

## ITEM 98

### SLOPE PROTECTION AND EROSION CONTROL

#### 98.01 SCOPE

(a) This Section shall consist of temporary control measures as shown in the plans or directed by the Engineer during the life of the Contract to control erosion and water pollution, through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.

(b) The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to assure economical, effective, and continuous erosion control throughout the construction and post-construction period.

#### 98.02 TEMPORARY BERMS

(a) A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.

These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

#### 98.03 TEMPORARY SLOPE DRAINS

A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the Engineer that may be used to carry water down slopes to reduce erosion.

#### 98.04 SEDIMENT STRUCTURES

Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

#### 98.05 CHECK DAMS

(a) Check dams are barriers composed of logs and poles, large stones or other materials placed across a natural or constructed drainway.

(b) Stone check dams shall not be utilized where the drainage area exceeds fifty (50) acres. Log and pole structures shall not be used where the drainage area exceeds five (5) acres.

#### 98.06 TEMPORARY SEEDING AND MULCHING

Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

#### 98.07 BRUSH BARRIERS

(a) Brush barriers shall consist of brush, tree trimmings, shrubs, plants, and other approved refuse from the clearing and grubbing operation.

(b) Brush barriers are placed on natural ground at the bottom of fill slopes, where the most likely erodible areas are located to restrain sedimentation particles.

#### 98.08 BALED HAY OR STRAW CHECKS

(a) Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material.

(a) Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

#### 98.09 TEMPORARY SILT FENCES

Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

#### 98.10 EROSION CONTROL FABRIC

Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved erosion control fabric, such as Curlex 1 as manufactured by American Excelsior Company, or an approved equal.

## 98.11 DITCH LINING FABRIC

### (a) Mat

The mat shall be of three-dimensional structures of entangled nylon filaments (0.40 mm minimum diameter) bonded at their intersections. The filaments shall be coated with polyurethane binder to increase tensile strength between the filaments and to increase abrasion resistance. The mat shall be resistant to chemical and environmental degradation. The mat shall be 10 mm in thickness and promote and maintain the integrity of the grass root system. Enkamat Type 7020 soil reinforcement matting as manufactured by the American Enka Company or an approved equal shall be used.

### (b) Ground Fasteners

Ground fasteners shall be one or a combination of the following:

1. T-Staple (wire)
2. Broad wire U-staple
3. Narrow wire U-staple
4. Wood Survey stake

All staples shall be 8- to 11-gauge wire with a minimum penetration of 8 inches. The wood survey stakes will be used when high velocity and/or large volumes of water are expected to occur.

## 98.12 PROJECT REVIEW

Prior to the preconstruction conference, the Contractor shall meet with the Engineer and go over in detail the expected problem areas in regard to the erosion control work. Different solutions should be discussed so that the best method might be determined. It is the basic responsibility of the Contractor to develop an erosion control plan acceptable to the Engineer.

## 98.13 PRECONSTRUCTION CONFERENCE

At the preconstruction conference the Contractor shall submit for acceptance his schedule for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, bridges and other structures at watercourse, construction, and paving. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the engineer.

## 98.14 CONSTRUCTION REQUIREMENTS

- (a) The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the Engineer.
- (b) The Contractor shall be required to incorporate all permanent erosion control features into project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- (c) Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing, exceed 750,000 square feet without approval by the Engineer.
- (d) The Engineer will limit the area of excavation, borrow, and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.
- (e) Under no conditions shall the amount of surface area or erodible earth material exposed at one time by excavation or fill within the project area exceed 750,000 square feet without prior approval by the Engineer.
- (f) The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.
- (g) In the event of conflict between these requirements and pollution control laws, rules, or regulations or other Federal or State or local agencies, the more restrictive laws, rules, or regulations shall apply.

## 98.15 CONSTRUCTION OF STRUCTURES

### (a) Temporary Berms

A temporary berm shall be constructed of compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills.

Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with minimum ponding in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a 10-degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

### (b) Temporary Slope Drains

Temporary slope drains shall consist of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.

1. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.
2. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipaters, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream. An ideal dissipater would be dumped rock or a small sediment basin which would slow the water and collect sediment. All temporary slope drains shall be removed when they are no longer necessary and the site restored to match the surroundings.

### (c) Sediment Structures

1. Sediment structures shall be utilized to control sediment at the foot of embankments at slope drain outlets, at the bottom and in the ditchlines atop waste sites, and in the ditchlines and/or borrow bits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

2. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

(d) Check Dams

1. Check dams shall be utilized to retard stream flow and catch small sediment loads. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.

2. All check dams shall be keyed into the sides and bottom of the channel a minimum depth of 2 feet. A design is not needed for check dams, but some typical designs are shown in the standard plans.

3. Stone check dams should generally not be utilized where the drainage area exceeds fifty (50) acres. Long and pole structures should generally not be used where the drainage area exceeds five (5) acres.

(e) Temporary Seeding and Mulching

Seeding and mulching shall be performed in accordance with Item 35, entitled "Sodding and/or Seeding."

(f) Brush Barriers

Brush barriers shall consist of brush, tree trimmings, shrubs, plants and other approved refuse from the clearing and grubbing operation. The brush barriers shall be constructed approximately parallel to original ground contour. The brush barrier shall be compressed to an approximate height of 3 to 5 feet and approximate width of 5 to 10 feet. The embankment shall not be supported by the construction of brush barriers.

(g) Baled Hay or Straw Erosion Checks

Hay or straw erosion checks shall be embedded in the ground 4 to 6 inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the Engineer. The Contractor shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

(h) Temporary Silt Fences

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.

2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

(i) Erosion Control Fabric

1. Fabric shall be installed immediately after seeding operations have been completed in work areas. Mulch shall not be used under the fabric.
2. Installation instructions shall be supplied by the manufacturer, and fabric shall be applied in accordance with the manufacturer's recommendation as directed by the specifier.
3. Fabric shall be unrolled and draped loosely, without stretching, so that continuous ground contact is maintained. In ditches, fabric shall be unrolled and applied parallel to the flow direction. On slopes, fabric shall be applied parallel to the slope direction unless the engineer approves an alternate application method.
4. In ditches and on slopes, each upslope and each downslope end of each piece of fabric shall be placed in a 4-inch trench, stapled on 9-inch centers, backfilled and tamped. Where one roll ends and a second roll starts, the upslope piece shall be brought over the end of the downslope roll so that there is a 12-inch overlap, placed in a 4-inch trench stapled on 9-inch centers, backfilled and tamped.
5. On slopes where two or more widths of fabric are applied, the two edges shall be overlapped according to manufacturer's installation instructions and stapled at 18 to 24-inch intervals along the exposed edge of the lap joint. The body of the fabric shall be stapled in a grid pattern with staples 3 feet maximum on center each way.
6. Where heavy concentrations of water or extremely erodible soil conditions exist, erosion checks shall be installed at intervals up to 50 feet as directed by the engineer. Erosion checks shall be a 4-inch deep trench perpendicular to the flow line across the width of the fabric. The fabric shall be stapled at 9-inch intervals along the bottom of the trench across the entire width of the fabric, backfilled and stamped.

(j) Ditch Lining Fabric

1. The ditch shall be shaped and dressed in accordance with the Specifications and Drawings at the location and grade shown on the plans or designated by the Engineer. Transverse check slots shall then be cut at the ends of the liner at 25-foot intervals along the ditch to a depth of 6 to 12 inches. Matting widths shall be as specified in the plans. Longitudinal shelves shall be cut 4 inches along the full length of the ditch for the mat edges to rest on.

2. Before the matting is placed, seeding operations shall be completed along the ditch line. Seeding operations shall conform to the requirements of Item 35, entitled, "Sodding and/or Seeding."

3. After seeding, the center strip of matting shall be rolled out starting at the upper end of the ditch. Then the side strips shall be rolled out, also starting at the upper end of the ditch, and overlapping the middle strip about 3 inches. The mat shall then be pinned down thoroughly and snugly in the transverse check slots and longitudinal shelves and at maximum intervals of 5 feet along the ditch. Where necessary, additional pins shall be used to hold the mat firmly in place, the transverse check slots and longitudinal shelves shall be covered with soil and tamped. Additional grass seed shall be applied to any disturbed areas after dressing is complete.

#### 98.16 MAINTENANCE

(a) The temporary erosion control features should be installed by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

(b) In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.

(c) Where the work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

#### 98.17 EROSION CONTROL OUTSIDE PROJECT AREA

Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads and equipment storage sites. Bid price in such cases shall include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed.

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