

SECTION 146

EROSION TREATMENT MATERIAL

146.1 DESCRIPTION

A. General

This work consists of shaping slope drains, ditches, medians or other waterway channels and applying erosion treatment material.

B. Related Work Items

| | |
|-------------|----------------------------------------------------------------------|
| Section 11 | Utility Excavation and Backfill |
| Section 12 | Roadway and Drainage Excavation |
| Section 14 | Embankment |
| Section 17 | Salvaging, Stockpiling and Placing Topsoil |
| Section 18 | Erosion and Water Pollution Control |
| Section 65 | Riprap |
| Section 66 | Slope Protection |
| Section 68 | Bank and Channel Protection Rock Filled Wire Baskets |
| Section 69 | Bank Protection Gabions |
| Section 70 | Seeding |
| Section 71 | Fertilizing |
| Section 72 | Mulching |
| Section 109 | Riprap and Slope Materials |
| Section 202 | Engineering Fabric |

146.2 MATERIALS

A. Fiberglass Roving

Fiberglass roving shall be formed from continuous fibers drawn from molten glass, coated with a chrome-complex sizing compound, collected into strands and lightly bound together into roving without the use of clay, starch or like deleterious substances.

The roving shall be wound into a cylindrical package approximately one foot high in such a manner that the roving can be continuously fed from the center of the package, through an ejector driven by compressed air and expanded into a mat of glass fiber on the soil surface.

The material shall contain no petroleum solvents or other agents known to be toxic to plant or animal life.

B. ~~Excelsior Blanket~~ Erosion Control Blankets or Turf Reinforcement Mats (TRMs)

Description

Erosion-control blankets are biodegradable, open-weave blankets used for establishing and reinforcing vegetation on slopes, ditch bottoms and shorelines. Erosion-control blankets and TRMs, are especially useful in critical areas such as swales, long channels and slopes steeper than 3:1.

Design

Erosion Control Blankets

Several categories are provided with different service application and specific uses as shown in the **Erosion Control Blanket Fabric Category Table** below.

Erosion Control Blanket Fabric Category Table

| Category | Service Application | Use | Acceptable Types |
|----------|---------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 1 | Very Temporary | Flat areas, shoulder drain outlets, roadway shoulders, lawns, mowed areas. | Straw, wood fiber, rapidly degradable netting on one side |
| 2 | One Season | Slopes 3:1 and steeper less than 50 ft long, ditches with gradients 2% or less, flow velocities less than 5.0 fps. | Straw, wood fiber, netting on one side |
| 3 | One Season | Slopes 3:1 and steeper, more than 50 ft long, ditches with gradients 3% or less, flow velocities less than 6.5 fps. | Straw, wood fiber, netting on one side |
| 4 | Semipermanent | Ditches with gradients 4% or less, flow velocities less than 8.0 fps, flow depth 6 inches or less. | Straw/coconut, wood fiber, netting on two sides |
| 5 | Semipermanent | Ditches with | Coconut fiber, |

| | | | |
|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| | | <p>gradients 8% or less, flow velocities less than 15.0 fps and flow depth less than 8 inches, watercourse banks within the normal flow elevation.</p> | <p>netting on two sides</p> |
|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|

Erosion-control blankets shall consist of a uniform web of interlocking fibers with net backing. The blanket shall be of uniform thickness, with the material fibers being evenly distributed over the area of the blanket. The blankets shall be porous enough to promote plant growth yet shield the underlying soil surface from erosion. All material shall have been properly cured to achieve curled and barbed fibers. All blankets shall be smolder resistant.

The net backing on each blanket shall consist of polypropylene mesh. For Category 1 blankets, the net backing should start to decompose after one month with 80% breakdown occurring within three months. For Category 2 and 3 blankets, the netting should contain sufficient UV stabilization for breakdown to occur within a normal growing season. For Category 4 and 5 blankets, the netting should be UV stabilized to provide a service life of two to three years.

Install erosion-control blankets per manufacturer’s recommendations.

Turf-Reinforcement Mats (TRMs)

Turf-reinforcement mats are synthetic, non-degradable mats that are usually buried to add stability to soils. They come in a wide range of designs and have been proven to be valuable on slopes and in channel-lining applications.

TRMs consisting of non-degradable , three-dimensional matrix materials should be used with expected velocities of 15 fps and shear stress of 8lbs/sf. Beyond these velocities and shears, vegetated structures such as articulated block, cable concrete and cribwalls, should be considered.

Install TRMs per manufacturer’s recommendations.

Maintenance

Inspect erosion-control blankets and TRMs periodically, and after rainstorms to check for rill erosion, dislocation or failure. Where erosion is observed, repair or replace fabric.

Continue inspections until vegetation is established.

If washout occurs, repair the slope grade, reseed and reinstall fabric.

~~Excelsior blanket shall consist of a uniform web of interlocking wood excelsior fibers. Excelsior shall be made from new, non-resinous, good quality, properly cured wood to produce curled and barbed fibers with good strength. The blanket shall have a backing of mulch net on both sides consisting of a fabric, woven on either twisted Kraft paper having a high wet strength or a biodegradable extruded plastic mesh with a mesh size not to exceed 1 inch X 1 inch. The blanket shall be of uniform thickness with the wood fibers evenly distributed over the entire area of the blanket.~~

~~1. Standard Excelsior Blanket~~

~~Standard excelsior blanket shall be furnished in rolled strips 48 inches wide, ±1 inch. Each roll shall contain approximately 180 lineal feet of excelsior blanket and shall weigh 78 lb, ±10% per roll.~~

~~2. Hi Velocity Excelsior Blanket~~

~~Hi-Velocity excelsior blanket shall be furnished in rolled strips 48 inches wide, ±1 inch. Each roll shall contain approximately 100 lineal feet of excelsior blanket and shall weigh 72 lb, ±10% per roll.~~

C. Staples

Staples shall be U-shaped and shall be approximately six inches long and one inch wide. Staples shall be 11 gage or heavier ungalvanized steel wire. Where 11 gage staples cannot be driven without bending, 9 gage or heavier ungalvanized steel wire staples will be required.

D. T-pins

T-pins shall be #6 bright wire T-pins consisting of a 12-inch long top bar and a minimum 9-inch leg. The top bar may be welded to the top at the side of the 9-inch leg or the T-pins may be machine bent to the proper configuration.

E. Erosion Bales

Erosion bales shall consist of hay or straw bales substantially free of weeds and a nominal size of 15 inches x 18 inches x 4 feet.

F. Erosion Bale Anchors

Erosion bales shall be anchored with #4 rebar 3 feet long or with 2 inch x 2 inch x 3 feet wood pegs.

G. Silt Fence

Description

A silt fence is a temporary barrier designed to retain sediment on the construction site. It consists of a geotextile attached to supporting posts that are trenched into the ground. The fence retains sediment primarily by retarding flow and promoting deposition on the uphill side of the fence. Runoff is also filtered as it passes through the geotextile.

Design

Install silt fences on the contour and construct so that flow cannot bypass the ends.

Ensure that the drainage area is no greater than $\frac{1}{4}$ acre per 100 feet of fence.

The use of silt fence as a sediment barrier shall not be used in areas of concentrated flow, such as ditches.

Ensure that the depth of impounded water does not exceed 2 feet at any point along the fence.

The fence must be tied into the slope so that the base of the fence is above the design storage depth.

When plastic mesh is used on the heavy duty silt fence, the mesh backing shall be joined to the geotextile at the top with two rows of stitching.

A 1 foot high by 2 foot wide berm of compost can be placed at the base of the sediment fence over the fabric lip. Placing the compost over the fabric fence lip eliminates the need to trench and bury the fabric. The compost particle sizes shall be the following: 3 inch-100% passing, 1 inch-90% to 100% passing, $\frac{3}{4}$ inch-70% to 100% passing, $\frac{1}{4}$ inch-30% to 75% passing, maximum particle length of 6 inches.

Alternately, a compost berm may be placed in lieu of silt fence. The berm shall be a minimum of 2 feet high by 4 feet wide. The particle sizes shall be the following: 3 inch-100% passing, 1 inch-90% to 100% passing, $\frac{3}{4}$ inch-70% to 100% passing, $\frac{1}{4}$ inch-30% to 75% passing, maximum particle length of 6 inches.

Maximum allowable slope lengths contributing runoff to a silt fence are listed in the **Silt Fence Slope Criteria Table**.

Silt Fence Slope Criteria Table

| Constructed Slope | Maximum Slope Length |
|-------------------|----------------------|
|-------------------|----------------------|

| | |
|--------------------|---------------|
| | (feet) |
| 2H:1V | 50 |
| 3H:1V | 75 |
| 4H:1V | 125 |
| 5H:1V | 175 |
| Flatter than 5H:1V | 200 |

Types

The following three types of silt fences are designated for use based on conditions. For details on each type of fence see the **Silt Fence Specifications Table**.

Heavy Duty: Use at locations where extra strength is required, such as near water bodies; on areas with unstable wetland soils, steep slopes, highly erodible soils or high runoff; and on areas that are inaccessible to equipment.

Preassembled: For light-duty applications, to protect temporary construction or to supplement the other types of silt fence. This type is installed with plow-type equipment with pre-attached stakes spread at 6 to 8 foot intervals.

Machine-Sliced Installation: Appropriate for general use during site grading and to protect critical areas.

Silt Fence Specifications Table

| | Heavy Duty | Machine Sliced | Preassembled |
|-----------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------|
| Description | Composite of mesh backing, posts, geotextile and fasteners, assembled | Machine installed geotextile fastened to posts on site | Ready-to-install geotextile attached to driveable posts |
| Geotextile | | | |
| Type | Woven | Woven Monofilament | Woven |
| Width | 48 inches | 36 inches | 36 inches |
| Grab Tensile ASTM C4632 | 100 lb. minimum | 130 lb. minimum | 100 lb. minimum |
| Apparent Opening Size ASTM D4751 | #20-70 sieve | #30-40 sieve | #20-70 sieve |
| UV Stability ASTM D4355 500 hours | 70 percent minimum | 70 percent minimum | 70 percent minimum |
| Flow Rate ASTM D4491 gal/min/sf | NA | 100 gal/min/sf | NA |

| | | | | |
|----------------------------------|-------------------------------------|--------------|-------------------------------------------|--------------|
| Top Fastening Component | 6-inch overlap, top of mesh backing | | Selvaged edge | Sewn-in cord |
| Net Backing | | | | |
| Material | Woven wire mesh | Plastic mesh | NA | NA |
| Steel Wire Gauge | 14 min. | NA | NA | NA |
| Max. Mesh Opening | 6 inches | 2 inches | NA | NA |
| Rope for Ditch Check | | | | |
| Type | NA | | Polyethylene | NA |
| Diameter | NA | | 5/8-inch minimum | NA |
| Posts | | | | |
| Material | Steel T-post | | Steel T-post with welded plate | Wood |
| Minimum Size | 1.26 lbs/in/ft | | 1.26 lbs/in/ft | 2 x 2 inch |
| Minimum Length | 5 feet | | 5 feet | 5 feet |
| Min. Embedment | 24 inches | | 24 inches | 18 inches |
| Maximum Spacing | 8 feet | | 6 feet | 6 feet |
| Post Fastener | U-shaped clips | | Plastic zip ties, 50 lb. tensile strength | Gun staples |
| Minimum Fasteners per post | 3(for both woven wire and mesh) | | 3 | 5 |
| Minimum Fastener Spacing on post | 2 foot | | 1 foot | 1 foot |

See the **Silt Fence Detail 146-1**.

Maintenance

Inspect silt fences at least once a week and after each rainfall, or as required by the NPDES permit. Make any required repairs immediately. Repair scoured areas on the back side of the fence at this time to prevent future problems.

Replace silt fence fabric that has torn, collapsed, decomposed or otherwise become ineffective within 24 hours of discovery.

Remove silt deposits once they reach 30 percent of the height of the fence to provide storage volume for the next rain and to reduce pressure on the fence.

Silt fences are to be removed upon stabilization of the contributing drainage area. Accumulated sediment may be spread to form a surface for turf or other vegetation establishment, or disposed of elsewhere. The area should be reshaped to permit natural drainage.

~~Silt fence shall consist of vertical barrier of woven geotextile fabric supported by woven wire stretched between, attached to, and supported by fence posts.~~

~~Fence posts shall be five feet minimum standard commercial section steel T line posts or commercial three inch minimum diameter treated wood posts.~~

~~Silt fence fabric shall consist of a woven geotextile fabric having a minimum grab strength of 90 pounds (ASTM D-4632); having an apparent opening size equivalent to a #20 sieve (ASTM D-4751); and be UV treated to last a minimum of two years (ASTM D-4355, 500 hrs., ICI 70 min.). Fabric shall be a minimum of 48 inches wide.~~

~~The woven wire fencing material shall be 14 1/2 gage, minimum of 32 inches wide. Mesh opening shall be four inches maximum vertically and six inches maximum horizontally for machine woven material or 12 inches maximum horizontally for hand woven fence with vertical stay wires.~~

146.3 CONSTRUCTION REQUIREMENTS

A. General

This work shall be done as soon as possible after finish grading and topsoiling is completed and, if practical, prior to seeding, fertilizing and mulching of adjacent areas.

Seasonal limitations on the installation of erosion treatment materials shall be as described in Section 70.3.

The Contractor is responsible for inspecting the erosion control materials and measures on a regular basis and after every runoff event during the construction period to insure proper function. The Contractor shall maintain areas where erosion materials and measures have been used until work on the project has been completed and accepted. Prior to final acceptance of work, the Contractor shall repair and replace any damaged areas to the satisfaction of the Engineer.

At the end of the 2-year warranty period, the Engineer and Contractor shall inspect the erosion control devices and will determine whether or not erosion control should be removed. Removal will be at the Contractors expense. If vegetated areas are disturbed by the removal, they shall be restored at the Contractors expense. If the Engineer determines that erosion control should remain, then the City shall remove the erosion control when vegetation adequately established.

B. Preparation of Areas to be treated

1. Shaping

Ditches and drainages shall be reshaped to their typical section or to the ditch liner material. Material shall be laid in ditches and drainages to the widths specified.

When watercourses leading out of ditches are shallow or not well defined, special channels shall be constructed and undercut to allow for placement of topsoil.

The material shall be placed below edges of channels and excavated material drifted back away from the edges of the material to direct flow directly into the treated waterway.

2. Top soiling

Topsoil shall be spread to the depths specified over reshaped areas in accordance with Section 17 - Salvaging, Stockpiling and Placing Topsoil.

3. Condition Of Finished Surface

Rocks or clods over 1 1/2 inches in diameter and other foreign material shall be removed prior to placing material.

C. Seeding, Fertilizing and Mulching

Immediately after the area to be treated has been shaped and smoothed and prior to placing, the areas to be treated shall be seeded and fertilized as prescribed in Sections 70 - Seeding, 71 - Fertilizing, and 72 - Mulching.

Broadcasting, raking or dragging in of seed and fertilizer will be permitted on areas where a drill cannot operate satisfactorily.

D. Application of ~~Excelsior Blanket~~Erosion Control Blanket or Turf Reinforcement Mat (TRM)

Install erosion control blankets and turf reinforcement mats per manufacturers recommendations.

1.Manner Of Application

~~Material shall be applied beginning at the top of the slope and rolling downward, parallel to and in the same direction as the flow of water. The center strip shall be placed first and centered in the low point of the ditch or channel throughout the length of treatment.~~

2.Overlap

~~Where more than one width of material is required, edges shall overlap approximately three inches and ends shall overlap approximately 12 inches, with the upslope section of material on top.~~

~~3. Top And Bottom Folds~~

~~The top and bottom ends shall be folded under approximately four inches and stapled.~~

~~4. Anchoring~~

~~Prior to anchoring, erosion treatment material must be adjusted laterally in ditches and channels to bring both edges to the same elevation. Material shall be held in place with T-pins and U-shaped wire staples driven vertically through the mesh in the low point of the ditch or channel, with heads perpendicular to the centerline of the ditch. A row of T-pins shall be placed head to head across the width of material and every 25 feet along the length of the treatment.~~

~~At all other points, U-staples shall be placed three feet apart in a staggered or diagonal pattern along the edges and in the center of the strips.~~

~~Material shall not be drawn taut in stapling. Material, which bridges over surface depressions, shall be secured with extra staples or T-pins to ensure good contact with the soil.~~

~~5. Maintenance and Repair~~

~~The Contractor shall maintain areas where material has been used until work on the project has been completed and accepted. Prior to acceptance of work, any damaged areas shall be repaired.~~

E. Application Of Fiberglass Roving

Fiberglass roving shall be applied over the designated area within 24 hours after normal seeding operations have been completed. Fiberglass roving shall be spread uniformly over the designated area to form a random mat of continuous glass fibers at the rate of 0.25 to 0.35 pound per square yard. This rate may be varied as directed by the Engineer.

Fiberglass roving shall be anchored to the ground with an emulsified asphalt Type SS-1 or CS-1 applied uniformly over the glass fibers at the rate of 0.25 to 0.35 gallon per square yard. This rate may be varied as directed by the Engineer.

Placement of asphalt will not be permitted when the air temperature is lower than 40°F.

The upgrade end of the lining shall be buried to a depth of one foot to prevent undermining.

F. Erosion Bales

Erosion bales shall be located as specified or as determined by the Engineer.

Each erosion bale shall be anchored in place with two anchor devices.

G. Silt Fence

Silt fence intended to limit soil migration due to precipitation runoff shall be installed perpendicular to ground slope and at intervals necessary to prevent excessive soil migration by capturing the majority of waterborne soil particles and reducing the velocity of the runoff water. Such installation may include excavation of silt traps upstream of the fence as called for on the contract documents. (See [the Silt Fence Slope Criteria Table, Silt Fence Specifications Table, and Standard Detail 146-1s](#))

~~The silt fence posts shall be placed perpendicular to the slope and driven two feet into the ground on six-foot centers maximum. The woven wire shall be stapled (wood posts) or tied (steel posts) to the fence posts on the upstream side of the post, with a minimum of three staples or ties per post. A trench shall be excavated on the uphill side of the posts to a depth and width of six inches to one foot. Silt fence fabric shall be keyed into the trench and backfilled with soil and shall be folded over the top of the fence a minimum of four inches and attached to the woven wire and posts. Where a trench cannot be dug to key the fabric into the ground, soil and/or rock may be placed over the bottom of the fabric sufficient to prevent flow under the fence/fabric. The fabric shall be attached to the woven wire with staples or wire rings.~~

146.4 METHOD OF MEASUREMENT

- A. Excelsior blanket will be measured to the nearest square yard. Measurement of the overlap and top and bottom folds will not be made. Contractors shall replace excelsior blanket that is damaged from causes beyond their control and they shall add the replacement quantity to the original quantities used. Excelsior blanket damaged by actions taken by the Contractor shall be replaced by the Contractor at no additional cost.
- B. Fiber mulching will be measured to the nearest one-tenth ton of satisfactory mulch applied. Contractors shall replace fiber mulching that is damaged from causes beyond their control and the replacement quantity shall be added to the original quantities used. Fiber mulching damaged by actions taken by the Contractor shall be replaced by the Contractor at no additional cost.
- C. Fiberglass roving with the asphalt anchor will be measured to the nearest square yard (surface measurement) complete in place and accepted. Contractors shall replace fiberglass roving that is damaged from causes beyond their control and the replacement quantity shall be added to the original quantity used. Fiberglass roving

damaged by actions taken by the Contractor shall be replaced by the Contractor at no additional cost.

- D. Erosion bales will be measured by the actual count of the bales placed.
- E. Silt fence will be measured by the lineal foot, inclusive of silt traps as required.

146.5 BASIS OF PAYMENT

- A. Excelsior blanket will be paid for at the contract unit price per square yard. Payment will be full compensation for shaping and finishing ditches and channels, which are not specifically addressed with the item "Ditch Shaping", installing material and the furnishing of labor, equipment, staples, material and incidentals necessary.
- B. Fiber mulching will be paid for at the contract unit price per ton for fiber mulching. Payment shall be full compensation for furnishing and placing, and for all labor, equipment and incidentals necessary.
- C. Fiberglass roving with the asphalt anchor will be paid for at the contract unit price per square yard. Payment will be full compensation for furnishing, installing and all labor, equipment and incidentals necessary.
- D. Erosion bales will be paid for at the contract unit price per bale. Payment will be full compensation for furnishing, installing and all labor, equipment and incidentals necessary.
- E. Topsoil will be paid for as provided in Section 11 and Section 14.
- F. Seed and fertilizer will be paid for as provided in Section 70 and Section 71.
- G. Silt fence will be paid by the lineal foot.

END OF SECTION