Ground Covers and Vegetation

- Erosion control
- Vegetation is the long term goal
- Ground cover provides protection until germination

Steps to get Vegetation started

- Seedbed preparation
- Pre-ground cover applications
- Ground cover
Seedbed Preparation

Grass emergence is the objective

- Smooth uneven areas
- Scarify to loosen soil to the following depths:
  - 5 inches on solid undisturbed earth
  - 3 inches on embankments or other disturbed areas where soil is loose
- Track slope

Tracking across slope creates rills!

Proper Tracking of Slope
Applications

- Lime
- Fertilizer
- Seed
- Ground cover

Lime

Why do we lime?
- Acidic soils in OK
- Al toxicity - growth limiting factor & restricts nutrient uptake

Application:
- 4,000 lbs/ac
- Prefer incorporation into soil

Fertilizer

10-20-10 N-P-K
- Nitrogen
- Phosphorus
- Potassium

Must be incorporated into soil
Fertilizer Application Rates

• Establishment:
  - x lbs/acre of 10-20-10 or analysis and rate specified

• Fertilizer Topdressing

What the hydro can’t reach... the chopper can!

Seed

• Temporary or Permanent
• Riparian Mix
Temporary Seeding

- Warm season species in summer months
- Cool season species in remaining months
- Follow up w/ temporary mulching or hydromulching

Temporary Seeding

- When work areas will not be active for more than 14 days
- Prior to anticipated precipitation

Includes: cut/ fill slopes, drainage ditches, sediment basins, road beds ...

Temporary Seeding

...
**Stage Seeding**
- Establishment of vegetative cover on cut/fill slopes as grading progresses

**Permanent Seeding**
- Perform as soon as possible after final grade is complete

**Sodding**
- Follow specs for proper installation and establishment
Riparian or Native Seed Mixture
- Native grass seeding
- Big/Little Bluestem, Indiangrass, Switchgrass

Seeding Problems
- Inadequate seed germination
- Poor seedbed preparation
- Wrong seed type
- Expired (old) seed

Maintenance
- Repair areas of damage or failure of grass stand establishment
- Mowing
- Maintain all measures until a permanent vegetative cover is established
- Supplemental Seeding
  - No seed bed preparation may be required
  - No fertilizer or lime/stone may be required
- Repair Seeding
  - Seed bed preparation generally required
  - Fertilizer and lime/stone generally required
Types of Ground Cover

- Straw Mulch
- Erosion Control Blankets
- Permanent Soil (Turf) Reinforcement Mats

Straw Mulch

- 2 tons/ac (85% coverage min.)
- Slopes 2:1 or flatter
- Spread uniformly over area
- Sufficient amount to completely cover area

The good...

...and the bad.

Straw Mulch

- Partially shade ground
- Reduce erosion
- Conserve soil moisture
- Allow air to circulate
- Allow sunlight to penetrate
- Within 24 hours of seeding
Binding Straw Mulch

- Sufficient amount of binding material to hold straw in place
- Uniform coverage

Tackifier Options
- Diluted Emulsified Asphalt
- Hydro - mulch

Straw Mulch Problems

- Not enough straw applied
- Insufficient tack on mulch
- Too steep or long of slope for straw mulch

Rolled Erosion Control Products - RECPs

- Temporary Products - used on 2:1 slopes and steeper or where grass establishment is poor
- Common types:
  - Excelsior
  - Coir (Coconut)
  - Straw
Why Use RECP’s for Slopes?

Applications for slopes, channel liners, & shorelines

• Pros
  - Immediate erosion protection
  - More aggressive treatment

• Cons
  - Labor intensive
  - Added costs

RECP Types

Erosion Control Netting (ECN)
Open Weave Textiles (OWT)
Erosion Control Blankets (ECB)
Turf Reinforcement Mats (TRM)
Erosion Control Netting (ECN)

- Planar woven natural fiber or extruded geosynthetic mesh
- Used as a component in RECP’s
- Used as a temporary degradable RECP to anchor loose fiber mulches

Open Weave Textiles (OWT)

- Temporary degradable
- Composed of processed natural or polymer yarns woven into a matrix

Erosion Control Blankets (ECB)

- Temporary degradable processes natural or polymer fibers
- Mechanically, structurally, or chemically bound together to form a continuous matrix
Turf Reinforcement Mats (TRM)

- Composed of non-degradable synthetic fibers, filaments, nets, wire mesh, or other elements
- Processed into a permanent, three dimensional matrix

Other Considerations

- Hard Armor vs. Soft Armor
  - Rip Rap
  - Gabions
  - TRMs
    - Composite
    - Synthetic
  - Geocells

Product Types

- Type 1 - Ultra Short Term
  - 3 months
- Type 2 - Short Term
  - 12 months
- Type 3 - Extended Term
  - 24 months
- Type 4 - Long Term
  - 36 months
- Type 5
  - Permanent
Typical Slope Applications

C - Factor Performance

- Cover Factor “C”
- Effectiveness - Primary soil loss value
- Ability to minimize soil movement during rain events

Engineering Properties
Riparian Buffer Considerations

- Netless vs. Net

RECP Installation

- Site Preparation
  - Fine graded to a smooth profile
  - Free from clods, roots, stone, etc.
- Seeding
  - Select seed mix to the geological area
- Trenching
  - 6” deep by 6” wide anchor trench at top of slope
- Staples

ODOT Excelsior Matting Detail
Why is stapling important?

Installed Costs

- Type 1 - $0.50 - $0.75/ sy
- Type 2
  - Single Net - $1.50/sy
  - Double Net - $1.75/sy
- Type 3 - $2.00 - $5.00/ sy
- Type 4 - $6.00/ sy
- Type 5 - $6.00 - $7.00/ sy

Erosion Control Blankets
Erosion Control Blanket Problems

Compost Seeding
• Alternative to Seeding and Matting
  - Single application of compost material and seed on slopes
  - Nutrient and pH benefits

Compost Seeding
Case Studies

- Different projects
  - Site 1) application over Anchor Mat System on steep fill slope
  - Site 2) application on eroding loamy cut slopes
  - Site 3) application on eroding highly acidic clay soil cut slopes

Site 1

LOCATION: US 1 near RDU Airport
AREA: 22,500 square foot, 1" thick, 1.5:1 fill slope
COST: $0.21/square foot = $4725/acre
SEASON: Fall (October)

Site 2

LOCATION: I-540 Raleigh, NC
AREA: 3,000 square foot, 1 inch thick, 3:1 slope
COST: DEMO
SEASON: Winter (January)
Site 3
LOCATION: US 70 Johnston County, 20 mi. east RDU
AREA: 4 Acres, 1" thick, 2:1 cut slopes
COST: $0.13/square foot, $22,215/4 Acres
SEASON: Winter (February)

Comparisons

• Compost Seeding
  - Ranges from $0.13/square foot to $0.22/square foot or $5662/acre to $9583/acre

• Seeding and Matting
  - Ranges from $0.17/square foot ($0.03/square foot for seeding + $0.14/square foot for matting) to $0.22/square foot ($0.03/square foot for seeding + $0.19/square foot for matting) or $7405/acre to $9583/acre

Benefits

• Access to slope
  - Large truck and hose operation can make application to steep slopes easier than traditional seeding and matting effort

• Seed bed preparation
  - Not as critical because seed will germinate in compost material. Have gone with ~ 2 inches and seen success.

• Long term benefit to soil
  - As compost leaches and decomposes it improves quality of existing soil and root zone of developing vegetation.

• Efficiency
  - Compost seeding provides seed and groundcover in one application
Drawbacks

- **Access to slope**
  - Large truck and hose operation
- **Seed bed preparation**
  - Must be done as a separate operation
- **Material Stockpile**
  - Area needed is relative to area to be seeded. ~130 cubic yards for 1 acre coverage at 1 inch thickness

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Why use HECP’s

Hydraulic Erosion Control Products

- **Easy to Install**
- **Better contact with soil**
- **Site prep savings**

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Characteristics

- **Quality raw materials - no germination inhibitors**
- **Long fiber lengths provide excellent erosion control and moisture absorption**
- **Thermally refined fibers provide greater moisture retention and ground coverage**
HECP Types

- Hydraulic Mulch (HM)
- Stabilized Mulch Matrix (SMM)
- Bonded Fiber Matrix (BFM)
- Fiber Reinforced Matrix (FRM)

Hydraulic Mulch

- Contains defibrated paper, wood and/or natural fibers
- May or may not contain tackifiers
- Use on mild slopes

Stabilized Mulch Matrix

- Contains defibrated organic fibers with at least one of the following:
  - Soil flocculants
  - Cross linked hydro-colloidal polymers
  - Cross linked tackifiers
- Use on moderate slopes
Bonded Fiber Matrix

- Matrix containing organic defibrated fibers and cross-linked insoluble hydro-colloidal tackifiers
- Use on steep slopes

Fiber Reinforced Matrix

- Matrix containing organic defibrated fibers
- Cross linked insoluble hydro colloidal tackifiers and reinforcing natural or synthetic fibers
- Use on very steep slopes

Application Rates

<table>
<thead>
<tr>
<th>Type</th>
<th>Functional Longevity</th>
<th>Typical Application Rates (lbs/ac)</th>
<th>Maximum Uninterrupted Slope Length (ft)</th>
<th>Maximum C Factor</th>
<th>Minimum Vegetation Establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM</td>
<td>up to 3 mo.</td>
<td>2000-3000</td>
<td>≤ 3:1</td>
<td>25</td>
<td>0.5</td>
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<tr>
<td>SMM</td>
<td>min. 3 mo.</td>
<td>2000-3500</td>
<td>≤ 2:1</td>
<td>50</td>
<td>0.15</td>
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<tr>
<td>BFM</td>
<td>min. 6 mo.</td>
<td>2500-4000</td>
<td>≤ 1:1</td>
<td>75</td>
<td>0.1</td>
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<tr>
<td>FRM</td>
<td>min. 12 mo.</td>
<td>3000-4500</td>
<td>≤ 0.5:1</td>
<td>100</td>
<td>0.02</td>
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</tbody>
</table>
Mixing Techniques

- **Mechanically Agitated Machines**
  - Have paddles to mix slurry in tank
  - Can use a wide range of fiber mulch materials

- **Jet Agitated Machines**
  - Generally smaller machines that mix slurry with jets
  - May have difficulty pumping wood based fiber mulch materials

HECP Research

- 30’ x 200’ area
- 20 plots
- 5 treatments were applied
- Each treatment replicated 4 times

Hydromulch Research

<table>
<thead>
<tr>
<th>Plot Type</th>
<th>HM subsample weight (g)</th>
<th>DOT recommended rate (lb/ac)</th>
<th>Actual application rate (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% wood</td>
<td>8.7</td>
<td>2000</td>
<td>3300</td>
</tr>
<tr>
<td>100% wood</td>
<td>8.4</td>
<td>2000</td>
<td>4100</td>
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<tr>
<td>100% wood</td>
<td>12.6</td>
<td>2000</td>
<td>6200</td>
</tr>
<tr>
<td>100% wood</td>
<td>11.8</td>
<td>2000</td>
<td>5800</td>
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<tr>
<td>BFM</td>
<td>17.3</td>
<td>3500</td>
<td>8500</td>
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<tr>
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<td>7.7</td>
<td>3500</td>
<td>3700</td>
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<tr>
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<td>10.1</td>
<td>3500</td>
<td>4900</td>
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<tr>
<td>BFM</td>
<td>11.2</td>
<td>3500</td>
<td>5650</td>
</tr>
<tr>
<td>70/30</td>
<td>6.8</td>
<td>2500</td>
<td>3300</td>
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<tr>
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<td>8.5</td>
<td>2500</td>
<td>3200</td>
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<tr>
<td>70/30</td>
<td>9.3</td>
<td>2500</td>
<td>4500</td>
</tr>
</tbody>
</table>
**Hydromulch Research**

- Event 1 - 3.87" rainfall
- Event 2 - 1.55" rainfall
- Event 3 - 2.07" rainfall

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**Results looked good compared to check.**
New Test Areas
Potential to save on matting quantities

Resident & Contractor Prefer BFM
About half the cost of matting: $4700/ac

Matting can be expensive if you have to re-work and re-mat.

Easier to patch than matting

BFM Area
Matting
Patched Area

Aerial Hydro Mulching
Installed Costs

- Hydraulic Mulch - $1500-$3000/ac
- Stabilized Mulch Matrix - $3000-$4000/ac
- Bonded Fiber Matrix - $4000-$5000/ac
- Fiber Reinforced Matrix - $5000-$6000/ac

HECP Summary

- A right tool/ product for every job!
- Select product based on engineering properties and site/ slope warrants
- HECP’s may serve as equivalent to some RECP’s at a cost savings

Borrow and Waste Sites

- Stockpile topsoil for plating
- Initiate Stage S&M w/ 1 acre exposure
- Stabilize perimeter cuts and fills
Borrow and Waste Sites

Questions