In-Service Performance Evaluation of Erosion Prevention and Sediment Control (EPSC) Devices

Tennessee Department of Transportation

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Final Report

October 31, 2018

Cover page photo: Rock check dam at State Road 65 /US Highway 431 near the Carr Creek bridge crossing with Ali Hangul near dam. *Photo by John Schwartz, November 2016.*

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16. Abstract

Erosion Prevention and Sediment Control (EPSC) devices are widely used during construction projects by Department of Transportations (DOTs) nationally to prevent or reduce the movement of sediment that is carried into lakes, streams and rivers by storm water runoff from a site during construction and are required by state water quality and storm water regulations. Preventing erosion reduces the amount of sediment that leaves a construction site which carries nutrients and pollutants that degrade water resources and harm aquatic wildlife. Proper planning of construction site activities greatly reduces the impact of soil disturbance on nearby resources. Although erosion on construction sites often affects only a relatively small acreage of land in a watershed, it is a major source of sediment because the potential for erosion on highly disturbed land is commonly 100 times greater than on agricultural land. DOTs in every state have developed standard drawings per state water quality and storm water regulations and a drainage manual to provide guidance to roadway designers in order to develop erosion control plans to protect natural water resources during temporary roadway construction activities. It is evident that more information is needed to better asses the amounts of sediment lost during the temporary construction actives, including phasing activities observing field performance of EPSC devices, and improving design and implementation of EPSC devices based on past experiences and. This need has been elevated not only by design professionals who are directly involved in the development of erosion plans, but also operations professionals and other agencies and research institutions.

The goals of this research were to investigate in-service performance of the effectiveness of current TDOT EPSC device installation practices in field. In addition, this research further evaluates the application guidance and quantity calculation methods currently provided for each EPSC device, estimates material quantities of installed devices based on initial installation, maintenance, and field performance. Available for use on highway construction project sites, TDOT Drainage Manual, Chapter 10 has 42 EPSC applications that include both flow and sediment control devices. The specific objectives of this research were to: 1) evaluate the applicability and performance of the current EPSC devices, 2) investigate how often EPSC devices are being modified during the construction under the SWPPP through on-site field inspections, and 3) determine if the changes are needed to roadway plans and specific EPSC applications in Chapter 10 of the TDOT Roadway Drainage Manual, and make any necessary recommendations.

The questionnaire/survey found that the majority of the 42 EPSC applications are not used. The most commonly used EPSC devices included: silt fences with and without wire backing, rock check dams and enhanced rock check dams, sediment tubes, catch basin protections, mulching/seeding, sediment filer bags or modifications to this device, and temporary slope drains on exposed steep slopes. The results of the questionnaire were consistent with the on-site field visits and discussions with the TDOT field inspectors. The survey also identified that there is a need for better contractor training for installation and maintenance of EPSC devices through most are Level I certified for installation of erosion control practices. Further investigation specific to contractors through a targeted survey could be beneficial to better understand why they are not following through on-site with their training knowledge. General installation issues can be grouped into two categories: 1) improvements on standards/plans and 2) field installation practices. Another related identified issue was that in many cases the quantities listed on the standard drawings are short, and a review of these quantities is warranted.

This study was a qualitative assessment of the 42 EPSC devices in the TDOT Roadway Drainage Manual that provided valuable information on device installation, performance, an maintenance. The information derived from the questionnaire and field site visits can be used to develop a more quantitative survey with targeted questions, particularly for those devices commonly used. This study also provides TDOT information on which EPSC devices to focus on to make improvements to standard drawings, specifications and material qualities, and cost estimates on the most commonly used devices.

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In-Service Performance Evaluation of Erosion Prevention and Sediment Control (EPSC) Devices

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List of Acronyms

BMP	Best management practice
CB	Catch basin
CEI	Consultant Engineering and Inspection
EPA	US Environmental Protection Agency
EPSC	Erosion Prevention and Sediment Control
FHWA	Federal Highway Administration
GPM	Gallons per minute
NCHRP	National Cooperative Highway Research Program
NPDES	National Pollutant Discharge Elimination System
PAM	Polyacrylamides
QPL	Qualified product list
RECP	Rolled erosion control products
ROW	Right-of-way
SQFT	Square feet
SWPPP	Storm Water Pollution Prevention Plans
TDOT	Tennessee Department of Transportation
TRB	Transportation Research Board
USGS	US Geological Survey
UTK	University of Tennessee, Knoxville

Executive Summary

In-Service Performance Evaluation of Erosion Prevention and Sediment Control Devices

Erosion Prevention and Sediment Control (EPSC) devices are widely used during construction projects by Department of Transportations (DOTs) nationally to prevent or reduce the movement of sediment that is carried into lakes, streams and rivers by storm water runoff from a site during construction and are required by state water quality and storm water regulations. Preventing erosion reduces the amount of sediment that leaves a construction site which carries nutrients and pollutants that degrade water resources and harm aquatic wildlife. Proper planning of construction site activities greatly reduces the impact of soil disturbance on nearby resources. Although erosion on construction sites often affects only a relatively small acreage of land in a watershed, it is a major source of sediment because the potential for erosion on highly disturbed land is commonly 100 times greater than on agricultural land. DOTs in every state have developed standard drawings per state water quality and storm water regulations and a drainage manual to provide guidance to roadway designers in order to develop erosion control plans to protect natural water resources during temporary roadway construction activities. It is evident that more information is needed to better asses the amounts of sediment lost during the temporary construction actives, including phasing activities observing field performance of EPSC devices, and improving design and implementation of EPSC devices based on past experiences and. This need has been elevated not only by design professionals who are directly involved in the development of erosion plans, but also operations professionals and other agencies and research institutions.

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knowledge. General installation issues can be grouped into two categories: 1) improvements on standards/plans and 2) field installation practices. Another related identified issue was that in many cases the quantities listed on the standard drawings are short, and a review of these quantities is warranted.

This study was a qualitative assessment of the 42 EPSC devices in the TDOT Roadway Drainage Manual that provided valuable information on device installation, performance, an maintenance. The information derived from the questionnaire and field site visits can be used to develop a more quantitative survey with targeted questions, particularly for those devices commonly used. This study also provides TDOT information on which EPSC devices to focus on to make improvements to standard drawings, specifications and material qualities, and cost estimates on the most commonly used devices.

Acknowledgments

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1.0 Introduction

1.1 Overview

Currently, Tennessee Department of Transportation (TDOT) spends millions of dollars annually on Erosion Prevention and Sediment Control (EPSC) applications for roadway construction projects. Available for use on these projects, TDOT Drainage Manual, Chapter 10 has 42 EPSC applications that include both flow and sediment control devices. However, there is a lack of feedback from the TDOT construction supervisors, Consultant Engineering and Inspection (CEI) staff, and field inspectors as to the effectiveness and acceptance of various practices. Recent investigations and communications among different TDOT divisions have revealed that the current stormwater and erosion control practices need to be reconciled with EPSC device designs in construction site Storm Water Pollution Prevention Plans (SWPPP) such that the manual is consistent with observed field implementation protocols. All EPSC applications in the TDOT Drainage Manual can be applied to a SWPPP, although some EPSCs are utilized more than others. And the rationale for how design decisions are made in a SWPPP remains generally undocumented. During construction, EPSC devices may be modified because of unforeseen on-site conditions requiring a change, but that information does not get documented, and cycled back to the designers for consideration in future plan development and construction drawings. In addition, EPSC quantities listed on the roadway plans for these practices may be outdated needing to be updated.

To improve the application of EPSC devices in roadway designs and provide suggestions to possible improvements to TDOT's Roadway Design Division Drainage Manual (Chapter X, 10), a thorough field investigation was needed to compile valuable institutional knowledge of TDOT's construction supervisors and field inspectors by documenting their current activities and experiences in the field. This research was supported by TDOT's EPSC Policies Committee. In general, the Committee understands that easily accessible and accurate policies will improve efficiency in the transportation network.

Research outcomes will reveal if TDOT's current design and construction practices for use of EPSC devices in SWPPPs are satisfactory. In summary, the information generated from this study will provide the necessary feedback from on-site construction and field conditions to the designers, which will improve efficiency, increase environmental protection, and save TDOT highway construction costs by reducing design changes and construction site change orders.

1.2 General Background

EPSC devices are widely used during construction projects by DOTs nationally to prevent or reduce the movement of sediment that is carried into lakes, streams and rivers by storm water runoff from a site during construction and are required by state water quality and storm water regulations. Preventing erosion reduces the amount of sediment that leaves a construction site which carries nutrients and pollutants that degrade water resources and harm aquatic wildlife. Proper planning of construction site activities greatly reduces the impact of soil disturbance on nearby resources (Minnesota Stormwater Manual, 2007). Although erosion on construction sites often affects only a relatively small acreage of land in a watershed, it is a major source of sediment because the potential for erosion on highly disturbed land is commonly 100 times greater than on agricultural land (Brady and Weil, 1999). TDOT has developed standard drawings per state water quality and stormwater regulations in their Roadway Drainage Manual (Chapter 10) to provide guidance to roadway designers in order to

develop erosion control plans to protect natural water resources during temporary roadway construction activities. The standard drawings are used to meet the requirements in the Tennessee Department of Environment and Conservation (TDEC), National Pollutant Discharge Elimination System (NPDES) Stormwater Construction General Permit (CN-0940), and applied in construction site SWPPPs (CN-1440).

It is evident that more information is needed to better asses the amount of sediment lost during the temporary construction actives including phasing activities observing field performance of EPSC devices, and improving design and implementation of EPSC devices based on past experience. This need has been elevated not only by design professionals who are directly involved in the development of erosion plans, but also operations professionals and other agencies and research institutions. Since the first published guidance, US Environmental Protection Agency (EPA), *Guidelines for Erosion and Sediment Control Planning and Implementation*, August 1972, other research has provided additional design guidance to improve practices such as the Transportation Research Board (TRB), National Cooperative Highway Research Program (NCHRP) Project 16-3 Erosion Control during Highway Construction, Volumes I and II, February 1976. Currently every state DOT provides specific EPSC guidance that serves best for their state needs based on geographical considerations. The Storm Water Best Management Practices Toolbox, Version 2, April 2014, developed by the North Carolina Department of Transportation is an example to such guidance. As the foundation of best management practices are laid and lessons are learned, new research projects continuously provide improved guidance for practitioners use.

The performance, in terms of reduction of sediment erosion, off-site transport, and product durability, has only been studied at TDOT active roadway construction sites at a limited degree. A few examples include: 1) Suspended Sediment Concentrations at Six Highway Construction Outfalls, Statewide Construction Storm Water Turbidity Monitoring Study for the Tennessee Department of Transportation 2010-2012 (Diehl, USGS, 2014); 2) TDOT Materials and Test Division, National Wattle (Sediment Tube) Survey Report, April 2006; and 3) Summary report, Detailed Analysis related to the Functionality of TDOT Standard Erosion and Sediment-Control Structures under Conditions Presented by the 2-year/24-Hour Storm Event in Tennessee, July 2002.

The EPSC market continuously expands with the addition of new products/devices based on research and development. While some products may require special equipment for installation, others are installation ready. There have not been any investigations conducted on installation complications and cost to gain feedback from construction field personnel with regards to which practices are performing better and/or are preferred. Performance of various devices may require different maintenance practices, and the required time effort may reflect on whether it is properly conducted. TDOT is aware of the issues with current practices and has recently established a new standing EPSC Policies Committee that is represented by multiple divisions.

1.3 Project Objectives

In order to implement the results of the subject studies into a practice, as well as assessing the current practices, the goals of this research were to investigate in-service performance of the effectiveness of current TDOT EPSC device installation practices in field. In addition, this research further evaluates the application guidance and quantity calculation methods currently provided for each EPSC device, estimates material quantities of installed devices based on

initial installation, maintenance, and field performance. Outcomes of this research will result in improved quality of standard drawings, accuracy of contract plans, as well as construction cost estimate, which should reduce the number of change orders and construction cost overruns. The practices included in the construction plans and SWPPP will need to control runoff, stabilize slopes and exposed soils, and limit the movement of soils into drainage systems and natural areas. A key element to ensure effectiveness of the erosion and sediment control plan is the implementation of an inspection and maintenance program. Frequent inspection and maintenance activities ensure that the installed temporary sediment control practices are operating effectively throughout the course of the project. All of the best management practices currently being used by the department are shown in the Drainage Manual Chapter 10 and roadway standard drawings. They have been certified by the TDEC, confirming that they meet the requirements of Construction General Permit. Erosion plan sheets in SWPPPs for the final construction plans were developed and quantities were calculated based on subject documents.

The specific objectives of this research were to: 1) evaluate the applicability and performance of the current EPSC devices, 2) investigate how often EPSC devices are being modified during the construction under the SWPPP through on-site field inspections, and 3) determine if the changes are needed to roadway plans and specific EPSC applications in Chapter 10 of the TDOT Roadway Drainage Manual, and make any necessary recommendations.

1.4 Scope of Work

The scope of the research work includes:

- Review current TDOT practices for EPSC devices documenting differences between what is proposed in SWPPPs and what is finally used on-site. To the degree possible, the reasons for those on-site modifications will be identified;
- Identify field personnel preferences and what EPSC devices have performed the best over time based on TDOT staff experience through meetings and on-site field surveys;
- Compile information on in-service performance of EPSC devices through in-office surveys, including construction supervisors, and CEI personnel, Environmental Compliance Office professionals, and others;
- Using a broadly disseminated questionnaire, complete surveys state-wide of the above noted TDOT staff, compile and assess information; and
- Produce a report documenting the results of the surveys.

1.5 Research Methodology

Task 1. The first task of this research was to meet with TDOT professional staff to survey in-service performance of EPSC devices, including construction supervisors; professionals from Standards & Guidelines, Quality Assurance, Training Office; the Environmental Compliance Office; and others within the agency that can provide useful assessment information on current EPSC practices and inform subsequent tasks. Based on these initial interviews, a questionnaire was developed and sent to relevant TDOT staff and consultants across Tennessee to generate needed information on EPSC device performance. Results from the answers to the individual questionnaires (surveys) were summarized, and presented in Chapter 2.

Task 2. To support and validate interview and survey observations, six site investigations were conducted with TDOT construction supervisors at active roadway construction sites to better document on-site conditions and performance issues. Multiple EPSC application locations

within each project site were inspected. Field survey information was compiled and general descriptive statistics were applied to summarize the information for this report. Recommendations on changes for Chapter 10 of the Roadway Design Division Drainage Manual are also included. Results of this effort are presented in Chapter 3.

Task 3: A final review of Task 1 and 3 results was completed in order to make recommendations on specific EPSC applications, and whether changes are needed to any specific standard drawings.

The appendices that support these tasks are listed in order below:

Appendix A. Field Visit Photos

Appendix B. Recommendations to EPSC Standard Drawings

Appendix C. Questionnaire/Survey - Summary of Responses

Appendix D. Current Standard Drawings for EPSC Devices

2.0 Practitioner Survey on the Installation and Performance of EPSC Devices Used in Tennessee Roadway Construction Sites

2.1 Introduction

Currently, issues with the installation, performance and maintenance are not well documented for the 42 EPSC devices in the TDOT Roadway Drainage Manual, Chapter 10. In order to implement the results of the subject studies in to a practice as well as assessing the current practices, the goal of this research defined as to investigate in service performance of the effectiveness of the current EPSC device installation practices in field. In addition, this research further to evaluates the application guidance and quantity calculation methods currently provided for each EPSC device. Outcome of this research will result in improved quality of standard drawings, accuracy of contract plans as well as construction cost estimate which should reduce the number of change orders, and construction cost overruns. The practices included in the construction plans and SWPPP will need to control runoff, stabilize slopes and exposed soils and limit the movement of soils into drainage systems and natural areas. A key element to ensure effectiveness of the erosion and sediment control plan is the implementation of an inspection and maintenance program. Frequent inspection and maintenance activities ensure that the installed temporary sediment control practices are operating effectively throughout the course of the project.

2.2 Questionnaire/Survey Development

A questionnaire was developed reflecting specific questions related to EPSC devices and concentrating on the installation, performance, maintenance, and SWPPP plan accuracy. A total of 56 survey questions were developed, and shown in Table 2.1. The questions are grouped into four major areas as noted above: installation (10 questions), performance (23 questions), maintenance (9 questions), plan accuracy (11 questions), and other (2 questions). Each survey form also included basic information of practitioner job title, position location in the state, and contact information. The questionnaire was prepared using Google Docs for ease of the respondent's use and for data compilation. The questionnaire was distributed to 400+ practitioners including roadway designers, consultant engineering firms, SWPPP consultants, construction field inspectors, and CEI consultants.

Table 2.1. List of questions used for the EPSC device in-service performance evaluations.

Installation

- Name the types of EPSC types typically used in your region/district:
- What difficulties are encountered during installation of named structure(s)?
- What can be done to improve the installation efficiency of named structure(s)?
- What can be done to improve the current installation practice per EPSC device?
- What EPSC products are the most difficult to install in accordance to the current installation details?
- How can the installation be modified to improve installation efficiency but retain the level of EPSC? performance effectiveness?
- What measure is consistently not installed in accordance with current installation details?
- Are multiple EPSC devices designed and installed in a drainage sequence?
- Does a treatment train of multiple EPSC devices improve site performance reducing erosion?
- Do you have any recommendations about current installation practices?

Table 2.1. *continued* …..

Performance

- Which products are failing once installed in accordance to the current installation details?
- What products are the most effective when installed properly?
- Which product's performances are not meeting the design criteria shown in the standard drawings?
- What component of the device is over designed or needs improvement?
- Is trenching of silt fence necessary? If so, what recommendations can be made to improve installation?
- Is trenching of rolled erosion control products necessary to maintain intimate contact with soil?
- Do you see any benefits in minimizing soil disturbance during the installation of such products?
- How often is newly applied straw mechanically crimped or chemically tacked to soil?
- Do you see the cost benefit of limiting the application of enhanced silt fence with wire backing to only steep fill or cut slope locations?
- What products are preferred by contractors?
- Is trenching of rock checks and enhanced rock checks necessary to improve performance of the measure?
- How often is mulch applied at the specified rates per TDOT standards?
- Are there any EPSC devices shown on the plans that you generally change to an alternate device in the field due to your experience with its performance? If so, please explain.
- How often is fertilizer used when applying vegetation?
- How often is lime used when applying vegetation?
- How often seed beds are properly developed when applying vegetation?
- Have you used polyacrylamide (PAM) on a project? If so, how did it perform?
- Have you used Bonded Fiber Matrix?
- Have you applied with seed or without seed? How did it perform?
- Did the performance justify the cost difference with typical seed and mulch? Are they equal to or better than blankets?
- Have you used Tackifiers? What types of Tackifiers are being used?
- Which TDOT catch basin/area drain inlet protection have you found to perform the best?
- Do you have any recommendations about performance of EPSC practices?

Maintenance

- Which EPSC products are the easiest to maintain?
- Which EPSC products are the most difficult to maintain?
- Do you have any recommendations to improve or eliminate maintenance activities?
- Are there products that seem to cost too much but perform superior to others?
- From your perspective, is it possible to reduce the frequency of inspection?
- What do you consider as the most difficult maintenance technique?
- Would there be a benefit to having a separate line item for maintenance of EPSC devices? Please explain.
- Do you feel that the estimated quantities for EPSC items generally include an adequate amount for maintenance and replacement? Please explain.
- Is the EPSC device installer typically responsible of maintaining the devices? Whether yes or no, please describe the pros and cons.

Plans Accuracy

- Are there any devices in which the tabulated quantities do not match the plans?
- Do you have any other recommendations to modify the current practices?
- Are there times when devices are not accurately depicted on the plans?
- Are there times when useful EPSC devices/measures are not included as items on the plans? If so, please describe.

Table 2.1. *continued* …..

Plans Accuracy

- Are there any EPSC devices, which TDOT has a standard drawing for, you never use? If so, please describe.
- Do designers properly utilize EPSC devices according to conditions shown on site plans?
- Are stream diversions being shown on the plans and are they the appropriate type for the field conditions/terrain?
- Are sediment traps being shown on plans where needed? How often do you add sediment traps as a revision to your SWPPP in the field?
- How often do you use sediment basins as shown on TDOT standard drawings?
- How much accuracy should be expected of the EPSC plans and quantities without knowledge of a contractor's construction phasing?
- Do you find that construction phasing and grading substantially affects the actual area draining to a device in contrast to the drainage areas on the plans that the EPSC measures were designed for? If so, how do you adjust for that?

Other

- Is there any specific training that you would like have?
- Are there devices that you have used on non-TDOT projects or that you have come up with on your own that you think would be beneficial for TDOT to review?

2.3 Questionnaire Results

A total of 24 responses were received from practitioners who are best represented by their involvement in the SWPPP development or field implementation of EPSC. Respondents were divided into 13 state DOT employees, 10 consultants, and 1 other (Figure 2.1). Table 2.2 provides details on job position and location of respondents. Individual names were not included to maintain confidentiality. Though, survey response numbers were a small percentage of the total surveys distributed, it represented about an 8% which is above 5% considered reasonable and typical. With the fact that the survey was developed as a qualitative exercise, the number of responses represents an acceptable respondent pool to gain new knowledge.

2.3.1 Evaluation of Installation Practices

Name the types of EPSC types typically used in your region/district:

The most common EPSC devices used on TDOT projects are, Silt fence, Silt fence with wire backing, Rock check dam, Enhanced rock check dam and sediment tubes.

What difficulties are encountered during installation of named structure(s)?

General installation issues are, not following contours or not properly trenching silt fence devices. Not having proper weir opening as well was not extending far enough to reach out above the banks. Responds indicated the calculated rock quantities on the plans for the rock check dams are always short. Methods to calculate estimated quantiles needs to be investigated. The last difficulty is, contractors not installing devices per the standards.

What can be done to improve the installation efficiency of named structure(s)?

Improved supervision with qualified personnel. Train contractors. Require a certification for a compiled list of TDOT Certified EPSC BMP contractors. Have contractors understand that no payment will be given for inappropriately installed BMPs.

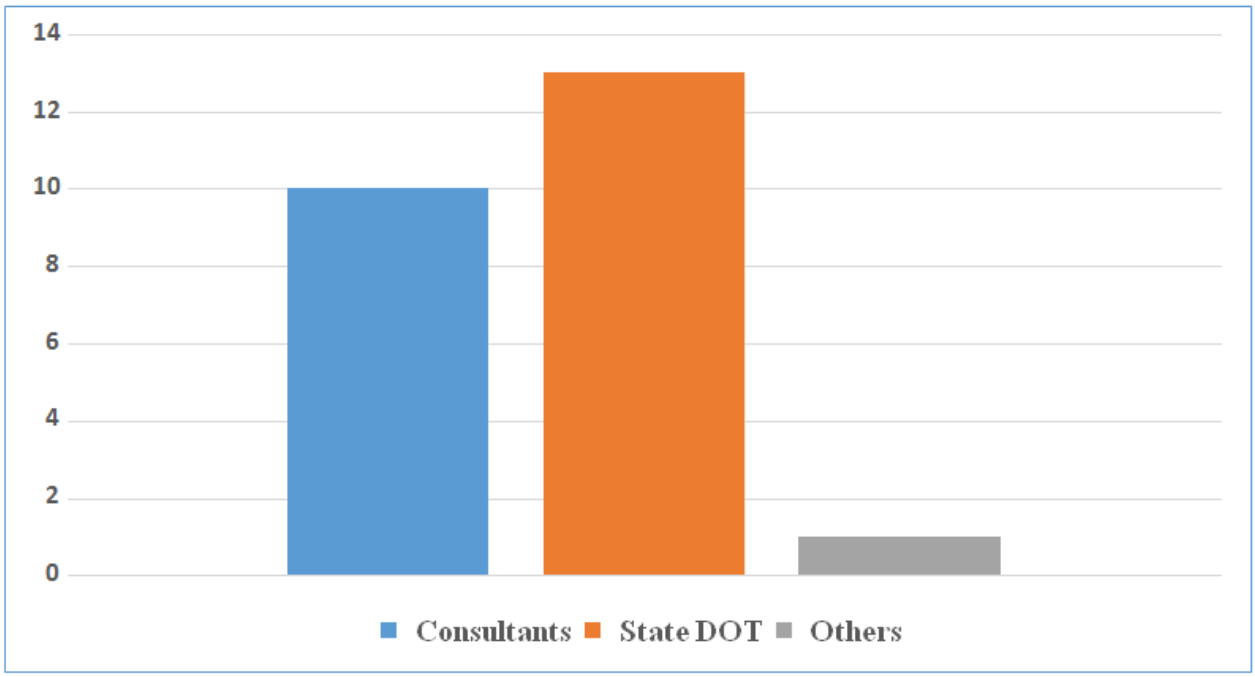

Figure 2.1. Number of questionnaire respondents per category state DOT employee or professional consultant.

Table 2.2. Survey respondent's job description and location information.

Project Manager, CEC Inc.
Project Engineer, BWSC
Environmental Coordinator Region 2
Operations Tech.2 /Region 2/District 28
Transportation Project Specialist
Operation District Assistant - District 48
Transportation Project Specialist, Region 2, District 29
Operations District Supervisor, Region 1, District 17
Transportation Project Specialist, Region 2, District 29
Operation District Supervisor,1
CADD Tech. 3, Region 1
VP Palmer Engineering
Engineering Technician, Palmer Eng.
CADD Tech 4
Staff Designer, DBS Eng.
Transportation Engineer, BWSC
Civil Engineer, Region One
Vice President, Wilson & Associates
Project Manager RGC
C.E. manager 2, Region 3 Project Dev.
Roadway Spec II
PE, CPESC, Allen Hoshall Eng.
Civil & Environmental Consultants, Inc.

What EPSC products are the most difficult to install in accordance to the current installation details?

In stream diversions are hard to install if it is not shown on plan set. Erosion control blankets are not keyed. Sediment tubes are not trenched. Silt fence with wire backing is hard to install.

What can be done to improve the current installation practice per EPSC device?

Better training of subcontractor and contractor personnel. Payment in lump sum of all BMP use per phase of SWPPP. Better selection of devices for particular applications. Do not pay for items not installed per standard specifications.

How can the installation be modified to improve installation efficiency but retain the level of EPSC performance effectiveness?

Rock check dam height based on dich depth. Develop a J-hook detail. Better categorization of storm water inlet protection devices. Alternative if rock is encountered during trenching. ROW to adequately accommodate the BMP.

What measure is consistently not installed in accordance with current installation details?

Check dams, erosion control blankets. The manufacturer's installation drawings/ instructions, which when the product is placed on the QPL need to be readily available during construction.

Are multiple EPSC devices designed and installed in a drainage sequence?

Yes

Does a treatment train of multiple EPSC devices improve site performance reducing erosion?

Yes

Do you have any recommendations about current installation practices?

Encourage the contractor to take the time to install the measures; Need to be more of a priority for contractors; Contractor has been paid for poor installation.

2.3.2 Evaluation of EPSC Application Performance

Which products are failing once installed in accordance to the current installation details?

Geo hay, sediment tubes, silt fence; Most all products work fine when installed in accordance to the current installation details.

What products are the most effective when installed properly?

Enhanced rock check dams.

Which product's performances are not meeting the design criteria shown in the standard drawings?

Sediment tubes and silt fences.

What component of the device is over designed or needs improvement?

Sediment tube staking and installation.

Is trenching of silt fence necessary? If so, what recommendations can be made to improve installation?

Yes, trenching is necessary, do not allow plowing or bucket trench excavation methods, and add J-hooks.

Is trenching of rolled erosion control products necessary to maintain intimate contact with soil?

Mixed feedback. Improving installation to have a better soil contact is needed.

Do you see any benefits in minimizing soil disturbance during the installation of such products?

Limit trenching practices do not allow digging with bucket equipment or ripping with plow.

How often is newly applied straw mechanically crimped or chemically tacked to soil?

Practice needs improvement in field.

Do you see the cost benefit of limiting the application of enhanced silt fence with wire backing to only steep fill or cut slope locations?

It lasts longer. Need to investigate the practice of using this device close to water.

What products are preferred by contractors?

Rock check dam and sediment tube.

Is trenching of rock checks and enhanced rock checks necessary to improve performance of the measure?

Mixed feedback but, NO.

How often is mulch applied at the specified rates per TDOT standards?

Mixed feedback. Seldom, practice needs improvement in field. No consistency.

Are there any EPSC devices shown on the plans that you generally change to an alternate device in the field due to your experience with its performance? If so, please explain.

Limit the use of catch basin (CB) inlet protection, especially for large structures. Delete Enhanced silt fence checks for dich applications. Set up short-term dich check application with sediment tube.

How often is fertilizer used when applying vegetation?

Mixed feedback. Practice needs improvement in the field.

How often seed beds are properly developed when applying vegetation?

Practice needs improvement in field to use often.

Have you used PAM (polyacrylamide) on a project? If so, how did it perform?

Practice needs improvement in field to use often.

Have you used Bonded Fiber Matrix?

Limited use. Explore to expand the use.

If you used Bonded Fiber Matrix, have you applied with seed or without seed?

Limited use. If it used, seed applied.

If you used Bonded Fiber Matrix, how did it perform?

Positive experiences explore how to use more.

If you used Bonded Fiber Matrix, did the performance justify the cost difference with typical seed and mulch?

Yes, the cost is justifiable. Especially at locations with limited access.

If you used Bonded Fiber Matrix, are they equal to or better than blankets?

Quick results and easy application.

Have you used Tackifiers? What types of Tackifiers are being used?

Very limited use. Explore how to expand the use of Tackifiers.

Which TDOT catch basin/area drain inlet protection have you found to perform the best?
Remove Type E from EC-STR-19. Others devices are working well. Limit the field installation time for generic CB assembly standard. Silt Saver is a good CB protection.

2.3.3 Evaluation of Maintenance Practices during Construction

Which EPSC products are the easiest to maintain?
Silt fence with wire backing and rock check dams.

Which EPSC products are the most difficult to maintain?
Sediment control devices, sediment trap, sediment filter bag, sediment ponds, and check dams.

Are there products that seem to cost too much but perform superior to others?
Hydro mulch, filtrexx, rock check dams.

From your perspective, is it possible to reduce the frequency of inspection?
Inspections are needed not only to monitor the performance of the device (stable and cleanout) but mostly to address dynamic changes within the construction area.

What do you consider as the most difficult maintenance technique?
Sediment removal, cleaning rock check dams or sediment filter bags.

Would there be a benefit to having a separate line item for maintenance of EPSC devices? Please explain.
Yes. Consider to pay maintenance separately.

Do you feel that the estimated quantities for EPSC items generally include an adequate amount for maintenance and replacement? Please explain.
The only maintenance pay item is removing sediment. There is no maintenance pay item to correct deficiencies has been established.

Is the EPSC device installer typically responsible of maintaining the devices? Whether yes or no, please describe the pros and cons.
Prime contractor is responsible for the maintenance.

Do you have any recommendations to improve or eliminate maintenance activities?
Separate pay item for maintenance of installed devices would give incentive to contractors.

2.3.4 Evaluation of EPSC Plans for Accuracy

*Are there any devices in which the tabulated quantities do not match the plans***?**
Yes. Rock check dam rock quantities.

Do you have any other recommendations to modify the current practices?
Design phase field visit, more oversight of contractors installing devices.

Are there times when devices are not accurately depicted on the plans?
Explore the possibility of correctly locating and scaling devices on the plans. Improve QA/QC review of SWPPP Erosion Control Plans.

Are there any EPSC devices, which TDOT has a standard drawing for, you never use? If so, please describe.
Recommend removing enhanced silt fence checks, gabion check dams, level spreaders, and catch basin filter assembly (Type 1).

Are there times when useful EPSC devices/measures are not included as items on the plans? If so, please describe.

List most common devices and item numbers on all roadway plans so a contractor can select an alternative EPSC method without change order.

Do designers properly utilize EPSC devices according to conditions shown on site plans?

Usually they do. Roadway design focused erosion plans development training is recommended.

Are stream diversions being shown on the plans and are they the appropriate type for the field conditions/terrain?

Yes, they are shown appropriately.

Are sediment traps being shown on plans where needed? How often do you add sediment traps as a revision to your SWPPP in the field?

Yes, they are shown on the plans. Seldom added to SWPPP at locations where rock check dam reached the limits. Suggest associating two applications so for small drainage areas check dam will be used and for large drainage areas sediment trap.

How often do you use sediment basins as shown on TDOT standard drawings?

They are used rarely, but if shown on plans usually it can be installed in accordance to the details.

How much accuracy should be expected of the EP SC plans and quantities without knowledge of a contractor's construction phasing?

Erosion plans should be discussed during the constructability field review in order to improve plans accuracy.

Do you find that construction phasing and grading substantially affects the actual area draining to a device in contrast to the drainage areas on the plans that the EPSC measures were designed for? If so, how do you adjust for that?

Yes. Often adjustments made to improve erosion control practices in the field.

Do you have any recommendations about how to improve plans accuracy?

Site review is needed. The new mandatory new site visit step should also identify erosion related issues.

2.3.5 Evaluation of EPSC Practices: Other Comments

Is there any specific training that you would like have?

Certifying installers should be considered. A new design training is also recommended.

Are there devices that you have used on non-TDOT projects or that you have come up with on your own that you think would be beneficial for TDOT to review?

Review and adopt I-840 devices, consider active treatment systems, limit distance for slope applications. Promote the use of mulch berms often if applicable.

Do you have any recommendations about performance of EPSC practices?

Explore how to use sediment basins often since they allow contractor to perform construction phasing freely. Remove sediment tubes from ditch applications. Provide erosion prevention measures at the earliest possible time.

2.4 Summary

The respondent's answers to the questionnaire/survey of the 42 EPSC applications provided valuable information on the common installation and maintenance practices, and design application for roadway construction sites and use in SWPPPs. The standard drawings for the EPSC devices in the TDOT Roadway Drainage Manual, Chapter 10 are in Appendix D. Also, please find the complete list of survey questions and responses in Appendix C, which were used to summarize responses in Section 2.3.

The survey found that the majority of the 42 EPSC applications are not used. The most commonly used EPSC devices included: silt fences with and without wire backing, rock check dams and enhanced rock check dams, sediment tubes, catch basin protections, mulching/seeding, sediment filer bags or modifications to this device, and temporary slope drains on exposed steep slopes. The results of the questionnaire were consistent with the on-site field visits and discussions with the TDOT field inspectors. Chapter 3.0 summarizes the findings from the field visits, and a photo record is in Appendix A.

The survey also identified that there is a need for better contractor training for installation and maintenance of EPSC devices through most are Level I certified for installation of erosion control practices. Further investigation specific to contractors through a targeted survey could be beneficial to better understand why they are not following through on-site with their training knowledge. General installation issues can be grouped into two categories: 1) improvements on standards/plans and 2) field installation practices. Another related identified issue was that in many cases the quantities listed on the standard drawings are short, and a review of these quantities is warranted. Chapter 4.0 synthesizes the information from the questionnaire/survey and the field visits. This chapter provides a more comprehensive summary of improvement needs and recommendations for TDOT roadway designers and field inspectors.

3.0 Field Survey Inspections of EPSC Devices at Active Roadway Construction Sites in Tennessee

3.1 Study Design

The second task of this study was to perform field visits on active roadway construction sites. They were identified by TDOT Environmental Compliance Officers (Figure 3.1). Two separate site visits were completed in summer/fall 2016. The first visit was to Region 1 (Knoxville and surrounding counties) and the second to Region 3 (Nashville and surrounding counties). Six construction sites were visited with large disturbed lands (Table 3.1). TDOT inspectors and contractors facilitated the field investigations and answered questions. S ite visit photos used to document the field survey inspections of EPSC devices are summarized in Appendix A.

While on the field site visits, five basic questions were asked among the TDOT field inspectors and CEI staff. These questions were used to substantiate and support the responses

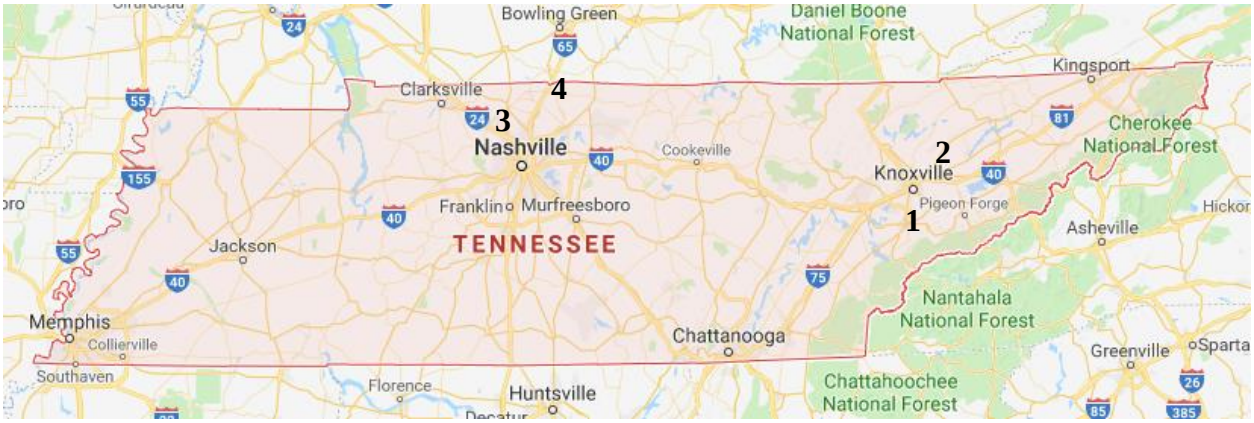

Figure 3.1. Field visit sites in Tennessee.

Table 3.1. Field visit site description of locations.

Highway	County	Latitude	Longitude	Figure 3.1 Map No.
SR-115, Alcoa Highway	Knox	35° 55’ 31” N	83° 56’ 45” W	1
SR-33 Maynardville Pike	Knox	36° 05’ 02” N	83° 55’ 30” W	2
SR-33 Maynardville Pike	Union	36° 10’ 26” N	83° 54’ 06” W	2
SR-65, US431 bridge at Carr Creek	Davidson	36° 24’ 56” N	83° 54’ 03” W	3
SR-65, US431, Springfield, TN	Robertson	36° 28’ 47” N	83° 53’ 16” W	3
SR-109/I-65 Interchange	Robertson	36° 37’ 44” N	83° 34’ 14” W	4

received from the questionnaire. The five questions were as follows:

1.) What are the most common field changes on erosion plans, as designed vs. as constructed, for EPSC best management applications and what is the reasoning behind these changes?
2.) What are the deficiencies of installation details shown on current roadway standards that are not applicable to common field conditions?
3.) What deficiencies can be further modified to address field conditions, for example modifying design parameters for some devices such as slope, distance, height, size, or using proprietary products?
4.) What benefits may be gained from installing repetitive EPSC devices and what is the cost- benefit ratio for different sediment control device treatment-train combinations?
5.) What project development phases need improvement?

Results from the field site visits are summarized in the Results sub-sections below.

3.2 Results

3.2.1 Common Field Changes for Installed EPSC Devices

What are the most common field changes on erosion plans, as designed vs. as constructed, for EPSC best management applications and what is the reasoning behind these changes?

Relocating silt fence, substituting it with silt fence with wire backing, modifying rock check dam (or enhanced rock check dam) to fit geometry or substituting them with sediment tubes, as well as increasing the number of ditch checks are the most common field changes. These practices are needed due to construction phasing and/or site management practices.

During construction it is common for a contractor to modify construction phasing. While the quantity and location of many devices may still function as designed, others may need modifications. The current practices do not allow any flexibility to add new devices and change quantities without a construction change order. Change orders are highly undesirable due to the additional time they take to get approved and the possible added cost to the original estimated construction cost. The department highly discourages this because numbers of change orders are performance indicators for the department monitored by the FHWA. In order to eliminate this issue, it is recommended to identify and list the most commonly used and EPSC best management practices and include them in tabulated quantities of construction plans. This will provide flexibility to use various products if the need arises during construction.

3.2.2 Installation Deficiencies due to EPSC Standards

What are the deficiencies of installation details shown on current roadway standards that are not applicable to common field conditions?

Silt fence, silt fence with wire backing, rock check dam, enhanced rock check dam, and sediment tubes are the most commonly used devices. The most common installation issues of each device are listed below.

a) Silt fence and silt fence with wire backing standard drawings show a maximum of 4" wide trenching. Despite this requirement, alternative trenching practices are common in the field such as plowing or using a backhoe. Those practices leave a wider trench width and excessive disturbance which results in structurally deficient post installations. It is recommended to further evaluate trenching practices and require installation of posts resting against undisturbed downstream banks. The current installation guidance does not address how posts should be installed when they encounter rocks. Guidance, such as

eliminating a few posts and trenching, going around an obstruction, or terminating the installation, is needed.

b) TDOT Qualified Product list and standard drawings were reviewed based on AASTHO Material Specification M-288, 2017 developed for road construction. It was found that the current silt fence fabric specifications for different class geotextiles and silt fence installation details are not corresponding with to each other.

c) Polyacrylamides (PAM) were used in a few projects. Application of PAM requires additional guidance on the types of products used, application rates, and different types of soil conditions. It was found that TDOT Design Division is currently working to develop a new flocculent guidance for the current Drainage Manual (Chapter 10).

d) The current instructions recommend installation of silt fence with wire backing when the disturbed areas are close to water. The geotextile fabric used for this device has a water flux value (18 vs. 4 GPM/SQFT) that is four times larger. Despite being stronger, the fabric and wire backing do not add any benefit to the protection of the waters of the state. More affordable and effective practices such as using silt fence with sediment tube or mulch would provide improved sediment filtration, compared to the more expensive and less effective silt fence with wire backing.

e) Catch basin inlet protections are generic devices designed by TDOT. While smaller CB inlet protection frames are manufactured and used by some contractors, many others prefer premanufactured light weight devices such as Silt Saver. Inlet protection standards for larger catch basin boxes, such as 7'x7', have never been used due to the amount of work that is required to manufacture one. Removing these applications will have no impact on the best management practices.

f) Level spreaders have not been used on any TDOT construction project. It may be an effective device to reduce erosive waters leaving construction and permanent agricultural applications. Unfortunately, installation of this device is not as practical as a temporary EPSC management practice. There are many other devices available, such as a sediment tube. Removing this application will have no impact on current practices.

g) Enhanced silt fence checks are not used any longer due to poor field performance. They are not stable and they require extensive maintenance. Removing this application will have no impact on the current best management practices.

h) Gabion check dams are not used. Gabion baskets are not practical to be installed as a temporary EPSC device. Manufacturing a gabion basket is time consuming and once placed cannot be relocated. They are excellent for permanent bank stabilization or preventing stream of head cut. It is recommended to remove gabion basket standard drawings EC-STR-55, 56, 57, 58, and 59. This move will have no impact on current best management practices.

i) Rock sediment dam and rock and earth sediment embankment devices have not been used. They are not practical and their size is too large for temporary EPSC management practices. Removing those applications will have no impact on current management practices.

3.2.3 Installation Deficiencies and Field Modifications

What deficiencies can be further modified to address field conditions, for example modifying design parameters for some devices such as slope, distance, height, size, or using proprietary products?

During field visits, it was observed that silt fences were being used as a construction site delineator. This installation practice crosses the contour lines. Regardless, the ground geometry silt fences installed at higher ground elevations where silt fence is not needed. It is recommended to develop a construction site delineator fence detail similar to a high visibility fence. This alternative device will be cheaper and faster to install since no trenching will be required during installation. Additionally it will provide better delineation of a construction site.

Regardless of the type of device installed, it is a challenge for TDOT Environmental Compliance Office inspectors to have a contractor repair or maintain identified deficiencies. The current payment method does not include the maintenance of installed devices, but only addresses sediment removal activity. It is recommended to create a new generic payment item number for contractors to get compensation for the maintenance of EPSC installation deficiencies.

Rock check dam and enhanced rock checks are the preferred ditch check methods because once installed they do not need frequent maintenance. Enhanced rock checks perform well in field. However, field observations showed variation in weir opening sizes when compared to the standard drawing weir opening requirements. Sediment tubes are also used often as a ditch check. They perform well at mildly sloped ditches and slopes. However, overlapping or stacking details for ditch application is not practiced to achieve the proper height for ditch checks. The feedback received from field personnel was that the lighter the material, the harder it is to maintain. It is suggested to reevaluate the ditch check installations practice using sediment tubes. Sediment tubes are not a direct substitution for rock check dams when it comes to field performance. Silt fences are rarely used for ditch check dams. Enhanced silt fences for dich checks should be removed from standards due to poor field performance.

3.2.4 Field Benefits from Installation of Repetitive EPSC Devices

What benefits may be gained from installing repetitive EPSC devices and what is the cost-benefit ratio for different sediment control device treatment-train combinations?

TDOT experienced repetitive installation of devices during the SR-840 construction in order to meet more restricted turbidity levels. The project included various repetitive applications and turbulence monitoring. The applications have been monitored and the results have been reported by USGS. It is recommended to adopt such devices as a standard practice and to further recommend them to be used close to bodies of water or environmentally sensitive areas.

The current practice is to install Temporary Silt Fence with backing item No. 209-08.02 close to bodies of water. The average installation cost is close to five dollars per linear ft. with #70-100 standard sieve opening. Replacing this with silt fence 209-08.03 #30-70 standard sieve opening in conjunction with a sediment tube 740-11.01 would double the system's filtration efficiency and with half the cost.

3.2.5 Improvements from Project Development Phasing

What project development phases need improvement?

Both design and construction phases need improvement. The engineering design phase should include a site visit to understand how projects will be constructed and phased. The site visit and communications among design, construction, and environmental divisions will improve the overall plans quality and EPSC practices for all construction projects. Currently, the department is adding a new mandatory site visit to improve final construction plans quality. Even though the purpose of this new field review step is to review more costly roadway features, such as structures, construction phasing, or work zone traffic control, it also includes a review of erosion plan development.

New design training is suggested in order to improve erosion plans' quality and consistency. Currently, the department offers two trainings to roadway designers, EPSC Level I and Level II. Both trainings are developed and provided to industry by TDEC. Level I is mandatory for all field personnel and Level II is mandatory for all design personnel. The TDOT Environmental Division developed new training for field personal to substitute TDEC Level I certification training. Several TDOT field inspectors and designers have EnviroCerts's CPECS certification to meet the industry's standards. It is strongly recommended to develop a new training module that is specific to the roadway design erosion plan development. Such training would provide base design knowledge on current practices and help designers understand how to calculate quantities better.

Another issue identified as a result of the questionnaire was the lack of knowledge about the installed proprietary product. Having installers certified to install proprietary products would eliminate delay due to corrections later. Changes have to be made to TDOT practices in order for contractors to not be paid for deficient installations. An inspection form similar to guardrail installation may be developed to document proper installation and payment release.

3.3 Summary

Silt fence, silt fence with wire backing, rock check dam, enhanced rock check dam, and sediment tubes are the most commonly used devices observed at the visited field sites. There were multiple recommendations for improving performance from silt fences, including a pay schedule for maintenance, and flexibility for on-site modifications from the highway design and SWPPP plans. Rock check dams were the EPSC device that required the least maintenance.

The results from the site field visits and practitioner questionnaires are summarized in Chapter 4.0 Chapter 4.0 provides the key recommendations for TDOT to improve implementation of EPSC devices at highway construction sites..

4.0 Key Questions and Summary of Study Findings

4.1 Introduction

The third task was to review all survey responses and field investigation findings and apply the findings to each current EPSC practice in accordance with the standard drawings. Appendix B of this report tabulates the recommendations to current standard EPSC drawings based on the research findings. General recommendations for the 42 EPSC devices in the TDOT Roadway Drainage Manual, Chapter 10 are summarized below.

4.2 Summary of Recommendations

Recommendations to Current Installation Practices

Survey responses identified that the most common EPSC devices used on TDOT projects are silt fence, silt fence with wire backing, rock check dam, Enhanced rock check dam and sediment tubes. The general installation issues can be grouped under two categories: improvements on standards/plans and field installation practices.

Design Standards/Construction Plans

Investigate the current guidance related to Rock check dam height based on dich depth. The rock check dam quantities on the plans are always less than what is needed. Update the estimated quantities practices for rock check dams. Re-categorize storm water inlet protection devices. Develop an alternative installation detail when rock is encountered during trenching. Develop a J hook detail for silt fence installations. Reevaluate and provide guidance for current trenching practices, plowing or using bucket. Provide guidance to have the necessary ROW to adequately accommodate the BMP.

Field Installation Practices

Have the manufacturer's installation drawings/instructions which, when the product is placed on the Qualified Product List (QPL), need to be readily available during construction. Better training of subcontractor and contractor personnel. Payment in lump sum of all BMP use per phase of SWPPP would be an improvement. Better selection of devices for particular applications. Develop an installer certification program to eliminate poor installation practices or devices installed not confirming standards. Encourage the contractor to take the time to install the measures. Contractors understanding installation and/or maintenance of EPSC devices in timely manner are a priority for TDOT construction sites. Do not pay for items not installed per standard specifications, such as erosion prevention devices not following ground contours, not properly trenching silt fence devices, not having a weir opening by depressing rock check dam or not extending far enough to reach out above the banks.

Recommendations to Field Performance

Most products work fine when installed in accordance to the standard drawings. However, light products such as Geo Hay, a filter sock (non-biodegradable), consisting of rolled recycled carpet, or sediment tubes (biodegradable) do not perform well in ditch applications if they are not staked correctly. They are not heavy, which provides handling benefit to installers. Therefore, unlike rock check dam, they move by the sediment leaden concentrated discharges. Survey responses, based on field performance, indicate that they are not a direct replacement to rock check dam or even silt fence when installed in ditches. Further investigation is recommended to improve the performance of rolled erosion control products (RECP),

especially staking options. Mixed responses were received regarding trenching of RECP. Although 2" trenching is shown on the current standard, it is favorable to minimize ground disturbance during installation. The benefits of trenching need to be investigated as well. It is recommended to provide guidance for service life of sediment tubes.

Stability and performance of silt fence is based on correct installation practices. Current trenching practices, trenching with bucket equipment or ripping the ground with plow, should not be allowed because removal of a large quantity of earth affects fence stability. Among all silt fence devices the silt fence with wire backing is the most preferred device by contractors because they stay stable for a long time. The current TDOT standards do not have a J-hook detail, however it is recommended to develop a detail for long installations.

Silt fence with wire backing is used at locations close to bodies of water. Other than stability, this practice does not offer any additional benefit. This practice needs further investigation. Another recommendation received from the responses is to eliminate the use of "enhanced silt dams in ditch". This practice has not been used in field often, however, when it is used, it performs poorly. Therefore, it is recommended to eliminate this device.

Rock check dams are the preferred device by contractors. Responses indicate enhanced rock check dams are effective and easy to install. They are durable and do not need frequent maintenance. Current installation issues are not having proper weir opening, not extending to dich banks and not placing geotextile fabric under the device extending downstream. Often, the provided rock quantities on plans are less than what is needed during construction, so it is recommended to investigate the current calculation methods for tabulated quantities.

Catch basin inlet protections, as shown on current standards, are manufactured by a wooden frame covered by geotextile fabric. Building boxes is time consuming, so it is not a desirable option by contractors in accordance to the responses. Often, "Silt Saver", a type of manufactured product is used for CB inlet protection. Limiting the use of this device to only small size catch basin structures is recommended. Remove Type E from EC-STR-19; this practice is not recommended.

Seeding and mulching related survey responses indicated that the application process needs improvement. Preparation of seed beds, applying fertilizer, and/or seed is not consistent. Clarifying the application requirements and quantities is recommended.

PAM is used rarely. There was mixed feedback on questions that indicated better guidance is needed. TDOT recently updated the guidance under a new section called, Flocculants. Future field practices will improve the use of flocculants.

TDOT has limited experience with the use of bonded fiber matrix. However, the feedback is very positive. The product has a promising future in erosion prevention practices. Seed has been used in this application. It is the preferred method compared to erosion control blankets. It provides intimate contact with a much faster growth rate. It is the preferred method for locations where the placement of erosion control blanket is not possible. Having bonded fiber matrix item numbers on all future erosion plans will increase the use of this application.

The experience with tackifiers is very limited. Using tackifiers with straw should be encouraged since crimping is not a common practice.

Sediment basins provide flexibility for a contractor to work freely within the disturbed area. It is recommended to explore the use of sediment basins more often. Currently TDOT is working on another research project to improve the design and installation of sediment basins.

Recommendations to Maintenance Practices During Construction

Silt fence with wire backing and rock check dams are the most preferred methods. They have stable installation processes and do not require excessive maintenance, other than sediment removal. On the other hand, Sediment Filter Bags and Sediment Traps are not easy to maintain

They remove large quantities of sediment which requires frequent cleaning. Responses indicated that Hydro mulch, filtrexx, and rock check dams are working better than the other devices. It is recommended that maintenance activities to correct device installation issues should be payed separately. This practice will give incentive to the contractor to fix and maintain installed devices. Also, no payment should be made until all deficiencies are corrected, as identified by field inspectors.

Recommendations to Erosion Control Plans Accuracy

Responses recommend having a site visit during the plans development phase to receive feedback from construction office regarding construction phasing to improve the quality of completed erosion plans. Discussions among TDOT personnel revealed that a new site review step is already scheduled about six months before completing the construction plans set for every project. This mandatory new site visit would help designers identify EPSC strategies during the development of erosion plans. Also, providing additional training to roadway designers on "how to develop erosion plans" is recommended. Currently EPSC device legends show that the plans are not scaled properly and causing confusion.

Silt fence installations sometimes do not follow the contours and miss calculated rock quantities are other common issues. The current practices allow field modifications as needed. Listing the most common devices and item numbers on all roadway plans would also allow contractors to select and use alternative EPSC methods without a change order.

There are few devices that have not been used. Few device delivers poor field performance. Recommended to remove, Enhanced silt fence checks, Gabion Check Dams, Level Spreaders, and catch basin filter assembly (type 1) from the current standards. The use of sediment basins rare but if they are shown on plans they can be built without major modification.

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Appendices

Appendix A: Field Visit Photos

Appendix B: Recommendations to EPSC Standard Drawings

Appendix C: Questionnaire/Survey – Summary of Responses

Appendix A: Current Standard Drawings for Roadway EPSC Devices

Appendix A:
Field Visit Photos

FIELD VISITS

REGION 3

Date: November 8, 2016

- **Trent Thomas, Region 3 & 4 TDOT Environmental Compliance Supervisor**
- **John S. Schwartz, PhD, PE, Associate Department Head and Professor, University of TN**
- **Sharon Schutz, TDOT Environmental Compliance Manager**
- **Ali Hangul**

TDOT Project: The widening of SR-65 in Springfield TN

Looking upstream

- **Enhanced rock check dam (EC-STR-6A).**
- **Silt deposits indicate that device performed well.**
- **Straw deposits at weir demonstrate that temporary mulch application on slopes did not crimp straw.**

Looking downstream from the proposed lane of the roadway widening project.

Rock check dam (EC-STR-6) used with sediment tubes (EC-STR-37) for ditch check.

Looking downstream

Enhanced Rock Check Dam (EC-STR-6A).

Additionally, silt fence (EC-STR-3B) used as a secondary barrier.

Catch Basin Protection (type B) with sediment tubes (type D) and temporary mulch (EC-STR-19).

Enhanced Rock check dam (EC-STR-6A).

Rock Check Dam (EC-STR-6).

I-65/SR-109 Interchange - North of Portland

Temporary slope protection (EC-STR-34).

Pipe inlet protection (EC-STR-11) used with Enhanced rock check dam (EC-STR-6A).

Temporary slope drain (EC-STR-27).

Culvert inlet protection (EC-STR-11A).

Silt fence with wire backing (EC-STR-3C).

Sediment tube used for ditch application (EC-STR-37)

Erosion control blanket used for slope Installation (EC-STR-34)

REGION I

Date: August 23, 2016

- **Hugh Hannah, Region 1 & 2 TDOT Environmental Compliance Supervisor**
- **John S. Schwartz, PhD, PE, Associate Department Head and Professor University of TN**
- **Payton M. Smith, University of TN**
- **Ali Hangul**

TDOT Project: **SR-115, Alcoa Highway Widening**

Enhanced rock check dam (EC-STR-6A).

Looking upstream

Rock check dam (EC-STR-6)

Curb inlet protection, Type 4 (EC-STR-39A)

Temporary slope drains (EC-STR-27)

Enhanced rock check dam (EC-STR-6A) shown with temporary slope drain outlet

Suspended pipe diversion (EC-STR-33A) Upstream side

Suspended pipe Diversion (EC-STR-33) Downstream side

Sediment Filter Bag (EC-STR-2).
Pad is ready for a filter bag. It will receive pumped water from suspended pipe diversion.

Sediment tube used as a berm (EC-STR-37).
Silt fence with Wire Backing used in the middle of cut slope (EC-STR-3C) .

Silt fence with wire backing (EC-STR-3C) used as a berm.
Mulch applied for temp slope protection.

Enhanced rock check dam (EC-STR-6A).

Silt fence with wire backing (EC-STR-3C) used around bodies of water.

SR-33 Widening Union Co.

Silt fence with wire backing (EC-STR-3C) used with sediment tube at the toe of fill slope.

Silt fence with wire backing (EC-STR-3C) used with rock or sediment tube weirs. Two rows of sediment tube used on the other bank.

Temporary Slope Stabilization – mulch W/O Seed.
Straw is not crimped, light coverage,
low berm height failed to divert off site drainage on top of the cut slope.
No intermediate protection within the slope.

Proposed roadway fill with temporary berm (EC-STR-27).
Temporary slope drain has not been installed yet.

Rock check dam (EC-STR-6) looking upstream

Filter sock (EC-STR-37). Short piece of geo-hay tube staked using steel posts.

Looking up

Temporary slope drain (EC-STR-27).

Looking down

Dewatering structure under construction (EC-STR-1).

SR-33 and Beaver Creek Road intersection Improvements, Knox Co.

Permanent drainage basin

Appendix B:
Recommendations to EPSC Standard Drawings

The list shown below is consist of all current EPSC standards available to roadway designers during the development of roadway pans. A short comment is provided to each standard drawing based on the research findings.

DEWATERING DEVICES

DRAWING	DESCRIPTION	COMMENTS
EC-STR-1	Dewatering structure	This is a generic type of device used seldom. Reevaluate the size and investigate how to improve efficiency.
EC-STR-2	Sediment filter bag	Revise QPL and list 15'x15' and 15'x10' devices only

SLOPE DEVICES

DRAWING	DESCRIPTION	
EC-STR-3B	Silt fence	Review and revise silt fence fabric specifications to be in conformance with AASHTO M-288 Material Specifications (table 7) Add J hook detail
EC-STR-3C	Silt fence with wire backing	Update fabric specifications and QPL.
EC-STR-3D	Enhanced silt fence	Standard has not been used consider voiding.
EC-STR-3E	Silt fence fabric joining details	No comment
EC-STR-8	Filter sock	Filter sock stacking not practiced. Remove detail, limit applicable slopes, revise spacing or eliminate dich application. DO not use Geohay in dich.
EC-STR-27	Temporary slope drain and berm	Min. pipe size is 15" for TDOT projects. Simplify berm details.
EC-STR-29	Permanent slope drain pipe	Standard has not been used consider voiding.
EC-STR-34	Erosion control blanket for slope installation	Hydro mulch should be considered as an alternate
EC-STR-35	Filter berms	No comment. Promote this practice.
EC-STR-37	Sediment tube	Improve staking details, limit ditch applications.

DITCH DEVICES

DRAWING	DESCRIPTION	
EC-STR-4	Enhanced silt fence check (trapezoidal ditch)	Standard has not been used consider voiding.
EC-STR-4A	Enhanced silt fence check (v-ditch)	Standard has not been used consider voiding.
EC-STR-4B	Enhanced silt fence check details	Standard has not been used consider voiding.
EC-STR-6	Rock check dam	Review rock quantity calculations
EC-STR-6A	Enhanced rock check dam	Review rock quantity calculations
EC-STR-7	Sediment trap with check dam	No comments.
EC-STR-55	Gabion check dam	Standard has not been used consider voiding.
EC-STR-56	Gabion check dam design tables	Standard has not been used consider voiding.
EC-STR-57	Gabion assembly details	Standard has not been used consider voiding.
EC-STR-58	Gabion assembly details	Standard has not been used consider voiding.
EC-STR-59	Gabion check dam general notes and component properties	Standard has not been used consider voiding.
EC-STR-61	Level spreaders	Standard has not been used consider voiding.

INLET PROTECTION

DRAWING	DESCRIPTION	
EC-STR-11	Culvert protection type 1	Remove sediment storage zone. Combine plan Views and leave more space for a placement of pipe headwall between the pipe end and rock check dam. Add pipe to title, remove type 1
EC-STR-19	Catch basin protection	Delete type E
EC-STR-39	Curb inlet protection type 1 & 2	Type 1, device has an excessive foot print. Impossible to maintain. Has not been used. Remove types. Label it as perimeter protection.
EC-STR-39A	Curb inlet protection type 3 & 4	Consider removing type 3, impossible to maintain. Minor modification is needed for type 4 to simplify maintenance.

EC-STE-40	Catch basin filter assembly for circular structures	Limit the use up to 72” CB
EC-STR-41	Catch basin filter assembly (type 1)	Limit the use up to 72” CB
EC-STR-41A	Catch basin filter assembly (type 1) slipcover details	Limit the use up to 72” CB
EC-STR-42	Catch basin filter assembly (type 2)	Limit the use up to 72” CB
EC-STR-42A	Catch basin filter assembly (type 2) slipcover details	Limit the use up to 72” CB
EC-STR-43	Catch basin filter assembly (type 3)	Limit the use up to 72” CB
EC-STR-43A	Catch basin filter assembly (type 3) slipcover details	Limit the use up to 72” CB
EC-STR-44	Catch basin filter assembly (type 4)	Delete – CB is too large
EC-STR-44A	Catch basin filter assembly (type 4) slipcover details	Delete – CB is too large
EC-STR-45	Catch basin filter assembly (type 5)	Delete – CB is too large
EC-STR-45A	Catch basin filter assembly (type 5) slipcover details	Delete – CB is too large
EC-STR-46	Catch basin filter assembly (type 6)	Limit the use up to 72” CB
EC-STR-46A	Catch basin filter assembly (type 6) slipcover details	Limit the use up to 72” CB
EC-STR-47	Catch basin filter assembly (type 7)	Limit the use up to 72” CB
EC-STR-47A	Catch basin filter assembly (type 7) slipcover details	Limit the use up to 72” CB
EC-STR-48	Catch basin filter assembly (type 8)	Limit the use up to 72” CB
EC-STR-48A	Catch basin filter assembly (type 8) slipcover details	Limit the use up to 72” CB
EC-STR-49	Catch basin filter assembly (type 9)	Delete, CB is too large
EC-STR-49A	Catch basin filter assembly (type 9) slipcover details	Delete, CB is too large
EC-STR-50	Catch basin filter assembly (type 10)	Delete, CB is too large
EC-STR-50A	Catch basin filter assembly (type 10) slipcover details	Delete, CB is too large
EC-STR-51	Catch basin filter assembly (type 11)	Delete, CB is too large
EC-STR-51A	Catch basin filter assembly (type 11) slipcover details	Delete, CB is too large

DETAINING DEVICES

DRAWING	DESCRIPTION	
EC-STR-12	Rock sediment dam	Standard has not been used consider voiding.
EC-STR-13	Rock and earth sediment embankment	Standard has not been used consider voiding.
EC-STR-15	Sediment basin	Will be modified based on current ongoing research
EC-STR-16	Sediment basins riser and collar appurtenances	To be revised
EC-STR-17	Sediment basin embankment details	To be revised
EC-STR-18	Sediment basin floating outlet structure	No comment
EC-STR-21	Permanent riprap basin energy dissipators	Revise number and move to new series standards under energy dissipators.

IN-STREAM DEVICES

DRAWING	DESCRIPTION	
Ec-str-11a	Culvert protection type 2	Remove type 2 add perimeter. EC-STR-11 will be renamed to pipe culvert protection.
EC-STR-25	Temporary culvert crossing, construction exit, construction ford	No comment
EC-STR-30	Instream diversion (without traffic)	No comment
EC-STR-30A	Instream diversion (with traffic)	No comment
EC-STR-31	Temporary diversion channel	No comment
EC-STR-31A	Temporary diversion channel design	No comment
EC-STR-32	Temporary diversion culverts	No comment
EC-STR-33	Suspended pipe diversion (downstream)	No comment
EC-STR-33A	Suspended pipe diversion (upstream)	No comment
EC-STR-36	Turf reinforcement mat for channel installation	No comment
EC-STR-38	Floating turbidity curtain	No comment

RECOMMENDED NEW DEVICES

EC-STR-XX	Construction site delineator	NEW
EC-STR-XX	Multi stage protection	NEW

Appendix C:
Questionnaire/Survey – Summary of Responses

Survey Questions

Name
Job title, region, and/or district
Contact information Email, Phone No.

Installation
Name the types of EPSC types typically used in your region/district:
What difficulties are encountered during installation of named structure(s)?
What can be done to improve the installation efficiency of named structure(s)?
What can be done to improve the current installation practice per EPSC device?
What EPSC products are the most difficult to install in accordance to the current installation details?
How can the installation be modified to improve installation efficiency but retain the level of EPSC performance effectiveness?
What measure is consistently not installed in accordance with current installation details?
Are multiple EPSC devices designed and installed in a drainage sequence?
Does a treatment train of multiple EPSC devices improve site performance reducing erosion?
Do you have any recommendations about current installation practices?

Performance
Which products are failing once installed in accordance to the current installation details?
What products are the most effective when installed properly?
Which product's performances are not meeting the design criteria shown in the standard drawings?
What component of the device is over designed or needs improvement?
Is trenching of silt fence necessary? If so, what recommendations can be made to improve installation?
Is trenching of rolled erosion control products necessary to maintain intimate contact with soil?
Do you see any benefits in minimizing soil disturbance during the installation of such products?
How often is newly applied straw mechanically crimped or chemically tacked to soil?
Do you see the cost benefit of limiting the application of enhanced silt fence with wire backing to only steep fill or cut slope locations?
What products are preferred by contractors?
Is trenching of rock checks and enhanced rock checks necessary to improve performance of the measure?
How often is mulch applied at the specified rates per TDOT standards?
Are there any EPSC devices shown on the plans that you generally change to an alternate device in the field due to your experience with its performance? If so, please explain.
How often is fertilizer used when applying vegetation?
How often is lime used when applying vegetation?
How often seed beds are properly developed when applying vegetation?
Have you used PAM (polyacrylamide) on a project? If so, how did it perform?
Have you used Bonded Fiber Matrix?
Have you applied with seed or without seed?
How did it perform?
Did the performance justify the cost difference with typical seed and mulch?
Are they equal to or better than blankets?
Have you used Tackifiers? What types of Tackifiers are being used?
Which TDOT catch basin/area drain inlet protection have you found to perform the best?
How often is mulch applied at the specified rates per TDOT standards?
Are there any EPSC devices shown on the plans that you generally change to an alternate device in the field due to your experience with its performance? If so, please explain.
How often is fertilizer used when applying vegetation?
How often is lime used when applying vegetation?

How often seed beds are properly developed when applying vegetation?
Have you used PAM (polyacrylamide) on a project? If so, how did it perform?
Have you used Bonded Fiber Matrix?
Have you applied with seed or without seed?
How did it perform?
Did the performance justify the cost difference with typical seed and mulch?
Are they equal to or better than blankets?
Have you used Tackifiers? What types of Tackifiers are being used?

Maintenance
Which EPSC products are the easiest to maintain?
Which EPSC products are the most difficult to maintain?
Do you have any recommendations to improve or eliminate maintenance activities?
Are there products that seem to cost too much but perform superior to others?
From your perspective, is it possible to reduce the frequency of inspection?
What do you consider as the most difficult maintenance technique?
Would there be a benefit to having a separate line item for maintenance of EPSC devices? Please explain.
Do you feel that the estimated quantities for EPSC items generally include an adequate amount for maintenance and replacement? Please explain.
Is the EPSC device installer typically responsible of maintaining the devices? Whether yes or no, please describe the pros and cons.

Plans Accuracy
Are there any devices in which the tabulated quantities do not match the plans?
Do you have any other recommendations to modify the current practices?
Are there times when devices are not accurately depicted on the plans?
Are there times when useful EPSC devices/measures are not included as items on the plans? If so, please describe.
Are there any EPSC devices, which TDOT has a standard drawing for, you never use? If so, please describe.
Do designers properly utilize EPSC devices according to conditions shown on site plans?
Are stream diversions being shown on the plans and are they the appropriate type for the field conditions/terrain?
Are sediment traps being shown on plans where needed? How often do you add sediment traps as a revision to your SWPPP in the field?
How often do you use sediment basins as shown on TDOT standard drawings?
How much accuracy should be expected of the EPSC plans and quantities without knowledge of a contractor's construction phasing?
Do you find that construction phasing and grading substantially affects the actual area draining to a device in contrast to the drainage areas on the plans that the EPSC measures were designed for? If so, how do you adjust for that?

Other
Is there any specific training that you would like have?
Are there devices that you have used on non-TDOT projects or that you have come up with on your own that you think would be beneficial for TDOT to review?

Survey Responses

Name the types of EPSC types typically used in your region/district?

Silt fence, silt fence with backing, sediment tubes, rock check dams, enhanced rock check dams, filter bags, temp stream diversion channels.

Sediment tubes, rock check dams, straw wattles, outlet protection, inlet protection, silt fence.

Gabion Check Dams, Rock Checks, Enhanced Rock Checks, Sediment traps with Check Dams, Silt Fence, Silt Fence Backing, Level Spreaders, Curb inlet protection Types 1, 2, 3, 4, Catch Basin protection 1, 2, 3, 4, Catch Basin Circular structures protection, Catch Basin Protections types 1-11, with some slip cover types, Filter Berms, silt/filter sock, sediment tubes, slope drains, ECB Erosion Control Blanket, Dewatering Structures, Sediment Filter Bag, Rock Sediment Dams, Rock basin Energy Dissipator, Sediment Basins, Turbidity Curtain, Coffer dams, Instream Diversions, Suspended pipe diversions, Diversion Channels, TRM Turf Reinforcement Matting, Culvert Protection Type 2, Crossings and Construction Entrances and Exits TCE.

Silt fence, check dams, sediment traps, geotextile, seeding and much, sod, stream diversions.

Rock check dams, enhanced rock check dams, filter sock, silt fence, silt fence with backing, temporary berm, turf reinforcement mat, erosion control blanket, sediment filter bag, temp slope drain.

Rcd, ercd sediment tube, silt fence, silt fence w/b, geotextiles, blankets, etc.

Silt fencing, silt fencing with backing, sediment tubes, Rock Check Dam, Enhanced Rock Check Dam, Sediment Filter Bag, Polyethylene Sheeting, Temporary In-Stream Diversion, High-Visibility Construction Fence, Geotextile Type III Erosion Control, Water, Sodding.

Silt Fence, Silt Fence with Backing, rock checks, and enhanced rock checks

Sediment Tubes, Silt Fence w & w/o backing, High Visibility Fence, Enhanced Rock Check Dam, Rock Check Dam, Filter Assembly, curb inlet protection, culvert protection type 1, suspended pipe diversion, stream diversion, sediment trap, slope drains, berms,

Sediment tubes, silt fence, check dams.

Level 1

Silt fence, sediment tubes, check dams

Sediment tubes, silt fence, silt fence with backing, rock check dams, and enhanced rock check dams

Don’t know.

Silt Fence, Sediment Tube, Enhanced Silt Fence, Rock Check Dams, Culvert Protections, Catch Basin Filters.

N/A

Silt fence

The most typical EPSC measures are: 1. Silt fence & Silt fence with backing 2. Check dams including both rock structures and manufactured products 3. Construction entrances 4. Storm water inlet protection.

All

Silt fence, rock check dam

Silt fence, check dam, enhanced check dam, straw wattles, construction exits, inlet protections

Discussion

The most common EPSC devices used on TDOT projects are, Silt fence, Silt fence with wire backing, Rock check dam, and Enhanced rock check dam. Evaluate CB filter assembly.

What difficulties are encountered during installation of named structure(s)?

Topography elevations and rock near bridge jobs, improper placement and installation by contractor subs. As a QA Auditor, I am typically not on-site when the EPSC measures are installed.

Compliance with STD drawings in applications by TDOT staff (Construction Maintenance personnel). Some applications require site specific changes in STD installs that may not follow STD requirement. These site specific applications differ from STD yet end result is compliance, creates some confusion by regulatory/consultant inspections of projects as non-compliance issues per TDOT follow the STD requirements. Contractor knowledge of the STD and application requirements of many of the products.

Alternative or Equivalent BMP per QPL and knowledge of Manufacturer's installation requirements, sometimes confusion in what part of STD is applied to such BMP installation vs Manufacturers requirements.
Always protect the streams.
I don't install them, so I am not sure.
N/A
Sometimes it is difficult to know exactly where to place a silt fence.
Rock during trenching of silt fence
Construction Question
Require manual labor/does not get installed properly
None
Rock, sub-contractors installing items want to be able to do it all mechanically instead of by hand in difficult areas, notches not placed correctly in checks
Contractor not installing to standards
N/A
N/A
Getting contractors to install correctly
1. Silt fence is sometime shown on plans in locations where it will be obliterated as soon as construction is initiated. It is also sometimes located on plans such that it is not on contour or proper installation of J-hooks is not indicated. 2. Check dams, both rock and manufactured, are many times installed without a wide enough cross-section in the flow path and/or with the outer ends higher than the obvious high flow level of the waterway. This is probably due to the fact that they are generally paid for with a “per each quantity”. 3. The rock specified is impractical. The rock as sized will lodge between the tandem wheels of standard over-the-road dump trucks and create a road hazard. 4. Wooden box type are impractical for installation under traffic situations.
Amount of right of way available, steep slopes.
Along contour, trenching.
Not properly trenching silt fence, not building check dams with the middle lower than the sides.
Discussion
General Installation issues such as following contours or trenching silt fence. Investigate installation (depression side extensions) and rock quantities for rock check dams.

What can be done to improve the installation efficiency of named structure(s)?
Adequate oversight of subs doing the install to correct errors when subs are still onsite, too hard to get the subs back to correct install issues.
Not Applicable
Maybe require certification process for a compiled list of TDOT Certified EPSC BMP Contractors that can work on TDOT projects. Require TDOT personnel that pay for and dictate the use of such BMPs for EPSC the same TDOT certification, previously noted. Contractor certifications of BMPs used for TDOT projects, Engineer knowledge base on TDOT used BMP for TDOT projects and personnel working on TDOT projects understand that no payment will be given for inappropriately installed BMPs or if end product of BMP is not performing the intended result of no sediment/turbidity issues in waters of State or off of project. Include the changes as indicated by Engineer on projects, will require Contractor and Engineer to work together on same goal to keep compliance if payment is not awarded until measure(s) have proven to maintain compliance on the project as whole.
More silt fence and check dams
n/a
Following the stand drawings
I am unsure. It may not be an easy problem to solve.
Contractor installing correctly
Construction Question

Find a product that does not require manual labor
Nothing
Don't pay for them if not installed correctly
Install per standards
N/A
N/A
Train contractors
The simple answer is: Improved supervision with qualified personnel.
No suggestions
Using trenching equipment

Discussion

Improved supervision with qualified personnel. Train contractors. Require certification process for a compiled list of TDOT Certified EPSC BMP contractors. Understand that no payment will be given for inappropriately installed BMPs.

What EPSC products are the most difficult to install in accordance to the current installation details?

Filter bags, temp stream channel diversions, silt fence with backing.
Not Applicable.
All have their niches. In stream diversions, to separate flowing water from construction activities is the one questioned frequently if not in design or construction plans. The sizing of and layout of in the plans is always open to interpretation if not in design/construction plans. STDs assist yet difficult based on high water flows and changing capacities of STR dependent on rain events that occur. Limited on increasing of such a BMP too site specific.
Stream crossings
N/A
N/A
I am unsure.
Silt Fence in general
Construction Question
Check dams
Unknown
Erosion control blanket - hardly anyone keys it in correctly and too many times the ground is not leveled enough to maintain contact with the blanket thus you get rilling underneath
Check dams (rock and tubes)
N/A
N/A
Sediment basin outlet structures.
Check dams and enhanced check dams.
No suggestions.
Depends on site and accessibility to the measure.
Sediment tubes typical are not entrenched as shown on the standard drawing.

Discussion

In stream diversions are had to install. If it is not shown on plan set hard to design. Erosion control blankets are not keyed. Sediment tubes are not trenched.

What can be done to improve the current installation practice per EPSC device?

Better training of subcontractor and contractor personnel to understand the EPSC device function and layout position
Not Applicable
TDOT Certification process of Contractors and TDOT Personnel to be able to install BMPs on

TDOT Projects. Payment in lump sum of all BMP use per phase of SWPPP if compliance was maintained meaning no loss of turbidity and sediment per each EPSC phase of project in lieu of payment per installation of each BMP with holding correct installation or effectiveness as currently done.
Watch job during rain to see if erosion measures are working
N/A
Follow the standard drawings
I am unsure since I don't work in the field.
Contractor install correctly
More visual inspections
Do not pay for items not installed per standard specifications
Check it more often
More education and less acceptance of improper installs
Contractor taking the time to install correctly
N/A
N/A
Train contractors
Improve supervision
Better selection of devices for particular applications and better supervision during installation
Proper inspection

Discussion

Better training of subcontractor and contractor personnel. Payment in lump sum of all BMP use per phase of SWPPP. Better selection of devices for particular applications. Do not pay for items not installed per standard specifications.

How can the installation be modified to improve installation efficiency but retain the level of EPSC performance effectiveness?

Not Applicable
Include worst case scenario in the design calculations for diversion in STR and allow more space ROW to adequately accommodate the BMP and staging of work that can occur in the construction.
Make sure measures are installed correct
N/A
N/A
Maybe some more education as to proper installation techniques could be offered.
Make sure there is an alternative if rock is encountered during trenching
Construction Question
Take more pride in work
I don’t know, mainly just make sure they are being installed per current standards
N/A
N/A
Use tighter survey/measuring controls
1. Silt fence should be understood before installation to be located at clearing limits (eg. a few feet beyond the toe of slopes) or at ROW if the project is to be cleared to ROW. Where silt fence is shown on plans running counter to contours, it should be installed in a J-hook fashion.
2. Check dams must, to be effective, must be installed must be with a wide enough cross-section in the flow path and with the outer ends higher than the obvious high flow level of the waterway but keeping in mind that it does no good to install a 3 foot high check dam in a 2-foot deep ditch.
3. Construction entrances of necessity should be constructed with larger stone and covered with some smaller stone when primary use is for small truck and automobile traffic.
4. Storm water inlet protection devices proliferate the market. They just need to be specified.
No suggestions

Discussion
Rock check dam height based on dich depth. Develop a J hook detail. Better categorization of storm water inlet protection devices. Alternative if rock is encountered during trenching. ROW to adequately accommodate the BMP.

What measure is consistently not installed in accordance with current installation details?
Filter bags assemblies
In my limited experience, I have found that EPSC measures are consistently installed correctly.
Temporary crossings, Silt Fence, SFB Silt Fence Backing, Rock Checks and ERC Enhanced
Rock Checks (weir height, use of geotextile, areas of concentrated flows)
All measures are installed correct
N/A
Enhanced rock check dam
Unsure
Rock checks
Silt Fence
Sediment tubes
Silt fence
Erosion control blanket
Check dams
N/A
N/A
Installing devices at correct elevation
1. See 2, 3 & 4 above.
Silt fencing
No suggestions
Check dams
Sediment Tubes, Check dams, Mulch Filter Berms. QPL products – the manufacture's installation drawings/instructions which when the product is placed on the QPL need to be readily available during construction.
Discussion
Check dams, Erosion control blanket. The manufacture's installation drawings/instructions which when the product is placed on the QPL need to be readily available during construction.

Are multiple EPSC devices designed and installed in a drainage sequence?
Yes
Yes.
Majority of cases yes, dependent on amount of ROW (space available to appropriately implement). All EPSC BMPs that TDOT has or applies require multiple installation in drainage sequence. Slow the velocity or "meter" the amount of water reaching perimeter BMP to prevent overwhelming of outer BMP and allow sediment to fall out of suspension.
YES
N/A
Yes
Unsure
Typically yes
Sometimes
Yes
Yes
Yes
Most of the time

Yes
N/A
Yes
Absolutely this is true. Multiple EPSC devices should be installed from higher to lower elevation in order of treatment of wider flow area to more concentrated flow and hopefully with an area of less slope toward the end of the sequence. Ditches filled with various sized rock and chips from clearing have proven effective.
Yes. Projects require that on occasion.
Yes
Yes
Most EPSC plans show EPSC devices in a sequence.
Discussion
Yes.

Does a treatment train of multiple EPSC devices improve site performance reducing erosion?
Yes
Yes. Areas that have multiple EPSC devices typically perform better than single device areas.
Overall and in most all cases YES! Treatment train or series of BMPs is the most effective when areas in the series allow for "stalling" allowing sediment to drop from suspension integrated in the treatment train. Most effective in phase one of the project. When excavations change elevations limits the amount of area available for stalling and multiple measures. Increases the need for quicker stabilization (sod) in majority of cases.
YES
I believe so.
Yes, in most cases.
Maybe
Typically yes, if installed correctly
Construction Question
Yes
Not all the time
Definitely
Yes, what sediment is not caught upstream can be caught by other measures before leaving the job
Yes, when done according to plans
N/A
Yes
The only way to prevent erosion is with some form of ground cover such as seeding with mulch or erosion blanket, etc. or some form of stone application. Proper “tracking” of slopes will reduce erosion but is not nearly as effective as temporary seeding with mulch or just temporary mulching which is not applied nearly as often as it is warranted. The idea that we can “just wait until where’re ready for permanent seeding” has in the past created several bad results. An ounce of erosion prevention is worth a pound of sediment control.
Yes but they must all be installed properly and maintained
Yes.
Yes
Sometimes. West TN has soils that stay suspended in water longer and do not always filter
Yes, if sufficient right-of-way is available to install the treatment train as shown on the plans.
Discussion
Yes.

Do you have any recommendations about current installation practices?
Not Applicable
Would be beneficial for TDOT site engineers on projects to be more aware of STD of installation of the BMP EPSC. Then to monitor the installation more closely. Especially at the beginning of the project to set expectations of the project with the Contractor as how expected to install. The more consistently this is monitored with contractors the better installation across the State on TDOT projects will become as these Contractors work multiple projects. Difficult to argue the way installed when Contractor has been paid for poor installation not meeting STD.
Always install erosion measures correct
N/A
Follow the standard drawing!
No
Just make sure they are installed according to the specification or don't pay for it.
No
Don’t allow use of sediment tubes they are not installed correctly used incorrectly and don't work Effectively.
None
Mainly just encourage the contractor to take the time to install the measures by the standards.
N/A
N/A
No
Improve supervision with qualified personnel
EPSC measures need to be more of a priority for contractors
No suggestions.
Discussion
Encourage the contractor to take the time to install the measures. Need to be more of a priority for contractors. Contractor has been paid for poor installation.

Which products are failing once installed in accordance to the current installation details?
Geo hay check dams
I find that silt fence is the most common measure to fail. Silt fence also seems to be the least maintained measure on site.
Sediment tubes (needs series of in ditch applications, spacing not in ditch applications needed)
All measure work when installed
N/A
Unless overwhelmed by a storm event, no measure should fail if installed correctly.
Most probably work properly if they are installed properly.
Depends on the situation but geo hays typically fail the most
Sediment tubes, silt fences, regular SF,
Sediment tubes
N/A
N/A
Silt fence
Most all products work fine when installed in accordance to the current installation details. In fact some of the current installation details are over complicated. The problems that arise are in the translation to installation. You can’t paint by numbers if you can’t count.
Any can fail with poor installation.
Silt fence
Discussion
Geo hay, sediment tubes, silt fence. Most all products work fine when installed in accordance to the current installation details.

What products are the most effective when installed properly?
Silt fence with backing, enhanced rock check dams
Rock check dams
Rock Check Dams and Enhanced Rock Checks in series or multiples with additional sumps or sediment traps.
Silt fence and check dams
I have seen filter socks in ditches work better than rock check dams for retaining silt/sediment.
Geotextiles, Silt Fences, ERCD's
Probably rock check dams, silt fences, and sod.
Check dams
Check dams
Check damns
SFB
Enhanced rock check dams
N/A
N/A
Sediment basins
All of them
If chosen for the right application all measures in the standards are effective.
Enhanced rock check dam
Enhanced Rock Check Dam
Discussion
Enhanced Rock check dams.

Which product's performances are not meeting the design criteria shown in the standard drawings?
Silt fence. Probably more of a maintenance issue though.
Sediment tubes current STD in Ditch applications do not require to be in series.
None
N/A
N/A
Unsure
N/A
Silt fences
Accepted alternative check dams
Sediment tubes
N/A
N/A
Silt fence
Manufactured check dam material known as Geo-Hay.
No suggestions
Discussion
Sediment Tubes and Silt fences.

What component of the device is over designed or needs improvement?
Weight and stability in ditch applications to be stable. Easily corrected when placed in series and double up on staking.
NONE
N/A
N/A

Unsure
None
The method of holding the sediment tubes in place
N/A
N/A
None
Just quit using the product altogether.
No suggestions
Discussion
Sediment tube staking, installation.

Is trenching of silt fence necessary? If so, what recommendations can be made to improve installation?
Yes, require trenching of ditch instead of digging with bucket
Yes depending on the location within the watershed
Yes, automated or mechanical trenching installation unit that creates trench and installs fence with one pass
YES
Trenching of Silt fence with backing is necessary to a minimum depth of 6".
Yes, follow the standard drawing.
Yes. Unsure
Yes, make sure that the contractor is installing correctly
Yes
Unknown
Yes, add j-hooks
Yes, trenching machines seem to work well when you can use them versus doing by hand
N/A
N/A
Yes, train contractors
Yes it's necessary and it should be insured that it is accomplished when the silt fence is installed or in some cases where it is impractical to trench the silt fence in, sediment tubes or similar should be installed at the base of the silt fence.
Yes, light hand compaction of the trench material will help stability
Yes.
Yes
Yes
Yes trenching of silt fence is necessary to prevent the sediment laden storm water from flowing under the silt fence.
Discussion
Yes, trenching is necessary, do not allow plowing or bucket trench excavation methods, and add j-hooks.

Is trenching of rolled erosion control products necessary to maintain intimate contact with soil?
Yes, it greatly helps
Yes
No, yet dependent on velocity of drainage controlling. If the tubes and filter sock, silt worms are trenched in 2" depth with geo textile and staked velocity is high of water controlling. Not trenched for applications of where sheet flows are to be maintained.
YES
N/A
Yes, it prevent undermining at the top of the slope.
I do not believe so

Not if it is correctly pinned to the slope
Yes
Yes
Yes
Yes, especially on the upstream end
N/A
N/A
No experience
I have never believed that it did much good for the trouble it takes. Better to get it installed in a timely fashion.
No, proper staking is adequate
Yes
No
Yes
Yes trenching of rolled erosion control products (RECP) is necessary to keep the RECP from being dislodged when storm water flows across it. Preparation of the ground surface prior to placing the RECP to achieve intimate contact with the soil is paramount. Observations of successful RECP installations on slopes where the RECP has been rolled out for a generous (usually >10 feet) back from the top of the slope and where there is no concentrated flow being directed to the top of the slope have been made. Therefore, providing sufficient "run out" distance back from the top of slope might be considered in lieu of trenching.

Discussion
Mixed feedback. Improving installation to have a better soil contact is needed.

Do you see any benefits in minimizing soil disturbance during the installation of such products?
Yes, trenching of ditch disturbs less soil vs digging with bucket equipment or ripping with plow
No. If your EPSC measure isn't installed with adequate contact with soil, you will lose more soil than if it was trenched initially.
Yes the more vegetated and less disturbed the surrounding the less to control and treat. Overall less measures save money and creates vegetative buffers that assist with sediment control and erosion prevention overall.
YES
N/A
Yes, an ounce of prevention/pound of cure.
Yes. The less soil disturbance, the less erosion.
Yes, stabilization would presumably occur faster with the less disturbance
Yes
In most cases
Definitely
Yes it is always best to minimize soil disturbance
N/A
N/A
Yes, much benefit
Not particularly if the disturbance is primarily kept on the up gradient side of the installation and all loose material is tamped back down.
Yes.
Yes
Yes
Yes minimizing soil disturbance is the best to prevent erosion. However, RECPs need to be installed on a prepared rather smooth surface to maintain the intimate contact.

Discussion
Limit trenching practices do not allow digging with bucket equipment or ripping with plow.

How often is newly applied straw mechanically crimped or chemically tacked to soil?
Never
Once in the 3 projects I have worked on.
Rarely if any, Crimping requires mechanical means and use in most cases the dozer is pulled away from earth moving needs (payed more for earth work than crimping/stabilizing slopes), limited options for chemical and cost of chemical tacks keeps this option from consideration in most cases.
MECHANICALLY CRIMP ALWAYS
N/A
At application
Unsure
Very little/never
Very little
Once during job
Never
I have never seen any done this away on a job.
N/A
N/A
Never
Very seldom. The personnel applying the straw usually don't have a tracked machine.
Not often
No suggestions
Discussion
Practice needs improvement in field.

Do you see the cost benefit of limiting the application of enhanced silt fence with wire backing to only steep fill or cut slope locations?

Maybe some, however silt fence with backing will last most of the project timeline if maintained and properly installed vs regular silt fence that needs to be fully replaced usually after 1 year
Yes, if you can utilize multiple lower cost EPSC measures in its place
Yes but should always be used for BMP for STREAM and WETLAND protection measures. In most cases bridging these features at STR will require rise in approaches with fill slopes at STR and Abutments. Same is true with WTL crossings with fill slopes. Limited need for cut slopes unless near STR or WTL.
STEEP SLOPES NEED SILT FENCE WITH BACKING IS NEEDED
N/A
No, it should also be required at streams at wetlands.
Yes
Yes
Yes
No
No
It costs more than silt fence but last longer and is stronger.
N/A
N/A
Yes
In TDOT Specs "enhanced silt fence" and regular "silt fence with backing" are two different things. Silt fence with backing should be used where necessary – steep slopes or not – depending on what is on the

down gradient side of the fence, i.e. waters of the state, etc. Depending on the situation it is at times necessary for its structural qualities, for example when dirt clods or larger rocks tend to roll down fill slopes.
Yes but it needs to be used adjacent to waters of the state as well
Yes.
Yes
I think silt fence w/b should be used more. It works better to retain soils
Yes. Enhanced silt fence should be removed from use in concentrated flow applications.
Discussion
It lasts longer. Need to investigate the practice of using this device close to water.

What products are preferred by contractors?
Sediment tubes
Filtrexx Socks, Straw wattles, straw mulch
SFB Silt Fence Backing, longevity of BMP if placed correctly can last most all phases of project.
Sediment tubes quick and easy fix measure.
SILT FENCE AND SLOPE DRAINS
n/a
Silt fences, geotextiles.
Unsure
Silt fence with backing, rock checks
Silt fence
Sediment tubes (anything they can put out quickly)
N/A
N/A
Cheap under designed products
Whichever products create the least delay and make them the most money.
Inexpensive products
No suggestions
Straw wattle
EPSC devices that utilize rock are preferred by contractors.
DISCUSSION
Rock check dam and, Sediment tube

Is trenching of rock checks and enhanced rock checks necessary to improve performance of the measure?
No, as long as they are installed to prevent bypassing and have a proper weir
No, as long as it is installed properly
No as long as it is Rip Rap! Equivalents probably due to weight differences and stability concerns in high velocity of concentrated flow applications.
YES
N/A
Yes!
No
Yes, this allows for the undermining of the check
No
Yes
Would help
Yes to prevent undercutting.
N/A
N/A

No
Yes
Yes
No. There is a study Auburn University did on this topic.
Yes
No.
DISCUSSION
Mixed feedback but NO

How often is mulch applied at the specified rates per TDOT standards?
Never
Unknown
Varies usually lower than specified. Cost of straw, multiple re-application but if paid for temporary mulch with every application explains why not crimped or tacked. Sometimes the availability of straw/mulch growing year dictates cost and availability of straw. High cost and availability of dictates the application rate for that season on some projects.
VERY OFTEN
N/A
As often as needed to maintain coverage.
Unsure
I would assume very often
Most of the time
Once
Seldom
Not too often.
N/A
N/A
Never measured
About 25% of the time.
No suggestions
Most of the time it is unless the inspection request something different
Not often. It is difficult to visually determine the application rate. Possibly have a handbook that contains photos of various application rates.
DISCUSSION
Seldom, practice needs improvement in field.

Are there any EPSC devices shown on the plans that you generally change to an alternate device in the field due to your experience with its performance? If so, please explain.
Erosion eels perform better than Geohay and sediment tubes
Not Applicable
QPL equivalents if the use of the BMP equivalent is not producing outcome as the original produced.
EPSC MEASURES PUT IN AS PLANS SHOW
N/A
RCD's to sediment tubes in the event of sodding in the next couple of days.
Unsure
Not at first, but contractor usually likes to change to geo-hay rather than rock check
No
Unknown
Rock check dams to sediment tube check dams
N/A
N/A

No
I never use the wood and wire fabric "chicken coops" for storm water structure protection. They are just too much trouble and are not feasible under traffic.
No suggestions
EC-STR-3D, EC-STR-4 & 4A. Rock check and Enhanced Rock Checks are easier to install and maintain than the Enhanced silt fence checks. Enhanced silt fence checks should be removed from use in concentrated flow applications.
Discussion
Limit the use of CB inlet protection, especially for large structures. Delete Enhanced silt fence checks for dich applications. Set up short-term dich check application with sediment tube.

How often is fertilizer used when applying vegetation?
Only when the contractor has to vegetate an area near end of project
Unknown
Dependent on existing soil condition and if top soil available on plans. Lately majority of projects have used sod as final stabilization. Fertilizer is used, yet application rates are questionable.
VERY OFTEN
N/A
Every time.
Unsure
Truthfully I would assume very little
Most of the time
Unknown
I do not think very often.
N/A
N/A
Always
I believe most reputable seeding subcontractors apply some fertilizer when seeding large areas. So it's probably about 50% of the time.
No suggestions
All the time
Discussion
Mixed feedback. Practice needs improvement in field.

How often seed beds are properly developed when applying vegetation?
Not very often
Unknown
VERY OFTEN
N/A
Sometimes (Not Enough)
Unsure
In the last few years I would say this has been going on regularly.
60/40
Unknown
Not often enough
Not too often.
N/A
N/A
Always

Not very often because the grading contractor is preparing the ground and a seeding sub is applying the vegetation. The seeding sub is probably not going to complain to the prime unless the preparation is awful.
Could be improved
Discussion
Practice needs improvement in field to use often.

Have you used PAM (polyacrylamide) on a project? If so, how did it perform?
Yes, not very well due to settling area and improper application rates
Never used
NO
N/A
Yes, very well.
No
No
No
No
Yes, the gel logs are not great but other works well
No
N/A
N/A
No
Yes. And there are very particular cases where nothing else will accomplish the necessary treatment. I think it should be used judiciously because you can end up spending 90% of your money to cure 10% of the problem. It must have contact time with storm flow and settling time after contact. It generally takes more than advertised.
No suggestions
Yes. It did not perform as well as we would have liked, we ended up using another product
Discussion
Practice needs improvement in field to use often.

Have you used Bonded Fiber Matrix?
Yes
No
NO
N/A
No
No
Yes
No
No
Yes
No
N/A
N/A
No
Yes
No suggestions
Yes we have performed TDOT Quality Assurance Audits for projects that have utilized bonded fiber matrix.

Discussion
Limited use. Explore how to expand the use.

If you used Bonded Fiber Matrix, have you applied with seed or without seed?
With seed and it worked great
Not Applicable
N/A
N/A
N/A
No
With seed
No
With
No used
N/A
N/A
N/A
I have always used with seed because the TDOT spec paid for it that way.
No suggestions
With seed.
Discussion
Limited use. If used seed is applied.

If you used Bonded Fiber Matrix, how did it perform?
Really good, however on steep or vertical slopes it sloughed due to vegetation and water weight
Not Applicable
Well, impressed with ability to hold to different slope rates. Fertilizer, seed, water and structual fiber works very well with one application. If used need to include a quick germinating seed to quickly stabilize application on steeper slopes. Have seen in rill out waiting on seeds to root and germinate if not applied during window where rain chances are low. Costly so the fewer applications, no reapplications for cover in not germinating quickly enough creating additional costs
N/A
N/A
N/A
NA
In most areas very good, only been few instances where it did not take.
Unknown
Pretty well
Not used
N/A
N/A
N/A
Very well if applied in sufficient amount per unit area and care was taken to eliminate gaps in coverage.
No suggestions
The bonded fiber matrix performed well.
Discussion
Positive experience explore how to use more.

If you used Bonded Fiber Matrix, did the performance justify the cost difference with typical seed and mulch?
Yes, did not have to reapply seed due to washing away
Not Applicable
Yes on a case by case basis. Where not safe to stabilize with seed mulch are other conventional methods that make application of seed mulch limited to impossible
N/A
N/A
N/A
NA
There is no cost difference for the department as it is paid per matting and seed.
Unknown
If used in the right situation
Not used
N/A
N/A
N/A
I only remember using it when it was not possible to apply seed and blanket.
No suggestions
The cost of bonded fiber matrix is justified when used on steep slopes and areas difficult to place typical seed and mulch and erosion control blankets.
Discussion
Yes the cost is justifiable. Especially at locations with limited access.

If you used Bonded Fiber Matrix, are they equal to or better than blankets?
Better
Not Applicable
Better, primarily the seed is bonded or attached to the slope or soil shere applied. Blankets do not have bond to seed and seed will sometimes wash out underneath the blanket.
Blankets work great
N/A
N/A
NA
I prefer this as you can see the result usually quicker
Unknown
Yes as long as they don't break up
Not used
N/A
N/A
N/A
Yes
No suggestions
Bonded fiber matrix could be used in area difficult to access for blanket install.
Discussion
Quick results and easy application

Have you used Tackifiers? What types of Tackifiers are being used?
No
No
Yes, petroleum based tacks only. No resins only seen once cost prohibitive.
NO

N/A
Yes, asphalt emulsion
No
No
No
No
N/A
N/A
N/A
Very seldom.
No suggestions
No.

Discussion

Very limited use. Explore how to expand the use of Tackifiers.

Which TDOT catch basin/area drain inlet protection have you found to perform the best?

Most do ok but the EC-STR-40 series does good but contractors hate them due to constructing
Filtrexxx Socks and Domed Drop inlet protectors
EC-STR-19 Type A Section C-C Mineral Aggregate use
SEDIMENT TUBES
N/A
Silt savers
I do not have much experience in this area
Silt savers if installed correctly
The ones made with 2x4" the dome ones wear out on long time bases
Unknown
Filter assemblies - silt savers
I think the silt saver devices perform well when installed properly.
N/A
N/A
Premanufactured devices
Silt savers work well and the TDOT Standards on EC-STR 11, 19, 39 and 39A (for under traffic situations) work well.
Curb Inlet Protection types 1 and 2 and slip cover filter assemblies
U end wall
They all work, but depends on the drainage area to each structure
EC-STR-19 Type E does not meet the current TDEC EPSC manual.

Discussion

Remove Type E from EC-STR-19. Others devices are working well. Limit the field installation time for generic CB assembly standard.

Do you have any recommendations about performance of EPSC practices?

No
Use of more detention on projects yet this will increase room needed for ROW. Series of BMPs with detention integrated in first two phase works very well to prevent overwhelming of outer measures and overall turbidity. Increase the need monetarily for final stabilization of disturbed areas as possible will prevent over expenditures of additional BMPs (multiples etc.) from needing to be used.
Always install EPSC measure correctly
N/A
N/A
No

Do not like sediment tubes for check dams
No
I think having the contractor install the devices correctly and also temporary stabilizing the work area quickly and often are big helps.
N/A
N/A
No
Schedule to install sediment control measures before they are critical by constantly surveying the forecast construction events and ascertaining the area, slope and flow path of anticipated storm flow from areas to be disturbed (project where the water is going to go).
Provide erosion prevention measures at the earliest possible time.
The standard measures work if installed properly and used for the right applications.
Discussion
Explore how to use sediment basins often since they allow contractor to perform construction phasing freely. Remove sediment tubes from ditch applications.

Which EPSC products are the easiest to maintain?
Silt fence with backing and check dams
Rock Check Dams
Silt Fence Backing Silt Fence
SILT FENCE
N/A
SILT FENCE / GEOTEXTILE
Rock Check Dams
Silt fence
Check dams and silt fence
Unknown
Silt fence with backing
N/A
N/A
Unknown
No suggestions
Silt fence
Discussion
Silt fence with wire backing and rock check dams.

Which EPSC products are the most difficult to maintain?
Regular silt fence, geo-hay
Silt Fence
Sediment Traps Basins
ROCK CHECK DAMS
N/A
ERCD's
Silt fences
Geo-hay, silt savers, and sediment filter bag
Unknown
Rock check dams
N/A
N/A
Unknown
Ponds

Check dams
EPSC products that are installed without sufficient access to maintain them are difficult.
Discussion
Interesting respond when compared to previous question's results.

Are there products that seem to cost too much but perform superior to others?
Hydro mulch
Filtrexxx Socks
Rock Checks, Enhanced Rock Checks, Silt Fence Backing
YES
N/A
N/A
Unsure
Rock checks vs geo-hay, rock checks are better
Unknown
I am not sure about the costs.
N/A
N/A
Unknown
No suggestions
Discussion
Rock check dams.

From your perspective, is it possible to reduce the frequency of inspection?
No, because most contractor only care about moving dirt not maintenance of EPSC
Yes
Yes the quicker stabilization (FINAL) with the use of sod on disturbed areas the quicker the EPSC inspections can be reduced or eliminated, leaving only roadway surface work, signage, marking etc.
YES
I guess it is possible, but not advisable. I have seen EPSC measures that have gone a while without being maintained.
NO
It depends on the frequency of rain in the area of the project
Yes, depending on the weather on the project and type of work
Depends on the project and exposed area
No
Depends on the project and site
No I think knowing the measures will be inspected regularly makes the contractor do a better job keeping them installed and working properly.
N/A
N/A
Probably not
No, I believe an EPSC inspector should be on site at all times on linear projects and projects disturbing greater than 5 acres.
Yes
No. A minimum of twice weekly inspections are necessary to make sure EPSC devices are maintained and adjusted to changing drainage patterns as construction progresses.
Discussion
Inspections are needed not only to monitor the performance of the device (stable and cleanout) but mostly to address dynamic changes within the construction area.

What do you consider as the most difficult maintenance technique?
Cleaning out sediment traps or basins
Keeping silt fence maintained due to typical large amounts of the measure on site
Consistency in performing maintenance, especially when BMP is not effective and requires routine maintenance.
TEMPORARY STREAM CROSSING
N/A
SEDIMENT REMOVAL
Unsure
Cleaning rock checks depending on the amount of cleaning
Unknown
Cleaning out sediment behind check dams
N/A
N/A
Unknown
No suggestions
Dewatering of devices is difficult.
Discussion
Sediment removal.

Would there be a benefit to having a separate line item for maintenance of EPSC devices? Please explain.
Yes, would improve contractor effort more if he knew he was getting paid for it
Yes. More accurate accounting. It would also provide insight to how much time is actually spent on maintenance.
No it would become wordy making the attention to detail become time consuming. Short too point be specific. If part of the contract then lump sum it.
NO
N/A
Yes, being able to establish between required installation and maintenance
Unsure
If they lowered the cost of the items then yes, but if not then there wouldn't be any benefit
It would be on a large project hard to keep up with an item for EPSC maintenance now the contractor is responsible for maintaining an item. the inspector can tell him to fix it and he will if you have an item i can foresee some contractors changing items out on a regular basis without the inspectors knowledge.
Unknown
Yes, then the sub-contractors or prime would be much more likely to do it.
It may give the contractor a reason to keep measures in good shape if they think they will be paid for doing this.
N/A
N/A
Yes, it’s always better to pay someone for work done.
I don't believe so. I think that would just add confusion to the bidding process. The contractors need to be educated on the maintenance and installation practices
No suggestions
No as long as pay items are provided to pay for items to be replaced.
Yes when maintenance of devices is included in the cost of the EPSC device there is not incentive for the contractor to perform the maintenance.
Discussion
Consider to pay maintenance separately.

Is the EPSC device installer typically responsible of maintaining the devices? Whether yes or no, please describe the pros and cons.

About half the time, if contractor maintains the devise it will get done a lot faster than EPSC subcontractor

Yes. The pros of this is that the contractor is intimately familiar with the measure and its placement but the downside to this is when you get a bad contractor, they may not be very responsive to maintenance requests.

Usually, yet varies so yes and no. Pros one contact and can do all. Con cannot keep up with multiple demands of large projects than Prime contractor who is on project 24/7. Quicker response if Prime is the maintainer of the BMPs and can implement some measures on an as needed basis. So Prime overall needs to be responsible for all and held responsible for all. Sub agreement between Prime and that contractor. TDOT deals with Prime and ultimately should be holding prime responsible.

YES

N/A

Yes

Yes

Typically yes, but in some instances where the installer is further away and doesn't have local forces then another contractor usually does the work

Yes, pros is the inspector can keep up with the repairs normally the EPSC installer only fixes them when they are directed to. Cons is the inspector normally has to tell them to fix or maintain an item.

No, it is everyone responsibility if see any failure.

yes, but the subs usually have to bid it so low that seems like the contractors have a hard time getting them back on site to do maintenance - they only make money on install of new items

No, generally the contractor does the maintenance. It seems the contractor could do the maintenance better since they are out there each day.

N/A

N/A

Yes

No suggestions

Yes

EPSC device installer is typically responsible for maintenance. However, some contractors will maintain certain devices. Pros – installer know how to properly repair/replace. Cons – difficult to meet required timeframe to complete repair when installer maintains devices.

Discussion

Prime contractor is responsible for the maintenance.

Do you have any recommendations to improve or eliminate maintenance activities?

Not really since it will always have to be done to allow devise to work properly

No

Sod get it green as soon as possible. Make it profitable for the Contractor to get project to final stabilization as possible.

Repair and clean as needed

N/A

N/A

No

No

Make it cost effective

Just to encourage contractors to be prompt to do maintenance recommended by the inspector.

N/A

N/A

No

No suggestions.
EPSC devices should be maintained as currently required.
Discussion
Maintenance needs improvement. Separate pay item for maintenance to give incentive. Have prime liable for maintenance.

Are there any devices in which the tabulated quantities do not match the plans?
Rock amounts
No
Rock Rip Rap Quantities Rock checks and Enhanced Rock Checks
YES
n/a
NO
Possibly
Depending on the project sometimes there are conditions that were not caught in the design that we have to add items for.
No
57 stone for construction entrances actually most stone is underestimated
Unknown
Everyone makes mistakes, but I know we try to check this when we do quantities
N/A
I am not aware of any.
No
Not with any consistency
No suggestions
Discussion
Rock quantities.

Do you have any other recommendations to modify the current practices?
Just need more oversight of subs/contractors installing measures
No
None at this time
NO
N/A
NO
No
The design phase field visits should help rectify some of these situations
Yes. Set a conformity for when EPSC items are used. For instance, sediment tubes are to be used for ditches or cut slopes.
No
No
N/A
Not at this time
No
Better supervision of installation of measures.
Comments from the reviewers need to be more consistent with recommendations
No suggestions
Discussion
Additional SITE REVIEW should address some design issues.

Are there times when devices are not accurately depicted on the plans?
Yes, a lot of the measures are not shown on the plans correctly but sometimes the plans vs field don't match
Not typically
Sediment filter bags locations to waters of State
YES
N/A
Yes
Possibly
It's a case by case situation in which something might have been missed or the weather changes the topography
Yes
Unknown
It is hard sometimes because of the scale of the drawings to show devices accurately.
N/A
N/A
Yes, some engineers do not take time to assure quality designs
Yes
Yes. Several EPSC features are incorrectly sized or unclear when using the TDOT CADD standards
Yes.
YES
Discussion
Explore the possibility of correctly locating scaling devices on the plans. Improve QA/QC review for Erosion Plans.

Are there any EPSC devices, which TDOT has a standard drawing for, you never use? If so, please describe.
CATCH BASIN FILTER ASSEMBLY (TYPE 1) because contractors hate making them
Unknown
None at this time rather have the option to use than not to have.
NO
Sediment tube, enhanced silt fence in ditches, rock sediment dam, sediment basin, floating turbidity curtain
NO
Unsure
Not sure
Yes. Sediment Basin
Unknown
Yes, in 28 years of doing this type of work I have never seen enhanced silt fence checks or some of the catch basin options used.
N/A
Perm. Slope Drains, Filter Berms, Enhanced Silt Fence Checks, Sediment Traps, Gabion Check Dams, Level Spreaders, Floating Turbidity Curtain
Yes, but perhaps the need hasn't arisen
I never use the wood and wire fabric “chicken coops” for storm water structure protection. They are just too much trouble and are not feasible under traffic.
No suggestions
Discussion
Recommend removing Enhanced silt fence checks, Gabion Check Dams, Level Spreaders, and CATCH BASIN FILTER ASSEMBLY (TYPE 1).

Are there times when useful EPSC devices/measures are not included as items on the plans? If so, please describe.

Yes, most general items should always be included in plans quantities even in small amount to allow use
Yes. Sometimes field conditions dictate additional measures not seen during the plan production
Sediment tubes are useful for quick fixes when needed. Usually not included in most plans smaller projects bridge repair projects etc. Very versatile measure need item number and some quantity to implement.
YES
N/A
NO
Unsure
It's a case by case situation in which something might have been missed or the weather changes the topography
NO
Slope drains on smaller projects
Unknown
All EPSC items should be available without the hassle of change order, need some type of standardized pricing
Probably because as a designer you try to account for all the contractors needs but sometimes situations come up that require other measures.
N/A
N/A
(Same)
Sediment tubes are sometimes left out. You can't build a job without sediment tubes. Also temporary seeding with mulch and mulch without seeding.
Yes. Construction often request items be added to the plans at field reviews.
Yes, sometimes there is not temporary seed and mulch in the plan quantities

Discussion

Evaluate and recommend listing all devices and item numbers on all roadway plans so a contractor can use an alternative EPSC method without a construction revision or change order.

Do designers properly utilize EPSC devices according to conditions shown on site plans?

50/50, some yes while other plans no not at all
Yes
In most cases. If so can address in Design reviews and Construction Reviews
MOST OF THE TIME
n/a
YES
Not necessarily
Typically yes
Yes
Most projects
Unknown
Most of the time
I will speak for our company that we try.
N/A
N/A
Sometimes, no
Most of the time.
Usually.
Usually

No. Silt fence and check dams are not always shown correctly on the plans. Silt fence is shown crossing contours instead of running parallel to the contours and check dams are not spaced properly on the plans, nor is the height of the check dam specified.

Discussion

Usually yes but recommend design specific train need instead of permit compliance such as level I and II.

Are stream diversions being shown on the plans and are they the appropriate type for the field conditions/terrain?

Yes
Not Applicable
Not always unless requested. If addressed on plans eliminates majority of questions from Contractors.
YES
I have put stream diversions on the plans.
YES
Unsure
Typically yes
Yes
Unknown
Yes
Mostly, but sometimes what you see on plans as a designer look different in the field and require changes.
N/A
N/A
No experience
In some cases they are impractical to construct in sequence of project construction.
Usually.
Varies, sometimes filed conditions differ
Yes.

Discussion

Yes, they are.

Are sediment traps being shown on plans where needed? How often do you add sediment traps as a revision to your SWPPP in the field?

Yes, and we do add them from time to time on big linear jobs
Not Applicable
Rarely, beginning to see change in plans. Add constantly and as many as possible.
Yes, several times
N/A
YES/NEVER
Unsure
Not much experience with these
Yes they are being provided where needed. No. We don't use them very often.
Yes, have not
Unknown
They are used but we have made recommendations to add sediment traps where the contractor is constantly cleaning out behind enhanced rock check dams.
N/A
N/A
Not experienced
No comment
No suggestions
Depends on the drainage area,

Additional storage behind check dams is added rather than sediment traps per the standard drawing.
Discussion
Yes, seldom added to SWPPP as needed.

How often do you use sediment basins as shown on TDOT standard drawings?
75% of the time, contractors don't like them due to maintenance requirements
Not Applicable
10-15% Dependent on project size drainage area size and receiving waters.
Very often
N/A
Most of the time
I do not have much experience with sediment basins.
Never if possible.
Unknown
Rarely
Fairly often
N/A
No
Every time one is needed
When absolutely necessary.
No suggestions
Have not used one
Rarely.
Discussion
They are used rarely, but if shown on plans usually it can be installed in accordance to the details.

How much accuracy should be expected of the EPSC plans and quantities without knowledge of a contractor's construction phasing?
Should be 80% accurate, however all contractors are different on when they work and finish an area
This should be reasonably accurate
Limited accuracy, SWPPP is living document for a reason. Contractor varies on how project to be constructed, guesses on how contractor will phase. If environmentally sensitive then TDOT plans and SWPPP should dictate the phasing when needed.
100 ACCURACY
n/a
85%
The designer is responsible for doing his best, but he does not always have all the information he needs.
Not much
Accurate to the SWPPP consultant's designation
most of the time the items are there to use the change in phasing my change the EPSC plans some but most of the time you can work with it as long as you have the items.
Unknown
Plans are just a depiction to give contractor an option that should work and items needed, can't always guess the sequence of construction
The plans should only be a guide for the contractor. In not knowing his phasing you have to go by a generic phasing plan that you have seen on other projects.
N/A
I would think that it would be reasonably close. Although the contractor may stage things differently, the items would still need to be used at some point in the project.
Accurately enough to make reasonable estimates and allow for unforeseen field conditions
None

The EPSC plans are useless without knowledge of the construction phasing
Accuracy suffers if phasing is not anticipated during design.
It should be an idea of how epsc should be done but needs to have enough quantity in plans to cover the contractors phasing
Designers should be familiar with roadway construction methods in order to prepare a set of plans are accurate and will work if constructed as shown in the plans. It is difficult to determine the method a specific contractor will use to construct the project.

Discussion

Erosion plans should be discussed during the constructability field review in order to improve plans accuracy.

Do you find that construction phasing and grading substantially affects the actual area draining to a device in contrast to the drainage areas on the plans that the EPSC measures were designed for? If so, how do you adjust for that?

Yes, however contractors typically change and argue that the phasing limits his progress and does not typically follow suggested phasing
No
Yes, varies constantly
YES, WE INCREASE EROSION MEASURES IN THAT AREA
N/A
NO
Unsure
Yes, just have to play with it and adjust as you proceed
Grading from the staging is added in by correspondence to the TDOT Drainage Manual
In some cases yes, but if you have items available you can adjust by using combination of required items
Unknown
Depends on the site, it can. Increase the length of the treatment train or try to break up the drainage area and divert flows
It could and if so you have to beef up the measures.
N/A
N/A
Yes, but that is a reasonable scenario. Make sure devices have "safety factors" built in to account for this.
Experience
Yes. Adjustments should be made in the field as grading progresses and the site changes.
Yes, it has to be at the inspector level to recognize that and make field modifications
No.

Discussion

Yes. Often adjustments made to improve erosion control practices in the field.

Do you have any recommendations about how to improve plans accuracy?

Hard for designer to understand site if they never see it vs designing off of topo sheets
No
None at this time. Unless Design wants to become more specific in dictating the Contractor's phasing
LOOK PLANS OVER GOOD AT FIELD REVIEWS
N/A
N/A
No
Start doing the field reviews in the field instead of in a Regional Office.
Conform EPSC measures to set quantities and conform all EPSC devices to be used only for certain measurements unless otherwise advised by a SWPPP consultant
Go to the field and visit the site.

Not at this time
Input during field review would help the designer. The TDOT construction office is familiar with what measure works best in their area and could pass along recommendations.
N/A
N/A
No
No comment
No suggestions.
Quantity calculations should be reviewed to reduce and/or limit quantity and cost overruns. It may be necessary to access selected projects to compare the estimated quantities to the actual quantities used during construction.
Discussion
Site review is needed. The new mandatory new site visit step should also identify erosion related issues.

Is there any specific training that you would like have?
No
Certification of installers of BMP EPSC on TDOT projects to include TDOT personnel.
NO
Since training is a part of my job now, I guess a class on how to train wouldn't hurt even though Randy and I have had good feedback in our training classes.
Not at this time.
No
Training for EPSC Design and Water Quality Requirements for Environmental Permitting Process
Unknown
It might be helping to have like a question and answer meeting with TDOT and contractors. this way everyone can find out problems the other are having and work toward a solution. I think communication is a big help doing anything.
N/A
N/A
My training level is sufficient
No
TDOT should maintain Level 1 and 2 certifications for all design employees.
Discussion
Mixed feedback. There are already few trainings. Certifying installers should be considered. A new design training is also recommended.

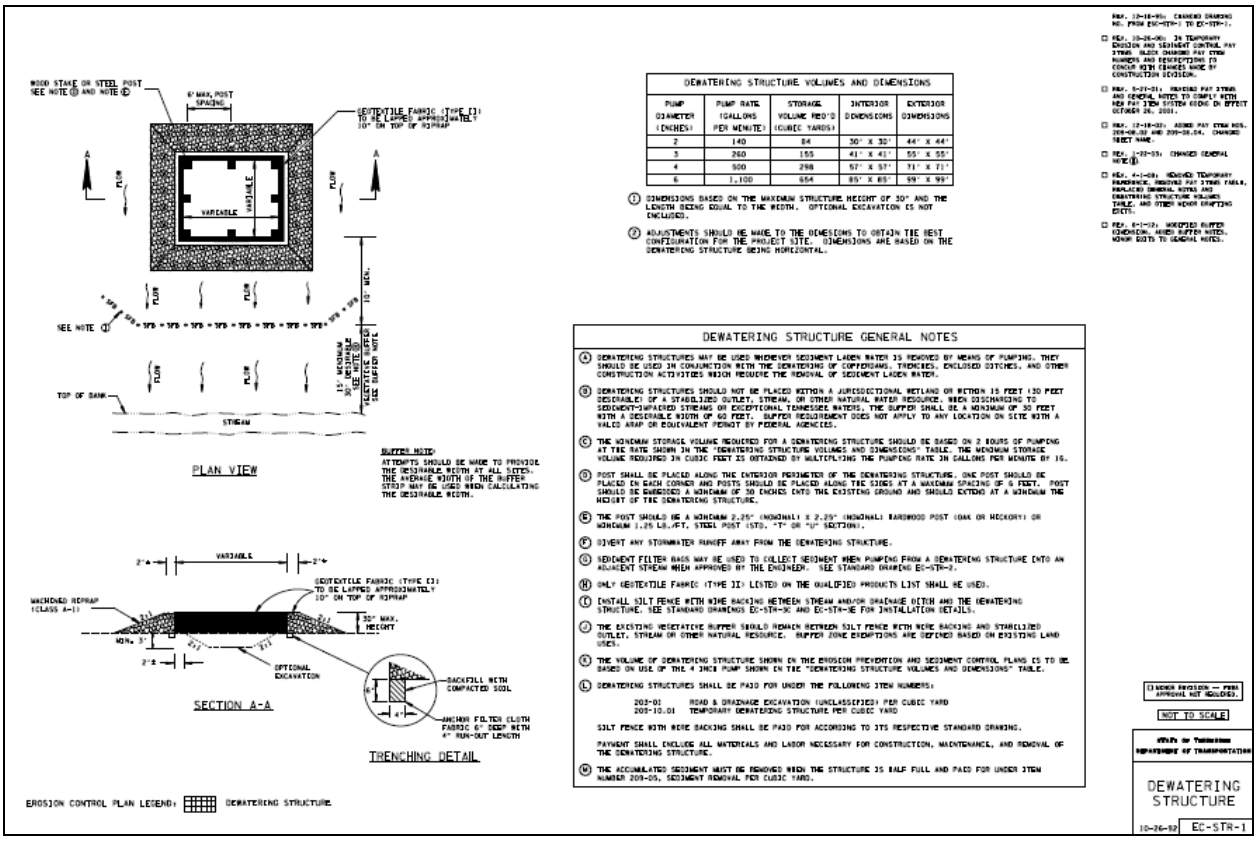
Are there devices that you have used on non-TDOT projects or that you have come up with on your own that you think would be beneficial for TDOT to review?
Would like to see more harvested trees used for mulch, mulch berms are a great EPSC device
No
Variations of slope application of sediment tubes or filter sock that prevents undercutting and riling on steep slopes. Allow a break point in each section on contour that allows water to find way out slowly to next contour. Maintains slope integrity and prevents riling.
NO
N/A
N/A
No
No.
Unknown
I cannot think of any. Most of our work is for TDOT.

I am brand new to EPSC and typically deal with the design portion. Therefore most of this survey did not pertain to myself.
N/A
Pre-fabricated inlet devices
In critical situations, I have used treatment ditches which are created flow way filled with appropriate material to filter out pam treated flow.
No.
PAM or other flocculants shall be looked at a little closer to determine which ones really work.
EPSC measures utilized on SR-840 project should be made into standards. An Equivalent Buffers standard should be developed based on equivalent sediment capture. A portable dewatering device – active treatment standard should be developed. The current EPSC standard drawings should be evaluated to see if they are equal to or better the devices in TDEC current manual and for changes in the upcoming construction general permit.

Discussion

Review and adopt 840 devices, consider active treatment systems, limit distance for slope applications. Promote the use of mulch berms often if applicable.

Appendix D:
Current Standard Drawings for Roadway EPSC Devices



DEWATERING STRUCTURE VOLUMES AND DIMENSIONS				
PUMP DIAMETER (INCHES)	PUMP RATE (GALLONS PER MINUTE)	STORAGE VOLUME REQ'D (CUBIC YARDS)	INTERIOR DIMENSIONS	EXTERIOR DIMENSIONS
2	140	84	30' X 30'	44' X 44'
3	260	155	41' X 41'	55' X 55'
4	500	298	57' X 57'	71' X 71'
6	1,100	654	85' X 85'	99' X 99'

(1) DIMENSIONS BASED ON THE MAXIMUM STRUCTURE HEIGHT OF 30" AND THE LENGTH BEING EQUAL TO THE WIDTH. OPTIONAL EXCAVATION IS NOT INCLUDED.

(2) ADJUSTMENTS SHOULD BE MADE TO THE DIMENSIONS TO OBTAIN THE BEST CONFIGURATION FOR THE PROJECT SITE. DIMENSIONS ARE BASED ON THE DEWATERING STRUCTURE BEING HORIZONTAL.

DEWATERING STRUCTURE GENERAL NOTES

(A) DEWATERING STRUCTURES MAY BE USED WHENEVER SEDIMENT LADEN WATER IS REMOVED BY MEANS OF PUMPING. THEY SHOULD BE USED IN CONJUNCTION WITH THE DEWATERING OF COFFERDAMS, TRENCHES, ENCLOSED DITCHES, AND OTHER CONSTRUCTION ACTIVITIES WHICH REQUIRE THE REMOVAL OF SEDIMENT LADEN WATER.

(B) DEWATERING STRUCTURES SHOULD NOT BE PLACED WITHIN A JURISDICTIONAL WETLAND OR WITHIN 15 FEET (30 FEET DESIRABLE) OF A STABILIZED OUTLET, STREAM, OR OTHER NATURAL WATER RESOURCE. WHEN DISCHARGING TO SEDIMENT-IMPAIRED STREAMS OR EXCEPTIONAL TENNESSEE WATERS, THE BUFFER SHALL BE A MINIMUM OF 30 FEET WITH A DESIRABLE WIDTH OF 60 FEET. BUFFER REQUIREMENT DOES NOT APPLY TO ANY LOCATION ON SITE WITH A VALID ARAP OR EQUIVALENT PERMIT BY FEDERAL AGENCIES.

(C) THE MINIMUM STORAGE VOLUME REQUIRED FOR A DEWATERING STRUCTURE SHOULD BE BASED ON 2 HOURS OF PUMPING AT THE RATE SHOWN IN THE "DEWATERING STRUCTURE VOLUMES AND DIMENSIONS" TABLE. THE MINIMUM STORAGE VOLUME REQUIRED IN CUBIC FEET IS OBTAINED BY MULTIPLYING THE PUMPING RATE IN GALLONS PER MINUTE BY 16.

(D) POST SHALL BE PLACED ALONG THE INTERIOR PERIMETER OF THE DEWATERING STRUCTURE. ONE POST SHOULD BE PLACED IN EACH CORNER AND POSTS SHOULD BE PLACED ALONG THE SIDES AT A MAXIMUM SPACING OF 6 FEET. POST SHOULD BE EMBEDDED A MINIMUM OF 30 INCHES INTO THE EXISTING GROUND AND SHOULD EXTEND AT A MINIMUM THE HEIGHT OF THE DEWATERING STRUCTURE.

(E) THE POST SHOULD BE A MINIMUM 2.25" (NOMINAL) X 2.25" (NOMINAL) HARDWOOD POST (OAK OR HICKORY) OR MINIMUM 1.25 LB./FT. STEEL POST (STD. "T" OR "U" SECTION).

(F) DIVERT ANY STORMWATER RUNOFF AWAY FROM THE DEWATERING STRUCTURE.

(G) SEDIMENT FILTER BAGS MAY BE USED TO COLLECT SEDIMENT WHEN PUMPING FROM A DEWATERING STRUCTURE INTO AN ADJACENT STREAM WHEN APPROVED BY THE ENGINEER. SEE STANDARD DRAWING EC-STR-2.

(H) ONLY (GEOTEXTILE FABRIC (TYPE II)) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(I) INSTALL SILT FENCE WITH WIRE BACKING BETWEEN STREAM AND/OR DRAINAGE DITCH AND THE (DEWATERING STRUCTURE. SEE STANDARD DRAWINGS EC-STR-3C AND EC-STR-3E FOR INSTALLATION DETAILS.

(J) THE EXISTING VEGETATIVE BUFFER SHOULD REMAIN BETWEEN SILT FENCE WITH WIRE BACKING AND STABILIZED OUTLET, STREAM OR OTHER NATURAL RESOURCE. BUFFER ZONE EXEMPTIONS ARE DEFINED BASED ON EXISTING LAND USES.

(K) THE VOLUME OF DEWATERING STRUCTURE SHOWN ON THE EROSION PREVENTION AND SEDIMENT CONTROL PLANS IS TO BE BASED ON USE OF THE 4 INCH PUMP SHOWN IN THE "DEWATERING STRUCTURE VOLUMES AND DIMENSIONS" TABLE.

(L) DEWATERING STRUCTURES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

203-01 ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER CUBIC YARD
209-10.01 TEMPORARY DEWATERING STRUCTURE PER CUBIC YARD

SILT FENCE WITH WIRE BACKING SHALL BE PAID FOR ACCORDING TO ITS RESPECTIVE STANDARD DRAWING.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE DEWATERING STRUCTURE.

(M) THE ACCUMULATED SEDIMENT MUST BE REMOVED WHEN THE STRUCTURE IS HALF FULL AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

REV. 12-18-09: CHANGED DRAWING NO. FROM EC-STR-1 TO EC-STR-1.

REV. 10-26-06: IN TEMPORARY EROSION AND SEDIMENT CONTROL PAY ITEMS OLDER DRAWING PAY ITEM NUMBERS AND DESCRIPTIONS TO CONCUR WITH CHANGES MADE BY CONSTRUCTION DIVISION.

REV. 9-27-01: REVISED PAY ITEMS AND GENERAL NOTES TO COMPLY WITH NEW PAY ITEM SYSTEM EFFECTIVE IN EFFECT OCTOBER 26, 2001.

REV. 12-18-02: ADDED PAY ITEM NOS. 209-08.02 AND 209-08.04. CHANGED SHEET NAME.

REV. 1-22-05: CHANGED GENERAL NOTE (L).

REV. 4-1-08: REMOVED TEMPORARY REFERENCE. REMOVED PAY ITEMS TABLE, REPLACED GENERAL NOTES AND DEWATERING STRUCTURE VOLUMES TABLE, AND OTHER MINOR DRAFTING EDITS.

REV. 6-1-12: MODIFIED BUFFER DIMENSION. ADDED BUFFER NOTES. MINOR EDITS TO GENERAL NOTES.

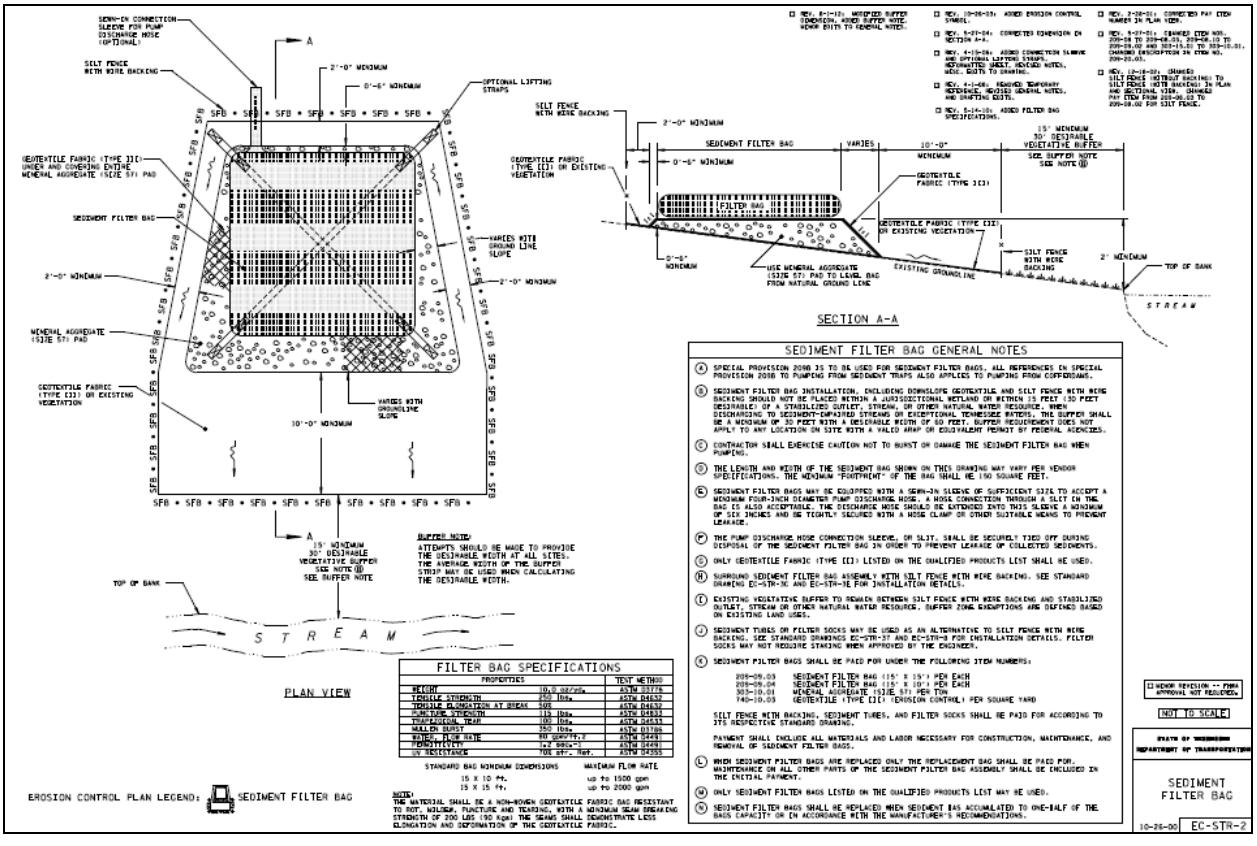
(1) MINOR REVISION — FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

DEWATERING STRUCTURE

10-26-99 EC-STR-1



FILTER BAG SPECIFICATIONS		
PROPERTIES		TEST METHOD
WEIGHT	10.0 oz/sq. yd.	ASTM D3776
TENSILE STRENGTH	250 lbs.	ASTM D4632
TENSILE ELONGATION AT BREAK	50%	ASTM D4632
PUNCTURE STRENGTH	115 lbs.	ASTM D4833
TRAPEZOIDAL TEAR	100 lbs.	ASTM D4533
MULLEN BURST	350 lbs.	ASTM D3786
WATER FLOW RATE	80 GPM/FT.²	ASTM D4491
PERMITTIVITY	1 x 10⁻¹ SEC⁻¹	ASTM D4491
UV RESISTANCE	70% @ 7. Hrs.	ASTM D4355

STANDARD BAG MINIMUM DIMENSIONS	MAXIMUM FLOW RATE
15 X 10 Ft.	up to 1500 gpm
15 X 15 Ft.	up to 2000 gpm

NOTE: THE MATERIAL SHALL BE A NON-WOVEN GEOTEXTILE FABRIC BAG RESISTANT TO ROT, MOLDING, PUNCTURE AND TEARING, WITH A MINIMUM SEAM BREAKING STRENGTH OF 200 LBS (90 Kgs) THE SEAMS SHALL DEMONSTRATE LESS ELONGATION AND DEFORMATION OF THE GEOTEXTILE FABRIC.

SEDIMENT FILTER BAG GENERAL NOTES

(A) SPECIAL PROVISION 2090 IS TO BE USED FOR SEDIMENT FILTER BAGS. ALL REFERENCES IN SPECIAL PROVISION 2090 TO PUMPING FROM SEDIMENT TRAPS ALSO APPLIES TO PUMPING FROM COFFERDAMS.

(B) SEDIMENT FILTER BAG INSTALLATION, INCLUDING DOWNSLOPE (GEOTEXTILE AND SILT FENCE WITH WIRE BACKING SHOULD NOT BE PLACED WITHIN A JURISDICTIONAL WETLAND OR WITHIN 15 FEET (30 FEET DESIRABLE) OF A STABILIZED OUTLET, STREAM, OR OTHER NATURAL WATER RESOURCE. WHEN DISCHARGING TO SEDIMENT-IMPAIRED STREAMS OR EXCEPTIONAL TENNESSEE WATERS, THE BUFFER SHALL BE A MINIMUM OF 30 FEET WITH A DESIRABLE WIDTH OF 60 FEET. BUFFER REQUIREMENT DOES NOT APPLY TO ANY LOCATION ON SITE WITH A VALID ARAP OR EQUIVALENT PERMIT BY FEDERAL AGENCIES.

(C) CONTRACTOR SHALL EXERCISE CAUTION NOT TO BURST OR DAMAGE THE SEDIMENT FILTER BAG WHEN PUMPING.

(D) THE LENGTH AND WIDTH OF THE SEDIMENT BAG SHOWN ON THIS DRAWING MAY VARY PER VENDOR SPECIFICATIONS. THE MINIMUM "FOOTPRINT" OF THE BAG SHALL BE 150 SQUARE FEET.

(E) SEDIMENT FILTER BAGS MAY BE EQUIPPED WITH A SEWN-IN SLEEVE OF SUFFICIENT SIZE TO ACCEPT A MINIMUM FOUR-INCH DIAMETER PUMP DISCHARGE HOSE. A HOSE CONNECTION THROUGH A SLIT IN THE BAG IS ALSO ACCEPTABLE. THE DISCHARGE HOSE SHOULD BE EXTENDED INTO THIS SLEEVE A MINIMUM OF SIX INCHES AND BE TIGHTLY SECURED WITH A HOSE CLAMP OR OTHER SUITABLE MEANS TO PREVENT LEAKAGE.

(F) THE PUMP DISCHARGE HOSE CONNECTION SLEEVE, OR SLIT, SHALL BE SECURELY TIED OFF DURING DISPOSAL OF THE SEDIMENT FILTER BAG IN ORDER TO PREVENT LEAKAGE OF COLLECTED SEDIMENTS.

(G) ONLY (GEOTEXTILE FABRIC (TYPE II)) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(H) SURROUND SEDIMENT FILTER BAG ASSEMBLY WITH SILT FENCE WITH WIRE BACKING. SEE STANDARD DRAWING EC-STR-3C AND EC-STR-3E FOR INSTALLATION DETAILS.

(I) EXISTING VEGETATIVE BUFFER TO REMAIN BETWEEN SILT FENCE WITH WIRE BACKING AND STABILIZED OUTLET, STREAM OR OTHER NATURAL WATER RESOURCE. BUFFER ZONE EXEMPTIONS ARE DEFINED BASED ON EXISTING LAND USES.

(J) SEDIMENT TUBES OR FILTER SOCKS MAY BE USED AS AN ALTERNATIVE TO SILT FENCE WITH WIRE BACKING. SEE STANDARD DRAWINGS EC-STR-3T AND EC-STR-4 FOR INSTALLATION DETAILS. FILTER SOCKS MAY NOT REQUIRE STAKING WHEN APPROVED BY THE ENGINEER.

(K) SEDIMENT FILTER BAGS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-09.03 SEDIMENT FILTER BAG (15' X 15') PER EACH
209-09.04 SEDIMENT FILTER BAG (15' X 10') PER EACH
303-10.01 MINERAL AGGREGATE (SIZE 57) PER TON
740-10.03 (GEOTEXTILE (TYPE (II)) "EROSION CONTROL") PER SQUARE YARD

SILT FENCE WITH BACKING, SEDIMENT TUBES, AND FILTER SOCKS SHALL BE PAID FOR ACCORDING TO ITS RESPECTIVE STANDARD DRAWING.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF SEDIMENT FILTER BAGS.

(L) WHEN SEDIMENT FILTER BAGS ARE REPLACED ONLY THE REPLACEMENT BAG SHALL BE PAID FOR. MAINTENANCE ON ALL OTHER PARTS OF THE SEDIMENT FILTER BAG ASSEMBLY SHALL BE INCLUDED IN THE INITIAL PAYMENT.

(M) ONLY SEDIMENT FILTER BAGS LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED.

(N) SEDIMENT FILTER BAGS SHALL BE REPLACED WHEN SEDIMENT HAS ACCUMULATED TO ONE-HALF OF THE BAGS CAPACITY OR IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

REV. 6-1-12: MODIFIED BUFFER DIMENSION. ADDED BUFFER NOTE. MINOR EDITS TO GENERAL NOTES.

REV. 10-26-06: ADDED EROSION CONTROL SYMBOL.

REV. 9-27-04: CORRECTED DIMENSION IN NOTION A-A.

REV. 4-1-08: ADDED CONNECTION SLEEVE AND OPTIONAL LIFTING STRAPS. REFORMATTED SHEET, REVISED NOTES, AND MINOR EDITS TO DRAWING.

REV. 4-1-08: REMOVED TEMPORARY REFERENCE, REVISED GENERAL NOTES, AND DRAFTING EDITS.

REV. 5-14-10: ADDED FILTER BAG SPECIFICATIONS.

REV. 2-28-01: CORRECTED PAY ITEM NUMBER IN PLAN VIEW.

REV. 9-27-01: CHANGED ITEM NOS. 209-08.70 TO 209-08.03, 209-08.10 TO 209-08.02 AND 303-15.01 TO 303-10.01. CHANGED DESCRIPTION IN ITEM NO. 209-02.01.

REV. 12-18-02: (SHOWS) (SILT FENCE (WITHOUT BACKING) TO SILT FENCE (WITH BACKING) IN PLAN AND SECTIONAL VIEW. (SHOWS) PAY ITEM FROM 209-08.03 TO 209-08.02 FOR SILT FENCE.

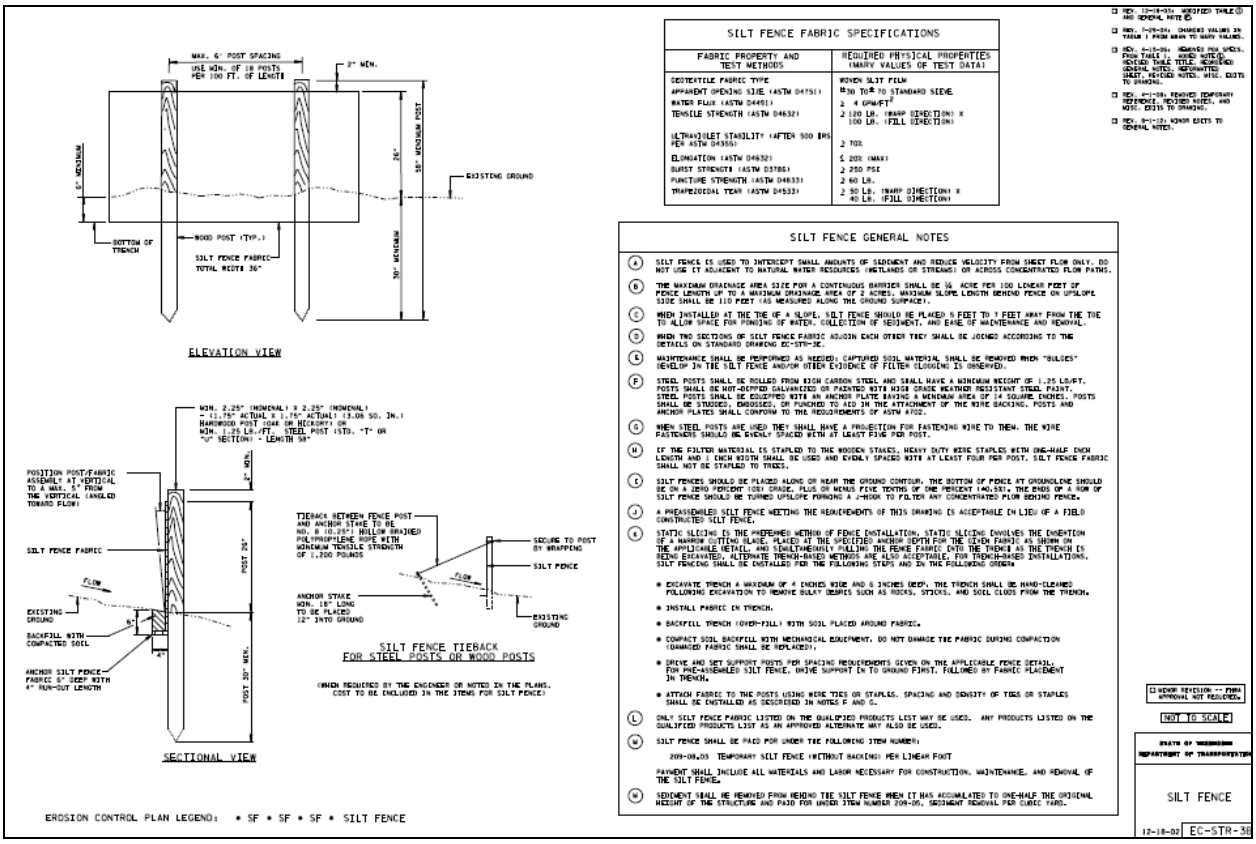
(1) MINOR REVISION — FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

SEDIMENT FILTER BAG

10-26-00 EC-STR-2



SILT FENCE FABRIC SPECIFICATIONS

FABRIC PROPERTY AND TEST METHODS	REQUIRED PHYSICAL PROPERTIES (MARV VALUES OF TEST DATA)
GEOTEXTILE FABRIC TYPE	WOVEN SLIT FILM
APPARENT OPENING SIZE (ASTM D4751)	#30 TO #70 STANDARD SIEVE
WATER FLUX (ASTM D4491)	≥ 4 GPM/FT²
TENSILE STRENGTH (ASTM D4632)	≥ 120 LB. (WARP DIRECTION) X 100 LB. (FILL DIRECTION)
ULTRAVIOLET STABILITY (AFTER 500 HRS PER ASTM D4355)	≥ 70%
ELONGATION (ASTM D4632)	≤ 20% (MAX)
BURST STRENGTH (ASTM D3786)	≥ 250 PSI
PUNCTURE STRENGTH (ASTM D4833)	≥ 60 LB.
TRAPEZOIDAL TEAR (ASTM D4533)	≥ 50 LB. (WARP DIRECTION) X 40 LB. (FILL DIRECTION)

SILT FENCE GENERAL NOTES

(A) SILT FENCE IS USED TO INTERCEPT SMALL AMOUNTS OF SEDIMENT AND REDUCE VELOCITY FROM SHEET FLOW ONLY. DO NOT USE IT ADJACENT TO NATURAL WATER RESOURCES (WETLANDS OR STREAMS) OR ACROSS CONCENTRATED FLOW PATHS.

(B) THE MAXIMUM DRAINAGE AREA SIZE FOR A CONTINUOUS BARRIER SHALL BE ½ ACRE PER 100 LINEAR FEET OF FENCE LENGTH UP TO A MAXIMUM DRAINAGE AREA OF 2 ACRES. MAXIMUM SLOPE LENGTH BEHIND FENCE ON UPSLOPE SIDE SHALL BE 100 FEET (AS MEASURED ALONG THE GROUND SURFACE).

(C) WHEN INSTALLED AT THE TOE OF A SLOPE, SILT FENCE SHOULD BE PLACED 5 FEET TO 7 FEET AWAY FROM THE TOE TO ALLOW SPACE FOR PONDING OF WATER, COLLECTION OF SEDIMENT, AND EASE OF MAINTENANCE AND REMOVAL.

(D) WHEN TWO SECTIONS OF SILT FENCE FABRIC ADJOIN EACH OTHER THEY SHALL BE JOINED ACCORDING TO THE DETAILS ON STANDARD DRAWING EC-STR-3E.

(E) MAINTENANCE SHALL BE PERFORMED AS NEEDED; CAPTURED SOIL MATERIAL SHALL BE REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE AND/OR OTHER EVIDENCE OF FILTER CLOGGING IS OBSERVED.

(F) STEEL POSTS SHALL BE ROLLED FROM HIGH CARBON STEEL AND SHALL HAVE A NOMINAL WEIGHT OF 1.25 LB/FT. POSTS SHALL BE HOT-DIPPED GALVANIZED OR PAINTED WITH HIGH GRADE WEATHER RESISTANT STEEL PAINT. STEEL POSTS SHALL BE EQUIPPED WITH AN ANCHOR PLATE HAVING A MINIMUM AREA OF 14 SQUARE INCHES. POSTS SHALL BE STUDDED, EMBOSSED, OR PUNCHED TO AID IN THE ATTACHMENT OF THE WIRE BACKING. POSTS AND ANCHOR PLATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A702.

(G) WHEN STEEL POSTS ARE USED THEY SHALL HAVE A PROJECTION FOR FASTENING WIRE TO THEM. THE WIRE FASTENERS SHOULD BE EVENLY SPACED WITH AT LEAST FIVE PER POST.

(H) IF THE FILTER MATERIAL IS STAPLED TO THE WOODEN STAKES, HEAVY DUTY WIRE STAPLES WITH ONE-HALF INCH LENGTH AND ¼ INCH WIDTH SHALL BE USED AND EVENLY SPACED WITH AT LEAST FOUR PER POST. SILT FENCE FABRIC SHALL NOT BE STAPLED TO TREES.

(I) SILT FENCES SHOULD BE PLACED ALONG OR NEAR THE GROUND CONTOUR, THE BOTTOM OF FENCE AT GROUNDLINE SHOULD BE ON A ZERO PERCENT (0%) GRADE, PLUS OR MINUS FIVE TENTHS OF ONE PERCENT (±0.5%). THE ENDS OF A ROW OF SILT FENCE SHOULD BE TURNED UPSLOPE FORMING A J-HOOK TO FILTER ANY CONCENTRATED FLOW BEHIND FENCE.

(J) A PREASSEMBLED SILT FENCE MEETING THE REQUIREMENTS OF THIS DRAWING IS ACCEPTABLE IN LIEU OF A FIELD CONSTRUCTED SILT FENCE.

(K) STATIC SLICING IS THE PREFERRED METHOD OF FENCE INSTALLATION; STATIC SLICING INVOLVES THE INSERTION OF A NARROW CUTTING BLADE, PLACED AT THE SPECIFIED ANCHOR DEPTH FOR THE GIVEN FABRIC AS SHOWN ON THE APPLICABLE DETAILS, AND SIMULTANEOUSLY PULLING THE FENCE FABRIC INTO THE TRENCH AS THE TRENCH IS BEING EXCAVATED. ALTERNATE TRENCH-BASED METHODS ARE ALSO ACCEPTABLE, FOR TRENCH-BASED INSTALLATIONS, SILT FENCING SHALL BE INSTALLED PER THE FOLLOWING STEPS AND IN THE FOLLOWING ORDER:

- EXCAVATE TRENCH A MAXIMUM OF 4 INCHES WIDE AND 6 INCHES DEEP. THE TRENCH SHALL BE HAND-CLEANED FOLLOWING EXCAVATION TO REMOVE BULKY DEBRIS SUCH AS ROCKS, STICKS, AND SOIL CLODS FROM THE TRENCH.
- INSTALL FABRIC IN TRENCH.
- BACKFILL TRENCH (OVER-FILL) WITH SOIL PLACED AROUND FABRIC.
- COMPACT SOIL BACKFILL WITH MECHANICAL EQUIPMENT. DO NOT DAMAGE THE FABRIC DURING COMPACTION (DAMAGED FABRIC SHALL BE REPLACED).
- DRIVE AND SET SUPPORT POSTS PER SPACING REQUIREMENTS GIVEN ON THE APPLICABLE FENCE DETAIL. FOR PRE-ASSEMBLED SILT FENCE, DRIVE SUPPORT IN TO GROUND FIRST, FOLLOWED BY FABRIC PLACEMENT IN TRENCH.
- ATTACH FABRIC TO THE POSTS USING WIRE TIES OR STAPLES. SPACING AND DENSITY OF TIES OR STAPLES SHALL BE INSTALLED AS DESCRIBED IN NOTES F AND G.

(L) ONLY SILT FENCE FABRIC LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED. ANY PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

(M) SILT FENCE SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.05 TEMPORARY SILT FENCE (WITHOUT BACKING) PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE SILT FENCE.

(N) SEDIMENT SHALL BE REMOVED FROM BEHIND THE SILT FENCE WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE STRUCTURE AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

REV. 12-18-02: MODIFIED TABLE ① AND GENERAL NOTE (K).
REV. 7-20-04: CHANGED VALUES IN TABLE 1 FROM MAX TO MARV VALUES.
REV. 4-15-05: MODIFIED FIBER ROLL, ADDED NOTES ⑤ AND ⑥, REVISED TITLE, REVISED GENERAL NOTES, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.
REV: 4-1-08: REMOVED TEMPORARY REFERENCE, REVISED NOTES, AND MISC. EDITS TO DRAWING.
REV: 8-1-12: MINOR EDITS TO GENERAL NOTES.

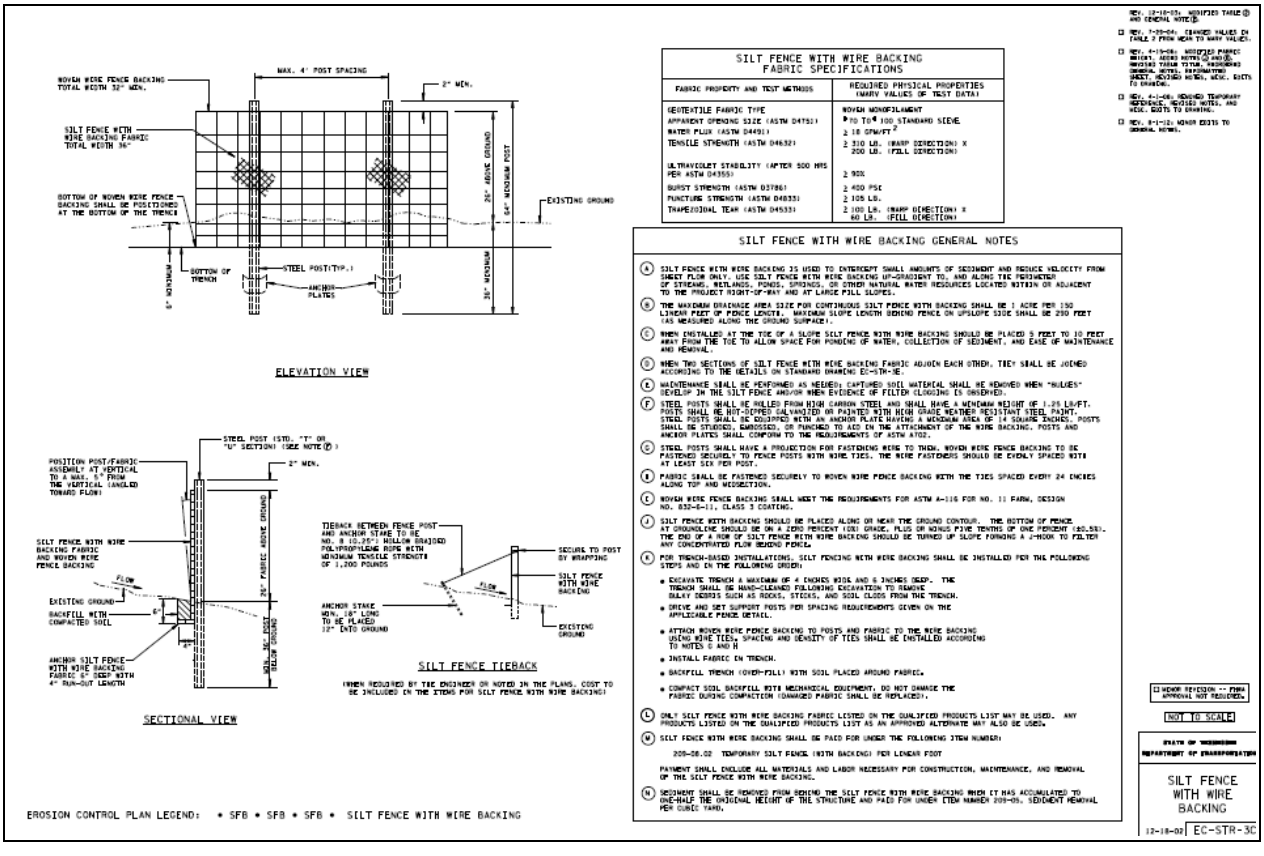
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF WASHINGTON
DEPARTMENT OF TRANSPORTATION

SILT FENCE

12-18-02 EC-STR-3B



SILT FENCE WITH WIRE BACKING FABRIC SPECIFICATIONS

FABRIC PROPERTY AND TEST METHODS	REQUIRED PHYSICAL PROPERTIES (MARV VALUES OF TEST DATA)
GEOTEXTILE FABRIC TYPE	WOVEN MONOFILAMENT
APPARENT OPENING SIZE (ASTM D4751)	#30 TO #70 STANDARD SIEVE
WATER FLUX (ASTM D4491)	≥ 18 GPM/FT²
TENSILE STRENGTH (ASTM D4632)	≥ 310 LB. (WARP DIRECTION) X 200 LB. (FILL DIRECTION)
ULTRAVIOLET STABILITY (AFTER 500 HRS PER ASTM D4355)	≥ 90%
BURST STRENGTH (ASTM D3786)	≥ 400 PSI
PUNCTURE STRENGTH (ASTM D4833)	≥ 205 LB.
TRAPEZOIDAL TEAR (ASTM D4533)	≥ 100 LB. (WARP DIRECTION) X 80 LB. (FILL DIRECTION)

SILT FENCE WITH WIRE BACKING GENERAL NOTES

(A) SILT FENCE WITH WIRE BACKING IS USED TO INTERCEPT SMALL AMOUNTS OF SEDIMENT AND REDUCE VELOCITY FROM SHEET FLOW ONLY. USE SILT FENCE WITH WIRE BACKING UP-GRADIENT TO, AND ALONG THE PERIMETER OF STREAMS, WETLANDS, PONDS, SPRINGS, OR OTHER NATURAL WATER RESOURCES LOCATED WITHIN OR ADJACENT TO THE PROJECT RIGHT-OF-WAY AND AT LARGE FILL SLOPES.

(B) THE MAXIMUM DRAINAGE AREA SIZE FOR CONTINUOUS SILT FENCE WITH BACKING SHALL BE 1 ACRE PER 150 LINEAR FEET OF FENCE LENGTH. MAXIMUM SLOPE LENGTH BEHIND FENCE ON UPSLOPE SIDE SHALL BE 250 FEET (AS MEASURED ALONG THE GROUND SURFACE).

(C) WHEN INSTALLED AT THE TOE OF A SLOPE SILT FENCE WITH WIRE BACKING SHOULD BE PLACED 5 FEET TO 10 FEET AWAY FROM THE TOE TO ALLOW SPACE FOR PONDING OF WATER, COLLECTION OF SEDIMENT, AND EASE OF MAINTENANCE AND REMOVAL.

(D) WHEN TWO SECTIONS OF SILT FENCE WITH WIRE BACKING FABRIC ADJOIN EACH OTHER, THEY SHALL BE JOINED ACCORDING TO THE DETAILS ON STANDARD DRAWING EC-STR-3E.

(E) MAINTENANCE SHALL BE PERFORMED AS NEEDED; CAPTURED SOIL MATERIAL SHALL BE REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE AND/OR WHEN EVIDENCE OF FILTER CLOGGING IS OBSERVED.

(F) STEEL POSTS SHALL BE ROLLED FROM HIGH CARBON STEEL AND SHALL HAVE A NOMINAL WEIGHT OF 1.25 LB/FT. POSTS SHALL BE HOT-DIPPED GALVANIZED OR PAINTED WITH HIGH GRADE WEATHER RESISTANT STEEL PAINT. STEEL POSTS SHALL BE EQUIPPED WITH AN ANCHOR PLATE HAVING A MINIMUM AREA OF 14 SQUARE INCHES. POSTS SHALL BE STUDDED, EMBOSSED, OR PUNCHED TO AID IN THE ATTACHMENT OF THE WIRE BACKING. POSTS AND ANCHOR PLATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A702.

(G) STEEL POSTS SHALL HAVE A PROJECTION FOR FASTENING WIRE TO THEM. WOVEN WIRE FENCE BACKING TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES. THE WIRE FASTENERS SHOULD BE EVENLY SPACED WITH AT LEAST SIX PER POST.

(H) FABRIC SHALL BE FASTENED SECURELY TO WOVEN WIRE FENCE BACKING WITH THE TIES SPACED EVERY 24 INCHES ALONG TOP AND INTERSECTION.

(I) WOVEN WIRE FENCE BACKING SHALL MEET THE REQUIREMENTS FOR ASTM A-116 FOR NO. 11 FARM, DESIGN NO. 832-6-11, CLASS 3 COATING.

(J) SILT FENCE WITH BACKING SHOULD BE PLACED ALONG OR NEAR THE GROUND CONTOUR. THE BOTTOM OF FENCE AT GROUNDLINE SHOULD BE ON A ZERO PERCENT (0%) GRADE, PLUS OR MINUS FIVE TENTHS OF ONE PERCENT (±0.5%). THE END OF A ROW OF SILT FENCE WITH WIRE BACKING SHOULD BE TURNED UP SLOPE FORMING A J-HOOK TO FILTER ANY CONCENTRATED FLOW BEHIND FENCE.

(K) FOR TRENCH-BASED INSTALLATIONS, SILT FENCING WITH WIRE BACKING SHALL BE INSTALLED FOR THE FOLLOWING STEPS AND IN THE FOLLOWING ORDER:

- EXCAVATE TRENCH A MAXIMUM OF 4 INCHES WIDE AND 6 INCHES DEEP. THE TRENCH SHALL BE HAND-CLEANED FOLLOWING EXCAVATION TO REMOVE BULKY DEBRIS SUCH AS ROCKS, STICKS, AND SOIL CLODS FROM THE TRENCH.
- DRIVE AND SET SUPPORT POSTS FOR SPACING REQUIREMENTS GIVEN ON THE APPLICABLE FENCE DETAIL.
- ATTACH WOVEN WIRE FENCE BACKING TO POSTS AND FABRIC TO THE WIRE BACKING USING WIRE TIES, SPACING AND DENSITY OF TIES SHALL BE INSTALLED ACCORDING TO NOTES G AND H
- INSTALL FABRIC IN TRENCH.
- BACKFILL TRENCH (OVER-FILL) WITH SOIL PLACED AROUND FABRIC.
- COMPACT SOIL BACKFILL WITH MECHANICAL EQUIPMENT. DO NOT DAMAGE THE FABRIC DURING COMPACTION (DAMAGED FABRIC SHALL BE REPLACED).

(L) ONLY SILT FENCE WITH WIRE BACKING FABRIC LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED. ANY PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

(M) SILT FENCE WITH WIRE BACKING SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.02 TEMPORARY SILT FENCE (WITH BACKING) PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE SILT FENCE WITH WIRE BACKING.

(N) SEDIMENT SHALL BE REMOVED FROM BEHIND THE SILT FENCE WITH WIRE BACKING WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE STRUCTURE AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

REV. 12-18-02: MODIFIED TABLE ① AND GENERAL NOTE (K).
REV. 7-20-04: CHANGED VALUES IN TABLE 1 FROM MAX TO MARV VALUES.
REV. 4-15-05: MODIFIED FIBER ROLL, ADDED NOTES ⑤ AND ⑥, REVISED TITLE, REVISED GENERAL NOTES, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.
REV: 4-1-08: REMOVED TEMPORARY REFERENCE, REVISED NOTES, AND MISC. EDITS TO DRAWING.
REV: 8-1-12: MINOR EDITS TO GENERAL NOTES.

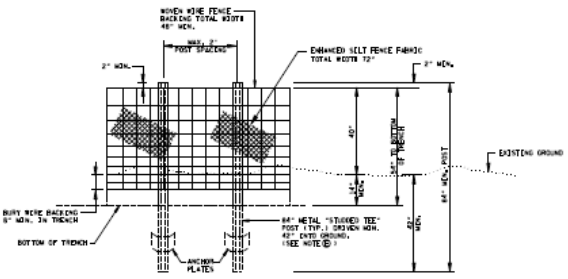
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

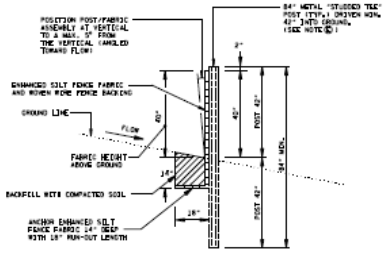
STATE OF WASHINGTON
DEPARTMENT OF TRANSPORTATION

SILT FENCE WITH WIRE BACKING

12-18-02 EC-STR-3C



ELEVATION VIEW



SECTIONAL VIEW

EROSION CONTROL PLAN LEGEND: ♦ ESF ♦ ESF ♦ ESF ♦ ENHANCED SILT FENCE

ENHANCED SILT FENCE FABRIC SPECIFICATIONS

FABRIC PROPERTY AND TEST METHODS	REQUIRED PHYSICAL PROPERTIES (MARV VALUES OF TEST DATA)
GEOTEXTILE FABRIC TYPE	WOVEN MONOFILAMENT
APPARENT OPENING SIZE (ASTM D4751)	♦ 30 TO ♦ 80 STANDARD SIEVE
WATER FLUX (ASTM D4491)	≥ 110 GPM/FT²
TENSILE STRENGTH (ASTM D4632)	≥ 370 LBS. (WARP DIRECTION) X 230 LBS. (FILL DIRECTION)
ULTRAVIOLET STABILITY (AFTER 500 HRS PER ASTM D4355)	≥ 90%
BURST STRENGTH (ASTM D3786)	≥ 470 PSI
PUNCTURE STRENGTH (ASTM D4833)	≥ 110 LB.
TRAPEZOIDAL TEAR (ASTM D4533)	≥ 115 LB. (WARP DIRECTION) X 75 LB. (FILL DIRECTION)
PERMEABILITY (ASTM D4491)	≥ 0.02 INCHES/SEC
THICKNESS (ASTM D5199)	≥ 35 MILS

ENHANCED SILT FENCE GENERAL NOTES

(A) ENHANCED SILT FENCE IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (e.g. SWALES, DITCHES, RUTS ALONG SLOPES) ARE ANTICIPATED. LENGTH OF FLOW APPLICATIONS FOR USE OF ENHANCED SILT FENCE ARE GIVEN ON STANDARD DRAWINGS EC-STR-4 AND EC-STR-4a. DO NOT USE ENHANCED SILT FENCE IN OR ADJACENT TO NATURAL WATER RESOURCES (WETLANDS OR STREAMS).

(B) ENHANCED SILT FENCE SHOULD NOT BE USED TO REPLACE SILT FENCE WITH WIRE BACKING.

(C) WHEN TWO SECTIONS OF ENHANCED SILT FENCE FABRIC ADJOIN EACH OTHER THEY SHALL BE JOINED ACCORDING TO THE DETAILS ON STANDARD DRAWING EC-STR-3E.

(D) MAINTENANCE SHALL BE PERFORMED AS NEEDED. CAPTURED SOIL MATERIAL SHALL BE REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE AND/OR WHEN EVIDENCE OF FILTER CLOGGING IS NOTED.

(E) STEEL POSTS SHALL BE ROLLED FROM HIGH CARBON STEEL AND SHALL HAVE A MINIMUM WEIGHT OF 1.25 LB/FT. POSTS SHALL BE HOT-DIPPED GALVANIZED OR PAINTED WITH HIGH GRADE WEATHER RESISTANT STEEL PAINT. STEEL POSTS SHALL BE EQUIPPED WITH AN ANCHOR PLATE HAVING A MINIMUM AREA OF 14 SQUARE INCHES. POSTS SHALL BE STUDDED, EMBOSSED, OR PUNCHED TO AID IN THE ATTACHMENT OF THE WIRE BACKING. POSTS AND ANCHOR PLATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A702.

(F) STEEL POSTS SHALL HAVE A PROJECTION FOR FASTENING WIRE TO THEM. WOVEN WIRE FENCE BACKING TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES. THE WIRE FASTENERS SHOULD BE EVENLY SPACED WITH AT LEAST SIX PER POST.

(G) WOVEN WIRE FENCE BACKING SHALL MEET THE REQUIREMENTS FOR ASTM A-116 FOR NO. 12 FARM, DESIGN NO. 1047-6-11, CLASS 3 COATING.

(H) FILTER FABRIC SHALL BE FASTENED SECURELY TO WOVEN WIRE FENCE BACKING WITH TIES SPACED EVERY 24 INCHES ALONG TOP AND MID SECTION.

(I) FOR TRENCH-BASED INSTALLATIONS, ENHANCED SILT FENCING SHALL BE INSTALLED PER THE FOLLOWING STEPS AND IN THE FOLLOWING ORDER:

- EXCAVATE TRENCH A MINIMUM OF 18 INCHES WIDE 14 INCHES DEEP. THE TRENCH SHALL BE HAND-CLEANED FOLLOWING EXCAVATION TO REMOVE BULKY DEBRIS SUCH AS ROCKS, STICKS, AND SOIL CLODS FROM THE TRENCH.
- DRIVE AND SET SUPPORT POSTS PER SPACING REQUIREMENTS GIVEN ON THE APPLICABLE FENCE DETAIL.
- ATTACH WOVEN WIRE FENCE BACKING TO POSTS AND FABRIC TO THE WIRE BACKING USING WIRE TIES. SPACING AND DENSITY OF TIES SHALL BE INSTALLED ACCORDING TO NOTES F AND H.
- INSTALL FABRIC IN TRENCH.
- BACKFILL TRENCH (OVER-FILL) WITH SOIL PLACED AROUND FABRIC.
- COMPACT SOIL BACKFILL WITH MECHANICAL EQUIPMENT. DO NOT DAMAGE THE FABRIC DURING COMPACTION (DAMAGED FABRIC SHALL BE REPLACED).

(J) ONLY ENHANCED SILT FENCE FABRIC LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED. ANY PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

(K) ENHANCED SILT FENCE SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.04 TEMPORARY ENHANCED SILT FENCE PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE ENHANCED SILT FENCE.

(L) SEDIMENT SHALL BE REMOVED FROM BEHIND THE ENHANCED SILT FENCE WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE STRUCTURE AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

REV. 12-18-02: REPLACED TABLE (J) AND MODIFIED GENERAL NOTES (B), (E) AND (I).

REV. 7-19-04: CHANGED VALUES IN TABLE 1 FROM MEAN TO MARV VALUES.

REV. 4-15-05: MODIFIED NOTE (K), ADDED NOTE (L), (E-FIGS) TABLE TITLE, REFERENCED GENERAL NOTES, REFORMATTED SHEET, MISC. EDITS TO DRAWING.

REV. 4-1-09: REMOVED TEMPORARY MONUMENTS, REVISED GENERAL NOTES, AND MISC. EDITS TO DRAWING.

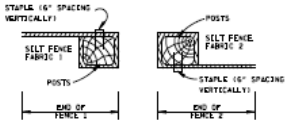
MINOR REVISION — NAME APPROVAL NOT REQUIRED.

STATE OF VERMONT
AGENCY OF TRANSPORTATION

ENHANCED SILT FENCE

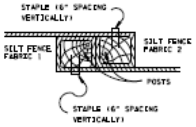
12-18-02 EC-STR-3D

STEP 1

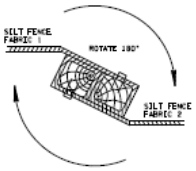


① WRAP FABRIC AROUND END SUPPORTS AS SHOWN AND ANCHOR FABRIC TO POSTS.
② POSITION POSTS/FABRIC AS SHOWN ABOVE.

STEP 2



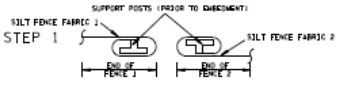
STEP 3



① ROTATE BOTH POSTS WITH FABRIC CLOCKWISE AT LEAST 180°.
② EMBED BOTH POSTS INTO GROUND PER SILT FENCE STANDARD DRAWING EC-STR-3B.

PLAN VIEW
JOINING SILT FENCE
FABRIC SECTIONS (WOOD POSTS)

STEP 1

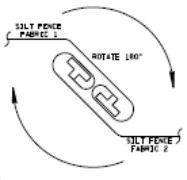


① WRAP FABRIC AROUND END SUPPORTS AS SHOWN AND ANCHOR FABRIC TO POSTS.
② POSITION POSTS/FABRIC AS SHOWN ABOVE.

STEP 2

② POSITION THE SILT FENCE FABRIC 2 POST INSIDE OF THE SILT FENCE FABRIC 1 POST AS SHOWN ABOVE.

STEP 3



② ROTATE BOTH POSTS WITH FABRIC CLOCKWISE AT LEAST 180°.
③ EMBED BOTH POSTS INTO GROUND PER APPLICABLE SILT FENCE STANDARD DRAWING. (EC-STR-3B, EC-STR-3C, OR EC-STR-3D)

PLAN VIEW
JOINING SILT FENCE
FABRIC SECTIONS (STEEL POSTS)

REV. 4-15-05: REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.

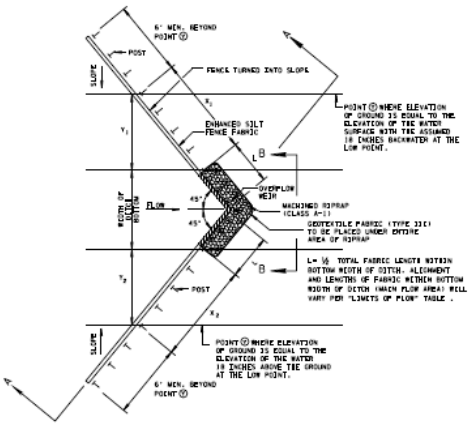
REV. 4-1-09: MISC. EDITS TO DRAWING, CHANGED DRAWING NAME, REFORMATTED SHEET.

MINOR REVISION — NAME APPROVAL NOT REQUIRED.

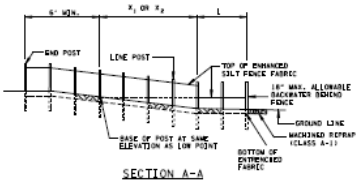
STATE OF VERMONT
AGENCY OF TRANSPORTATION

SILT FENCE FABRIC JOINING DETAILS

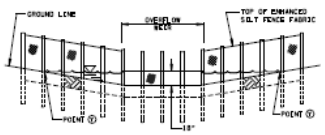
12-18-02 EC-STR-3E



PLAN VIEW



SECTION A-A



ELEVATION VIEW B-B

- REV. 12-18-09: MODIFIED SPACING FOR ENHANCED SILT FENCE DETAIL AND ADDED SUPPORTING TABLE, MODIFIED TABLE 4 AND GENERAL NOTES.
- REV. 3-15-04: CHANGED PLANS LEGEND SYMBOL.
- REV. 4-15-04: ADDED OVERFLOW WEIR SECTION B-B, REVISED TABLE TITLE, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING, CHANGED PLAN SYMBOL. (CHANGED DRAWING NAME.
- REV. 4-1-08: REMOVED TEMPORARY REFERENCE, MISC. EDITS TO DRAWING, CHANGED DRAWING NAME, REVISED GENERAL NOTES.
- REV. 1-1-10: MOVED SPACING DETAILS TO EC-STR-4B. REVISED GENERAL NOTES.
- REV. 8-1-12: REVISED GENERAL NOTES.

LIMITS OF FLOW

WIDTH OF DITCH BOTTOM (FT) (SEE NOTE E)	② TOTAL ENHANCED SILT FENCE CHECK LENGTH 2L (LENGTH L1 WITHIN FLAT-BOTTOM ZONE OF DITCH, (FT)	X_1 OR X_2 (FT)			TOTAL AVAILABLE SURFACE AREA OF FABRIC IN DITCH AT 18 INCHES OF FLOW DEPTH (FT²)			① MAXIMUM ALLOWABLE PEAK FLOW (CFS)		
		2:1	3:1	4:1	2:1 SIDESLOPE	3:1 SIDESLOPE	4:1 SIDESLOPE	2:1 SIDESLOPE	3:1 SIDESLOPE	4:1 SIDESLOPE
3	4.2 (2.1)	4.2	6.4	8.5	12.6	15.8	19.0	4.6	5.5	6.4
4	5.7 (2.9)	4.2	6.4	8.5	14.9	18.0	21.2	5.6	6.5	7.4
5	7.0 (3.5)	4.2	6.4	8.5	16.8	20.0	23.2	6.4	7.3	8.3
6	8.5 (4.3)	4.2	6.4	8.5	19.1	22.2	25.4	7.4	8.3	9.2
7	9.9 (5.0)	4.2	6.4	8.5	21.2	24.3	27.5	8.3	9.2	10.1
8	11.3 (5.7)	4.2	6.4	8.5	23.3	26.4	29.6	9.2	10.1	11.1
9	12.7 (6.4)	4.2	6.4	8.5	25.4	28.5	31.7	10.1	11.0	12.0
10	14.1 (7.1)	4.2	6.4	8.5	27.5	30.6	33.8	11.0	12.0	12.9
12	17.0 (8.5)	4.2	6.4	8.5	31.8	35.0	38.2	12.9	13.8	14.8
15	21.2 (10.6)	4.2	6.4	8.5	38.1	41.3	44.5	15.7	16.6	17.5

① BASED ON 110 GPM/FT² (0.02 INCHES/SEC PERMEABILITY) ENHANCED SILT FENCE DITCH CHECK FABRIC AND TRAPEZOIDAL DITCH CROSS SECTION. SEE STANDARD DRAWING EC-STR-3D FOR FABRIC SPECIFICATIONS. A HEAD OF 18 INCHES BEHIND THE FENCE WAS USED TO DETERMINE MAXIMUM ALLOWABLE DESIGN PEAK FLOW THROUGH THE FILTER FABRIC. ALLOWABLE FLOWS DO NOT INCLUDE HYDRAULIC REDUCTION DUE TO ACCUMULATION OF CAPTURED SOIL PARTICLES ON THE FABRIC SURFACE AREA.

② THIS LENGTH IS TO BE ADDED TO CALCULATED LENGTHS X_1 AND X_2. LENGTH Y_1 AND Y_2 ARE BASED ON PERPENDICULAR SLOPE LENGTHS TO A POINT WHERE THE BASE OF POST ENTERING THE GROUND IS AT THE SAME ELEVATION AS A POINT 18 INCHES ABOVE THE GROUND AT THE LOW POINT OF THE DITCH. LENGTHS X_1 AND X_2 ARE CALCULATED BY MULTIPLYING THE LENGTHS OF SLOPE Y_1 OR Y_2 AT EACH INDIVIDUAL LOCATION BY 1.414.

ENHANCED SILT FENCE CHECK GENERAL NOTES

A. ENHANCED SILT FENCE CHECKS ARE USED TO REMOVE SUSPENDED SEDIMENTS FROM STORM WATER FLOW VIA SETTLING AND FILTRATION. THEY ARE ALSO USED FOR VELOCITY REDUCTION. ENHANCED SILT FENCE CHECKS SHOULD NOT BE PLACED IN STREAMS OR OTHER NATURAL WATER RESOURCES.

B. A DITCH WITH A TRAPEZOIDAL CROSS-SECTION IS ASSUMED WITH SIDE SLOPES AS NOTED.

C. CHECK LENGTH DESIGNATED IN THE "LIMITS OF FLOW" TABLE ONLY INCLUDES THE LENGTH OF FENCE STAKED WITHIN THE BOTTOM WIDTH OF DITCH (2L).

D. SELECT A DITCH BOTTOM WIDTH FROM THE "LIMITS OF FLOW" TABLE SUCH THAT THE MAXIMUM ALLOWABLE DESIGN PEAK FLOW OBTAINED FROM THE APPROPRIATE COLUMN AT THE RIGHT SIDE OF THE TABLE IS EQUAL TO OR GREATER THAN THE 2-YEAR, 24-HOUR FLOW RATE AT THE CHECK. IF THE SITE DRAINS TO A SEDIMENT-IMPAIRED STREAM OR EXCEPTIONAL TENNESSEE WATERS, THE FLOW OBTAINED FROM THE TABLE MUST BE EQUAL TO OR GREATER THAN THE 5-YEAR, 24-HOUR FLOW RATE. FLOWS IN EXCESS OF THESE VALUES MAY BE PASSED OVER THE WEIR.

E. IT MAY BE NECESSARY TO FLATTEN THE DITCH SIDE SLOPES AND/OR WIDEN THE DITCH BOTTOM WIDTH IN THE VICINITY OF THE CHECK IN ORDER TO ACHIEVE THE SURFACE AREA OF FABRIC REQUIRED FOR THE CHECK. REFER TO EC-STR-4B.

F. THE SPACING OF ENHANCED SILT FENCE CHECKS ALONG A DITCH SHOULD BE BASED ON A COMBINATION OF HYDRAULIC PROPERTIES OF THE FENCE MATERIAL, LIMITS OF FLOW TABLE, AND THE SPACING TABLE (EC-STR-4B).

G. THE FLOW VALUES IN THE LIMITS OF FLOW TABLE ASSUME NO CLOGGING OF THE ENHANCED SILT FENCE CHECK FABRIC SURFACE. IN ORDER TO INSURE MINIMAL INFLUENCE FROM CLOGGING, ENHANCED SILT FENCE CHECKS SHOULD BE REGULARLY CLEANED BY DRY BRUSHING AND/OR PRESSURE WASHING THE FABRIC SURFACE.

H. FOR INSTALLATION DETAILS FOR ENHANCED SILT FENCE SEE STANDARD DRAWINGS EC-STR-3D AND EC-STR-3E.

C. UPON REMOVAL OF THE ENHANCED SILT FENCE CHECK THE AREA BENEATH THE ENHANCED SILT FENCE CHECK LOCATION SHOULD BE IMMEDIATELY COVERED WITH SEEDING AND EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS OR IT SHOULD BE SODDED.

J. ANY PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

K. ENHANCED SILT FENCE CHECKS SHOULD BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.06 ENHANCED SILT FENCE CHECK (TRAPEZOIDAL) PER EACH

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE ENHANCED SILT FENCE CHECK.

L. SEDIMENT SHALL BE REMOVED FROM BEHIND THE ENHANCED SILT FENCE CHECK WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT TO THE STRUCTURE AND PAID FOR UNDER ITEM NO. 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

EROSION CONTROL PLAN LEGEND: > ENHANCED SILT FENCE CHECK (TRAPEZOIDAL DITCH)

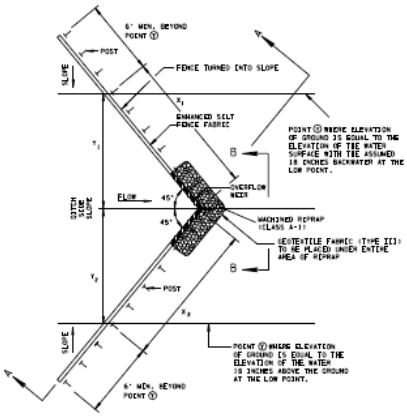
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

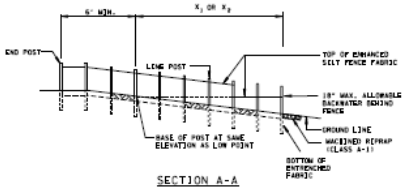
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

ENHANCED SILT FENCE CHECK (TRAPEZOIDAL DITCH)

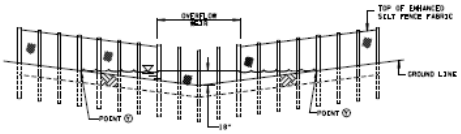
12-28-02 EC-STR-4



PLAN VIEW



SECTION A-A



ELEVATION VIEW B-B

- REV. 12-18-09: MODIFIED SPACING FOR ENHANCED SILT FENCE DETAIL AND ADDED SUPPORTING TABLE, MODIFIED TABLE 5 AND GENERAL NOTES.
- REV. 3-15-04: CHANGED PLANS LEGEND SYMBOL.
- REV. 4-15-04: ADDED OVERFLOW WEIR AND SECTION B-B, REVISED TABLE TITLE, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING, CHANGED DRAWING NAME.
- REV. 4-1-08: REMOVED TEMPORARY REFERENCE, MISC. EDITS TO DRAWING, CHANGED DRAWING NAME, REVISED GENERAL NOTES.
- REV. 1-1-10: MOVED SPACING DETAILS TO EC-STR-4B. REVISED GENERAL NOTES.
- REV. 8-1-12: REVISED GENERAL NOTES.

LIMITS OF FLOW

DITCH SIDESLOPES (SEE NOTE D)	②X_1 OR X_2 (FT)	TOTAL AVAILABLE SURFACE AREA OF FABRIC IN DITCH AT 18 INCHES OF FLOW DEPTH (FT²)	① MAXIMUM ALLOWABLE PEAK FLOW (CFS)
2:1	4.2	6.4	1.9
3:1	6.4	9.5	2.8
4:1	8.5	12.7	3.7
5:1	10.6	15.9	4.6
6:1	12.7	19.1	5.6
7:1	14.8	22.3	6.5
8:1	17.0	25.4	7.4
9:1	19.1	28.6	8.3
10:1	21.2	31.8	9.3

① BASED ON 110 GPM/FT² (0.02 INCHES/SEC PERMEABILITY) ENHANCED SILT FENCE, DITCH CHECK FABRIC AND TRIANGULAR DITCH CROSS SECTION. SEE STANDARD DRAWING EC-STR-3D FOR FABRIC SPECIFICATIONS. A HEAD OF 18 INCHES BEHIND THE FENCE WAS USED TO DETERMINE MAXIMUM ALLOWABLE DESIGN PEAK FLOW THROUGH THE FILTER FABRIC. ALLOWABLE FLOWS DO NOT INCLUDE HYDRAULIC REDUCTION DUE TO ACCUMULATION OF CAPTURED SOIL PARTICLES ON THE FABRIC SURFACE AREA.

② LENGTHS Y_1 AND Y_2 ARE BASED ON PERPENDICULAR SLOPE LENGTHS TO A POINT WHERE THE BASE OF THE POST ENTERING THE GROUND IS AT THE SAME ELEVATION AS A POINT 18 INCHES ABOVE THE GROUND AT THE LOW POINT OF THE DITCH. LENGTHS X_1 AND X_2 ARE CALCULATED BY MULTIPLYING THE LENGTHS OF THE SLOPE Y_1 OR Y_2 AT EACH INDIVIDUAL LOCATION BY 1.414.

ENHANCED SILT FENCE CHECK GENERAL NOTES

A. ENHANCED SILT FENCE CHECKS ARE USED TO REMOVE SUSPENDED SEDIMENTS FROM STORM WATER FLOW VIA SETTLING AND FILTRATION. THEY ARE ALSO USED FOR VELOCITY REDUCTION. ENHANCED SILT FENCE CHECKS SHOULD NOT BE PLACED IN STREAMS OR OTHER NATURAL WATER RESOURCES. ENHANCED SILT FENCE CHECKS SHOULD NOT BE USED WITHIN THE CLEAR ZONE OF A ROADWAY WHERE TRAFFIC IS TO BE MAINTAINED DURING CONSTRUCTION.

B. A DITCH WITH A TRIANGULAR CROSS-SECTION IS ASSUMED WITH SIDE SLOPES AS NOTED.

C. SELECT DITCH SIDE SLOPES FROM THE "LIMITS OF FLOW" TABLE SUCH THAT THE MAXIMUM ALLOWABLE DESIGN PEAK FLOW OBTAINED FROM THE APPROPRIATE COLUMN AT THE RIGHT SIDE OF THE TABLE IS EQUAL TO OR GREATER THAN THE 2-YEAR, 24-HOUR FLOW RATE AT THE CHECK. IF THE SITE DRAINS TO A SEDIMENT-IMPAIRED STREAM OR EXCEPTIONAL TENNESSEE WATERS, THE FLOW OBTAINED FROM THE TABLE MUST BE EQUAL TO OR GREATER THAN THE 5-YEAR, 24-HOUR FLOW RATE. FLOWS IN EXCESS OF THESE VALUES MAY BE PASSED OVER THE WEIR.

D. IT MAY BE NECESSARY TO FLATTEN THE DITCH SIDE SLOPES AND/OR WIDEN THE DITCH BOTTOM WIDTH IN THE VELOCITY OF THE CHECK IN ORDER TO ACHIEVE THE SURFACE AREA OF FABRIC REQUIRED FOR THE CHECK. REFER TO EC-STR-4B.

E. THE SPACING OF ENHANCED SILT FENCE CHECK ALONG A DITCH SHOULD BE BASED ON A COMBINATION OF HYDRAULIC PROPERTIES OF THE FENCE MATERIAL, THE LIMITS OF FLOW TABLE, AND THE SPACING TABLE (EC-STR-4B).

F. THE FLOW VALUES IN THE LIMITS OF FLOW TABLE ASSUME NO CLOGGING OF THE ENHANCED SILT FENCE CHECK FABRIC SURFACE. IN ORDER TO INSURE MINIMAL INFLUENCE FROM CLOGGING, ENHANCED SILT FENCE CHECKS SHOULD BE REGULARLY CLEANED BY DRY BRUSHING AND/OR PRESSURE WASHING THE FABRIC SURFACE.

G. FOR INSTALLATION DETAILS FOR ENHANCED SILT FENCE SEE STANDARD DRAWINGS EC-STR-3D AND EC-STR-3E.

H. UPON REMOVAL OF THE ENHANCED SILT FENCE CHECK THE AREA BENEATH THE ENHANCED SILT FENCE CHECK LOCATION SHOULD BE IMMEDIATELY COVERED WITH SEEDING AND EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS OR IT SHOULD BE SODDED.

I. ANY PRODUCT LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE MAY ALSO BE USED.

J. ENHANCED SILT FENCE CHECKS SHOULD BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.05 ENHANCED SILT FENCE CHECK (V-DITCH) PER EACH

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE ENHANCED SILT FENCE CHECK.

K. SEDIMENT SHALL BE REMOVED FROM BEHIND THE ENHANCED SILT FENCE CHECK WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT TO THE STRUCTURE AND PAID FOR UNDER ITEM NO. 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

EROSION CONTROL PLAN LEGEND: > ENHANCED SILT FENCE CHECK (V-DITCH)

☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

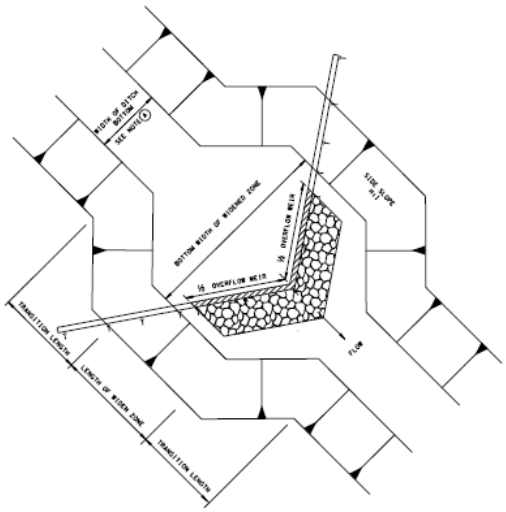
ENHANCED SILT FENCE CHECK (V-DITCH)

12-28-02 EC-STR-4A

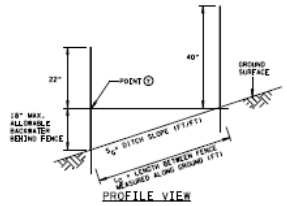
STATION (LT or RT)	L (FT) (1)	X1 (FT) (1)	X2 (FT) (1)	OVERFLOW WEIR LENGTH (FT)	TOTAL LENGTH OF ESF (FT)	WIDENED ZONE				
						BOTTOM WIDTH (FT)	SIDE SLOPE (H:1)	LENGTH (FT)	TRANSITION RATIO	TRANSITION LENGTH (FT)

(1) REFER TO STD. DWG. EC-STR-4 OR EC-STR-4A

DITCH SLOPE S_d(FT/FT)	RECOMMENDED SPACING, (L_s) BETWEEN ENHANCED SILT FENCE CHECKS(FT)
0.01	150
0.02	75
0.03	50
0.04	40
0.05	30
0.06 AND STEEPER	25



PLAN VIEW



PROFILE VIEW

SPACING FOR ENHANCED SILT FENCE CHECKS

ENHANCED SILT FENCE CHECK GENERAL NOTES

(A) ENHANCED SILT FENCE CHECKS ARE USED TO REMOVE SUSPENDED SEDIMENTS FROM STORM WATER FLOW VIA SETTLING AND FILTRATION. THEY ARE ALSO USED FOR VELOCITY REDUCTION. ENHANCED SILT FENCE CHECKS SHOULD NOT BE PLACED IN STREAMS OR OTHER NATURAL WATER RESOURCES.

(B) IT MAY BE NECESSARY TO FLATTEN THE DITCH SIDE SLOPES AND/OR WIDEN THE DITCH BOTTOM WIDTH IN THE VICINITY OF THE CHECK IN ORDER TO ACHIEVE THE SURFACE AREA OF FABRIC REQUIRED FOR THE CHECK. REFER TO LENGTH OF FLOW TABLE ON EC-STR-4 AND EC-STR-4A.

(C) FOR ADDITIONAL INSTALLATION INFORMATION REFER TO EC-STR-4 FOR ENHANCED SILT FENCE CHECK USED IN TRAPEZOIDAL DITCHES AND EC-STR-4A FOR ENHANCED SILT FENCE CHECKS USED IN V-DITCHES.

(D) FOR INSTALLATION DETAILS FOR ENHANCED SILT FENCE SEE STANDARD DRAWING EC-STR-3D AND EC-STR-3E.

(E) THE SPACING OF ENHANCED SILT FENCE CHECKS, ALONG A DITCH SHOULD BE BASED ON A COMBINATION OF HYDRAULIC PROPERTIES OF THE FENCE MATERIAL, LENGTH OF FLOW TABLE (EC-STR-4 AND EC-STR-4A), AND THE SPACING TABLE.

(F) UPON REMOVAL OF THE ENHANCED SILT FENCE CHECK THE WIDENED ZONE SHOULD BE IMMEDIATELY RESHAPED TO MATCH THE PROPOSED DITCH SIZE. IT SHOULD BE COVERED WITH SEEDING AND EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS OR IT SHOULD BE SODDED.

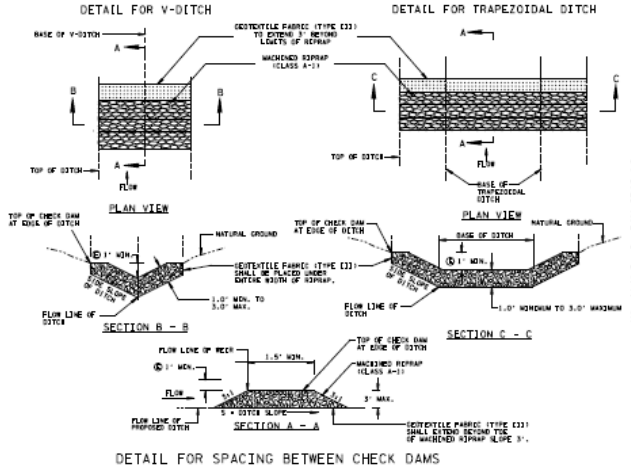
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

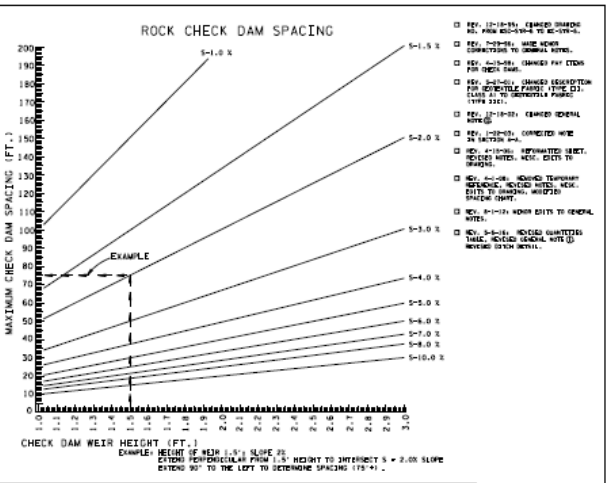
NOT TO SCALE

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

ENHANCED SILT FENCE CHECK DETAILS

01-01-10 EC-STR-4B

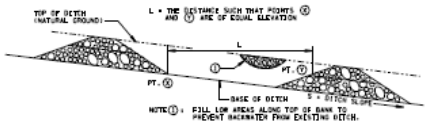




EXAMPLE: HEIGHT OF WEIR (.5') & SLOPE 2% EXTEND PERPENDICULAR FROM (.5') HEIGHT TO INTERSECT S = 2.0% SLOPE EXTEND 90° TO THE LEFT TO DETERMINE SPACING (75'+) .

☐ REV. (2-18-99), CHANGED DRAWING NO. FROM EC-STR-6 TO EC-STR-6.
☐ REV. 7-03-08, MADE MINOR CORRECTIONS TO GENERAL NOTES.
☐ REV. 4-15-09, CHANGED PAY ITEMS FOR CHECK DAMS.
☐ REV. 2-17-10, CHANGED DESCRIPTION FOR GEOTEXTILE FABRIC (TYPE (3), CLASS A) TO GEOTEXTILE FABRIC (TYPE 332).
☐ REV. 12-18-02, CHANGED GENERAL NOTE (5).
☐ REV. 1-20-03, CORRECTED NOTE IN SECTION B-B.
☐ REV. 4-15-05, REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.
☐ REV. 4-4-08, REMOVED TEMPORARY REFERENCE, REVISED NOTES, MISC. EDITS TO DRAWING, MODIFIED SPACING CHART.
☐ REV. 8-1-12, MINOR EDITS TO GENERAL NOTES.
☐ REV. 5-5-15, REVISED QUANTITIES TABLE, REVISED GENERAL NOTE (1), REVISED DITCH DETAIL.

DETAIL FOR SPACING BETWEEN CHECK DAMS



NOTE (1): FILL LOW AREAS ALONG TOP OF BANK TO PREVENT BACKWATER FROM EXISTING DITCH.

ROCK CHECK DAM ESTIMATED QUANTITIES

	2:1 DITCH SLOPE			3:1 DITCH SLOPE			4:1 DITCH SLOPE		
V-DITCH	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF
	1.5	8.5	16.8	1.5	9.2	23.7	1.5	12.0	30.5
	2.0	13.0	30.5	2.0	13.5	34.8	2.0	14.1	43.4
	2.5	22.4	49.5	2.5	23.5	49.0	2.5	24.1	62.5
	3.0	36.5	74.1	3.0	37.1	81.2	3.0	37.3	92.5
TRAPEZOIDAL DITCH	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF
	1.5	8.9	22.8	1.5	11.6	28.7	1.5	14.4	36.6
	2.0	16.4	41.9	2.0	22.1	42.1	2.0	23.5	62.1
	2.5	28.7	62.6	2.5	36.1	56.6	2.5	47.9	71.2
	3.0	44.7	84.9	3.0	53.8	73.2	3.0	75.5	92.4

1. ESTIMATED QUANTITIES BASED ON 4:1 SIDE SLOPES. QUANTITIES WILL VARY BASED ON ACTUAL DITCH CONFIGURATION.
2. ESTIMATED QUANTITIES BASED ON 4FT BOTTOM WIDTH, AND 4:1 SIDE SLOPES. QUANTITIES WILL VARY BASED ON ACTUAL DITCH CONFIGURATION.

EROSION CONTROL PLAN LEGEND : ROCK CHECK DAM (V-DITCH)

EROSION CONTROL PLAN LEGEND : ROCK CHECK DAM (TRAPEZOIDAL DITCH)

ROCK CHECK DAM GENERAL NOTES

(A) ROCK CHECK DAMS ARE TO BE USED FOR VELOCITY REDUCTION AND EROSION PREVENTION IN AREAS WHERE CONCENTRATED FLOW EXISTS. ROCK CHECK DAMS SHALL NOT BE USED IN STREAMS OR OTHER NATURAL WATER RESOURCES. ROCK CHECK DAMS ARE NOT TO BE USED FOR SEDIMENT CONTROL AND SHALL NOT BE CONSIDERED A SEDIMENT TRAPPING DEVICE.

(B) THE DRAINAGE AREA FOR THE ROCK CHECK DAMS SHALL BE 10 ACRES OR LESS.

(C) ROCK CHECK DAMS MAY REMAIN IN PLACE AS PERMANENT CHECK DAMS, IF SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

(D) THE CENTER OF THE ROCK CHECK DAM MUST BE AT LEAST ONE (1) FOOT LOWER THAN THE OUTER EDGES.

(E) THE DEPTH OF FLOW ON THE CENTER OF THE STRUCTURE SHALL BE COMPUTED FOR THE PEAK FLOW RATE GENERATED BY THE 2-YEAR, 24-HOUR STORM IN ORDER TO ENSURE THAT THE TOP OF THE STRUCTURE WILL NOT BE OVERTOPPED. FOR SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE DEPTH SHOULD BE DETERMINED FOR THE 5-YEAR, 24-HOUR PEAK FLOW RATE. THIS WILL ELIMINATE THE ROCK-SOIL FAILURE POINT WHERE THE ROCK CHECK DAM AND NATURAL GROUND MERGE.

(F) FOR SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE MINIMUM HEIGHT OF THE STRUCTURE ABOVE THE DITCH BOTTOM SHALL BE INCREASED TO 2 FEET.

(G) THE MAXIMUM SPACING BETWEEN ROCK CHECK DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE FLOW LINE OF THE WEIR OF THE DOWNSTREAM DAM (SEE ROCK CHECK SPACING GRAPH THIS SHEET).

(H) ONLY GEOTEXTILE FABRIC (TYPE (3)) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(I) PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST FOR FILTER SOCK DITCH APPLICATION MAY BE USED AND SHALL BE PAID UNDER FOLLOWING ITEM NUMBER:

209-08.09 FILTER SOCK CHECK DAM PER EACH

(J) ROCK CHECK DAMS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.07 ROCK CHECK DAM PER EACH

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF ROCK CHECK DAMS.

(K) SEDIMENT SHALL BE REMOVED FROM BEHIND THE ROCK CHECK DAMS WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE DAM AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL PER CUBIC YARD.

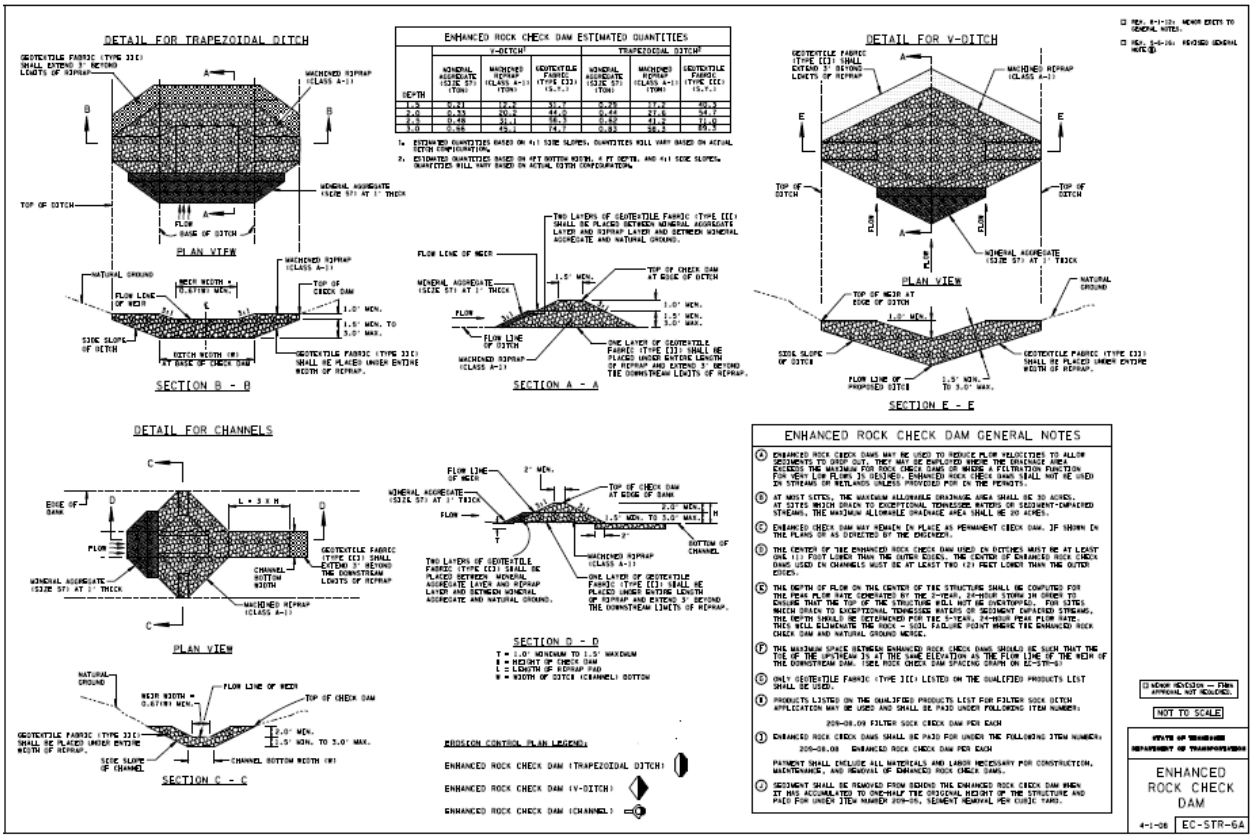
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

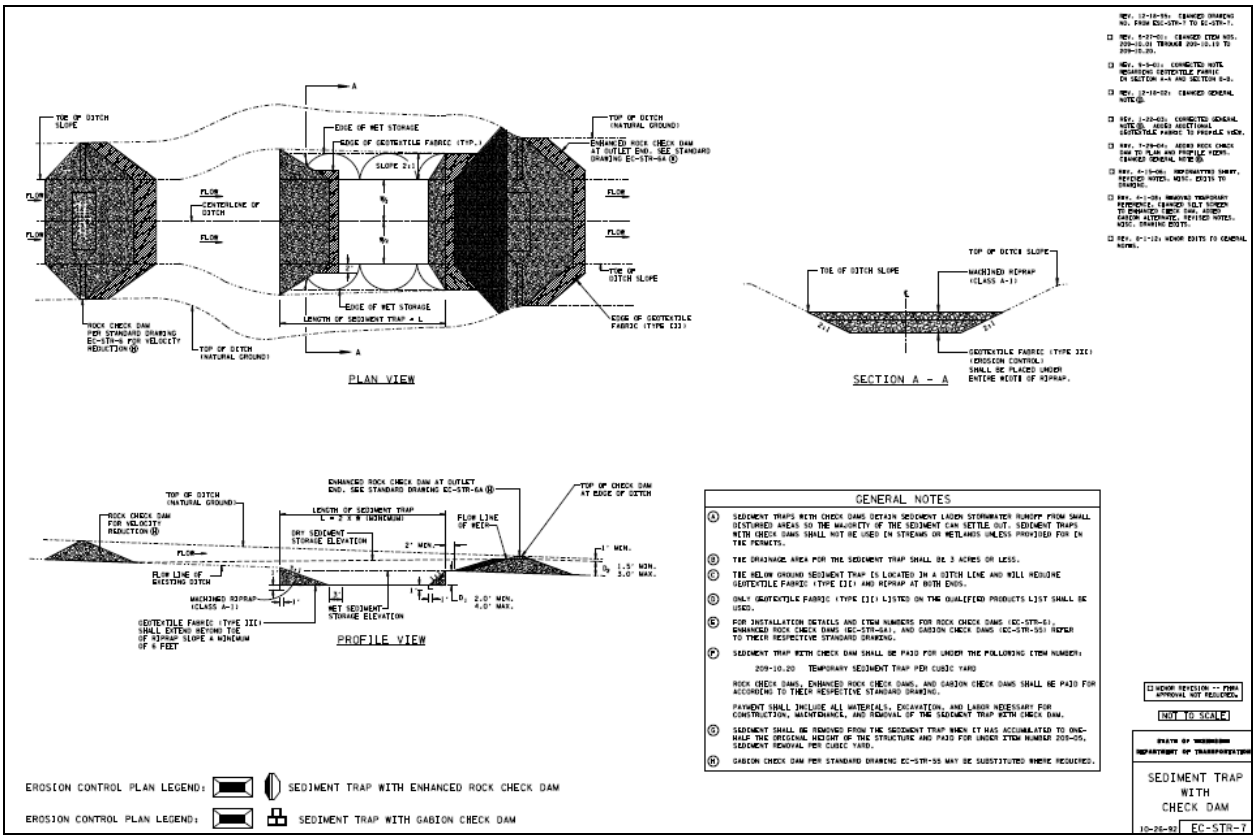
NOT TO SCALE

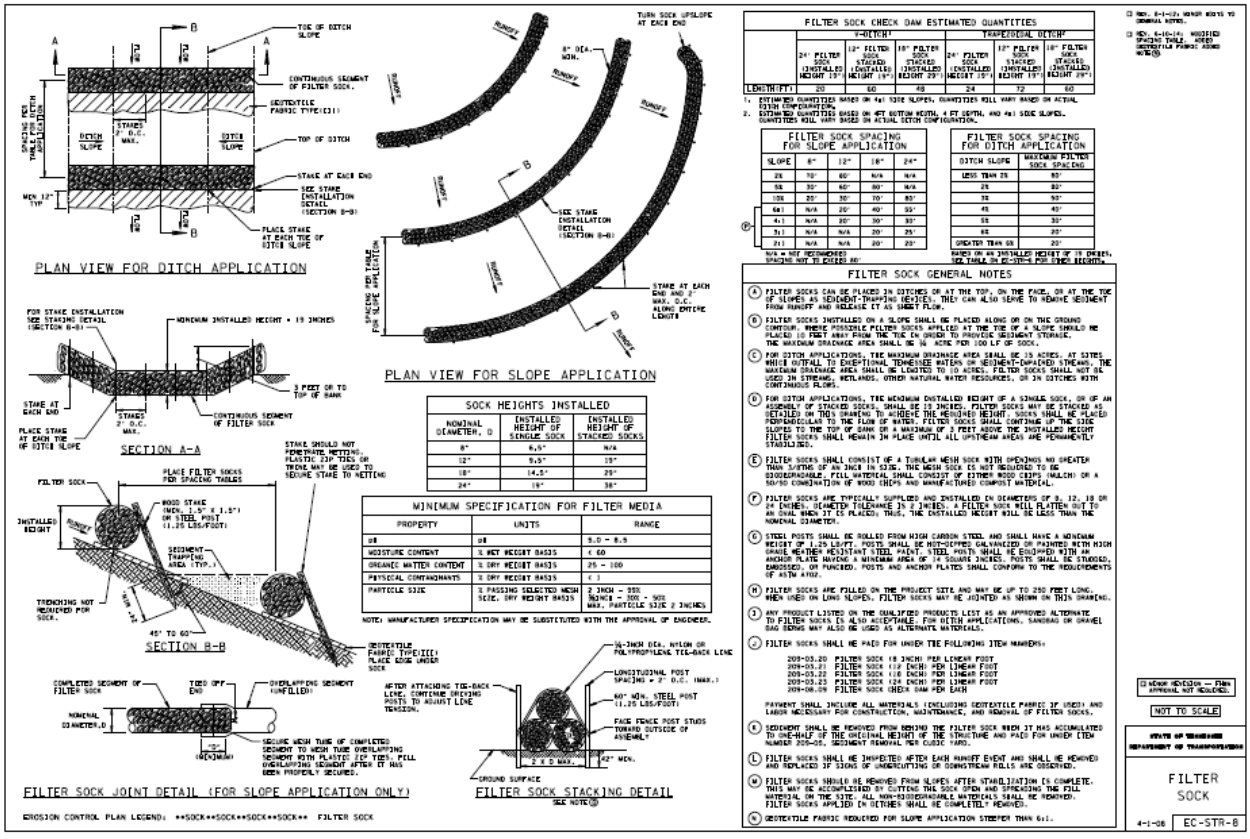
STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

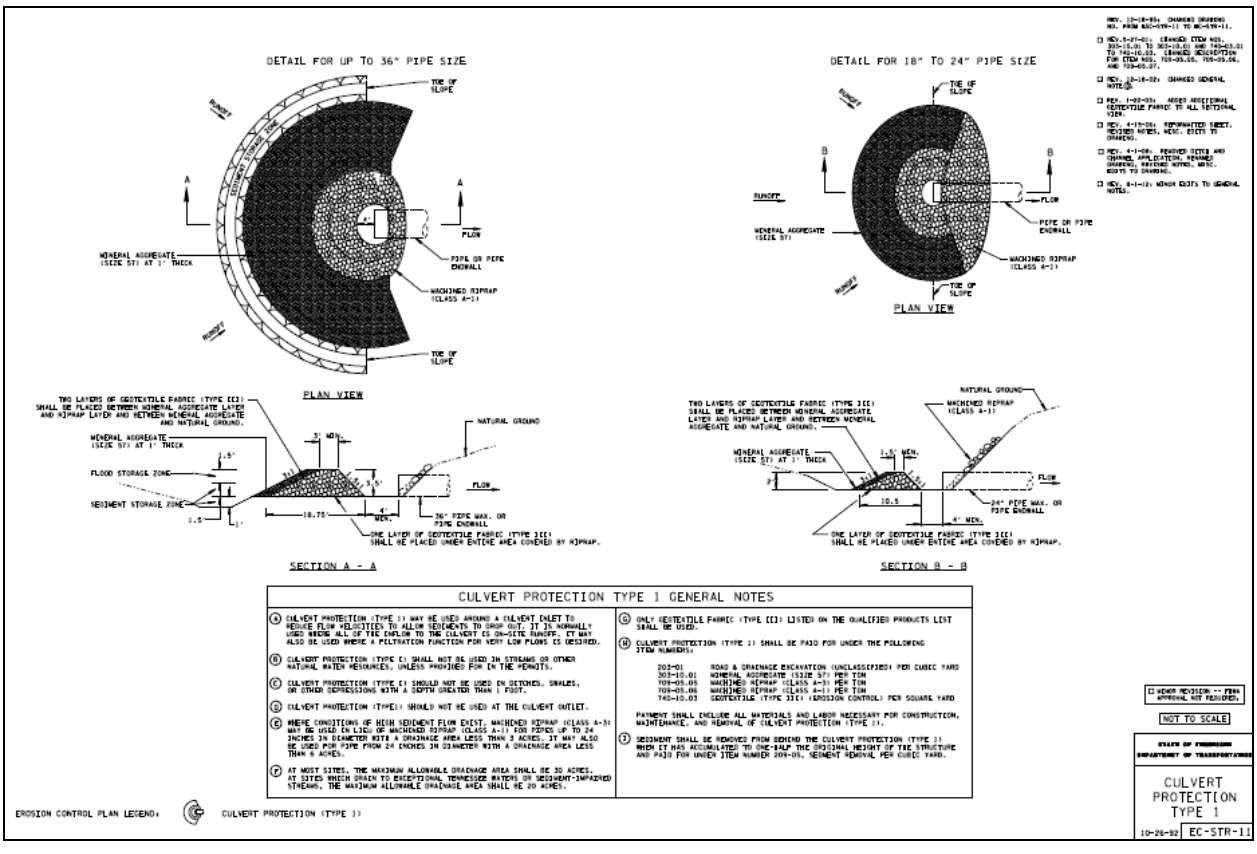
ROCK CHECK DAM

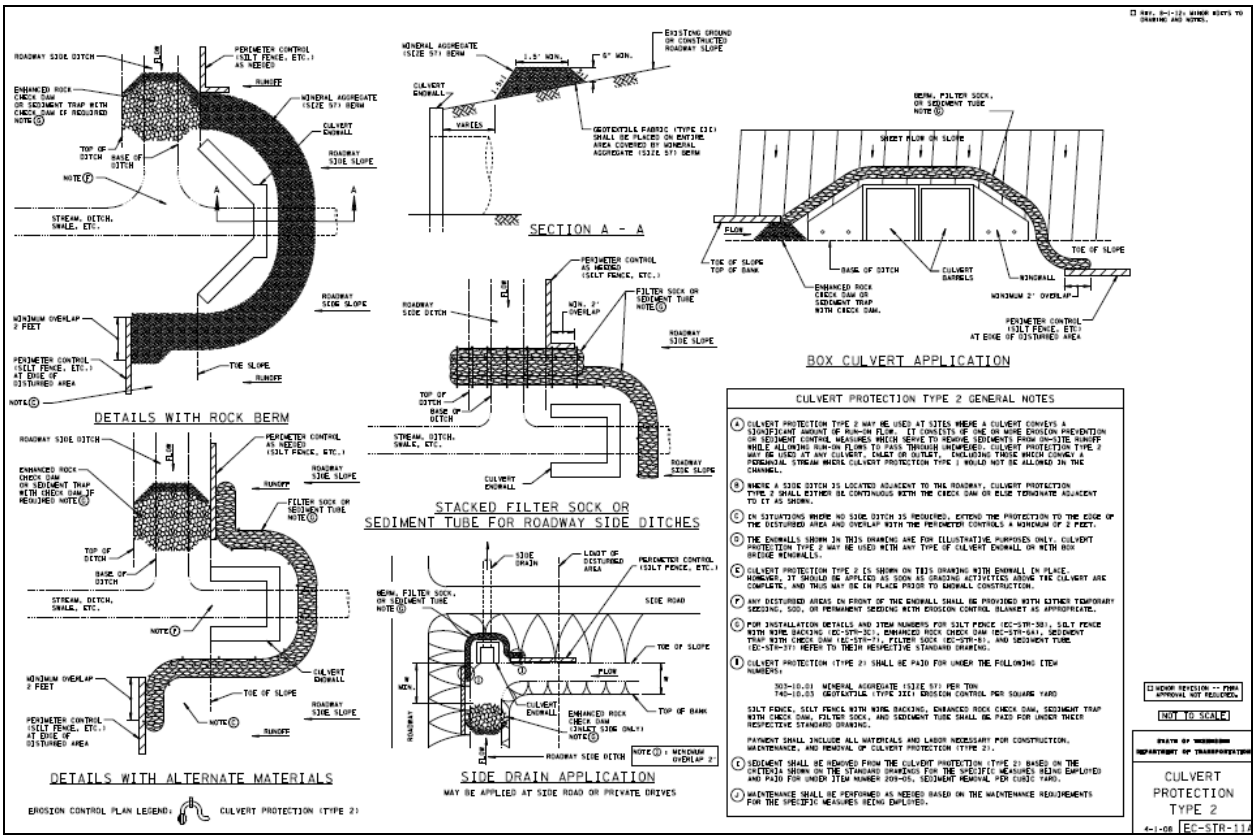
10-26-92 EC-STR-6

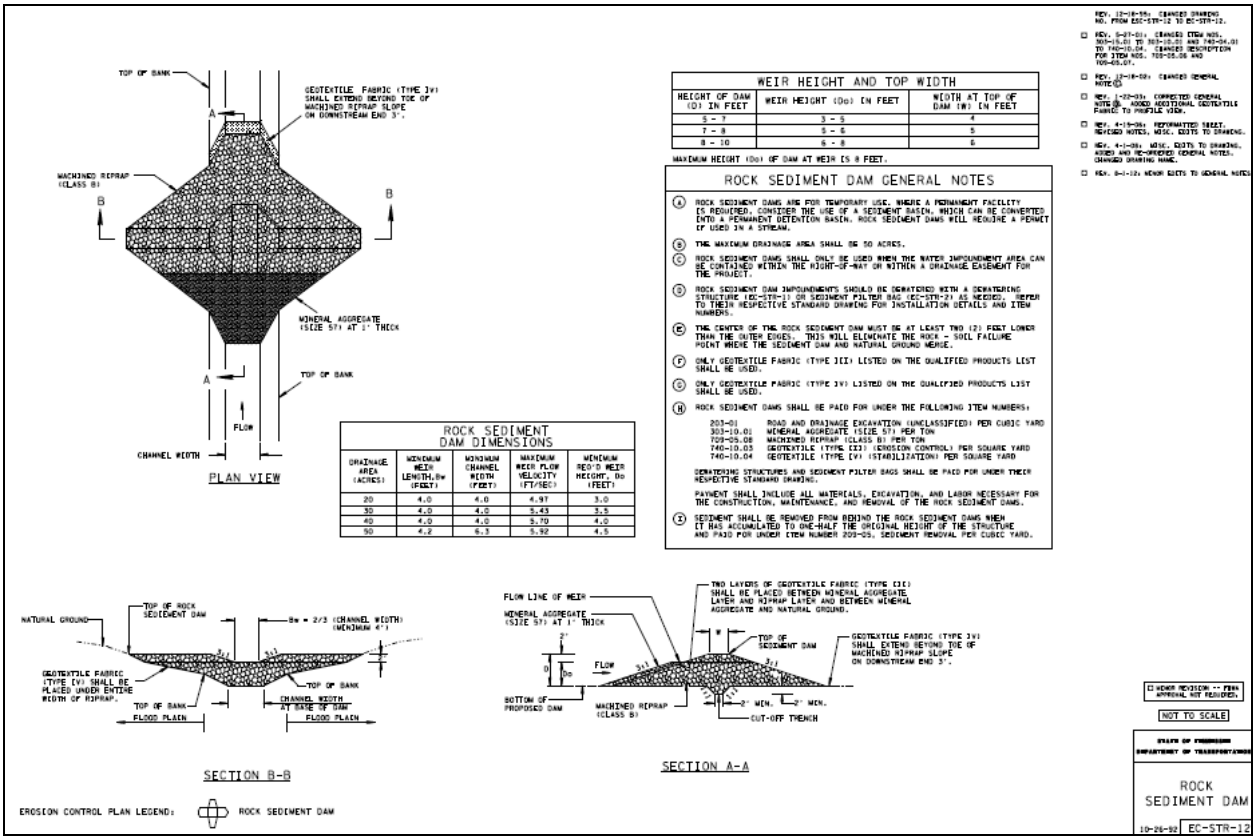

DETAIL FOR TRAPEZOIDAL DITCH
ENHANCED ROCK CHECK DAM ESTIMATED QUANTITIES
DETAIL FOR V-DITCH
PLAN VIEW
SECTION B - B
SECTION A - A
SECTION E - E
DETAIL FOR CHANNELS
SECTION D - D
SECTION C - C
ENHANCED ROCK CHECK DAM GENERAL NOTES
EROSION CONTROL PLAN LEGEND:
ENHANCED ROCK CHECK DAM (TRAPEZOIDAL DITCH)
ENHANCED ROCK CHECK DAM (V-DITCH)
ENHANCED ROCK CHECK DAM (CHANNEL)
NOT TO SCALE
ENHANCED ROCK CHECK DAM
4-1-08
EC-STR-6A

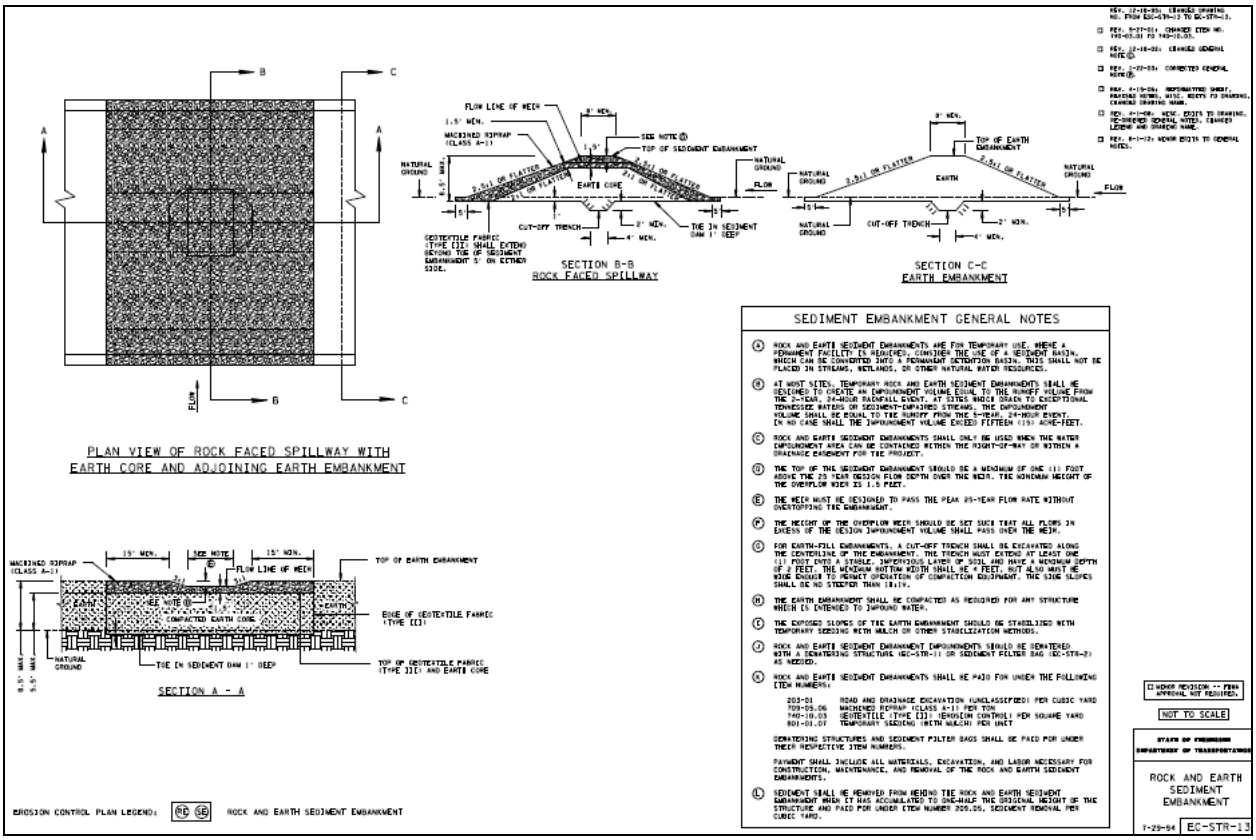

PLAN VIEW
SECTION A - A
PROFILE VIEW
GENERAL NOTES
EROSION CONTROL PLAN LEGEND: SEDIMENT TRAP WITH ENHANCED ROCK CHECK DAM
EROSION CONTROL PLAN LEGEND: SEDIMENT TRAP WITH GABION CHECK DAM
NOT TO SCALE
SEDIMENT TRAP WITH CHECK DAM
10-26-92
EC-STR-7

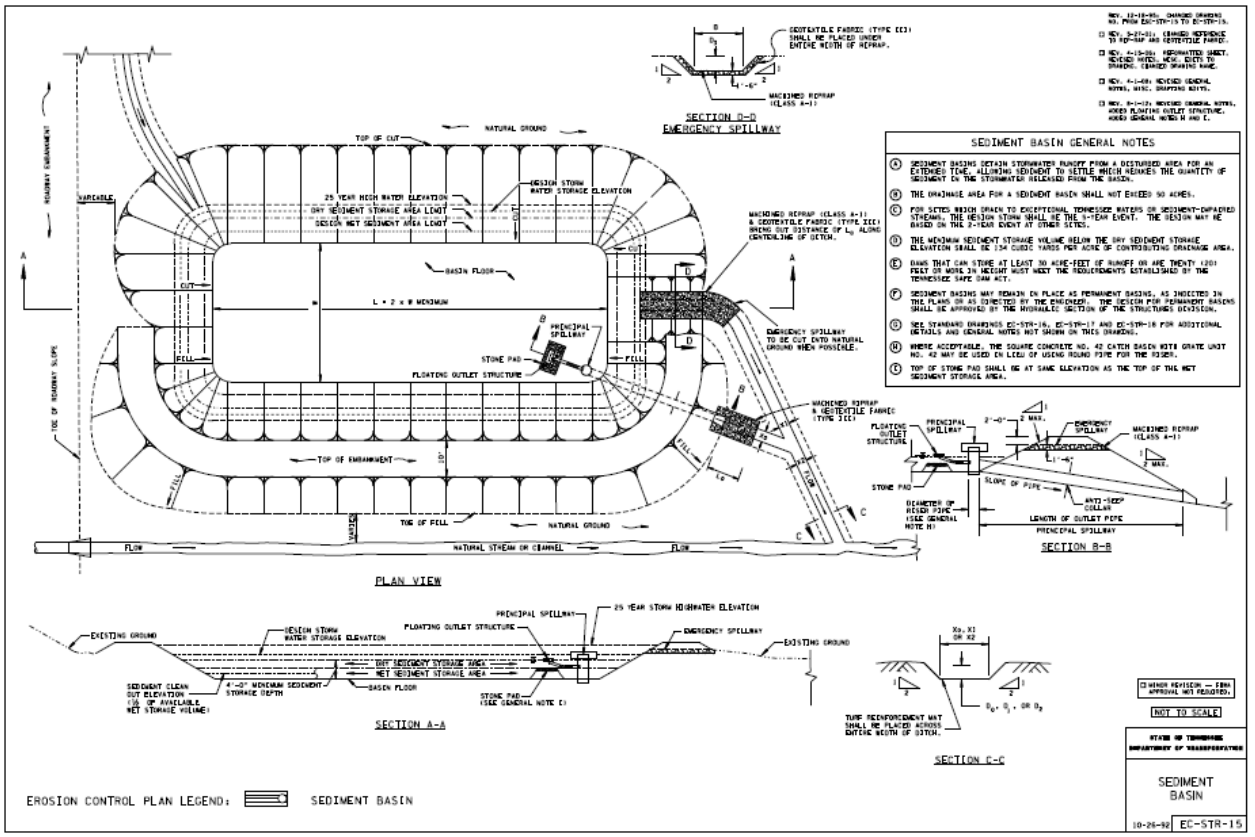

PLAN VIEW FOR DITCH APPLICATION
PLAN VIEW FOR SLOPE APPLICATION
SECTION A-A
SECTION B-B
FILTER SOCK JOINT DETAIL (FOR SLOPE APPLICATION ONLY)
FILTER SOCK STACKING DETAIL
EROSION CONTROL PLAN LEGEND: **SOCK**SOCK**SOCK**SOCK** FILTER SOCK
FILTER SOCK CHECK DAM ESTIMATED QUANTITIES
FILTER SOCK SPACING FOR SLOPE APPLICATION
FILTER SOCK SPACING FOR DITCH APPLICATION
SOCK HEIGHTS INSTALLED
MINIMUM SPECIFICATION FOR FILTER MEDIA
FILTER SOCK GENERAL NOTES
FILTER SOCK

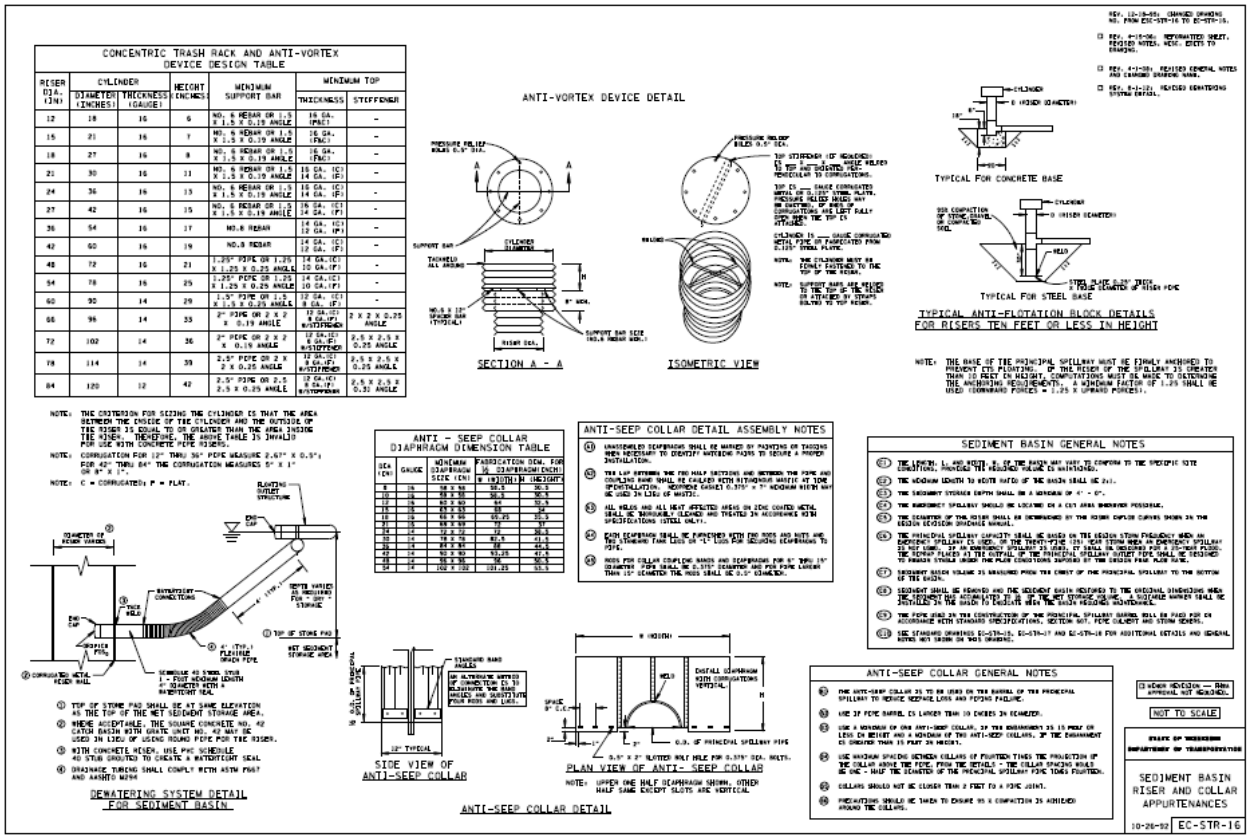

DETAIL FOR UP TO 36" PIPE SIZE
DETAIL FOR 18" TO 24" PIPE SIZE
PLAN VIEW
PLAN VIEW
SECTION A - A
SECTION B - B
CULVERT PROTECTION TYPE 1 GENERAL NOTES
EROSION CONTROL PLAN LEGEND:
CULVERT PROTECTION (TYPE 1)
CULVERT PROTECTION TYPE 1

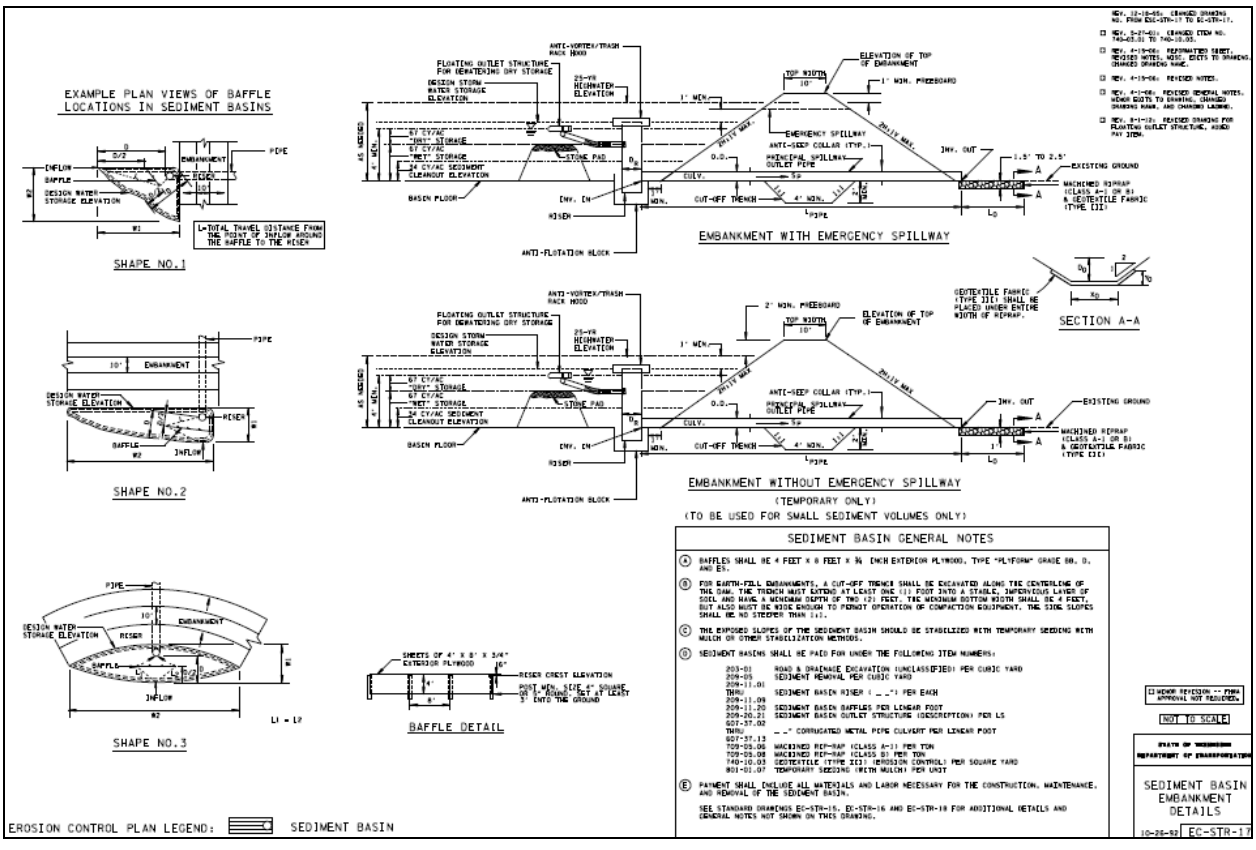

DETAILS WITH ROCK BERM
SECTION A - A
BOX CULVERT APPLICATION
STACKED FILTER SOCK OR SEDIMENT TUBE FOR ROADWAY SIDE DITCHES
DETAILS WITH ALTERNATE MATERIALS
SIDE DRAIN APPLICATION
MAY BE APPLIED AT SIDE ROAD OR PRIVATE DRIVES
EROSION CONTROL PLAN LEGEND:
CULVERT PROTECTION (TYPE 2)
CULVERT PROTECTION TYPE 2 GENERAL NOTES
CULVERT PROTECTION TYPE 2
EC-STR-11A

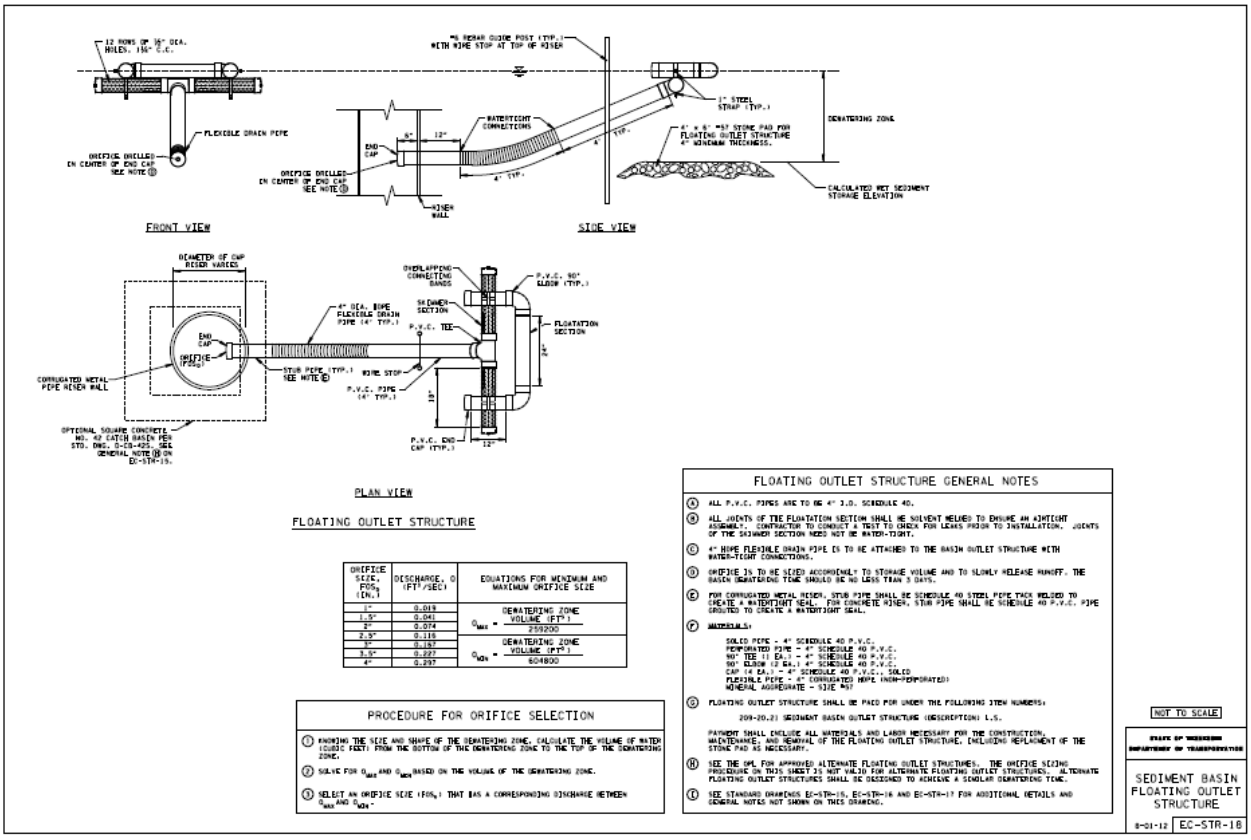

PLAN VIEW
WEIR HEIGHT AND TOP WIDTH
ROCK SEDIMENT DAM GENERAL NOTES
ROCK SEDIMENT DAM DIMENSIONS
SECTION B-B
SECTION A-A
EROSION CONTROL PLAN LEGEND:
ROCK SEDIMENT DAM
ROCK SEDIMENT DAM
EC-STR-12


PLAN VIEW OF ROCK FACED SPILLWAY WITH EARTH CORE AND ADJOINING EARTH EMBANKMENT
SECTION B-B ROCK FACED SPILLWAY
SECTION C-C EARTH EMBANKMENT
SECTION A - A
EROSION CONTROL PLAN LEGEND: ROCK AND EARTH SEDIMENT EMBANKMENT
SEDIMENT EMBANKMENT GENERAL NOTES
ROCK AND EARTH SEDIMENT EMBANKMENT
EC-STR-13

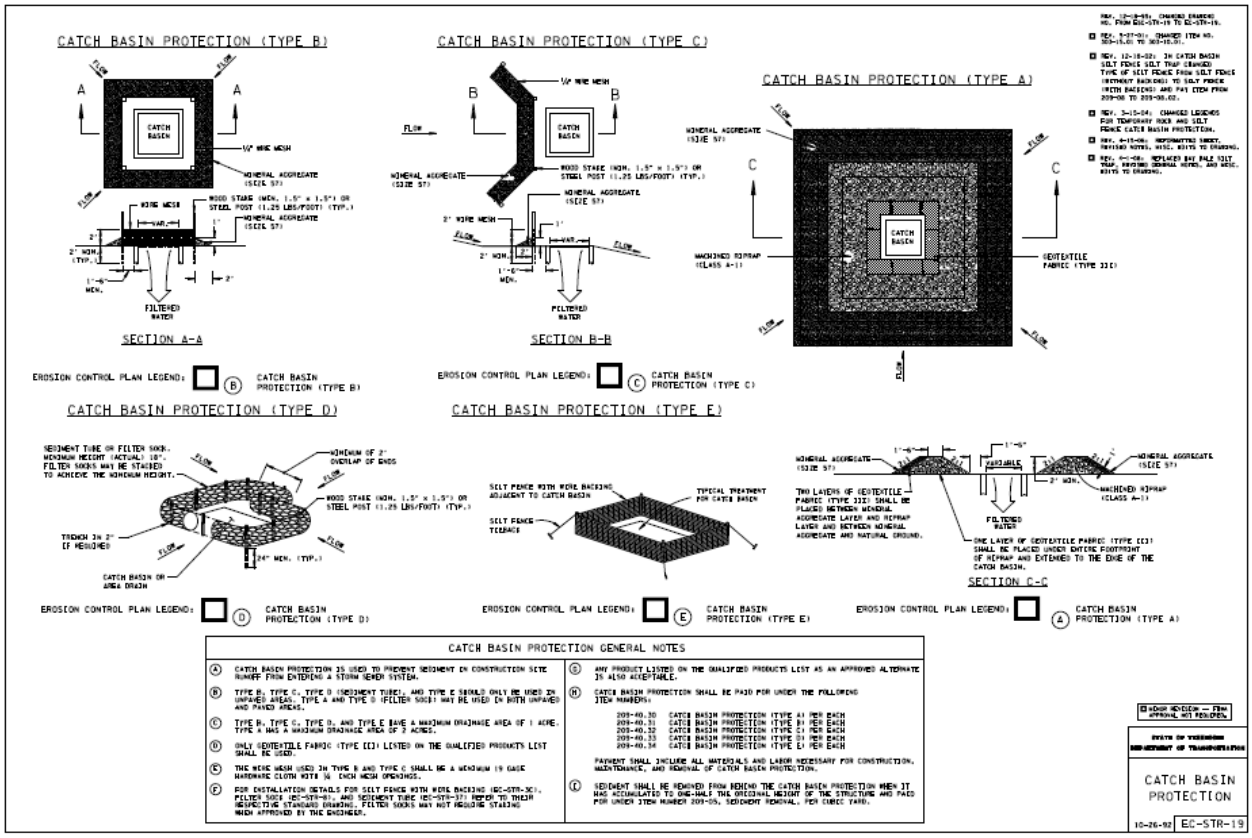

SECTION D-D EMERGENCY SPILLWAY
PLAN VIEW
SECTION A-A
SECTION B-B
SECTION C-C
SEDIMENT BASIN GENERAL NOTES
EROSION CONTROL PLAN LEGEND: SEDIMENT BASIN
SEDIMENT BASIN
EC-STR-15

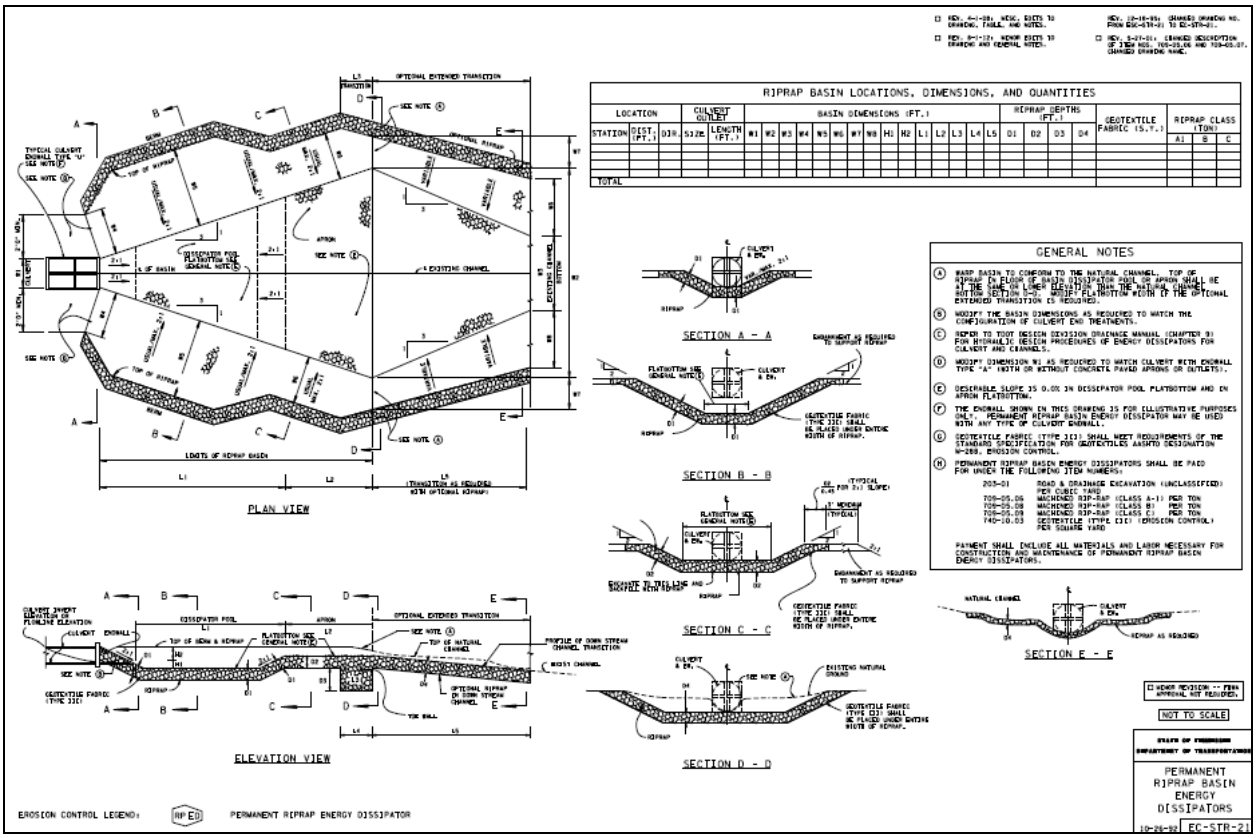

CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE DESIGN TABLE
ANTI-VORTEX DEVICE DETAIL
SECTION A - A
ISOMETRIC VIEW
TYPICAL FOR CONCRETE BASE
TYPICAL FOR STEEL BASE
TYPICAL ANTI-FLOTATION BLOCK DETAILS FOR RISERS TEN FEET OR LESS IN HEIGHT
NOTE: THE BASE OF THE PRINCIPAL SPILLWAY MUST BE FIRMLY ANCHORED TO PREVENT ITS FLOATING. IF THE RISER OF THE SPILLWAY IS GREATER THAN 10 FEET IN HEIGHT, COMPUTATIONS MUST BE MADE TO DETERMINE THE ANCHORING REQUIREMENTS. A MINIMUM FACTOR OF 1.25 SHALL BE USED (DOWNWARD FORCES ÷ 1.25 X UPWARD FORCES).
ANTI - SEEP COLLAR DIAPHRAGM DIMENSION TABLE
ANTI-SEEP COLLAR DETAIL ASSEMBLY NOTES
SEDIMENT BASIN GENERAL NOTES
ANTI-SEEP COLLAR GENERAL NOTES
DEWATERING SYSTEM DETAIL FOR SEDIMENT BASIN
SIDE VIEW OF ANTI-SEEP COLLAR
PLAN VIEW OF ANTI- SEEP COLLAR
ANTI-SEEP COLLAR DETAIL
SEDIMENT BASIN RISER AND COLLAR APPURTENANCES
EC-STR-16

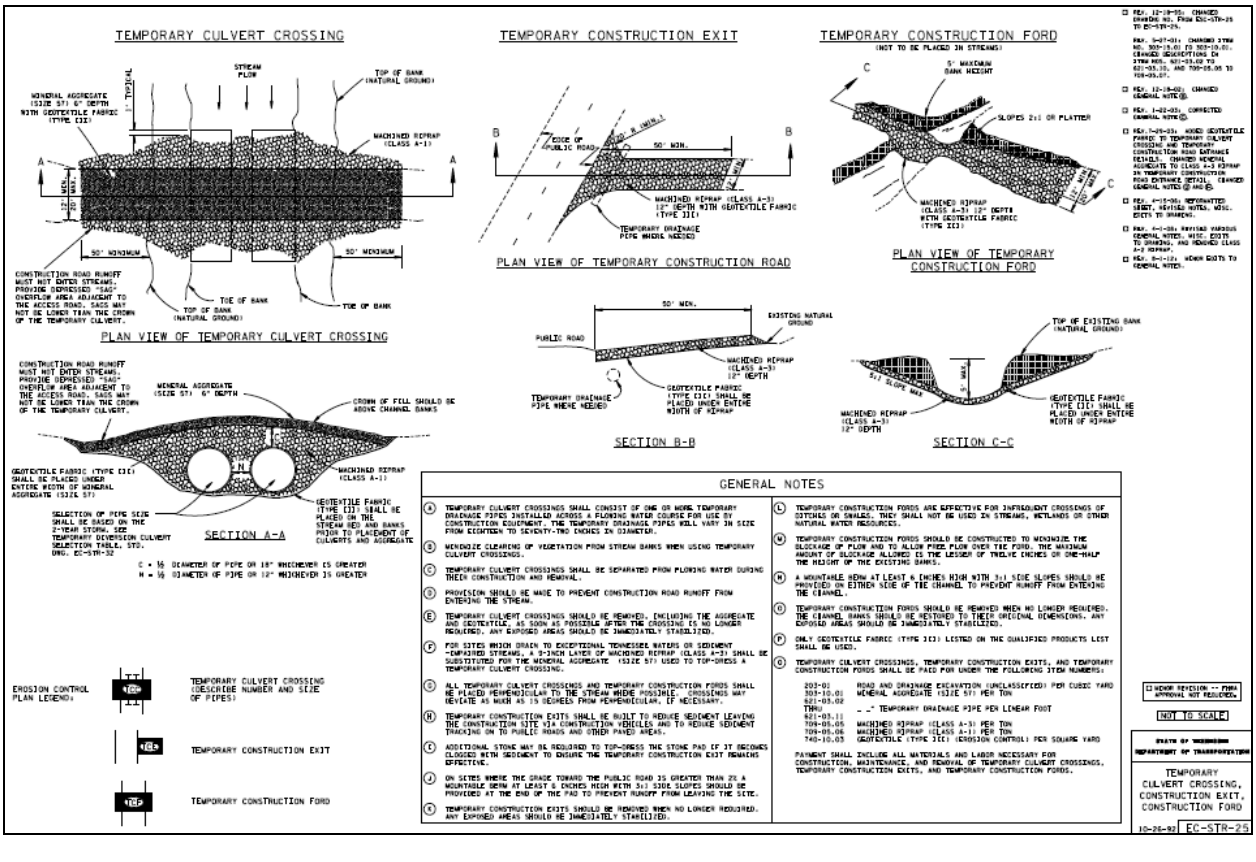

EXAMPLE PLAN VIEWS OF BAFFLE LOCATIONS IN SEDIMENT BASINS
SHAPE NO.1
SHAPE NO.2
SHAPE NO.3
EMBANKMENT WITH EMERGENCY SPILLWAY
EMBANKMENT WITHOUT EMERGENCY SPILLWAY
(TEMPORARY ONLY)
(TO BE USED FOR SMALL SEDIMENT VOLUMES ONLY)
SECTION A-A
BAFFLE DETAIL
SEDIMENT BASIN GENERAL NOTES
EROSION CONTROL PLAN LEGEND: SEDIMENT BASIN
SEDIMENT BASIN EMBANKMENT DETAILS
EC-STR-17

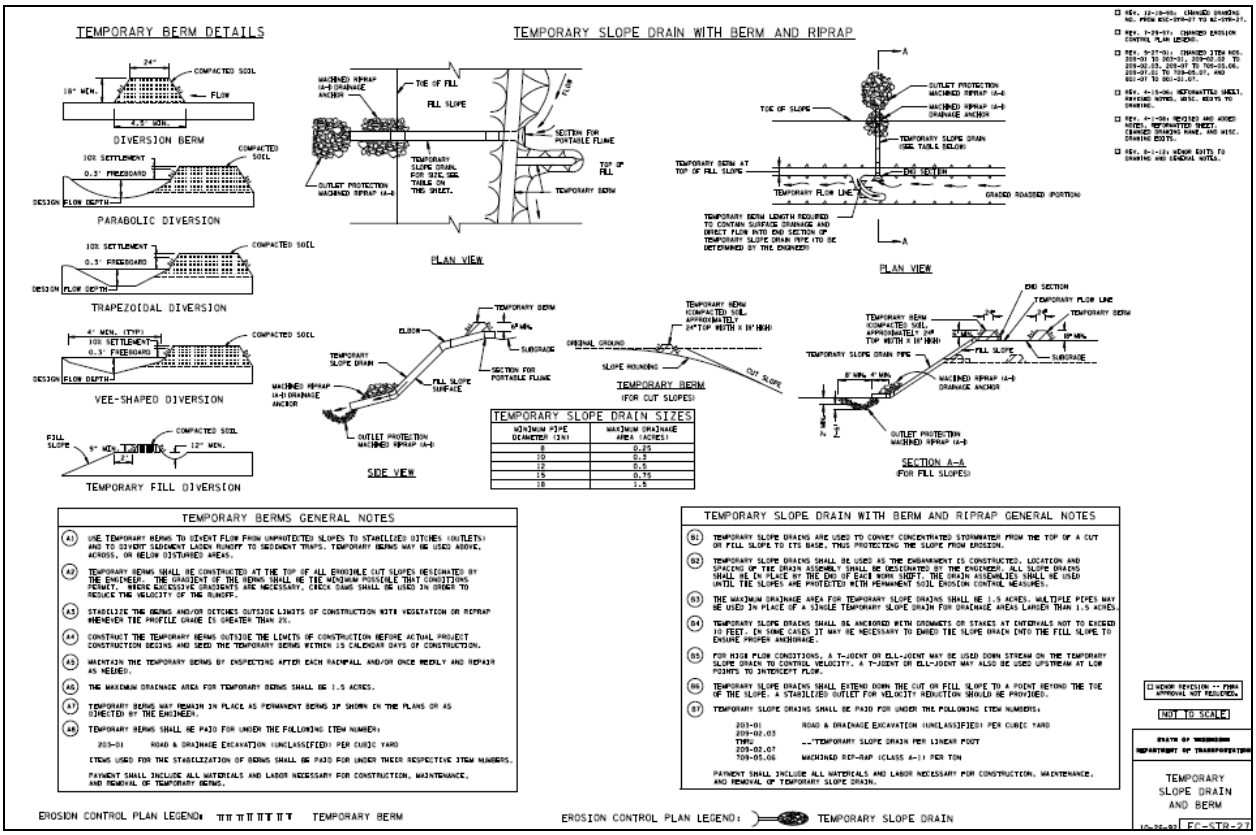


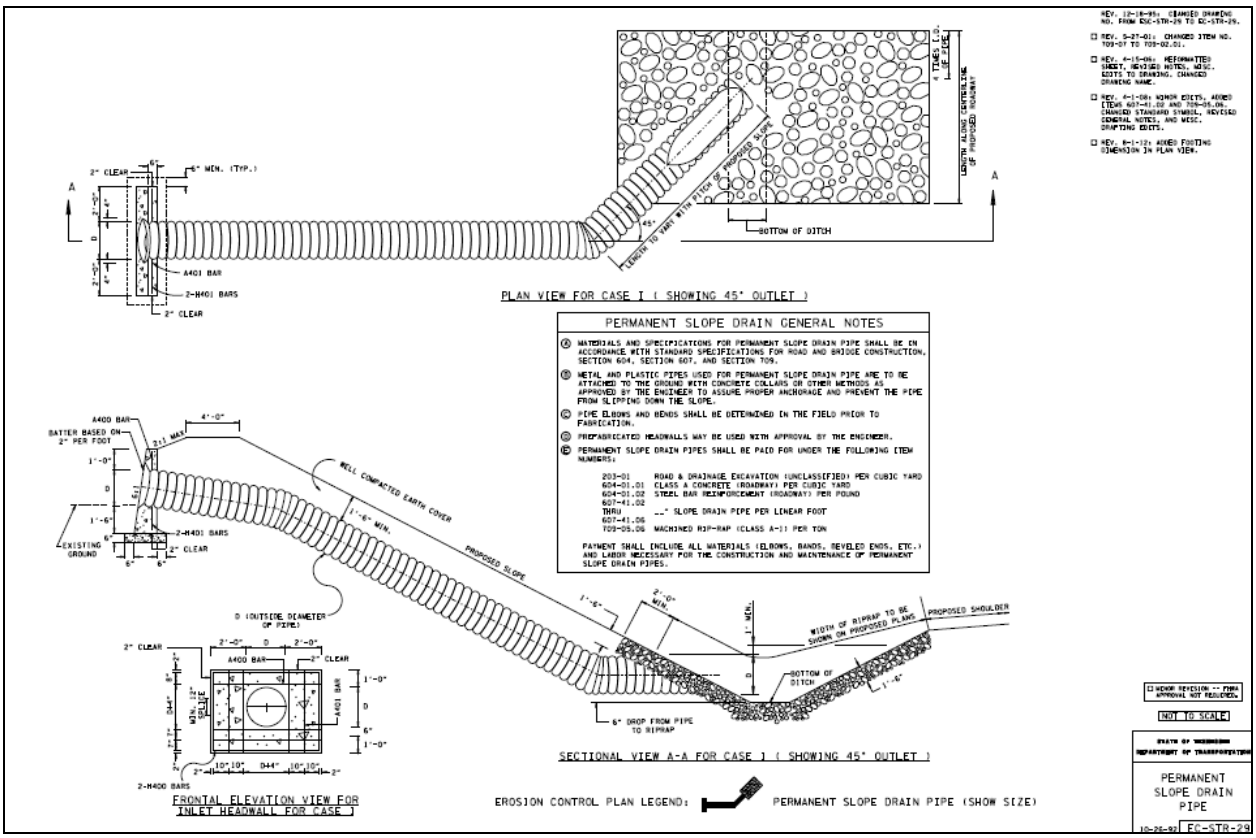
ORIFICE SIZE, FOS_1 (IN.)	DISCHARGE, Q (FT³/SEC)	EQUATIONS FOR MINIMUM AND MAXIMUM ORIFICE SIZE
1"	0.013	DEWATERING ZONE VOLUME (FT³) $Q_{MAX} = \frac{\text{VOLUME (FT}^3\text{)}}{259200}$
1.5"	0.041	
2"	0.074	
2.5"	0.115	DEWATERING ZONE VOLUME (FT³) $Q_{MIN} = \frac{\text{VOLUME (FT}^3\text{)}}{604800}$
3"	0.167	
3.5"	0.227	
4"	0.297	

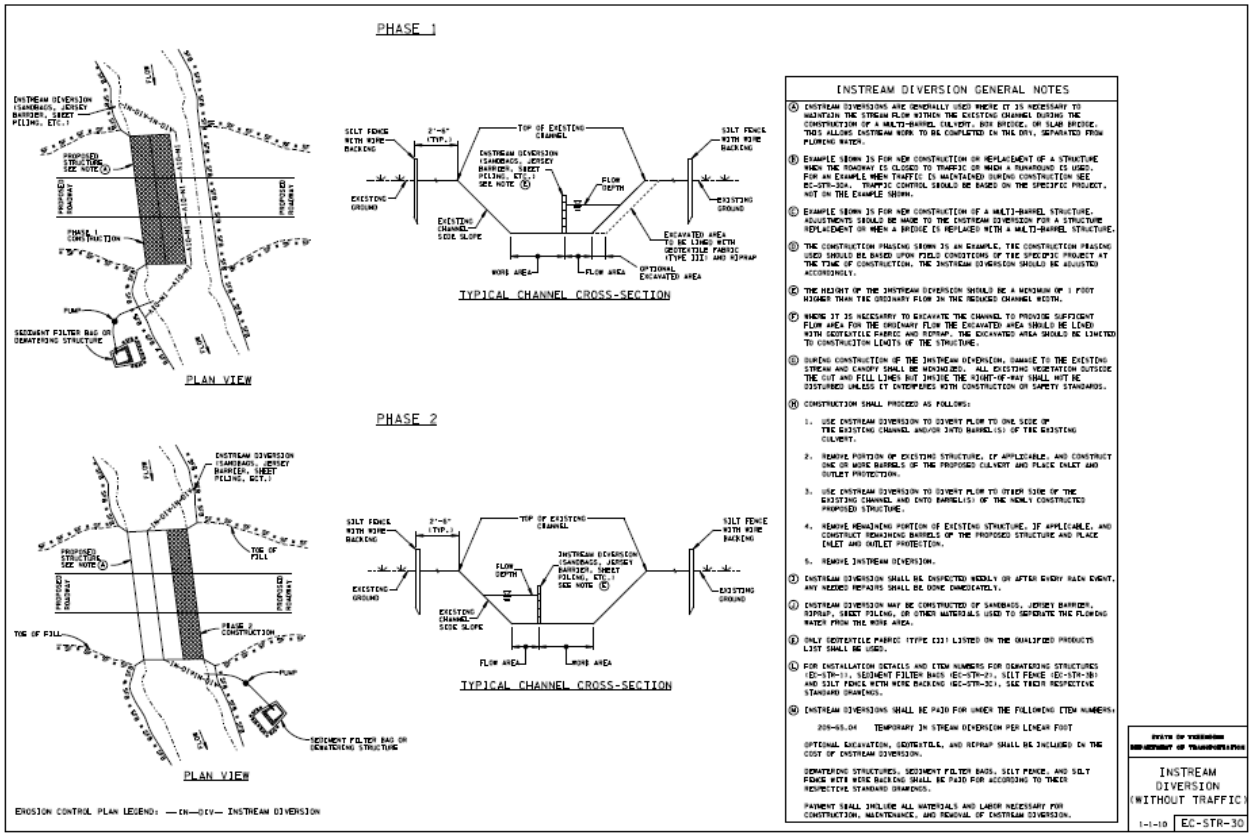


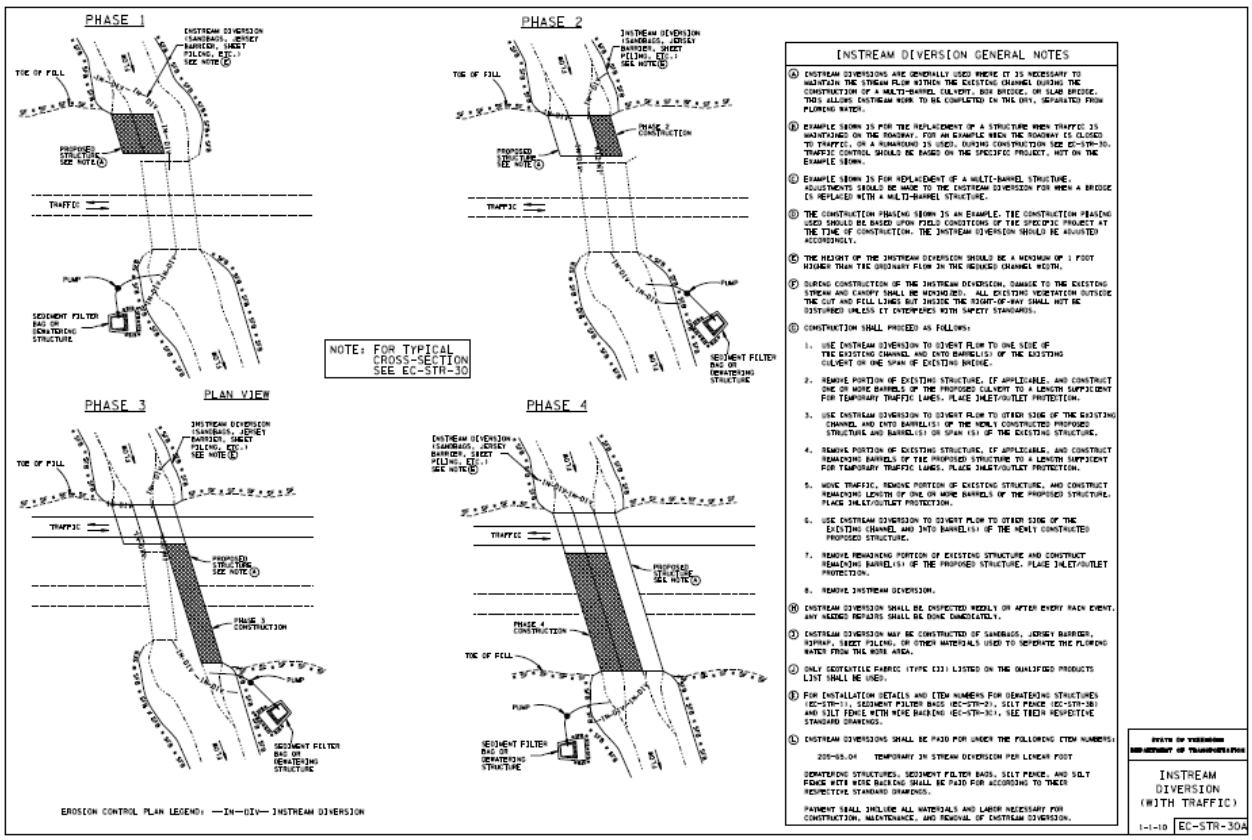

RIPRAP BASIN LOCATIONS, DIMENSIONS, AND QUANTITIES
GENERAL NOTES
PLAN VIEW
ELEVATION VIEW
SECTION A - A
SECTION B - B
SECTION C - C
SECTION D - D
SECTION E - E
NOT TO SCALE
PERMANENT RIPRAP BASIN ENERGY DISSIPATORS
EC-STR-21

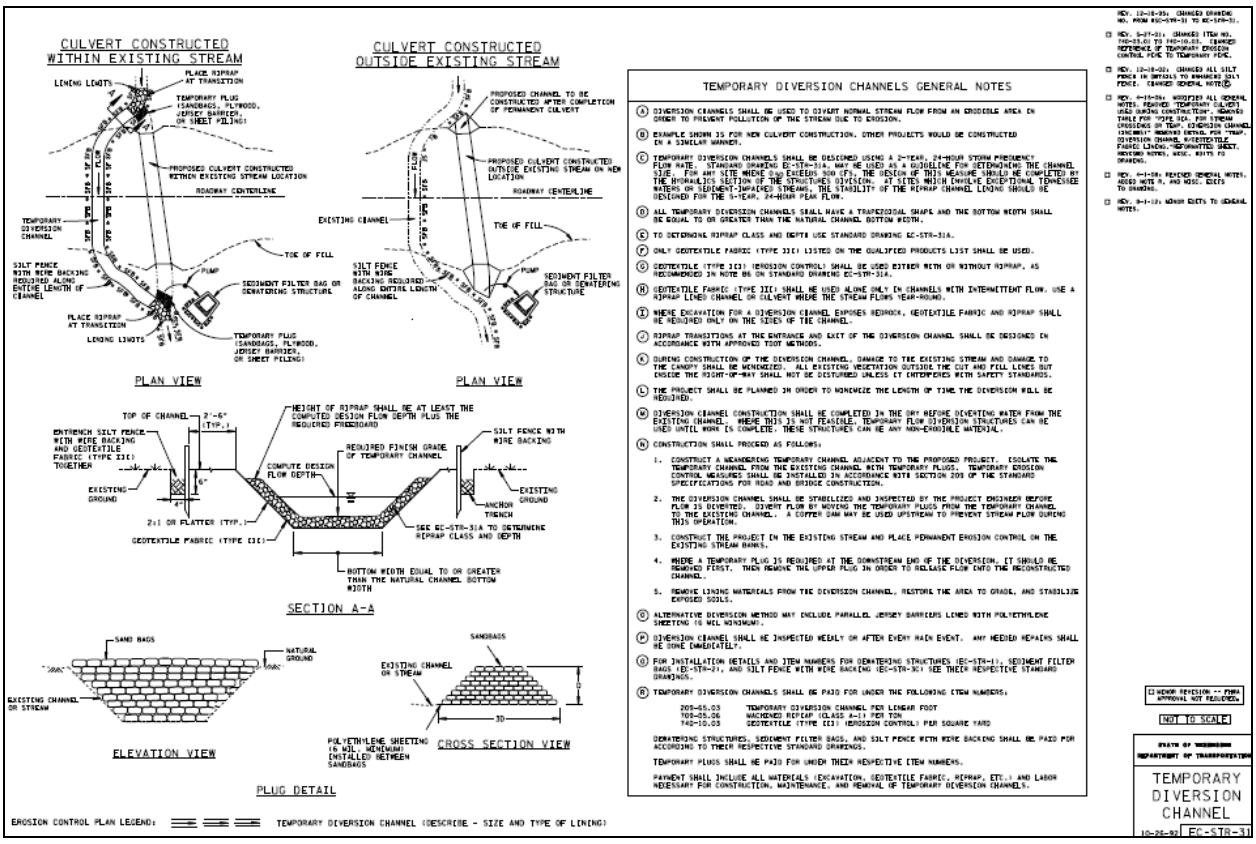

TEMPORARY CULVERT CROSSING
TEMPORARY CONSTRUCTION EXIT
TEMPORARY CONSTRUCTION FORD
PLAN VIEW OF TEMPORARY CULVERT CROSSING
PLAN VIEW OF TEMPORARY CONSTRUCTION ROAD
PLAN VIEW OF TEMPORARY CONSTRUCTION FORD
SECTION A-A
SECTION B-B
SECTION C-C
GENERAL NOTES
NOT TO SCALE
TEMPORARY CULVERT CROSSING, CONSTRUCTION EXIT, CONSTRUCTION FORD
EC-STR-25


TEMPORARY BERM DETAILS
DIVERSION BERM
PARABOLIC DIVERSION
TRAPEZOIDAL DIVERSION
VEE-SHAPED DIVERSION
TEMPORARY FILL DIVERSION
TEMPORARY SLOPE DRAIN WITH BERM AND RIPRAP
PLAN VIEW
SIDE VIEW
TEMPORARY BERM (FOR CUT SLOPES)
SECTION A-A (FOR FILL SLOPES)
TEMPORARY SLOPE DRAIN SIZES
MAXIMUM PIPE DIAMETER (IN) | MAXIMUM DRAINAGE AREA (ACRES)
8 | 0.25
10 | 0.2
12 | 0.5
15 | 0.75
18 | 1.5
TEMPORARY BERMS GENERAL NOTES
A1) USE TEMPORARY BERMS TO DIVERT FLOW FROM UNPROTECTED SLOPES TO STABILIZED DITCHES (OUTLETS) AND TO DIVERT SEDIMENT LADEN RUNOFF TO SEDIMENT TRAPS. TEMPORARY BERMS MAY BE USED ABOVE, ACROSS, OR BELOW DISTURBED AREAS.
A2) TEMPORARY BERMS SHALL BE CONSTRUCTED AT THE TOP OF ALL ERODIBLE CUT SLOPES DESIGNATED BY THE ENGINEER. THE GRADIENT OF THE BERMS SHALL BE THE MINIMUM POSSIBLE THAT CONDITIONS PERMIT. WHERE EXCESSIVE GRADIENTS ARE NECESSARY, CHECK DAMS SHALL BE USED IN ORDER TO REDUCE THE VELOCITY OF THE RUNOFF.
A3) STABILIZE THE BERMS AND/OR DITCHES OUTSIDE LIMITS OF CONSTRUCTION WITH VEGETATION OR RIPRAP WHENEVER THE PROFILE GRADE IS GREATER THAN 2%.
A4) CONSTRUCT THE TEMPORARY BERMS OUTSIDE THE LIMITS OF CONSTRUCTION BEFORE ACTUAL PROJECT CONSTRUCTION BEGINS AND SEED THE TEMPORARY BERMS WITHIN 15 CALENDAR DAYS OF CONSTRUCTION.
A5) MAINTAIN THE TEMPORARY BERMS BY INSPECTING AFTER EACH RAINFALL AND/OR ONCE WEEKLY AND REPAIR AS NEEDED.
A6) THE MAXIMUM DRAINAGE AREA FOR TEMPORARY BERMS SHALL BE 1.5 ACRES.
A7) TEMPORARY BERMS MAY REMAIN IN PLACE AS PERMANENT BERMS IF SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.
A8) TEMPORARY BERMS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:
203-01 ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER CUBIC YARD
ITEMS USED FOR THE STABILIZATION OF BERMS SHALL BE PAID FOR UNDER THEIR RESPECTIVE ITEM NUMBERS.
PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF TEMPORARY BERMS.
TEMPORARY SLOPE DRAIN WITH BERM AND RIPRAP GENERAL NOTES
B1) TEMPORARY SLOPE DRAINS ARE USED TO CONVEY CONCENTRATED STORMWATER FROM THE TOP OF A CUT OR FILL SLOPE TO ITS BASE, THUS PROTECTING THE SLOPE FROM EROSION.
B2) TEMPORARY SLOPE DRAINS SHALL BE USED AS THE EMBANKMENT IS CONSTRUCTED. LOCATION AND SPACING OF THE DRAIN ASSEMBLY SHALL BE DESIGNATED BY THE ENGINEER. ALL SLOPE DRAINS SHALL BE IN PLACE BY THE END OF EACH WORK SHIFT. THE DRAIN ASSEMBLIES SHALL BE USED UNTIL THE SLOPES ARE PROTECTED WITH PERMANENT SOIL EROSION CONTROL MEASURES.
B3) THE MAXIMUM DRAINAGE AREA FOR TEMPORARY SLOPE DRAINS SHALL BE 1.5 ACRES. MULTIPLE PIPES MAY BE USED IN PLACE OF A SINGLE TEMPORARY SLOPE DRAIN FOR DRAINAGE AREAS LARGER THAN 1.5 ACRES.
B4) TEMPORARY SLOPE DRAINS SHALL BE ANCHORED WITH GROMMETS OR STAKES AT INTERVALS NOT TO EXCEED 10 FEET. IN SOME CASES IT MAY BE NECESSARY TO BURY THE SLOPE DRAIN INTO THE FILL SLOPE TO ENSURE PROPER ANCHORAGE.
B5) FOR HIGH FLOW CONDITIONS, A T-JOINT OR ELL-JOINT MAY BE USED DOWN STREAM ON THE TEMPORARY SLOPE DRAIN TO CONTROL VELOCITY. A T-JOINT OR ELL-JOINT MAY ALSO BE USED UPSTREAM AT LOW POINTS TO INTERCEPT FLOW.
B6) TEMPORARY SLOPE DRAINS SHALL EXTEND DOWN THE CUT OR FILL SLOPE TO A POINT BEYOND THE TOE OF THE SLOPE. A STABILIZED OUTLET FOR VELOCITY REDUCTION SHOULD BE PROVIDED.
B7) TEMPORARY SLOPE DRAINS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:
203-01 ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER CUBIC YARD
209-02.03 THRU --"TEMPORARY SLOPE DRAIN PER LINEAR FOOT
209-02.07
709-05.06 MACHINED RIP-RAP (CLASS A-1) PER TON
PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF TEMPORARY SLOPE DRAIN.
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.
NOT TO SCALE
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION
TEMPORARY SLOPE DRAIN AND BERM
10-26-92 EC-STR-27
EROSION CONTROL PLAN LEGEND: TEMPORARY BERM
EROSION CONTROL PLAN LEGEND: TEMPORARY SLOPE DRAIN


PLAN VIEW FOR CASE I (SHOWING 45° OUTLET)
PERMANENT SLOPE DRAIN GENERAL NOTES
A) MATERIALS AND SPECIFICATIONS FOR PERMANENT SLOPE DRAIN PIPE SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 604, SECTION 607, AND SECTION 709.
B) METAL AND PLASTIC PIPES USED FOR PERMANENT SLOPE DRAIN PIPE ARE TO BE ATTACHED TO THE GROUND WITH CONCRETE COLLARS OR OTHER METHODS AS APPROVED BY THE ENGINEER TO ASSURE PROPER ANCHORAGE AND PREVENT THE PIPE FROM SLIPPING DOWN THE SLOPE.
C) PIPE ELBOWS AND BENDS SHALL BE DETERMINED IN THE FIELD PRIOR TO FABRICATION.
D) PREFABRICATED HEADWALLS MAY BE USED WITH APPROVAL BY THE ENGINEER.
E) PERMANENT SLOPE DRAIN PIPES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:
203-01 ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER CUBIC YARD
604-01.01 CLASS A CONCRETE (ROADWAY) PER CUBIC YARD
604-01.02 STEEL BAR REINFORCEMENT (ROADWAY) PER POUND
607-41.02 THRU --" SLOPE DRAIN PIPE PER LINEAR FOOT
607-41.06
709-05.06 MACHINED RIP-RAP (CLASS A-1) PER TON
PAYMENT SHALL INCLUDE ALL MATERIALS (ELBOWS, BANDS, BEVELED ENDS, ETC.) AND LABOR NECESSARY FOR THE CONSTRUCTION AND MAINTENANCE OF PERMANENT SLOPE DRAIN PIPES.
SECTIONAL VIEW A-A FOR CASE I (SHOWING 45° OUTLET)
FRONTAL ELEVATION VIEW FOR INLET HEADWALL FOR CASE I
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.
NOT TO SCALE
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION
PERMANENT SLOPE DRAIN PIPE
10-26-92 EC-STR-29
EROSION CONTROL PLAN LEGEND: PERMANENT SLOPE DRAIN PIPE (SHOW SIZE)


PHASE 1
PLAN VIEW
TYPICAL CHANNEL CROSS-SECTION
PHASE 2
PLAN VIEW
TYPICAL CHANNEL CROSS-SECTION
EROSION CONTROL PLAN LEGEND: —IN—DIV— INSTREAM DIVERSION
INSTREAM DIVERSION GENERAL NOTES
INSTREAM DIVERSION (WITHOUT TRAFFIC)
1-1-10
EC-STR-30


PHASE 1
PHASE 2
PLAN VIEW
NOTE: FOR TYPICAL CROSS-SECTION SEE EC-STR-30
PHASE 3
PHASE 4
EROSION CONTROL PLAN LEGEND: —IN—DIV— INSTREAM DIVERSION
INSTREAM DIVERSION GENERAL NOTES
INSTREAM DIVERSION (WITH TRAFFIC)
1-1-10
EC-STR-30A



TEMPORARY DIVERSION CHANNELS GENERAL NOTES

(A) DIVERSION CHANNELS SHALL BE USED TO DIVERT NORMAL STREAM FLOW FROM AN EXCAVATED AREA IN ORDER TO PREVENT POLLUTION OF THE STREAM DUE TO EROSION.

(B) EXAMPLE SHOWN IS FOR NEW CULVERT CONSTRUCTION. OTHER PROJECTS WOULD BE CONSTRUCTED IN A SIMILAR MANNER.

(C) TEMPORARY DIVERSION CHANNELS SHALL BE DESIGNED USING A 2-YEAR, 24-HOUR STORM FREQUENCY FLOW RATE. STANDARD DRAWING EC-STR-31A MAY BE USED AS A GUIDELINE FOR DETERMINING THE CHANNEL SIZE. FOR ANY SITE WHERE D50 EXCEEDS 300 (F), THE DESIGN OF THIS MEASURE SHALL BE COMPLETED BY THE HYDRAULICS SECTION OF THE STRUCTURES DIVISION. AT SITES WHICH INVOLVE EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE FEASIBILITY OF THE RIPRAP CHANNEL LINING SHOULD BE DESIGNED FOR THE 5-YEAR, 24-HOUR PEAK FLOW.

(D) ALL TEMPORARY DIVERSION CHANNELS SHALL HAVE A TRAPEZOIDAL SHAPE AND THE BOTTOM WIDTH SHALL BE EQUAL TO OR GREATER THAN THE NATURAL CHANNEL BOTTOM WIDTH.

(E) TO DETERMINE RIPRAP CLASS AND DEPTH USE STANDARD DRAWING EC-STR-31A.

(F) ONLY GEOTEXTILE FABRIC (TYPE 313) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(G) GEOTEXTILE (TYPE 323) (EROSION CONTROL) SHALL BE USED EITHER WITH OR WITHOUT RIPRAP, AS RECOMMENDED IN NOTE B6 ON STANDARD DRAWING EC-STR-31A.

(H) GEOTEXTILE FABRIC (TYPE 311) SHALL BE USED ALONE ONLY IN CHANNELS WITH INTERMITTENT FLOW. USE A RIPRAP LINED CHANNEL OR CULVERT WHERE THE STREAM FLOWS YEAR-ROUND.

(I) WHERE EXCAVATION FOR A DIVERSION CHANNEL EXPOSES BEDROCK, GEOTEXTILE FABRIC AND RIPRAP SHALL BE REQUIRED ONLY ON THE SIDES OF THE CHANNEL.

(J) RIPRAP TRANSITIONS AT THE ENTRANCE AND EXIT OF THE DIVERSION CHANNEL SHALL BE DESIGNED IN ACCORDANCE WITH APPROVED TDOT METHODS.

(K) DURING CONSTRUCTION OF THE DIVERSION CHANNEL, DAMAGE TO THE EXISTING STREAM AND DAMAGE TO THE CANOPY SHALL BE MINIMIZED. ALL EXISTING VEGETATION OUTSIDE THE CUT AND FILL LINES BUT INSIDE THE RIGHT-OF-WAY SHALL NOT BE DISTURBED UNLESS IT INTERFERES WITH SAFETY STANDARDS.

(L) THE PROJECT SHALL BE PLANNED IN ORDER TO MINIMIZE THE LENGTH OF TIME THE DIVERSION WILL BE REQUIRED.

(M) DIVERSION CHANNEL CONSTRUCTION SHALL BE COMPLETED IN THE DRY BEFORE DIVERTING WATER FROM THE EXISTING CHANNEL. WHERE THIS IS NOT FEASIBLE, TEMPORARY FLOW DIVERSION STRUCTURES CAN BE USED UNTIL WORK IS COMPLETE. THESE STRUCTURES CAN BE ANY NON-ERODIBLE MATERIAL.

(N) CONSTRUCTION SHALL PROCEED AS FOLLOWS:

1. CONSTRUCT A MEANDERING TEMPORARY CHANNEL ADJACENT TO THE PROPOSED PROJECT. ISOLATE THE TEMPORARY CHANNEL FROM THE EXISTING CHANNEL WITH TEMPORARY PLUGS. TEMPORARY EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 209 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
2. THE DIVERSION CHANNEL SHALL BE STABILIZED AND INSPECTED BY THE PROJECT ENGINEER BEFORE FLOW IS DIVERTED. DIVERT FLOW BY MOVING THE TEMPORARY PLUGS FROM THE TEMPORARY CHANNEL TO THE EXISTING CHANNEL. A COFFER DAM MAY BE USED UPSTREAM TO PREVENT STREAM FLOW DURING THIS OPERATION.
3. CONSTRUCT THE PROJECT IN THE EXISTING STREAM AND PLACE PERMANENT EROSION CONTROL ON THE EXISTING STREAM BANKS.
4. WHERE A TEMPORARY PLUG IS REQUIRED AT THE DOWNSTREAM END OF THE DIVERSION, IT SHOULD BE REMOVED FIRST. THEN REMOVE THE UPPER PLUG IN ORDER TO RELEASE FLOW INTO THE RECONSTRUCTED CHANNEL.
5. REMOVE LINING MATERIALS FROM THE DIVERSION CHANNEL. RESTORE THE AREA TO GRADE, AND STABILIZE EXPOSED SOILS.

(O) ALTERNATIVE DIVERSION METHOD MAY INCLUDE PARALLEL JERSEY BARRIERS LINED WITH POLYETHYLENE SHEETING 10 MIL MINIMUM.

(P) DIVERSION CHANNEL SHALL BE INSPECTED WEEKLY OR AFTER EVERY RAIN EVENT. ANY NEEDED REPAIRS SHALL BE DONE IMMEDIATELY.

(Q) FOR INSTALLATION DETAILS AND ITEM NUMBERS FOR DEWATERING STRUCTURES (EC-STR-1), SEDIMENT FILTER BAGS (EC-STR-2), AND SILT FENCE WITH WIRE BACKING (EC-STR-3C) SEE THEIR RESPECTIVE STANDARD DRAWINGS.

(R) TEMPORARY DIVERSION CHANNELS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-65.03	TEMPORARY DIVERSION CHANNEL PER LINEAR FOOT
709-05.06	MACHINED RIPRAP (CLASS A-1) PER TON
740-10.03	GEOTEXTILE (TYPE 323) (EROSION CONTROL) PER SQUARE YARD

DEWATERING STRUCTURES, SEDIMENT FILTER BAGS, AND SILT FENCE WITH WIRE BACKING SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE STANDARD DRAWINGS.

TEMPORARY PLUGS SHALL BE PAID FOR UNDER THEIR RESPECTIVE ITEM NUMBERS.

PAYMENT SHALL INCLUDE ALL MATERIALS (EXCAVATION, GEOTEXTILE FABRIC, RIPRAP, ETC.) AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF TEMPORARY DIVERSION CHANNELS.

REV. 12-16-95: (CHANGED DRAWING NO. FROM EC-STR-31 TO EC-STR-31).

REV. 5-27-01: (CHANGED ITEM NO. 740-03.01 TO 740-10.03. CHANGED REFERENCE OF TEMPORARY EROSION CONTROL FENCE TO TEMPORARY FENCE.

REV. 12-16-02: (CHANGED ALL SILT FENCE IN DETAILS TO ENHANCED SILT FENCE. CHANGED GENERAL NOTE(P).

REV. 4-15-04: MODIFIED ALL GENERAL NOTES. RENAMED TEMPORARY CULVERT USED DURING CONSTRUCTION". REMOVED TABLE FOR "PIPE DIA. FOR STREAM CROSSINGS OR TEMP. DIVERSION CHANNEL (INCHES)" REMOVED DETAIL FOR "TEMP. DIVERSION CHANNEL W/GEOTEXTILE FABRIC LINING." REFORMATTED SHEET. REVISED NOTES, MISC. EDITS TO DRAWING.

REV. 4-1-08: REVISED GENERAL NOTES. ADDED NOTE R, AND MISC. EDITS TO DRAWING.

REV. 9-1-12: MINOR EDITS TO GENERAL NOTES.

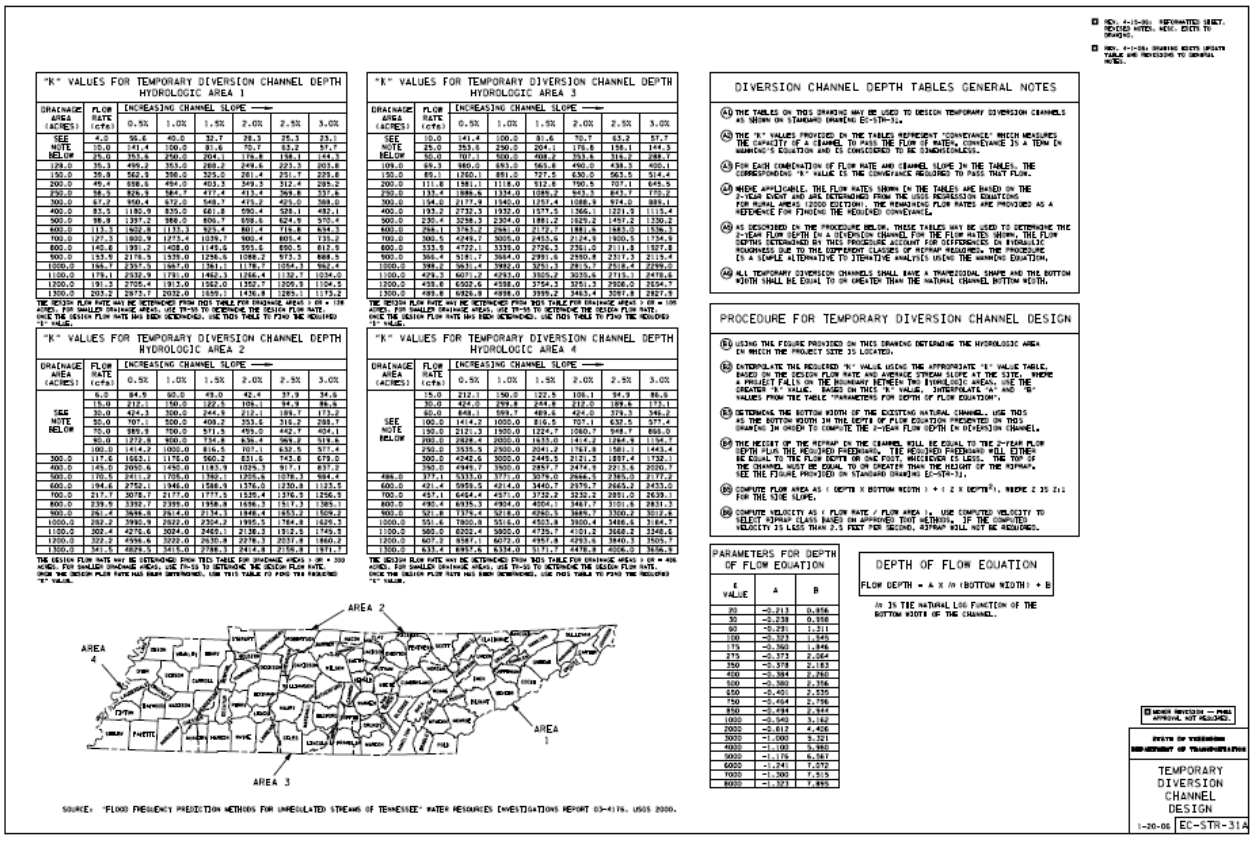
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

TEMPORARY DIVERSION CHANNEL

10-26-92 EC-STR-31



"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 1

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	4.0	96.6	45.0	32.7	26.3	25.3	23.1
	10.0	141.4	100.0	81.6	70.7	63.2	57.7
128.0	25.0	353.6	250.0	204.1	176.8	158.1	144.3
128.0	35.3	499.2	353.0	288.2	249.6	223.3	203.8
150.0	38.8	562.5	398.0	325.0	281.4	251.7	229.8
200.0	49.4	698.6	494.0	403.3	349.3	312.4	285.2
250.0	58.5	826.1	584.7	477.4	413.3	369.8	337.6
300.0	67.2	950.4	672.0	548.7	475.2	425.0	388.0
400.0	83.5	1180.9	835.0	681.8	590.4	528.1	482.1
500.0	98.8	1397.2	988.0	806.7	698.6	624.9	570.4
600.0	113.3	1602.8	1133.3	925.4	801.4	716.8	654.3
700.0	127.3	1800.9	1273.4	1039.7	900.4	805.4	735.2
800.0	140.6	1991.2	1408.0	1149.6	995.6	890.5	812.9
900.0	153.5	2176.5	1539.0	1256.5	1088.2	973.3	888.5
1000.0	166.1	2357.5	1667.0	1361.1	1178.7	1054.3	962.4
1100.0	178.4	2532.9	1791.0	1462.3	1266.4	1132.7	1034.0
1200.0	191.3	2705.4	1913.0	1562.0	1352.7	1209.9	1104.5
1300.0	203.2	2873.7	2032.0	1659.1	1436.8	1285.1	1173.2

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > 00 < 128 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 3

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
SEE NOTE BELOW	10.0	141.4	100.0	81.6	70.7	63.2	57.7
	25.0	353.6	250.0	204.1	176.8	158.1	144.3
	50.0	707.1	500.0	408.2	353.6	316.2	288.7
109.0	69.3	980.0	693.0	565.8	490.0	438.3	400.1
150.0	85.1	1260.1	891.0	727.5	630.0	563.5	514.4
200.0	111.8	1581.1	1118.0	912.8	790.5	707.1	645.5
250.0	133.4	1886.6	1334.0	1089.2	943.3	843.7	770.2
300.0	154.0	2177.9	1540.0	1257.4	1088.9	974.0	889.1
400.0	193.2	2732.3	1932.0	1577.5	1366.1	1221.8	1115.4
500.0	230.1	3298.3	2304.0	1881.2	1629.2	1457.2	1330.2
600.0	266.1	3763.2	2661.0	2172.7	1881.6	1683.0	1536.3
700.0	300.5	4249.7	3005.0	2453.6	2124.9	1900.5	1734.9
800.0	333.9	4722.1	3339.0	2726.3	2361.0	2111.8	1927.8
900.0	366.4	5181.7	3664.0	2991.6	2590.8	2317.3	2115.4
1000.0	398.2	5631.4	3982.0	3251.3	2815.7	2518.4	2299.0
1100.0	429.3	6071.2	4293.0	3505.2	3035.6	2715.1	2478.6
1200.0	459.8	6502.6	4598.0	3754.3	3251.3	2908.0	2654.7
1300.0	489.8	6926.8	4898.0	3999.2	3463.4	3097.8	2827.5

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > 00 < 100 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 2

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
	6.0	84.9	60.0	49.0	42.4	37.9	34.6
	15.0	212.1	150.0	122.5	106.1	94.9	86.6
SEE NOTE BELOW	30.0	424.3	300.0	244.9	212.1	189.7	173.2
	50.0	707.1	500.0	408.2	353.6	316.2	288.7
	70.0	989.9	700.0	571.5	495.0	442.7	404.1
	90.0	1272.8	900.0	734.8	636.4	569.2	519.6
	100.0	1414.2	1000.0	816.5	707.1	632.5	577.4
300.0	117.6	1663.1	1176.0	960.2	831.6	743.8	679.0
400.0	145.0	2050.6	1450.0	1183.9	1025.3	917.1	837.2
500.0	170.5	2411.2	1705.0	1392.1	1205.6	1078.3	984.4
600.0	194.7	2752.1	1946.0	1588.9	1376.0	1230.8	1123.5
700.0	217.7	3078.7	2177.0	1777.5	1539.4	1376.5	1256.9
800.0	239.5	3392.7	2395.0	1956.8	1696.3	1517.3	1385.1
900.0	261.4	3698.8	2614.0	2134.1	1848.4	1653.2	1509.2
1000.0	282.2	3990.9	2822.0	2304.2	1995.5	1784.8	1629.3
1100.0	302.4	4276.6	3024.0	2469.1	2138.3	1912.5	1745.5
1200.0	322.0	4556.6	3220.0	2629.0	2276.3	2037.0	1860.2
1300.0	341.5	4829.5	3415.0	2788.1	2414.4	2158.8	1971.7

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > 00 < 300 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

"K" VALUES FOR TEMPORARY DIVERSION CHANNEL DEPTH HYDROLOGIC AREA 4

DRAINAGE AREA (ACRES)	FLOW RATE (cfs)	INCREASING CHANNEL SLOPE → 0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
	15.0	212.1	150.0	122.5	106.1	94.9	86.6
	30.0	424.3	299.8	244.9	212.0	189.6	173.1
SEE NOTE BELOW	60.0	848.1	599.7	489.6	424.0	379.5	346.2
	100.0	1414.2	1000.0	816.5	707.1	632.5	577.4
	200.0	2828.4	2000.0	1633.0	1414.2	1264.9	1154.7
	250.0	3535.5	2500.0	2041.2	1767.8	1581.1	1443.4
	300.0	4242.6	3000.0	2449.5	2121.3	1897.4	1732.1
	350.0	4949.7	3500.0	2857.7	2474.5	2213.6	2020.7
486.0	377.1	5333.0	3771.0	3079.0	2666.5	2385.0	2177.2
600.0	421.4	5958.5	4214.0	3440.7	2979.7	2665.2	2433.0
700.0	457.1	6464.4	4571.0	3732.2	3232.2	2891.0	2639.1
800.0	490.4	6935.3	4904.0	4004.1	3467.7	3101.5	2831.3
900.0	521.8	7379.4	5218.0	4260.5	3689.7	3300.2	3012.6
1000.0	551.6	7800.8	5516.0	4503.8	3900.4	3488.6	3184.7
1100.0	580.0	8202.4	5800.0	4735.7	4101.2	3668.2	3348.6
1200.0	607.2	8587.1	6072.0	4957.8	4293.6	3840.3	3505.9
1300.0	633.4	8957.6	6334.0	5171.7	4478.8	4006.0	3656.9

THE DESIGN FLOW RATE MAY BE DETERMINED FROM THIS TABLE FOR DRAINAGE AREAS > 00 < 486 ACRES. FOR SMALLER DRAINAGE AREAS, USE TR-55 TO DETERMINE THE DESIGN FLOW RATE. ONCE THE DESIGN FLOW RATE HAS BEEN DETERMINED, USE THIS TABLE TO FIND THE REQUIRED "K" VALUE.

SOURCE: "FLOOD FREQUENCY PREDICTION METHODS FOR UNREGULATED STREAMS OF TENNESSEE" WATER RESOURCES INVESTIGATIONS REPORT 03-4176, USGS 2000.

DIVERSION CHANNEL DEPTH TABLES GENERAL NOTES

(A1) THE TABLES ON THIS DRAWING MAY BE USED TO DESIGN TEMPORARY DIVERSION CHANNELS AS SHOWN ON STANDARD DRAWING EC-STR-31A.

(A2) THE "K" VALUES PROVIDED IN THE TABLES REPRESENT "CONVEYANCE" WHICH MEASURES THE CAPACITY OF A CHANNEL TO PASS THE FLOW OF WATER. CONVEYANCE IS A TERM IN MANNING'S EQUATION AND IS CONSIDERED TO BE DIMENSIONLESS.

(A3) FOR EACH COMBINATION OF FLOW RATE AND CHANNEL SLOPE IN THE TABLES, THE CORRESPONDING "K" VALUE IS THE CONVEYANCE REQUIRED TO PASS THAT FLOW.

(A4) WHERE APPLICABLE, THE FLOW RATES SHOWN IN THE TABLES ARE BASED ON THE 2-YEAR EVENT AND ARE DETERMINED FROM THE USGS REGRESSION EQUATIONS FOR RURAL AREAS (2000 EDITION). THE REMAINING FLOW RATES ARE PROVIDED AS A REFERENCE FOR FINDING THE REQUIRED CONVEYANCE.

(A5) AS DESCRIBED IN THE PROCEDURE BELOW, THESE TABLES MAY BE USED TO DETERMINE THE 2-YEAR FLOW DEPTH IN A DIVERSION CHANNEL FOR THE FLOW RATES SHOWN. THE FLOW DEPTHS DETERMINED BY THIS PROCEDURE ACCOUNT FOR DIFFERENCES IN HYDRAULIC ROUGHNESS DUE TO THE DIFFERENT CLASSES OF RIPRAP REQUIRED. THE PROCEDURE IS A SIMPLE ALTERNATIVE TO ITERATIVE ANALYSIS USING THE MANNING EQUATION.

(A6) ALL TEMPORARY DIVERSION CHANNELS SHALL HAVE A TRAPEZOIDAL SHAPE AND THE BOTTOM WIDTH SHALL BE EQUAL TO OR GREATER THAN THE NATURAL CHANNEL BOTTOM WIDTH.

PROCEDURE FOR TEMPORARY DIVERSION CHANNEL DESIGN

(B1) USING THE FIGURE PROVIDED ON THIS DRAWING DETERMINE THE HYDROLOGIC AREA IN WHICH THE PROJECT SITE IS LOCATED.

(B2) INTERPOLATE THE REQUIRED "K" VALUE USING THE APPROPRIATE "K" VALUE TABLE, BASED ON THE DESIGN FLOW RATE AND AVERAGE STREAM SLOPE AT THE SITE. WHERE A PROJECT FALLS ON THE BOUNDARY BETWEEN TWO HYDROLOGIC AREAS, USE THE GREATER "K" VALUE. BASED ON THIS "K" VALUE, INTERPOLATE "A" AND "B" VALUES FROM THE TABLE "PARAMETERS FOR DEPTH OF FLOW EQUATION".

(B3) DETERMINE THE BOTTOM WIDTH OF THE EXISTING NATURAL CHANNEL. USE THIS AS THE BOTTOM WIDTH IN THE DEPTH OF FLOW EQUATION PRESENTED ON THIS DRAWING IN ORDER TO COMPUTE THE 2-YEAR FLOW DEPTH IN DIVERSION CHANNEL.

(B4) THE HEIGHT OF THE RIPRAP IN THE CHANNEL SHALL BE EQUAL TO THE 2-YEAR FLOW DEPTH PLUS THE REQUIRED FREEBOARD. THE REQUIRED FREEBOARD WILL EITHER BE EQUAL TO THE FLOW DEPTH OR ONE FOOT, WHICHEVER IS LESS. THE TOP OF THE CHANNEL MUST BE EQUAL TO OR GREATER THAN THE HEIGHT OF THE RIPRAP. SEE THE FIGURE PROVIDED ON STANDARD DRAWING EC-STR-31.

(B5) COMPUTE FLOW AREA AS: (DEPTH X BOTTOM WIDTH) + (Z X DEPTH^2), WHERE Z IS Z:1 FOR THE SIDE SLOPE.

(B6) COMPUTE VELOCITY AS (FLOW RATE / FLOW AREA). USE COMPUTED VELOCITY TO SELECT RIPRAP (CLASS BASED ON APPROVED TDOT METHODS). IF THE COMPUTED VELOCITY IS LESS THAN 2.5 FEET PER SECOND, RIPRAP WILL NOT BE REQUIRED.

PARAMETERS FOR DEPTH OF FLOW EQUATION

K VALUE	A	B
20	-0.213	0.956
30	-0.238	0.958
40	-0.251	1.211
100	-0.323	1.545
175	-0.360	1.946
275	-0.373	2.064
350	-0.378	2.183
400	-0.384	2.260
500	-0.380	2.356
650	-0.401	2.535
750	-0.464	2.756
850	-0.484	2.944
1000	-0.540	3.162
2000	-0.812	4.406
3000	-1.000	5.321
4000	-1.100	5.980
5000	-1.176	6.567
6000	-1.241	7.072
7000	-1.300	7.515
8000	-1.323	7.895

DEPTH OF FLOW EQUATION

FLOW DEPTH = A X ln (BOTTOM WIDTH) + B

ln IS THE NATURAL LOG FUNCTION OF THE BOTTOM WIDTH OF THE CHANNEL.

REV. 4-15-04: REFORMATTED SHEET. REVISED NOTES, MISC. EDITS TO DRAWING.

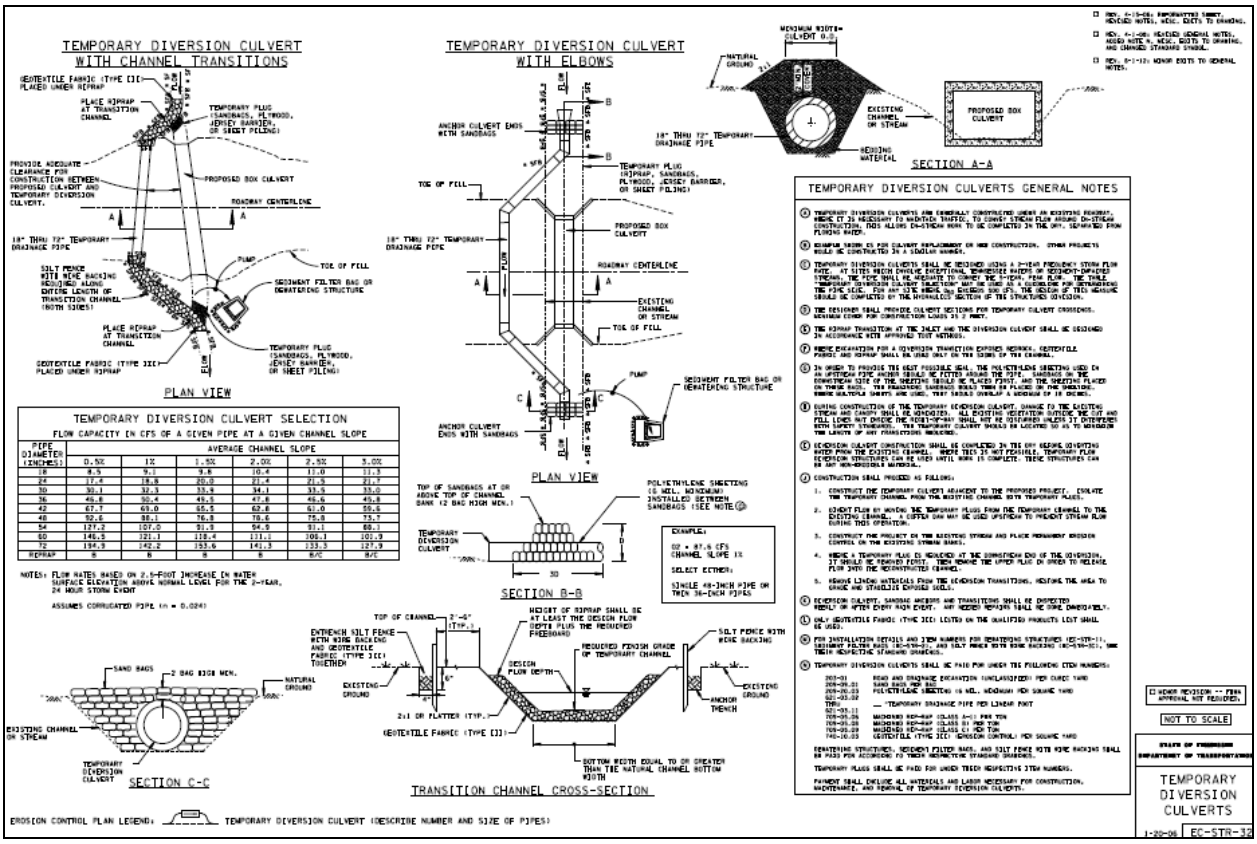
REV. 4-1-08: DRAWING RESETS UPDATE TABLE AND PROVISIONS TO GENERAL NOTES.

MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

TEMPORARY DIVERSION CHANNEL DESIGN

1-20-06 EC-STR-31A

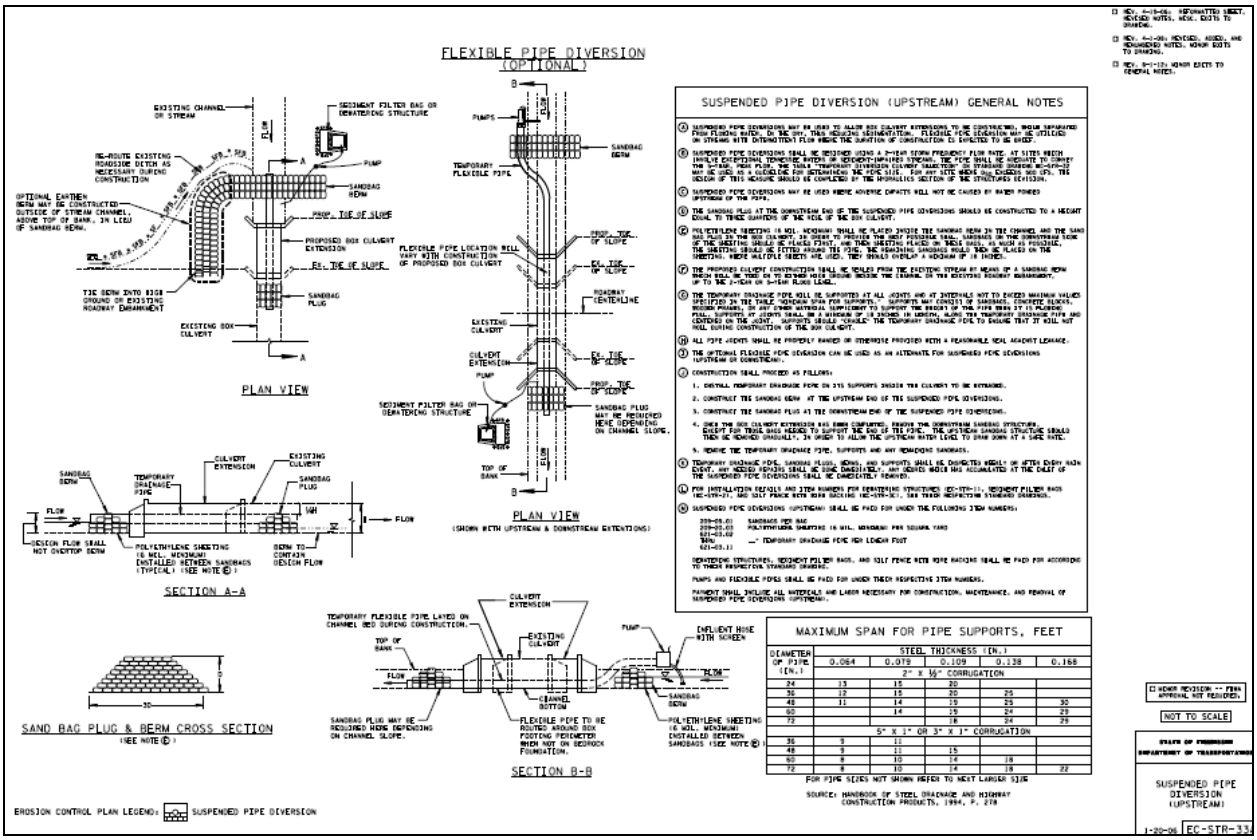


PIPE DIAMETER (INCHES)	AVERAGE CHANNEL SLOPE					
	0.5%	1%	1.5%	2.0%	2.5%	3.0%
18	8.5	9.1	9.8	10.4	11.0	11.3
24	17.4	18.8	20.0	21.4	21.5	21.7
30	30.1	32.3	33.9	34.1	33.5	33.0
36	45.8	50.4	49.5	47.8	46.6	45.8
42	67.7	69.0	65.5	62.8	61.0	59.6
48	92.6	88.1	76.8	78.6	75.8	73.7
54	121.2	107.0	91.3	94.5	91.1	88.1
60	146.5	121.1	118.4	131.1	106.1	101.9
72	194.9	142.2	153.6	141.3	133.3	127.9
REPRAP	6	6	6	6	6/C	6/C

DIAMETER OF PIPE (IN.)	STEEL THICKNESS (IN.)				
	0.064	0.079	0.109	0.138	0.168
	2" x ½" CORRUGATION				
24	13	15	20		
36	12	13	20	25	
48	11	14	19	25	30
60		14	18	24	29
72			18	24	29
	5" x 1" OR 5" x 1" CORRUGATION				
36	9	11			
48	9	11	15		
60	8	10	14	18	
72	8	10	14	18	22

FOR PIPE SIZES NOT SHOWN REFER TO NEXT LARGER SIZE

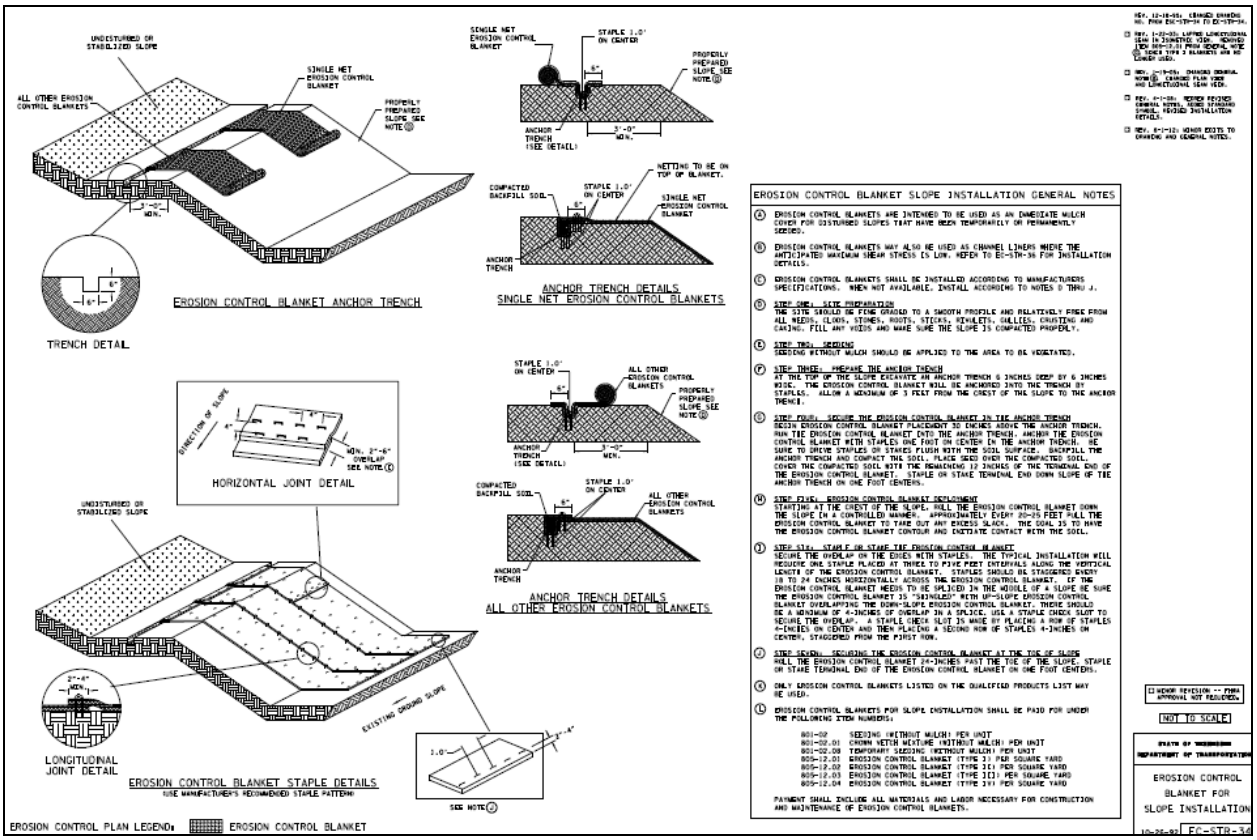
SOURCE: HANDBOOK OF STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS, 1994, P. 270

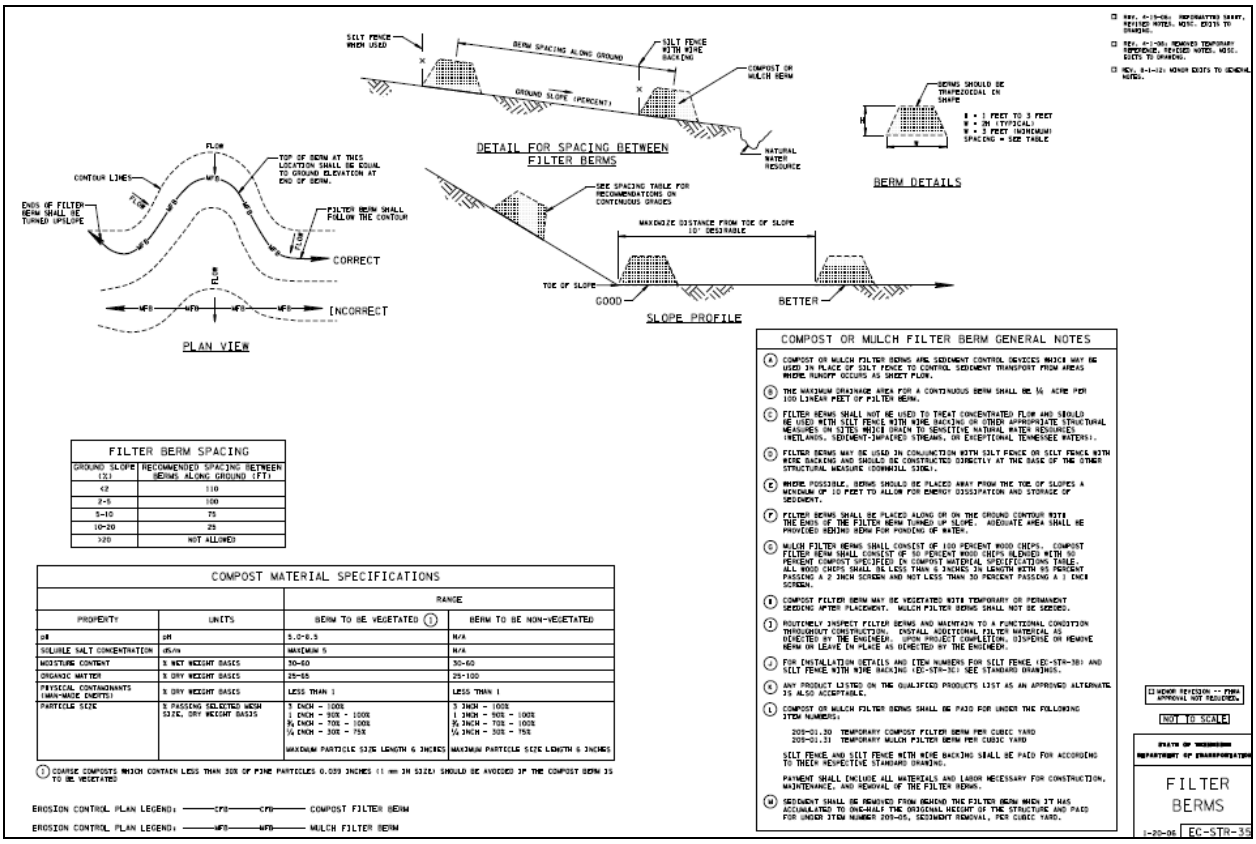


DIAMETER OF PIPE (IN.)	STEEL THICKNESS (IN.)				
	0.064	0.079	0.109	0.138	0.168
	2" x ½" CORRUGATION				
24	13	15	20		
36	12	15	20	25	
48	11	14	19	25	30
60		14	19	24	29
72			18	24	29
	5" X 1" OR 3" X 1" CORRUGATION				
36	9	11			
48	9	11	15		
60	8	10	14	18	
72	8	10	14	18	22

FOR PIPE SIZES NOT SHOWN REFER TO NEXT LARGER SIZE

SOURCE: HANDBOOK OF STEEL DRAINAGE AND HIGHWAY CONSTRUCTION PRODUCTS, 1994, P. 278





FILTER BERM SPACING	
GROUND SLOPE (%)	RECOMMENDED SPACING BETWEEN BERMS ALONG GROUND (FT)
<2	110
2-5	100
5-10	75
10-20	25
>20	NOT ALLOWED

COMPOST MATERIAL SPECIFICATIONS			
		RANGE	
PROPERTY	UNITS	BERM TO BE VEGETATED (1)	BERM TO BE NON-VEGETATED
pH	pH	5.0-8.5	N/A
SOLUBLE SALT CONCENTRATION	dS/m	MAXIMUM 5	N/A
MOISTURE CONTENT	% WET WEIGHT BASES	30-60	30-60
ORGANIC MATTER	% DRY WEIGHT BASES	25-65	25-100
PHYSICAL CONTAMINANTS (MAN-MADE INERTS)	% DRY WEIGHT BASES	LESS THAN 1	LESS THAN 1
PARTICLE SIZE	% PASSING SELECTED MESH SIZE, DRY WEIGHT BASIS	3 INCH - 100% 1 INCH - 90% - 100% ¾ INCH - 70% - 100% ¼ INCH - 30% - 75% MAXIMUM PARTICLE SIZE LENGTH 6 INCHES	3 INCH - 100% 1 INCH - 90% - 100% ¾ INCH - 70% - 100% ¼ INCH - 30% - 75% MAXIMUM PARTICLE SIZE LENGTH 6 INCHES

(1) COARSE COMPOSTS WHICH CONTAIN LESS THAN 30% OF FINE PARTICLES 0.039 INCHES (1 mm IN SIZE) SHOULD BE AVOIDED IF THE COMPOST BERM IS TO BE VEGETATED

EROSION CONTROL PLAN LEGEND: CFB COMPOST FILTER BERM

EROSION CONTROL PLAN LEGEND: MFB MULCH FILTER BERM

COMPOST OR MULCH FILTER BERM GENERAL NOTES

(A) COMPOST OR MULCH FILTER BERMS ARE SEDIMENT CONTROL DEVICES WHICH MAY BE USED IN PLACE OF SILT FENCE TO CONTROL SEDIMENT TRANSPORT FROM AREAS WHERE RUNOFF OCCURS AS SHEET FLOW.

(B) THE MAXIMUM DRAINAGE AREA FOR A CONTINUOUS BERM SHALL BE ¼ ACRE PER 100 LINEAR FEET OF FILTER BERM.

(C) FILTER BERMS SHALL NOT BE USED TO TREAT CONCENTRATED FLOW AND SHOULD BE USED WITH SILT FENCE WITH WIRE BACKING OR OTHER APPROPRIATE STRUCTURAL MEASURES ON SITES WHICH DRAIN TO SENSITIVE NATURAL WATER RESOURCES, WETLANDS, SEDIMENT-IMPAIRED STREAMS, OR EXCEPTIONAL TEMPERATURE WATERS).

(D) FILTER BERMS MAY BE USED IN CONJUNCTION WITH SILT FENCE OR SILT FENCE WITH WIRE BACKING AND SHOULD BE CONSTRUCTED DIRECTLY AT THE BASE OF THE OTHER STRUCTURAL MEASURE (DOWNHILL SIDE).

(E) WHERE POSSIBLE, BERMS SHOULD BE PLACED AWAY FROM THE TOE OF SLOPES A MINIMUM OF 10 FEET TO ALLOW FOR ENERGY DISSIPATION AND STORAGE OF SEDIMENT.

(F) FILTER BERMS SHALL BE PLACED ALONG OR ON THE GROUND CONTOUR WITH THE ENDS OF THE FILTER BERM TURNED UP SLOPE. ADEQUATE AREA SHALL BE PROVIDED BEHIND BERM FOR PONDING OF WATER.

(G) MULCH FILTER BERMS SHALL CONSIST OF 100 PERCENT WOOD CHIPS. COMPOST FILTER BERM SHALL CONSIST OF 50 PERCENT WOOD CHIPS BLENDED WITH 50 PERCENT COMPOST SPECIFIED IN COMPOST MATERIAL SPECIFICATIONS TABLE. ALL WOOD CHIPS SHALL BE LESS THAN 6 INCHES IN LENGTH AND 30 PERCENT PASSING A 2 INCH SCREEN AND NOT LESS THAN 30 PERCENT PASSING A 1 INCH SCREEN.

(H) COMPOST FILTER BERM MAY BE VEGETATED WITH TEMPORARY OR PERMANENT SEEDING AFTER PLACEMENT. MULCH FILTER BERMS SHALL NOT BE SEEDED.

(I) ROUTINELY INSPECT FILTER BERMS AND MAINTAIN TO A FUNCTIONAL CONDITION THROUGHOUT CONSTRUCTION. INSTALL ADDITIONAL FILTER MATERIAL AS DIRECTED BY THE ENGINEER. UPON PROJECT COMPLETION, DISPOSE OR REMOVE BERM OR LEAVE IN PLACE AS DIRECTED BY THE ENGINEER.

(J) FOR INSTALLATION DETAILS AND ITEM NUMBERS FOR SILT FENCE (EC-STR-3B) AND SILT FENCE WITH WIRE BACKING (EC-STR-3C) SEE STANDARD DRAWINGS.

(K) ANY PRODUCT LISTED ON THE QUALIFIED PRODUCTS LIST AS AN APPROVED ALTERNATE IS ALSO ACCEPTABLE.

(L) COMPOST OR MULCH FILTER BERMS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-01.30 TEMPORARY COMPOST FILTER BERM PER CUBIC YARD
209-01.31 TEMPORARY MULCH FILTER BERM PER CUBIC YARD

SILT FENCE AND SILT FENCE WITH WIRE BACKING SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE STANDARD DRAWING.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF THE FILTER BERMS.

(M) SEDIMENT SHALL BE REMOVED FROM BEHIND THE FILTER BERM WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE STRUCTURE AND PAID FOR UNDER ITEM NUMBER 209-05, SEDIMENT REMOVAL, PER CUBIC YARD.

REV. 4-15-05: REFORMATTED SHEET, REVISED NOTES. MISC. EDITS TO DRAWING.
REV. 4-1-08: REMOVED TEMPORARY SEEDING. REVISED NOTES. MISC. EDITS TO DRAWING.
REV. 8-1-12: MINOR EDITS TO GENERAL NOTES.

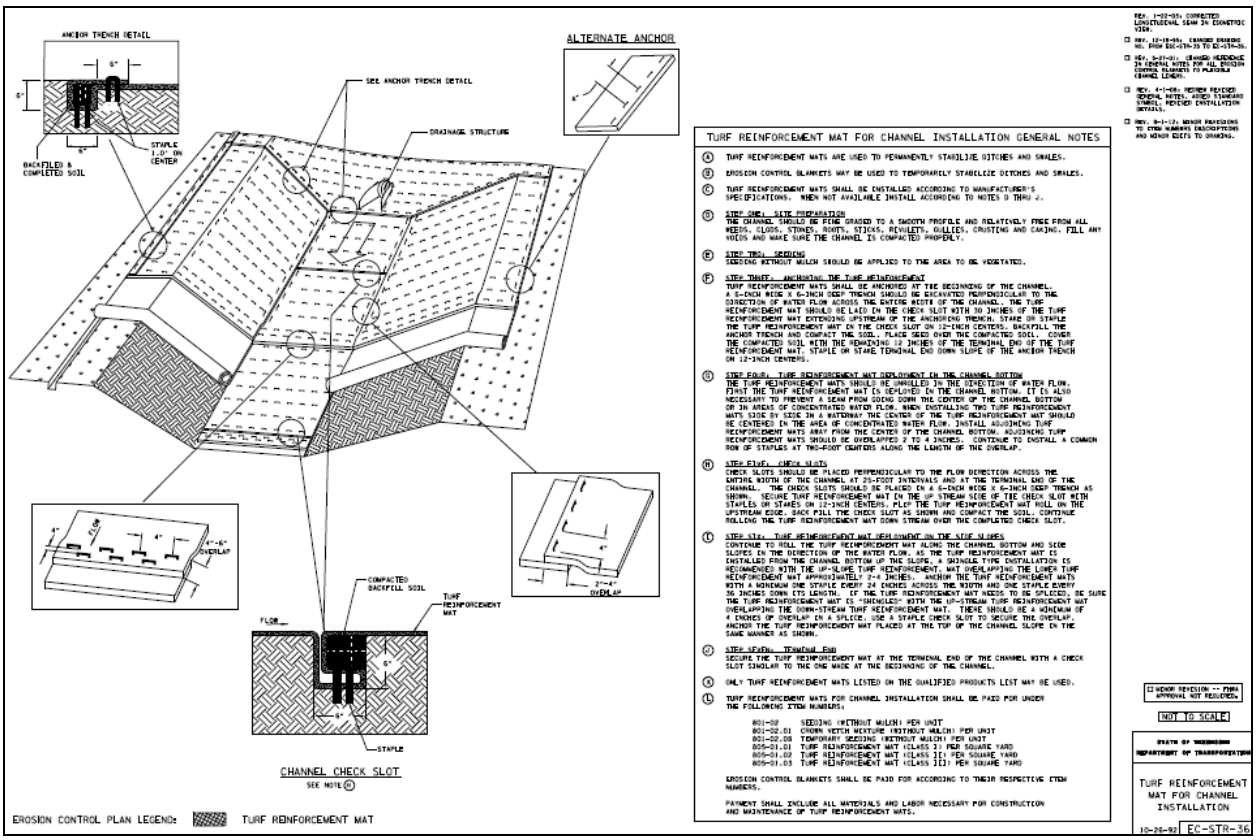
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

STATE OF WASHINGTON
DEPARTMENT OF TRANSPORTATION

FILTER BERMS

1-20-06 EC-STR-35



TURF REINFORCEMENT MAT FOR CHANNEL INSTALLATION GENERAL NOTES

(A) TURF REINFORCEMENT MATS ARE USED TO PERMANENTLY STABILIZE DITCHES AND SWALES.

(B) EROSION CONTROL BLANKETS MAY BE USED TO TEMPORARILY STABILIZE DITCHES AND SWALES.

(C) TURF REINFORCEMENT MATS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS. WHEN NOT AVAILABLE INSTALL ACCORDING TO NOTES D THRU J.

(D) STEP ONE: SITE PREPARATION
THE CHANNEL SHOULD BE FINE GRADED TO A SMOOTH PROFILE AND RELATIVELY FREE FROM ALL WEEDS, CLODS, STONES, ROOTS, STICKS, REVELETS, GULLIES, CRUSTING AND CAKING. FILL ANY VOIDS AND MAKE SURE THE CHANNEL IS COMPACTED PROPERLY.

(E) STEP TWO: SEEDING
SEEDING WITHOUT MULCH SHOULD BE APPLIED TO THE AREA TO BE VEGETATED.

(F) STEP THREE: ANCHORING THE TURF REINFORCEMENT
TURF REINFORCEMENT MATS SHALL BE ANCHORED AT THE BEGINNING OF THE CHANNEL. A 6-INCH WIDE X 6-INCH DEEP TRENCH SHOULD BE EXCAVATED PERPENDICULAR TO THE DIRECTION OF WATER FLOW ACROSS THE ENTIRE WIDTH OF THE CHANNEL. THE TURF REINFORCEMENT MAT SHOULD BE LAID IN THE CHECK SLOT WITH 30 INCHES OF THE TURF REINFORCEMENT MAT EXTENDING UPSTREAM OF THE ANCHORING TRENCH. STAKE OR STAPLE THE TURF REINFORCEMENT MAT IN THE CHECK SLOT ON 12-INCH CENTERS. BACKFILL THE ANCHOR TRENCH AND COMPACT THE SOIL. PLACE SEED OVER THE COMPACTED SOIL. COVER THE COMPACTED SOIL WITH THE REMAINING 12 INCHES OF THE TERMINAL END OF THE TURF REINFORCEMENT MAT. STAPLE OR STAKE TERMINAL END DOWN SLOPE OF THE ANCHOR TRENCH ON 12-INCH CENTERS.

(G) STEP FOUR: TURF REINFORCEMENT MAT DEPLOYMENT IN THE CHANNEL BOTTOM
THE TURF REINFORCEMENT MATS SHOULD BE UNROLLED IN THE DIRECTION OF WATER FLOW. FIRST THE TURF REINFORCEMENT MAT IS INSTALLED IN THE CHANNEL BOTTOM. IT IS ALSO NECESSARY TO PREVENT A SEAM FROM GOING DOWN THE CENTER OF THE CHANNEL BOTTOM OR IN AREAS OF CONCENTRATED WATER FLOW. WHEN INSTALLING TWO TURF REINFORCEMENT MATS SIDE BY SIDE IN A WATERWAY THE CENTER OF THE TURF REINFORCEMENT MAT SHOULD BE CENTERED IN THE AREA OF CONCENTRATED WATER FLOW. INSTALL ADJOINING TURF REINFORCEMENT MATS AWAY FROM THE CENTER OF THE CHANNEL BOTTOM. ADJOINING TURF REINFORCEMENT MATS SHOULD BE OVERLAPPED 2 TO 4 INCHES. CONTINUE TO INSTALL A COMMON ROW OF STAPLES AT TWO-FOOT CENTERS ALONG THE LENGTH OF THE OVERLAP.

(H) STEP FIVE: CHECK SLOTS
CHECK SLOTS SHOULD BE PLACED PERPENDICULAR TO THE FLOW DIRECTION ACROSS THE ENTIRE WIDTH OF THE CHANNEL AT 25-FOOT INTERVALS AND AT THE TERMINAL END OF THE CHANNEL. THE CHECK SLOTS SHOULD BE PLACED IN A 6-INCH WIDE X 6-INCH DEEP TRENCH AS SHOWN. SECURE TURF REINFORCEMENT MAT IN THE UP STREAM SIDE OF THE CHECK SLOT WITH STAPLES OR STAKES ON 12-INCH CENTERS. PLOP THE TURF REINFORCEMENT MAT ROLL ON THE UPSTREAM SIDE. BACK FOLD THE CHECK SLOT AS SHOWN AND COMPACT THE SOIL. CONTINUE ROLLING THE TURF REINFORCEMENT MAT DOWN STREAM OVER THE COMPLETED CHECK SLOT.

(I) STEP SIX: TURF REINFORCEMENT MAT INSTALLMENT ON THE SIDE SLOPES
CONTINUE TO ROLL THE TURF REINFORCEMENT MAT ALONG THE CHANNEL BOTTOM AND SIDE SLOPES IN THE DIRECTION OF THE WATER FLOW. AS THE TURF REINFORCEMENT MAT IS INSTALLED FROM THE CHANNEL BOTTOM UP THE SLOPE, A SHINGLE TYPE INSTALLATION IS RECOMMENDED WITH THE UP-SLOPE TURF REINFORCEMENT MAT OVERLAPPING THE LOWER TURF REINFORCEMENT MAT APPROXIMATELY 2-4 INCHES. ANCHOR THE TURF REINFORCEMENT MATS WITH A MINIMUM ONE STAPLE EVERY 2-4 INCHES ACROSS THE WIDTH AND ONE STAPLE EVERY 36 INCHES DOWN ITS LENGTH. IF THE TURF REINFORCEMENT MAT NEEDS TO BE SPLICED, BE SURE THE TURF REINFORCEMENT MAT IS "SHINGLED" WITH THE UP-STREAM TURF REINFORCEMENT MAT OVERLAPPING THE DOWN-STREAM TURF REINFORCEMENT MAT. THERE SHOULD BE A MINIMUM OF 4 INCHES OF OVERLAP ON A SPLICE. USE A STAPLE CHECK SLOT TO SECURE THE OVERLAP. ANCHOR THE TURF REINFORCEMENT MAT PLACED AT THE TOP OF THE CHANNEL SLOPE IN THE SAME MANNER AS SHOWN.

(J) STEP SEVEN: TERMINAL END
SECURE THE TURF REINFORCEMENT MAT AT THE TERMINAL END OF THE CHANNEL WITH A CHECK SLOT SIMILAR TO THE ONE MADE AT THE BEGINNING OF THE CHANNEL.

(K) ONLY TURF REINFORCEMENT MATS LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED.

(L) TURF REINFORCEMENT MATS FOR CHANNEL INSTALLATION SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

801-02	SEEDING (WITHOUT MULCH) PER UNIT
801-02.01	CROWN VETCH MIXTURE (WITHOUT MULCH) PER UNIT
801-02.08	TEMPORARY SEEDING (WITHOUT MULCH) PER UNIT
805-01.01	TURF REINFORCEMENT MAT (CLASS I) PER SQUARE YARD
805-01.02	TURF REINFORCEMENT MAT (CLASS II) PER SQUARE YARD
805-01.03	TURF REINFORCEMENT MAT (CLASS III) PER SQUARE YARD

EROSION CONTROL BLANKETS SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE ITEM NUMBERS.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION AND MAINTENANCE OF TURF REINFORCEMENT MATS.

REV. 1-02-13: CORRECTED LONGITUDINAL SEAM IN CONSTRUCTION VIEW.
REV. 12-18-09: CHANGED DRAWING NO. FROM ESC-STR-35 TO EC-STR-36.
REV. 5-27-11: CHANGED REFERENCE IN GENERAL NOTES FOR ALL EROSION CONTROL BLANKETS TO FLEXIBLE CHANNEL LINERS.
REV. 4-1-08: REVISED REVISED GENERAL NOTES, ADDED STANDARD SYMBOL, REVISED INSTALLATION DETAILS.
REV. 8-1-12: MINOR REVISIONS TO ITEM NUMBERS DESCRIPTIONS AND MINOR EDITS TO DRAWING.

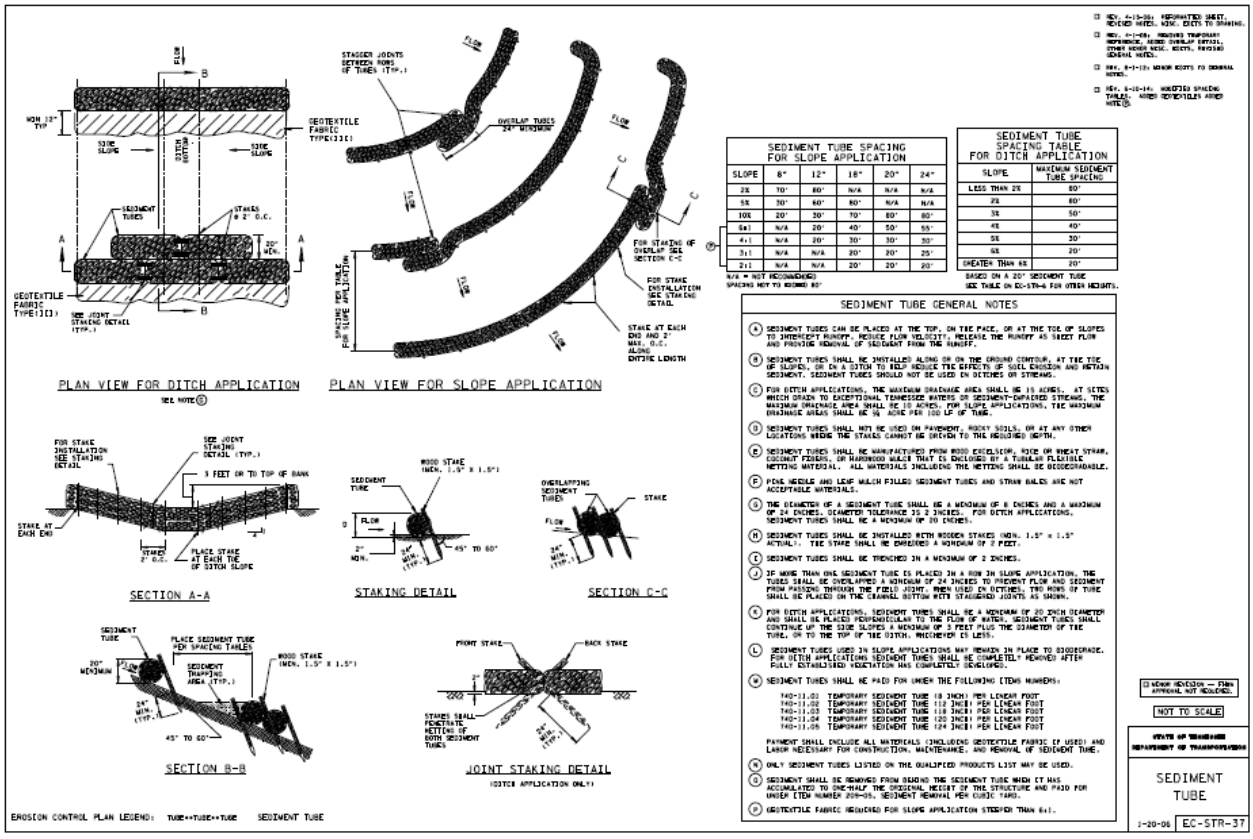
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

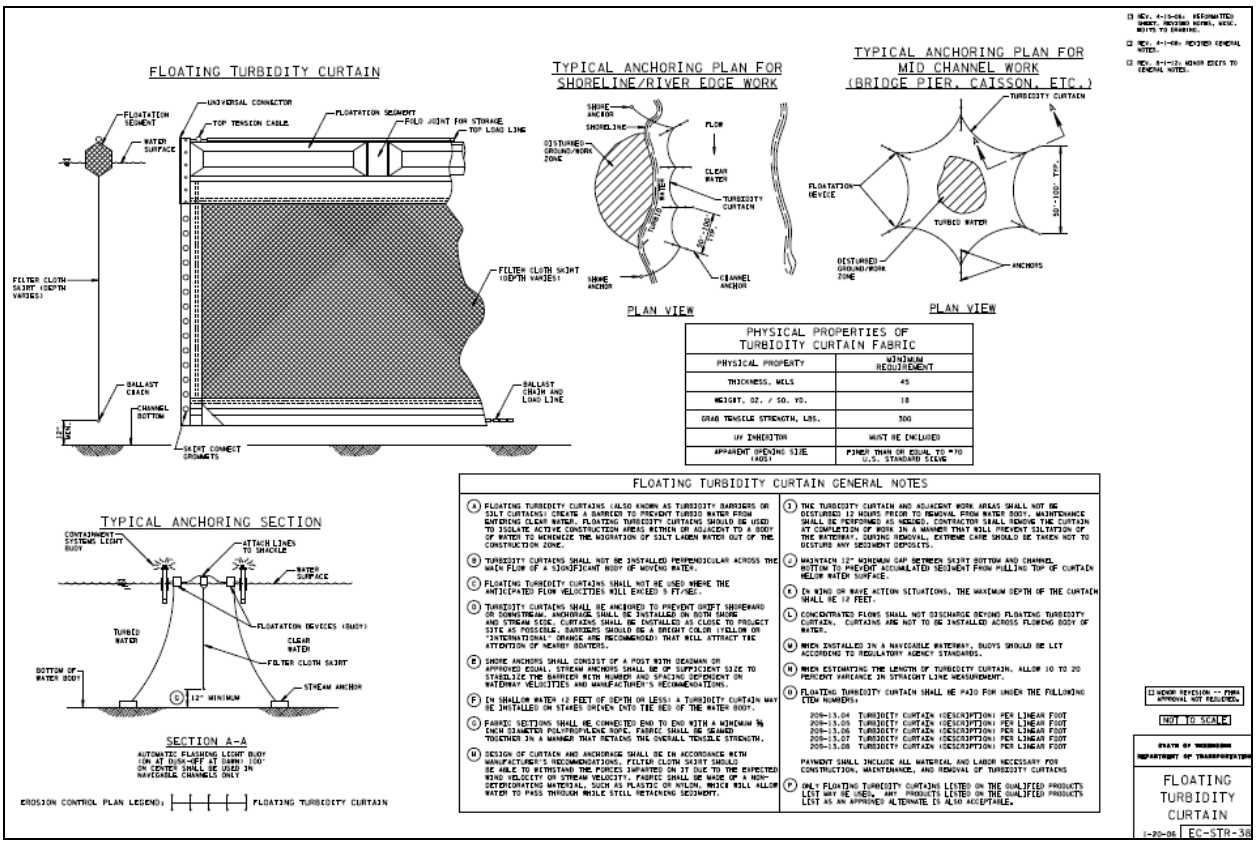
NOT TO SCALE

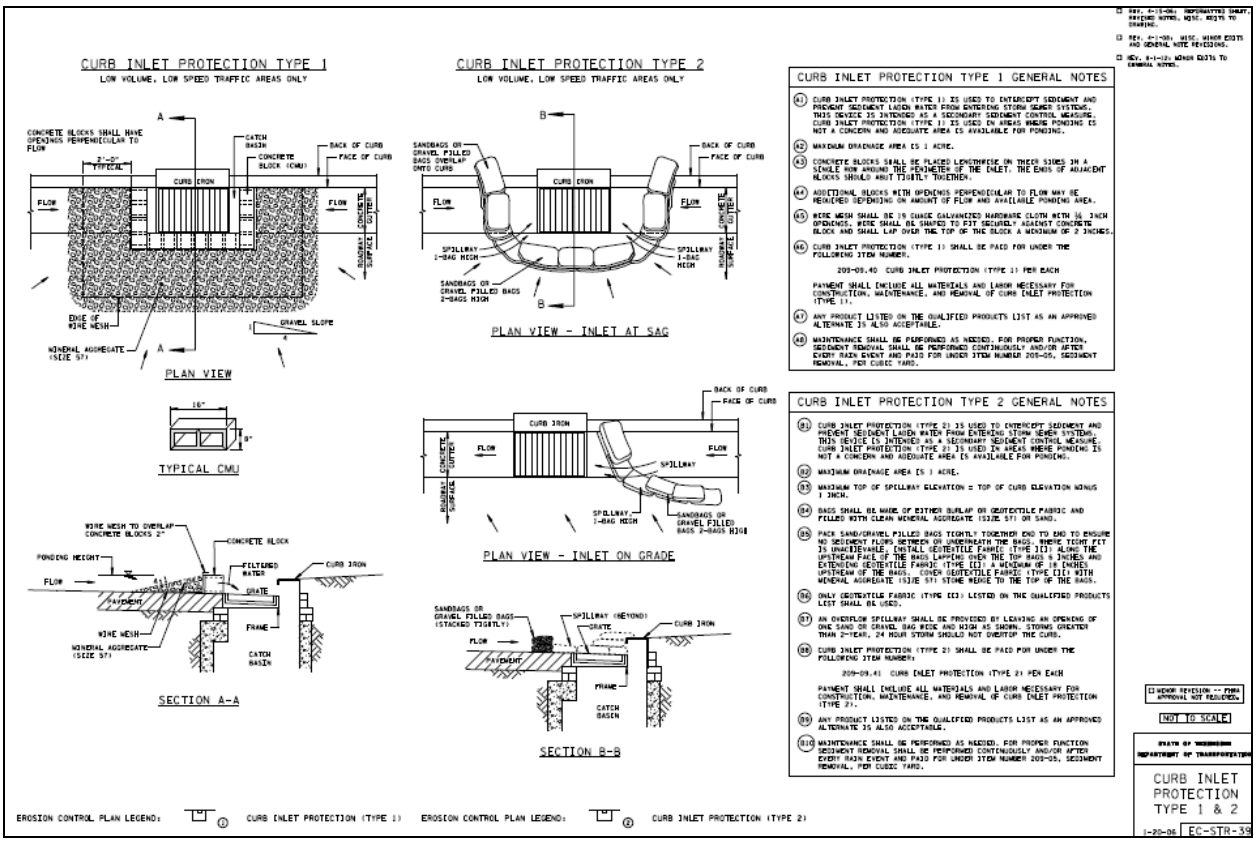
STATE OF WASHINGTON
DEPARTMENT OF TRANSPORTATION

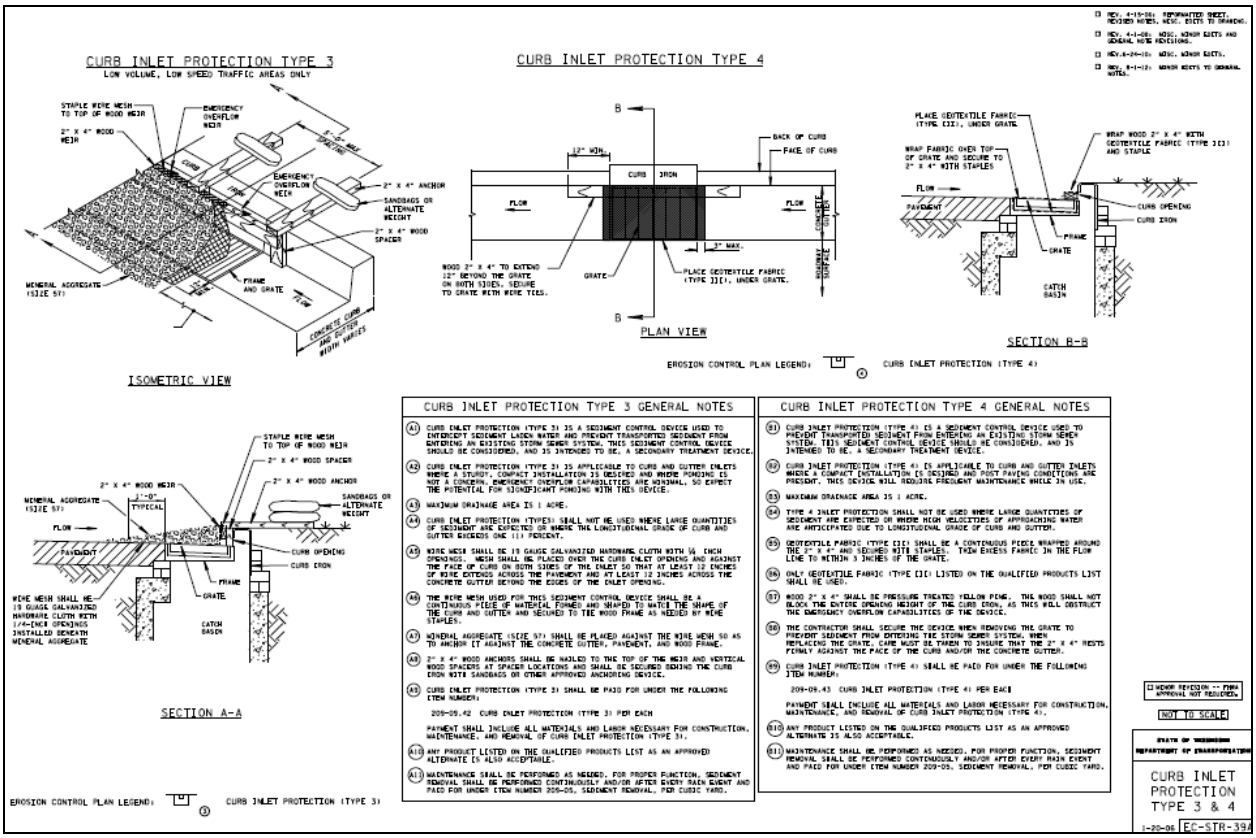
TURF REINFORCEMENT MAT FOR CHANNEL INSTALLATION

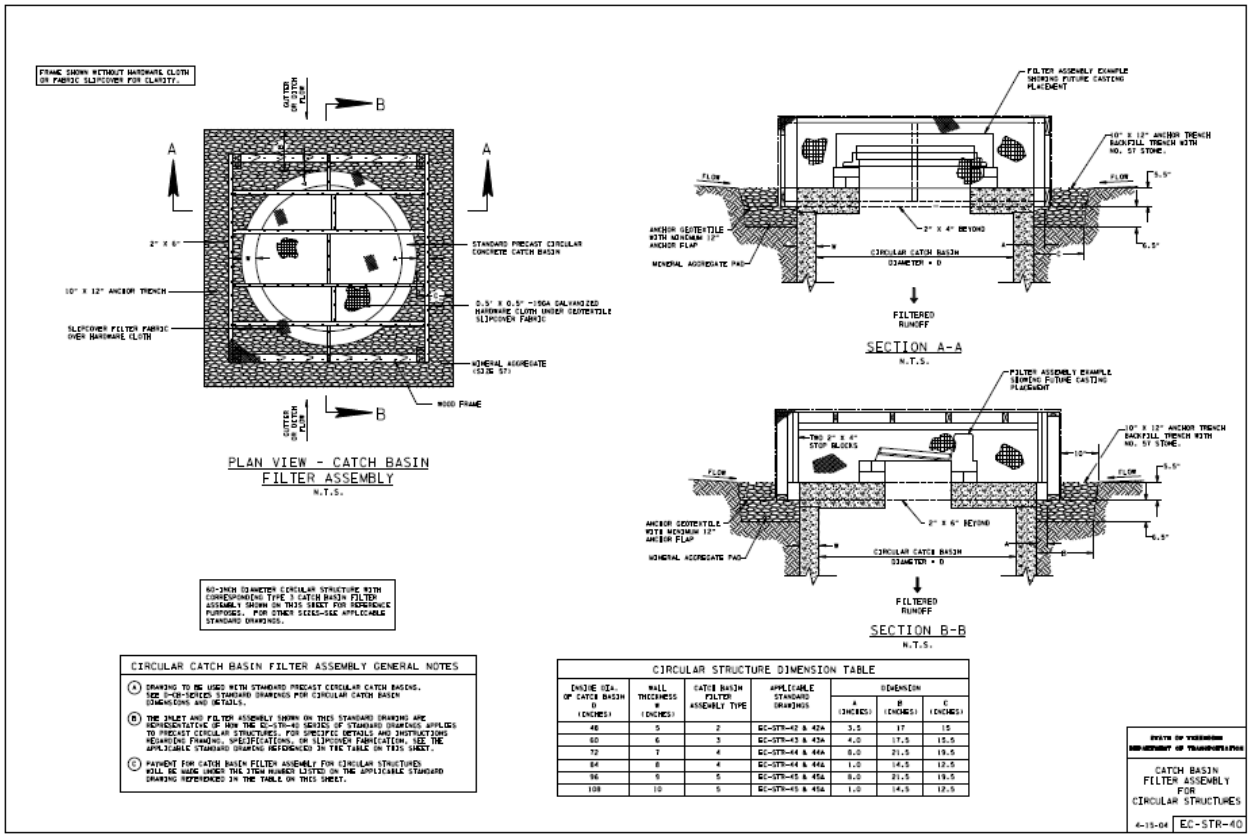
10-26-92 EC-STR-36


PLAN VIEW FOR DITCH APPLICATION
PLAN VIEW FOR SLOPE APPLICATION
SECTION A-A
STAKING DETAIL
SECTION C-C
SECTION B-B
JOINT STAKING DETAIL
SEDIMENT TUBE SPACING FOR SLOPE APPLICATION
SLOPE | 6" | 12" | 18" | 20" | 24"
2:1 | 70' | 80' | N/A | N/A | N/A
3:1 | 50' | 60' | 80' | N/A | N/A
4:1 | 40' | 50' | 70' | 80' | 80'
5:1 | N/A | 40' | 60' | 70' | 80'
6:1 | N/A | 30' | 50' | 60' | 70'
8:1 | N/A | N/A | 40' | 50' | 60'
10:1 | N/A | N/A | 30' | 40' | 50'
12:1 | N/A | N/A | 20' | 30' | 40'
SEDIMENT TUBE SPACING FOR DITCH APPLICATION
SLOPE | MAXIMUM SEDIMENT TUBE SPACING
LESS THAN 2% | 80'
2% | 60'
3% | 50'
4% | 40'
5% | 30'
6% | 20'
GREATER THAN 6% | 20'
SEDIMENT TUBE GENERAL NOTES
SEDIMENT TUBE
EC-STR-37


FLOATING TURBIDITY CURTAIN
TYPICAL ANCHORING PLAN FOR SHORELINE/RIVER EDGE WORK
TYPICAL ANCHORING PLAN FOR MID CHANNEL WORK (BRIDGE PIER, CAISSON, ETC.)
PLAN VIEW
PLAN VIEW
PHYSICAL PROPERTIES OF TURBIDITY CURTAIN FABRIC
PHYSICAL PROPERTY | MINIMUM REQUIREMENT
THICKNESS, MILS | 45
WEIGHT, OZ. / SQ. YD. | 18
GRAB TENSILE STRENGTH, LBS. | 300
UV INHIBITOR | MUST BE INCLUDED
APPARENT OPENING SIZE (AOS) | FINER THAN OR EQUAL TO #70 U.S. STANDARD SIEVE
TYPICAL ANCHORING SECTION
SECTION A-A
FLOATING TURBIDITY CURTAIN GENERAL NOTES
FLOATING TURBIDITY CURTAIN
EC-STR-38


CURB INLET PROTECTION TYPE 1
LOW VOLUME, LOW SPEED TRAFFIC AREAS ONLY
CURB INLET PROTECTION TYPE 2
LOW VOLUME, LOW SPEED TRAFFIC AREAS ONLY
CURB INLET PROTECTION TYPE 1 GENERAL NOTES
CURB INLET PROTECTION TYPE 2 GENERAL NOTES
PLAN VIEW
PLAN VIEW - INLET AT SAG
PLAN VIEW - INLET ON GRADE
TYPICAL CMU
SECTION A-A
SECTION B-B
EROSION CONTROL PLAN LEGEND: CURB INLET PROTECTION (TYPE 1)
EROSION CONTROL PLAN LEGEND: CURB INLET PROTECTION (TYPE 2)
NOT TO SCALE
CURB INLET PROTECTION TYPE 1 & 2
EC-STR-39


CURB INLET PROTECTION TYPE 3
LOW VOLUME, LOW SPEED TRAFFIC AREAS ONLY
CURB INLET PROTECTION TYPE 4
ISOMETRIC VIEW
PLAN VIEW
SECTION A-A
SECTION B-B
CURB INLET PROTECTION TYPE 3 GENERAL NOTES
CURB INLET PROTECTION TYPE 4 GENERAL NOTES
EROSION CONTROL PLAN LEGEND: CURB INLET PROTECTION (TYPE 3)
EROSION CONTROL PLAN LEGEND: CURB INLET PROTECTION (TYPE 4)
NOT TO SCALE
CURB INLET PROTECTION TYPE 3 & 4
EC-STR-39A



CIRCULAR CATCH BASIN FILTER ASSEMBLY GENERAL NOTES

(A) DRAWING TO BE USED WITH STANDARD PRECAST CIRCULAR CATCH BASINS. SEE D-CB-SERIES STANDARD DRAWINGS FOR CIRCULAR CATCH BASIN DIMENSIONS AND DETAILS.

(B) THE INLET AND FILTER ASSEMBLY SHOWN ON THIS STANDARD DRAWING ARE REPRESENTATIVE OF HOW THE EC-STR-40 SERIES OF STANDARD DRAWINGS APPLIES TO PRECAST CIRCULAR STRUCTURES. FOR SPECIFIC DETAILS AND INSTRUCTIONS REGARDING FRAMING, SPECIFICATIONS, OR SLIPCOVER FABRICATION, SEE THE APPLICABLE STANDARD DRAWING REFERENCED IN THE TABLE ON THIS SHEET.

(C) PAYMENT FOR CATCH BASIN FILTER ASSEMBLY FOR CIRCULAR STRUCTURES WILL BE MADE UNDER THE ITEM NUMBER LISTED ON THE APPLICABLE STANDARD DRAWING REFERENCED IN THE TABLE ON THIS SHEET.

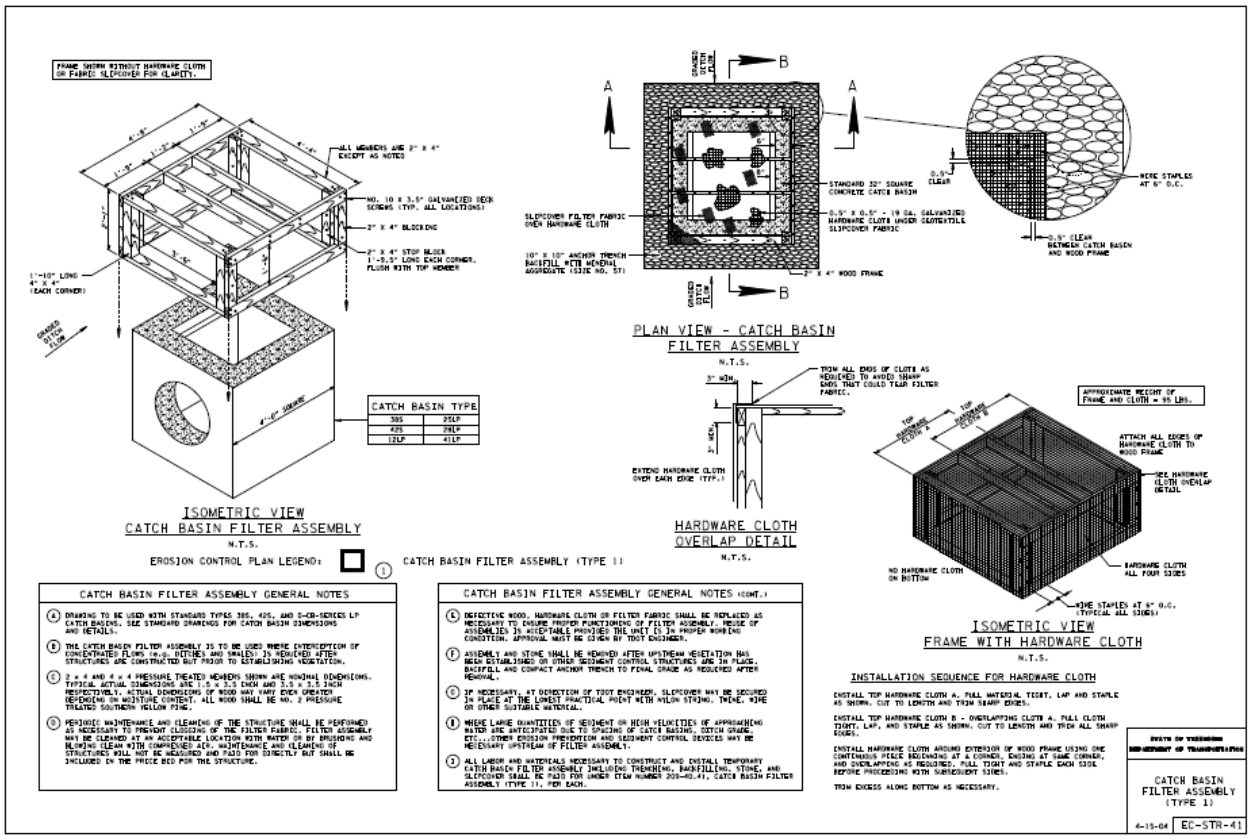
CIRCULAR STRUCTURE DIMENSION TABLE

ENGINE DIA. OF CATCH BASIN D (INCHES)	WALL THICKNESS W (INCHES)	CATCH BASIN FILTER ASSEMBLY TYPE	APPLICABLE STANDARD DRAWINGS	DIMENSION A (INCHES)	DIMENSION B (INCHES)	DIMENSION C (INCHES)
48	5	2	EC-STR-42 & 42A	3.5	17	15
60	6	3	EC-STR-43 & 43A	4.0	17.5	15.5
72	7	4	EC-STR-44 & 44A	8.0	21.5	19.5
84	8	4	EC-STR-44 & 44A	1.0	14.5	12.5
96	9	5	EC-STR-45 & 45A	8.0	21.5	19.5
108	10	5	EC-STR-45 & 45A	1.0	14.5	12.5

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY FOR CIRCULAR STRUCTURES

4-15-04 | EC-STR-40



CATCH BASIN FILTER ASSEMBLY GENERAL NOTES

(A) DRAWING TO BE USED WITH STANDARD TYPES 38S, 42S, AND D-CB-SERIES LP CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.

(B) THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (E.G. DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.

(C) 2 x 4 AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH AND 3.5 x 3.5 INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EACH GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.

(D) PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)

(E) DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. REUSE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST BE GIVEN BY TROT ENGINEER.

(F) ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.

(G) IF NECESSARY, AT DIRECTION OF TROT ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.

(H) WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC., OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.

(I) ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209-40.41, CATCH BASIN FILTER ASSEMBLY (TYPE 1), PER EACH.

INSTALLATION SEQUENCE FOR HARDWARE CLOTH

INSTALL TOP HARDWARE CLOTH A, FULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

INSTALL TOP HARDWARE CLOTH B - OVERLAPPING CLOTH A. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.

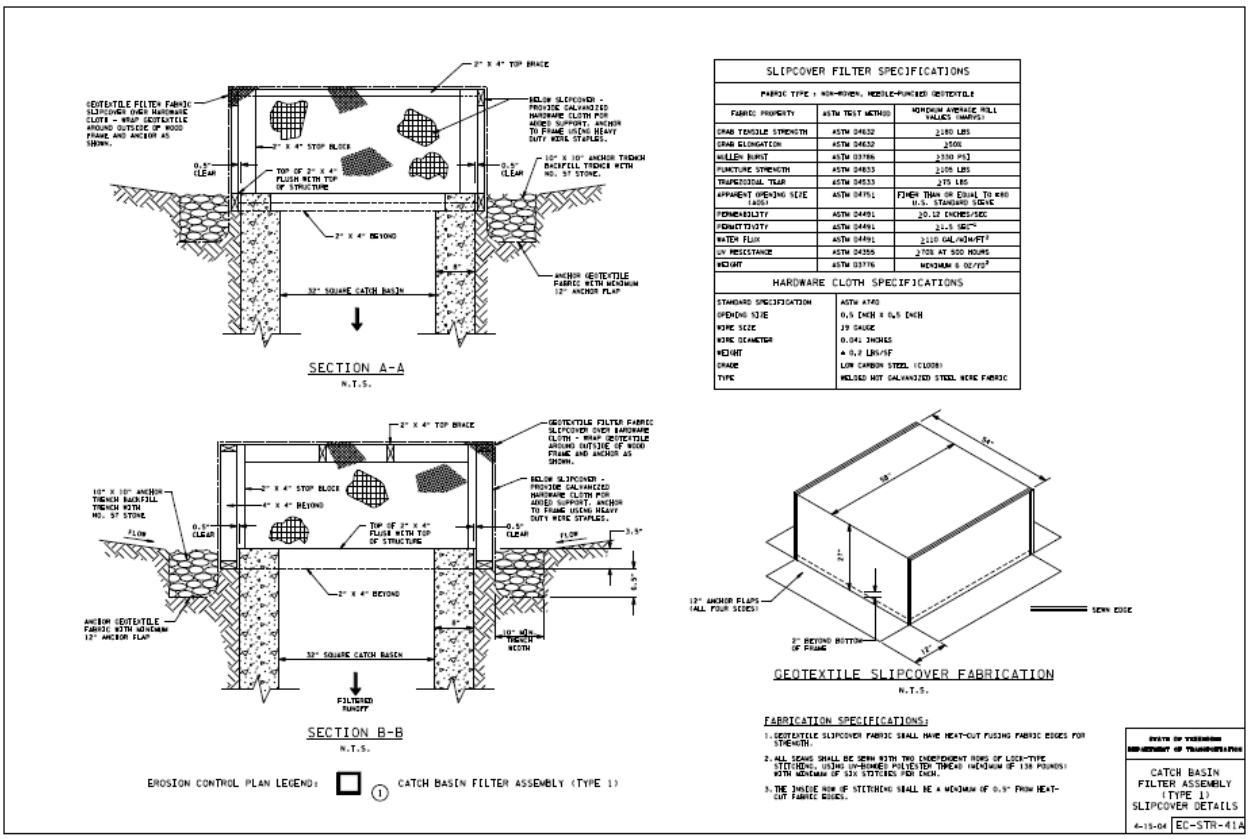
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME USING ONE CONTINUOUS PIECE BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.

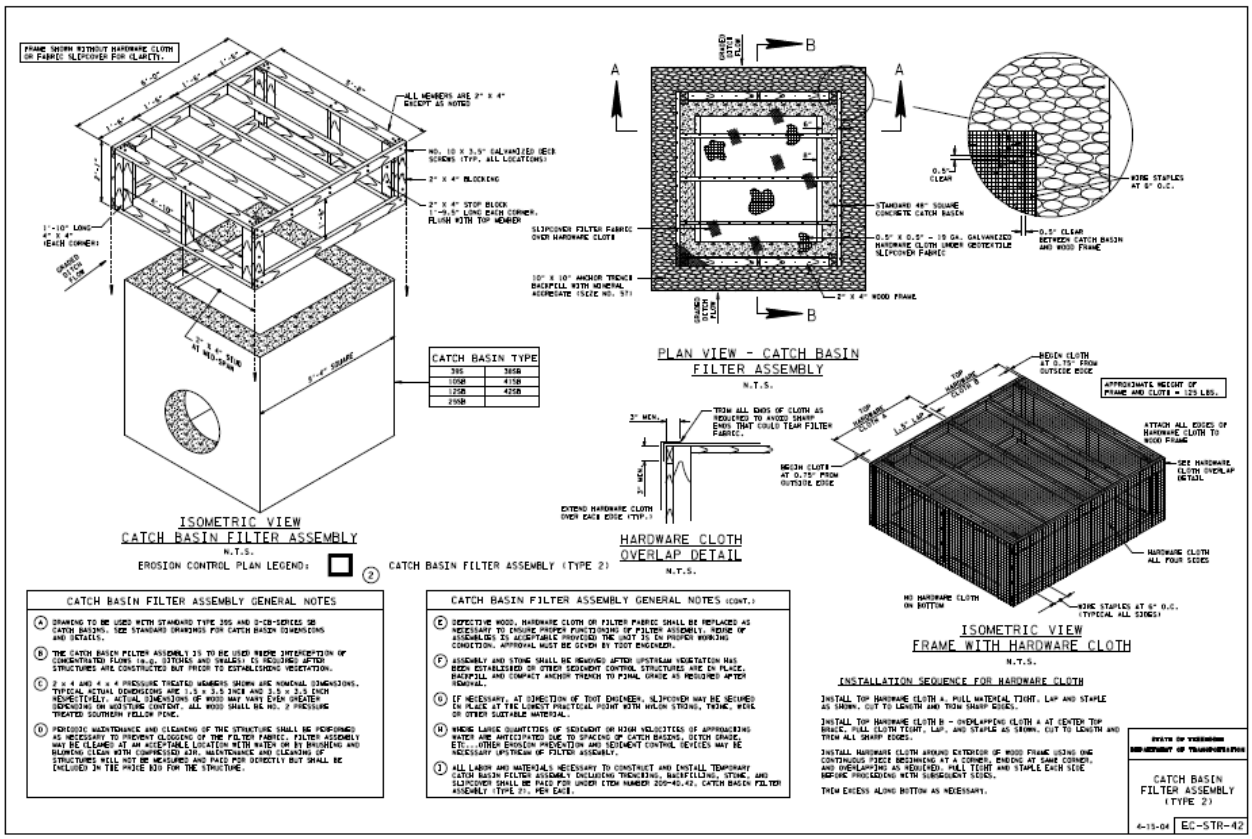
TRIM EXCESS ALONG BOTTOM AS NECESSARY.

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

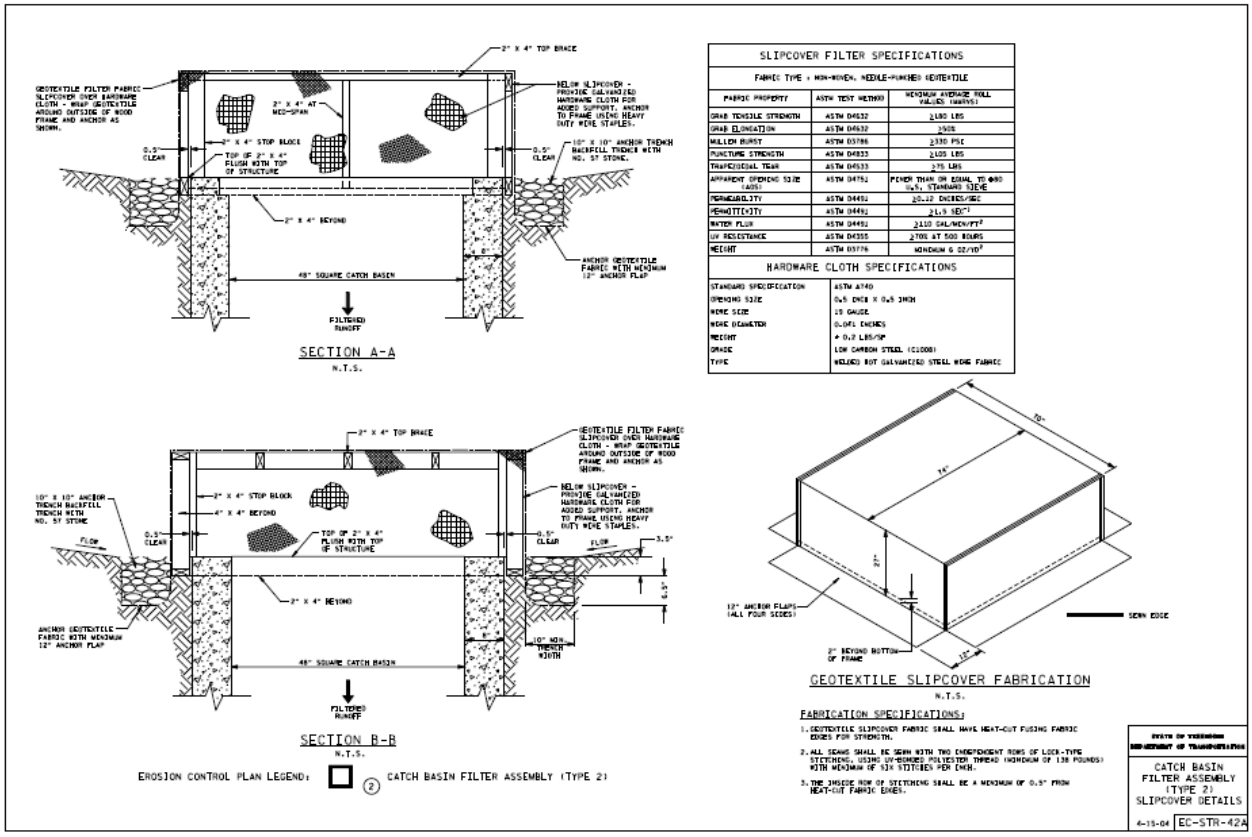
CATCH BASIN FILTER ASSEMBLY (TYPE 1)

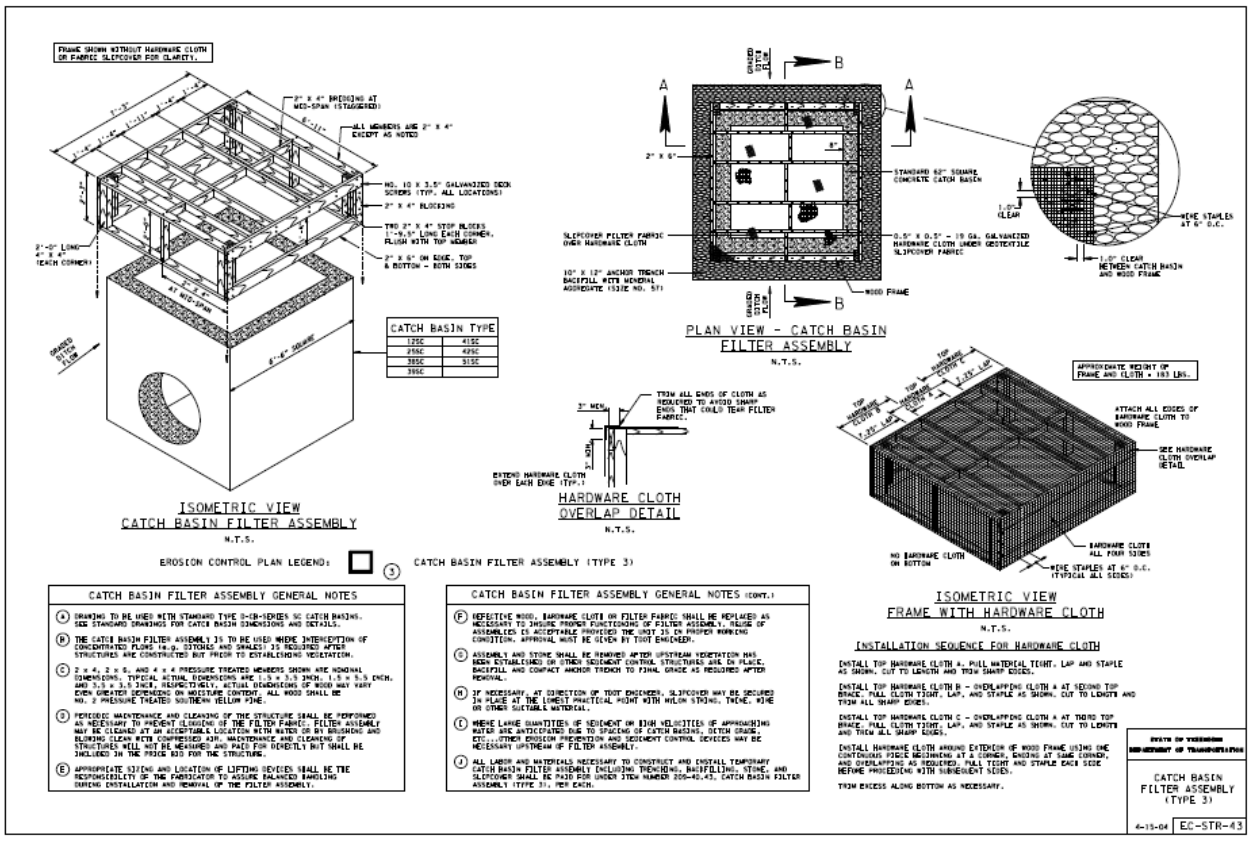
4-15-04 | EC-STR-41

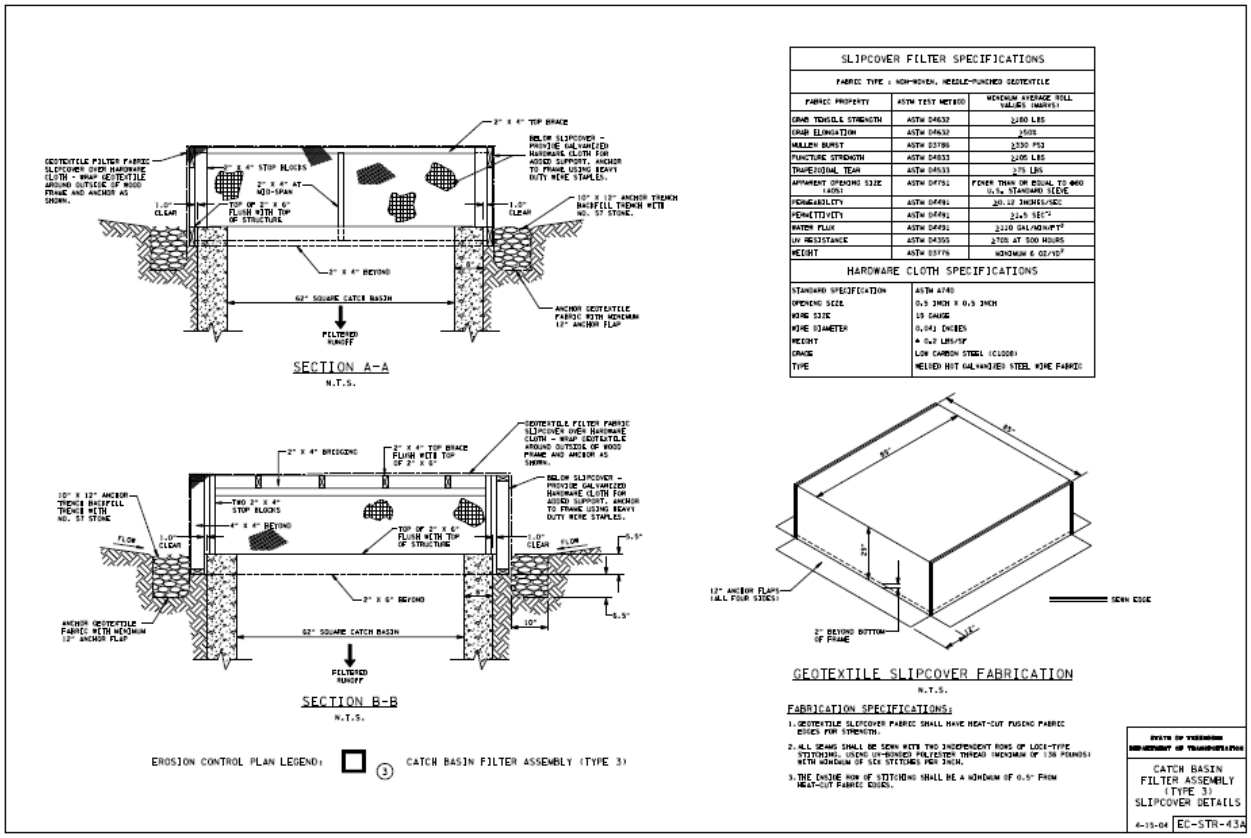




CATCH BASIN TYPE	
3SS	3SSB
105B	415B
125B	425B
235B	

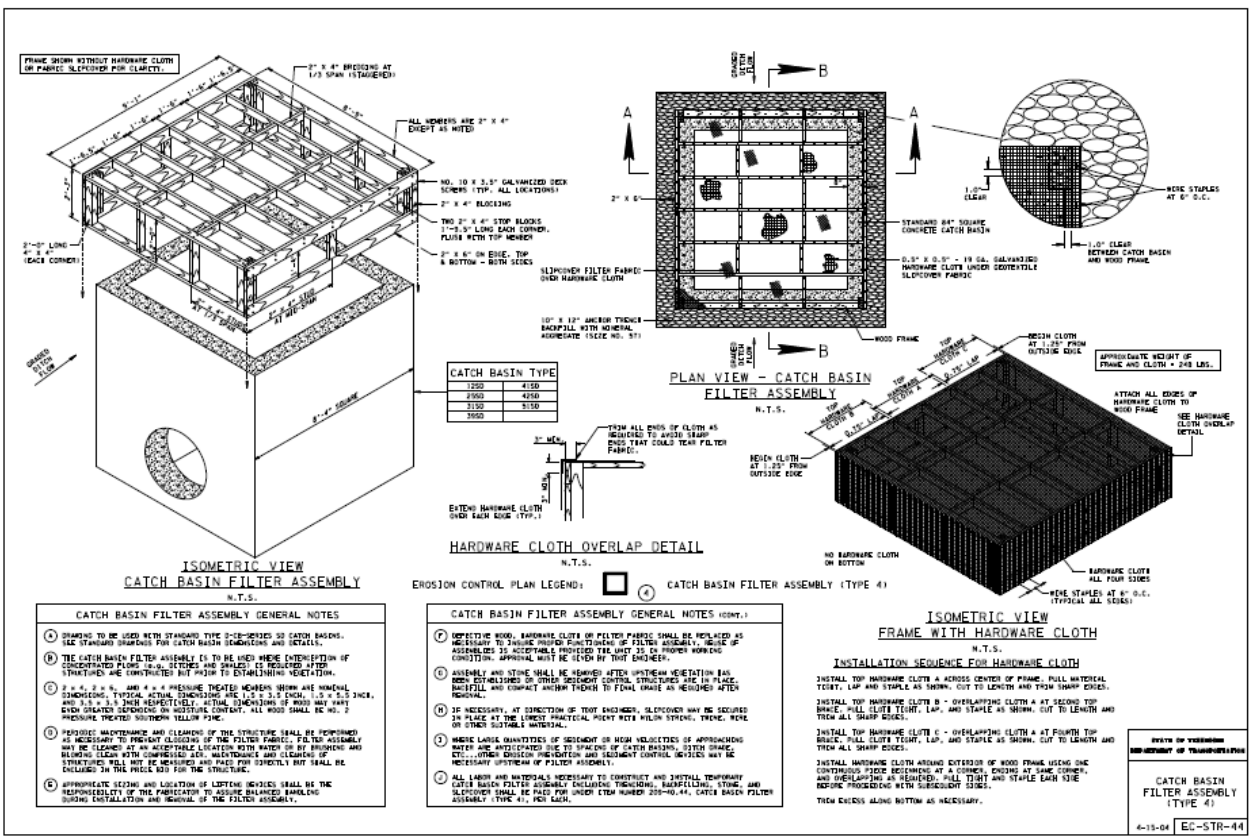

2" X 4" TOP BRACE
GEOTEXTILE FILTER FABRIC SLIPCOVER OVER HARDWARE CLOTH - WRAP GEOTEXTILE AROUND OUTSIDE OF WOOD FRAME AND ANCHOR AS SHOWN.
BELOW SLIPCOVER - PROVIDE GALVANIZED HARDWARE CLOTH FOR ADDED SUPPORT, ANCHOR TO FRAME USING HEAVY DUTY WIRE STAPLES.
2" X 4" AT MID-SPAN
2" X 4" STOP BLOCK
TOP OF 2" X 4" FLUSH WITH TOP OF STRUCTURE
0.5" CLEAR
10" X 10" ANCHOR TRENCH BACKFILL TRENCH WITH NO. 57 STONE.
2" X 4" BEYOND
ANCHOR GEOTEXTILE FABRIC WITH MINIMUM 12" ANCHOR FLAP
48" SQUARE CATCH BASIN
FILTERED RUNOFF
SECTION A-A
N.T.S.
SLIPCOVER FILTER SPECIFICATIONS
FABRIC TYPE = NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE
FABRIC PROPERTY | ASTM TEST METHOD | MINIMUM AVERAGE ROLL VALUES (MARV'S)
GRAB TENSILE STRENGTH | ASTM D4632 | ≥180 LBS
GRAB ELONGATION | ASTM D4632 | ≥50%
MULLEN BURST | ASTM D3786 | ≥330 PSI
PUNCTURE STRENGTH | ASTM D4833 | ≥105 LBS
TRAPEZOIDAL TEAR | ASTM D4533 | ≥75 LBS
APPARENT OPENING SIZE (AOS) | ASTM D4751 | FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY | ASTM D4491 | .20 CM/SEC/SEC
PERMITTIVITY | ASTM D4491 | .21 SEC-1
WATER FLUX | ASTM D4491 | ≥110 GAL/MIN/FT2
UV RESISTANCE | ASTM D4355 | ≥70% AT 500 HOURS
WEIGHT | ASTM D3776 | MINIMUM 6 OZ/YD2
HARDWARE CLOTH SPECIFICATIONS
STANDARD SPECIFICATION | ASTM A740
OPENING SIZE | 0.5 INCH X 0.5 INCH
WIRE SIZE | 19 GAUGE
WIRE DIAMETER | 0.041 INCHES
WEIGHT | ≈ 0.2 LBS/SF
GRADE | LOW CARBON STEEL (C1008)
TYPE | WELDED HOT GALVANIZED STEEL WIRE FABRIC
2" X 4" TOP BRACE
GEOTEXTILE FILTER FABRIC SLIPCOVER OVER HARDWARE CLOTH - WRAP GEOTEXTILE AROUND OUTSIDE OF WOOD FRAME AND ANCHOR AS SHOWN.
BELOW SLIPCOVER - PROVIDE GALVANIZED HARDWARE CLOTH FOR ADDED SUPPORT, ANCHOR TO FRAME USING HEAVY DUTY WIRE STAPLES.
10" X 10" ANCHOR TRENCH BACKFILL TRENCH WITH NO. 57 STONE
2" X 4" STOP BLOCK
4" X 4" BEYOND
TOP OF 2" X 4" FLUSH WITH TOP OF STRUCTURE
0.5" CLEAR
FLOW
3.5"
6.5"
2" X 4" BEYOND
ANCHOR GEOTEXTILE FABRIC WITH MINIMUM 12" ANCHOR FLAP
10" MIN. TRENCH WIDTH
48" SQUARE CATCH BASIN
FILTERED RUNOFF
SECTION B-B
N.T.S.
EROSION CONTROL PLAN LEGEND: CATCH BASIN FILTER ASSEMBLY (TYPE 2)
70"
74"
21"
12" ANCHOR FLAPS (ALL FOUR SIDES)
SEWN EDGE
2" BEYOND BOTTOM OF FRAME
GEOTEXTILE SLIPCOVER FABRICATION
N.T.S.
FABRICATION SPECIFICATIONS:
1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO ENDEMENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-RESISTED POLYESTER THREAD (MINIMUM OF 138 POUNDS) WITH MINIMUM OF 4.5 STITCHES PER INCH.
3. THE INSIDE ROW OF STICTHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGE.
STATE OF WASHINGTON DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 2) SLIPCOVER DETAILS
4-15-04 EC-STR-42A


FRAME SHOWN WITHOUT HARDWARE CLOTH OR FABRIC SLIPCOVER FOR CLARITY.
2" X 4" BRIDGING AT MID-SPAN (STAGGERED)
ALL MEMBERS ARE 2" X 4" EXCEPT AS NOTED
NO. 10 X 3.5" GALVANIZED DECK SCREWS (TYP. ALL LOCATIONS)
2" X 4" BLOCKING
TWO 2" X 4" STOP BLOCKS 1'-9.5" LONG EACH CORNER, FLUSH WITH TOP MEMBER
2" X 6" ON EDGE, TOP & BOTTOM - BOTH SIDES
2'-0" LONG 4" X 4" TEACH CORNER)
AT MID-SPAN
6'-4" SQUARE
GRADED SITE FLOW
CATCH BASIN TYPE
125C | 415C
255C | 425C
385C | 515C
395C
ISOMETRIC VIEW
CATCH BASIN FILTER ASSEMBLY
N.T.S.
EROSION CONTROL PLAN LEGEND: CATCH BASIN FILTER ASSEMBLY (TYPE 3)
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES
(A) DRAWING TO BE USED WITH STANDARD TYPE B-CB-SERIES SC CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.
(B) THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERRUPTION OF CONCENTRATED FLOWS (e.g. DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.
(C) 2 x 4, 2 x 6, AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH, 1.5 x 5.5 INCH, AND 3.5 x 3.5 INCH, RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.
(D) PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.
(E) APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)
(F) DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO INSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. REUSE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST BE GIVEN BY TDOT ENGINEER.
(G) ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.
(H) IF NECESSARY, AT DIRECTION OF TDOT ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.
(I) WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC., OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.
(J) ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209-40.43, CATCH BASIN FILTER ASSEMBLY (TYPE 3), PER EACH.
A
B
GRADED SITE FLOW
2" X 6"
STANDARD 62" SQUARE CONCRETE CATCH BASIN
SLIPCOVER FILTER FABRIC OVER HARDWARE CLOTH
10" X 12" ANCHOR TRENCH BACKFILL WITH MINERAL AGGREGATE (SIZE NO. 57)
0.5" X 0.5" - 19 GA. GALVANIZED HARDWARE CLOTH UNDER GEOTEXTILE SLIPCOVER FABRIC
WOOD FRAME
1.0" CLEAR
WIRE STAPLES AT 6" O.C.
1.0" CLEAR BETWEEN CATCH BASIN AND WOOD FRAME
PLAN VIEW - CATCH BASIN FILTER ASSEMBLY
N.T.S.
3" MIN.
3" MIN.
TRIM ALL ENDS OF CLOTH AS REQUIRED TO AVOID SHARP ENDS THAT COULD TEAR FILTER FABRIC.
EXTEND HARDWARE CLOTH OVER EACH EDGE (TYP.)
HARDWARE CLOTH OVERLAP DETAIL
N.T.S.
TOP HARDWARE CLOTH
TOP HARDWARE CLOTH
2'-2" LAP
2'-2" LAP
APPROXIMATE WEIGHT OF FRAME AND CLOTH = 183 LBS.
ATTACH ALL EDGES OF HARDWARE CLOTH TO WOOD FRAME
SEE HARDWARE CLOTH OVERLAP DETAIL
HARDWARE CLOTH ALL FOUR SIDES
NO HARDWARE CLOTH ON BOTTOM
WIRE STAPLES AT 6" O.C. (TYPICAL ALL SIDES)
ISOMETRIC VIEW
FRAME WITH HARDWARE CLOTH
N.T.S.
INSTALLATION SEQUENCE FOR HARDWARE CLOTH
INSTALL TOP HARDWARE CLOTH A, PULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.
INSTALL TOP HARDWARE CLOTH B - OVERLAPPING CLOTH A AT SECOND TOP BRACE. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL TOP HARDWARE CLOTH C - OVERLAPPING CLOTH A AT THIRD TOP BRACE. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME USING ONE CONTINUOUS PIECE BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.
TRIM EXCESS ALONG BOTTOM AS NECESSARY.
STATE OF WASHINGTON DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 3)
4-15-04 EC-STR-43

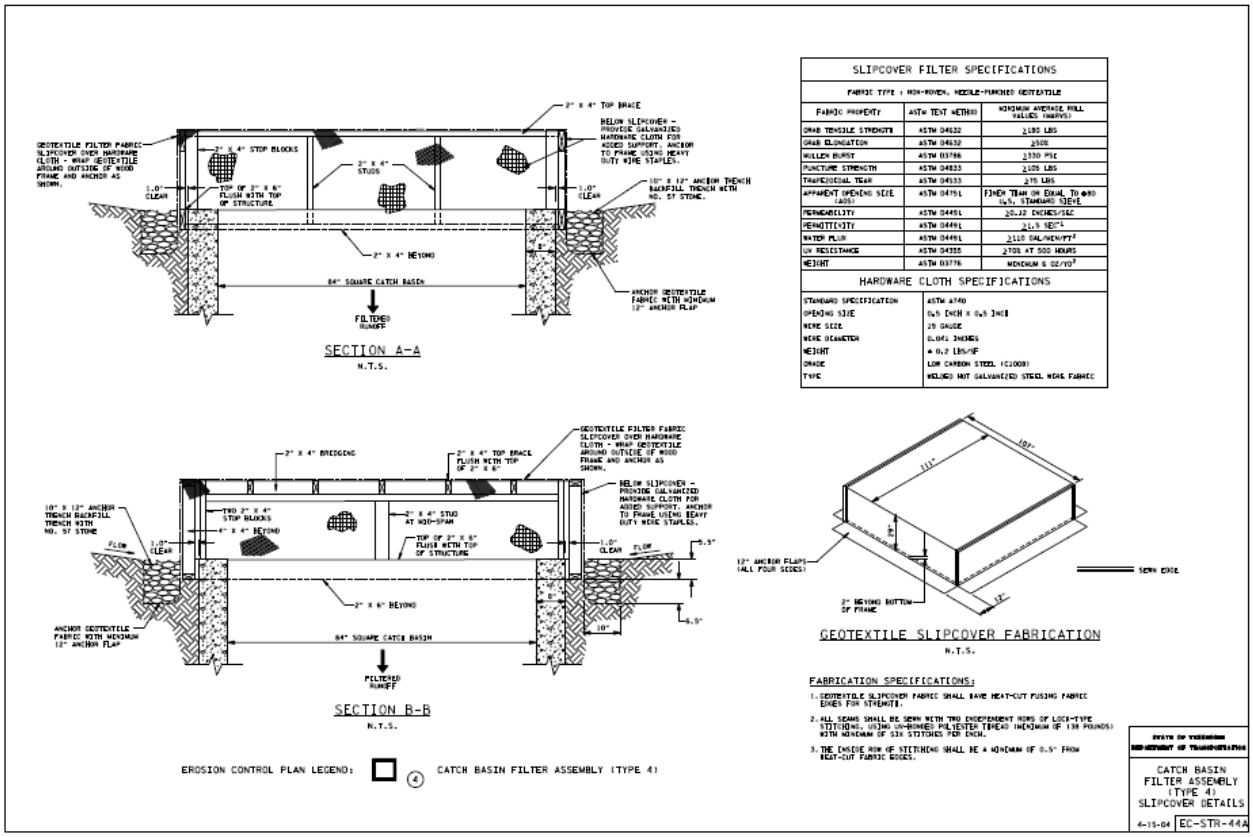


FABRIC PROPERTY	ASTM TEST METHOD	MINIMUM AVERAGE ROLL VALUES (MARV's)
GRAB TENSILE STRENGTH	ASTM D4632	≥180 LBS
GRAB ELONGATION	ASTM D4632	≥50%
MULLEN BURST	ASTM D3786	≥350 PSI
PUNCTURE STRENGTH	ASTM D4833	≥105 LBS
TRAPEZOIDAL TEAR	ASTM D4533	≥75 LBS
APPARENT OPENING SIZE (AOS)	ASTM D4751	FINER THAN OR EQUAL TO 0.600 MM (No. 30 STANDARD SIEVE)
PERMEABILITY	ASTM D4491	≥0.12 INCHES/SEC
PERMITTIVITY	ASTM D4491	≥1.5 SEC^{-1}
WATER FLUX	ASTM D4491	≥120 GAL/MIN/FT^2
UV RESISTANCE	ASTM D4355	≥70% AT 500 HOURS
WEIGHT	ASTM D3776	MINIMUM 6 OZ/YD^2

STANDARD SPECIFICATION	ASTM A740
OPENING SIZE	0.5 INCH X 0.5 INCH
WIRE SIZE	19 GAUGE
WIRE DIAMETER	(0.04) INCHES
WEIGHT	≈ 0.2 LBS/SF
GRADE	LOW CARBON STEEL (CL1008)
TYPE	WELDED HOT GALVANIZED STEEL WIRE FABRIC



CATCH BASIN TYPE	
1250	4150
2150	4250
3150	5150
3650	



SLIPCOVER FILTER SPECIFICATIONS		
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE		
FABRIC PROPERTY	ASTM TEST METHOD	MINIMUM AVERAGE ROLL VALUES (MARV'S)
GRAB TENSILE STRENGTH	ASTM D4632	180 LBS
GRAB ELONGATION	ASTM D4632	250%
MULLEN BURST	ASTM D3786	330 PSI
PUNCTURE STRENGTH	ASTM D4833	105 LBS
TRAPEZOIDAL TEAR	ASTM D4533	215 LBS
APPARENT OPENING SIZE (AOS)	ASTM D4751	#70 (#0.21 MM) OR EQUAL TO #80 (0.4, STANDARD SIEVE
PERMEABILITY	ASTM D4491	0.2 CM/SEC
PERMITTIVITY	ASTM D4491	0.5 SEC^{-1}
WATER FLUX	ASTM D4491	110 GAL/MIN/FT^2
UV RESISTANCE	ASTM D4355	70% AT 500 HOURS
WEIGHT	ASTM D3776	MINIMUM 6 OZ/YD^2

HARDWARE CLOTH SPECIFICATIONS	
STANDARD SPECIFICATION	ASTM A740
OPENING SIZE	0.5 INCH X 0.5 INCH
WIRE SIZE	19 GAUGE
WIRE DIAMETER	0.041 INCHES
WEIGHT	± 0.2 LBS/SF
GRADE	LOW CARBON STEEL (C1008)
TYPE	WELDED HOT GALVANIZED STEEL WIRE FABRIC

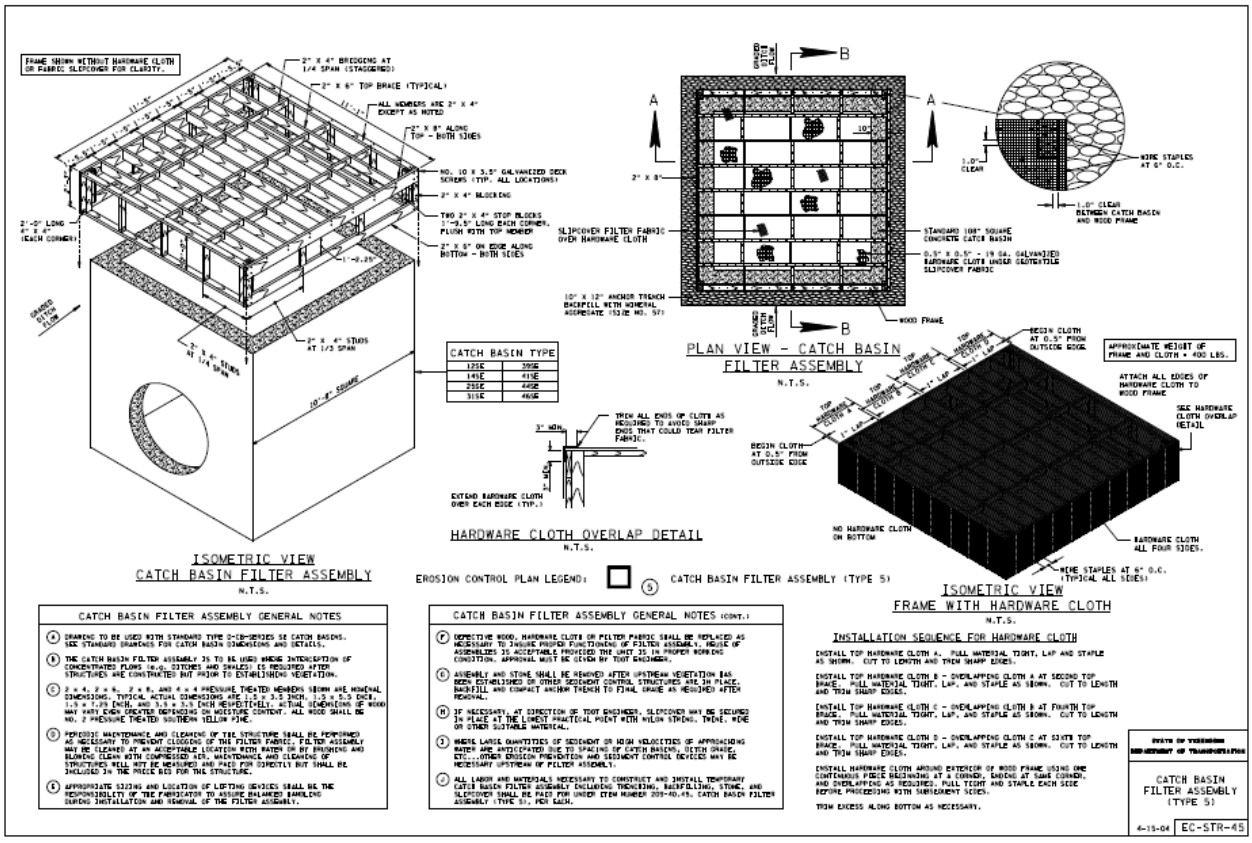
FABRICATION SPECIFICATIONS:

1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO INDEPENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-ROTTED POLYESTER THREAD (MINIMUM OF 130 POUNDS) WITH MINIMUM OF SIX STITCHES PER INCH.
3. THE ENDSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.

STATE OF WASHINGTON DEPARTMENT OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY (TYPE 4) SLIPCOVER DETAILS

4-15-04 EC-STR-44A



CATCH BASIN TYPE	
125E	395E
145E	415E
255E	440E
315E	465E

CATCH BASIN FILTER ASSEMBLY GENERAL NOTES

A. DRAWING TO BE USED WITH STANDARD TYPE 8-18-SERIES SE CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.

B. THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (e.g. DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.

C. 2 x 4, 2 x 6, 2 x 8, AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH, 1.5 x 5.5 INCH, 1.5 x 7.25 INCH, AND 3.5 x 3.5 INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.

D. PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

E. APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.

CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)

F. DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. MODIFICATIONS OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST BE GIVEN BY THE ENGINEER.

G. ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.

H. IF NECESSARY, AT DIRECTION OF THE ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PERMITTED POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.

J. WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC...OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.

J. ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209-40.45, CATCH BASIN FILTER ASSEMBLY (TYPE 5), PER EACH.

INSTALLATION SEQUENCE FOR HARDWARE CLOTH

INSTALL TOP HARDWARE CLOTH A. PULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

INSTALL TOP HARDWARE CLOTH B - OVERLAPPING CLOTH A AT SECOND TOP BRACE. PULL MATERIAL TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

INSTALL TOP HARDWARE CLOTH C - OVERLAPPING CLOTH B AT FOURTH TOP BRACE. PULL MATERIAL TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

INSTALL TOP HARDWARE CLOTH D - OVERLAPPING CLOTH C AT SIXTH TOP BRACE. PULL MATERIAL TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

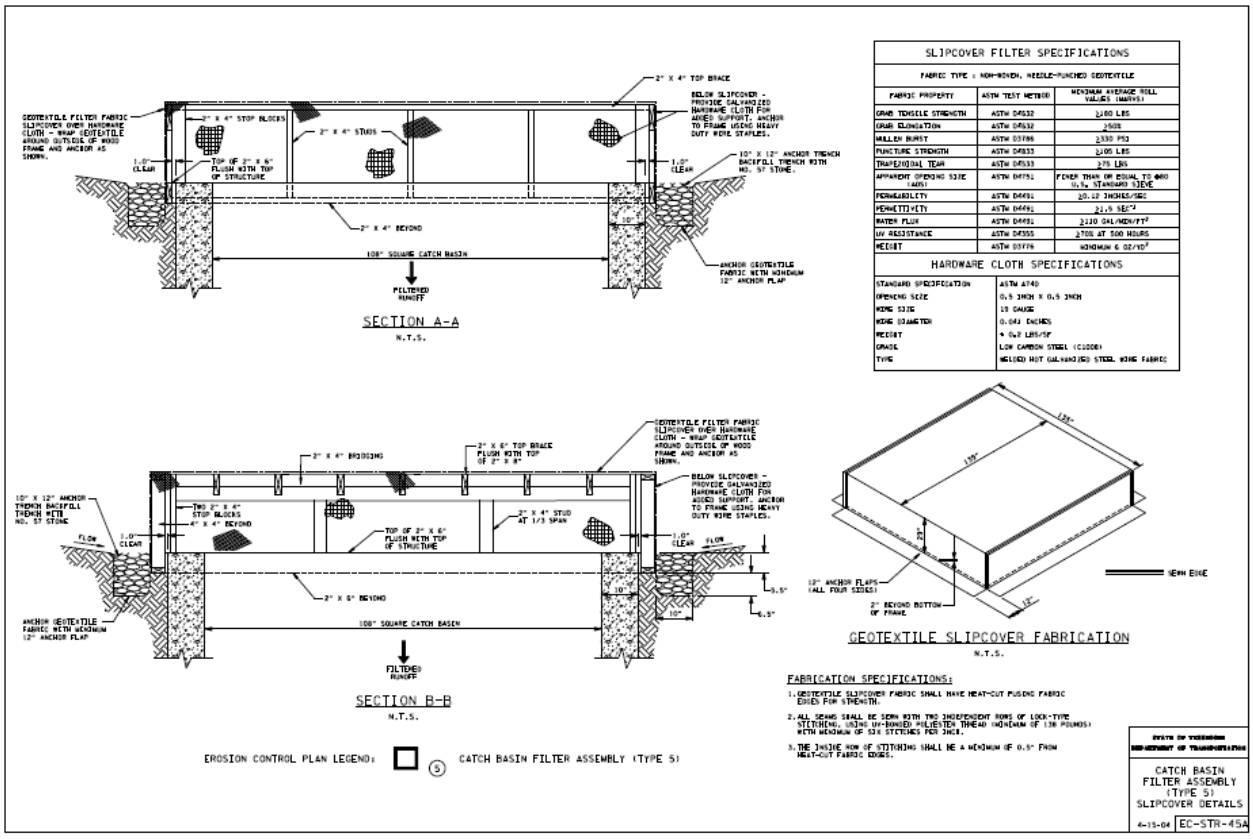
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME USING ONE CONTINUOUS PIECE BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.

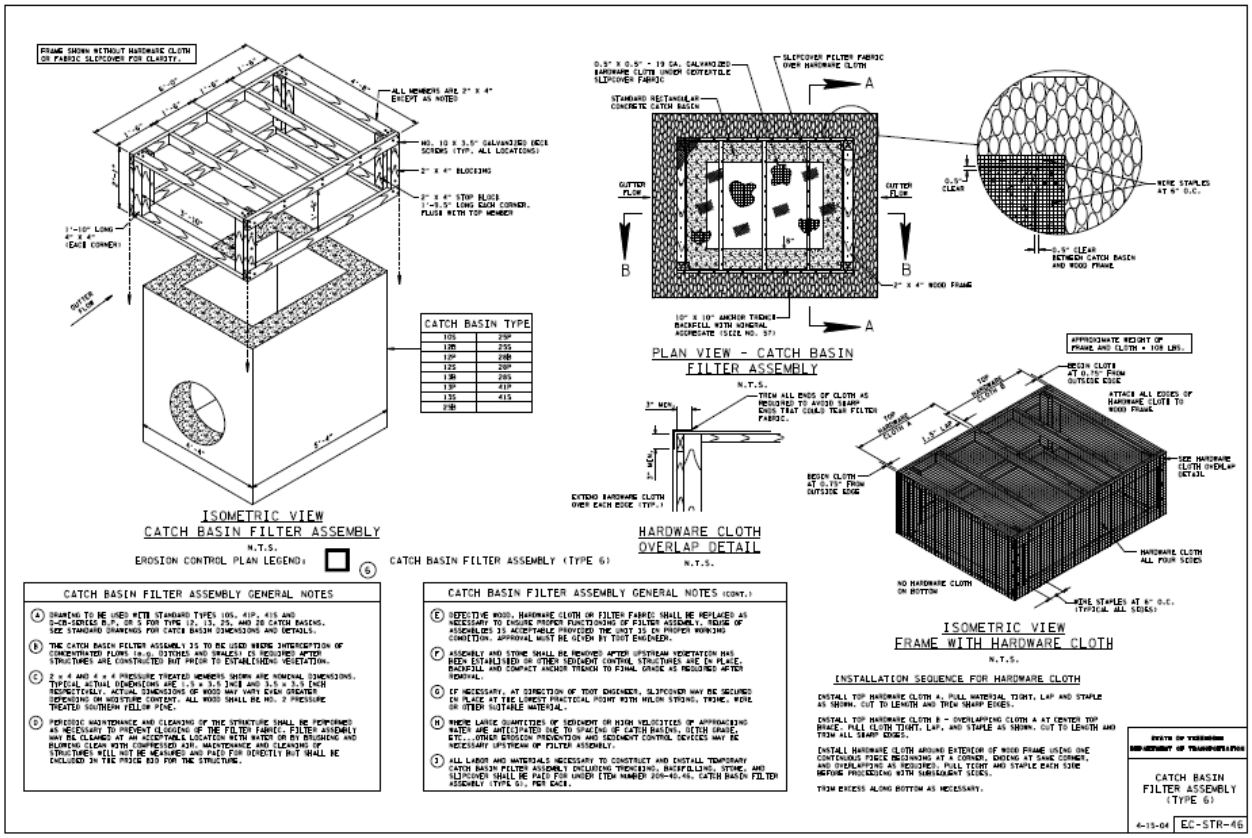
TRIM EXCESS ALONG BOTTOM AS NECESSARY.

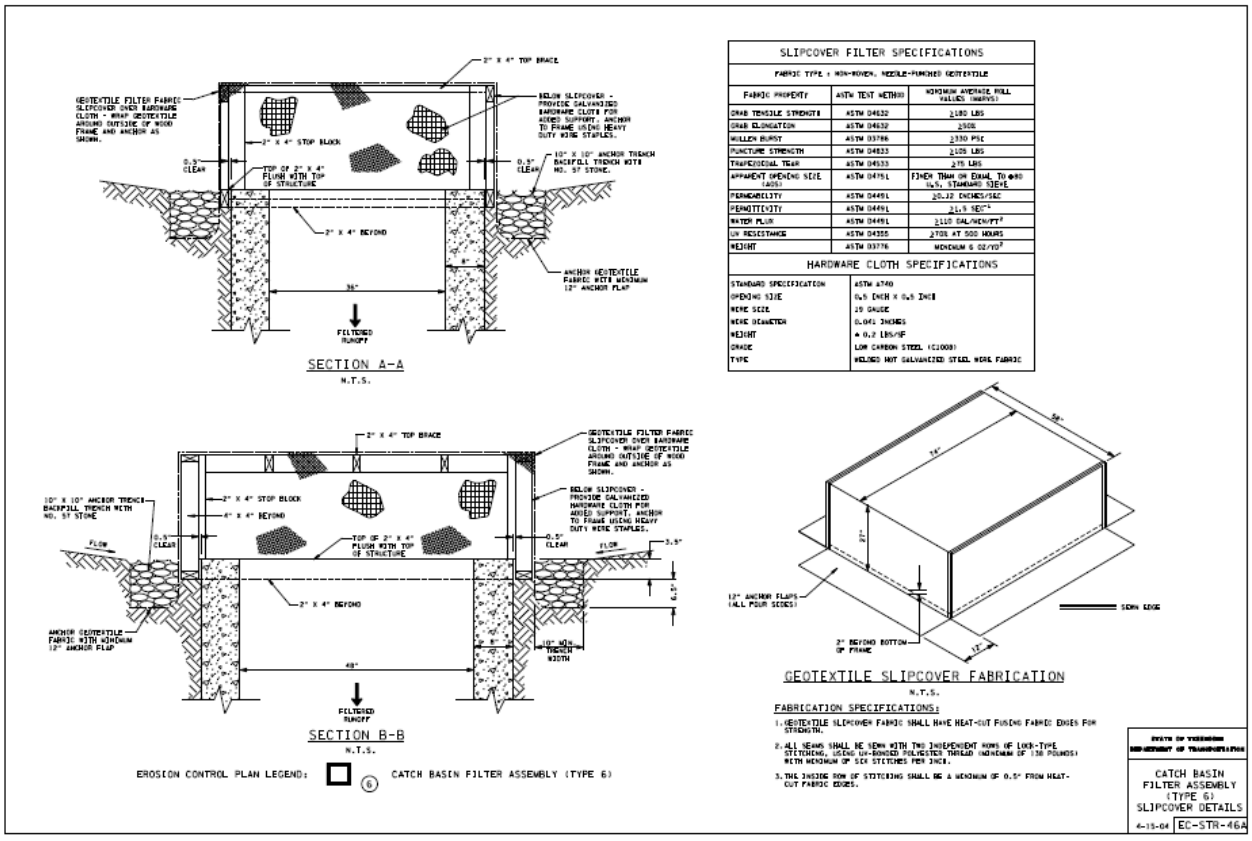
STATE OF WASHINGTON DEPARTMENT OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY (TYPE 5)

4-15-04 EC-STR-45


SECTION A-A
N.T.S.
SECTION B-B
N.T.S.
GEOTEXTILE SLIPCOVER FABRICATION
N.T.S.
EROSION CONTROL PLAN LEGEND:
CATCH BASIN FILTER ASSEMBLY (TYPE S)
SLIPCOVER FILTER SPECIFICATIONS
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE
HARDWARE CLOTH SPECIFICATIONS
FABRICATION SPECIFICATIONS:
1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO INDEPENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-BONDED POLYESTER THREAD (MINIMUM OF 138 POUNDS) WITH MINIMUM OF 5X STITCHES PER INCH.
3. THE INSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.
CATCH BASIN FILTER ASSEMBLY (TYPE S) SLIPCOVER DETAILS
4-15-04
EC-STR-45A


ISOMETRIC VIEW
CATCH BASIN FILTER ASSEMBLY
N.T.S.
PLAN VIEW - CATCH BASIN FILTER ASSEMBLY
N.T.S.
HARDWARE CLOTH OVERLAP DETAIL
N.T.S.
ISOMETRIC VIEW
FRAME WITH HARDWARE CLOTH
N.T.S.
EROSION CONTROL PLAN LEGEND:
CATCH BASIN FILTER ASSEMBLY (TYPE 6)
CATCH BASIN TYPE
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)
INSTALLATION SEQUENCE FOR HARDWARE CLOTH
CATCH BASIN FILTER ASSEMBLY (TYPE 6)
4-15-04
EC-STR-46

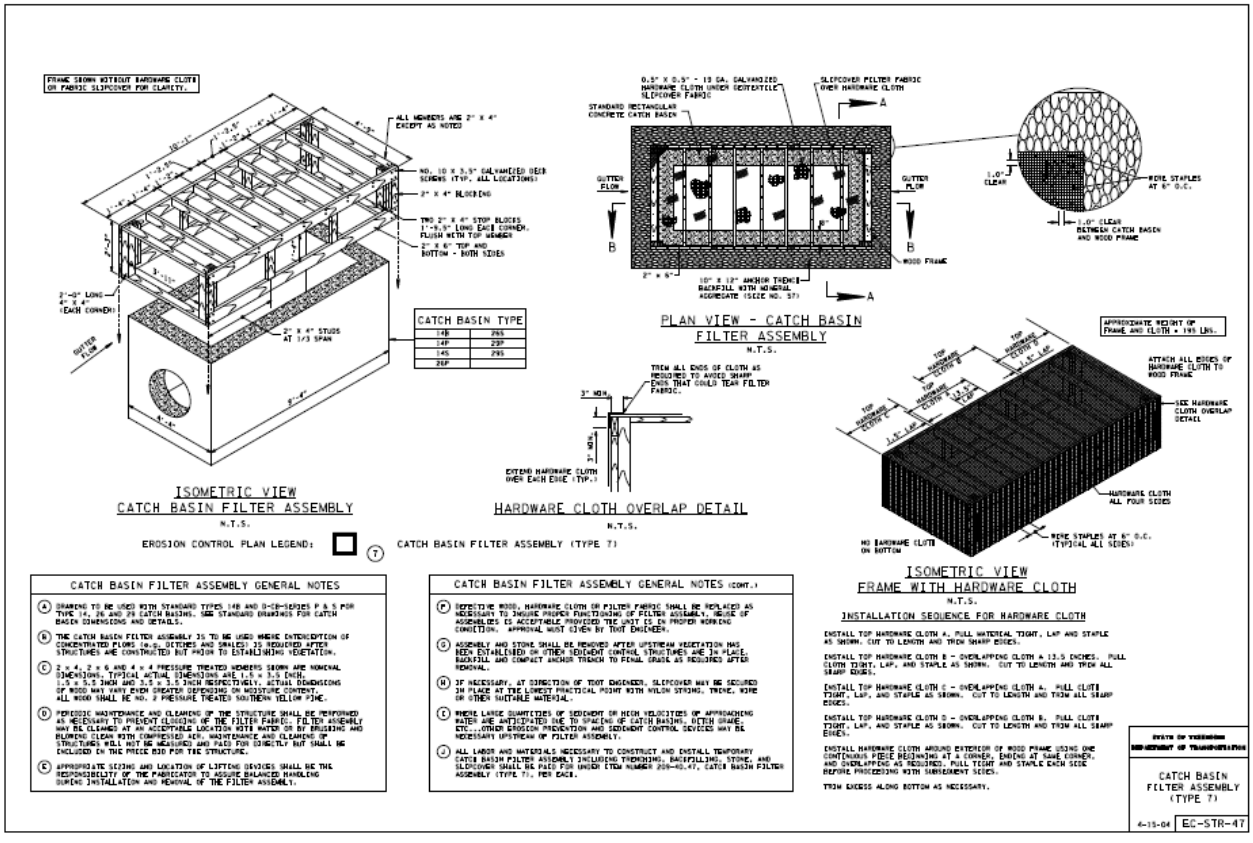


SLIPCOVER FILTER SPECIFICATIONS		
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE		
FABRIC PROPERTY	ASTM TEST METHOD	MINIMUM AVERAGE ROLL VALUES (MARVS)
GRAB TENSILE STRENGTH	ASTM D4632	≥180 LBS
GRAB ELONGATION	ASTM D4632	≥50%
MULLEN BURST	ASTM D3786	≥330 PSI
PUNCTURE STRENGTH	ASTM D4833	≥105 LBS
TRAPEZOIDAL TEAR	ASTM D4533	≥75 LBS
APPARENT OPENING SIZE (AOS)	ASTM D4751	FINER THAN OR EQUAL TO #80 (0.5, STANDARD SIEVE
PERMEABILITY	ASTM D4491	.20.12 INCHES/SEC
PERMITTIVITY	ASTM D4491	≥1.9 SEC^{-1}
WATER FLUX	ASTM D4491	≥110 GAL/MIN/FT^2
UV RESISTANCE	ASTM D4355	≥70% AT 500 HOURS
WEIGHT	ASTM D3776	MINIMUM 6 OZ/YD^2
HARDWARE CLOTH SPECIFICATIONS		
STANDARD SPECIFICATION	ASTM A740	
OPENING SIZE	0.5 INCH X 0.5 INCH	
WIRE SIZE	19 GAUGE	
WIRE DIAMETER	0.041 INCHES	
WEIGHT	≥ 0.2 LBS/SF	
GRADE	LOW CARBON STEEL (C1008)	
TYPE	WELDED HOT GALVANIZED STEEL WIRE FABRIC	

STATE OF VERMONT DEPARTMENT OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY (TYPE 6) SLIPCOVER DETAILS

4-15-04 EC-STR-46A



CATCH BASIN FILTER ASSEMBLY GENERAL NOTES

(A) DRAWING TO BE USED WITH STANDARD TYPES 14B AND D-SB-SERIES P & S FOR TYPE 14, 26 AND 29 CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.

(B) THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERRUPTION OF CONCENTRATED FLOWS (e.g. DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.

(C) 2 x 4, 2 x 6 AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH, 1.5 x 5.5 INCH AND 3.5 x 3.5 INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.

(D) PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

(E) APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.

CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)

(F) DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. REUSE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST GIVEN BY THE ENGINEER.

(G) ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.

(H) IF NECESSARY, AT DIRECTION OF THE ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.

(I) WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC...OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.

(J) ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 208-40.47, CATCH BASIN FILTER ASSEMBLY (TYPE 7), PER EACH.

INSTALLATION SEQUENCE FOR HARDWARE CLOTH

INSTALL TOP HARDWARE CLOTH A. PULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.

INSTALL TOP HARDWARE CLOTH B - OVERLAPPING CLOTH A 13.5 INCHES. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.

INSTALL TOP HARDWARE CLOTH C - OVERLAPPING CLOTH A. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.

INSTALL TOP HARDWARE CLOTH D - OVERLAPPING CLOTH B. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.

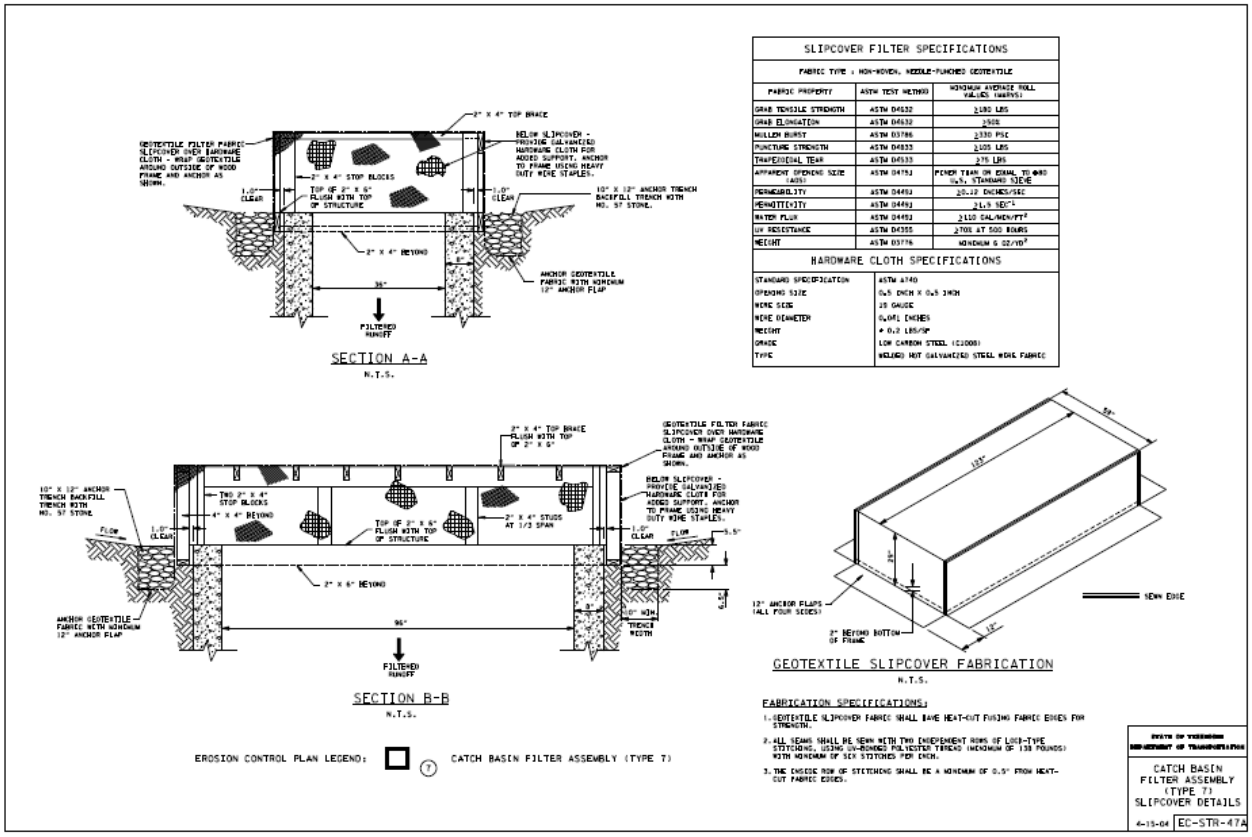
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME USING ONE CONTINUOUS PIECE BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.

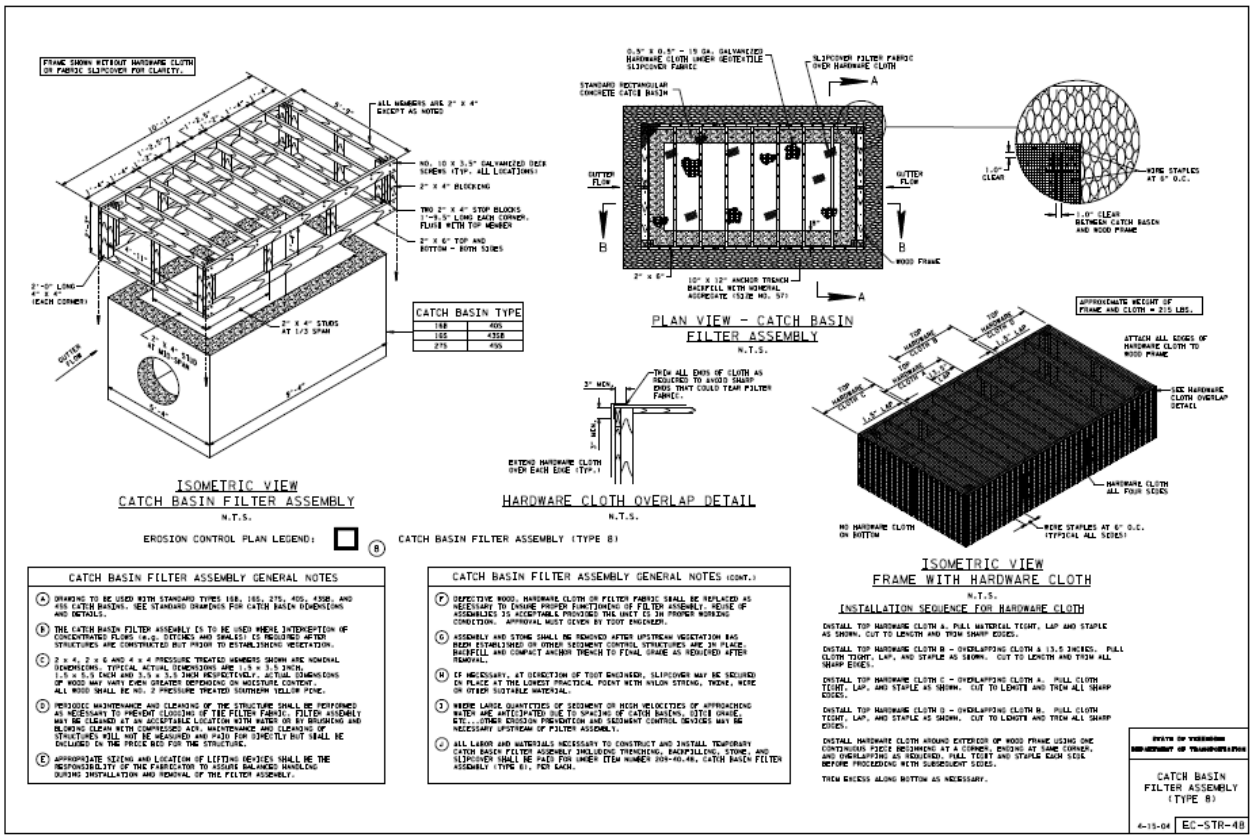
TRIM EXCESS ALONG BOTTOM AS NECESSARY.

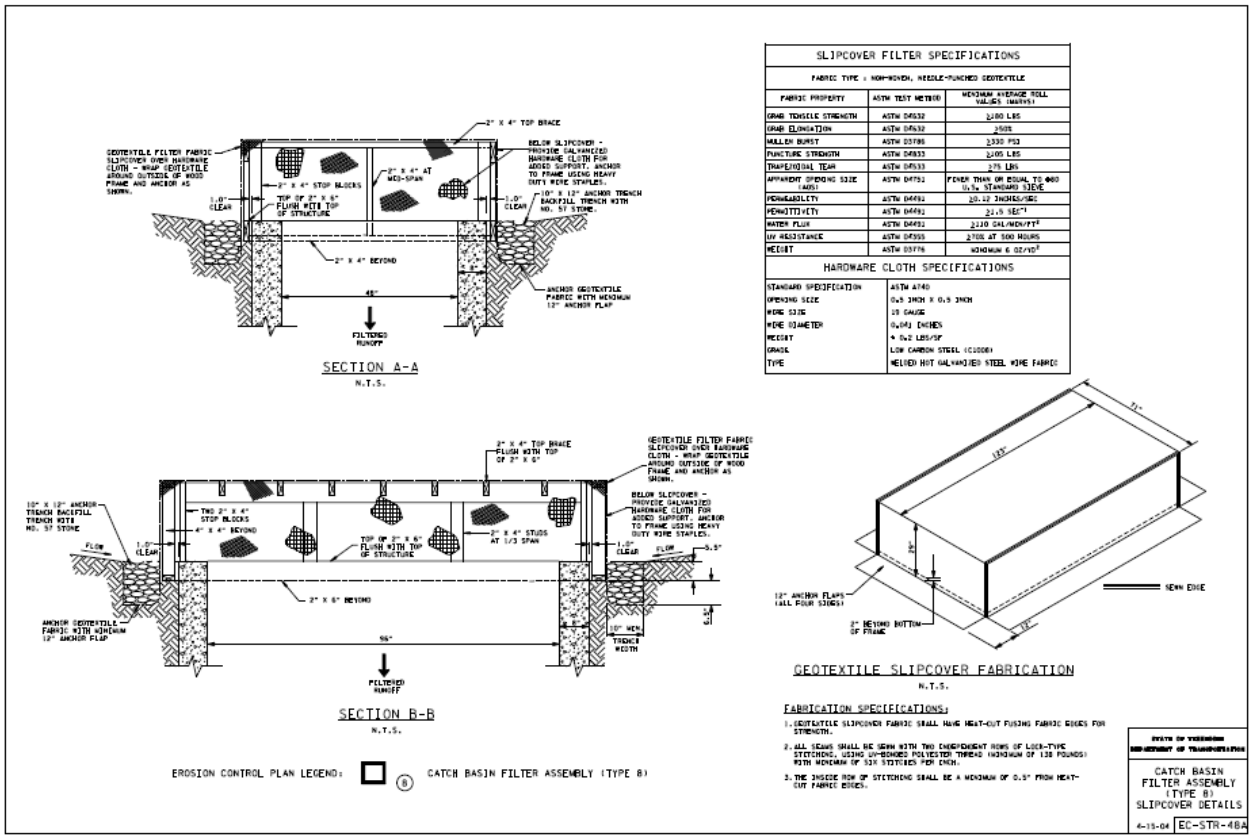
STATE OF VERMONT DEPARTMENT OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY (TYPE 7)

4-15-04 EC-STR-47


SLIPCOVER FILTER SPECIFICATIONS
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE
FABRIC PROPERTY | ASTM TEST METHOD | MINIMUM AVERAGE ROLL VALUES (MARV'S)
GRAB TENSILE STRENGTH | ASTM D4632 | ≥180 LBS
GRAB ELONGATION | ASTM D4632 | ≥50%
MULLEN BURST | ASTM D3786 | ≥330 PSI
PUNCTURE STRENGTH | ASTM D4833 | ≥105 LBS
TRAPEZOIDAL TEAR | ASTM D4533 | ≥75 LBS
APPARENT OPENING SIZE (AOS) | ASTM D4751 | FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY | ASTM D4491 | .20 INCHES/SEC
PERMITTIVITY | ASTM D4491 | .11 SEC-1
WATER FLUX | ASTM D4491 | ≥110 GAL/MIN/FT2
UV RESISTANCE | ASTM D4355 | 70% AT 500 HOURS
WEIGHT | ASTM D3776 | MINIMUM 6 OZ/YD2
HARDWARE CLOTH SPECIFICATIONS
STANDARD SPECIFICATION | ASTM A740
OPENING SIZE | 0.5 INCH X 0.5 INCH
WIRE SIZE | 19 GAUGE
WIRE DIAMETER | 0.041 INCHES
WEIGHT | ± 0.2 LBS/SF
GRADE | LOW CARBON STEEL (C1008)
TYPE | WELDED HOT Galvan(ZE) STEEL WIRE FABRIC
2" X 4" TOP BRACE
GEOTEXTILE FILTER FABRIC SLIPCOVER OVER HARDWARE CLOTH - WRAP GEOTEXTILE AROUND OUTSIDE OF WOOD FRAME AND ANCHOR AS SHOWN.
BELOW SLIPCOVER - PROVIDE GALVANIZED HARDWARE CLOTH FOR ADDED SUPPORT. ANCHOR TO FRAME USING HEAVY DUTY WIRE STAPLES.
2" X 4" STOP BLOCKS
1.0" CLEAR
TOP OF 2" X 6" FLUSH WITH TOP OF STRUCTURE
10" X 12" ANCHOR TRENCH BACKFILL TRENCH WITH NO. 57 STONE.
2" X 4" BEYOND
36"
ANCHOR GEOTEXTILE FABRIC WITH MINIMUM 12" ANCHOR FLAP
FILTERED RUNOFF
SECTION A-A
N.T.S.
2" X 4" TOP BRACE FLUSH WITH TOP OF 2" X 6"
TWO 2" X 4" STOP BLOCKS
4" X 4" BEYOND
2" X 4" STUDS AT 1/3 SPAN
2" X 6" BEYOND
96"
10" MIN. TRENCH WIDTH
SECTION B-B
N.T.S.
EROSION CONTROL PLAN LEGEND:
CATCH BASIN FILTER ASSEMBLY (TYPE 7)
12" ANCHOR FLAPS (ALL FOUR SIDES)
2" BEYOND BOTTOM OF FRAME
SEWN EDGE
GEOTEXTILE SLIPCOVER FABRICATION
N.T.S.
FABRICATION SPECIFICATIONS:
1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO INDEPENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-BONDED POLYESTER THREAD (MINIMUM OF 130 POUNDS) WITH MINIMUM OF SIX STITCHES PER INCH.
3. THE INSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 7) SLIPCOVER DETAILS
4-15-04
EC-STR-47A


FRAME SHOWN WITHOUT HARDWARE CLOTH OR FABRIC SLIPCOVER FOR CLARITY.
ALL MEMBERS ARE 2" X 4" EXCEPT AS NOTED
NO. 10 X 3.5" GALVANIZED DECK SCREWS (TYP. ALL LOCATIONS)
2" X 4" BLOCKING
TWO 2" X 4" STOP BLOCKS 1'-4.5" LONG EACH CORNER, FLUSH WITH TOP MEMBER
2" X 6" TOP AND BOTTOM - BOTH SIDES
2'-0" LONG 4" X 4" (EACH CORNER)
2" X 4" STUDS AT 1/3 SPAN
GUTTER FLOW
CATCH BASIN TYPE
TYPE | DIA
18B | 48S
18S | 43SB
27S | 49S
ISOMETRIC VIEW
CATCH BASIN FILTER ASSEMBLY
N.T.S.
0.5" X 0.5" - 19 Ga. GALVANIZED HARDWARE CLOTH UNDER GEOTEXTILE SLIPCOVER FABRIC
SLIPCOVER FILTER FABRIC OVER HARDWARE CLOTH
STANDARD RECTANGULAR CONCRETE CATCH BASIN
GUTTER FLOW
WOOD FRAME
2" X 6"
10" X 12" ANCHOR TRENCH BACKFILL WITH NOMINAL AGGREGATE (SIZE NO. 57)
WIRE STAPLES AT 6" O.C.
1.0" CLEAR
1.0" CLEAR BETWEEN CATCH BASIN AND WOOD FRAME
PLAN VIEW - CATCH BASIN FILTER ASSEMBLY
N.T.S.
TRIM ALL ENDS OF CLOTH AS REQUIRED TO AVOID SHARP ENDS THAT COULD TEAR FILTER FABRIC.
3" MIN.
EXTEND HARDWARE CLOTH OVER EACH EDGE (TYP.)
HARDWARE CLOTH OVERLAP DETAIL
N.T.S.
APPROXIMATE WEIGHT OF FRAME AND CLOTH = 215 LBS.
TOP HARDWARE CLOTH B
TOP HARDWARE CLOTH A
1.5" LAP
ATTACH ALL EDGES OF HARDWARE CLOTH TO WOOD FRAME
SEE HARDWARE CLOTH OVERLAP DETAIL
HARDWARE CLOTH ALL FOUR SIDES
NO HARDWARE CLOTH ON BOTTOM
WIRE STAPLES AT 6" O.C. (TYPICAL ALL SIDES)
ISOMETRIC VIEW
FRAME WITH HARDWARE CLOTH
N.T.S.
EROSION CONTROL PLAN LEGEND:
CATCH BASIN FILTER ASSEMBLY (TYPE 8)
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES
(A) DRAWING TO BE USED WITH STANDARD TYPES 18B, 18S, 27S, 40S, 43SB, AND 49S CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.
(B) THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (e.g. DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.
(C) 2 x 4, 2 x 6 AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH, 1.5 x 5.5 INCH AND 3.5 x 3.5 INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.
(D) PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.
(E) APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)
(F) DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. REUSE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THEY MEET IN PROPER WORKING CONDITION. APPROVAL MUST BE GIVEN BY TOWN ENGINEER.
(G) ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.
(H) IF NECESSARY, AT DIRECTION OF TOWN ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.
(I) WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC., OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.
(J) ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209.40.48, CATCH BASIN FILTER ASSEMBLY (TYPE 8), PER EACH.
INSTALLATION SEQUENCE FOR HARDWARE CLOTH
INSTALL TOP HARDWARE CLOTH A. PULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.
INSTALL TOP HARDWARE CLOTH B - OVERLAPPING CLOTH A 1.5 INCHES. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL TOP HARDWARE CLOTH C - OVERLAPPING CLOTH A. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL TOP HARDWARE CLOTH D - OVERLAPPING CLOTH B. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME USING ONE CONTINUOUS PIECE BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.
TRIM EXCESS ALONG BOTTOM AS NECESSARY.
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 8)
4-15-04
EC-STR-48



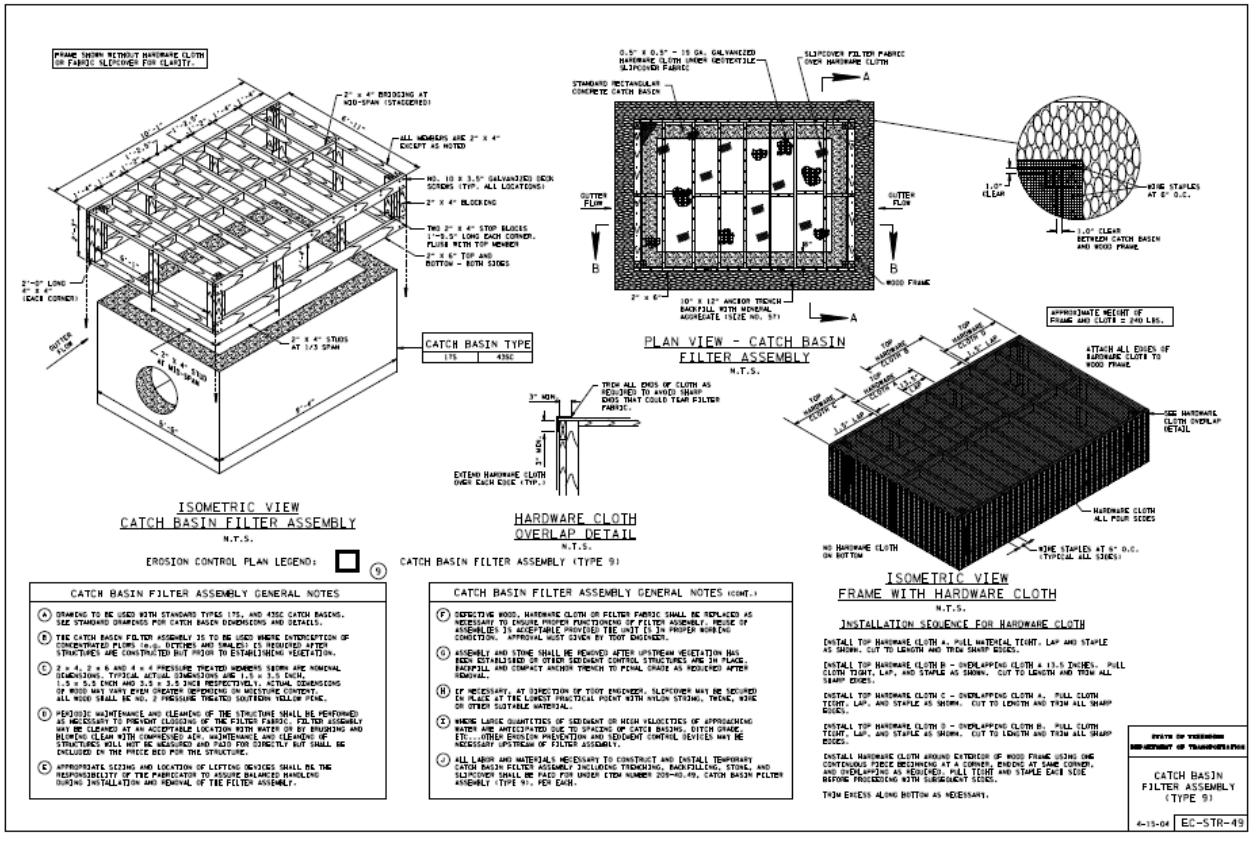
SLIPCOVER FILTER SPECIFICATIONS

FABRIC TYPE = NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE

FABRIC PROPERTY	ASTM TEST METHOD	MINIMUM AVERAGE ROLL VALUES (MARV'S)
GRAB TENSILE STRENGTH	ASTM D4632	180 LBS
GRAB ELONGATION	ASTM D4632	50%
MULLEN BURST	ASTM D3786	330 PSI
PUNCTURE STRENGTH	ASTM D4833	105 LBS
TRAPEZOIDAL TEAR	ASTM D4533	75 LBS
APPARENT OPENING SIZE (AOS)	ASTM D4751	FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY	ASTM D4491	20.12 INCHES/SEC
PERMITTIVITY	ASTM D4491	2.5 SEC^{-1}
WATER FLUX	ASTM D4491	2210 GAL/MIN/FT^2
UV RESISTANCE	ASTM D4355	70% AT 500 HOURS
WEIGHT	ASTM D5776	MINIMUM 6 OZ/YD^2

HARDWARE CLOTH SPECIFICATIONS

STANDARD SPECIFICATION	ASTM A740
OPENING SIZE	0.5 INCH X 0.5 INCH
WIRE SIZE	19 GAUGE
WIRE DIAMETER	0.041 INCHES
WEIGHT	4.042 LBS/SF
GRADE	LOW CARBON STEEL (C1008)
TYPE	WELDED HOT GALVANIZED STEEL WIRE FABRIC



CATCH BASIN FILTER ASSEMBLY GENERAL NOTES

(A) DRAWING TO BE USED WITH STANDARD TYPES 17S, AND 43SC CATCH BASINS. SEE STANDARD DRAWINGS FOR CATCH BASIN DIMENSIONS AND DETAILS.

(B) THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (e.g., DITCHES AND SWALES) IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.

(C) 2 x 4, 2 x 6 AND 4 x 4 PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5 x 3.5 INCH, 1.5 x 5.5 INCH AND 3.5 x 3.5 INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.

(D) PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND RINSING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.

(E) APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.

CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)

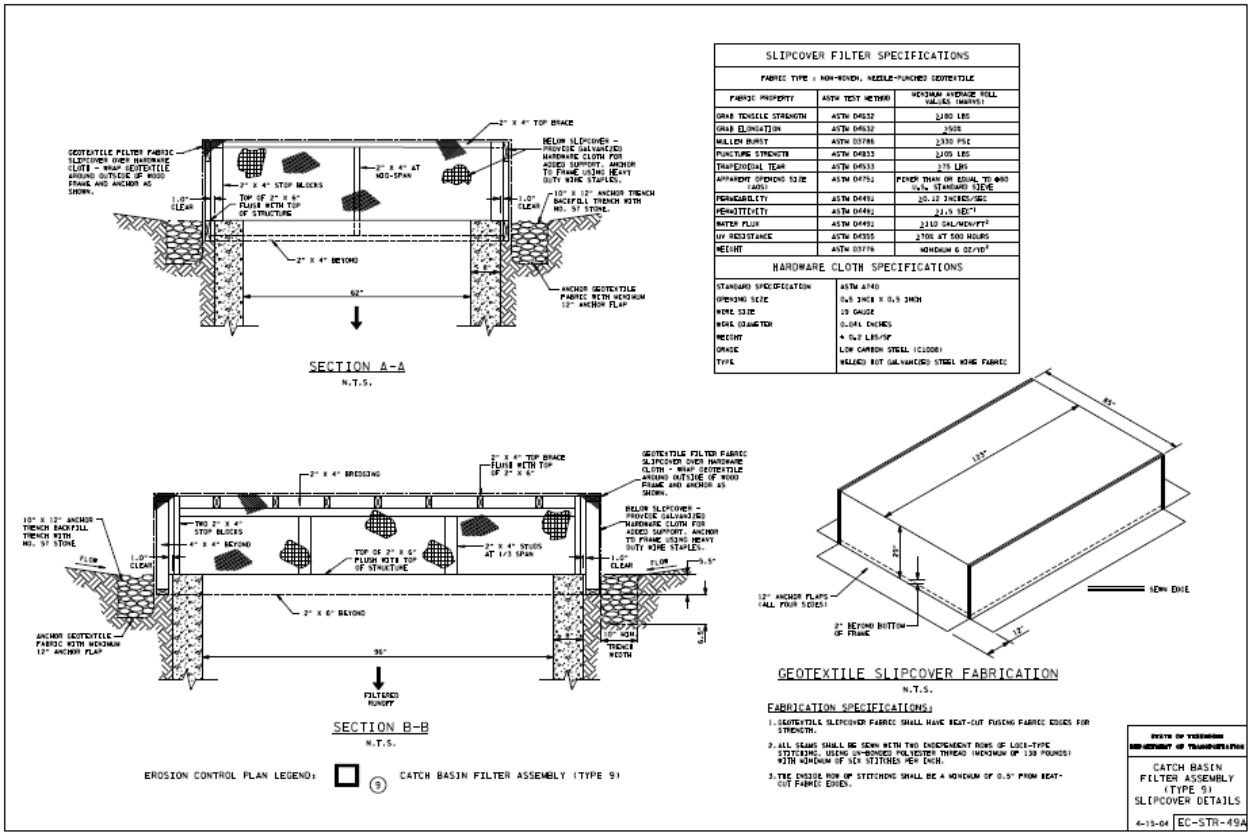
(F) DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. REUSE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST GIVEN BY TDOT ENGINEER.

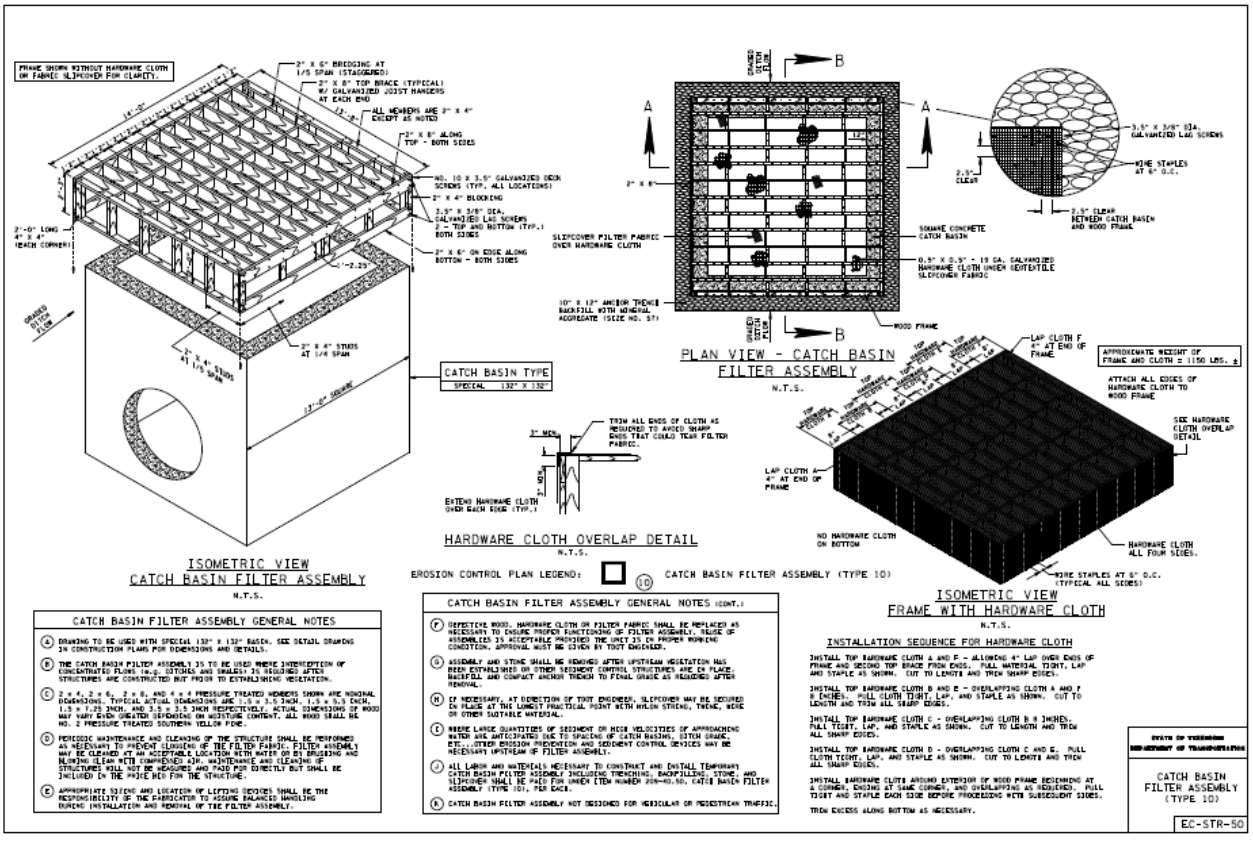
(G) ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.

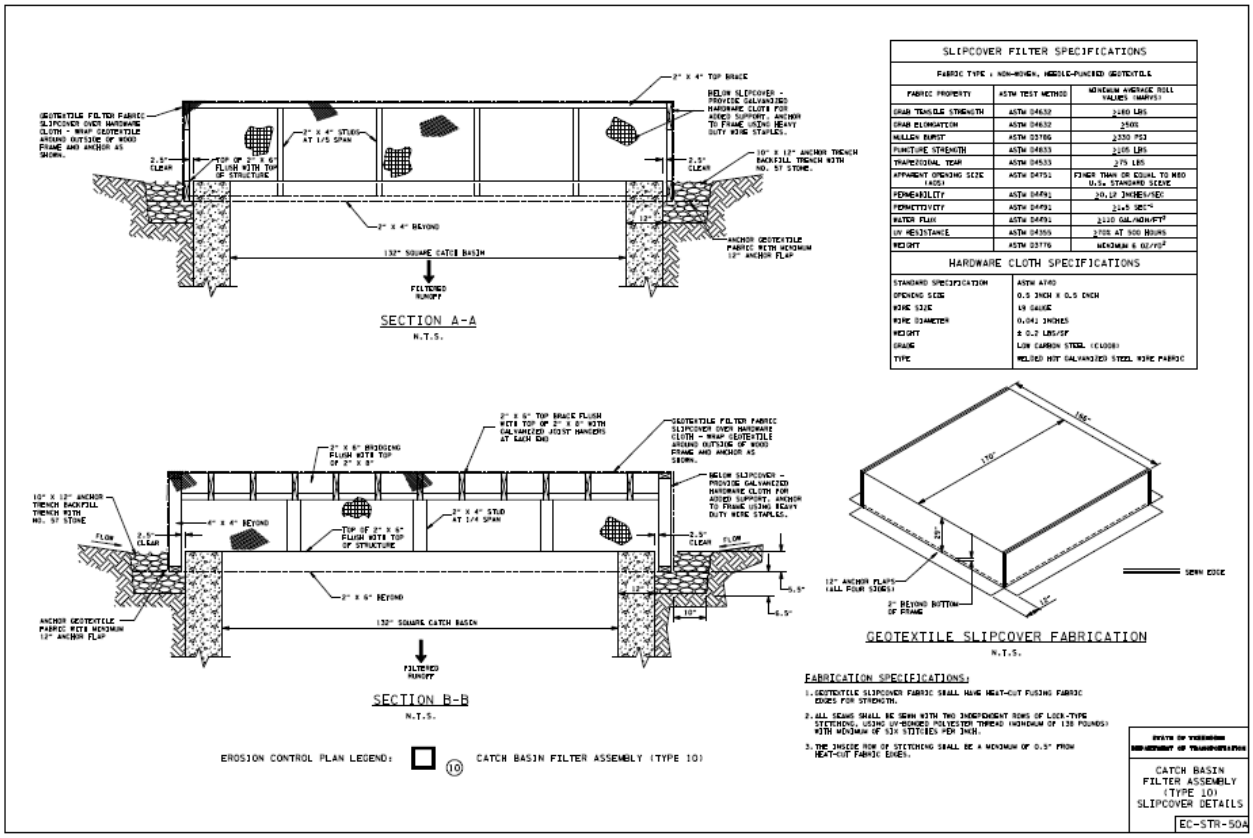
(H) IF NECESSARY, AT DIRECTION OF TDOT ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.

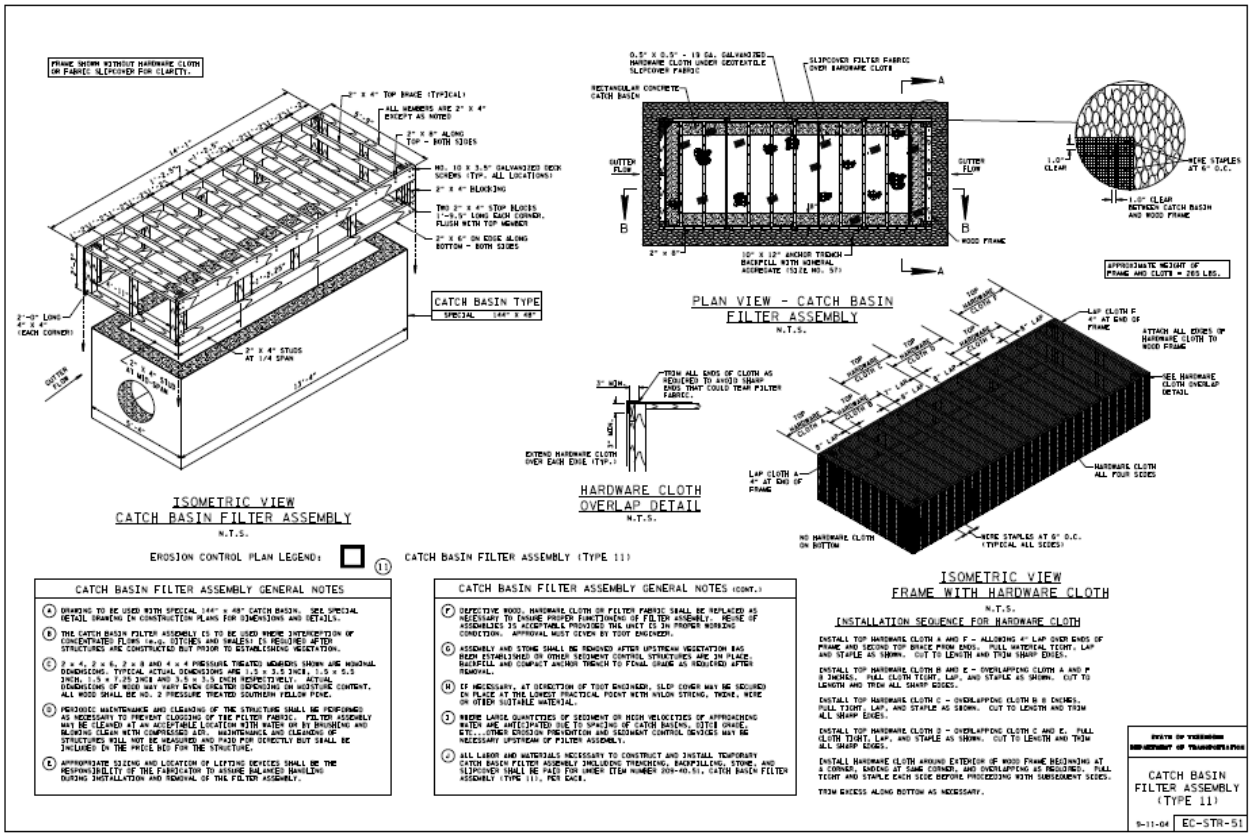
(I) WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC...OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.

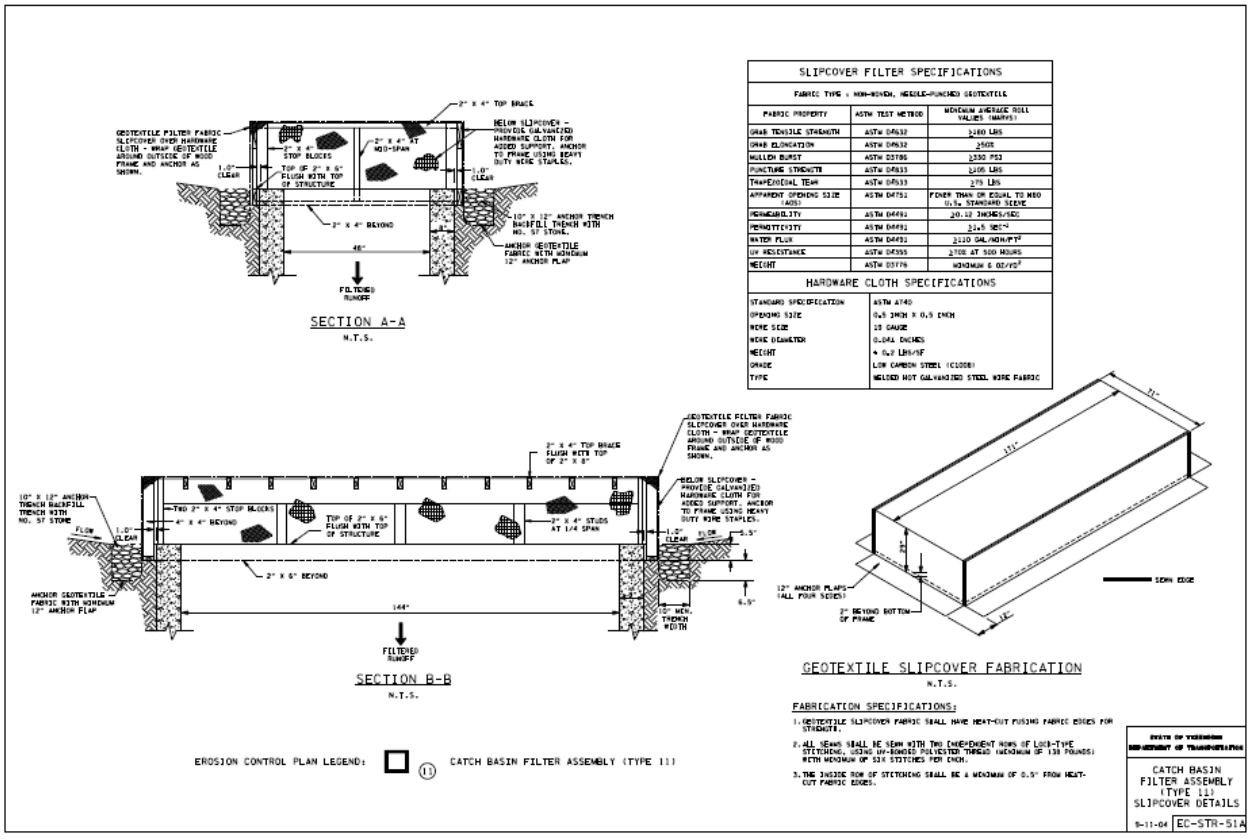
(J) ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209-40.49, CATCH BASIN FILTER ASSEMBLY (TYPE 9), PER EACH.


SLIPCOVER FILTER SPECIFICATIONS
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE
FABRIC PROPERTY
ASTM TEST METHOD
MINIMUM AVERAGE ROLL VALUES (MARV)
GRAB TENSILE STRENGTH
ASTM D4632
≥180 LBS
GRAB ELONGATION
ASTM D4632
≥50%
MULLEN BURST
ASTM D3786
≥330 PSI
PUNCTURE STRENGTH
ASTM D4833
≥105 LBS
TRAPEZOIDAL TEAR
ASTM D4533
≥75 LBS
APPARENT OPENING SIZE (AOS)
ASTM D4751
FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY
ASTM D4491
≥0.12 INCHES/SEC
PERMITTIVITY
ASTM D4491
≥1.9 SEC-1
WATER FLUX
ASTM D4491
≥110 GAL/MIN/FT2
UV RESISTANCE
ASTM D4355
≥70% AT 500 HOURS
WEIGHT
ASTM D3776
MINIMUM 6 OZ/YD2
HARDWARE CLOTH SPECIFICATIONS
STANDARD SPECIFICATION
ASTM A740
OPENING SIZE
0.5 INCH X 0.5 INCH
WIRE SIZE
19 GAUGE
WIRE DIAMETER
0.041 INCHES
WEIGHT
≈ 0.2 LBS/SF
GRADE
LOW CARBON STEEL (C1008)
TYPE
WELDED HOT GALVANIZED STEEL WIRE FABRIC
2" X 4" TOP BRACE
GEOTEXTILE FILTER FABRIC SLIPCOVER OVER HARDWARE CLOTH - WRAP GEOTEXTILE AROUND OUTSIDE OF WOOD FRAME AND ANCHOR AS SHOWN.
2" X 4" STOP BLOCKS
TOP OF 2" X 6" FLUSH WITH TOP OF STRUCTURE
2" X 4" AT MID-SPAN
BELOW SLIPCOVER - PROVIDE GALVANIZED HARDWARE CLOTH FOR ADDED SUPPORT. ANCHOR TO FRAME USING HEAVY DUTY #3NE STAPLES.
1.0" CLEAR
10" X 12" ANCHOR TRENCH BACKFILL WITH NO. 57 STONE.
2" X 4" BEYOND
62"
ANCHOR GEOTEXTILE FABRIC WITH MINIMUM 12" ANCHOR FLAP
SECTION A-A
N.T.S.
2" X 4" BRIDGING
2" X 4" TOP BRACE FLUSH WITH TOP OF 2" X 6"
TWO 2" X 4" STOP BLOCKS
4" X 4" BEYOND
2" X 4" STUDS AT 1/3 SPAN
2" X 6" BEYOND
3.5"
6.5"
10" MIN. TRENCH WIDTH
96"
FILTERED RUNOFF
SECTION B-B
N.T.S.
85"
125"
25"
17"
SEWN EDGE
12" ANCHOR FLAPS (ALL FOUR SIDES)
2" BEYOND BOTTOM OF FRAME
GEOTEXTILE SLIPCOVER FABRICATION
N.T.S.
FABRICATION SPECIFICATIONS:
1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO ENDEMENT ROWS OF LOCK-TYPE STITCHING, USING UV-BONDED POLYESTER THREAD (MINIMUM OF 138 POUNDS) WITH MINIMUM OF SIX STITCHES PER INCH.
3. THE OUTSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.
EROSION CONTROL PLAN LEGEND:
9
CATCH BASIN FILTER ASSEMBLY (TYPE 9)
STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 9) SLIPCOVER DETAILS
4-19-04
EC-STR-49A


FRAME SHOWN WITHOUT HARDWARE CLOTH OR FABRIC SLIPCOVER FOR CLARITY.
2" X 6" BRIDGING AT 1/3 SPAN (STAGGERED)
2" X 8" TOP BRACE (TYPICAL) W/ GALVANIZED JOIST HANGERS AT EACH END
ALL MEMBERS ARE 2" X 4" EXCEPT AS NOTED
2" X 8" ALONG TOP - BOTH SIDES
NO. 10 X 3.5" GALVANIZED DECK SCREWS (TYP. ALL LOCATIONS)
2" X 4" BLOCKING
3.5" X 3/8" DIA. GALVANIZED LAG SCREWS 2 - TOP AND BOTTOM (TYP.) BOTH SIDES
2" X 6" ON EDGE ALONG BOTTOM - BOTH SIDES
2'-0" LONG 4" X 4" (EACH CORNER)
GRADED DITCH FLOW
2" X 4" STUDS AT 1/3 SPAN
17'-0" SQUARE
CATCH BASIN TYPE
SPECIAL 132" X 132"
ISOMETRIC VIEW
CATCH BASIN FILTER ASSEMBLY
N.T.S.
GRADED DITCH FLOW
B
A
A
2" X 8"
12"
3.5" X 3/8" DIA. GALVANIZED LAG SCREWS
#3NE STAPLES AT 6" O.C.
2.5" CLEAR
2.5" CLEAR BETWEEN CATCH BASIN AND WOOD FRAME
SLIPCOVER FILTER FABRIC OVER HARDWARE CLOTH
SQUARE CONCRETE CATCH BASIN
0.5" X 0.5" - 19 GA. GALVANIZED HARDWARE CLOTH UNDER GEOTEXTILE SLIPCOVER FABRIC
10" X 12" ANCHOR TRENCH BACKFILL WITH MINERAL AGGREGATE (SIZE NO. 57)
WOOD FRAME
B
PLAN VIEW - CATCH BASIN FILTER ASSEMBLY
N.T.S.
3" MIN.
TRIM ALL ENDS OF CLOTH AS REQUIRED TO AVOID SHARP ENDS THAT COULD TEAR FILTER FABRIC.
3" MIN.
EXTEND HARDWARE CLOTH OVER EACH SIDE (TYP.)
HARDWARE CLOTH OVERLAP DETAIL
N.T.S.
LAP CLOTH F 4" AT END OF FRAME
APPROXIMATE WEIGHT OF FRAME AND CLOTH = 1150 LBS. ±
ATTACH ALL EDGES OF HARDWARE CLOTH TO WOOD FRAME
SEE HARDWARE CLOTH OVERLAP DETAIL
LAP CLOTH A 4" AT END OF FRAME
NO HARDWARE CLOTH ON BOTTOM
HARDWARE CLOTH ALL FOUR SIDES.
#3NE STAPLES AT 6" O.C. (TYPICAL ALL SIDES)
ISOMETRIC VIEW
FRAME WITH HARDWARE CLOTH
N.T.S.
EROSION CONTROL PLAN LEGEND:
10
CATCH BASIN FILTER ASSEMBLY (TYPE 10)
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES
A. DRAWING TO BE USED WITH SPECIAL 132" X 132" BASIN. SEE DETAIL DRAWING IN CONSTRUCTION PLANS FOR DIMENSIONS AND DETAILS.
B. THE CATCH BASIN FILTER ASSEMBLY IS TO BE USED WHERE INTERCEPTION OF CONCENTRATED FLOWS (e.g., DITCHES) AND SMALLER IS REQUIRED AFTER STRUCTURES ARE CONSTRUCTED BUT PRIOR TO ESTABLISHING VEGETATION.
C. 2" x 4", 2" x 6", 2" x 8", AND 4" x 4" PRESSURE TREATED MEMBERS SHOWN ARE NOMINAL DIMENSIONS. TYPICAL ACTUAL DIMENSIONS ARE 1.5" x 3.5" INCH, 1.5" x 5.5" INCH, 1.5" x 7.25" INCH, AND 3.5" x 3.5" INCH RESPECTIVELY. ACTUAL DIMENSIONS OF WOOD MAY VARY EVEN GREATER DEPENDING ON MOISTURE CONTENT. ALL WOOD SHALL BE NO. 2 PRESSURE TREATED SOUTHERN YELLOW PINE.
D. PERIODIC MAINTENANCE AND CLEANING OF THE STRUCTURE SHALL BE PERFORMED AS NECESSARY TO PREVENT CLOGGING OF THE FILTER FABRIC. FILTER ASSEMBLY MAY BE CLEANED AT AN ACCEPTABLE LOCATION WITH WATER OR BY BRUSHING AND BLOWING CLEAN WITH COMPRESSED AIR. MAINTENANCE AND CLEANING OF STRUCTURES WILL NOT BE MEASURED AND PAID FOR DIRECTLY BUT SHALL BE INCLUDED IN THE PRICE BID FOR THE STRUCTURE.
E. APPROPRIATE SIZING AND LOCATION OF LIFTING DEVICES SHALL BE THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE BALANCED HANDLING DURING INSTALLATION AND REMOVAL OF THE FILTER ASSEMBLY.
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (cont.)
F. DEFECTIVE WOOD, HARDWARE CLOTH OR FILTER FABRIC SHALL BE REPLACED AS NECESSARY TO ENSURE PROPER FUNCTIONING OF FILTER ASSEMBLY. FAILURE OF ASSEMBLIES IS ACCEPTABLE PROVIDED THE UNIT IS IN PROPER WORKING CONDITION. APPROVAL MUST BE GIVEN BY TDOT ENGINEER.
G. ASSEMBLY AND STONE SHALL BE REMOVED AFTER UPSTREAM VEGETATION HAS BEEN ESTABLISHED OR OTHER SEDIMENT CONTROL STRUCTURES ARE IN PLACE. BACKFILL AND COMPACT ANCHOR TRENCH TO FINAL GRADE AS REQUIRED AFTER REMOVAL.
H. IF NECESSARY, AT DIRECTION OF TDOT ENGINEER, SLIPCOVER MAY BE SECURED IN PLACE AT THE LOWEST PRACTICAL POINT WITH NYLON STRING, TWINE, WIRE OR OTHER SUITABLE MATERIAL.
I. WHERE LARGE QUANTITIES OF SEDIMENT OR HIGH VELOCITIES OF APPROACHING WATER ARE ANTICIPATED DUE TO SPACING OF CATCH BASINS, DITCH GRADE, ETC., OTHER EROSION PREVENTION AND SEDIMENT CONTROL DEVICES MAY BE NECESSARY UPSTREAM OF FILTER ASSEMBLY.
J. ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT AND INSTALL TEMPORARY CATCH BASIN FILTER ASSEMBLY INCLUDING TRENCHING, BACKFILLING, STONE, AND SLIPCOVER SHALL BE PAID FOR UNDER ITEM NUMBER 209-40.50, CATCH BASIN FILTER ASSEMBLY (TYPE 10), PER EACH.
K. CATCH BASIN FILTER ASSEMBLY NOT DESIGNED FOR VEHICULAR OR PEDESTRIAN TRAFFIC.
INSTALLATION SEQUENCE FOR HARDWARE CLOTH
INSTALL TOP HARDWARE CLOTH A AND F - ALLOWING 4" LAP OVER ENDS OF FRAME AND SECOND TOP BRACE FROM ENDS. PULL MATERIAL TIGHT, LAP AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM SHARP EDGES.
INSTALL TOP HARDWARE CLOTH B AND E - OVERLAPPING CLOTH A AND F 8 INCHES. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL TOP HARDWARE CLOTH C - OVERLAPPING CLOTH B 8 INCHES. PULL TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL TOP HARDWARE CLOTH D - OVERLAPPING CLOTH C AND E. PULL CLOTH TIGHT, LAP, AND STAPLE AS SHOWN. CUT TO LENGTH AND TRIM ALL SHARP EDGES.
INSTALL HARDWARE CLOTH AROUND EXTERIOR OF WOOD FRAME BEGINNING AT A CORNER, ENDING AT SAME CORNER, AND OVERLAPPING AS REQUIRED. PULL TIGHT AND STAPLE EACH SIDE BEFORE PROCEEDING WITH SUBSEQUENT SIDES.
TRIM EXCESS ALONG BOTTOM AS NECESSARY.
STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION
CATCH BASIN FILTER ASSEMBLY (TYPE 10)
EC-STR-50


SECTION A-A
N.T.S.
SECTION B-B
N.T.S.
GEOTEXTILE SLIPCOVER FABRICATION
N.T.S.
EROSION CONTROL PLAN LEGEND:
10
CATCH BASIN FILTER ASSEMBLY (TYPE 10)
SLIPCOVER FILTER SPECIFICATIONS
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE
FABRIC PROPERTY
ASTM TEST METHOD
MINIMUM AVERAGE ROLL VALUES (MARV'S)
GRAB TENSILE STRENGTH
ASTM D4632
≥180 LBS
GRAB ELONGATION
ASTM D4632
≥50%
MULLEN BURST
ASTM D3786
≥330 PSI
PUNCTURE STRENGTH
ASTM D4833
≥105 LBS
TRAPEZOIDAL TEAR
ASTM D4533
≥75 LBS
APPARENT OPENING SIZE (AOS)
ASTM D4751
FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY
ASTM D4491
≥0.12 INCHES/SEC
PERMITTIVITY
ASTM D4491
≥1.5 SEC-1
WATER FLUX
ASTM D4491
≥110 GAL/MIN/FT2
UV RESISTANCE
ASTM D4355
≥70% AT 500 HOURS
WEIGHT
ASTM D3776
MINIMUM 6 OZ/YD2
HARDWARE CLOTH SPECIFICATIONS
STANDARD SPECIFICATION
ASTM A740
OPENING SIZE
0.5 INCH X 0.5 INCH
WIRE SIZE
19 GAUGE
WIRE DIAMETER
0.041 INCHES
WEIGHT
± 0.2 LBS/SF
GRADE
LOW CARBON STEEL (CL308)
TYPE
WELDED HOT GALVANIZED STEEL WIRE FABRIC
FABRICATION SPECIFICATIONS:
1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEWN WITH TWO INDEPENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-BONDED POLYESTER THREAD (MINIMUM OF 138 POUNDS) WITH MINIMUM OF 10X STITCHES PER INCH.
3. THE INSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.
CATCH BASIN FILTER ASSEMBLY (TYPE 10) SLIPCOVER DETAILS
EC-STR-50A


ISOMETRIC VIEW
CATCH BASIN FILTER ASSEMBLY
N.T.S.
PLAN VIEW - CATCH BASIN FILTER ASSEMBLY
N.T.S.
HARDWARE CLOTH OVERLAP DETAIL
N.T.S.
ISOMETRIC VIEW
FRAME WITH HARDWARE CLOTH
N.T.S.
EROSION CONTROL PLAN LEGEND:
11
CATCH BASIN FILTER ASSEMBLY (TYPE 11)
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES
CATCH BASIN FILTER ASSEMBLY GENERAL NOTES (CONT.)
INSTALLATION SEQUENCE FOR HARDWARE CLOTH
CATCH BASIN FILTER ASSEMBLY (TYPE 11)
9-11-04
EC-STR-51



SLIPCOVER FILTER SPECIFICATIONS		
FABRIC TYPE : NON-WOVEN, NEEDLE-PUNCHED GEOTEXTILE		
FABRIC PROPERTY	ASTM TEST METHOD	MINIMUM AVERAGE ROLL VALUES (MARV)
GRAB TENSILE STRENGTH	ASTM D4632	≥180 LBS
GRAB ELONGATION	ASTM D4632	≥50%
MULLEN BURST	ASTM D3786	≥350 PSI
PUNCTURE STRENGTH	ASTM D4833	≥106 LBS
TRAPEZOIDAL TEAR	ASTM D4533	≥75 LBS
APPARENT OPENING SIZE (AOS)	ASTM D4751	FINER THAN OR EQUAL TO #80 U.S. STANDARD SIEVE
PERMEABILITY	ASTM D4491	≥0.12 CM/SEC/SEC
PERMITTIVITY	ASTM D4491	≥1.5 SEC^{-1}
WATER FLUX	ASTM D4491	≥120 GAL/MIN/FT^2
UV RESISTANCE	ASTM D4355	≥70% AT 500 HOURS
WEIGHT	ASTM D3776	MINIMUM 6 OZ/YD^2

HARDWARE CLOTH SPECIFICATIONS	
STANDARD SPECIFICATION	ASTM A740
OPENING SIZE	0.5 INCH X 0.5 INCH
WIRE SIZE	19 GAUGE
WIRE DIAMETER	0.041 INCHES
WEIGHT	≈ 0.2 LBS/SF
GRADE	LOW CARBON STEEL (C1008)
TYPE	WELDED HOT GALVANIZED STEEL WIRE FABRIC

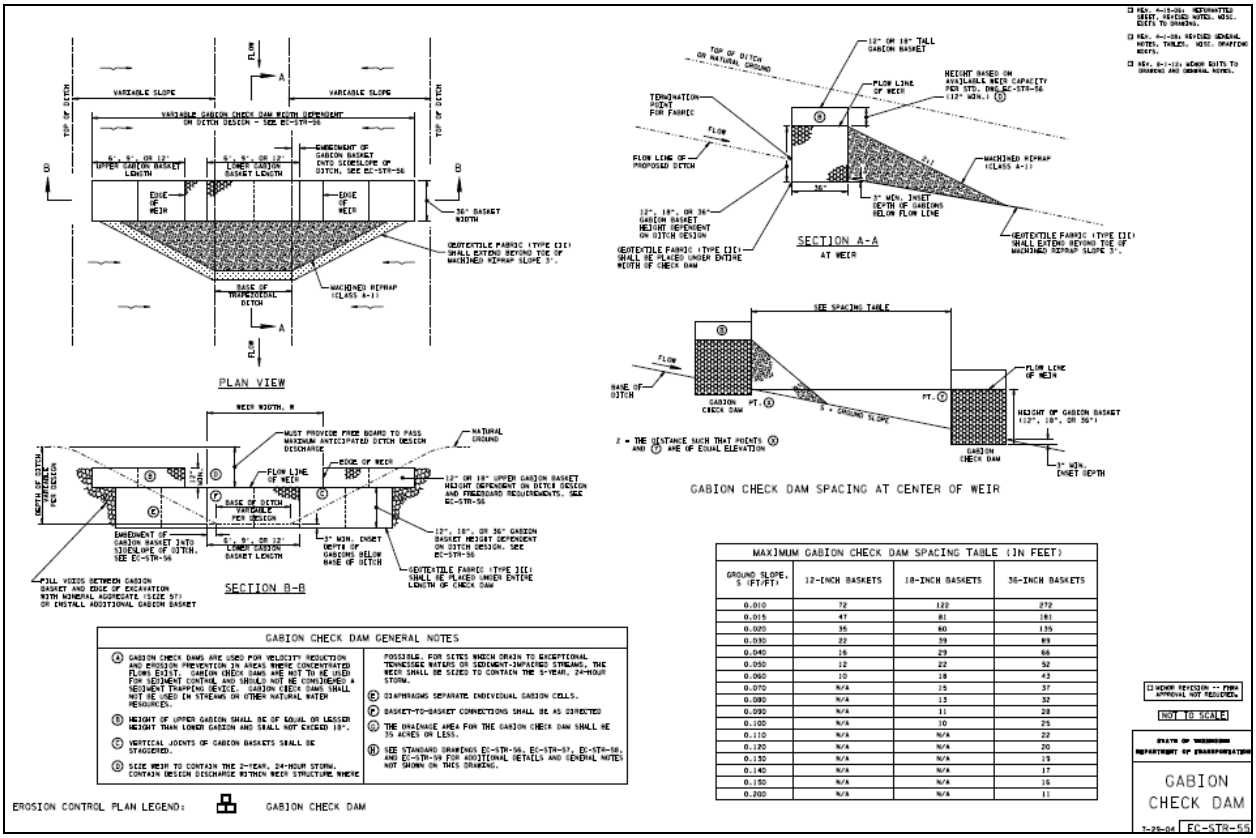
FABRICATION SPECIFICATIONS:

1. GEOTEXTILE SLIPCOVER FABRIC SHALL HAVE HEAT-CUT FUSING FABRIC EDGES FOR STRENGTH.
2. ALL SEAMS SHALL BE SEAM WITH TWO INDEPENDENT ROWS OF LOCK-TYPE STITCHING, USING UV-BONDED POLYESTER THREAD (MINIMUM OF 130 POUNDS) WITH MINIMUM OF 324 STITCHES PER INCH.
3. THE INSIDE ROW OF STITCHING SHALL BE A MINIMUM OF 0.5" FROM HEAT-CUT FABRIC EDGES.

STATE OF VERMONT AGENCY OF TRANSPORTATION

CATCH BASIN FILTER ASSEMBLY (TYPE 11) SLIPCOVER DETAILS

9-11-04 EC-STR-51A



GABION CHECK DAM GENERAL NOTES
(A) GABION CHECK DAMS ARE USED FOR VELOCITY REDUCTION AND EROSION PREVENTION IN AREAS WHERE CONCENTRATED FLOWS EXIST. GABION CHECK DAMS ARE NOT TO BE USED FOR SEDIMENT CONTROL AND SHOULD NOT BE CONSIDERED A SEDIMENT TRAPPING DEVICE. GABION CHECK DAMS SHALL NOT BE USED IN STREAMS OR OTHER NATURAL WATER RESOURCES.
(B) HEIGHT OF UPPER GABION SHALL BE OF EQUAL OR LESSER HEIGHT THAN LOWER GABION AND SHALL NOT EXCEED 18".
(C) VERTICAL JOINTS OF GABION BASKETS SHALL BE STAGGERED.
(D) SIZE WEIR TO CONTAIN THE 2-YEAR, 24-HOUR STORM. CONTAIN DESIGN DISCHARGE WITHIN WEIR STRUCTURE WHERE POSSIBLE. FOR SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE WEIR SHALL BE SIZED TO CONTAIN THE 5-YEAR, 24-HOUR STORM.
(E) DIAPHRAGMS SEPARATE ENDEVIDUAL GABION CELLS.
(F) BASKET-TO-BASKET CONNECTIONS SHALL BE AS DIRECTED
(G) THE DRAINAGE AREA FOR THE GABION CHECK DAM SHALL BE 3½ ACRES OR LESS.
(H) SEE STANDARD DRAWINGS EC-STR-56, EC-STR-57, EC-STR-58, AND EC-STR-59 FOR ADDITIONAL DETAILS AND GENERAL NOTES NOT SHOWN ON THIS DRAWING.

MAXIMUM GABION CHECK DAM SPACING TABLE (IN FEET)

GROUND SLOPE, S (FT/FT)	12-INCH BASKETS	18-INCH BASKETS	36-INCH BASKETS
0.010	72	122	272
0.015	47	81	181
0.020	35	60	135
0.030	22	39	89
0.040	16	29	66
0.050	12	22	52
0.060	10	18	43
0.070	N/A	15	37
0.080	N/A	13	32
0.090	N/A	11	28
0.100	N/A	10	25
0.110	N/A	N/A	22
0.120	N/A	N/A	20
0.130	N/A	N/A	19
0.140	N/A	N/A	17
0.150	N/A	N/A	16
0.200	N/A	N/A	11

REV. A-10-06: REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.

REV. A-1-09: REVISED GENERAL NOTES, TABLES, MISC. DRAFTING WORKS.

REV. A-1-12: MINOR EDITS TO DRAWING AND GENERAL NOTES.

12 MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

NOT TO SCALE

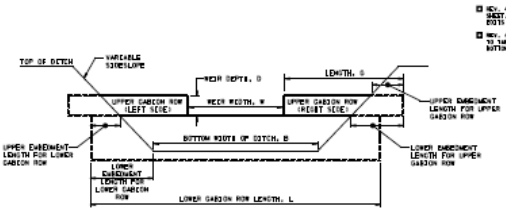
STATE OF VERMONT DEPARTMENT OF TRANSPORTATION

GABION CHECK DAM

7-29-04 EC-STR-55

DESIGN DIMENSIONS, UPPER GABION ROW

BOTTOM WIDTH OF DITCH, B (in feet)	UPPER GABION ROW, 12-INCH GABION HEIGHT: MINIMUM LENGTH OF GABIONS, L (LOWER ROW), IN FEET			UPPER GABION ROW, 12-INCH GABION HEIGHT: LOWER EMBEDMENT LENGTH FOR UPPER GABIONS, IN FEET			UPPER GABION ROW, 12-INCH GABION HEIGHT: UPPER EMBEDMENT LENGTH FOR UPPER GABIONS, IN FEET			UPPER GABION ROW, 18-INCH GABION HEIGHT: MINIMUM LENGTH OF GABIONS, L (UPPER ROW), IN FEET			UPPER GABION ROW, 18-INCH GABION HEIGHT: LOWER EMBEDMENT LENGTH FOR UPPER GABIONS, IN FEET			UPPER GABION ROW, 18-INCH GABION HEIGHT: UPPER EMBEDMENT LENGTH FOR UPPER GABIONS, IN FEET			BOTTOM WIDTH OF DITCH, B (in feet)
	SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			
	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	
3	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	3
4	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	4
5	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	5
6	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	6
7	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	7
8	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	8
9	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	9
10	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	10
12	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	12
15	3	6	6	2.1	4.5	4.5	0.1	1.5	0.5	6	9	9	3.3	5.4	6.3	0.3	0.9	0.3	15



DEFINITION OF TERMS FOR GABION CHECK DAM IN TRAPEZOIDAL DITCH

DESIGN DIMENSIONS, LOWER GABION ROW

BOTTOM WIDTH OF DITCH, B (in feet)	LOWER GABION ROW, 12-INCH GABION HEIGHT: MINIMUM LENGTH OF GABIONS, L (LOWER ROW), IN FEET			LOWER GABION ROW, 12-INCH GABION HEIGHT: LOWER EMBEDMENT LENGTH, IN FEET			LOWER GABION ROW, 12-INCH GABION HEIGHT: UPPER EMBEDMENT LENGTH, IN FEET			LOWER GABION ROW, 18-INCH GABION HEIGHT: MINIMUM LENGTH OF GABIONS, L (LOWER ROW), IN FEET			LOWER GABION ROW, 18-INCH GABION HEIGHT: LOWER EMBEDMENT LENGTH, IN FEET			LOWER GABION ROW, 18-INCH GABION HEIGHT: UPPER EMBEDMENT LENGTH, IN FEET			LOWER GABION ROW, 36-INCH GABION HEIGHT: MINIMUM LENGTH OF GABIONS, L (LOWER ROW), IN FEET			LOWER GABION ROW, 36-INCH GABION HEIGHT: LOWER EMBEDMENT LENGTH, IN FEET			LOWER GABION ROW, 36-INCH GABION HEIGHT: UPPER EMBEDMENT LENGTH, IN FEET			BOTTOM WIDTH OF DITCH, B (in feet)
	SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			
	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	
3	9	9	12	3	3	4.5	1.5	0.75	1.5	9	12	15	3	4.5	6	0.5	0.75	1	15	21	27	6	9	12	0.5	0.75	1	3
4	9	9	12	2.5	3.5	4	1	0.25	1	12	15	15	4	5.5	5.5	1.5	1.75	0.5	18	21	27	7	8.5	11.5	1.5	0.25	0.5	4
5	9	12	12	2	3.5	3.5	0.5	1.25	0.5	12	15	18	3.5	5	6.5	1	1.25	1.5	18	24	30	6.5	9.5	12.5	1	1.25	1.5	5
6	12	12	15	3	3	4.5	1.5	0.75	1.5	12	15	18	3	4.5	6	0.5	0.75	1	18	24	30	6	9	12	0.5	0.75	1	6
7	12	15	15	2.5	4	4	1	1.75	1	15	15	18	4	4	5.5	1.5	0.25	0.5	21	24	30	7	8.5	11.5	1.5	0.25	0.5	7
8	12	15	15	2	3.5	3.5	0.5	1.25	0.5	15	18	21	3.5	5	6.5	1	1.25	1.5	21	27	33	6.5	9.5	12.5	1	1.25	1.5	8
9	15	15	18	3	3	4.5	1.5	0.75	1.5	15	18	21	3	4.5	6	0.5	0.75	1	21	27	33	6	9	12	0.5	0.75	1	9
10	15	15	18	2.5	2.5	4	1	0.25	1	18	18	21	4	4	5.5	1.5	0.25	0.5	24	27	33	7	8.5	11.5	1.5	0.25	0.5	10
12	18	18	21	3	3	4.5	1.5	0.75	1.5	18	21	24	3	4.5	6	0.5	0.75	1	24	30	36	6	9	12	0.5	0.75	1	12
15	21	21	24	3	3	4.5	1.5	0.75	1.5	21	24	27	3	4.5	6	0.5	0.75	1	27	33	39	6	9	12	0.5	0.75	1	15

◆ ASSUMING 3 INCH EMBEDMENT DEPTH AT BASE OF GABION

GABION CHECK DAM WEIR LENGTHS AND ALLOWABLE FLOW RATES

BOTTOM WIDTH OF DITCH, B (in feet)	UPPER GABION ROW, 12-INCH GABION HEIGHT: 12-INCH LOWER GABION ROW: RECTANGULAR WEIR WIDTH, W (in feet)			UPPER GABION ROW, 12-INCH GABION HEIGHT: 12-INCH LOWER GABION ROW: ALLOWABLE FLOW (cfs) FOR 12-INCH UPPER GABION HEIGHT			UPPER GABION ROW, 12-INCH GABION HEIGHT: 18-INCH LOWER GABION ROW: RECTANGULAR WEIR WIDTH, W (in feet)			UPPER GABION ROW, 12-INCH GABION HEIGHT: 18-INCH LOWER GABION ROW: ALLOWABLE FLOW (cfs) FOR 12-INCH UPPER GABION HEIGHT			UPPER GABION ROW, 12-INCH GABION HEIGHT: 36-INCH LOWER GABION ROW: RECTANGULAR WEIR WIDTH, W (in feet)			UPPER GABION ROW, 12-INCH GABION HEIGHT: 36-INCH LOWER GABION ROW: ALLOWABLE FLOW (cfs) FOR 12-INCH UPPER GABION HEIGHT			UPPER GABION ROW, 18-INCH GABION HEIGHT: 12-INCH LOWER GABION ROW: RECTANGULAR WEIR WIDTH, W (in feet)			UPPER GABION ROW, 18-INCH GABION HEIGHT: 12-INCH LOWER GABION ROW: ALLOWABLE FLOW (cfs) FOR 18-INCH UPPER GABION HEIGHT			UPPER GABION ROW, 18-INCH GABION HEIGHT: 18-INCH LOWER GABION ROW: RECTANGULAR WEIR WIDTH, W (in feet)			UPPER GABION ROW, 18-INCH GABION HEIGHT: 18-INCH LOWER GABION ROW: ALLOWABLE FLOW (cfs) FOR 18-INCH UPPER GABION HEIGHT			BOTTOM WIDTH OF DITCH, B (in feet)
	SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			SIDESLOPE			
	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	2:1	3:1	4:1	
3	4.2	4.5	6	4.7	6.5	6.9	6.2	7.5	10	7.6	9.6	11.4	12.2	16.5	22	20.4	27.8	34.3	2.6	3.3	7.6	13.4	16.8	15.4	8.6	12.5	19.6	23.1	31.6	35.6	3
4	5.2	5.5	7	5.6	7.1	7.7	7.2	8.5	11	9.0	11.3	12.8	13.2	17.5	23	23.2	30.6	37.1	3.6	4.3	8.6	13.2	17.7	14.7	9.6	13.3	20.6	25.9	33.6	38.5	4
5	6.2	6.5	8	6.5	7.9	8.6	8.2	9.5	12	10.4	12.7	14.3	14.2	18.5	24	26.1	33.5	40.0	4.6	5.3	9.6	13.5	17.9	16.0	10.5	14.3	21.5	28.8	36.7	41.4	5
6	7.2	7.5	9	7.5	8.8	9.5	9.2	10.5	13	11.9	14.2	15.7	15.2	19.5	25	29.0	36.5	42.9	5.6	6.3	10.6	15.0	18.7	17.4	11.5	15.2	22.5	31.7	39.6	44.4	6
7	8.2	8.5	10	8.4	9.8	10.4	10.2	11.5	14	13.4	15.7	17.2	16.2	20.5	26	31.9	39.5	45.9	6.6	7.3	11.6	16.1	19.7	18.7	12.6	16.3	23.6	34.7	42.6	47.2	7
8	9.2	9.5	11	9.4	10.7	11.4	11.2	12.5	15	14.9	17.1	18.6	17.2	21.5	27	34.9	42.3	48.8	7.6	8.3	12.6	17.5	20.9	20.1	13.8	17.3	24.6	37.7	45.7	50.0	8
9	10.2	10.5	12	10.4	11.7	12.3	12.2	13.5	16	16.4	18.6	20.1	18.2	22.5	28	37.9	45.3	51.8	8.6	9.3	13.6	18.8	22.2	21.5	14.6	18.3	25.6	40.7	48.4	53.2	9
10	11.2	11.5	13	11.4	12.6	13.3	13.2	14.5	17	18.0	20.1	21.6	19.2	23.5	29	41.0	48.3	54.8	9.6	10.3	14.6	20.1	23.4	23.0	15.6	19.3	26.5	43.8	51.6	56.2	10
12	13.2	13.5	15	13.4	14.6	15.2	15.2	16.5	19	21.0	23.2	24.6	21.2	25.5	31	47.1	54.4	60.9	11.6	12.3	16.6	23.2	26.1	26.0	17.6	21.3	28.6	49.8	57.7	62.3	12
15	16.2	16.5	18	16.5	17.6	18.2	18.2	19.5	22	25.6	27.8	29.2	24.2	28.5	34	56.4	65.6	70.1	14.6	15.3	19.6	27.8	30.5	30.5	20.6	24.3	31.6	59.2	66.9	71.4	15

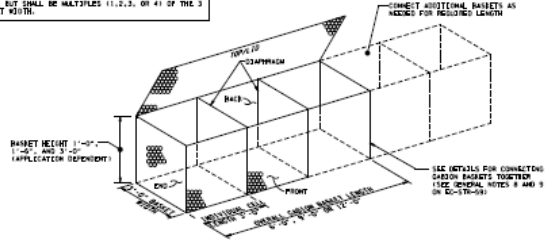
EROSION CONTROL PLAN LEGEND: GABION CHECK DAM

STATE OF VERMONT DEPARTMENT OF TRANSPORTATION

GABION CHECK DAM DESIGN TABLES

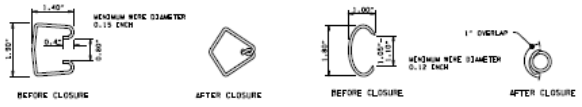
7-29-04 EC-STR-56

EXAMPLE BELOW SHOWS 3-CELLED, 9 FOOT LONG GABION BASKET WITH ATTACHED 6 FOOT LONG GABION. ACTUAL GABION LENGTHS WILL VARY, BUT SHALL BE MULTIPLES (1,2,3, OR 4) OF THE 3 FOOT BASKET WIDTH.



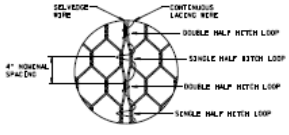
ISOMETRIC - TYPICAL GABION

N.T.S.



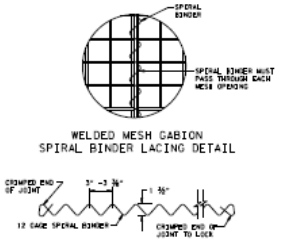
TYPE 1 FASTENER INTERLOCKING WIRE

TYPE 2 FASTENER OVERLAPPING RING



WOVEN MESH GABION LACING DETAIL

TYPE 3 FASTENER LACING WIRE



WELDED MESH GABION SPIRAL BINDER LACING DETAIL

TYPE 4 FASTENER SPIRAL BINDER

NOTE: DIMENSIONS SHOWN ARE NOMINAL

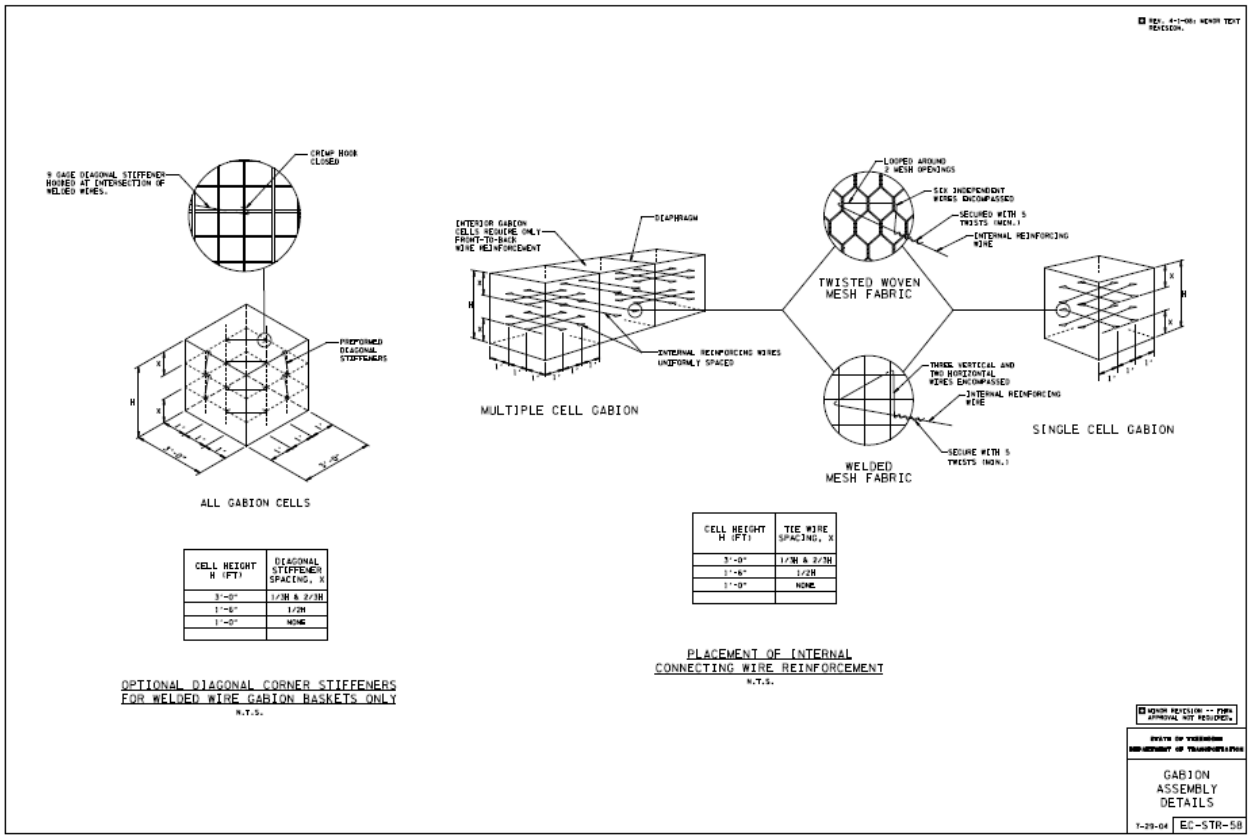
INSTALL TYPE 1 OR TYPE 2 FASTENERS AT EACH MESH OPENING ALONG GABION BASKET EDGE.

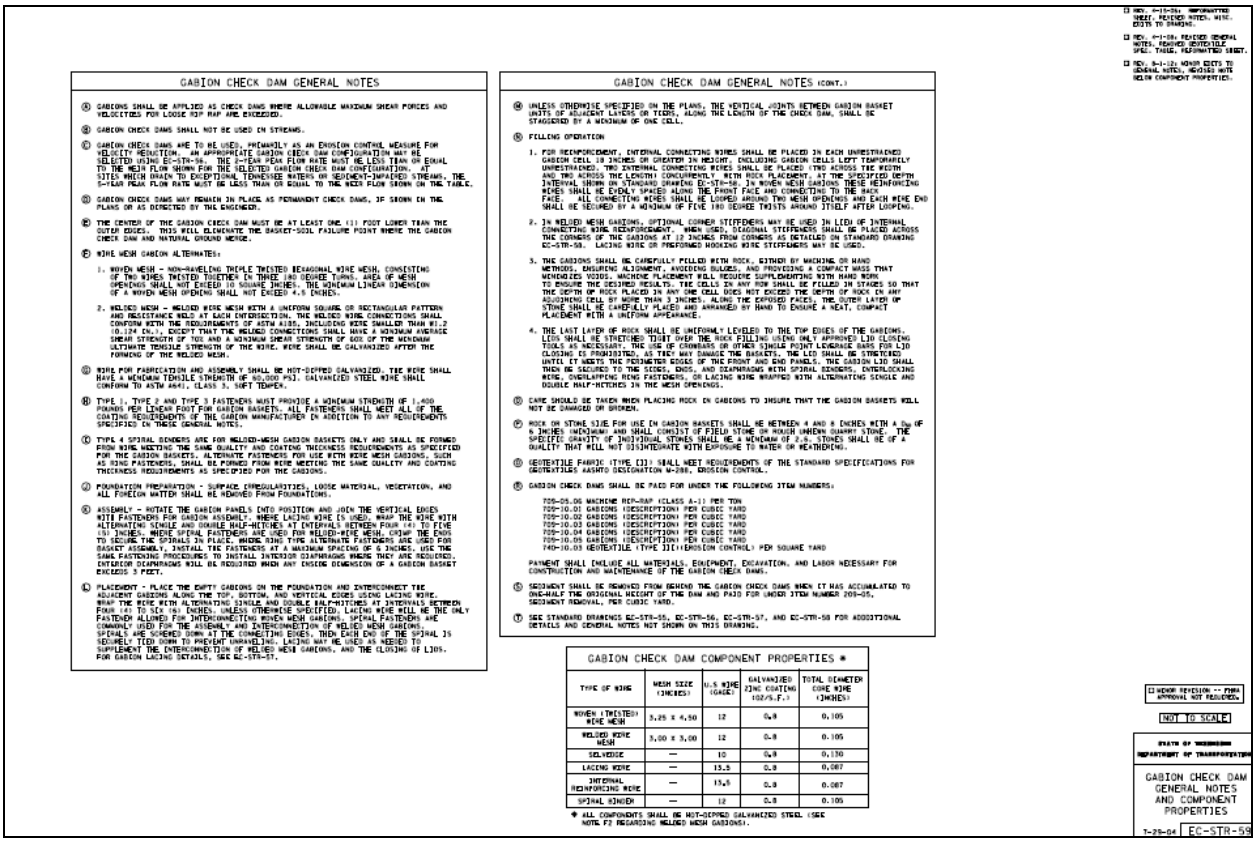
TO BE USED WITH WELDED MESH ONLY

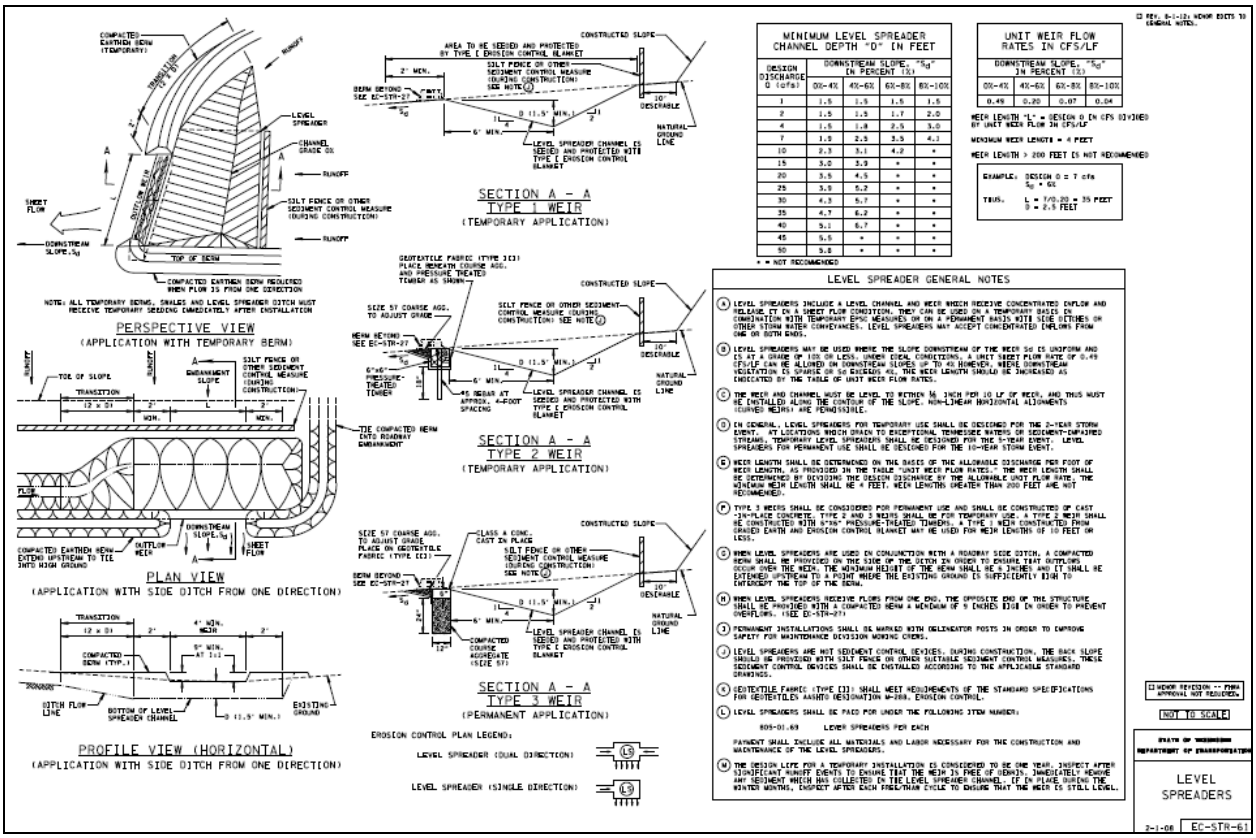
STATE OF VERMONT DEPARTMENT OF TRANSPORTATION

GABION ASSEMBLY DETAILS

7-29-04 EC-STR-57


9 GAGE DIAGONAL STIFFENER HOOKED AT INTERSECTION OF WELDED WIRES.
CRIMP HOOK CLOSED
PREFORMED DIAGONAL STIFFENERS
ALL GABION CELLS
CELL HEIGHT H (FT)
DIAGONAL STIFFENER SPACING, X
3'-0"
1/3H & 2/3H
1'-6"
1/2H
1'-0"
NONE
OPTIONAL DIAGONAL CORNER STIFFENERS FOR WELDED WIRE GABION BASKETS ONLY
N.T.S.
EXTERIOR GABION CELLS REQUIRE ONLY FRONT-TO-BACK WIRE REINFORCEMENT
DIAPHRAGM
INTERNAL REINFORCING WIRES UNIFORMLY SPACED
MULTIPLE CELL GABION
LOOPED AROUND 2 MESH OPENINGS
SIX INDEPENDENT WIRES ENCOMPASSED
SECURED WITH 5 TWISTS (MIN.)
INTERNAL REINFORCING WIRE
TWISTED WOVEN MESH FABRIC
THREE VERTICAL AND TWO HORIZONTAL WIRES ENCOMPASSED
INTERNAL REINFORCING WIRE
SECURE WITH 5 TWISTS (MIN.)
WELDED MESH FABRIC
SINGLE CELL GABION
CELL HEIGHT H (FT)
TIE WIRE SPACING, X
3'-0"
1/3H & 2/3H
1'-6"
1/2H
1'-0"
NONE
PLACEMENT OF INTERNAL CONNECTING WIRE REINFORCEMENT
N.T.S.
GABION ASSEMBLY DETAILS
7-29-04
EC-STR-58


GABION CHECK DAM GENERAL NOTES
GABION CHECK DAM GENERAL NOTES (CONT.)
GABION CHECK DAM COMPONENT PROPERTIES *
NOT TO SCALE
GABION CHECK DAM GENERAL NOTES AND COMPONENT PROPERTIES
7-29-04
EC-STR-59


PERSPECTIVE VIEW
(APPLICATION WITH TEMPORARY BERM)
PLAN VIEW
(APPLICATION WITH SIDE DITCH FROM ONE DIRECTION)
PROFILE VIEW (HORIZONTAL)
(APPLICATION WITH SIDE DITCH FROM ONE DIRECTION)
SECTION A - A
TYPE 1 WEIR
(TEMPORARY APPLICATION)
SECTION A - A
TYPE 2 WEIR
(TEMPORARY APPLICATION)
SECTION A - A
TYPE 3 WEIR
(PERMANENT APPLICATION)
EROSION CONTROL PLAN LEGEND:
LEVEL SPREADER (DUAL DIRECTION)
LEVEL SPREADER (SINGLE DIRECTION)
MINIMUM LEVEL SPREADER CHANNEL DEPTH "D" IN FEET
UNIT WEIR FLOW RATES IN CFS/LF
LEVEL SPREADER GENERAL NOTES
LEVEL SPREADERS
EC-STR-61