NDDOT Erosion & Sediment Control – Construction Course

Module 3: Temporary & Permanent Erosion & Sediment Control Measures

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Construction ESC

How do we define Erosion Control?

Temporary vs. Permanent

– What does temporary vs. permanent mean in the Special Provision?

What is temporary erosion control?

What is temporary sediment control?

Are the two mutually exclusive terms?

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Construction ESC

Key Considerations:

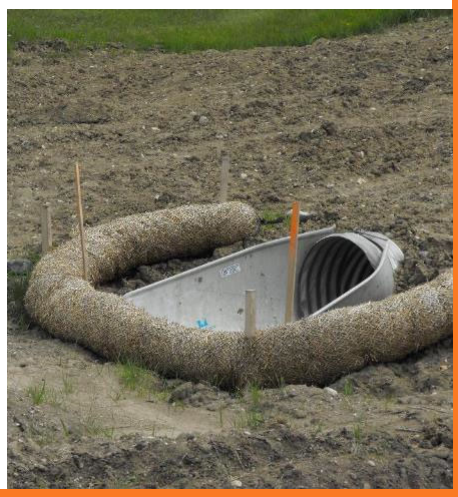
– Meet Specifications

– Installation (constructability*)

– Maintenance

– Inspection

– Removal



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Construction ESC

Site visits are needed to properly plan the project

– Critical areas

– Does the ESC design match what is needed in the field?

Think about progression through the project

– What should be one of the first things to do when you move on to a site?

– What comes next?

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Phasing

Construction planning and phasing is an erosion and sediment control measure.

– Phasing the project

– Phasing the ESC plan

Plan construction activities to minimize the areas of disturbance and minimize impact

Complete grading activities and establish permanent controls as soon as possible

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Phasing

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Phasing

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Perimeter Controls

Installing perimeter controls should be one of the first tasks before beginning earthwork operations

Options Available:

- Silt fence
- Fiber rolls
- Berms
- Inlet Protection

Should consider location and type to maintain proper control

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Silt Fence (Section 260)

Consists of partially buried fabric that is supported by posts used to control sediment from small disturbed areas

Only good for low-flow situations

Proper placement and installation are critical to their success

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Silt Fence

Construction Considerations:

- Drainage area
  - ¼ acre per 100 feet of unsupported fence
  - 1/2 acre per 100 feet of supported fence
- Functional Longevity: approximately 6 months

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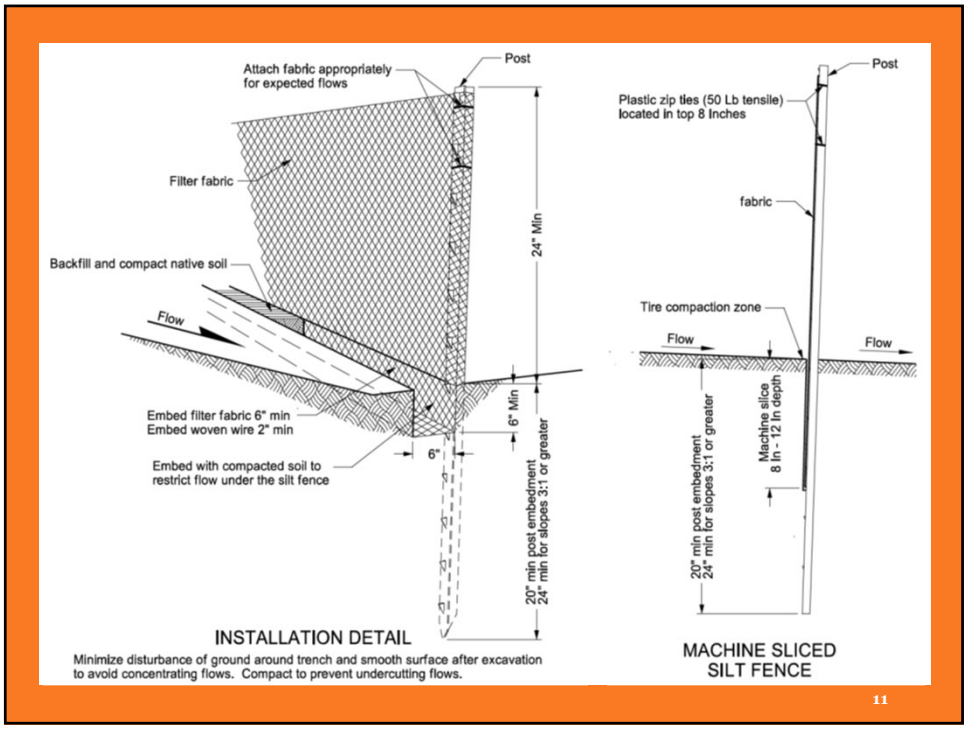
Attach fabric appropriately for expected flows
Post
Filter fabric
Backfill and compact native soil
Flow
24" Min
Embed filter fabric 6" min
Embed woven wire 2" min
6" Min
6"
Embed with compacted soil to restrict flow under the silt fence
20" min post embedment
24" min for slopes 3:1 or greater
INSTALLATION DETAIL
Minimize disturbance of ground around trench and smooth surface after excavation to avoid concentrating flows. Compact to prevent undercutting flows.
Post
Plastic zip ties (50 Lb tensile) located in top 8 Inches
fabric
Tire compaction zone
Flow
Flow
Machine slice 8 In - 12 In depth
20" min post embedment
24" min for slopes 3:1 or greater
MACHINE SLICED SILT FENCE
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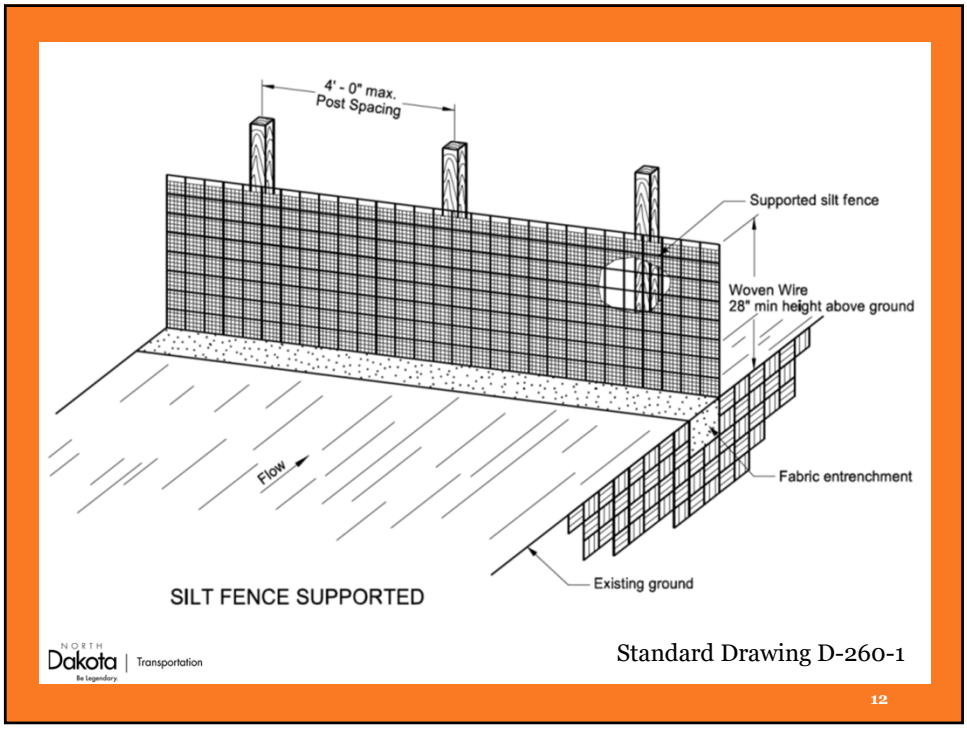
4' - 0" max. Post Spacing
Supported silt fence
Woven Wire
28" min height above ground
Flow
Fabric entrenchment
Existing ground
SILT FENCE SUPPORTED
NORTH Dakota Be Legendary | Transportation
Standard Drawing D-260-1
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Silt Fence (Section 260.04 B. & C.)

Maintenance:

– Remove accumulated sediment when it reaches 1/3 of the exposed height of the silt fence

– Repair/replace damaged sections

Removal:

– Prep soil and seed and mulch removal area to match existing conditions

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Fiber Rolls (Section 261.04 A. & B.)

Consists of wood excelsior, hay or straw that is seed free and free of noxious weeds, contained in degradable netting used to control sediment from small disturbed areas.

Only good for low-flow situations

Proper placement and installation are critical to their success

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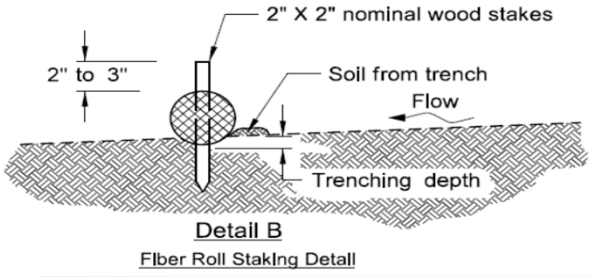

Detail B

Fiber Roll Staking Detail

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Fiber Rolls (Section 261.04 A. & B.)

Maintenance:

- Remove accumulated sediment when it reaches **1/3** of the exposed height of the fiber roll
- Repair/replace damaged sections

Removal:

- Prep soil and seed and mulch removal area to match existing conditions

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Berms

Slows sediment-laden water and filters sediment in low-flow areas

Common types:

– Topsoil

– Compost

May be used in conjunction with other sediment control measures

Must be stabilized in accordance with the permit

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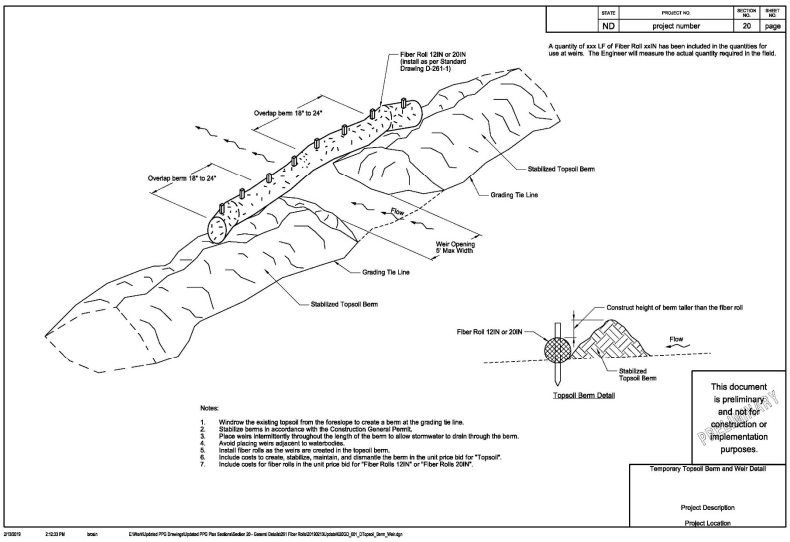

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Inlet Protection

Multiple options available to prevent sediment from entering inlets

– Fabric

– Fiber rolls

– Gravel

– Manufactured (bags/domes/curb inlets)

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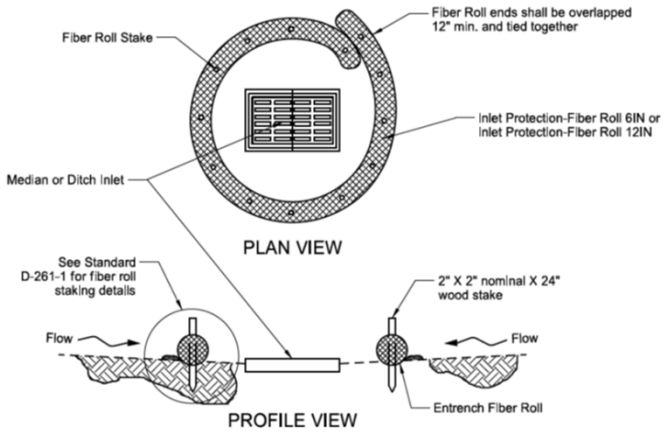

FIBER ROLL PROTECTION
(MEDIAN OR DITCH INLET)

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Standard Drawing D-708-6

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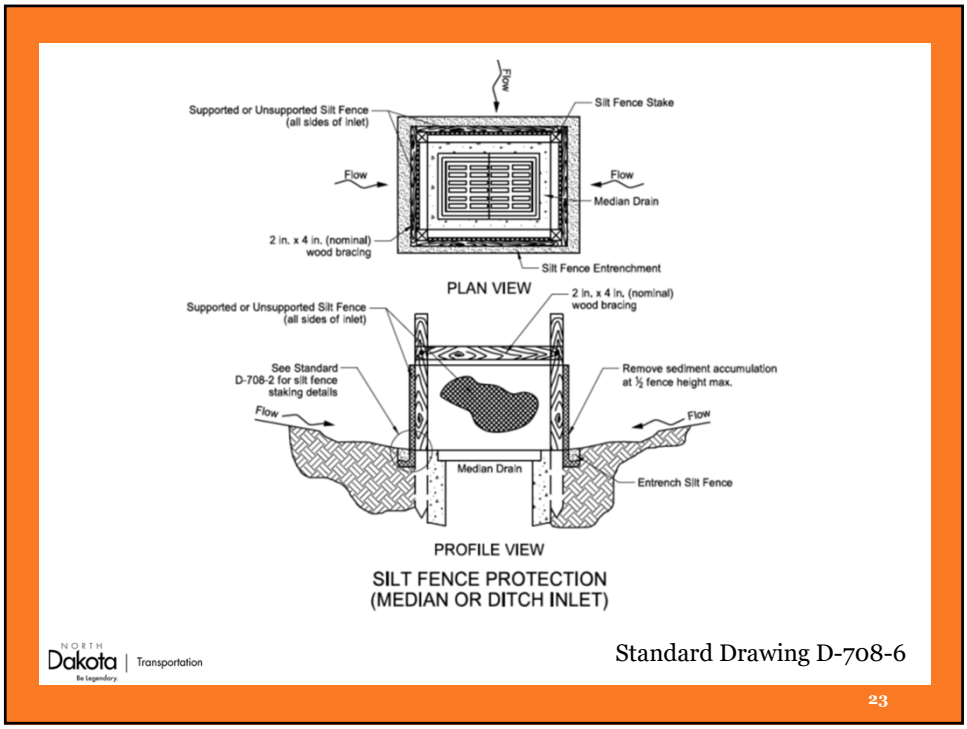
Flow
Supported or Unsupported Silt Fence (all sides of inlet)
Silt Fence Stake
Flow
Flow
Median Drain
2 in. x 4 in. (nominal) wood bracing
Silt Fence Entrenchment
PLAN VIEW
Supported or Unsupported Silt Fence (all sides of inlet)
2 in. x 4 in. (nominal) wood bracing
See Standard D-708-2 for silt fence staking details
Remove sediment accumulation at ½ fence height max.
Flow
Flow
Median Drain
Entrench Silt Fence
PROFILE VIEW
SILT FENCE PROTECTION
(MEDIAN OR DITCH INLET)
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Standard Drawing D-708-6
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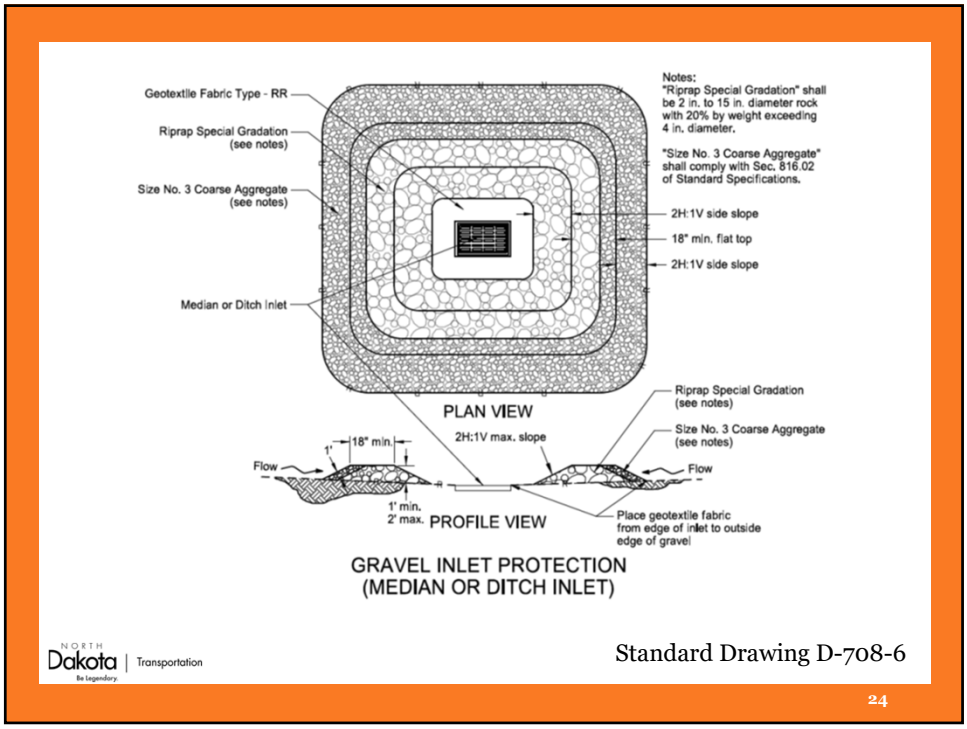
Geotextile Fabric Type - RR
Riprap Special Gradation (see notes)
Size No. 3 Coarse Aggregate (see notes)
Median or Ditch Inlet
Notes:
"Riprap Special Gradation" shall be 2 in. to 15 in. diameter rock with 20% by weight exceeding 4 in. diameter.
"Size No. 3 Coarse Aggregate" shall comply with Sec. 816.02 of Standard Specifications.
2H:1V side slope
18" min. flat top
2H:1V side slope
PLAN VIEW
Riprap Special Gradation (see notes)
Size No. 3 Coarse Aggregate (see notes)
2H:1V max. slope
18" min.
1'
Flow
Flow
1' min.
2' max.
PROFILE VIEW
Place geotextile fabric from edge of inlet to outside edge of gravel
GRAVEL INLET PROTECTION
(MEDIAN OR DITCH INLET)
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Standard Drawing D-708-6
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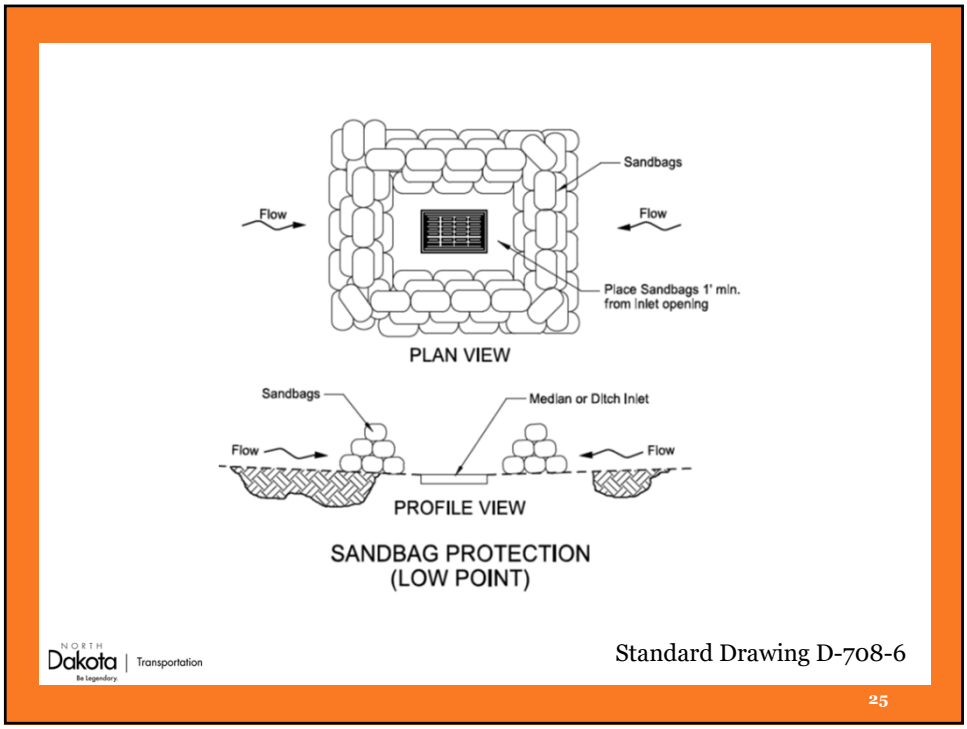
Sandbags
Flow
Flow
Place Sandbags 1' min. from inlet opening
PLAN VIEW
Sandbags
Median or Ditch Inlet
Flow
Flow
PROFILE VIEW
SANDBAG PROTECTION
(LOW POINT)
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Standard Drawing D-708-6
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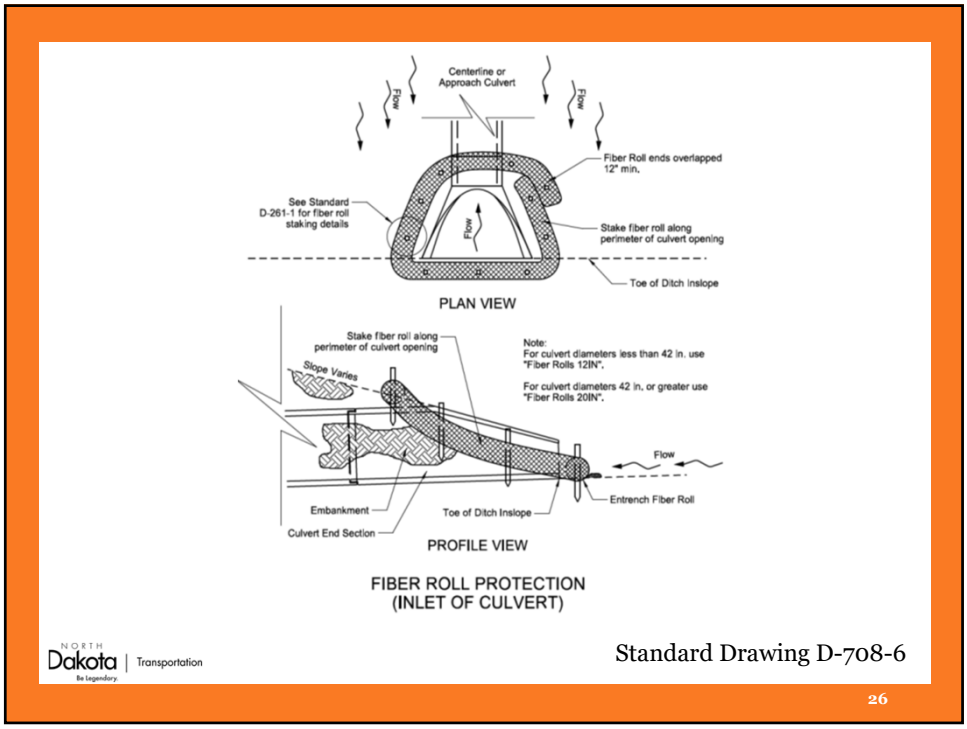
Centerline or Approach Culvert
Flow
Flow
Fiber Roll ends overlapped 12" min.
See Standard D-261-1 for fiber roll staking details
Flow
Stake fiber roll along perimeter of culvert opening
Toe of Ditch Inslope
PLAN VIEW
Stake fiber roll along perimeter of culvert opening
Slope Varies
Note:
For culvert diameters less than 42 in. use "Fiber Rolls 12IN",
For culvert diameters 42 in. or greater use "Fiber Rolls 20IN".
Flow
Entrench Fiber Roll
Embankment
Culvert End Section
Toe of Ditch Inslope
PROFILE VIEW
FIBER ROLL PROTECTION
(INLET OF CULVERT)
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Standard Drawing D-708-6
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Sediment Traps

Small basins used for drainage areas that are 5 acres or less

Storage should provide for 3,600 cubic feet per acre of drainage area

– Should safely pass 2-yr, 24-hr design storm

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Sediment Traps

Sediment Trap Guidelines	
Dam height	Maximum of 5 ft.
Top width (embankment)	Minimum of 5 ft.
Fill slopes (embankment)	2.5:1 or flatter
Dam settlement	10% or less
Principal spillway	Rock-lined open channel or perforated riser
Bottom width	Minimum of 5 ft.
Freeboard	1.5 ft.

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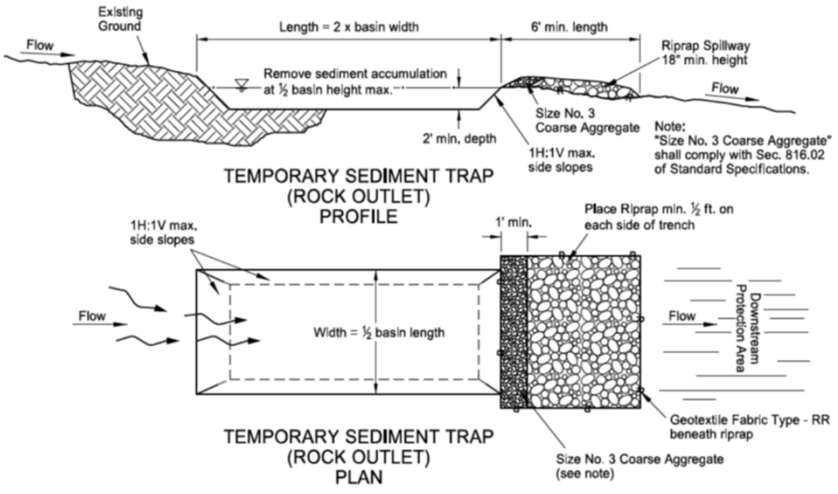
Sediment Traps



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Standard Drawing D-256-1

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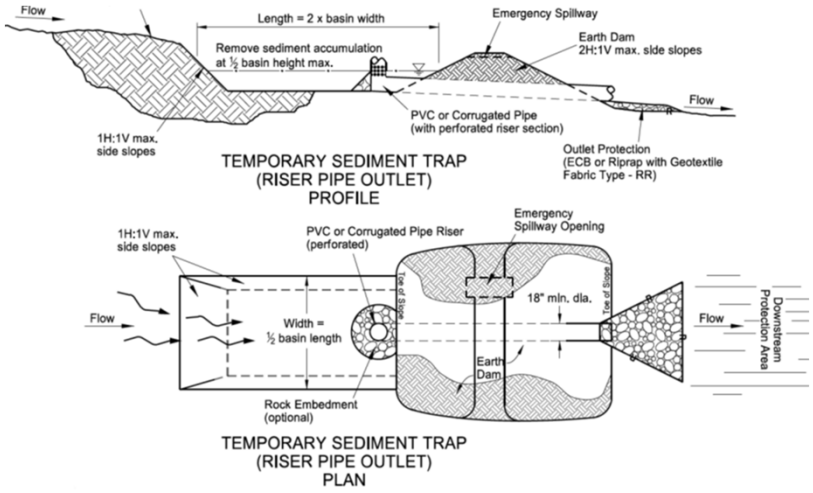
Sediment Traps



Standard Drawing D-256-1

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Sediment Basins

Structures that impound water and allow sedimentation of finer particles

Stormwater quality:

– Total suspended solids (TSS)

– Pollutants (heavy metals, nutrients, chemicals)

Stormwater quantity:

– Slow release of stormwater

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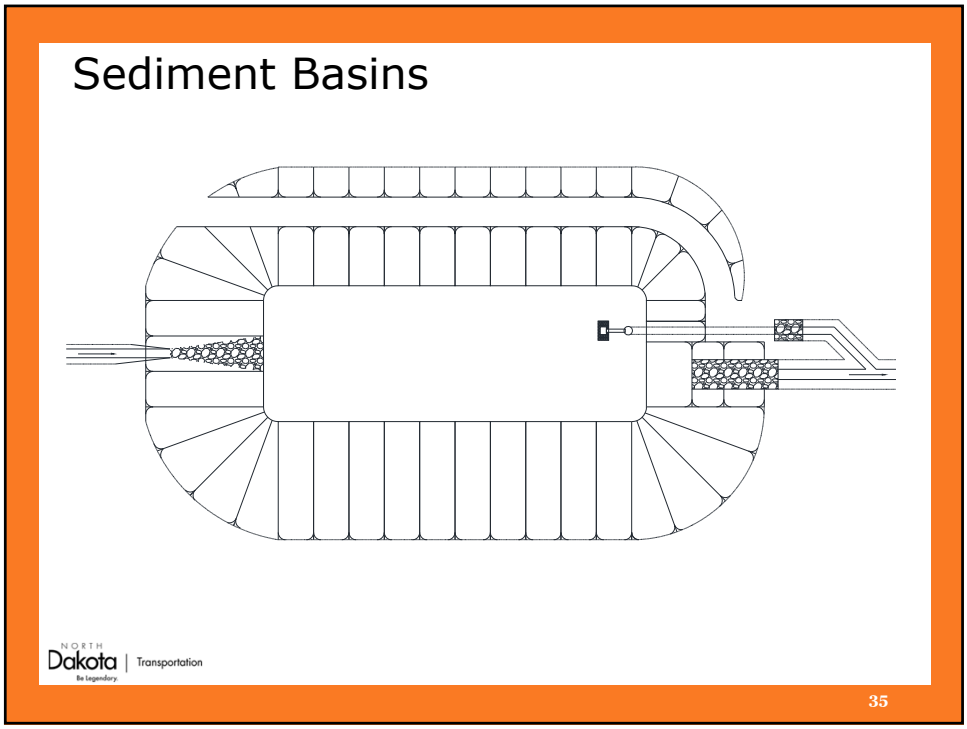

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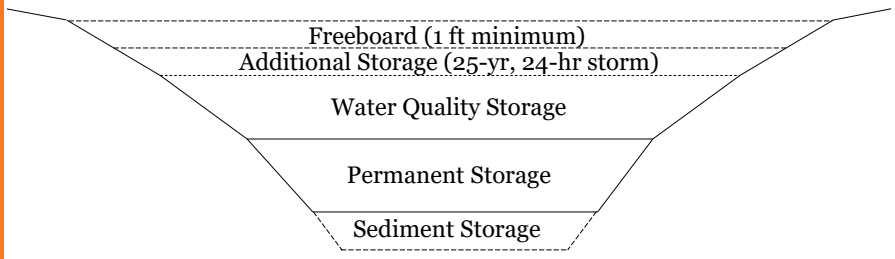
Sediment Basins

Parts of a Sediment Basin:



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Sediment Basins

Location of the Basin:

– Never locate in natural drainage ways (perennial streams, wetlands, etc.)

– Should be placed to receive the maximum amount of runoff from the site

– Divert run-on to avoid travel through the basin

– Discharge point

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Sediment Basins

Settled sediment should be removed to maintain capacity of basin

– May be necessary multiple times during the life of the project

– Should design sediment basin to allow access for cleanout

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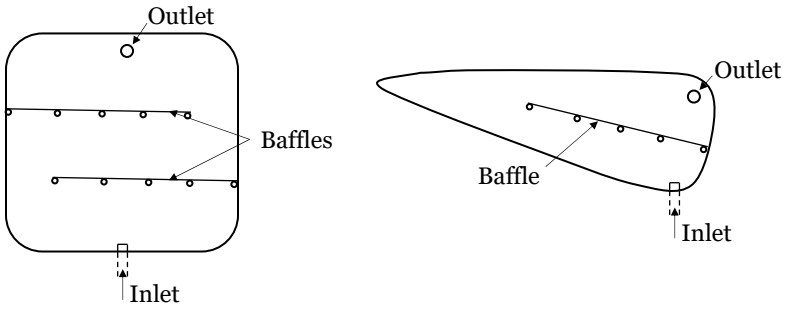
Sediment Basins

Baffles increase the flow length and reduce velocity of flow through basin



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Sediment Basins

Forebays create a small detention area before inflow reaches main part of basin

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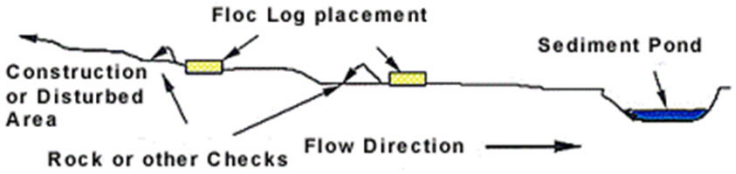
Sediment Basins

Flocculants and coagulants can aid in sedimentation

– Passive vs. active applications



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Stockpiles

Locate stockpiles as far away from bodies of water as possible

Protection of Stockpiles:

– Seeding (temporary or permanent)

– Plastic/geotextile

– Sediment barriers around piles

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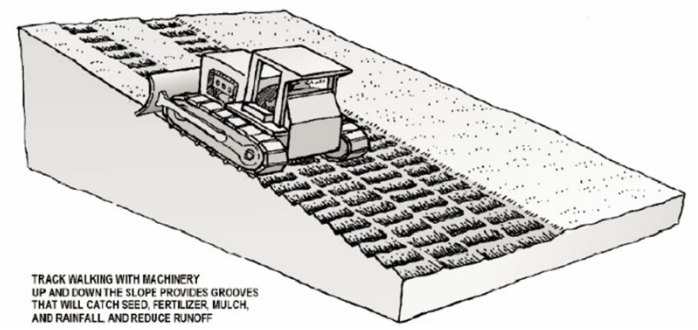
Cat Tracking

Equipment tracking (or cat tracking) and roughening of the soil surface slows water flow over slopes



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Operational Measures

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Tillage (Section 251.04 B.)

During construction soils can become very compacted

Tillage introduces air into the soil and aids in the establishment and growth of vegetation

– Need approximately 3 inches of loosened soil for seedbed preparation

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Track-out

Soil tracked out onto roadways by equipment causes numerous problems

Methods to prevent track-out:

– Stabilized construction access (Section 265)

– Rumble plates

– Wheel wash stations

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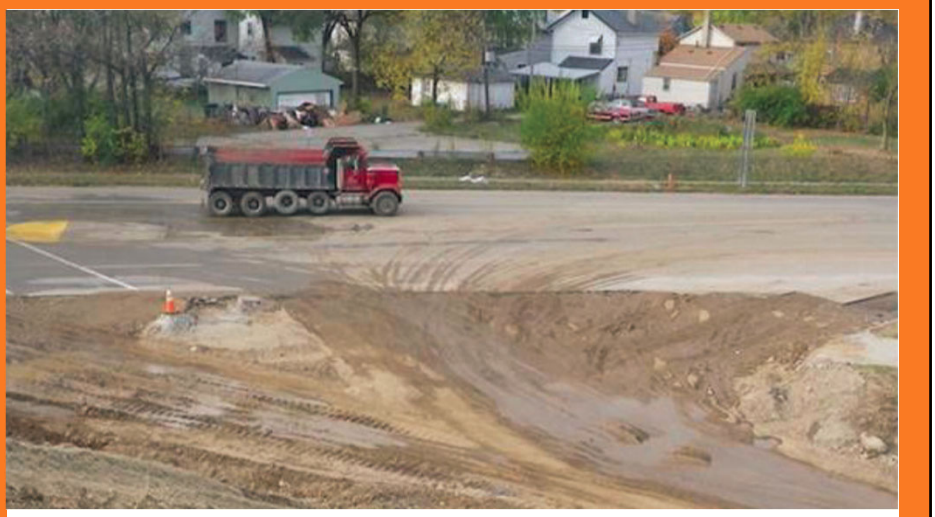

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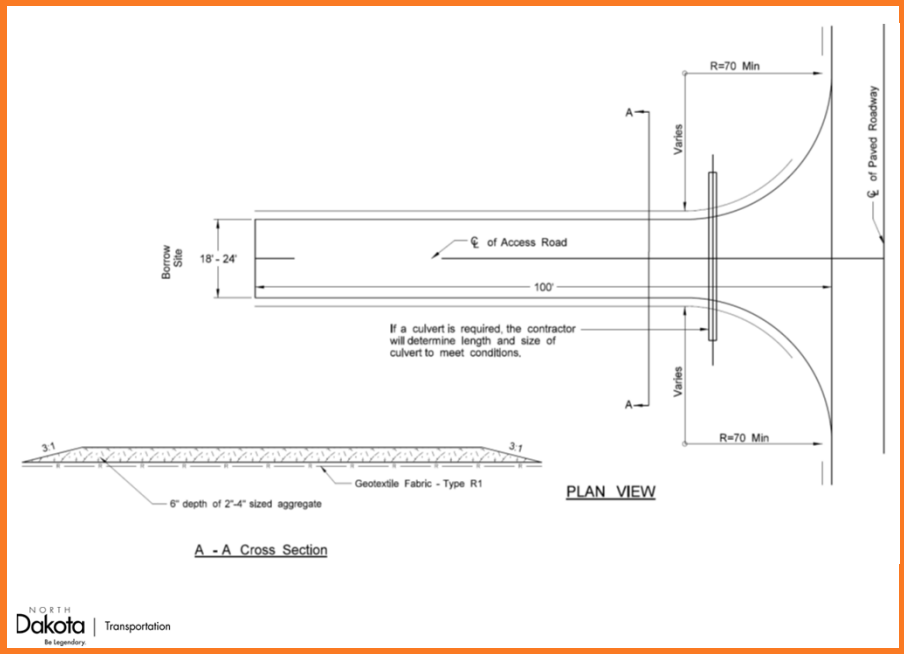

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Dust Control (Sections 107.07 E. and 216)

Phasing and physical controls are the best way to prevent wind erosion

– Vegetation

– Mulches/blankets

Other methods:

– Water

– Barriers

– Chemical applications (emulsions, tackifiers)

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Seed and Mulch Stabilization

Temporary and Permanent stabilization as soon as possible is the most cost-effective method

– May also be temporary

Should be considered during the planning stages of the project

– Phasing of the project

– When and where to seed and mulch

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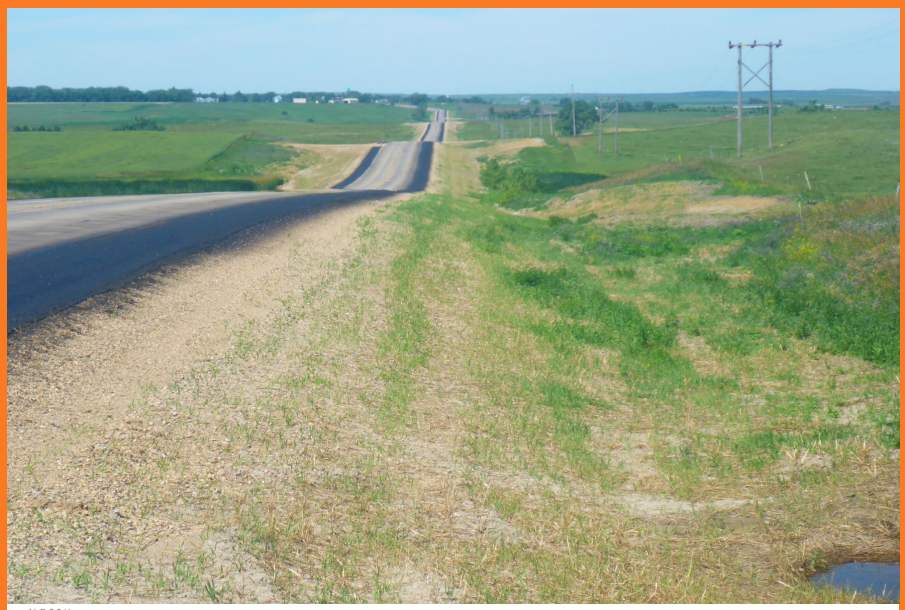

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Vegetation (Seeding) (Section 251)

Permanent vegetation provides excellent erosion and sediment control benefits

– Should aim to establish permanent vegetation as quickly as possible

Temporary cover crop may be used to help perennial vegetation growth

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Vegetation

	Seeding Dates			
Seeding Type	**Before April 20**	**April 20 to July 15**	**July 16 to August 9**	**August 10 to ground freeze**
Class I	X	X	X	X
Class II – Early Season mixture		X		
Class II – Late Season mixture				X
Temporary cover crop	X	X	X	X

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Section 251.04 C.

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Temporary Seeding

Short-term establishment of vegetation to protect exposed areas.

Is not considered a measure until vegetative growth (leaf and root structure) is present.

Site considerations:

– Time of planting (no seasonal limitations)

– Soils

Oat application rate is 64 lbs. of pure live seed per acre (Section 251.03 E.)

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Vegetation

Seed Class Mix Requirements		
Grass Species	**Variety**	**Pounds Pure Live Seed per Acre**
Class I		
Kentucky bluegrass	Park	4.0
Perennial Rye grass	--	5.4
Blue Gamma	Bad River	2.4
Sideoats Grama[1]	Killdeer, Pierre, Butte	7.2
	TOTAL	**19.0**

[1]Substitute Thickspike or Stream bank Wheatgrass of the Critana, Banstock, Sodar, AC Polar, or Elbee variety if Sideoats Grama is unavailable.

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Section 251.03 D. Table 251-01

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Seed Class Mix Requirements		
Grass Species	**Variety**	**Pounds Pure Live Seed per Acre**
Class II – Early Season		
Western Wheatgrass	Rodan, Rosana, Walsh, Flintlock, W. R. Poole, Recovery	9.6
Switchgrass	Dacotah, Forestburg, or Sunburst, Summer	3.2
Green Needlegrass	Lodorm, AC Mallard, Fowler	2.4
Sideoats Grama[1]	Killdeer, Pierre, Butte	3.6
Slender Wheatgrass	Revenue, Primar, Adanac, Pryor, Firstrike	5.0
	TOTAL	**23.8**
Class II – Late Season		
Western Wheatgrass	Rodan, Rosana, Walsh, Flintlock, W. R. Poole, Recovery	9.6
Switchgrass	Dacotah, Forestburg, or Sunburst, Summer	1.6
Green Needlegrass	Lodorm, AC Mallard, Fowler	3.6
Canada Wild-rye	Mandan	5.2
Slender Wheatgrass	Revenue, Primar, Adanac, Pryor, Firstrike	5.0
	TOTAL	**25.0**

[1]Substitute Thickspike or Stream bank Wheatgrass of the Critana, Banstock, Sodar, AC Polar, or Elbee variety if Sideoats Grama is unavailable.

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Section 251.03 D. Table 251-01

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Vegetation

Wetland Seed Mix			
Grass		**Pounds Pure Live Seed per Acre**	
Common Name	**Variety**	**East of HWY 83**	**West of HWY 83**
Prairie Cord Grass	Red River	1.1	1.1
American Slough Grass	Common	0.2	0.2
Fowl Blue Grass	Common	0.2	0.2
Fox Sedge	Common	0.2	0.2
American Manna Grass[1]	Common	0.2	0.2
Fowl Manna Grass[1]	Common	0.1	0.1
Bluejoint Grass[2]	Common	0.1	0.1
Virginia Wild-rye	Omaha	2.0	---
Canada Wild-rye	Mandan	---	1.3
	TOTAL	**4.1**	**3.4**

[1]American, Fowl, or may be used. If only one is used the seeding rate of other species does not need to be increased.
[2]Seed may not be available and can be removed without increasing the seeding rate of other species.

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Section 251.03 F. Table 251-02

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Vegetation

Sodding provides immediate erosion control

Must select grass variety for region and intended use and maintenance

Must consider irrigation while sod is establishing

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Mulches (Section 253)

Benefits of Mulches:

– Protects soil by providing ground cover

– Quality environment for seed and young plants

– Only resistant to raindrop impact and sheet flow

– Not for use in areas with concentrated flow

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Mulches

Construction Considerations:

– Preparation of site (soil, seed, fertilizer)

– Slope gradient and length

– Longevity

– Constructability

– Stability

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Hay or Straw Mulch (Section 253.04 C.)

Method of placement: Manually or with commercial blowers

Application rates: 2 tons per acre

Coverage: 90% minimum

Usage: Slopes < 2H:1V (see spec 253 D)

Longevity: Approximately 1 month

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Hydraulic Soil Stabilizers

Matrix of fibers and additives

Requires specialized equipment to apply

Most types require a tracer material containing green dye.

Better protection and extended functional longevity compared to loose mulches

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Hydromulch (Section 253.04 B.)

Shredded wood and/or paper fibers

Application rates: 2,000 lbs/acre

Coverage: 95% of the seedbed

Usage: Slopes < 4H:1V

Longevity: Up to 3 months

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Bonded Fiber Matrix (BFM) (Section 253.04 D)

Wood fibers and tackifiers

Application rate: Manufacturer's recommended rate or 3,900 lbs/acre

Coverage: 100%

Usage: Slopes ≤ 2H:1V

Longevity: 6 to 12 months

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Flexible Growth Medium (FGM)

Natural and crimped synthetic fibers

Application rate: 3,000 to 4,500 lbs/acre

Coverage: 100%

Usage: Slopes ≤ 1H:1V

Longevity: Minimum of 12 months

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Polyacrylamide (PAM)

Flocculating agent used in erosion/sediment control

Anionic PAM should only be used

Must be tailored to soils on site

Most effective when used with in conjunction with mulches

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Rolled Erosion Control Products (RECP)

Range from simple nets to high performance products

Come in degradable or permanent forms

High performance RECPs can be used in areas with concentrated flow

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Rolled Erosion Control Products (RECP)

Construction considerations for RECPs:

– Application

– Soils

– Longevity

– Maintenance

– Constructability

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Rolled Erosion Control Products (RECP)

RECP Property	Common Test Method
Thickness	ASTM D6525
Density	ASTM D792
Tensile strength/elongation	ASTM D6818
Bench scale testing: • Soil loss ratio • Shear resistance • Germination	 ECTC Method 2 ECTC Method 3 ECTC Method 4
Large scale testing: • Slope • Channel	 ASTM D6459 ASTM D6460

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Erosion Control Blankets (ECB) (Section 255 & 856)

Straw, coconut, excelsior, or combination used in matrix

Netting used on both sides, one side, or not at all

Slope and channel applications

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Erosion Control Blankets (ECB)

Product Description	Slope Applications	Channel Applications Permissible Shear Stress (lbs/ft²)
Netless	Up to 3H:1V	Up to 1
Single-net	Up to 2H:1V	Up to 1.5
Double-net	Up to 1H:1V	1.5 – 2.5

Category	Functional Longevity
Ultra short-term	Up to 3 months
Short-term	3 to 12 months
Extended-term	12 to 24 months
Long-term	24 to 36 months

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Erosion Control Blankets (ECB)

	ECB Type 1		ECB Type 2	
	Straw	**Wood**	**Straw**	**Wood**
Material	100% straw	100% excelsior fibers	100% straw	100% excelsior fibers
Min. Thickness (ASTM D 6525)	0.25 inch	0.25 inch	0.25 inch	0.25 inch
Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)	N/A	1.50 lbs/sf	1.50 lbs/sf	1.75 lbs/sf
Slope Gradient Application	≤ 3H:1V	< 3H:1V to 2H:1V	≤ 2H:1V	< 2H:1V to 1.5H:1V
Functional Longevity	≤ 3 months		≤ 12 months	

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Section 856.01 Table 856-01

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Erosion Control Blankets (ECB)

	ECB Type 3		ECB Type 4	
	Straw/ Coconut	**Wood**	**Coconut**	**Wood**
Material	70% straw and 30% coconut fibers	100% excelsior fibers	100% coconut fibers	100% excelsior fibers
Min. Thickness (ASTM D 6525)	0.25 inch	0.25 inch	0.25 inch	0.50 inch
Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460)	1.75 lbs/sf	2.00 lbs/sf	2.25 lbs/sf	2.25 lbs/sf
Slope Gradient Application	≤ 1.5H:1V	≤ 1.5H:1V	≤ 1H:1V	≤ 1H:1V
Functional Longevity	12 to 24 months		> 24 months	

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Section 856.01 Table 856-02

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Turf Reinforcement Mats (TRM)

Turf reinforcement mats (TRM) are a type of permanent RECP with non-degradable, synthetic fibers and nettings

Provides reinforcement for the soil and vegetation

Usage Areas:

– High shear stress areas (concentrated flows)

– Very steep slopes

– Shorelines

– Pipe inlets and outlets

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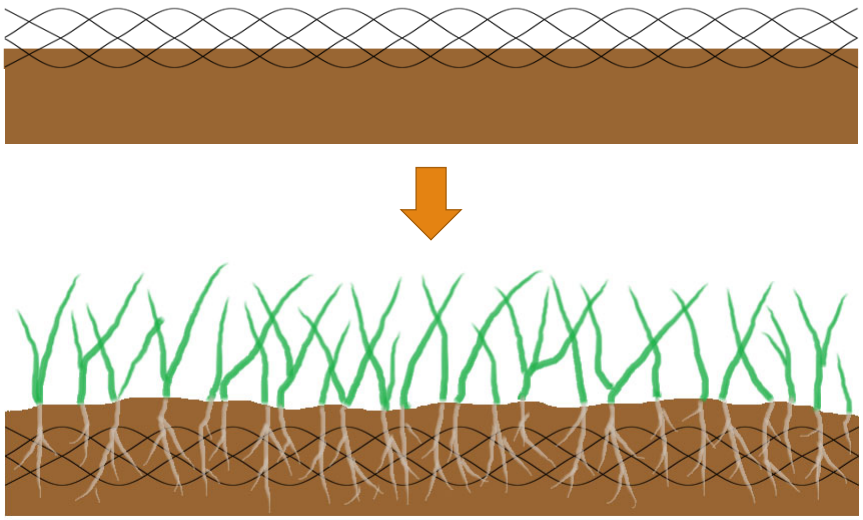

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Turf Reinforcement Mats (TRM)

	TRM Type 1	TRM Type 2
Matrix Fill Material	Wood excelsior, coconut or polymer fibers	100% stabilized polypropylene fibers
Min. Thickness (ASTM D 6525)	0.25 inch	0.50 inch
Min. Mass Unit Area (ASTM D 6475 for natural fibers)(ASTM D 6566 for synthetic fibers)	0.625 lbs/sy	0.625 lbs/sy
Max. Shear Stress at 0.5 inch soil loss (ASTM D 6460 under vegetated conditions)	6.0 lbs/sf	8.0 lbs/sf

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Section 856.02 Table 856-03

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Permanent RECPs

TRM Placement Types:

– Topically – directly applied over soil/seed

– Soil filled – typically requires sod or an ECB and seed over the TRM to hold soil in place

– Hydro injected – seed, place TRM, hydro-inject FGM (total coverage)

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RECP Construction

Should always consider the edges of RECPs

– Higher erosion potential

General RECP Installation Considerations:

– Site preparation (clods must be less than 1", bridging)

– Stapling

– Trenching in

– Overlapping

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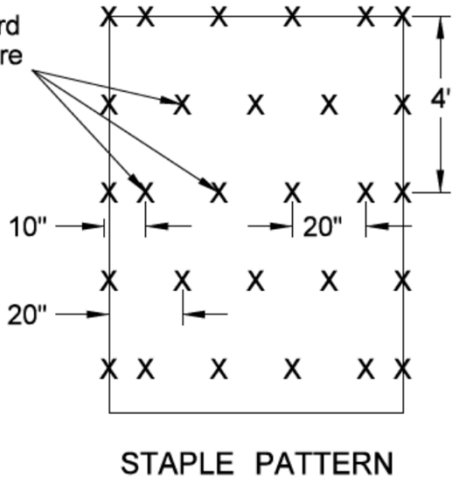
RECP Construction

3.8 staples per square yard using 8-inch 11 gauge wire "u" staples.



STAPLE PATTERN

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Standard Drawing D-255-2

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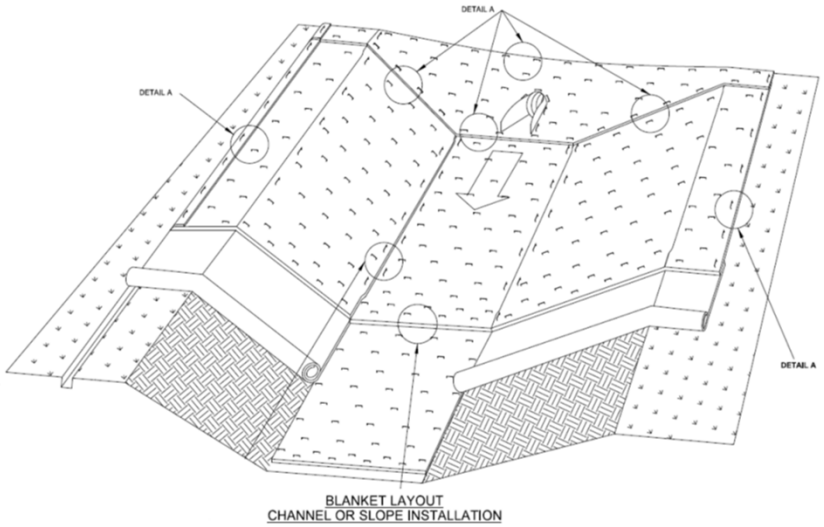
RECP Construction

Standard Drawing D-255-2



BLANKET LAYOUT
CHANNEL OR SLOPE INSTALLATION

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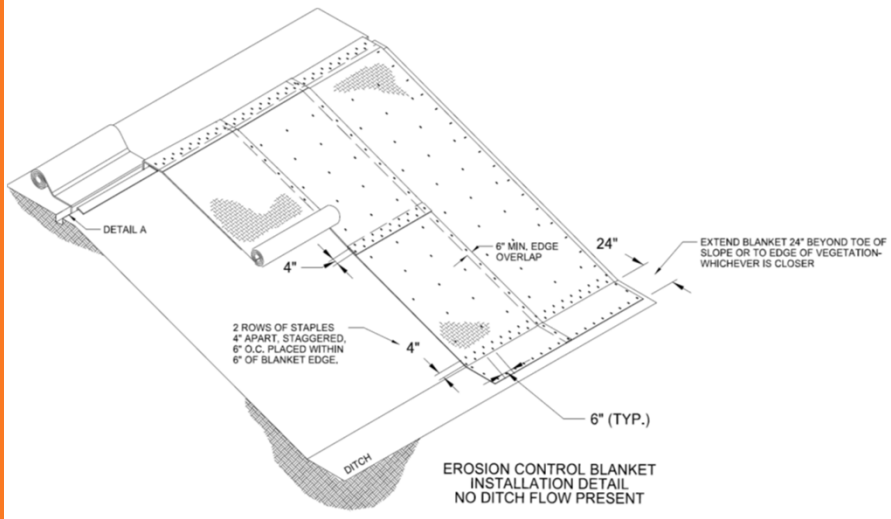
RECP Construction



EROSION CONTROL BLANKET
INSTALLATION DETAIL
NO DITCH FLOW PRESENT

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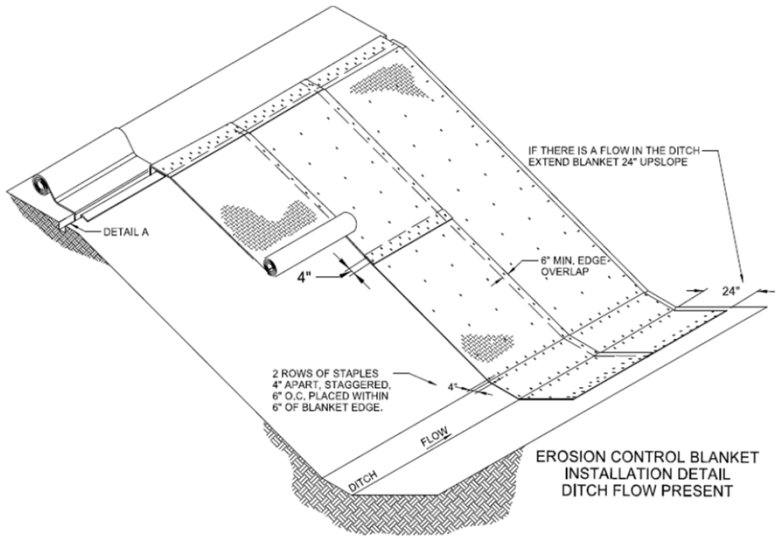
RECP Construction



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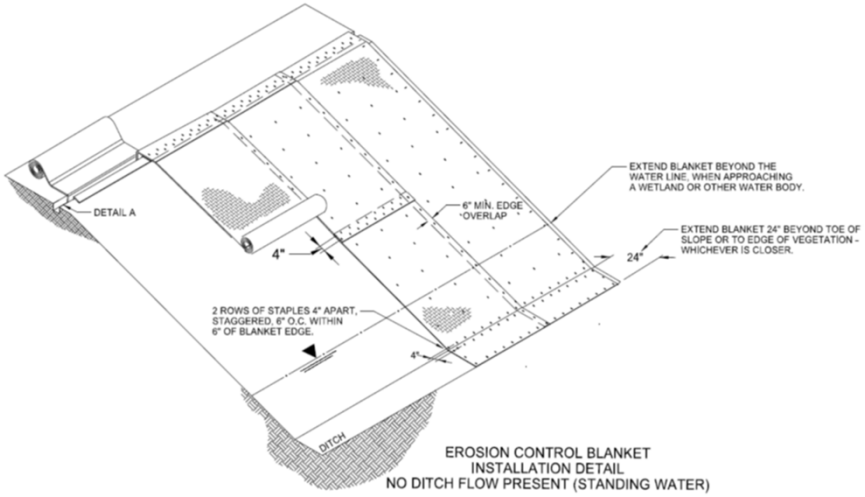
RECP Construction



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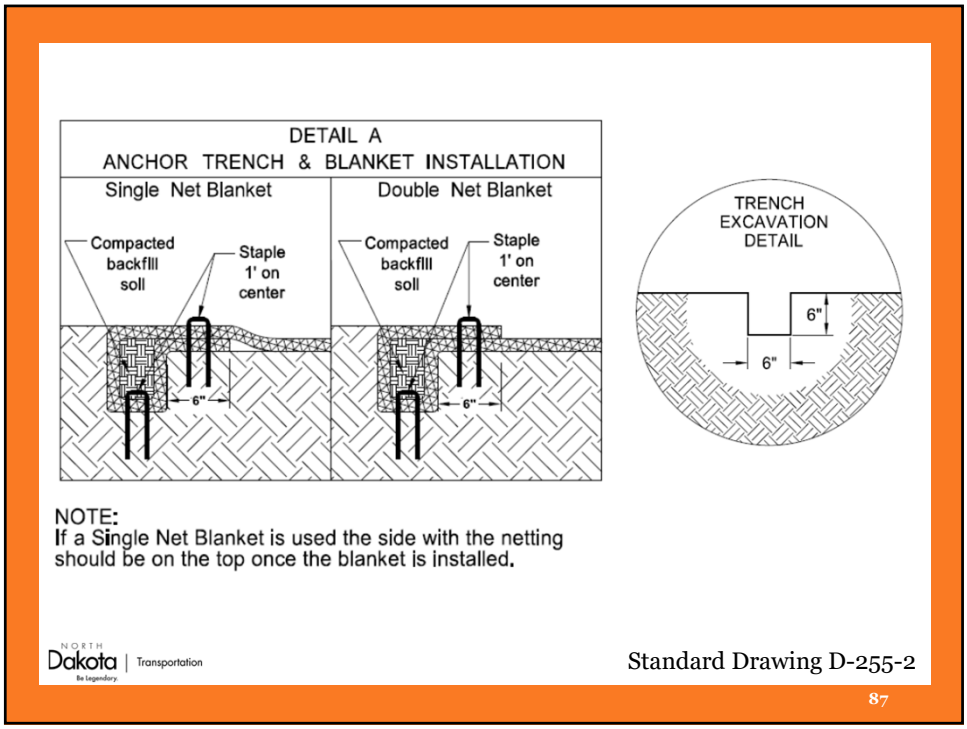
DETAIL A
ANCHOR TRENCH & BLANKET INSTALLATION
Single Net Blanket
Double Net Blanket
Compacted backfill soil
Staple 1' on center
Compacted backfill soil
Staple 1' on center
6"
6"
TRENCH EXCAVATION DETAIL
6"
6"
NOTE:
If a Single Net Blanket is used the side with the netting should be on the top once the blanket is installed.
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Standard Drawing D-255-2
87

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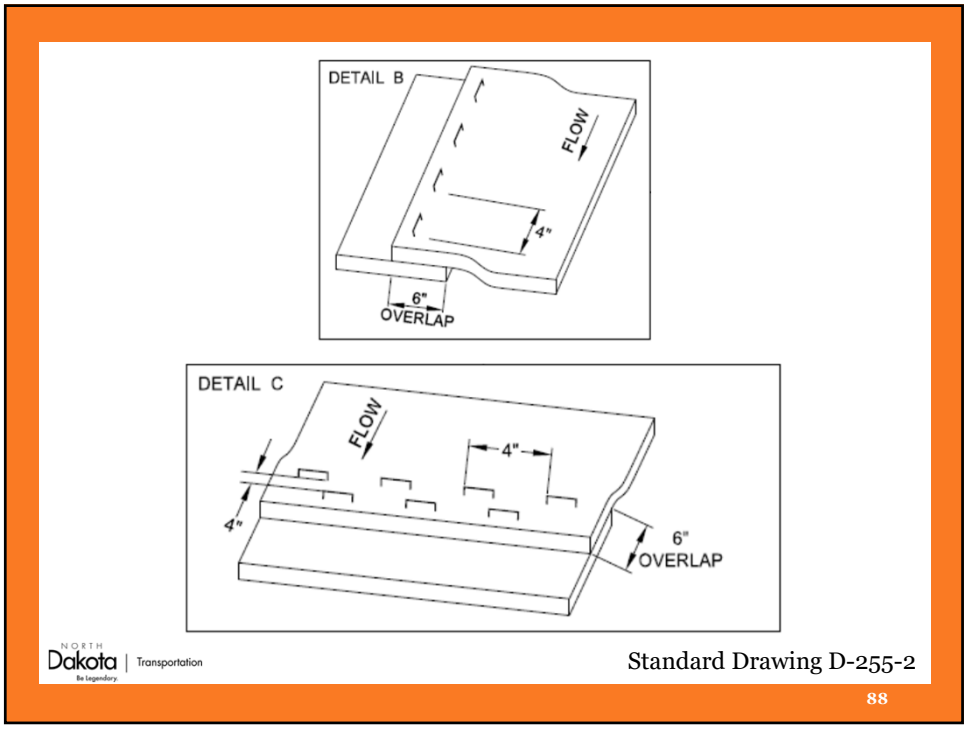
DETAIL B
FLOW
4"
6"
OVERLAP
DETAIL C
FLOW
4"
4"
6"
OVERLAP
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Standard Drawing D-255-2
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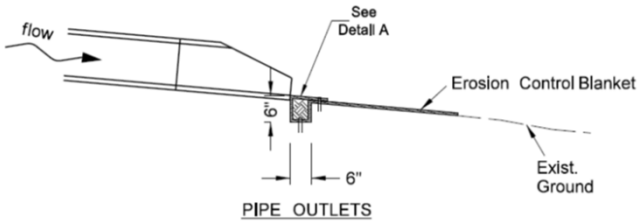
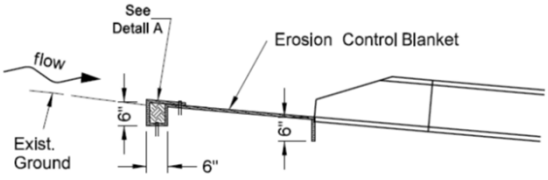
RECP Construction



PIPE OUTLETS



PIPE INLETS

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Standard Drawing D-255-2

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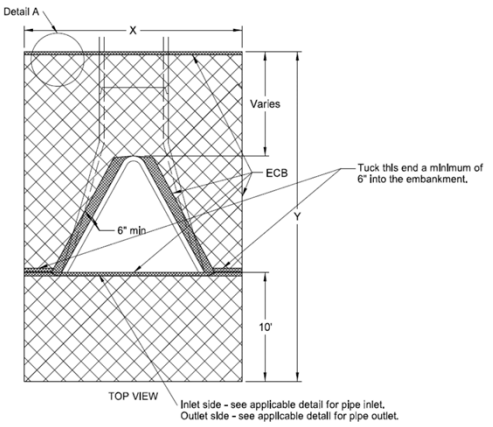
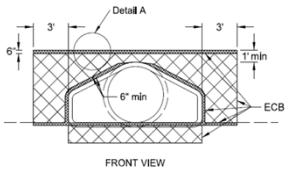
RECP Construction





FRONT VIEW

APPROACH CULVERTS				
DIA	X	Y	Surface area to be protected	ECB
In	Ft	Ft	SF	SY
15	9.0	20.0	176.0	20
18	9.5	20.7	190.7	22
21	9.5	21.0	190.9	22
24	10.5	21.6	214.1	24
27	11.0	22.0	226.3	25
30	11.6	22.5	241.5	27
36	12.7	23.3	268.8	30
42	13.3	23.3	279.7	31
48	13.8	24.0	293.2	33
54	14.5	23.4	300.6	34
60	15.0	23.0	307.5	35
66	15.6	24.0	325.6	37
72	16.2	24.5	340.6	38
Note: Quantities based on 8:1 slope.				

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Interceptor Ditches

Interceptor ditches are used to divert run-on safely around the active construction areas

– May be temporary or permanent structures

– Channels and swales may be unlined or use linings depending on length of use

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Slope Diversions

Berms can be used to prevent run-on onto the site or down slopes

– Direct flow to a stable channel

– Short-term usage until more permanent conveyance systems are in place

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Slope Diversions

Ridge Design	
Side slopes	2:1 or flatter (3:1 or flatter where vehicles must cross)
Top width	2.0 ft.
Freeboard	0.3 ft.
Settlement	10% of fill height

Channel Design	
Side slopes	2:1 or flatter (3:1 or flatter where vehicles must cross)
Grade	Stable, positive grade towards outlet (should not exceed 2%)

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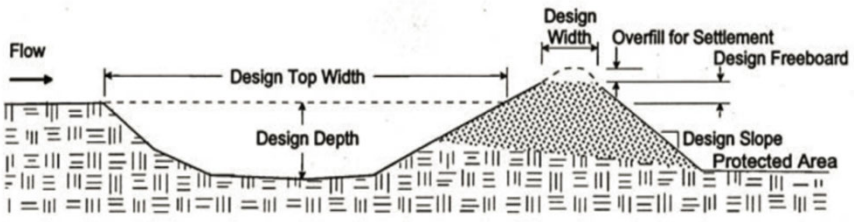
Slope Diversions



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Slope Diversions

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Be Legendary.

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Slope Diversions

Temporary slope drains are used to safely convey runoff down the slope

Slope drain considerations:

- Drainage area
- Type and size of drains
- Drain location
- Inlet type
- Outlet protection

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Be Legendary.

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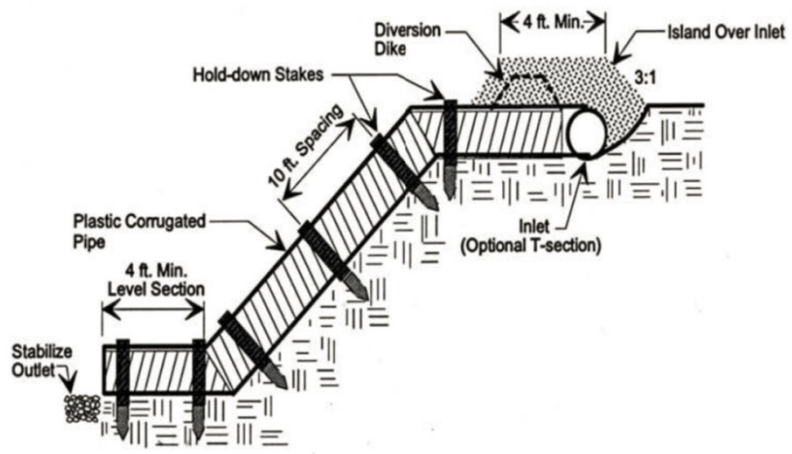
Slope Diversions



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Slope Breaks

Fiber rolls and silt fence used to shorten a slope and prevent rill erosion

– Slows sediment-laden water and filters sediment in low-flow areas

- Not recommended to be used with RECPs

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Slope Breaks

Recommended spacing of fiber rolls on slopes (ft):

		Fiber Roll Nominal Diameter			
		6”	**9”**	**12”**	**20”**
Slope Gradient	**≤4H:1V**	20	40	60	80
	3H:1V	15	30	45	60
	2H:1V	10	20	30	40
	1H:1V	5	10	15	20

Source: Sediment retention fiber roll (SRFR) general usage and installation guidelines, Erosion Control Technology Council (ECTC), 2011

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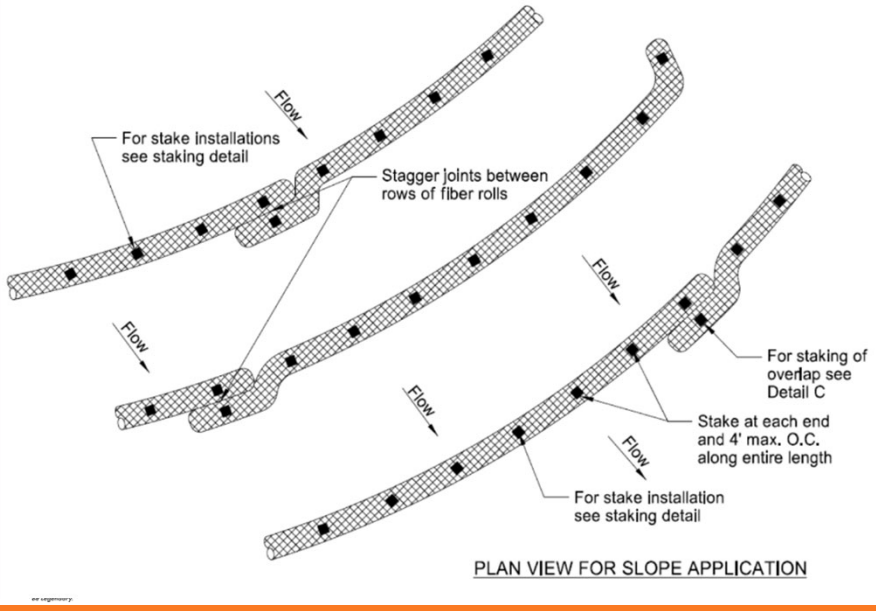
Standard Drawing D-261-1



PLAN VIEW FOR SLOPE APPLICATION

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Silt Fence

Placement:

– Placed along elevation contours or as perimeter control

Slope (%)	Slope Length (ft)	Maximum Drainage Area (ft²)
< 2	100	10,000
2 to 5	75	7,500
5 to 10	50	5,000
10 to 20	25	2,500
> 20	15	1,500

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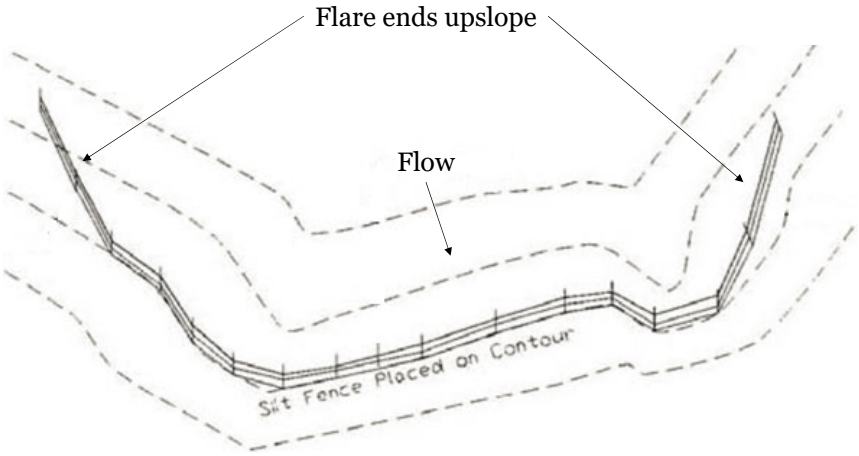
Silt Fence



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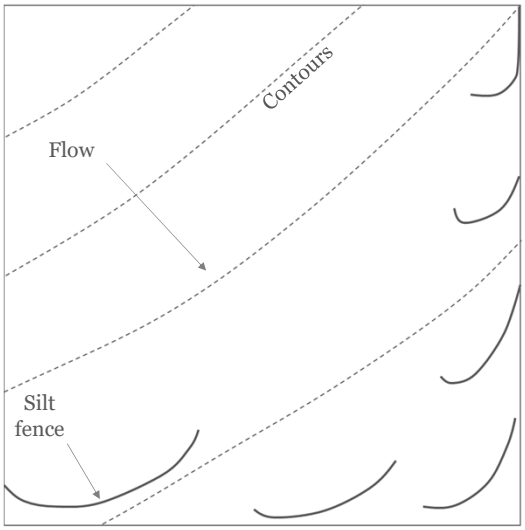
Silt Fence

Placement:

– "J" hooks increase ponding and prevents flow along the silt fence perimeter



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Flotation Silt Curtain (Section 262)

Geotextiles with floats and an anchorage system to prevent significant sediment from reaching watercourse

Available in different lengths and depths to match conditions

Never install across flowing channels or ditches

Placed as close to shore as possible

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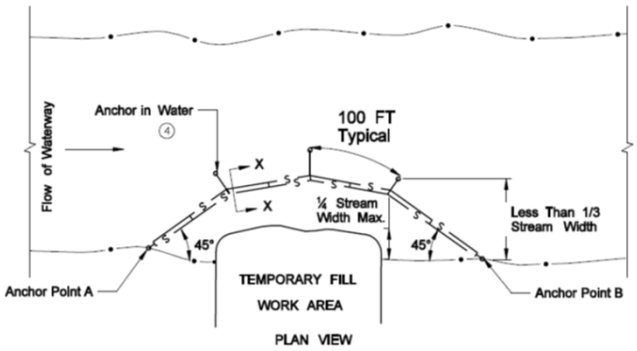
Flotation Silt Curtain (Section 262)



FLOTATION SILT CURTAIN - TYPE WORK AREA

FOR CONTAINING OVERFLOWS FROM WEIRS, STANDPIPES, SETTLING PONDS

DESIGN GUIDELINES:
WHEN TEMPORARY FILL ENCROACHES LESS THAN 1/4 OF THE WIDTH OF STREAM.
MAXIMUM WATER VELOCITY: 5 FT./SEC.
MAXIMUM WATER DEPTH: 11 FT.

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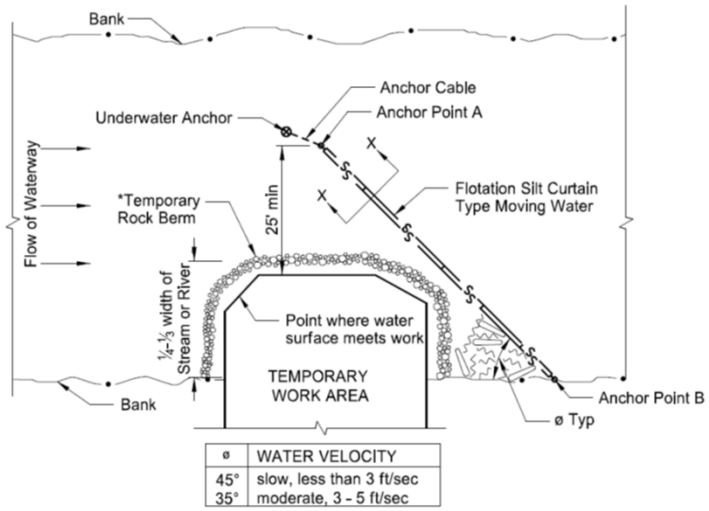
Flotation Silt Curtain (Section 262)



ø	WATER VELOCITY
45°	slow, less than 3 ft/sec
35°	moderate, 3 - 5 ft/sec

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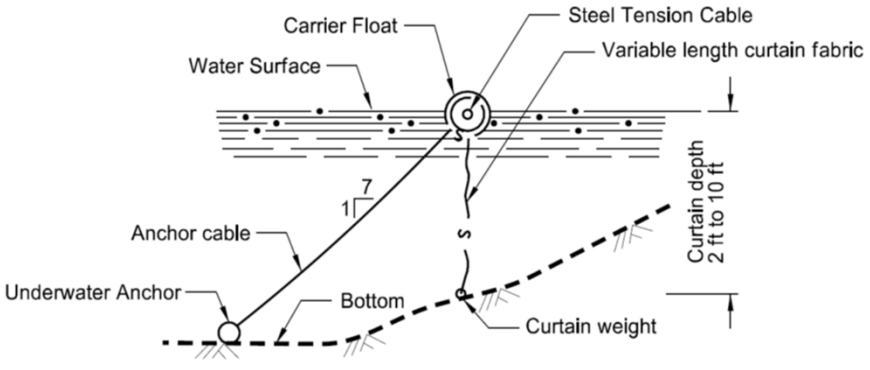
Flotation Silt Curtain (Section 262)



SECTION X-X
FLOTATION SILT CURTAINS

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Checks

Barriers built to temporarily hold water in concentrated flow channels (ditches)

– Provides both erosion and sediment control

Can be made of rock or tubes filled with straw, excelsior, or other materials

Should consider drainage area, depth of flow, and water velocity

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Rock Ditch Checks

Construction considerations:

– Spacing between checks

– Minimum 18 inches in height

– Center of rock ditch check should be lower than the ends (spillway)

– Back end of check should be protected to prevent erosion

– Remove sediment when it has reached ½ the height of the check

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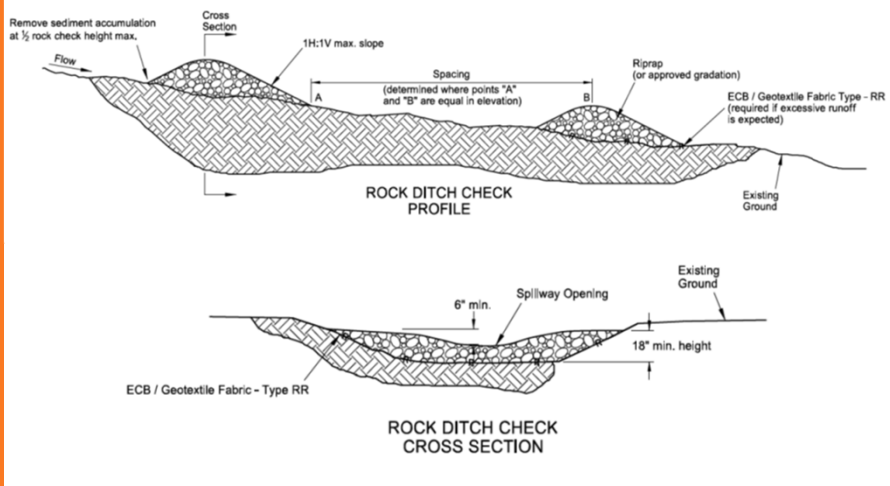

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Standard Drawing D-256-1

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Fiber Roll Ditch Checks (Section 261)

May be filled with straw or wood excelsior

Available in multiple tube diameters

– 6 inch to 20 inch

Placed on ECBs or bare soil

– Must be trenched in on bare soil (2 to 3 inches)

Stake spacing should not exceed 4 feet

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Fiber Roll Ditch Checks

Spacing of fiber rolls in a channel:

$$Spacing = \frac{D_{FR} - TD}{S_{Channel}}$$

Where:

D_{FR} = nominal diameter of fiber roll (ft)

TD = trench depth (ft)

$S_{Channel}$ = slope of channel (ft/ft)

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Fiber Roll Ditch Checks

Spacing of fiber rolls in a channel (Example):

20” roll trenched in 3” in a 4% (0.04 ft/ft) slope

$$Spacing = \frac{20/12 - 3/12}{0.04}$$

$$Spacing \cong 35\ ft\ between\ rolls$$

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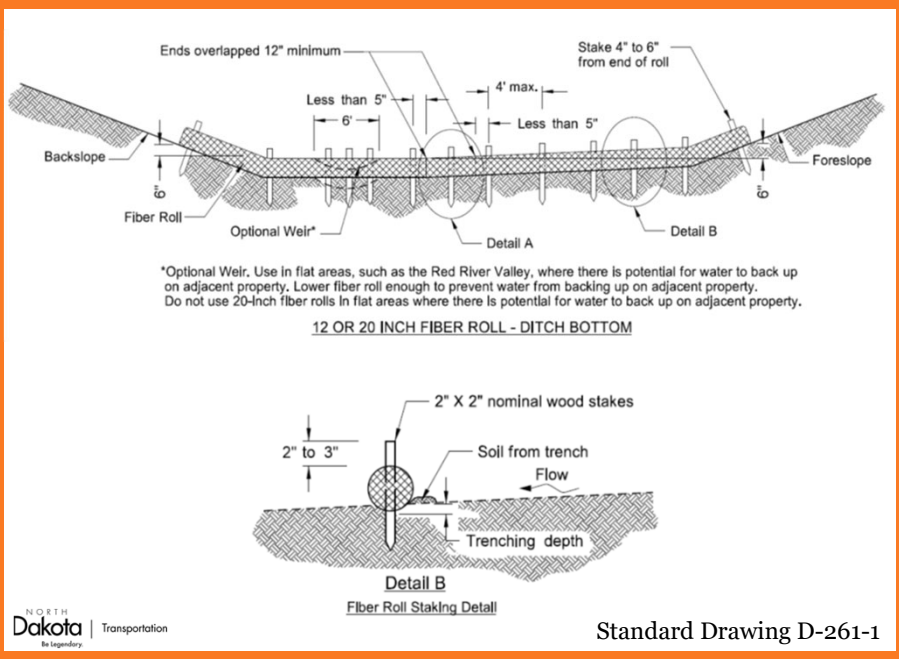

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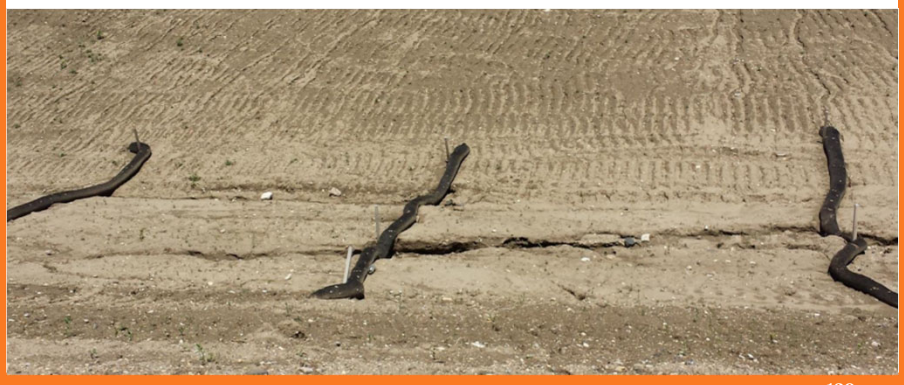
Ditch Checks

Inspect checks after significant rainfall events

Should watch for erosion at the ends of the check, downstream toe, and undercutting



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Good Housekeeping

Waste management

Sanitary waste management (portable toilets)

Petroleum/chemical/ hazardous waste management

Concrete washout

Subcontractors?

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Good Housekeeping

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Dewatering/Pumping

Dewatering on a construction site is a common practice

– Remove water from excavated areas

– Provide storage room in a sediment trap or basin before a rain event

For projects that require dewatering or pumping, sediment laden water cannot be pumped directly into surface waters

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Dewatering/Pumping

General Guidance:

– Draw water from top of water column for improved efficiency

– Know pump rates and filtration rates

– Knowledge of particle size within sediment laden water

– Stabilization of discharge

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Be Legendary.

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Dewatering/Pumping

Water treatment options:

– Sediment basins and traps

– Filtration

– Flocculants

– Weir tanks

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Outlet Protection

Riprap aprons and hard armor are common methods of reducing the impact of water exiting an outlet

Other Options:

– Energy dissipators

– Transition mats

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Outlet Protection

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Outlet Protection

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Outlet Protection

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Outlet Protection

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Vegetative Buffer Strips

Vegetative buffer strips are used to slow down runoff and intercept sediment

Must have a minimum width of 1 foot for every 5 feet of disturbed area which drains to the buffer

Buffer strip should be uniform and have a slope less than 5%

Area draining to the buffer should have a slope of 6% or less

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Stabilization Measures

Banks of streams and channels may need remediation or extra protection against increased flows

– Soil bioengineering techniques are becoming increasing popular for their effectiveness and aesthetics

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Flow Dissipation and Stabilization Measures

Structural stabilization:

– Riprap

– Gabions

– Precast elements

Geotextiles:

– TRM

– Geogrids

– Cellular confinement systems

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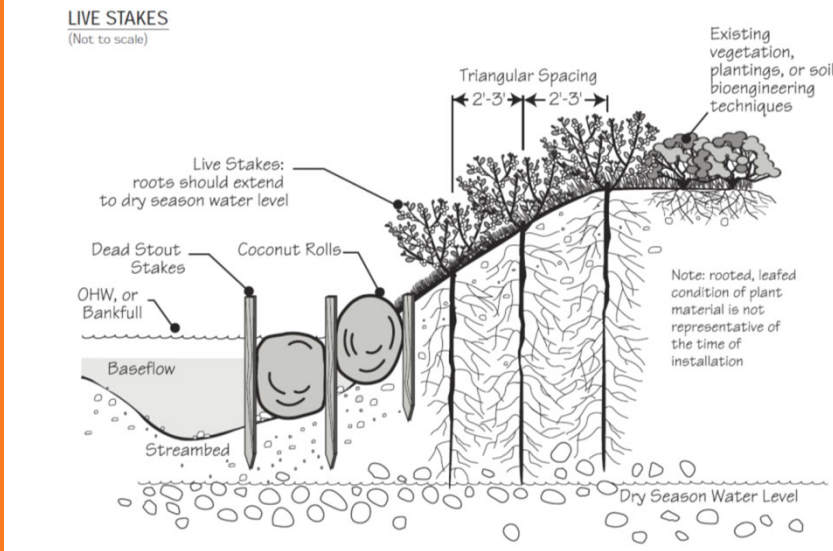

Source: Eubanks, C. E.,, and Medaows, D. (2002). A soil bioengineering guide for streambank and lakeshore stabilization, *USDA Forest Service FS-683*, pps. 184

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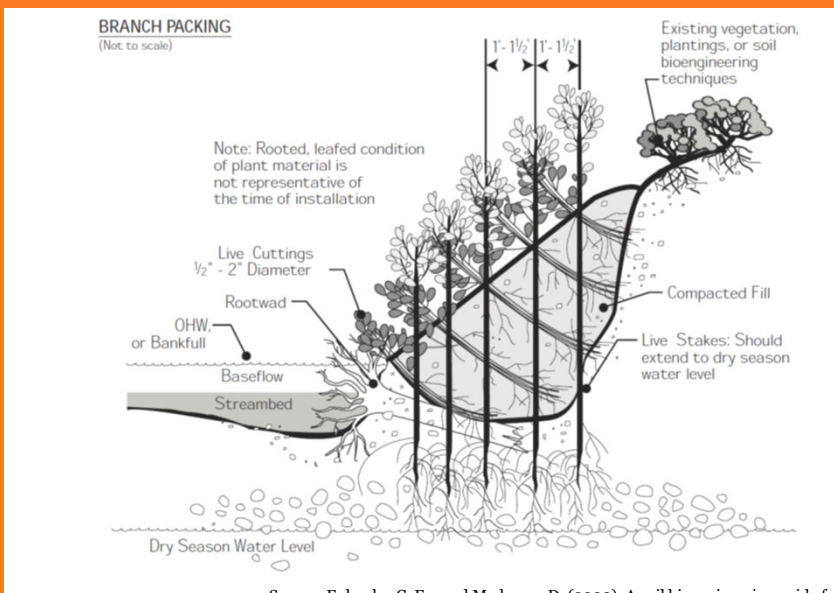

Source: Eubanks, C. E.,, and Medaows, D. (2002). A soil bioengineering guide for streambank and lakeshore stabilization, *USDA Forest Service FS-683*, pps. 184

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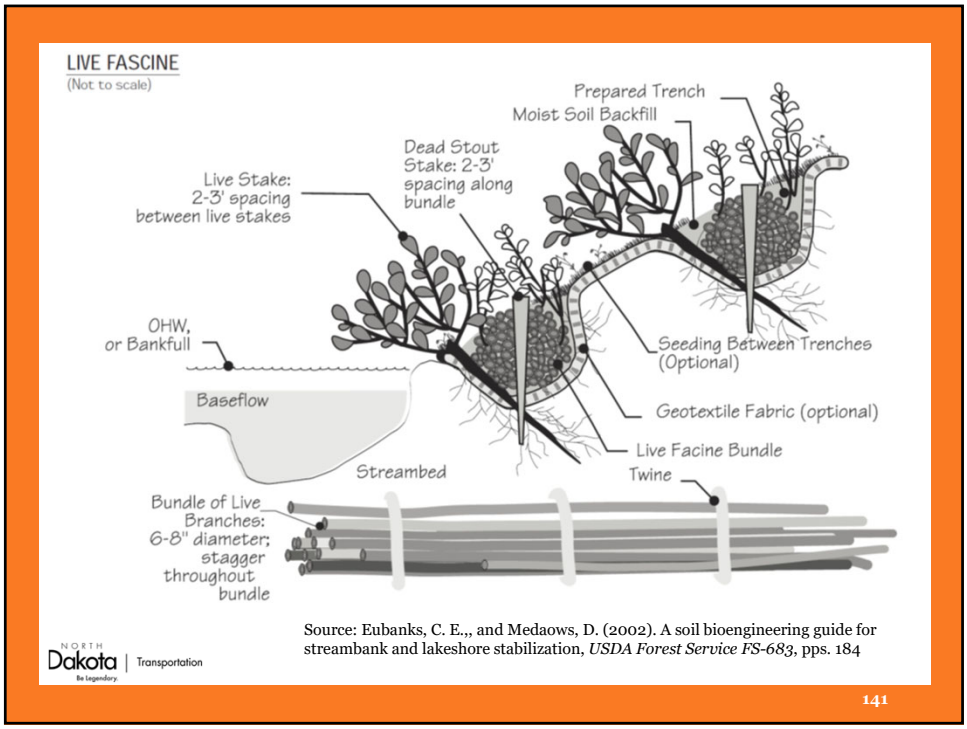
LIVE FASCINE
(Not to scale)
Prepared Trench
Moist Soil Backfill
Dead Stout Stake: 2-3' spacing along bundle
Live Stake: 2-3' spacing between live stakes
OHW, or Bankfull
Seeding Between Trenches (Optional)
Baseflow
Geotextile Fabric (optional)
Live Facine Bundle
Streambed
Twine
Bundle of Live Branches: 6-8" diameter; stagger throughout bundle
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Source: Eubanks, C. E.,, and Medaows, D. (2002). A soil bioengineering guide for streambank and lakeshore stabilization, *USDA Forest Service FS-683*, pps. 184
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Stormwater Management

Bioswales/bioretention

Underground storage

Infiltration basins

Grit chambers

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Questions?

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