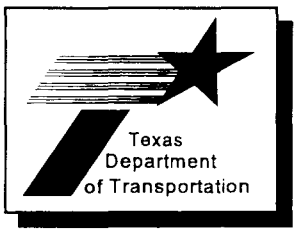
TXDOT / TTI HYDRAULICS AND EROSION CONTROL LABORATORY

Field Performance Testing of Selected Erosion Control Products Final Performance Analysis Through the 1996 Evaluation Cycle

Class 1 - "Slope Protection"
Class 2 - "Flexible Channel Liners"
"Hydraulic Mulches"



Prepared by:

Paul Northcutt
Texas Department of Transportation
Construction & Maintenance Division
(512)416-3091

Jett McFalls
Texas Transportation Institute
Environmental Management Program
(409)845-6158

February, 1997

Table of Contents

Introduction ..... 1 - 2
The Testing Facility ..... 2 - 3
Industry Advisory Council 3
Advisory Fees and Installation Options 4
Evaluation Waiting List 4
Installation Procedures ..... 5 - 6
Evaluation Procedures ..... 6 - 8
    Cellulose Fiber Mulches 6
    Class 1 "Slope Protection" Products 7
    Class 2 "Flexible Channel Liner" Products ..... 7 - 8
Approval by Extension 8
Release of Performance Data 9
Retest Procedures ..... 9 - 10
    Class 1 "Slope Protection" and Cellulose Fiber Mulch Products 9
    Class 2 "Flexible Channel Liner" Products 10
Revision of Minimum Performance Standards 10
Contractor's Option 11
Private Labeling 11
Required Manufacturer's Literature 11
Approved Product List 11
Product Brand or Trade Name Revisions 12
Summary 12
Program Contact Personnel 13

Minimum Performance Standards 15

Record of Product Private Labels ..... 16 - 21

Brand or Trade Name Revisions Made by Industry 23

Key to Abbreviations Used Within Statistical Reports ..... 24 - 27

General Product Material Descriptions ..... 28 - 34

Class 1 "Slope Protection" Final Performance Data ..... 35 - 83

    Record of Product Evaluations ..... 36 - 37

    1:2 Clay ..... 39 - 44
        Tabular Data ..... 40 - 41
        Graph - Sediment Loss 42
        Graph - Vegetation Density 43
    1:2 Sand ..... 45 - 50
        Tabular Data ..... 46 - 47
        Graph - Sediment Loss 48
        Graph - Vegetation Density 49
    1:3 Clay ..... 51 - 56
        Tabular Data ..... 52 - 53
        Graph - Sediment Loss 54
        Graph - Vegetation Density 55
    1:3 Sand ..... 57 - 62
        Tabular Data ..... 58 - 59
        Graph - Sediment Loss 60
        Graph - Vegetation Density 61

Class 1 "Slope Protection" Final Performance Data (continued)

Statistical Analysis ..... 63 - 83
1:2 Clay Sediment Loss ..... 64 - 65
1:2 Clay Vegetation Density ..... 66 - 67
1:2 Sand Sediment Loss ..... 70 - 71
1:2 Sand Vegetation Density ..... 72 - 73

1:3 Clay Sediment Loss 76
1:3 Clay Vegetation Density 77
1:3 Sand Sediment Loss ..... 80 - 81
1:3 Sand Vegetation Density ..... 82 - 83

Class 2 "Flexible Channel Liner" Final Performance Data ..... 84 - 141

Record of Product Evaluations and Level of Shear Stress Flows Performed 85

96 Pascal Flows Only ..... 87 - 90
Tabular Data ..... 88 - 89
Graph - Sediment Loss 90

144 Pascal Flows Only ..... 91 - 94
Tabular Data ..... 92 - 93
Graph - Sediment Loss 94

192 Pascal Flows Only ..... 95 - 98
Tabular Data ..... 96 - 97
Graph - Sediment Loss 98

239 Pascal Flows Only ..... 99 - 102
Tabular Data ..... 100 - 101
Graph - Sediment Loss 102

287 Pascal Flows Only ..... 103 - 106
Tabular Data ..... 104 - 105
Graph - Sediment Loss 106

335 Pascal Flows Only ..... 107 - 110
Tabular Data ..... 108 - 109
Graph - Sediment Loss 110

383 Pascal Flows Only ..... 111 - 114
Tabular Data ..... 112 - 113
Graph - Sediment Loss 114

0 - 96 Pascal Flows (0 - 2 Lbs per Square Foot) ..... 115 - 118
Tabular Data ..... 116 - 117
Graph - Sediment Loss 118

0 - 192 Pascal Flows (0 - 4 Lbs per Square Foot) ..... 119 - 122
Tabular Data ..... 120 - 121
Graph - Sediment Loss 122

Class 2 "Flexible Channel Liner" Final Performance Data (continued)

0 - 287 Pascal Flows (0 - 6 Lbs per Square Foot) ..... 123 - 126
Tabular Data 124
Graph - Sediment Loss 125

0 - 383 Pascal Flows (0 - 8 Lbs per Square Foot) ..... 127 - 129
Tabular Data 128
Graph - Sediment Loss 129

Final Vegetation Density 131

Statistical Analysis ..... 132 - 141
0 -96 Pascal Flows Sediment Loss 133
0 -192 Pascal Flows Sediment Loss 135
0 - 287 Pascal Flows Sediment Loss 137
0 - 383 Pascal Flows Sediment Loss 139
Final Vegetation Density 141

Hydraulic Mulches (Cellulose Fiber Mulches) Final Performance Data ..... 142 - 155

Record of Product Evaluations 143

1:3 Clay ..... 145 - 148
Tabular Data 146
Graph - Vegetation Density 147

1:3 Sand ..... 149 - 151
Tabular Data 150
Graph - Vegetation Density 151

Statistical Analysis ..... 152 - 155
1:3 Clay Vegetative Density 153
1:3 Sand Vegetative Density 155

APPENDIX A - Standard Specification Item 164 "Seeding for Erosion Control" ..... 156 - 168

APPENDIX B - Standard Specification Item 169 "Soil Retention Blanket" ..... 169 - 171

APPENDIX C - Proposed Approved Product List - Soil Retention Blanket ..... 172 - 175

APPENDIX D - Proposed Approved Product List - Cellulose Fiber Mulches ..... 176 - 177

TxDOT/TTI HYDRAULICS AND EROSION CONTROL LABORATORY

INTRODUCTION:

The Texas Department of Transportation (TxDOT) has shifted from a material-type specification for hydraulic mulches (termed "cellulose fiber mulches" within Standard Specification Item 164 *Seeding For Erosion Control*), and for roll-type erosion control mats (termed "soil retention blankets" within Standard Specification Item 169 *Soil Retention Blanket*,) into an "approved product" type specification. The Approved Product List (APL) is based upon the demonstrated field performance of products tested through TxDOT's formal evaluation program.

TxDOT's current specifications for cellulose fiber mulches (Appendix A), and for soil retention blankets (Appendix B), do not include any of the typical ASTM-type material requirements, such as weight, tensile strength, elongation, water-holding capacity, pH, etc.

TxDOT has defined critical performance measures and has established minimum performance standards for selected erosion control and revegetation products which are promoted by industry for use within TxDOT's construction and/or maintenance activities. In cooperation with the Texas Transportation Institute (TTI) Environmental Management Program, TxDOT has funded the construction and annual operation of an extensive, outdoor, field-testing facility designed to collect performance data which may be used by TxDOT to produce and maintain a defensible APL.

With respect to soil retention blankets, TxDOT felt that the critical performance factors included:

- how well the product protects the seedbed or the geometry of a channel from the loss of sediment during rainfall or flow events; and
- how well the product promotes the establishment of a warm-season, perennial vegetative cover within a single March - December growing season.

Further, TxDOT recognized that soil retention blankets are utilized within two broad use classifications:

- products designed for normal overland flows associated with typical embankment protection (Class 1 - Slope Protection Applications); and
- products designed for concentrated water flows associated with drainage channels (Class 2 - Flexible Channel Liner Applications).

With respect to cellulose fiber mulches, TxDOT felt that sediment loss was not a critical performance factor, in that TxDOT recommends limiting the use of these products to slopes of 1:3 or flatter. The single performance factor adopted is the amount of warm-season, perennial vegetation produced within a single March - December growing season.

INTRODUCTION (continued):

By statistically analyzing the performance data produced through controlled, field performance tests performed at the TxDOT/TTI Hydraulics and Erosion Control Laboratory (HECL,) TxDOT maintains discrete minimum performance standards for each application. In order for a product to be placed upon TxDOT's APL, it must meet (or exceed) the currently adopted performance standards associated with that application.

In the case of soil retention blankets, products must meet the minimum performance standards for both of the adopted critical performance measures. Failure within either of the measures will automatically reject the product from being placed upon TxDOT's APL.

THE TESTING FACILITY

The HECL was constructed by TTI on the Texas A&M University Riverside Campus, 6.5 km (4 mi) west of Bryan, Texas. The testing facility encompasses 8.5 ha (21 acres) and includes an L-shaped embankment, a series of 10, at-grade channels, water reservoirs, pumping stations and various instrumentation.

The facility is located on what was once a military airport, and is bounded on the north, east and west sides by runways. Because the site is located on a ridge just above the Brazos River, it is exposed to harsh climatic conditions. Existing soils are generally low in organic content and the site is influenced by heat energy stored in, or reflected from the surrounding pavement. These unique physical conditions were deliberately selected by TTI to provide the most realistic conditions possible for conducting controlled experiments related to the roadside environment.

The L-shaped embankment is approximately 300 linear meters by 6.7 meters in vertical height (984 linear feet by 22 feet high). The embankment was constructed to strict TxDOT standards with respect to compaction in order to simulate a typical highway embankment as closely as possible. In order to test the significance of slope steepness, one side of the embankment was constructed to a 1:2 (2:1) slope, while the other side was constructed to a 1:3 (3:1) slope. To test the significance of soil texture, one-half of the embankment is plated with 98 cm (6 inches) of an erosive, sandy loam soil, while the remaining one-half of the embankment is plated with 98 cm (6 inches) of a tight, clay soil.

Individual embankment treatment plots are 6 meters (20 feet) across and either 15 meters (50 feet) or 21 meters (70 feet) in length depending upon the slope conditions. The embankment provides the capability of establishing a total of approximately seventy-six (76) individual evaluation plots.

THE TESTING FACILITY (Continued):

Sediment collection troughs are constructed at the base of each treatment plot. The troughs are of precast concrete and permit the collection of sediment from each plot as produced within simulated rainfall events.

The HECL contains two reservoirs to provide necessary water to provide rainfall simulations, channel flows, and supplemental water during drought periods. The upper reservoir surface area is 2.43 ha (6.5 acres) which is the primary water source for all experimental work.

A ten-horsepower centrifugal pump supplies the rainfall simulators stationed on the embankment. Each rainfall simulator consists of a series of tubular steel arms, piping and irrigation nozzles. The nozzles were selected so as to create a droplet size which is generally representative of natural rainfall.

The flexible channel liner testing facility consists of ten, at-grade channels (six with a 7% centerline grade, and four with a 3% centerline grade.) Each open channel has a trapezoidal cross section that includes a 0.30 meter (1 foot) bottom, 1:1 side slopes, and a typical 0.91 meter (3 feet) depth beginning 4.5 meters (15 feet) downstream of the channel release gate. The total length of each test channel is 26 meters (85 feet.) Water for channel flows is supplied by an industrial grade, high-volume, low-head, axial-flow pump which is capable of producing over 136,260 liters per minute (36,000 gallons per minute.)

INDUSTRY ADVISORY COUNCIL:

TxDOT and TTI have encouraged the formation of the Industry Advisory Council (IAC) to encourage dialogue and communication between industry, participants, associations and TxDOT/TTI staff. Each participant is automatically a member of the council. Members call meetings at their convenience to discuss matters appropriate to the evaluation facility. TxDOT/TTI personnel will be available to meet with IAC personnel to discuss and provide answers to any question or concern raised by the IAC.

Although TxDOT will remain sensitive to all matters voiced by the IAC, the final decision and authority regarding the conduct of the evaluation facility remains with TxDOT.

EVALUATION FEES AND INSTALLATION OPTIONS:

Neither TxDOT nor TTI charges an evaluation fee for work under this contract. Participants, however, must choose, from the following installation options:

- Option 1- Participant donates the product(s) for evaluation as well as all labor, equipment and incidentals necessary to install the product to TTI's satisfaction, and in strict accordance with the manufacturer's published literature. Installation is supervised by TTI; or

- Option 2 - Participant donates the product(s) for evaluation and reimburses TTI for all costs associated with labor, equipment and incidentals necessary to install the material in strict accordance with the manufacturer's published literature; or

- TTI purchases the product(s) and is reimbursed by the participant for all costs associated with the purchase, labor, equipment and incidentals necessary to install the product in strict accordance with the manufacturer's published literature.

Each participant who elects to perform actual work at the facility must furnish TTI all necessary certificates of insurance andompleted release agreement forms.

EVALUATION WAITING LIST:

The final decision regarding confirming that a product will be tested at the HECL rests with the TTI facility manager. The TTI facility manager will maintain a waiting list of products desiring to be tested at the facility during the next available evaluation cycle. The waiting list shall be maintained based upon the postmarked date on an acceptable, completed "Request for Performance Evaluation" packet, as received within TTI. Personal memoranda, telephone calls, fax transmissions or letters to the TTI facility manager will not be utilized to determine a product's position on the waiting list.

Based upon space availability, TTI will offer an evaluation slot of the gradient and soil type requested by the participant for Class 1, and of the centerline gradient channel requested by the participant or available for Class 2, to new participants in the order of the postmarked date shown on the completed "Request for Performance Evaluation" packet. In the event that a participant fails to commit to testing by the deadline established by TTI, the next product on the waiting list will be offered the evaluation slot.

TxDOT reserves the right to restrict the number of products any single company, manufacturer or distributor may evaluate during any given evaluation cycle, and will treat requests for different gradients, soil types, and/or channel gradients as separate requests.

INSTALLATION PROCEDURES:

With respect to soil retention blankets tested for Class 1 "Slope Protection" applications, participants must select the steepness of slope on which their product is to be evaluated. Participants have the option of having their product evaluated on the 1:2 slopes only, 1:3 slopes only, or on both 1:2 and 1:3 slopes. (Except in the case of a product retest as discussed later,) TTI will install the product on both a clay and a sand plot regardless of the slope steepness selected by the participant.

With respect to soil retention blankets tested for Class 2 "Flexible Channel Liner" applications, industry has the option of specifying the shear-stress range most appropriate for their product.

Generally, the 3% centerline-gradient channels are utilized to evaluate products which are designed to withstand shear stresses of up to 192 Pascals (4 pounds per square foot), while the 7% centerline-gradient channels are utilized to test products designed for shear stresses up to 383 Pascals (8 pounds per square foot.)

All soil retention blankets, whether submitted for Class 1 or Class 2 applications, are installed in strict accordance with the manufacturer's published installation literature, as determined by TTI. Particular attention is paid to edge and junction overlaps, stapling patterns, check, transverse, top or slope or bottom of slope anchor slots, etc. Installation techniques, which in TTI's opinion, cannot be supported by the manufacturer's standard installation literature, is not permitted. The adopted installation techniques as taken from the manufacturer's published literature shall be utilized by TxDOT to produce standard installation detail sheets for the approved products as may be appropriate.

All cellulose fiber mulches are applied at the following rates:

- Sandy Soils - 2.3 Mg/ha (2000 pounds/acre);
- Clay Soils - 2.8 Mg/ha (2500 pounds/acre) for clay soils.

Installation of all products for a given evaluation cycle occurs on or about March 15 of each year. All performance evaluations take place between March 15 and December 31 of each year.

Each plot, regardless of product, slope or soil type, receives the identical mixture and rate of the standard rural-area, warm-season, permanent, perennial seed mix for TxDOT's Bryan District 17. (Table 2 of Appendix A.) Further, each plot receives the identical amounts of fertilizer during installation.

INSTALLATION PROCEDURES (continued):

Prior to product installation, the embankment is cleared of all vegetation, repaired with stockpiled or excavated soil, and brought to a uniform grade and condition. Each plot is treated as necessary to remove any existing vegetation.

All channel treatment plots are cleared of vegetation, repaired with stockpiled or excavated soil, brought to a uniform grade, and final-graded with a trapezoidal-shaped tool.

EVALUATION PROCEDURES:

Cellulose Fiber Mulch Products:

Currently, two separate methods of application are repeated for each product:

- A one-step application process where seed, fertilizer and mulch are applied to the plot in a single slurry; and
- A two-step application process where a seed-fertilizer slurry is applied to the plot, followed by a separate application of the mulch slurry.

TxDOT is testing the significance of vegetative density production between these two application techniques.

Cellulose fiber mulch products are not subjected to simulated rainfall events, as TxDOT feels they should not be used to protect a slope to the degree capable by a soil retention blanket.

Each treatment, however, is sprinkle irrigated to provide sufficient moisture for vegetative growth. For the first three months following installation, water is applied evenly to each plot to provide a minimum of 25.4 mm (1 inch) of water per month per plot. After the initial three month period, no supplemental water is provided except in the event of a drought in excess of 30 days.

Vegetation density data is recorded throughout the duration of the March - December growing season. The vegetation density achieved by the final measurement round is compared to the adopted minimum vegetation density standard to determine acceptance or rejection.

EVALUATION PROCEDURES (continued):

Class 1 "Slope Protection" Products:

Starting approximately two weeks after installation and continuing throughout the March - December evaluation cycle, each plot is subjected to a series of six (6) simulated rainfall events on increasing intensities. By the end of each evaluation cycle, each plot, including Control plots, has received two repetitions of each of the following 10-minute duration design storms:

- 1-Year = 30.2 mm/hr (1.19 in/hr);
- 2-Year = 145.5 mm/hr (5.73 in/hr); and
- 5-Year = 183.6 mm/hr (7.23 in/hr.)

Sediment, as produced within each of the six simulated individual rainfall events is collected, dried and weighed. The average sediment loss, expressed in kilograms per 10 square meters, as collected from the six individual rainfall events is compared to the adopted maximum sediment loss standard to determine acceptance or rejection with respect to sediment loss.

Using video and computer masking technology, each plot is also sampled four separate times during the March - December growing season to determine vegetation density production. The initial sample is normally taken on or about the fourth week following product installation. The final sample is normally taken during December. The vegetative density production which has been achieved by the final sampling round only is compared to the adopted minimum vegetative density standard to determine acceptance or rejection.

Class 2 "Flexible Channel Liner" Products:

Prior to actual installation within the outdoor channels, TTI determines Manning's *n* for all products through the use of an indoor flume facility located at the College of Ocean Engineering, Texas A&M University.

Following installation, the channels experience a 90-day resting period to promote the initial vegetative growth. After this resting period, a series of increasing shear-stress flows begin. Prior to each flow, channels are pre-wetted to moisten the channel surface. Based upon the determined Manning's *n*, and the known geometry of the channel, the depth of water is controlled to initiate a series of increasing flows, starting at 96 Pascal (2 lb/sq ft), and continuing on a 48 Pascal (1 lb/sq ft) increment. Each flow is repeated twice and continues for twenty (20) minutes after a stable flow has been achieved.

EVALUATION PROCEDURES (continued):

Class 2 "Flexible Channel Liner" Products:

During the test flows, measurements are taken approximately every two minutes to determine the amount of soil displaced by the flow. Further, data is collected regarding product movement (loss of intimate soil contact), depth of flow, and velocity of flow. The average soil displacement exhibited within the channel is compared to the adopted maximum soil displacement standard to determine acceptance or rejection.

All channels are also sampled to determine the growth of vegetation over a March through December growing season. Similar to the embankment, channels are initially sampled at the end of the 90-day resting period for vegetation production. The final density sample is normally taken during December. The vegetation density achieved within the channel by the final sampling only is compared to the adopted minimum vegetation density standard to determine acceptance or rejection.

APPROVAL BY EXTENSION:

For Class 1 "Slope Protection Products", if a participant elects to evaluate a product on the severe-slope conditions only (Types C and D), and the product successfully meets the current minimum performance standards established by TxDOT for the particular application, the product will also be included as an approved product (by extension) on the associated, less-severe conditions as well. For example, if a product is evaluated on both Types C and D slopes (Slopes Steeper than 1:3 - Clay and Sand soils, respectively), and successfully meets the performance standards for Type C (Slopes Steeper than 1:3 - Clay Soils), the product will be added by extension to the Approved Product List for Type A (Slopes 1:3 or Flatter - Clay Soils).

If a participant, however, elects to evaluate a product on the gentle slope conditions only (Types A and B), the product will not be added to the severe-slope conditions as an approved equal regardless of the performance of the material.

If a participant elects to test a product within each of the four available Class 1 applications, the product's performance, as documented within each individual application shall determine placement on the Approved Product List, and approval by extension shall not apply.

Approval by extension shall not apply to Class 2 "Flexible Channel Liner" applications, or for cellulose fiber mulch products.

RELEASE OF PERFORMANCE DATA:

With the exception of the final research reports as published by TTI, all performance data will be released by TxDOT only. Data will only be released at the end of a complete evaluation cycle. As the annual operation of the HECL is funded with state funds, all performance data will be released regardless of the performance of any individual product.

Performance data for all products evaluated to date are available to any interested party from TxDOT without charge. Final research reports, as published by TTI are available for a fee through the Texas Transportation Institute Information and Technology Exchange Center.

RETEST PROCEDURES:

Class 1 "Slope Protection" and Cellulose Fiber Mulch Products:

If, after the initial test at the HECL, a product fails to meet the established minimum performance standards, as established by TxDOT, TTI will reserve an evaluation slot of the same gradient and soil type within the next available evaluation cycle for that product. The participant must commit to retesting the identical product within the same gradient and soil type plot as originally evaluated by the deadline established by TTI. In the event the participant fails to confirm retesting, or elects not to retest the product by the deadline established by TTI, the evaluation slot will be offered to the next product on the waiting list.

In the event a product is retested at the HECL and again fails to meet the established minimum performance standards for any application as established by TxDOT, an evaluation plot will not be guaranteed the product during the next available evaluation cycle. The product representative must complete a new "Request for Performance Evaluation" packet and the product will be scheduled for retesting according to the postmark date on the completed "Request for Performance Evaluation" and the procedures established within the normal waiting list process.

RETEST PROCEDURES (continued):

Class 2 "Flexible Channel Liner" Products:

Due to the limited number of evaluation channels available at the HECL and the number of individual products currently requesting Class 2 applications evaluation, a product cannot be guaranteed an evaluation slot within the next available evaluation cycle in the event that product fails to meet any of the established minimum performance standards established by TxDOT.

The product representative must complete and forward to TTI, a new "Request for Performance Evaluation" packet if they desire to retest the identical product. The product will be scheduled for retesting according to the postmark date on the completed "Request for Performance Evaluation" packet, and the procedures established within the normal waiting list process.

REVISION OF MINIMUM PERFORMANCE STANDARDS:

Based upon statistical analysis of performance data as produced through the HECL, TxDOT reserves the right to revise the minimum performance standards for the Approved Product List (APL).

In the event that a product's performance no longer meets the revised minimum performance standards, the product will be notified in writing by TxDOT and provided the opportunity to retest the product within the next available evaluation cycle as determined by TTI.

The product will remain on the APL pending results of the next available evaluation cycle. In the event that the product fails to meet the revised standards at the end of the evaluation cycle retest, the product will be removed from the APL during the next scheduled revision of the APL. In the event that the product's performance meets the newly adopted minimum performance standards, the product will remain on the APL.

In the event that the participant fails to commit to retesting the product within the next available evaluation cycle by the deadline established by TTI, the product will be removed from the APL during the next scheduled revision.

CONTRACTOR'S OPTION:

The APL will be maintained by TxDOT according to the Class and Type as may be appropriate for any given product. It is the Contractor's option to use any of the products provided that the product is listed by brand name on the current APL for the Class and Type specified, and provided the Contractor installs the product in strict accordance with TxDOT specifications and the manufacturer's installation literature.

PRIVATE LABELING:

If the original manufacturer of a product tested and approved at the HECL will, to TxDOT's satisfaction, certify that the brand or trade name evaluated is also distributed under other trade names (private labels), TxDOT will include those private label names on the APL for the appropriate Class and Type. Addition and/or revision of the APL due to private labels will only be made by TxDOT during the normally scheduled revision of the APL.

REQUIRED MANUFACTURER'S LITERATURE:

A product will not be accepted for evaluation or placed on the waiting list for future evaluation at the HECL unless the participant furnishes evidence that the product is currently being marketed under a discrete brand or trade name, and unless the product has published product literature, including complete material specifications and installation guidelines.

"Request for Performance Analysis" packets received by TTI for products currently under development and evaluation by industry, which are not generally marketed, or which do not have complete published material specifications and installation literature, shall not be used by TTI to place the product on the waiting list for evaluation at the HECL.

APPROVED PRODUCT LIST:

Based upon the data collected through the HECL, TxDOT will establish and maintain a current Approved Product List in the form of a Special Provision to Standard Specification Item 169 "Soil Retention Blanket." Product brand or trade names which are placed on the Approved Product List will become eligible for use by Contractors after statewide distribution of the official Approved Product List, normally issued in the form of a special provision to Item 169 "Soil Retention Blanket". This event typically occurs during the May or June following the close of the previous March - December evaluation cycle.

Copies of the current Approved Product List for soil retention blankets, may be requested through the Director, Construction and Maintenance Division, Attn: Mr. Paul Northcutt, 125 East 11th Street, Austin, TX 78701-2483, telephone (512)416-3091.

PRODUCT BRAND OR TRADE NAME REVISIONS:

The manufacturer shall notify TxDOT should the manufacturer elect to make any revisions to the discrete brand or trade name of a product which has been evaluated through the HECL. The manufacturer must provide the revised brand or trade name for the product, and must certify that this action reflects a brand or trade name revision only, and that no material properties were revised. The manufacturer must also notify TxDOT if any brand or trade name revisions are made to any of the product's private labels, if they exist.

Any revisions to TxDOT's final performance reports or the Approved Product List necessitated by manufacturers revising brand or trade names of products evaluated through the HECL, will occur only during the next regularly scheduled release of either the final performance report or the Approved Product List as may be appropriate.

SUMMARY:

The TxDOT/TTI Hydraulics and Erosion Control Laboratory provides TxDOT the capability of using selected erosion control products which have demonstrated their capability of protecting the natural environment through controlled performance evaluations.

The program also provides industry with a uniform, fair and timely testing program for products they propose for use within TxDOT's construction and maintenance activities, and for new products as developed by industry. The program seeks to establish and maintain the greatest number of individual products on the APL as possible, provided those products have demonstrated their capability to meet the adopted minimum standards for the critical performance measures as established by TxDOT.

Final performance data as published by TxDOT for all of the products evaluated through the HECL are available to any interested party without charge. Final reports as published by TTI are available for a fee through the Information and Technology Exchange Center, Texas Transportation Institute. Specify Report Number 1914 when ordering.

PROGRAM CONTACT PERSONNEL:

To discuss TxDOT's overall evaluation program, request copies of available final performance reports, or secure the current Approved Product List, contact:

Mr. Paul Northcutt
Texas Department of Transportation
Construction & Maintenance Division
125 E. 11th Street
Austin, TX 78701-2483
Phone: (512)416-3091
Fax: (512)416-3044

To secure a "Request for Performance Evaluation" packet, to inquire about evaluation schedules, or arrange for a visit to the facility, contact:

Mr. Jett McFalls
Principal Researcher & HECL Facility Manager
Texas Transportation Institute
Environmental Management Program
707 Texas Avenue, Suite 100-E
College Station , TX 77843-3135
Phone: (409) 847-8709
Fax: (409) 862-1759

To order final research reports for Research Project 1914, for a fee, as published by Texas Transportation Institute, contact:

Texas Transportation Institute
Information & Technology Exchange Cntr
Texas A&M University System
College Station, TX 77843-3135
Phone: (409)845-4853
Fax: (409)862-3703
Internet: dolores@ttiadmin.tamu.edu

MINIMUM PERFORMANCE STANDARDS

Texas Department of Transportation

Class 1 "Slope Protection
Class 2 "Flexible Channel Liners"
Cellulose Fiber Mulches

Texas Department of Transportation

Minimum Performance Standards

Item 169 "Soil Retention Blanket"
Item 164 "Seeding For Erosion Control"

Effective Date: March 1, 1997

Specification Pay Item	Class	Type	Site Conditions	Maximum Sediment Loss[1]	Minimum Vegetation Density[2]
169 Soil Retention Blanket	1 Slope Protection	A	Slopes 1:3 or Flatter - Clay Soils	0.34	80%
		B	Slopes 1:3 or Flatter - Sandy Soils	12.20	70%
		C	Slopes Steeper than 1:3 - Clay Soils	0.34	80%
		D	Slopes Steeper than 1:3 - Sandy Soils	26.84	70%
	Class	**Type**	**Site Conditions**	**Maximum Sediment Loss[3]**	**Minimum Vegetation Density**
	2 Flexible Channel Liners	E	Shear Stress Range 0 to 96 Pa (0 to 2 Lb/Ft²)	1.15	70%
		F	Shear Stress Range 0 to 192 Pa (0 to 4 Lb/Ft²)	1.00	70%
		G	Shear Stress Range 0 to 287 Pa (0 to 6 Lb/Ft²)	1.00	70%
		H	Shear Stress Range 0 to 383 Pa (0 to 8 Lb/Ft²)	0.80	70%
164 Seeding for Erosion Control	Hydraulic Mulch	N/A	Clay or Tight Soils	N/A	70%
		N/A	Sandy or Loose Soils	N/A	60%

All performance standards must be achieved through formal testing conducted at the TxDOT/TTI Hydraulics and Erosion Control Laboratory.

1. Kilograms per 10 Square Meters
2. Average Percent of Vegetative Cover Achieved by the Final Measurement Round
3. Average Soil Deformation in Centimeters

RECORD OF PRODUCT PRIVATE LABELS

TxDOT/TTI Hydraulics and Erosion Control Laboratory
Record of Products Private Labels

Name of Product Tested	Manufacturer / Distributor Contact	Tested As[1]	Private Label Name
Airtrol®	U.S. Gypsum Co., 700 North Highway 45, Libertyville, IL 60048-1296; (708)970-5138	Class 1	None
Airtrol® Plus	U.S. Gypsum Co., 700 North Highway 45, Libertyville, IL 60048-1296; (708)970-5138	Class 1	None
American Fiber Mulch	American Fiber Manufacturing, Inc., 1701 Bench Mark Drive, Austin, TX 78728; (512)251-3401	Mulch	None
American Fiber Mulch (with Hydro-Stik)	American Fiber Manufacturing, Inc., 1701 Bench Mark Drive, Austin, TX 78728; (512)251-3401	Mulch	None
American Fiber Mulch (with Fiber-Plus)	American Fiber Manufacturing, Inc., 1701 Bench Mark Drive, Austin, TX 78728; (512)251-3401	Mulch	None
Anti-Wash®/Geojute®	Belton Industries, 8613 Roswell Road, Atlanta, GA 30350; (800)225-4099	Class 1	Soil Saver
BonTerra® S2™	BonTerra America, 355 West Chestnut Street, Genesee, ID 83832; (208)285-0701	Class 1	None
BonTerra® S1™	BonTerra America, Inc., 355 West Chestnut Street, Genesee, ID 83832; (800)882-9489	Class 1	None
BonTerra® SFB12™	BonTerra America, Inc., 355 West Chestnut Street, Genesee, ID 83832; (208)285-0701	Class 2	Tensar TB 1000
BonTerra® CS2™	BonTerra America, Inc., 355 West Chestnut Street, Genesee, ID 83832; (800)882-9489	Class 1	None
Conwed® Hydro Mulch®	Conwed Fibers, 1st Plaza, Suite 350, 1985 Tabe Boulevard, S.E., Hickory, NC 28601; (704)327-6670	Mulch	None
Curlex® I	American Excelsior Co., 900 Avenue H East, P.O. Box 5624, Arlington, TX 76011; (800)777-2691	Class 1	None

TxDOT/TTI Hydraulics and Erosion Control Laboratory
Record of Products Private Labels

Name of Product Tested	Manufacturer / Distributor Contact	Tested As[1]	Private Label Name
Curlex® II (Double Sided)	American Excelsior Co., 900 Avenue H East, P.O. Box 5624, Arlington, TX 76011; (800)777-2691	Class 2	None
Curlex®-LT	American Excelsior Co., 900 Avenue H East, P.O. Box 5624, Arlington, TX 76011; (800)777-2691	Class 2	None
Earth-Lock	Erosion Control Systems, Inc., 1800 McFarland Blvd., Suite 180, Tuscaloosa, AL 35406; (800)942-1986	Class 2	None
ECS Straw Blanket Standard	Erosion Control Systems, Inc., 1800 McFarland Blvd., Suite 180, Tuscaloosa, AL 35406; (800)942-1986	Class 1	None
ECS Excelsior Blanket Standard	Erosion Control Systems, Inc., 1800 McFarland Blvd., Suite 180, Tuscaloosa, AL 35406; (800)942-1986	Class 1	None
Enkamat® 7020	AKZO/NOBEL, P.O. Box 7249, Asheville, NC 28802; (704)665-5050	Class 2	None
Enkamat® 7018	AKZO/NOBEL, P.O. Box 7249, Asheville, NC 28802; (704)665-5050	Class 2	None
Enviro-Gro	Southwest Environmental Services, Inc., P.O. Box 134, Tyler, TX 75710; (903)531-2312	Mulch	None
Excel® Fibermulch II with Exact-Tac™	American Excelsior Co., 900 Avenue H East, P.O. Box 5624, Arlington, TX 76011; (800)777-2691	Mulch	None
GEOCOIR®/DeKoWe® 700	Belton Industries, Inc., 8613 Roswell Road, Atlanta, GA 30350; (800)225-4099	Class 1	None
Geogro	U.S. Gypsym Corporation, 700 North Highway 45, Libertyville, IL 60048-1296; (847)970-5138	Class 1	None
Geojute® Plus 1	Belton Industries, Inc., 8613 Roswell Road, Atlanta, GA 30350; (800)225-4099	Class 1	None
Geojute® Plus-Regular High Velocity	Belton Industries, Inc., 8613 Roswell Road, Atlanta, GA 30350; (800)225-4099	Class 1	None

TxDOT/TTI Hydraulics and Erosion Control Laboratory
Record of Products Private Labels

Name of Product Tested	Manufacturer / Distributor Contact	Tested As[1]	Private Label Name
Geojute® Plus	Belton Industries, Inc., 8613 Roswell Road, Atlanta, GA 30350; (800)225-4099	Class 1	None
GREENSTREAK® PEC-MAT™	Greenstreak, Inc., 3400 Tree Court Ind. Blvd., St. Louis, MO 63122-6689; 800-325-9504	Class 1 Class 2	Webmat 280
KoirMat™ 740	Nedia Enterprises, 89- 66 217th Street, Jamaica, NY 11427; (718)740-5171	Class 2	None
KoirMat™ 400	Nedia Enterprises, 89- 66 217th Street, Jamaica, NY 11427; (718)740-5171	Class 1	None
Landlok® TRM 450	Synthetic Industries, Inc., 4019 Industry Drive, Chattanooga, TN 37416; (800)621-9444	Class 2	Contech TRM C-45
Landlok® 407GT	Synthetic Industries, Inc., 4019 Industry Drive, Chattanooga, TN 75230; 800-621-0444	Class 1	Contech C-Jute TerraJute
LANDLOK® FRS 3112	Synthetic Industries, Inc., 4019 Industry Drive, Chattanooga, TN 37416; (800)621-9444	Class 1	None
Miramat® TM8™	Nicolon Mirafi Group, 3500 Parkway Lane, Suite 500, Norcross, GA 30092; (404)447-6272	Class 2	None
Miramat® 1000	Nicolon Mirafi Group, 3500 Parkway Lane, Suite 500, Norcross, GA 30092; (404)447-6272	Class 1	None
North American Green C350™ Three Phase™	North American Green, Inc., 14649 Highway 41 North, Evansville, Indiana 47711; (800)772-2040	Class 2	None
North American Green S75	North American Green, Inc., 14649 Highway 41 North, Evansville, Indiana 47711; (800)772-2040	Class 1	None
North American Green SC150	North American Green, Inc., 14649 Highway 41 North, Evansville, Indiana 47711; (800)772-2040	Class 1	None

TxDOT/TTI Hydraulics and Erosion Control Laboratory
Record of Products Private Labels

Name of Product Tested	Manufacturer / Distributor Contact	Tested As[1]	Private Label Name
North American Green S150	North American Green, Inc., 14649 Highway 41 North, Evansville, Indiana 47711; (800)772-2040	Class 1 Class 2	None
Permamat 200F	P.P.S. Packaging Company, P.O. Box 427, Fowler, CA 93625; (209)834-1641	Class 2	None
POZ-O-CAP®	Chemical Lime Company, P.O. Box 121874, Fort Worth, TX 76107; (800)365-6724	Class 1	None
Pro Mat® XL	Tascon, Inc., 7607 Fairview, Houston, Tx 77041; (713)937-0900	Mulch	None
Pro Mat® (with RMBplus)	Tascon, Inc., 7607 Fairview, Houston, Tx 77041; (713)937-0900	Mulch	None
Pro Mat®	Tascon, Inc., 7607 Fairview, Houston, Tx 77041; (713)937-0900	Mulch	None
Pyramat®	Synthetic Industries, Inc., 4019 Industry Drive, Chattanooga, TN 75230; 800-621-0444	Class 2	None
Second Nature® Regenerated Wood Fiber	Central Fiber Corporation, 4814 Fiber Lane, Wellsville, KS 66092; (800)654-6117	Mulch	None
Seed-Guard™	Belton Industrie, 8613 Roswell Road, Atlanta, GA 30350; (404)587-0257	Class 1	None
Silva-Fiber Plus®	Weyerhaeuser, P.O. Box 434, Montclair, New Jersey 07042; (201)744-2625	Mulch	None
Soil Guard™	Weyerhaeuser, P.O. Box 434, Montclair, New Jersey 07042; (201)744-2625	Class 1	None
SuperGro™	AMOCO Fabrics and Fibers, 260 The Bluffs, Austell, GA 30001; (770)944-4419	Class 1	None
Tensar® Erosion Mat TM3000	The Tensar Corporation, 1210 Citizens Parkway, Morrow, GA 30260; (404)250-1290	Class 2	None
Tensar® Erosion Blanket TB1000	The Tensar Corporation, 1210 Citizens Parkway, Morrow, GA 30260; (404)250-1290	Class 2	BonTerra SFB12 (orig manuf)

TxDOT/TTI Hydraulics and Erosion Control Laboratory
Record of Products Private Labels

Name of Product Tested	Manufacturer / Distributor Contact	Tested As[1]	Private Label Name
Terra-Control®	Acumen International, P.O. Box 41303, Houston, TX 77241-1303; (713)896-0050	Class 1	None
verdyol® Excelsior Standard	Verdyol Alabama, Inc, P.O. Box 605, Pell City, AL 35125; (205)338-4411	Class 1	Winters Excelsior Inc "POPLAR EXCELSIOR BLANKET"
verdyol® Excelsior High-Velocity	Verdyol Alabama, Inc, P.O. Box 605, Pell City, AL 35125; (205)338-4411	Class 2	None
verdyol® ERO-MAT®	Verdyol Alabama, Inc, P.O. Box 605, Pell City, AL 35125; (205)338-4411	Class 1	None
Xcel Superior	P.P.S. Packaging Co., 204 N. Seventh Street, P.O. Box 56, Fowler, CA 93625; 209-834-2011	Class 1	Contech Standard Plus Green Triangle Superior
Xcel Regular	P.P.S. Packaging Co., 204 N. Seventh Street, P.O. Box 56, Fowler, CA 93625; 209-834-2011	Class 1	Contech Standard Green Triangle Regular

1. Class 1 = "Slope Protection" Applications; Class 2 = "Flexible Channel Liner" Applications; Mulch = Cellulose Fiber Mulch applications.

BRAND OR TRADE NAME REVISIONS MADE BY INDUSTRY

INDUSTRY REVISIONS TO PRODUCT BRAND/TRADE NAMES

The following list documents the product brand or trade name revisions as made by the manufacturer, on products evaluated through the TxDOT/TTI Hydraulics and Erosion Control Laboratory:

Brand/Trade Name as Originally Evaluated	Manufactured By	New Brand/Trade Name	Announced In
Curlex®	American Excelsior Co	*Curlex® I*	*Oct 1995*
LANDLOK® ECRM 450	Synthetic Industries, Inc.	*LANDLOK® TRM 450*	1996
POLYJUTE® 407GT	Synthetic Industries, Inc.	*LANDLOK® 407GT*	1996
LANDSTRAND® Natural	Synthetic Industries, Inc.	*LANDLOK® FRS 3112*	1996

KEY TO ABBREVIATIONS USED
WITHIN STATISTICAL REPORTS

Key to Abbreviations Used Within Statistical Reports

The abbreviations as used within the statistical reports, are intended to refer to the following product trade names as evaluated through the TxDOT/TTI Hydraulics and Erosion Control Laboratory. Numbers in parenthetis indicate the evaluation cycle year in which the product was evaluated.

Abbreviation	*Actual Trade Name*; Manufacturer/Distributor
AIRTROL PLUS(96)	*Airtrol® Plus; U.S.Gypsum Company*
AIRTROL(92)	*Airtrol®; U.S. Gypsum Company*
AIRTROL(94)	*Airtrol®; U.S. Gypsum Company*
AIRTROL(95)	*Airtrol®; U.S. Gypsum Company*
AMER FIBER(92)	*American Fiber Mulch; American Fiber Manufacturing, Inc.*
AMFIBTAK1(94)	*American Fiber Mulch (with Hydro-Stik); American Fiber Manufacturing, Inc.*
AMFIBTAK2(94)	*American Fiber Mulch (with Fiber-Plus); American Fiber Manufacturing, Inc.*
BONTERRA S2(96)	*BonTerra S2; BonTerra America, Inc.*
BONTERRA CS2(96)	*Bonterra CS2; BonTerra America, Inc.*
BONTERRA S2(95)	*BonTerra S2; BonTerra America, Inc.*
BONTERRA S1(95)	*BonTerra S1; BonTerra America, Inc.*
CONTROL	
CONWED(92)	*Conwed® Hydro Mulch*
CURLEX I (92)	*Curlex® I; American Excelsior Co.*
CURLEX II(95)	*Curlex® II (Double Sided); American Excelsior Co.*
CURLEX I(91)	*Curlex® I; American Excelsior Co.*
CURLEX 1(94)	*Curlex® I; American Excelsior Co.*
CURLEX-LT(96)	*Curlex®-LT; American Excelsior Co.*
DEKOWE 700(95)	*GEOCOIR®/DeKoWe® 700; Belton Industries, Inc.*
DEKOWE 700(94)	*GEOCOIR®/DeKoWe® 700; Belton Industries, Inc.*
DEKOWE 700(92)	*GEOCOIR®/DeKoWe® 700; Belton Industries, Inc.*
EARTHLOCK(96)	*Earth-Lock; Erosion Control Systems, Inc.*
ECS EXCEL STD(96)	*ECS Excelsior Blanket Standard; Erosion Control Systems, Inc.*

Key to Abbreviations Used Within Statistical Reports

Abbreviation	*Actual Trade Name*: Manufacturer/Distributor
ECS STRAW(95)	*ECS Straw Blanket Standard; Erosion Control Systems, Inc.*
ENKA7018(96)	*Enkamat® 7018; AKZO/NOBEL*
ENKAMAT 7020(95)	*Enkamat® 7020; AKZO/NOBEL*
ENKAMAT7018(96)	*Enkamat® 7018; AKZO/NOBEL*
ENVIRO GRO(96)	*Enviro-Gro; Southwest Environment Services, Inc.*
EROMAT(91)	*verdyol®ERO-MAT™; Verdyol Alabama, Inc.*
FIBERMULCH2(96)	*Excel Fibermulch® II; American Excelsior Company*
GEOGRO(96)	*Geogro; U.S. Gypsum Company*
GEOJUTE PLS1(95)	*Geojute Plus 1; Belton Industries, Inc.*
GEOJUTE PLUS(94)	*Geojute Plus; Belton Industries, Inc.*
GEOJUTE PLS1(96)	*Geojute Plus 1; Belton Industries, Inc.*
GEOJUTE(91)	*Antiwash Geojute; Belton Industries, Inc.*
GEOPLUS HI-V(95)	*Geojute® Plus-Regular High Velocity; Belton Industries, Inc.*
KOIRMAT 400(96)	*KoirMat™ 400; Nedia Enterprises*
KOIRMAT740(96)	*KoirMat™ 740; Nedia Enterprises*
LANDLOK 450(95)	*LANDLOK® TRM 450; Synthetic Industries, Inc.*
LANDLOKFRS(95)	*Landlok® FRS 3112; Synthetic Industries, Inc.*
LANDLOKFRS(96)	*Landlok® FRS 3112; Synthetic Industries, Inc.*
LANDLOK407GT(91)	*Landlok® 407GT; Synthetic Industries, Inc.*
MIRAMAT 1000(94)	*Miramat 1000; Nicolon Mirafi Group*
MIRAMAT TM8(95)	*Miramat® TM8™; Nicolon Mirafi Group*
N/A/G S75(91)	*S75; North American Green, Inc.*
N/A/G S75(96)	*S75; North American Green, Inc.*
N/A/G SC150(91)	*SC150; North American Green, Inc.*
N/A/G S150(96)	*S150; North American Green, Inc.*
N/A/G S150(91)	*S150; North American Green, Inc.*

Key to Abbreviations Used Within Statistical Reports

Abbreviation	*Actual Trade Name*; Manufacturer/Distributor
NAG C350(95)	*North American Green C350™ Three Phase™; North American Green, Inc.*
NAGS150(96)	*S150; North American Green, Inc.*
PECMAT(91)	*GREENSTREAK® PEC-MAT™; Greenstreak, Inc.*
PERMAMAT200F(95)	*Permamat 200F; PPS Packaging Co.*
POZ-O-CAP(95)	*POZ-O-CAP®; Chemical Lime Company*
PROMAT XL TAC(94)	*Pro Mat® XL (with RMBplus tackifier); Tascon, Inc.*
PROMAT XL(94)	*Pro Mat® XL; Tascon, Inc.*
PROMAT(94)	*Pro Mat®; Tascon, Inc.*
PYRAMAT(96)	*Pyramat®; Synthetic Industries, Inc.*
REGEN FIBER(95)	*Second Nature® Regenerated Wood Fiber; Central Fiber Corporation*
REGEN FIBER(96)	*Second Nature® Regenerated Wood Fiber; Central Fiber Corporation*
SEED GUARD(96)	*Seed-Guard™; Belton Industries, Inc.*
SFB12(96)	*BonTerra® SFB12™; BonTerra, Inc.*
SILVAFIB PLUS(94)	*Silva-Fiber Plus®; Weyerhaeuser*
SOIL GUARD(94)	*Soil Guard; Weyerhaeuser*
SUPER GRO(94)	*SuperGro™; AMOCO Fabrics and Fibers*
SUPER GRO(95)	*SuperGro™; AMOCO Fabrics and Fibers*
TB 1000(96)	*Tensar® Erosion Blanket TB 1000; The Tensar Corporation*
TERRA CNTL(96)	*Terra-Control®; Acumen International*
TM3000(95)	*Tensar® Erosion Mat TM 3000; The Tensar Corporation*
VERDYOL STD(95)	*verdyol® EXCELSIOR Standard; Verdyol Alabama, Inc.*
VERDYOL HI-V(96)	*verdyol® Excelsior High-Velocity; Verdyol Alabama, Inc.*
VERDYOL HI-V(95)	*verdyol® Excelsior High-Velocity; Verdyol Alabama, Inc.*
XCEL REG(91)	*Xcel Regular; PPS Packaging Co.*
XCEL SUP(91)	*Xcel Superior; PPS Packaging Co.*

GENERAL PRODUCT MATERIAL DESCRIPTIONS

Disclaimer:

The product descriptions shown within this table are general in nature, intended for overall product comparison purposes only, and are not to be used for specification purposes. Refer to individual manufacturer's literature for the specific brand for complete product material specifications.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
Airtrol®	Class 1	A cementious plaster binder produced from high-purity gypsum and applied in conjunction with an approved cellulose fiber mulch through a hydraulic (hydraulic seeding) process. The plaster is nontoxic, noncombustible, and harmless to fish, birds, plants and animals.
Airtrol® Plus	Class 1	A cementious plaster binder produced from high-purity gypsum and applied in conjunction with an approved cellulose fiber mulch through a hydraulic (hydraulic seeding) process. The plaster is nontoxic, noncombustible, and harmless to fish, birds, plants and animals. *Tackifibers*, as produced by Synthetic Industries, Inc., is added to the plaster binder.
American Fiber Mulch	Mulch	Produced from recycled paper. No published literature available on this product.
American Fiber Mulch (with Hydro-Stik)	Mulch	Mulch produced from recycled paper. No published literature available on the hydraulic mulch. *Hydro-Stik is* a special gum based tackifier, as available through the Finn Corporation.
American Fiber Mulch (with Fiber-Plus)	Mulch	Mulch produced from recycled paper. No published literature available on the hydraulic mulch. *Fiber-Plus is* a specially coated synthetic fiber tackifier with long fiber length, as available through the Finn Corporation.
ANTI-WASH®/GEOJUTE®	Class 1	Heavy jute mesh of undyed, unbleached jute yarn. Yarn count - warp - 78 per width min; weft - 42 per linear yard, min. Typical weight = 0.92 lbs / sq yd. Typical roll width = 48 inches.
BonTerra® S1	Class 1	Machine-produced mat of 100%, weed-free wheat straw by weight, covered on the top side with a lightweight, photodegradable polypropylene netting with approximate ½ " x ½ " openings, sewn together on two inch centers. Typical weight = 0.5 lbs / sq yd. Typical roll width = 7.5 feet. Typical roll length = 90 feet.
BonTerra® SFB12™	Class 2	100% synthetic fiber mat consisting of long-lasting, UV stabilized netting on the bottom, and heavy duty UV stabilized netting on the top, sewn on two inch centers. Typical roll weight = 57 lbs. Typical roll length = 90 feet. Typical roll width = 7.5 feet.
BonTerra® CS2™	Class 1	70% straw and 30% coconut fiber mat with a lightweight photodegradable netting on the bottom side, and a long-lasting UV stabilized netting on the top side, sewn on two inch centers. Typical roll weight = 40 lbs (0.5 lbs / sq yd); Typical roll length = 90 feet; Typical roll width = 7.5 feet.
BonTerra®S2	Class 1	Machine-produced mat of 100%, weed-free wheat straw by weight, covered on the top and bottom sides with a lightweight, photodegradable polypropylene netting with approximate ½ " x ½ " openings, sewn together on two ineh centers. Typical weight = 0.5 lbs / sq yd. Typical roll width = 7.5 feet. Typical roll length = 90 feet.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
Conwed® Hydro Mulch®	Mulch	Wood fiber mulch consisting of virgin wood fibers manufactured expressly from whole wood chips and shall not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Typical bag wight = 100 lbs. Typical moisture content 10% ±3%. Typical ash content 0.8% ± 0.2% O.D. basis.
Curlex® II(Double Sided)	Class 2	Wood-machined mat of curled wood excelsior of 80%, six-inch or longer fibers. Both the top and the bottom of the blanket is covered with a photodegradable, extruded plastic mesh. Typical weight = 1.0 lb / sq yd; Typical roll length = 112.5 feet or 180 feet; Typical roll width = 4 feet.
Curlex® I	Class 1 Class 2	Machined mat of curled wood excelsior of 80%, six-inch or longer fibers. The top of each blanket is covered with a photo-degradable, extruded plastic mesh. Typical weight = 0.975 lbs / sq yd. Typical roll width = 48 or 96 inches. Typical roll length = 180 feet.
Curlex®-LT	Class 1	Natural, excelsior blanket made of 100% virgin aspen excelsior, covered on the top and bottom sides with polypropylene netting with approximate 3/4" x 1-5/8" openings. Typical weight = 0.64 lbs / sq yd. Typical roll width = 8 feet. Typical roll length = 90 feet.
Earth-Lock	Class 2	Machine-produced mat of curled wood excelsior of 80%, 9 inches or longer fiber length with consistent thickness and the fiber evenly distributed over the entire area of the mat. The top side of the mat shall be covered with a high-tenacity polyester geogrid. The excelsior shall be stitched to the plastic mesh and geogrid on a minimum of three inch centers with synthetic yarn. Typical roll weight = 75 lbs ± 10%; Typical roll length = 60 feet; Typical roll width = 6.5 feet.
ECS Excelsior Blanket Standard	Class 1	Extra long fibers of interlocking stitched wood excelsior mat. Typical weight per roll = 68 lbs ± 10%; Typical roll length = 96 feet; Typical roll width = 7.5 feet.
ECS Straw Blanket Standard	Class 1	Organic blanket made from virgin wheat straw covered on the top side by netting. Typical roll weight = 50 lbs ± 10%. Typical roll width = 7.5 feet. Typical roll length = 120 feet.
Enkamat® 7020	Class 2	Mat consisting of heavy nylon monofilaments fused at their intersection. 97% of the geomatrix shall be open space available for soil and root interaction. Matting will have three-dimensional stability without laminated or stitched layers. Typical weight = 12 oz / sq yd; Typical roll length = 277 feet; Typical Roll width = 39 inches.
Enkamat® 7018	Class 2	Mat consisting of heavy nylon monofilaments fused at their intersection. 97% of the geomatrix shall be open space available for soil and root interaction. Matting will have three-dimensional stability without laminated or stitched layers. Typical weight = 8.6 oz / sq yd; Typical roll length = 277 feet; Typical Roll width = 39 inches.
Enviro-Gro	Mulch	No product literature available for this product.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
Excel® Fibermulch II with Exact-Tac™	Mulch	Hydraulic mulch manufactured from 100% Aspenwood fibers and contains measured amounts of a green water-activated dye and Exact-Tac™ tackifier. Typical moisture content = 10% ± 3%. Typical ash content 0.7% ± 0.2% (O.D. basis).
Geocoir®/DeKoWe® 700	Class 1	100% spun coir mat derived from the husk of coconuts. Typical weight = 20.6 oz / sq yd; Typical open area 50%; Typical roll length = 50 meters; Typical roll width = 1, 2, 3 or 4 meters.
Geogro	Class 1	No product literature available.
Geojute Plus	Class 1	Woven jute mat, undyed and unbleached. Yarn count 78 - width warp; 180 per linear yard weft. Typical roll weight = 2.82 lbs / linear yard; Typical roll length 100 feet. Typical roll width = 4 feet.
Geojute Plus 1	Class 1	No product literature available.
Geojute® Plus-Regular High Velocity	Class 2	No product literature available.
GREENSTREAK® PEC-MAT™	Class 1 Class 2	Flexible mat of non-woven, randomly-oriented monofilaments, thermally welded together into a three-dimensional porous web. Typical weight = 28 oz / sq yd. Typical roll width = 6 feet.
KoirMat 400	Class 1	No product literature available.
KoirMat™ 740	Class 2	No product literature available.
LANDLOK FRS 3112	Class 1	Fiber roving system consisting of continuous fibrillated, fine-denier, polypropylene yarn fibers, processed such that interlocking fibrils attach to slightly coarser stem fibrils, without UV stabilization, designed for application through air-gun process. Typical yarn is wound onto two cylindrical packages weighing 18-25 pounds.
LANDLOK® TRM 450	Class 2	Dense, three-dimensional web of polyolefin fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polyolefin thread. Typical weight = 10.5 oz / square yard. Typical roll width = 6.5 feet. Typical roll length = 138.5 feet.
LANDLOK® 407GT	Class 1	Flexible, non-organic, open-weave geotextile consisting of perpendicular rows of multifilament and tape yarns woven together resulting in a dimensionally stable matrix. Typical weight = 2.25 oz / sq yd. Typical roll width = 12 ½ feet (4 ft width optional).
Miramat® 1000	Class 1	A flexible, three-dimensional web of bonded polypropylene monofilaments. Typical weight - 9.6 oz / sq yd. Typical roll width = 4.3 feet. Typical roll length = 210 feet.
Miramat® TM8™	Class 2	Flexible, three-dimensional synthetic mat. Typical weight = 12 oz / sq yd. Typical roll width = 12 feet. Typical rol l length = 100 feet.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
North American Green SC150	Class 1	Machine-produced mat consisting of 70% agricultural straw and 30% coconut fiber, covered on the top side by a polypropylene net having an approximate 5/8" x 5/8" mesh, and on the bottom side by a polypropylene net with an approximate ½ " x ½ " mesh, sewn together by cotton thread. Typical weight per roll = 30 lbs ± 10% per roll. Typical roll length = 83.3 feet. Typical roll width = 6.5 feet.
North American Green S150	Class 1 Class 2	Machine-produced mat of 100% agricultural straw, covered on the top and bottom sides with a polypropylene net having an approximate opening size of ½ " x ½ ", and sewn together by cotton thread. Typical roll weight = 30 lbs ± 10% per roll. Typical roll width = 6.5 feet. Typical roll length = 83.5 feet.
North American Green C350™ Three Phase™	Class 2	100% coconut fiber stitch bonded between a heavy duty UV stabilized bottom net and a heavy duty UV stabilized cuspated (crimped) middle netting overlaid with a heavy duty UV stabilized top net. The three nettings are stitched together on 1.5 inch centers with UV stabilized polyester thread. Typical weight = 0.92 lbs / sq yd;
North American Green S75	Class 1	Machine-produced mat of 100% agricultural straw, covered on the top side with a polypropylene net having an approximate ½ " x ½ " mesh, sewn together with cotton thread. Typical roll weight = 30 lbs ± 10% per roll. Typical roll length = 83.5 feet.
Permamat 200F	Class 2	Machine-produced mat of evenly distributed Aspen wood excelsior fibers, 80% of which are six inches or longer. The mat is completely encased in a black extreuded plastic netting treated to retain intact both in direct sunlight and when burried. The netting mesh size is approx. 3/4" x 3/8". Plastic netting is securely attached to the excelsior. Typical weight = 2.34 lbs / sq yd; Typical roll length = 75 feet; Typical roll width = 4 feet.
POZ-O-CAP®	Class 1	Product consisting of dry powder mix of cemtious and hydrated lime with a dry, cellulose-derived fiber reinforcing additive, applied through standard hydraulic (hydraulic seeding) processes.
Pro Mat® XL	Mulch	Natural cellulose wood fiber hydro-mulch manufactured from 85% recycled newspaper. Ash content less than 1.6% (dust). Moisture content of not more than 15%.
Pro Mat® XL with Airtak	Mulch	
Pro Mat®	Mulch	Recycled cellulose fiber mulch manufactured from corrugated paper fibers. Typical bag width = 50 lbs. Typical moisture content = 12% ± 3%. Typical Ash content = 1.6% max.
Pyramat®	Class 2	Three-dimensional, lofty, woven polypropylene geotextile, composed of polypropylene monofilament yarns woven into a uniform configuration of resilient pyramid-like projectsions. Typical weight = 15 oz / sq yd; Typical roll length = 90 feet; Typical roll width = 6 feet.
Second Nature® Regenerated Wood Fiber	Mulch	Recycled, natural fiber mulch. Typical bag weight = 50 lbs. Typical moisture content = 12% ± 3%.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
Seed-Guard™	Class 1	Natural green mat woven from photo-degradable polypropylene yarns. No additional material specifications available at printing.
Silva-Fiber Plus®	Mulch	100% virgin wood fiber with 3% tackifier. Typical bag weight = 50 lbs. Typical moisture content = 12% ± 3%. Typical ash content 1.0%.
Soil Guard™	Class 1	A bonded fiber matrix material produced from 100% wood fiber with natural binders. The product is designed to disperse rapidly in water, remain in uniform suspension under agitation, and be applied through standard hydraulic (hydraulic seeding) processes.
SuperGro™	Class 1	Flexible, light-weight geocomposite consisting of nonwoven, isotactic, polypropylene staple, uniform fiber blanket, reinforced with polypropylene netting, earthtone in color. Typical weight = 1.0 oz per sq yd; Typical roll length = 250 linear yards; Typical roll width = 4 feet.
Tensar TB 1000	Class 1 Class 2	Lofty web of polyolefin fibers between two high strength, biaxially oriented nets and bound securely together by parallel stitching with polyolefin thread. Stabilized against ultraviolet degradation and inert to chemicals normally encountered in a natural soil environment. Typical weight = 10 ounces per yd (ASTM D-3776); Typical roll length = 120 feet; Typical roll width = 7.5 feet.
Tensar® Erosion Mat TM3000	Class 2	Consists of polymer nettings, fused at the intersections of the fibers and formed into a strong and dimensionally stable mat. Material is UV stabilized with a minimum of 2.0% carbon black. Typical weight =- 12 oz / sq yd (min); Typical roll length = 100 feet; Typical roll width = 5 feet.
Terra Control	Class 1	Polyvinylacetat dispersion containing easily biodegradable plasticizer, formulated as a milky-white, bio-degradable synthetic resin dispersion in water, designed for hydraulic applications.
verdyol® EXCELSIOR High Velocity	Class 1 Class 2	Machine-produced mat of 100% clean wood excelsior fibers processed from hardwood. The top and bottom sides of the blanket is covered with an extruded, degradable polypropylene netting of 3/4" x 3/4" openings. Typical weight = 1.1 lbs / sq yd. Typical roll width = 7.5 feet. Typical roll length = 96 feet.
verdyol® EXCELSIOR Standard	Class 1	Machine-produced mat of 100% clean, wood excelsior fibers processed from hardwood. The top side of the blanket is covered with an extruded, degradable polypropylene netting with 3/4" x 3/4" openings. Typical weight = 0.85 lbs / sq yd. Typical roll width = 7.5 feet. Typical roll length = 96 feet.
verdyol® ERO-MAT™	Class 1	Machine-produced mat consisting of agricultural straw, covered on one side of the blanket with a photodegradable, synthetic mesh adhered to the straw by a knitting process using degradable thread. Typical roll weight = 50 lbs ± 1 lb per roll. Typical roll width = 7.5 feet. Typical roll length = 120 feet.

General Product Material Descriptions

Brand Name of Product	Tested As	Material Description
Xcel Regular®	Class1	Machine-produced mat of curled wood excelsior of 80% six-inch or longer fiber length, covered on the top side by a photo-degradable, extruded plastic net. Typical weight = 0.98 lbs / sq yd ± 0.10 lbs / sq yd. Typical roll width = 48 inches ± 1 inch. Typical roll length = 180 feet (min).
Xcel Superior®	Class 1	Machine-produced mat of curled wood excelsior of 80%, six-inch or longer fiber length, covered on the top and bottom sides by a photo-degradable, extruded plastic net. Typical weight = 1.0 lbs / sq yd ± 0.10 lbs / sq yd. Typical roll width = 48 inches ± 1 inch. Typical roll length = 180 feet (min).

Disclaimer:

The product descriptions shown within this table are general in nature, intended for overall product comparison purposes only, and are not to be used for specification purposes. Refer to individual manufacturer's literature for the specific brand for complete product material specifications.

CLASS 1 "SLOPE PROTECTION"
Final Performance Analysis

(Analysis by Steepness of Slope and Type of Soil)

ANALYSIS LEVEL USED BY TxDOT TO DETERMINE APPROVED PRODUCT LIST

This analysis level seeks to determine what the sediment-loss and vegetation-density performance of each product was *based upon both the steepness of slope and type of soil.*

Sediment-loss figures shown represent the average sediment loss from the six, simulated rainfall events given each plot, and are expressed in terms of Kilograms of Sediment Loss per 10 Square Meters.

Vegetation-density figures shown represent the average percent of vegetative cover achieved within the plot by the final measurement cycle only.

Class 1 "Slope Protection" Applications
Record of Product Evaluations

Cycle	No	Product Evaluated	1:2 Clay	1:2 Sand	1:3 Clay	1:3 Sand
1991	1	*Anti-Wash®/Geojute®*				
	2	*Curlex® I*				
	3	*Greenstreak® Pec-Mat™*				
	4	*Landlok® 407GT*				
	5	*North American Green S75*				
	6	*North American Green S150*				
	7	*North American Green SC150*				
	8	*verdyol® ERO-MAT®*				
	9	*Xcel Regular*				
	10	*Xcel Superior*				
1992	1	*Airtrol®*				
	2	*Curlex® I*				
	3	*Geocoir®/DeKoWe® 700*				
1993		Cycle Cancelled Due to Weather Damage				
1994	1	*Airtrol®*				
	2	*Curlex® I*				
	3	*Geocoir®/DeKoWe® 700*				
	4	*Geojute® Plus*				
	5	*Miramat® 1000*				
	6	*Soil Guard™*				
	7	*SuperGro™*				

Class 1 "Slope Protection" Applications
Record of Product Evaluations

Cycle	No	Product Evaluated	1:2 Clay	1:2 Sand	1:3 Clay	1:3 Sand
1995	1	*Airtrol®*		■		■
	2	*BonTerra® S1™*			■	■
	3	*BonTerra® S2™*	■	■		
	4	*Curlex® I*				■
	5	*ECS Straw Blanket Standard*			■	■
	6	*Geocoir®/DeKoWe® 700*		■		
	7	*Geojute® Plus 1*	■	■		
	8	*Landlok® FRS 3112*	■	■		
	9	*Miramat® TM8™*	■	■		
	10	*POZ-O-CAP®*			■	■
	11	*SuperGro™*		■	■	■
	12	*verdyol® Excelsior Standard*			■	■
	13	*verdyol® Excelsior High-Velocity*	■	■		
1996	1	*Airtrol® Plus*	■	■		
	2	*BonTerra® S2™*		■		
	3	*BonTerra® CS2™*	■	■		
	4	*Curlex®-LT*			■	■
	5	*ECS Excelsior Blanket Standard*			■	■
	6	*Geogro*	■	■	■	■
	7	*Geojute® Plus 1*	■	■		
	8	*KoirMat™ 400*	■	■		
	9	*Landlok® FRS 3112*		■		
	10	*North American Green S75*	■	■		
	11	*POZ-O-CAP®*			■	■
	12	*Seed-Guard™*	■	■		
	13	*Tensar® Erosion Blanket TB1000*	■	■		
	14	*Terra-Control®*			■	■
	15	*verdyol® Excelsior High-Velocity*	■	■		

Shaded cells represent evaluation conditions as requested by the participant.

This Page Left Blank

TABULAR DATA
Class 1 "Slope Protection"

1:2 Clay

Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (0.34 kg/10 m²)**	**Vegetation Density (80%)**
1	*KoirMat™ 400*	1996	1:2	Clay	0.2450	74.071
2	*BonTerra® CS2™*	1996	1:2	Clay	0.3011	71.978
3	*North American Green S75*	1996	1:2	Clay	0.3047	87.390
4	*verdyol® Excelsior High-Velocity*	1996	1:2	Clay	0.3096	82.477
5	*Geojute® Plus 1*	1996	1:2	Clay	0.3243	79.748
6	*Tensar® Erosion Blanket TB1000*	1996	1:2	Clay	0.3335	91.244
7	*Airtrol® Plus*	1996	1:2	Clay	0.4037	71.508
8	*Geogro*	1996	1:2	Clay	0.4152	87.304
9	*Seed-Guard™*	1996	1:2	Clay	0.4234	74.210
Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (0.34 kg/10 m²)**	**Vegetation Density (80%)**
1	*Curlex® I*	1991	1:2	Clay	0.1917	97.834
2	*North American Green SC150*	1991	1:2	Clay	0.2130	89.979
3	*Geocoir®/DeKoWe® 700*	1992	1:2	Clay	0.2201	73.717
4	*North American Green S150*	1991	1:2	Clay	0.2258	92.014
5	*LANDLOK® 407GT*	1991	1:2	Clay	0.2380	96.151
6	*Airtrol®*	1992	1:2	Clay	0.2432	86.094
7	*KoirMat™ 400*	1996	1:2	Clay	0.2450	74.071
8	*Greenstreak® Pec-Mat™*	1991	1:2	Clay	0.2499	87.580
9	*Soil Guard™*	1994	1:2	Clay	0.2712	83.987
10	*Anti-Wash®/Geojute®*	1991	1:2	Clay	0.2727	90.058
11	*Landlok® FRS 3112*	1995	1:2	Clay	0.2835	96.513
12	*BonTerra® CS2™*	1996	1:2	Clay	0.3011	71.978
13	*North American Green S75*	1996	1:2	Clay	0.3047	87.390
14	*verdyol® Excelsior High-Velocity*	1996	1:2	Clay	0.3096	82.477

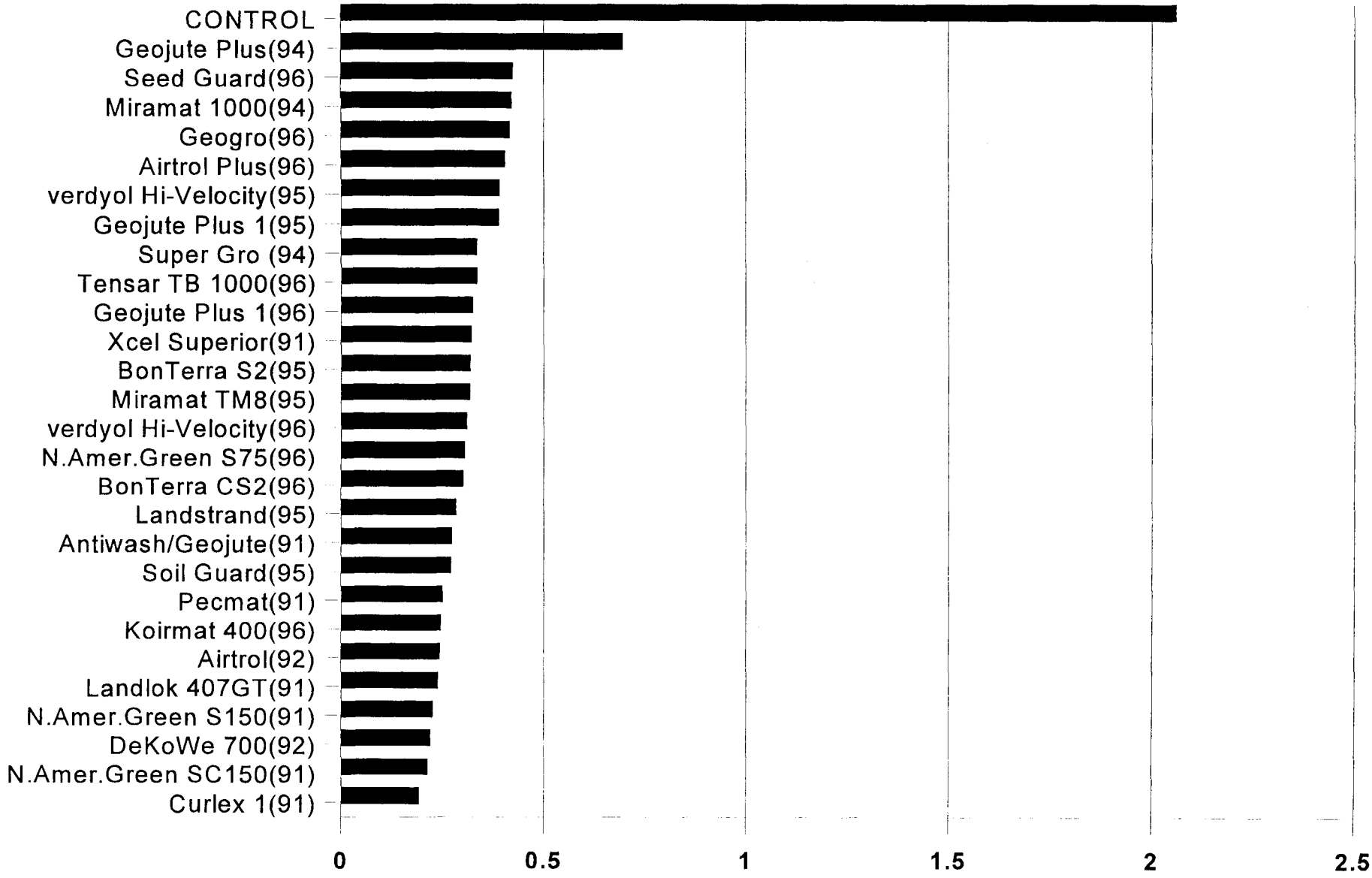
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

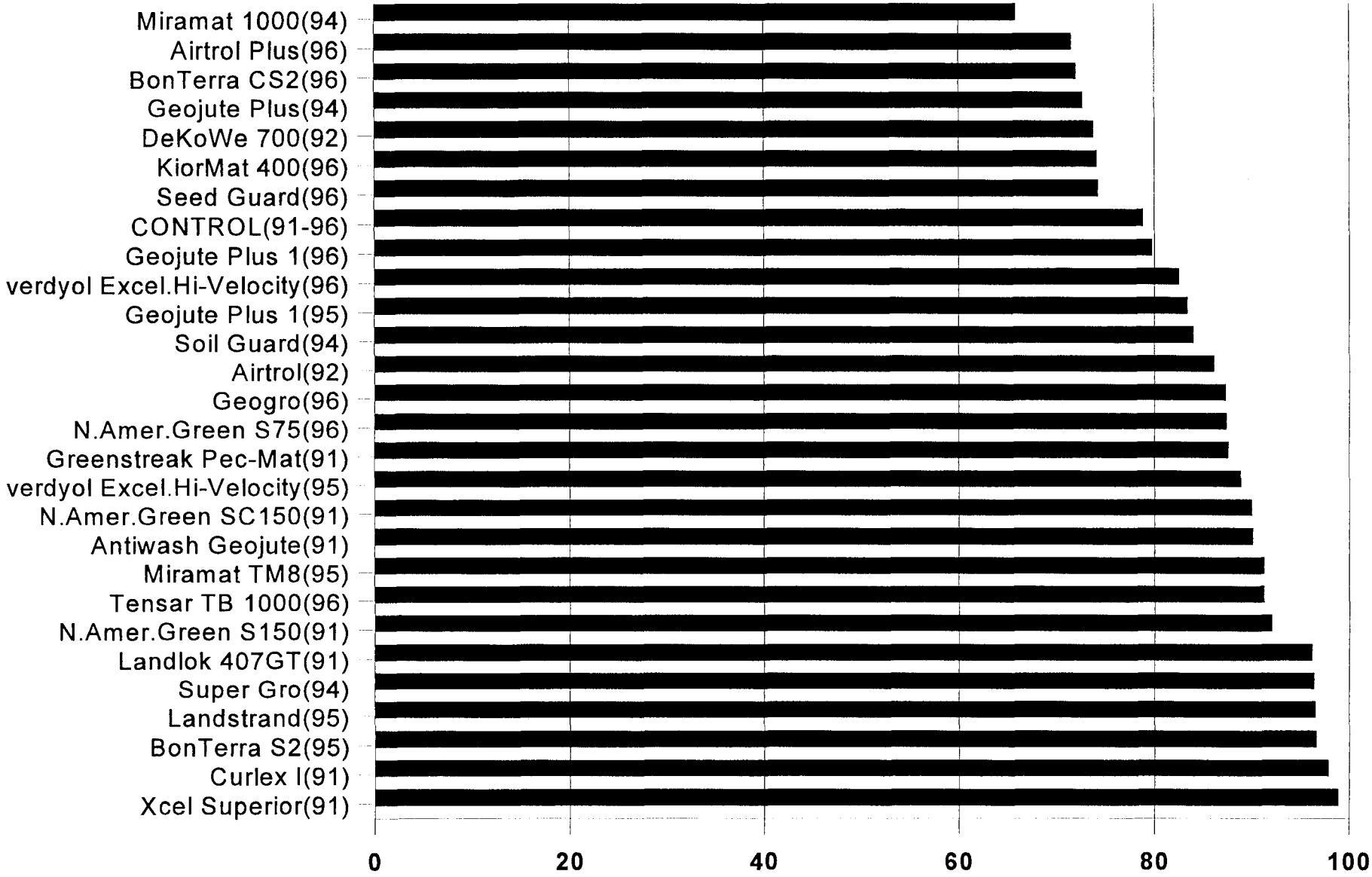
Product Performance - 1996 Evaluation Cycle						
No	Product Name	Year	Slope	Soil	Sediment Loss (0.34 kg/10 m^2)	Vegetation Density (80%)
15	*Miramat® TM8™*	1995	1:2	Clay	0.3175	91.236
16	*BonTerra® S2™*	1995	1:2	Clay	0.3177	96.584
17	*Xcel Superior*	1991	1:2	Clay	0.3212	98.814
18	*Geojute® Plus 1*	1996	1:2	Clay	0.3243	79.748
19	*Tensar® Erosion Blanket TB1000*	1996	1:2	Clay	0.3335	91.244
20	*SuperGro™*	1994	1:2	Clay	0.3342	96.353
21	*Geojute® Plus 1*	1995	1:2	Clay	0.3885	83.351
22	*verdyol® Excelsior High-Velocity*	1995	1:2	Clay	0.3892	88.837
23	*Airtrol® Plus*	1996	1:2	Clay	0.4037	71.508
24	*Geogro*	1996	1:2	Clay	0.4152	87.304
25	*Miramat® 1000*	1994	1:2	Clay	0.4199	65.814
26	*Seed-Guard™*	1996	1:2	Clay	0.4234	74.210
27	*Geojute® Plus*	1994	1:2	Clay	0.6942	72.647
28	CONTROL	91-94	1:2	Clay	2.0598	78.843

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

1:2 Clay Soils
Sediment Loss (Kilograms per 10 Square Meters)



2:1 Clay Soils
Final Vegetative Density (Percent)



This Page Left Blank

TABULAR DATA
Class 1 "Slope Protection"

1:2 Sand

Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (26.84 kg/10 m²)**	**Vegetation Density (70%)**
1	*Tensar® Erosion Blanket TB1000*	1996	1:2	Sand	16.821	65.708
2	*Landlok® FRS 3112*	1996	1:2	Sand	16.938	90.418
3	*BonTerra® CS2™*	1996	1:2	Sand	19.984	70.761
4	*Seed-Guard™*	1996	1:2	Sand	23.398	66.882
5	*BonTerra® S2™*	1996	1:2	Sand	25.230	83.239
6	*Geojute® Plus 1*	1996	1:2	Sand	26.107	80.444
7	*verdyol® Excelsior High-Velocity*	1996	1:2	Sand	26.976	38.088
8	*North American Green S75*	1996	1:2	Sand	27.010	72.063
9	*KoirMat™ 400*	1996	1:2	Sand	27.054	57.435
10	*Geogro*	1996	1:2	Sand	27.328	70.473
11	*Airtrol® Plus*	1996	1:2	Sand	29.998	72.793
Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (26.84 kg/10 m²)**	**Vegetation Density (70%)**
1	*Soil Guard™*	1994	1:2	Sand	8.042	86.735
2	*Geojute® Plus 1*	1994	1:2	Sand	8.157	3.883
3	*SuperGro™*	1994	1:2	Sand	8.967	69.570
4	*Curlex® I*	1994	1:2	Sand	9.124	89.461
5	*Geocoir®/DeKoWe® 700*	1994	1:2	Sand	10.389	49.623
6	*Miramat® 1000*	1994	1:2	Sand	11.824	81.466
7	*Airtrol®*	1994	1:2	Sand	13.417	17.614
8	*Landlok® FRS 3112*	1995	1:2	Sand	14.253	64.758
9	*BonTerra® S2™*	1995	1:2	Sand	15.299	68.348
10	*Xcel Superior*	1991	1:2	Sand	15.676	85.805
11	*verdyol® Excelsior High-Velocity*	1995	1:2	Sand	16.728	63.538
12	*Tensar® Erosion Blanket TB1000*	1996	1:2	Sand	16.821	65.708

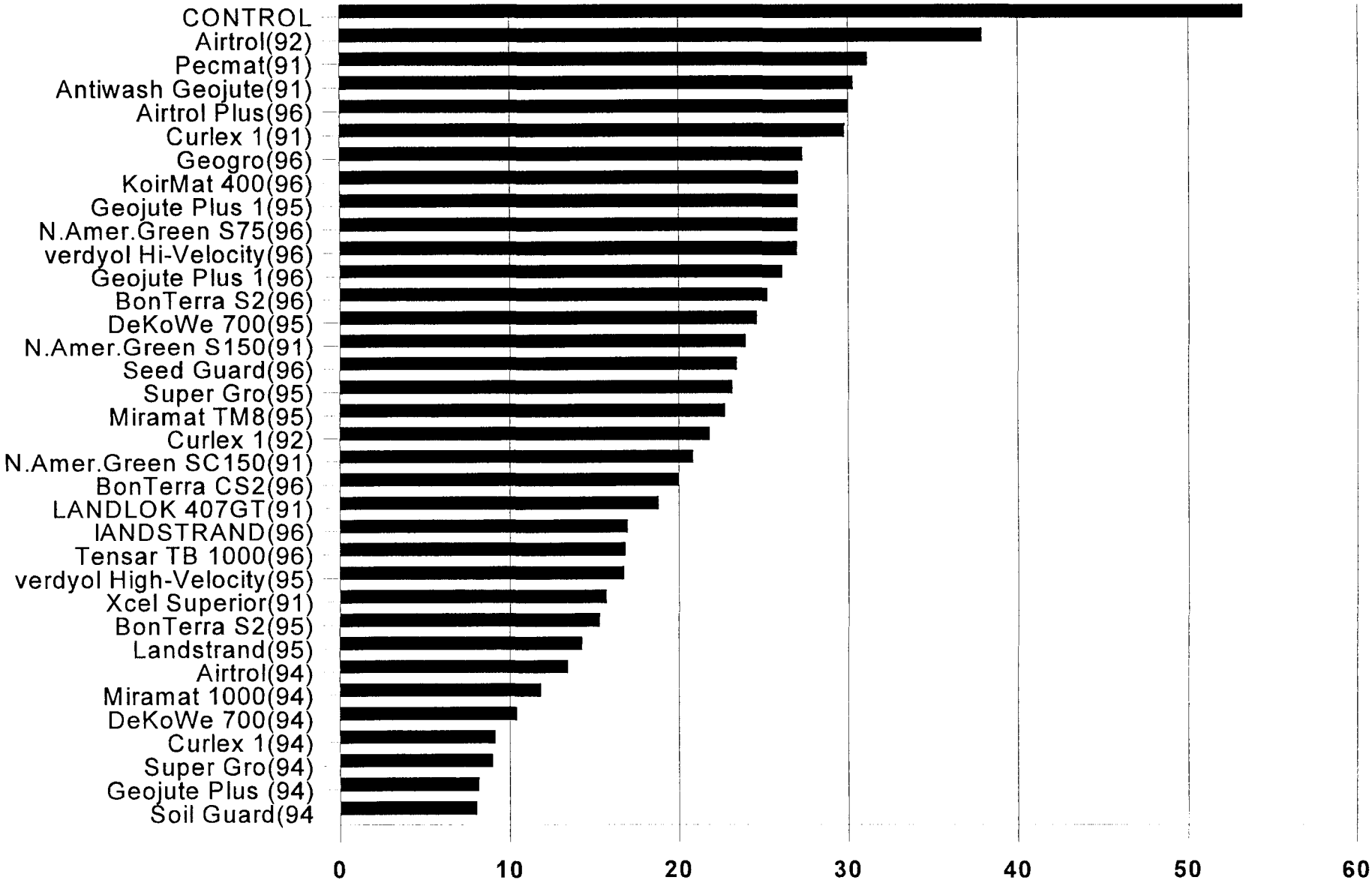
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

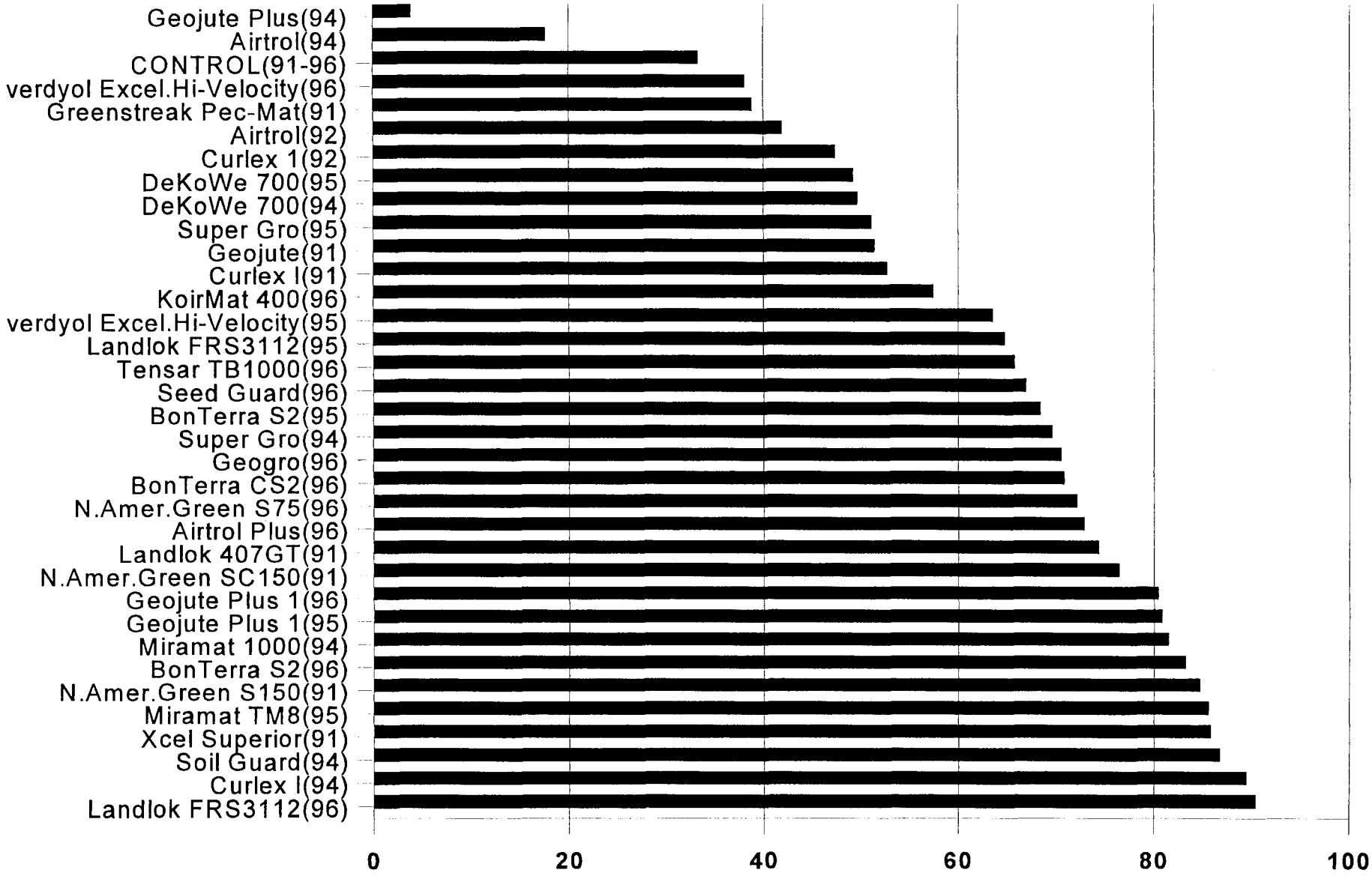
Product Performance - 1996 Evaluation Cycle						
No	Product Name	Year	Slope	Soil	Sediment Loss (26.84 kg/10 m²)	Vegetation Density (70%)
13	*Landlok® FRS 3112*	1996	1:2	Sand	16.938	90.418
14	*Landlok® 407GT*	1991	1:2	Sand	18.769	74.302
15	*BonTerra® CS2™*	1996	1:2	Sand	19.984	70.761
16	*North American Green SC150*	1991	1:2	Sand	20.819	76.409
17	*Curlex® I*	1992	1:2	Sand	21.806	47.335
18	*Miramat® TM8™*	1995	1:2	Sand	22.731	85.597
19	*SuperGro™*	1995	1:2	Sand	23.170	51.092
20	*Seed-Guard™*	1996	1:2	Sand	23.398	66.882
21	*North American Green S150*	1991	1:2	Sand	23.916	84.746
22	*Geocoir®/DeKoWe® 700*	1995	1:2	Sand	24.587	49.192
23	*BonTerra® S2™*	1996	1:2	Sand	25.230	83.239
24	*Geojute® Plus 1*	1996	1:2	Sand	26.107	80.444
25	*verdyol® Excelsior High-Velocity*	1996	1:2	Sand	29.976	38.088
26	*North American Green S75*	1996	1:2	Sand	27.010	72.063
27	*Geojute® Plus 1*	1995	1:2	Sand	27.032	80.797
28	*KoirMat™ 400*	1996	1:2	Sand	27.054	57.435
29	*Geogro*	1996	1:2	Sand	27.328	70.473
30	*Curlex® I*	1991	1:2	Sand	29.795	52.674
31	*Airtrol® Plus*	1996	1:2	Sand	29.998	72.793
32	*Anti-Wash®/Geojute®*	1991	1:2	Sand	30.295	51.372
33	*Airtrol®*	1992	1:2	Sand	37.888	41.882
34	CONTROL	91-96	1:2	Sand	53.210	33.361

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

1:2 Sand Soils
Sediment Loss (Kilograms per 10 Square Meters)



2:1 Sand Soils
Final Vegetative Density (Percent)



This Page Left Blank

TABULAR DATA
Class 1 "Slope Protection"

1:3 Clay

Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (0.34 kg/10 m²)**	**Vegetation Density (80%)**
1	*ECS Excelsior Blanket Standard*	1996	1:3	Clay	0.2494	83.363
2	*Curlex®-LT*	1996	1:3	Clay	0.2808	75.390
3	*Terra-Control®*	1996	1:3	Clay	0.3449	92.087
4	*Geogro*	1996	1:3	Clay	0.3778	87.947
5	*POZ-O-CAP®*	1996	1:3	Clay	0.4217	90.312
Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (0.34kg/10 m²)**	**Vegetation Density (80%)**
1	*SuperGro™*	1994	1:3	Clay	0.0819	70.378
2	*Curlex® I*	1992	1:3	Clay	0.1153	98.125
3	*Curlex® I*	1991	1:3	Clay	0.1470	63.230
4	*verdyol® ERO-MAT®*	1991	1:3	Clay	0.1525	87.809
5	*Greenstreak® Pec-Mat™*	1991	1:3	Clay	0.2001	90.525
6	*Airtrol®*	1992	1:3	Clay	0.2441	86.444
7	*ECS Excelsior Blanket Standard*	1996	1:3	Clay	0.2494	83.363
8	*BonTerra® S1™*	1995	1:3	Clay	0.2516	93.424
9	*North American Green S75*	1991	1:3	Clay	0.2727	96.187
10	*Curlex®-LT*	1996	1:3	Clay	0.2808	75.390
11	*ECS Straw Blanket Standard*	1995	1:3	Clay	0.2879	90.708
12	*SuperGro™*	1995	1:3	Clay	0.3062	89.418
13	*Xcel Regular*	1991	1:3	Clay	0.3196	90.166
14	*verdyol® Excelsior Standard*	1995	1:3	Clay	0.3197	91.212
15	*Terra-Control®*	1996	1:3	Clay	0.3449	92.087
16	*POZ-O-CAP®*	1995	1:3	Clay	0.3576	83.479
17	*Geogro*	1996	1:3	Clay	0.3778	87.947
18	*POZ-O-CAP®*	1996	1:3	Clay	0.4217	90.312

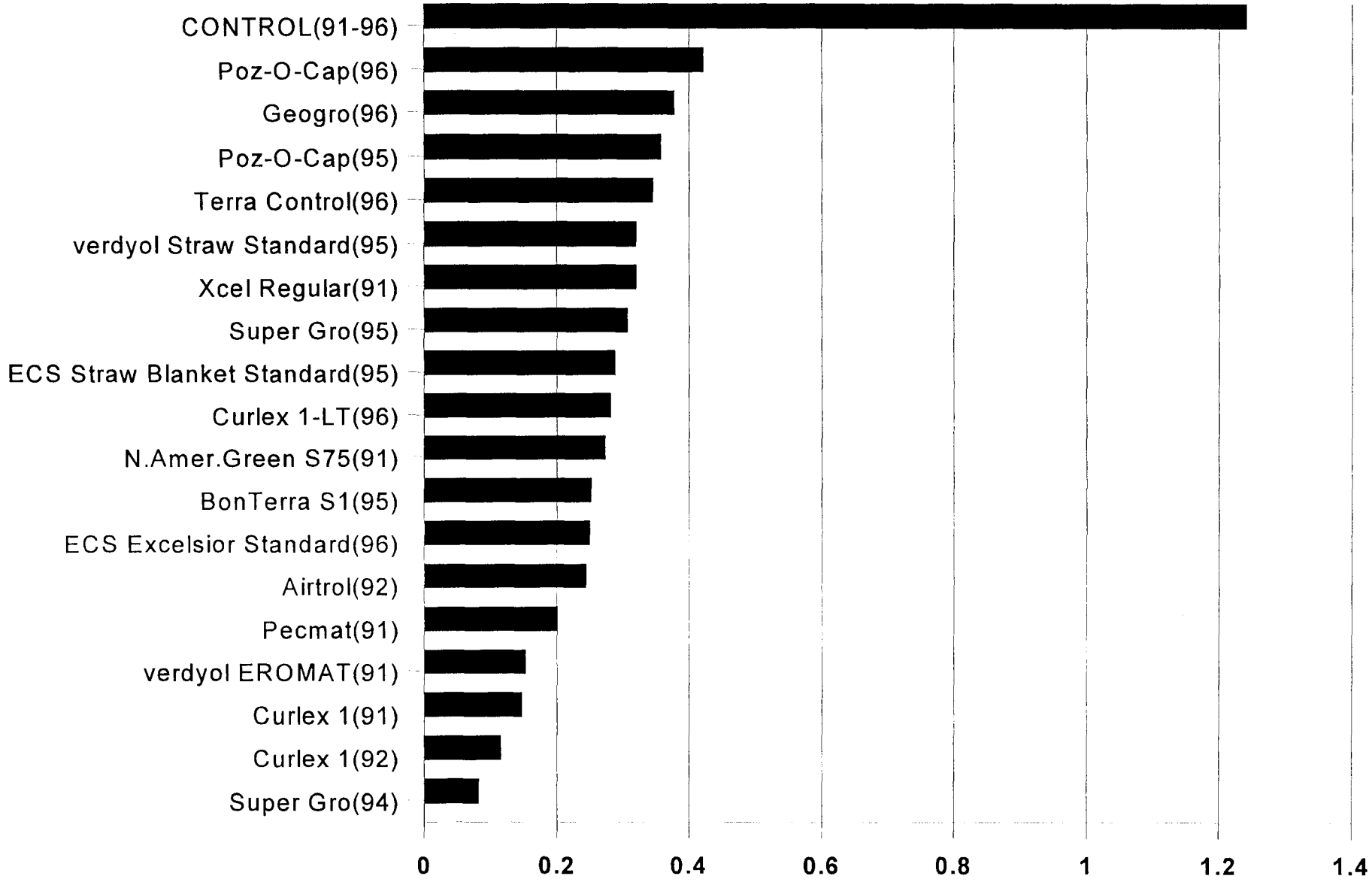
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

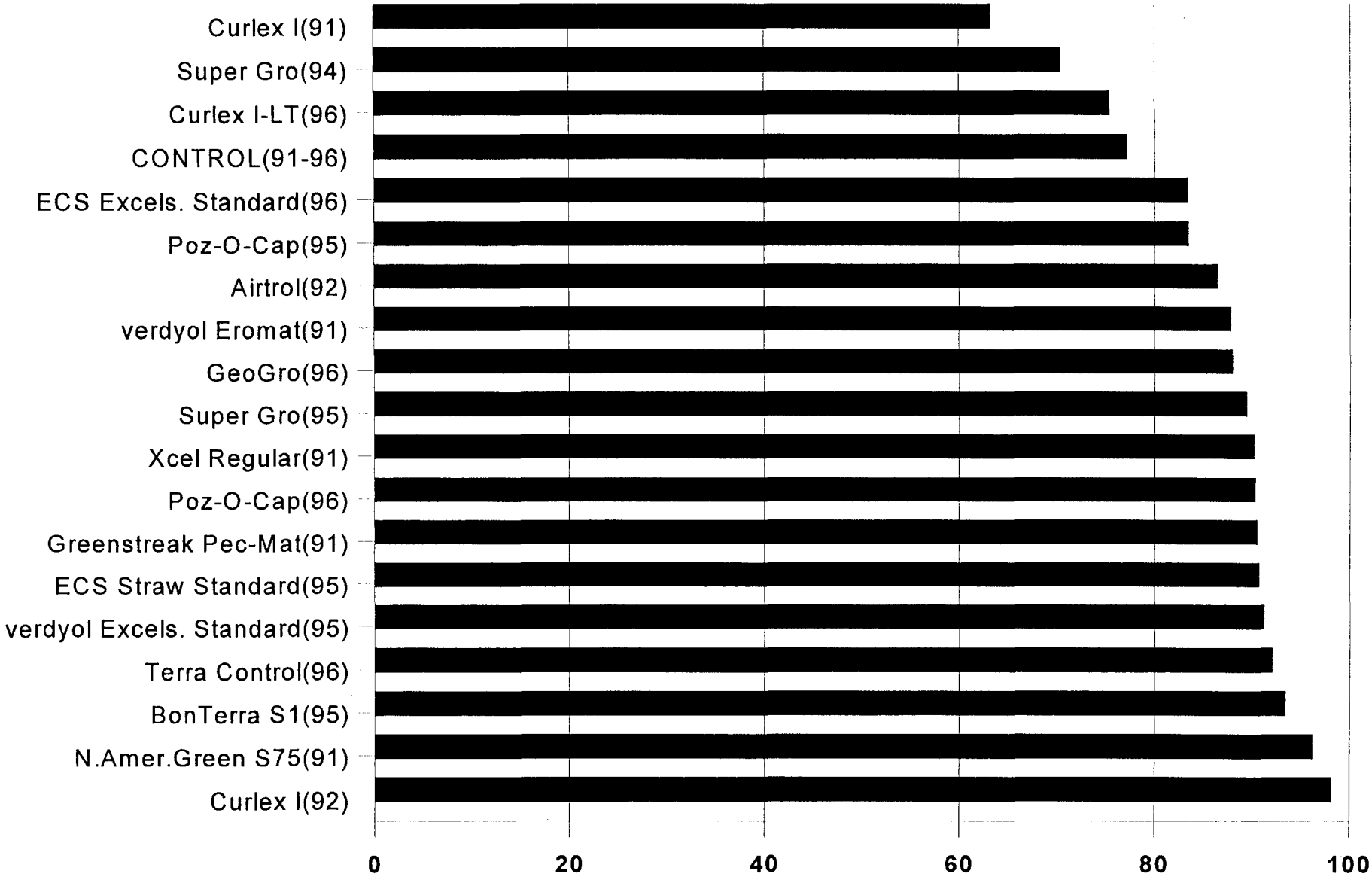
Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (0.34 kg/10 m²)**	**Vegetation Density (80%)**
19	CONTROL	91-96	1:3	Clay	1.2414	77.167

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

1:3 Clay Soils
Sediment Loss (Kilograms per 10 Square Meters)



3:1 Clay Soils
Final Vegetative Density (Percent)



This Page Left Blank

TABULAR DATA

Class 1 "Slope Protection

1:3 Sand

Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (12.20 kg/10 m²)**	**Vegetation Density (70%)**
1	*Curlex®-LT*	1996	1:3	Sand	8.465	76.032
2	*ECS Excelsior Blanket Standard*	1996	1:3	Sand	10.007	77.252
3	*Terra-Control®*	1996	1:3	Sand	13.149	72.321
4	*Geogro*	1996	1:3	Sand	13.391	73.245
5	*POZ-O-CAP®*	1996	1:3	Sand	13.443	69.810
Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (12.20 kg/10 m²)**	**Vegetation Density (70%)**
1	*Curlex® I*	1994	1:3	Sand	2.936	48.632
2	*SuperGro™*	1994	1:3	Sand	3.002	17.585
3	*Curlex® I*	1992	1:3	Sand	4.119	33.232
4	*Curlex® I*	1991	1:3	Sand	4.406	60.937
5	*Xcel Regular*	1991	1:3	Sand	4.712	72.263
6	*BonTerra® S1™*	1995	1:3	Sand	6.289	77.089
7	*verdyol® Excelsior Standard*	1995	1:3	Sand	7.411	75.330
8	*Curlex® I*	1995	1:3	Sand	7.835	63.962
9	*ECS Straw Blanket Standard*	1995	1:3	Sand	8.063	80.276
10	*North American Green S75*	1991	1:3	Sand	8.099	77.904
11	*Curlex®-LT*	1996	1:3	Sand	8.465	76.032
12	*verdyol® ERO-MAT®*	1991	1:3	Sand	9.078	73.202
13	*Airtrol®*	1994	1:3	Sand	9.261	33.638
14	*SuperGro™*	1995	1:3	Sand	9.742	56.888
15	*ECS Excelsior Blanket Standard*	1996	1:3	Sand	10.007	77.252
16	*Airtrol®*	1992	1:3	Sand	12.389	68.749
17	*Airtrol®*	1995	1:3	Sand	13.018	26.180
18	*Terra-Control®*	1996	1:3	`Sand	13.149	72.321

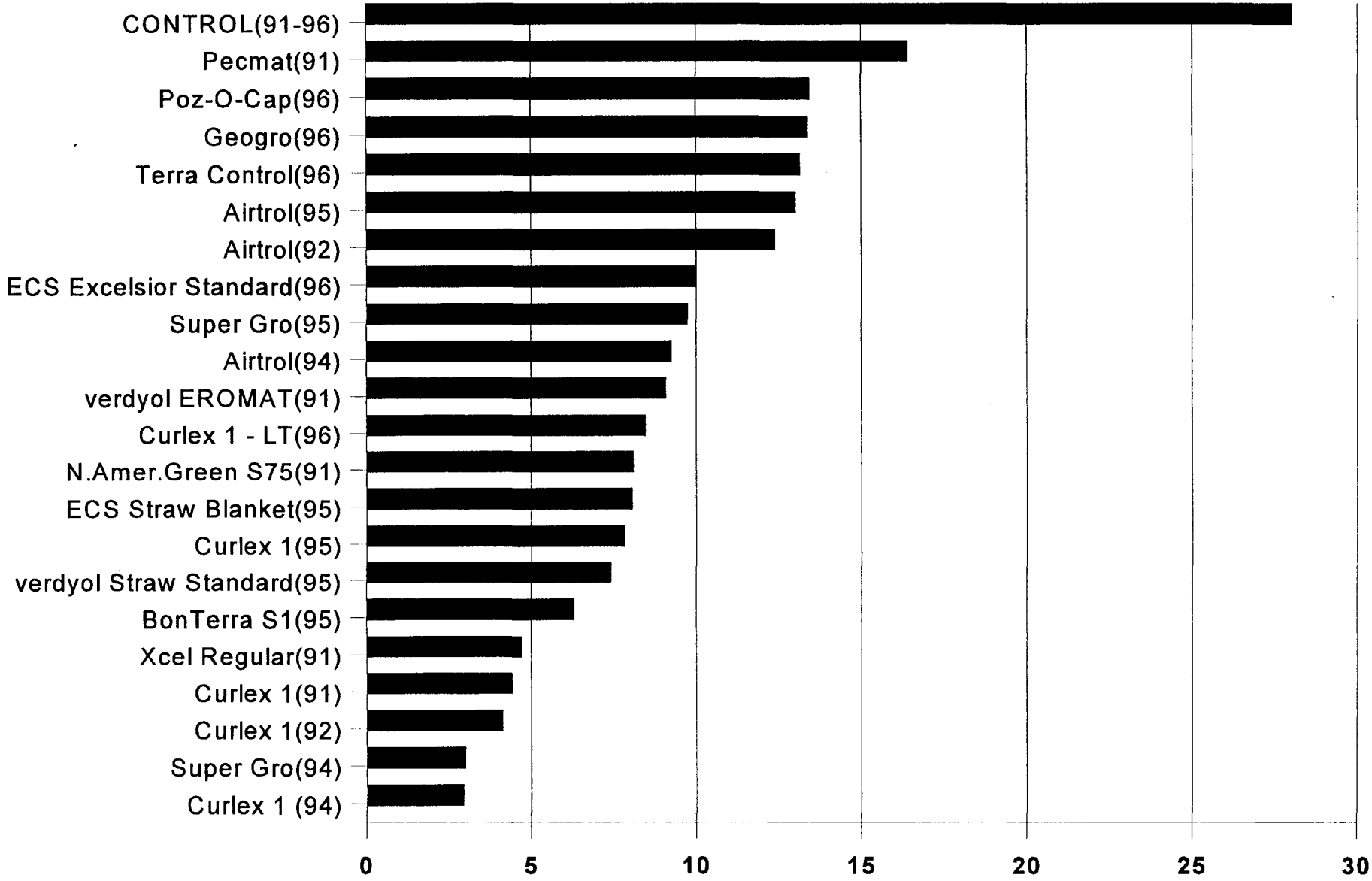
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 1 "Slope Protection Applications"

Analysis by Steepness of Slope and Type of Soil

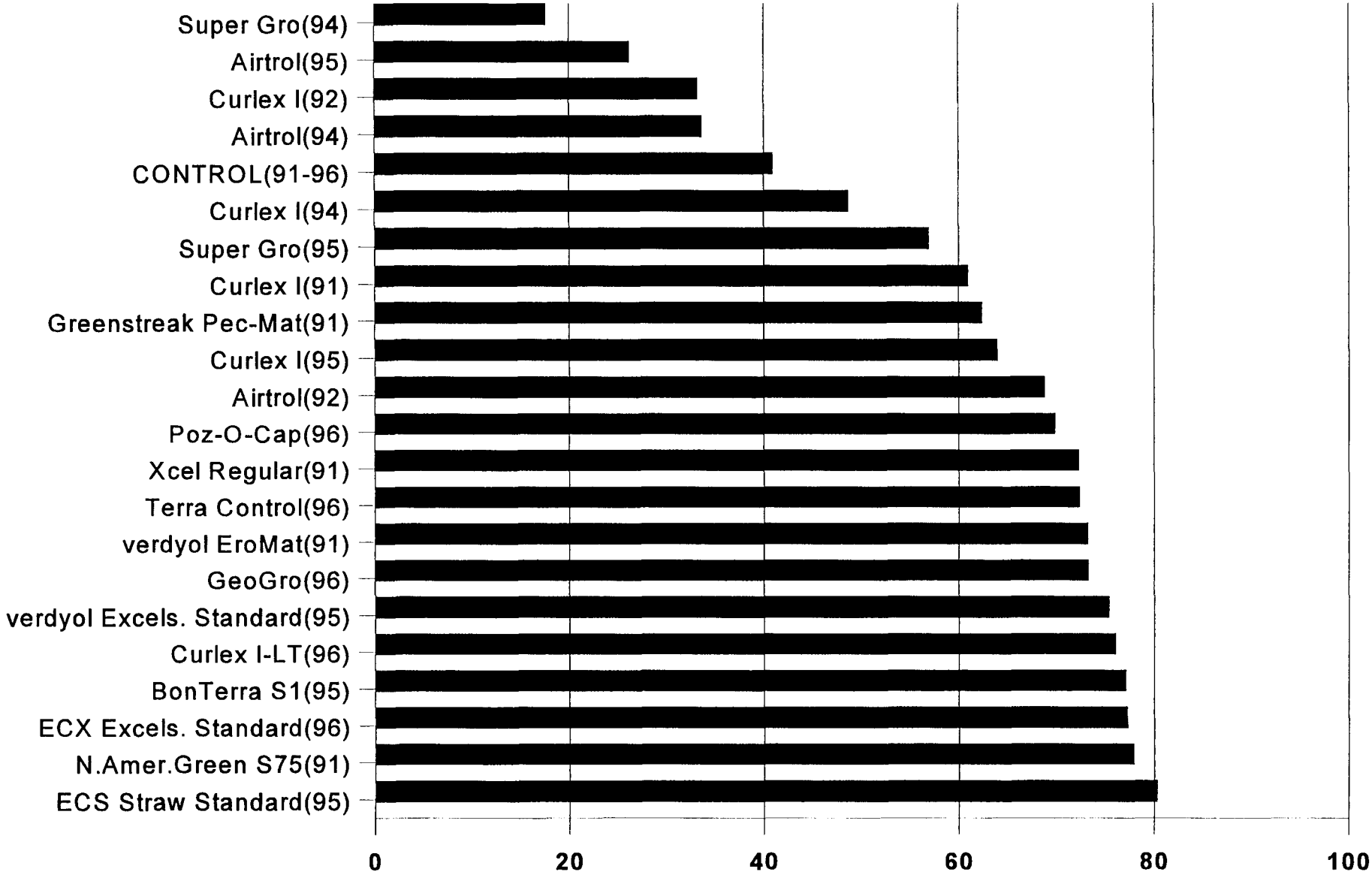
Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Slope**	**Soil**	**Sediment Loss (12.20 kg/10 m²)**	**Vegetation Density (70%)**
19	*Geogro*	1996	1:3	Sand	13.391	73.245
20	*POZ-O-CAP®*	1996	1:3	Sand	13.443	69.810
21	*Greenstreak® Pec-Mat™*	1991	1:3	Sand	16.402	62.385
22	CONTROL	91-96	1:3	Sand	28.013	40.895

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

1:3 Sand Soils
Sediment Loss (Kilograms per 10 Square Meters)



1:3 Sand Soils
Final Vegetative Density (Percent)



This Page Left Blank

STATISTICAL ANALYSIS
Class 1 "Slope Protection" Applications

1:2 Clay

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

---------- SLOPE=2:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SDMT

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 878 MSE= 0.41126
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 21.73585

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CRITICAL RANGE	.3818	.4020	.4155	.4255	.4333	.4397	.4450	.4496	.4535	.4570	.4601	.4629	.4654	.4677

NUMBER OF MEANS	16	17	18	19	20	21	22	23	24	25	26	27	28
CRITICAL RANGE	.4698	.4717	.4735	.4752	.4767	.4782	.4795	.4808	.4820	.4831	.4842	.4852	.4862

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING		MEAN	N	PLOT
	A	-0.1917	10	CURLEX I(91)
	A			
B	A	-0.2130	10	N/A/G SC150(91)
B	A			
B	A	-0.2201	30	DEKOWE 700(92)
B	A			
B	A	-0.2258	10	N/A/G S150(91)
B	A			
B	A	-0.2380	10	LANDLOK407GT(91)
B	A			
B	A	-0.2432	32	AIRTROL(92)
B	A			
B	A	-0.2450	36	KOIRMAT 400(96)
B	A			
B	A	-0.2499	10	PECMAT(91)
B	A			
B	A	-0.2712	30	SOIL GUARD(94)
B	A			
B	A	-0.2727	10	GEOJUTE(91)
B	A			
B	A	-0.2835	36	LANDLOKFRS(95)
B	A			
B	A	-0.3011	36	BONTERRA CS2(96)
B	A			
B	A	-0.3047	36	N/A/G S75(96)
B	A			
B	A	-0.3096	36	VERDYOL HI-V(96)
B	A			
B	A	-0.3175	36	MIRAMAT TM8(95)
B	A			
B	A	-0.3177	36	BONTERRA S2(95)
B	A			
B	A	-0.3212	10	XCEL SUP(91)

94

---------- SLOPE=2:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING		MEAN	N	PLOT
B	A			
B	A	-0.3243	36	GEOJUTE PLS1(96)
B	A			
B	A	-0.3335	36	TB 1000(96)
B	A			
B	A	-0.3342	30	SUPER GRO(94)
B	A			
B	A	-0.3885	36	GEOJUTE PLS1(95)
B	A			
B	A	-0.3892	36	VERDYOL HI-V(95)
B	A			
B	A	-0.4037	36	AIRTROL PLUS(96)
B	A			
B	A	-0.4152	36	GEOGRO(96)
B	A			
B	A	-0.4199	30	MIRAMAT 1000(94)
B	A			
B	A	-0.4234	36	SEED GUARD(96)
B				
B		-0.6942	36	GEOJUTE PLUS(94)
	C	-2.0598	144	CONTROL

---------- SLOPE=2:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 566 MSE= 455.0039
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 19.00094

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CRITICAL RANGE	13.59	14.31	14.79	15.15	15.42	15.65	15.84	16.00	16.14	16.26	16.37	16.47	16.56	16.64

NUMBER OF MEANS	16	17	18	19	20	21	22	23	24	25	26	27	28
CRITICAL RANGE	16.72	16.78	16.85	16.91	16.96	17.01	17.06	17.10	17.14	17.18	17.22	17.26	17.29

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING					MEAN	N	PLOT
			A		98.814	16	XCEL SUP(91)
			A				
			A		97.834	16	CURLEX I(91)
			A				
	B		A		96.584	20	BONTERRA S2(95)
	B		A				
	B		A		96.513	20	LANDLOKFRS(95)
	B		A				
	B		A		96.353	20	SUPER GRO(94)
	B		A				
	B		A		96.151	16	LANDLOK407GT(91)
	B		A				
	B		A	C	92.014	16	N/A/G S150(91)
	B		A	C			
	B		A	C	91.244	20	TB 1000(96)
	B		A	C			
	B		A	C	91.236	20	MIRAMAT TM8(95)
	B		A	C			
	B	D	A	C	90.058	16	GEOJUTE(91)
	B	D	A	C			
	B	D	A	C	89.979	16	N/A/G SC150(91)
	B	D	A	C			
E	B	D	A	C	88.837	20	VERDYOL HI-V(95)
E	B	D	A	C			
E	B	D	A	C F	87.580	16	PECMAT(91)
E	B	D	A	C F			
E	B	D	A	C F	87.390	20	N/A/G S75(96)
E	B	D	A	C F			
E	B	D	A	C F	87.304	20	GEOGRO(96)
E	B	D	A	C F			
E	B	D	A	C F	86.094	16	AIRTROL(92)
E	B	D	A	C F			
E	B	D	A	C F	83.987	20	SOIL GUARD(94)

96

TXDOT/TTI HYDRAULICS AND EROSION CONTROL LABORATORY

FINAL PERFORMANCE ANALYSIS - THROUGH THE 1996 EVALUATION CYCLE

---------- SLOPE=2:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING	MEAN	N	PLOT
E B D A C F			
E B D A C F	83.351	20	GEOJUTE PLS1(95)
E B D A C F			
E B D A C F	82.477	20	VERDYOL HI-V(96)
E B D C F			
E B D G C F	79.748	20	GEOJUTE PLS1(96)
E D G C F			
E D G C F	78.843	90	CONTROL
E D G F			
E D G F	74.210	20	SEED GUARD(96)
E D G F			
E D G F	74.071	20	KOIRMAT 400(96)
E D G F			
E D G F	73.717	16	DEKOWE 700(92)
E G F			
E G F	72.647	20	GEOJUTE PLUS(94)
G F			
G F	71.978	20	BONTERRA CS2(96)
G F			
G F	71.508	20	AIRTROL PLUS(96)
G			
G	65.814	20	MIRAMAT 1000(94)

This Page Left Blank

STATISTICAL ANALYSIS
Class 1 "Slope Protection" Applications

1:2 Sand

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

TXDOT/TTI HYDRAULICS AND EROSION CONTROL LABORATORY
FINAL PERFORMANCE ANALYSIS - THROUGH THE 1996 EVALUATION CYCLE

---------- SLOPE=2:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SDMT

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 1227 MSE= 555.9562
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 31.98486

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CRITICAL RANGE	11.57	12.18	12.59	12.89	13.13	13.32	13.48	13.62	13.74	13.85	13.94	14.03	14.10	14.17	14.24	14.30	14.35

NUMBER OF MEANS	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
CRITICAL RANGE	14.40	14.45	14.49	14.53	14.57	14.61	14.64	14.68	14.71	14.74	14.77	14.79	14.82	14.84	14.87	14.89	14.91

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PLOT
A	-8.042	30	SOIL GUARD(94)
A			
A	-8.157	30	GEOJUTE PLUS(94)
A			
B A	-8.967	30	SUPER GRO(94)
B A			
B A C	-9.124	30	CURLEX I(94)
B A C			
B D A C	-10.389	30	DEKOWE 700(94)
B D A C			
E B D A C	-11.824	30	MIRAMAT 1000(94)
E B D A C			
E B D A C F	-13.417	30	AIRTROL(94)
E B D A C F			
E B D A C F	-14.253	36	LANDLOKFRS(95)
E B D A C F			
E B D A G C F	-15.299	36	BONTERRA S2(95)
E B D A G C F			
E B D H A G C F	-15.676	18	XCEL SUP(91)
E B D H A G C F			
E B I D H A G C F	-16.728	36	VERDYOL HI-V(95)
E B I D H A G C F			
E B I D H A G C F	-16.821	36	TB 1000(96)
E B I D H A G C F			
E B I D H A G C F	-16.938	36	LANDLOKFRS(96)
E B I D H A G C F			
E B I D H A G C F	-18.769	24	LANDLOK407GT(91)
E B I D H A G C F			
E B I D H A G C F	-19.984	36	BONTERRA CS2(96)
E B I D H A G C F			
E B I D H A G C F	-20.819	21	N/A/G SC150(91)
E B I D H A G C F			
E B I D H A G C F	-21.806	34	CURLEX I(92)

SLOPE=2:1 SOIL=SAND

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING	MEAN	N	PLOT
E B I D H G C F			
E B I D H G C F	-22.731	36	MIRAMAT TM8(95)
E B I D H G C F			
E B I D H G C F	-23.170	36	SUPER GRO(95)
E I D H G C F			
E I D H G C F	-23.398	36	SEED GUARD(96)
E I D H G F			
E I D H J G F	-23.916	24	N/A/G S150(91)
E I D H J G F			
E I D H J G F	-24.587	36	DEKOWE 700(95)
E I H J G F			
E I H J G F	-25.230	36	BONTERRA S2(96)
E I H J G F			
E I H J G F	-26.107	36	GEOJUTE PLS1(96)
I H J G F			
I H J G F	-26.976	36	VERDYOL HI-V(96)
I H J G F			
I H J G F	-27.010	36	N/A/G S75(96)
I H J G F			
I H J G F	-27.032	36	GEOJUTE PLS1(95)
I H J G F			
I H J G F	-27.054	36	KOIRMAT 400(96)
I H J G F			
I H J G F	-27.328	36	GEOGRO(96)
I H J G			
I H J G	-29.795	26	CURLEX I(91)
I H J			
I H J	-29.998	36	AIRTROL PLUS(96)
I J			
I J	-30.295	27	GEOJUTE(91)
I J			
I J	-31.143	28	PECMAT(91)
J			
J	-37.888	36	AIRTROL(92)
K	-53.210	166	CONTROL

17

---------- SLOPE=2:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 677 MSE= 731.5119
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 19.01275

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CRITICAL RANGE	17.22	18.13	18.74	19.19	19.55	19.83	20.07	20.28	20.46	20.61	20.75	20.88	20.99	21.09	21.19	21.27	21.35

NUMBER OF MEANS	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
CRITICAL RANGE	21.43	21.50	21.56	21.62	21.68	21.73	21.78	21.83	21.88	21.92	21.96	22.00	22.04	22.07	22.11	22.14	22.17

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PLOT
A	90.418	20	LANDLOKFRS(96)
A			
B A	89.461	20	CURLEX I(94)
B A			
B A C	86.735	20	SOIL GUARD(94)
B A C			
B D A C	85.805	16	XCEL SUP(91)
B D A C			
B D A C	85.597	20	MIRAMAT TM8(95)
B D A C			
E B D A C	84.746	16	N/A/G S150(91)
E B D A C			
E B D A C	83.239	20	BONTERRA S2(96)
E B D A C			
E B D A C	81.466	20	MIRAMAT 1000(94)
E B D A C			
E B D A C	80.797	20	GEOJUTE PLS1(95)
E B D A C			
E B D A C	80.444	20	GEOJUTE PLS1(96)
E B D A C			
E B D A C F	76.409	15	N/A/G SC150(91)
E B D A C F			
E B D A C F	74.302	16	LANDLOK407GT(91)
E B D A C F			
E B D A G C F	72.793	20	AIRTROL PLUS(96)
E B D A G C F			
E B D H A G C F	72.063	20	N/A/G S75(96)
E B D H A G C F			
E B I D H A G C F	70.761	20	BONTERRA CS2(96)
E B I D H A G C F			
E B I D H A G C F	70.473	20	GEOGRO(96)
E B I D H A G C F			
E J B I D H A G C F	69.570	20	SUPER GRO(94)

22

---------- SLOPE=2:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING	MEAN	N	PLOT
E J B I D H G C F			
E J B I D H G C F	68.348	20	BONTERRA S2(95)
E J I D H G C F			
E J I D H K G C F	66.882	20	SEED GUARD(96)
E J I D H K G C F			
E J I D H K G C F	65.708	20	TB 1000(96)
E J I D H K G F			
E J I D H K G F	64.758	20	LANDLOKFRS(95)
E J I H K G F			
E J I H K G F	63.538	20	VERDYOL HI-V(95)
J I H K G F			
J L I H K G F	57.435	20	KOIRMAT 400(96)
J L I H K G			
J L I H K G M	52.674	16	CURLEX I(91)
J L I H K M			
J L I H K M	51.372	15	GEOJUTE(91)
J L I K M			
J L I K M	51.092	21	SUPER GRO(95)
J L K M			
J L K M	49.623	20	DEKOWE 700(94)
J L K M			
J L K M	49.192	20	DEKOWE 700(95)
L K M			
L K M	47.335	15	CURLEX I(92)
L M			
L M	41.882	16	AIRTROL(92)
L M			
L M	38.863	15	PECMAT(91)
L M			
L M	38.088	20	VERDYOL HI-V(96)
M			
N M	33.361	71	CONTROL
N			
O N	17.614	20	AIRTROL(94)
O			
O	3.883	20	GEOJUTE PLUS(94)

This Page Left Blank

STATISTICAL ANALYSIS
Class 1 "Slope Protection" Applications

1:3 Clay

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

---------- SLOPE=3:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SDMT

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 634 MSE= 0.236176
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 21.50726

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CRITICAL RANGE	.2910	.3064	.3167	.3243	.3302	.3351	.3391	.3426	.3456	.3482	.3506	.3527	.3546	.3563	.3579	.3594	.3608	.3620

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PLOT
A	-0.0819	30	SUPER GRO(94)
A			
A	-0.1153	29	CURLEX I(92)
A			
A	-0.1470	10	CURLEX I(91)
A			
A	-0.1525	10	EROMAT(91)
A			
A	-0.2001	10	PECMAT(91)
A			
A	-0.2441	32	AIRTROL(92)
A			
A	-0.2494	36	ECS EXCL STD(96)
A			
A	-0.2516	36	BONTERRA S1(95)
A			
A	-0.2727	10	N/A/G S75(91)
A			
A	-0.2808	36	CURLEX-LT(96)
A			
A	-0.2879	36	ECS STRAW (95)
A			
A	-0.3062	36	SUPER GRO(95)
A			
A	-0.3196	10	XCEL REG(91)
A			
A	-0.3197	36	VERDYOL STD(95)
A			
A	-0.3449	36	TERRA CNTL(96)
A			
A	-0.3576	36	POZ-O-CAP(95)
A			
A	-0.3778	36	GEOGRO(96)
A			
A	-0.4217	36	POZ-O-CAP(96)
B	-1.2414	152	CONTROL

---------- SLOPE=3:1 SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 524 MSE= 329.7119
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 24.30837

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CRITICAL RANGE	10.23	10.77	11.13	11.40	11.61	11.78	11.92	12.04	12.15	12.24	12.32	12.40	12.46	12.53	12.58	12.63	12.68	12.72

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING				MEAN	N	PLOT
		A		98.125	20	CURLEX I(92)
		A				
		A		96.187	20	N/A/G S75(91)
		A				
B		A		93.424	26	BONTERRA S1(95)
B		A				
B		A		92.087	26	TERRA CNTL(96)
B		A				
B		A		91.212	26	VERDYOL STD(95)
B		A				
B		A		90.708	26	ECS STRAW (95)
B		A				
B		A		90.525	20	PECMAT(91)
B		A				
B		A		90.312	26	POZ-O-CAP(96)
B		A				
B		A		90.166	20	XCEL REG(91)
B		A				
B		A		89.418	26	SUPER GRO(95)
B		A				
B		A	C	87.947	26	GEOGRO(96)
B		A	C			
B		A	C	87.809	20	EROMAT(91)
B		A	C			
B	D	A	C	86.444	20	AIRTROL(92)
B	D		C			
B	D		C	83.479	26	POZ-O-CAP(95)
B	D		C			
B	D		C	83.363	26	ECS EXCL STD(96)
	D		C			
	D	E	C	77.167	117	CONTROL
	D	E				
	D	E		75.390	26	CURLEX-LT(96)
		E				
F		E		70.378	26	SUPER GRO(94)
F						
F				63.230	20	CURLEX I(91)

77

This Page Left Blank

STATISTICAL ANALYSIS
Class 1 "Slope Protection" Applications

1:3 Sand

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

---------- SLOPE=3:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: SDMT

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 819 MSE= 104.6156
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 31.3783

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12
CRITICAL RANGE	5.069	5.337	5.516	5.648	5.752	5.837	5.907	5.968	6.020	6.067	6.108

NUMBER OF MEANS	13	14	15	16	17	18	19	20	21	22
CRITICAL RANGE	6.145	6.178	6.208	6.236	6.262	6.286	6.308	6.328	6.347	6.365

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING			MEAN	N	PLOT
	A		-2.936	30	CURLEX I(94)
	A				
	A		-3.002	36	SUPER GRO(94)
	A				
B	A		-4.119	34	CURLEX I(92)
B	A				
B	A		-4.406	18	CURLEX I(91)
B	A				
B	A		-4.712	19	XCEL REG(91)
B	A				
B	A		-6.289	37	BONTERRA S1(95)
B	A				
B	A	C	-7.411	36	VERDYOL STD(95)
B	A	C			
B	A	C	-7.835	36	CURLEX I(95)
B	A	C			
B	A	C	-8.063	36	ECS STRAW (95)
B	A	C			
B	A	C	-8.099	25	N/A/G S75(91)
B	A	C			
B	A	C	-8.465	36	CURLEX-LT(96)
B		C			
B		C	-9.078	22	EROMAT(91)
B		C			
B		C	-9.261	24	AIRTROL(94)
B		C			
B		C	-9.742	36	SUPER GRO(95)
B		C			
B		C	-10.007	36	ECS EXCL STD(96)
		C			
	D	C	-12.389	42	AIRTROL(92)
	D	C			
	D	C	-13.018	36	AIRTROL(95)

---------- SLOPE=3:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING		MEAN	N	PLOT
D	C			
D	C	-13.149	36	TERRA CNTL(96)
D	C			
D	C	-13.391	36	GEOGRO(96)
D	C			
D	C	-13.443	36	POZ-O-CAP(96)
D				
D		-16.402	25	PECMAT(91)
E		-28.013	170	CONTROL

---------- SLOPE=3:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 572 MSE= 528.6488
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 24.3203

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12
CRITICAL RANGE	12.95	13.63	14.09	14.43	14.69	14.91	15.09	15.24	15.38	15.50	15.60

NUMBER OF MEANS	13	14	15	16	17	18	19	20	21	22
CRITICAL RANGE	15.69	15.78	15.86	15.93	15.99	16.05	16.11	16.16	16.21	16.25

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING				MEAN	N	PLOT
		A		80.276	26	ECS STRAW (95)
		A				
B		A		77.904	20	N/A/G S75(91)
B		A				
B		A		77.252	26	ECS EXCL STD(96)
B		A				
B		A		77.089	26	BONTERRA S1(95)
B		A				
B		A	C	76.032	26	CURLEX-LT(96)
B		A	C			
B		A	C	75.330	26	VERDYOL STD(95)
B		A	C			
B		A	C	73.245	26	GEOGRO(96)
B		A	C			
B		A	C	73.202	20	EROMAT(91)
B		A	C			
B		A	C	72.321	26	TERRA CNTL(96)
B		A	C			
B		A	C	72.263	20	XCEL REG(91)
B		A	C			
B	D	A	C	69.810	26	POZ-O-CAP(96)
B	D	A	C			
B	D	A	C	68.749	19	AIRTROL(92)
B	D		C			
B	D		C	63.962	26	CURLEX I(95)
B	D		C			
B	D	E	C	62.385	20	PECMAT(91)
	D	E	C			
	D	E	C	60.937	20	CURLEX I(91)
	D	E				
	D	E		56.888	26	SUPER GRO(95)
		E				
F		E		48.632	26	CURLEX I(94)

82

---------- SLOPE=3:1 SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN GROUPING		MEAN	N	PLOT
F				
F	G	40.895	92	CONTROL
	G			
H	G	33.638	26	AIRTROL(94)
H	G			
H	G	33.232	19	CURLEX I(92)
H				
H	I	26.180	26	AIRTROL(95)
	I			
	I	17.585	26	SUPER GRO(94)

CLASS 2 "FLEXIBLE CHANNEL LINER" APPLICATIONS
Final Performance Analysis

This analysis level seeks to determine how well each product: *(a) resisted the erosive forces of concentrated water flows* by protecting the geometry of a channel; and *(b) established warm-season, perennial vegetation within* a single March through December growing season.

Sediment-loss figures shown represent the average amount of soil displaced within either the particular shear-stress event shown within those tables marked "For Information Only", or within the shear-stress range of flows shown which is the analysis level used by TxDOT to produce the approved product list. Sediment loss is expressed in terms of Centimeters of Soil Displacement.

Vegetation-density figures shown represent the average percent of vegetative cover achieved within the channel by the final measurement cycle only.

Class 2 "Flexible Channel Liner" Applications
Record of Product Evaluations &
Level of Shear Stress Flows Performed

Year	Channel[1]	Product Evaluated	Shear Stress Level Flows Performed (Pascals / Lb Sq Ft)						
			96/2	144/3	192/4	239/5	287/6	335/7	383/8
91	Channel Construction Not Completed								
92	Channel Construction Not Completed								
93	Evaluation Cycle Cancelled Due to Weather Damage								
94	Began shear stress flows immediately after installation. No channel was able to produce vegetation and all channels exhibited significant and unacceptable sediment loss. Evaluation protocol was revised to provide 90-day resting period between installation and initial shear stress flow. New evaluation protocol scheduled to begin in 1995.								
95	1	*Miramat® TM8™*	▨	▨	▨	▨	▨	▨	▨
	2	*North American Green C350™ Three Phase™*	▨	▨	▨	▨	▨	▨	▨
	3	*Landlok® TRM 450*	▨	▨	▨	▨	▨	▨	▨
	4	*Enkamat® 7020*	▨	▨	▨	▨	▨	▨	▨
	5	*Greenstreak® Pec-Mat™*	▨	▨	▨	▨	▨	▨	▨
	6	*Tensar® Erosion Mat TM3000*	▨	▨	▨	▨	▨	▨	▨
	7	*Geojute® Plus-Regular High Velocity*	▨	▨	▨				
	8	CONTROL	▨	▨	▨				
	9	*Permamat 200F*	▨	▨	▨	▨			
	10	*Curlex® II(Double Sided)*	▨	▨					
96	1	*verdyol® Excelsior High-Velocity*	▨	▨	▨	▨	▨		
	2	*Enkamat® 7018*	▨	▨	▨	▨	▨	▨	▨
	3	*Earth-Lock*	▨	▨	▨	▨	▨	▨	▨
	4	*BonTerra® SFB12™*	▨	▨	▨	▨	▨	▨	▨
	5	*Tensar® Erosion Blanket TB1000*	▨	▨	▨	▨	▨	▨	▨
	6	*Pyramat®*	▨	▨	▨	▨	▨	▨	▨
	7	*Curlex® I*	▨	▨	▨				
	8	CONTROL	▨	▨	▨				
	9	*North American Green S150*	▨	▨	▨				
	10	*KoirMat™ 740*	▨	▨	▨				

[1] Channels 1 through 6 have 7% centerline gradient; channels 7 through 10 have 3% centerline gradient.

This Page Left Blank

TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

96 Pascal (2 Lb/Sq Ft) Shear Stress Flows Only

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 96 Pascal (2 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*KoirMat™ 740*	96	3	4.00	32.61	0.4166
2	*Earth-Lock*		7	2.75	15.24	0.4932
3	*BonTerra® SFB12™*		7	2.95	15.24	0.4987
4	*North American Green S150*		3	2.50	32.61	0.7111
5	*Tensar® Erosion Blanket TB1000*		7	2.30	15.24	0.7170
6	*verdyol® Excelsior High-Velocity*		7	2.80	15.24	0.7766
7	*Enkamat® 7018*		7	3.10	15.24	0.8312
8	*Pyramat®*		7	3.10	15.24	0.8745
9	*Curlex® I*		3	1.70	32.61	2.2950

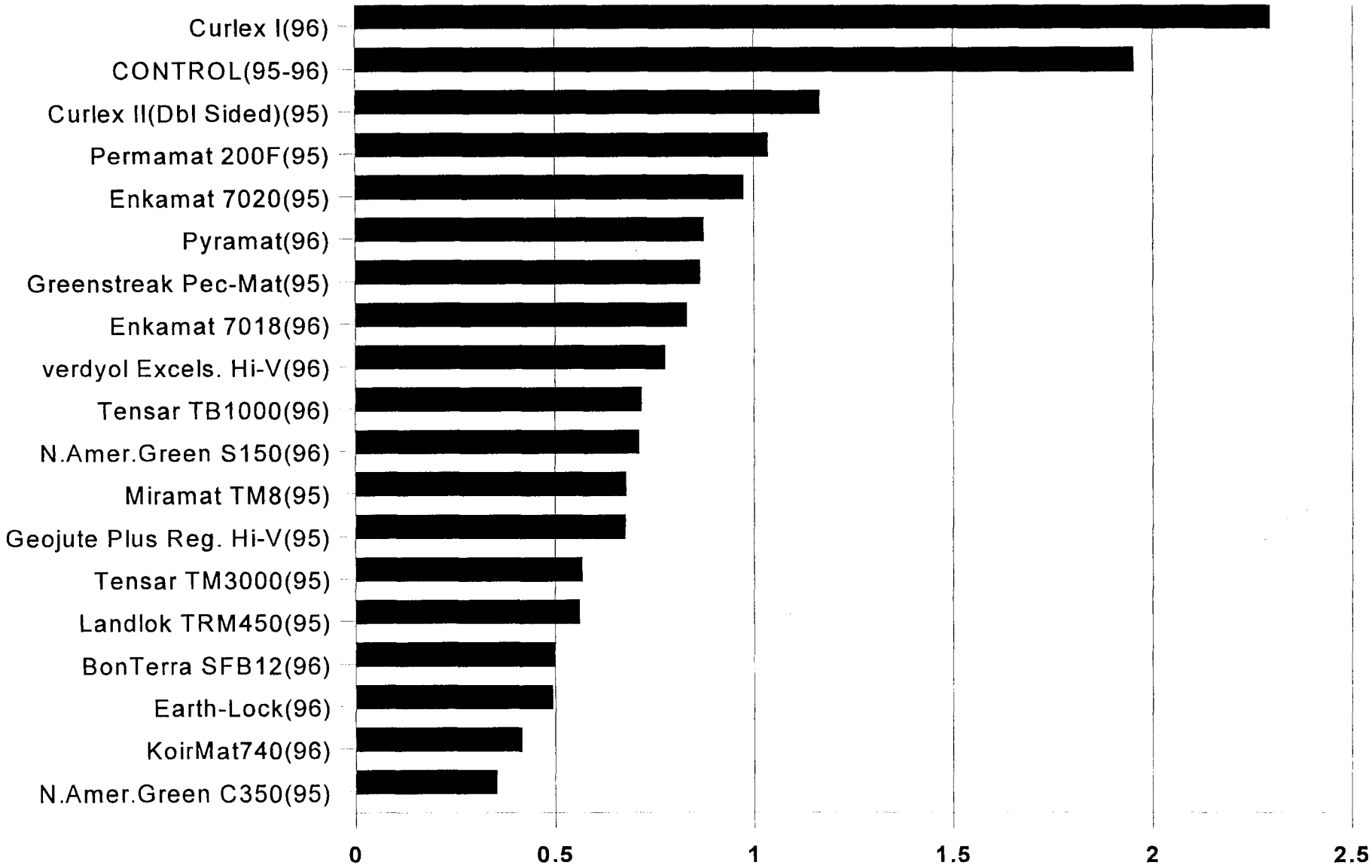
Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**C/L Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*North American Green C350™ Three Phase™*	95	7	5.43	15.24	0.3541
2	*KoirMat™ 740*	96	3	4.00	32.61	0.4166
3	*Earth-Lock*	96	7	2.75	15.24	0.4932
4	*BonTerra® SFB12™*	96	7	2.95	15.24	0.4987
5	*Landlok® TRM 450*	95	7	5.17	15.24	0.5611
6	*Tensar® Erosion Mat TM3000*	95	7	3.89	15.24	0.5666
7	*Geojute® Plus-Regular High Velocity*	95	3	4.95	32.61	0.6762
8	*Miramat® TM8™*	95	7	6.39	15.24	0.6784
9	*North American Green S150*	96	3	2.50	32.61	0.7111
10	*Tensar® Erosion Blanket TB1000*	96	7	2.30	15.24	0.7170
11	*verdyol® Excelsior High-Velocity*	96	7	2.80	15.24	0.7766
12	*Enkamat® 7018*	96	7	3.10	15.24	0.8312

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 96 Pascal (2 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
13	*Greenstreak® Pec-Mat™*	95	7	4.54	15.24	0.8648
14	*Pyramat®*	96	7	3.10	15.24	0.8745
15	*Enkamat® 7020*	95	7	4.72	15.24	0.9736
16	*Permamat 200F*	95	3	4.55	32.61	1.0346
17	*Curlex® II(Double Sided)*	95	3	4.25	32.61	1.1646
18	CONTROL	95-96	3	4.00	32.61	1.9525
19	*Curlex® I*	96	3	1.70	32.61	2.2950

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
96 Pascal Flows (2 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

144 Pascal Shear Stress Flows Only (3 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 144 Pascal (3 Lb/Sq Ft)
(For Information Only)

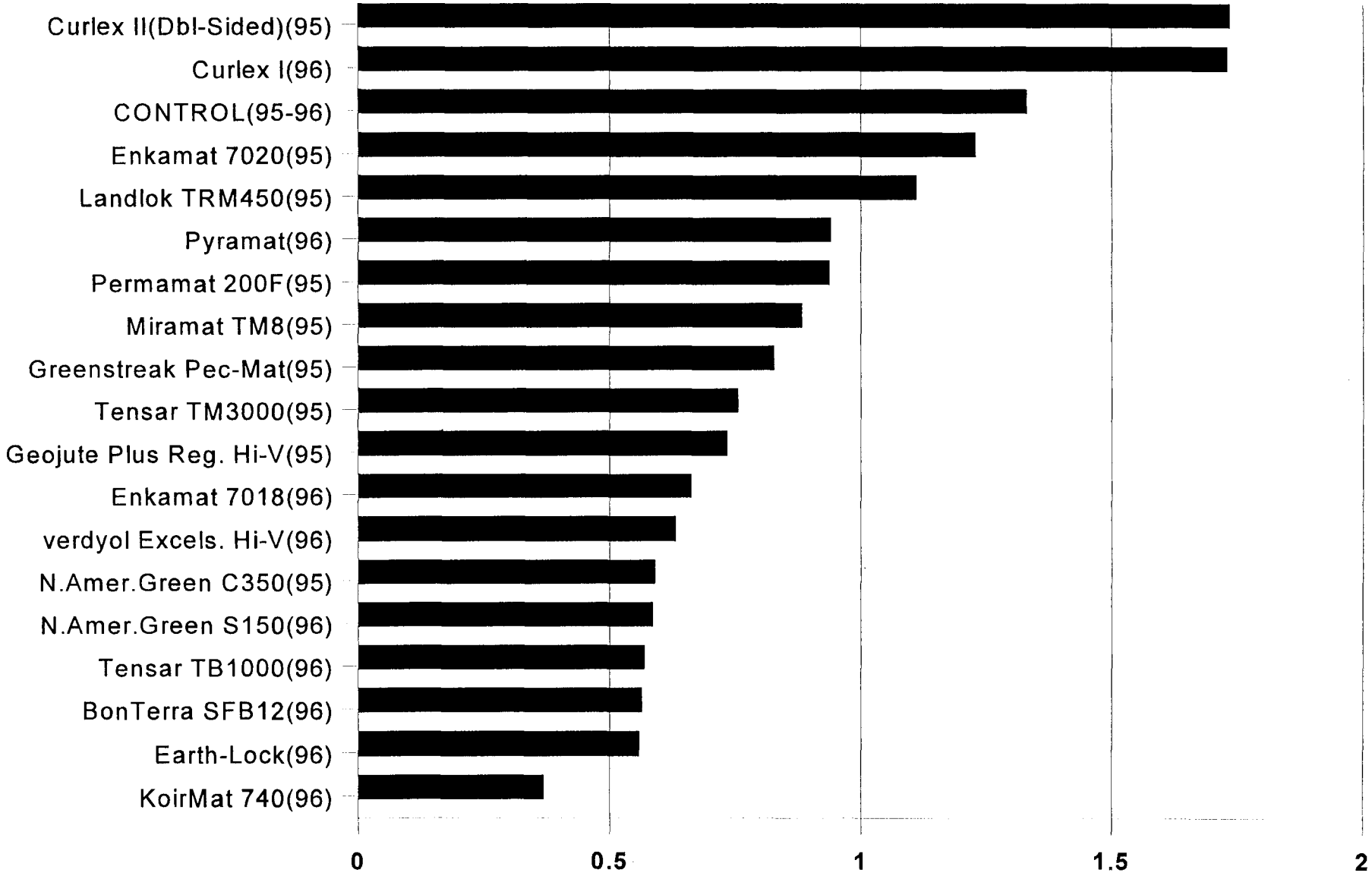
Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*KoirMat™ 740*	96	3	5.00	48.77	0.3680
2	*Earth-Lock*		7	4.15	21.34	0.5587
3	*BonTerra® SFB12™*		7	4.15	21.34	0.5645
4	*Tensar® Erosion Blanket TB1000*		7	3.80	21.34	0.5691
5	*North American Green S150*		3	5.05	48.77	0.5862
6	*verdyol® Excelsior High-Velocity*		7	3.75	21.34	0.6316
7	*Enkamat® 7018*		7	3.40	21.34	0.6620
8	*Pyramat®*		7	4.35	21.34	0.9398
9	*Curlex® I*		3	2.95	48.77	1.7296

Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**C/L Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*KoirMat™ 740*	96	3	5.00	48.77	0.3680
2	*Earth-Lock*	96	7	4.15	21.34	0.5587
3	*BonTerra® SFB12™*	96	7	4.15	21.34	0.5645
4	*Tensar® Erosion Blanket TB1000*	96	7	3.80	21.34	0.5691
5	*North American Green S150*	96	3	5.05	48.77	0.5862
6	*North American Green C350™ Three Phase™*	95	7	7.54	21.34	0.5904
7	*verdyol® Excelsior High-Velocity*	96	7	3.75	21.34	0.6316
8	*Enkamat® 7018*	96	7	3.40	21.34	0.6620
9	*Geojute® Plus-Regular High Velocity*	95	3	5.44	48.77	0.7345
10	*Tensar® Erosion Mat TM3000*	95	7	4.89	21.34	0.7555
11	*Greenstreak® Pec-Mat™*	95	7	7.47	21.34	0.8275
12	*Miramat® TM8™*	95	7	5.97	21.34	0.8823

Shear Stress = 144 Pascal (3 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
13	*Permamat 200F*	95	3	4.94	48.77	0.9371
14	*Pyramat®*	96	7	4.35	21.34	0.9398
15	*Landlok® TRM 450*	95	7	4.15	21.34	1.1111
16	*Enkamat® 7020*	95	7	4.41	21.34	1.2287
17	*Curlex® I*	96	3	2.95	48.77	1.7296
18	*Curlex® II(Double Sided)*	95	3	4.98	48.77	1.7354

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
144 Pascal Flows (3 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

192 Pascal Shear Stress Flows Only (4 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 192 Pascal (4 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*BonTerra® SFB12™*	96	7	5.05	27.43	0.4882
2	*Enkamat® 7018*		7	4.00	27.43	0.4995
3	*Earth-Lock*		7	4.55	27.43	0.5152
4	*Tensar® Erosion Blanket TB1000*		7	4.60	27.43	0.7052
5	*Pyramat®*		7	4.65	27.43	0.7109
6	*verdyol® Excelsior High-Velocity*		7	4.80	27.43	0.8112
7	*KoirMat™ 740*		3	5.90	64.01	0.9350
8	*North American Green S150*		3	5.85	64.01	1.3207
9	*Curlex® I*		3	4.70	64.01	3.5043

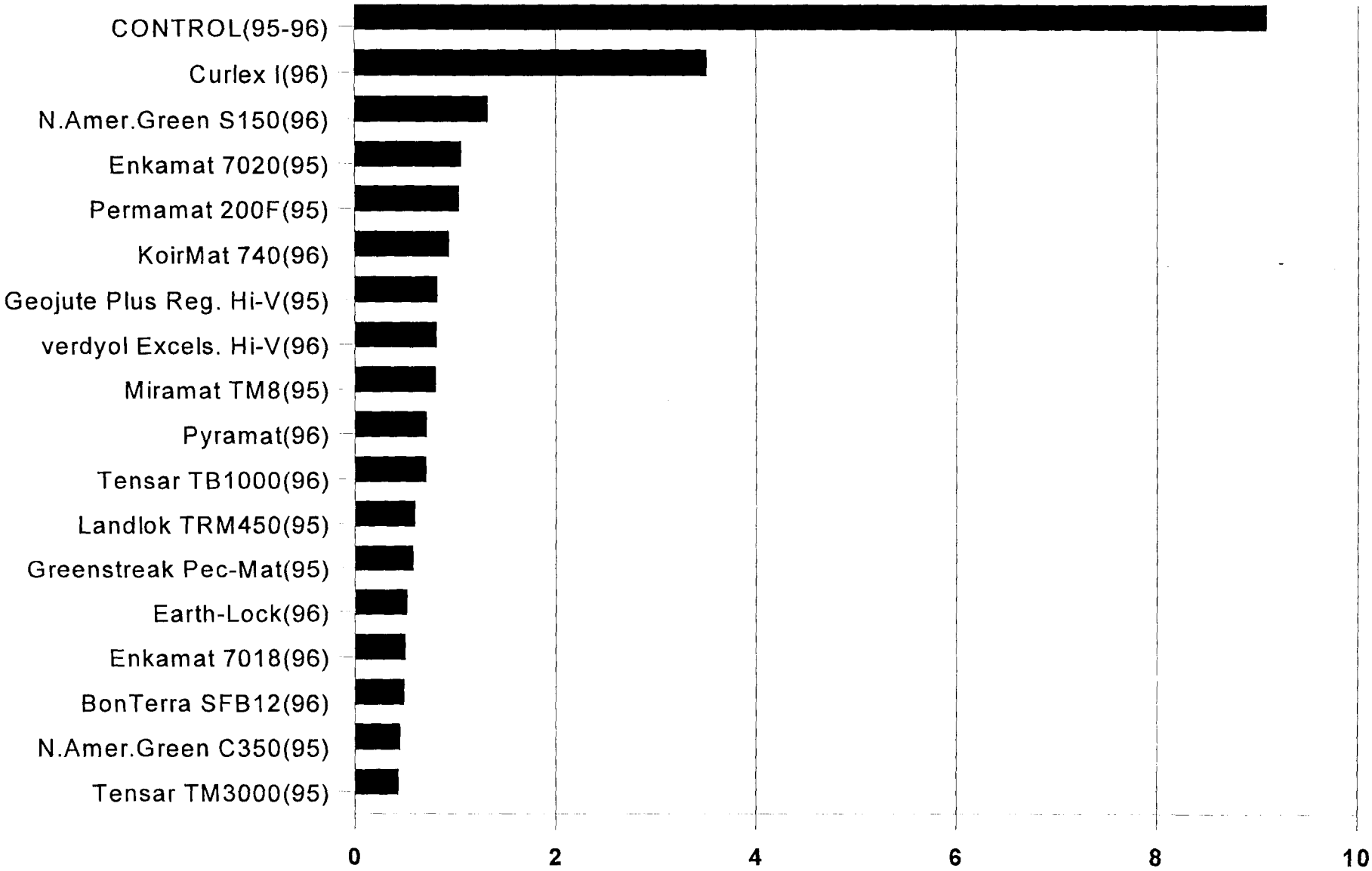
Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**C/L Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Tensar® Erosion Mat TM3000*	95	7	5.22	27.43	0.4307
2	*North American Green C350™ Three Phase™*	95	7	4.54	27.43	0.4493
3	*BonTerra® SFB12™*	96	7	5.05	27.43	0.4882
4	*Enkamat® 7018*	96	7	4.00	27.43	0.4995
5	*Earth-Lock*	96	7	4. 55	27.43	0.5152
6	*Greenstreak® Pec-Mat™*	95	7	4.74	27.43	0.5773
7	*Landlok® TRM 450*	95	7	6.61	27.43	0.5939
8	*Tensar® Erosion Blanket TB1000*	96	7	4.60	27.43	0.7052
9	*Pyramat®*	96	7	4.65	27.43	0.7109
10	*Miramat® TM8™*	95	7	6.40	27.43	0.8007
11	*verdyol® Excelsior High-Velocity*	96	7	4.80	27.43	0.8112
12	*Geojute® Plus-Regular High Velocity*	95	3	3.37	64.01	0.8164

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 192 Pascal (4 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
13	*KoirMat™ 740*	96	3	5.90	64.01	0.9350
14	*Permamat 200F*	95	3	6.30	64.01	1.0339
15	*Enkamat® 7020*	95	7	5.22	27.43	1.0559
16	*North American Green S150*	96	3	5.85	64.01	1.3207
17	*Curlex® I*	96	3	4.70	64.01	3.5043
18	CONTROL	95-96	3	5.6	64.01	9.0837

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
192 Pascal Flows (4 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

239 Pascal Shear Stress Flows Only (5 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 239 Pascal (5 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*BonTerra® SFB12™*	96	7	6.65	33.53	0.4166
2	*Tensar® Erosion Blanket TB1000*		7	5.65	33.53	0.4986
3	*Earth-Lock*		7	5.95	33.53	0.5636
4	*Enkamat® 7018*		7	4.90	33.53	0.5966
5	*Pyramat®*		7	5.85	33.53	0.6298
6	*verdyol® Excelsior High-Velocity*		7	4.95	33.53	1.3157
	KoirMat™ 740		Not Tested			
	North American Green S150		Not Tested			
	Curlex® I		Not Tested			
	CONTROL		Not Tested			

Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*BonTerra® SFB12™*	96	7	6.65	33.53	0.4166
2	*Tensar® Erosion Blanket TB1000*	96	7	5.65	33.53	0.4986
3	*Earth-Lock*	96	7	5.95	33.53	0.5636
4	*Enkamat® 7018*	96	7	4.90	33.53	0.5966
5	*Pyramat®*	96	7	5.85	33.53	0.6298
6	*North American Green C350™ Three Phase™*	95	7	5.81	33.53	0.6337
7	*Landlok® TRM 450*	95	7	5.49	33.53	0.6811
8	*Tensar® Erosion Mat TM3000*	95	7	5.57	33.53	0.7107
9	*Greenstreak® Pec-Mat™*	95	7	6.25	33.53	0.8493
10	*Miramat® TM8™*	95	7	6.75	33.53	1.1002
11	*verdyol® Excelsior High-Velocity*	96	7	4.95	33.53	1.3157

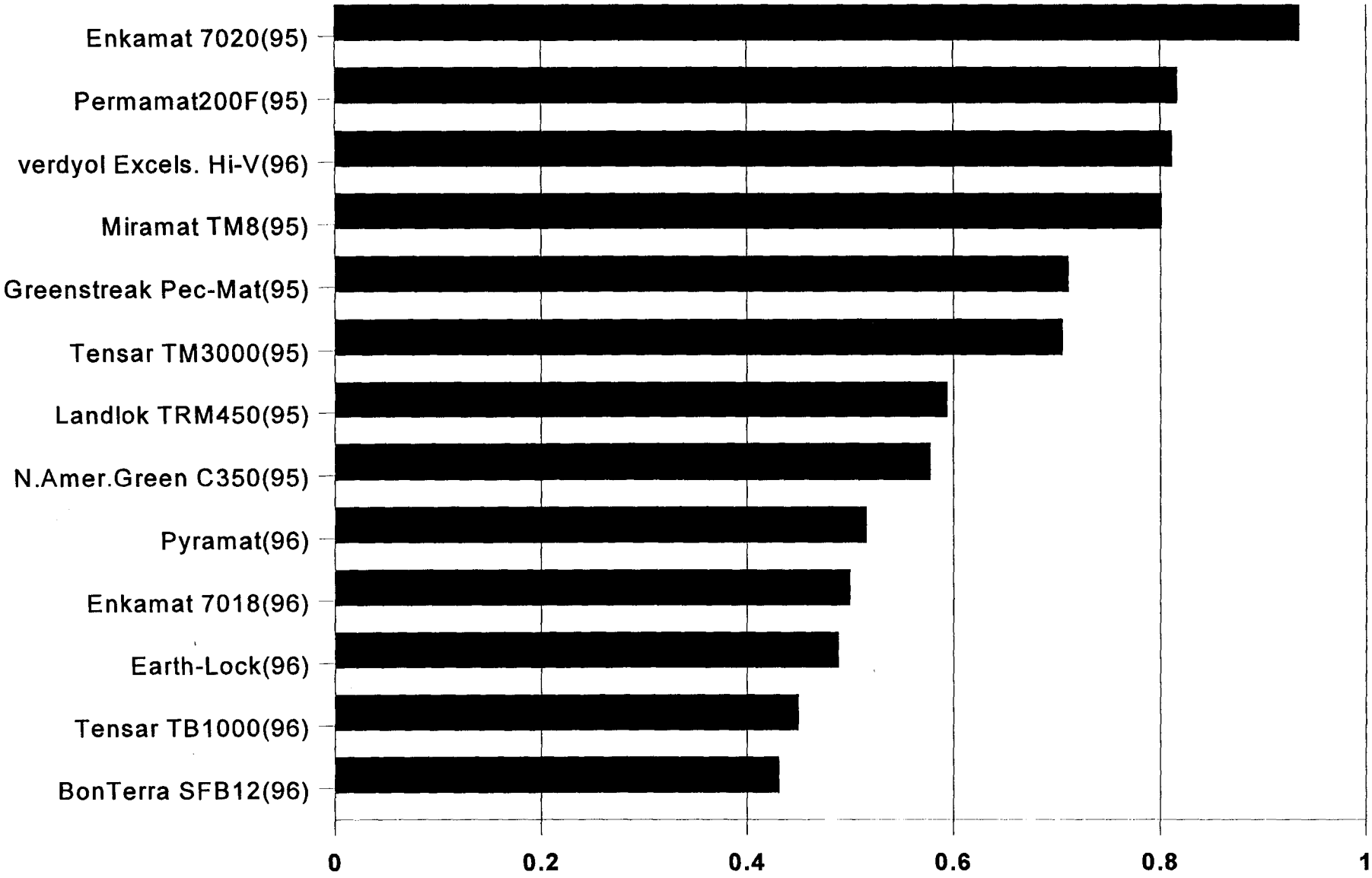
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 239 Pascal (5 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
12	*Permamat 200F*	95	3	3.70	82.30	1.3175
13	*Enkamat® 7020*	95	7	5.51	33.53	1.5620
	Geojute® Plus-Regular High Velocity	95	3	Not Tested		
	KoirMat™ 740	96	3	Not Tested		
	North American Green S150	96	3	Not Tested		
	Curlex® I	96	3	Not Tested		

NOTE: "Not Tested" indicates that the product did not receive flow events at this shear stress level.

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
239 Pascal Flows (5 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

287 Pascal Shear Stress Flows Only (6 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 287 Pascal (6 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Earth-Lock*	96	7	6.30	42.67	0.6023
2	*BonTerra® SFB12™*		7	7.25	42.67	0.6843
3	*Enkamat® 7018*		7	6.05	42.67	0.6893
4	*Pyramat®*		7	7.15	42.67	1.1470
5	*Tensar® Erosion Blanket TB1000*		7	6.25	42.67	1.2548
6	*verdyol® Excelsior High-Velocity*		7	5.50	42.68	1.8382
	KoirMat™ 740		Not Tested			
	North American Green S150		Not Tested			
	Curlex® I		Not Tested			
	CONTROL		Not Tested			

Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Tensar® Erosion Blanket TB1000*	96	7	6.25	42.67	0.5012
2	*Earth-Lock*	96	7	6.30	42.67	0.6023
3	*BonTerra® SFB12™*	96	7	7.25	42.67	0.6843
4	*Enkamat® 7018*	96	7	6.05	42.67	0.6893
5	*Landlok® TRM 450*	95	7	8.46	42.67	0.8107
6	*Greenstreak® Pec-Mat™*	95	7	8.71	42.67	1.0291
7	*North American Green C350™ Three Phase™*	95	7	8.21	42.67	1.0496
8	*Pyramat®*	96	7	7.15	42.67	1.1470
9	*Tensar® Erosion Blanket TB1000*	96	7	6.25	42.67	1.2548
10	*Enkamat® 7020*	95	7	7.75	42.67	1.5698
11	*Miramat® TM8™*	95	7	7.81	42.67	1.6229

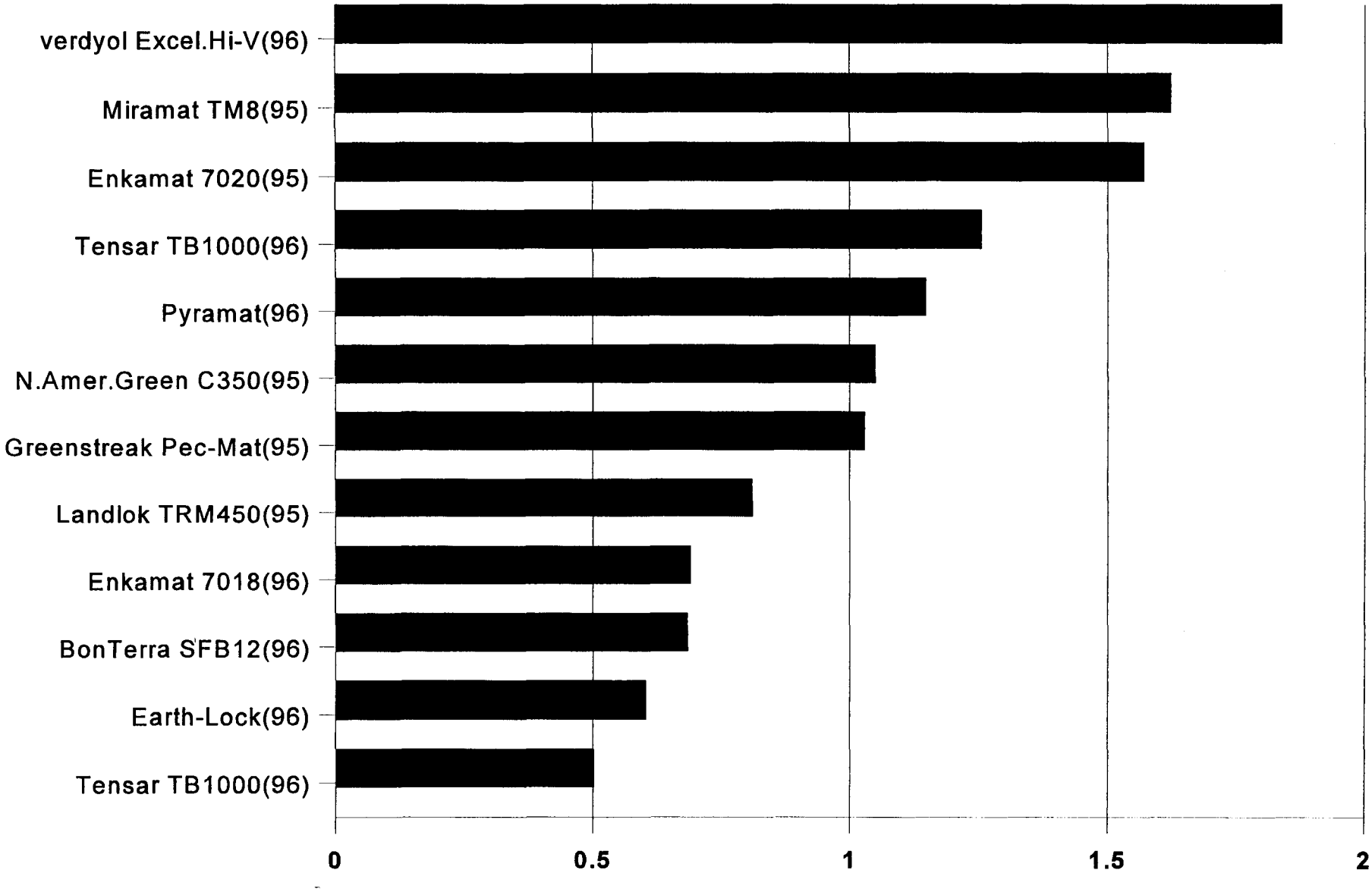
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 287 Pascal (6 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
12	*verdyol® Excelsior High-Velocity*	96	7	5.50	42.67	1.8382
	Permamat 200F	95	3	Not Tested		
	Geojute® Plus-Regular High Velocity	95	3	Not Tested		
	KoirMat™ 740	96	3	Not Tested		
	North American Green S150	96	3	Not Tested		
	Curlex® I	96	3	Not Tested		

NOTE: "Not Tested" indicates that the product did not receive flow events at this shear stress level.

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
287 Pascal Flows (6 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

335 Pascal Shear Stress Flows Only (7 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 335 Pascal (7 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Pyramat®*	96	7	7.90	49.68	0.5471
2	*BonTerra® SFB12™*		7	8.00	49.68	0.5693
3	*Earth-Lock*		7	7.65	49.68	0.8254
4	*Tensar® Erosion Blanket TB1000*		7	7.85	49.68	0.9016
5	*Enkamat® 7018*		7	7.85	49.68	1.5605
	verdyol® Excelsior High-Velocity		Not Tested			
	KoirMat™ 740		Not Tested			
	North American Green S150		Not Tested			
	Curlex® I		Not Tested			
	CONTROL		Not Tested			

Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*North American Green C350™ Three Phase™*	95	7	9.57	49.68	0.5386
2	*Pyramat®*	96	7	7.90	49.68	0.5471
3	*Tensar® Erosion Mat TM3000*	95	7	7.19	49.68	0.5491
4	*BonTerra® SFB12™*	96	7	8.00	49.68	0.5693
5	*Landlok® TRM 450*	95	7	9.29	49.68	0.5711
6	*Earth-Lock*	96	7	7.65	49.68	0.8254
7	*Tensar® Erosion Blanket TB1000*	96	7	7.85	49.68	0.9016
8	*Miramat® TM8™*	95	7	7.60	49.68	0.9625
9	*Enkamat® 7020*	95	7	8.15	49.68	1.0825
10	*Greenstreak® Pec-Mat™*	95	7	9.24	49.68	1.2629
11	*Enkamat® 7018*	96	7	7.85	49.68	1.5605

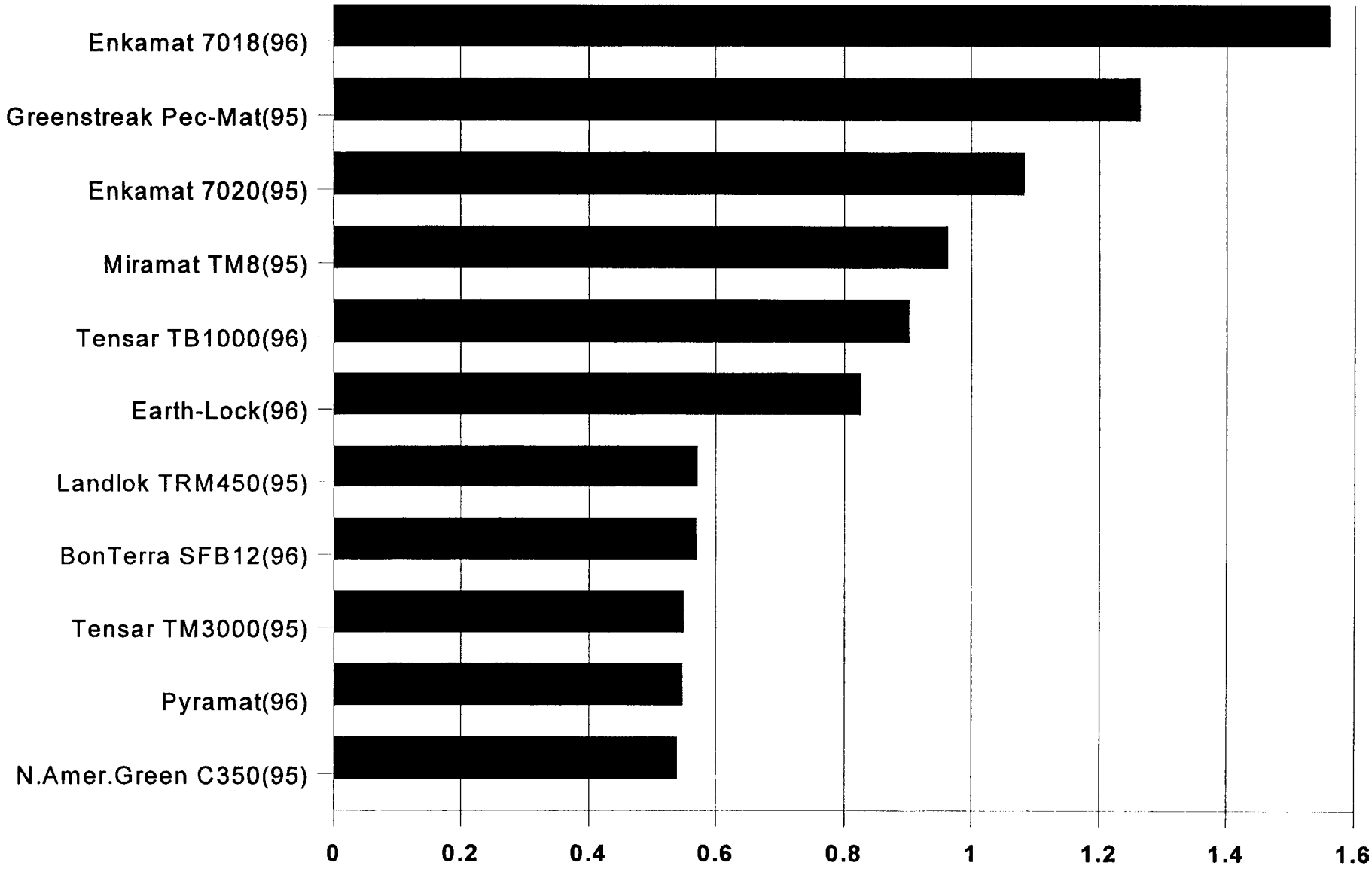
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 335 Pascal (7 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
	verdyol® Excelsior High-Velocity	96	Not Tested			
	Permamat 200F	95	Not Tested			
	Geojute® Plus-Regular High Velocity	95	Not Tested			
	KoirMat™ 740	96	Not Tested			
	North American Green S150	96	Not Tested			
	Curlex® I	96	Not Tested			

NOTE: "Not Tested" indicates that the product did not receive flow events at this shear stress level.

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
335 Pascal Flows (7 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

383 Pascal Shear Stress Flows Only (7 Lb/Sq Ft)

(For Information Only)

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 383 Pascal (8 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Pyramat®*	96	7	8.5	57.00	0.5639
2	*Tensar® Erosion Blanket TB1000*		7	7.85	57.00	0.6954
3	*BonTerra® SFB12™*		7	8.4	57.00	0.8905
4	*Earth-Lock*		7	8.4	57.00	1.1195
5	*Enkamat® 7018*		7	8.5	57.00	2.8614
	verdyol® Excelsior High-Velocity		Not Tested			
	KoirMat™ 740		Not Tested			
	North American Green S150		Not Tested			
	Curlex® I		Not Tested			
	CONTROL		Not Tested			

Product Performance: 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
1	*Landlok® TRM 450*	95	7	9.70	54.86	0.5227
2	*Pyramat®*	96	7	8.5	57.00	0.5639
3	*Tensar® Erosion Mat TM3000*	95	7	9.14	54.86	0.6311
4	*Tensar® Erosion Blanket TB1000*	96	7	7.85	57.00	0.6954
5	*North American Green C350™ Three Phase™*	95	7	10.00	54.86	0.7893
6	*BonTerra® SFB12™*	96	7	8.4	57.00	0.8905
7	*Earth-Lock*	96	7	8.4	57.00	1.1195
8	*Miramat® TM8™*	95	7	7.21	54.86	1.4021
9	*Greenstreak® Pec-Mat™*	95	7	9.93	54.86	1.5852
10	*Enkamat® 7020*	95	7	8.58	54.86	1.8061
11	*Enkamat® 7018*	96	7	8.5	57.00	2.8614

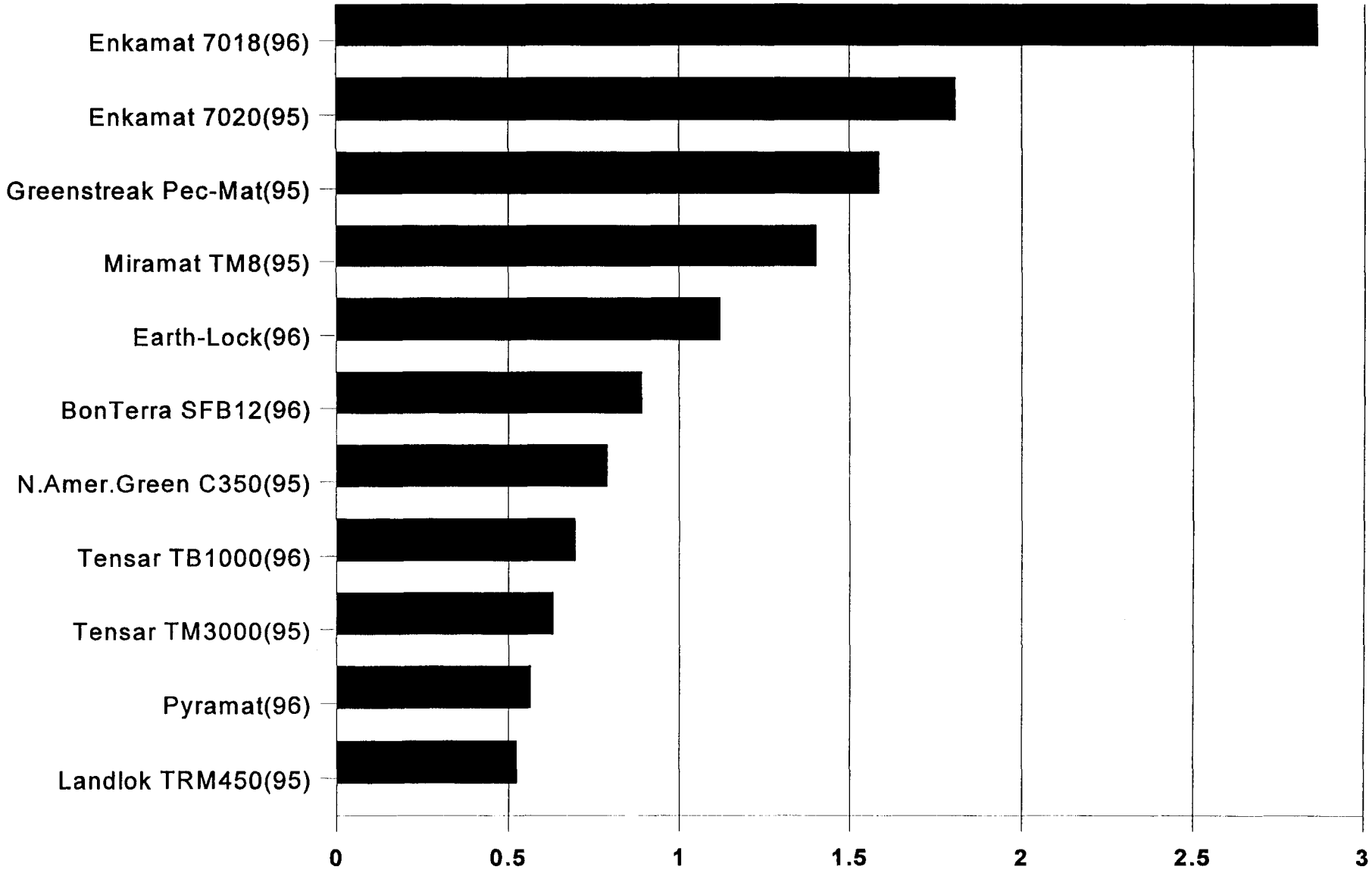
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress = 383 Pascal (8 Lb/Sq Ft)
(For Information Only)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Chnl Grade (%)**	**Flow Velocity (mps)**	**Depth of Flow (cm)**	**Sediment Loss (cm)**
	verdyol® Excelsior High-Velocity	96	Not Tested			
	Permamat 200F	95	Not Tested			
	Geojute® Plus-Regular High Velocity	95	Not Tested			
	KoirMat™ 740	96	Not Tested			
	North American Green S150	96	Not Tested			
	Curlex® I	96	Not Tested			

NOTE: "Not Tested" indicates that the product did not receive flow events at this shear stress level.

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
383 Pascal Flows (8 Lbs/Sq Ft)
(For Information Only)



TABULAR DATA
Class 2 "Flexible Channel Liner" applications

0 - 96 Pascal Shear Stress Flows

ANALYSIS LEVEL USED BY TXDOT TO DETERMINE APPROVED PRODUCT LIST

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress Range = 0 - 96 Pascal
(0 - 2 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*KoirMat™ 740*	96	0.4166	1.15	65.643	70
2	*Earth-Lock*		0.4932		69.880	
3	*BonTerra® SFB12™*		0.4987		72.632	
4	*North American Green S150*		0.7111		82.834	
5	*Tensar® Erosion Blanket TB1000*		0.7170		73.100	
6	*verdyol® Excelsior High-Velocity*		0.7766		68.844	
7	*Enkamat® 7018*		0.8312		79.835	
8	*Pyramat®*		0.8745		67.161	
9	CONTROL		1.9525		47.660	
10	*Curlex® I*		2.2950		69.982	

Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*North American Green C350™ Three Phase™*	95	0.3541	1.15	79.982	70
2	*KoirMat™ 740*	96	0.4166		65.643	
3	*Earth-Lock*	96	0.4932		69.880	
4	*Geojute® Plus-Regular High Velocity*	95	0.4974		59.490	
5	*BonTerra® SFB12™*	96	0.4987		72.632	
6	*Landlok® TRM 450*	95	0.5611		78.116	
7	*Tensar® Erosion Mat TM3000*	95	0.5666		92.853	
8	*Miramat® TM8™*	95	0.6784		86.574	
9	*North American Green S150*	96	0.7111		82.834	
10	*Tensar® Erosion Blanket TB1000*	96	0.7170		73.100	
11	*verdyol® Excelsior High-Velocity*	96	0.7766		68.844	
12	*Curlex® II(Double Sided)*	95	0.7866		54.664	

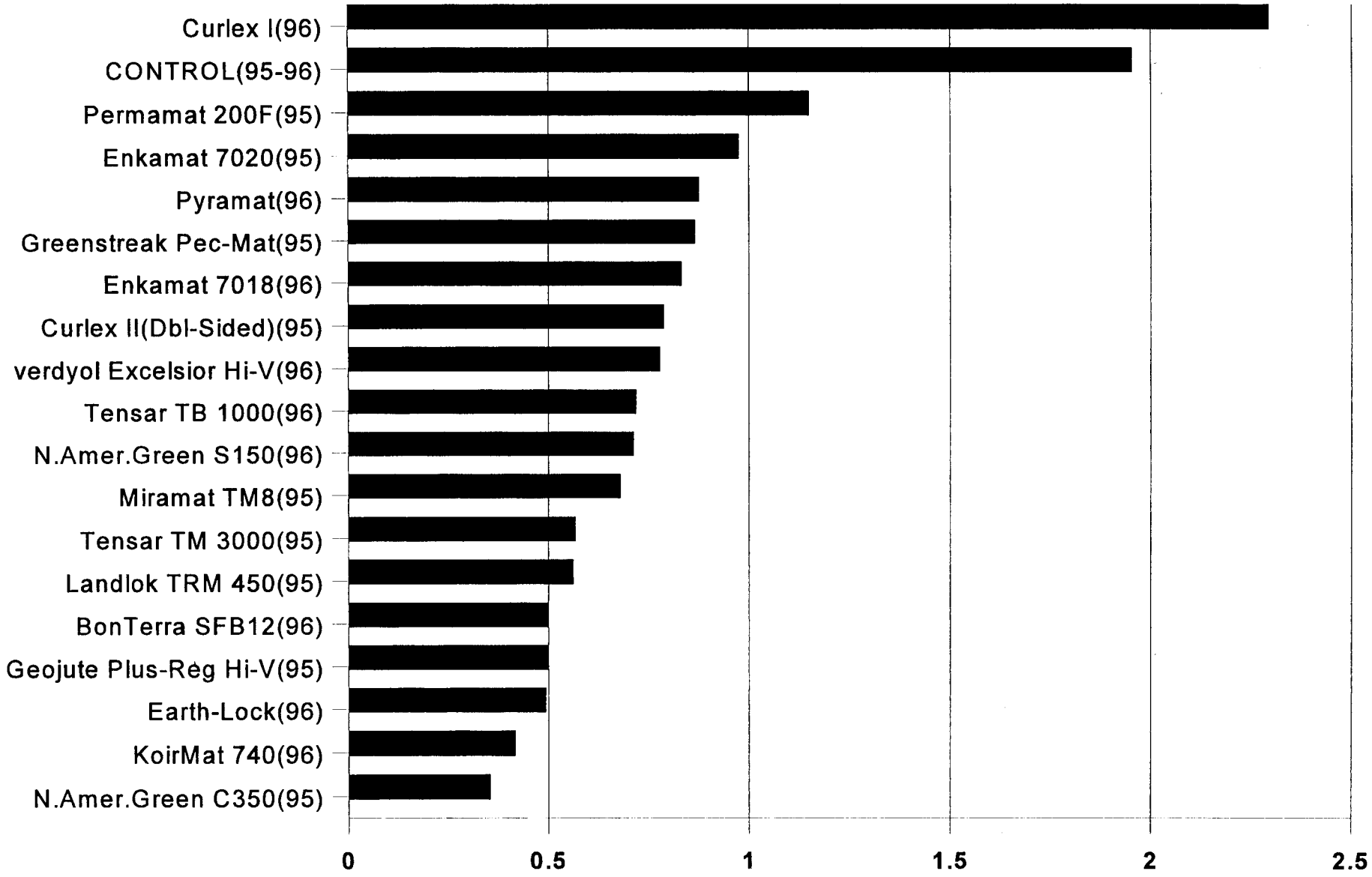
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress Range = 0 - 96 Pascal
(0 - 2 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
13	*Enkamat® 7018*	96	0.8312	1.15	79.835	70
14	*Greenstreak® Pec-Mat™*	95	0.8648		71.830	
15	*Pyramat®*	96	0.8745		67.161	
16	*Enkamat® 7020*	95	0.9736		82.394	
17	*Permamat 200F*	95	1.1487		56.954	
18	CONTROL	95-96	1.9525		47.660	
19	*Curlex® I*	96	2.2950		69.982	

NOTES: *Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.*

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
0 - 96 Pascal Flows (0 - 2 Lbs/Sq Ft)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

0 - 192 Pascal Shear Stress Flows

ANALYSIS LEVEL USED BY TXDOT TO DETERMINE APPROVED PRODUCT LIST

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress Range = 0 - 192 Pascal

(0 - 4 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*BonTerra® SFB12™*	96	0.5171	1.00	72.632	70
2	*Earth-Lock*		0.5224		69.880	
3	*KoirMat™ 740*		0.5732		65.643	
4	*Tensar® Erosion Blanket TB1000*		0.6637		73.100	
5	*Enkamat® 7018*		0.6642		79.835	
6	*verdyol® Excelsior High-Velocity*		0.7398		68.844	
7	*Pyramat®*		0.8417		67.161	
8	*North American Green S150*		0.8727		82.834	
9	*Curlex® I*		2.5096		69.982	

Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*North American Green C350™ Three Phase™*	95	0.4646	1.00	79.982	70
2	*BonTerra® SFB12™*	96	0.5171		72.632	
3	*Earth-Lock*	96	0.5224		69.880	
4	*KoirMat™ 740*	96	0.5732		65.643	
5	*Tensar® Erosion Mat TM3000*	95	0.5843		92.853	
6	*Geojute® Plus-Regular High Velocity*	95	0.6113		59.490	
7	*Tensar® Erosion Blanket TB1000*	96	0.6637		73.100	
8	*Enkamat® 7018*	96	0.6642		79.835	
9	*verdyol® Excelsior High-Velocity*	96	0.7398		68.844	
10	*Landlok® TRM 450*	95	0.7554		78.116	
11	*Greenstreak® Pec-Mat™*	95	0.7565		71.830	

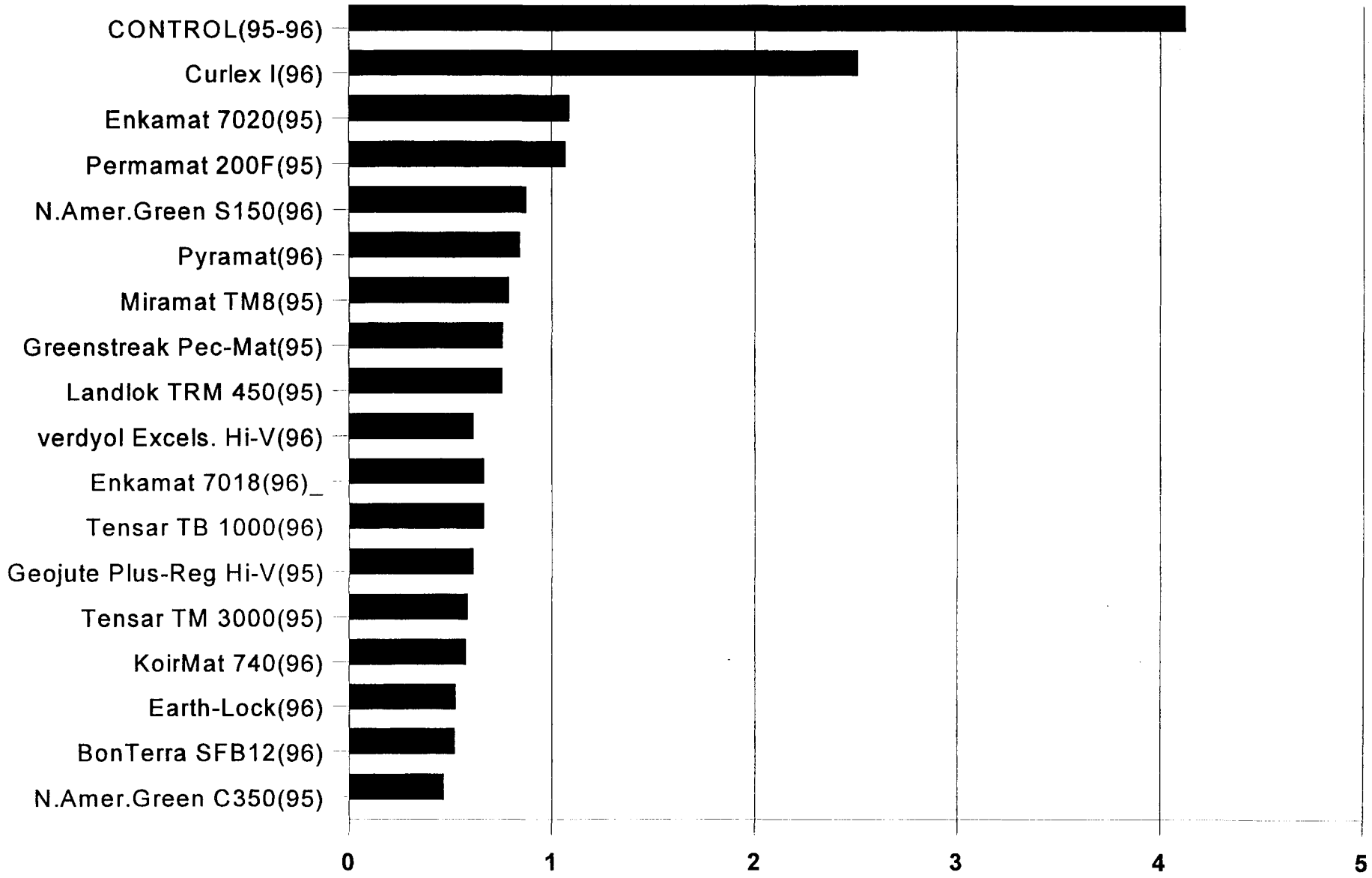
Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

Shear Stress Range = 0 - 192 Pascal
(0 - 4 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
12	*Miramat® TM8™*	95	0.7871	1.00	86.574	70
13	*Pyramat®*	96	0.8417		67.161	
14	*North American Green S150*	96	0.8727		82.834	
15	*Permamat 200F*	95	1.0671		56.954	
16	*Enkamat® 7020*	95	1.0861		82.394	
17	*Curlex® I*	96	2.5096		69.982	
18	CONTROL	95-96	4.1225		47.660	

NOTES: *Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.*

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
0 - 192 Pascal Flows (0 - 4 Lbs/Sq Ft)



TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

0 - 287 Pascal Shear Stress Flows

ANALYSIS LEVEL USED BY TXDOT TO DETERMINE APPROVED PRODUCT LIST

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

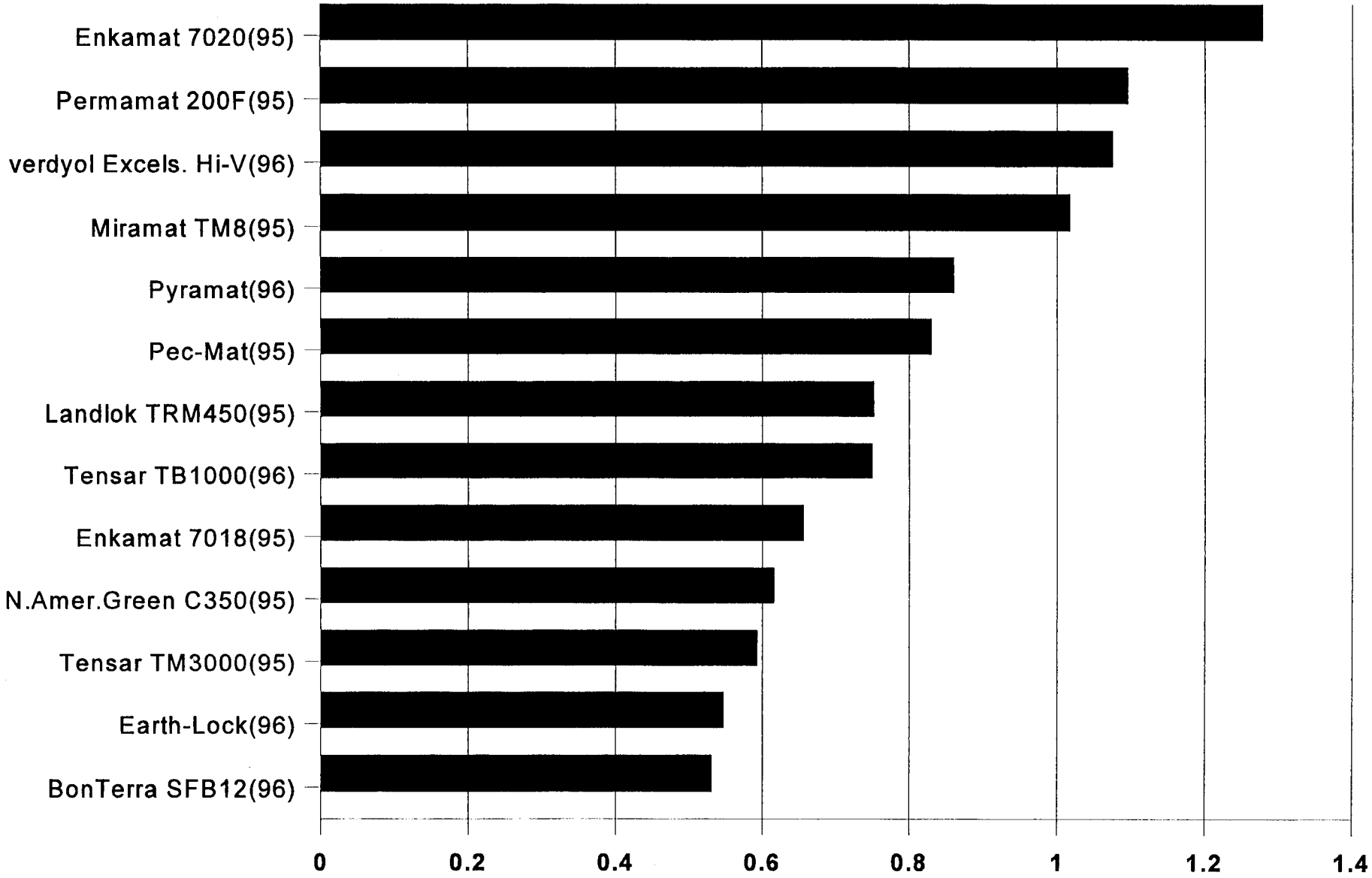
Shear Stress Range = 0 - 287 Pascal
(0 - 6 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard(cm)**	**Vegetation Density(%)**	**Current Standard(%)**
1	*BonTerra® SFB12™*	96	0.53046	1.00	72.632	70
2	*Earth-Lock*		0.54661		69.880	
3	*Enkamat® 7018*		0.65571		79.835	
4	*Tensar® Erosion Blanket TB1000*		0.74893		73.100	
5	*Pyramat®*		0.86039		67.161	
6	*verdyol® Excelsior High-Velocity*		1.07468		68.844	

Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*BonTerra® SFB12™*	96	0.53046	1.00	72.632	70
2	*Earth-Lock*	96	0.54661		69.880	
3	*Tensar® Erosion Mat TM3000*	95	0.59296		92.853	
4	*North American Green C350™ Three Phase™*	95	0.61543		82.834	
5	*Enkamat® 7018*	96	0.65571		79.835	
6	*Tensar® Erosion Blanket TB1000*	96	0.74893		73.100	
7	*Landlok® TRM 450*	95	0.75157		78.116	
8	*Greenstreak® Pec-Mat™*	95	0.82961		71.830	
9	*Pyramat®*	96	0.86039		67.161	
10	*Miramat® TM8™*	95	1.01689		86.574	
11	*verdyol® Excelsior High-Velocity*	96	1.07468		68.844	
12	*Permamat 200F*	95	1.09496		56.954	
13	*Enkamat® 7020*	95	1.27800		82.394	
	CONTROL	95-96	Not Tested		47.660	

NOTES: *Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards. "Not Tested" indicates that the product did not receive flow events through this shear stress level.*

Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
0 - 287 Pascal Flows (0 - 6 Lbs/Sq Ft)



This Page Left Blank

TABULAR DATA
Class 2 "Flexible Channel Liner" Applications

0 - 383 Pascal Shear Stress Flows

ANALYSIS LEVEL USED BY TXDOT TO DETERMINE APPROVED PRODUCT LIST

Texas Department of Transportation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Class 2 "Flexible Channel Liner Applications"

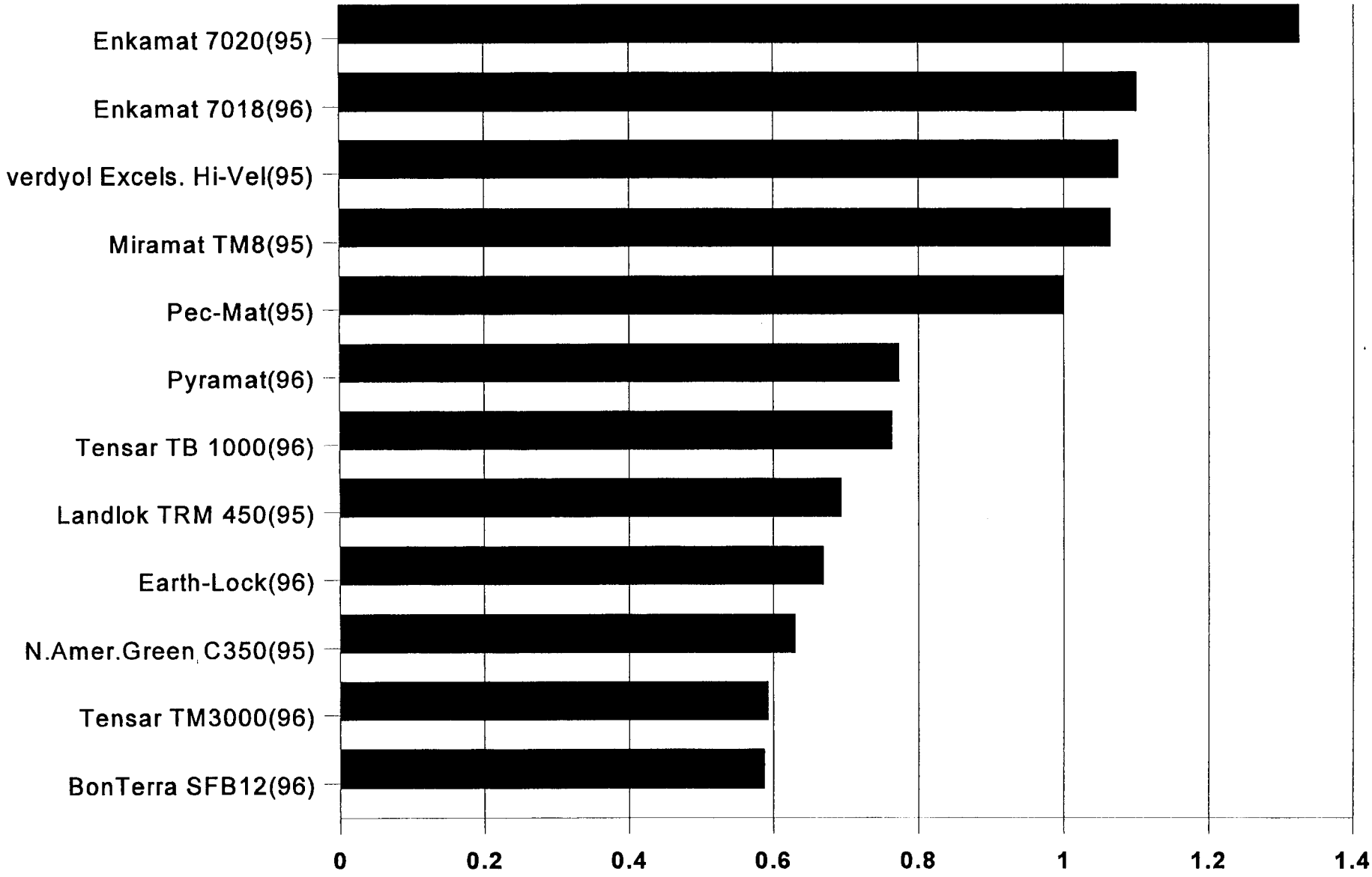
Shear Stress Range = 0 - 383 Pascal
(0 - 8 Lb/Sq Ft)

Product Performance - 1996 Evaluation Cycle						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*BonTerra® SFB12™*	96	0.58745	0.80	72.632	70
2	*Earth-Lock*		0.66827		69.880	
3	*Tensar® Erosion Blanket TB1000*		0.76309		73.100	
4	*Pyramat®*		0.77329		67.161	
5	*Enkamat® 7018*		1.10008		79.835	

Product Performance : 1991 - 1996 Evaluation Cycles						
No	**Product Name**	**Year**	**Sediment Loss (cm)**	**Current Standard (cm)**	**Vegetation Density (%)**	**Current Standard (%)**
1	*BonTerra® SFB12™*	96	0.58745	0.80	72.632	70
2	*Tensar® Erosion Mat TM3000*	96	0.59214		92.853	
3	*North American Green C350™ Three Phase™*	95	0.62929		79.982	
4	*Earth-Lock*	96	0.66827		69.880	
5	*Landlok® TRM 450*	95	0.69309		78.116	
6	*Tensar® Erosion Blanket TB1000*	96	0.76309		73.100	
7	*Pyramat®*	96	0.77329		67.161	
8	*Greenstreak® Pec-Mat™*	95	0.99944		71.83	
9	*Miramat® TM8™*	95	1.06416		86.574	
10	*Enkamat® 7018*	96	1.10008		79.835	
11	*Enkamat® 7020*	95	1.32551		82.394	
	CONTROL	95-96	Not Tested		47.660	

NOTES: *Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards. "Not Tested" indicates that the product did not receive flow events through this shear stress level.*

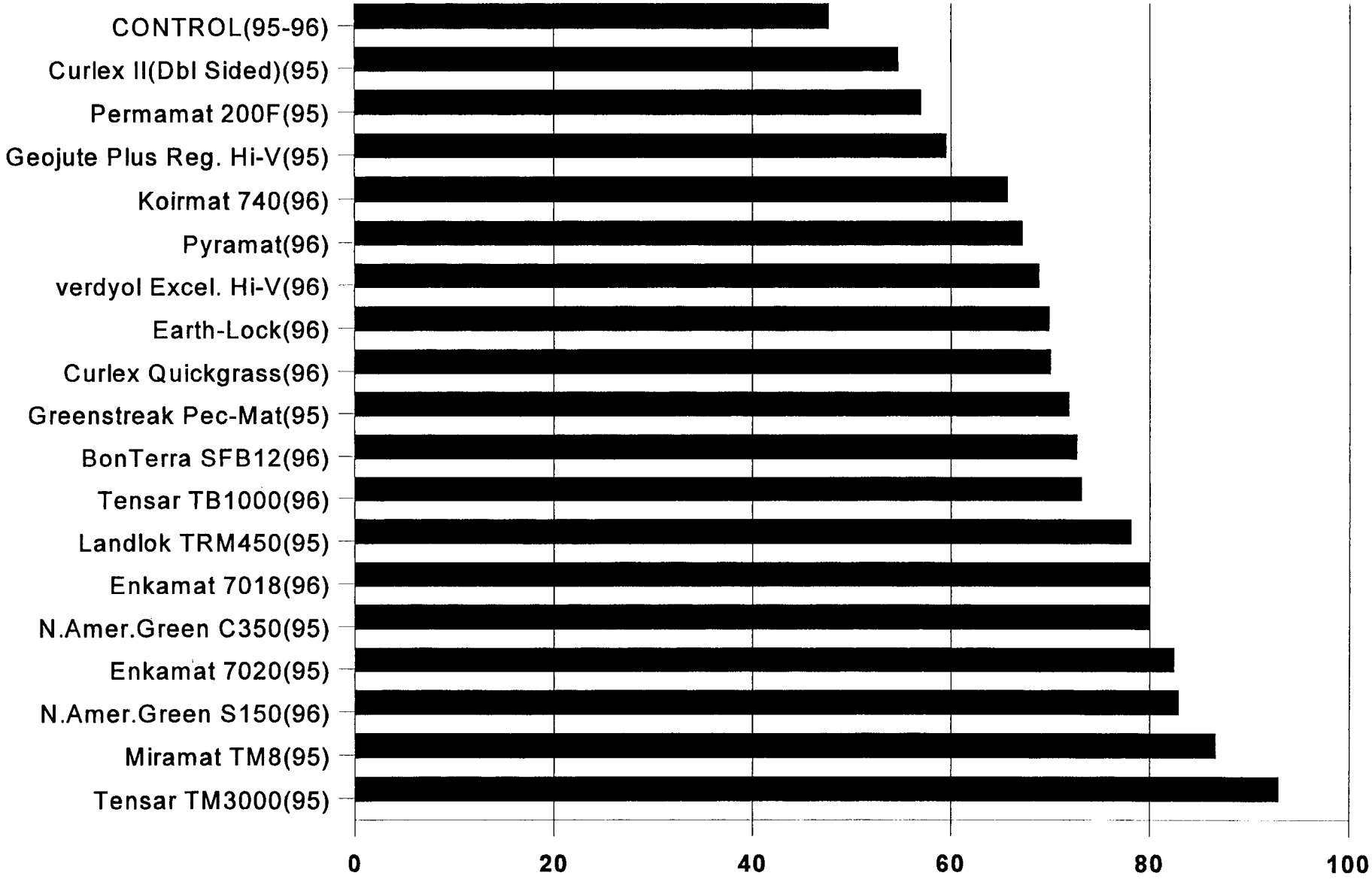
Class 2 - Flexible Channel Liners
Average Channel Deformation (Centimeters)
0 - 383 Pascal Flows (0 - 8 Lbs/Sq Ft)



Class 2 "Flexible Channel Liner" Applications

Final Vegetative Density

Class 2 - Flexible Channel Liners
Vegetation Density
(Percent of Cover Achieved by Final Measurement Round)



STATISTICAL ANALYSIS
Class 2 "Flexible Channel Liner" Applications

Soil Displacement
0 - 96 Pascal Shear Stress Flows

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DEF

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 1212 MSE= 1.090476
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 60.78435

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CRITICAL RANGE	.3717	.3913	.4044	.4142	.4218	.4280	.4332	.4376	.4415	.4449	.4479	.4507	.4531	.4553	.4574	.4593	.4610	.4627

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING					MEAN	N	CHANNEL
			A		-0.3541	56	NAG C350(95)
			A				
	B		A		-0.4166	56	KOIRMAT 740(96)
	B		A				
	B		A	C	-0.4932	56	EARTHLOCK(96)
	B		A	C			
	B		A	C	-0.4974	111	GEOPLUS HI-V(95)
	B		A	C			
	B		A	C	-0.4987	56	SFB12(96)
	B		A	C			
	B	D	A	C	-0.5611	56	LANDLOK 450(95)
	B	D	A	C			
	B	D	A	C	-0.5666	56	TM3000(95)
	B	D	A	C			
	B	D	A	C	-0.6784	56	MIRAMAT TM8(95)
	B	D	A	C			
	B	D	A	C	-0.7111	56	N/A/G S150(96)
	B	D	A	C			
E	B	D	A	C	-0.7170	56	TB 1000(96)
E	B	D	A	C			
E	B	D	A	C	-0.7766	56	VERDYOL HI-V(96)
E	B	D	A	C			
E	B	D	A	C	-0.7866	112	CURLEX II(95)
E	B	D		C			
E	B	D		C	-0.8312	56	ENKAMAT7018(96)
E	B	D		C			
E	B	D		C	-0.8648	56	PECMAT(95)
E		D		C			
E		D		C	-0.8745	56	PYRAMAT(96)
E		D					
E		D			-0.9736	56	ENKAMAT 7020(95)
E							
E					-1.1487	112	PERMAMAT200F(95)
			F		-1.9525	56	CONTROL
			F				
			F		-2.2950	56	CURLEX 1(96)

STATISTICAL ANALYSIS
Class 2 "Flexible Channel Liner" Applications

Soil Displacement
0 - 192 Pascal Shear Stress Flows

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

FINAL PERFORMANCE ANALYSIS - THROUGH THE 1996 CYCLE
SHEAR STRESS RANGE 0 - 192 PASCAL (0-4 LB/SQ/FT)

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DEF

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 3089 MSE= 3.682547
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 171.7056

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CRITICAL RANGE	.4061	.4276	.4420	.4526	.4609	.4678	.4735	.4783	.4826	.4863	.4896	.4926	.4953	.4978	.5000	.5021	.5041

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING			MEAN	N	CHANNEL
	A		-0.4646	168	NAG C350(95)
	A				
	A		-0.5171	168	SFB12(96)
	A				
	A		-0.5224	168	EARTHLOCK(96)
	A				
	A		-0.5732	168	KOIRMAT 740(96)
	A				
B	A		-0.5843	168	TM3000(95)
B	A				
B	A	C	-0.6113	195	GEOPLUS HI-V(95)
B	A	C			
B	A	C	-0.6637	168	TB 1000(96)
B	A	C			
B	A	C	-0.6642	168	ENKAMAT7018(96)
B	A	C			
B	A	C	-0.7398	168	VERDYOL HI-V(96)
B	A	C			
B	A	C	-0.7554	168	LANDLOK 450(95)
B	A	C			
B	A	C	-0.7565	168	PECMAT(95)
B	A	C			
B	A	C	-0.7871	168	MIRAMAT TM8(95)
B	A	C			
B	A	C	-0.8417	168	PYRAMAT(96)
B	A	C			
B	A	C	-0.8727	168	N/A/G S150(96)
B		C			
B		C	-1.0671	224	PERMAMAT200F(95)
		C			
		C	-1.0861	168	ENKAMAT 7020(95)
	D		-2.5096	168	CURLEX 1(96)
	E		-4.1225	168	CONTROL

STATISTICAL ANALYSIS
Class 2 "Flexible Channel Liner" Applications

Soil Displacement
0 - 287 Pascal Shear Stress Flows

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DEF

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 3348 MSE= 1.064538

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12
CRITICAL RANGE	.1710	.1800	.1861	.1906	.1941	.1969	.1993	.2014	.2032	.2047	.2061

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING			MEAN	N	CHANNEL
	A		-0.53046	280	SFB12(96)
	A				
	A		-0.54661	280	EARTHLOCK(96)
	A				
B	A		-0.59296	280	TM3000(95)
B	A				
B	A		-0.61543	280	NAG C350(95)
B	A				
B	A	C	-0.65571	280	ENKAMAT7018(96)
B		C			
B	D	C	-0.74893	280	TB 1000(96)
B	D	C			
B	D	C	-0.75157	280	LANDLOK 450(95)
	D	C			
	D	C	-0.82961	280	PECMAT(95)
	D				
E	D		-0.86039	280	PYRAMAT(96)
E					
E	F		-1.01689	280	MIRAMAT TM8(95)
	F				
	F		-1.07468	280	VERDYOL HI-V(96)
	G		-1.27800	280	ENKAMAT 7020(95)

151

STATISTICAL ANALYSIS
Class 2 "Flexible Channel Liner" Applications

Soil Displacement
0 - 383 Pascal Shear Stress Flows

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

FINAL PERFORMANCE ANALYSIS - THROUGH THE 1996 CYCLE
SHEAR STRESS RANGE 0 - 383 PASCAL (0-8 LB/SQ/FT)

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: DEF

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 4301 MSE= 1.407155

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11
CRITICAL RANGE	.1661	.1749	.1808	.1851	.1886	.1913	.1937	.1957	.1974	.1989

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	CHANNEL
A	-0.58745	392	SFB12(96)
A			
A	-0.59214	392	TM3000(95)
A			
A	-0.62929	392	NAG C350(95)
A			
A	-0.66827	392	EARTHLOCK(96)
A			
A	-0.69309	392	LANDLOK 450(95)
A			
A	-0.76309	392	TB 1000(96)
A			
A	-0.77329	392	PYRAMAT(96)
B	-0.99944	392	PECMAT(95)
B			
B	-1.06416	392	MIRAMAT TM8(95)
B			
B	-1.10008	392	ENKAMAT7018(96)
C	-1.32551	392	ENKAMAT 7020(95)

STATISTICAL ANALYSIS
Class 2 "Flexible Channel Liner" Applications

Final Vegetative Density

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

TXDOT/TTI HYDRAULICS AND EROSION CONTROL LABORATORY
FINAL PERFORMANCE ANALYSIS THROUGH THE 1996 EVALUATION CYCLE

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 665 MSE= 540.1087

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CRITICAL RANGE	10.76	11.32	11.70	11.99	12.21	12.38	12.53	12.66	12.77	12.87	12.96	13.04	13.11	13.17	13.23	13.28	13.33	13.38

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING					MEAN	N	CHANNEL
			A		92.853	36	TM3000(95)
			A				
	B		A		86.574	36	MIRAMAT TM8(95)
	B		A				
	B		A	C	82.834	36	N/A/G S150(96)
	B		A	C			
	B	D	A	C	82.394	36	ENKAMAT 7020(95)
	B	D		C			
	B	D	E	C	79.982	36	NAG C350(95)
	B	D	E	C			
	B	D	E	C	79.835	36	ENKAMAT7018(96)
	B	D	E	C			
F	B	D	E	C	78.116	36	LANDLOK 450(95)
F		D	E	C			
F		D	E	C	73.100	36	TB 1000(96)
F		D	E	C			
F		D	E	C	72.632	36	SPB12(96)
F		D	E	C			
F	G	D	E	C	71.830	36	PECMAT(95)
F	G	D	E				
F	G	D	E		69.982	36	CURLEX 1(96)
F	G	D	E				
F	G	D	E		69.880	36	EARTHLOCK(96)
F	G		E				
F	G		E	H	68.844	36	VERDYOL HI-V(96)
F	G			H			
F	G			H	67.161	36	PYRAMAT(96)
F	G			H			
F	G		I	H	65.643	36	KOIRMAT 740(96)
	G		I	H			
	G		I	H	59.490	36	GEOPLUS HI-V(95)
			I	H			
	J		I	H	56.954	36	PERMAMAT200F(95)
	J		I				
	J		I		54.664	36	CURLEX II(95)
	J						
	J				47.660	36	CONTROL

HYDRAULIC MULCHES
ITEM 164 "SEEDING FOR EROSION CONTROL"

This analysis level seeks to determine the final vegetation density which was achieved during the single March through December growing season by each of the separate hydraulic mulches.

Vegetative Density figures shown represent the average percent of vegetative cover achieved within the plot by the final measurement round only.

Cellulose Fiber Mulch Applications
Record of Product Evaluations
1:3 Slopes Only

Year	No	Product Evaluated	Clay	Sand
1991	No Cellulose Fiber Mulch Evaluations Performed			
1992	1	***American Fiber Mulch***	▨	▨
	2	***Conwed® Hydro Mulch®***	▨	▨
	3	***Second Nature® Regenerated Wood Fiber***	▨	▨
1993	Evaluation Cycle Cancelled Due to Weather Damage			
1994	1	***American Fiber Mulch (with Hydro-Stik)***	▨	
	2	***American Fiber Mulch (with Fiber Plus)***		▨
	3	***Pro Mat®***	▨	▨
	3	***Pro Mat® XL***	▨	▨
	4	***Pro Mat® (with RMBplus)***	▨	▨
	5	***Silva-Fiber Plus®***	▨	▨
1995	1	***Second Nature® Regenerated Wood Fiber***	▨	[1]
	2	***Excel Fibermulch® II***	▨	[1]
1996	1	***Enviro-Gro***	▨	▨
	2	***Excel Fibermulch® II***		▨
	3	***Second Nature® Regenerated Wood Fiber***		▨

NOTES: [1] Products were destroyed by natural rainfall event soon after installation. Product was reinstalled by TTI, but was subsequently destroyed by another rainfall event. TxDOT instructed TTI to cease performance evaluations.

This Page Left Blank

TABULAR DATA

Cellulose Fiber Mulch Applications

1:3 Clay

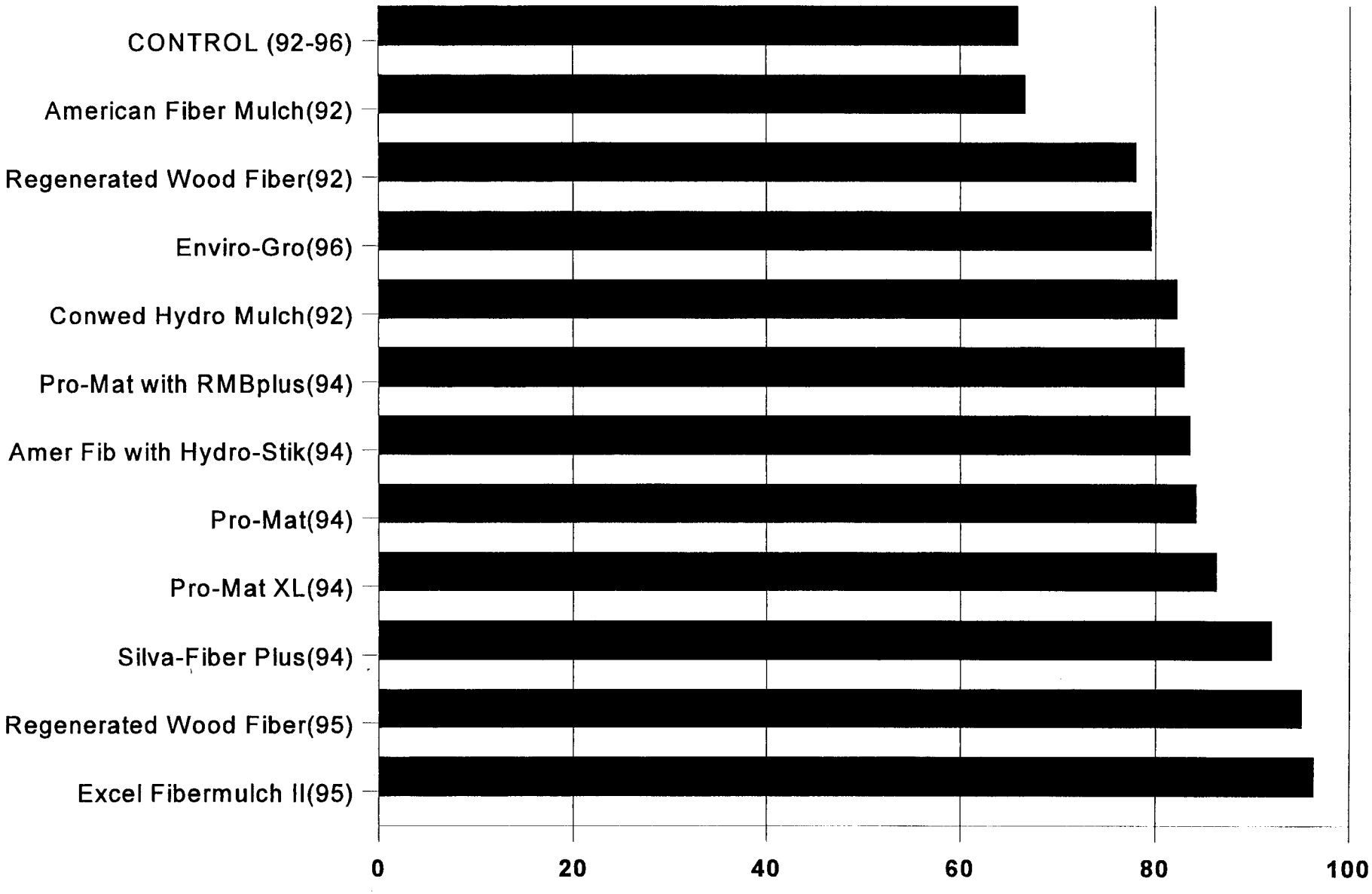
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Cellulose Fiber Mulch

1:3 Clay Slopes Only

Product Performance - 1996 Evaluation Cycle			
No	**Product Name**	**Year**	**Final Vegetation Density Standard (70%)**
1	*Enviro-Gro*	1996	79.534
Product Performance : 1991 - 1996 Evaluation Cycles			
No	**Product Name**	**Year**	**Final Vegetation Density Standard (70%)**
1	*Excel Fibermulch® II*	1995	96.328
2	*Second Nature® Regenerated Wood Fiber*	1995	95.079
3	*Silva-Fiber Plus®*	1994	91.983
4	*Pro Mat® XL*	1994	86.245
5	*Pro Mat®*	1994	84.154
6	*American Fiber Mulch (with Hydro-Stik)*	1994	83.568
7	*Promat® (with RMBplus)*	1994	82.960
8	*Conwed® Hydro Mulch®*	1992	82.169
9	*Enviro-Gro*	1996	79.534
10	*Second Nature® Regenerated Wood Fiber*	1992	77.968
11	*American Fiber Mulch*	1992	66.611
12	*CONTROL*	92-96	65.905

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

3:1 Clay Soils
Cellulose Fiber Mulches
Final Vegetative Density (Percent)



This Page Left Blank

TABULAR DATA
Cellulose Fiber Mulch Applications

1:3 Sand

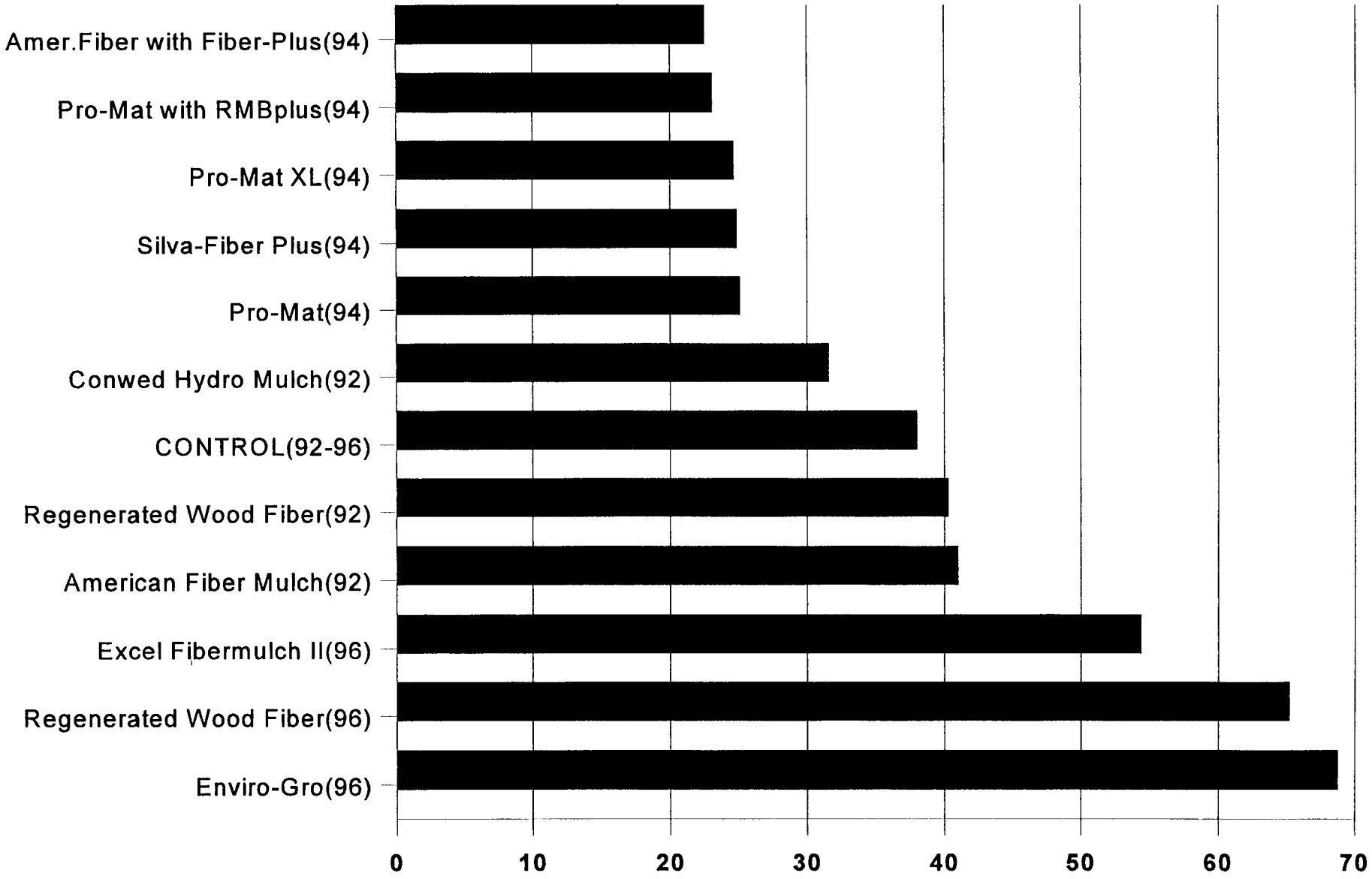
Texas Department of Transporation
Final Performance Analysis - Through the 1996 Evaluation Cycle
Cellulose Fiber Mulch

1:3 Sand Slopes Only

Product Performance - 1996 Evaluation Cycle			
No	**Product Name**	**Year**	**Final Vegetation Density Standard (70%)**
1	*Enviro-Gro*	1996	68.721
2	*Second Nature® Regenerated Wood Fiber*	1996	65.189
3	*Excel Fibermulch® II*	1996	54.372
Product Performance : 1991 - 1996 Evaluation Cycles			
No	**Product Name**	**Year**	**Final Vegetation Density Standard (70%)**
1	*Enviro-Gro*	1996	68.721
2	*Second Nature® Regenerated Wood Fiber*	1996	65.189
3	*Excel Fibermulch® II*	1996	54.372
4	*American Fiber Mulch*	1992	40.987
5	*Second Nature® Regenerated Wood Fiber*	1992	40.272
6	*CONTROL*	92-96	37.987
7	*Conwed® Hydro Mulch®*	1992	31.551
8	*Pro Mat®*	1994	25.070
9	*Silva-Fiber Plus®*	1994	24.833
10	*Pro Mat® XL*	1994	24.615
11	*Pro Mat® (with RMBplus)*	1994	23.045
12	*American Fiber Mulch (with Fiber Plus)*	1994	22.518

NOTE: Shaded cells (if any) indicate performance which failed to meet currently established minimum performance standards.

3:1 Sand Soils
Cellulose Fiber Mulches
Final Vegetative Density (Percent)



STATISTICAL ANALYSIS
Cellulose Fiber Mulch Applications

Final Vegetative Density
1:3 Clay Soils

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

---------- SOIL=CLAY ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 327 MSE= 303.3726
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 25.3051

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12
CRITICAL RANGE	9.63	10.14	10.48	10.73	10.93	11.09	11.22	11.33	11.43	11.52	11.59

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING			MEAN	N	PLOT
	A		96.328	26	FIBERMULCH2(95)
	A				
	A		95.079	26	REGEN FIBER(95)
	A				
B	A		91.983	26	SILVAFIB PLUS(94
B	A				
B	A	C	86.245	26	PROMAT XL(94)
B		C			
B		C	84.154	26	PROMAT(94)
B		C			
B		C	83.568	26	AMFIBTAK1(94)
B		C			
B		C	82.960	26	PROMAT TAC(94)
B		C			
B		C	82.169	20	CONWED(92)
		C			
		C	79.534	26	ENVIRO GRO(96)
		C			
		C	77.968	20	REGEN FIBER(92)
	D		66.611	19	AMER FIBER(92)
	D				
	D		65.905	72	CONTROL

STATISTICAL ANALYSIS
Cellulose Fiber Mulch Applications

Final Vegetative Density
1:3 Sand Soils

Analysis of Variance
Duncan's Multiple Range Test
Confidence Level = 95%

---------- SOIL=SAND ----------

ANALYSIS OF VARIANCE PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: COVER

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA= 0.05 DF= 327 MSE= 311.953
WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES= 25.43576

NUMBER OF MEANS	2	3	4	5	6	7	8	9	10	11	12
CRITICAL RANGE	9.74	10.26	10.60	10.85	11.05	11.21	11.35	11.46	11.56	11.65	11.73

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PLOT
A	68.721	26	ENVIRO GRO(96)
A			
A	65.189	26	REGEN FIBER(96)
B	54.372	26	FIBERMULCH2(96)
C	40.987	20	AMER FIBER(92)
C			
C	40.272	20	REGEN FIBER(92)
C			
C	37.987	71	CONTROL
C			
D C	31.551	20	CONWED(92)
D			
D	25.070	26	PROMAT(94)
D			
D	24.833	26	SILVAFIB PLUS(94
D			
D	24.615	26	PROMAT XL(94)
D			
D	23.045	26	PROMAT TAC(94)
D			
D	22.518	26	AMFIBTAK2(94)

APPENDIX A

Standard Specification Item 164
"Seeding for Erosion Control"

Texas Department of Transportation
1995 Standard Specifications
for Construction and Maintenance of
Highways, Streets and Bridges

Water used for preparing the sod for digging and keeping the sod moist from the source until it is planted shall be considered subsidiary to the various pay items involved.

"Fertilizer" will not be paid for directly, but will be considered subsidiary to this Item unless otherwise shown on the plans.

ITEM 164

SEEDING FOR EROSION CONTROL

164.1. Description. This Item shall govern for preparing ground, providing for sowing of seeds, mulching with straw, hay, or cellulose fiber and other management practices on areas shown on the plans and in accordance with this Item.

It includes seeding for permanent erosion control and seeding for temporary erosion control during the initial winter season.

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. The species and varieties of seed shall be from among the types specified in Tables 1A and 1B.

Table 1A. List of Selected Grass Species with Their Scientific and Common Names

Scientific Name	Common Name (Acceptable Varieties)	Season Warm/Cool	Native/ Introduced
Agropyron smithii	Western Wheatgrass	C	N
Andropogon hallii	Sand Bluestem	W	N
Avena sativa	Oats	C	I
Bothriochloa ischaemum	K-R Bluestem	W	I
Bouteloua curtipendula	Sideoats Grama (see seed mix table for appropriate varieties)	W	N
Bouteloua eriopoda	Black Grama	W	N
Bouteloua gracilis	Blue Grama (see seed mix table for appropriate varieties)	W	N
Buchloe dactyloides	Buffalograss	W	N
Cenchrus ciliaris	Buffelgrass	W	I
Chloris guyana	Rhodesgrass	W	I
Cynodon dactylon	Bermudagrass	W	I
Eragrostis trichodes	Sand Lovegrass (see seed mix table for appropriate varieties)	W	N
Festuca arundinaceae	Tall Fescue	C	N
Hordeum vulgare	Barley	C	I

Scientific Name	Common Name (Acceptable Varieties)	Season Warm/Cool	Native/ Introduced
Leptochloa dubia	Green Sprangletop	W	N
Panicum virgatum	Switchgrass (see seed mix table for appropriate varieties)	W	N
Paspalum notatum	Bahiagrass (Pensacola variety)	W	I
Schizachyrium scoparium	Little Bluestem (Texas origin only)	W	N
Setaria italica	Foxtail Millet	W	I
Setaria macrostachya	Plains Bristlegrass	W	N
Sorghastrum avenaceum	Indiangrass (see seed mix table for appropriate varieties)	W	N
Sporobolus cryptandrus	Sand Dropseed	W	N
Triticum aestivum	Wheat (Red, Winter)	C	I

Table 1B. List of Selected Legumes Species with Their Scientific and Common Names

Scientific Name	Common Name	Season Warm/Cool	Native/ Introduced
Trifolium incarnatum	Crimson Clover	C	I
Melilotus officinalis	Yellow Sweetclover	C	I
Vicia villosa	Hairy Vetch	C	I

851

(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".

(4) **Mulch.**

(a) **Straw Mulch or Hay Mulch.** Straw mulch shall be oat, wheat or rice straw. Hay mulch shall be prairie grass, bermudagrass or other hay as approved by the Engineer. The straw mulch or hay mulch shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

(b) **Cellulose Fiber Mulch.** It shall meet the requirements of and be approved by the Director of Construction and Maintenance. A list of pretested and approved materials will be maintained and can be obtained by writing the Director of Construction and Maintenance, 125 East 11th Street, Austin, Texas 78701-2483.

The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such that, when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder. It shall be kept in a dry condition until applied and shall not be molded or rotted.

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

(6) **Tacking Agents.** Tacking agents for straw or hay mulch shall be SS-1, unless otherwise shown on the plans. A biodegradable tacking agent may be used in lieu of the SS-1 tacking agent when approved by the Engineer. Asphaltic material shall conform to the requirements of Item 300, "Asphalt, Oils and Emulsions".

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 hereinafter described. Unless otherwise approved by the Engineer, all areas to be seeded shall be cultivated to a depth of at least 100 millimeters, 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 100 millimeters 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 hectare shall be of the type specified in Table 2 for rural areas (warm season), Table 3 for urban areas (warm season), Tables 4A and 4B for temporary erosion control (cool season) and Table 5 for temporary erosion control (warm season), with the mixture, rates and planting dates except as shown on the plans.

Table 2.
Rural Area Species-Specific Warm-Season Seeding Mixtures in Kilograms of Pure Live Seed Per Hectare, by District.

District and Planting Dates *		Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
1 (Paris)	(Eastern Sections)	(Western Sections)		(All Sections)	
Feb 1 - May 15	Green Sprangletop	Green Sprangletop	0.8	Green Sprangletop	1.2
	Bermudagrass	Bermudagrass	1.0	Bermudagrass	1.7
	Little Bluestem	Little Bluestem	1.6	Bahiagrass	7.5
	Indiangrass (Lometa)	Indiangrass (Lometa)	2.0	(Pensacola)	
		Switchgrass (Alamo or Blackwell)	1.6		

District and Planting Dates *		Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
2 (Ft. Worth)	(Eastern Sections)	(Western Sections)		(All Sections)	
Feb 1 - May 1	Green Sprangletop	Green Sprangletop	0.7	Green Sprangletop	0.8
	Sideoats Grama (El Reno)	Sideoats Grama (Haskell or El Reno)	2.0	Sideoats Grama (Haskell)	2.5
	Bermudagrass	Little Bluestem	1.2	Bermudagrass	1.0
	Little Bluestem	Indiangrass	1.7	Little Bluestem	1.6
	K-R Bluestem	(Lometa or Cheyenne)		Sand Dropseed	0.2
	Switchgrass (Alamo or Blackwell)	K-R Bluestem	0.8		
		Switchgrass (Alamo or Blackwell)	1.3		
3 (Wichita Falls)	(Eastern Sections)	(Western Sections, i.e., Clay Co. West)		(All Sections)	
Feb 1 - May 1 ** ***	Green Sprangletop	Green Sprangletop	0.8	Green Sprangletop	0.7
	Sideoats Grama (El Reno)	Sideoats Grama (El Reno)	2.5	Sideoats Grama (El Reno)	2.0
	Bermudagrass	Blue Grama (Lovington)	0.7	Bermudagrass	0.9
	Buffalograss	Buffalograss	7.2	Little Bluestem	1.2
	Western Wheatgr.	Western Wheatgr.	3.1	Sand Dropseed	0.2
				Sand Bluestem	0.2
4 (Amarillo)	(All Sections)			(All Sections)	
Feb 15 - May 15 ***	Green Sprangletop	1.0		Green Sprangletop	0.8
	Sideoats Grama (El Reno)	3.1		Sideoats Grama (El Reno)	2.5
	Blue Grama (Lovington)	0.9		Blue Grama (Lovington)	0.7
	Buffalograss	9.0		Sand Dropseed	0.2
				Sand Bluestem	0.2

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
5	(E. of IH 27)		(W. of IH 27)		(All Sections)	
(Lubbock)						
Feb 15 -	Green Sprangletop	1.0	Green Sprangletop	1.0	Green Sprangletop	0.8
May 15	Sideoats Grama	3.1	Sideoats Grama	3.1	Sideoats Grama	2.5
***	(El Reno)		(Coronado)		(Coronado)	
	Blue Grama	0.9	Blue Grama	0.9	Blue Grama	0.7
	(Lovington)		(Lovington)		(Lovington)	
	Buffalograss	9.0	Buffalograss	9.0	Sand Dropseed	0.2
					Sand Bluestem	0.2
6	(N. of Pecos River)		(S. of Pecos River)		(All Sections)	
(Odessa)						
Feb 1 -	Green Sprangletop	0.8	Green Sprangletop	1.0	Green Sprangletop	0.7
May 15	Sideoats Grama	2.5	Sideoats Grama	3.1	Black Grama	0.3
	(Premier or Uvalde)		(Premier or Tucson)		Blue Grama	0.6
	Black Grama	0.5	Black Grama	0.6	(Hachita)	
	Blue Grama	0.7	Blue Grama	0.9	Little Bluestem	1.2
	(Hachita)				Sand Dropseed	0.2
	Little Bluestem	1.6			Sand Bluestem	0.2
7	(All Sections)				(All Sections)	
(San Angelo)						
Feb 1 -	Green Sprangletop	0.8			Green Sprangletop	0.8
May 1	Sideoats Grama	2.5			Sideoats Grama	2.5
	(Haskell)				(Haskell)	
	Buffalograss	7.2			Little Bluestem	1.6
	Little Bluestem	1.6			K-R Bluestem	0.9
	K-R Bluestem	0.9			Sand Dropseed	0.2
8	(N., W., E. of and		(S. of Fisher Co.)		(All Sections)	
(Abilene)	including Fisher Co.)					
Feb 1 -						
May 15	Green Sprangletop	1.0	Green Sprangletop	1.0	Green Sprangletop	0.8
***	Sideoats Grama	3.1	Sideoats Grama	3.1	Sideoats Grama	2.5
	(Haskell)		(Haskell)		(Haskell)	
	Buffalograss	9.0	Buffalograss	9.0	K-R Bluestem	0.9
	Blue Grama	0.9	Little Bluestem	1.9	Sand Dropseed	0.2
	(Hachita)				Sand Bluestem	0.2

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
9	(E. of IH 35)		(W. of IH 35)		(All Sections)	
(Waco)						
Feb 1 -	Green Sprangletop	0.7	Green Sprangletop	0.7	Green Sprangletop	1.0
May 15	Bermudagrass	0.9	Sideoats Grama	2.0	Bermudagrass	1.3
	Little Bluestem	1.2	(Haskell or Premier)		K-R Bluestem	1.1
	Indiangrass	1.7	Buffalograss	5.9	Sand Dropseed	0.3
	(Lometa)		Little Bluestem	1.2		
	K-R Bluestem	0.8	K-R Bluestem	0.8		
	Switchgrass	1.3	Switchgrass	1.3		
	(Alamo)		(Alamo)			
10	(All Sections)				(All Sections)	
(Tyler)						
Feb 1 -	Green Sprangletop	0.8			Green Sprangletop	1.9
May 15	Bermudagrass	1.0			Bermudagrass	2.6
	Little Bluestem	1.6				
	Indiangrass	2.0				
	(Lometa)					
	Switchgrass	1.6				
	(Alamo)					
11	(All Sections)				(All Sections)	
(Lufkin)						
Feb 15 -	Green Sprangletop	0.7			Green Sprangletop	1.9
May 15	Bermudagrass	1.0			Bermudagrass	2.6
	Little Bluestem	1.6				
	Indiangrass	2.0				
	(Lometa)					
	Switchgrass	1.6				
	(Alamo)					

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
12 (Houston)	(All Sections)				(All Sections)	
Jan 15 - May 15	Green Sprangletop	0.7			Green Sprangletop	1.0
	Bermudagrass	0.9			Bermudagrass	1.3
	Little Bluestem	1.2			Bahiagrass	5.6
	Indiangrass	1.7			(Pensacola)	
	(Lometa)				K-R Bluestem	1.1
	K-R Bluestem	0.8				
	Switchgrass	1.3				
	(Alamo)					
13 (Yoakum)	(Wharton and Matagorda Cos.)		(All Other Sections)		(All Sections)	
Jan 15 - May 15	Green Sprangletop	1.0	Green Sprangletop	0.7	Green Sprangletop	0.8
	Bermudagrass	1.3	Bermudagrass	0.9	Bermudagrass	1.0
	Little Bluestem	1.9	Little Bluestem	1.2	Bahiagrass	4.5
	K-R Bluestem	1.1	Indiangrass	1.7	(Pensacola)	
			(Lometa)		Little Bluestem	1.6
			K-R Bluestem	0.8	K-R Bluestem	0.9
			Switchgrass	1.3		
			(Alamo)			
14 (Austin)	(E. of IH 35)		(W. of IH 35)		(All Sections)	
Feb 1 - May 15	Green Sprangletop	0.7	Green Sprangletop	0.7	Green Sprangletop	1.0
	Bermudagrass	0.9	Little Bluestem	1.2	Bermudagrass	1.3
	Little Bluestem	1.2	Indiangrass	1.7	Sand Lovegrass	0.9
	Indiangrass	1.7	(Lometa)		K-R Bluestem	1.1
	(Lometa)		Buffalograss	5.9		
	Buffalograss	5.9	Sideoats Grama	2.0		
	Sideoats Grama	2.0	(Haskell or Uvalde)			
	(Haskell or Uvalde)		Switchgrass	1.3		
			(Alamo)			

164.3

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
15 (San Antonio)	(Uvalde, Frio, and Atascosa Cos., N.E.)		(Zavala, LaSalle, and McMullen Cos., S.W.)		(All Sections)	
Feb 1 - May 1	Green Sprangletop	0.7	Green Sprangletop	0.7	Green Sprangletop	1.0
	Sideoats Grama	2.0	Sideoats Grama	2.0	Bermudagrass	1.3
	(Haskell or Uvalde)		(Haskell or Uvalde)		Buffelgrass	2.2
	Little Bluestem	1.2	Buffalograss	5.9	K-R Bluestem	1.1
	Bermudagrass	0.9	Plains Bristlegr.	1.1		
	Buffalograss	5.9	K-R Bluestem	0.8		
	K-R Bluestem	0.8	Bermudagrass	0.9		
16 (Corpus Christi)	(E. of U.S. 77)		(W. of U.S. 77)		(All Sections)	
	Green Sprangletop	0.8	Green Sprangletop	0.8	Green Sprangletop	1.0
Jan 15 - May 1	Bermudagrass	1.0	Rhodesgrass	0.5	Bermudagrass	1.3
	Sideoats Grama	2.5	Plains Bristlegr.	1.3	Buffelgrass	2.2
	(Haskell or Uvalde)		Buffalograss	7.2	K-R Bluestem	1.1
	Little Bluestem	1.6	K-R Bluestem	0.9		
	K-R Bluestem	0.9				
17 (Bryan)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	0.7			Green Sprangletop	1.2
	Bermudagrass	0.9			Bermudagrass	1.7
	Little Bluestem	1.2			Bahiagrass	7.5
	Indiangrass	1.7			(Pensacola)	
	(Lometa)					
	K-R Bluestem	0.8				
	Switchgrass	1.3				
	(Alamo)					

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
18	(E. of U.S. 75)		(W. of U.S. 75)		(All Sections)	
(Dallas)						
Feb 1 -	Green Sprangletop	0.7	Green Sprangletop	0.8	Green Sprangletop	1.2
May 1	Bermudagrass	0.9	Bermudagrass	1.0	Bermudagrass	1.7
	Little Bluestem	1.2	Sideoats Grama	2.5	Sand Dropseed	0.5
	Indiangrass	1.7	(El Reno)			
	(Lometa or Cheyenne)		Little Bluestem	1.6		
	Buffalograss	5.9	Indiangrass	2.0		
	Switchgrass	1.3	(Lometa or Cheyenne)			
	(Alamo or Blackwell)					
19	(All Sections)				(All Sections)	
(Atlanta)						
Feb 1 -	Green Sprangletop	0.7			Green Sprangletop	1.2
May 15	Bermudagrass	0.9			Bermudagrass	1.7
	Little Bluestem	1.2			Bahiagrass	7.5
	Indiangrass	1.7			(Pensacola)	
	(Lometa or Cheyenne)					
	Switchgrass	1.3				
	(Alamo)					
	Bahiagrass	3.7				
	(Pensacola)					
20	(All Sections)				(All Sections)	
(Beaumont)						
Jan 15 -	Green Sprangletop	0.8			Green Sprangletop	1.2
May 15	Bermudagrass	1.0			Bermudagrass	1.7
	Little Bluestem	1.6			Bahiagrass	7.5
	Indiangrass	2.0			(Pensacola)	
	(Lometa)					
	Switchgrass	1.6				
	(Alamo)					
21	(All Sections)				(All Sections)	
(Pharr)						
Jan 15 -	Green Sprangletop	0.8			Green Sprangletop	0.8
May 1	Rhodesgrass	0.5			Bermudagrass	1.0
	Plains Bristlegr.	1.3			Rhodesgrass	0.5
	Buffalograss	7.2			Buffelgrass	1.3
	K-R Bluestem	0.9			Sand Dropseed	0.2

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
22			(Val Verde Co.)		(All Sections)	
(Laredo)						
Jan 15 -	Green Sprangletop	0.8	Green Sprangletop	1.4	Green Sprangletop	0.8
May 1	Rhodesgrass	0.5	Sideoats Grama	2.7	Bermudagrass	1.0
	Plains Bristlegr.	1.3	K-R Bluestem	1.1	Rhodesgrass	0.5
	Buffalograss	7.2	Buffalograss	9.0	Buffelgrass	1.3
	K-R Bluestem	0.9			Sand Dropseed	0.2
23	(All Sections)				(All Sections)	
(Brownwood)						
Feb 1 -	Green Sprangletop	0.8			Green Sprangletop	0.7
May 15	Little Bluestem	1.6			Little Bluestem	1.2
	Sideoats Grama	2.5			Sideoats Grama	2.0
	(Haskell)				(Haskell)	
	Buffalograss	7.2			Bermudagrass	0.9
	K-R Bluestem	0.9			Sand Lovegrass	0.6
					Sand Dropseed	0.2
24	(All Sections)				(All Sections)	
(El Paso)						
Feb 1 -	Green Sprangletop	0.8			Green Sprangletop	1.0
May 1	Black Grama	0.5			Black Grama	0.6
****	Blue Grama	0.7			Blue Grama	0.9
	(Hachita)				(Hachita)	
	Sideoats Grama	2.5			Sand Dropseed	0.3
	(Tucson)					
	Sand Dropseed	0.2				
25	(All Sections)				(All Sections)	
(Childress)						
Feb 1 -	Green Sprangletop	0.8			Green Sprangletop	0.8
May 15	Sideoats Grama	2.5			Sideoats Grama	2.5
**	(El Reno)				(El Reno)	
	Blue Grama	0.7			Blue Grama	0.7
	(Lovington)				(Lovington)	
	Buffalograss	7.2			Little Bluestem	1.6
	Western Wheatgr.	3.1			Sand Dropseed	0.2

* Planting dates are optima.

** In the seed mix, Western Wheatgrass must be sown between September 1 and February 28.

*** In the seed mix, use Woodward variety of Sand Bluestem in the Rolling Plains (including the Canadian River Valley), and Elida variety of Sand Bluestem in the High Plains.

**** In the seed mix, substitute Premier variety of Sideoats Grama in E. Brewster Co.

Table 3.
Urban Area Species-Specific Warm-Season Seeding Mixtures in Kilograms of Pure Live Seed Per Hectare, by District.

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
1 (Paris)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.9			Green Sprangletop	1.9
	Bermudagrass	2.6			Bermudagrass	2.6
2 (Ft. Worth)	(Eastern Sections)		(Western Sections)		(All Sections)	
Feb 1 - May 1	Green Sprangletop	1.0	Green Sprangletop	1.2	Green Sprangletop	1.2
	K-R Bluestem	1.1	K-R Bluestem	1.5	K-R Bluestem	1.5
	Bermudagrass	1.3	Buffalograss	12.0	Bermudagrass	1.7
	Buffalograss	9.0				
3 (Wichita Falls)	(Eastern Sections)		(Western Sections)		(All Sections)	
	Green Sprangletop	1.2	Green Sprangletop	1.0	Green Sprangletop	1.2
Feb 1 - May 1 **	Bermudagrass	1.7	Sideoats Grama (El Reno)	3.1	Bermudagrass	1.7
	Buffalograss	12.0	Western Wheatgr.	3.9	Sand Dropseed	0.5
			Buffalograss	9.0		

District and Planting Dates *			Mixture for Use in Clay or Tight Soils	Mixture for Use in Sand or Sandy Soils	
4 (Amarillo)	(All Sections)			(All Sections)	
Feb 15 - May 15	Green Sprangletop	1.0		Green Sprangletop	1.0
	Sideoats Grama (El Reno)	3.1		Sideoats Grama (El Reno)	3.1
	Blue Grama (Lovington)	0.9		Blue Grama (Lovington)	0.9
	Buffalograss	9.0		Sand Dropseed	0.4
5 (Lubbock)	(All Sections)			(All Sections)	
Feb 15 - May 15	Green Sprangletop	1.0		Green Sprangletop	1.0
	Sideoats Grama (El Reno)	3.1		Sideoats Grama (Coronado)	3.1
	Blue Grama (Lovington)	0.9		Blue Grama (Lovington)	0.9
	Buffalograss	9.0		Sand Dropseed	0.4
6 (Odessa)	(All Sections)			(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.0		Green Sprangletop	1.0
	Black Grama	0.6		Black Grama	0.6
***	Blue Grama (Hachita)	0.9		Blue Grama (Hachita)	0.9
	Sideoats Grama	3.1		Sand Dropseed	0.3
7 (San Angelo)	(All Sections)			(All Sections)	
Feb 1 - May 1	Green Sprangletop	1.0		Green Sprangletop	1.0
	Buffalograss	9.0		K-R Bluestem	1.1
	K-R Bluestem	1.1		Sand Dropseed	0.3
	Sideoats Grama (Haskell)	3.1		Sideoats Grama (Haskell)	3.1

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
8 (Abilene)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	0.8			Green Sprangletop	1.0
	Buffalograss	7.2			Sand Dropseed	0.3
	Sideoats Grama (Haskell)	2.5			Sideoats Grama (Haskell)	3.1
	K-R Bluestem	0.9			K-R Bluestem	1.1
	Blue Grama (Hachita)	0.7				
9 (Waco)	(E. of IH 35)		(W. of IH 35)		(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.0	Green Sprangletop	1.0	Green Sprangletop	0.8
	Bermudagrass	1.3	Sideoats Grama (Premier or Haskell)	3.1	Bermudagrass	1.0
	K-R Bluestem	1.1	K-R Bluestem	1.1	Sideoats Grama (Premier or Haskell)	2.5
	Buffalograss	9.0	Buffalograss	9.0	K-R Bluestem	0.9
					Sand Dropseed	0.2
10 (Tyler)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.9			Green Sprangletop	1.9
	Bermudagrass	2.6			Bermudagrass	2.6
11 (Lufkin)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.9			Green Sprangletop	1.9
	Bermudagrass	2.6			Bermudagrass	2.6
12 (Houston)	(All Sections)				(All Sections)	
Jan 15 - May 15	Green Sprangletop	1.2			Green Sprangletop	1.2
	Bermudagrass	1.7			Bermudagrass	1.7
	K-R Bluestem	1.5			K-R Bluestem	1.5
13 (Yoakum)	(All Sections)				(All Sections)	
Jan 15 - May 15	Green Sprangletop	1.2			Green Sprangletop	1.2
	Bermudagrass	1.7			Bermudagrass	1.7
	K-R Bluestem	1.5			K-R Bluestem	1.5

District and Planting Dates *			Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
14 (Austin)	(E. of IH 35)		(W. of IH 35)		(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.0	Green Sprangletop	1.0	Green Sprangletop	1.0
	Bermudagrass	1.3	Buffalograss	9.0	K-R Bluestem	1.1
	Buffalograss	9.0	K-R Bluestem	1.1	Bermudagrass	1.3
	Sideoats Grama (Haskell)	3.1	Sideoats Grama (Haskell or Uvalde)	3.1	Sand Lovegrass	0.9
15 (San Antonio)	(E. of U.S. 281)		(W. of U.S. 281)		(All Sections)	
Feb 1 - May 1	Green Sprangletop	1.2	Green Sprangletop	1.0	Green Sprangletop	1.2
	Buffalograss	12.0	Sideoats Grama (Haskell or Uvalde)	3.1	Bermudagrass	1.7
	Bermudagrass	1.7	Buffalograss	9.0	Sideoats Grama (Haskell or Uvalde)	4.1
			Bermudagrass	1.3		
16 (Corpus Christi)	(E. of U.S. 77)		(W. of U.S. 77)		(All Sections)	
Jan 15 - May 1	Green Sprangletop	1.2	Green Sprangletop	1.0	Green Sprangletop	1.0
	Bermudagrass	1.7	K-R Bluestem	1.1	Bermudagrass	1.3
	K-R Bluestem	1.5	Buffalograss	9.0	K-R Bluestem	1.1
			Bermudagrass	1.3	Sand Dropseed	0.3
17 (Bryan)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.2			Green Sprangletop	1.2
	Bermudagrass	1.7			Bermudagrass	1.7
	K-R Bluestem	1.5			K-R Bluestem	1.5
18 (Dallas)	(All Sections)				(All Sections)	
Feb 1 - May 1	Green Sprangletop	1.2			Green Sprangletop	1.2
	Bermudagrass	1.7			Bermudagrass	1.7
	Buffalograss	12.0			Sand Dropseed	0.5
19 (Atlanta)	(All Sections)				(All Sections)	
Feb 1 - May 15	Green Sprangletop	1.9			Green Sprangletop	1.9
	Bermudagrass	2.6			Bermudagrass	2.6

District and Planting Dates *	Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
20 (All Sections)			(All Sections)	
(Beaumont)				
Jan 15 - Green Sprangletop	1.7		Green Sprangletop	1.7
May 15 Bermudagrass	1.3		Bermudagrass	1.3
21 (E. of U.S. 281)		(W. of U.S. 281)	(All Sections)	
(Pharr)				
Jan 15 - Green Sprangletop	1.0	Green Sprangletop 1.0	Green Sprangletop	1.0
May 1 Bermudagrass	1.3	Sideoats Grama 3.1	Bermudagrass	1.3
K-R Bluestem	1.1	(Premier or Uvalde)	K-R Bluestem	1.1
Buffalograss	9.0	K-R Bluestem 1.1	Sand Dropseed	0.3
		Buffalograss 9.0		
22		(Val Verde Co.)	(All Sections)	
(Laredo)				
Jan 15 - Green Sprangletop	1.0	Green Sprangletop 1.0	Green Sprangletop	1.0
May 1 Sideoats Grama	3.1	Sideoats Grama 3.1	Bermudagrass	1.3
(Premier or Uvalde)		(Haskell or Uvalde)	K-R Bluestem	1.1
K-R Bluestem	1.1	Buffalograss 9.0	Sand Dropseed	0.3
Buffalograss	9.0	Bermudagrass 1.3		
23 (All Sections)			(All Sections)	
(Brownwood)				
Feb 1 - Green Sprangletop	0.8		Green Sprangletop	0.8
May 15 Buffalograss	7.2		K-R Bluestem	0.9
K-R Bluestem	0.9		Bermudagrass	1.0
Sideoats Grama	2.5		Sideoats Grama	2.5
(Haskell)			(Haskell)	
Bermudagrass	1.0		Sand Dropseed	0.2
24 (All Sections)			(All Sections)	
(El Paso)				
Feb 1 - Green Sprangletop	0.8		Green Sprangletop	1.0
May 1 Black Grama	0.5		Black Grama	0.6
**** Blue Grama	0.7		Blue Grama	0.9
Sideoats Grama	2.5		Sand Dropseed	0.3
(Tucson)				
Sand Dropseed	0.2			

District and Planting Dates *	Mixture for Use in Clay or Tight Soils		Mixture for Use in Sand or Sandy Soils	
25 (All Sections)			(All Sections)	
(Childress)				
Feb 1 - Green Sprangletop	0.8		Green Sprangletop	0.8
May 15 Sideoats Grama	2.5		Sideoats Grama	2.5
** (El Reno)			(El Reno)	
Blue Grama	0.7		Blue Grama	0.7
(Lovington)			(Lovington)	
Western Wheatgr.	3.1		Western Wheatgr.	3.1
Buffalograss	7.2		Sand Dropseed	0.2

* Planting dates are optima.

** In the seed mix, Western Wheatgrass must be sown between September 1 and February 28.

*** North of Pecos River use either Premier or Uvalde varieties of Sideoats Grama in the seed mix. South of the Pecos River use either Premier or Tucson varieties in the seed mix.

**** In the seed mix, substitute Premier variety of Sideoats Grama in E. Brewster County.

(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 to 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.

(3) Straw or Hay Mulch 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 to 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 all components are placed in the equipment.

Immediately upon completion of planting of the seed, straw or hay mulch shall be spread uniformly over the seeded area at the rate of approximately 3.4 to 4.5 megagrams of hay mulch or 4.5 to 5.6 megagrams of straw mulch per hectare. When a mulching machine is used it must be approved by the Engineer and may be equipped to inject a tacking agent into the straw or hay mulch uniformly as it leaves the equipment at a rate of 0.25 to 0.5 liter of tacking agent per square meter of mulched area. When the tacking agent is placed by hand, then the rate of application for the tacking agent shall be approximately 0.7 liter per square meter.

(4) **Cellulose Fiber Mulch 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 to 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 that area to be seeded within 30 minutes after all components are placed in the equipment.

Immediately upon completion of planting of the seed, cellulose fiber mulch shall be spread uniformly over the seeded area at the following rates:

Sandy soils with 1:3 slope or less - min. 2.3 Mg/ha
Sandy soils with greater than 1:3 slope - min. 2.6 Mg/ha
Clay soils with 1:3 slope or less - min. 2.8 Mg/ha
Clay soils with greater than 1:3 slope - min. 3.4 Mg/ha

Cellulose fiber mulch rates are based on dry mass of mulch per hectare. When used, a mulching machine, approved by the Engineer, shall be equipped to eject the thoroughly wet mulch material at a uniform rate to provide the mulch coverage specified.

(5) **Drill 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. All varieties of seed, as well as fertilizer, may be distributed simultaneously provided that each component

is uniformly applied at the specified rate. Seed shall be drilled at a depth of from five (5) to ten (10) millimeters utilizing a pasture or rangeland type drill. All drilling shall be along the contour of the slope. After planting, the area shall be rolled with a roller integral to the seed drill, or a light corrugated drum roller or with another type of roller approved by the Engineer. All rolling of sloped areas shall be on the contour of the slopes.

(6) **Straw or Hay Mulching.** Mulch shall be spread uniformly over the area indicated on plans or as designated by the Engineer at the rate of approximately 3.4 to 4.5 megagrams of hay mulch or 4.5 to 5.6 megagrams of straw mulch per hectare. When used, a mulching machine approved by the Engineer shall be equipped to inject a tacking agent into the straw or hay mulch uniformly as it leaves the equipment at a rate of 0.25 to 0.5 liter of tacking agent per square meter of mulched area. If the straw or hay mulch and tacking agent are placed by hand, then the rate of application for the tacking agent shall be approximately 0.7 liter per square meter.

(7) **Soil Retention Blanket.** If specified on the plans, a soil retention blanket shall be applied in accordance with Item 169, "Soil Retention Blanket".

(8) **Watering.** Watering of the seeded area shall be conducted when, in the judgement of the Engineer, sufficient seedling survival is threatened by insufficient natural precipitation and shall be in accordance with Item 168, "Vegetative Watering".

(9) **Fertilizer.** Fertilizer, when required, shall be applied in accordance with Item 166, "Fertilizer".

164.4. Seeding for Cool Season Temporary Erosion Control.

(1) **Standard Seeding.** When specified on the plans or directed by the Engineer, temporary erosion control measures shall be performed. These measures shall consist of the sowing of seed mixtures appropriate for the season and the work and materials as required in Article 164.3. These measures shall be performed over the areas shown on the plans or where directed by the Engineer. Temporary erosion control measures shall be performed in addition to other "Seeding for Erosion Control" as herein specified. The pure live seed, of the cool season plants, planted per hectare shall be of the type specified, with the mixture, rate and planting dates as follows in Tables 4A and 4B, except as shown on the plans.

Table 4A.
Cool Season Grass Seeding Mixtures for Temporary Erosion Control, in Kilograms of Pure Live Seed per Hectare, by District.

Districts & Optimum Planting Dates	Common Name	Rate
Paris (1), Fort Worth (2), Wichita Falls (3), Amarillo (4), Lubbock (5), Abilene (8), Dallas (18), Brownwood (23), Childress (25) August 15 - November 30	Tall Fescue	4.5
	Western Wheatgrass	5.6
	Wheat (Red, Winter)	33.6
Odessa (6), San Angelo (7), El Paso (24) August 15 - November 30	Western Wheatgrass	8.4
	Wheat (Red, Winter)	50.4
Waco (9), Tyler (10), Lufkin (11), Austin (14), San Antonio (15), Bryan (17), Atlanta (19) September 1 - November 30	Tall Fescue	4.5
	Oats	23.5*
	Wheat (Red, Winter)	33.6
Houston (12), Yoakum (13), Corpus Christi (16), Beaumont (20), Pharr (21), Laredo (22) September 1 - November 30	Oats	71.7*

* May substitute Barley at 80.6 kg/ha divided by the number of species in the mix.

(2) Legume Seeding. When specified on the plans or directed by the Engineer, the following regionally adapted legumes shall be planted.

Table 4B.
Cool Season Legume Seeding for Temporary Erosion Control, in Kilograms of Pure Live Seed per Hectare, by District.

Districts & Optimum Planting Dates	Common Name	Rate
Paris (1), Fort Worth (2), Wichita Falls (3), Waco (9), Tyler (10), Lufkin (11), Houston (12), Bryan (17), Dallas (18), Atlanta (19), Beaumont (20) August 15 - November 30	Crimson Clover	7.8
Yoakum (13), Austin (14), San Antonio (15), Corpus Christi (16), Pharr (21), Laredo (22) September 1 - November 30	Hairy Vetch	9.0
Amarillo (4), Lubbock (5), Odessa (6), San Angelo (7), Abilene (8), Brownwood (23), El Paso (24), Childress (25) August 15 - November 30	Yellow Sweetclover	4.5

164.5. Seeding for Warm Season Temporary Erosion Control.

(1) Standard Seeding. When specified on the plans or directed by the Engineer, temporary erosion control measures shall be performed. This measure shall consist of the sowing of seed appropriate for the season and the work and materials as required in Article 164.3. These measures shall be performed over the areas shown on the plans or where directed by the Engineer. Temporary erosion control measures shall be performed in addition to other "Seeding for Erosion Control" as herein specified. The pure live seed planted per hectare shall be of the type specified, rate and seed planting date as follows in Table 5 except as shown on the plans.

Table 5.
Warm Season Seeding for Temporary Erosion Control, in Kilograms of Pure Live Seed per Hectare, by District.

Districts & Optimum Planting Dates	Common Name	Rate
Fort Worth (2), Wichita Falls (3), San Angelo (7), San Antonio (15), Corpus Christi (16), Dallas (18), Pharr (21), Laredo (22), El Paso (24) May 1 - August 31	Foxtail Millet	33.6
Paris (1), Amarillo (4), Lubbock (5), Odessa (6), Abilene (8), Waco (9), Tyler (10), Lufkin (11), Houston (12), Yoakum (13), Austin (14), Bryan (17), Atlanta (19), Beaumont (20), Brownwood (23), Childress (25) May 15 - August 31	Foxtail Millet	33.6

164.6. Measurement. "Straw or Hay Mulch" will be measured by the square meter or by the hectare, complete and in place.

All "Seeding", of the type specified, will be measured by the square meter or by the hectare, complete and in place.

164.7. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Broadcast Seeding", "Straw or Hay Mulch Seeding", "Cellulose Fiber Mulch Seeding", "Drill Seeding", "Straw or Hay Mulching", "Standard Seeding for Cool Season Temporary Erosion Control", "Legume Seeding for Temporary Erosion Control" or "Standard Seeding for Warm Season Temporary Erosion Control", of the common names specified. This price will be full compensation for furnishing all materials, including water for seed-fertilizer slurry and

hydraulic mulching, tacking agents if required, and for performing all operations necessary to complete the work.

Unless otherwise shown on the plans, fertilizer will not be paid for directly, but will be considered subsidiary work pertaining to this Item.

"Soil Retention Blanket" will be paid for under Item 169, "Soil Retention Blanket".

Water for irrigating the cultivated area or seedbed, when required, will be paid for under Item 168, "Vegetative Watering".

ITEM 166

FERTILIZER

166.1. Description. This Item shall govern for providing and distributing fertilizer over such areas as designated on the plans and in accordance with these specifications.

166.2. Materials. All fertilizer shall be delivered in bags or containers clearly labeled showing the analysis. The figures in the analysis represent the percent of nitrogen, phosphoric acid, and potash nutrients, respectively, as determined by the methods of the Association of Official Analytical Chemists. The fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service in accordance with the Texas Fertilizer Law.

The fertilizer shall have the analysis shown on the plans. The Contractor shall have the option of providing a fertilizer of a different analysis, if approved by the Engineer. However, the amount of each nutrient specified shall not be less than that shown on the plans.

166.3. Construction Methods. Fertilizer shall be in an acceptable condition for distribution and shall be applied uniformly over the specified area and at the rate shown on the plans. Distribution of fertilizer for the particular item of work shall be approved by the Engineer.

166.4. Measurement. When Fertilizer is specified on the plans to be a pay item, work and acceptable material for "Fertilizer" will be measured by the megagram as determined by approved scales or guaranteed mass of bags or containers as shown by the manufacturer.

166.5. Payment. Unless otherwise specified on the plans, the work performed and materials furnished in accordance with this Item will not be paid for directly but will be considered subsidiary to the various bid items of the contract.

When fertilizer is specified on the plans to be a pay item, the work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit price bid for "Fertilizer", of the analysis specified. This price shall be full compensation for furnishing all materials and performing all operations necessary to complete the work.

ITEM 168

VEGETATIVE WATERING

168.1. Description. This Item shall govern for the authorized application of water through an aboveground system to promote and sustain growth of grasses and other plants on those portions of the right of way as shown on the plans or as directed by the Engineer, and in accordance with this Item.

168.2. Materials. Water shall be furnished by the Contractor and shall be clean and free of industrial wastes and other substances harmful to the growth of vegetation.

168.3. Construction Methods. This work shall be done only at such time as directed by the Engineer. The Contractor shall furnish and operate watering equipment approved by the Engineer which will insure the distribution of water in a uniform and controllable rate of application. The Contractor shall apply the water in the required quantity where shown on the plans or as directed by the Engineer.

168.4. Measurement. This Item will be measured by the kiloliter as delivered on the designated areas.

168.5. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Vegetative Watering". This price shall be full compensation for furnishing and operating approved watering equipment and measuring devices and for furnishing and applying the water as directed including hauling, equipment, labor and incidentals necessary to complete the work.

APPENDIX B

Standard Specification Item 169
"Soil Retention Blanket"

Texas Department of Transportation
1995 Standard Specification
for Construction and Maintenance of
Highways, Streets and Bridges

ITEM 169

SOIL RETENTION BLANKET

169.1. Description. This Item shall govern for providing and placing wood, straw or coconut fiber mat, synthetic mat, paper mat, jute mesh or other material as a soil retention blanket for erosion control on slopes or ditches or for short-term or long-term protection of seeded or sodded areas as shown on the plans or as specified by the Engineer.

169.2. Materials.

(1) Soil Retention Blankets. All soil retention blankets must be prequalified by the Director of Construction and Maintenance prior to use.

Prequalification procedures and a current list of prequalified materials may be obtained by writing to the Director of Construction and Maintenance, 125 East 11th Street, Austin, Texas 78701-2483. A 300 millimeters x 300 millimeters sample of the material may be required by the Engineer in order to verify prequalification. Samples taken, accompanied by the manufacturer's literature, will be sent, properly wrapped and identified, to the Construction and Maintenance Division for verification.

The soil retention blanket shall be one (1) of the following classes and types as shown on plans:

(a) **Class 1.** "Slope Protection"

(i) **Type A.** Slopes 1:3 or flatter - Clay soils

(ii) **Type B.** Slopes 1:3 or flatter - Sandy soils

(iii) **Type C.** Slopes steeper than 1:3 - Clay soils

(iv) **Type D.** Slopes steeper than 1:3 - Sandy soils

(b) **Class 2.** "Flexible Channel Liner"

(i) **Type E.** Short-term duration (Up to 2 years)
Shear Stress (t_d) < 48 Pa

(ii) **Type F.** Short-term duration (Up to 2 years)
Shear Stress (t_d) 48 to 96 Pa

(iii) **Type G.** Long-term duration (Longer than 2 years)
Shear Stress (t_d) > 96 to < 239 Pa

(iv) **Type H.** Long-term duration (Longer than 2 years)
Shear Stress (t_d) $\geq$ 239 Pa

(2) Fasteners. Fasteners shall conform to the requirements shown on Standard Detail Sheet "Soil Retention Blanket (SRB)".

169.3. Construction Methods.

(1) General. The soil retention blanket shall conform to the class and type shown on the plans. The Contractor has the option of selecting an approved soil retention blanket conforming to the class and type shown on the plans and according to the current approved material list.

(2) Installation. The soil retention blanket, whether installed as slope protection or as flexible channel liner in accordance with the approved materials list, shall be placed within 24 hours after seeding or sodding operations have been completed, or as approved by the Engineer. Prior to placing the blanket, the area to be covered shall be relatively free of all rocks or clods over 40 millimeters in maximum dimension and all sticks or other foreign material which will prevent the close contact of the blanket with the soil. The area shall be smooth and free of ruts and other depressions. If as a result of rain, the prepared bed becomes crusted or eroded or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's expense.

Installation and anchorage of the soil retention blanket shall be in accordance with the Manufacturer's recommendations and the Standard Detail Sheet "Soil Retention Blanket (SRB)".

(3) Literature. The Contractor shall submit one (1) full set of manufacturer's literature and manufacturer's installation recommendations for the soil retention blanket selected in accordance with the approved material list.

169.4. Measurement. This Item will be measured by the square meter of surface area covered.

169.5. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under *"Measurement"*

will be paid for at the unit price bid for "Soil Retention Blanket" of the class and type shown on the plans. This price shall be full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work. Anchors, checks, terminals or junction slots, and wire staples or wood stakes will not be paid for directly but will be considered subsidiary to this Item.

ITEM 170

IRRIGATION SYSTEM

170.1. Description. This Item shall govern for constructing an irrigation system as shown on the plans and as approved by the Engineer.

170.2. General.

License Requirements. The Contractor shall be required to possess an irrigator's license issued by the Texas Board of Irrigators or employ such a licensed irrigator to construct the irrigation system. The Engineer may require documentation of such license for his records. The irrigation system shall be installed and maintained under the supervision of the licensed irrigator who must be on the site at all times during this work or at such times as required by the Engineer.

170.3. Materials. Materials shall conform to the requirements shown on the plans and to the following requirements.

(1) Irrigation Pipe. Irrigation pipe shall be polyvinyl chloride (PVC) conforming to ASTM D 1785, Schedule 40 or ASTM D 2241, SDR 13.5 or SDR 17 or SDR 21, as shown on the plans.

(2) Fittings. Fittings, not including valves or sprinkler heads, shall conform to ASTM D 2466.

(3) Encasement Pipe. Unless otherwise shown on the plans and specifications, encasement pipe shall be PVC conforming to ASTM D 1785, Schedule 40.

(4) Bentonite Slurry. The slurry shall be a viscous mixture of a commercial bentonite and fresh water. The slurry shall contain two (2) to eight (8) percent of the bentonite additive by mass.

APPENDIX C

Proposed Approved Product List
(Through the 1996 Evaluation Cycle)
Soil Retention Blankets

Class 1 "Slope Protection"
Class 2 "Flexible Channel Liner"

PROPOSED APPROVED PRODUCT LIST
Specification Item 169 - Soil Retention Blanket

Through the 1996 Evaluation Cycle

CLASS 1 - SLOPE PROTECTION APPLICATIONS:

TYPE A - Slopes 1:3 or Flatter - Clay Soils

Airtrol®
Anti-Wash®/Geojute®
BonTerra® S2™
BonTerra® S1™
C-Jute
Contech Standard
Contech Standard Plus
Curlex® I
ECS Straw Blanket Standard
ECS Excelsior Blanket Standard
Green Triangle Superior
Green Triangle Regular
Greenstreak® Pec-Mat™
Landlok® FRS 3112
Landlok® 407GT
Miramat® TM8™
North American Green S75
North American Green S150
North American Green SC150
Poplar Erosion Blanket
Soil Saver
Soil Guard™
SuperGro™
Tensar® Erosion Blanket TB1000
TerraJute
verdyol® ERO-MAT®
verdyol® Excelsior Standard
verdyol® Excelsior High-Velocity
Webmat 280
Xcel Superior
Xcel Regular

Type B - Slopes 1:3 or Flatter - Sandy Soils

BonTerra® S1™
BonTerra® CS2™
BonTerra® S2™
C-Jute
Contech Standard
Contech Standard Plus
Curlex®-LT
ECS Straw Blanket Standard
ECS Excelsior Blanket Standard
Geojute® Plus 1
Green Triangle Regular
Green Triangle Superior
Landlok® FRS 3112
Landlok® 407GT
Miramat® 1000
Miramat® TM8™
North American Green S150
North American Green SC150
North American Green S75
Poplar Erosion Blanket
Soil Guard™
TerraJute
verdyol® ERO-MAT®
verdyol® Excelsior Standard
Xcel Regular
Xcel Superior

PROPOSED APPROVED PRODUCT LIST
Specification Item 169 - Soil Retention Blanket

Through the 1996 Evaluation Cycle

CLASS 1 - SLOPE PROTECTION APPLICATIONS (continued):

Type C - Slopes Steeper than 1:3 - Clay Soils

Airtrol®
Anti-Wash®/Geojute®
BonTerra® S2™
BonTerra® S1™
C-Jute
Contech Standard Plus
Curlex® I
Green Triangle Superior
Greenstreak® Pec-Mat™
Landlok® 407GT
Landlok® FRS 3112
Miramat® TM8™
North American Green S75
North American Green S150
North American Green SC150
Soil Saver
Soil Guard™
SuperGro™
Tensar® Erosion Blanket TB1000
TerraJute
verdyol® Excelsior High-Velocity
Webmat 280
Xcel Superior

Type D - Slopes Steeper than 1:3 - Sandy Soils

BonTerra® CS2™
BonTerra® S2™
C-Jute
Contech Standard Plus
Curlex® I
Geojute® Plus 1
Green Triangle Superior
Landlok® 407GT
Landlok® FRS 3112
Miramat® 1000
Miramat® TM8™
North American Green SC150
North American Green S150
Soil Guard™
TerraJute
Xcel Superior

PROPOSED APPROVED PRODUCT LIST
Specification Item 169 - Soil Retention Blanket

Through the 1996 Evaluation Cycle

CLASS 2 - FLEXIBLE CHANNEL LINER APPLICATIONS

Type E - Shear Stress Range 0 - 96 Pascal (0 - 2 Lbs / Sq Ft):

BonTerra® SFB12™
Contech TRM C-45
Enkamat® 7020
Enkamat® 7018
Greenstreak® Pec-Mat™
Landlok® TRM 450
Miramat® TM8™
North American Green C350™ Three Phase™
North American Green S150
Tensar® Erosion Mat TM3000
Tensar® Erosion Blanket TB1000
Webmat 280

Type F - Shear Stress Range 0 - 192 Pascal (0 - 4 Lbs / Sq Ft)

BonTerra® SFB12™
Contech TRM C-45
Enkamat® 7018
Greenstreak® Pec-Mat™
Landlok® TRM 450
Miramat® TM8™
North American Green C350™ Three Phase™
North American Green S150
Tensar® Erosion Blanket TB1000
Tensar® Erosion Mat TM3000
Webmat 280

Type G - Shear Stress Range 0 - 287 Pascal (0 - 6 Lbs / Sq Ft)

BonTerra® SFB12™
Contech TRM C-45
Enkamat® 7018
Greenstreak® Pec-Mat™
Landlok® TRM 450
North American Green C350™ Three Phase™
Tensar® Erosion Mat TM3000
Tensar® Erosion Blanket TB1000
Webmat 280

Type H - Shear Stress Range 0 - 383 Pascal (0 - 8 Lbs / Sq Ft)

BonTerra® SFB12™
Contech TRM C-45
Landlok® TRM 450
North American Green C350™ Three Phase™
Tensar® Erosion Mat TM3000
Tensar® Erosion Blanket TB1000

APPENDIX D

Proposed Approved Product List
(Through the 1996 Evaluation Cycle)
Cellulose Fiber Mulches

Proposed Approved Product List
Cellulose Fiber Mulches

Through the 1996 Evaluation Cycle

Slopes 1:3 or Flatter - Clay Soils

American Fiber Mulch (with Hydro-Stik)
Conwed® Hydro Mulch®
Enviro-Gro
Excel® Fibermulch II with *Exact-Tac™*
Pro Mat®
Pro Mat® with *RMBplus*
Pro Mat® XL
Second Nature® Regenerated Wood Fiber
Silva-Fiber Plus®

Slopes 1:3 or Flatter - Sandy Soils

Enviro-Gro
Second Nature® Regenerated Wood Fiber

Note: TxDOT does not recommend the use of cellular fiber mulches as the primary revegetation technique for final revegetation efforts on slopes steeper than 1:3.