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WATER CANADA THE COMPLETE WATER MAGAZINE

Doing it right the first time

Vegetation Establishment Utilizing Soil Analysis and Stabilization Techniques

By: Stephen R. Zwilling

Overview:

- Understanding the fundamentals of erosion control
- Picking the right products for the application
- Options for stabilizing water conveyances
- Proper product installation
- New technologies

Terminology

RECP – Rolled Erosion Control Products

SMM – Stabilized Mulch Matrix

BFM/EFM – Bonded Fiber Matrix/Engineered Fiber Matrix

FRM – Fiber Reinforced Matrix

BMP – Best Management Practice

RUSLE – Revised Universal Soil Loss Equation

C Factor – Cover Factor used in RUSLE Equation

Percent Effectiveness – Inverse of C factor which relates to product performance

Revised Universal Soil Loss Equation - RUSLE

$$A=R*K*LS*C*P$$

- A =Tons per acre per year of eroded sediment
- R = Rainfall runoff erosivity factor
- K = Soil erodibility factor
- LS = Topographic factor
- ✓ C = Cover factor
- ✓ P = Support practice factor

“C” FACTOR IS CRITICAL FOR EROSION MANAGEMENT

The lower the ”C” factor value or (Cover Factor) an erosion control medium has the better control of soil loss.

High “C” Factor

Low “C” Factor

Traditional approach: defensive

We need to move from a Defensive Strategy – Sediment Control" (trapping soil particles after dislodgment)

To an Offensive Strategy
Upgraded erosion control practices

How to pick the Right Vegetation solution?

- What should I plant?
- What is my budget?
- How can it be stabilized?
- What am I trying to achieve on this site?

Picking the right erosion control product is critical

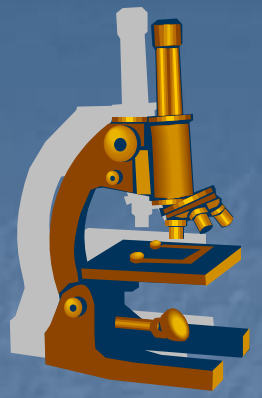
Understanding your soil and your plant material – questions to answer

- What kind soil are you working with?
- How well does it drain or retain water?
- Is a balanced environment – PH organics?
- What vegetation works well in this soil?
- What is the range of slope gradients?
- Were are the area's of concentrated water flow?
- What am I going to do with the water?
- What are the local sediment control regulations?
- What is the expected precipitation?

Agronomic Considerations

- Vegetation is critical to long-term erosion control
- **Start with a soil test**
- Enhance germination by providing the plant what it needs during first stages of growth
- Assure long-term plant survivability
- Establishment of healthier vegetation and less nutrient run-off

Soil Test – Key Factors



- Organic Matter
- pH
- Electrical Conductivity
- Total Dissolved Salts
- Sodium Absorption Ratio
- % Organic Acids
- Cation Exchange Capacity
- Nitrogen, Phosphate & Potassium (N, P, and K)

Organic Matter

Frequently associated with N Target 3- 5%, anything below 2% would be lacking,

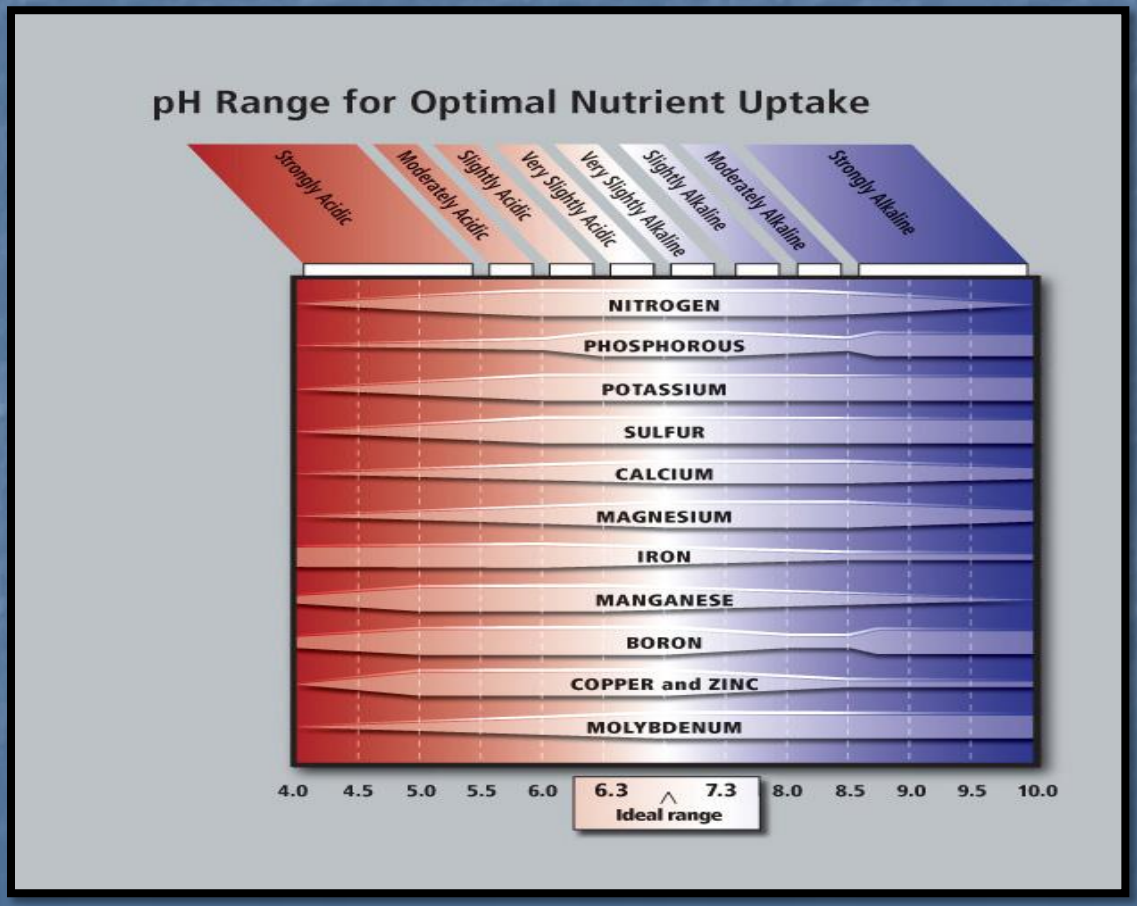
Phosphorus

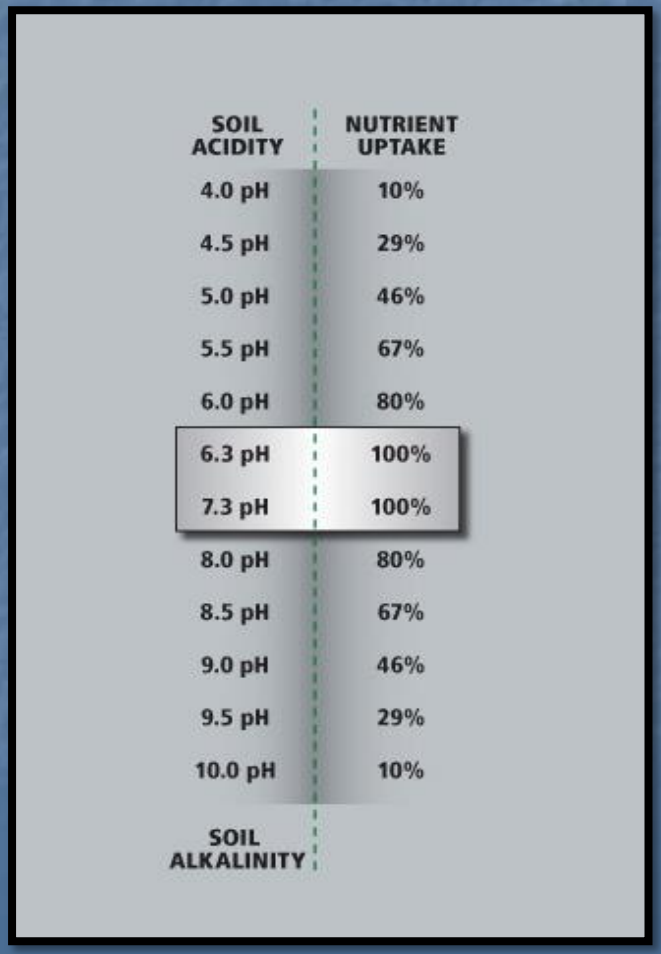
Important for early root development. Important to put the right amount out.

pH

Is critical - controls the availability of plant nutrients, too low “acid” too high “alkaline”.

How pH Affects Nutrient Uptake





Growth Stimulants can help to improve organics and plant growth

Fertilizer Alone

Fertilizer plus Endo Mycorrihizae

Hydraulically Applied Soils

ProGanics™ is engineered to shoot smoothly
for optimum performance.

Designed as a topsoil alternative that brings depleted soils back to life!

Grassing Options

Sod Stabilization

- Provides immediate protection & vegetation
- Can be used in buffer areas for filtration of runoff
- Great erosion control but very expensive

Seeding

- Quick revegetation of disturbed sites
- Requires selection of appropriate seed mix
- Site specific stabilization materials are needed to keep seed in place

Straw Mulch

Advantages

Low cost seeding practice

Fast way of distributing seed and mulching

Disadvantages

Poor erosion control qualities

Weed seed contamination

Messy and can blow away

Erosion Blankets – Picking the right one

- Easy to transport
- Ideal for small areas critical slopes
- Wide range of choices: strength, longevity and materials

- Can be labor intensive
- Requires a fine graded soil
- Requires staples
- Seed migration is possible
- Nettings can be an issue with mowing

Proper installation, staple patters and grading are critical for success

Good soil to blanket contact is critical!

JOURNAL OF SOIL AND WATER CONSERVATION

IN THIS ISSUE

EROSION CONTROL AND SNAKES DON'T MIX

VALUE OF CARBON CREDITS

RESERVOIR SEDIMENT

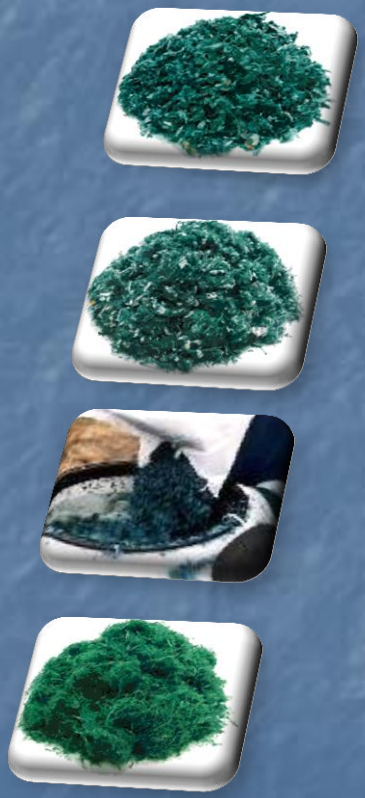
Hydroseeding

- Can be customized site specific
- Economical way to grow grass
- Provides a wide range of performance platforms
- Minimal labor – very efficient

Types of Fiber Mulch

Seeding Mulches

- Cellulose
- Cellulose / tack
- Blend
- Blend with tack
- Palletized fiber
- Wood Fiber
- Wood with Tack



Erosion Control Mulches

- Stabilized Mulch Matrix (SMM)
- Bonded Fiber Matrix (BFM/EFM)
- Fiber Reinforced Matrix (FRM)

“Spray-on Erosion Control”

Mix into hydro-seeder, add seed and fertilizer then shoot from hose or cannon

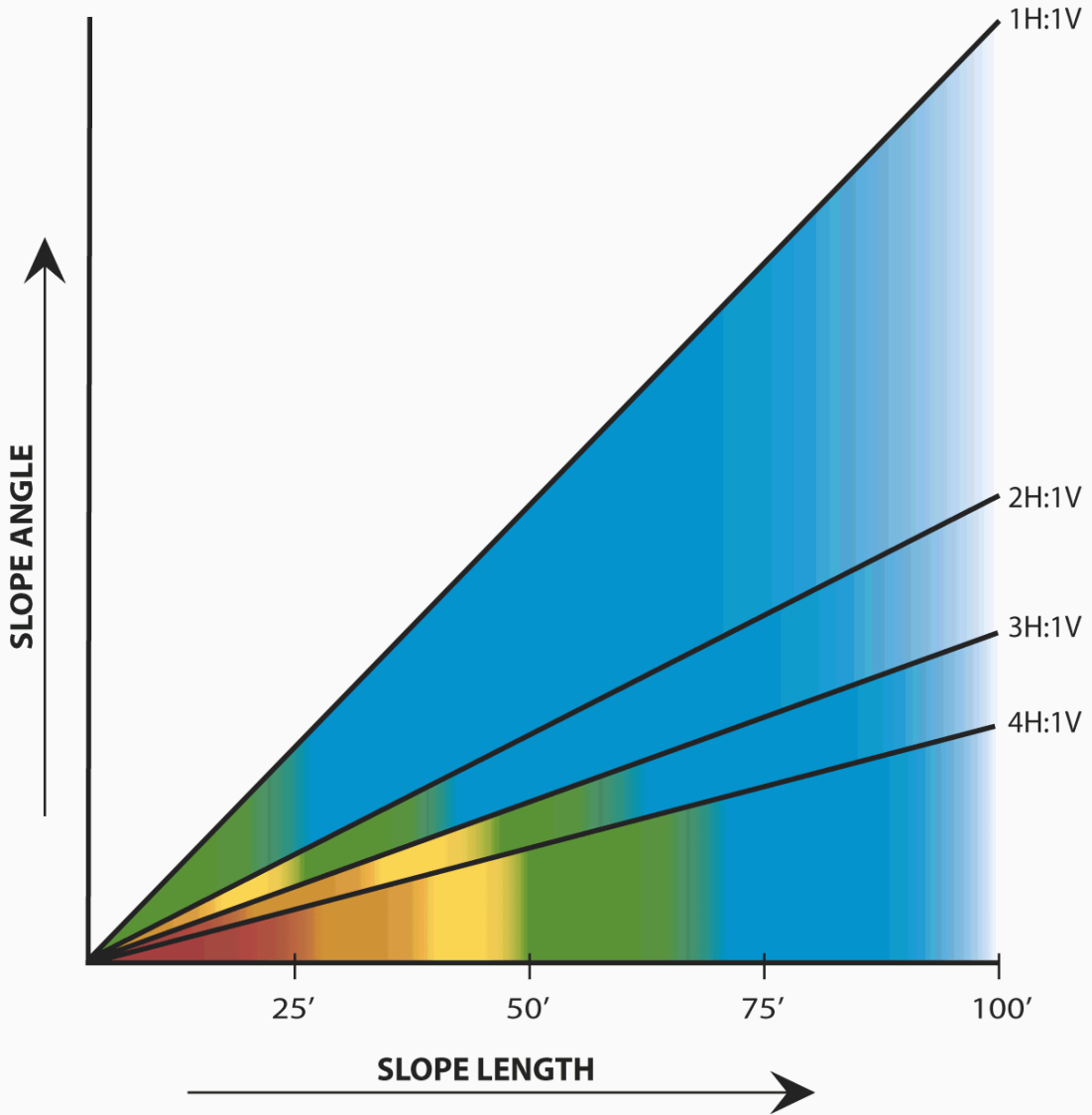
Hydraulic Mulch Rates Makes a Big Difference in Results

Test Plot 1 After 18 Days
(1,500 lbs. mulch)

Test Plot 3 After 18 Days
(3,000 lbs. mulch)

Test Plot 2 After 18 Days
(2,250 lbs. mulch)

Slope Protection Guidelines by Product Category



FGM =
BFM =
SFM =
Wood Fiber =
Blends and Paper =

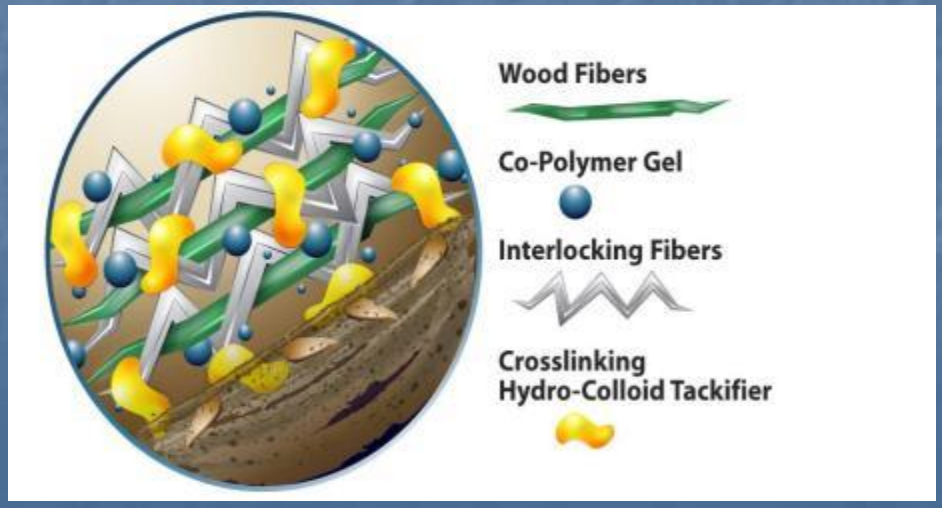
Erosion Control Mulches

BFM/EFM

- Application rate can be customized to accommodate steep, rough or irregularly shaped slopes
- Cost effective versus sod or erosion control blankets
- Saves time and labor
- Approved by numerous DOTs and agencies
- Not designed for areas of concentrated water flow
- Functional Longevity - 6 -12 months

Fiber Reinforced Matrix

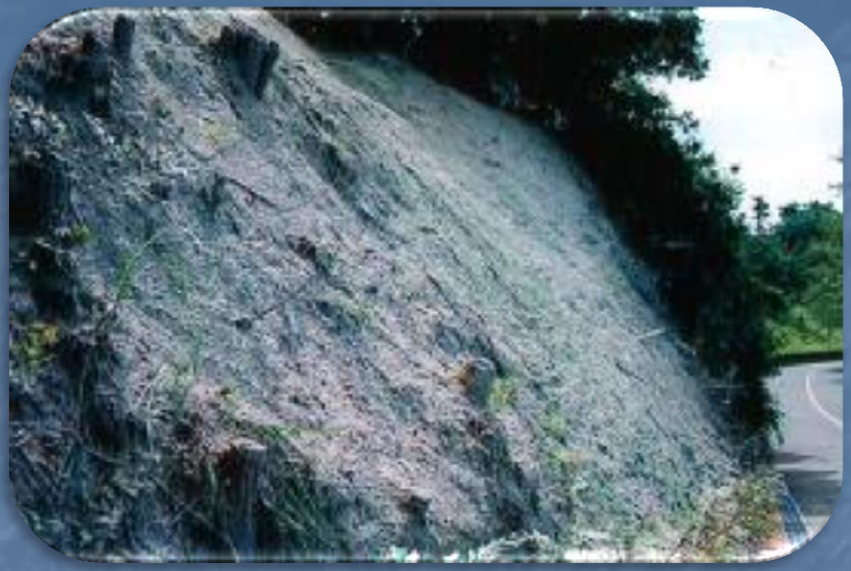
- 40% Greater Loft than BFMs
- Cavities Increase Water Holding Capacity
- Superior Vegetative Establishment
- Chemical and Mechanical Bonding
- No cure time – effective upon application
- 99% Erosion Control Effectiveness



Adhesion to Soil

FRM unique combination of mechanical and chemical bonding creates an erosion control blanket with unequaled structure and adhesion to soil

Fiber Reinforced Matrix (FRM)



Erosion Control Effectiveness after Curing

TESTING FACILITY	UWRL[1]	SDSU/SERL[2]	TTI[3]	TRI[4]
Test Method	Lab Protocol[1]	Lab Protocol[2]	Lab Protocol[3]	ASTM D6459[4]
Application Rate	3,000 lb/ac	3,500 lb/ac	3,500 lb/ac	3,500 lb/ac
Test Conditions[5]: Slope Gradient Soil Type Test Duration	 2.5H:1V sandy loam 1 hr	 2H:1V clayey sand 3 successive 1.8 hr	 2H:1V sandy loam 3 successive 1/2 hr	 3H:1V sandy loam 3 successive 1/3 hr
Rainfall Rate	5 in/hr	1.9 in/hr	3.5 in/hr	2, 4, 6 in/hr
Cover or "C" Factor[6]	0.0004	0.0001	0.0026	0.01
% Effectiveness[6]	99.96%	99.99%	99.74%	99%

1. UWRL—**Utah Water Research Laboratory**—Lab protocol developed over 20 years of rainfall simulation testing.
2. SDSU/SERL—**San Diego State University/Soil Erosion Research Laboratory**—Testing simulated three successive 50-year storm events in Los Angeles Basin.
3. TTI—**Texas Transportation Institute**—Hydraulics, Sedimentation and Erosion Control Laboratory under auspices of Texas DOT.
4. TRI—**TRI/Environmental, Inc.**—"Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hill Slopes from Rainfall Erosion"
5. Testing conducted on fully cured matrix.
6. Cover or "C" Factor determined from comparison of treated slope vs. bare slope condition. The "C" Factor is the component of the Modified Universal Soil Loss Equation (MULSE) that measures the erosion control effectiveness of a product. % Effectiveness = One minus "C" Factor times 100%.

When should I specify a FRM?

- Cost effective option to blankets
- Slopes up to 1:1
- When getting grass is a priority
- Requires no curing / drying time
- Poorly graded soils
- Not for concentrated flow areas

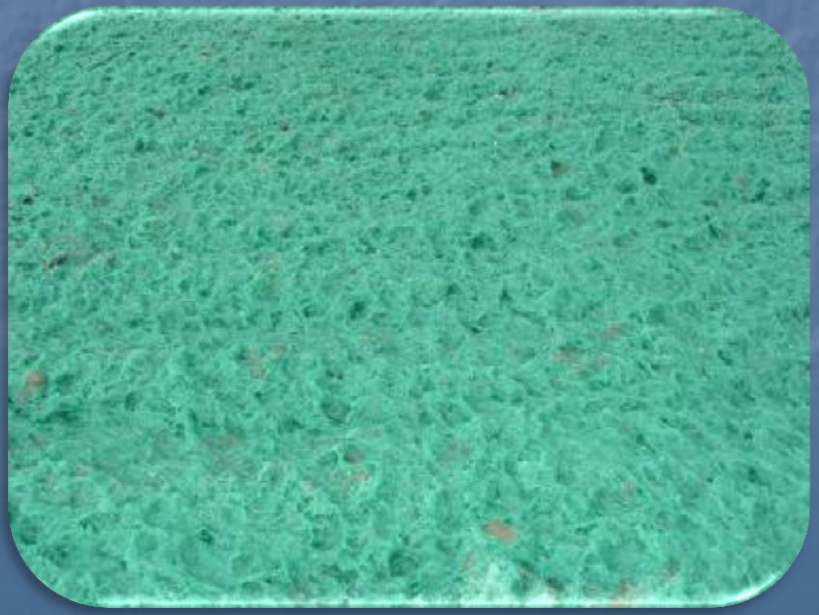
When should I use a blanket?

- Smaller projects
- When a Hydroseeder is not available
- When greater than 1 year longevity is needed
- When water is not located near the site
- Some can be used on concentrated flow areas

Applying (FRM – BFM/EFM – SMM)

- Use a fan-type nozzle (50-degree tip) whenever possible for best soil surface coverage.
- Apply FGM from opposing directions to soil surface reducing the shadow effect and assuring a minimum of 95% soil surface coverage.
- Two Step Method provides the best seed to soil contact

Proper Application



Improper Application

Highway Projects using FRM

Griffith Park Fire

JFK Airport Project – 2009 - 2015
NJ/NY Port Authority


03/22/2007

General seeding for area's 5:1 or less

Seed and Straw / Hydroseeding / broadcast seeding

Slopes 5:1 to 3:1

Seed and Straw with tack / Hydroseeding with tack

Slopes 3:1 to 2:1

Erosion Control Blankets / BFM/EFM

TRM or FRM

Slopes 2:1 to 1:1

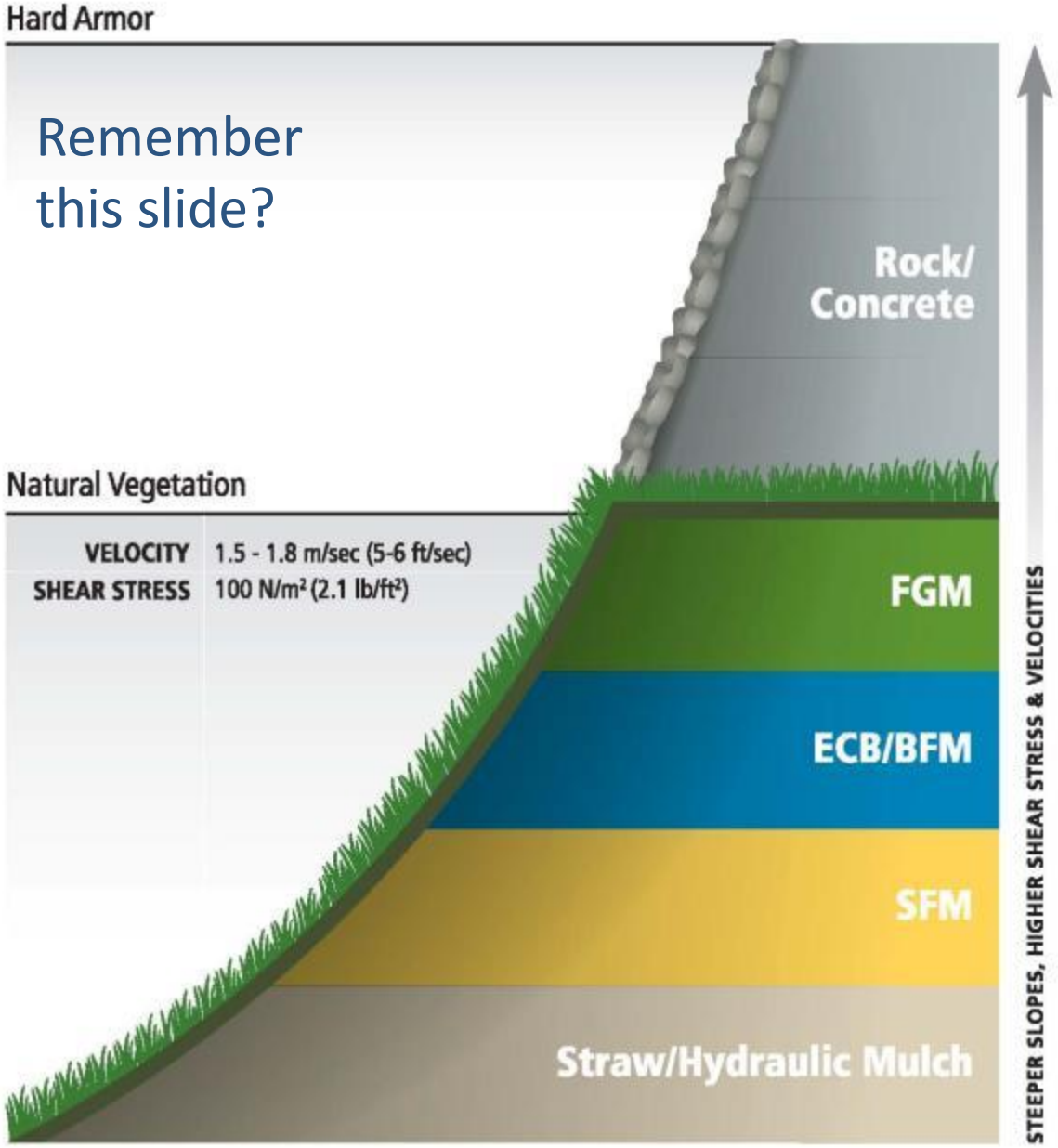
Erosion Control Blankets / TRM or FRM

Slopes 1:1 or greater

TRM /FRM or structural support

Options for moderate to high flow areas on slopes or conveyance

- Rip rap
- Articulated block systems
- Concrete lined channels
- Retaining walls
- Turf Reinforcement Mats



Limits of Natural Vegetation

Techniques for controlling erosion

Limits of Natural Vegetation

Velocity - 1.5 - 1.8 m/sec (5 - 6 ft/sec)

Shear stress - 100 N/m^2 (2.1lb/ft^2)


Rip Rap,….and concrete

Schematic of TRM

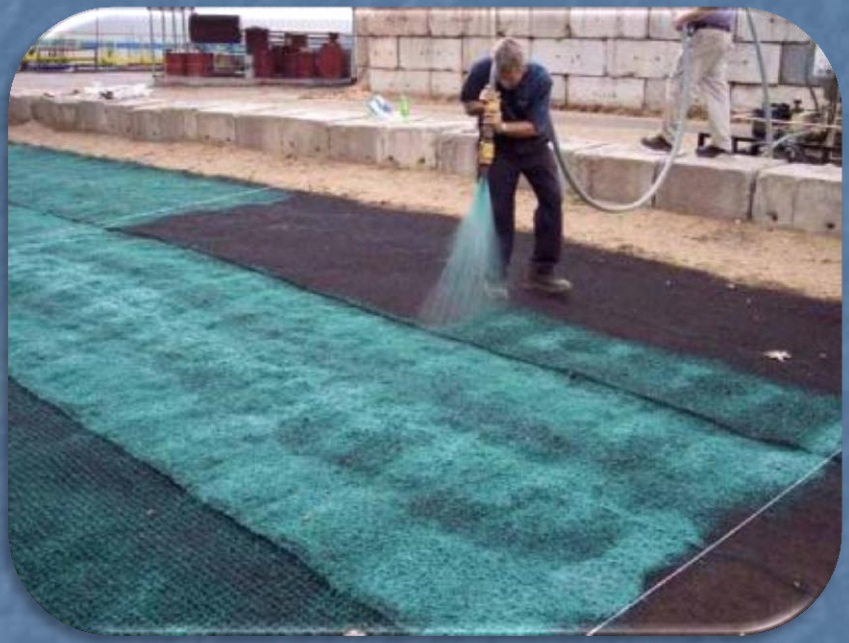
Root Reinforcement
Soil Filled Matrix

Stem Reinforcement
Stitch-Bonded Product

Which system is going to provide greater performance?

Infilling TRM's with soil or a growing medium is critical for successful turf establishment and root reinforcement

New composite 3D-TRM system in-filled with FRM or BFM



Some mats accept infill and grow grass better than others

Composition of a 3D-TRM / FRM system

3D TRM/FGM System


Composite Systems can establish
high density grass


11.27.2007

Slope Application with Hydraulic Infill – UNC Chapel Hill


2007 11 14

Keys to Installation

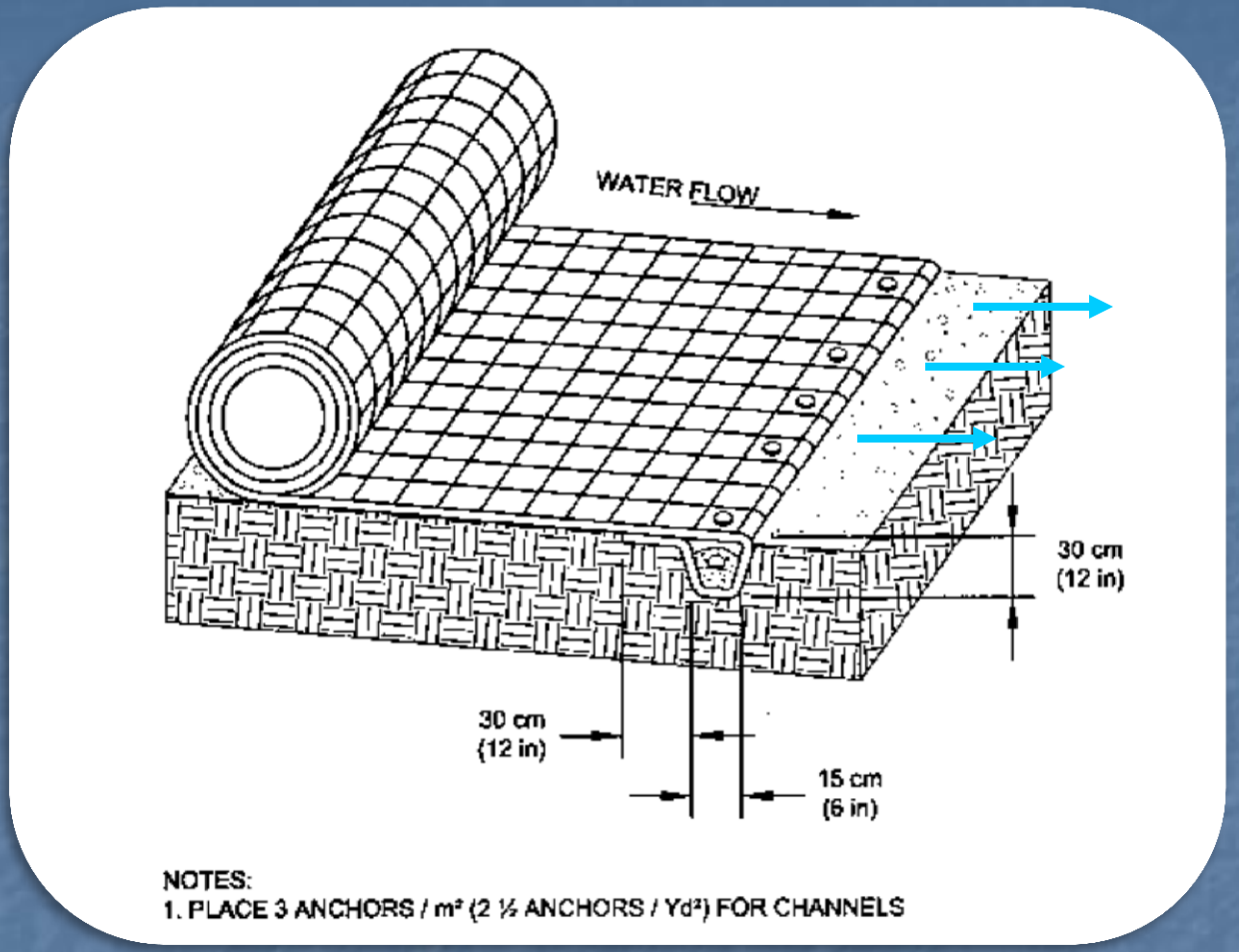
SOIL CONTACT: Establishing intimate contact with the final soil grade is essential for any successful TRM installation

ANCHORS: Proper anchor selection, frequency and pattern is another essential aspect of successful TRM installation

ANCHOR TRENCHES: Protecting the integrity of the TRM with proper termination, longitudinal and check slot anchor trenches is the final essential issue in successful TRM installation

Installation

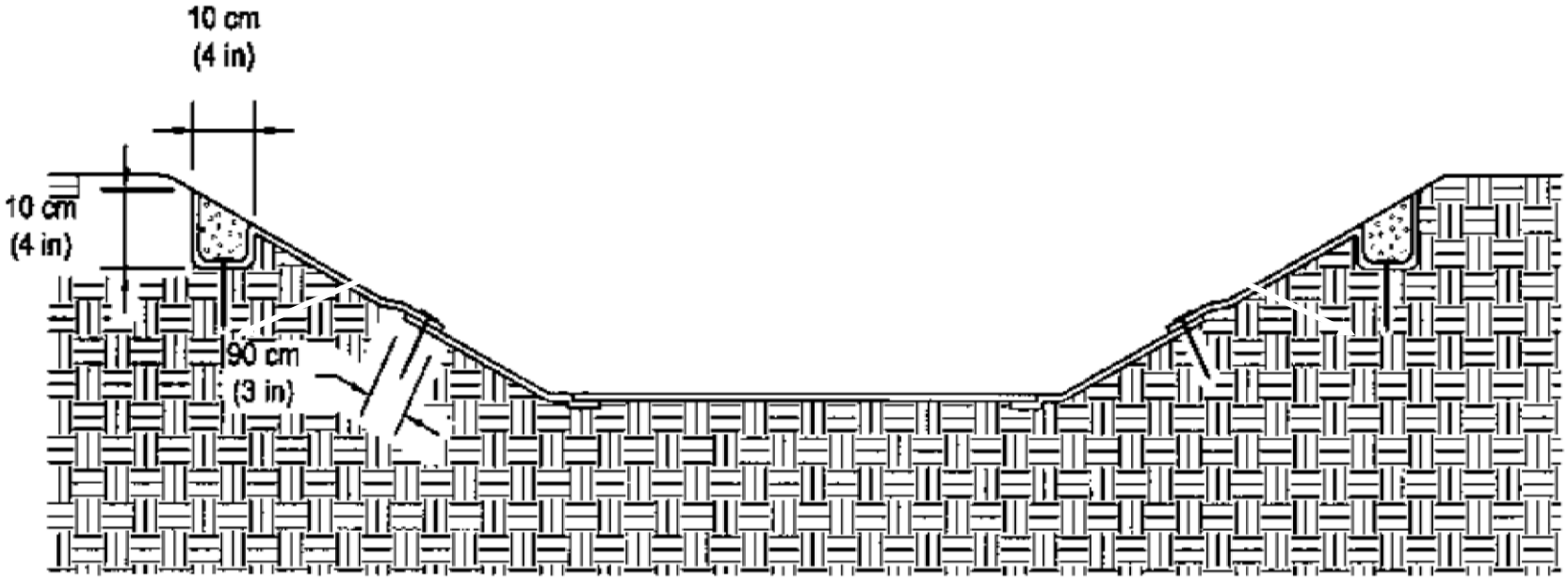
Initial anchor trench detail



Required to prevent flow leaving reinforced area from taking soil with it.

Installation

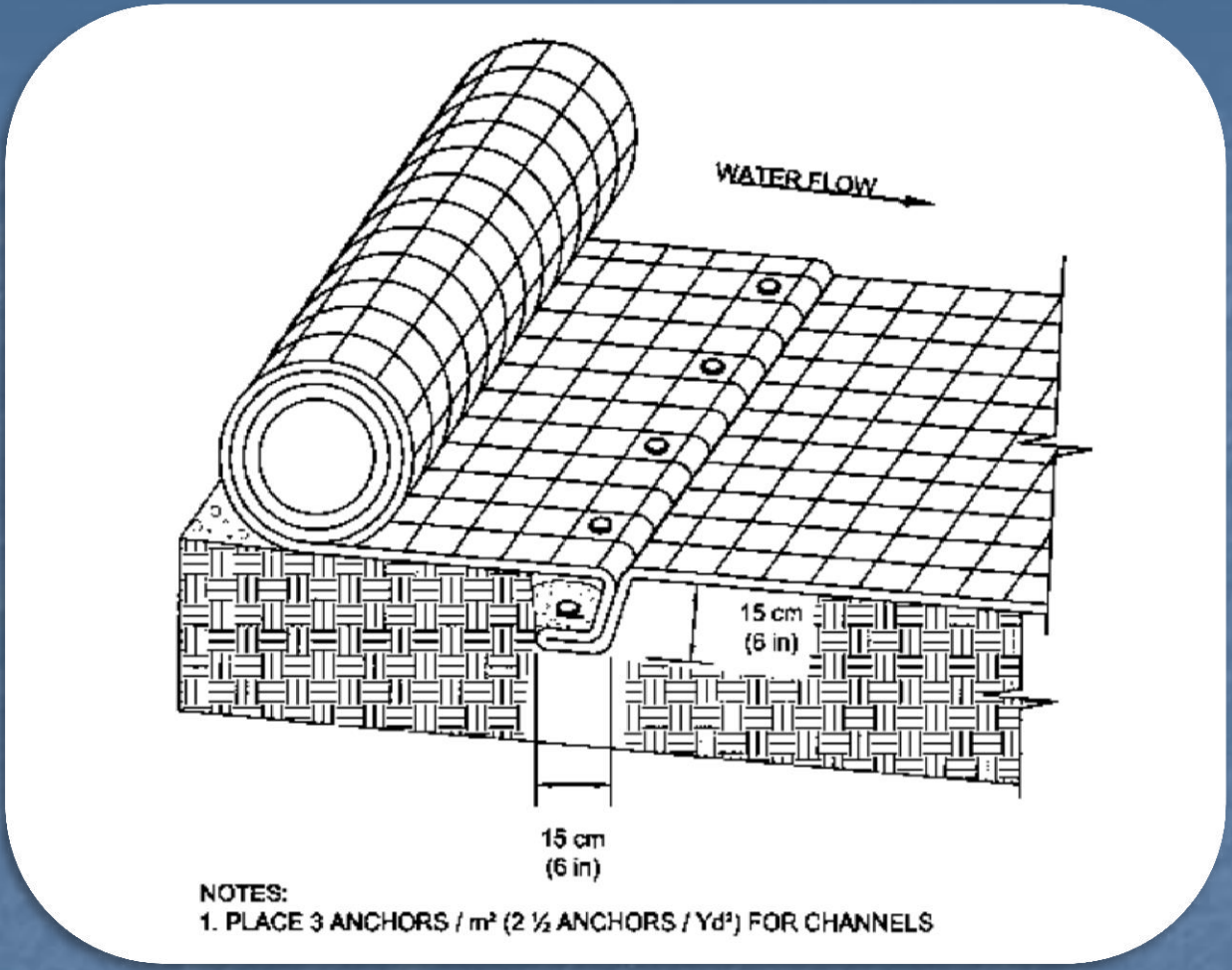
Longitudinal anchor trench detail



Required to prevent flow coming in along sides of channel, or overtopping protected area, from undercutting mat.

Installation

Intermittent check slot detail

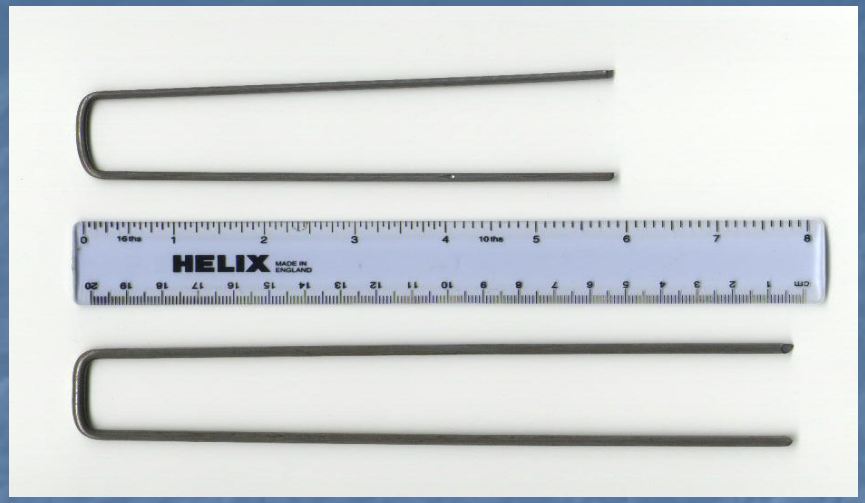


Help to anchor mat and provide protection from problem spots running the length of the mat installation.

Anchors

ECBs generally use 6”x 1”x 6” 11 Gauge U shaped Staples

TRMs at a minimum use 8”x 1”x 8” 8 Gauge U shaped Staples, 12” welded wire pins ate recommended in many applications

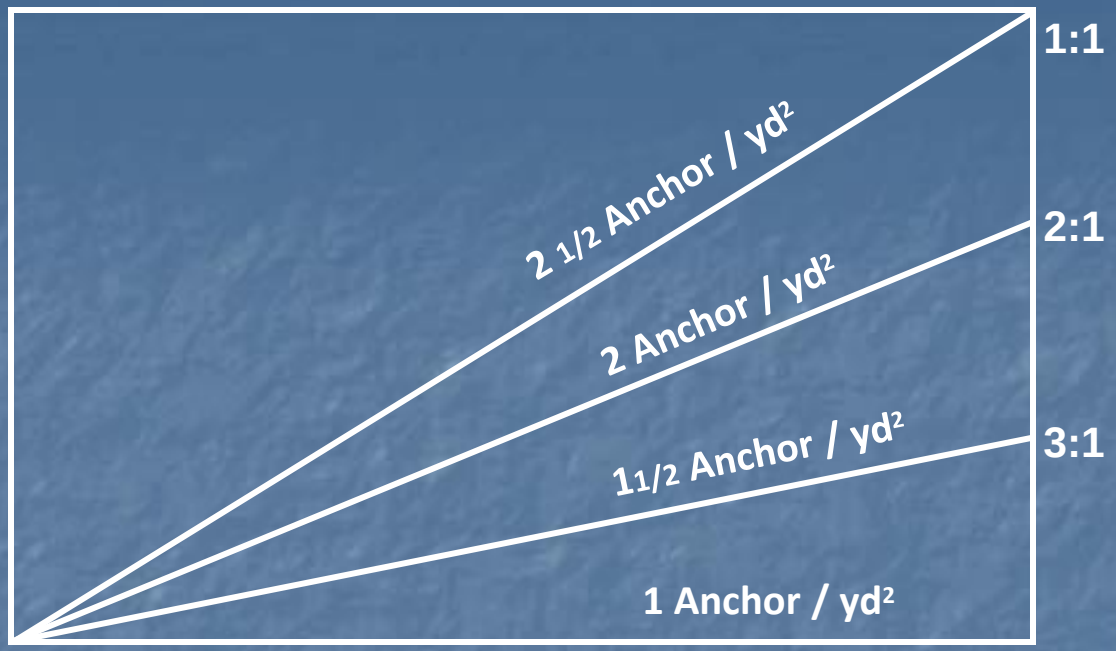


For hard or rocky soils, heavy duty 6” nails with washers can be used to anchor TRMs

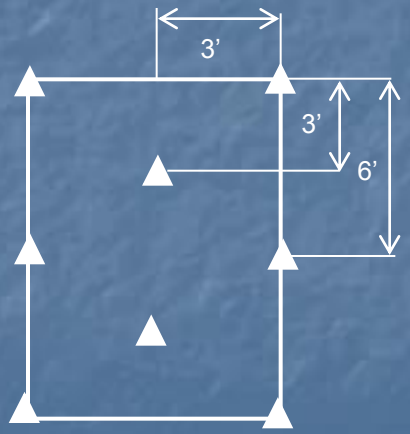
For sandy soils 12” or 18” geotextile pins with washers may be used

Installation

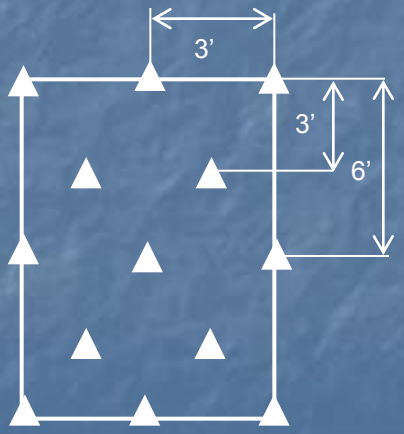
Anchors:
Frequency and Patterns



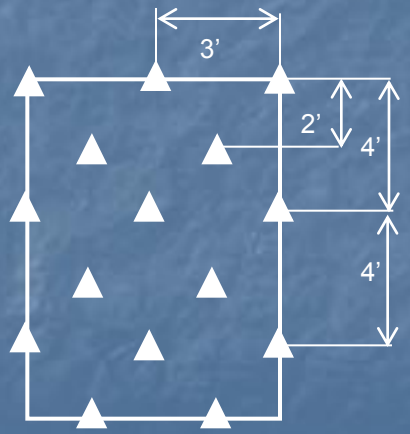
Anchor patterns are determined by steepness of slopes and channel beds



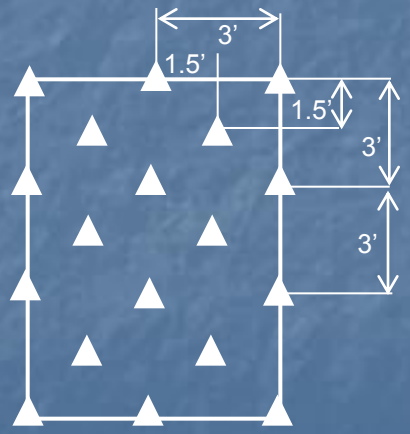
1 Anchor / yd²



1 1/2 Anchor / yd²



2 Anchor / yd²



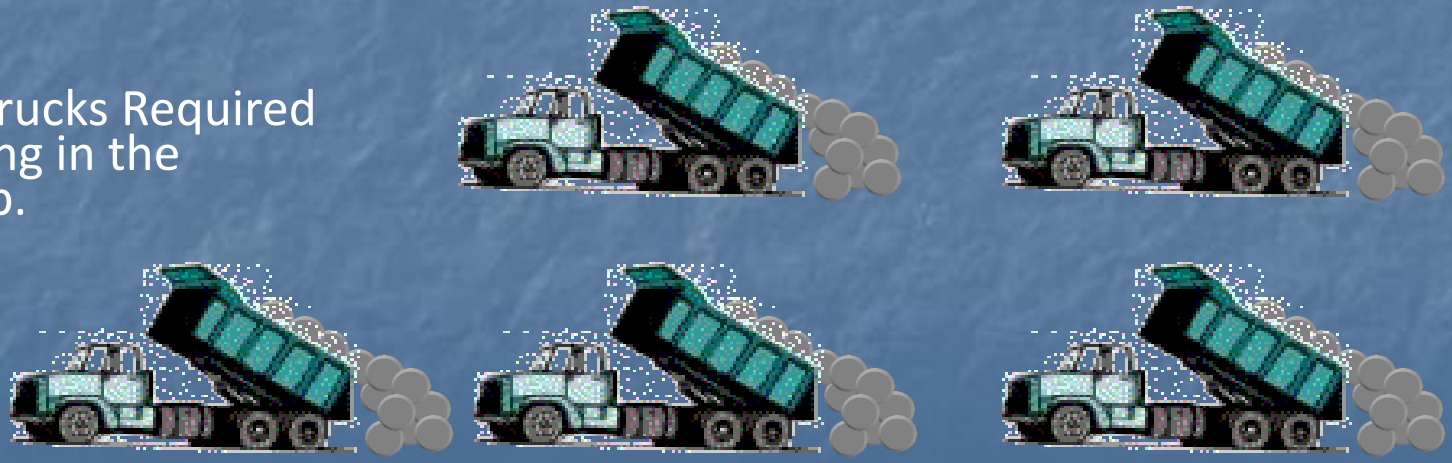
2 1/2 Anchor / yd²

Reduced Site Disturbance

By reducing the undercut excavation, one roll of TRM can eliminate as many as…

Seven Trucks Required to Remove the Over-Excavated material, and...

Five Trucks Required to Bring in the Riprap.



Conclusion

- Environmental awareness is growing
- Technologies are changing
- Product performance is improving

Staying current on new technologies will help meet the needs of this ever changing industry.

For more information – Quality Seeds / Cathy Wall or stevez@profileproducts.com

Questions?