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DESIGN DIVISION DRAINAGE MANUAL
REVISION 23-01

TO: TDOT Design Division Drainage Manual Users

FROM: JL Jennifer Lloyd, Civil Engineering Director
Headquarters Roadway Design and Aerial Surveys Division

DATE: July 6, 2023

SUBJECT: Revision to Chapter 10 of the Design Division Drainage Manual

Chapter 10 of the Design Division Drainage Manual has been updated to reflect updates to TDEC's Construction General Permit (CGP):

10.04.2.3 FLOW CONTROL

While erosion prevention and sediment control measures are primarily aimed at stabilizing and retaining sediments, flow control measures are used to manage the flow of water in drainage ways, which is one of the main mechanisms causing erosion. Riprap basin energy dissipators and riprap aprons absorb the impact of outflows from culverts, or other high-velocity concentrated flows, allowing them to return to a non-erosive velocity before entering the waterway. Detention basins capture peak flows which may be increased as the result of a project, and release it at a reduced rate, thus preventing the potential for increased erosion in the downstream waterway. These basins may also be used to retain a portion of the stormwater for an extended period of time to allow suspended sediments to drop out. Although these measures tend to be permanent structures, they can be installed early in the project as a complement to the temporary measures.

When a project discharges into a waterway that has been classified by TDEC as Waters with Unavailable Parameters for Siltation the designer may be required to select a flow control measure to reduce or minimize any increase in the volume of stormwater leaving the site. While this may be considered a post-construction issue, increased flows due to removal of vegetation during a construction project should be considered. For additional information on flow control measures, see Section 10.08.3.

10.04.4.1 VEGETATIVE

Vegetative control measures, usually in the form of grasses, can play a key role in controlling erosion. These measures serve to prevent erosion by protecting soil from the impact of raindrops, holding soil particles together, and reducing the velocity of runoff. Vegetation can also help control sedimentation by working as a filter to strain out sediment, debris and other pollutants. Where vegetative measures are feasible, they are usually preferred to structural measures because they provide a relatively inexpensive and highly effective means of controlling erosion. In addition, the use of native grass species can help reduce the need for maintenance. Where possible, the ideal vegetative control measure would be to minimize the disturbed area to preserve the existing vegetation as much as possible.

It is important to establish vegetation as soon as possible on areas where a grading operation has been completed, or where a graded area is to be left inactive for more than 14 days (2 weeks). Significant vegetation growth becomes difficult after the topsoil has been removed from the surface by erosion. The remaining subsoil usually has very little available nitrogen for plants and minimal water holding capacity. In these conditions, root development is very week and plant establishment becomes difficult. Thus, temporary seeding should be carried out as soon as possible and permanent seeding should be carried out only when stockpiled topsoil has been replaced on the site. On sloping sites, or in other situations where establishment might be difficult, erosion control blankets or hydraulic erosion control products (HECP) may be used to help hold seed and fertilizer in place and to encourage germination.

10.04.5 DESIGN ELEMENTS WHICH ASSIST IN EROSION PREVENTION

Several elements of the roadway design can contribute to the overall success of the temporary erosion prevention measures, even though they may not be directly addressed in the EPSC plan. These design elements break up long slopes or minimize opportunities for flows to concentrate, thus allowing the erosion BMPs for the project to function more efficiently or even reducing the need for these measures. This section presents a number of basic design elements which could be incorporated into a project to supplement erosion prevention.

Slope of Cuts or Fills: Slope steepness and slope length are critical factors in determining the volume and velocity of runoff and its associated erosion. As both slope length and steepness increase, the rate of runoff increases and the potential for erosion is magnified, increasing the effort required to provide stabilization. Thus, flatter slopes are desirable where they can be accommodated by the right of way, and where they can be economically justified. Normally, the slope of a cut or fill should be as specified in the Roadway Design Standard Drawings. Flatter slopes may be used only with the approval of the Design Manager.

In general, a 3H:1V slope is the steepest which may be stabilized by seeded vegetation (although crown vetch may be used on steeper slopes) and is also the steepest slope which may be safely mowed. Slopes steeper than 3H:1V may also present more stringent requirements for stabilization. Slopes with grades of 35 percent or steeper are required to be stabilized not later than 7 days (1 week) after construction activity has ceased (temporarily or permanently). While the designer cannot control a contractor’s schedule and sequence of construction, they should be aware that the need for control measures such as temporary seeding with mulch may be needed in the final construction documents to meet these time restrictions. In addition, slope lengths longer than 100 feet should be avoided. Fill slopes are usually more erodible than cuts through naturally deposited material. Thus, erosion prevention measures on fill slopes may require extra attention.

10.05.1.3 STORM FREQUENCY FOR DESIGN OF EPSC MEASURES

Several control measures which may be utilized in an EPSC plan require detailed design based on the expected peak discharges at a site. In general, EPSC best management practices should be designed to accommodate the 5-year/24-hour storm event. However, when the Environmental Division has completed the Permit Assessment prior to the submittal of Right-of-Way Plans and has determined that the waters receiving runoff from the project are not listed as Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation (see definitions in the Appendix), the 2-year peak discharge may be used for BMP design, subject to the approval of the Design Manager. Any volume-based measures which require specific design should be based on the 24-hour storm duration. Chapter 4 of this Manual provides procedures which may be used to determine peak discharges, intensities, or runoff flow volumes for design.

10.05.2 OBJECTIVES OF THE EPSC PLAN

3. **Minimize disturbed area and duration of the exposure.** The best method of controlling sediment is to prevent erosion in the first place. Thus, when earthwork is required and natural vegetation is removed, the area and the duration of exposure should be kept to a minimum. The project site should be phased so that the only exposed area is the area which is actively being developed. All other areas should have a good cover of temporary or permanent vegetation, mulch, or erosion control blankets. Grading should be completed as soon as is practical after beginning the project. Once grading has been completed, permanent vegetation should be established as soon as possible.

   No more than 50 acres of active soil disturbance is allowed at any time during the construction of most TDOT projects. Off-site borrow or waste areas are to be included in the total disturbed area, if the borrow or waste area is exclusive to the project per TDOT's Waste and Borrow Procedure. More than 50 acres of active soil disturbance at any time shall be considered by TDOT for select projects. Disturbances of more than 50 acres of soil disturbance at any time will require the approval of the TDOT Environmental Division – Environmental Engineering Office and will be subject to additional requirements including the development and implementation of a Stormwater Monitoring Plan and post-rain EPSC inspections. The designer will compute the total disturbed area as the total area inside the slope lines plus the area inside a 15' wide strip immediately adjacent to the slope lines.

5. **Apply erosion prevention practices to minimize on-site damage.** As much as possible, erosion prevention practices should be used to prevent excessive sediment from being produced. Sediment control is more difficult and expensive when erosion is not controlled at the source. Ideally, all erosion would be prevented on a site. However, it is usually impractical to prevent sheet and rill erosion, since grading requires that at least some soil be exposed and complete prevention of erosion would require a very large number of BMPs. More practical goals are to prevent erosion in the form of gullies and to minimize the area of soil exposed at any given time. A number of practices are available to achieve these goals. Exposed soils which are to be left idle for more than 14 days (2 weeks) can be covered with temporary or permanent vegetation, mulch, hydroseeding or erosion control blankets. Stabilization of slopes steeper than 35 percent is required not later than 7 days (1 week) after activity on the slope has ceased, either temporarily or permanently. Special land grading methods such as roughening a slope on the contour or tracking with a cleated dozer may also be used. Temporary berms or other diversion structures can be used to direct surface runoff away from disturbed soils.

10.05.2.1 WATER QUALIY RIPARIAN BUFFER ZONES FOR EXCEPTIONAL TENNESSEE WATERS OR WATERS WITH UNAVAILABLE PARAMETERS FOR SILTATION

For sites that contain or are constructed adjacent to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, a natural water quality riparian buffer zone (buffer zone) consisting of undisturbed existing vegetation should be left in place between the limits of the disturbance and the top of the stream bank. It should be noted that these waters could also include lakes, ponds, wetlands, springs, and seeps. In the case of streams, the width of the buffer zone is measured from the top of stream bank to the limit of disturbance. For other water sources listed, the edge of water to the limit of disturbance should be used to determine the buffer width.

The buffer zone should be 60 feet in width (along both sides of a stream), measured from the top of the stream bank to the disturbed area. The buffer may be as narrow as 30 feet, provided that the average width of the entire buffer zone is 60 feet. Buffer zones adjacent to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation shall not be less than 30 feet wide at any measured location.

Attempts should be made for construction activities not to take place within the buffer zones. When the designer is unable to provide or maintain the required buffer strip, it may be possible to provide equivalent sediment control measures (BMPs) along the edge of the proposed disturbed area. In this situation, the designer should provide justification why it was not possible to provide or maintain the required buffer zone, along with documentation showing that the proposed sediment control measures provide a level of protection equivalent to a buffer zone.

For sites with an ARAP (i.e. temporary stream crossings, bridge crossings, box culverts, etc.), the buffer zone requirements provided herein do not apply, as the requirements in the valid ARAP will govern. Additionally, when existing land use (roadway, bridges, utility lines, etc.) already encroaches on a buffer; an exemption to these requirements is allowed for the portion of the buffer that contains the “footprint” of the existing land use or feature.

A buffer zone should not be considered the primary means of controlling project derived sediment. A natural vegetative buffer alone will not provide adequate sediment control. Additional sediment control measure should be provided to isolate the project from the buffer zone. These additional measures may consist of BMPs such as silt fence with wire backing, linear enhanced rock check dams, sediment tubes, filter socks, mulch berms, or a combination of these measures that will provide the desired result.

Buffer zones should be clearly identified on the project EPSC plans. The use of high-visibility orange fencing may be required to keep construction equipment out of the buffer zone.

Projects with approved right-of-way plans prior to February 1, 2010 are exempt from the buffer zone requirements of this section.

10.05.2.2 WATER QUALITY RIPARIAN BUFFER ZONES FOR ALL OTHER STREAMS

For all other projects adjacent to streams that do not meet the classification requirements of 10.05.2.1, a water quality riparian buffer zone (buffer zone) is also required between the top of the stream bank and the proposed disturbed area. To the maximum extent practical, a natural riparian buffer zone with an average width of 30 feet (on both sides of a stream) should be preserved; provided that at any measured location, the width of the buffer is not less than 15 feet.

10.05.3.2 EXISTING AND PROPOSED SITE FEATURES

Following the erosion prevention and sediment control notes sheets, the EPSC site plan sheets consists of roadway plan sheets showing the proposed construction with symbols denoting the intended locations of all BMPs, as well as any needed performance notes. Since all projects with one or more acres of disturbance will require a staged EPSC plan, a complete set of roadway plan sheets will be required for each stage. When the EPSC plan includes a sub-stage, as described in Section 10.06, only the sheets pertinent to that sub-stage need to be included. The sheets for the sub-stage should follow the sheets for the main stage to which it applies.

At a minimum, the following features should be included on the erosion prevention and sediment control site plan sheets:

- North arrow and scale
- Roadway centerline and stationing
- Existing and proposed right of way lines
- Existing and proposed elevation contours (see below)
- Edges of cut and fill lines
- Proposed cross drains, side drains, and end sections
- Existing waterways, wetlands, and ponds
- Stream relocations
- Flow direction for proposed special ditches
- All temporary erosion prevention and sediment control measures
- All permanent erosion prevention measures, including riprap (final stage)
- Names of named streams and receiving waters
- Energy dissipators for culverts, whether riprap or concrete (if used as an EPSC item)
- Performance notes on application of BMPs, restrictions on clearing, sensitive areas, etc.

- Proposed drainage easements
- Stormwater outfall locations
- Sinkholes, Wetlands and Wet Weather Conveyances numbered (i.e. WWC-1, WTL-4, etc…)
- Limits of land disturbance/clearing
- Undisturbed areas should be labeled as such on plans
- Water Quality Riparian Buffer Zones
- Beginning and end stations of the project for mainline and side roads

10.05.3.4 STORMWATER OUTFALLS

Designers will be responsible for identifying and labeling stormwater outfalls on all stages (and sub-stages when necessary) of the Erosion Prevention and Sediment Control plan for projects which require a Storm Water Pollution Prevention Plan (SWPPP). Outfalls will generally be located where concentrated flow leaves the site, flows off the State's ROW, and at locations where stormwater will directly enter jurisdictional or project features such as streams, wetlands, sinkholes, MS4, etc.). The drainage area to each outfall should also be provided by the roadway designer for each stage of the EPSC plan. Outfall labeling shall be included on right-of-way field review and all subsequent plans. The SWPPP Consultant shall be responsible for verifying the stormwater outfalls during the right-of-way field review.

Outfalls are defined as stormwater point source discharges from construction sites which pollutants are or may be discharged into waters of the State of Tennessee (i.e. streams, wetlands, etc.). A point source is any discernible, confined, and discrete conveyance, including but not limited to permanent (final) pipes, culverts, ditches, channels, flumes, curbs, curb and gutters, catch basins and inlets, and the ends of permanent diversions. A stream flowing through a site is not an outfall.

Outfalls may also be temporary, but necessary for construction activities and should be identified as such on the EPSC plans when known at the time of plan preparation. Examples of temporary outfalls may include temporary ditches, outlets to temporary pipes or culverts used with run-arounds, and diversions. All temporary outfall locations may not be discernable or identifiable to the designer due to uncertainties in terms of construction means and methods; however, it may be possible to identify some temporary outfalls during the design process such as outlets to proposed dewatering structures, sediment basin outlets, and at some proposed filter bag locations.

Outfalls may be subdivided so the drainage area to each sub-outfall is below the sediment basin or sediment trap drainage area threshold, and to allow drainage from undisturbed offsite areas ("run-on" water) to pass through a pipe, culvert, ditch, or channel without having to be treated.

See Figures 10-11 and 10-12 for examples of outfall labeling on project plans.

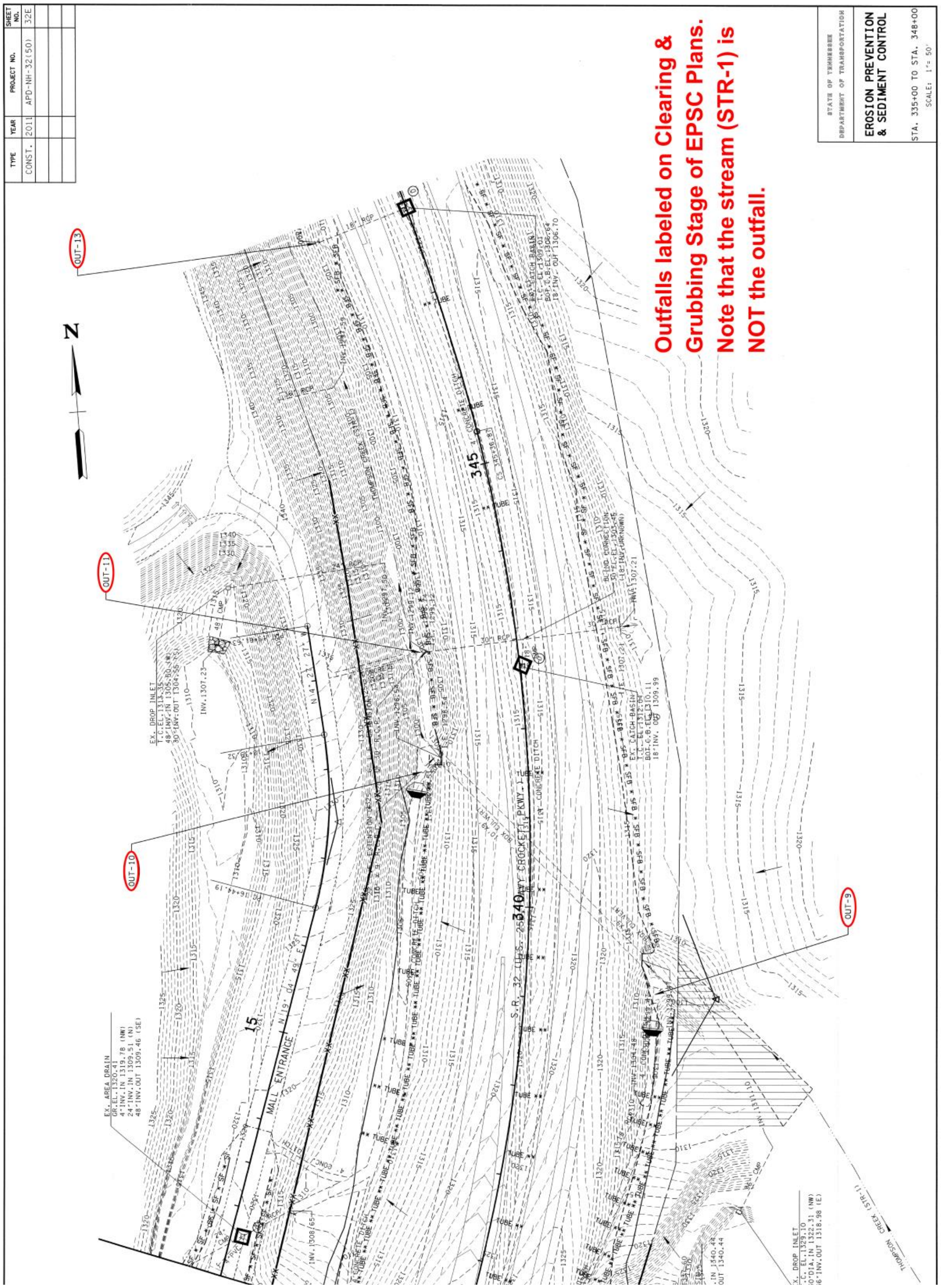

Figure 10-11
Examples of Outfall Labeling for EPSC Plan Sheets Figure 10-12
Examples of Outfall Labeling for EPSC Plan Sheets

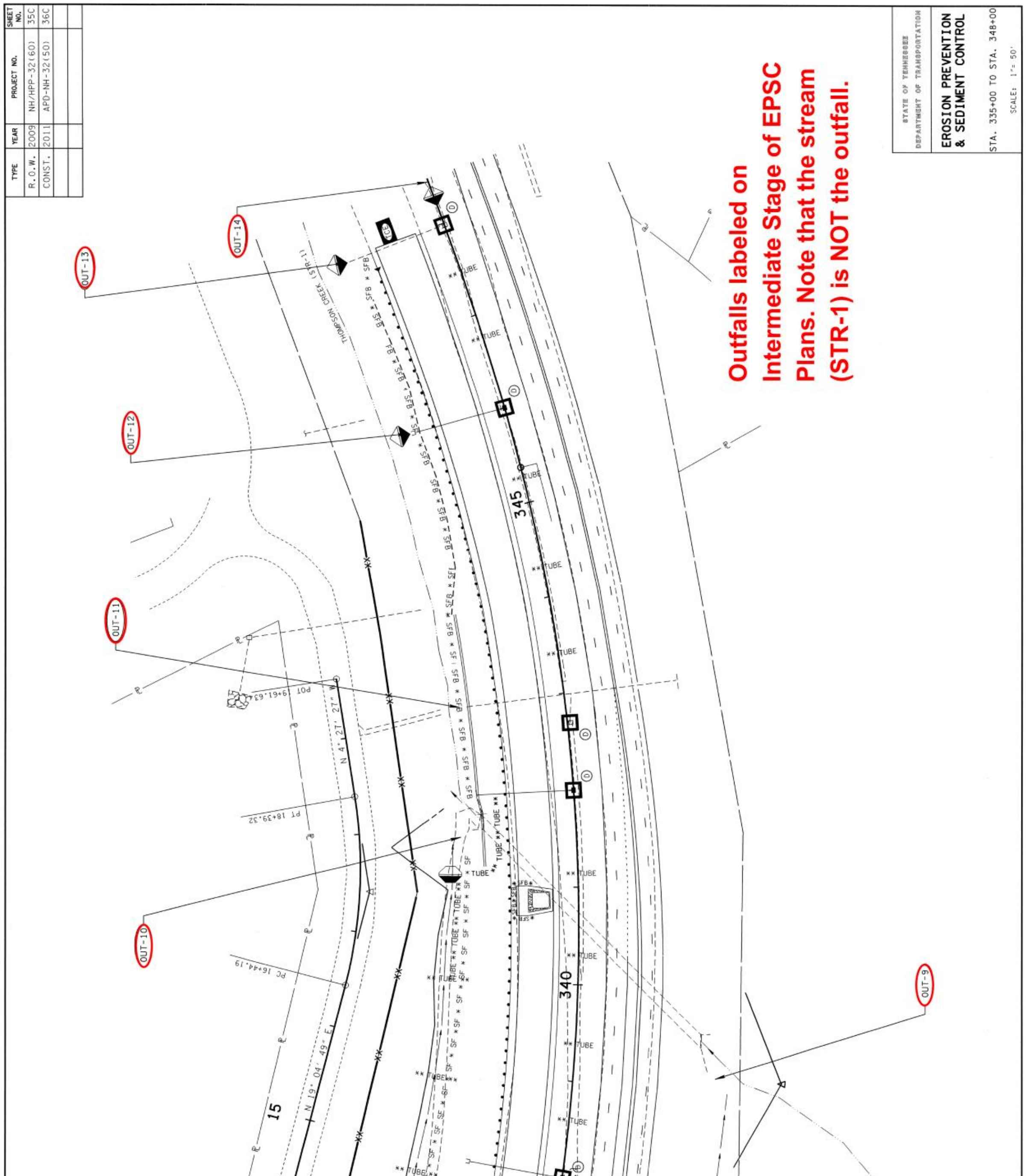

Figure 10-12
Examples of Outfall Labeling for EPSC Plan Sheets

SECTION 10.06 – STAGING OF EPSC PLANS

As a construction project progresses, the conditions on the site and types of activity taking place can change quite significantly. Thus, erosion prevention and sediment control measures which are effective during the early parts of the project may not be appropriate or effective in the later stages of construction. As a result, EPSC plans should be broken into stages to ensure that they will be effective. Staging the EPSC plan may be defined as specifying different sets of structural BMPs to address the changing erosion prevention and sediment control needs of a project as it progresses.

It is important to note that staging an EPSC plan is not the same thing as phasing the project (e.g. project phase or phase of construction). The NPDES permit refers to construction phasing as limiting the disturbed area to 50 acres at any one time.

The Contractor will normally be responsible for determining the need for construction phasing in accordance with the planned construction/operation activities such as traffic control. Regardless, each "construction phase" (if construction phase activity disturbs additional land) there will be a minimum of three EPSC stages as described below for all projects requiring a NPDES permit.

When a construction phase disturbs more than 50 acres (or special instances) of land, devising the phase into manageable EPSC sub-phases to control or limit the disturb land area at any given time will be necessary. The designer is to ensure that the appropriate phasing instructions are provided and a minimum of three EPSC stages shown, and Special notes included in the EPSC plans.

10.06.1 NECESSITY OF STAGING

To ensure that erosion prevention and sediment control measures will be effective throughout the construction of a project, a three staged EPSC plan will be required for all projects which require a NPDES permit.

Usually, the early stages of a roadway construction project involve the clearing and grubbing of vegetation and rough grading. Since it is not always practical to install erosion or sediment controls on the site during these operations, the measures which may be used at that time will principally be perimeter controls, such as silt fence. Further, since this part of the project often involves extensive re-working of the soil, it is not possible to install erosion prevention measures. Thus, sediment control measures are of primary importance. Once the rough grading has been completed, there will be opportunities for measures to be installed across the entire site. Although perimeter controls and other sediment control measures will continue to be important, the emphasis can shift from sediment controls to temporary and permanent erosion prevention measures, biodegradable rolled erosion control blankets, HECP, temporary seeding and mulch, tackifiers or sod.

10.06.2 EPSC PLAN STAGES

Controlling sediment during each construction phase depends on the timely installation of appropriate erosion protection and sediment control measures over the duration of the project. Thus, an EPSC plan will be divided into multiple stages, regardless of the size of the project. The EPSC plan will have an equal number of stages to the Traffic Control Plan. If Traffic Control consists of less than three (3) phases, and the project requires a NPDES permit, a minimum of three EPSC stages are required. The assessment of the disturbed area should include the project construction limits as well as any off-site borrow or disposal sites that are dedicated to the project. The following requirements shall apply:

NPDES Permit Required: Projects which require a NPDES permit will be developed with a minimum of three (3) EPSC stages. At a minimum, the three stages of the EPSC plan should include the following stages:

- Clearing and Grubbing Stage
- Intermediate Grading Stage
- Final Construction Stage

Each stage of the EPSC plan will require a separate set of plan sheets. However, the plans for each stage may refer to a common set of detail sheets. Additionally, it should be noted that many EPSC devices may be shown (and used) during more than one stage of the EPSC plan for the project. Items such as silt fence may be shown on all stages, and many times at the same location on each stage.

Although not a design issue, the designer should keep in mind that not all areas of a project need to be in the same stage of the ESPC plan at the same time. A contractor's staging plan may call for rough grading to be complete in one portion of the project before clearing and grubbing is even started in another portion. Thus, the intermediate grading stage of the EPSC plan may be applied to one area while another project area is still under the clearing and grubbing stage of the EPSC plan.

Additional sub-stages may be added to the ESPC plan to address unusual conditions which affect the entire length of the project. An example of this could include a project for which grading must be done in two parts to accommodate the traffic control plan. Further, it is possible to include "sub-stages" into the EPSC plan to address the needs at specific locations in the project. Examples of this could be the construction of a box culvert during clearing and grubbing operations, or the relocation of a section of railroad. See Section 10.06.2.4.

Phased construction (e.g. Phasing Plan) is not required, and generally should not be addressed in the EPSC plans by the designer unless special project requirements or conditions exist and are known at the time of plan preparation. A Phasing Plan is not required for all projects but can be utilized to limit the project disturbance to 50 acres at any one time during the project's lifespan. The contractor will be responsible for devising a Phasing Plan based on the staged EPSC plans provided with the project documents when the total project disturbance exceeds 50 acres or where certain site constraints limit the ability of the project to be constructed at one time. The purpose of the Phasing Plan is to ensure that no more than 50 acres of land are disturbed at any given time during the construction of the project. The designer should be aware of when a phased plan might be required and should ensure that appropriate instructions are included in the Special Erosion Prevention and Sediment Control Notes. It should be emphasized that the designer will prepare the staged EPSC plans for the entire project; however, it is normally the contractor's responsibility to develop a plan as to how he or she proposes to phase construction at the project site (especially for sites more than 50 acres). Phasing is generally considered a function of the contractor's means and methods and will normally not be addressed by the roadway designer.

10.06.2.2 INTERMEDIATE GRADING STAGE

The intermediate grading stage of the EPSC plans should include those devices needed during the roadway grading of the site and should also include temporary measures used during the construction of site features such as bridges, storm sewers and inlets, cross drains, box culverts, and utilities. At this point in the project, some outfall locations may change, new outfalls may be created, and some existing outfalls may be removed. All these changes require additional EPSC measures to be shown for the changing conditions. Roadway grading is occurring on site, and thus significant changes to the original topography and on-site surface drainage flow patterns should be expected. In addition to many of the devices previously shown on the clearing and grubbing stage, the following are some EPSC measures commonly shown on the intermediate grading stage of an EPSC plan:

- dewatering structures and sediment bags
- diversion channels, berms, and culverts
- rock check dams and enhanced rock check dams
- sediment traps
- culvert protection
- in-stream diversions

- suspended pipe diversions

- turbidity curtains
- catch basin filter assemblies

The designer should note that site conditions during this stage are changing rapidly on a typical active construction project. Many of the measures to be used and shown as part of the intermediate stage of the EPSC plans are truly “temporary” and may be used for very brief periods of time such as during bridge construction as in the case of a turbidity curtain. Perimeter controls previously shown on the clearing and grubbing stage (i.e. silt fence) are considered pertinent to this stage and should also be shown on this stage of the EPSC plans.

10.06.2.3 FINAL CONSTRUCTION STAGE

The final construction stage of the EPSC plan should include the measures needed from the intermediate grading stage to the final completion of the project. Usually, major grading will be complete or nearly complete by this time and the project is close to final grades and contours. The erosion prevention and sediment control measures provided in this stage should be designed to accommodate the final proposed site topography. The final construction stage should address final grading, shaping, and topsoil operations, base stone and paving, permanent stabilization of slopes and ditches, and construction of permanent features such as detention basins and riprap outlet protection.

SECTION 10.07 – ACCEPTABLE SOFTWARE

Computer applications for soil erosion prevention and sediment control design are described in this section. These software packages assist the designer in determining an effective erosion prevention and sediment control plan by providing estimates of the amount of soil loss which would occur at a given site. The Tennessee Department of Transportation does not encourage or endorse the use of any specific software package. Currently, RUSLE2 and WEPP are the most widely recognized software tools available for estimating sediment loads. When projects involve particularly sensitive waters (Exceptional Tennessee Waters, Waters with Unavailable Parameters for Siltation, etc.) or habitat, these programs may be considered valuable tools for addressing how decisions will be made regarding appropriate BMPs and how they will be maintained.

10.08.1.2.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required. However, rock check dams should be shown in the EPSC plans based on EC-STR-6, supplemented with the following criteria.

The drainage area at any given check dam should not be more than 10 acres.

The height of the dam at the center should be at least 1 foot lower than its height at the outer edges. This will form a weir to minimize the potential for erosion due to flows around the ends of the dam where the rock check dam and natural ground meet.

The height of the weir at the center of the dam should be a minimum of 1 foot above the ditch bottom (2 feet minimum for sites that drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation). The weir may be as high as 3 feet above the channel bottom, provided that the overall structure would not be higher than the ditch banks. The upstream and downstream faces of the dam should be at a slope of 3H:1V

10.08.1.4.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is required in that the hydrologic and hydraulic analysis of the waterway is necessary to determine the number and size of pipes required for a temporary culvert crossing. For each temporary culvert crossing the number, diameter, and length of temporary drainage pipes and the type of driving surface should be labeled in the EPSC Plans.

The selection of the number and size of pipes to be used in the crossing should be based on the table "Temporary Diversion Culvert Selection" on Standard Drawing EC-STR-32. Where the size for a single pipe determined from the table will not adequately fit into the channel, Table 10A-13 in the Appendix may serve as an aid in selecting multiple pipes.

This measure may include one or more temporary pipes (culverts) from 18 inches to 72 inches in diameter. The culverts should be covered with machined riprap Class A-1, and the driving surface should consist of a minimum of 6 inches of mineral aggregate, (size 57).

When this measure is applied at sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the Mineral Aggregate (Size 57) used to form the driving surface should be changed to a minimum 9-inch layer of Machined Riprap, Class A-3.

10.08.1.10.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is required in that the hydrologic and hydraulic analysis of the waterway is necessary in order to determine the temporary drainage pipe size and channel transitions required for a temporary diversion culvert. For each temporary diversion culvert the diameter and length of temporary drainage pipe should be placed on the EPSC plans. The designer shall provide culvert sections in the plans. In addition, when channel transitions are used, the type of lining and lining limits for the channel transitions should be labeled in the EPSC plans.

Temporary diversion culverts should be designed using the storm frequency specified in Section 10.05.1. At a site that involves an Exceptional Tennessee Water or Water with Unavailable Parameters for Siltation, the diversion pipe (culvert) shall be sized to convey the 5-year peak flow in the stream.

The table "Temporary Diversion Culvert Selection" on Standard Drawing EC-STR-32 may be used to select the pipe size. It should be noted that this table is based upon allowing a 2.5-foot increase in water surface elevation for the design flow rate, as compared to the water surface elevation without the culvert. The designer should include a culvert section for the temporary culvert in the project plans.

The drainage area should be 1280 acres or less. Typically, where the drainage area is larger than this, a multi-cell box culvert would be required, allowing one cell of the structure to be used as the diversion while construction is occurring on the other cell. Where this option is available, it is preferred over constructing a temporary diversion culvert. See Section 10.08.108 for more information.

Where excavated channel transitions are employed, they should normally be trapezoidal in shape. The bottom width of the channel transition should be equal to the bottom width of the natural channel. The side slopes of the transition should be 2H:1V or flatter. In no case should the side slopes be steeper than the natural side slopes.

Excavated channel transitions should be lined with riprap on geotextile fabric (Type III). Guidelines for the selection of the riprap class may be found on the table "Temporary Diversion Culvert Selection" on Standard Drawing EC-STR-32.

Excavated channel transition linings should utilize geotextile fabric (Type III). The geotextile fabric should extend to the top of the bank of the diversion channel and be entrenched there as shown in Standard Drawing EC-STR-31. This fabric should meet the requirements of the standard specification for geotextiles, AASHTO designation M-288, Erosion Control.

Riprap should be placed to at least the minimum thickness provided in the TDOT Standard Specifications. The transition channel should be over-excavated such that the top of the riprap layer will be at the required ditch grade. At a site that involves Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the diversion pipe (culvert) shall be sized to convey the 5-year peak flow in the stream.

10.08.1.11.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is required in that the hydrologic and hydraulic analysis of the waterway is necessary to determine the temporary drainage pipe size required for a suspended pipe diversion. For each suspended pipe diversion, the diameter and length of temporary drainage pipe should be placed in the EPSC plans.

The maximum allowable drainage area for this practice is 1280 acres. In general, this measure should be designed using the storm frequency specified in Section 10.05.1. At a site that involves Exceptional Tennessee Waters or a Water with Unavailable Parameters for Siltation, the diversion pipe (culvert) shall be sized to convey the 5-year peak flow in the stream. For intermittent streams, or very small streams, or sites where the construction period is expected to be brief, the designer may specify the optional flexible pipe diversion using a pump as shown on EC-STR-33A.

10.08.1.12.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required. However, for each location erosion control blankets are used the type of blanket should be indicated in the EPSC plans.

As described in Section 5.04.7, erosion control blankets are classified into four types. Refer to the TDOT Qualified Products List and TDOT Standard Specification 918.28 for additional information.

The use of erosion control blankets on cut or fill slopes may be considered for the following conditions:

In flat or rolling terrain, on 2H:1V or 3H:1V fill slopes and/or 2H:1V or 3H:1V cut slopes (in soils) that are 20 feet or greater in height;

In mountainous or hilly terrain, 2H:1V or 3H:1V fill slopes and/or 2H:1V or 3H:1V cut slopes (in soils) that are 30 feet or greater in height;

On slopes that have heights less than A or B but are built of highly erodible soils such as sandy soils in West Tennessee;

On slopes where a roadway is passing through a small urban or residential area and sod is not specified. Slopes on urban projects with curb and gutter should be sodded;

On slopes running adjacent to a stream or adjacent to a large ditch or channel that drains directly into Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation near the roadway construction;

On bridge and approach projects when crossing Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation;

As temporary slope protection on the front and side slopes of bridge abutments, when sod is not required;

On slopes where the installation of silt fence, sediment tubes, and/ or filter socks would be considered unduly difficult;

At points of stormwater runoff concentration from pavement to slope, such as the low side of a superelevated section, the low areas of sag vertical curves, etc.;

At point of stormwater runoff concentration where off-site runoff threatens stability of cut slopes;

At all locations specified by the Soils and Geology Sections of the Materials and Test Division

a. At locations requested during project field reviews

The erosion control blanket type for a graded area should be selected as follows:

- Type I blankets should be used on continuous slopes that are 3H:1V or flatter and up to 20 feet in height.
- Type II blankets should be used on continuous slopes that are 3H:1V or flatter and greater than 20 feet in height and on continuous 2H:1V slopes that are up to 80 feet in height.
- Type III blankets should be used on continuous 2H:1V slopes that are over 80 feet in height.
- Type IV blankets should be used on slopes only when specified by the Soils and Geology Section of the Materials and Tests Division.

The guidance provided above should be sufficient for the selection of an erosion control blanket type. However, where a more detailed analysis is desired, the Revised Universal Soil Loss Equation may be utilized, as described in Section 10.03. The expected soil loss from a slope protected with erosion control blanket can be compared with the loss from a bare slope by adjusting the cover-management factor, C. Manufacturers of erosion control blankets supply typical C factors for each type of blanket. These values are based on field testing of the blankets under varied conditions.

On sites with flat slopes or short slope lengths, it may be possible to substitute mulch control netting or open weave textiles for erosion control blanket, based on economic considerations. Where this is done, the seeding quantity should be computed as Item No. 801-01, Seeding (with Mulch) per unit for the graded area.

The selection of an erosion control blanket for a stream channel lining will be based on whether the seeding will be temporary or permanent. For permanent seeding, the designer should consider the shear stress imposed on the fully vegetated channel at the ditch design flow rate (that is, the 10-year or the 50-year event). As described in Chapter 5, a seeded or sodded ditch lining will resist erosion only when the maximum shear is 2.0 lb/ft^2 or less. As a result, the ultimate strength of the lining will be limited even where the erosion control blanket is capable of resisting higher shear stresses. Thus, for permanent seeding in a channel, an erosion control blanket should be specified only where the maximum shear at the design discharge is 2.0 lb/ft^2 or less. Where it is greater than this amount, a turf reinforcement mat may be specified as described in section 10.08.1.12. Procedures for determining the shear stress in a grassed waterway are provided in Section 5.06.

Where temporary seeding is being applied to a channel, it is usually not necessary to consider the ultimate shear strength of the grassed lining. In this case, the type of erosion control blanket may be selected based on the maximum shear imposed by the 2-year peak discharge on the un-vegetated blanket. However, at sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the maximum shear imposed by the 5-year peak discharge should be considered. Procedures for determining this shear stress are also provided in Section 5.06 and permissible shear stresses are provided in Table 5A-7.

10.08.1.14.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required when used as a temporary measure. However, when gabion check dams are to remain as a permanent feature, formal design is required. Each gabion check dam used should be labeled on the EPSC plans with the following information: as permanent or temporary (or both), the required weir width, the size and length of gabion for the lower row, and the size and length of gabion for the upper row.

Standard Drawing EC-STR-56 provides tables which may be used to select a check dam configuration based on the bottom width and the side slopes of the ditch, as well as the flow rate, as described in the following paragraph.

The table “Gabion Check Dam Weir Lengths and Allowable Flow Rates” on EC-STR-56 specifies the maximum flow rates which may be allowed for a large variety of check dam configurations. In order for the structure to provide adequate erosion prevention during construction, the peak discharge generated by the storm event specified in Section 10.05.1 at the site should be less than or equal to the weir flow value provided on the table. For sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the weir shall be sized to contain the 5-year/24-hour storm.

10.08.1.16.2 APPROPRIATE APPLICATIONS

Temporary seeding is applicable on disturbed areas which will be left idle for more than 14 days (2 weeks) but are not yet at final grade. Permanent seeding should be applied only when the final grade has been established. Additionally, temporary seeding (normally with mulch) may be used when an area is cleared and grubbed of its pre-construction vegetation, but significant project grading will not begin for more than 14 days (2 weeks) from the date of the clearing and grubbing operations.

10.08.1.16.3 LIMITATIONS

Temporary seeding and mulch should not be used if construction activities on the area will be resumed within 14 days (2 weeks).

10.08.1.16.4 PLANNING AND DESIGN CRITERIA

Formal design is not required. As with any other measure required by the standard drawings or standard specifications, it is not necessary to specifically indicate areas for permanent or temporary seeding the EPSC plan sheets.

Temporary seeding should be applied on the appropriate portions of the site as soon as practicable, but no more than 7 days (1 week) after construction activities have been suspended. Temporary vegetative measures should be coordinated with permanent measures to assure economical and effective stabilization. It is preferable to plan grading operations to minimize the use of temporary seeding.

10.08.1.17.5 EXAMPLE APPLICATION

Example 1:

Given: Due to right of way constraints, the topsoil stockpile for a proposed project must be located within 100 feet of a Water with Unavailable Parameters for Siltation. Although the stockpile will be seeded and surrounded with Silt Fence with Backing, it is decided to provide an extra level of protection by specifying some form of soil stabilization. The stockpile area is to be located adjacent to the proposed roadway and cover an area 100 feet by 150 feet. It is also estimated that the stockpile will have to remain in place for 12 months.

10.08.1.18.2 APPROPRIATE APPLICATIONS

There are two primary applications of PAM. First, it can be applied to graded areas or slopes in order to cause soil particles to bind together. For example, PAM powder can be applied to jute mesh when used with a temporary sediment tube along the contour of a slope. The larger effective particle size increases the resistance of the soil to erosion and creates a more open soil texture. This results in a reduction of soil loss and provides an improved environment for the germination and growth of grass seed. PAM applied to graded areas is usually in the form of a liquid or powder.

The second application of PAM is in ditches or other areas of concentrated flow. In this situation, the chemical is introduced into the flow in the form of a solid log or gel which is slowly dissolved as the water passes over it. These flows must then be directed into a sediment basin or other form of BMP which functions by allowing sediments to settle. The PAM released from the log binds the suspended sediment particles together into larger “flocs” which then settle at an increased rate. PAM can be used in variety of ways such as: a PAM mixing zone prior to the flow entering a sediment trap or basin, PAM applied to jute mesh to cover check dams, or PAM applied to jute mesh to create baffles in a sediment basin.

Normally, PAM is applied in conjunction with mulched seeding or as a constituent in another soil stabilization measure. However, it can be applied by itself to graded areas which will be left idle for less than 14 days (2 weeks) and would not otherwise receive mulched seeding.

10.08.1.19 CONSTRUCTION PHASING

Construction phasing involves coordinating the construction schedule to minimize the amount of disturbed area at any given time and coordinating land clearing with the installation of erosion prevention and sediment control measures. This includes managing excavated material. Construction phasing is usually determined by the contractor; thus, it is discussed here only in general terms.

Planning the sequence of construction activities in relation to the installation of erosion prevention and sediment control measures is a key to efficient and cost-effective erosion prevention and sediment control. By clearing small sections of the project and limiting areas of disturbance, it is much easier to prevent and control erosion than if the entire site were exposed at once. Perimeter controls, sediment traps, basins, and diversions should be in place to control runoff and capture sediments before site disturbance occurs. Disturbed areas in the vicinity of water bodies, wetlands, steep grades, or long slopes, should be made a priority and be stabilized within 7 days (1 week) of disturbance. Graded areas which will be left idle for more than 14 days (2 weeks) should be immediately temporarily or permanently stabilized, rather than waiting until all project grading is complete. Excavated material which is retained within the project limits should be stockpiled near the work area and contained by an appropriate BMP. If the material is removed from the site, it should be disposed of properly. Excavated material shall not be placed in any wetlands.

Section 10.06 provides a complete discussion of this BMP in relation to the staging of Erosion Prevention and Sediment Control plans.

10.08.2.1.3 LIMITATIONS

Dewatering structures should not be placed within a jurisdictional wetland or within 15 feet of a stabilized outlet, stream, or other natural water resource.

When filtered water from the dewatering structure will discharge into Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the minimum installation distance from the top of bank shall be 30 feet.

Use requires a flat or gently sloped area for placement and use.

10.08.2.1.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required. However, for each dewatering structure used the dimensions should be labeled in the EPSC Plans.

The following guidelines should be used when planning and designing dewatering structures as described in Standard Drawing EC-STR-1.

A dewatering structure should be sized to allow pumped water to flow through the filtering device without overtopping the structure. The geotextile fabric used around the inside perimeter of the structure should be anchored and staked into existing ground as shown in the standard drawing.

The minimum required volume of storage in cubic feet for a dewatering structure is obtained by multiplying the pumping rate (in gallons per minute) by 16, as shown in the table on Standard Drawing EC-STR-1. The recommended volume is based on 2 hours of pumping at the full rate shown on the drawing. In situations where it is likely that a pump will be operated for longer periods of time, the volume of the structure should be appropriately increased.

The minimum dewatering structure volumes provided in Standard Drawing EC-STR-1 are based on assuming that the structure will be horizontal. Where the structure is to be placed in a sloping area, the available storage capacity will be reduced. It may be necessary to increase the size of the structure to compensate for this.

The geotextile fabric (Type II) used in a dewatering structure shall meet the requirements of the standard specifications for geotextiles, AASHTO designation M-288, Sediment Control.

The maximum height of the dewatering structure is 30 inches. Therefore, when placing a dewatering structure, the designer should consider the area available within the Right-of-Way. If the available area is less than that required for the structure, a construction easement may be required for the construction and maintenance of the structure.

An optional excavated area may be added to a dewatering structure to provide storage area for sediments trapped within the structure. Where it is included, this excavated area should be a minimum of 3 feet deep. Since the excavated area will be below grade, any water collected in it may not drain out in between times that the pump is operated. Therefore, the volume of this area should not be included in computing the storage volume offered by the dewatering structure.

Silt fence with wire backing should be provided on the down-slope side of a dewatering structure, across its entire width. This fence will serve to filter any sediment remaining in the water released from the dewatering structure. Off-site stormwater runoff should be diverted away from all dewatering structures.

Once the water level nears the top of the structure, the pump should be turned off while the structure drains down to the elevation of the excavated area. The remaining water may be removed only after a minimum of 6 hours of sediment settling time. This effluent should be pumped across an area with established vegetation or through a silt fence with wire backing prior to entering a watercourse.

The existing vegetative buffer should remain between the silt fence with wire backing and the stabilized outlet, stream, or other natural water resource. The desirable vegetative buffer to maintain when placing this structure adjacent to most streams shall be an average 30 feet, measured from the top of the stream bank to the silt fence with wire backing provided that the minimum width of the buffer zone is more than 15 feet at any measured location. For locations where the dewatering structure will discharge to Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the desirable distance shall be an average 60 feet, with a minimum distance of 30 feet. At all sites, the designer should attempt to maintain the <u>desirable</u> vegetative buffer.

Dewatering structures shall be paid for under the following item numbers

- 203-01, Road & Drainage Excavation (Unclassified), per CY
- 209-05, Sediment Removal, per CY
- 209-10.01, Temporary Dewatering Structure, per CY

Silt fence with wire backing shall be paid for according to its respective standard drawing.

10.08.2.2.3 LIMITATIONS

A sediment filter bag should not be placed within a jurisdictional wetland or within 15 feet of a stabilized outlet, stream, or other natural water resource. When filtered water from the sediment bag will discharge into Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the minimum installation distance from the top of bank should be 30 feet.

10.08.2.2.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required. However, for each sediment filter bag used the size of the bag should be labeled in the EPSC plans. The following guidelines should be considered when using a sediment filter bag in the EPSC plans.

A sediment filter bag should be placed on a level pad a minimum of 6 inches thick composed of mineral aggregate (size 57). This pad should be constructed on an area with sufficient slope to allow water entering the pad to drain away from the project work area. However, it is necessary for the pad to be level to prevent the bag from rolling along the slope as water is pumped into the structure. The pad, including the slopes, should be wrapped with geotextile fabric (Type III). This geotextile fabric (Type III) shall meet the requirements of the standard specifications for geotextiles, AASHTO designation M-288, Erosion Control. Off-site stormwater runoff should be diverted around the sediment filter bag location.

A sediment filter bag should be surrounded on all sides by silt fence with wire backing. Sediment Tube (EC-STR-37) or Filter Sock (EC-STR-8) may be used as alternate materials.

Where necessary, a sediment filter bag may be applied on pavement or other impervious surface. In such situations, the bag should be placed on a minimum 6-inch layer of mineral aggregate (size 57) with geotextile fabric as shown in the standard drawing. In addition, it should be surrounded by filter sock or another BMP which may be applied without trenching or staking.

Sediment filter bags used for TDOT projects may be equipped with a sleeve sufficient to accept a 4-inch pump discharge hose. Slitting the bag to make the hose connection is also acceptable.

The bag sizes shown in the pay item list are approximate only. The actual size of bag supplied for a project may vary based on the products available from a specific vendor. The minimum “footprint” of the bag shall be 150 square feet.

A sediment filter bag should be considered full once the accumulated sediments have reached a depth of 6 inches. In the filter bag shown on the standard drawing, this corresponds to approximately 4 CY of material, which can weigh as much as 7 tons. Once the bag has reached this point, it should be removed and replaced with a new one. The rate at which a bag will collect sediments depends on a number of variables, including the pumping rate, the nature of the sediments in the slurry water, and the frequency at which pumping is required. The designer should consider these factors along with the duration of the operation to estimate the quantity of bags which will be required.

In determining the location for a proposed sediment filter bag, the designer should allow sufficient room and a clear path to allow access for the equipment needed for bag removal. Bag disposal should be in a landfill or other suitable area. It will not be acceptable to open the bag and spread the collected

sediments on site. Lifting and removal of the bag may be facilitated by means of the optional lifting straps shown on the standard drawing.

The desirable vegetative buffer to maintain when placing this structure adjacent to most streams shall be an average 30 feet, measured from the top of the stream bank to the silt fence with wire backing provided that the minimum width of the buffer zone is more than 15 feet at any measured location. For locations where the filter bag will discharge to Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the desirable distance shall be an average 60 feet, with a minimum distance of 30 feet. At all sites, the designer should attempt to maintain the desirable vegetative buffer width between the top of the stream bank and the filter bag installation.

10.08.2.4.5 EXAMPLE APPLICATION

Given: A 1-acre area within a freeway construction project will drain to a stream which crosses the project right-of-way. The construction of the cross drain for the stream will require a temporary diversion channel, and during the time that the diversion and new culvert are being constructed, on-going grading work will occur on the 1-acre drainage area. Thus, sediment controls will be needed to provide protection for the stream during the construction of the cross drain. The right of way in this area is 150 feet wide.

Find: Select a sediment control measure for this site and estimate the required quantities.

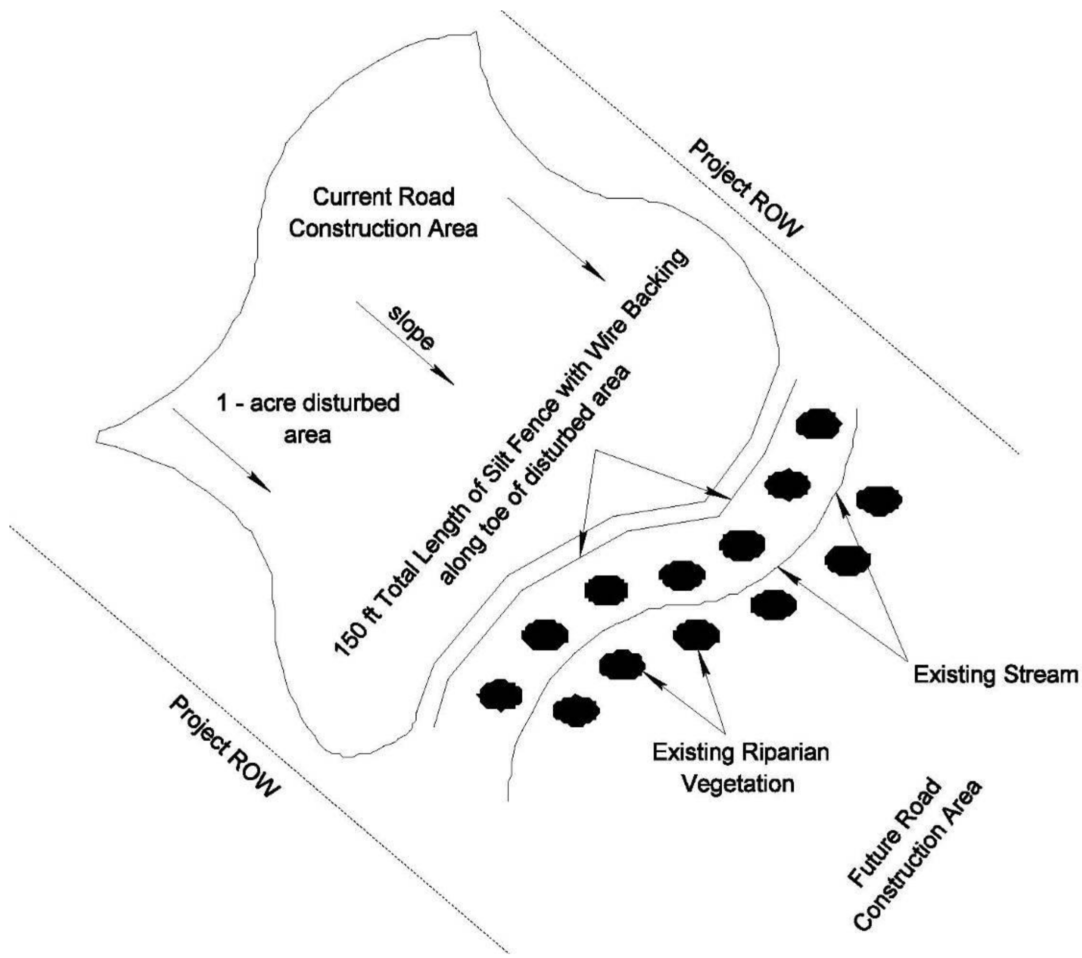

Figure 10SC-1
Site Sketch for Disturbed Area Adjacent to a Waterway

Solution: Silt fence with wire backing will be needed at this site for two reasons. First, since the 1-acre drainage area is being actively worked, it will be difficult to install or maintain structural BMPs on the disturbed areas. Thus, silt fence with wire backing is the only measure which will provide adequate sediment control across the 150 feet wide right-of-way. In addition, silt fence with wire backing is specifically intended for use adjacent to water resources such as streams. Although the stream is not listed as an Exceptional Tennessee Water or Waters with Unavailable Parameters for Siltation, the existing riparian vegetation is being allowed to remain in place if possible before the construction of the cross drain.

10.08.2.6.2 APPROPRIATE APPLICATIONS

Enhanced rock check dams may be used in roadside ditches, as well as in waterways which have defined channels. This measure is often installed at the ultimate outfall point (or “critical point” as defined in Section 10.08.1.1) for runoff from a project and is thus the last line of defense against pollution caused by the release of sediments from a construction site. They should therefore be used in conjunction with other on-site measures, such as silt fence, catch basin filters, slope drains, etc. Enhanced rock check dams are also used with sediment traps.

Since the maximum drainage area for an enhanced rock check dam can be as great as 30 acres, they may be applied in situations where the drainage area exceeds the maximum for measures such as rock check dams and enhanced silt fence. For sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the maximum allowable drainage area shall be 20 acres.

10.08.2.6.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required when the drainage area for the enhanced rock check dam is less than 20 acres. When the drainage area for the enhanced rock check dam is greater than 20 acres formal design is required. Enhanced rock check dams should be shown in the EPSC plans based on EC-STR-6A, supplemented with the following criteria. When enhanced rock check dams are used with a drainage area of 20 acres or more the structure height, weir height, weir width, and spacing should be labeled for each one used in the EPSC plans.

Enhanced rock check dams may be applied at sites with drainage areas up to 20 acres. However, where the Environmental Division has determined that a site does not drain to listed Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the allowable drainage area may be increased to 30 acres.

10.08.2.7.2 APPROPRIATE APPLICATIONS

Sediment traps should be used in ditches downstream of disturbed areas no more than 5 acres in size. They should be used when high sediment loads are expected, and additional storage is needed behind an enhanced rock check dam.

When an outfall drains to Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, a sediment trap shall be used if the contributing drainage area to the outfall is 3.5 – 4.9 acres. The acreage limitations provided above include both disturbed and undisturbed areas draining to the outfall; however, diverted areas within the outfall’s watershed may be omitted from the computed area.

10.08.2.7.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is required in that the hydrologic and hydraulic analysis of the ditch is necessary to determine the dimensions of the sediment trap. For each sediment trap the length (L), width (W), depth (D1), and height of the enhanced rock check dam (D2) should be provided in the EPSC plans.

The drainage area for a sediment trap with a check dam should be 5 acres or less. Where the drainage area is greater than 5 acres, the designer should consider the use of a Sediment Basin (see 10.08.2.12).

10.08.2.8.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required; however, when filter socks are specified they should be shown in the EPSC plans according to EC-STR-8. At each location filter socks are used their size should be labeled in the EPSC plans.

Filter socks are available in nominal diameters of 8, 12, 18 and 24 inches. Because they are constructed on site, individual segments of filter sock can be up to 250 feet long. Typically, the tubing mesh will be constructed of 5 mil HDPE filaments which are not biodegradable; although, biodegradable tubing material is available.

The minimum specification for filter sock filler material is provided on the standard drawing. This specification provides for somewhat coarser material than would be used in a filter berm (see Section 10.08.2.14), so that particles of the media will not be able to escape through the 3/8th inch openings in the tubing mesh.

Compost or other organic materials used as filtration media should be blown into the sock using appropriate pneumatic equipment. Hand-filling of these materials will not achieve the level of compaction necessary to ensure the effectiveness of the measure.

Compost is a manufactured product which should be acquired from an approved supplier. Thus, the cost of bringing this material to the job site may be a factor at some locations. Wood chips, on the other hand, can be produced on-site as a byproduct of site clearing activities. The choice of measure (filter sock, filter berm, silt fence, etc.) to be applied at a given site should be based on the availability and relative costs of the required materials.

Filter socks should be placed on properly prepared surfaces. In general, the surface should be even, free of large rocks or other surface irregularities and be cleared of large vegetation such as brush or tall grasses. This is essential to maintain good ground contact in order to prevent any leakage under the sock. Additional mulch or compost can be placed along the upstream face of the sock in order to provide extra protection from this leakage.

Stakes used to install filter socks should not penetrate the tubing mesh as this will cause damage which would allow the filler material to leak out, resulting in the failure of the measure. Stakes should be placed on the downstream face of the sock, inclined toward the flow direction. At locations where a sturdier installation is desired, the mesh tube can be secured to the stakes by means of zip ties or twine.

The drainage area upstream of a filter sock on a slope should be no greater than ¼ acre per 100 linear feet of sock.

Filter socks should be applied at the top of a slope which receives runoff from areas above the slope. A sock should also be placed at the base of a slope, about 10 feet away from the toe in order to provide an area for the storage of sediments. On long slopes where the drainage area limit given above would be exceeded, one or more additional rows of filter sock should be placed, spaced as recommended in the table “Filter Sock Spacing for Slope Application” on the standard drawing. Sock spacing using the values on this table will ensure that the drainage area limitation is met.

Both ends of a run of filter sock should be turned up-slope and extended to a point where the ground is higher than the top of the sock at its lowest point. This will prevent erosion which could occur if flow were to bypass around the ends of the measure.

Where long continuous rows are required on a slope, the ends of the individual segments of sock should be joined as shown on the standard drawing. This will ensure that gaps will not occur between the individual segments, allowing sediment-laden water to escape.

In most cases, filter sock on slopes should be removed when permanent vegetation is fully developed or when any other form of permanent erosion protection is in place. Removal may be accomplished by cutting the sock open and spreading the fill material on the site. All non-biodegradable materials shall be removed. The tubing mesh would then typically be removed, unless it is composed of biodegradable material. In such cases, it would be allowable to leave the tubing mesh on the site to decompose.

Filter socks used in a ditch should extend on the sides of the ditch to a height equal to 3 feet plus the installed height of the sock, or to the top of the ditch, whichever is less. This will ensure that the ends of the sock will not be overtopped during the design storm event, causing erosion due to bypass flows.

The minimum nominal diameter for a single filter sock applied in a ditch should be 24 inches, which corresponds to a 19-inch installed height. The required height may also be achieved by stacking smaller diameter socks as shown on the standard drawing. This will ensure that the sock will function effectively as a velocity control device, allowing sediment to drop out of the flow. A clean filter sock in a ditch application will typically have a flow-through capacity smaller than the design discharge. Thus, its primary benefit will be as a velocity control device as filtration will be provided only for smaller flows. The spacing between filter socks should be based on the table “Filter Sock Spacing for Ditch Application” on the standard drawing.

At sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the maximum drainage area for a filter sock in a ditch application should be no more than 10 acres. At other sites, the maximum drainage area may be increased to 15 acres.

10.08.2.9.4 PLANNING AND DESIGN CRITERIA

Formal design will usually not be required. The determination of the dimensions of culvert protection should be based on Standard Drawings EC-STR-11 and EC-STR-11A, supplemented with the following criteria:

The use of Culvert Protection Type 1 is limited to pipes up to 36 inches in diameter. However, Culvert Protection Type 2 may be applied to any size of culvert, including box bridges. Culvert protection may also be applied around any type of endwall, including box bridge wingwalls. Culvert protection may be applied both before and after the endwalls have been constructed.

Culvert Protection Type 1 may be applied at sites with drainage areas up to 30 acres. However, where the Environmental Division has determined that a site drains to Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, the maximum allowable drainage area shall be 20 acres. As described in the “Appropriate Applications” section, the drainage area is assessed differently for Culvert Protection Type 1 and Type 2.

10.08.2.11.1 DEFINITION AND PURPOSE

This measure consists of a temporary compacted earth embankment with no drainage outlet except for an overflow weir at the top of the structure. The portion of the embankment which contains the overflow weir is protected by a layer of machined riprap Class A-1 in order to provide protection against washouts during periods of high flow. Because the embankment essentially forms a temporary retention basin, it can achieve very high sediment removal rates; and thus, maybe useful at sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation.

10.08.2.11.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is required in that the hydrologic and hydraulic analysis of the rock and earth sediment embankment is necessary to determine the impoundment volume, and the dimensions of the rock and earth sediment embankment. For each rock and earth sediment embankment the height of the embankment, height of the weir, width at the top of the embankment, and length of the weir should be provided in the EPSC plans.

Rock and earth sediment embankments should generally be designed to impound the full runoff volume generated by the storm event specified in Section 10.05.1. At most sites, this volume will be that which is necessary to capture the 2-year/24-hour rainfall event. At sites that drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the impoundment volume should be equal to the 5-year/24-hour event. Additionally, rock and earth sediment embankments should be dewatered using a Dewatering Structure (EC-STR-1) or Sediment Filter Bag (EC-STR-2) so that sufficient volume is available to accommodate runoff from the next storm event. The designer should consider this necessity and provide the appropriate items for dewatering in the project plans.

10.08.2.12.2 APPROPRIATE APPLICATIONS

Sediment basins shall be used at project locations where a drainage area of 10 acres or more discharges to a single outfall location. When an outfall drains to Exceptional Tennessee Waters or a Waters with Unavailable Parameters for Siltation, a sediment basin shall be used if the contributing drainage area to the outfall is 5 acres or more. The acreage limitations provided above include both disturbed and undisturbed areas draining to the outfall; however, diverted areas within the outfall's watershed may be omitted from the computed area.

10.08.2.14.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required; however, when filter berms are specified, the following standards should be used.

Compost is a manufactured product which should be acquired from an approved supplier. Thus, the cost of bringing this material to the job site may be a factor at some locations. Wood chips, on the other hand, can be produced on-site as a byproduct of site clearing activities. The choice of measure (mulch berm, compost berm, silt fence, etc.) to be applied at a given site should be based on the availability and relative costs of the required materials.

The drainage area upstream of a filter berm should be no greater than ¼ acre per 100 linear feet of berm. On long slopes where this limit would be exceeded, it is possible to place multiple filters, spaced as recommended in the table "Filter Berm Spacing" on the Standard Drawing. Berm spacing using the values on this table will ensure that the drainage area limit is not exceeded. Both ends of a run of filter berm should be turned up-slope to a point where the base of the berm at the terminus points will be higher than the top of the berm anywhere along the contour.

Filter berms should be trapezoidal in shape and may be installed along the contour by means of pneumatic blowers or by other suitable equipment. It is important that a berm be placed along the ground contour as they will be sensitive to failure due to concentration of flows. Runoff must be intercepted on the contour to insure that sheet flow is not converted into concentrated flow. When placed at the base of a slope, the berm should be located at least 10 feet away from the toe in order to provide an area for the storage of sediments. Filter berms should be constructed within the range of sizes indicated on the standard drawing. As a general rule, steeper slopes would require a larger berm size. In addition, the bottom width of a berm should be about twice its height.

Compost Filter Berm Installed Along Contour
Reference: Construction Site ESC BMPs for Iowa, (2003)

The material used to construct a filter berm should be well-graded as specified on the standard drawing. Usually, the particles in a berm will range in size from ¼ inch to 6 inches in length. The smaller particles serve to increase the effectiveness of the measure as a filter while the larger particles help to increase its stability under the pressure exerted by the runoff.

Filter berms should not be used alone at sites which drain directly to sensitive natural water resources such as wetlands or streams, or streams listed as Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation. At these sites, silt fence with wire backing should be used on the upstream side of the berm. The fence will prevent excessive hydraulic forces from displacing the material in the berm, while the filter berm will provide increased filtration of runoff passing through the fence.

10.08.2.15.4 PLANNING AND DESIGN CRITERIA

Formal design of this measure is not required; however, when sediment tubes are specified, they should be shown in the EPSC plans according to EC-STR-37. At each location sediment tubes are used their size should be labeled in the EPSC plans.

A list of acceptable filler material for a sediment tube is provided on the standard drawing. When straw is utilized, the material should be certified as free of weed seeds. The tube should be placed a minimum of 2 inches deep in a trench that is free of stones or other materials which would prevent good contact between the tube and the ground surface. This is necessary to ensure that the tube will not be undercut.

When applied on slopes, sediment tubes ranging from 8 to 24 inches in diameter should be placed along the contour, and the ends of the tubes should be turned upslope in order to prevent erosion which could occur as flow bypasses around the ends of the row. This will force the discharge to overtop the tubes away from the end points. The spacing between rows of tubes should be based on the table "Sediment Tube Spacing Table for Slope Application" on the standard drawing. In general, for slope applications, the maximum drainage area should be ¼ acre per 100 linear feet of tube.

The size of a sediment tube for a slope application should be selected based on the gradient and length of the slope. In general, larger tube diameters should be selected for steeper or longer slopes.

Where long rows are required on a slope, the ends of the individual tube segments should be overlapped a minimum of 24 inches as shown on the standard drawing. This will ensure that gaps will not occur between individual tube segments, allowing sediment laden water to escape the measure.

Removal is not necessary for sediment tubes which have been placed on slopes. Rather, they may be left in place to decompose over time.

When applied in a ditch, the tube should extend on the sides to a height equal to 3 feet plus the diameter of the tube, or to the top of the ditch, whichever is less. This will ensure that the ends of the tube will not be overtopped during the design storm event (see Section 10.05.1). This criterion is essential to minimize the potential for the water to flow around the ends of the measure prior to overtopping at the center. Typically, an individual tube segment will not be sufficiently long to meet this criterion. Where joints are necessary within the ditch, it will be necessary to provide a second row of sediment tube with the joints staggered by a distance equal to half of the individual segment length as shown on the Standard Drawing. The staking and arrangement of the joints should be as shown on the standard drawing.

The minimum diameter for any sediment tube applied in a ditch should be 20 inches. This will ensure that the tube will function effectively as a velocity control device, allowing sediment to drop out of the flow.

At sites which drain to Exceptional Tennessee Waters or Waters with Unavailable Parameters for Siltation, the maximum drainage area to any given sediment tube should be no more than 10 acres. At all other sites, the maximum drainage area may be increased to 15 acres.

10.09.3 GLOSSARY

The following list of terms is representative of those used in erosion prevention and sediment control practices. The terms may not all be used in the chapter text; but rather are commonly used by engineers, scientists, and planners.

BEST MANAGEMENT PRACTICES (BMPs) – The schedules of activities, prohibitions of practices, maintenance procedures and other management practices to prevent or reduce the discharge of pollutants to waters of the state. BMPs include source control practices (non-structural BMPs) and engineered structures designed to treat runoff.

BUFFER ZONE – See Water Quality Riparian Buffer Zone.

EXCEPTIONAL TENNESSEE WATERS – are surface waters designated by the division as having the characteristics set forth at Tennessee Rules, Chapter 0400-40-03-.06(4). Characteristics include waters within parks or refuges; scenic rivers; waters with threatened or endangered species; waters that provide specialized recreational opportunities; waters within areas designated as lands unsuitable for mining; waters with naturally reproducing trout; waters with exceptional biological diversity and other waters with outstanding ecological or recreational value.

IMPAIRED WATERS – See Waters with Unavailable Parameters.

WATER QUALITY RIPARIAN BUFFER ZONE - A permanent strip of natural perennial vegetation, adjacent to a stream, river, wetland, pond, or lake that contains dense vegetation made up of grass, shrubs, and/or trees. The purpose of a water quality riparian buffer is to maintain existing water quality by minimizing risk of any potential sediments, nutrients or other pollutants reaching adjacent surface waters and to further prevent negative water quality impacts by providing canopy over adjacent waters.

WATERS OF THE STATE – Any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through, or border upon Tennessee or any portion thereof, except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters.

WATERS WITH UNAVAILABLE PARAMETERS - Any segment of surface waters that has been identified by the division as failing to support one or more classified uses. For this permit, pollutant of concern is siltation. Based on the most recent assessment information available to staff, the division will notify applicants and permittees if their discharge is into, or is affecting, waters with unavailable parameters.

The updated Chapter 10 of the Design Division Drainage Manual is located on the web site and can be found at the following link:

https://www.tn.gov/content/dam/tn/tdot/roadway-design/documents/drainage_manual/DM-Chapter_10.pdf

KJL: LHC: MBB
June 29, 2023