

SMALL PROJECT/ LOW-HAZARD EROSION CONTROL GUIDE



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INTRODUCTION

Noticing low levels of sediment in the streams and rivers of Pennsylvania during times of high flows and velocities is a natural event. However, accelerated erosion and sedimentation pollution, resulting from human activities, smothers and destroys aquatic life in streams, causes losses of valuable topsoil, and impairs water quality. Sediment pollution is the single largest pollutant, by volume, to the streams and waterways of PA. Sediment pollution can be defined as any man-made disturbance that leads to increases in sediment (clay, silts, sands, and other “mud”) levels in streams, wetlands, and watercourses.

In an attempt to control accelerated erosion and sedimentation, the Department of Environmental Protection adopted Chapter 102, Erosion and Sedimentation Control Rules and Regulations, in accordance with the PA Clean Streams Law.

Under current Chapter 102 regulations, anyone disturbing (i.e. digging, grubbing, grading, or in any way disturbing the topsoil) 5000 square feet or more of ground is required to develop *and implement* an Erosion and Sediment Control Plan (E&S plan). This plan must be submitted to the county Conservation District if required by a municipality, if requested by the District, or if the total disturbance is 1 acre or more for the life of the project. REMEMBER: under the Clean Streams Law and the Chapter 102 regulations both the landowner *and* contractors may be held responsible when sediment-laden water is running or discharged from a construction site.

Purpose of This Guide

This document was designed to assist landowners in developing and implementing an E&S plan for small-scale, low-hazard projects. Use of this guide may be limited to:

- Projects where disturbance is less than 1 acre
- Projects where there are no slopes on or near the site exceeding 10%
- Projects with no associated impacts to wetlands, streams, or major waterways

Considerations in Plan Development

Practice Proper Site Grading-Hold Grading to a Minimum

The risk of severe erosion increases in relationship to the amount of site disturbance. Excessive cutting and filling may alter the ground water system, open seeps, or expose unstable soils. Improperly compacted fills may also be extremely erosive. Cutting, filling, and road grades over 10% require more intensive stabilization and often result in more long-term stabilization problems. All of the topsoil from areas where cuts and fills have been made should be stockpiled and redistributed uniformly after grading. This is the key to revegetating the site.

Save Existing Vegetation, Especially Trees

Vegetative cover is the best and most economical protection against soil erosion. Vegetation and trees should be roped off during construction to prevent damage from equipment (trees should be roped off under the crowns so that roots systems are not destroyed).

Minimize the Area and Time of Exposure

Any disturbed area should be stabilized as soon as earth disturbance is completed (usually this means the area should be seeded and mulched). Minimize the amount of disturbed ground at any given time. Sequence the construction such that only the areas to be immediately worked on are disturbed. Stabilization of the site should not wait until the entire project is completed. Applying a stone base immediately after the driveway is cut in is an example.

Protect Any Watercourses or Wetlands

Install temporary controls, such as silt fence or hay bales, in order to prevent sediment pollution to water courses and drainages. Remember the basic idea: keep muddy water from getting into the streams.

Maintenance

Plan to inspect and repair all E&S controls (Best Management Practices, or BMPs) after every significant rain event, and at the end of each week, at a minimum. E&S controls/ BMPs are not totally maintenance free: silt fences fall; re-vegetated areas sometimes wash out before vegetation can get established.

What Should be Included in an Erosion and Sedimentation Control Plan?

1. Complete Plan Checklist (provided as Attachment A).
2. Existing topography of the site (slope directions and estimated grades).
3. Location of any water bodies (streams, ditches, springs, etc.).
4. Brief description of the proposed project.
5. Types of E&S controls to be used and their locations on the site.

Suggested Construction Sequence

1. Cut and install a stone-based driveway or access area for equipment.
2. Install all temporary E&S controls/ BMPs (such as hay bales, silt fence, etc.).
3. Strip topsoil from areas where work will begin, stockpile for final stabilization of site.
4. Construct buildings.
5. Finish grading and permanently stabilize (seed/ mulch/ stone, etc.) entire site.
6. Remove all temporary controls after site is completely stabilized and vegetated.

Seeding and Mulching Recommendations

Temporary Seeding Recommendations/ Mixtures

If temporary seeding is necessary, follow the chart below. Then, when final stabilization is to be completed, apply the remainder of the recommendations below for lime and fertilizer prior to final seeding and mulching. Annual Ryegrass is a quick germinating species of grass that can be seeded at almost anytime. If you plan to leave your project or part of your project area inactive before final stabilization/ permanent cover is achieved, a temporary seeding should be applied immediately.

Lime	1 ton per acre	50 lbs. per 1000 square feet
Fertilizer	150 lbs. per acre	5 lbs. per 1000 square feet
Annual Ryegrass	40 lbs. per acre	1 lbs. per 1000 square feet

Permanent Seeding Mixtures

Establishing a permanent vegetative cover is the final step to effective erosion and sediment pollution control. It is recommended that the Penn State Agronomy Guide be consulted (available from PSU Cooperative Extension or the County Conservation District). All mixtures below are for 100% PLS (Pure Live Seed). Depending on your percent PLS, you may have to adjust recommendations accordingly. General recommendations are as follows:

Lawn and Mowed Areas

A. Kentucky Bluegrass	30 lbs. per acre	12 oz. per 1000 square feet
Redtop	3 lbs. per acre	2 oz. per 1000 square feet
Perennial Ryegrass	20 lbs. per acre	8 oz. per 1000 square feet
B. Pennlawn-Fine Fescue	40 lbs. per acre	16 oz. per 1000 square feet
Redtop	3 lbs. per acre	2 oz. per 1000 square feet
Perennial Ryegrass	20 lbs. per acre	8 oz. per 1000 square feet

Slopes and Un-Mowed Areas

Crownvetch	25 lbs. per acre	10 oz. per 1000 square feet
Perennial Ryegrass	25 lbs. per acre	10 oz. per 1000 square feet

Note: Crownvetch is a legume and requires an inoculant. Contact your seed supplier for more specific information. Although providing a thick ground cover, crownvetch is also an extremely aggressive invasive species, offering little wildlife benefit. Use with caution.

Timing of Permanent Seeding

For best results, grass and legume seedings should be completed in the spring; however, with proper establishment techniques, disturbed sites can be seeded almost anytime from spring to fall. General rules are: legume seedings need 10-12 growing weeks prior to hard frost, and grasses generally require 4-6 weeks of growth prior to hard frost.

Lime

Adding agricultural grade limestone to a site is often the key to establishing vegetation. Soil tests from a reputable source are recommended. But in the case where test results are not available, use the following guide.

Fertilizer – Commercial Type 10-20-20

The need for fertilizer cannot be underestimated. Soil tests are again recommended, but the guide below can be used in their absence.

Mulch (Hay or Straw)

All areas that are seeded, temporarily or for permanent stabilization, should be mulched. Mulch is a loose layer of hay or straw (or sometimes bark mulch) 1” deep. Mulch reduces erosion of soils and aids in seedling germination.

<i>Lime</i>	4 tons per acre	190 lbs. per 1000 square feet
<i>Fertilizer</i>	930 lbs. per acre	25 lbs. per 1000 square feet
<i>Mulch (hay or straw)</i>	3 tons per acre	140 lbs. per 1000 square feet

Above Site Drainage

It is important to consider the aspect of stormwater and off-site runoff as it could affect your site. Areas up-slope of your construction site may allow large amounts of water to run over your site. This water should be diverted around or through your site in such a way that clean, sediment-free water does not pick up sediment from the construction site. The basic concept is to keep the clean water clean, and treat the dirty (sediment-laden) water prior to allowing it to run off your site. Downspouts, swale outlets, parking lots, and other items that collect and concentrate water have the potential to cause soil erosion both on your site and on adjoining properties. Take care to plan for stormwater related issues during construction.

E&S Detail Sheets

The next section is devoted strictly to providing detailed installation instruction for E&S measures, and general rules of thumb as to when each practice should be used. This guide is designed so landowners can plan for and install erosion control practices to minimize accelerated erosion, and meet the Chapter 102 regulations and Clean Streams Law of Pennsylvania. The details that follow were developed from the Department of Environmental Protection Erosion and Sedimentation Pollution Control Manual, March 2000. These are not the only BMPs that can be used, but are ones that have been previously reviewed, approved, and recommended.

This guide is not intended to be a substitute for E&S plans developed for complex, several acre, or high-hazard sites. Professional engineering should be considered for sites requiring permanent E&S measures or on sites where the hazards of sediment pollution to streams and wetlands are high. The local Conservation District will gladly assist you in completing and implementing this E&S guide, as well as determining if a more detailed E&S plan would be necessary.

A copy of this plan should be kept on site during construction. Your contractor should have a copy of this plan. At your request the Conservation District will keep a copy of your plan on record at our office.

Complete Plan Checklist

A Complete Plan Checklist is available for your use in developing an E&S plan. Depending on the site, some of the items on the checklist may not apply. The items indicated in this low-hazard E&S guide are those items typically applicable for such sites according to the Chapter 102 regulations.

ADDITIONAL SEEDING AND MULCHING RECOMMENDATIONS

TABLE 15
Plant Tolerances of Soil Limitation Factors

Species	Growth Habit ¹	Tolerances				Minimum Seed Specifications ²				
		Wet Soil	Dry Site	Low Fertility	Acid Soil (pH 5-5.5) ³	Purity (%)	Ready Germ (%)	Hard Seed (%)	Total Germ (%)	Seeds/lb (1,000)
Warm-Season Grasses										
Doan's grass	bunch	yes	yes	yes	yes	85	75		75	280
Weeping lovegrass	bunch	yes	yes	yes	yes	87	75		75	1,500
Switchgrass	bunch	yes	yes	yes	yes	(80 PLS)				380
Big bluestem	bunch	no	yes	yes	yes	(50 PLS)				150
Cool-Season Grasses										
Roadgrass	sod	yes	yes	yes	yes	82	80		80	1,000
Fine fescue	sod	no	no	yes	no	85	80		80	400
Pennsylvania bluegrass	bunch	yes	no	no	no	88	88		88	227
Annual ryegrass	bunch	yes	no	yes	no	85	85		85	227
Kentucky bluegrass	sod	no	no	no	no	85	75		75	2,200
Orchardgrass	bunch	yes	yes	yes	yes	85	80		80	654
Timothy	bunch	yes	no	yes	yes	85	80		80	1,230
Smooth bromegrass	sod	no	yes	yes	no	85	80		80	136
Legumes ⁴										
Crownvetch	sod	no	yes	yes	no	98	40	20	60	120
Blackfoot trefoil ⁵	bunch	yes	no	yes	yes	98	80	20	80	400
Field pea	sod	no	no	yes	yes	98	55	20	75	10
Saracat vetch	bunch	no	yes	yes	yes	98	80	20	80	338
Cereals										
Winter wheat	bunch	no	no	no	no	98	85		85	10
Winter rye	bunch	no	no	yes	yes	98	85		85	18
Spring oats	bunch	no	no	no	no	98	85		85	12
Bromegrass	bunch	no	yes	no	no	98	85		85	55
Japanese millet	bunch	yes	no	yes	yes	98	80		80	155

¹ Growth habit refers to the ability of the species to either form a dense sod by vegetative means (stems, rhizomes, or roots) or remain in a bunch or single plant form. If seeded heavily enough, even bunch formers can produce a very dense stand. This is sometimes called a sod, but not in the sense of a sod formed by vegetative means.

² Once established, plants may grow at a somewhat lower pH, but cover generally is only adequate at pH 6.0 or above.

³ Minimum seedlots are only minimum, and seedlots to be used for revegetation purposes should equal or exceed these standards. Thus, doan's grass should germinate 75% or better. Crownvetch should have at least 40% readily germinable seed and 30% hard seed. Currently, seedlots are available that equal or exceed minimum specifications. Remember that detailed data are adverse for plant establishment. Ready germination refers to seed that germinates during the period of the germination test and that would be expected, if conditions are favorable, to germinate rapidly when planted. The opposite of ready germination is dormant seed, of which hard seed is one type.

⁴ Switchgrass seed is sold only on the basis of pure live seed (PLS).

⁵ Seed specific legume inoculant. Inoculant suitable for grasses and vetches usually is satisfactory for legumes.

⁶ Blackfoot trefoil is adapted over the entire state, except in the extreme southeast where brown and red soils may injure stands.

TABLE 16
Mulch Application Rates

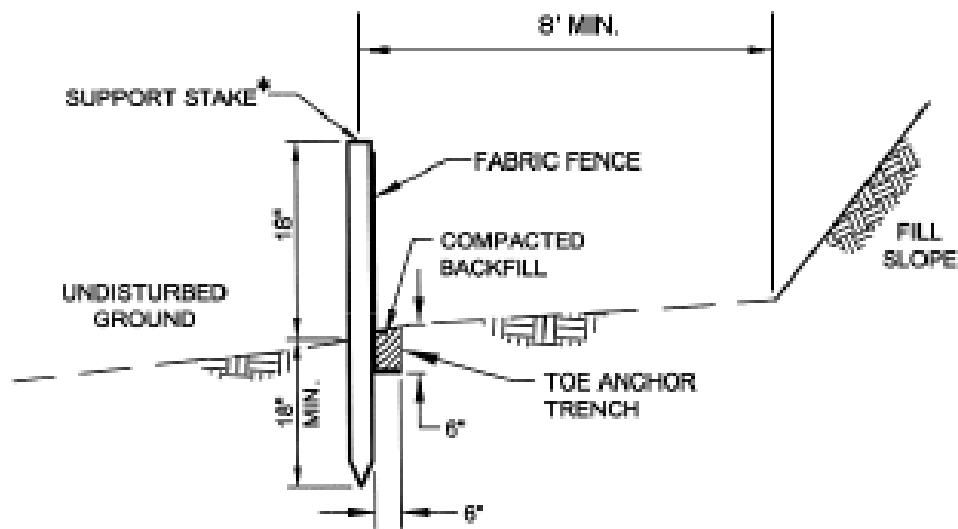
Mulch Type	Application Rate (Min.)			Notes
	Per Acre	Per 1,000 sq. ft.	Per 1,000 sq. yd.	
Straw	3 tons	140 lb.	1,240 lb.	Either wheat or oat straw, free of weeds, not chopped or finely broken
Hay	3 tons	140 lb.	1,240 lb.	Timothy, mixed clover and timothy or other native forage grasses
Wood Cellulose	1,500 lb.	35 lb.	310 lb.	Do not use alone in winter, during hot and dry weather or on steep slopes ($\geq 3:1$)
Wood Cellulose	1,000 lb.	25 lb.	210 lb.	When used over straw or hay
Wood Chips	4 - 6 tons	185 - 275 lb.	1,650 - 2,500 lb.	May prevent germination of grasses and legumes

STANDARD CONSTRUCTION DETAIL # 4-7 Standard Silt Fence (18" High)

*STAKES SPACED @ 8' MAX.
USE 2" x 2" ($\pm 3/8"$) WOOD
OR EQUIVALENT STEEL
(U OR T) STAKES



JOINING FENCE SECTIONS



ELEVATION VIEW

PA DEP

Fabric shall have the minimum properties as shown in Table 4.3.

Fabric width shall be 30" minimum. Stakes shall be hardwood or equivalent steel (U or T) stakes.

Silt fence shall be placed at level existing grade. Both ends of the fence shall be extended at least 8 feet up slope at 45 degrees to the main fence alignment (see Figure 4.1).

Sediment shall be removed when accumulations reach half the aboveground height of the fence.

Any section of silt fence which has been undermined or topped shall be immediately replaced with a rock filter outlet (Standard Construction Detail # 4-6).

Fence shall be removed and properly disposed of when tributary area is permanently stabilized.

Straw bale barriers should not be used in areas where rock prevents full and uniform anchoring of the bales.

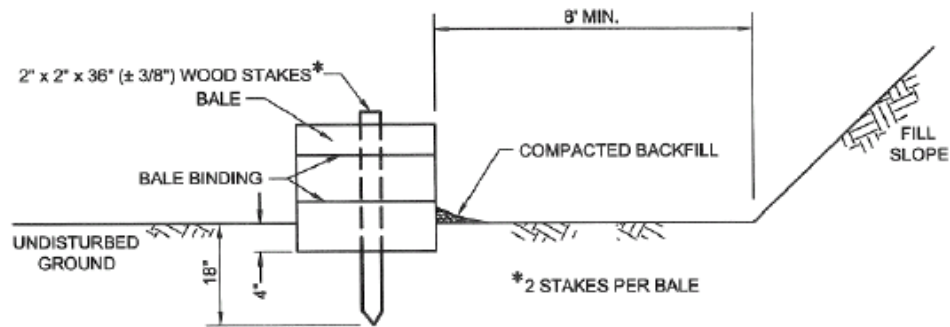
Straw bale barriers should be installed according to Standard Construction Detail # 4-13.

Bales should be installed in an anchoring trench. When improperly placed and installed (such as staking the bales directly to the ground with no soil seal or entrenchment), undercutting and other failures typically occur.

Two support stakes should be driven through each bale to a depth 18" below the ground surface.

The excavated soil should be backfilled and compacted on the upslope side of the bales.

STANDARD CONSTRUCTION DETAIL # 4-13 Straw Bale Barrier



PA DEP

Straw bale barriers shall not be used for projects extending more than 3 months.

Straw bale barriers shall be placed at existing level grade with ends tightly abutting the adjacent bales. First stake of each bale shall be angled toward adjacent bale to draw bales together. Stakes shall be driven flush with the top of the bale (see Figure 4.4). Both ends of the barrier shall be extended at least 8 feet up slope at 45 degrees to the main barrier alignment (see Figure 4.1).

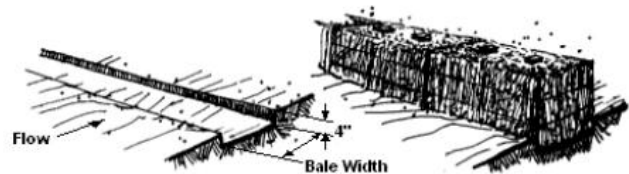
Compacted backfill shall extend approximately 4 inches above ground level.

Sediment shall be removed when accumulations reach 1/3 the aboveground height of the barrier. Damaged or deteriorated bales shall be replaced immediately upon inspection.

Any section of straw bale barrier which has been undermined or topped shall be immediately replaced with a rock filter outlet (Standard Construction Detail # 4-6).

Bales shall be removed when the tributary area has been permanently stabilized.

FIGURE 4.4
Straw Bale Barrier Installation



1. EXCAVATE THE TRENCH.

2. PLACE AND STAKE STRAW BALES

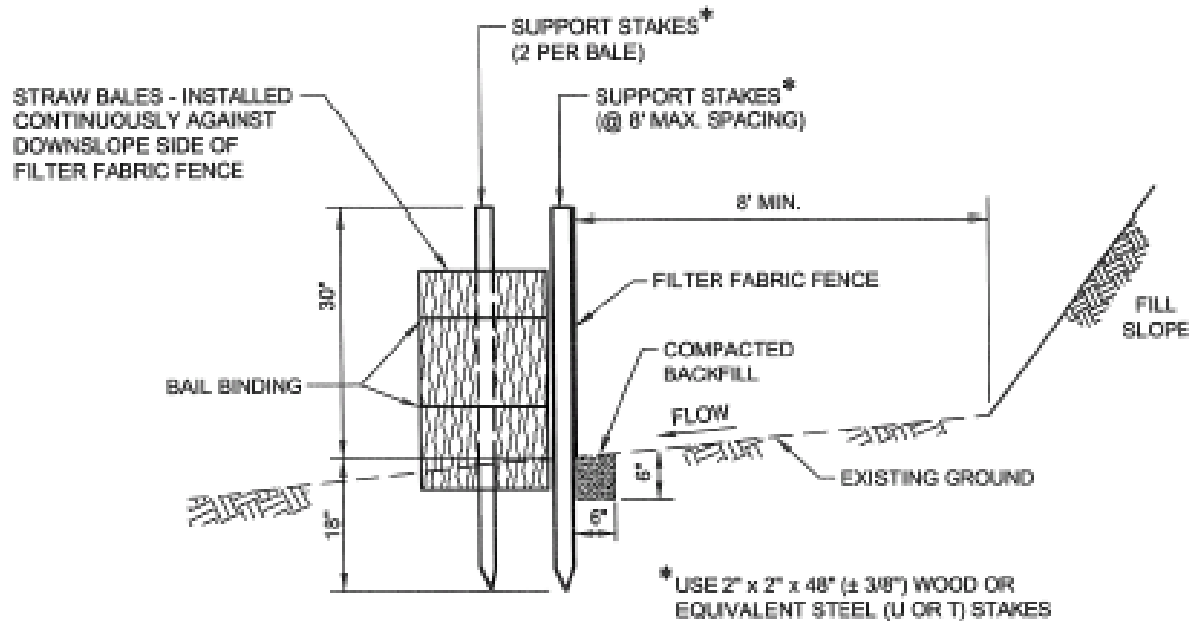


3. WEDGE LOOSE STRAW BETWEEN BALES

4. BACKFILL AND COMPACT THE LOOSE SOIL. (ANCHOR TOE)

NRCS

STANDARD CONSTRUCTION DETAIL # 4-9 Silt Fence Reinforced by Staked Straw Bales



PA DEP

Fabric shall have the minimum properties as shown in Table 4.3.

This BMP is not suitable for projects lasting longer than 3 months unless bales are replaced quarterly.

Fabric width shall be 42" minimum. Stakes shall be hardwood or equivalent steel (U or T) stakes.

Silt fence shall be installed at existing level grade. Both ends of each fence section shall be extended at least 8 feet upslope at 45 degrees to the main fence alignment (Figure 4.1).

Sediment shall be removed where accumulations reach half the aboveground height of the fence.

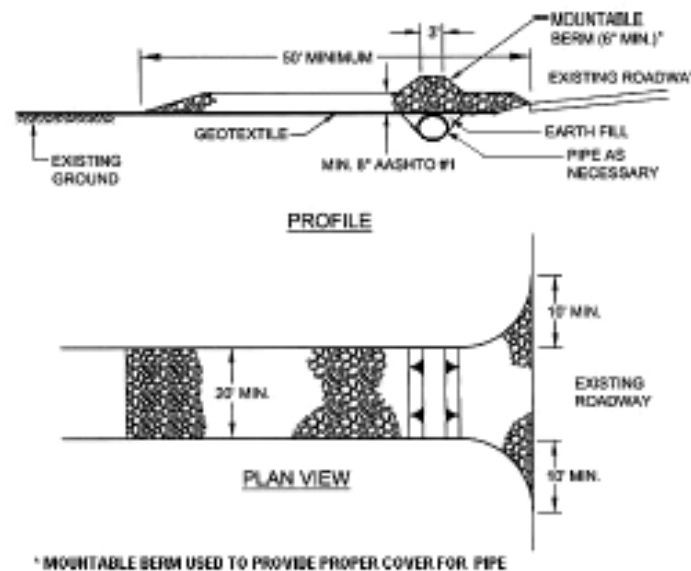
Any fence section which has been undermined or topped shall be immediately replaced with a rock filter outlet (Standard Construction Detail # 4-6).

Fence shall be removed and properly disposed of when tributary area is permanently stabilized.

Sediment deposited on public roadways should be removed and returned to the construction site immediately. **Note: Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.**

Rock construction entrances are not effective sediment removal devices for runoff coming off the roadway above the entrance. Surface runoff should be directed off the roadway by means of appropriate drainage devices described later in this chapter. Where these devices do not discharge to a suitable vegetative filter strip, an appropriately sized sediment trap should be provided. For locations not having sufficient room for a conventional sediment trap, consideration should be given to use of a compost sock sediment trap. Compost sock traps may also be used instead of conventional sediment traps at other points of discharge. Where used, care should be taken to provide continuous contact between the sock and the underlying soil in order to prevent undermining. It is also important to properly anchor the sock (Standard Construction Detail #3-1).

STANDARD CONSTRUCTION DETAIL #3-1 Rock Construction Entrance



Modified from Maryland DOE

Remove topsoil prior to installation of rock construction entrance. Extend rock over full width of entrance.

Runoff shall be diverted from roadway to a suitable sediment removal BMP prior to entering rock construction entrance.

Mountable berm shall be installed wherever optional culvert pipe is used and proper pipe cover as specified by manufacturer is not otherwise provided. Pipe shall be sized appropriately for size of ditch being crossed.

MAINTENANCE: Rock construction entrance thickness shall be constantly maintained to the specified dimensions by adding rock. A stockpile shall be maintained on site for this purpose. All sediment deposited on paved roadways shall be removed and returned to the construction site immediately. If excessive amounts of sediment are being deposited on roadway, extend length of rock construction entrance by 50 foot increments until condition is alleviated or install wash rack. Washing the roadway or sweeping the deposits into roadway ditches, sewers, culverts, or other drainage courses is not acceptable.

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A one foot thick layer of AASHTO #57 (or smaller) stone should be placed on the upstream side of the filter. In special protection watersheds, a 6" layer of compost should be placed and anchored on top of the filter stone. NOTE: Filter fabric and straw bales should not be used in rock filters!

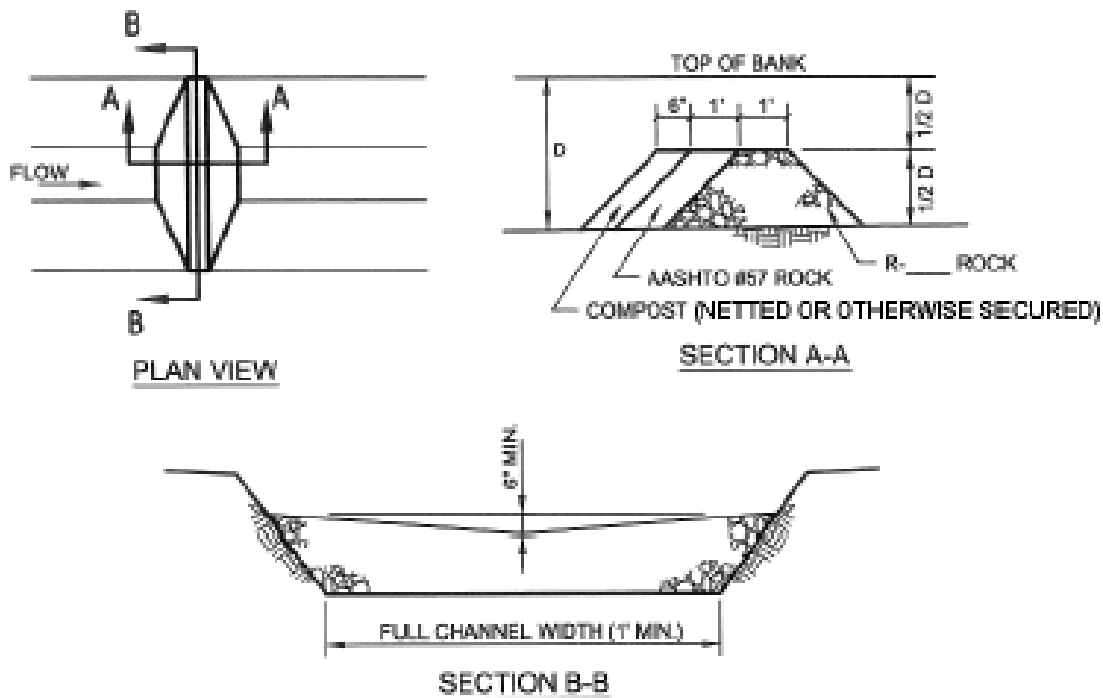
Rock filters should be inspected weekly and after each runoff event.

Clogged filter stone (AASHTO # 57) should be replaced.

Needed repairs should be initiated immediately after the inspection.

STANDARD CONSTRUCTION DETAIL # 4-14

Rock Filter



PA DEP

FOR $3' \leq D$ USE R-4
 FOR $2' < D < 3'$ USE R-3
 NOT APPLICABLE FOR $D < 2'$

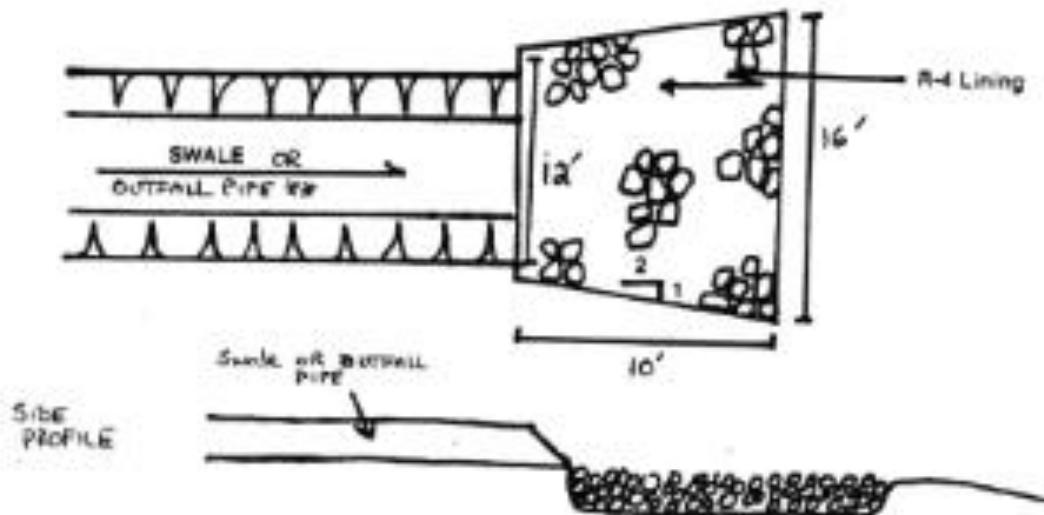
NOTE: This table is intentionally blank and should be filled in by the plan preparer.

ROCK FILTER NO.	LOCATION	D (FT.)	RIPRAP SIZE

Sediment shall be removed when accumulations reach 1/2 the height of the filter.

Immediately upon stabilization of each channel, installer shall remove accumulated sediment, remove rock filter, and stabilize disturbed areas.

ROCK APRON OUTLET PROTECTION



DIMENSIONS

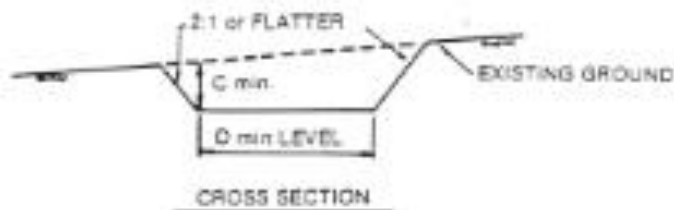
- 12' ** Match with grades from outlet of swale (Inlet End)
- 10' Length
- 16' Outlet End

CONSTRUCTION SPECIFICATIONS

1. Rock Aprons are required to reduce the outlet velocity of a swale to 3.0 f.p.s. or less.
2. R-4 Rock has a maximum diameter of 12" and a minimum diameter of 3".
3. The placement of a layer of geotextile prior to installing the rock lining is recommended.
4. Outlets must discharge to a stable non-erosive outlet.
5. Install R4 rock a minimum of 18" into ground.

* * Rock Apron detail can also be used as outfall protection for stormwater pipes carrying similar velocities and flows.

TEMPORARY SWALE

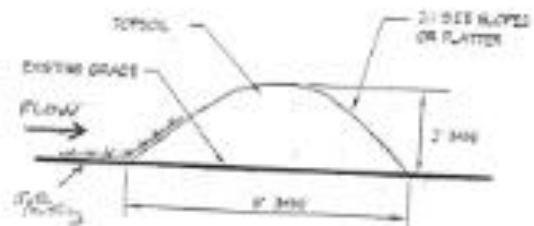


DIMENSIONS

- C - Depth 1.5' (includes 1/2' freeboard)
- D - Bottom width 4'

EARTHEN BERM / TOPSOIL WINDROW

NOT TO SCALE



NOTES:

1. RUN LOADER OVER TOPS AND SIDES TO COMPACT AND SHAPE.
2. FILL WITH TEMPORARY MULCH.
3. Jute matting should be installed where earthen berm is in contact with flowing water.

Flow Channel Stabilization	
Channel Grade	Type of Stabilization
0.5 - 1.0%	Seed and Straw Mulch
1.0 - 2.5%	Jute Matting (or equivalent) with straw mulch
2.5 - 8.0%	*Sod Lining
*requires rock apron or some other device to slow the velocity of the water	

INSTALLATION

1. Remove all trees and shrubs that may interfere with the functioning of the swale.
2. The swale should be excavated to the required depth and slope. Fills should be compacted by earthmoving equipment.
3. Seed, mulch, and jute matting should be placed immediately after final grade is reached.

MAINTENANCE

1. Periodic maintenance should be performed. Any eroded areas should be seed/ mulched/ and jute matting installed immediately. Erosion resulting from concentrated water flows should be re-stabilized with jute matting or with rock, depending on velocity and amount of flows.

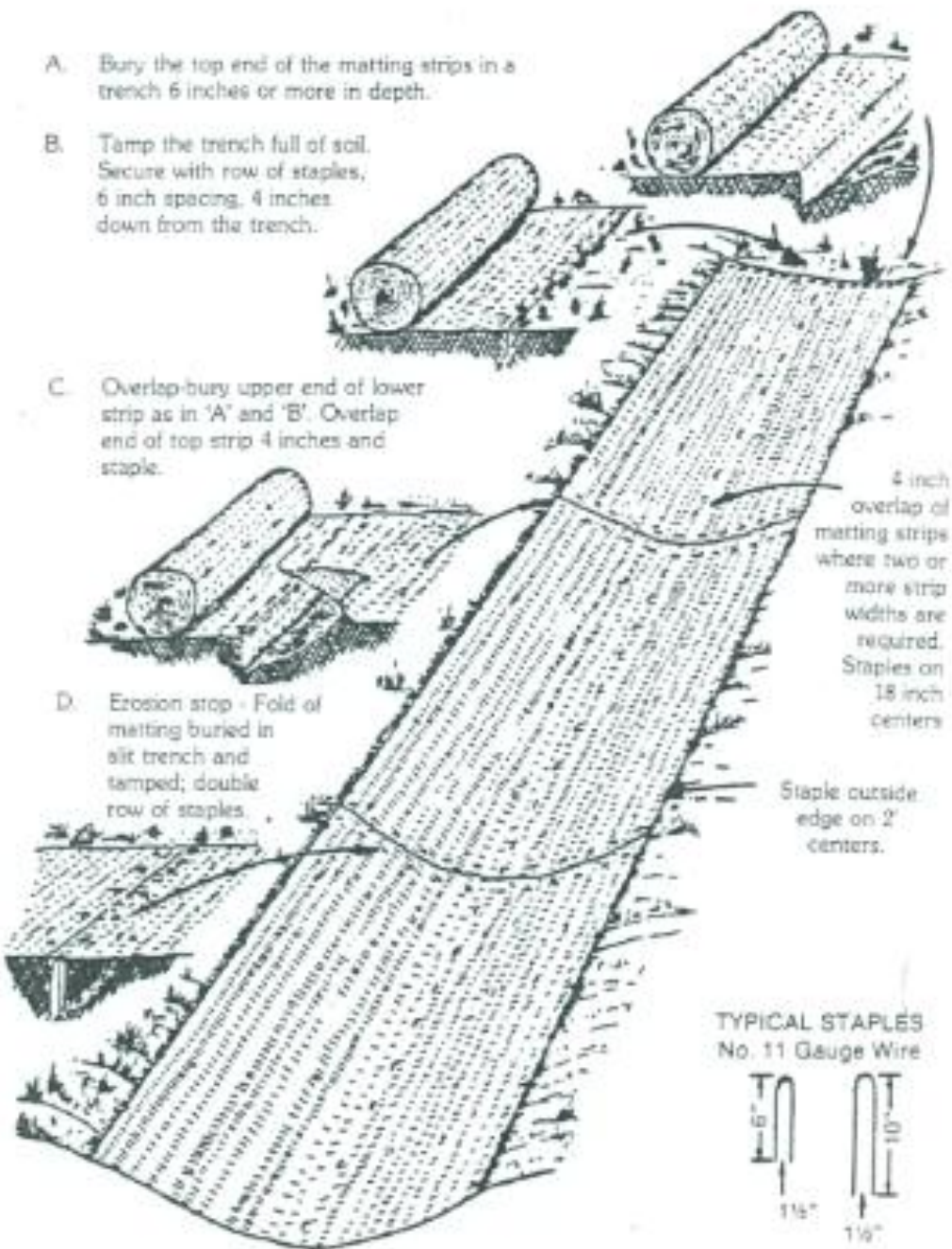
RESTRICTIONS

1. All swales should have uninterrupted positive grade to a stabilized outlet.
2. Diverted runoff from a disturbed area (i.e. construction site) should be conveyed to a sediment-trapping device (i.e. rock filter).
3. Diverted runoff from an undisturbed area shall outlet directly into an undisturbed, stabilized area at non-erosive velocity.
4. Maximum drainage area for diversions is 5 acres, and maximum slope of swale is 8%.

NOTES

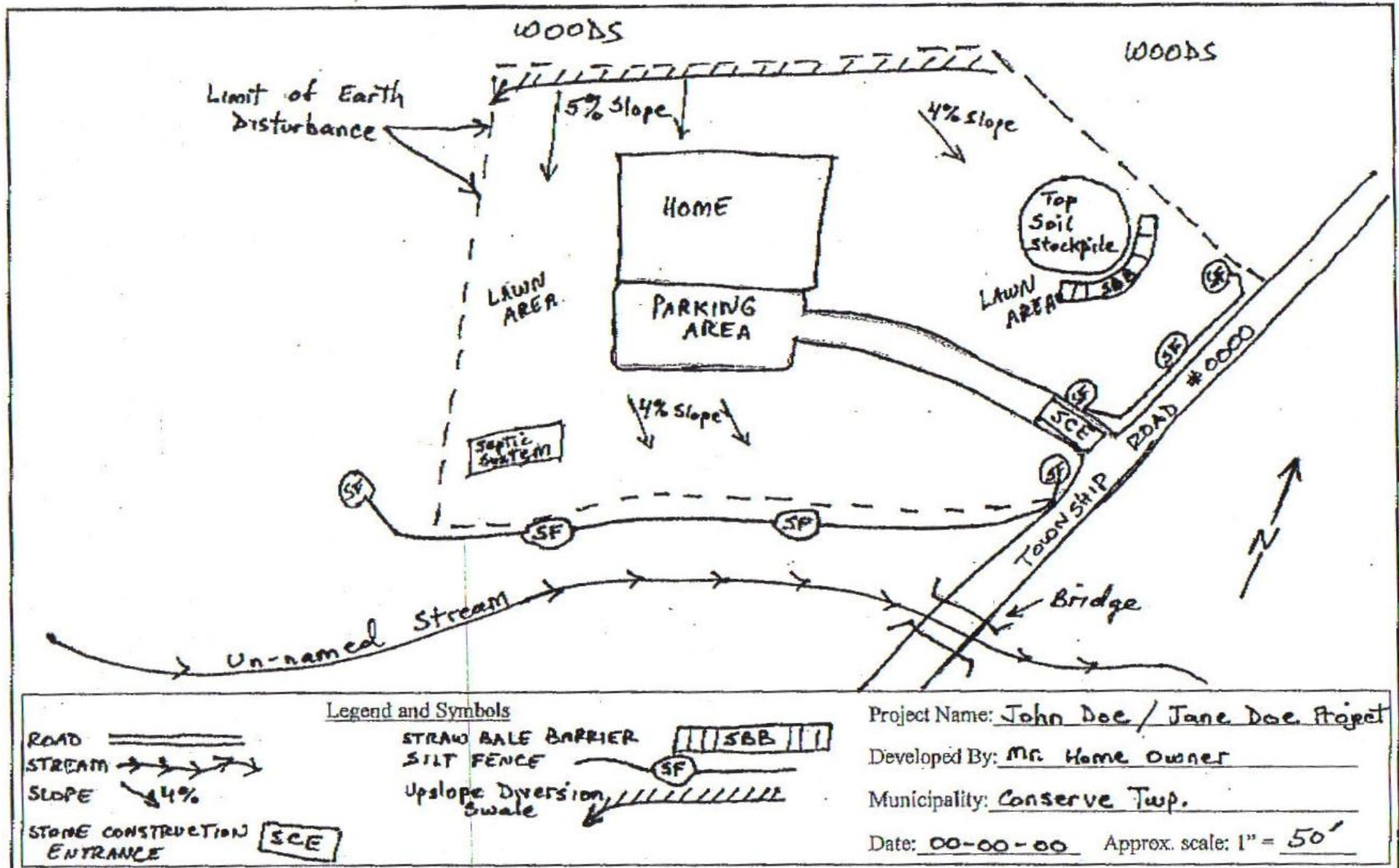
1. Earthen berms are to be used for the same purposes as diversion swales, and follow the same restrictions as listed above.

DETAIL FOR STABILIZING WATERWAYS WITH JUTE OR EXCELSIOR MATTINGS



SAMPLE PLAN

Erosion and Sedimentation Pollution Control Plan



Erosion and Sediment Control Plan Information Sheet

Property Owner:_____ Date:_____
Address:_____ City:_____ State & Zip:_____
Phone Number:_____ Municipality:_____
Contact Person (if other than owner):_____
Location of Project:_____
Name of Nearest Receiving Stream, Wetland, or Waterbody:_____
Estimated Dates for Start-up and Completion: Start:_____ End:_____
Project Acres (entire site):_____ Disturbed Acres:_____
Present Site Conditions (i.e. type of land use):_____

Narrative (give specific description of the proposed work):

Sequence of Construction (specifically, what will be done first, second, last, etc.):

Temporary Control Measures:

Check if applicable: ☐ straw bale barrier ☐ filter fabric
 ☐ temporary swale ☐ rock filters
 ☐ rock construction entrance ☐ temporary seeding
 ☐ permanent seeding ☐ other

List other controls: _____

Describe any temporary E&S controls you will be using on your site (such as silt fence, rock filters, temporary seeding, etc.).

Permanent Control Measures:

Prior to completion of a project, state law requires that the site be stabilized to prevent erosion of the soils. Examples include: re-vegetation, rip-rap, pavement, and stone surfaces. With final seeding of disturbed areas, lime and fertilizers should be utilized as necessary.

Erosion and Sedimentation Control Plan

Project Name: _____

Developed By: _____

Municipality: _____

Date: _____ Approx. scale: 1" = _____.