4.05 STRAW BALE BARRIER (ES BMP 1.05)

Definition

A temporary sediment barrier consisting of a row of entrenched and anchored straw bales.

Purposes

1. To intercept and detain small amounts of sediment from disturbed areas of limited extent.

2. To decrease the velocity of sheet flows and low-to-moderate level channel flows.

Conditions Where Practice Applies

1. Below disturbed areas subject to sheet and rill erosion.

2. Where the size of the drainage area is no greater than 1/4 acre per 100 feet (1.3 ha/100 m) of barrier length; the maximum slope length behind the barrier is 100 feet (30 m); and the maximum slope gradient behind the barrier is 50 percent (2:1).

3. In minor swales or ditch lines where the maximum contributing drainage area is no greater than 2 acres(0.8 ha).

4. Where effectiveness is required for less than 3 months.

5. Under no circumstances should straw bale barriers be constructed in streams or in swales where there is a possibility of a washout.

Planning Considerations

Improper use of straw bale barriers has been a major problem. Straw bale barriers have been used in streams and drainageways where high water velocities and volumes have destroyed or impaired their effectiveness. Improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, has allowed undercutting and end flow. This has resulted in additions instead of removal of sediment from runoff waters. Finally, inadequate maintenance lowers the effectiveness of these barriers. Trapping efficiencies of carefully installed straw bale barriers on one project in Virginia dropped from 57 percent to 16 percent in one month due to lack of maintenance.

There are serious questions about the continued use of straw bale barriers as they are presently installed and maintained. Averaging approximately $3 to $6 per linear foot installed ($10 to $20 / m) the thousands of straw bale barriers used annually in Florida represent sufficient expense that optimum installation procedures should be emphasized. If such procedures are carefully followed, straw bale barriers can be quite effective.

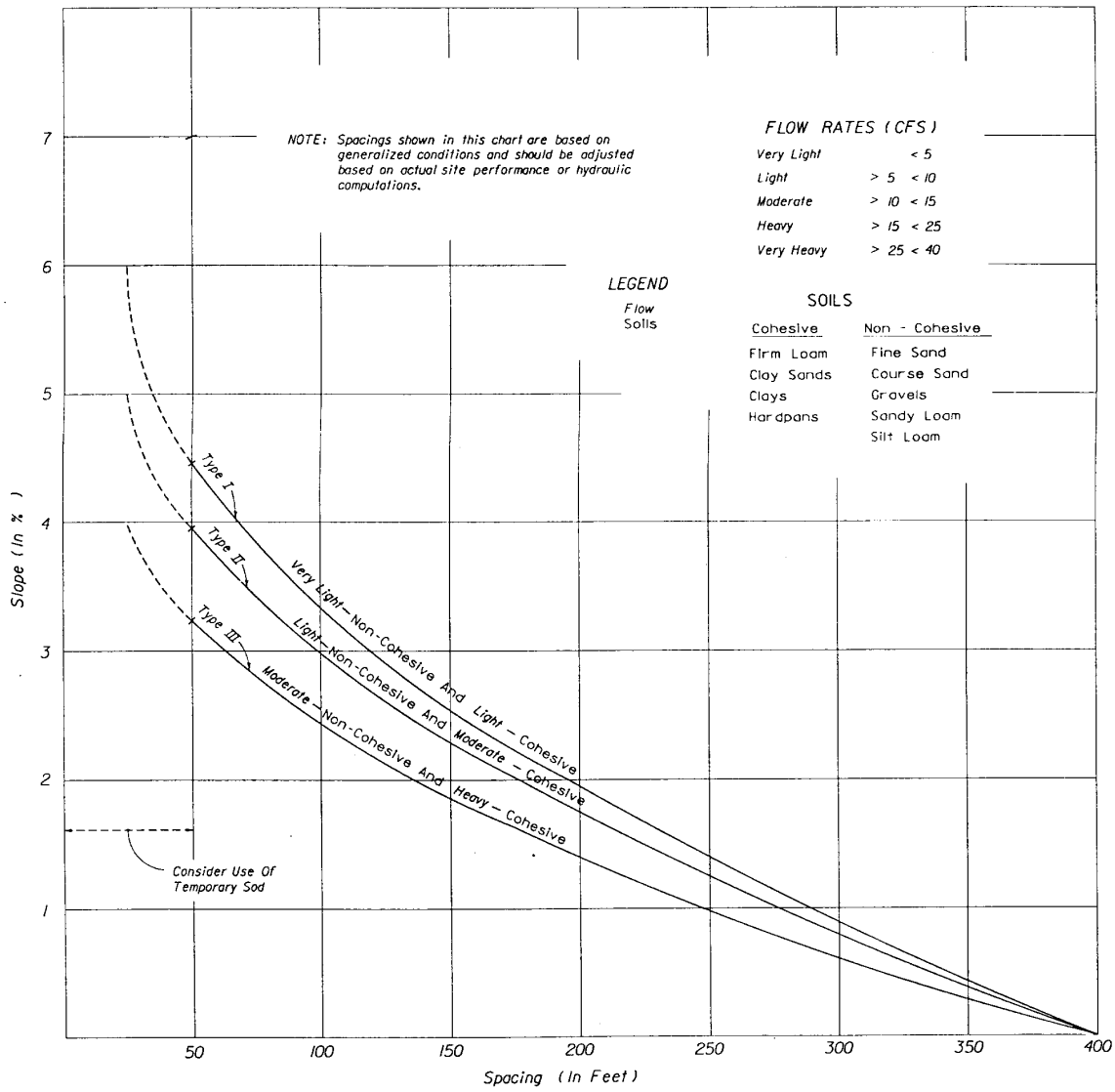
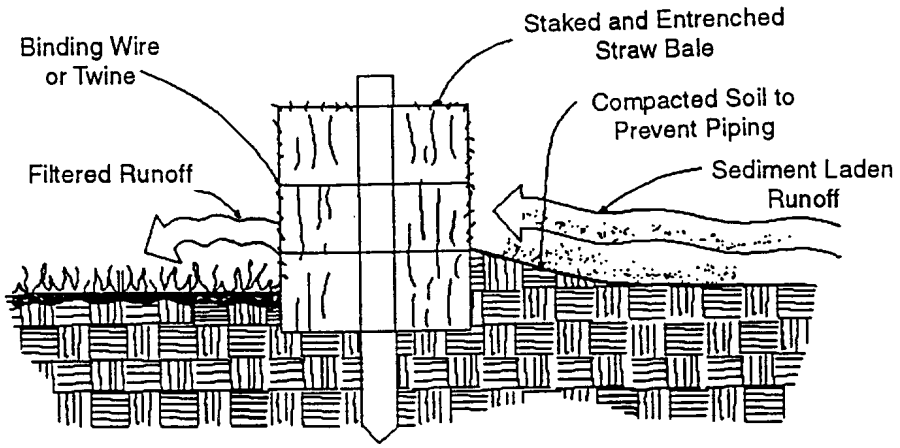


CHART I

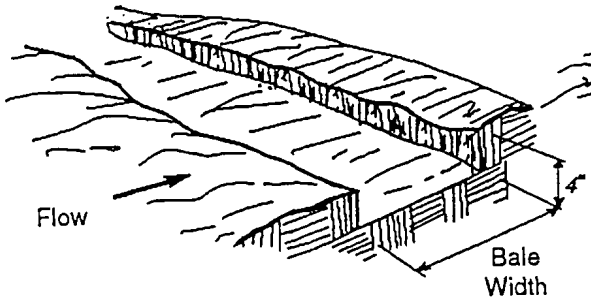
RECOMMENDED SPACING FOR TYPE I AND TYPE II HAY BALE BARRIERS, AND TYPE III SILT FENCES

Plate 4.05a FDOT Standard Index 102, Chart 1
Source: FDOT Erosion and Sediment Control Handbook

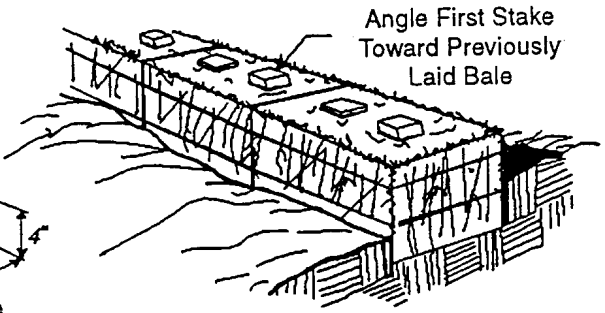


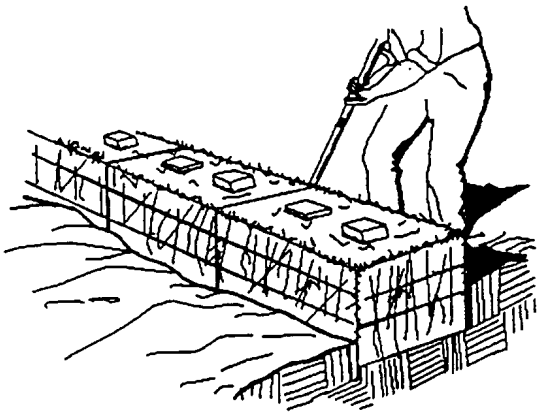
Properly Installed Straw Bale
(Cross-Section)

1. Excavate the Trench

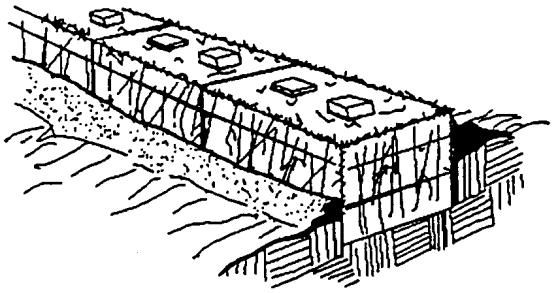


2. Place and Stake Straw Bales





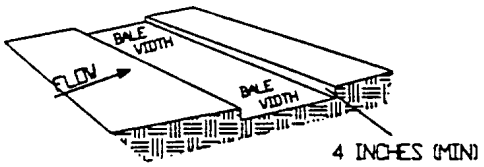
3. Wedge Loose Straw Between Between Bales



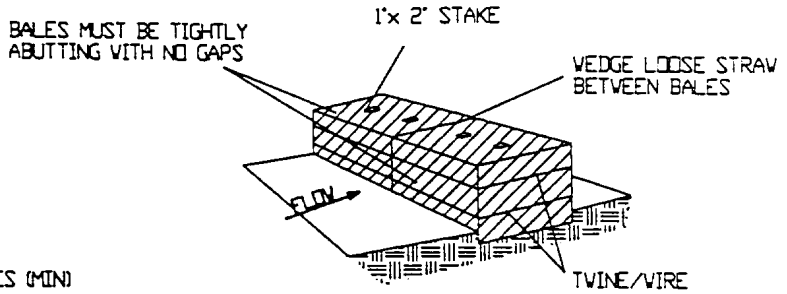
4. Backfill and Compact the
Excavated Soil

Construction of Straw Bale Barrier

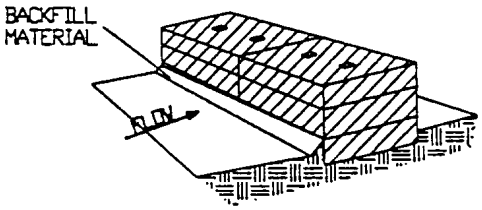
Plate 4.05b Construction of a Straw Bale Barrier
Source: NRCS



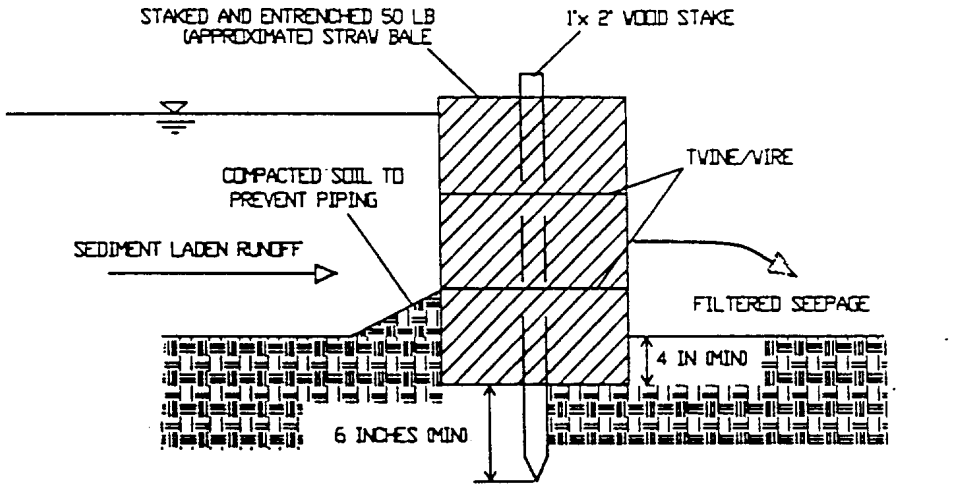
1. EXCAVATE THE TRENCH



2. PLACE AND STAKE STRAW BALES



3. BACKFILL AND COMPACT EXCAVATED SOIL



CROSS-SECTION OF A PROPERLY INSTALLED STRAW BALE

Plate 4.05c Installation of Straw Bales
Source: HydroDynamics, Inc.

Design Criteria

A formal design is not required for many small projects and for minor or incidental applications. For larger projects refer to Figure 4.05a (FDOT Standard Index 102, Chart 1) for guidance on recommended spacing.

Construction Specifications

Sheet Flow Applications

1. Bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting each other.

2. All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales (in order to prevent deterioration of the bindings). (See Plate 4.05b)

3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches (10 cm). After the bales are staked and chinked, the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches (10 cm) against the uphill side of the barrier (See Plate 4.05c)

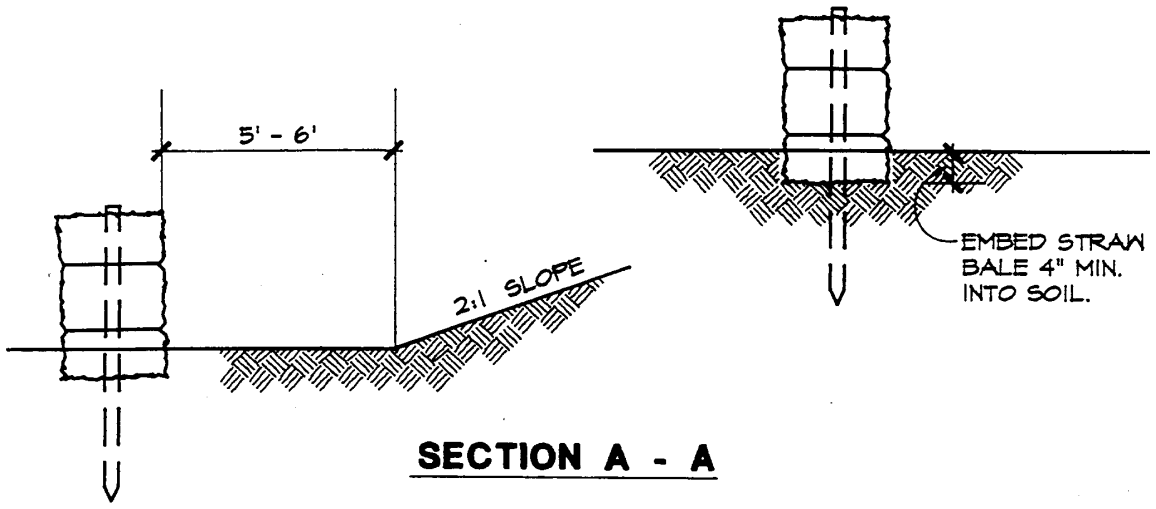
4. Each bale shall be securely anchored by at least two 2" x 2" (5 cm x 5 cm) minimum wooden stakes or two #5 (16 mm) minimum rebars at least 3 feet (0.9 m) driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or rebars shall be driven deep enough into the ground to securely anchor the bales. Straw bale barriers placed on paved surfaces may be secured by placing heavy sand bags on top, and/or by bracing with 2 x 4's (5 x 10 cm). (See Plate 4.05d)

5. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales. (See Plate 4.05b) Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency.

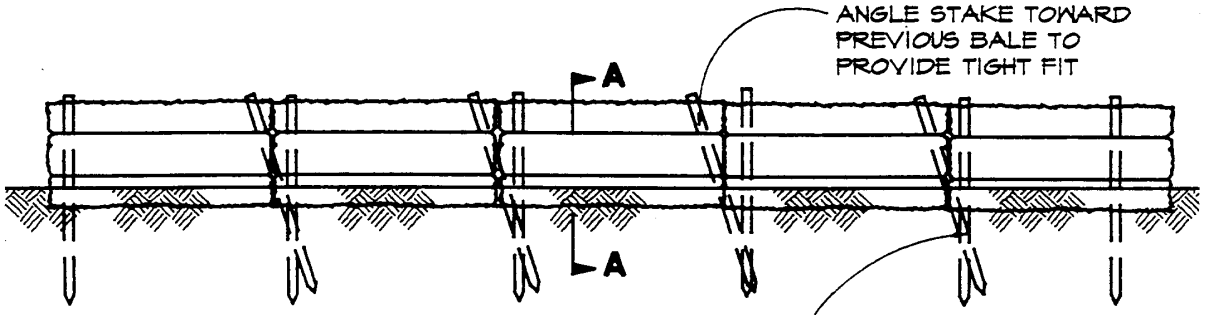
6. When bales are installed at the toe of a slope, they should be placed away from the slope for increased storage capacity. (See Plate 4.05e)

7. Inspection shall be frequent and repair or replacement shall be made promptly as needed.

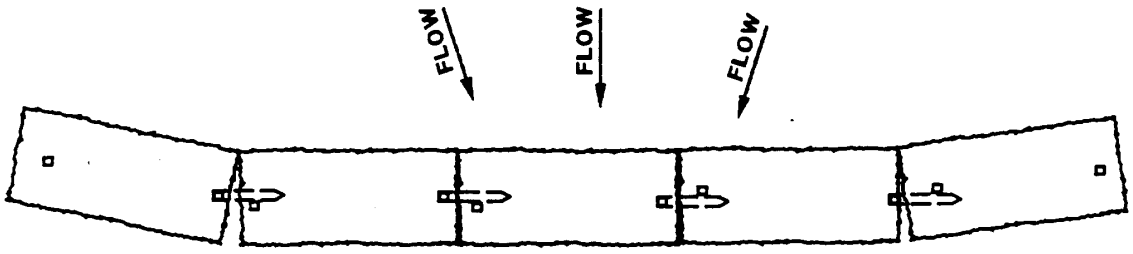
8. Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.



SECTION A - A



SECTION B - B



PLAN

NOTES:

1. THE STRAW BALES SHALL BE PLACED ON SLOPE CONTOUR.
2. BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING. USE STRAW, ROCKS, OR FILTER FABRIC TO FILL GAPS BETWEEN THE BALES AND TAMP THE BACKFILL MATERIAL TO PREVENT EROSION OR FLOW AROUND BALES.

Plate 4.05d Straw Bale Barrier
Source: Erosion Draw

Plate 4.05d Straw Bale Barrier
Source: Erosion Draw

Channel Flow Applications

1. Bales shall be placed in a single row, lengthwise, oriented perpendicular to the contour, with ends of adjacent bales tightly abutting each other.

2. The remaining steps for installing a straw bale barrier for sheet flow applications apply here, with the following addition.

3. The barrier shall be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to assure that sediment-laden runoff will flow either through or over the barrier, but not around it. (See Plate 4.05f)

Maintenance

1. Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

2. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

3. Necessary repairs to barriers or replacement of bales shall be accomplished promptly.

4. Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

5. Any sediment deposits remaining in place after the straw bale barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

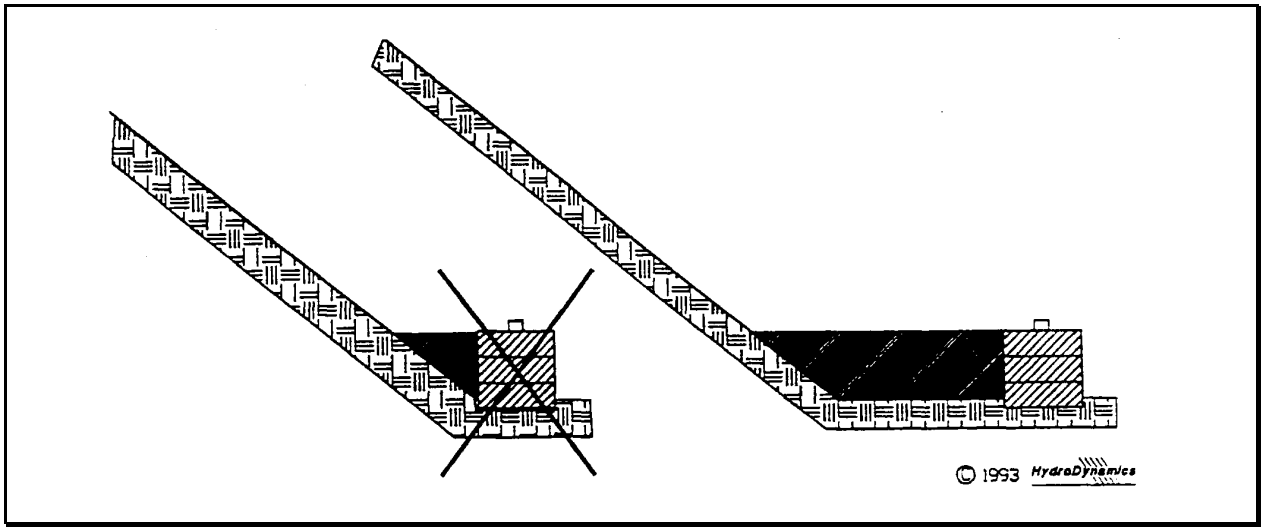
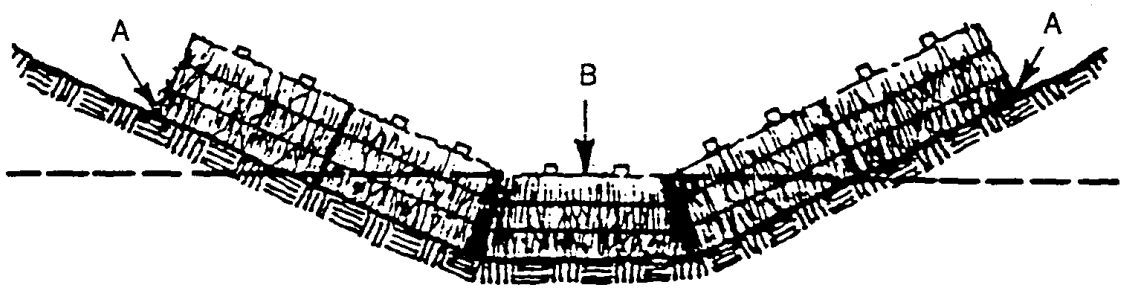


Plate 4.05e Proper Placement of Straw Bales at the Toe of a Slope
Source: HydroDynamics, Inc.



Points A Should be Higher than Point B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

Plate 4.05f Proper Placement of Straw Bale Barrier in a Drainage Way
Source: Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant