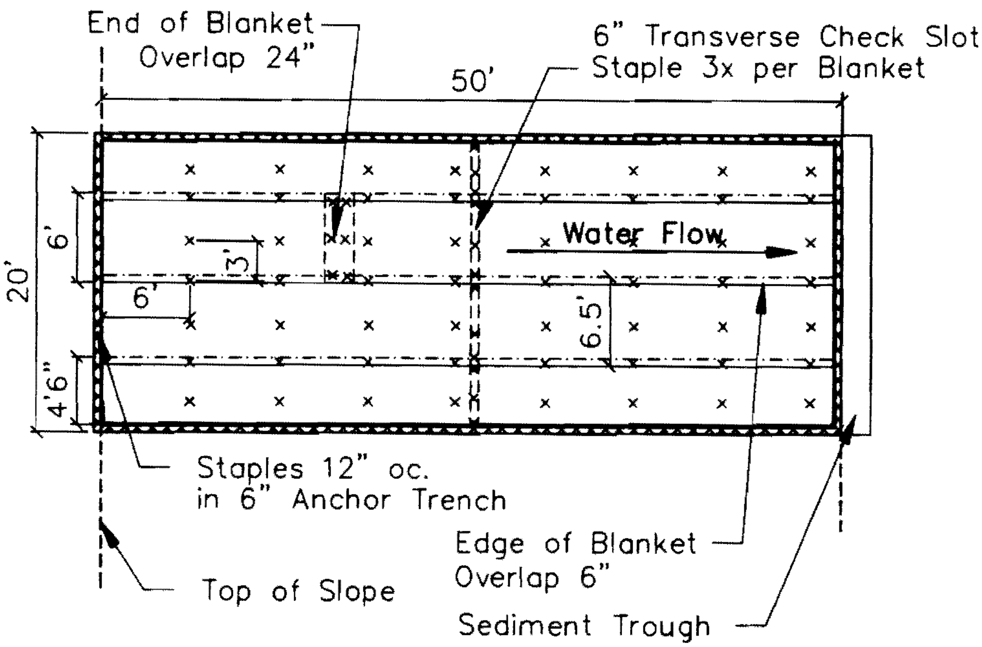


Figure 28. GREENSTREAK® PEC-MAT® - 2:1 Sand & Clay Installation Plan

GREENSTREAK® PEC-MAT® - 2:1 Clay Slope

The GREENSTREAK® PEC-MAT® blanket was installed according to the manufacturer's published literature on May 21, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30 m) on center on the bottom of the anchor trench and two rows of staples within 3' of the anchor trench. The material was anchored in 6" x 6" (0.15 x 0.15m) perimeter edge (transverse) slots and stapled every 12" (0.30-m) on center. There was one transverse check slot installed mid-way down the slope, which was 6" x 12" (0.20 x 0.30 m) with the material stapled three places on the bottom of the slot. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 3 to 6 inches (75-mm to 150-mm). Researchers spliced the blankets down the slope by overlapping the edges 24" (0.60-m) in a shingle style with the overlapped area stapled with two rows of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20m). During the installation of the GREENSTREAK® PEC-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 28 graphically depicts the installation of GREENSTREAK® PEC-MAT® on the 2:1 clay slope.

GREENSTREAK® PEC-MAT® - 3:1 Sand Slope

The GREENSTREAK® PEC-MAT® blanket was installed according to the manufacturer's published literature on May 21, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30 m) on center on the bottom of the anchor trench and two rows of staples within 3' (0.91-m) of the anchor trench. The material was anchored in 6" x 6" (0.15 x 0.15 m) perimeter edge (transverse) slots and stapled every 12" (0.30-m) on center. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 3 to 6 inches (75-mm to 150-mm). Researchers spliced the blankets down the slope by overlapping the edges 24" (0.60-m) in a shingle style with the overlapped area stapled with two rows of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the GREENSTREAK® PEC-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 29 graphically depicts the installation of GREENSTREAK® PEC-MAT® on the 3:1 sand slope.

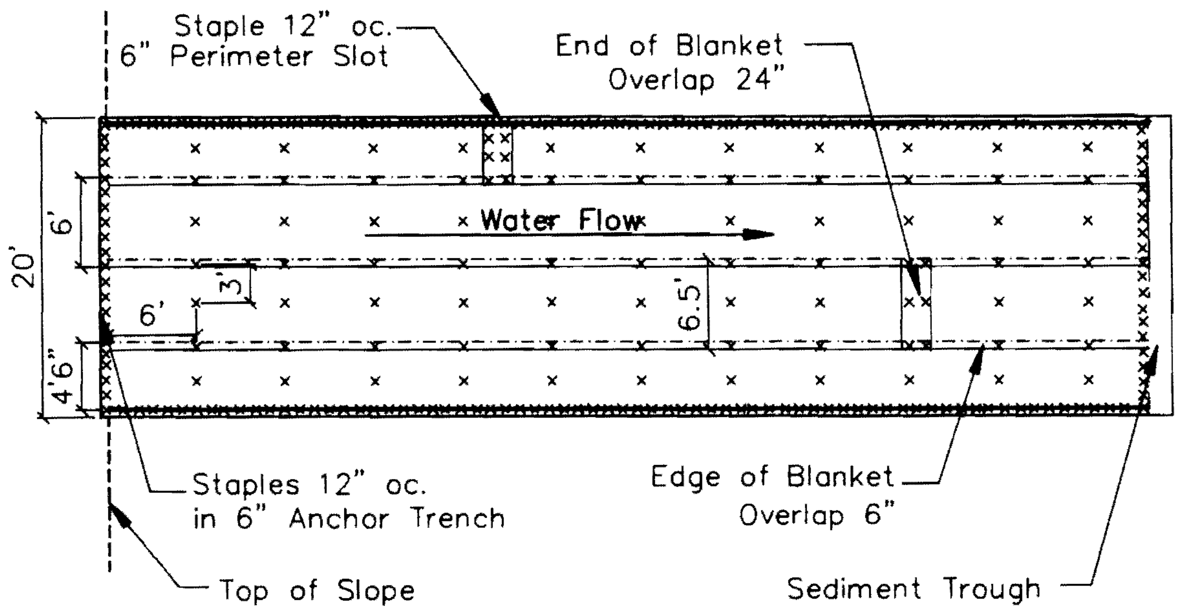


Figure 29. GREENSTREAK® PEC-MAT® - 31 Sand & Clay Installation Plan

GREENSTREAK® PEC-MAT® - 3:1 Clay Slope

The GREENSTREAK® PEC-MAT® blanket was installed according to the manufacturer's published literature on May 21, 1991. Researchers anchored the material in a 6" x 6" (0.15 x 0.15 m) anchor trench at the top of the slope, with staples placed every 12" (0.30-m) on center on the bottom of the anchor trench and two rows of staples within 3' (0.91-m) of the anchor trench. The material was anchored in 6" x 6" (0.15 x 0.15 m) perimeter edge (transverse) slots and stapled every 12" (0.30-m) on center. The backfill was compacted after stapling the blanket. Researchers rolled the blanket downhill in the direction of the water flow. The edges of parallel blankets were overlapped 3 to 6 inches (75-mm to 150-mm). Researchers spliced the blankets down the slope by overlapping the edges 24" (0.60-m) in a shingle style with the overlapped area stapled with two rows of staples. The staple pattern formed a 6' x 3' (1.83 x 0.91 m) pattern and the staple size measured 8" x 2" x 8" (0.20 x 0.05 x 0.20 m). During the installation of the GREENSTREAK® PEC-MAT® material, no visible signs of punctures, tears, or other physical damage existed. Figure 29 graphically depicts the installation of GREENSTREAK® PEC-MAT® on the 3:1 clay slope.

Polyfelt TS220 - 2:1 Sand Slope

The Polyfelt TS220 material was installed according to the guidelines issued by Polyfelt Inc. for the purpose of evaluating their product as a surficial erosion control media. The plot was fine graded in the same manner as the other study plots. Researchers anchored the material in a 6" (150-mm) anchor trench at the top of slope, and stapled every 12" (0.30-m) on the vertical side of the anchor trench. The backfill was compacted after stapling the material. Researchers placed the material in direct contact with the soil and rolled downhill in the direction of water flow. The edges of parallel blankets were overlapped 6" (150-mm). The staple pattern formed a 4' x 2' (1.22 x 0.60 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Polyfelt TS220 material, no visible signs of punctures, tears, or other physical damage existed. Figure 30 graphically depicts the installation of Polyfelt TS220 on the 2:1 sand slope.

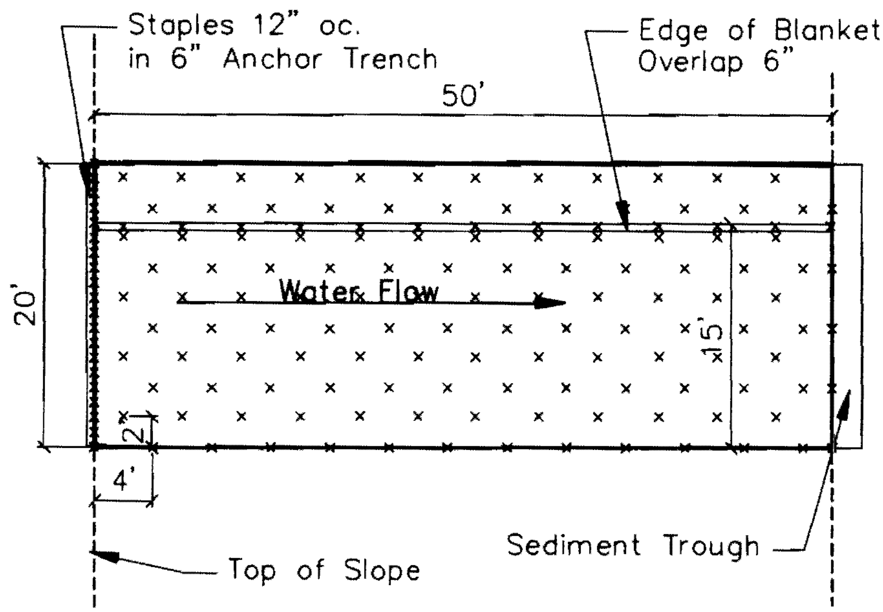


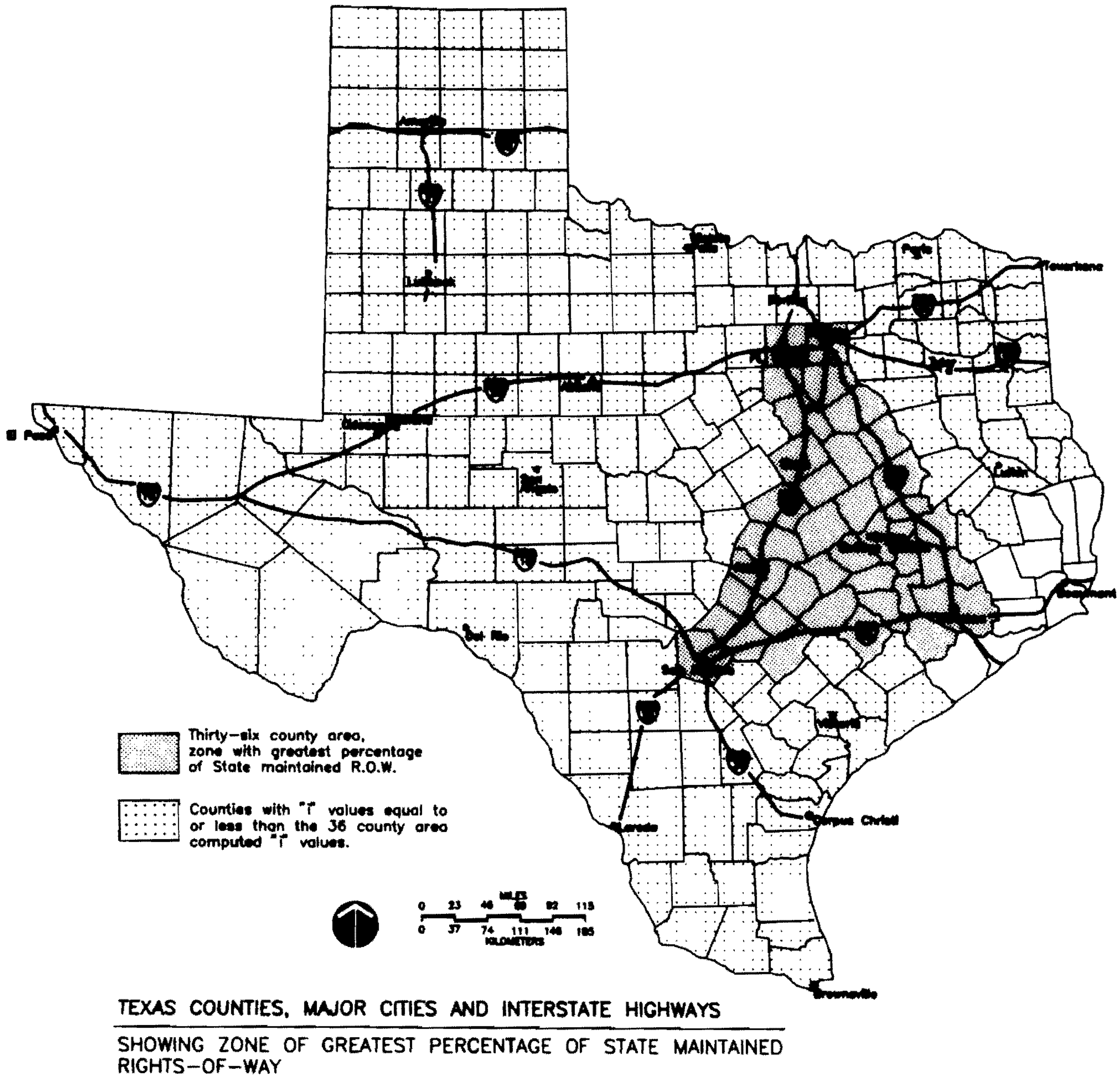
Figure 30. Polyfelt TS220 - 2:1 Sand & Clay Installation Plan

Polyfelt TS220 - 2:1 Clay Slope

The Polyfelt TS220 material was installed according to the guidelines issued by Polyfelt for the purpose of evaluating their product as a surficial erosion control media. The plot was fine graded in the same manner as the other study plots. Researchers anchored the material in a 6" (150-mm) anchor trench at the top of slope, and stapled every 12" (0.30-m) on the vertical side of the anchor trench. The backfill was compacted after stapling the material. Researchers placed the material in direct contact with the soil and rolled downhill in the direction of water flow. The edges of parallel blankets were overlapped 6" (150-mm). The staple pattern formed a 4' x 2' (1.22 x 0.60 m) pattern and the staple size measured 6" x 1" x 6" (0.15 x 0.02 x 0.15 m). During the installation of the Polyfelt TS220 material, no visible signs of punctures, tears, or other physical damage existed. Figure 30 graphically depicts the installation of Polyfelt TS220 on the 2:1 clay slope.

Rainfall Simulation

To maintain uniformity throughout a multi-year testing program, all results were and will be based on artificially generated rainfall. Researchers recognized that no way of controlling natural rainfall exists, so all reporting included a profile of the on-site weather conditions, and any unusual or mitigating events were noted and considered in the test results.



Firgure 31. Texas County Map (showing Zone of Greatest Concentration of State Maintained Right-of-Way).

Rainfall Intensity. Researchers based the rainfall intensity determination on rainfall intensities of 5.73 in/hr (145.5-mm/hr) and 7.23 in/hr (183.6 mm/hr per hour). These were the anticipated intensities from storms of a 10 minute duration and a 2-year and 5-year return frequency (50 percent and 20 percent probability of occurrence in a given year) respectively. The method used to derive these values was the modified "Steel Formula," recommended in the Texas State Department of Highways and Public Transportation (now TxDOT), Bridge Division (D-5), Hydraulics Manual, Third Edition, 1985, for estimating intensity values "i" for use in the Rational Formula.

$$i = \frac{b}{(t_c+d)^e}$$ where: b, d and e are constants.

The values of the constants b, d, and e come from the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Technical Paper No. 40, *"Rainfall Frequency Atlas of the United States."* The constants recommended for use in each county of Texas appear in Table 6 of the TxDOT Hydraulics Manual. Researchers derived the values used in the evaluation procedures by computing the values of "i" for all counties in the state based upon the assumption that "tc" equaled the storm duration, and the majority of slopes (cut slopes and fill embankments) that required protection on the highway represented the upper limit of the micro-watershed, (i.e.. not water from adjoining properties flows over the face of the slope). The final values selected represented the median values for the portion of the state with the highest percentage of state maintained rights-of-way. Researchers encountered higher intensities in the immediate coastal zones of the state. However, including these values would have unduly biased the test results. Figure 31 shows the representation of the counties throughout the State according to the computed "i" values.

Table M. 1991-92 Cycle Rainfall Simulations, 3:1 Slope

3:1 SAND STUDY PLOTS						
Product Brand Name	**Install**	**1-Year**	**2-Year #1**	**2-Year #2**	**5-Year #1**	**5-Year #2**
North American Green® S75	05/17/91	06/06/91	07/24/91	10/08/91	11/10/91	11/27/91
Xcel Regular®	05/17/91	06/07/91	07/24/91	10/08/91	11/04/91	11/27/91
GREENSTREAKEAK® PEC-MAT®	05/23/91	06/26/91	08/09/91	10/16/91	11/10/91	12/09/91
Verdyol®™ ERO-MAT®	05/23/91	07/01/91	08/09/91	10/17/91	11/11/91	12/11/91
American Excelsior Curlex®	05/29/91	07/03/91	08/09/91	10/17/91	11/12/91	12/12/91
Control	05/23/91	07/05/91	08/12/91	10/17/91	11/13/91	12/16/91
3:1 CLAY STUDY PLOTS						
North American Green® S75	05/17/91	06/05/91	07/24/91	10/08/91	11/01/91	11/26/91
Xcel Regular®	05/18/91	06/11/91	07/26/91	10/09/91	11/07/91	12/07/91
GREENSTREAK® PEC-MAT®	05/21/91	06/26/91	07/29/91	10/16/91	11/08/91	12/07/91
Verdyol® ERO-MAT®	05/22/91	07/03/91	09/17/91	10/24/91	11/16/91	12/19/91
American Excelsior Curlex®	05/24/91	07/05/91	09/17/91	10/30/91	11/18/91	12/21/91
Control	05/29/91	07/01/91	08/12/91	10/24/91	11/15/91	12/17/91

Rainfall Events. Researchers subjected each study plot to five simulated rainfall events. The first simulated rainfall event was a 1-year return frequency (1.19 in/hr) with a 10 minute duration. The second two rainfall events were 2-year return frequency (5.73 in/hr) with a 10 minute duration. The last two rainfall events were 5-year return frequency (7.23 in/hr) with a 10 minute duration. Table M and N show the dates of material installation and simulated rainfall events.

Table N. 1991-92 Cycle Rainfall Simulations, 2:1 Slope

2:1 SAND STUDY PLOTS						
Product Brand Name	**Install**	**1-Year**	**2-Year #1**	**2-Year #2**	**5-Year #1**	**5-Year #2**
POLYJUTE™ 407GT	05/18/91	06/21/91	07/25/91	10/11/91	11/16/91	12/06/91
Xcel Superior®	05/18/91	06/14/91	07/25/91	10/11/91	11/07/91	12/17/91
North American Green® S150	05/20/91	06/14/91	07/26/91	10/14/91	11/08/91	12/18/91
North American Green® SC150	05/20/91	06/21/91	07/26/91	10/14/91	11/19/91	12/20/91
GREENSTREAK® PEC-MAT®	05/21/91	07/01/91	07/29/91	10/18/91	11/20/91	12/20/91
Polyfelt TS220	05/23/91	07/02/91	08/05/91	10/18/91	11/20/91	12/23/91
American Excelsior Curlex®	05/24/91	07/02/91	08/06/91	10/24/91	11/21/91	12/13/91
ANTIWASH®/GEOJUTE® (Regular)	05/28/91	07/04/91	09/10/91	10/25/91	11/22/91	12/24/91
Control	05/29/91	07/05/91	09/11/91	10/25/91	11/25/91	12/24/91
2:1 CLAY STUDY PLOTS						
POLYJUTE™ 407GT	05/18/91	06/11/91	07/25/91	10/09/91	11/05/91	12/05/91
Xcel Superior®	05/18/91	06/13/91	07/25/91	10/09/91	11/05/91	12/05/91
North American Green® S150	05/20/91	06/20/91	07/26/91	10/11/91	11/10/91	12/09/91
North American Green® SC150	05/20/91	06/25/91	7/29/91	10/15/91	11/11/91	12/10/91
GREENSTREAK® PEC-MAT®	05/21/91	06/26/91	07/30/91	10/15/91	11/12/91	12/11/91
Polyfelt TS220	05/22/91	07/02/91	08/05/91	10/17/91	11/13/91	12/12/91
American Excelsior Curlex®	05/24/91	07/03/91	09/18/91	10/28/91	11/14/91	12/13/91
ANTIWASH®/GEOJUTE® (Regular)	05/28/91	07/04/91	09/18/91	10/28/91	11/15/91	12/13/91
Control	05/29/91	07/05/91	08/13/91	10/29/91	11/16/91	12/16/91

Researchers adhered to the following criteria for the rainfall simulation process: Rainfall simulations did not occur within 24 hours of a natural rainfall or during any precipitation. Researchers did not perform the simulations when the wind conditions were such that the majority of the water was blown onto the adjacent plots. If the wind was calm, researchers covered the plots adjacent to the test plot with a plastic film immediately before starting the rain simulation. Once the material had been "rained" upon, researchers removed the plastic film and collected the sediment and water was collected in the trough(s).

V. Data Collection

The following procedures guided researchers in collecting and recording data.

Weather Data

Weather data was collected and recorded daily, on-site either from the weather station, or from Easterwood Airport, located 6.5 miles (10.5 kilometers) southeast of the laboratory site.

Sediment Data

After each simulated rainfall event, the sediment and water was suctioned with a wet-dry vacuum into buckets, then labeled, covered, and temporarily stored. The sediment was allowed to settle for at least twenty-four hours before researchers siphoned off and discarded the top layer of water. Soil samples were collected from each bucket, then capped, labeled, and stored. The remaining soil in the buckets was weighed, recorded and discarded at that time. Researchers used the soil samples to determine the moisture-to-sediment ratio to calculate the total dry weight of sediment.

Each soil sample went through a drying process to arrive at the wet/dry ratio. First, the soil sample was weighed, recorded, and then emptied onto a microwave cooking dish. Any material left in the sample bottle was rinsed with water and added to the cooking dish. Researchers cooked the soil for several minutes, then weighed it. This process continued until three consecutive weights measured equally. The dry sample weight was recorded and averaged with the other samples to determine an average wet/dry ratio. Researchers divided this ratio into the total weight of sediment to obtain the total dry weight of the collected sediment (Appendix A). Finally, the total dry, collected sediment weight was divided by the number of 100 square feet for each plot to determine the total sediment loss per 100 square feet.

Material Performance Data

Throughout the growing season, Researchers visually inspected the study plots for any damage or undermining of the material. Failures were recorded on a plot diagram and photographed (Appendix A). No repairs were made to the materials.

Vegetation Establishment Data

Vegetation establishment observation began in the fourth week of plot installation and continued at approximately six week intervals until the end of the growing season (March 15 - November 15). In order to determine the apparent vegetative establishment of each plot, the research team modified an existing software package, VeCAP for (Vegetation Coverage Analysis Program), to calculate the coverage using a computer-based process vs. other sampling methods. Researchers performed the following process for each round of vegetation establishment data collection.

Each plot was subdivided on a graph (Appendix A) into a grid of one-half square meter sections. Next, a random sampling pattern was established using a table of random numbers. Observations from twenty random sections were recorded on the 3:1 slope plots, and sixteen random sections were recorded on the 2:1 slope plots. The observations were recorded using a Hi8mm video camera positioned perpendicular to the slope face. The video analog images were converted to digital images using a Targa 16 board and TIPS software. The single images were imported and analyzed with the *VeCAP* program to calculate the percent of vegetation coverage.

Prior to analyzing each data set, the program required a training session to establish the vegetation portion of the image. The percentage of apparent coverage for each section image was averaged to arrive at the overall percent coverage for the study plot (Appendix A). Table O shows the videotaping schedule for the 1991-92 cycle.

Table O. 1991-92 Cycle Videotaping Schedule

ROUND	DATE	LENGTH OF VIDEOTAPING ROUND	INTERVAL BETWEEN VIDEOTAPING
1	06/18/91 - 07/02/91	14 Days (2 Weeks)	Start
2	08/05/91 - 08/08/91	3 Days (0.5 Weeks)	31 Days (4.5 Weeks)
3	09/16/91 - 10/07/91	22 Days (3 Weeks)	37 Days (5 Weeks)
4	12/05/91 - 12/16/91	11 Days (1.5 Weeks)	56 Days (8 Weeks)

Laboratory Index Tests

TxDOT conducted laboratory index tests at Division 9, Materials and Tests, Austin, Texas, that described and documented basic material properties of the study materials. These tests were selected by the Industry Advisory Council and TxDOT/TTI. Separate index tests were conducted for synthetics, biodegradable, and jute materials. Table P indicates the index tests for each set of materials. Appendix G shows the results of the index tests for each product evaluated.

Table P. Laboratory Index Tests conducted by TxDOT

MATERIAL PROPERTY		TEST METHOD
SYNTHETIC MATS		
Polymer Type(s)		ASTM E 1252
Weight		ASTM D 3776
Thickness		ASTM D 1777
Tensile Strength		ASTM D 1682, Grab Method G
Elongation, ultimate		ASTM D 1682, Grab Method G
Tensil Modulus		ASTM D 1682, at 10% elongation
UV Resistance		ASTM D 4355, Tensile D 1682
Flexibility		ASTM D 1388-64
BIODEGRADABLE MATS		
Weight		ASTM D 3776 (Total roll only)
Netting:	Composition	ASTM E 1252
	Aperture Size	Direct measure
	Placement	Visual
	Weight	ASTM D 3776
	Color	Tex-839-B
	Number of Nets	Visual
	Net/Matrix Binding Method	Visual/Direct measure
JUTE MATS		
Fabric Weave/Yarn Count		Threads/foot
Weight		ASTM D 3776

VI. EVALUATION CRITERIA

Researchers established the following evaluation criteria prior to the 1991-92 cycle to provide the framework for the analysis levels used in statistical analyzing data. The data was statistically analyzed with the SAS (Statistical Analysis System) variance test. The variance test was Duncan's "t" test for significant differences within a sample grouping. The evaluation criteria, as established by the evaluation procedures, is presented first; the eight analysis levels and Analysis Level 5 graphic and tabular data are presented in the Section VII, Analysis Levels and Results. Appendix F shows the other seven analysis levels graphical and tabular results. In addition, there are three more analysis levels that combine various levels of data and relate the results to the Control (bare ground) results (Appendix J).

Erosion Control Criteria

Acceptable erosion control materials should sustain little damage from normal rainfall events, and effectively protect a slope and seed bed from a storm of a ten-minute duration and two-Year return frequency (50% probability of occurrence within a given year).

Acceptable erosion control materials, together with the emerging vegetation, should be able to resist a storm of a five-year return frequency (20% probability of occurrence within a given year), with four weeks of installation.[8]

Acceptable erosion control materials should reduce the soil loss from the protected area by a statistically significant amount over an unprotected plot (dry weight) of the same soil.

Vegetation Establishment Criteria

Acceptable erosion control materials should establish a protective vegetative stand. Researchers based the acceptable coverage on statistical comparison against all materials evaluated and against an unprotected control plot. Cover estimates were based on one growing season (March 15 - November 15).

Material Performance Criteria

Acceptable erosion control materials installed in accordance with the manufacturer's published recommendations should remain on the protected surface without developing major ripples, sags, tears, or gaps in the joints or become undermined.

Overall Performance Criteria

No material was rejected out-of-hand for poor or questionable performance in a single measure. It was the overall performance, judged against all applicable criteria, which determined the final acceptance or rejection of a material.

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[8]Four weeks is considered the average germination and emergence period for the "nurse-grasses" in the standard seed mixes used by TxDOT.

Longevity

The research team tried to extend the evaluation period beyond the one year cycle, as deemed necessary by TxDOT, TTI, and the Industry Advisory Council. Data relating to retention of strength properties, material degradation, and continued soil retention is important for certain types of projects, such as those with longer anticipated establishment periods, or environmentally sensitive areas. However, the 1992-93 cycle required a small portion of the 1991-92 cycle plots. TTI maintains a photographic catalog to document the long-term vegetation and sediment retention performance of the material.

VII. ANALYSIS LEVELS AND RESULTS

Analysis Level Description

The research team identified eight logical analysis levels (Figures 32, 33), which demonstrated how a particular product performed. Generally, this analysis approach starts "broad-brush," then isolates different variables on an increasingly specific manner.

Level 1: Analyzed the product's overall performance without separating performance steepness of slope, type of soil, or design storm level.[9]

Level 2: Analyzed the product's performance with respect to steepness of slope only, without separating performance into clay or sand soils, or design storm level.[10]

Level 3: Analyzed the product's performance with respect to soil conditions only, without separating performance into 2:1 or 3:1 slopes or design storm level.[11]

Level 4: Analyzed the average sediment loss for each product within each of the three simulated design storms. The vegetative density achieved by each product at each round of measurement was determined.

Level 5: Analyzed the product's performance with respect to both steepness of slope and soil condition. This level averages the sediment loss determined within each of the three simulated design storms and uses final vegetative density measurements. **(This is the primary analysis level used by TxDOT to determine the minimum acceptable performance standards, and to produce the annual "Approved Materials List.")**

Level 6: Analyzed the average sediment loss for each product within each of the simulated design storms within the 2:1 and 3:1 slopes. The data collected from the vegetative densities achieved by each product at each measurement stage within the 2:1 and 3:1 slopes was used for this analysis level.

Level 7: Analyzed the average sediment loss for each product within each of the simulated design storms within the clay and sand soils. The data collected from the vegetative densities achieved by each product at each measurement stage within the clay and sand soils was used for this analysis level.

Level 8: Analyzed the sediment loss by each product within each of the simulated design storms, within the clay and sand soils and within the 2:1 and 3:1 slopes. The data collected from the vegetative densities produced by each product at each measurement stage within the clay and sand soils and within the 2:1 and 3:1 slopes was used for this analysis level.

The analysis trees in Figures 32 and 33 graphically depict the analysis levels described above.

---

[9]This level uses the final vegetative density measurements only.

[10]This level uses the final vegetative density measurements only.

[11]This level uses the final vegetative density measurements only.

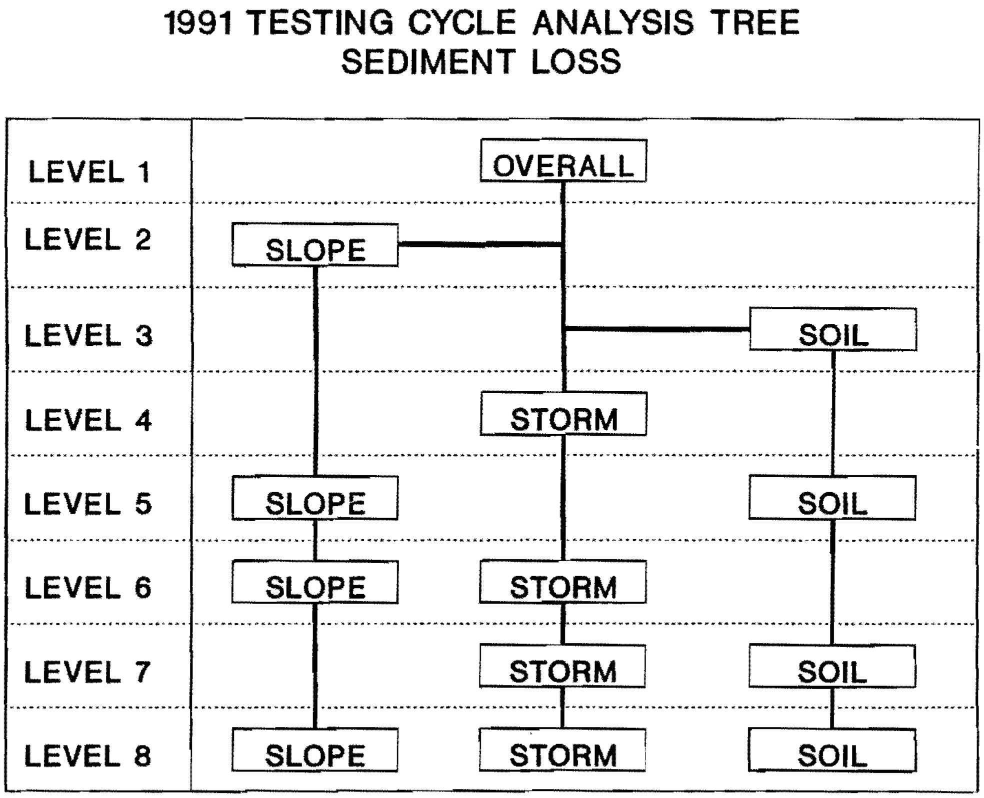

Figure 32. 1991-92 Cycle Sediment Loss Analysis Tree

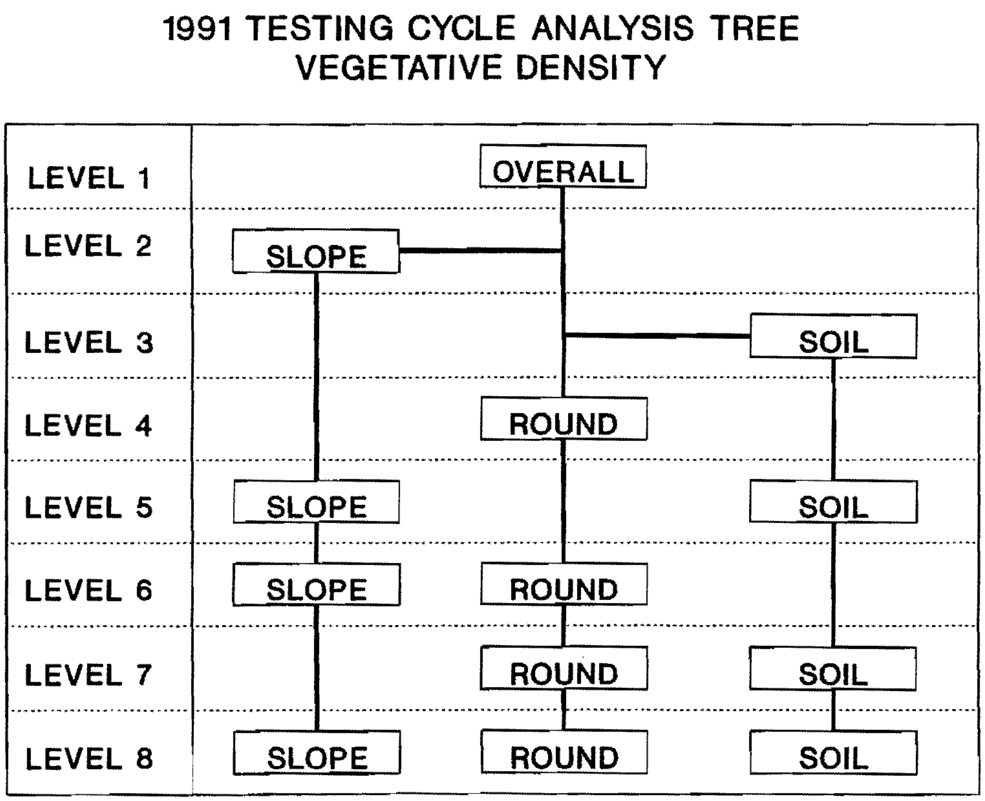

Figure 33. 1991-92 Cycle Vegetative Density Analysis Tree

The results of the level 5 Analysis: The following tables and figures show the product Performance with respect to both Steepness of Slope and Soil Condition. Figures 34 and 35 show the results of average sediment loss and vegetation density, respectively. Table Q shows the same results in tabular format.

ANALYSIS LEVEL 5

Performance with Respect to Steepness of Slope and Type of Soil Slope Protection

Table Q. Analysis Level 5 - 2:1 Clay performance with respect to steepness of slope and type of soil slope protection

Product Tested	Design Storm	Slope	Type of Soil	Sediment Loss	Sediment Rank	Veg Density	Veg Rank
American Excelsior Curlex®	All	2:1	Clay	0.3912	1/9	97.834	2/9
North American Green® SC150	All	2:1	Clay	0.4346	2/9	89.979	6/9
Polyfelt®	All	2:1	Clay	0.4437	3/9	35.909	9/9
North American Green® S150	All	2:1	Clay	0.4608	4/9	92.014	4/9
POLYJUTE 407G®	All	2:1	Clay	0.4857	5/9	96.151	3/9
GREENSTREAK® PEC-MAT®	All	2:1	Clay	0.5100	6/9	87.580	7/9
ANTIWASH®/GEOJUTE®	All	2:1	Clay	0.5565	7/9	90.058	5/9
Xcel Superior®	All	2:1	Clay	0.6555	8/9	98.814	1/9
CONTROL	All	2:1	Clay	2.3907	9/9	76.430	8/9

NOTE: "Sediment Loss" = Pounds of sediment lost per 100 square feet
"Veg Density" = Average percentage of Vegetative Cover (Round Four Only)

Sediment Loss (lbs/100 sq ft) - 2:1 Clay

The performance of each of the eight products evaluated on 2:1 Clay plots and the CONTROL plot with respect to total sediment loss (lbs/100 sq ft) is shown in Figure 34.

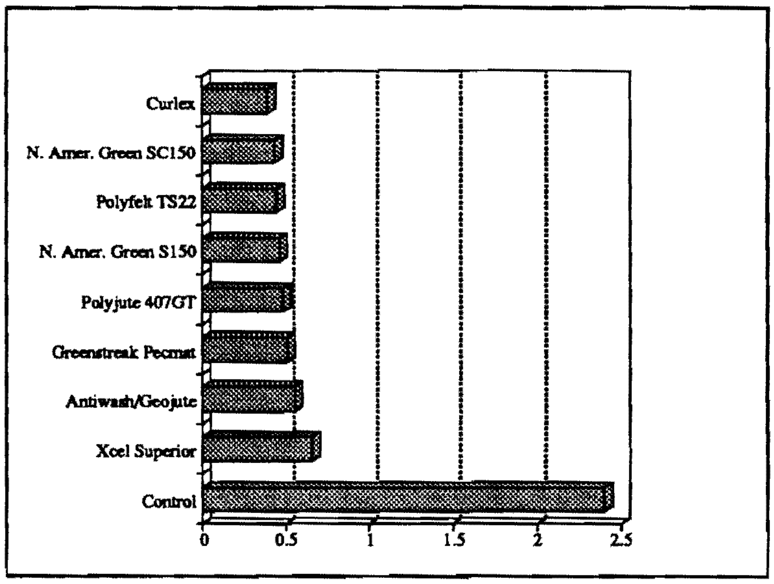

Figure 34. Average Sediment Loss - 2:1 Clay

Vegetative Density (Final Measurement Round Four Only) - 2:1 Clay

The performance of each of the eight products tested on 2:1 Clay plots and the CONTROL plot with respect to the final percentage of vegetative cover is shown in Figure 35.

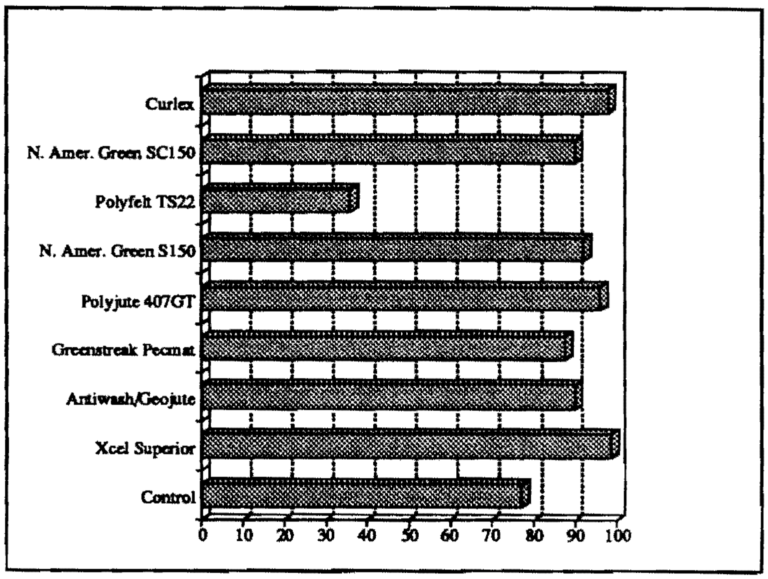

Figure 35. Vegetative Density (Final Measurement Round Four Only) - 2:1 Clay

ANALYSIS LEVEL 5

ANALYSIS LEVEL 5

Performance with Respect to Steepness of Slope and Type of Soil Slope Protection

Table R. Analysis Level 5 - 2:1 Sand Slope

Product Tested	Design Storm	Slope	Type of Soil	Sediment Loss	Sediment Rank	Veg Density	Veg Rank
Xcel Superior®	All	2:1	Sand	31.99	1/9	85.805	1/9
POLYJUTE 407G®	All	2:1	Sand	38.30	2/9	74.302	4/9
North American Green® SC150	All	2:1	Sand	42.49	3/9	76.409	3/9
North American Green® S150	All	2:1	Sand	48.81	4/9	84.746	2/9
Polyfelt®	All	2:1	Sand	51.27	5/9	46.051	7/9
American Excelsior Curlex®	All	2:1	Sand	60.81	6/9	52.674	5/9
ANTIWASH®/GEOJUTE®	All	2:1	Sand	61.83	7/9	51.372	6/9
GREENSTREAK® PEC-MAT®	All	2:1	Sand	63.56	8/9	38.863	9/9
CONTROL	All	2:1	Sand	159.20	9/9	44.699	8/9

NOTE:

"Sediment Loss" = Pounds of Sediment Lost Per 100 Square Feet

"Veg Density" = Average Percent of Vegetative Cover (Round Four Only)

Sediment Loss (lbs/100 sq ft) - 2:1 Sand

The performance of each of the 8 products evaluated on 2:1 Sand plots and the CONTROL plot with respect to total sediment loss (lbs/100 sq ft) is shown in Figure 36.

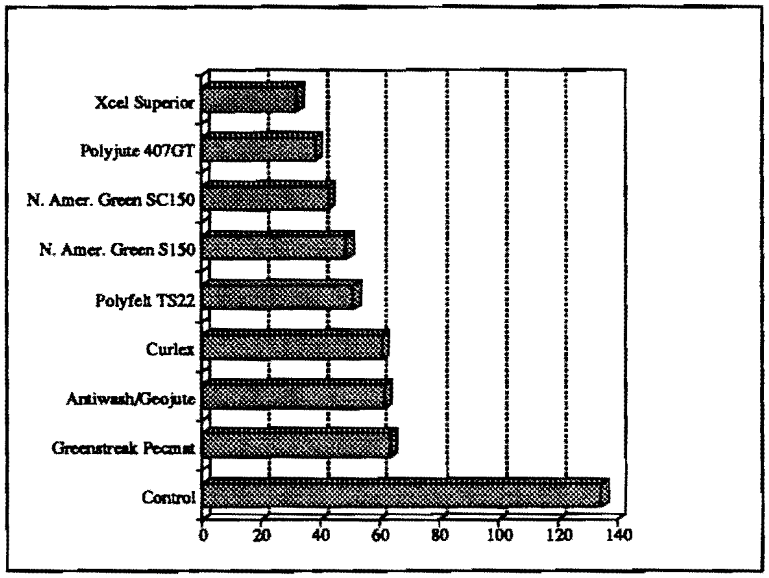

Figure 36. Average Sediment Loss - 2:1 Sand

Vegetative Density (Final Measurement Round Four Only)-2:1 Sand

The performance of each of the 8 products evaluated on 2:1 Sand plots and the CONTROL plot with respect to the final percentage of vegetative cover is shown in Figure 37.

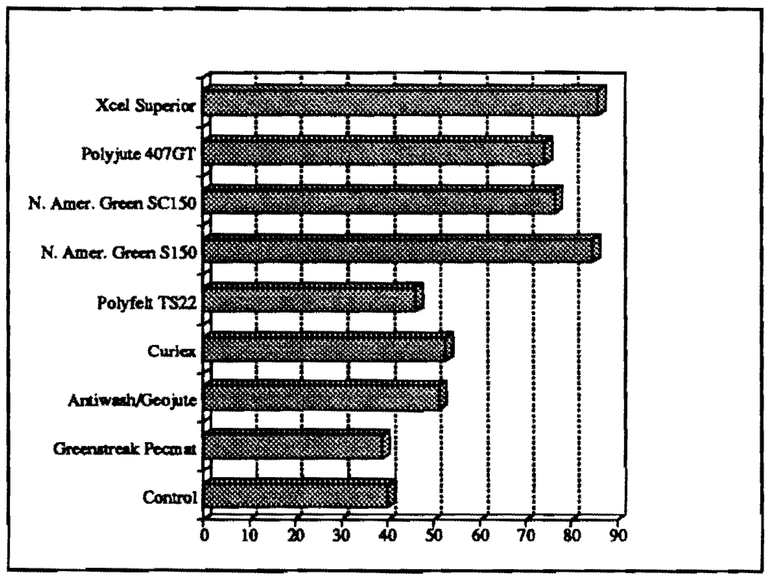

Figure 37. Vegetative Density (Final measurement Round Four Only) - 2:1 Sand

ANALYSIS LEVEL 5

Performance with Respect to Slope and Type of Soil Slope Protection

Table S. Analysis Level 5 - 3:1 Clay Slope

Product Tested	Design Storm	Slope	Type of Soil	Sediment Loss	Sediment Rank	Veg Density	Veg Rank
American Excelsior Curlex®	All	3:1	Clay	0.3017	1/6	63.230	5/6
Verdyol® ERO-MAT®	All	3:1	Clay	0.3129	2/6	87.808	4/6
GREENSTREAK® PEC-MAT®	All	3:1	Clay	0.4107	3/6	90.524	2/6
North American Green® S75	All	3:1	Clay	0.5598	4/6	96.187	1/6
Xcel Regular®	All	3:1	Clay	0.6559	5/6	90.166	3/6
CONTROL	All	3:1	Clay	2.9205	6/6	58.575	6/6

NOTE:

"Sediment Loss" = Pounds of Sediment Lost Per 100 Square Feet

"Veg Density" = Average Percent of Vegetative Cover (Round Four Only)

Sediment Loss (lbs/100 sq ft) - 3:1 Clay

The performance of each of the 5 products evaluated on 3:1 Clay plots and the CONTROL plot with respect to total sediment loss (lbs/100 sq ft) is shown in Figure 38.

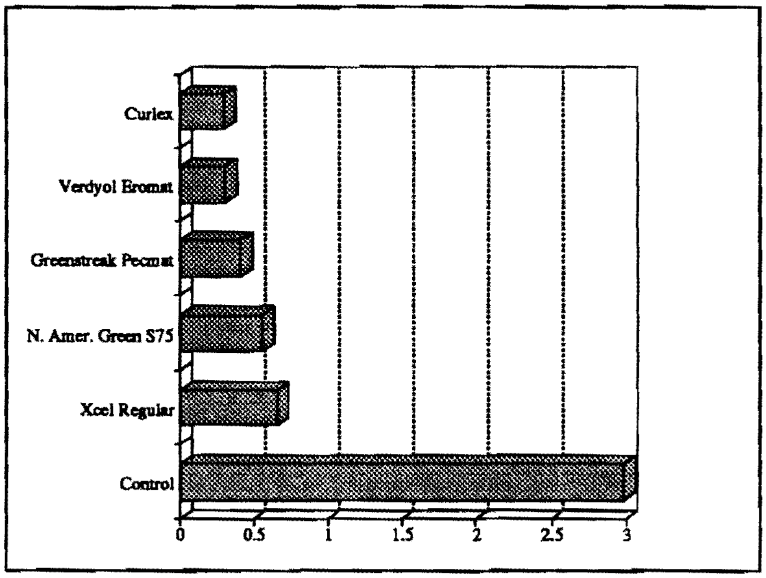

Figure 38. Sediment Loss (lbs/100 sq ft) - 3:1 Clay

Vegetative Density (Final Measurement Round Four Only)-3:1 Clay

The performance of each of the 5 products evaluated on 3:1 Clay plots and the CONTROL plot with respect to the final percentage of vegetative cover is shown in Figure 39.

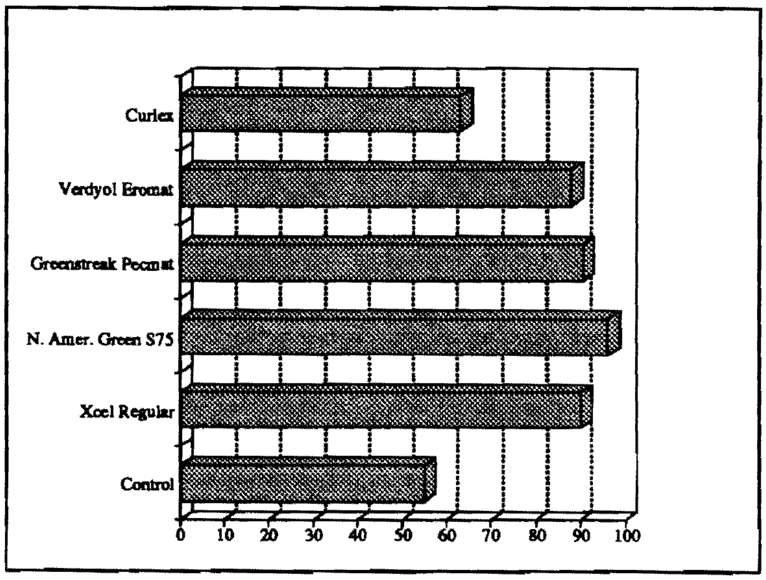

Figure 39. Vegetative Density (Final Measurement Round Four Only) - 3:1 Clay

ANALYSIS LEVEL 5

Performance with Respect to Slope and Type of Soil Slope Protection

Table T. Analysis Level 5 - 3:1 Sand Slope

Product Tested	Design Storm	Slope	Type of Soil	Sediment Loss	Sediment Rank	Veg Density	Veg Rank
American Excelsior Curlex®	All	3:1	Sand	9.043	1/6	60.937	5/6
Xcel Regular®	All	3:1	Sand	9.672	2/6	72.263	3/6
North American Green® S75	All	3:1	Sand	16.624	3/6	77.904	1/6
Verdyol® ERO-MAT®	All	3:1	Sand	18.634	4/6	73.202	2/6
GREENSTREAK® PEC-MAT®	All	3:1	Sand	33.667	5/6	62.385	5/6
CONTROL	All	3:1	Sand	61.564	6/6	53.808	6/6

NOTE:

"Sediment Loss" = Pounds of Sediment Lost Per 100 Square Feet

"Veg Density" = Average Percent of Vegetative Cover (Round Four Only)

Sediment Loss (lbs/100 sq ft) - 3:1 Sand

The performance of each of the 5 products evaluated on 3:1 Sand plots and the CONTROL plot with respect to total sediment loss (lbs/100 sq ft) is shown in Figure 40.

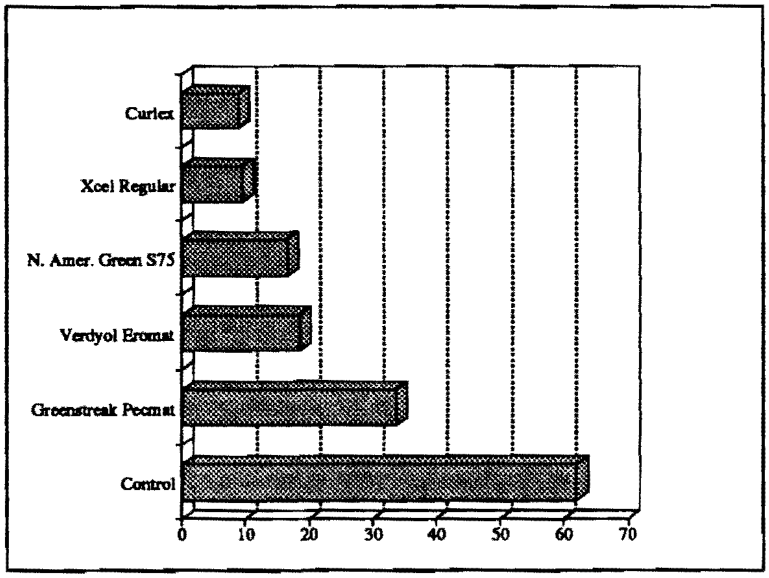

Figure 40. Sediment Loss (lbs/100 sq ft) - 3:1 Sand

Vegetative Density (Final Measurement Round Four Only)-3:1 Sand

The performance of each of the 5 products evaluated on 2:1 Sand plots and the CONTROL plot with respect to the final percentage of vegetative cover is shown in Figure 41.

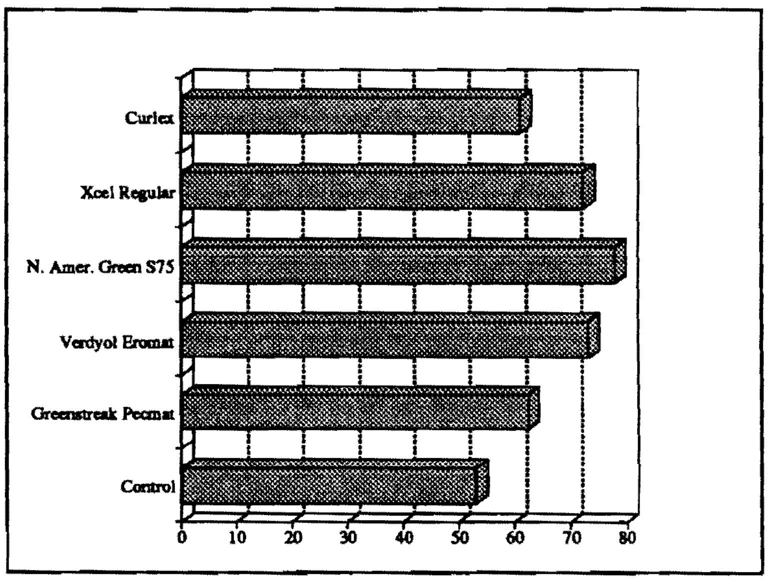

Figure 41. Vegetative Density (Final Measurement Round Four Only) - 3:1 Sand

Minimum Performance Standards

The results of the Level 5 analysis established the basis for TxDOT's initial Approved Materials List, which will go into effect with the new 1992 Standard Specifications for Construction of Highways, Streets, and Bridges. All soil retention blankets within any TxDOT's maintenance or construction activities must meet or exceed the minimum performance standards through controlled evaluations at the Hydraulics and Erosion Control Laboratory. TxDOT reserves the right to refine the minimum acceptable performance standards based upon additional data collected through the evaluation program. Tables U and V show the minimum performance standards established from the 1991-92 Evaluation Cycle.

Table U. Minimum Acceptable Vegetation Density

Minimum Acceptable Vegetation Density
Achieved by the Final (Round 4) Measurement Cycle

	Clay Soils	Sandy Soils
3:1 or Flatter	80%	70%
Steeper than 3:1	80%	70%

Table V. Maximum Acceptable Sediment Loss

Maximum Acceptable Sediment Loss
Average of all 1-Year, 2-Year, and 5-Year Design Storms

	Clay Soils	Sandy Soils
3:1 or Flatter	0.70 lbs/100 sq. ft.	25 lbs/100 sq. ft.
Steeper than 3:1	0.70 lbs/100 sq. ft.	55 lbs/100 sq. ft.

VIII. SUMMARY AND CONCLUSIONS

Vegetation Cover Establishment

Upon completion of the vegetation establishment evaluations and analysis on the flexible erosion control materials, researchers drew several conclusions. They are as follows:

1) Overall apparent vegetative cover on the erosion resistant (K=.20) soil proved more abundant than on the erodible soil (K=.05), regardless of the slope condition. The erosion resistant soil contains a higher percentage of clay and silt and organic content, which could have promoted better germination and growth. Also, the intermittent "rainfall" during the entire growing season could have aided in the overall high levels of vegetative cover.

2) The materials that had straw, polypropylene, and straw/coconut as the primary component of the blanket produced a higher percentage of vegetation than the other organic and synthetic materials. The initial vegetation growth data was similar between the material groups, with the differences becoming significant in Round 2 of data analysis.

3) The bare soil plots, Controls, produced significantly less vegetative cover than the plots protected by the straw, excelsior, polypropylene, and straw/coconut flexible erosion control material.

4) During the evaluation period, lifting of the flexible erosion control material by vegetation did not prove problematic.

The following photographs illustrate the vegetative coverage within four months of installation of the flexible erosion control product.

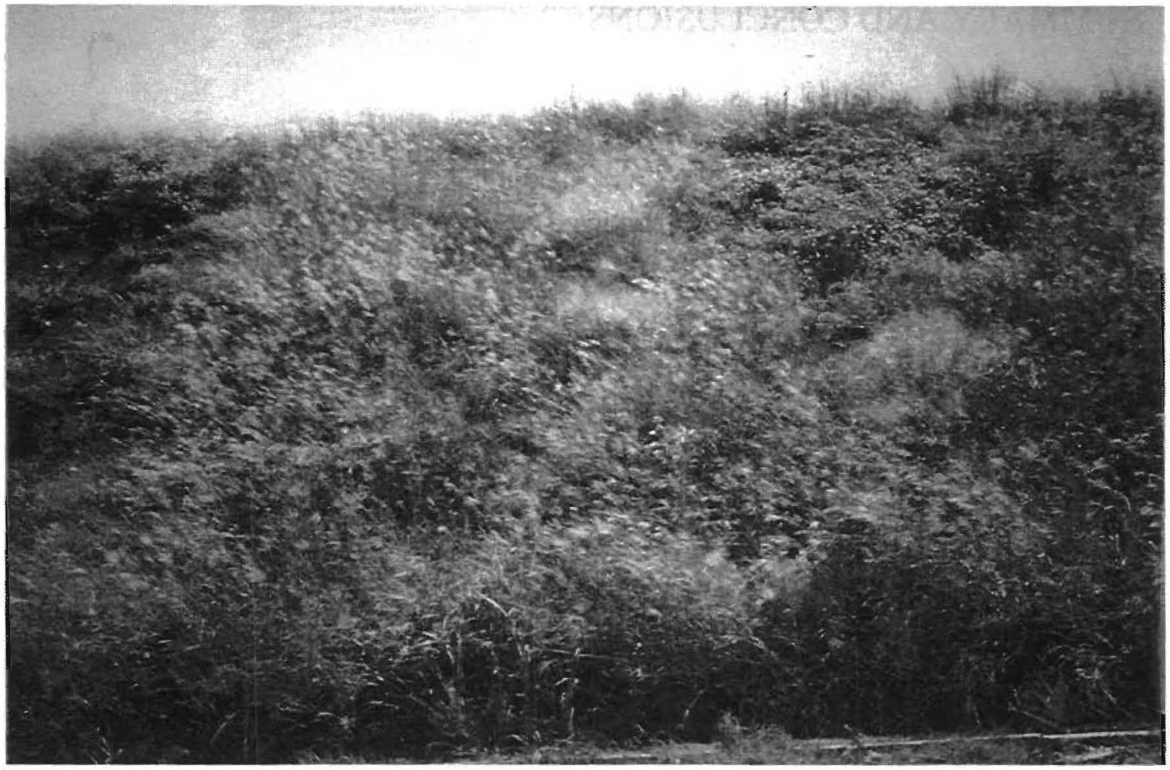

Figure 42. Vegetative coverage on a 2:1 Clay Polypropylene product plot

Figure 43. Vegetative coverage on a 3:1 Clay Straw product plot

Figure 44. Vegetative coverage on a 3:1 Clay Excelsior product plot

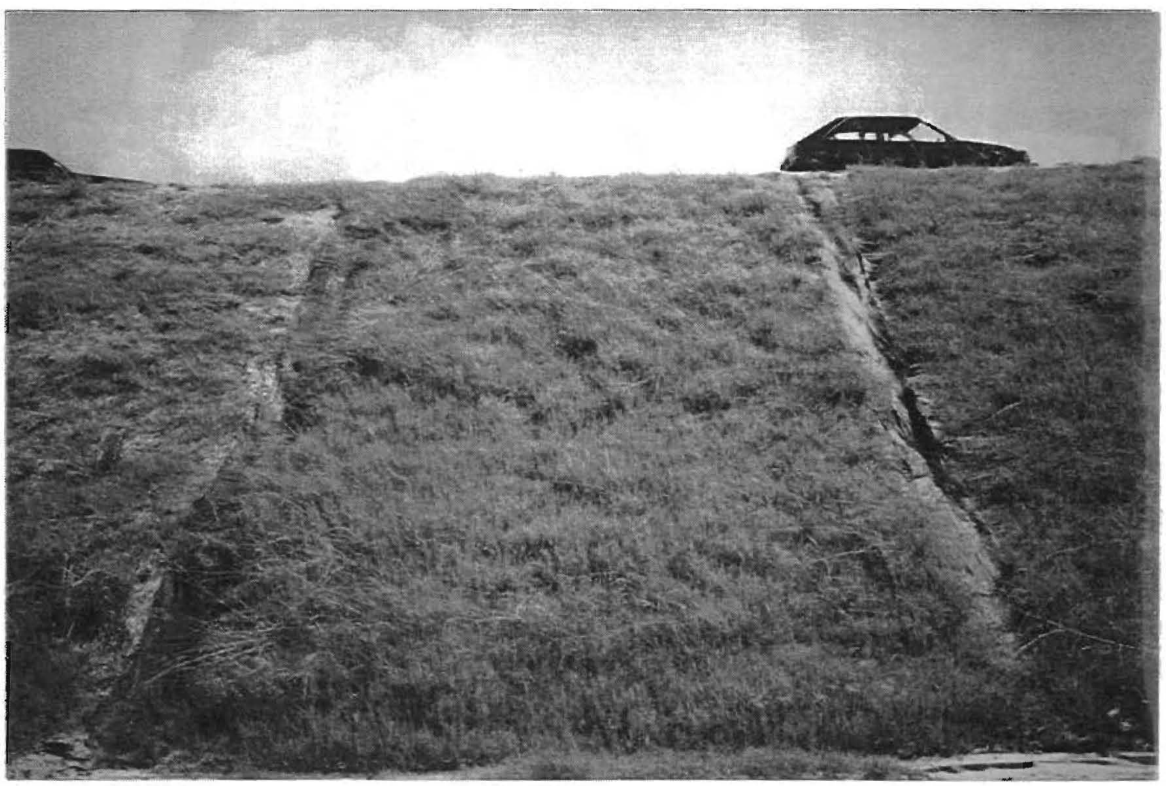

Figure 45. Vegetative coverage on a 3:1 Sand Excelsior product plot

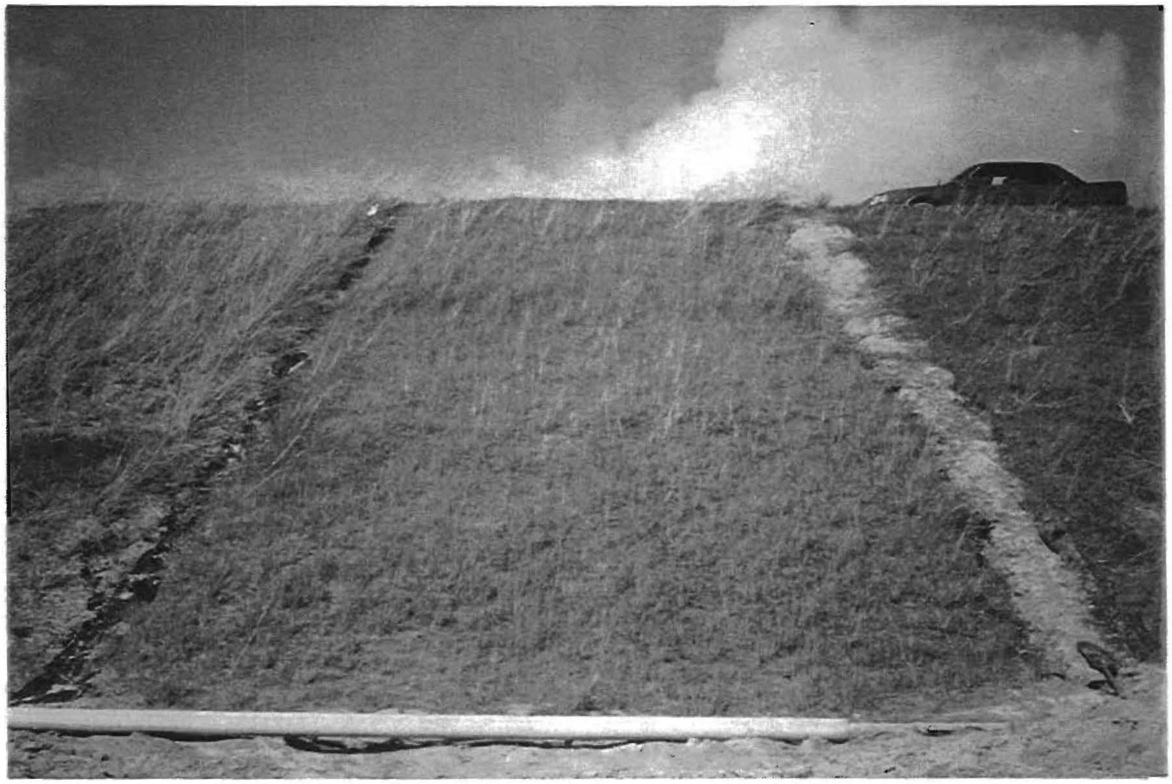

Figure 46. Vegetative coverage on a 3:1 Sand Excelsior product plot

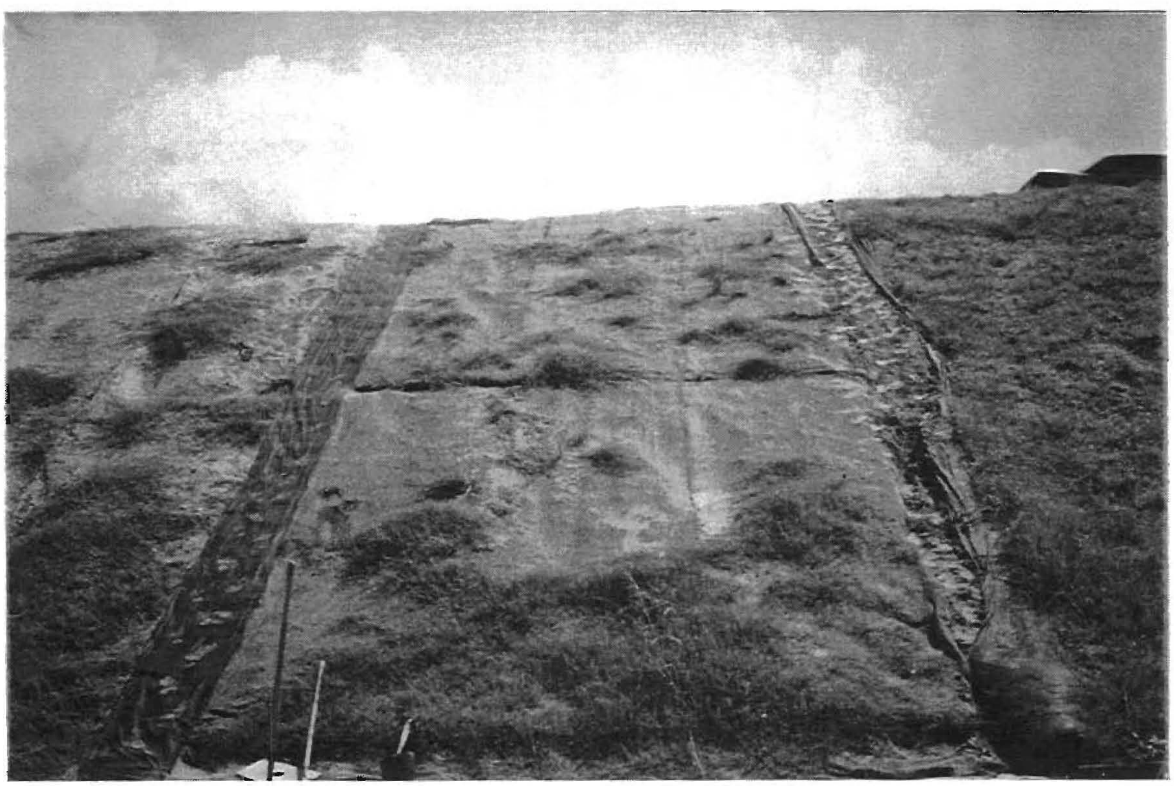

Figure 47. Vegetative coverage on a 2:1 Sand PVC product plot

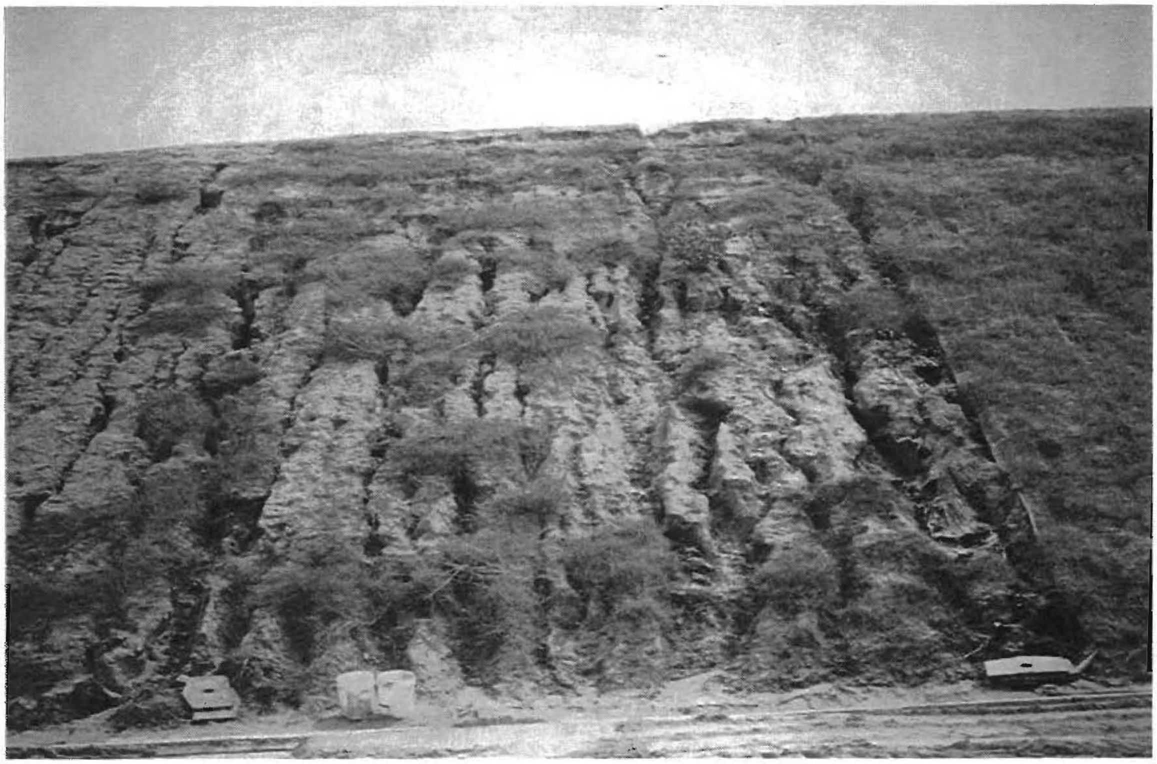

Figure 48. Vegetative coverage on a 2:1 Sand Control product plot

Erosion Control

Upon completion of the erosion control evaluations and analysis of the flexible erosion control materials, researchers drew several conclusions. They are as follows:

1) The sediment loss proved significantly greater on the erodible soil (K=.05) than the erosion resistant soil (K=.20), regardless of the slope condition. The erosion resistant soil is more cohesive than the erodible soil, which could enhance the soil's capability to resist the forces of rain splash.

2) Generally, the organic products reduced the amount of sediment loss significantly more than the synthetic products. The organic products tended to burrow down into the soil to form a soil/material bond, an occurrence not as visually apparent with the synthetic products. The synthetic products tended to span the surface and any rill formations that developed, whereas the organic products conformed to the shape of the slope.

3) The bare soil plots, Controls, yielded significantly greater quantities of sediment loss than the study plots protected by a flexible erosion control material.

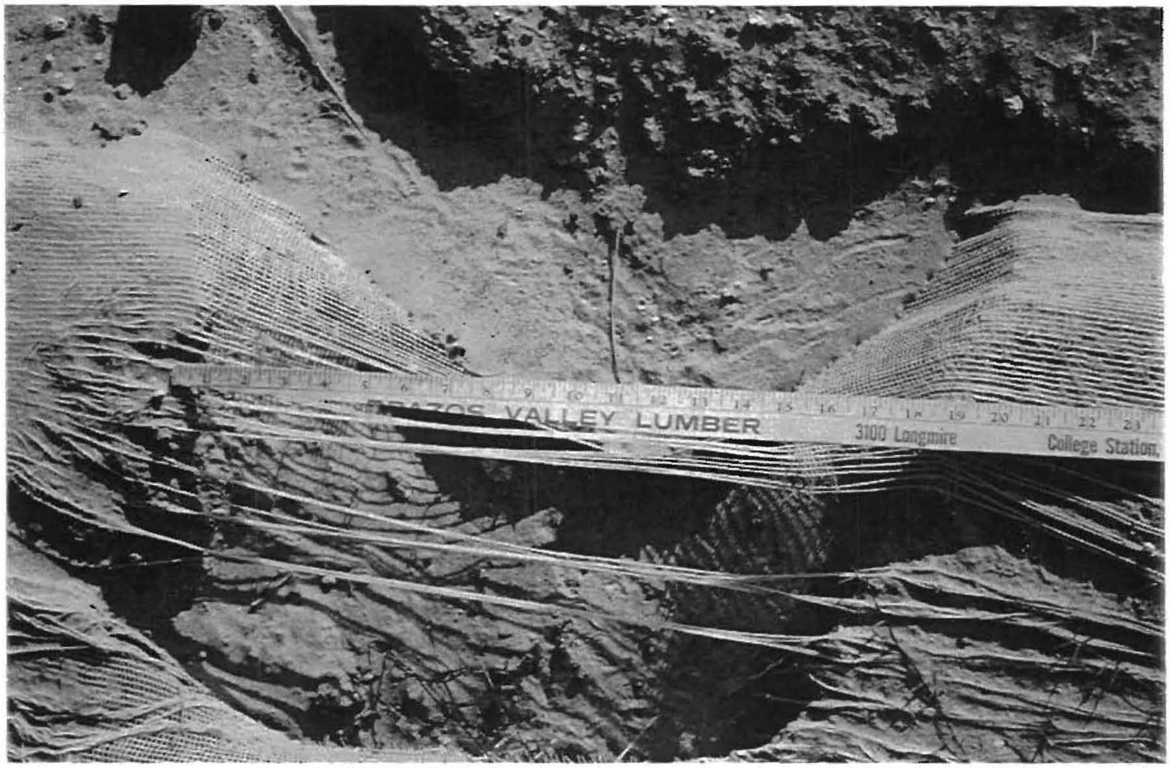

Figure 49. Undermining failure located at top of 2:1 Sand slope, Polypropylene product plot

Figure 50. Washout of the 6' cap on the 2:1 Sand CONTROL plot

Material Performance

1) The most prevalent problem during the first half of the evaluation cycle was undermining of the flexible erosion control materials. A likely contributing factor for these occurrences may be the atypical number of intermittent showers and overcast days during the months of June, July, and early August. There were few major tears, rips and separated seams.

2) In general, the flexible erosion control materials' properties degraded considerably during the last half of the evaluation cycle. The problem of joint separation tended to be located on the upper portion of the plots, while tears, rips, and undermining tended to be located on the bottom portion of the plots. General material degradation was not centralized in any particular area.

The sediment accumulation on the lower portions of the plots that overstress the tensile properties of the materials explain the relationship of the location and type of material failures. The result of this stress produced the tears and rips, which in turn overstressed the joint seams on the upper portion of the plot. The general material degradation after a six-month period may indicate an assumed material property, which correlates an appropriate amount of time for predominant vegetation coverage to the material's durability performance. After this time, the roots of the vegetation, instead of the material itself, will adequately hold the soil and prevent further loss of sediment.

The following photographs illustrate various material degradation, seam separation, and tears within four months of installation of the flexible erosion control product.

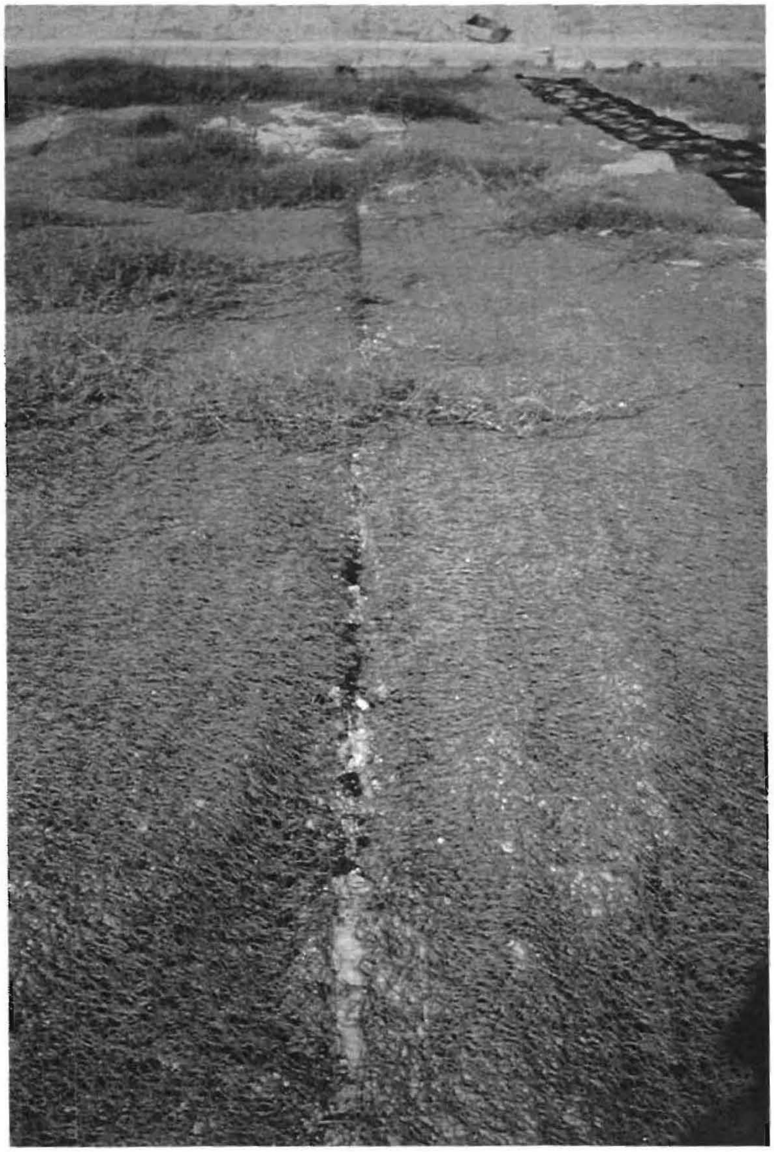

Figure 51. Seam separation on a 2:1 Sand PVC product plot

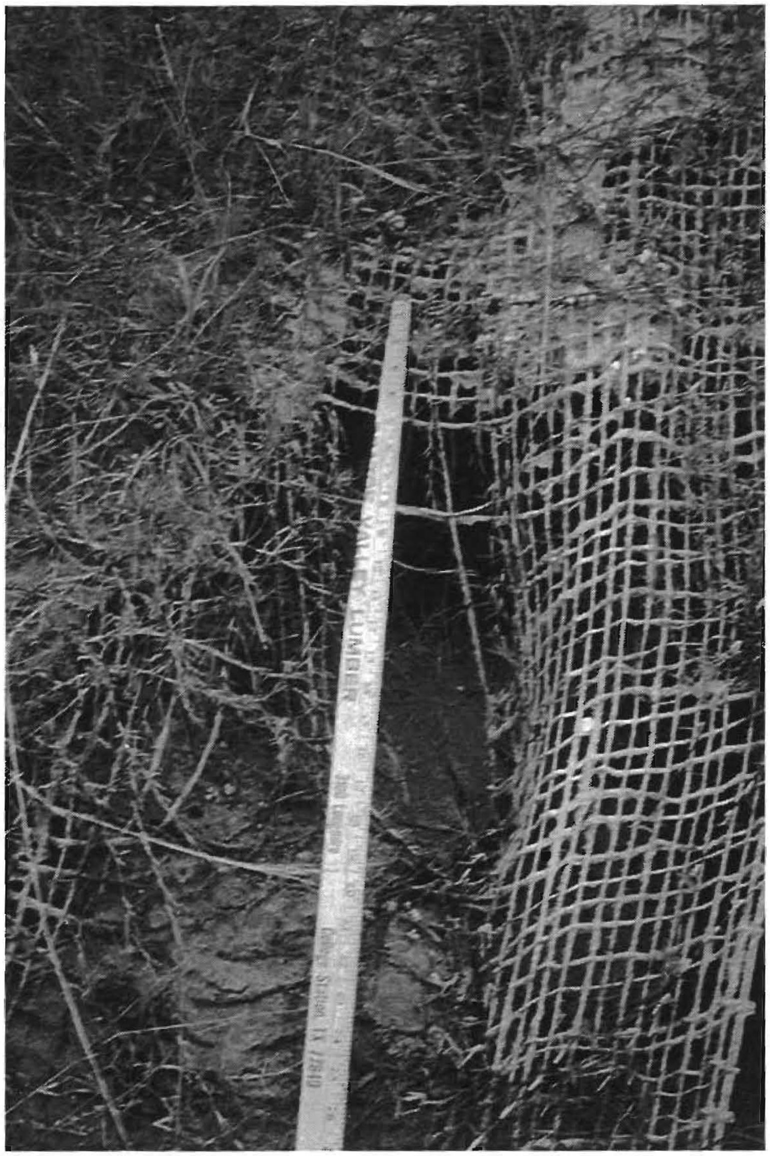

Figure 52. Material failure located on the lower portion of a 2:1 Sand Jute product plot

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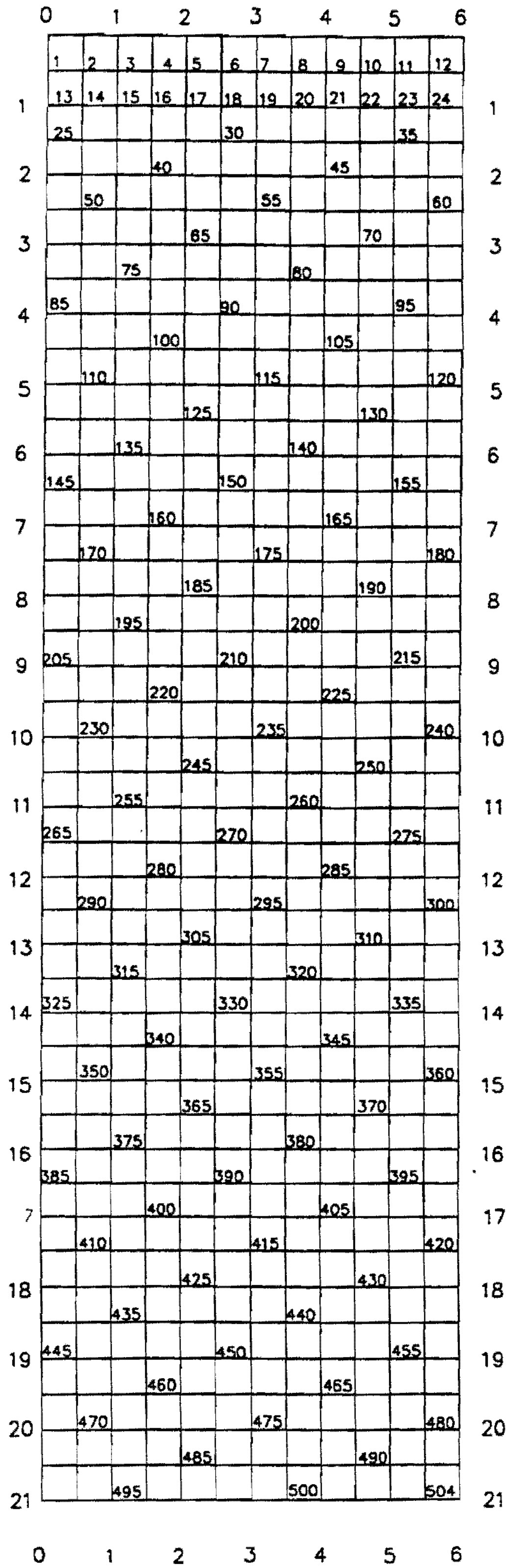
APPEINDIX A

Data Forms

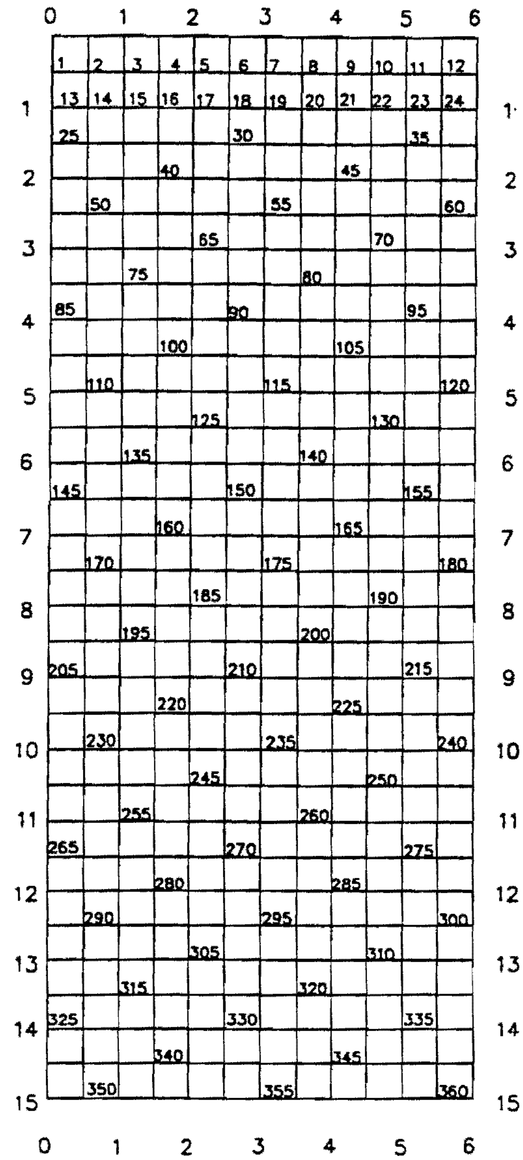
The following forms are examples of what will be used to record data during the evaluation period:

1. Videotaping Form (mat/blanket on embankment)
2. Video Processing Form (mat/blanket on 3:1 embankment)
3. Video Processing Form (mat/blanket on 2:1 embankment)
4. Material Visual Damage Assessment Form
5. Soil Processing Form

3:1
6M X 21M



2:1
6M X 15M



MATERIAL ______________________

PLOT ______________________

DATE ______________________

WEEKS ______________________

TIME ______________________

EMBANKMENT EROSION CONTROL

FILM DATA

1. DATE ____________
2. TIME ____________
3. MATERIAL CODE ____________
4. FILM OPERATOR ____________

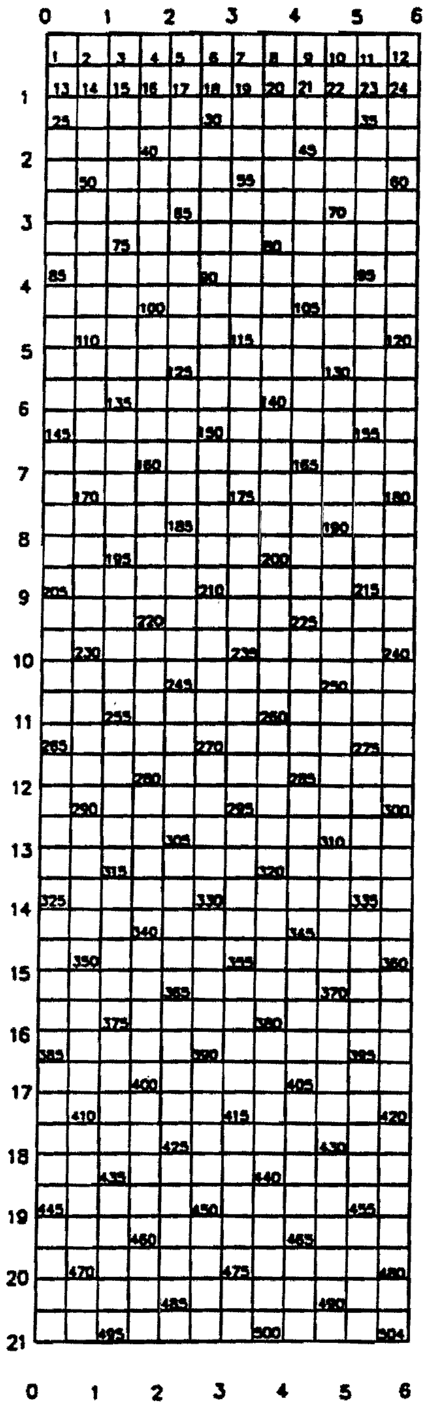
FILE DATA

1. DATE ____________
2. TAPE ____________
3. VECAP OPERATOR ____________
4. FILENAME ____________

SAS PROGRAM DATA

1. PLOT ____________
2. BRAND ____________
3. SLOPE ____________
4. SOIL ____________
5. ROUND # ____________
6. SAMPLE (SEE BELOW)
7. COVER (SEE BELOW)

3:1
6M X 21M



PATTERN & NO. OF SHOTS

FILM RECORDS

FILE NAME	FILM LOCATION	SAMPLE	% COVER VECAP
		1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	
		18	
		19	
		20	

EMBANKMENT EROSION CONTROL

FILM DATA

1. DATE ____________
2. TIME ____________
3. MATERIAL CODE ____________
4. FILM OPERATOR ____________

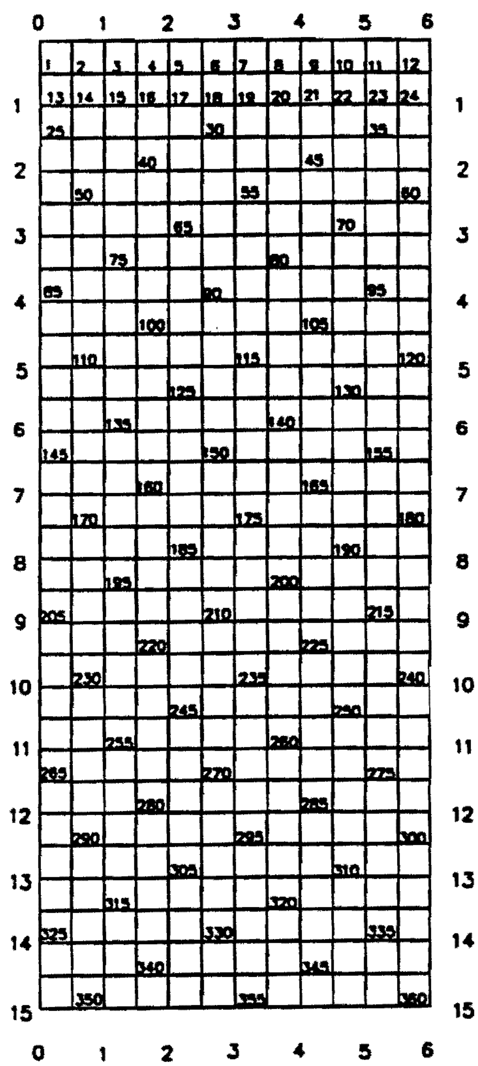
FILE DATA

1. DATE ____________
2. TAPE ____________
3. VECAP OPERATOR ____________
4. FILENAME ____________

SAS PROGRAM DATA

1. PLOT ____________
2. BRAND ____________
3. SLOPE ____________
4. SOIL ____________
5. ROUND # ____________
6. SAMPLE (SEE BELOW)
7. COVER (SEE BELOW)

2:1
6M X 15M



PATTERN & NO. OF SHOTS

FILM RECORDS

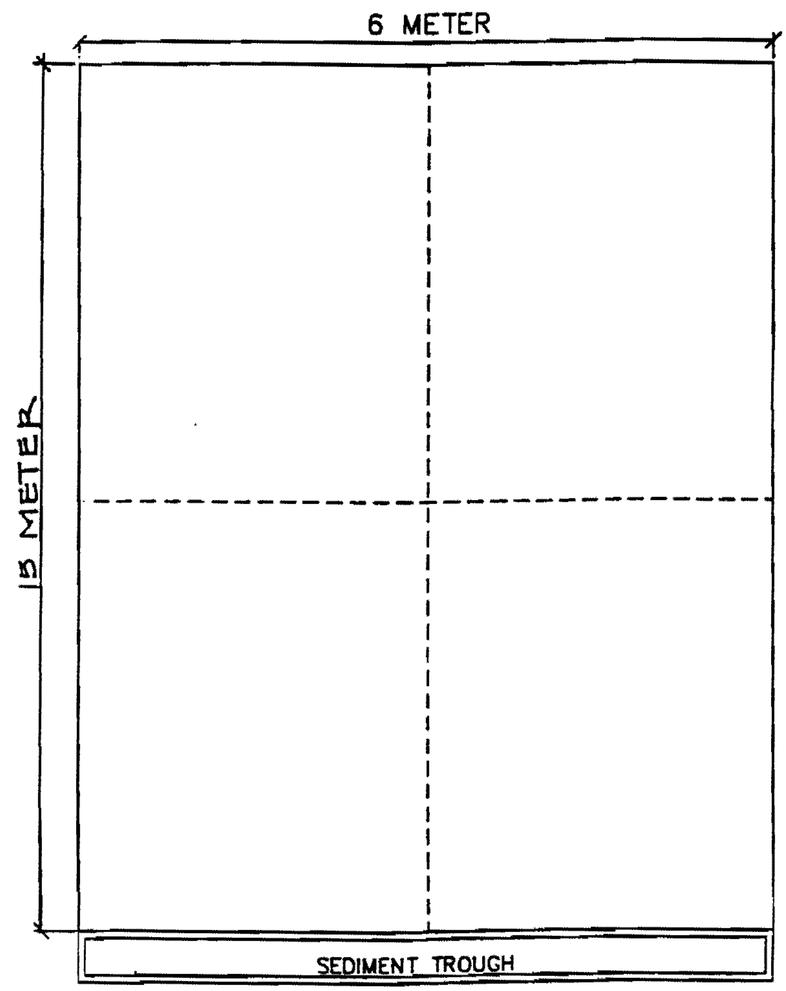
FILE NAME	FILM LOCATION	SAMPLE	% COVER VECAP
		1	
		2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	

EMBANKMENT EROSION CONTROL

SAS PROGRAM DATA

1. PLOT = ________
2. BRAND = ________
3. SLOPE = ____
4. SOIL = ____
5. STORM = ____
6. SEDIMENT = ____.____

EROSION CONTROL DATA



Material Damage Description ______________________________

Remarks: ______________________________

Film/ Tape # ____________________ Date/Time: ____________________

SOIL PROCESSING FORM

PLOT	SLOPE	SOIL	STORM	SAMPLE NUMBER	WET SAMPLE &BOTTLE	WET SAMPLE & PAN	DRY WEIGHTS 1	2	3	4	5	% DRY WT	% DRY AVE	TL DRY SED	TDS PER 100 SQ FT

APPEINDIX B

Specification Item 164. (partial specification)

—ITEM 164 - SEEDING FOR EROSION CONTROL—

164.2. Materials.

"Seeding for Erosion Control" shall consist of preparing ground, providing for sowing of seeds, mulching with straw, hay, or cellulose fiber and other management practices along and across such areas as are designated on the plans and in accordance with this Item.

164.2. Materials.

(1) Seed. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed, (PLS = purity x germination), name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of use on the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Engineer. Buffalograss shall be treated with a dormancy method approved by the Engineer.

(2) Fertilizer. Fertilizer shall conform to the requirements of Item 166, "Fertilizer." The fertilizer used shall have the analysis as shown on the plans.

(3) Water. Water shall conform to the requirements of Item 168, "Vegetative Watering."

(5) Soil Retention Blanket. Soil retention blanket shall meet the requirements of Item 169, "Soil Retention Blanket."

164.3. Construction Methods.

After designated areas have been completed to the lines, grades and cross sections shown on the plans and as provided for in other items of this contract, seeding shall be performed in accordance with the requirements herein after described. All areas to be seeded shall be cultivated to a depth of at least four (4) inches, except where seeding is to be done using a seed drill suitable for seeding into untilled soil. The seedbeds shall be cultivated sufficiently to reduce the soil to a state of good tilth when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deeply for optimum germination. Cultivation of the seedbed will not be required in loose sand where depth of sand is four (4) inches or more.

The cross-section previously established shall be maintained throughout the process of cultivation. Any necessary reshaping shall be done prior to any planting of seed.

(1) Planting Season and Seed Mixes. All planting shall be done between the dates specified for each highway district except as specifically authorized in writing by the Engineer.

The pure live seed planted per acre shall be of the type specified in Table 2 for rural areas (warm season), Table 3 for urban areas (warm season) and Tables 4A and 4B for temporary erosion control (cool season), with the mixture, rates, and planting except dates shown on the plans.

(Information taken from Table 3)
Seeding Rate for District 17 - (Bryan), February 1 - May 15*

Mixture for Use in Clay or Tight Soils

(All Sections)

Green Sprangletop	0.6
Bermudagrass	0.8
Little Bluestem	1.1
Indiangrass (Lometa)	1.5
K-R Bluestem	0.7
Switchgrass (Alamo)	1.2

Mixture for Use in Sand or Sandy Soils

(All Sections)

Green Sprangletop	1.1
Bermudagrass	1.5
Bahiagrass (Pensacola)	6.7

*Planting dates are optimal.

(2) Broadcast Seeding. The seed or seed mixture, in the quantity specified, shall be uniformly distributed over the areas shown on the plans or where directed by the Engineer. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles FCto each other. If mechanical equipment is used, all varieties of seed as well as fertilizer, may be distributed simultaneously provided that each component is uniformly applied at the specified rate. When seed and fertilizer are to be distributed as a water slurry, the mixture shall be applied to the area to be seeded within 30 minutes after components are placed in the equipment. After planting, the planted area shall be rolled with a light corrugated drum roller or another type of roller approved by the Engineer. All rolling of the sloped areas shall be along the contour of the slopes.

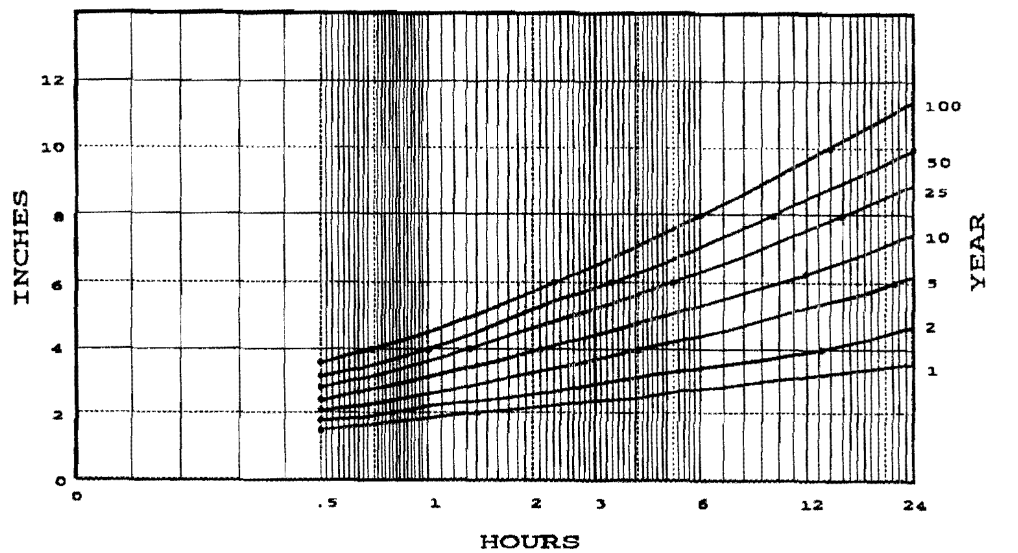
APPEINDIX C

Rainfall Graph for Selected Return Periods

This graph shows the curves for return periods of 1, 2, 5, 10, 25, 50, and 100 year. These apply to Brazos and Grimes counties and are taken from a work initiated by the National Weather Service. For the 24-hour period, the 50- and 100-year return periods suggest values of 9.9 inches and 11.3 inches respectively. The highest 24-hour totals measured are:

College Station	104 year record	9.9"
Anderson	58 year record	7.3"
Bedias	38 year record	5.6"
Richards	34 year record	10.0"

so that the graphical values prove very credible.[1]



AMOUNT OF RAINFALL FOR SELECTED
RETURN PERIODS IN GRIMES/BRAZOS COUNTIES
[FROM 0.5 HOURS TO 24 HOURS]

[1] Graph obtained from the State Climatologist's Office @ TAMU.

APPEINDIX D

Terminology

Terminology:

Definitions of terms as approved by the International Standards Organization (ISO), related to geo-textiles and erosion control.

Geotextile-related products: Permeable, polymeric, sheet or strip-like construction materials used in geotechnical and civil engineering applications

Geogrid: A polymeric, planar structure consisting of a regular open network of integrally connected tensile elements and used in geotechnical and civil engineering applications.

Geonet: A polymeric, planar structure, used in geotechnical applications, whose openings are much larger than the constituents and in which the mesh is linked by knots.

Geocomposite: An assembled materials using at least one geotextile or geotextile-related product among the components.

Drainage: The collecting and carrying of precipitation, groundwater, and/or other fluids in the plane of a geotextile.

Filtration: The restraining of soil or other particles subjected to hydrodynamic forces while allowing the passage of fluids.

Separation: The preventing from intermixing of dissimilar soils and/or fill materials.

Reinforcement: The use of the tensile properties of a geotextile to improve the mechanical properties of a soil layer.

Protection: The limiting or preventing with a geotextile of local damage to a geotechnical system.

Geotextile: A permeable, polymeric, woven nonwoven or knitted material used in geotechnical and civil engineering applications.

Woven geotextile (Geowoven): A geotextile produced by interlacing, usually at right angle, two or more sets of yarns, fibers, filaments, tapes, or other elements. (Knitted fabrics are excluded.)

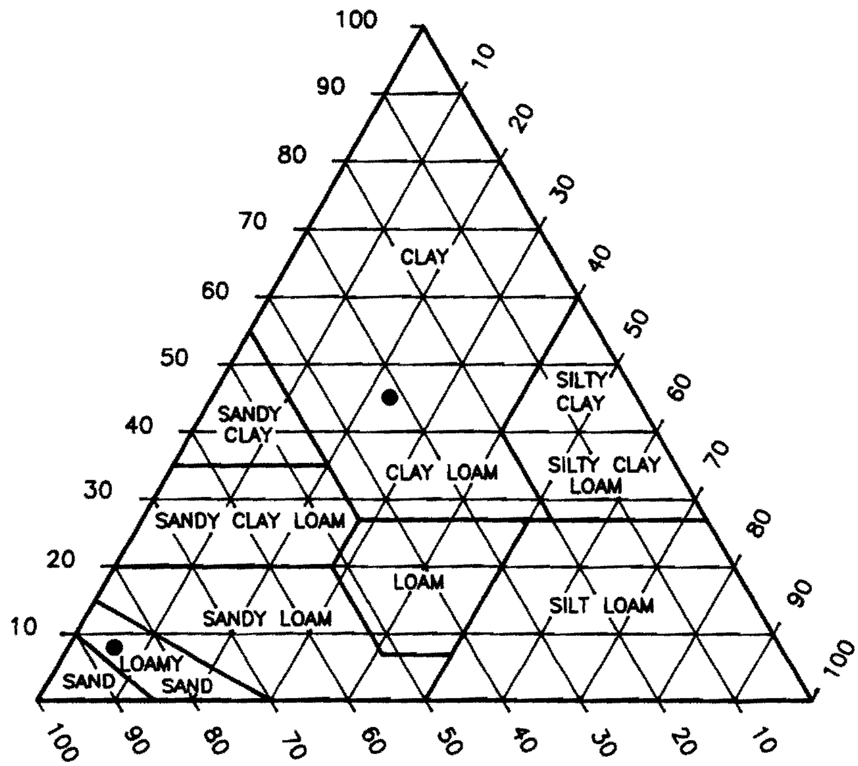
Nonwoven geotextile (Geononwoven): A geotextile in the form of a manufactured sheet, wed or batt of directionally or randomly orientated fibers, bonded by friction, and/or cohesion and/or adhesion (See ISO 9092:1988)

Knitted geotextile (Geoknitted): A geotextile produced by interlooping one or more yarns, fibers, filaments, or other elements.

APPEINDIX E

Soil Texture Triangle

The soil texture triangle is from the National Soils Handbook, Figure 603-1, which shows the two soil types used in the 1991-92 evaluations of erosion control materials at the Hydraulics and Erosion Control Field Laboratory, Bryan, TX.



APPEINDIX F

Analysis Level Results

Tabular Data
Graphical Data

ANALYSIS LEVEL 1
Overall Performance (Without Regard to Slope, Soil, or Storm Level)
Slope Protection

Table F1. Level 1 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank	Veg Density	Veg Rank
Xcel Regular®[1]	All	All	All	6.563	1/12	81.215	6/12
North American Green® S75[2]	All	All	All	12.034	2/12	87.046	3/12
Verdyol® ERO-MAT®[3]	All	All	All	12.909	3/12	80.505	7/12
Xcel Superior®[4]	All	All	All	20.800	4/12	92.310	1/12
POLYJUTE 407GT®[5]	All	All	All	27.181	5/12	85.227	4/12
Curlex®[6]	All	All	All	27.354	6/12	67.937	10/12
North American Green® SC150[7]	All	All	All	28.923	7/12	83.413	5/12
North American Green® S150[8]	All	All	All	34.589	8/12	88.380	2/12
Greenstreak® PEC-MAT®[9]	All	All	All	36.034	9/12	71.020	9/12
Polyfelt®[10]	All	All	All	37.153	10/12	71.339	8/12
ANTIWASH®/GEOJUTE®[11]	All	All	All	45.267	11/12	40.980	12/12
CONTROL	All	All	All	80.492	12/12	58.059	11/12

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"Veg Density" = Average Percent of Vegetative Cover (Round 4 Only)

[1] Tested on 3:1 slopes only.

[2] Tested on 3:1 Slopes only.

[3] Tested on 3:1 Slopes only.

[4] Tested on 2:1 Slopes only.

[5] Tested on 2:1 Slopes only.

[6] Tested on 2:1 and 3:1 Slopes only.

[7] Tested on 2:1 Slopes only.

[8] Tested on 2:1 Slopes only.

[9] Tested on 2:1 and 3:1 Slopes only.

[10] Tested on 2:1 Slopes only.

[11] Tested on 2:1 Slopes only.

ANALYSIS LEVEL 1
Overall Performance (Without Regard to Slope, Soil or, Storm Level)
Slope Protection

Sediment Loss (lbs/100 sq ft)

The performance of each of the 11 products tested and the CONTROL plot (without regard to steepness of slope, type of soil, or level of simulated rainfall events) with respect to the average amount of sediment loss are in FIGURE 1.

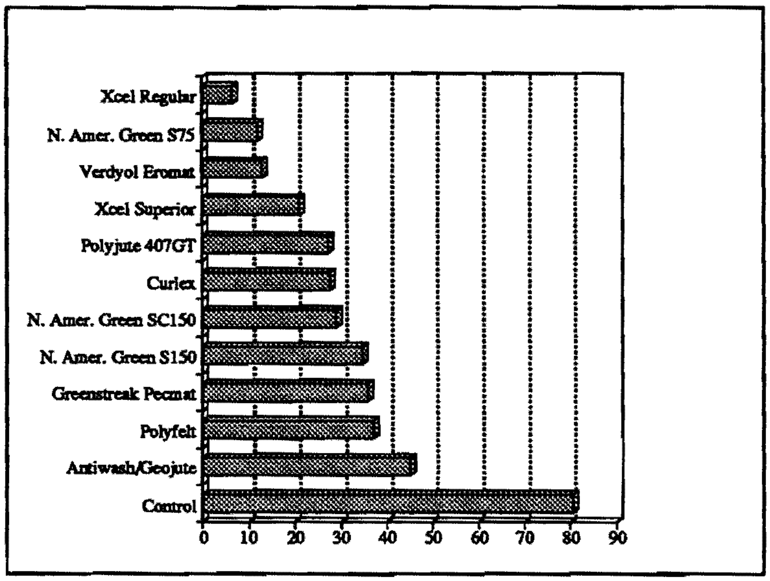


Figure 1. Sediment Loss (lbs/100 sq ft)

Vegetative Density (4th Measurement Round Only)

The performance of each of the 11 products tested and the CONTROL plot (without regard to steepness of slope or type of soil) with respect to the final percentage of vegetative density achieved are shown in FIGURE 2.

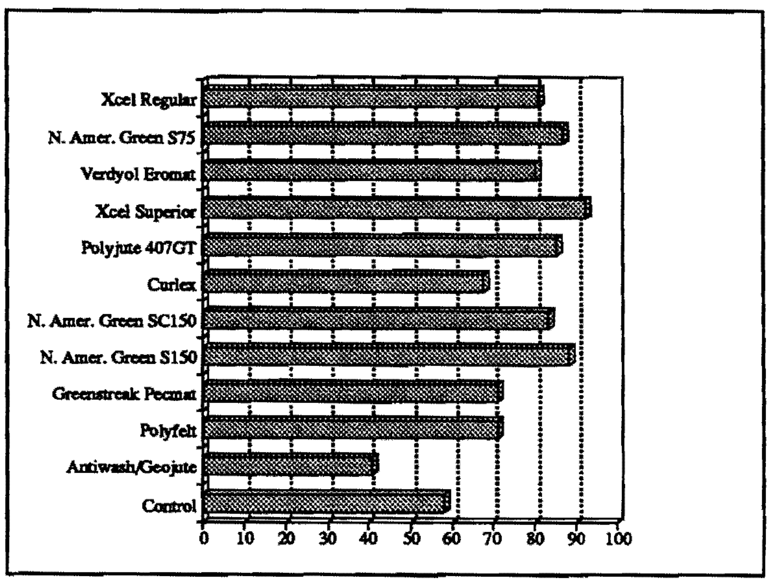


Figure 2. Vegetative Density

ANALYSIS LEVEL 2
Performance with Respect to Steepness of Slope Only
Slope Protection

Table F2. Level 2 Analysis

Product Tested	Design Storm	Slope	Type of Soil	SdmtLoss	Sdmt Rank	Veg Density	Veg Rank
Xcel Superior®	All	2:1	All	20.80	1/9	92.310	1/9
Polyjute®	All	2:1	All	27.18	2/9	85.227	3/9
North American Green® SC150	All	2:1	All	28.92	3/9	83.413	4/9
North American Green® S150	All	2:1	All	34.59	4/9	88.380	2/9
Polyfelt®	All	2:1	All	37.15	5/9	40.980	9/9
Curlex®	All	2:1	All	44.02	6/9	75.254	5/9
ANTIWASH®/GEOJUTE®	All	2:1	All	45.27	7/9	71.339	6/9
Greenstreak®PECMAT®	All	2:1	All	46.97	8/9	64.007	7/9
CONTROL	All	2:1	All	117.94	9/9	60.564	8/9

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"Veg Density" = Average Percent of Vegetative Cover (Round 4 Only)

ANALYSIS LEVEL 2
Performance with Respect to Steepness of Slope Only
Slope Protection

Sediment Loss (lbs/100 sq ft) - 2:1 Slopes

Ther performance of each of the 11 products tested on 2:1 slopes and the CONTROL plot with respect to the total sediment loss (lbs/100 sq ft) are shown in Figure 3.

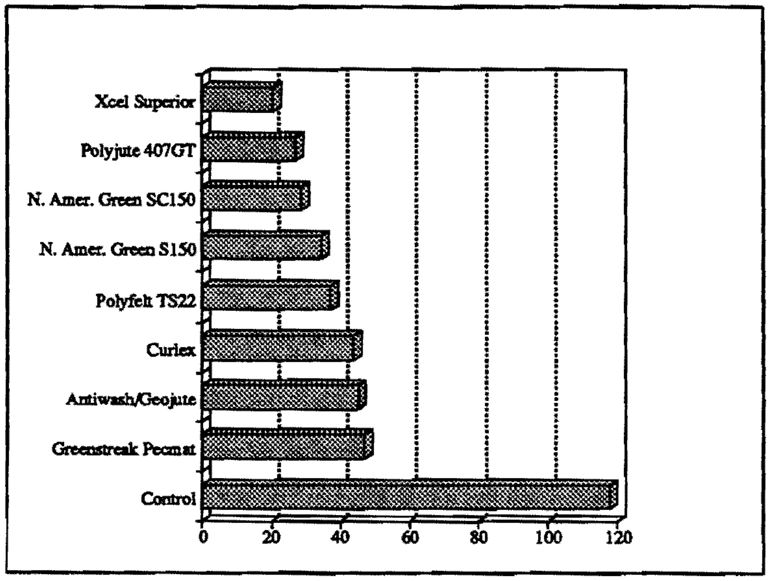


Figure 3. Sediment Loss (lbs/100 sq ft)

Vegetative Density (4th Measurement Round Only)

The performance of each of the 11 products tested on 2:1 slopes and the CONTROL plot with respect to the final percentage of vegetative density achieved are shown in FIGURE 4.

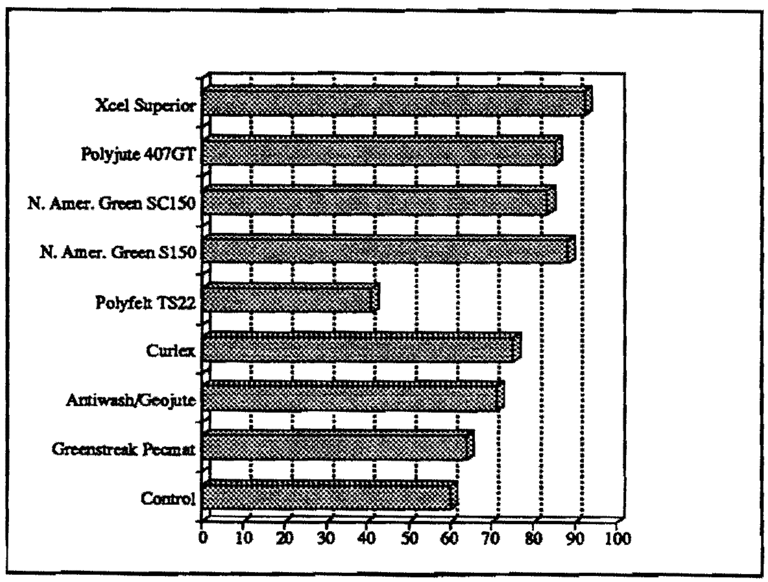


Figure 4. Vegetative Density

ANALYSIS LEVEL 2 (continued)
Performance with Respect to Steepness of Slope Only
Slope Protection

Table F3. Level 2 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank	Veg Density	Veg Rank
Curlex®	All	3:1	All	5.921	1/6	62.083	5/6
Xcel Regular®	All	3:1	All	6.563	2/6	81.215	2/6
North American Green ® S75	All	3:1	All	12.034	3/6	87.046	1/6
Verdyol® Ero-Mat®	All	3:1	All	12.909	4/6	80.505	3/6
Greenstreak® PECMAT®	All	3:1	All	24.165	5/6	76.455	4/6
CONTROL	All	3:1	All	43.045	6/6	56.131	6/6

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"Veg Density" = Average Percent of Vegetative Cover (Round 4 Only)

ANALYSIS LEVEL 2 (continued) - Performance with Respect to Steepness of Slope Only
Slope Protection

<u>Sediment Loss (lbs/100 sq ft) - 3:1 Slopes</u>

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the average sediment loss are shown in FIGURE 5.

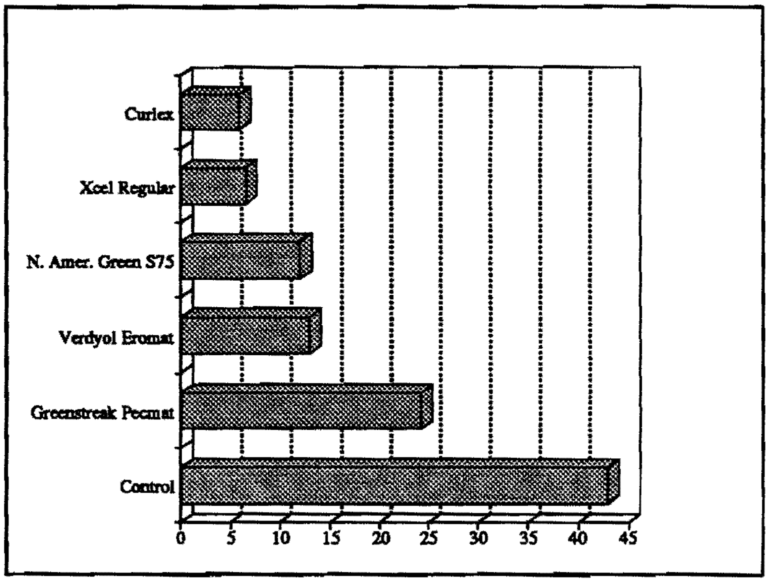


Figure 5. Sediment Loss (lbs/100 sq ft)

<u>Vegetative Density (4th Measurement Round Only) - 3:1 Slopes</u>

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the final percentage of vegetative density achieved are shown in FIGURE 6.

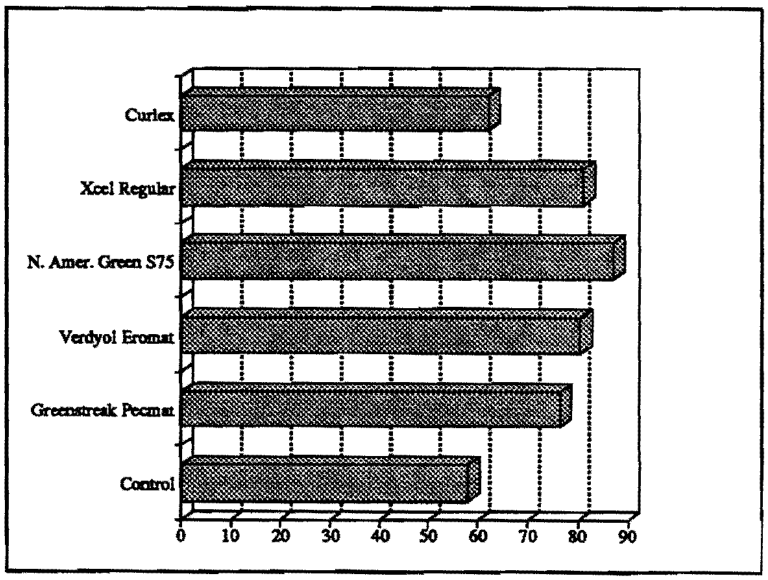


Figure 6. Vegetative Density

ANALYSIS LEVEL 3
Performance with Respect to Type of Soil Only
Slope Protection

Table F4. Level 3 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank	Veg Density	Veg Rank
Verdyol® ERO-MAT®	All	All	Clay	0.3129	1/12	87.808	9/12
Curlex®	All	All	Clay	0.3465	2/12	78.609	10/12
North American Green® SC150	All	All	Clay	0.4346	3/12	89.979	7/12
Polyfelt®	All	All	Clay	0.4437	4/12	35.909	12/12
Greenstreak® PEC-MAT®	All	All	Clay	0.4604	5/12	89.216	8/12
North American Green® S150	All	All	Clay	0.4608	6/12	92.014	4/12
POLYJUTE 407GT®	All	All	Clay	0.4857	7/12	96.151	3/12
ANTIWASH®/GEOJUTE®	All	All	Clay	0.5565	8/12	90.058	6/12
North American Green® S75	All	All	Clay	0.5598	9/12	96.187	2/12
Xcel Superior®	All	All	Clay	0.6555	10/12	98.814	1/12
Xcel Regular®	All	All	Clay	0.6559	11/12	90.166	5/12
CONTROL	All	All	Clay	2.6797	12/12	66.452	11/12

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"Veg Density" = Average Percent of Vegetative Cover (Round 4 Only)

ANALYSIS LEVEL 3 - Performance with respect to Type of Soil Only
Slope Protection

Sediment Loss (lbs/100 sq ft) - Clay Soils Only

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to total sediment loss (lbs/100 sq ft) are shown in FIGURE 7.

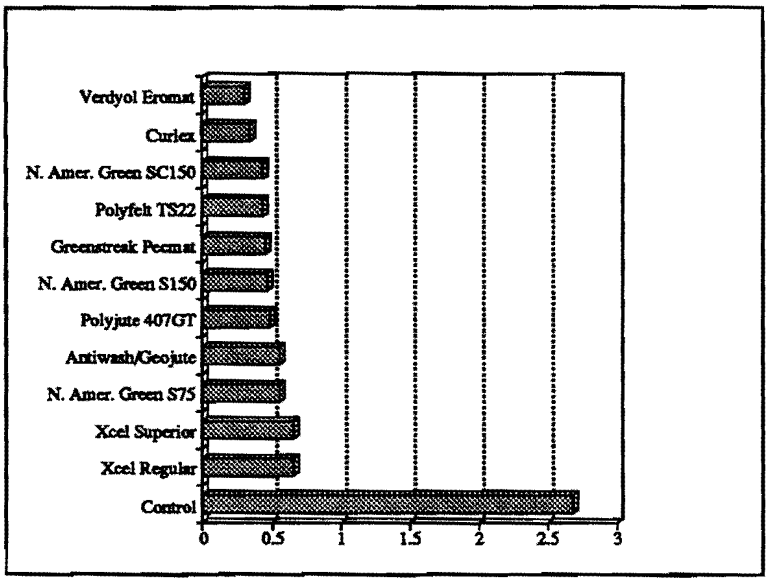


Figure 7. Sediment Loss (lbs/100 sq ft)

Vegetative Density (4th Measurement Round Only) - Clay Soils Only

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the final percentage of vegetative cover achieved are shown in FIGURE 8.

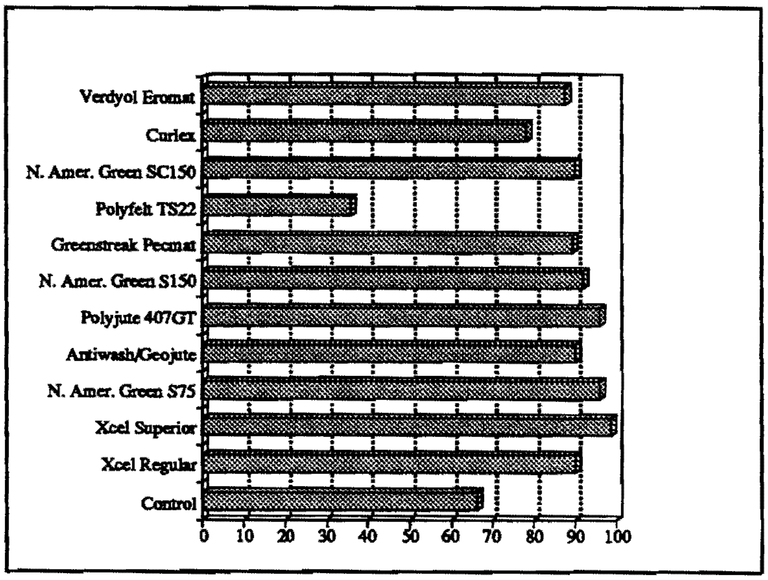


Figure 8. Vegetative Density

ANALYSIS LEVEL 3
Performance with Respect to Type of Soil Only
Slope Protection

Table F5. Level 3 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank	Veg Density	Veg Rank
Xcel Regular®	All	All	Sand	9.67	1/12	72.263	7/12
North American Green® S75	All	All	Sand	16.62	2/12	77.904	4/12
Verdyol® ERO-MAT®	All	All	Sand	18.63	3/12	73.202	6/12
Xcel Superior®	All	All	Sand	31.99	4/12	85.805	1/12
POLYJUTE™ 407GT	All	All	Sand	38.30	5/12	74.302	5/12
Curlex®	All	All	Sand	39.63	6/12	57.265	8/12
North American Green® SC150	All	All	Sand	42.49	7/12	76.409	4/12
North American Green® S150	All	All	Sand	48.81	8/12	84.746	2/12
Greenstreak® PECMAT®	All	All	Sand	49.46	9/12	52.304	9/12
Polyfelt®	All	All	Sand	51.27	11/12	46.051	12/12
ANTIWASH®/GEOJUTE®	All	All	Sand	61.83	10/12	51.372	10/12
CONTROL	All	All	Sand	112.19	12/12	49.904	11/12

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"Veg Density" = Average Percent of Vegetative Cover (Round 4 Only)

<u>Sediment Loss (lbs/100 sq ft) - Sand Soils Only</u>

The performance of each of the 11 products tested on Sand soils and the CONTROL plot with respect to average sediment loss (lbs/100 sq ft) are shown in FIGURE 9.

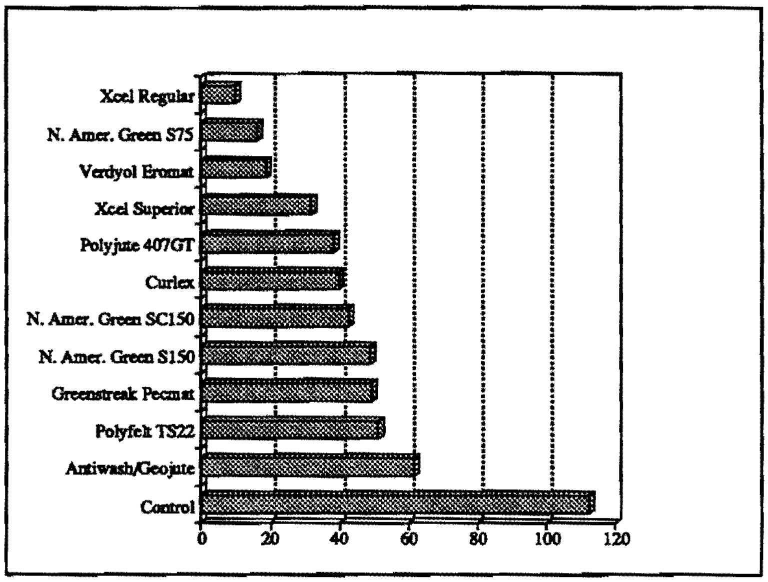


Figure 9. Sediment Loss (lbs/100 sq ft)

<u>Vegetative Density (4th Measurement Round Only) - Sand Soils Only</u>

The performance of each of the 11 products tested on Sand soils and the CONTROL plot with respect to the final percentage of vegetative cover achieved are shown in FIGURE 10.

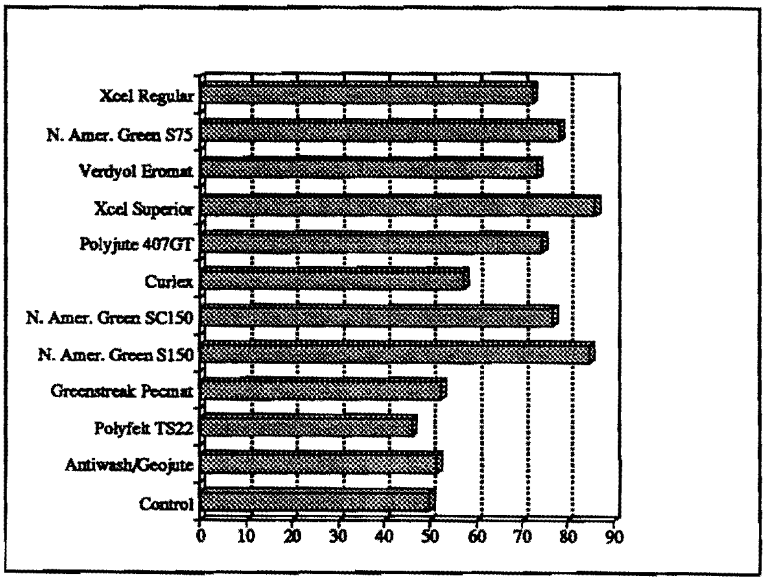


Figure 10. Vegetative Density

ANALYSIS LEVEL 4
Performance with Respect to Design Storm Level
Slope Protection

Table F6. Level 4 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol®ERO-MAT®	1-Year	All	All	0.926	1/12
North American Green® S150	1-Year	All	All	1.122	2/12
North American Green® SC150	1-Year	All	All	1.179	3/12
Xcel Regular®	1-Year	All	All	1.490	4/12
North American Green® S75	1-Year	All	All	1.513	5/12
Polyfelt®	1-Year	All	All	1.909	6/12
Xcel Superior®	1-Year	All	All	2.224	7/12
Curlex®	1-Year	All	All	2.371	8/12
ANTIWASH®/GEOJUTE®	1-Year	All	All	4.219	9/12
POLYJUTE™ 407GT	1-Year	All	All	7.850	10/12
Greenstreak®PECTMAT®	1-Year	All	All	9.460	11/12
CONTROL	1-Year	All	All	10.536	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Table F7. Level 4 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	2-Year	All	All	3.36	1/12
Xcel Superior®	2-Year	All	All	6.94	2/12
Verdyol®ERO-MAT®	2-Year	All	All	11.12	3/12
North American Green® SC150	2-Year	All	All	12.55	4/12
North American Green® S75	2-Year	All	All	13.74	5/12
North American Green® S150	2-Year	All	All	17.52	6/12
POLYJUTE™ 407GT	2-Year	All	All	18.78	7/12
Curlex®	2-Year	All	All	24.96	8/12
Polyfelt®	2-Year	All	All	32.49	9/12
Greenstreak® PECMAT®	2-Year	All	All	32.62	10/12
ANTIWASH®/GEOJUTE®	2-Year	All	All	41.85	11/12
CONTROL	2-Year	All	All	93.29	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

ANALYSIS LEVEL 4 - Performance with Respect to Design Storm Level
Slope Protection

<u>Sediment Loss (lbs/100 sq ft) - 1 Year Rainfall Event</u>

The performance of each of the 11 products tested and the CONTROL plot with respect to the average amount of sediment loss within the 1-Year simulated rainfall events are shown in FIGURE 11.

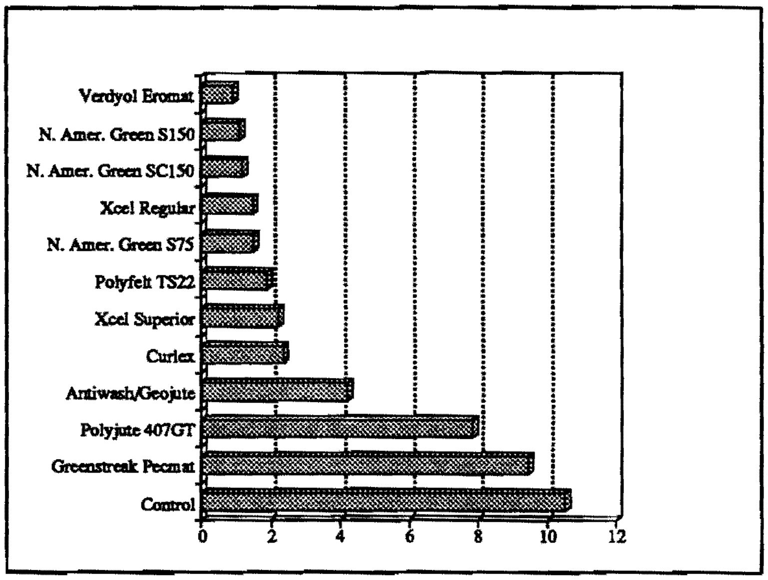


Figure 11. Sediment Loss 1-Yr. Design Storm

<u>Sediment Loss (lbs/100 sq ft) - 2 year Rainfall Event</u>

The performance of each of the 11 products tested and the CONTROL plot with respect to the average amount of sediment loss within the 2-Year simulated rainfall events are shown in FIGURE 12.

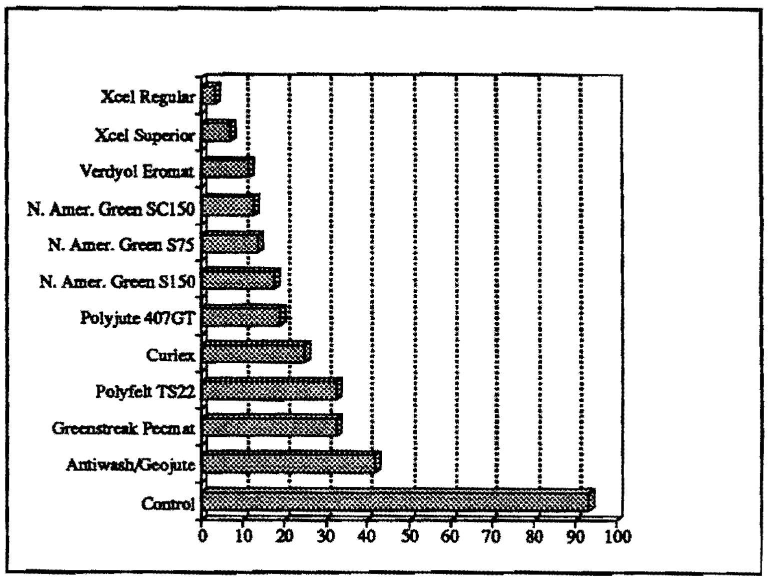


Figure 12. Sediment Loss 2-Yr. Design

ANALYSIS LEVEL 4 (continued)
Performance with Respect to Design Storm Level
Slope Protection

Table F8. Level 4 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	5-Year	All	All	9.75	1/12
North American Green® S75	5-Year	All	All	13.06	2/12
Verdyol®ERO-MAT®	5-Year	All	All	17.25	3/12
Xcel Superior®	5-Year	All	All	34.07	4/12
Curlex®	5-Year	All	All	36.46	5/12
POLYJUTE™ 407GT	5-Year	All	All	40.05	6/12
North American Green® SC150	5-Year	All	All	47.12	7/12
Greenstreak® PECMAT®	5-Year	All	All	48.37	8/12
Polyfelt®	5-Year	All	All	50.63	9/12
North American Green® S150	5-Year	All	All	57.89	10/12
ANTIWASH®/GEOJUTE®	5-Year	All	All	61.51	11/12
CONTROL	5-Year	All	All	91.34	12/12

NOTE:

"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

<u>Sediment Loss (lbs/100 sq ft) - 5 Year Rainfall Event</u>

The performance of each of the 11 products tested and the CONTROL plot with respect to the average amount of sediment loss within the 5-Year simulated rainfall events are shown in FIGURE 13.

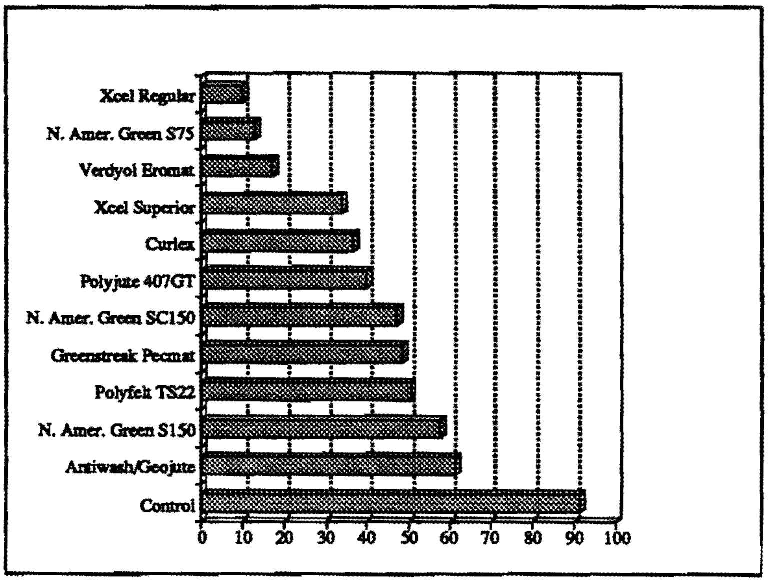


Figure 13. Sediment Loss 5-Yr. Design Storm

ANALYSIS LEVEL 4 (continued)
Vegetative Density Achieved in Each Measurement Round
Slope Protection

Table F9. Level 4 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 1	All	All	8.228	1/12
Xcel Regular®	Round 1	All	All	7.296	2/12
Xcel Superior®	Round 1	All	All	5.636	3/12
POLYJUTE™ 407GT	Round 1	All	All	5.158	4/12
Greenstreak®PECTMAT®	Round 1	All	All	3.436	5/12
CONTROL	Round 1	All	All	3.192	6/12
Curlex®	Round 1	All	All	2.100	7/12
ANTIWASH®/GEOJUTE®	Round 1	All	All	1.596	8/12
North American Green® S150	Round 1	All	All	1.581	9/12
Verdyol® ERO-MAT®	Round 1	All	All	1.414	10/12
Polyfelt®	Round 1	All	All	0.540	11/12
North American Green® SC150	Round 1	All	All	0.482	12/12

NOTE: "Round 1" = 1st Vegetative Density Measurement

Table F10. Level 4 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 2	All	All	59.565	1/12
Xcel Regular®	Round 2	All	All	56.240	2/12
North American Green® S75	Round 2	All	All	53.151	3/12
POLYJUTE™ 407GT	Round 2	All	All	46.952	4/12
Curlex®	Round 2	All	All	39.558	5/12
Verdyol®ERO-MAT®	Round 2	All	All	35.889	6/12
North American Green® SC150	Round 2	All	All	31.402	7/12
North American Green® S150	Round 2	All	All	30.235	8/12
Greenstreak® PECMAT®	Round 2	All	All	26.929	9/12
ANTIWASH®/GEOJUTE®	Round 2	All	All	24.267	10/12
CONTROL	Round 2	All	All	22.645	11/12
Polyfelt®	Round 2	All	All	6.659	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

ANALYSIS LEVEL 4 (continued) - Vegetative Density Achieved in Each Measurement Round Slope Protection

Vegetative Density - 1st Measurement Round

The performance of each of the 11 products tested and the CONTROL plot with respect to the average percent of vegetative density achieved by the 1st Measurement Round are shown in FIGURE 14.

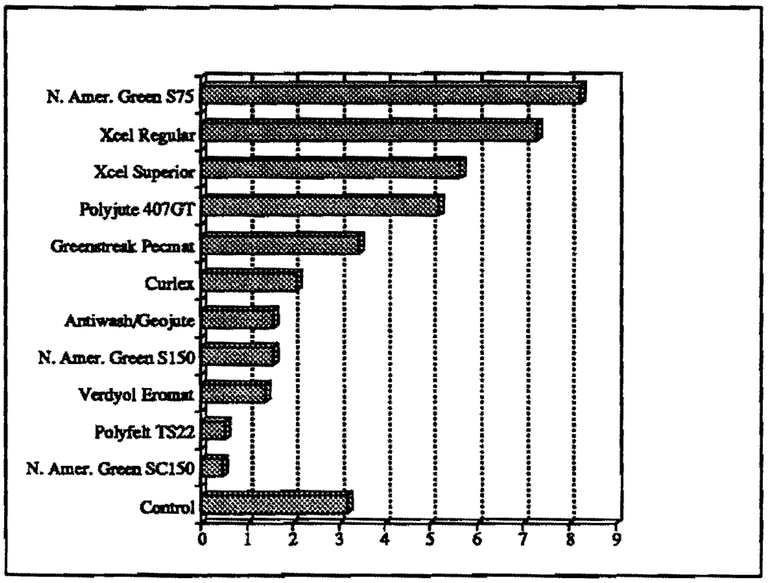


Figure 14. Vegetative Density - 1st Measurement Round

Vegetative Density - 2nd Measurement Round

The performance of each of the 11 products tested and the CONTROL plot with respect to the average percentage of vegetative density achieved by the 2nd Measurement Round are shown in FIGURE 15.

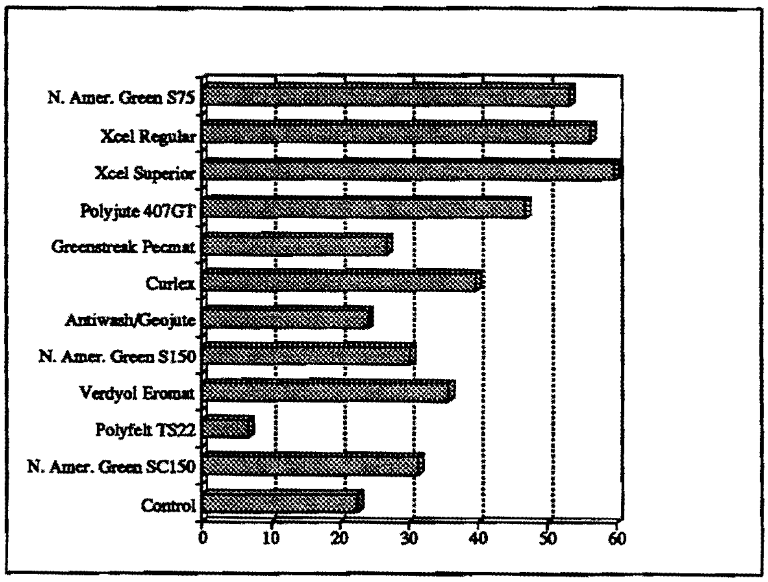


Figure 15. Vegetative Density - 2nd Measurement Round

ANALYSIS LEVEL 4 (continued)
Performance with Respect to Measurement Round
Slope Protection

Table F11. Level 4 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 3	All	All	91.127	1/12
POLYJUTE™ 407GT	Round 3	All	All	90.487	2/12
North American Green® S75	Round 3	All	All	89.849	3/12
North American Green® SC150	Round 3	All	All	84.453	4/12
North American Green® S150	Round 3	All	All	82.846	5/12
Xcel Regular®	Round 3	All	All	76.490	6/12
Curlex®	Round 3	All	All	67.032	7/12
ANTIWASH®/GEOJUTE®	Round 3	All	All	66.630	8/12
Verdyol® ERO-MAT®	Round 3	All	All	64.790	9/12
Greenstreak® PECMAT®	Round 3	All	All	61.730	10/12
CONTROL	Round 3	All	All	59.958	11/12
Polyfelt®	Round 3	All	All	36.894	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

Table F12. Level 4 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	All	All	92.310	1/12
North American Green® S150	Round 4	All	All	88.380	2/12
North American Green® S75	Round 4	All	All	87.046	3/12
POLYJUTE™ 407GT	Round 4	All	All	85.227	4/12
North American Green® SC150	Round 4	All	All	83.413	5/12
Xcel Regular®	Round 4	All	All	81.215	6/12
Verdyol®ERO-MAT®	Round 4	All	All	80.505	7/12
ANTIWASH®/GEOJUTE®	Round 4	All	All	71.339	8/12
Greenstreak®PECMAT®	Round 4	All	All	71.020	9/12
Curlex®	Round 4	All	All	67.937	10/12
CONTROL	Round 4	All	All	58.058	11/12
Polyfelt®	Round 4	All	All	40.980	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

ANALYSIS LEVEL 4 (continued) - Performance with Respect to Measurement Round Slope Protection

<u>Vegetative Density - 3rd Measurement Round</u>

The performance of Each of the 11 products tested and the CONTROL plot with respect to the average percent of vegetative density achieved by the 3rd Measurement Round are shown in FIGURE 16.

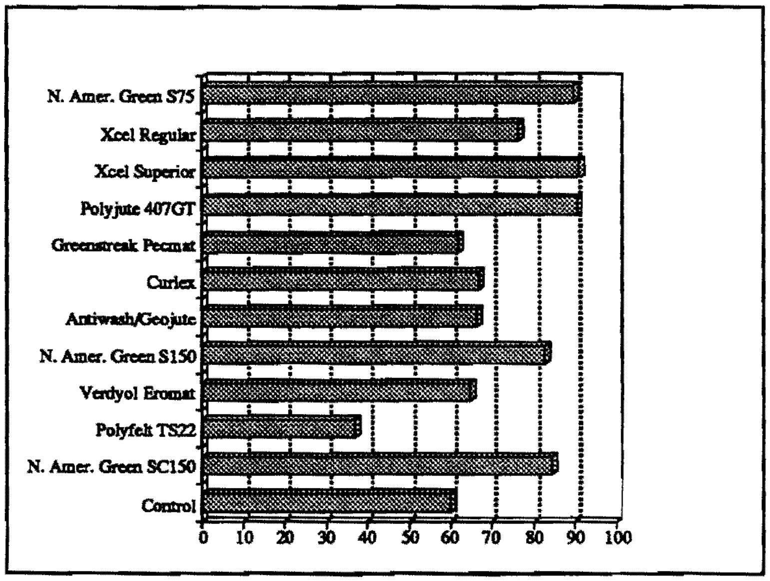


Figure 16. Vegetative Density - 3rd Measurement Round

<u>Vegetative Density - 4th Measurement Round</u>

The performance of each of the 11 products tested and the CONTROL plot with respect to the average percent of vegetative density achieved by the 4th Measurement Round are shown in FIGURE 17.

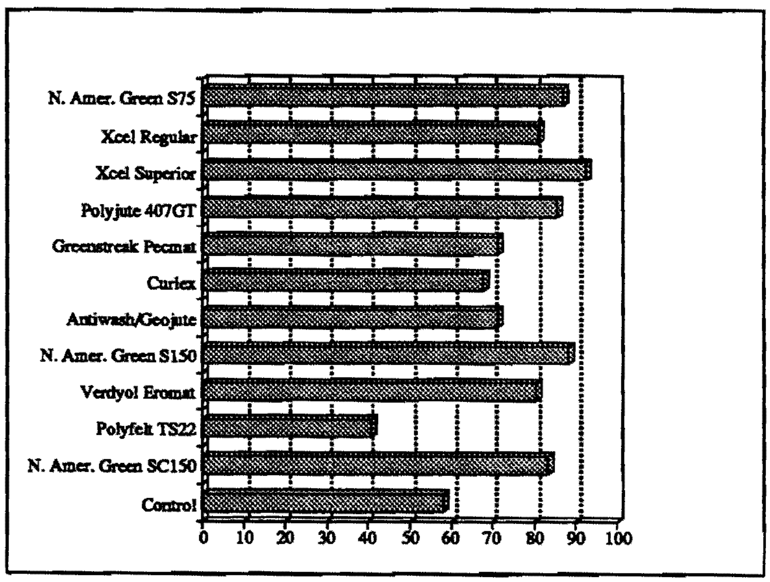


Figure 17. Vegetative Density - 4th Measurement Round

ANALYSIS LEVEL 6
Performance with Respect to Design Storm and Steepness of Slope
Slope Protection

Table F13. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
North American Green® S150	1-Year	2:1	All	1.122	1/9
North American Green® SC150	1-Year	2:1	All	1.179	2/9
Curlex®	1-Year	2:1	All	1.659	3/9
Polyfelt®	1-Year	2:1	All	1.909	4/9
Xcel Superior®	1-Year	2:1	All	2.224	5/9
ANTIWASH®/GEOJUTE®	1-Year	2:1	All	4.219	6/9
POLYJUTE™ 407GT	1-Year	2:1	All	7.850	7/9
Greenstreak® PECMAT®	1-Year	2:1	All	13.144	8/9
CONTROL	1-Year	2:1	All	13.773	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Table F14. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol® ERO-MAT®	1-Year	3:1	All	0.926	1/6
Xcel Regular®	1-Year	3:1	All	1.490	2/6
North American Green® SC75	1-Year	3:1	All	1.513	3/6
Curlex®	1-Year	3:1	All	2.940	4/6
Greenstreak® PECMAT®	1-Year	3:1	All	5.038	5/6
CONTROL	1-Year	3:1	All	6.651	6/6

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

ANALYSIS LEVEL 6 - Performance with Respect to Design Storm and Steepness of Slope
Slope Protection

Sediment Loss (lbs/100 sq ft) - 2:1, 1-Year Design Storm

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 18.

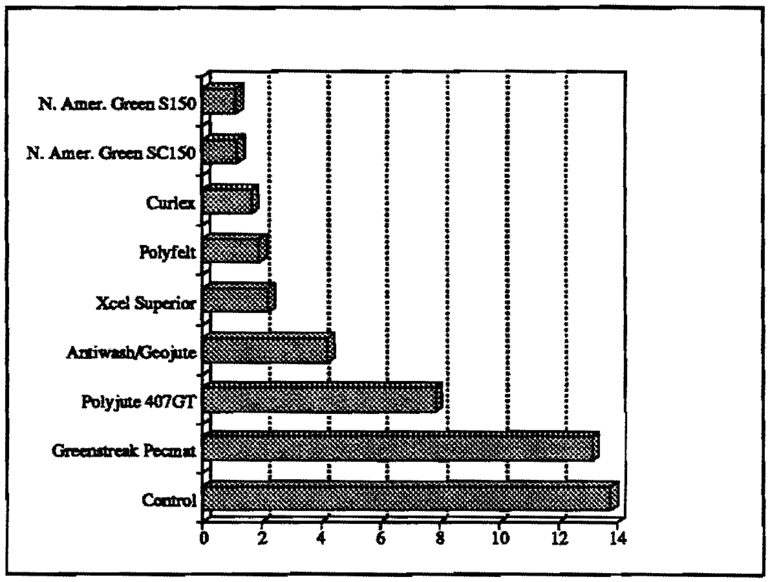


Figure 18. Sediment Loss (lbs/100 sq ft)

Sediment Loss (lbs/100 sq ft) - 3:1, 1-Year Design Storm

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 19.

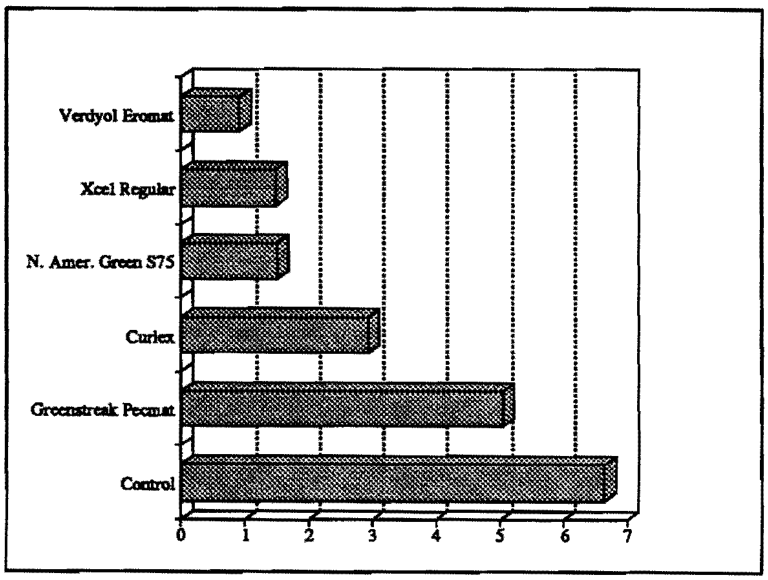


Figure 19. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Design Storm and Steepness of Slope
Slope Protection

Table F15. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Superior®	2-Year	2:1	All	6.94	1/9
North American Green® SC150	2-Year	2:1	All	12.55	2/9
North American Green® S150	2-Year	2:1	All	17.52	3/9
POLYJUTE™ 407GT	2-Year	2:1	All	18.78	4/9
Polyfelt®	2-Year	2:1	All	32.49	5/9
Curlex®	2-Year	2:1	All	35.58	6/9
Greenstreak® PECMAT®	2-Year	2:1	All	36.89	7/9
ANTIWASH®/GEOJUTE®	2-Year	2:1	All	41.85	8/9
CONTROL	2-Year	2:1	All	138.47	9/9

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Table F16. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	2-Year	3:1	All	3.356	1/6
Curlex®	2-Year	3:1	All	3.716	2/6
Verdyol® ERO-MAT®	2-Year	3:1	All	11.116	3/6
North American Green® S75	2-Year	3:1	All	13.742	4/6
Greenstreak® PECMAT®	2-Year	3:1	All	27.744	5/6
CONTROL	2-Year	3:1	All	50.762	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

ANALYSIS LEVEL 6 (continued) - Performance with Respect to Design Storm and Steepness of Slope Slope Protection

Sediment Loss (lbs/100 sq ft) - 2:1, 2-Year Design Storm

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 20.

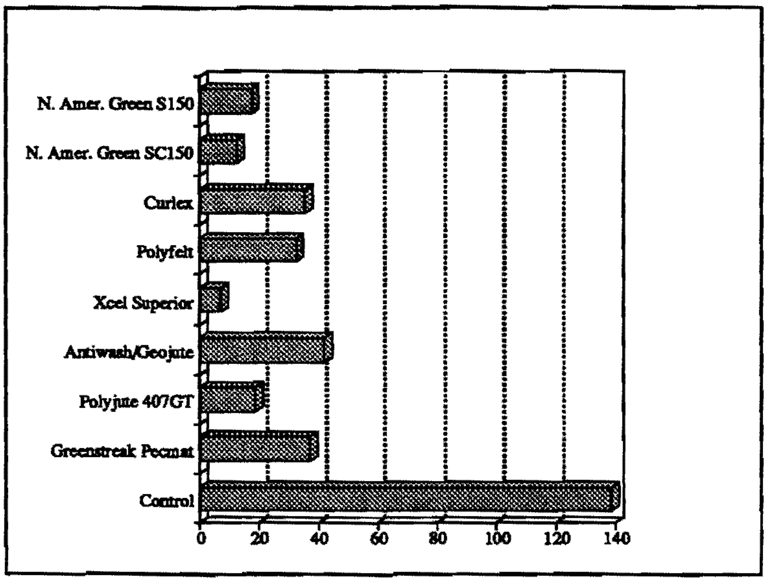


Figure 20. Sediment Loss (lbs/100 sq ft)

Sediment Loss (lbs/100 sq ft) - 3:1, 2-Year Design Storm

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 21.

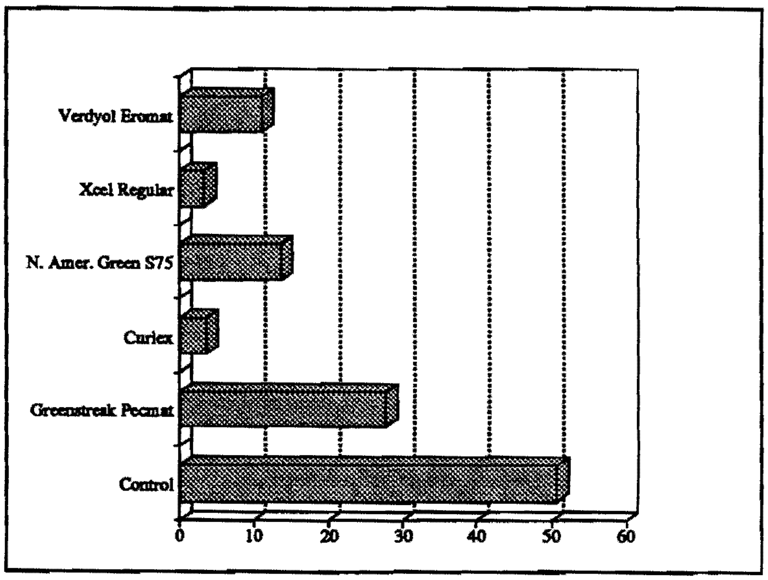


Figure 21. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Design Storm and Steepness of Slope
Slope Protection

Table F17. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Superior®	5-Year	2:1	All	34.07	1/9
POLYJUTE™ 407GT	5-Year	2:1	All	40.05	2/9
North American Green® SC150	5-Year	2:1	All	47.12	3/9
Polyfelt®	5-Year	2:1	All	50.63	4/9
North American Green® S150	5-Year	2:1	All	57.89	5/9
ANTIWASH®/GEOJUTE®	5-Year	2:1	All	61.51	6/9
Curlex®	5-Year	2:1	All	63.06	7/9
Greenstreak® PECMAT®	5-Year	2:1	All	69.73	8/9
CONTROL	5-Year	2:1	All	136.47	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

Table F18. Level 6 Analysis

Product Tested	Design Storm	Slope	Type of Soil	SdmtL oss	Sdmt Rank
Curlex®	5-Year	3:1	All	8.090	1/6
Xcel Regular®	5-Year	3:1	All	9.752	2/6
North American Green® S75	5-Year	3:1	All	13.064	3/6
Verdyol® ERO-MAT®	5-Year	3:1	All	17.249	4/6
Greenstreak® PECMAT®	5-Year	3:1	All	27.010	5/6
CONTROL	5-Year	3:1	All	46.218	6/6

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

<u>Sediment Loss (lbs/100 sq ft) - 2:1, 5-Year Design Storm</u>

The performance of each of the 8 products tested on 2:1 slopes and the plot with respect to the amount of sediment loss within a 5-Year simulated rainfall event are shown in FIGURE 22.

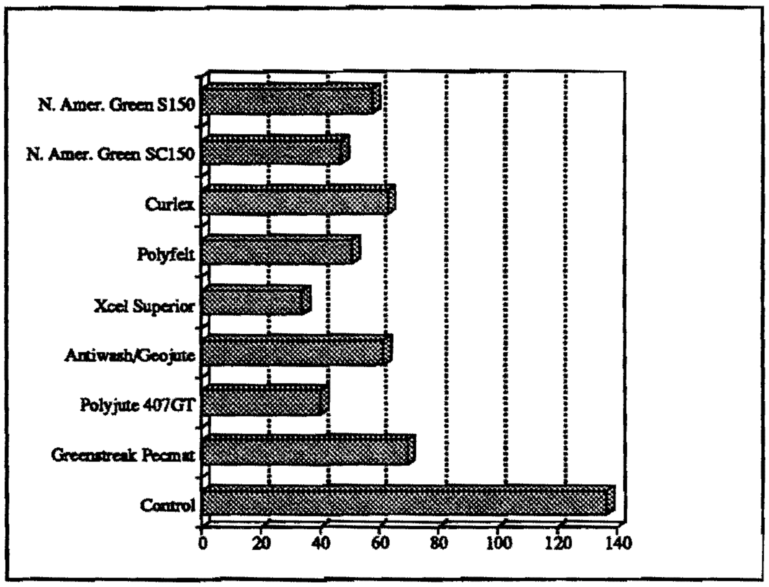


Figure 22. Sediment Loss (lbs/100 sq ft)

<u>Sediment Loss (lbs/100 sq ft) - 3:1, 5-Year Design Storm</u>

The performance of each of the 5 products tested on 3:1 slopes and the plot with respect to the amount of sediment loss within a 5-Year simulated rainfall event are shown in FIGURE 23.

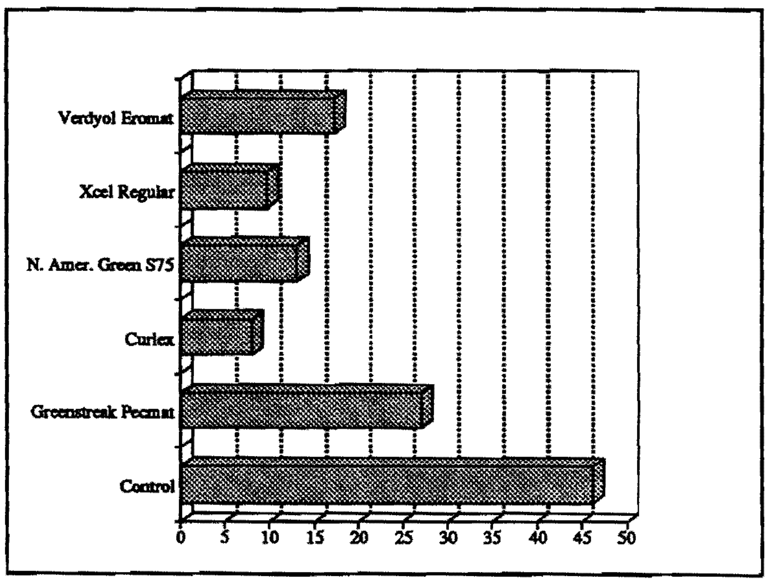


Figure 23. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Steepness of Slope and Measurement Round
Slope Protection

Table F19. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 1	2:1	All	5.636	1/9
POLYJUTE®	Round 1	2:1	All	5.158	2/9
CONTROL	Round 1	2:1	All	2.750	3/9
Curlex®	Round 1	2:1	All	2.222	4/9
ANTIWASH®/GEOJUTE®	Round 1	2:1	All	1.596	5/9
North American Green® S150	Round 1	2:1	All	1.581	6/9
Greenstreak® PECMAT®	Round 1	2:1	All	1.473	7/9
Polyfelt®	Round 1	2:1	All	0.540	8/9
North American Green® SC150	Round 1	2:1	All	0.482	9/9

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegative Density Measurement

Table F20. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 1	3:1	All	8.228	1/6
Xcel Regular®	Round 1	3:1	All	7.296	2/6
Greenstreak® PECMAT®	Round 1	3:1	All	4.909	3/6
CONTROL	Round 1	3:1	All	3.635	4/6
Curlex®	Round 1	3:1	All	2.006	5/6
Verdyol® ERO-MAT®	Round 1	3:1	All	1.414	6/6

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegative Density Measurement

ANALYSIS LEVEL 6 (continued) - Performance with Respect to Steepness of Slope and Measurement Round Slope Protection

Vegetative Density - 2:1, Measurement Round 1

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 1st Measurement Round are shown in FIGURE 24.

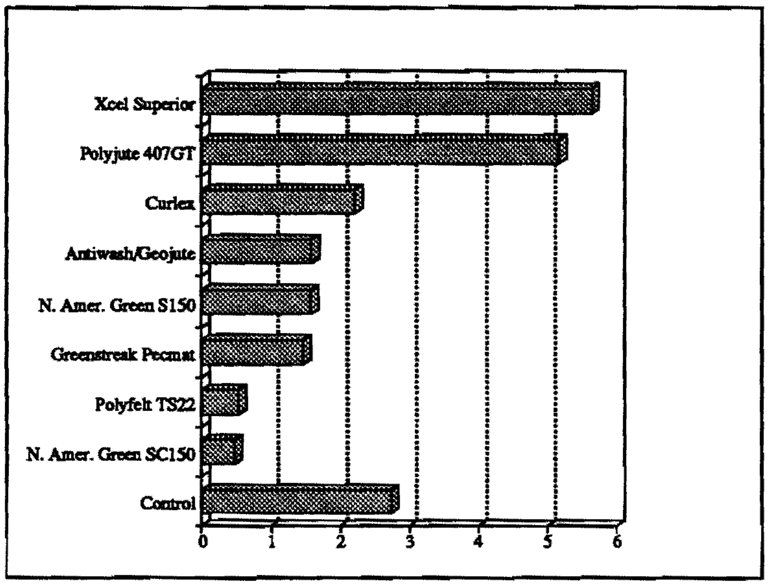


Figure 24. Vegetative Density

Vegetative Density - 3:1, Measurement Round 1

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 1st Measurement Round are shown in FIGURE 25.

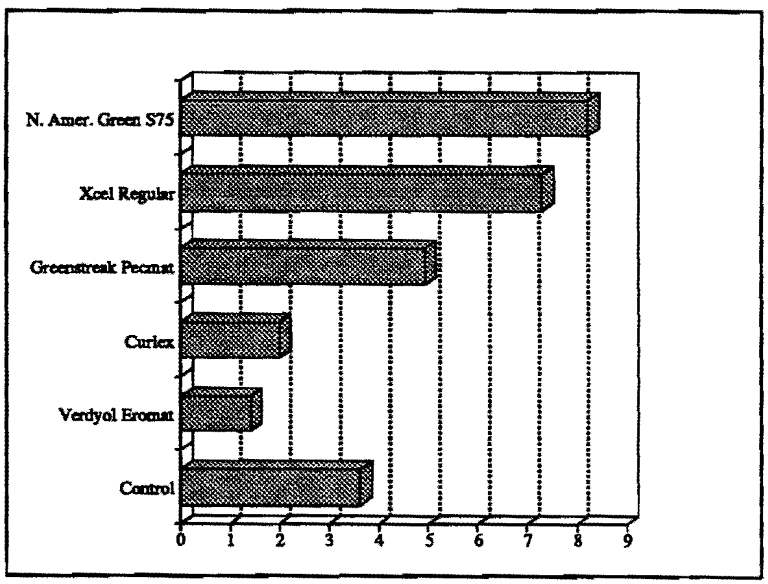


Figure 25. Vegetative Density

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Steepness of Slope and Measurement Round
Slope Protection

Table F21. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 2	2:1	All	59.565	1/9
Curlex®	Round 2	2:1	All	47.918	2/9
POLYJUTE™ 407GT	Round 2	2:1	All	46.952	3/9
North American Green® SC150	Round 2	2:1	All	31.402	4/9
North American Green® S150	Round 2	2:1	All	30.235	5/9
ANTIWASH®/GEOJUTE®	Round 2	2:1	All	24.267	6/9
CONTROL	Round 2	2:1	All	23.452	7/9
Greenstreak® PECMAT®	Round 2	2:1	All	15.063	8/9
Polyfelt®	Round 2	2:1	All	6.659	9/9

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

Table F22. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Regular®	Round 2	3:1	All	56.240	1/6
North American Green® S75	Round 2	3:1	All	53.151	2/6
Verdyol® ERO-MAT®	Round 2	3:1	All	35.889	3/6
Greenstreak® PECMAT®	Round 2	3:1	All	35.829	4/6
Curlex®	Round 2	3:1	All	32.698	5/6
CONTROL	Round 2	3:1	All	21.982	6/6

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

ANALYSIS LEVEL 6 (continued) - Performance with Respect to Steepness of Slope and Measurement Round Slope Protection

Vegetative Density - 2:1, Measurement Round 2

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 2nd Measurement Round are shown on FIGURE 26.

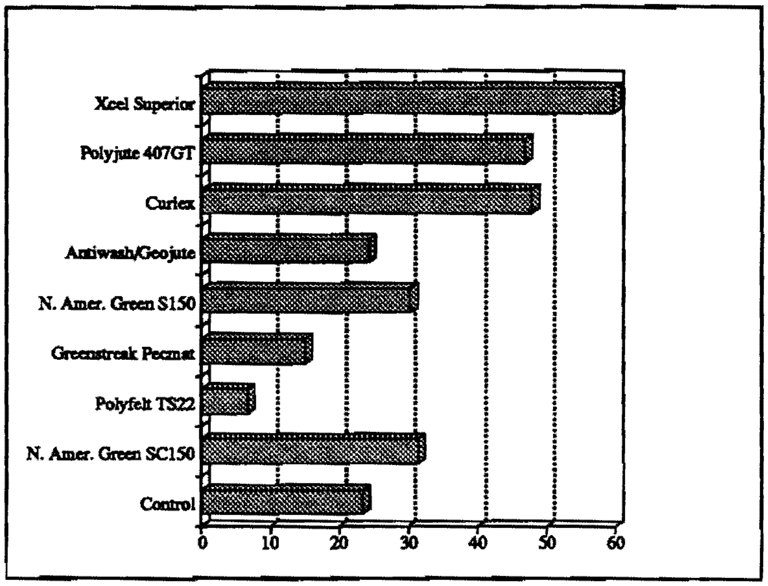


Figure 26. Vegetative Density

Vegetative Density - 3:1, Measurement Round 2

The performance of Each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 2nd Measurement Round are shown on FIGURE 27.

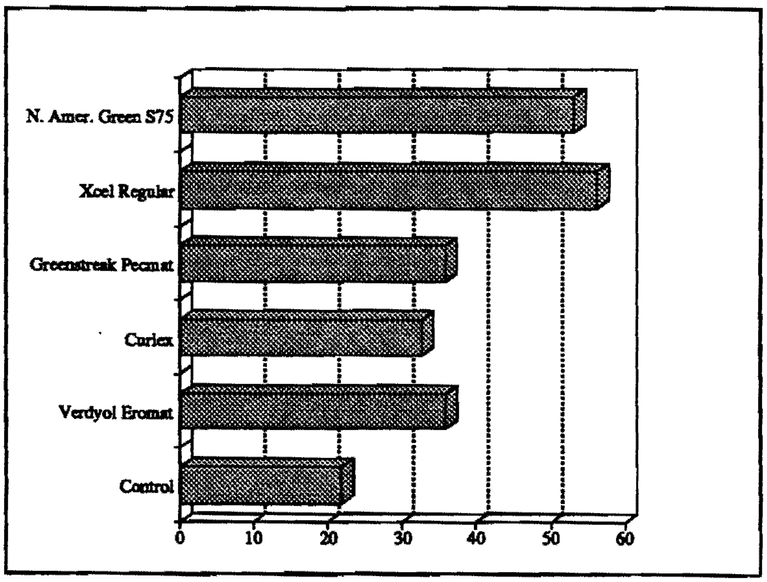


Figure 27. Vegetative Density

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Steepness of Slope and Measurement Round
Slope Protection

Table F23. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Density Produced	Density Rank
Xcel Superior®	Round 3	2:1	All	91.127	1/9
POLYJUTE™ 407GT	Round 3	2:1	All	90.487	2/9
North American Green® SC150	Round 3	2:1	All	84.453	3/9
North American Green® S150	Round 3	2:1	All	82.846	4/9
Curlex®	Round 3	2:1	All	76.749	5/9
ANTIWASH®/GEOJUTE®	Round 3	2:1	All	66.630	6/9
CONTROL	Round 3	2:1	All	57.469	7/9
Greenstreak® PECMAT®	Round 3	2:1	All	46.226	8/9
Polyfelt®	Round 3	2:1	All	36.894	9/9

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

Table F24. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 3	3:1	All	89.849	1/6
Xcel Regular®	Round 3	3:1	All	76.490	2/6
Greenstreak® PECMAT®	Round 3	3:1	All	73.970	3/6
Verdyol® ERO-MAT®	Round 3	3:1	All	74.790	4/6
CONTROL	Round 3	3:1	All	61.988	5/6
Curlex®	Round 3	3:1	All	59.153	6/6

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

<u>Vegetative Density - 2:1, Measurement Round 3</u>

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 3rd Measurement Round are shown on FIGURE 28.

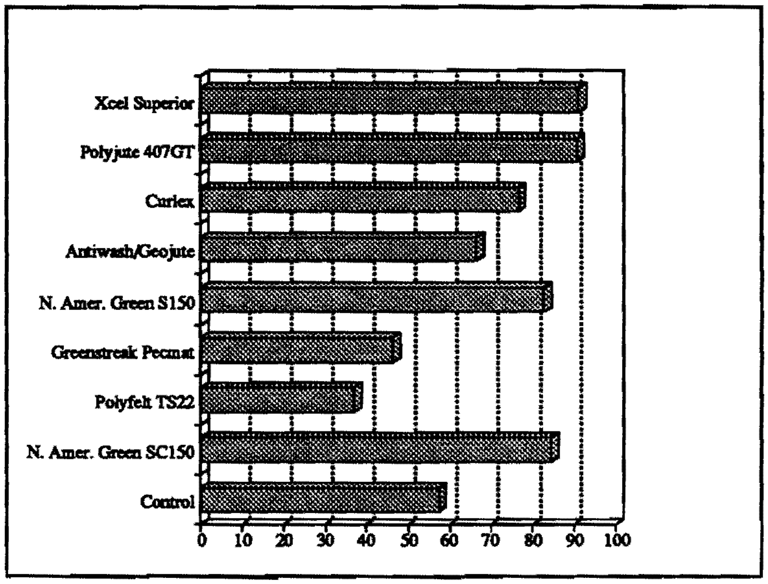


Figure 28. Vegetative Density

<u>Vegetative Density - 3:1, Measurement Round 3</u>

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 3rd Measurement Round are shown on FIGURE 29.

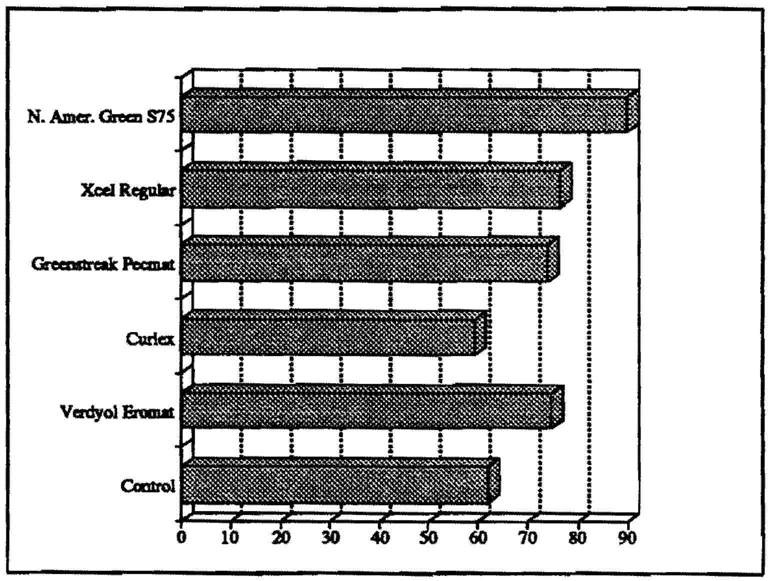


Figure 29. Vegetative Density

ANALYSIS LEVEL 6 (continued)
Performance with Respect to Steepness of Slope and Measurement Round
Slope Protection

Table F25. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	2:1	All	92.310	1/9
North American Green® S150	Round 4	2:1	All	88.380	2/9
POLYJUTE™ 407GT	Round 4	2:1	All	85.227	3/9
North American Green® SC150	Round 4	2:1	All	83.413	4/9
Curlex®	Round 4	2:1	All	75.254	5/9
ANTIWASH®/GEOJUTE®	Round 4	2:1	All	71.339	6/9
Greenstreak® PECMAT®	Round 4	2:1	All	64.007	7/9
CONTROL	Round 4	2:1	All	60.564	8/9
Polyfelt®	Round 4	2:1	All	40.980	9/9

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

Table 26. Level 6 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 4	3:1	All	87.046	1/6
Xcel Regular®	Round 4	3:1	All	81.215	2/6
Verdyol® Ero-Mat®	Round 4	3:1	All	80.505	3/6
Greenstreak® PEC-MAT®	Round 4	3:1	All	76.455	4/6
Curlex®	Round 4	3:1	All	62.083	5/6
CONTROL	Round 4	3:1	All	56.131	6/6

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

ANALYSIS LEVEL 6 (continued) - Performance with Respect to Steepness of Slope and Measurement Round Slope Protection

Vegetative Density - 2:1, 4th Measurement Round

The performance of each of the 8 products tested on 2:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 4th Measurement Round are shown on FIGURE 30.

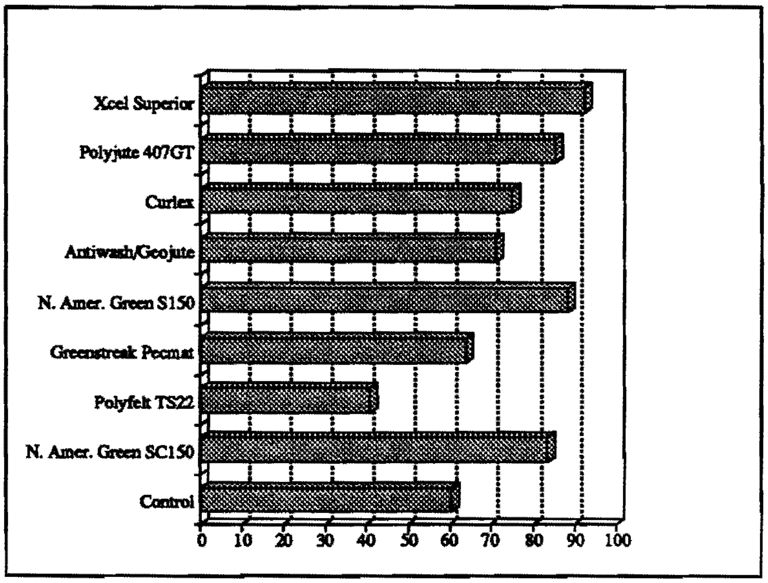


Figure 30. Vegetative Density

Vegetative Density - 3:1, 4th Measurement Round

The performance of each of the 5 products tested on 3:1 slopes and the CONTROL plot with respect to the percentage of vegetative density achieved during the 4th Measurement Round are shown on FIGURE 31.

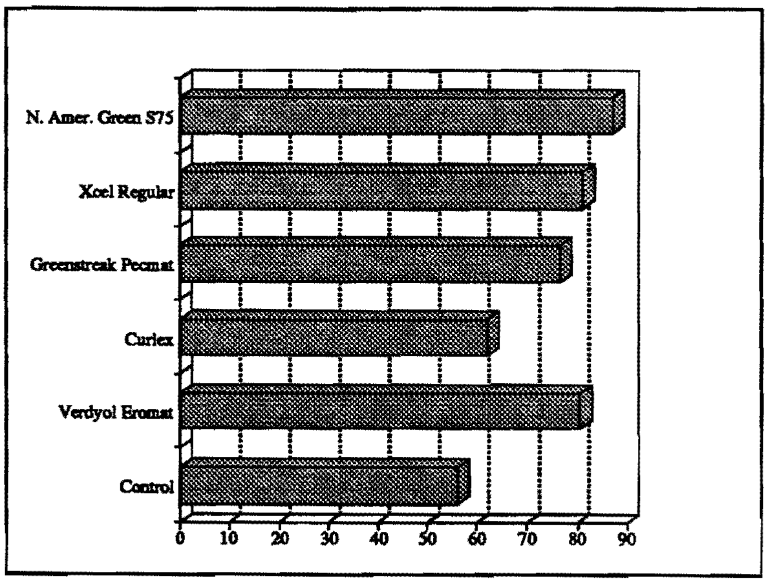


Figure 31. Vegetative Density

ANALYSIS LEVEL 7
Performance with Respect to Type of Soil and Design Storm Slope Protection

Table F27. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
ANTIWASH®/GEOJUTE®	1-Year	All	Clay	0.7385	1/12
Verdyol® ERO-MAT®	1-Year	All	Clay	0.7518	2/12
Curlex®	1-Year	All	Clay	0.8040	3/12
North American Green® S150	1-Year	All	Clay	0.8310	4/12
Greenstreak® PEC-MAT®	1-Year	All	Clay	0.9124	5/12
North American Green® SC150	1-Year	All	Clay	1.0120	6/12
Polyfelt®	1-Year	All	Clay	1.0255	7/12
POLYJUTE™ 407GT	1-Year	All	Clay	1.0635	8/12
North American Green® S75	1-Year	All	Clay	1.3175	9/12
Xcel Superior®	1-Year	All	Clay	1.5955	10/12
Xcel Regular®	1-Year	All	Clay	1.6029	11/12
CONTROL	1-Year	All	Clay	1.9366	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Table F28. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol® ERO-MAT®	1-Year	All	Sand	1.100	1/12
North American Green® SC150	1-Year	All	Sand	1.347	2/12
North American Green® S150	1-Year	All	Sand	1.412	3/12
Xcel Regular®	1-Year	All	Sand	1.415	4/12
North American Green® S75	1-Year	All	Sand	1.709	5/12
Polyfelt®	1-Year	All	Sand	2.792	6/12
Xcel Superior®	1-Year	All	Sand	2.852	7/12
Curlex®	1-Year	All	Sand	3.624	8/12
ANTIWASH®/GEOJUTE®	1-Year	All	Sand	6.539	9/12
POLYJUTE™ 407GT	1-Year	All	Sand	12.375	10/12
Greenstreak® PECMAT®	1-Year	All	Sand	14.344	11/12
CONTROL	1-Year	All	Sand	17.702	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

ANALYSIS LEVEL 7 - Performance with Respect to Type of Soil and Design Storm Slope Protection

Sediment Loss (lbs/100 sq ft) - Clay Soils, 1-Year Storm

The performance of each of the 11 product tested on Clay soils and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 32.

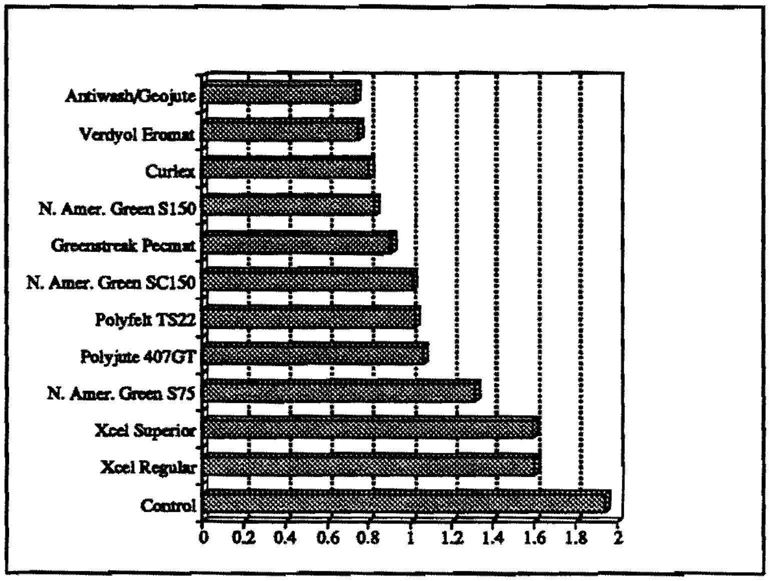


Figure 32. Sediment Loss (lbs/100 sq ft)

Sediment Loss (lbs/100 sq ft) - Sandy Soils, 1-Year Storm

The performance of each of the 11 products tested on Sandy soils and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 33.

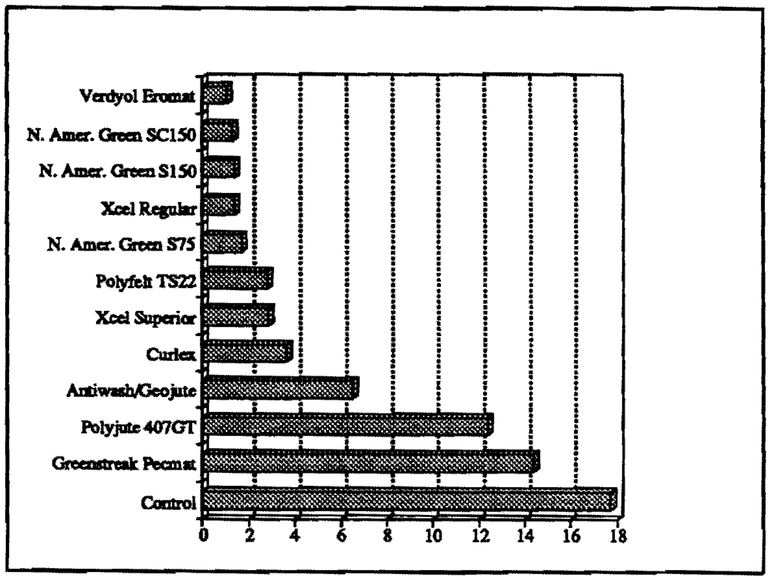


Figure 33. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Design Storm
Slope Protection

Table F29. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Curlex®	2-Year	All	Clay	0.2577	1/12
Polyfelt®	2-Year	All	Clay	0.2590	2/12
Verdyol® ERO-MAT®	2-Year	All	Clay	0.3054	3/12
North American Green® SC150	2-Year	All	Clay	0.3527	4/12
POLYJUTE™ 407GT	2-Year	All	Clay	0.4247	5/12
Greenstreak® PECMAT®	2-Year	All	Clay	0.5075	6/12
North American Green® S150	2-Year	All	Clay	0.5617	7/12
North American Green® S75	2-Year	All	Clay	0.6393	8/12
Xcel Superior®	2-Year	All	Clay	0.6525	9/12
Xcel Regular®	2-Year	All	Clay	0.6904	10/12
ANTIWASH®/GEOJUTE®	2-Year	All	Clay	0.8135	11/12
CONTROL	2-Year	All	Clay	4.6703	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Table F30. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	2-Year	All	Sand	6.02	1/12
Xcel Superior®	2-Year	All	Sand	11.98	2/12
Verdyol® ERO-MAT®	2-Year	All	Sand	16.52	3/12
North American Green® S75	2-Year	All	Sand	18.51	4/12
North American Green® SC150	2-Year	All	Sand	19.51	5/12
North American Green® S150	2-Year	All	Sand	24.30	6/12
POLYJUTE™ 407GT	2-Year	All	Sand	26.94	7/12
Curlex®	2-Year	All	Sand	37.31	8/12
Polyfelt®	2-Year	All	Sand	43.23	9/12
Greenstreak® PECMAT®	2-Year	All	Sand	44.30	10/12
ANTIWASH®/GEOJUTE®	2-Year	All	Sand	55.53	11/12
CONTROL	2-Year	All	Sand	126.52	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

ANALYSIS LEVEL 7 (continued) - Performance with Respect to Type of Soil and Design Storm Slope Protection

<u>Sediment Loss (lbs/100 sq ft) - Clay Soils, 2-Year Storm</u>

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 34.

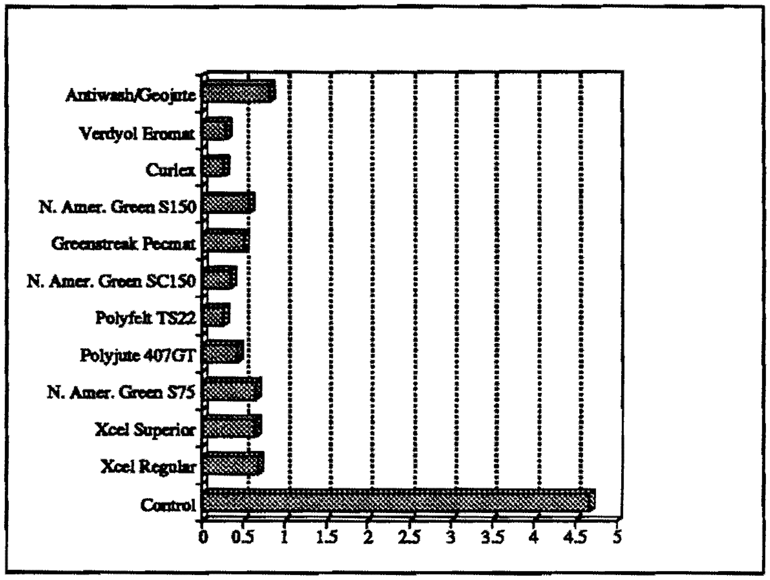


Figure 34. Sediment Loss (lbs/100 sq ft)

<u>Sediment Loss (lbs/100 sq ft) - Sandy Soils, 2-Year Storm</u>

The performance of each of the 11 products tested on Sandy soils and the CONTROL plot with respect to the amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 35.

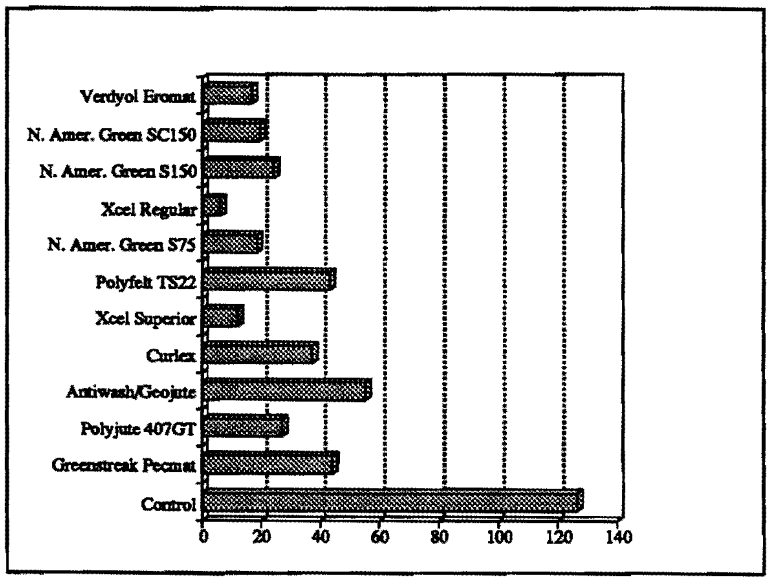


Figure 35. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Design Storm
Slope Protection

Table F31. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol® ERO-MAT®	5-Year	All	Clay	0.1011	1/12
North American Green® S75	5-Year	All	Clay	0.1014	2/12
Xcel Regular®	5-Year	All	Clay	0.1480	3/12
North American Green® S150	5-Year	All	Clay	0.1747	4/12
Greenstreak® PECMAT®	5-Year	All	Clay	0.1872	5/12
Xcel Superior®	5-Year	All	Clay	0.1885	6/12
Curlex®	5-Year	All	Clay	0.2064	7/12
ANTIWASH®/GEOJUTE®	5-Year	All	Clay	0.2085	8/12
North American Green® SC150	5-Year	All	Clay	0.2277	9/12
POLYJUTE™ 407GT	5-Year	All	Clay	0.2577	10/12
Polyfelt®	5-Year	All	Clay	0.3375	11/12
CONTROL	5-Year	All	Clay	0.9047	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

Table F32. Level 7 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	5-Year	All	Sand	12.95	1/12
North American Green® S75	5-Year	All	Sand	17.39	2/12
Verdyol® ERO-MAT®	5-Year	All	Sand	22.96	3/12
Xcel Superior®	5-Year	All	Sand	46.39	4/12
Curlex®	5-Year	All	Sand	49.07	5/12
POLYJUTE™ 407GT	5-Year	All	Sand	53.31	6/12
North American Green® SC150	5-Year	All	Sand	62.75	7/12
Greenstreak® PECMAT®	5-Year	All	Sand	64.43	8/12
Polyfelt®	5-Year	All	Sand	67.39	9/12
North American Green® S150	5-Year	All	Sand	77.13	10/12
ANTIWASH®/GEOJUTE®	5-Year	All	Sand	81.94	11/12
CONTROL	5-Year	All	Sand	121.49	12/12

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

ANALYSIS LEVEL 7 (continued) - Performance with Respect to Type of Soil and Design Storm Slope Protection

Sediment Loss (lbs/100 sq ft) - Clay Soils, 5-Year Storm

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the amount of sediment loss within a 5-Year simulated rainfall event are shown in FIGURE 36.

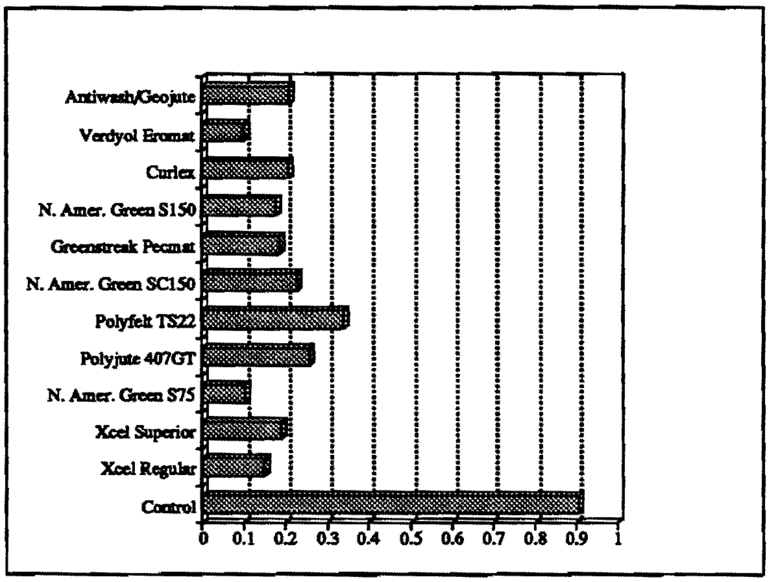


Figure 36. Sediment Loss (lbs/100 sq ft)

Sediment Loss (lbs/100 sq ft) - Sandy Soils, 5-Year Storm

The performance of each of the 11 products tested on Sandy soils and the CONTROL plot with respect to the amount of sediment loss within a 5-Year simulated rainfall event are shown in FIGURE 37.

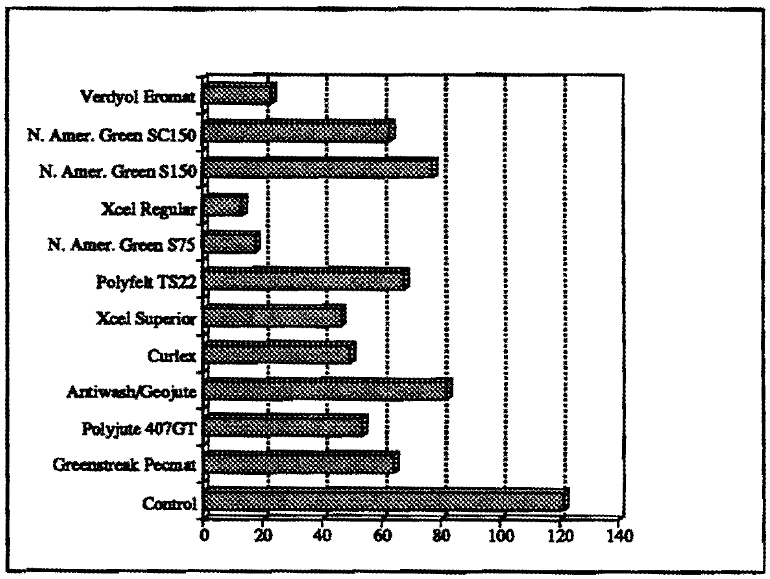


Figure 37. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Measurement Round
Slope Protection

Table F33. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Regular®	Round 1	All	Clay	6.469	1/12
Greenstreak® PECMAT®	Round 1	All	Clay	5.941	2/12
North American Green® S75	Round 1	All	Clay	5.481	3/12
POLYJUTE™ 407GT	Round 1	All	Clay	4.394	4/12
CONTROL	Round 1	All	Clay	3.190	5/12
Curlex®	Round 1	All	Clay	2.485	6/12
ANTIWASH®/GEOJUTE®	Round 1	All	Clay	2.039	7/12
North American Green® S150	Round 1	All	Clay	1.581	8/12
Xcel Superior®	Round 1	All	Clay	1.327	9/12
North American Green® SC150	Round 1	All	Clay	0.482	10/12
Polyfelt®	Round 1	All	Clay	0.466	11/12
Verdyol® ERO-MAT®	Round 1	All	Clay	0.000	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegative Density Measurement

Table F34. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 1	All	Sand	10.975	1/12
Xcel Superior®	Round 1	All	Sand	9.676	2/12
Xcel Regular®	Round 1	All	Sand	8.123	3/12
POLYJUTE™ 407GT	Round 1	All	Sand	5.973	4/12
CONTROL	Round 1	All	Sand	3.195	5/12
Verdyol® ERO-MAT®	Round 1	All	Sand	2.615	6/12
Curlex®	Round 1	All	Sand	1.726	7/12
ANTIWASH®/GEOJUTE®	Round 1	All	Sand	1.152	8/12
Greenstreak® PECMAT®	Round 1	All	Sand	1.071	9/12
Polyfelt®	Round 1	All	Sand	0.610	10/12
North American Green® S150[1]	Round 1	All	Sand	N/A	N/A
North American Green® SC150[2]	Round 1	All	Sand	N/A	N/A

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegative Density Measurement

[1] **No measurements taken during Round 1**

[2] **No measurements taken during Round 1**

Vegetative Density - Clay Soils, 1st Measurement Round

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 1st Measurement Round are shown in FIGURE 38.

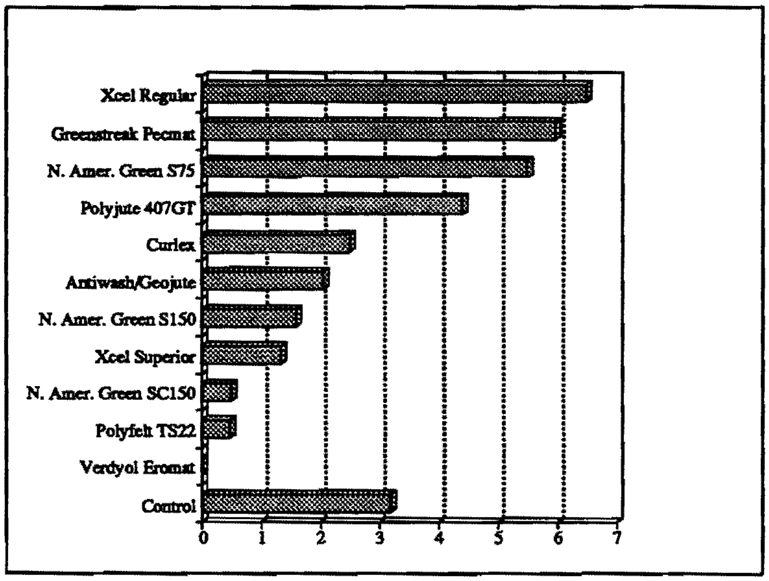


Figure 38. Vegetative Density

Vegetative Density - Sand Soils, 1st Measurement Round

The performance of each of the 9 products tested on Sand Soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 1st Measurement Round are shown in FIGURE 39. (No density measurements were taken during Round 1 for North American Green SC150 or North American Green S150).

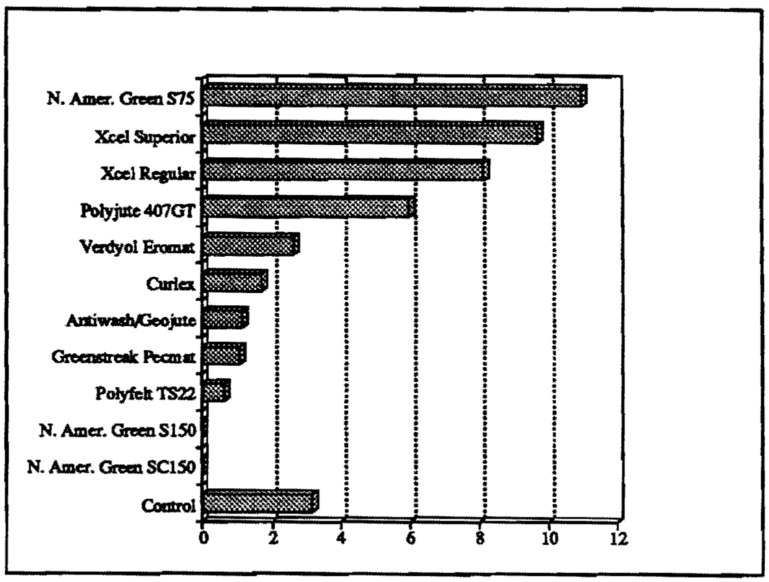


Figure 39 Vegetative Density

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Measurement Round
Slope Protection

Table F35. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Regular®	Round 2	All	Clay	56.160	1/12
North American Green® S75	Round 2	All	Clay	54.713	2/12
Xcel Superior®	Round 2	All	Clay	54.382	3/12
POLYJUTE™ 407GT	Round 2	All	Clay	46.749	4/12
Curlex®	Round 2	All	Clay	40.672	5/12
Greenstreak® PECMAT®	Round 2	All	Clay	37.456	6/12
North American Green® SC150	Round 2	All	Clay	31.442	7/12
CONTROL	Round 2	All	Clay	30.298	8/12
Verdyol® ERO-MAT®	Round 2	All	Clay	30.193	9/12
North American Green® S150	Round 2	All	Clay	29.503	10/12
ANTIWASH®/GEOJUTE®	Round 2	All	Clay	26.075	11/12
Polyfelt®	Round 2	All	Clay	4.436	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

Table F36. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 2	All	Sand	64.747	1/12
Xcel Regular®	Round 2	All	Sand	56.320	2/12
North American Green® S75	Round 2	All	Sand	51.507	3/12
POLYJUTE™ 407GT	Round 2	All	Sand	47.156	4/12
Verdyol® ERO-MAT®	Round 2	All	Sand	41.884	5/12
Curlex®	Round 2	All	Sand	38.474	6/12
North American Green® SC150	Round 2	All	Sand	31.362	7/12
North American Green® S150	Round 2	All	Sand	31.016	8/12
ANTIWASH®/GEOJUTE®	Round 2	All	Sand	22.458	9/12
Greenstreak® PECMAT®	Round 2	All	Sand	16.988	10/12
CONTROL	Round 2	All	Sand	15.204	11/12
Polyfelt®	Round 2	All	Sand	8.881	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

ANALYSIS LEVEL 7 (continued) - Performance with Respect to Type of Soil and Measurement Round Slope Protection

Vegetative Density - Clay Soils, 2nd Measurement Round

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 2nd Measurement Round are shown in FIGURE 40.

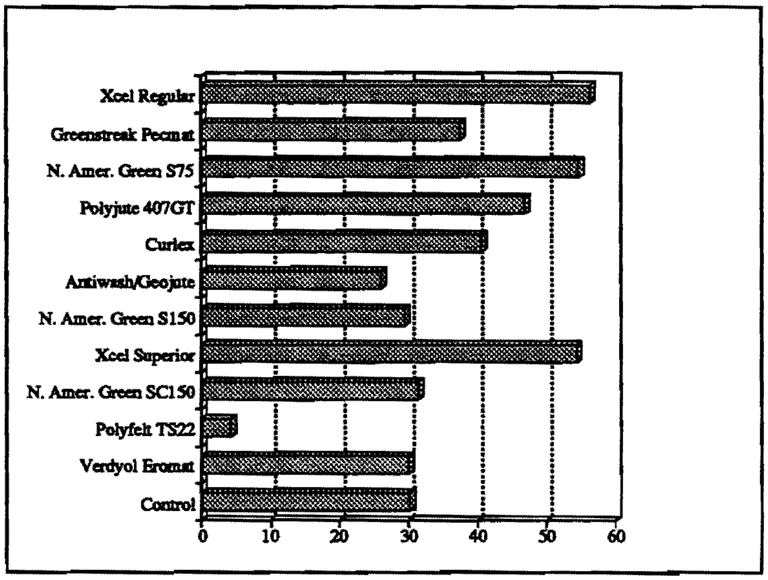


Figure 40. Vegetative Density

Vegetative Density - Sandy Soils, 2nd Measurement Round

The performance of each of the 11 products tested on Sand Soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 2nd Measurement Round are shown in FIGURE 41.

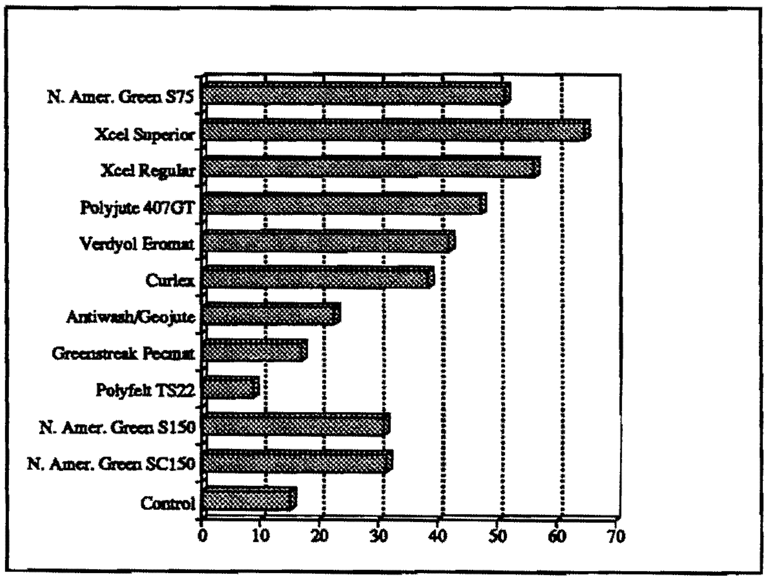


Figure 41. Vegetative Density

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Measurement Round
Slope Protection

Table F37. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
POLYJUTE 407GT	Round 3	All	Clay	98.263	1/12
North American Green® S75	Round 3	All	Clay	95.122	2/12
Xcel Superior®	Round 3	All	Clay	94.947	3/12
North American Green® S150	Round 3	All	Clay	93.921	4/12
ANTIWASH®/GEOJUTE®	Round 3	All	Clay	93.840	5/12
North American Green® SC150	Round 3	All	Clay	90.680	6/12
Greenstreak® PECMAT®	Round 3	All	Clay	86.546	7/12
Xcel Regular®	Round 3	All	Clay	84.222	8/12
CONTROL	Round 3	All	Clay	78.250	9/12
Curlex®	Round 3	All	Clay	72.446	10/12
Verdyol® ERO-MAT®	Round 3	All	Clay	69.620	11/12
Polyfelt®	Round 3	All	Clay	32.107	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

Table F38. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 3	All	Sand	87.307	1/12
North American Green® S75	Round 3	All	Sand	84.576	2/12
POLYJUTE 407GT	Round 3	All	Sand	82.710	3/12
North American Green® SC150	Round 3	All	Sand	78.226	4/12
Xcel Regular®	Round 3	All	Sand	68.758	5/12
North American Green® S150	Round 3	All	Sand	66.736	6/12
Curlex®	Round 3	All	Sand	61.776	7/12
Verdyol® ERO-MAT®	Round 3	All	Sand	59.706	8/12
Polyfelt®	Round 3	All	Sand	41.680	9/12
CONTROL	Round 3	All	Sand	41.128	10/12
ANTIWASH®/GEOJUTE®	Round 3	All	Sand	41.121	11/12
Greenstreak® PECMAT®	Round 3	All	Sand	38.332	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

ANALYSIS LEVEL 7 (continued) - Performance with Respect to Type of Soil and Measurement Round Slope Protection

Vegetative Density - Clay Soils, 3rd Measurement Round

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 3rd Measurement Round are shown in FIGURE 42.

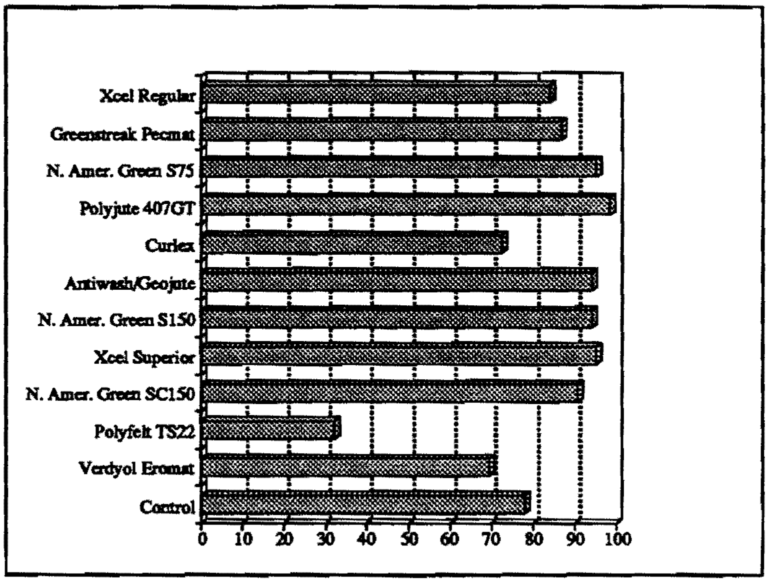


Figure 42. Vegetative Density

Vegetative Density - Sandy Soils, 3rd Measurement Round

The performance of each of the 11 products tested on Sand Soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 3rd Measurement Round are shown in FIGURE 43.

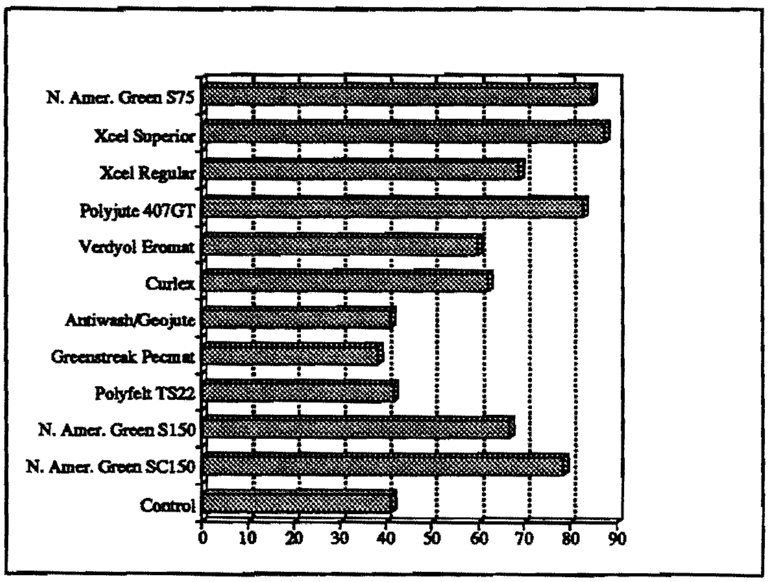


Figure 43. Vegetative Density

ANALYSIS LEVEL 7 (continued)
Performance with Respect to Type of Soil and Measurement Round
Slope Protection

Table F39. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	All	Clay	98.814	1/12
North American Green® S75	Round 4	All	Clay	96.187	2/12
POLYJUTE™ 407GT	Round 4	All	Clay	96.151	3/12
North American Green® S150	Round 4	All	Clay	92.014	4/12
Xcel Regular®	Round 4	All	Clay	90.166	5/12
ANTIWASH®/GEOJUTE®	Round 4	All	Clay	90.058	6/12
North American Green® SC150	Round 4	All	Clay	89.979	7/12
Greenstreak® PECMAT®	Round 4	All	Clay	89.216	8/12
Verdyol® ERO-MAT®	Round 4	All	Clay	87.808	9/12
Curlex®	Round 4	All	Clay	78.609	10/12
CONTROL	Round 4	All	Clay	66.452	11/12
Polyfelt®	Round 4	All	Clay	35.909	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

Table F40. Level 7 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	All	Sand	85.805	1/12
North American Green® S150	Round 4	All	Sand	84.746	2/12
POLYJUTE™ 407GT	Round 4	All	Sand	77.904	3/12
North American Green® SC150	Round 4	All	Sand	76.409	4/12
POLYJUTE™ 407GT	Round 4	All	Sand	74.302	5/12
Verdyol® ERO-MAT®	Round 4	All	Sand	73.202	6/12
Xcel Regular®	Round 4	All	Sand	72.263	7/12
Curlex®	Round 4	All	Sand	57.265	8/12
Greenstreak® Pecmat®	Round 4	All	Sand	52.304	9/12
ANTIWASH®/GEOJUTE®	Round 4	All	Sand	51.372	10/12
CONTROL	Round 4	All	Sand	49.904	11/12
Polyfelt®	Round 4	All	Sand	46.051	12/12

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

<u>Vegetative Density - Clay Soils, 4th Measurement Round</u>

The performance of each of the 11 products tested on Clay soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 4th Measurement Round are shown in FIGURE 44.

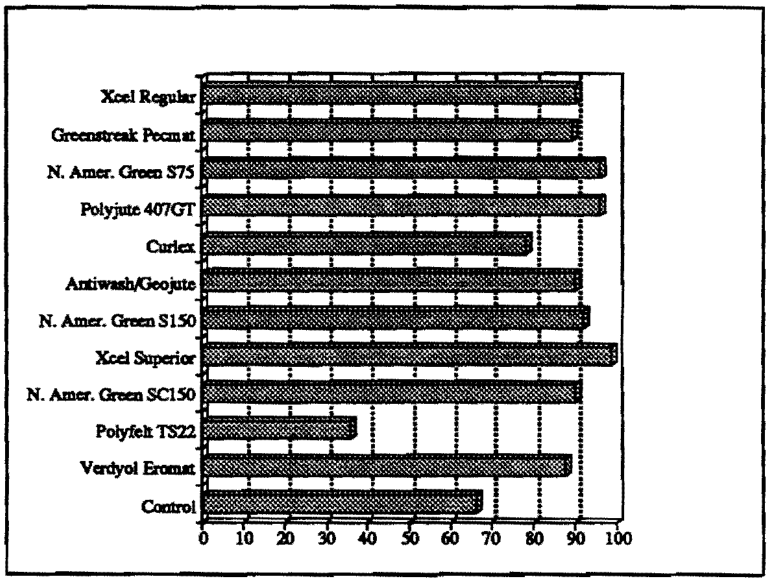


Figure 44. Vegetative Density

<u>Vegetative Density - Sandy Soils, 4th Measurement Round</u>

The performance of each of the 11 products tested on Sand Soils and the CONTROL plot with respect to the percentage of vegetative density achieved during the 4th Measurement Round are shown in FIGURE 45.

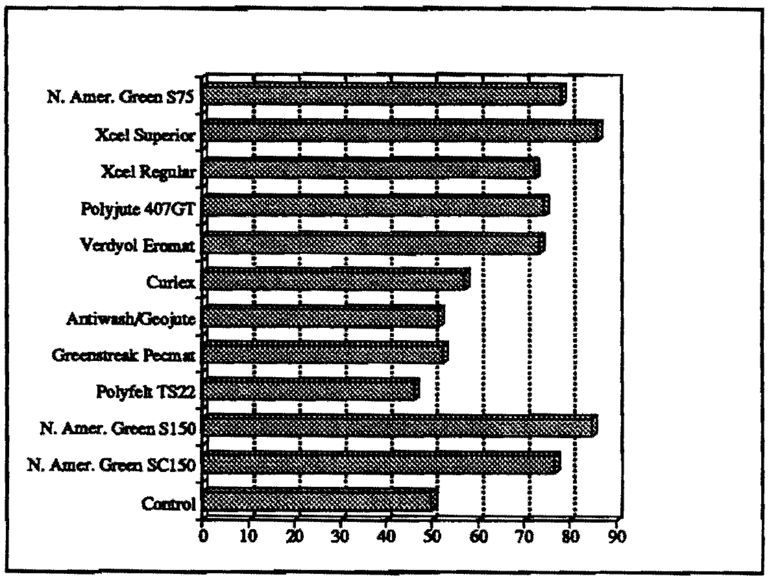


Figure 45. Vegetative Density

ANALYSIS LEVEL 8
Performance with Respect to Steepness of Slope, Soil Type and Design Storm
Slope Protection

Table F41. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
ANTIWASH®/GEOJUTE®	1-Year	2:1	Clay	0.7385	1/9
North American Green® S150	1-Year	2:1	Clay	0.8310	2/9
Curlex®	1-Year	2:1	Clay	0.9320	3/9
North American Green® SC150	1-Year	2:1	Clay	1.0120	4/9
Polyfelt®	1-Year	2:1	Clay	1.0255	5/9
POLYJUTE™ 407GT	1-Year	2:1	Clay	1.0635	6/9
Greenstreak® PECMAT®	1-Year	2:1	Clay	1.1070	7/9
Xcel Superior®	1-Year	2:1	Clay	1.5955	8/9
CONTROL	1-Year	2:1	Clay	1.7515	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Table F42. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
North American Green® SC150	1-Year	2:1	Sand	1.3470	1/9
North American Green® S150	1-Year	2:1	Sand	1.4125	2/9
Curlex®	1-Year	2:1	Sand	2.3855	3/9
Polyfelt®	1-Year	2:1	Sand	2.7925	4/9
Xcel Superior®	1-Year	2:1	Sand	2.8520	5/9
ANTIWASH®/GEOJUTE®	1-Year	2:1	Sand	6.5390	6/9
POLYJUTE™ 407GT	1-Year	2:1	Sand	12.3747	7/9
Greenstreak® PECMAT®	1-Year	2:1	Sand	19.1630	8/9
CONTROL	1-Year	2:1	Sand	19.7842	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

ANALYSIS LEVEL 8

Performance with Respect to Steepness of Slope, Soil Type, and Design Storm Slope Protection

Sediment Loss (lbs/100 sq ft) - 2:1, Clay Soils, 1-Year Storm

The performance of each of the 8 products tested on 2:1 Clay soils and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 46.

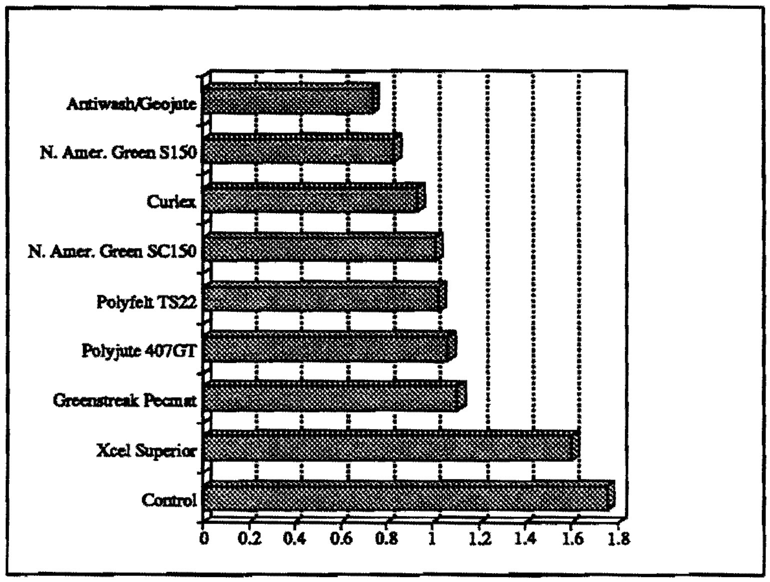


Figure 46. Sediment Loss (lbs/100 sq ft)

Sediment Loss (lbs/100 sq ft) - 2:1, Sandy Soils, 1-Year Storm

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the amount of sediment loss within a 1-Year simulated rainfall even are shown in FIGURE 47.

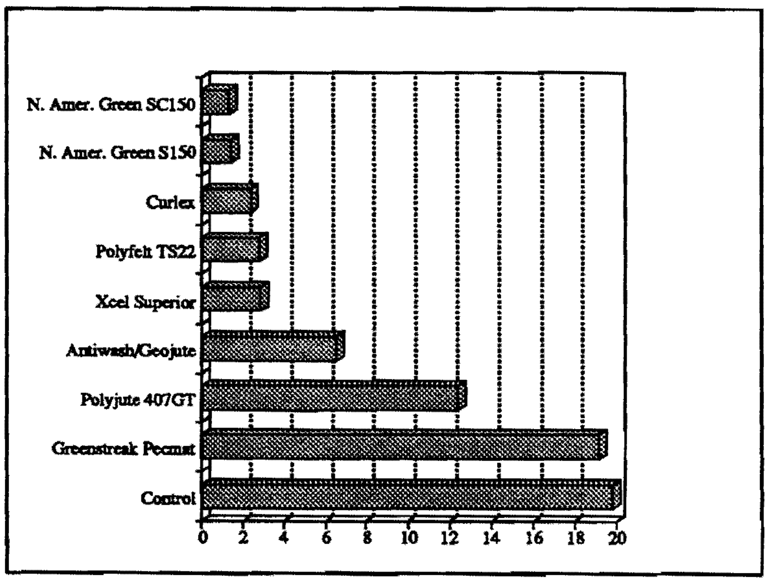


Figure 47. Sediment Loss (lbs/100 sq ft)

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Design Storm
Slope Protection

Table F43. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Polyfelt®	2-Year	2:1	Clay	0.2590	1/9
Curlex®	2-Year	2:1	Clay	0.2660	2/9
North American Green® SC150	2-Year	2:1	Clay	0.3527	3/9
POLYJUTE™ 407GT	2-Year	2:1	Clay	0.4247	4/9
Greenstreak® PECMAT®	2-Year	2:1	Clay	0.4717	5/9
North American Green® S150	2-Year	2:1	Clay	0.5617	6/9
Xcel Superior®	2-Year	2:1	Clay	0.6525	7/9
ANTIWASH®/GEOJUTE®	2-Year	2:1	Clay	0.8135	8/9
CONTROL	2-Year	2:1	Clay	4.6655	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Table F44. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Superior®	2-Year	2:1	Sand	11.977	1/9
North American Green® SC150	2-Year	2:1	Sand	19.513	2/9
North American Green® S150	2-Year	2:1	Sand	24.303	3/9
POLYJUTE™ 407GT	2-Year	2:1	Sand	26.943	4/9
Polyfelt®	2-Year	2:1	Sand	43.234	5/9
Curlex®	2-Year	2:1	Sand	47.352	6/9
Greenstreak® PECMAT®	2-Year	2:1	Sand	49.024	7/9
ANTIWASH®/GEOJUTE®	2-Year	2:1	Sand	55.534	8/9
CONTROL	2-Year	2:1	Sand	183.074	9/9

NOTE: "Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Sediment Loss (lbs/100 sq ft) - 2:1, Clay Soils, 2-Year Storm

The performance of each of the 8 products tested on 2:1 Clay soils and the CONTROL plot with respect to the average amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 48.

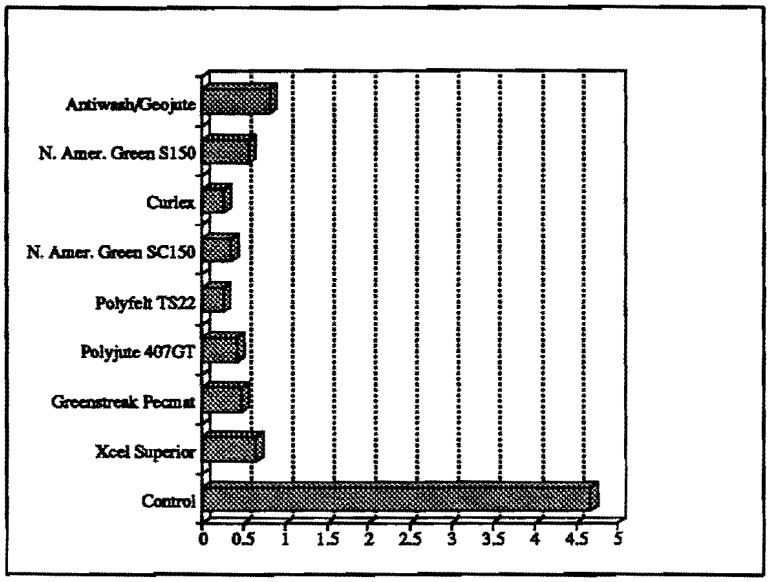


Figure 48. Sediment Loss

Sediment Loss (lbs/100 sq ft) - 2:1, Sandy Soils, 2-Year Storm

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average amount of sediment loss within a 2-Year simulated rainfall even are shown in FIGURE 49.

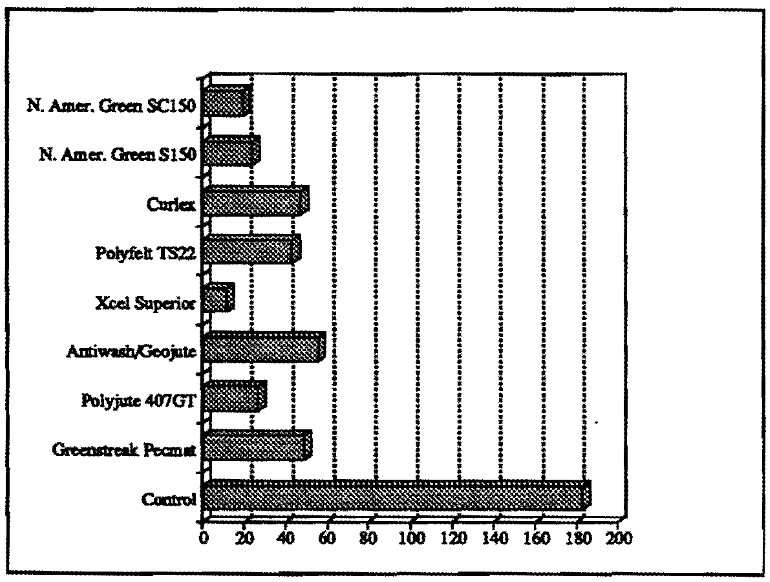


Figure 49. Sediment Loss

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Design Storm
Slope Protection

Table F45. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
North American Green® S150	5-Year	2:1	Clay	0.17475	1/9
Xcel Superior®	5-Year	2:1	Clay	0.18850	2/9
ANTIWASH®/GEOJUTE®	5-Year	2:1	Clay	0.20850	3/9
North American Green® SC150	5-Year	2:1	Clay	0.22775	4/9
Curlex®	5-Year	2:1	Clay	0.24600	5/9
Greenstreak® PECMAT®	5-Year	2:1	Clay	0.24975	6/9
POLYJUTE™ 407GT	5-Year	2:1	Clay	0.25775	7/9
Polyfelt®	5-Year	2:1	Clay	0.33750	8/9
CONTROL	5-Year	2:1	Clay	0.43550	9/9

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

Table F46. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Superior®	5-Year	2:1	Sand	46.39	1/9
POLYJUTE™ 407GT	5-Year	2:1	Sand	53.31	2/9
North American Green® SC150	5-Year	2:1	Sand	62.75	3/9
Polyfelt®	5-Year	2:1	Sand	67.39	4/9
North American Green® S150	5-Year	2:1	Sand	77.13	5/9
ANTIWASH®/GEOJUTE®	5-Year	2:1	Sand	81.94	6/9
Curlex®	5-Year	2:1	Sand	83.99	7/9
Greenstreak® PECMAT®	5-Year	2:1	Sand	92.89	8/9
CONTROL	5-Year	2:1	Sand	181.81	9/9

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

<u>Sediment Loss (lbs/100 sq ft) - 2:1, Clay Soils, 5-Year Storm</u>

The performance of each of the 8 products tested on 2:1 Clay soils and the CONTROL plot with respect to the average amount of sediment loss within a 5-Year simulated rainfall event areshown in FIGURE 50.

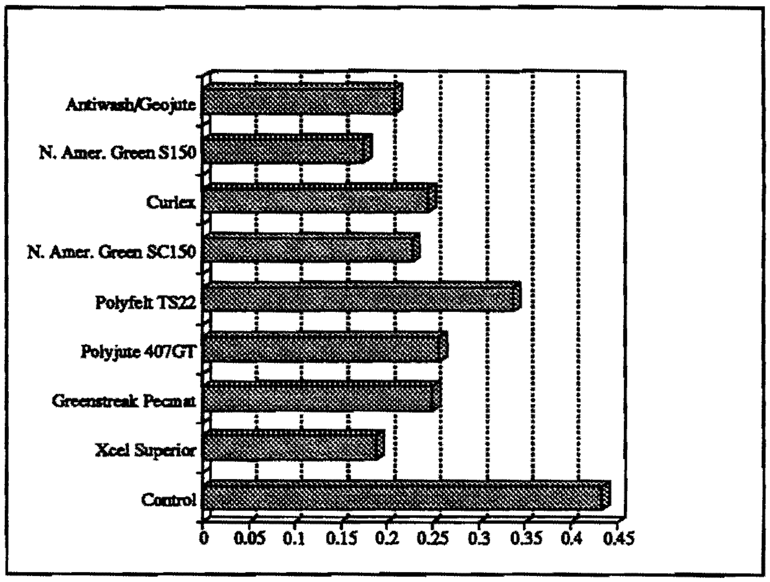


Figure 50. Sediment Loss

<u>Sediment Loss (lbs/100 sq ft) - 2:1, Sandy Soils, 5-Year Storm</u>

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average amount of sediment loss within a 5-Year simulated rainfall even are shown in FIGURE 51.

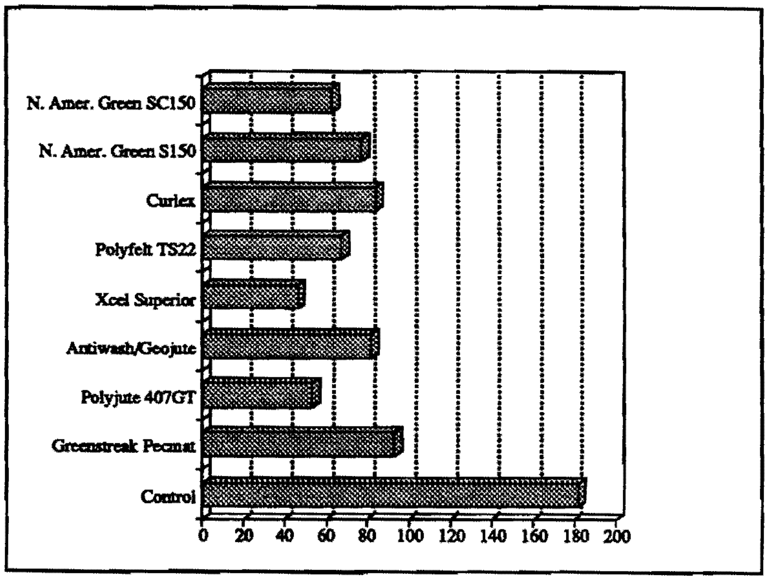


Figure 51. Sediment Loss

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Design Slope Protection

Table F47. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Curlex®	1-Year	3:1	Clay	0.6761	1/6
Greenstreak® PECMAT®	1-Year	3:1	Clay	0.7179	2/6
Verdyol® ERO-MAT®	1-Year	3:1	Clay	0.7518	3/6
North American Green® S75	1-Year	3:1	Clay	1.3175	4/6
Xcel Regular®	1-Year	3:1	Clay	1.6029	5/6
CONTROL	1-Year	3:1	Clay	2.0600	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Table F48. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol® ERO-MAT®	1-Year	3:1	Sand	1.1004	1/6
Xcel Regular®	1-Year	3:1	Sand	1.4152	2/6
North American Green® S75	1-Year	3:1	Sand	1.7086	3/6
Curlex®	1-Year	3:1	Sand	1.4500	4/6
Greenstreak® PECMAT®	1-Year	3:1	Sand	7.9186	5/6
CONTROL	1-Year	3:1	Sand	13.5386	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"1-Year" = 1.19 inches/hour (10 minute duration)

Sediment Loss (lbs/100 sq ft) - 3:1, Clay Soils, 1-Year Storm

The performance of each of the 5 products tested on 3:1 Clay soils and the CONTROL plot with respect to the average amount of sediment loss within a 1-Year simulated rainfall event are shown in FIGURE 52.

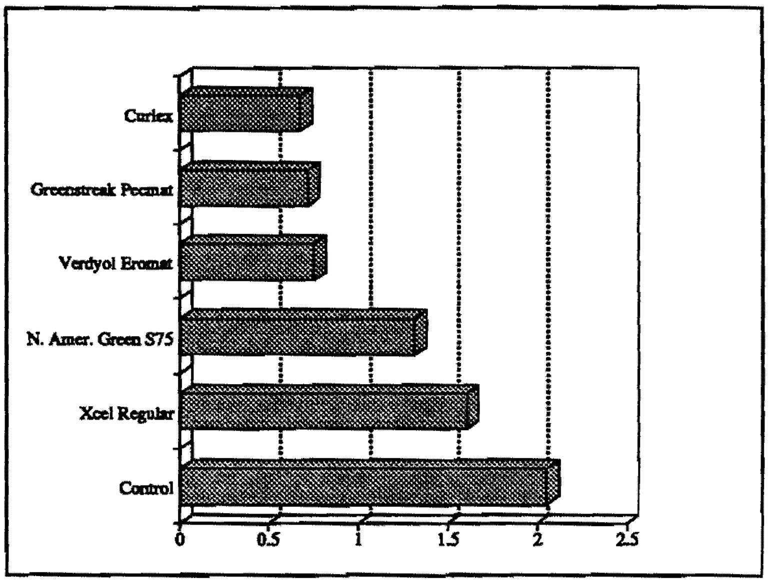


Figure 52. Sediment Loss

Sediment Loss (lbs/100 sq ft) - 3:1, Sandy Soils, 1-Year Storm

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average amount of sediment loss within a 1-Year simulated rainfall even are shown in FIGURE 53.

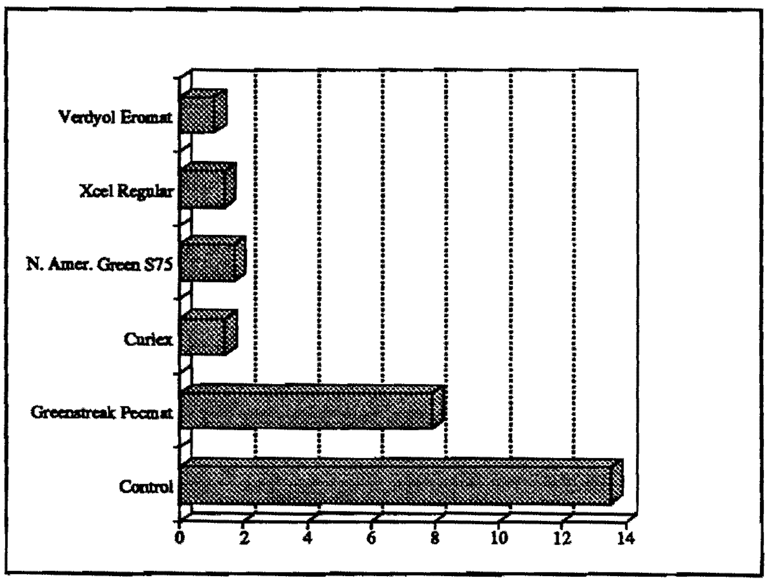


Figure 53. Sediment Loss

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Design Storm Slope Protection

Table F49. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Curlex®	2-Year	3:1	Clay	0.2495	1/6
Verdyol® ERO-MAT®	2-Year	3:1	Clay	0.3054	2/6
Greenstreak® PECMAT®	2-Year	3:1	Clay	0.5432	3/6
North American Green® S75	2-Year	3:1	Clay	0.6393	4/6
Xcel Regular®	2-Year	3:1	Clay	0.6904	5/6
CONTROL	2-Year	3:1	Clay	4.6741	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Table F50. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Xcel Regular®	2-Year	3:1	Sand	6.021	1/6
Curlex®	2-Year	3:1	Sand	7.183	2/6
Verdyol® ERO-MAT®	2-Year	3:1	Sand	16.521	3/6
North American Green® S75	2-Year	3:1	Sand	18.506	4/6
Greenstreak® PECMAT®	2-Year	3:1	Sand	38.625	5/6
CONTROL	2-Year	3:1	Sand	69.966	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"2-Year" = 5.73 inches/hour (10 minute duration)

Sediment Loss (lbs/100 sq ft) - 3:1, Clay Soils, 2-Year Storm

The performance of each of the 5 products tested on 3:1 Clay soils and the CONTROL plot with respect to the average amount of sediment loss within a 2-Year simulated rainfall event are shown in FIGURE 54.

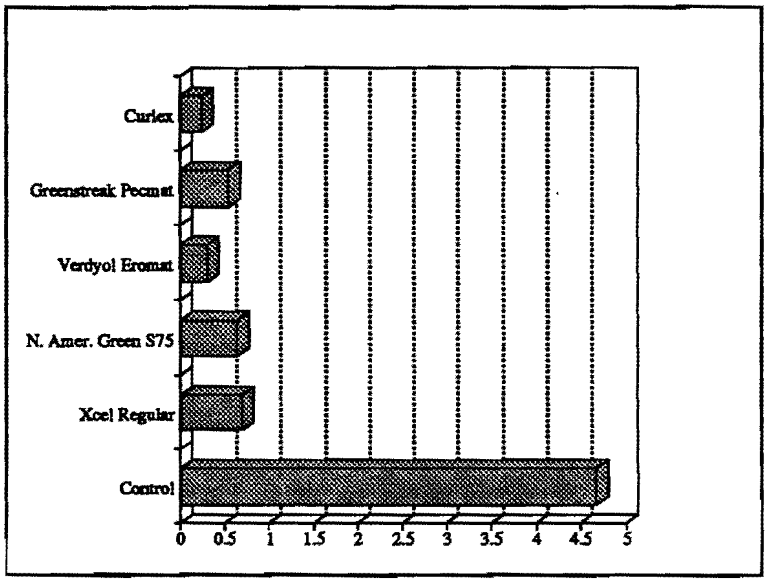


Figure 54. Sediment Loss

Sediment Loss (lbs/100 sq ft) - 3:1, Sandy Soils, 2-Year Storm

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average amount of sediment loss within a 2-Year simulated rainfall even are shown in FIGURE 55.

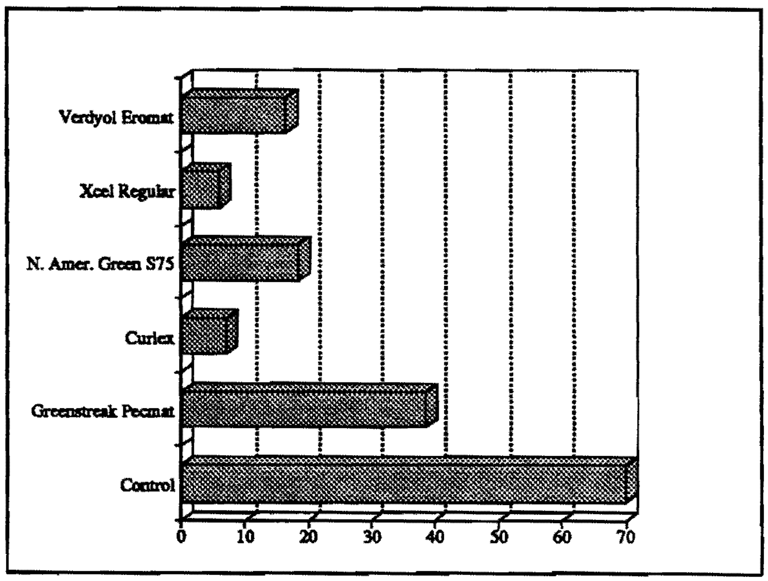


Figure 55. Sediment Loss

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Design Storm
Slope Protection

Table F51. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Verdyol® ERO-MAT®	5-Year	3:1	Clay	0.1011	1/6
North American Green® S75	5-Year	3:1	Clay	0.1014	2/6
Greenstreak® PECMAT®	5-Year	3:1	Clay	0.1246	3/6
Xcel Regular®	5-Year	3:1	Clay	0.1480	4/6
Curlex®	5-Year	3:1	Clay	0.1668	5/6
CONTROL	5-Year	3:1	Clay	1.3739	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

Table F52. Level 8 Analysis

Product Tested	Design Storm	Slope	Type of Soil	Sdmt Loss	Sdmt Rank
Curlex®	5-Year	3:1	Sand	10.972	1/6
Xcel Regular®	5-Year	3:1	Sand	12.953	2/6
North American Green® S75	5-Year	3:1	Sand	17.385	3/6
Verdyol® ERO-MAT®	5-Year	3:1	Sand	22.965	4/6
Greenstreak® PECMAT®	5-Year	3:1	Sand	35.972	5/6
CONTROL	5-Year	3:1	Sand	61.167	6/6

NOTE:
"Sdmt Loss" = Pounds Sediment Lost Per 100 Square Feet
"5-Year" = 7.23 inches/hour (10 minute duration)

Sediment Loss (lbs/100 sq ft) - 3:1, Clay Soils, 5-Year Storm

The performance of each of the 5 products tested on 3:1 Clay soils and the CONTROL plot with respect to the average amount of sediment loss within a 5-Year simulated rainfall event are shown in FIGURE 56.

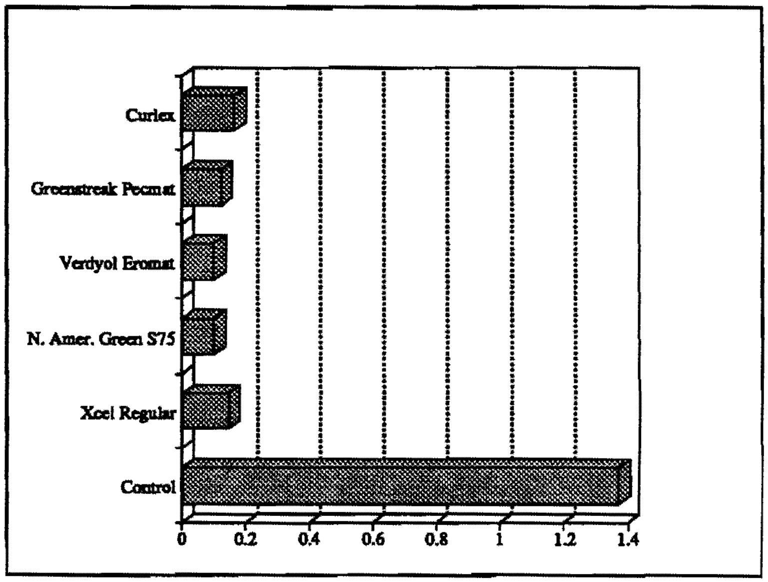


Figure 56. Sediment Loss

Sediment Loss (lbs/100 sq ft) - 3:1, Sandy Soils, 5-Year Storm

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average amount of sediment loss within a 5-Year simulated rainfall even are shown in FIGURE 57.

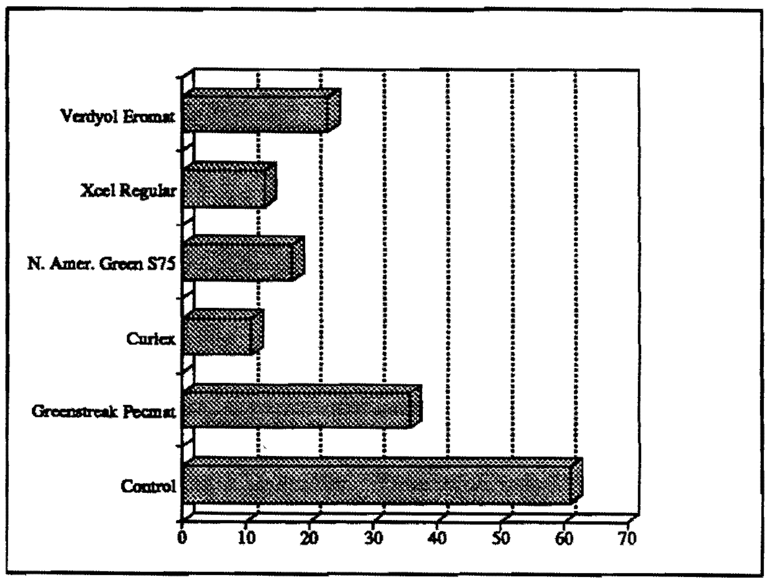


Figure 57. Sediment Loss

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F53. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
POLYJUTE™ 407GT	Round 1	2:1	Clay	4.394	1/9
Curlex®	Round 1	2:1	Clay	3.791	2/9
CONTROL	Round 1	2:1	Clay	2.630	3/9
Greenstreak® PECMAT®	Round 1	2:1	Clay	2.266	4/9
ANTIWASH®/GEOJUTE®	Round 1	2:1	Clay	2.039	5/9
North American Green® S150	Round 1	2:1	Clay	1.581	6/9
Xcel Superior®	Round 1	2:1	Clay	1.327	7/9
North American Green® SC150	Round 1	2:1	Clay	0.482	8/9
Polyfelt®	Round 1	2:1	Clay	0.466	9/9

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegetative Density Measurement

Table F54. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 1	2:1	Sand	9.676	1/9
POLYJUTE™ 407GT	Round 1	2:1	Sand	5.973	2/9
CONTROL	Round 1	2:1	Sand	2.870	3/9
ANTIWASH®/GEOJUTE®	Round 1	2:1	Sand	1.152	4/9
Greenstreak® PECMAT®	Round 1	2:1	Sand	0.779	5/9
Curlex®	Round 1	2:1	Sand	0.751	6/9
Polyfelt®	Round 1	2:1	Sand	0.610	7/9
North American Green® SC150[1]	Round 1	2:1	Sand	N/A	8/9
North American Green® S150[2]	Round 1	2:1	Sand	N/A	9/9

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegetative Density Measurement

[1] No density measurements taken.

[2] No density measurements taken.

Vegetative Density - 2:1, Clay Soils, 1st Measurement Round

The performance of each of the 5 products tested on 2:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 1st Measurement Round are shown in FIGURE 58.

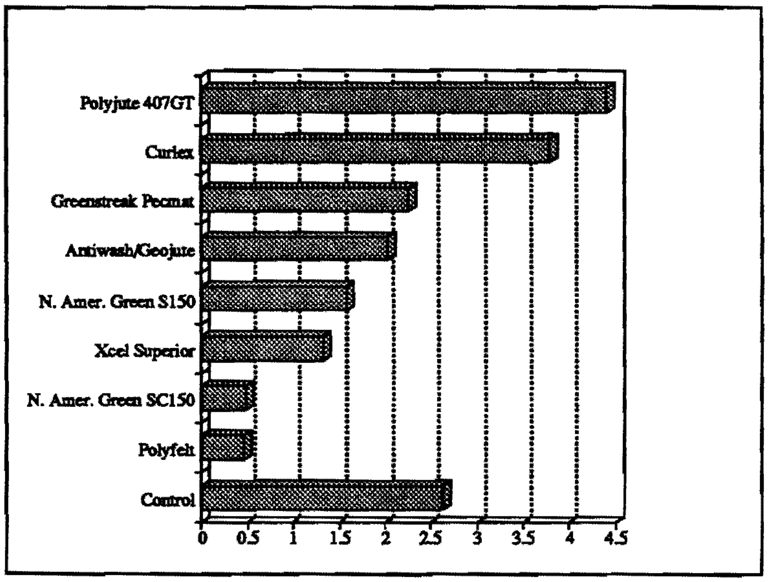


Figure 58. Vegetative Density

Vegetative Density - 2:1, Sandy Soils, 1st Measurement Round

The performance of each of the 5 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 1st Measurement Round are shown in FIGURE 59.

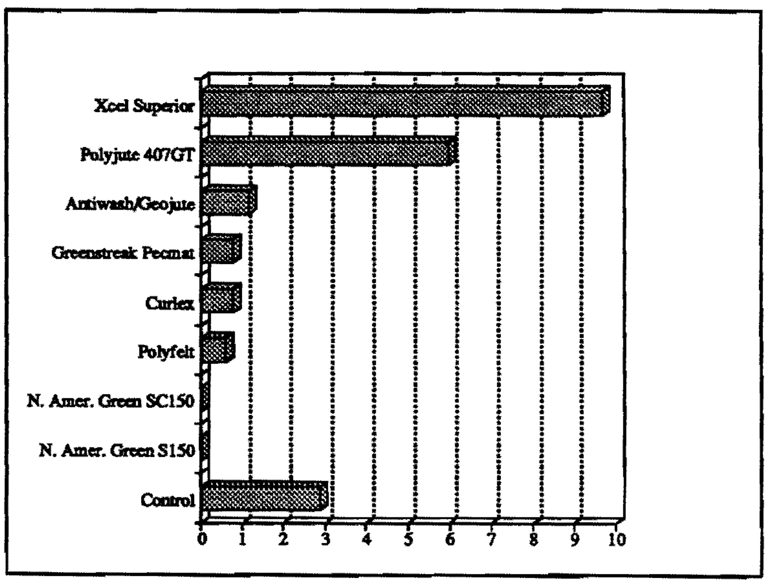


Figure 69. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F55. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Curlex®	Round 2	2:1	Clay	69.786	1/9
Xcel Superior®	Round 2	2:1	Clay	54.382	2/9
POLYJUTE™ 407GT	Round 2	2:1	Clay	46.749	3/9
CONTROL	Round 2	2:1	Clay	42.826	4/9
Greenstreak® PECMAT®	Round 2	2:1	Clay	31.764	5/9
North American Green® SC150	Round 2	2:1	Clay	31.442	6/9
North American Green® S150	Round 2	2:1	Clay	29.503	7/9
ANTIWASH®/GEOJUTE®	Round 2	2:1	Clay	26.075	8/9
Polyfelt®	Round 2	2:1	Clay	4.436	9/9

NOTE: "Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

Table F56. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 2	2:1	Sand	64.747	1/9
POLYJUTE™ 407GT	Round 2	2:1	Sand	47.156	2/9
North American Green® SC150	Round 2	2:1	Sand	31.362	3/9
North American Green® S150	Round 2	2:1	Sand	31.016	4/9
Curlex®	Round 2	2:1	Sand	26.051	5/9
ANTIWASH®/GEOJUTE®	Round 2	2:1	Sand	22.458	6/9
Polyfelt®	Round 2	2:1	Sand	8.881	7/9
CONTROL	Round 2	2:1	Sand	4.079	8/9
Greenstreak® PECMAT®	Round 2	2:1	Sand	0.449	9/9

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

Vegetative Density - 2:1, Clay Soils, 2nd Measurement Round

The performance of each of the 8 products tested on 2:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 2nd Measurement Round are shown in FIGURE 60

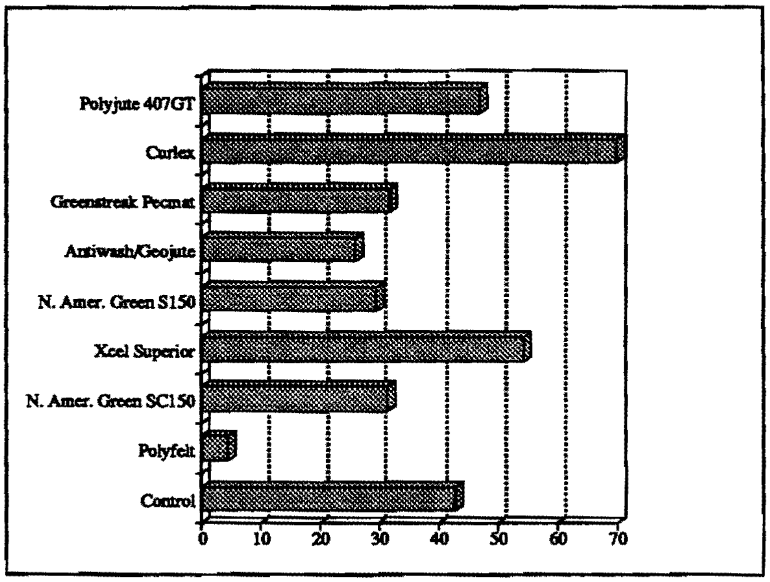


Figure 60. Vegetative Density

Vegetative Density - 2:1, Sandy Soils, 2nd Measurement Round

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 2nd Measurement Round are shown in FIGURE 61.

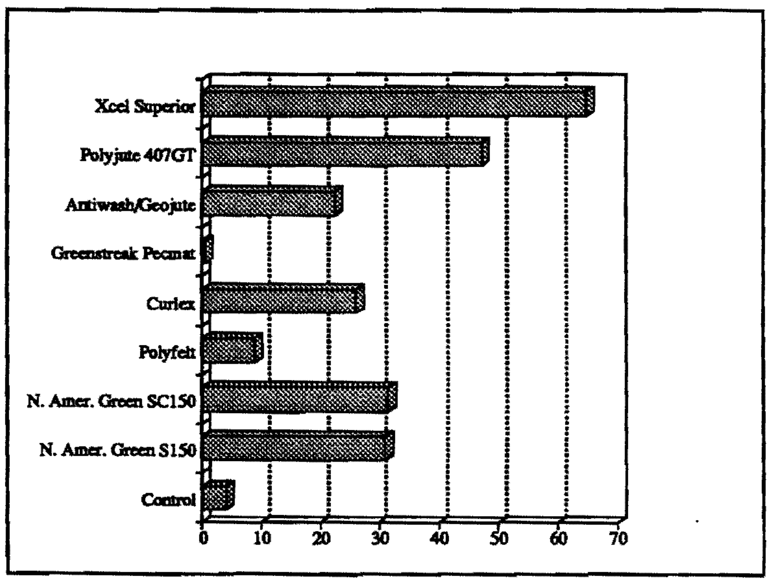


Figure 61. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F57. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
POLYJUTE™ 407GT	Round 3	2:1	Clay	98.263	1/9
Xcel Superior®	Round 3	2:1	Clay	94.947	2/9
North American Green® S150	Round 3	2:1	Clay	93.921	3/9
ANTIWASH®/GEOJUTE®	Round 3	2:1	Clay	93.840	4/9
CONTROL	Round 3	2:1	Clay	92.516	5/9
North American Green® SC150	Round 3	2:1	Clay	90.680	6/9
Curlex®	Round 3	2:1	Clay	87.019	7/9
Greenstreak® PECMAT®	Round 3	2:1	Clay	79.928	8/9
Polyfelt®	Round 3	2:1	Clay	32.107	9/9

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

Table F58. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 3	2:1	Sand	87.307	1/9
POLYJUTE™ 407GT	Round 3	2:1	Sand	82.710	2/9
North American Green® SC150	Round 3	2:1	Sand	78.226	3/9
North American Green® S150	Round 3	2:1	Sand	66.736	4/9
Curlex®	Round 3	2:1	Sand	65.011	5/9
Polyfelt®	Round 3	2:1	Sand	41.680	6/9
ANTIWASH®/GEOJUTE®	Round 3	2:1	Sand	41.121	7/9
CONTROL	Round 3	2:1	Sand	20.086	8/9
Greenstreak® PECMAT®	Round 3	2:1	Sand	12.525	9/9

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type and Measurement Round Slope Protection

Vegetative Density - 2:1, Clay Soils, 3rd Measurement Round

The performance of each of the 8 products tested on 2:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 3rd Measurement Round are shown in FIGURE 62.

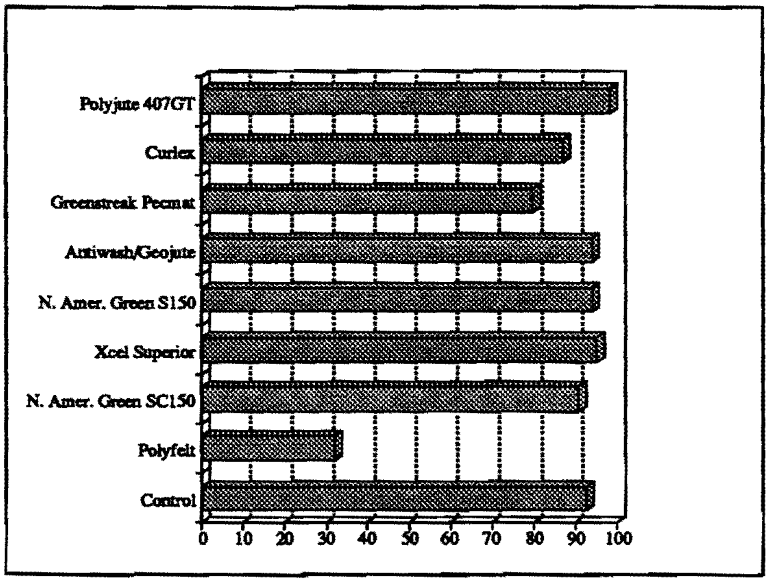


Figure 62. Vegetative Density

Vegetative Density - 2:1, Sandy Soils, 3rd Measurement Round

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 3rd Measurement Round are shown in FIGURE 63.

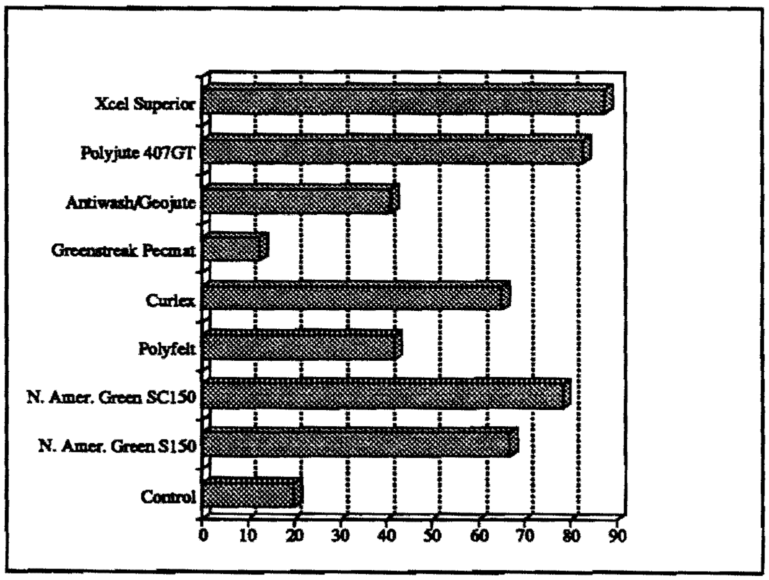


Figure 63. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F59. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	2:1	Clay	98.814	1/9
Curlex®	Round 4	2:1	Clay	97.834	2/9
POLYJUTE™ 407GT	Round 4	2:1	Clay	96.151	3/9
North American Green® S150	Round 4	2:1	Clay	92.014	4/9
ANTIWASH®/GEOJUTE®	Round 4	2:1	Clay	90.058	5/9
North American Green® SC150	Round 4	2:1	Clay	89.979	6/9
Greenstreak® PECMAT®	Round 4	2:1	Clay	87.580	7/9
CONTROL	Round 4	2:1	Clay	76.430	8/9
Polyfelt®	Round 4	2:1	Clay	35.909	9/9

Table F60. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Superior®	Round 4	2:1	Sand	85.805	1/9
North American Green® S150	Round 4	2:1	Sand	84.746	2/9
North American Green® SC150	Round 4	2:1	Sand	76.409	3/9
POLYJUTE™ 407GT	Round 4	2:1	Sand	74.302	4/9
Curlex®	Round 4	2:1	Sand	52.674	5/9
ANTIWASH®/GEOJUTE®	Round 4	2:1	Sand	51.372	6/9
Polyfelt®	Round 4	2:1	Sand	46.051	7/9
CONTROL	Round 4	2:1	Sand	44.699	8/9
Greenstreak® PECMAT®	Round 4	2:1	Sand	38.863	9/9

NOTE:

"Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type and Measurement Round Slope Protection

Vegetative Density - 2:1, Clay Soils, 4th Measurement Round

The performance of each of the 8 products tested on 2:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 4th Measurement Round are shown in FIGURE 64.

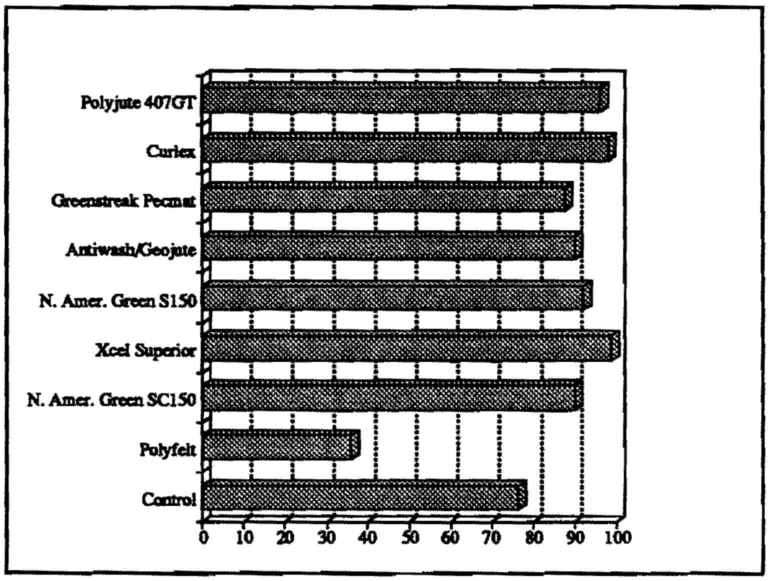


Figure 64. Vegetative Density

Vegetative Density - 2:1, Sandy Soils, 4th Measurement Round

The performance of each of the 8 products tested on 2:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 4th Measurement Round are shown in FIGURE 65.

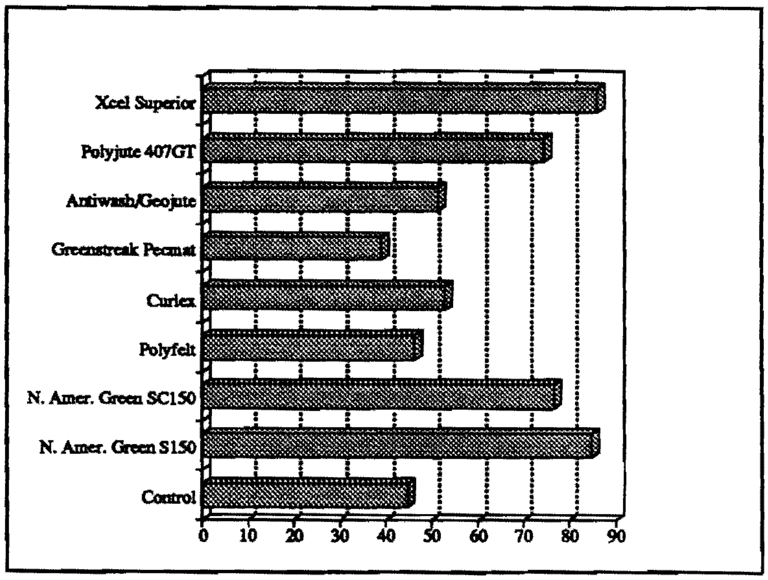


Figure 65. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F61. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Greenstreak® PECMAT®	Round 1	3:1	Clay	8.513	1/6
Xcel Regular®	Round 1	3:1	Clay	6.469	2/6
North American Green® S75	Round 1	3:1	Clay	5.481	3/6
CONTROL	Round 1	3:1	Clay	3.750	4/6
Curlex®	Round 1	3:1	Clay	1.505	5/6
Verdyol® ERO-MAT®	Round 1	3:1	Clay	0.000	6/6

NOTE:

"Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegetative Density Measurement

Table F62. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 1	3:1	Sand	10.975	1/6
Xcel Regular®	Round 1	3:1	Sand	8.123	2/6
CONTROL	Round 1	3:1	Sand	3.520	3/6
Verdyol® ERO-MAT®	Round 1	3:1	Sand	2.615	4/6
Curlex®	Round 1	3:1	Sand	2.506	5/6
Greenstreak® PECMAT®	Round 1	3:1	Sand	1.304	6/6

NOTE:

"Veg Density" = Average Percent of Vegetative Cover
"Round 1" = 1st Vegetative Density Measurement

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type and Measurement Round Slope Protection

Vegetative Density - 3:1, Clay Soils, 1st Measurement Round

The performance of each of the 5 products tested on 3:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 1st Measurement Round are shown in FIGURE 66.

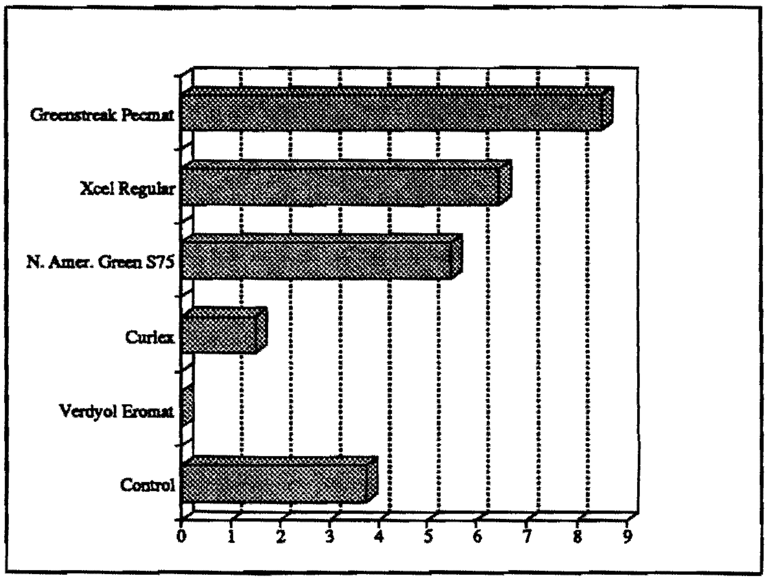


Figure 66. Vegetative Density

Vegetative Density - 3:1, Sandy Soils, 1st Measurement Round

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 1st Measurement Round are shown in FIGURE 67.

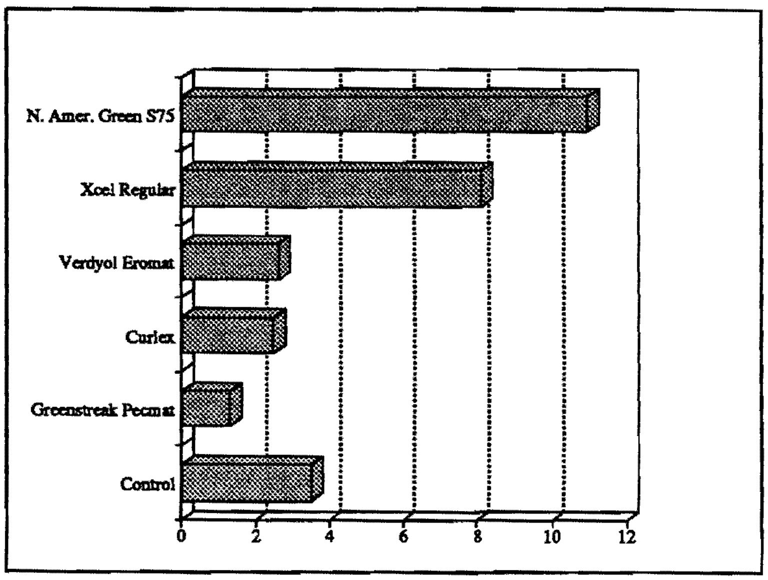


Figure 67. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F63. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Regular®	Round 2	3:1	Clay	56.160	1/6
North American Green® S75	Round 2	3:1	Clay	54.713	2/6
Greenstreak® PECMAT®	Round 2	3:1	Clay	41.439	3/6
Verdyol® ERO-MAT®	Round 2	3:1	Clay	30.193	4/6
CONTROL	Round 2	3:1	Clay	19.748	5/6
Curlex®	Round 2	3:1	Clay	16.155	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

Table F64. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
Xcel Regular®	Round 2	3:1	Sand	56.320	1/6
North American Green® S75	Round 2	3:1	Sand	51.507	2/6
Curlex®	Round 2	3:1	Sand	48.413	3/6
Verdyol® ERO-MAT®	Round 2	3:1	Sand	41.884	4/6
Greenstreak® PECMAT®	Round 2	3:1	Sand	30.219	5/6
CONTROL	Round 2	3:1	Sand	24.104	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 2" = 2nd Vegetative Density Measurement

<u>Vegetative Density - 3:1, Clay Soils, 2nd Measurement Round</u>

The performance of each of the 5 products tested on 3:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 2nd Measurement Round are shown in FIGURE 68.

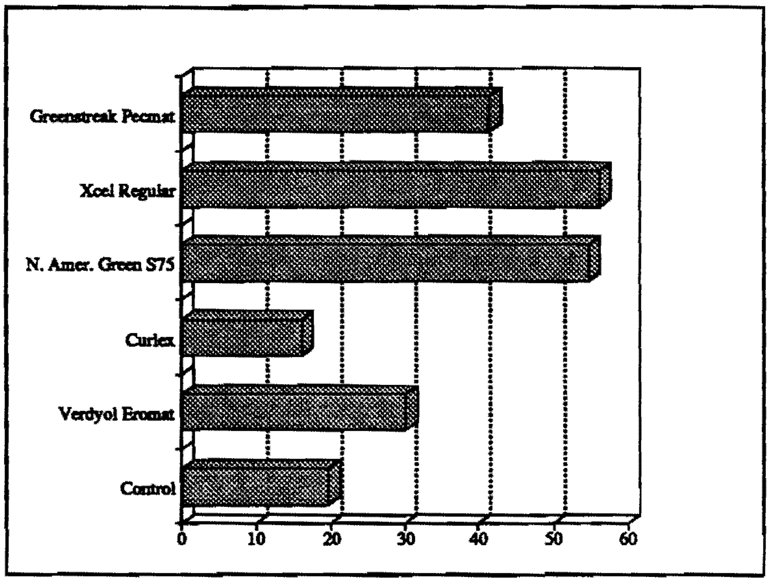


Figure 68. Vegetative Density

<u>Vegetative Density - 3:1, Sandy Soils, 2nd Measurement Round</u>

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 2nd MeasurementRound are shown in FIGURE 69.

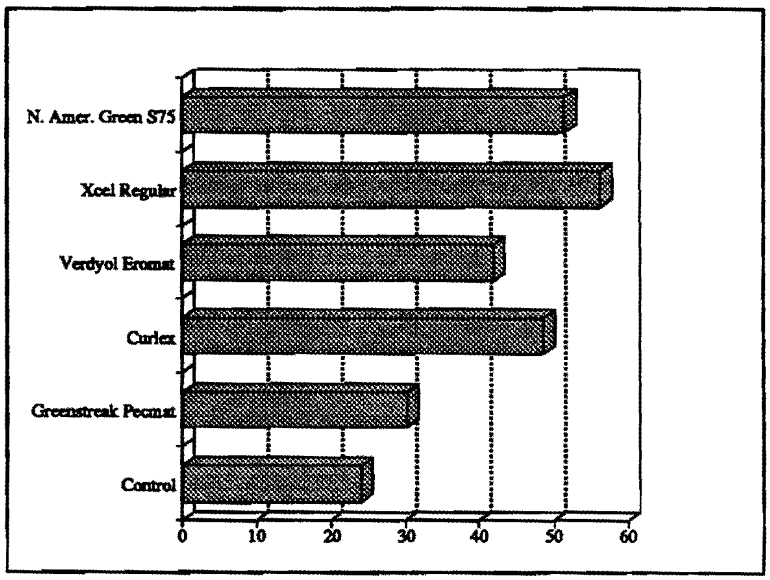


Figure 69. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F65. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 3	3:1	Clay	95.122	1/6
Greenstreak® PECMAT®	Round 3	3:1	Clay	92.061	2/6
Xcel Regular®	Round 3	3:1	Clay	84.222	3/6
Verdyol® ERO-MAT®	Round 3	3:1	Clay	69.620	4/6
CONTROL	Round 3	3:1	Clay	66.236	5/6
Curlex®	Round 3	3:1	Clay	58.731	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

Table F66. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 3	3:1	Sand	84.576	1/6
Xcel Regular®	Round 3	3:1	Sand	68.758	2/6
Verdyol® ERO-MAT®	Round 3	3:1	Sand	59.706	3/6
Curlex®	Round 3	3:1	Sand	59.511	4/6
CONTROL	Round 3	3:1	Sand	57.740	5/6
Greenstreak® PECMAT®	Round 3	3:1	Sand	57.687	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 3" = 3rd Vegetative Density Measurement

<u>Vegetative Density - 3:1, Clay Soils, 3rd Measurement Round</u>

The performance of each of the 5 products tested on 3:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 3rd Measurement Round are shown in FIGURE 70.

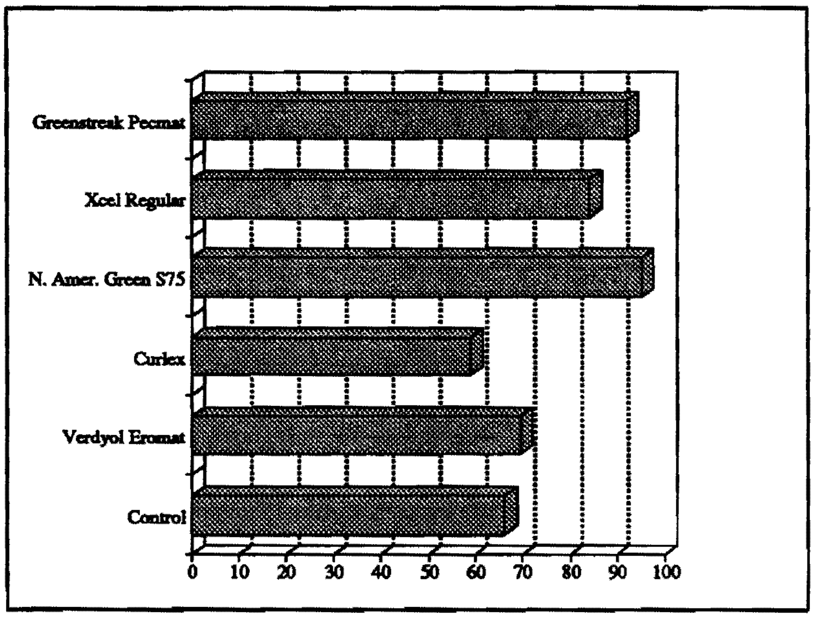


Figure 70. Vegetative Density

<u>Vegetative Density - 3:1, Sandy Soils, 3rd Measurement Round</u>

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 3rd Measurement Round are shown in FIGURE 71.

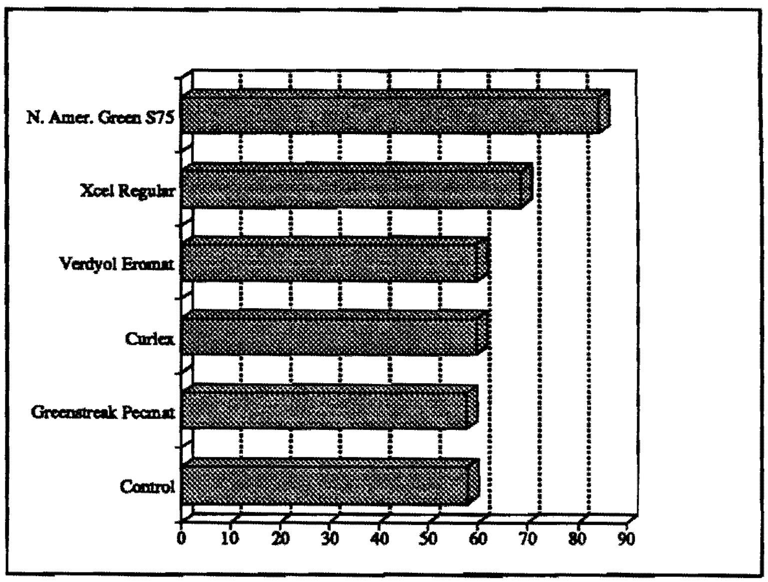


Figure 71. Vegetative Density

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type, and Measurement Round
Slope Protection

Table F67. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 4	3:1	Clay	96.187	1/6
Greenstreak® PECMAT®	Round 4	3:1	Clay	90.524	2/6
Xcel Regular®	Round 4	3:1	Clay	90.166	3/6
Verdyol® ERO-MAT®	Round 4	3:1	Clay	87.808	4/6
Curlex®	Round 4	3:1	Clay	63.230	5/6
CONTROL	Round 4	3:1	Clay	58.575	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

Table F68. Level 8 Analysis

Product Tested	Measurement	Slope	Type of Soil	Veg Density	Density Rank
North American Green® S75	Round 4	3:1	Sand	77.904	1/6
Verdyol® ERO-MAT®	Round 4	3:1	Sand	73.202	2/6
Xcel Regular®	Round 4	3:1	Sand	72.263	3/6
Greenstreak® PECMAT®	Round 4	3:1	Sand	62.385	4/6
Curlex®	Round 4	3:1	Sand	60.937	5/6
CONTROL	Round 4	3:1	Sand	53.808	6/6

NOTE:
"Veg Density" = Average Percent of Vegetative Cover
"Round 4" = 4th Vegetative Density Measurement

ANALYSIS LEVEL 8 (continued)
Performance with Respect to Steepness of Slope, Soil Type and Measurement Round Slope Protection

Vegetative Density - 3:1, Clay Soils, 4th Measurement Round

The performance of each of the 5 products tested on 3:1 Clays soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 4th Measurement Round are shown in FIGURE 72.

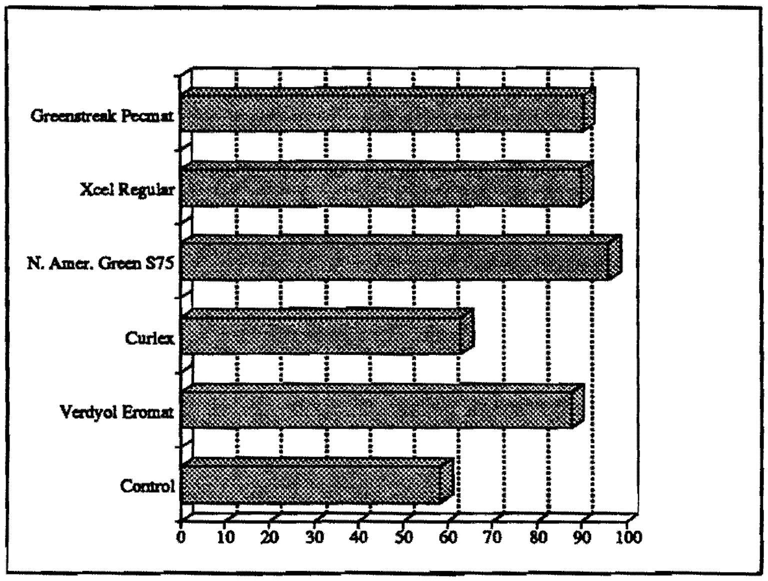


Figure 72. Vegetative Density

Vegetative Density - 3:1, Sandy Soils, 4th Measurement Round

The performance of each of the 5 products tested on 3:1 Sandy soils and the CONTROL plot with respect to the average percent of vegetative density achieved by the 4th Measurement Round are shown in FIGURE 73.

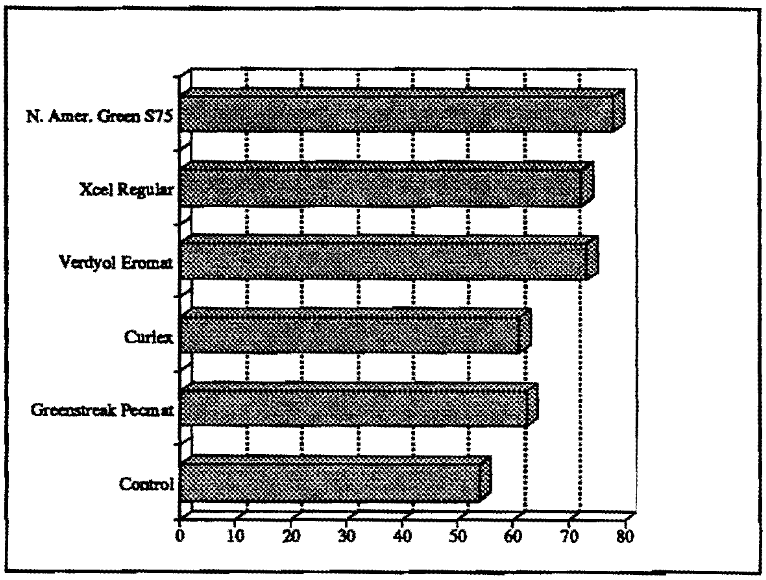


Figure 73. Vegetative Density

APPENDIX G

Laboratory Index Test Results
(performed by TxDOT Division 9 - Materials & Tests)

Table G - 1. American Excelsior Curlex® Index Test Results.

Laboratory Index Tests for American Excelsior Curlex®, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	78 lbs.[1]
Netting		
Composition	ASTM E 1252	Plastic
Aperture Size	Direct Measure	0.625 x 0.625 inches
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.8 oz./sy.
Color	Visual	Black
Number of nets	Visual	One side only
Net/Matrix Binding Method	Visual/Direct Measure	glued with a plastic hot melt glue (several lines in the machine direction)

Table G - 2. Xcel Regular® Index Test Results.

Laboratory Index Tests for Xcel Regular®, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	78 lbs.[2]
Netting		
Composition	ASTM E 1252	Black plastic
Aperture Size	Direct Measure	1/2" x 3/4"
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.4 oz./sy.
Color	Visual	Black
Number of nets	Visual	One side only
Net/Matrix Binding Method	Visual/Direct Measure	hot melt glue, 4 beads evenly spaced running in the machine direction)

[1] Information obtained from 1991 Product Specifications.

[2] Information obtained from 1991 Product Specifications

Table G - 3. Xcel Superior® Index Test Results.

Laboratory Index Tests for Xcel Superior®, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	80 lbs.[3]
Netting		
Composition	ASTM E 1252	Black plastic
Aperture Size	Direct Measure	1-5/8" x 7/8"
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.2 oz./sy.
Color	Visual	Black
Number of nets	Visual	One side only
Net/Matrix Binding Method	Visual/Direct Measure	hot melt glue, 3 beads evenly spaced running in the machine direction)

Table G - 4. North American Green® S75 Index Test Results.

Laboratory Index Tests for North American Green® S75, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	30 lbs.[4]
Netting		
Composition	ASTM E 1252	Plastic
Aperture Size	Direct Measure	0.42" x 0.42"
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.32 oz./sy.
Color	Visual	Green
Number of nets	Visual	One side only
Net/Matrix Binding Method	Visual/Direct Measure	sewn with cotton thread

[3] Information obtained from 1991 Product Specifications

[4] Information obtained from 1991 Product Specifications

Table G - 5. North American Green® S150 Index Test Results.

Laboratory Index Tests for North American Green® S150, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	30 lbs.[5]
Netting		
Composition	ASTM E 1252	Plastic
Aperture Size	Direct Measure	0.42" x 0.42"
Placement	Visual	full width & length, both sides
Weight	ASTM D 3776	0.32 oz./sy.
Color	Visual	2 Green nets
Number of nets	Visual	2, one per side
Net/Matrix Binding Method	Visual/Direct Measure	sewn with cotton thread

Table G - 6. Verdyol® ERO-MAT® Index Test Results.

Laboratory Index Tests for Verdyol® ERO-MAT®, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	50 lbs.[6]
Netting		
Composition	ASTM E 1252	Clear Plastic
Aperture Size	Direct Measure	1/4" x 1/4"
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.60 oz./sy.
Color	Visual	Clear plastic
Number of nets	Visual	One side only
Net/Matrix Binding Method	Visual/Direct Measure	sewn with cotton thread approximately 25 evenly spaced strands in the machine direction

[5] Information obtained from 1991 Product Specifications

[6] Information obtained from 1991 Product Specifications

Table G - 7. North American Green® SC150, Index Test Results.

Laboratory Index Tests for North American Green® SC150, 1991-92 Cycle Biodegradable Mat		
Property	**Index Test**	**Results**
Weight	ASTM D 3776 (Total roll only)	30 lbs.[7]
Netting		
Composition	ASTM E 1252	Plastic
Aperture Size	Direct Measure	0.42" x 0.42"
Placement	Visual	full width & length, one side only
Weight	ASTM D 3776	0.32 oz./sy.(green net); 0.57 oz./sy.(black net)
Color	Visual	One green net and one black net
Number of nets	Visual	2 nets; one per side
Net/Matrix Binding Method	Visual/Direct Measure	sewn with cotton thread

Table G - 8. ANTIWASH®/GEOJUTE® (Regular), Index Test Results.

Laboratory Index Tests for ANTIWASH®/GEOJUTE®, 1991-92 Cycle Jute Mat		
Property	**Index Test**	**Results**
Fabric Weave/Yarn Count	Threads/foot	MD: 18 threads/ft. CMD: 14 threads/ft.
Weight	ASTM D 3776	13.7 oz./sy.

[7] Information obtained from 1991 Product Specifications

Table G - 9. POLYJUTE™ 407GT, Index Test Results.

Laboratory Index Tests for POLYJUTE™, 1991-92 Cycle Synthetic Mat		
Property	**Index Test**	**Results**
Polymer Type(s)	ASTM E 1252	Jute/cotton, polypropylene
Weight	ASTM D 3776	4.8 oz./sy.
Thickness	ASTM D 1777	N/A
Tensile Strength	ASTM D 1682, Grab Method G	Cotton direction: 37 lbs Poly direction: 66 lbs
Elongation, ultimate	ASTM D 1682, Grab Method G	Cotton direction: 34% Poly direction: 20%
Tensile Modulus	ASTM D 1682 AT 10% elongation	N/A
UV Resistance	ASTM D 4355, Tensile D 1682	N/A
Flexibility	ASTM D 1388-64	N/A

Table G - 10. GREENSTREAK® PEC-MAT™, Index Test Results.

Laboratory Index Tests for GREENSTREAK® PEC-MAT™, 1991-92 Cycle Synthetic Mat		
Property	**Index Test**	**Results**
Polymer Type(s)	ASTM E 1252	Polyvinylchloride
Weight	ASTM D 3776	27.8 oz./sy.
Thickness	ASTM D 1777	0.10 in.
Tensile Strength	ASTM D 1682, Grab Method G	Machine direction: 51 lbs. at break Cross machine direction: 18 lbs. at break
Elongation, ultimate	ASTM D 1682, Grab Method G	Machine direction: 129% Cross machine direction: 99%
Tensile Modulus	ASTM D 1682 AT 10% elongation	difficult to measure accurately
UV Resistance	ASTM D 4355, Tensile D 1682	N/A
Flexibility	ASTM D 1388-64	N/A

APPENDIX H

Weather Observations from the Hydraulics
and Erosion Control Laboratory
and
Easterwood Airport Facility

DAILY TEMPERATURE/PRECIPITATION DATA
EASTERWOOD AIRPORT, COLLEGE STATION,TX.

DATE	TEMPERATURE		PRECIPITATION
	MAX	MIN	
01-01-91	42°	26°	0.01
01-02-91	48°	41°	2.47
01-03-91	48°	36°	T
01-04-91	48°	36°	T
01-05-91	64°	47°	0.04
01-06-91	63°	41°	0.18
01-07-91	44°	37°	T
01-08-91	48°	40°	0.05
01-09-91	54°	46°	5.63
01-10-91	51°	41°	0.52
01-10-91	51°	36°	---
01-12-91	55°	31°	---
01-13-91	62°	31°	---
01-14-91	66°	43°	3.23
01-15-91	59°	39°	T
01-16-91	65°	36°	---
01-17-91	66°	39°	0.01
01-18-91	54°	46°	2.07
01-19-91	56°	43°	T
01-20-91	53°	40°	---
01-21-91	43°	36°	---
01-22-91	49°	28°	---
01-23-91	54°	38°	0.44
01-24-91	50°	37°	0.77
01-25-91	58°	34°	---

01-26-91	48°	38°	---
01-27-91	69°	46°	T
01-28-91	63°	49°	T
01-29-91	71°	39°	---
01-30-91	39°	30°	0.18
01-31-91	56°	29°	---
02-01-91	63°	29°	---
02-02-91	67°	33°	---
02-03-91	67°	45°	---
02-04-91	62°	58°	1.34
02-05-91	63°	53°	0.01
02-06-91	67°	48°	---
02-07-91	67°	41°	---
02-08-91	69°	38°	---
02-09-91	68°	36°	---
02-10-91	76	46°	---
02-11-91	71°	52°	---
02-12-91	74°	55°	T
02-13-91	78°	58°	---
02-14-91	71°	46°	---
02-15-91	52°	39°	---
02-16-91	59°	36°	0.16
02-17-91	72°	59°	T
02-18-91	75°	61°	0.17
02-19-91	61°	48°	0.26
02-20-91	55°	45°	0.05
02-21-91	51°	46°	0.15
02-22-91	64°	45°	T
02-23-91	64°	38°	---
02-24-91	67°	41°	---

02-25-91	58°	42°	0.29
02-26-91	59°	35°	---
02-27-91	60°	41°	---
02-28-91	66	52°	.049
03-01-91	81°	57°	0.05
03-02-91	79°	52°	0.39
03-03-91	62°	41°	---
03-04-91	80°	40°	---
03-05-91	89°	53°	---
03-06-91	89°	58°	---
03-07-91	71°	53°	---
03-08-91	69°	45°	---
03-09-91	70°	46°	---
03-10-91	70°	45°	---
03-11-91	75°	51°	---
03-12-91	81°	53°	0.02
03-13-91	68°	48°	---
03-14-91	53°	48°	---
03-15-91	50°	45°	0.66
03-16-91	60°	47°	0.54
03-17-91	75°	55°	T
03-18-91	66°	43°	---
03-19-91	74°	44°	---
03-20-91	74°	54°	T
03-21-91	78°	66°	T
03-22-91	78°	54°	T
03-23-91	74°	50°	---
03-24-91	79°	50°	---
03-25-91	81°	63°	T
03-26-91	82°	70°	T

03-27-91	79°	58°	0.08
03-28-91	79°	56°	0.53
03-29-91	66°	46°	---
03-30-91	63°	43°	---
03-31-91	68°	41°	T
04-01-91	73°	40°	---
04-02-91	71°	53°	---
04-03-91	80°	58°	---
04-04-91	82°	63°	1.21
04-05-91	65°	61°	1.18
04-06-91	72°	61°	0.11
04-07-91	80°	58°	0.25
04-08-91	83°	65°	T
04-09-91	82°	66°	---
04-10-91	79°	63°	---
04-11-91	82°	66	0.09
04-12-91	79°	62°	T
04-13-91	82°	64°	0.15
04-14-91	79°	56°	1.38
04-15-91	80°	54°	---
04-16-91	80°	61°	T
04-17-91	81°	66°	0.65
04-18-91	84°	66°	T
04-19-91	83°	64°	0.08
04-20-91	73°	53°	---
04-21-91	76°	53°	---
04-22-91	85°	60°	---
04-23-91	78°	54°	---
04-24-91	78°	62°	---
04-25-91	83°	63°	---

04-26-91	88°	72°	---
04-27-91	88°	70°	0.55
04-28-91	82°	61°	0.09
04-29-91	78°	55°	---
04-30-91	84°	53°	---
05-01-91	84°	61°	---
05-02-91	78°	67°	0.01
05-03-91	81°	66°	0.81
05-04-91	83°	66°	T
05-05-91	75°	58°	---
05-06-91	75°	52°	---
05-07-91	78°	55°	T
05-08-91	73°	62°	0.34
05-09-91	78°	63°	---
05-10-91	84°	64°	0.17
05-11-91	87°	73°	---
05-12-91	87°	70°	0.27
05-13-91	87°	69°	0.48
05-14-91	83°	67°	0.15
05-15-91	88°	66°	---
05-16-91	86°	65°	0.65
05-17-91	84°	64°	---
05-18-91	85°	69°	0.03
05-19-91	80°	69°	0.10
05-20-91	87°	70°	T
05-21-91	84°	68°	0.34
05-22-91	83°	70°	T
05-23-91	88°	72°	---
05-24-91	89°	72°	---
05-25-91	89°	69°	---

05-26-91	93°	67°	---
05-27-91	91°	71°	T
05-28-91	92°	72°	---
05-29-91	85°	72°	0.16
05-30-91	90°	71°	T
05-31-91	90°	76°	T
06-01-91	90°	76°	0.04
06-02-91	92°	76°	0.02
06-03-91	91°	66°	1.13
06-04-91	90°	66°	T
06-05-91	92°	74°	---
06-06-91	93°	71°	---
06-07-91	85°	69°	0.74
06-08-91	85°	70°	---
06-09-91	80°	69°	0.50
06-10-91	82°	69°	T
06-11-91	91°	69°	---
06-12-91	91°	72°	---
06-13-91	92°	75°	---
06-14-91	92°	75°	0.18
06-15-91	86°	68°	0.51
06-16-91	92°	69°	0.29
06-17-91	91°	71°	---
06-18-91	94°	73°	---
06-19-91	92°	72°	---
06-20-91	93°	72°	---
06-21-91	93°	72°	---
06-22-91	87°	67°	1.65
06-23-91	93°	71°	---
06-24-91	92°	72°	T

06-25-91	91°	70°	T
06-26-91	92°	72°	---
06-27-91	93°	73°	---
06-28-91	91°	73°	0.43
06-29-91	91°	71°	0.02
06-30-91	93°	74°	---
07-01-91	93°	73°	T
07-02-91	96°	73°	T
07-03-91	92°	74°	---
07-04-91	89°	72°	---
07-05-91	94°	72°	---
07-06-91	95°	75°	T
07-07-91	92°	75°	T
07-08-91	92°	74°	0.02
07-09-91	93°	76°	---
07-10-91	94°	73°	---
07-11-91	93°	75°	---
07-12-91	95°	73°	---
07-13-91	94°	72°	---
07-14-91	96°	71°	---
07-15-91	97°	73°	---
07-16-91	95°	73°	0.12
07-17-91	93°	69°	---
07-18-91	95°	72°	---
07-19-91	96°	73°	---
07-20-91	96°	75°	---
07-21-91	94°	73°	---
07-22-91	95°	72°	0.22
07-23-91	93°	72°	0.06
07-24-91	94°	73°	T

07-25-91	95°	75°	---
07-26-91	96°	75°	---
07-27-91	97°	73°	---
07-28-91	97°	74°	---
07-29-91	96°	74°	0.58
07-30-91	99°	72°	---
07-31-91	101°	70°	---
08-01-91	99°	74°	---
08-02-91	97°	72°	---
08-03-91	98°	75°	---
08-04-91	98°	75°	---
08-05-91	95°	74°	0.01
08-06-91	99°	74°	---
08-07-91	98°	74°	T
08-08-91	98°	73°	---
08-09-91	98°	74°	T
08-10-91	96°	74°	0.06
08-11-91	99°	73°	---
08-12-91	96°	73°	---
08-13-91	95°	78°	T
08-14-91	86°	75°	0.37
08-15-91	88°	72°	0.41
08-16-91	94°	73°	---
08-17-91	95°	74°	---
08-18-91	95°	76°	0.06
08-19-91	98°	73°	---
08-20-91	98°	74°	---
08-21-91	97°	73°	---
08-22-91	94°	75°	T
08-23-91	95°	73°	---

08-24-91	97°	72°	T
08-25-91	95°	70°	---
08-26-91	94°	71°	---
08-27-91	96°	72°	T
08-28-91	96°	71°	---
08-29-91	97°	73°	---
08-30-91	93°	73°	0.43
08-31-91	91°	70°	1.31
09-01-91	90°	74°	---
09-02-91	92°	74°	1.50
09-03-91	91°	72°	0.22
09-04-91	88°	72°	0.72
09-05-91	88°	73°	0.64
09-06-91	87°	74°	0.87
09-07-91	89°	75°	0.33
09-08-91	90°	75°	0.68
09-09-91	92°	74°	---
09-10-91	93°	74°	---
09-11-91	91°	71°	---
09-12-91	90°	71°	T
09-13-91	92°	74°	T
09-14-91	92°	73°	1.44
09-15-91	91°	76°	T
09-16-91	93°	74°	---
09-17-91	93°	73°	T
09-18-91	91°	69°	---
09-19-91	69°	60°	T
09-20-91	69°	60°	---
09-21-91	83°	57°	---
09-22-91	89°	63°	---

09-23-91	87°	72°	---
09-24-91	88	60°	0.37
09-25-91	77°	53°	---
09-26-91	87°	53°	---
09-27-91	81°	57°	0.80
09-28-91	80°	54°	---
09-29-91	83°	56°	---
09-30-91	88°	62°	---
10-01-91	85°	65°	1.11
10-02-91	87°	63°	---
10-03-91	88°	65°	---
10-04-91	90°	68°	---
10-05-91	76°	59°	---
10-06-91	75°	51°	---
10-07-91	78°	49°	---
10-08-91	78°	54°	---
10-09-91	83°	52°	---
10-10-91	86°	54°	---
10-11-91	93°	58°	---
10-12-91	96°	60°	---
10-13-91	94°	65°	---
10-14-91	89°	59°	---
10-15-91	85°	51°	---
10-16-91	83°	49°	---
10-17-91	85°	55°	---
10-18-91	85°	58°	---
10-19-91	84°	58°	---
10-20-91	82°	58°	---
10-21-91	83°	52°	---
10-22-91	87°	65°	---

10-23-91	89°	71°	T
10-24-91	89°	74°	T
10-25-91	88°	73°	T
10-26-91	88°	71°	0.01
10-27-91	89°	69°	---
10-28-91	87°	74°	T
10-29-91	88°	51°	1.19
10-30-91	56°	50°	T
10-31-91	51°	37°	0.55
11-01-91	55°	33°	---
11-02-91	56°	34°	---
11-03-91	46°	30°	---
11-04-91	53°	26°	---
11-05-91	57°	30°	---
11-06-91	68°	49°	---
11-07-91	64°	45°	0.18
11-08-91	53°	26°	---
11-09-91	57°	29°	---
11-10-91	68°	49°	---
11-11-91	70°	43°	---
11-12-91	71°	48°	---
11-13-91	73°	48°	---
11-14-91	74°	55°	---
11-15-91	80°	66°	0.14
11-16-91	75°	66°	T
11-17-91	71°	50°	0.42
11-18-91	83°	49°	---
11-19-91	82°	52°	0.21
11-20-91	62°	43°	---
11-21-91	69°	35°	---

11-22-91	76°	44°	---
11-23-91	55°	37°	---
11-24-91	60°	29°	---
11-25-91	63°	32°	---
11-26-91	65°	51°	T
11-27-91	75°	60°	0.02
11-28-91	80°	64°	---
11-29-91	80°	64°	T
11-30-91	76°	46°	0.31
12-01-91	48°	40°	0.03
12-02-91	50°	36°	0.08
12-03-91	55°	35°	---
12-04-91	61°	30°	---
12-05-91	67°	38°	---
12-06-91	71°	53°	---
12-07-91	76°	57°	0.01
12-08-91	71°	69°	0.02
12-09-91	77°	58°	0.02
12-10-91	75°	49°	T
12-11-91	70°	58°	0.07
12-12-91	73°	69°	0.14
12-13-91	69°	60°	0.29
12-14-91	62°	42°	---
12-15-91	57°	35°	---
12-16-91	63°	35°	---
12-17-91	63°	40°	0.01
12-18-91	58°	54°	1.12
12-19-91	59°	47°	0.95
12-20-91	71°	59°	0.09
12-21-91	62°	53°	2.38

12-22-91	71°	49°	0.79
12-23-91	61°	47°	---
12-24-91	53°	37°	---
12-25-91	56°	34°	0.13
12-26-91	48°	43°	1.35
12-27-91	52°	43°	0.03
12-28-91	51°	38°	---
12-29-91	56°	33°	---
12-30-91	65°	41°	---
12-31-91	64°	44°	---