TDOT Roadway Design Division

Module 1:

Introduction to EPSC Design

Knowledge Check

- Erosion - Natural process in which, by the actions of external forces such as wind, water, freeze-thaw that soil particles are detached and transported.
- Sediment - Eroded soil particles or materials suspended in wind or water.
- Sedimentation - Deposition of the eroded soil particles or material (based on particle size).

If you concentrate the flow, then you are responsible for controlling the flow.

What is Accelerated Erosion?

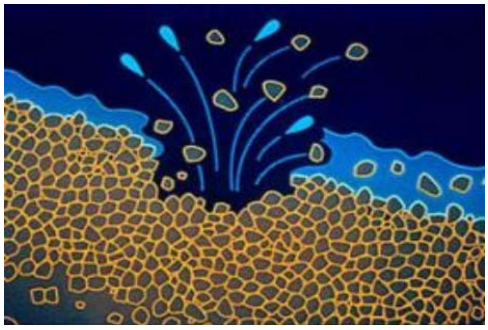
- Removal of natural vegetation
  - clearing limits/project area
- Grading and excavation operations
- Increased stormwater runoff velocities and sediment movement due to:
  - Soil types
  - Soil erosivity
- BMP installation and maintenance

Accelerated Erosion =
Natural Erosion + Human Activities

Increases erosion an order of magnitude – 10X more

Types of Erosion

- Splash
  - Rain hitting the land surface can dislodge significant amounts of sediment and other pollutants
  - Minimal sediment loss
- Use Erosion Prevention Measures
  - Natural vegetation
  - Vegetative buffers
  - Temporary Mulch (wood or straw)



Types of Erosion

- Sheet
  - Detached soil particles transported in shallow sheets of flow down a slope
  - Small increase in sediment loss
- Use Erosion Prevention Measures
  - Erosion control blankets
  - Turf reinforcement mats
  - Sod
  - Temporary and permanent seeding

Types of Erosion

- Rill
  - Develops as sheet flow begins to become concentrated
  - Small channels begin to form on sloped surfaces
  - Rule of thumb < 6” deep
  - Medium increase in sediment loss
- Use Erosion Prevention, Runoff & Sediment Control Measures
  - Silt fence (with & without wire backing)
  - Rock & enhanced rock checks dams
  - Sediment tube/Filter sock
  - Inlet protection
  - Temporary slope drain & berm
  - Diversions

Types of Erosion

- Gully
  - Flow from several rills come together
  - Increased runoff velocities
  - Rills get deeper and wider
  - Rule of thumb 6” to 12” deep
  - Large amounts of sediment loss
- Use Runoff & Sediment Control Measures
  - Temporary diversion channel/culverts
  - Sediment trap
  - Sediment basin
  - Rock sediment dam
  - Filter berm

Types of Erosion

- Channel
  - Formation of a large unstable channels
  - Increased flows and velocities
  - Significant amounts of sediment loss
- Use Flow Control Measures
  - Outlet protection
  - Permanent riprap energy dissipaters
  - Channel linings
  - Permanent basins

Erosion Prevention (Primary)

- Process of applying planned measures
  - Prevent erosion
  - Slow the increased erosion
  - Minimize the dislodging of sediment
- Begins with identifying locations with higher potential for erosion
  - Soil type and erosivity
  - Topographic conditions (e.g. steep slopes)
  - Type of construction activity
- Mitigation or risk reduction
  - Limit vegetation removal/clearing
  - Design measures to “shield” or hold the soil particles together
  - Reduce stormwater velocities
  - Bypass/divert offsite drainage

Sediment Control (Secondary)

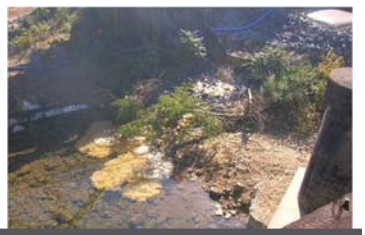
- Process of applying planned measures
  - Collect eroded material
  - Prevent loss of sediment off TDOT ROW/Easements
  - Prevent sediment from entering jurisdictional features
  - Prevent sediment from filling in drainage pipes, culverts, etc.
- Begins with identifying locations where sediment can be collected:
  - Low lying areas
  - Existing natural swales or drainage features
  - Proposed drainage channels
- Mitigation or risk reduction
  - Direct stormwater runoff to specific locations
  - Design for proper sediment storage
  - Provide necessary ROW/Easements for installation & maintenance

Erosion Prevention and Sediment Control (EPSC)

- Best sediment control measure is to prevent erosion
- Sediment control measures should be considered a "back-up" to the erosion prevention measures
- It's cheaper to prevent erosion then to control sediment
- Cost to maintain and repair sediment control structures is directly correlated to the efficiency of the erosion prevention measures

Erosion Prevention and Sediment Control (EPSC)

- When sediment control structures fail they can potentially release a large sediment load:
  - Off TDOT ROW/easements onto adjacent property owners
  - Into jurisdictional features (streams, wetlands, sinkholes, etc.)
  - Can result in notice of violations (NOV) being issued from regulatory authorities



Can discredit TDOT's reputation with the public and regulatory agencies.

EPSC Design Factors

- Four Principal Design Factors
  - Soil characteristics
    - ✓ Hydrologic Soil Group (A-D)
    - ✓ Erosivity Factor, K
  - Topography (Slope)
    - ✓ Steepness
    - ✓ Length
    - ✓ Orientation
  - Surface cover conditions
    - ✓ Removal of vegetation – area of disturbance
    - ✓ Vegetative cover – temporary & permanent
  - Rainfall intensity
    - ✓ Design storm events
    - ✓ Seasonal/Climate
    - ✓ Frequency, intensity, duration

EPSC Design Factors

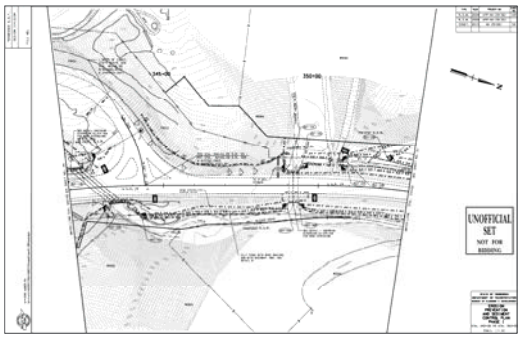
What Principal EPSC Design Factors apply to this site?

Land Disturbance Effects

- Water Quality
  - Sediment contains nutrients & other pollutants
  - Water clarity
- Loss of Flood Conveyances & Storage
  - Reduced hydraulic capacities – clogged drainage systems
  - Increased flooding
  - Fill in wetlands or low lying storage areas
- Safety & Nuisance
  - Traffic hazard on roadways
  - Dust (air pollution)
- Natural Areas
  - Degradation of jurisdictional features
  - Promote invasive species
  - Cover sensitive habitat areas

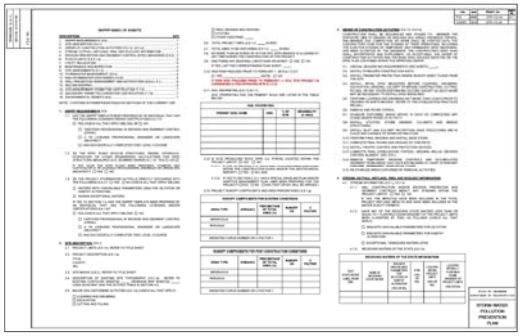
Design of EPSC Plans

- Responsibility of the roadway designer
  - To prepare EPSC plans – all Stages
  - To document
    - ✓ Computations
    - ✓ Design considerations
    - ✓ Assumptions
    - ✓ Special considerations or procedures other than normally accepted
    - ✓ Special requirements from environmental documents



Design of EPSC Plans

- Responsibility of the SWPPP Preparer
  - Provide EPSC guidance
  - Assist with outfall locations, standard drawings, pay items, special notes, etc.
  - Prepare the SWPPP and Documentation & Permits Binder
  - **Not design the EPSC Plans**



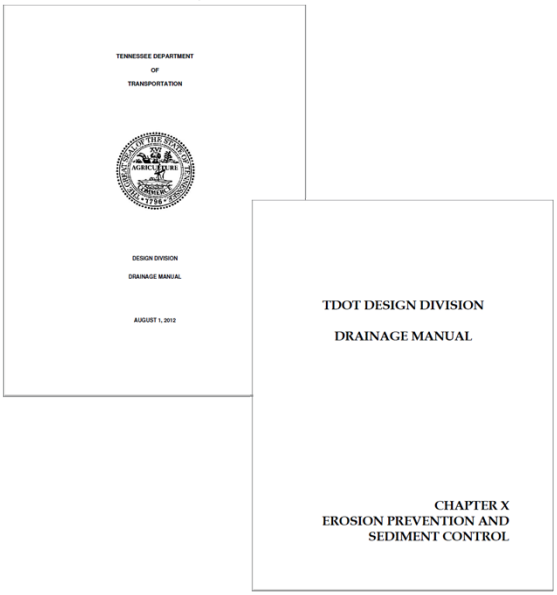
Design of EPSC Plans

- EPSC Plan Designer
  - Drainage background
  - Familiarity with construction a plus
  - Include variety of EPSC measures in operation's "tool box"
  - Include in quantity calculations
    - ✓ Replacement factor
    - ✓ Sediment removal
  - Visit design projects during construction
    - ✓ Participate on a QA Inspection with the Compliance and Field Services Office
    - ✓ Visit the site during each stage of EPSC
    - ✓ Learn what does and doesn't work

Design Resources

TDOT Drainage Manual Chapter 10

- Types and causes of erosion and sedimentation
- Methods of calculating potential sediment loss
- Best Management Practices (BMPs) for controlling erosion and sedimentation
- The development of an effective EPSC plan
- EPSC plan requirements for TDOT projects



Design Resources

TDOT Drainage Manual Chapter 10 Appendix

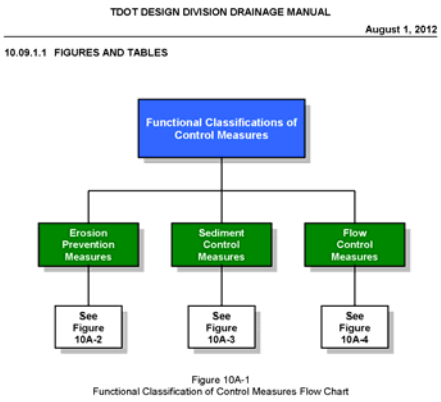
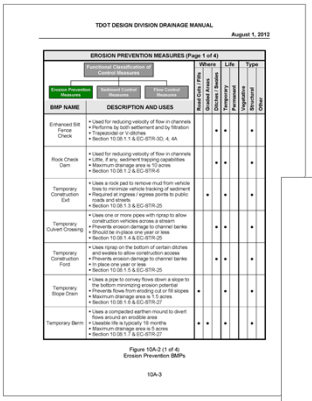
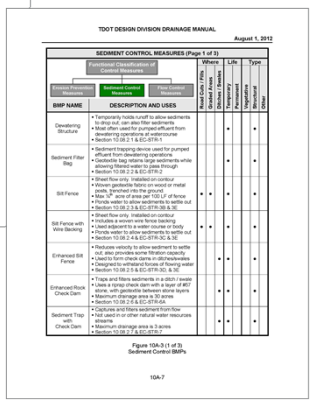


Figure 10A-1
Functional Classification of Control Measures Flow Chart





Design Resources

TDOT Drainage Manual Chapter 10 Appendix

EROSION PREVENTION MEASURES (Page 1 of 4)

Functional Classification of Control Measures: Erosion Prevention Measures | Sediment Control Measures | Flow Control Measures

BMP NAME	DESCRIPTION AND USES	Where: Road Cuts / Fills	Where: Graded Areas	Where: Ditches / Swales	Life: Temporary	Life: Permanent	Type: Vegetative	Type: Structural	Type: Other
Enhanced Silt Fence Check	• Used for reducing velocity of flow in channels • Performs by both settlement and by filtration • Trapezoidal or V-ditches • Section 10.08.1.1 & EC-STR-3D, 4, 4A			•	•			•	
Rock Check Dam	• Used for reducing velocity of flow in channels • Little, if any, sediment trapping capabilities • Maximum drainage area is 10 acres • Section 10.08.1.2 & EC-STR-6			•	•			•	
Temporary Construction Exit	• Uses a rock pad to remove mud from vehicle tires to minimize vehicle tracking of sediment • Required at ingress / egress points to public roads and streets • Section 10.08.1.3 & EC-STR-25		•		•			•	
Temporary Culvert Crossing	• Uses one or more pipes with riprap to allow construction vehicles across a stream • Prevents erosion damage to channel banks • Should be in-place one year or less • Section 10.08.1.4 & EC-STR-25			•	•			•	
Temporary Construction Ford	• Uses riprap on the bottom of certain ditches and swales to allow construction access • Prevents erosion damage to channel banks • In place one year or less • Section 10.08.1.5 & EC-STR-25			•	•			•	
Temporary Slope Drain	• Uses a pipe to convey flows down a slope to the bottom minimizing erosion potential • Prevents flows from eroding cut or fill slopes • Maximum drainage area is 1.5 acres • Section 10.08.1.6 & EC-STR-27	•			•			•	
Temporary Berm	• Uses a compacted earthen mound to divert flows around an erodible area • Useable life is typically 18 months • Maximum drainage area is 5 acres • Section 10.08.1.7 & EC-STR-27	•	•		•			•	

SEDIMENT CONTROL MEASURES (Page 1 of 3)

Functional Classification of Control Measures: Erosion Prevention Measures | Sediment Control Measures | Flow Control Measures

BMP NAME	DESCRIPTION AND USES	Where: Road Cuts / Fills	Where: Graded Areas	Where: Ditches / Swales	Life: Temporary	Life: Permanent	Type: Vegetative	Type: Structural	Type: Other
Dewatering Structure	• Temporarily holds runoff to allow sediments to drop out; can also filter sediments • Most often used for pumped effluent from dewatering operations at watercourse • Section 10.08.2.1 & EC-STR-1				•			•	
Sediment Filter Bag	• Sediment trapping device used for pumped effluent from dewatering operations • Geotextile bag retains large sediments while allowing filtered water to pass through • Section 10.08.2.2 & EC-STR-2				•			•	
Silt Fence	• Sheet flow only. Installed on contour • Woven geotextile fabric on wood or metal posts, trenched into the ground. • Max ¼th acre of area per 100 LF of fence • Ponds water to allow sediments to settle out • Section 10.08.2.3 & EC-STR-3B & 3E	•	•		•			•	
Silt Fence with Wire Backing	• Sheet flow only. Installed on contour • Includes a woven wire fence backing • Used adjacent to a water course or body • Ponds water to allow sediments to settle out • Section 10.08.2.4 & EC-STR-3C & 3E	•	•		•			•	
Enhanced Silt Fence	• Reduces velocity to allow sediment to settle out, also provides some filtration capacity • Used to form check dams in ditches/swales • Designed to withstand forces of flowing water • Section 10.08.2.5 & EC-STR-3D, & 3E			•	•			•	
Enhanced Rock Check Dam	• Traps and filters sediments in a ditch / swale • Uses a riprap check dam with a layer of #57 stone, with geotextile between stone layers • Maximum drainage area is 30 acres • Section 10.08.2.6 & EC-STR-6A			•	•			•	
Sediment Trap with Check Dam	• Captures and filters sediment from flow • Not used in or other natural water resources streams • Maximum drainage area is 3 acres • Section 10.08.2.7 & EC-STR-7			•	•			•	

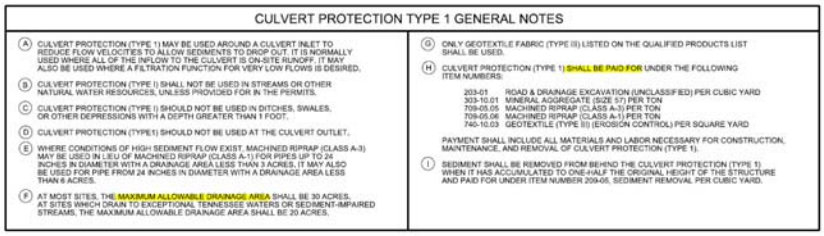
Design Resources

TDOT Standard EPSC Drawings

- Recent Updates
  - Silt Fence (EC-STR-3B)
  - Culvert Protection Type 1 (EC-STR-11)
- Eliminating
  - Level spreaders
  - Gabions used for EPSC
  - Silt Fence Ditch Checks

Design Resources

TDOT Standard
EPSC Drawings



CULVERT PROTECTION TYPE 1 GENERAL NOTES

(A) CULVERT PROTECTION (TYPE 1) MAY BE USED AROUND A CULVERT INLET TO REDUCE FLOW VELOCITIES TO ALLOW SEDIMENTS TO DROP OUT. IT IS NORMALLY USED WHERE ALL OF THE INFLOW TO THE CULVERT IS ON-SITE RUNOFF. IT MAY ALSO BE USED WHERE A FILTRATION FUNCTION FOR VERY LOW FLOWS IS DESIRED.

(B) CULVERT PROTECTION (TYPE I) SHALL NOT BE USED IN STREAMS OR OTHER NATURAL WATER RESOURCES, UNLESS PROVIDED FOR IN THE PERMITS.

(C) CULVERT PROTECTION (TYPE I) SHOULD NOT BE USED IN DITCHES, SWALES, OR OTHER DEPRESSIONS WITH A DEPTH GREATER THAN 1 FOOT.

(D) CULVERT PROTECTION (TYPE1) SHOULD NOT BE USED AT THE CULVERT OUTLET.

(E) WHERE CONDITIONS OF HIGH SEDIMENT FLOW EXIST, MACHINED RIPRAP (CLASS A-3) MAY BE USED IN LIEU OF MACHINED RIPRAP (CLASS A-1) FOR PIPES UP TO 24 INCHES IN DIAMETER WITH A DRAINAGE AREA LESS THAN 3 ACRES. IT MAY ALSO BE USED FOR PIPE FROM 24 INCHES IN DIAMETER WITH A DRAINAGE AREA LESS THAN 6 ACRES.

(F) AT MOST SITES, THE MAXIMUM ALLOWABLE DRAINAGE AREA SHALL BE 30 ACRES. AT SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE MAXIMUM ALLOWABLE DRAINAGE AREA SHALL BE 20 ACRES.

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

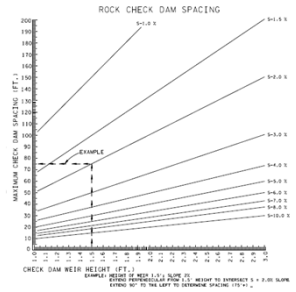
(H) CULVERT PROTECTION (TYPE 1) SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

203-01	ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER CUBIC YARD
303-10.01	MINERAL AGGREGATE (SIZE 57) PER TON
709-05.05	MACHINED RIPRAP (CLASS A-3) PER TON
709-05.06	MACHINED RIPRAP (CLASS A-1) PER TON
740-10.03	GEOTEXTILE (TYPE III) (EROSION CONTROL) PER SQUARE YARD

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF CULVERT PROTECTION (TYPE 1).

(I) SEDIMENT SHALL BE REMOVED FROM BEHIND THE CULVERT PROTECTION (TYPE 1) 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.

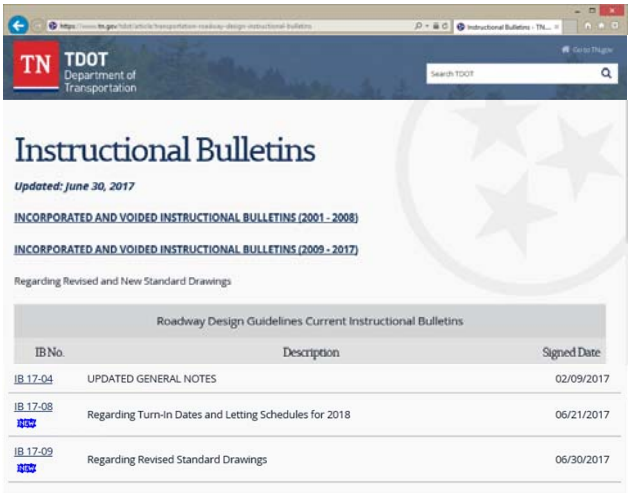
EROSION CONTROL PLAN LEGEND: (D) CATCH BASIN PROTECTION (TYPE D)



Design Resources

TDOT Instructional Bulletins

- Current Revisions
  - General Notes (IB 17-04)
  - Standard Drawing Updates (IB 17-09)



TDOT Department of Transportation

Instructional Bulletins

Updated: June 30, 2017

INCORPORATED AND VOIDED INSTRUCTIONAL BULLETINS (2001 - 2008)

INCORPORATED AND VOIDED INSTRUCTIONAL BULLETINS (2009 - 2017)

Regarding Revised and New Standard Drawings

Roadway Design Guidelines Current Instructional Bulletins

IB No.	Description	Signed Date
IB 17-04	UPDATED GENERAL NOTES	02/09/2017
IB 17-08 NEW	Regarding Turn-In Dates and Letting Schedules for 2018	06/21/2017
IB 17-09 NEW	Regarding Revised Standard Drawings	06/30/2017

Design Resources

General & Special EPSC Notes

- Don't copy over from older projects
- Specific EPSC notes for:
  - Projects <1 ac.
  - Projects ≥ 1 ac.
  - For all projects

6-180.04 SPECIES

NOTE: NOTE (20) IS REQUIRED FOR ALL PROJECTS.

(20) NO ACTIVITY MAY SUBSTANTIALLY DISRUPT THE MOVEMENT OF THOSE SPECIES OF AQUATIC LIFE INDIGENOUS TO THE WATER BODY, INCLUDING THOSE SPECIES THAT NORMALLY MIGRATE THROUGH THE AREA.

6-180.05 INSPECTION, MAINTENANCE & REPAIR

NOTE: NOTE 21 SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING MORE THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH, AN NPDES PERMIT IS REQUIRED.

(21) REFER TO THE STORM WATER POLLUTION AND PREVENTION PLAN SHEETS (S-_) FOR SWPPP, PERMITS, AND RECORDS NOTES.

NOTE: NOTES (22-29) SHALL BE ADDED TO THE PLANS FOR PROJECTS REQUIRING LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH, AN NPDES PERMIT IS NOT REQUIRED.

(22) THE TDOT CONSTRUCTION SUPERVISOR (OR THEIR DESIGNEE) AND THE CONTRACTOR'S RESPONSIBLE PARTY ARE RESPONSIBLE FOR INSPECTIONS. MAINTENANCE AND REPAIR ACTIVITIES ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE TDOT CONSTRUCTION SUPERVISOR OR THEIR DESIGNEE SHALL COMPLETE THE EPSC INSPECTION REPORTS AND DISTRIBUTE COPIES PER THE CONTRACT.

Design Resources

Personnel

- SWPPP Preparer
- TDOT Regional & District Offices
  - Environmental Tech
  - Operations (construction)
  - Compliance & Field Services
- Contractor

Design Resources

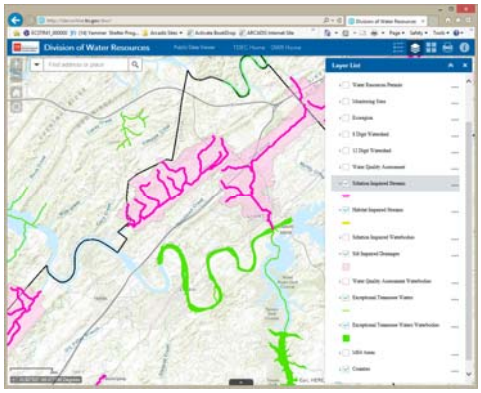
Other Resources

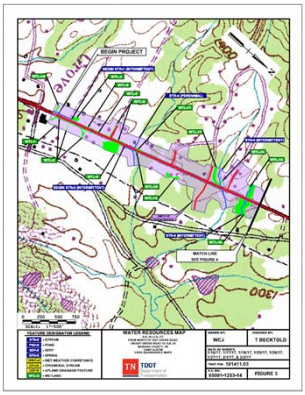
- USDA Web Soil Survey
  - https://websoilsurvey.nrcs.usda.gov
- TDOT Geotech Report

Design Resources

Other Resources

- TDEC Water Resource Map Viewer
  - http://tdeconline.tn.gov/dwr/
- Ecology - Environmental Boundaries Survey (EBR)
- TDOT Project Commitments
- PPRM (TDOT) or A&E Report (Consultants)





TN TDOT Department of Transportation

ARCADIS Design & Consultancy for natural and built assets

Questions?

TDOT Roadway Design Division

Module 2:

Rules & Regulations

Why do we need EPSC Plans?

- US EPA – The Clean Water Act
  - Restore and maintain the chemical, physical, and biological integrity of our Nation's waters
  - Section 402 – National Pollutant Discharge Elimination System (NPDES) for point source discharges (including stormwater runoff)
- TDEC – TN Water Quality Control Act
  - NPDES Permit for Discharges of Stormwater Associated with Construction Activities
    - ✓ Construction General Permit
    - ✓ Requires EPSC Plans and a Stormwater Pollution Prevention Plan (SWPPP) for land disturbances ≥ 1 ac.

swim drink fish

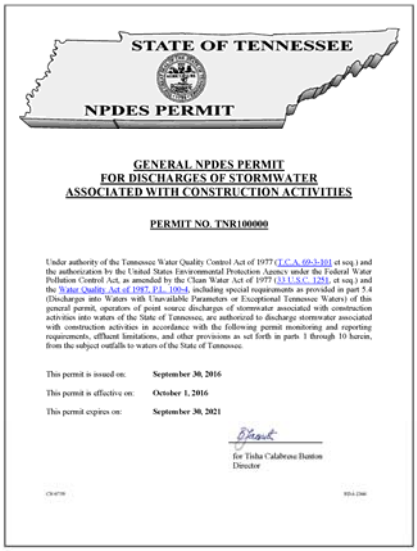
TN Department of Environment & Conservation

Why do we need EPSC Plans?

- TDOT
  - To reduce the physical, chemical, biological and economic damage which can be caused by pollution due to sediments which have been eroded from a construction site.
  - To minimize erosion and ensure that any eroded sediments are retained on site playing an important role in protecting Tennessee's natural environment

TDEC Construction General Permit (CGP)

- Tennessee is Granted Primacy by EPA to Oversee the State NPDES Program
  - Managed by the Tennessee Department of Environment & Conservation (TDEC) – Water Resources
  - "*General NPDES Permit for Discharges of Stormwater Associated with Construction Activities" or "Construction General Permit*" (CGP)



STATE OF TENNESSEE

NPDES PERMIT

GENERAL NPDES PERMIT
FOR DISCHARGES OF STORMWATER
ASSOCIATED WITH CONSTRUCTION ACTIVITIES

PERMIT NO. TNR100000

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the authorization by the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4, including special requirements as provided in part 5.4 (Discharges into Waters with Unavailable Parameters or Exceptional Tennessee Waters) of this general permit, operators of point source discharges of stormwater associated with construction activities into waters of the State of Tennessee, are authorized to discharge stormwater associated with construction activities in accordance with the following permit monitoring and reporting requirements, effluent limitations, and other provisions as set forth in parts 1 through 10 herein, from the subject outfalls to waters of the State of Tennessee.

This permit is issued on: **September 30, 2016**

This permit is effective on: **October 1, 2016**

This permit expires on: **September 30, 2021**

for Tisha Calabrese Bunton
Director

TDEC CGP

Issue date: September 30, 2016
Effective date: October 1, 2016
Expiration date: September 30, 2021

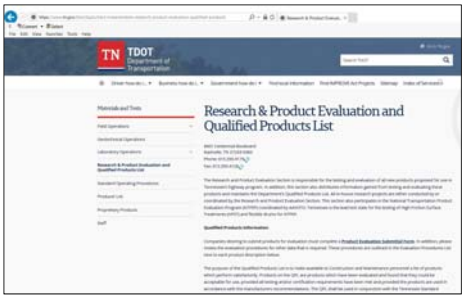
- CGP authorizes *point source* discharges of stormwater from construction activities *(outfalls)*
- Required for land disturbances ≥ 1 acre
- Includes support activities (borrow and waste areas, concrete and asphalt plants, staging yards, haul roads, material storage areas, etc.)

TDEC CGP

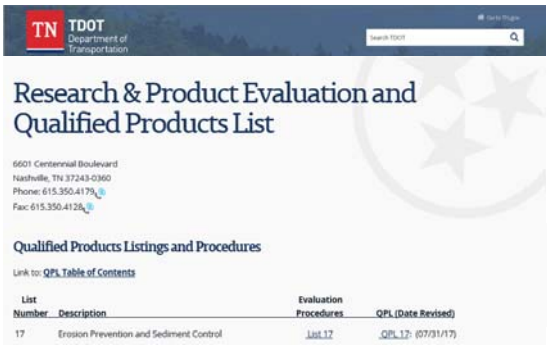
Section 3: SWPPP Requirements

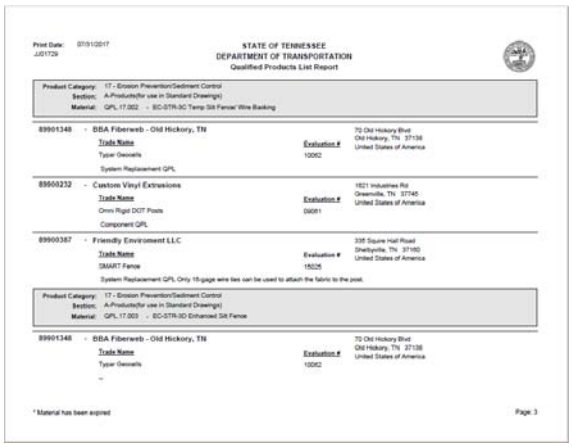
3.1. The General Purpose of the SWPPP

- A site-specific SWPPP must be developed for each construction project
- The *design*, inspection and maintenance of Best Management Practices (BMPs) must be:
  - described in the SWPPP
  - prepared in accordance with good engineering practices
- Permit allows use of innovative or alternative BMPs
  - performance has been documented to be equivalent or superior to conventional BMPs
  - certified by the SWPPP/EPSC designer
  - TDOT Qualified Products List (QPL)



Qualified Products List (QPL)





TDEC CGP

Section 3: SWPPP Requirements

3.1.1. Registered engineer or landscape architect requirement

- SWPPP narrative may be prepared by:
  - CPESC or
  - TDEC Level II
- Plans and specifications requiring structural, hydraulic, hydrologic or other engineering calculations be *stamped and certified* by PE or LA

TDEC CGP

Section 3: SWPPP Requirements

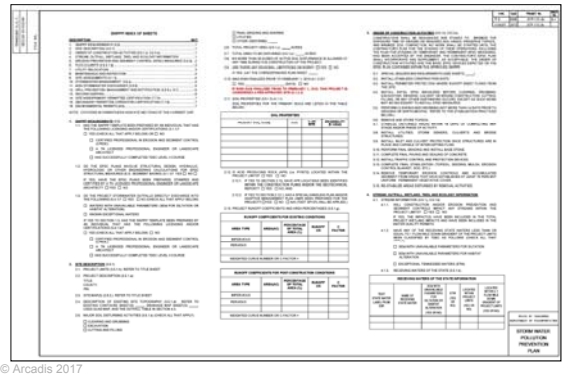
3.5 Components of the SWPPP

- Site description
- Description of stormwater runoff controls
- *Erosion prevention and sediment controls (EPSC Plans)*
- Stabilization practices
- Structural practices
- Stormwater management
- Other items needing control
- Maintenance
- Inspections
- Pollution prevention measures for non-stormwater discharges
- Documentation of permit eligibility related to TMDLs (303d siltation or habitat alteration)

TDEC CGP

Components of the SWPPP

- SWPPP Sheets
- Documentation & Permits Binder



DOCUMENTATION AND PERMITS BINDER
CHECKLIST

PROJECT NAME: ROUTE, TERMINI
PIN:
PROJECT NO.:
COUNTY:

1. EPSC INSPECTION REPORTS
   - 1.1. ☒ TDOT FORM
   - 1.2. ☒ TDEC FORM
2. ☒ EPSC INSPECTION DELEGATION OF AUTHORITY
3. ☒ PRECIPITATION RECORDS
   - 3.1. ☒ MONTHLY RAINFALL LOG
   - 3.2. ☒ PRECIPITATION FREQUENCY ESTIMATES
4. ☒ PROJECT EPSC POSTING INFORMATION
5. ☒ PROJECT RELATED TDOT EPSC STANDARD DRAWINGS
6. ☒ NOI AND TOPO MAP
7. ☒ BLANK NOT
8. ENVIRONMENTAL PERMITS
   - 8.1. ☒ PERMIT APPLICATION LETTER
   - 8.2. ☒ PERMITS
     - 8.2.1. ☒ TDEC ARAP
     - 8.2.2. ☒ CORPS OF ENGINEERS (COE)
     - 8.2.3. ☒ TVA 26A
     - 8.2.4. ☐ OTHER
9. ☒ ENVIRONMENTAL BOUNDARIES REPORT
10. ☒ TDOT AND TDEC WEB LINKS
11. EPSC INSPECTION TRAINING CERTIFICATIONS
12. SOIL TEST RESULTS

TDEC CGP

Section 3: SWPPP Requirements

3.5.1. Site description

- c) Estimates of the total area:
  - of the site (project area)
  - disturbed area (including all construction easements)
- d) Estimate of percent slope at each outfall drainage area
- e) Estimate of drainage area serving each outfall
- l) Buffer zones identified and outlined
- o) Limits of disturbance shall be clearly marked in the SWPPP (EPSC plans)

DISTURBED AREA		
IN BETWEEN SLOPE LINES	44.09	(AC)
15 FOOT WIDE STRIP (OUTSIDE SLOPE LINES)	5.65	(AC)
TOTAL DISTURBED AREA	49.74	(AC)

OUTFALL TABULATION		
OUTFALL	AREA	SLOPE
1	1.12 AC.	3.5%
2	0.20 AC.	3.5%
3	0.18 AC.	2.6%
4	0.06 AC.	2.7%
4A	0.42 AC.	9.9%
4B	0.43 AC.	0.5%
5	3.83 AC.	2.2%
5A	0.08 AC.	2.4%
5B	0.06 AC.	2.7%
5C	0.21 AC.	0.6%

TDEC CGP

Section 3: SWPPP Requirements

3.5.2. Description of stormwater runoff controls

EPSC plans that reflect construction phases (i.e. initial, interim grading, final, etc.) should be depicted on multiple plan sheets.

EPSC staging

- One sheet depicting *all* EPSC that will be used during the life of the project *will not* be considered complete
- Sites disturbance
  - <5 acres – minimum of 2 stages of EPSC (initial/clearing and final)
  - ≥5 acres - minimum of 3 stages of EPSC (initial/clearing, interim and final)

TDOT submits EPSC Plans to TDEC for review.

TDEC CGP

Section 3: SWPPP Requirements

3.5.3.1 EPSC General Criteria and Requirements

- a) Erosion prevention controls designed to *eliminate* the dislodging and suspension of soil in water
- b) Sediment controls designed to retain sediment on-site
- c) Proposed physical and/or chemical treatment must be:
  - Researched
  - Applied according to the manufacturer's guidelines
  - Fully described in the SWPPP

TDOT Standard Flocculent Notes

6-415.00 FLOCCULANTS

NOTE: NOTES (1) THROUGH (8) SHALL BE INCLUDED ON THE FIRST SHEET OF THE EPSC PLAN SET FOR ALL PROJECTS WHERE FLOCCULANTS ARE USED IN WHICH THE PROJECTS REQUIRES LESS THAN 1 ACRE OF TOTAL DISTURBED AREA, FOR WHICH AN NPDES PERMIT IS NOT REQUIRED.

(1) ENSURE THE FLOCCULANT EMULSIONS AND POWDERS ARE OF THE ANIONIC TYPE AND MEET THE FOLLOWING REQUIREMENTS:

A. MEETS THE EPA AND FDA ACRYLAMIDE MONOMER LIMITS OF EQUAL TO OR GREATER THAN 0.005% ACRYLAMIDE MONOMER.

B. HAS A DENSITY OF 10% TO 55% BY WEIGHT AND A MOLECULAR WEIGHT OF 16 TO 24 MG/MOLE.

C. MIXTURE IS NON-COMBUSTIBLE.

D. CONTAINS ONLY MANUFACTURER'S RECOMMENDED ADDITIVES.

(2) FLOCCULANT SHALL BE MIXED AND APPLIED IN ACCORDANCE WITH ALL OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) MATERIAL SAFETY DATA SHEET REQUIREMENTS AND THE MANUFACTURER'S RECOMMENDATIONS FOR THE SPECIFIED USES CONFORMING TO ALL FEDERAL, STATE, AND LOCAL LAWS, RULES, AND REGULATIONS.

(3) ALL VENDORS AND SUPPLIERS OF FLOCCULANT BLENDS SHALL PRESENT OR SUPPLY A WRITTEN TOXICITY REPORT WHICH VERIFIES ACCEPTABLE TOXICITY PARAMETERS WHICH MEET OR EXCEED THE EPA REQUIREMENTS FOR THE STATE AND FEDERAL WATER QUALITY STANDARDS. WHOLE EFFLUENT TESTING DOES NOT MEET THIS REQUIREMENT AS PRIMARY REACTIONS HAVE OCCURRED AND TOXIC POTENTIALS HAVE BEEN REDUCED.

TDEC CGP

Section 3: SWPPP Requirements

3.5.3.1. EPSC General criteria and requirements (cont.)

- n)
  - Offsite vehicle tracking of sediments and the generation of dust shall be minimized
  - Construction entrances shall be described and implemented

TDEC CGP

Section 3: SWPPP Requirements

Steep Slopes

- A natural or created slope of 35% grade (3:1 slope or steeper)
- No height restrictions
- *Designers must pay special attention to stormwater management to convey runoff non-erosively around or over a steep slope*

TDEC CGP

Section 3: SWPPP Requirements

3.5.3.3 Structural practices (design requirements)

- 2-year and 5-year design storm depths and intensities
  - TDOT EPSC measures already meet this requirement
- Drainage area (onsite + offsite) of ≥ 10 acres:
  - Both disturbed and undisturbed portions of the site or
  - Areas adjacent to the site
  - All draining through the common outfall
- Exceptional TN Waters and 303d impaired streams
  Drainage area (onsite + offsite) of ≥ 5 acres

TDEC CGP

Section 3: SWPPP Requirements

3.5.9. Pollution prevention measures for non-stormwater discharges

- Estimated *volume* of the non-stormwater component(s) of the discharge must be included in the design of all impacted control measures
  - Dewatering of work areas (sediment filter bags)
  - Water for dust control
  - Waterline flushings
  - Groundwater
  - Wash areas

Non-Stormwater Discharges

Sediment Filter Bags

Dust Control

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.1. Erosion Prevention and Sediment Controls

EPSC must be *designed*, installed and maintained to:

- Control stormwater *volume and velocity* within the site to minimize soil erosion
- Control stormwater discharges, including both *peak flows and total stormwater volume*, to minimize erosion at outlets, stream channels and streams banks
- Minimize the amount of soil exposed
- Minimize the disturbance of steep slopes

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.1. Erosion Prevention and Sediment Controls

- Minimize sediment discharges from the site
- *Design*, installation and maintenance of EPSC controls must address:
  - design storm (2 yr. or 5 yr. – 24 hour)
  - soil characteristics
  - include range of soil particle sizes expected to be present
- Provide and maintain natural buffers around surface waters
- Minimize soil compaction – preserve topsoil

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.2. Buffer zone requirements

- Applicable to *all streams*
  - 60 feet (on each side of stream) for impaired and exceptional TN waters (average width with a min. of 30 feet)
  - 30 feet (on each side of stream) for all other streams (average width with a min. of 15 feet)
- Water of the U.S.
  - 15 feet (on each side) for wet weather conveyances identified as *ephemeral streams* by the USACE or EPA
- Ecology EBR forms include this information

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.2. Buffer zone requirements (cont.)

- Are not primary sediment control structures
- Requirement does not apply to any valid ARAP or equivalent permit by federal agencies
- Buffer zone exemptions defined based on existing land uses

Coordinate with the Permits Office!

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.2.2. Pre-Approved Sites

- TDOT projects are exempt from buffer zone requirements if final TDOT right-of-way plans were finalized before February 1, 2010

TDEC CGP

Section 4: Construction and Development Effluent Guidelines

4.1.4. Dewatering

- Discharges from dewatering activities are prohibited unless managed by controls providing equivalent level of treatment (filters – i.e. sediment filter bags)

4.1.7 Surface Outlets

- Discharges from basins and impoundments, utilize outlet structures that only withdraw water from near the surface of the basin or impoundment (i.e. Faircloth skimmer)

TDEC CGP

4.1.7 Surface Outlets

- "Sediment Basin" definition updated to reflect new design components including:
  - forebay cell
  - permanent pool
  - primary spillway with secondary or emergency spillway
  - surface dewatering
- Size dependent upon
  - shape
  - incoming runoff volume and peak flow
  - particle size
  - receiving stream classification (impaired or exceptional waters)
- TDOT working with UTK on potentially reducing the size of sediment basins.

TDEC CGP

Section 5: Special Conditions, Management Practices, and Other Non-Numeric Limitations

5.4.1. Additional SWPPP/BMP Requirements for discharges into impaired or exceptional TN Waters

- Includes discharges from sites upstream or within *"proximity"* of the impaired or exceptional segment
  - TDOT/TDEC agreement defines proximity as: the project is within a one mile flow length upstream of the ETW or 303d impaired stream
- b) Requires SWPPP *(including EPSC plans)* to be prepared by a person who possesses one of the following:
  - PE or LA
  - CPESC
  - TDEC Level II

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Questions?

TDOT Roadway Design Division

Module 3:

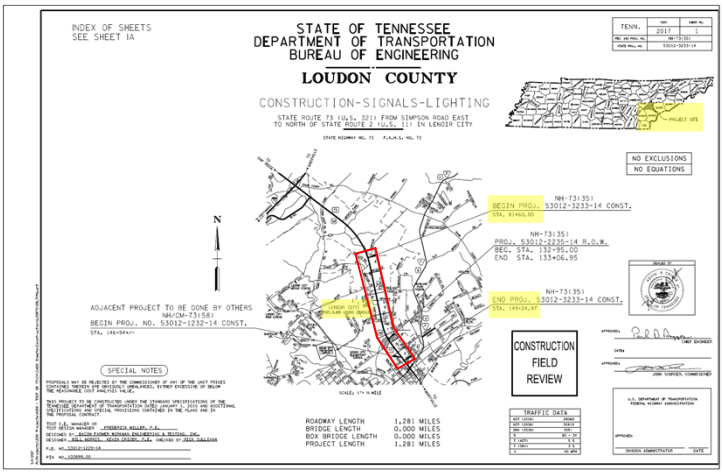
TDOT SWPPP Process

Assignment of SWPPP Developer

- Contact the TDOT Roadway Design Manager
- Ask questions:
  - ✓ What stage is the project in? (Preliminary ROW, ROW or Construction Field Review)
  - ✓ When is the next field review?
  - ✓ Have there been any major design changes?
  - ✓ Is it ok to contact the design consultant directly with questions and comments?
  - ✓ Exchange contact information
  - ✓ Request to be placed on the distribution list for future field review(s)

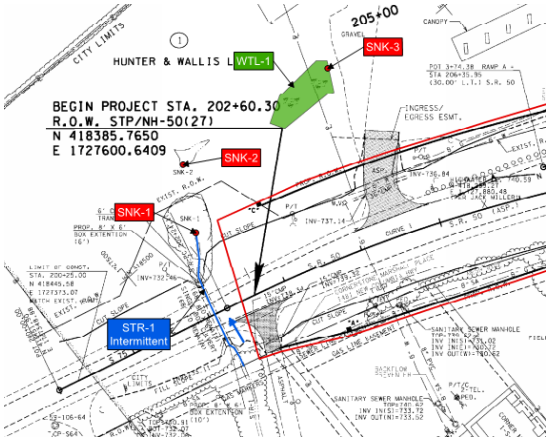
Project Site Review

- General Site Information
  - Project location
  - Limits of work
  - Lat/Long coordinates from center of project
    - ✓ Decimal degrees format (35.9485°, -84.8564°)



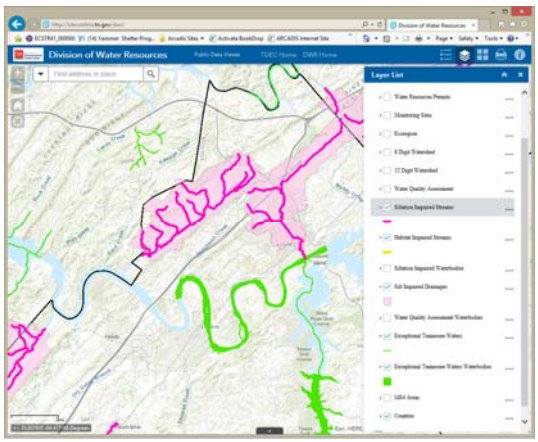
Project Site Review

- Watershed and Stream Designation Review
  - Verify Natural Resources/Jurisdictional Features (Streams, Wetlands, Springs, Sinkholes, etc.) within and adjacent to the project site
  - Resources:
    - ✓ Environmental Boundaries Report (EBR)
    - ✓ Design Plans
    - ✓ USGS Topographic Mapping



Project Site Review

- Watershed and Stream Designation Review
  - Does the project directly discharge or is located within 1 flow mile upstream of a designated ETW or 303(d) listed stream?
  - Resources:
    - ✓ TDEC Division of Water Resource Map Data Viewer
    - ✓ TDEC TMDL Report
    - ✓ http://tdeconline.tn.gov/dwr/

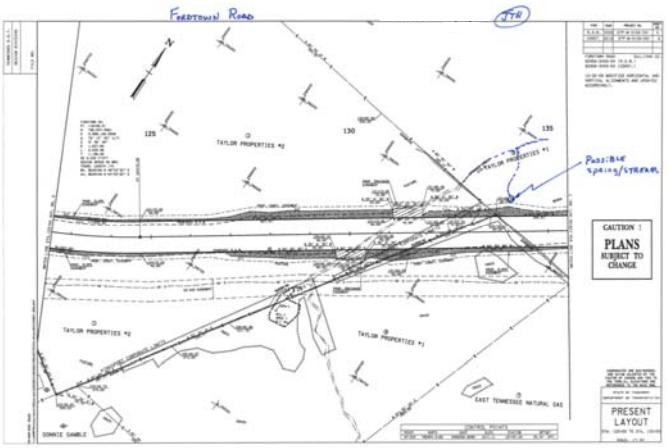


Project Site Review

- Site Review (currently not required)
  - On-site and adjacent topographic conditions and land uses
  - Existing and proposed drainage patterns
  - Existing erosion problems
  - Other problem areas
  - Jurisdictional features
  - Sufficient ROW
- Changes Coming in the Near Future
  - New Activity within PPRM (site review)
    - ✓ 6 months prior to ROW turn-in
    - ✓ Site review check list
    - ✓ Representative from each Division

Project Site Review

- Site Review Example
  - Additional Jurisdictional Features Found



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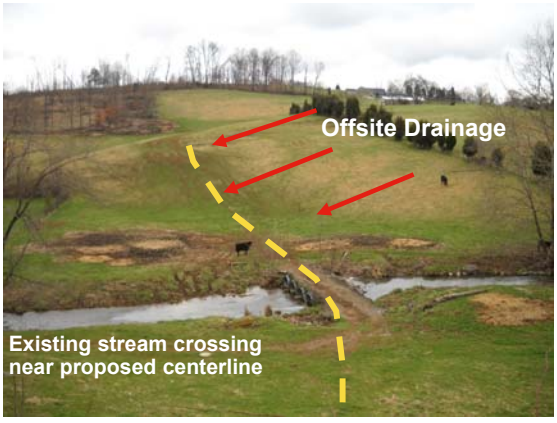
Project Site Review

- Site Review Example
  - Offsite Drainage
  - Existing Stream Crossing
  - Sediment Filter Bag



Project Site Review

- Site Review Example

Existing Erosion

Utility Work by Others

Storm Sewer Not Surveyed

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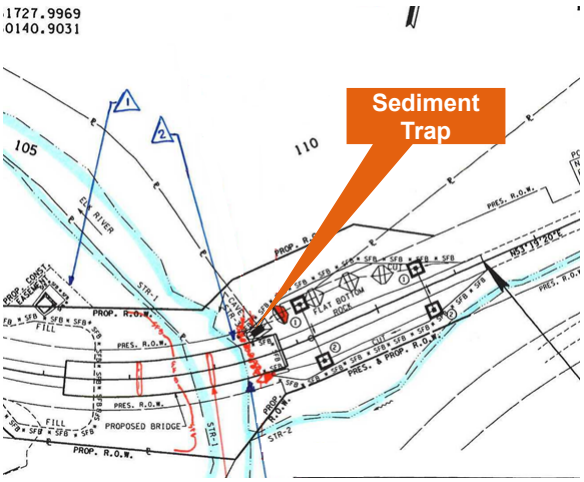
Project Site Review

- Site Review Example
  - Existing Construction
  - Bridge Construction Needs – Haul Road, Jetties, Barge Access, etc.

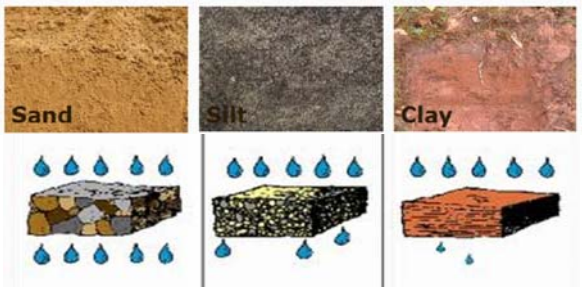
Project Site Review

- Site Review Example
  - Site Constraints



Preparing for EPSC Design

- Know your project's topography and soil types
  - Hydrologic Soil Group (HSG) (A-D soil)
  - Erodibility of the soil (k value for whole soil not rock-free)
  - Steep slopes (3:1 or steeper)



Tables — Hydrologic Soil Group — Summary By Map Unit

HSG

Summary by Map Unit — Morgan County Area

Map unit symbol	Map unit name	Rating	Component % in AOI	Percent of AOI
GnD	Gilpin silt loam, 12 to 20 percent slopes	C	15.9	15.1%
GpE	Gilpin-Petros complex, 20 to 35 percent slopes	C	26.9	25.5%
GpF	Gilpin-Petros complex, 35 to 80 percent slopes	C	3.1	3.0%
LbC	Lily loam, 5 to 12 percent slopes	B	2.3	2.2%
LgC	Lily-Gilpin complex, 5 to 12 percent slopes	B	2.3	2.2%
W	Water		0.8	0.8%
WrB	Wernock silt loam, 2 to 5 percent slopes	B	17.0	16.1%
WrC	Wernock silt loam, 5 to 12 percent slopes	B	37.1	35.3%
Subtotals for Soil Survey Area			105.3	100.0%
Totals for Area of Interest			105.3	100.0%

Tables — K Factor, Whole Soil — Summary By Map Unit

K Value

Summary by Map Unit — Morgan County Area,

Map unit symbol	Map unit name	Rating	Component % in AOI	Percent of AOI
GnD	GILPIN SILT LOAM, 12 TO 20 PERCENT SLOPES	.32	15.9	15.1%
GpE	GILPIN-PETROS COMPLEX, 20 TO 35 PERCENT SLOPES	.32	26.9	25.5%
GpF	GILPIN-PETROS COMPLEX, 35 TO 80 PERCENT SLOPES	.32	3.1	3.0%
LbC	LILY LOAM, 5 TO 12 PERCENT SLOPES	.28	2.3	2.2%
LgC	LILY-GILPIN COMPLEX, 5 TO 12 PERCENT SLOPES	.28	2.3	2.2%
W	WATER		0.8	0.8%
WrB	WERNOCK SILT LOAM, 2 TO 5 PERCENT SLOPES	.37	17.0	16.1%
WrC	WERNOCK SILT LOAM, 5 TO 12 PERCENT SLOPES	.37	37.1	35.3%
Subtotals for Soil Survey Area			105.3	100.0%
Totals for Area of Interest			105.3	100.0%

Source: https://aminghori.blogspot.com/2016/04/lesson-plan-of-effects-of-moving-water.html

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Preparing for EPSC Design

HYDROLOGIC SOIL GROUP

A (SAND) ⟷ D (CLAY)

RUNOFF POTENTIAL

LESS ⟷ MORE

Cover Description	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
Impervious areas: Paved parking lots, roofs, driveways, etc. (excluding ROW)	98	98	98	98
Streets and roads:				
Paved: curbs and strom sewers (excluding ROW)	98	98	98	98
Paved: open ditches (including ROW)	83	89	92	93
Gravel (including ROW)	76	85	89	91
Dirt (including ROW)	72	82	87	89
Newly graded areas (pervious areas only, no vegetation)	77	86	91	94
Meadow - continous grass	30	58	71	78
Woods - good condition	30	55	70	77

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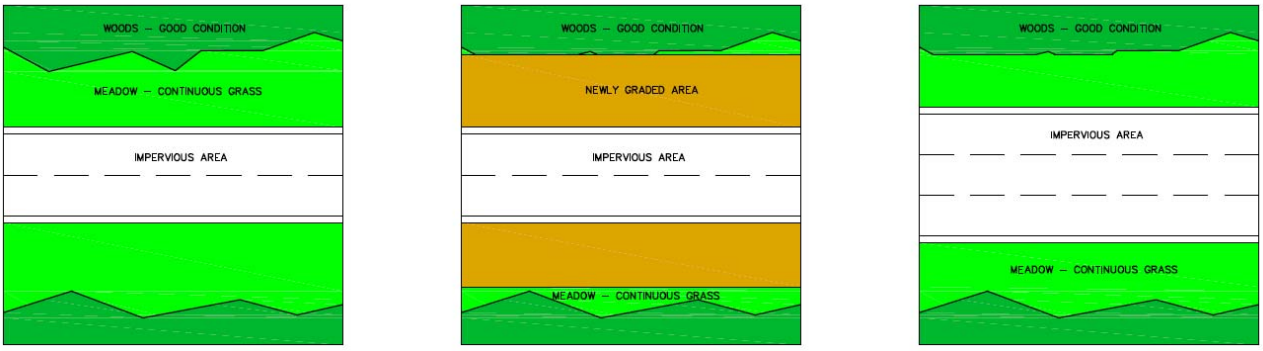
Preparing for EPSC Design

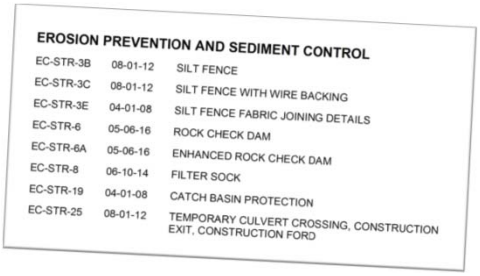


COVER DESCRIPTION	CN VALUE	PRE-DEVELOPED AREA	CONSTRUCTION AREA	POST-DEVELOPED AREA
WOODS - GOOD CONDITION	55	2578	2460	2460
MEADOW-CONTINUOUS GRASS	56	4622	701	3540
IMPERVIOUS AREA	98	2800	2800	4000
NEWLY GRADED AREA	86		4039	
COMPOSITE CN VALUE		**67.5**	**79.6**	**72.6**

TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

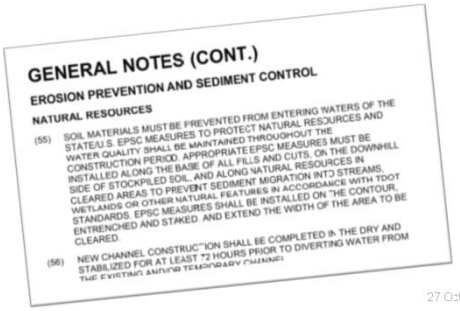
Preparing for EPSC Design

- SWPPP Sheets included in index (S-1)
- Applicable standard drawings
- General and Special Notes
  - EPSC notes based on latest IB
  - Special EPSC/ecology notes
  - Project commitments



EROSION PREVENTION AND SEDIMENT CONTROL

EC-STR-3B	08-01-12	SILT FENCE
EC-STR-3C	08-01-12	SILT FENCE WITH WIRE BACKING
EC-STR-3E	04-01-08	SILT FENCE FABRIC JOINING DETAILS
EC-STR-6	05-06-16	ROCK CHECK DAM
EC-STR-6A	05-06-16	ENHANCED ROCK CHECK DAM
EC-STR-8	06-10-14	FILTER SOCK
EC-STR-19	04-01-08	CATCH BASIN PROTECTION
EC-STR-25	08-01-12	TEMPORARY CULVERT CROSSING, CONSTRUCTION EXIT, CONSTRUCTION FORD



GENERAL NOTES (CONT.)

EROSION PREVENTION AND SEDIMENT CONTROL

NATURAL RESOURCES

(55) SOIL MATERIALS MUST BE PREVENTED FROM ENTERING WATERS OF THE STATE/U.S. EPSC MEASURES TO PROTECT NATURAL RESOURCES AND WATER QUALITY SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD. APPROPRIATE EPSC MEASURES MUST BE INSTALLED ALONG THE BASE OF ALL FILLS AND CUTS, ON THE DOWNHILL SIDE OF STOCKPILED SOIL, AND ALONG NATURAL RESOURCES IN CLEARED AREAS TO PREVENT SEDIMENT MIGRATION INTO STREAMS, WETLANDS OR OTHER NATURAL FEATURES IN ACCORDANCE WITH TDOT STANDARDS. EPSC MEASURES SHALL BE INSTALLED ON THE CONTOUR, ENTRENCHED AND STAKED, AND EXTEND THE WIDTH OF THE AREA TO BE CLEARED.

(56) NEW CHANNEL CONSTRUCTION SHALL BE COMPLETED IN THE DRY AND STABILIZED FOR AT LEAST 72 HOURS PRIOR TO DIVERTING WATER FROM THE EXISTING AND/OR TEMPORARY CHANNEL

TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

Preparing for EPSC Design

- Disturbed Area Table
  - Provided on ROW Acquisition Sheet

DISTURBED AREA	
IN BETWEEN SLOPE LINES	6.105 (AC)
15 FOOT WIDE STRIP (OUTSIDE SLOPE LINES)	1.754 (AC)
TOTAL DISTURBED AREA	7.859 (AC)

TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

Preparing for EPSC Design

- Estimated Roadway Quantities
  - EPSC pay items provided
  - Quantities
    - ✓ Look appropriate
    - ✓ Tabulated & Estimated match
  - Footnotes
    - ✓ Applied as needed
    - ✓ Specific

ESTIMATED ROADWAY QUANTITIES

	ITEM NO.	DESCRIPTION	UNIT	QUANTITY
	209-08.02	TEMPORARY SILT FENCE (WITH BACKING)	L.F.	1173
	209-08.03	TEMPORARY SILT FENCE (WITHOUT BACKING)	L.F.	1714
④	209-08.07	ROCK CHECK DAM	EACH	14
	209-08.08	ENHANCED ROCK CHECK DAM	EACH	4
	209-09.40	CURB INLET PROTECTION (TYPE 1)	EACH	2
	209-09.43	CURB INLET PROTECTION (TYPE 4)	EACH	29
	209-13.04	TURBIDITY CURTAIN(AT BRIDGE PIERS)	L.F.	998
	209-40.33	CATCH BASIN PROTECTION (TYPE D)	EACH	3
	209-40.42	CATCH BASIN FILTER ASSEMBLY(TYPE 2)	EACH	2
	209-40.46	CATCH BASIN FILTER ASSEMBLY(TYPE 6)	EACH	15

FOOTNOTES:

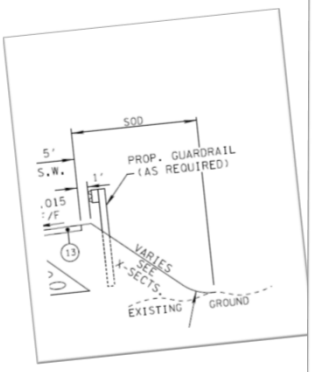
④ SEE SUBSECTION 209.07 OF THE STANDARD SPECIFICATIONS FOR MAINTENANCE AND REPLACEMENT. ALL QUANTITIES ARE TO BE USED AS DIRECTED BY THE ENGINEER.

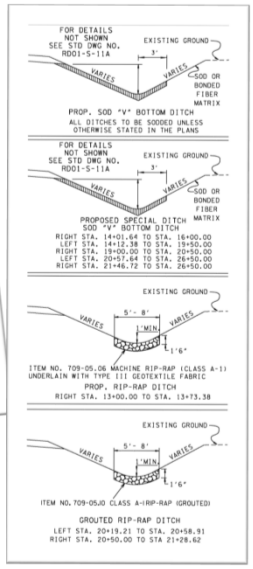
⑦ INCLUDES 100 TONS FOR USE WITH TEMPORARY CONSTRUCTION ENTRANCES/EXITS AND INCLUDES 628 TONS FOR USE AT NORTH AND SOUTH ABUTMENTS.

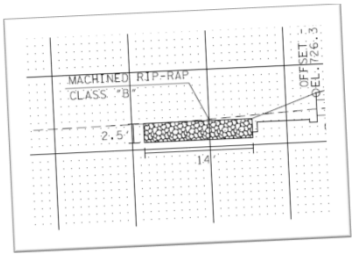
TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

Preparing for EPSC Design

- Typical Sections and Details
  - Stabilization (seed & blanket, sod, etc.)
- Special Ditch Sections
  - Stabilization, lining, dimensions, etc.
- Culvert X-Sections
  - Outlet protection depicted, type, length, depth, etc.



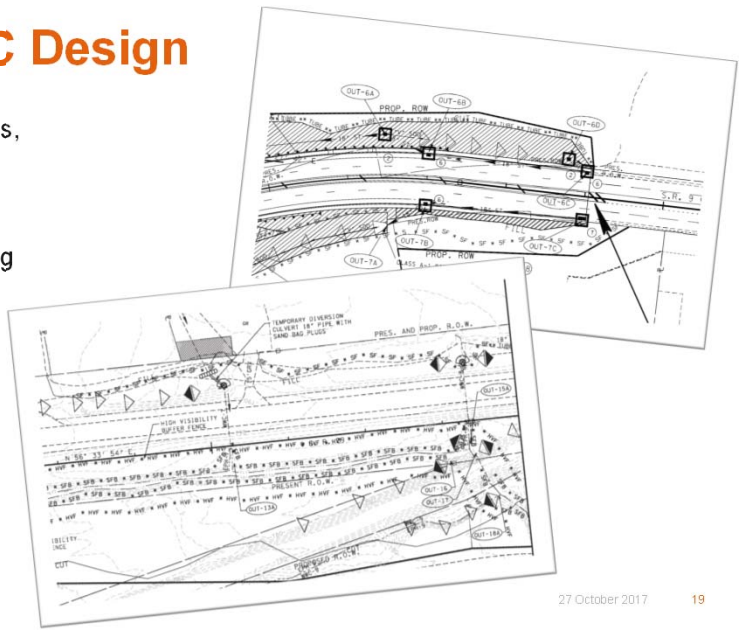




TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

Preparing for EPSC Design

- Existing and proposed inlets (pipes, culverts, storm sewer - not in a designated stream) have appropriate inlet protection
- Existing drainage ditches are being protected (i.e. rock check dams, sediment tube ditch checks, etc.)
- Each outfall has an appropriate EPSC measure installed. (i.e. enhanced rock check dam)



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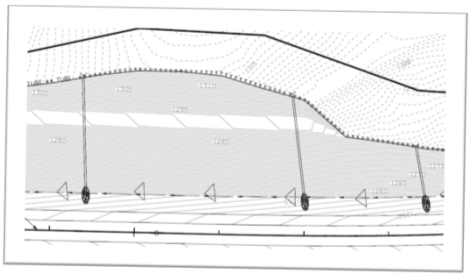
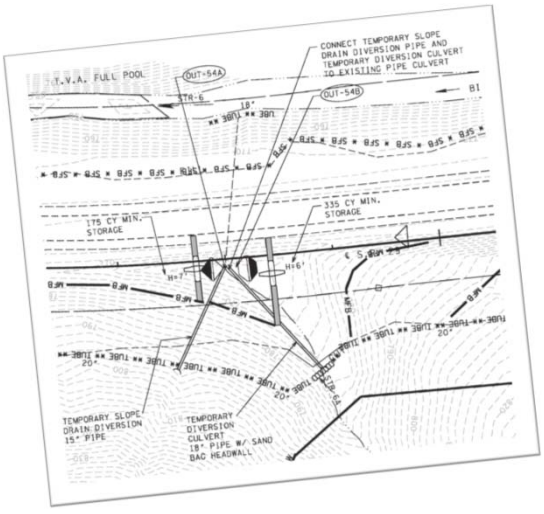
Preparing for EPSC Design

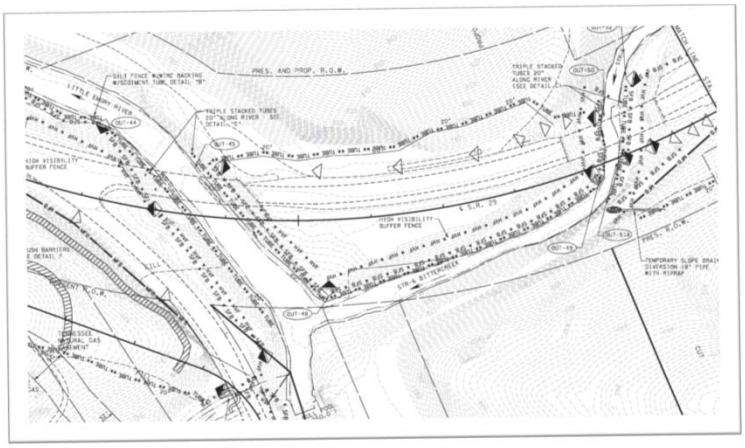
- Off-site water being diverted by diversion berms, diversion pipes, sediment tubes, filter socks, or other methods
- Slope drains being utilized in low points of the diversion berms





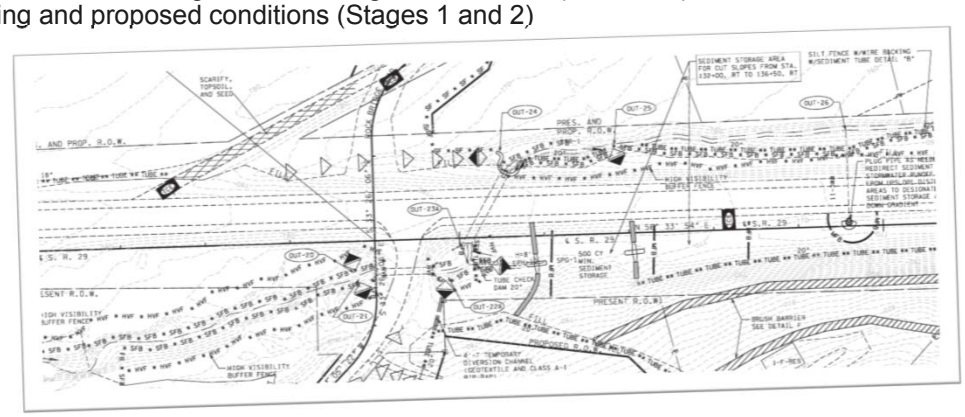
Preparing for EPSC Design

- Silt fence
  - Not installed in concentrated flow areas (ditches, swales, etc.)
  - Installed along the contour
    - ✓ Provide outlet at low points
  - J-hooks added
    - ✓ Prevents undercutting
    - ✓ Additional sediment storage



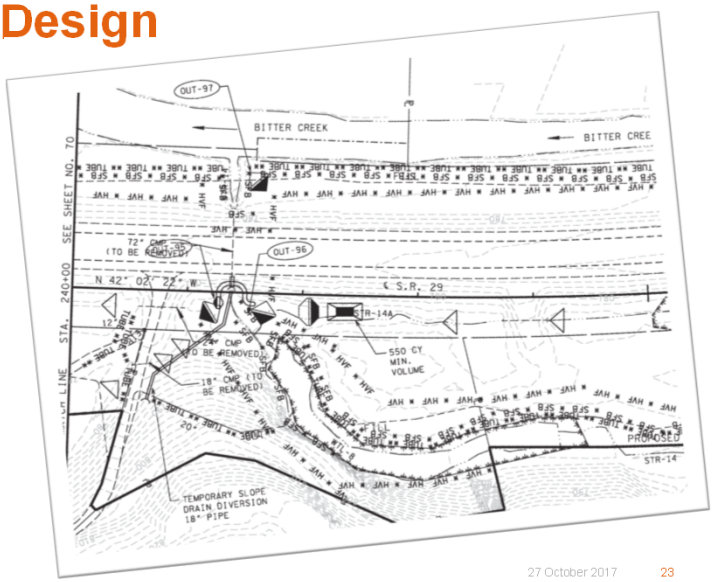
Preparing for EPSC Design

- Silt fence with backing (or other adequate BMPs) utilized at the toe of large fill slopes
- Silt fence with backing installed along stream banks (each side) and wetlands in existing and proposed conditions (Stages 1 and 2)



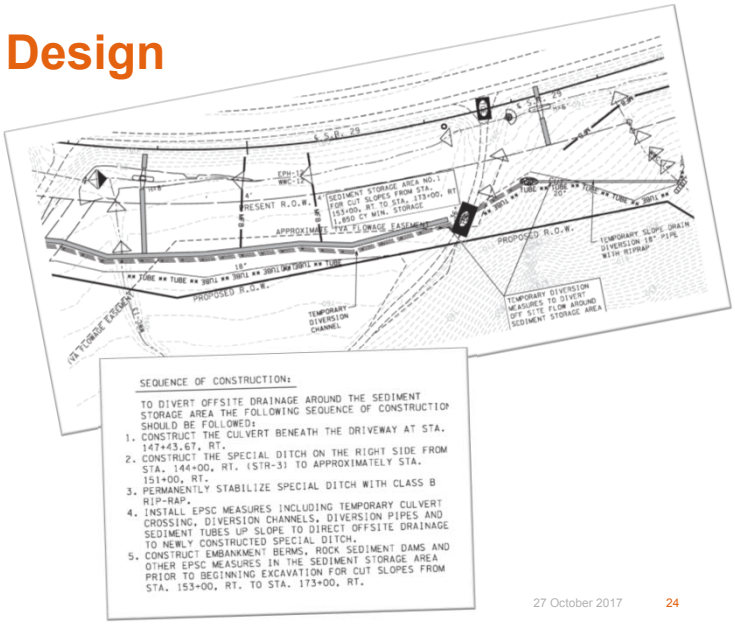
Preparing for EPSC Design

- Environmentally sensitive areas are protected with adequate BMPs
- Streams may need a designated buffer zone (delineate with high visibility fencing) or equivalent measures
- No EPSC measures are installed across streams
  - EPSC measures **CAN** be installed within ephemerals if not a permanent measure



Preparing for EPSC Design

- Temporary diversion channel (shape, size and lining) or temporary diversion culvert is depicted for all stream relocations
- Temporary stream crossings designated (size and number of culverts provided)
- Suspended pipe diversions (size provided)
- Graded solid rock being utilized to fill wetland areas (geotech report)
- Sequence of construction



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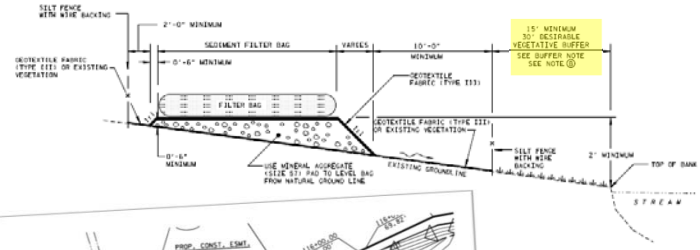
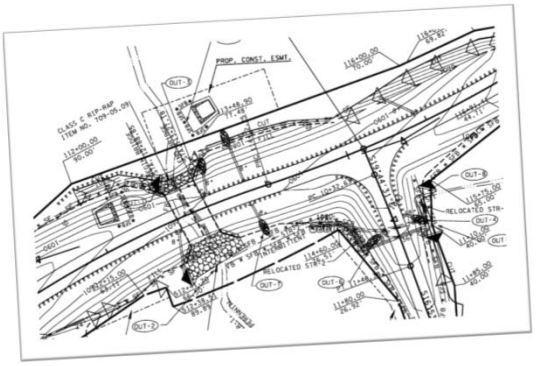
Preparing for EPSC Design

- Sediment filter bags
  - Provided for:
    - ✓ Box and pipe culvert construction on streams
    - ✓ Bridge construction over streams/wetlands
    - ✓ Stream diversion or coffer dams
- Sufficient ROW or easement area
- Located proper distance from the top of stream bank
- Can't locate on steep slopes





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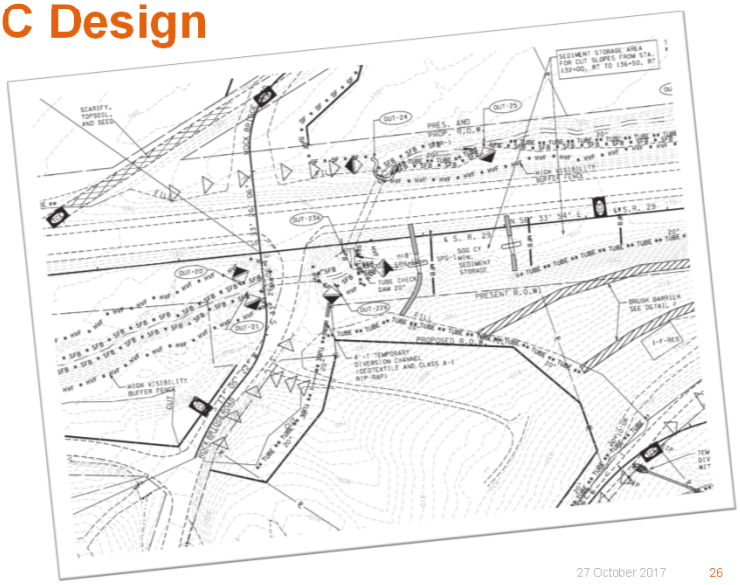
Preparing for EPSC Design

- Construction exits
  - Depicted on the plans
  - Multiple locations provided
  - Located were proposed alignment crosses an existing road(s)
- Haul roads necessary for bridge construction
  - Future changes are coming



Attending Field Reviews (SWPPP Developer)

- Watershed information provided
  - Receiving waters with unavailable parameters (303d for siltation or habitat alteration)
  - Exceptional Tennessee Waters (ETW)
  - Outstanding Natural Resources (ONR)
  - TMDL and waste load allocation (WLA)
- EPSC Comments/Recommendations
  - Are to be explained and backed up
    - ✓ IB's
    - ✓ Drainage Manual
    - ✓ Std. Drawings
    - ✓ Experience
    - ✓ Etc.

Issuing Comments (SWPPP Developer)

- May be provided as electronic PDF or hand written.
- To be issued within 2 weeks after the field review
  - TDOT Roadway Design Manager
  - Consultant Design Project Manager
  - TDOT NPDES Permits email address
  - Other Region personnel as needed

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Questions?

TDOT Roadway Design Division

Module 4:

Outfalls

Outfalls - Definition

- Stormwater runoff, snow melt runoff, and surface runoff and drainage
- Stormwater must be in a discernable/discrete/confined conveyance
  - pipes and culverts
  - ditches and channels
  - curb and gutter
  - catch basins or curb inlets (outfall or sub-outfall)
- May include the discharge of
  - sediment filter bags
  - dewatering structures

Outfalls - Locations

- Leaves the project:
  - ROW
  - Project termini
  - Easement (i.e. temporary construction or permanent drainage)
- Directly enters TDEC jurisdictional features (streams, springs, wetlands and sinkholes)
  - Does not include ephemeral streams

Outfall Examples

Clearing and Grubbing

Natural drainage features need to be protected

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Outfall Examples

Intermediate Grading

Natural drainage features need to be protected

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Outfall Examples

Final Stabilization

Rip rap channel to stream.

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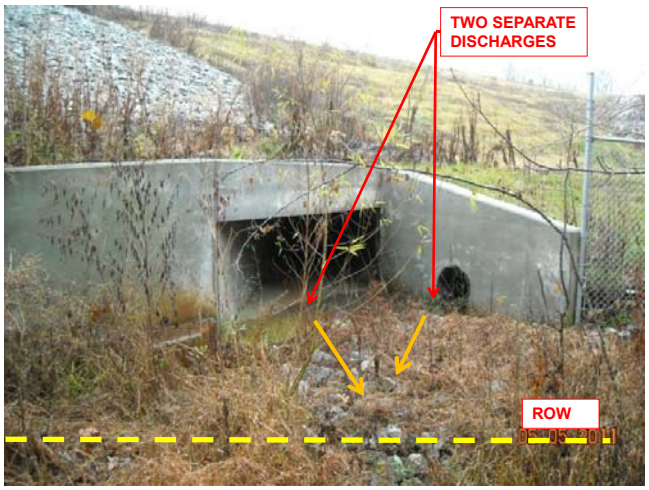
Outfall Examples

Multiple culverts discharging into a wet weather conveyance



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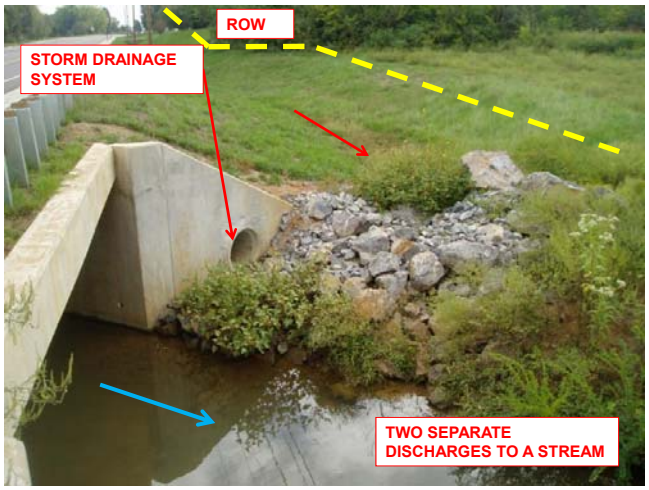
Outfall Examples

Multiple discharges entering stream.



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Outfall Examples

Natural drainage swales or toe ditches that discharge to streams

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Outfall Examples

Relocated stream channel discharging to another stream

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Outfall Examples

Pipe/culvert/ditch discharging at ROW or easement before entering offsite stream

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Outfall Examples

Discharge from a sediment filter bag

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Outfall Examples

Low area discharge in silt fence from sediment filter bag

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Sub-Outfalls - Definition

- A sub-division of a main outfall to accomplish the following:
  - To reduce the drainage area (eliminate need for sediment basins and/or traps)
  - To account for drainage in a closed storm system that is collected in area drains or curb inlets
    - Closed drainage system directly discharges to a jurisdictional feature or outfall within the project

Closed Drainage System Inlets - Last Place to Capture Sediment

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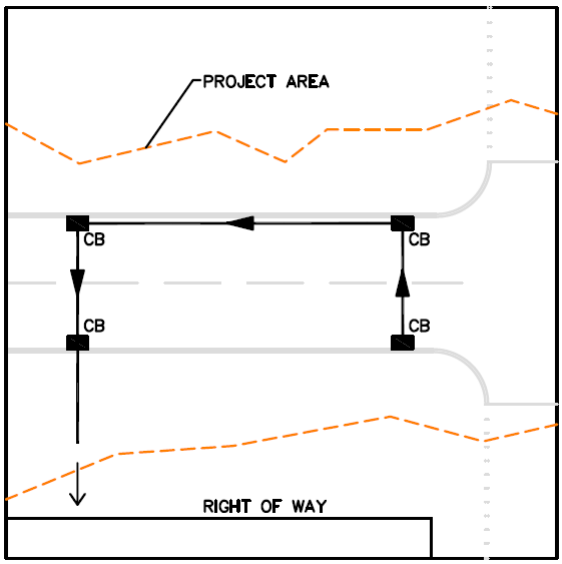
Outfall or Sub-Outfall?

- Identify the Outfall(s)



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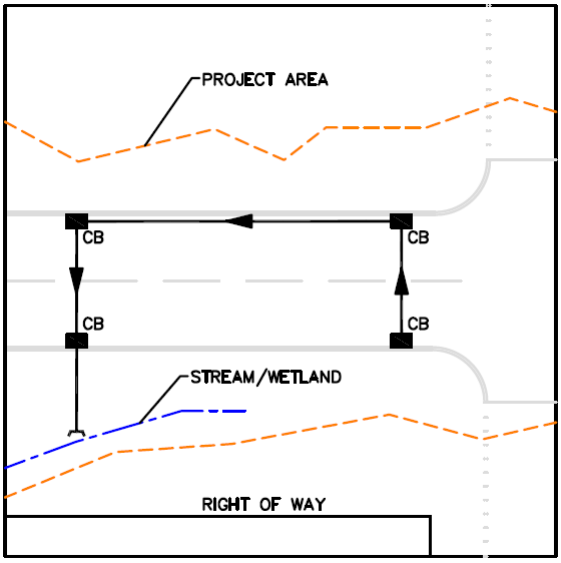
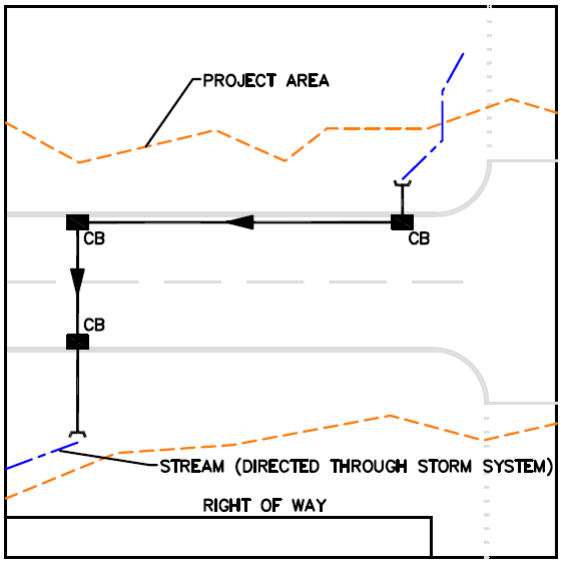
Outfall or Sub-Outfall?

- Identify the Outfall(s)



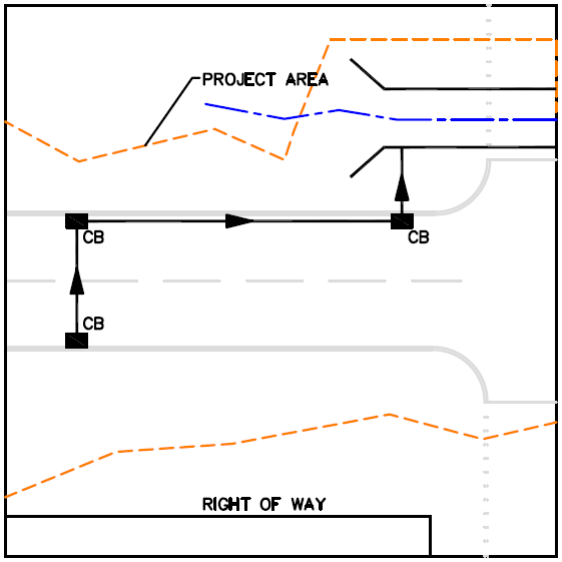
Outfall or Sub-Outfall?

- Identify the Outfall(s)



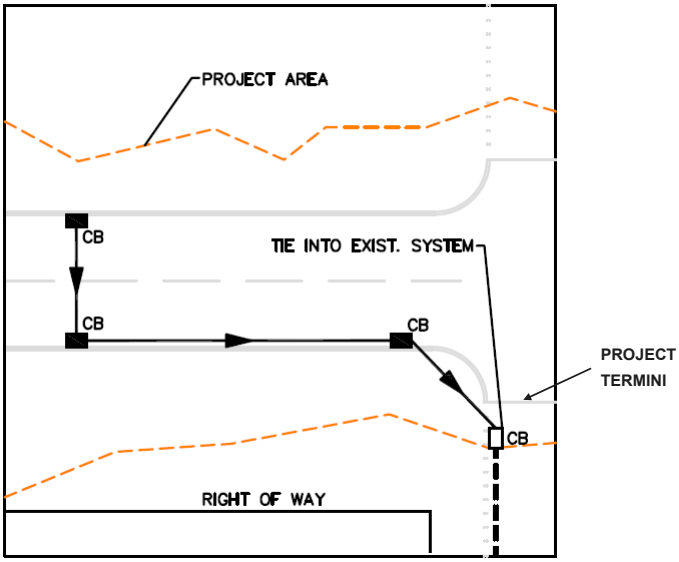
Outfall or Sub-Outfall?

- Identify the Outfall(s)



Outfall or Sub-Outfall?

- Identify the Outfall(s)



Sub-Outfall Examples

EPSC Stage 2 of curb inlets

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Sub-Outfall Examples

EPSC Stage 3 of curb inlets

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Sub-Outfall Examples

Curb inlet with no inlet protection

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Sub-Outfall Examples

Area drain/catch basin protection

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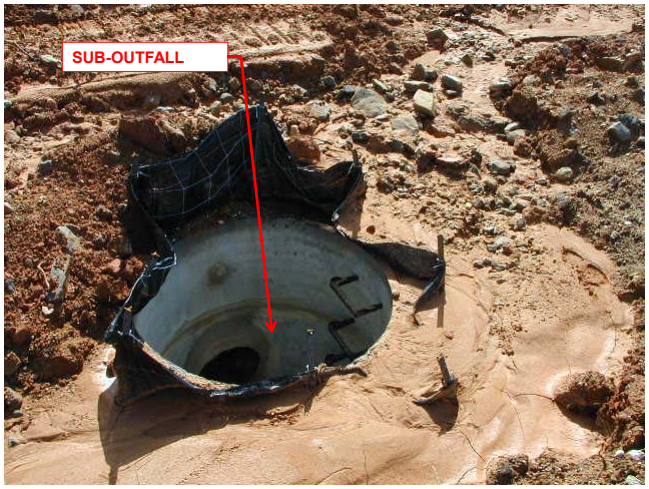
Sub-Outfall Examples

Stormwater manholes



Sub-Outfall Examples

Stage 2/3 EPSC

Area drain during construction

Sub-Outfall Examples

Stage 3 EPSC

Area drain after construction

Outfalls

- Outfalls may change in the EPSC stages
  - Existing
  - Intermediate
  - Final
- Roadway designer to provide for each EPSC stage:
  - Outfalls
  - Respective drainage area
  - Average slope of drainage area (Percent slopes)

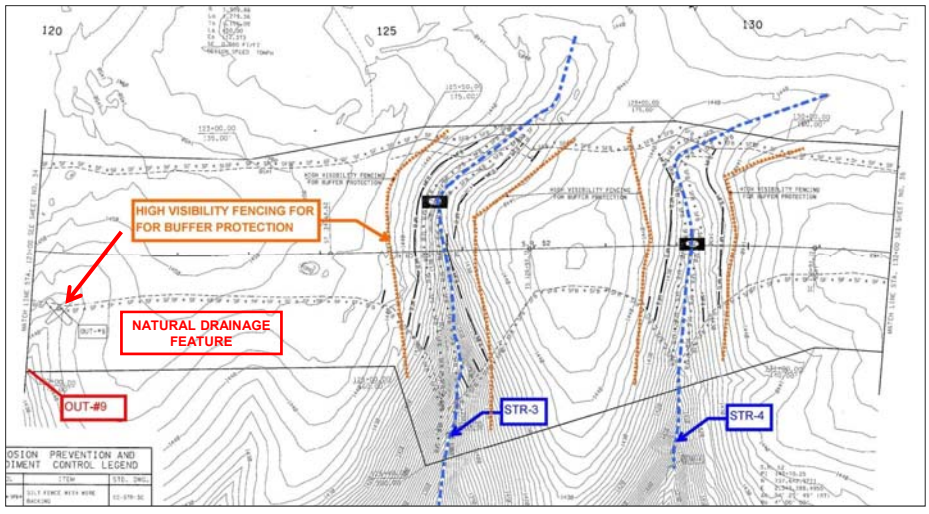
4.2.3 OUTFALL TABLE (3.5.1 d, 5.4.1.f)

EPSC STAGE	OUTFALL LABEL	SUB OUT-FALL	STATION	CL, LT OR RT	SLOPE WITHIN ROW (%)	STAGE 1 (P1) DRAINAGE AREA (AC)	STAGE 2 (P2) DRAINAGE AREA (AC)	STAGE 3 (P3) DRAINAGE AREA (AC)	SEDIMENT BASIN OR EQUIVALENT MEASURE(S) (YES, NO OR N/A)	RECEIVING NATURAL RESOURCE NAME OR LABEL	COMMENTS
1, 2, 3	1		10+000	LT	30	1.85	1.85	1.85	N/A	ROADSIDE DITCH	
1, 2, 3	2		9+090	RT	50	7.64	1.43	1.43	N/A	ROADSIDE DITCH	
2, 3	3		2+355 DRESSER RD	RT	2		0.32	0.32	N/A	ROADSIDE DITCH	
2, 3		3A	2+355 DRESSER RD	LT	3		0.27	0.27	N/A	ROADSIDE DITCH	CLOSED STORM DRAINAGE SYSTEM
1		3B	2+215 DRESSER RD	CL	2	0.02			N/A	ROADSIDE DITCH	CLOSED STORM DRAINAGE SYSTEM
1		3C	2+215 DRESSER RD	LT	2	0.07			N/A	ROADSIDE DITCH	CLOSED STORM DRAINAGE SYSTEM
2, 3		3D	2+205 DRESSER RD	LT	5		0.17	0.17	N/A	ROADSIDE DITCH	CLOSED STORM DRAINAGE SYSTEM
1		3E	2+200 DRESSER RD	LT	2	0.69			N/A	ROADSIDE DITCH	CLOSED STORM DRAINAGE SYSTEM
				RT	39	0.05	0.05	0.05	N/A	ROADSIDE DITCH	
				LT	2	0.20 (10.09)*			N/A	STR-1	TOTAL DRAINAGE AREA OF OUTFALL & SUB-OUTFALLS ONLY

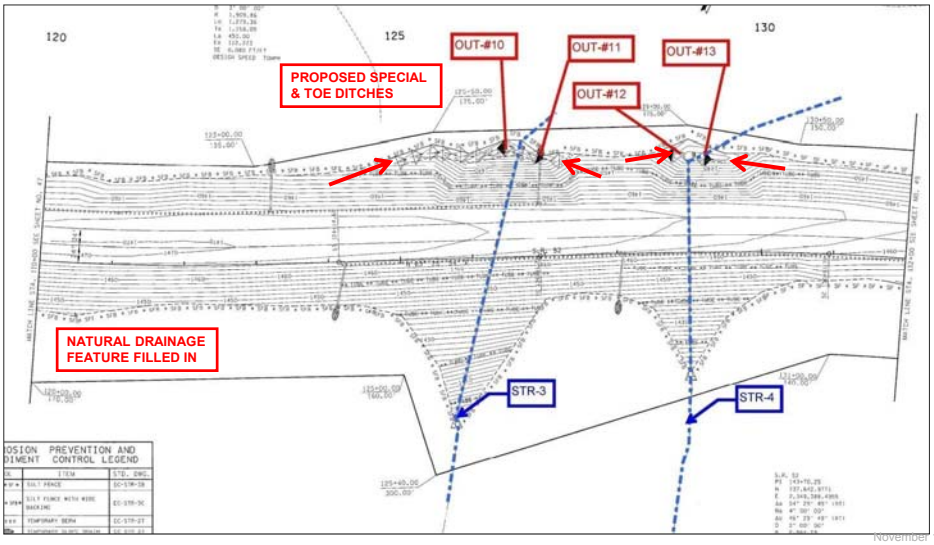
OUTFALL TABULATION

OUTFALL	AREA	SLOPE
1	1.12 AC.	3.5%
2	0.20 AC.	3.5%
3	0.18 AC.	2.6%
4	1.06 AC.	2.7%
4A	0.42 AC.	9.9%
4B	0.43 AC.	0.5%
5	3.83 AC.	2.2%
5A	0.08 AC.	2.4%
5B	0.06 AC.	2.7%
5C	0.21 AC.	0.6%

Outfall Location(s) - Present (existing) Conditions – Stage 1 EPSC



Outfall Location(s) – Proposed Conditions – Stage 2 EPSC



Outfall Location(s) – Proposed Conditions – Stage 2 EPSC

- Toe Ditch or Special Ditch
  - Formed where fill meets existing ground
  - Becomes a “v-ditch”
  - Steep slope
  - Concentrated flow
  - High velocities
  - Protection needed
    - During construction
    - Post construction

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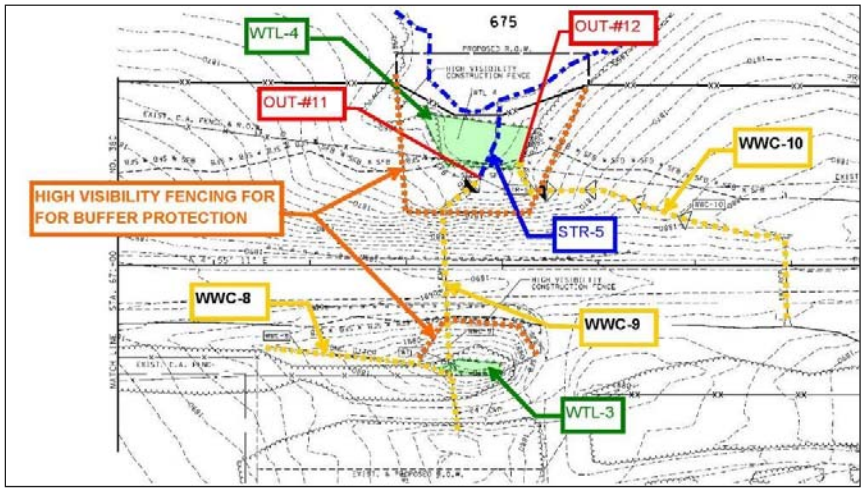

Outfall Locations

Present (existing) Conditions

Stage 1 EPSC

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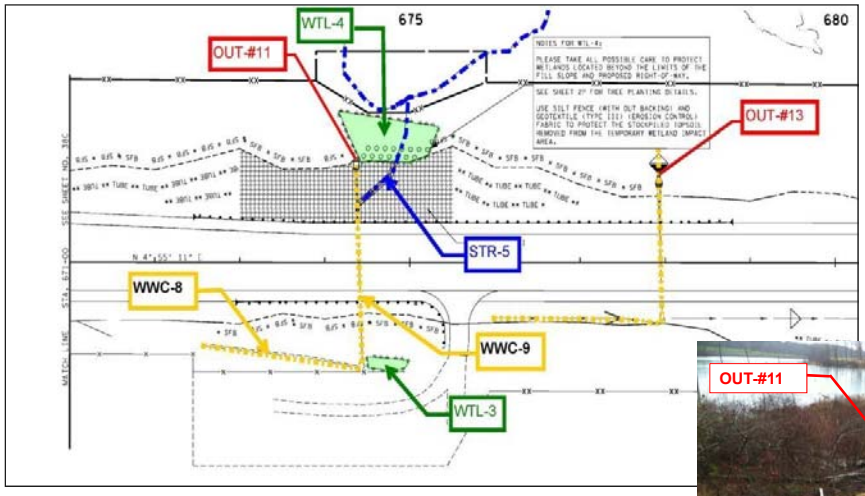
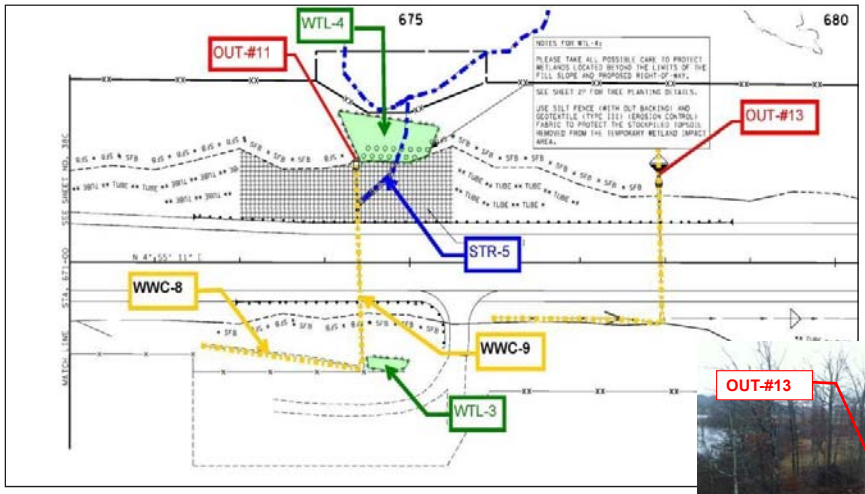


Outfall Locations

Proposed Conditions

Stage 2/3 EPSC

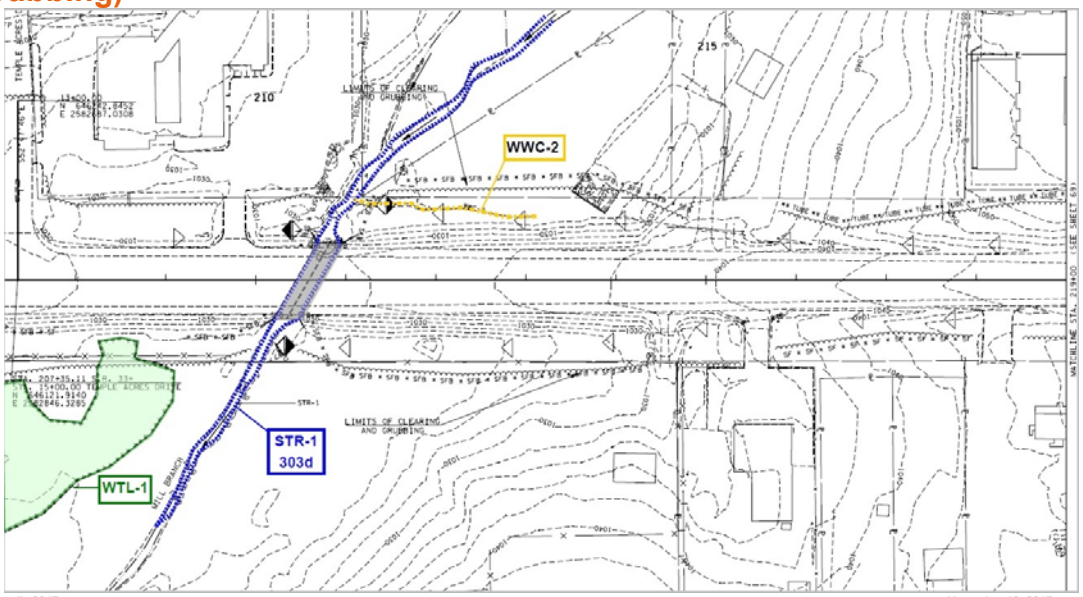


Outfall Locations

Proposed Conditions

Stage 2/3 EPSC

Outfall Locations – Stage 1 EPSC (Clearing & Grubbing)



Outfall Locations – Stage 2 EPSC (Intermediate - Mass Grading)

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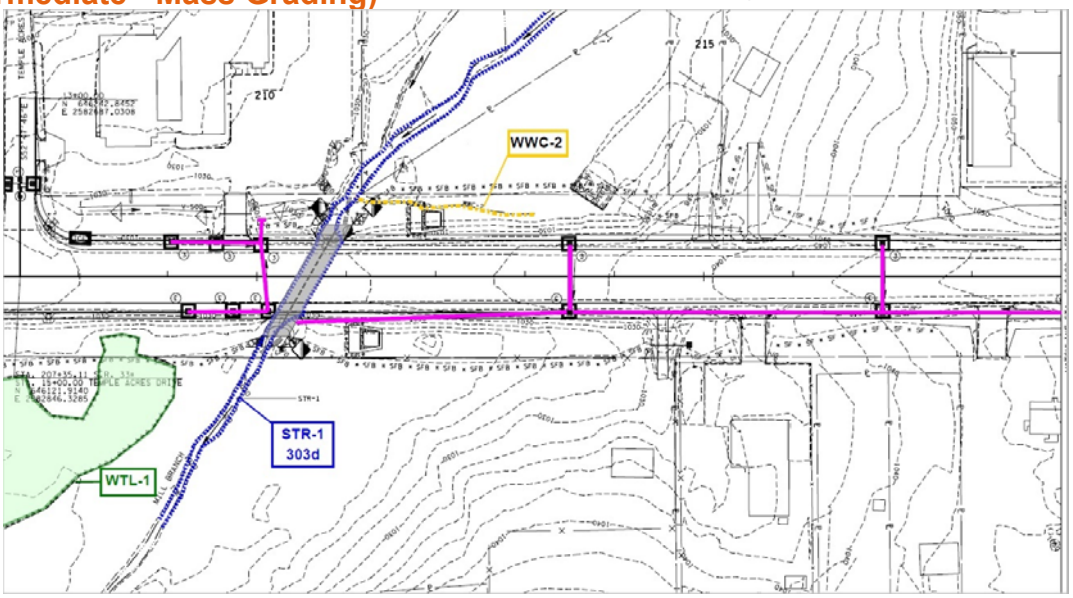

Outfall Locations – Stage 3 EPSC (Final Grading)

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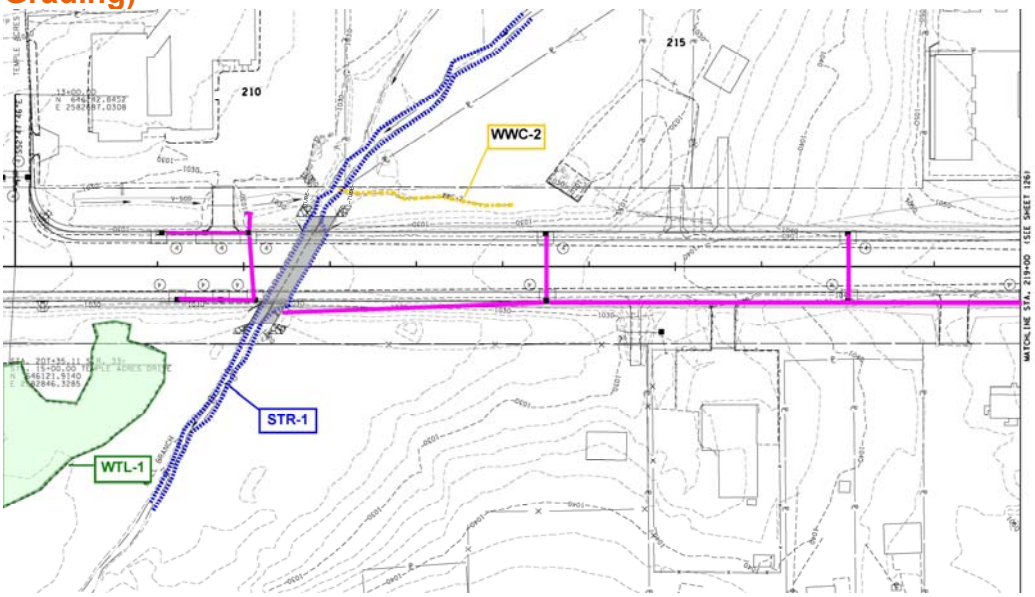
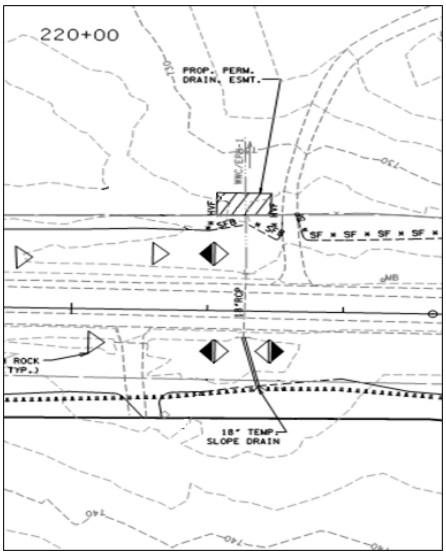
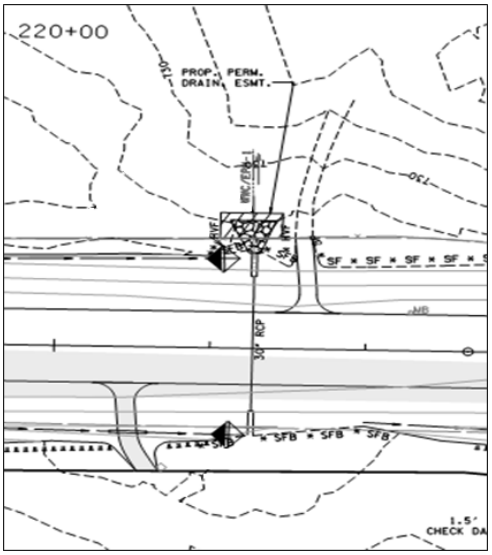


Outfall Locations – Stage 1/2





Questions?

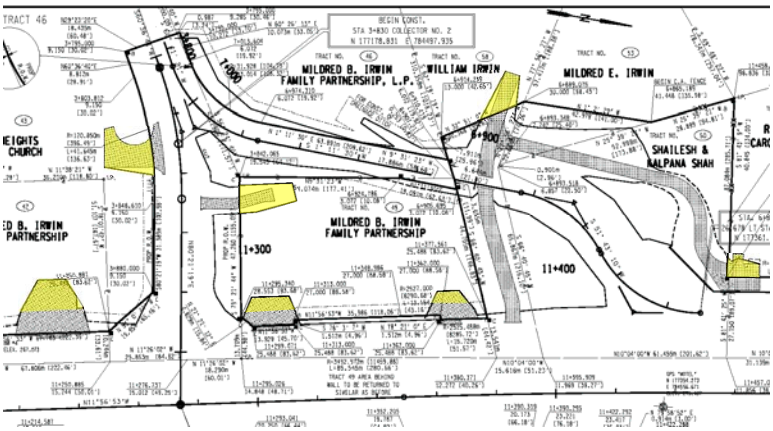
TDOT Roadway Design Division

Module 5:

Project Area and Disturbed Area

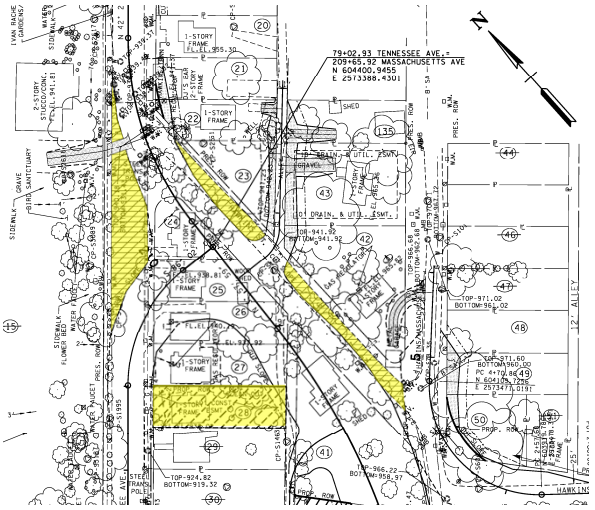
Project Area

- Includes all areas within the project limits:
  - Existing and Proposed project ROW
  - Easements (slope, construction, permanent drainage, etc.)
  - Driveways
- Required by the CGP



Disturbed Area

- Area to be cleared, graded or excavated during the life of the project
- Includes utility locations
- CGP requires limits of disturbance to be clearly marked on the plans and in the field
  - cut and fill lines
  - roadways to be abandoned, seeded & scarified
  - Buildings, bridges, and other structures to be removed
  - slope easements
  - construction easements
  - drainage easements
  - driveways



Disturbed Area

- Determines minimum number of EPSC stages required
- Determines the CGP Permit Fee
- Determines sediment storage needed
- To be provided by the roadway designer
- To be checked by the SWPPP developer

DISTURBED AREA		
IN BETWEEN SLOPE LINES	44.09	(AC)
15 FOOT WIDE STRIP (OUTSIDE SLOPE LINES)	5.65	(AC)
TOTAL DISTURBED AREA	49.74	(AC)

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SWPPP Input

- Both values required for SWPPP

2. **SITE DESCRIPTION** (3.5.1)

2.1. PROJECT LIMITS (3.5.1.h): REFER TO TITLE SHEET

2.2. PROJECT DESCRIPTION (3.5.1.a):

TITLE: SR-73 (US-321), FROM SIMPSON ROAD EAST TO NORTH OF SR-2 (US-11) IN LENOIR CITY
COUNTY: LOUDON
PIN: 103899.00

2.3. SITE MAP(S) (2.6.2.): REFER TO TITLE SHEET

2.4. DESCRIPTION OF EXISTING SITE TOPOGRAPHY (3.5.1.d): REFER TO EXISTING CONTOURS SHEET(S) 19-24, USGS QUAD MAP, AND THE OUTFALL TABLE IN SECTION 4.3.

2.5. MAJOR SOIL DISTURBING ACTIVITIES (3.5.1.b) (CHECK ALL THAT APPLY):

- ☒ CLEARING AND GRUBBING
- ☒ EXCAVATION
- ☒ CUTTING AND FILLING
- ☒ FINAL GRADING AND SHAPING
- ☒ UTILITIES
- ☐ OTHER (DESCRIBE):

2.6. TOTAL PROJECT AREA (3.5.1.c): 27.3 ACRES

2.7. TOTAL AREA TO BE DISTURBED (3.5.1.c): 13.2 ACRES

2.8. NO MORE THAN 50 ACRES OF ACTIVE SOIL DISTURBANCE IS ALLOWED AT ANY TIME DURING THE CONSTRUCTION OF THE PROJECT

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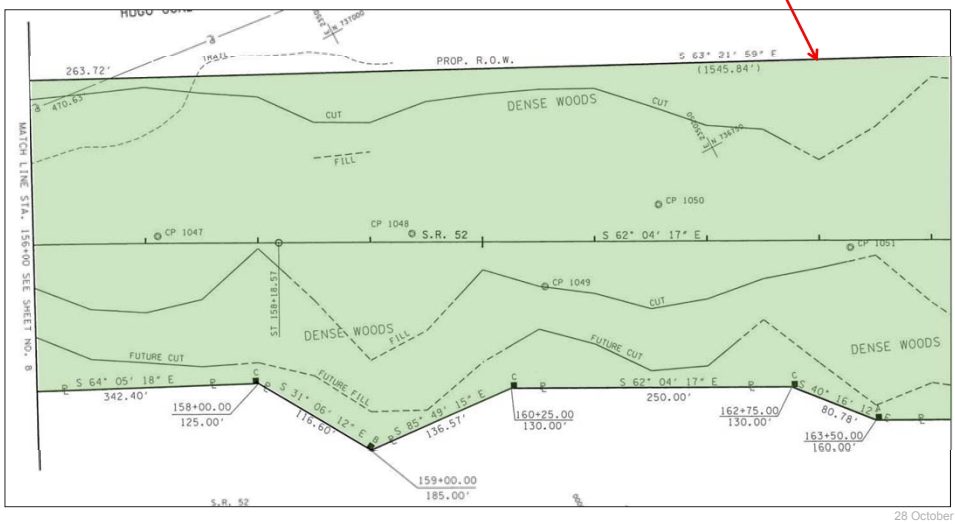
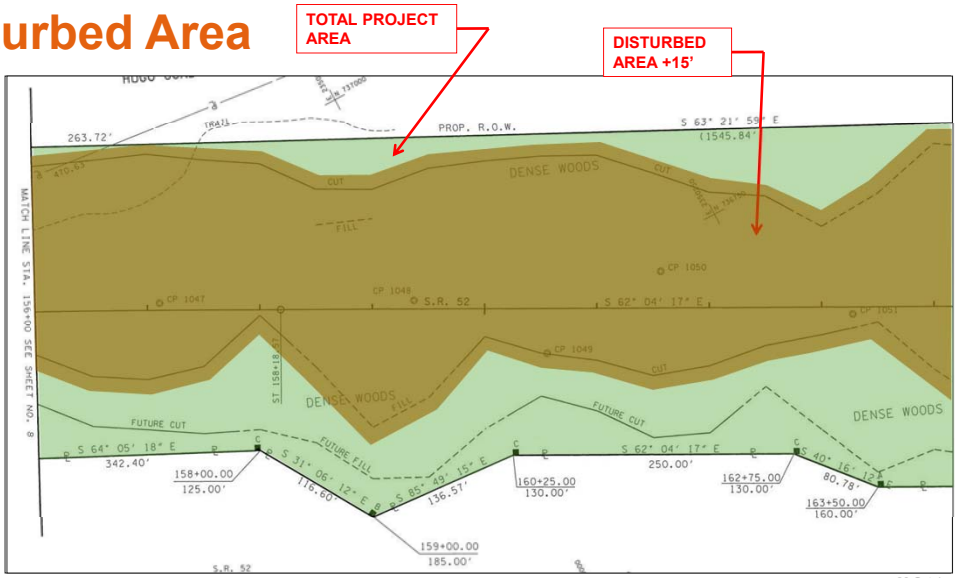
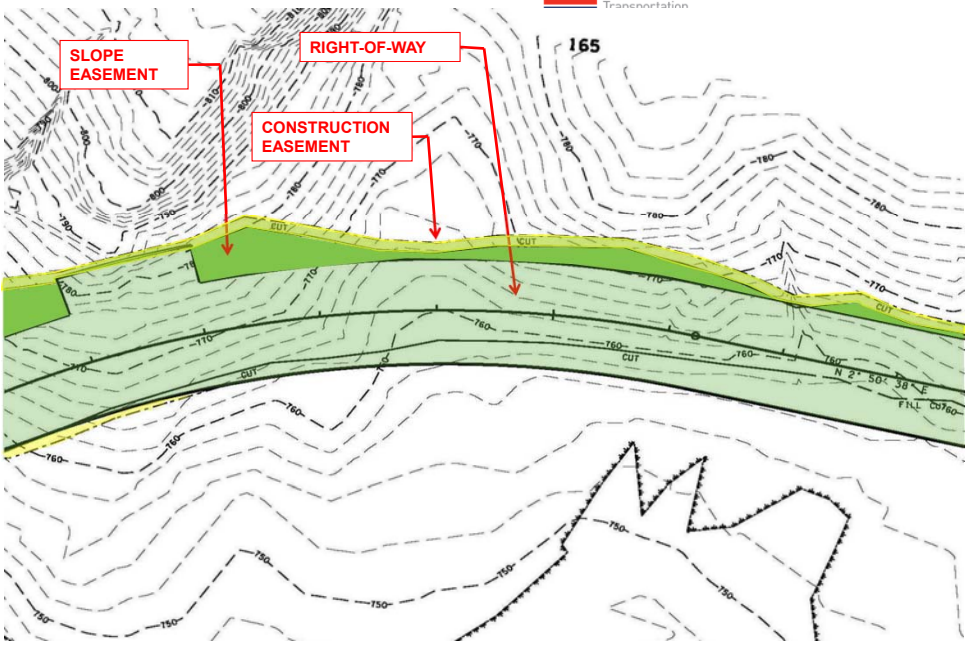
Total Project Area



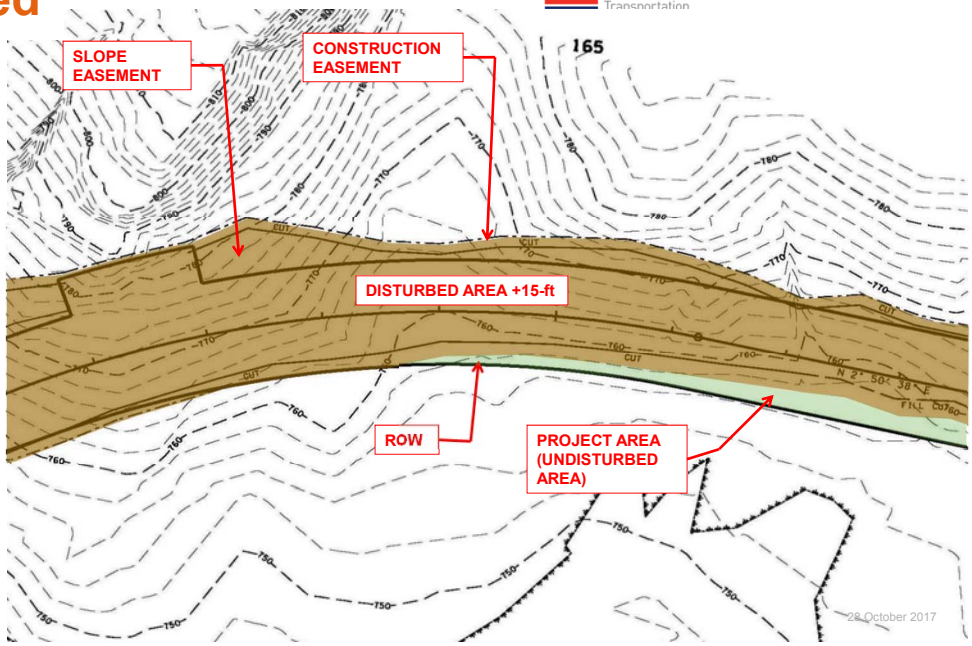
Disturbed Area



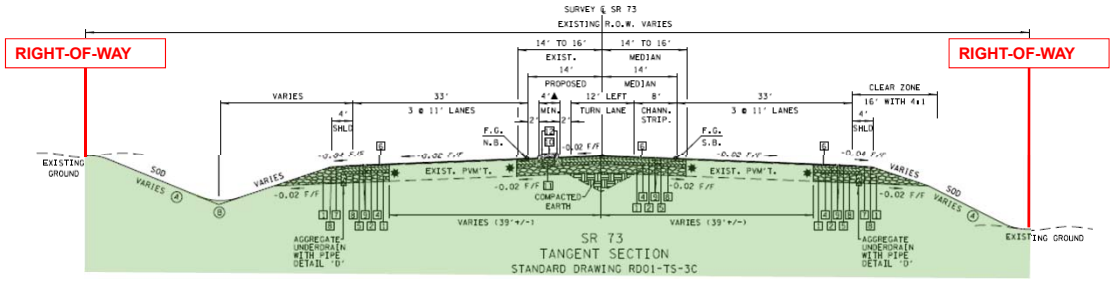
Total Project Area



Disturbed Area



Total Project Area



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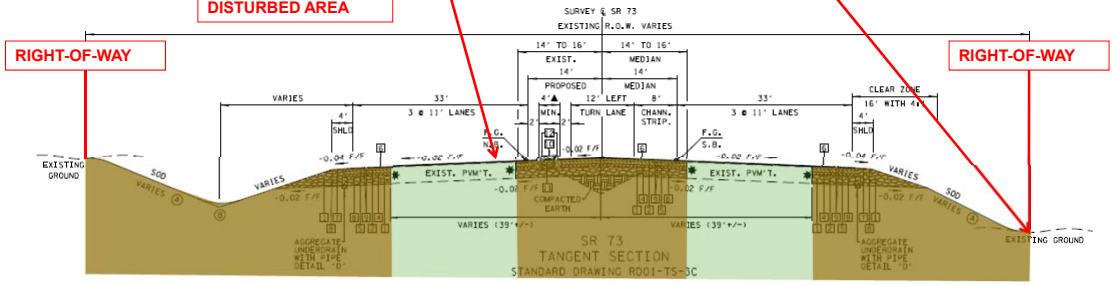
Disturbed Area

OVERLAY AREAS DO NOT EXPOSE GROUND AND ARE NOT CONSIDERED IN DISTURBED AREA

URBAN PROJECT - WORK DOES NOT EXTEND PAST EXISTING ROW IN THIS EXAMPLE.

RIGHT-OF-WAY

RIGHT-OF-WAY



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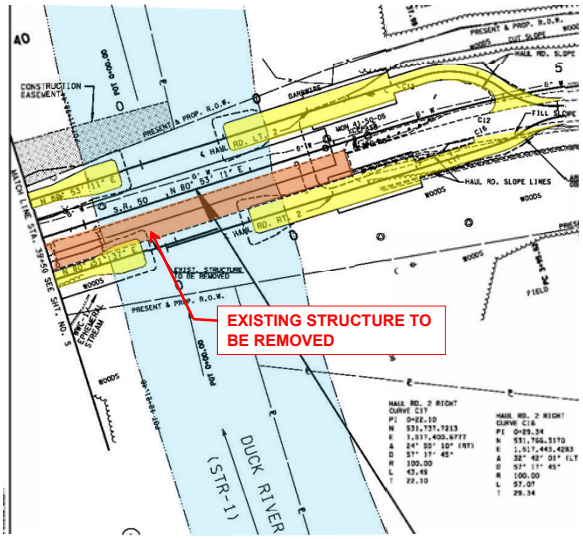
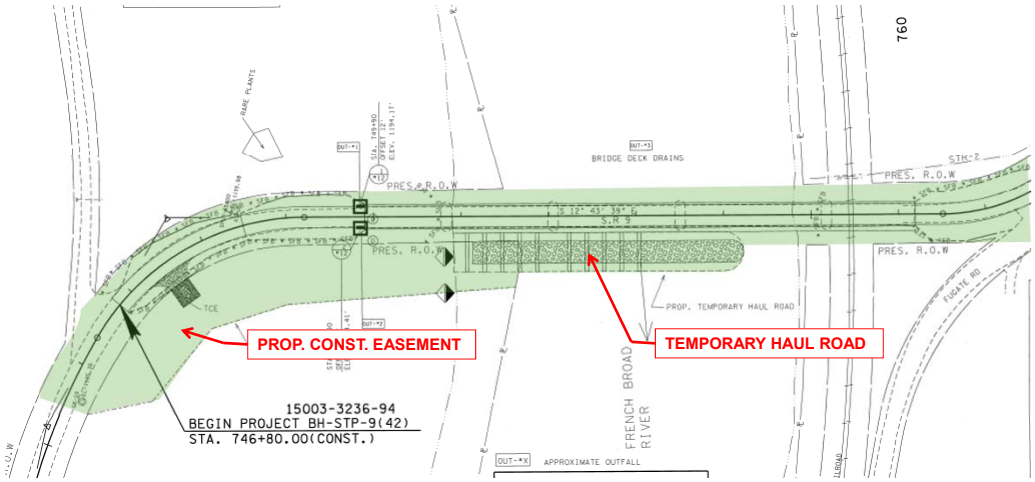
Bridge Projects Disturbed Area

- Removal of existing structures
  - Increases disturbed area
  - May require access (haul roads, jetties, etc.)
  - Permanent stabilization should be noted
  - Stream disturbance requires permitting
- Omissions could cause
  - Overrun of quantities
  - Change orders
  - Project delays



Bridge Projects Disturbed Area

Total Project Area



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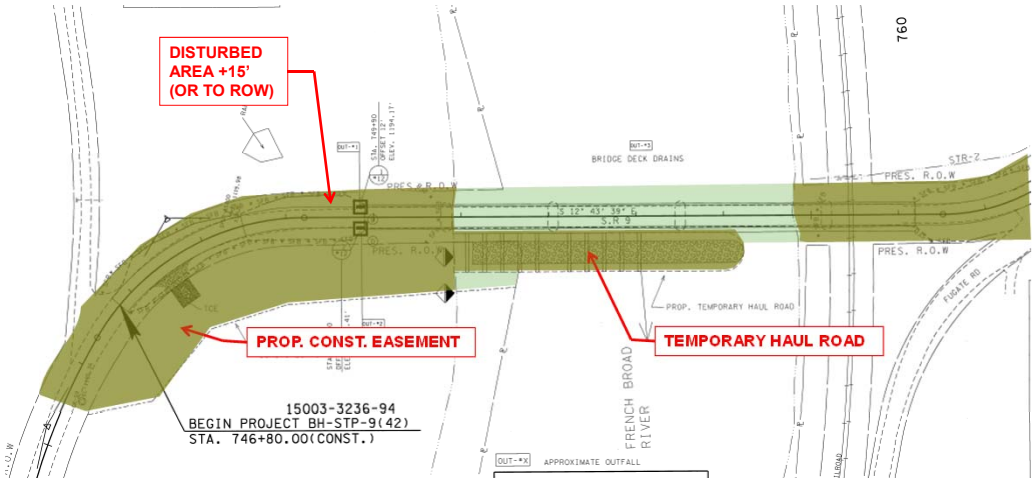
Disturbed Area



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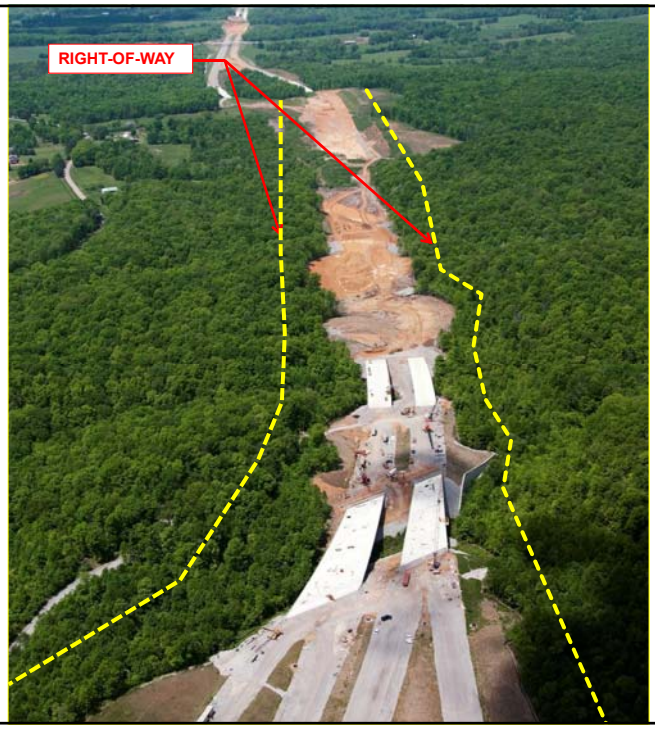
Bridge Projects Disturbed Area

- Have you included the existing bridge removal area?
- Have you included EPSC items and quantities to stabilize the existing bridge area once it's removed?
- What about during construction? Are there additional measures needed?



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Total Project Area vs. Disturbed Area

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- Have you thought about how large is your disturbed area?
- What if the entire project area was disturbed at one time?

Clearing Limits

- Limits of Disturbance + 15-feet
- Prevents unnecessary clearing
- Less disturbed area =
  - Reduced active (in place) EPSC measures
  - Reduced construction costs
  - Reduced risk of sediment releases and potential NOVs

Special Notes

- Be creative
  - specify sequence of clearing and grubbing
- Protect environmental sensitive areas
  - chip and use existing wood/debris for mulch
- Add as a footnote
  - Pay Item 201-01

ESTIMATED ROADWAY QUANTITIES

	ITEM NO.	DESCRIPTION	UNIT	ROANE QUANTITY	MORGAN QUANTITY	TOTAL QUANTITY
	105-01	CONSTRUCTION STAKES, LINES AND GRADES	LS	0.4	0.6	1
2	201-01	CLEARING AND GRUBBING	LS	0.4	0.6	1

FOOTNOTES

2. SEE SPECIAL NOTES REGARDING CLEARING AND GRUBBING ON SHEET 2X.

Special Notes

CLEARING AND GRUBBING

(5) CLEARING OPERATIONS FOR THE ENTIRE PROJECT SHALL INCLUDE THE CHIPPING/MULCHING OF TREES AND VEGETATION (EXCLUDING TREES AND VEGETATION USED TO CONSTRUCT BRUSH BARRIERS) AND THE SPREADING/BLOWING OF WOOD MULCH OVER THE CLEARED AREA(S) AT A DEPTH OF 3-INCHES (MIN.) FOR TEMPORARY STABILIZATION. THE COST FOR REMOBILIZATION, CHIPPING/MULCHING AND SPREADING/BLOWING OF WOOD MULCH IS TO BE INCLUDED IN THE COST OF PAY ITEM 201-01.

(6) IN AREAS OF THE PROJECT SITE THAT CONTAIN BENCH CUTS AND ASSOCIATED SLOPES, THE CONTRACTOR SHALL NOT CLEAR THE ENTIRE BENCH CUT SLOPE AREA AT ONE TIME. CLEARING SHALL BE STAGED AND LIMITED TO THE CONSTRUCTION OF ACCESS AND HAUL ROADS AND THE AREA REQUIRED TO CONSTRUCT THREE (3) BENCH CUTS AT A TIME. ONCE A BENCH CUT AND ASSOCIATED SLOPE ARE STABILIZED ADDITIONAL AREA MAY BE CLEARED FOR THE NEXT BENCH CUT. BRUSH BARRIERS SHALL BE CONSTRUCTED BELOW EACH CLEARED BENCH CONSTRUCTION AREA AND IN LOCATIONS DEPICTED ON THE EPSC PLANS. BRUSH BARRIERS AND/OR OTHER SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED PER DETAIL "F" LOCATED ON SHEET 81A AND SUPPLEMENTED AS NEEDED WITH ADDITIONAL BRUSH BARRIERS OR OTHER EPSC MEASURES. ONCE A BENCH CUT AND ASSOCIATED SLOPE IS CONSTRUCTED AND STABILIZED THEN ADDITIONAL AREA(S) CAN BE CLEARED.

Questions?

TDOT Roadway Design Division

Module 6:

Buffer Zone Requirements

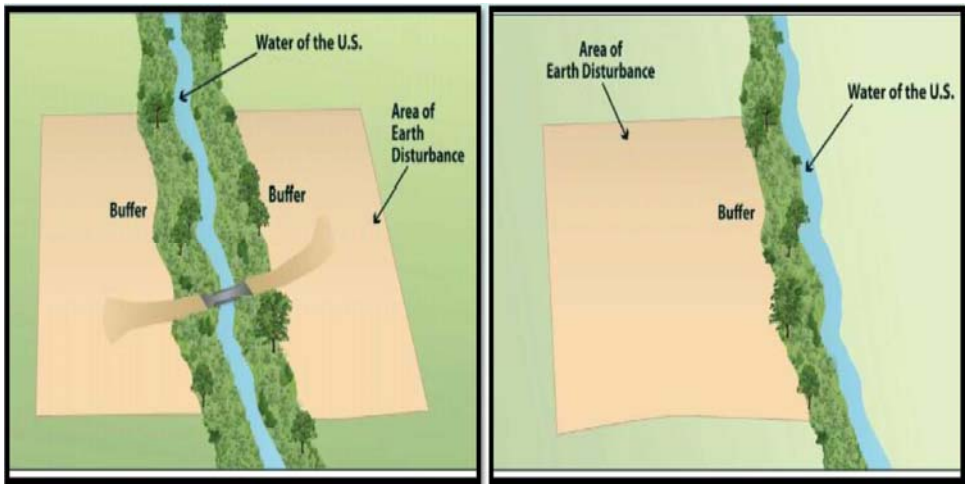
Buffer Zones

- A strip of dense undisturbed native vegetation, original or re-established that borders:
  - streams and rivers
  - ponds and lakes
  - wetlands and seeps

Buffer Zones

- NOT primary sediment control structures
- Purpose of buffer:
  - Slow water runoff
  - Enhance water infiltration
  - Minimize risk of sediment, nutrients and other pollutants travelling downstream
- Stormwater should enter buffer zone as sheet flow.

Buffer Zones



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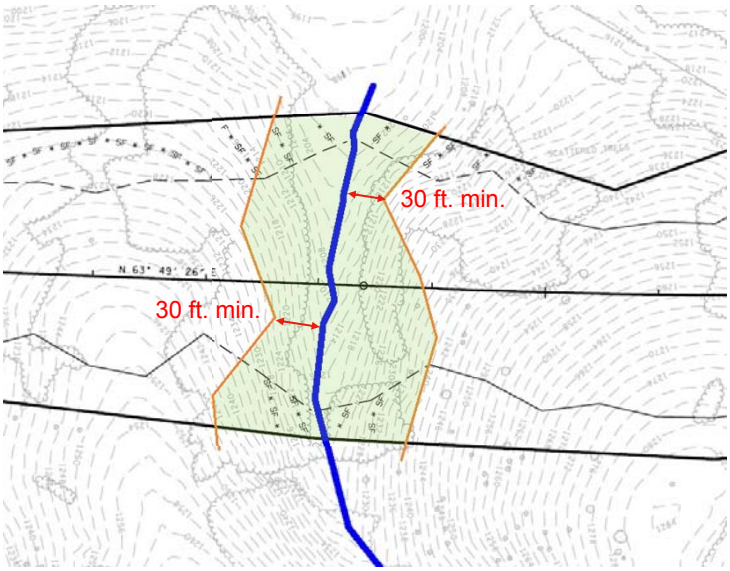
Buffer Zones

- Impaired and Exceptional TN Waters
  - Minimum width of 30-feet



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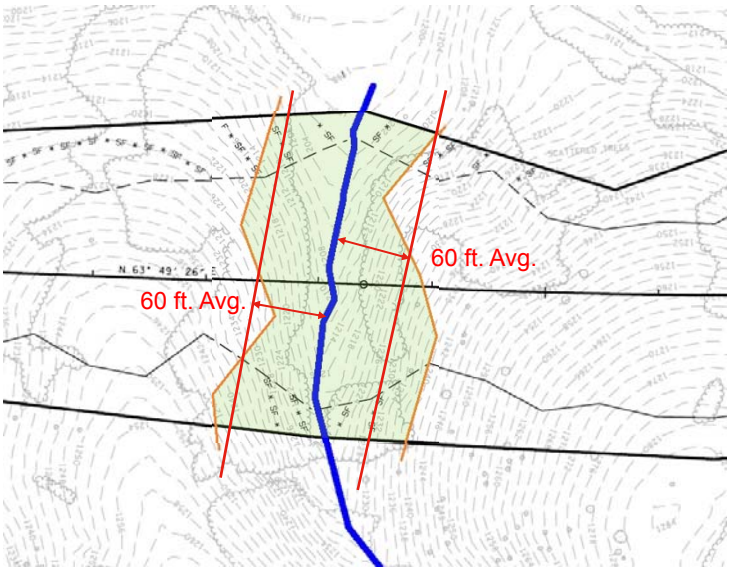
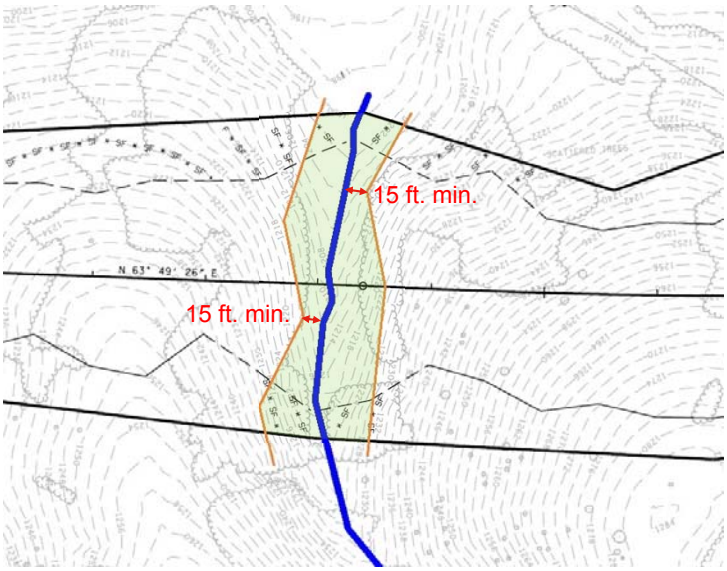
Buffer Zones

- Impaired and Exceptional TN Waters
  - Minimum width of 30-feet
  - Average width of 60-feet



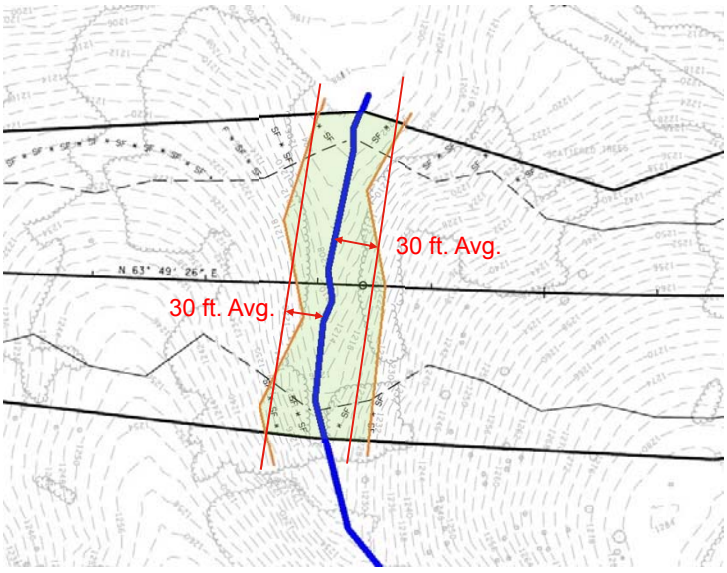
Buffer Zones

- All Other Streams
  - Minimum width of 15-feet



Buffer Zones

- All Other Streams
  - Minimum width of 15-feet
  - Average width of 30-feet



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Buffer Zone Field Examples

- High visibility fence identifying clearing limits around exceptional Tennessee waters (ETW) prior to bridge construction

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Buffer Zone Field Examples

- High visibility fence identifying clearing limits around exceptional Tennessee waters (ETW) during bridge construction

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Buffer Zone Field Examples

- High visibility fence
- Vegetative buffer left in place during bridge construction

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Buffer Zone Field Examples

- Vegetated buffer and equivalent measures adjacent to a spring

Buffer Zone Field Examples

- High visibility fencing (HVF) identifying clearing limits and buffer zone adjacent to a wetland

Buffer Zones Exemptions

- Valid ARAP or equivalent federal permit
- Existing land use exemptions:
  - Buildings
  - Parking lots
  - Roadways
  - Utilities
  - On Site Sanitary Sewer System
- TDOT sites pre-approved with ROW finalized before February 1, 2010

Buffer Zone Equivalent Measures

- If buffer requirements cannot be achieved:
  - Partial Buffer Reduction
    - ✓ Provide a narrower buffer that is supplemented by additional sediment and erosion controls, achieving an equivalent sediment load reduction as the designated buffer
  - Entire Buffer Reduction
    - ✓ If infeasible to provide a buffer of any size, implement sediment and erosion controls that achieve an equivalent sediment load reduction as the designated buffer

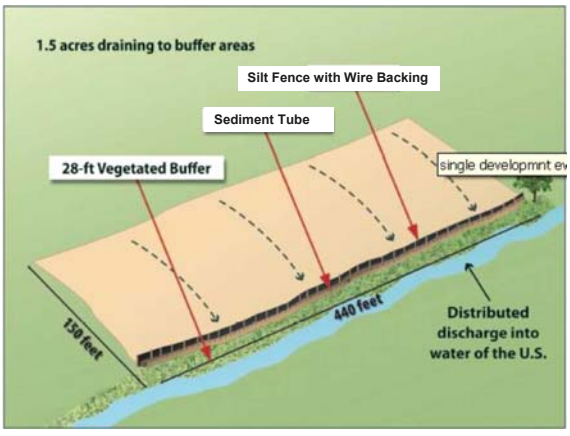
Buffer Zone Equivalent Measures

- Step 1.

  Estimate sediment reduction from designated buffer.
- Step 2.

  Design EPSC measures that matches sediment removal efficiency of designated buffer.
- Step 3.

  Document how site-specific EPSC controls will achieve sediment removal efficiency of the designated buffer.



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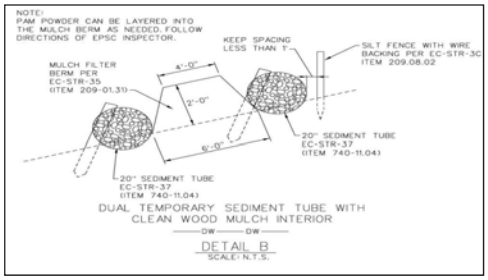
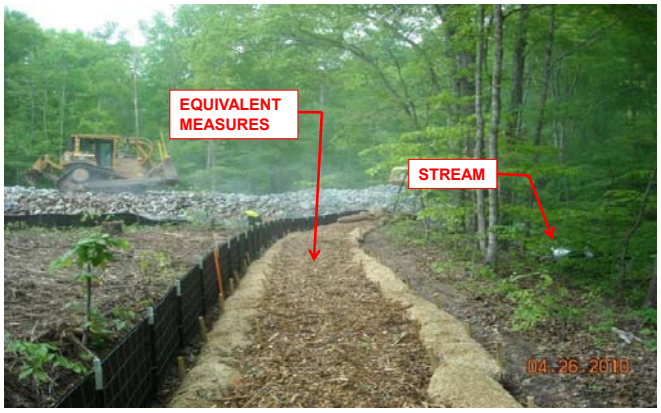
Equivalent Buffer Measure Example

- Silt fence with backing
- Dual temporary sediment tubes with mulch filter berm





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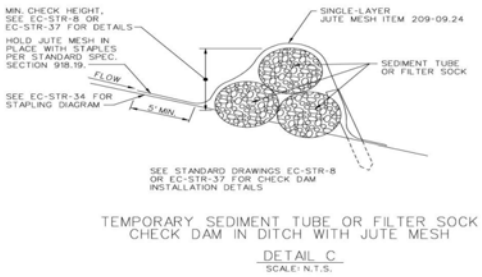
Equivalent Buffer Measure Example

- Silt fence with backing
- Single temporary sediment tube with mulch filter berm

Equivalent Buffer Measure Example

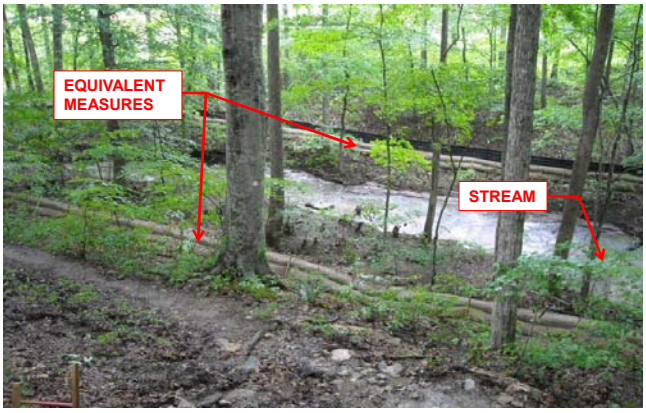
- Silt fence with backing triple stacked sediment tubes and jute mesh



TEMPORARY SEDIMENT TUBE OR FILTER SOCK CHECK DAM IN DITCH WITH JUTE MESH

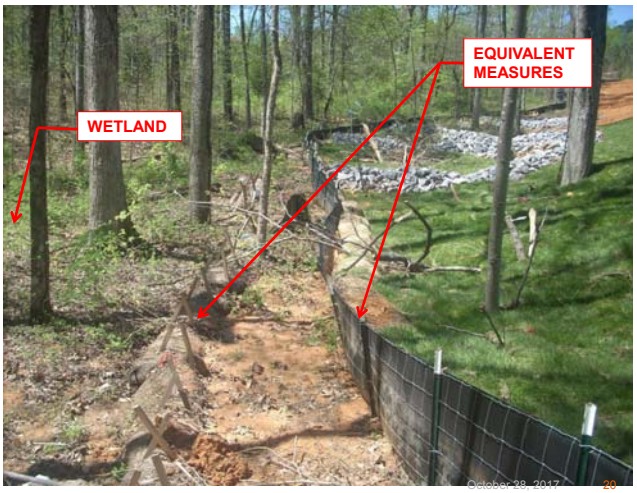
DETAIL C

SCALE: N.T.S.



Equivalent Buffer Measure Example

- Sediment tubes on both sides of silt fence with backing



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Equivalent Buffer Measure Example

- Silt fence with wire backing alone may not be an acceptable equivalent measure.

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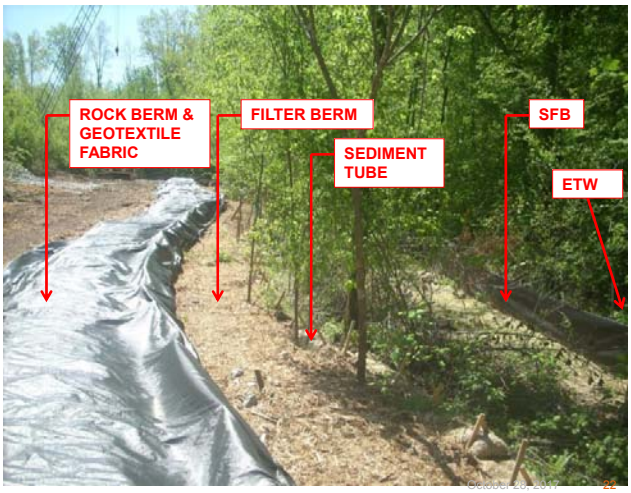
Equivalent Buffer Measure Example

- Silt fence with backing
- Sediment tubes with filter berm
- Rock berm overlain with geotextile fabric



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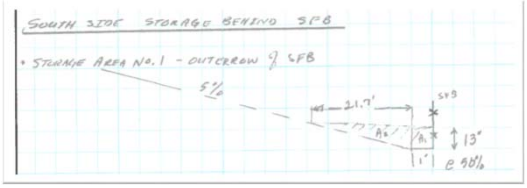
Equivalent Buffer Measure Justification

- Determine sediment yield/loss from construction area
- Size/space measures to offset sediment yield/loss, providing storage as needed
- RUSLE (Equation 10-1)



The RUSLE is written as:

$$A = (R)(K)(LS)(C)(P) \qquad (10\text{-}1)$$

Where:

A = average annual soil loss, tons per acre per year
R = rainfall-runoff erosivity factor, hundreds of foot-ton (force)-inch per acre-hour-year
K = soil erodibility factor, ton-acre-hour per hundreds of acre-foot-ton (force)-inch
LS = topographic factor, dimensionless
L = slope length factor, dimensionless
S = slope steepness factor, dimensionless
C = cover management factor, dimensionless
P = support practice factor, dimensionless

Therefore the ESC measures will work for a 5yr storm event. (equivalent)

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Questions?

TDOT Roadway Design Division

Module 7:

Commonly Used EPSC Measures

Erosion and Sediment Control Design

- Where do you put the measure in play and practice?
- When should a particular measure be used?
- What are some limitations in practice?

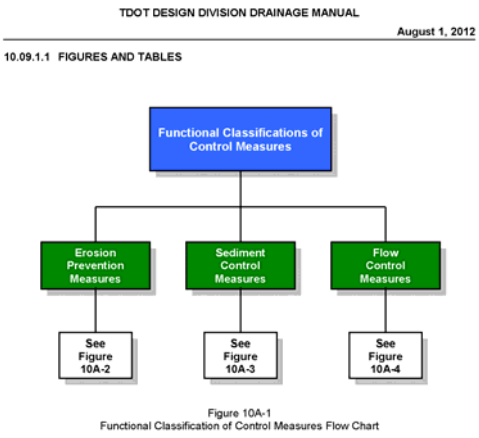

Figure 10A-1
Functional Classification of Control Measures Flow Chart

Erosion and Sediment Control Design

- TDOT Drainage Manual
  - Chapter 10 EPSC
  - Appendix 10A Decision Tables
    - Erosion Prevention Measures
    - Sediment Control Measures

EROSION PREVENTION MEASURES (Page 1 of 4)

Functional Classification of Control Measures: Erosion Prevention Measures | Sediment Control Measures | Flow Control Measures

BMP NAME	DESCRIPTION AND USES	Where: Road Cuts / Fills	Where: Graded Areas	Where: Ditches / Swales	Life: Temporary	Life: Permanent	Type: Vegetative	Type: Structural	Type: Other
Enhanced Silt Fence Check	• Used for reducing velocity of flow in channels • Performs by both settlement and by filtration • Trapezoidal or V-ditches • Section 10.08.1.1 & EC-STR-3D, 4, 4A			•	•			•	
Rock Check Dam	• Used for reducing velocity of flow in channels • Little, if any, sediment trapping capabilities • Maximum drainage area is 10 acres • Section 10.08.1.2 & EC-STR-6			•	•			•	

SEDIMENT CONTROL MEASURES (Page 1 of 3)

Functional Classification of Control Measures: Erosion Prevention Measures | Sediment Control Measures | Flow Control Measures

BMP NAME	DESCRIPTION AND USES	Where: Road Cuts / Fills	Where: Graded Areas	Where: Ditches / Swales	Life: Temporary	Life: Permanent	Type: Vegetative	Type: Structural	Type: Other
Dewatering Structure	• Temporarily holds runoff to allow sediments to drop out; can also filter sediments • Most often used for pumped effluent from dewatering operations at watercourse • Section 10.08.2.1 & EC-STR-1				•			•	
Sediment Filter Bag	• Sediment trapping device used for pumped effluent from dewatering operations • Geotextile bag retains large sediments while allowing filtered water to pass through • Section 10.08.2.2 & EC-STR-2				•			•	
Silt Fence	• Sheet flow only. Installed on contour • Woven geotextile fabric on wood or metal posts, trenched into the ground. • Max ¼th acre of area per 100 LF of fence • Ponds water to allow sediments to settle out • Section 10.08.2.3 & EC-STR-3B & 3E	•	•		•			•	
Silt Fence with Wire Backing	• Sheet flow only. Installed on contour • Includes a woven wire fence backing • Used adjacent to a water course or body • Ponds water to allow sediments to settle out • Section 10.08.2.4 & EC-STR-3C & 3E	•	•		•			•	

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Erosion and Sediment Control Design

- Sediment Removal
  - Required as a separate pay item for several EPSC Items
  - Calculated for entire project based on disturbed area. Calculation equations found in Chapter 10.

Related Item Numbers

ITEM NO.	U/M	DESCRIPTION	REMARKS
209-03.20	L.F.	FILTER SOCK (8 INCH)	
209-03.21	L.F.	FILTER SOCK (12 INCH)	
209-03.22	L.F.	FILTER SOCK (18 INCH)	
209-03.23	L.F.	FILTER SOCK (24 INCH)	
209-05	C.Y.	SEDIMENT REMOVAL	
209-08.09	EACH	FILTER SOCK CHECK DAM	

(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.

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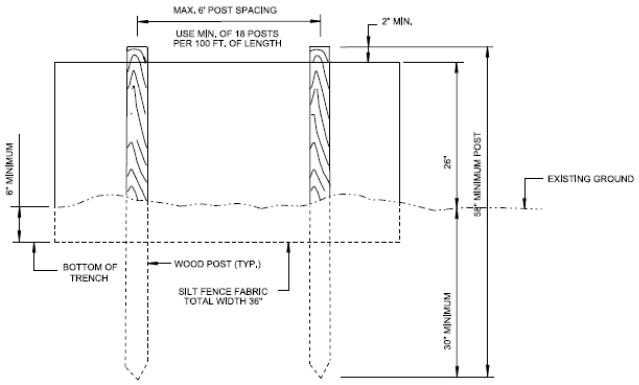
Slope Devices – Silt Fence

- Applications:
  - Sheet flow
  - Capture small amounts of sediment
  - Reduce velocity from sheet flow
- Drainage area
  - ¼ acre per 100 linear feet
  - 2 ac. max.
- TDOT Std. Dwg. EC-STR-3B
- Pay Item No.: 209-08.03 (LF)
  - Include replacement quantities and sediment removal (Chapter 10)



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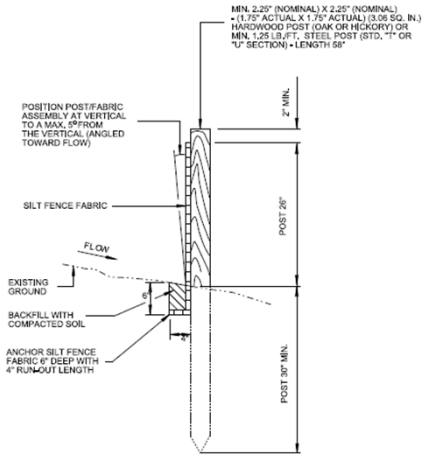
Slope Devices – Silt Fence

- Design layout:
  - Toe of slopes (with 5-7 feet buffer)
  - Along exposed slopes (parallel to contour)
  - Perimeter of construction site
  - Perimeter of soil stockpile
  - Banks of ditches or swales



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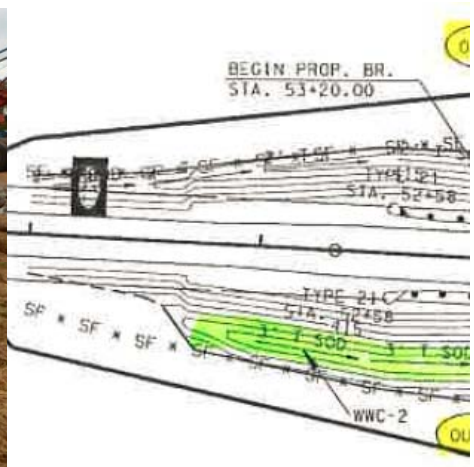
Slope Devices – Silt Fence

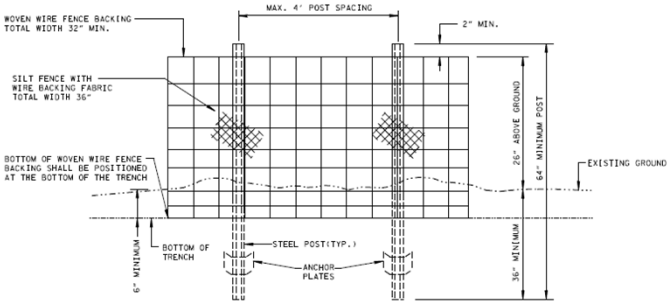


TN TDOT Department of Transportation ARCADIS Design & Consultancy for natural and built assets

Slope Devices – Silt Fence

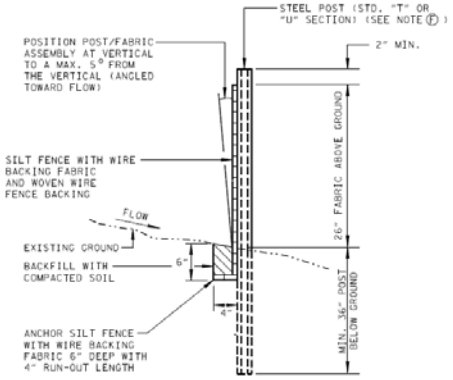
Slope Devices – Silt Fence with Wire Backing

- Applications:
  - Sheet flow
  - Capture small amounts of sediment
  - Reduce velocity from sheet flow
- Drainage area
  - 1 acre per 150 linear feet
- TDOT Std. Dwg. EC-STR-3C
- Pay Item No.: 209-08.02 (LF)
  - Include replacement quantities and sediment removal

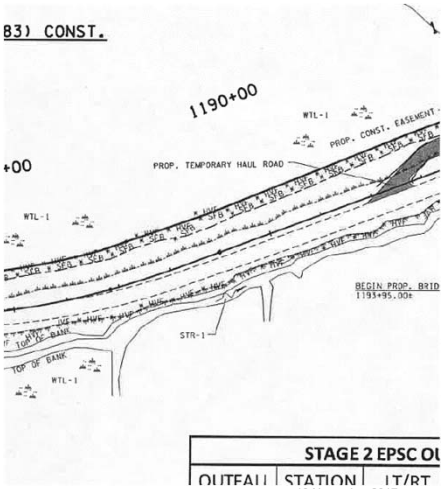


Slope Devices – Silt Fence with Wire Backing

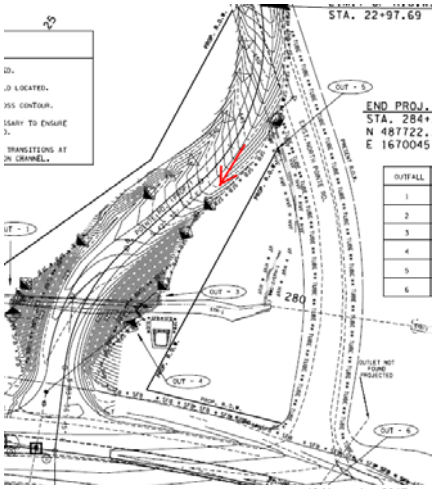
- Design layout:
  - Toe of large and/or steep fill slopes
  - Adjacent to:
    - ✓ Streams/Springs
    - ✓ Wetlands
    - ✓ Ponds
    - ✓ WWCs and ephemeral streams



Slope Devices – Silt Fence with Wire Backing



Slope Devices – Silt Fence with Wire Backing



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Slope Devices – Silt Fence with Wire Backing

- Protecting natural resources

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Slope Devices – Silt Fence with Wire Backing

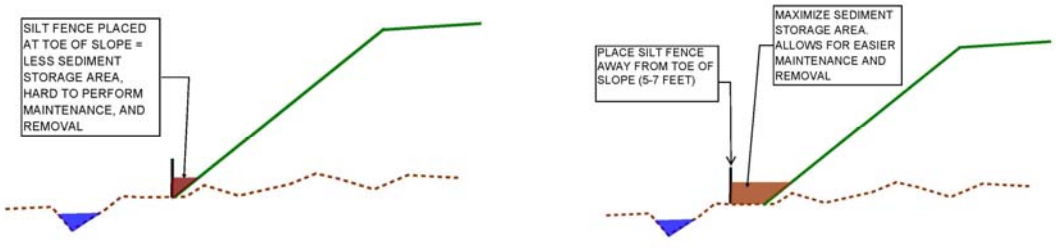
- Protecting steep slopes

Slope Devices – Silt Fence (with Wire Backing)

- Design layout:
  - Not a “cure all” – ROW and/or clearing limits do not need completely lined
  - Ensure enough ROW or construction easements are provided for sediment storage and maintenance
  - Place on contour to maximum extent practicable
  - Use J Hooks as needed
  - DO NOT USE ACROSS CONCENTRATED FLOW PATHS
  - INCLUDE OUTLETS AT LOW POINTS

Slope Devices – Silt Fence (with Wire Backing)

- Design layout:
  - Provide sufficient storage space at toe of slope

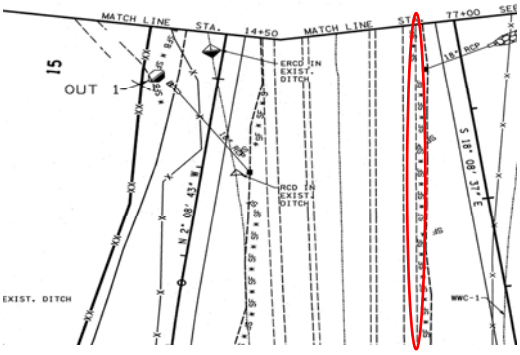


Slope Devices – Silt Fence (with Wire Backing)

- Design layout:
  - Provide sufficient buffer at toe of slope

Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Silt fence placed on top of slope with minimal drainage area
    - Ponding water onto roadways



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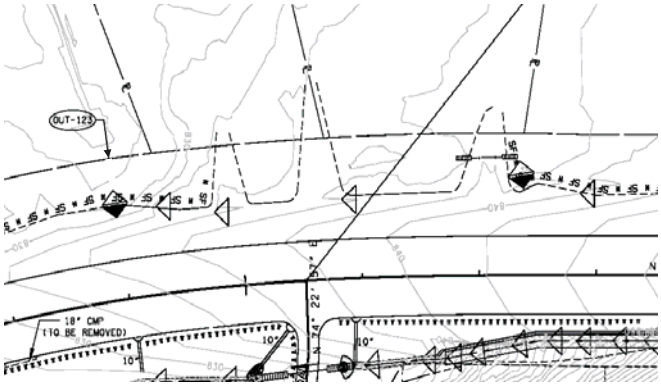
Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Low Points Along SF
  - Pipe outlet protection
- Outlet needed at low points (outfalls)
  - Rock or enhanced rock check dams
  - Sediment tube check dam
- Failures will occur
  - Overtopping
  - Sediment loss
  - Potential for NOV



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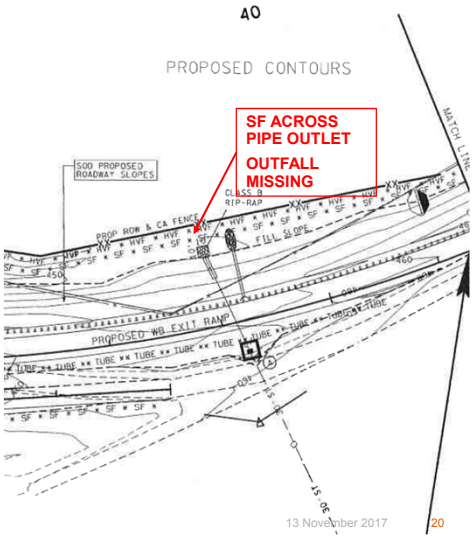
Slope Devices – Silt Fence (with Wire Backing)



Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Failures at low points

Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Silt fence placed along concentrated flow paths or within streams

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Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Silt fence placed along concentrated flow paths or streams

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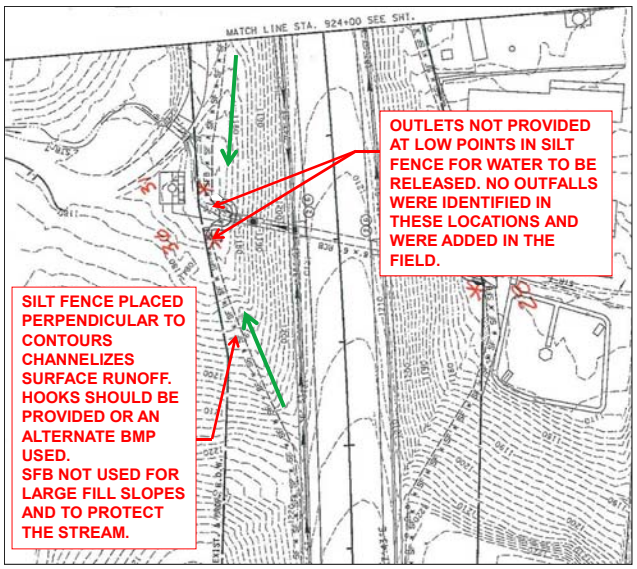
Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - Silt fence used for culvert outlet protection

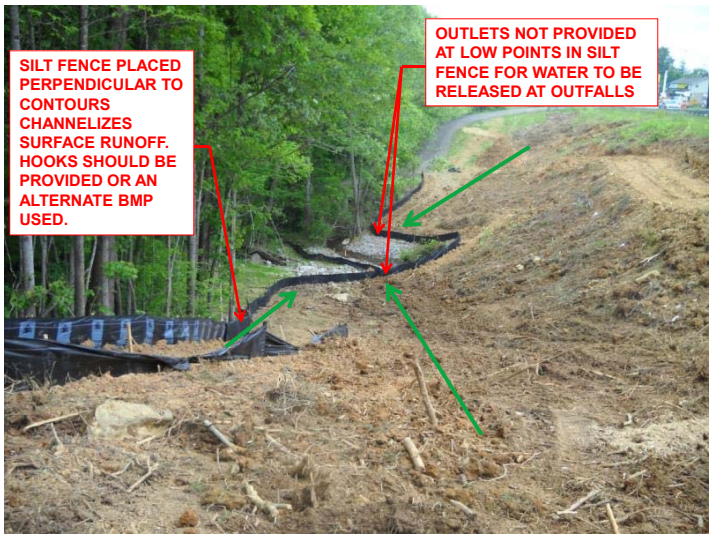
Slope Devices – Silt Fence (with Wire Backing)

- Common design placement errors
  - J-Hooks

Slope Devices – Silt Fence (with Wire Backing) Project Example (Lessons Learned)



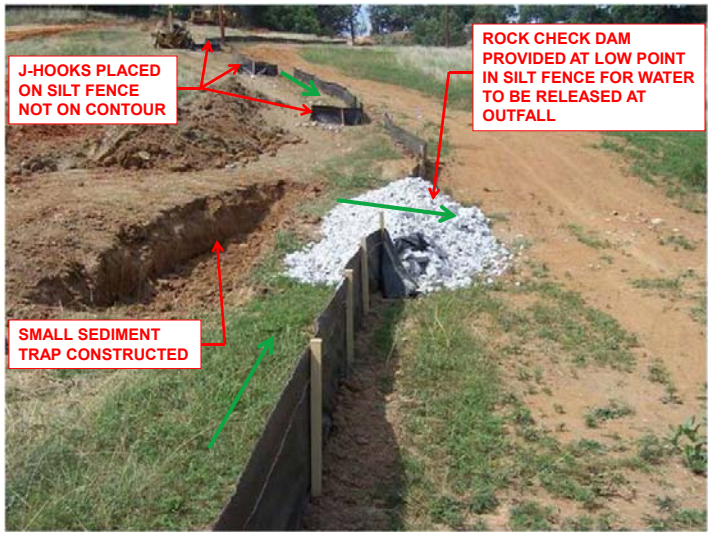
Slope Devices – Silt Fence (with Wire Backing) Project Example (Lessons Learned)



Slope Devices – Silt Fence (with Wire Backing) Project Example (Lessons Learned)

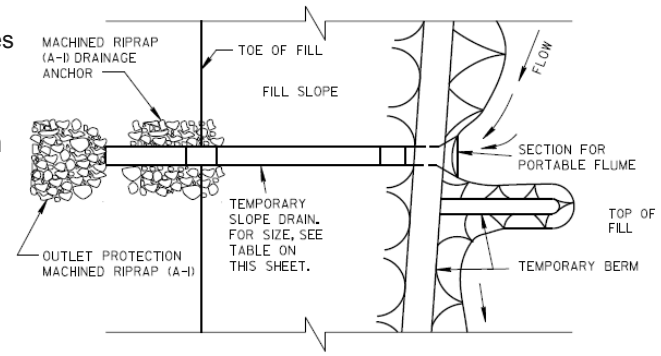
- Failures will occur
  - Overtopping
  - Sediment loss
  - Potential for NOV

Slope Devices – Silt Fence



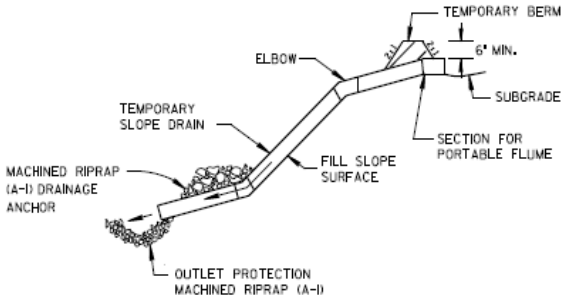
Slope Devices – Temporary Slope Drain and Berm

- Applications:
  - Concentrated flow
  - Convey stormwater runoff from steep slopes or offsite areas
  - Divert flows from unprotected slopes
- Drainage area = 1.5 acres max. per drain
- TDOT Std. Dwg. EC-STR-27
- Pay Item Nos.:
  - 203-01 (CY berm)
  - 209-02.03 – 209-02.07 (LF slope drain)
  - 709-05.06 (TON A-1 rip-rap)



Slope Devices – Temporary Slope Drain and Berm

- Design layout:
  - Use to provide a diversion of offsite drainage around or through a construction area
  - Install on low point of super elevated road sections
  - Ensure an outlet is provided (rip rap or structure)
  - Pipe should extend 4-feet beyond toe of slope
  - Pipes should be sized according to flow with size listed on EPSC plans



Slope Devices – Temporary Slope Drain and Berm

Slope Devices – Temporary Slope Drain and Berm

Slope Devices – Temporary Slope Drain and Berm

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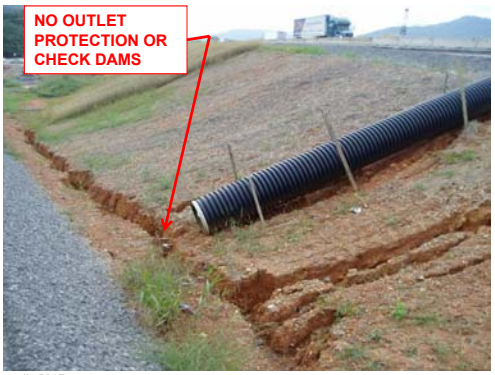
Slope Devices – Temporary Slope Drain and Berm

- Common design placement errors
  - No outlet protection
  - Pipe did not extend 4-feet beyond toe of slope



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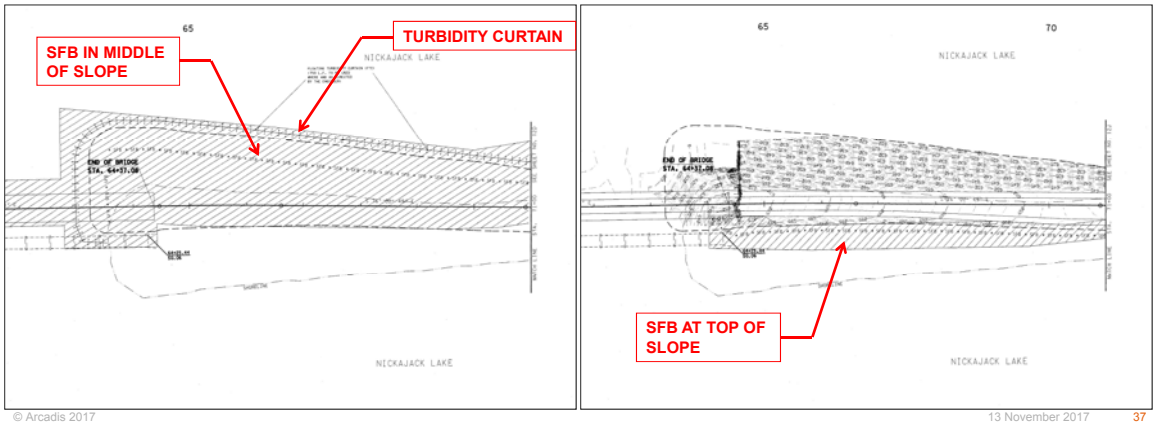
Slope Devices – Temporary Slope Drain and Berm

- Discharge at toe of slope or in channel
- Rock check dams can be used as outlet protection

Slope Devices – Project Example (Lessons Learned)

- Stage 1 and 2 ESPC



Slope Devices – Project Example (Lessons Learned)

- Bridge replacement on an ETW

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Slope Devices – Project Example (Lessons Learned)

- No slope drains in EPSC plans. Several slope failures occurred due to surface runoff from compacted roadway surface.

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Slope Devices – Project Example (Lessons Learned)

- Multiple slope drains added to convey runoff to toe of slope
- Project delays and change order

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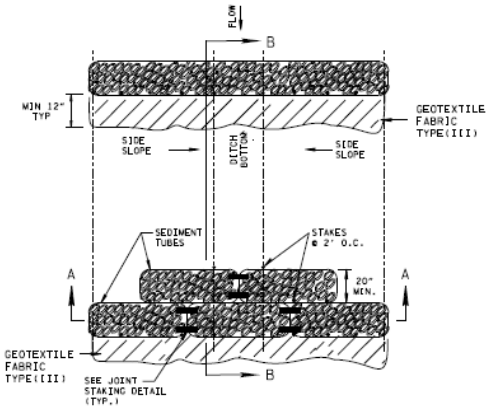
Slope Devices – Sediment Tube

- Applications:
  - Sheet flow or small concentrated flow applications (ditches)
  - Intercept runoff
  - Reduce velocities
  - Capture small amounts of sediment
- Dependent on staking – not good for rocky or paved areas
- TDOT Std. Dwg. EC-STR-37
- Pay Item No.: 740-11.01 – 740-11.05 (LF)
  - Include quantities for replacement & overlap, and sediment removal



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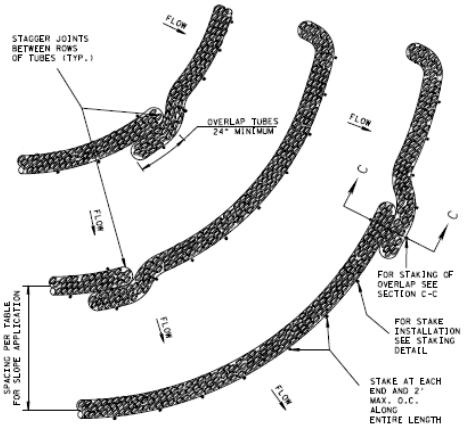
Slope Devices – Sediment Tube

- Tube size ranges from 8 to 24-inch diameter
- Slope application drainage area = ¼ acre per 100 linear feet
- Ditch application drainage area
  - 10 acres max. for impaired or ETW waters
  - 15 acres max. otherwise
- Minimum size for ditch = 20-inch diameter

SEDIMENT TUBE SPACING FOR SLOPE APPLICATION

SLOPE	8"	12"	18"	20"	24"
2%	70'	80'	N/A	N/A	N/A
5%	30'	60'	80'	N/A	N/A
10%	20'	30'	70'	80'	80'
6:1	N/A	20'	40'	50'	55'
4:1	N/A	20'	30'	30'	30'
3:1	N/A	N/A	20'	20'	25'
2:1	N/A	N/A	20'	20'	20'

N/A = NOT RECOMMENDED
SPACING NOT TO EXCEED 80'



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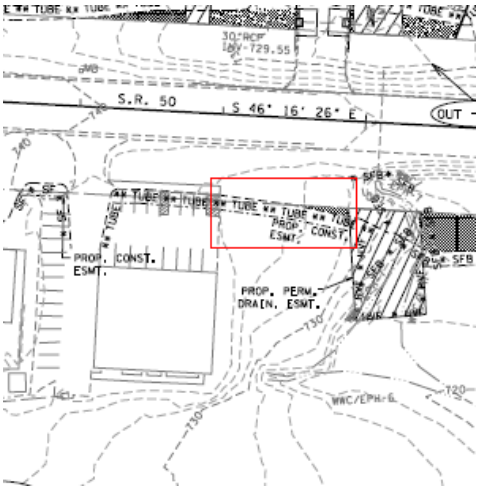
Slope Devices – Sediment Tubes



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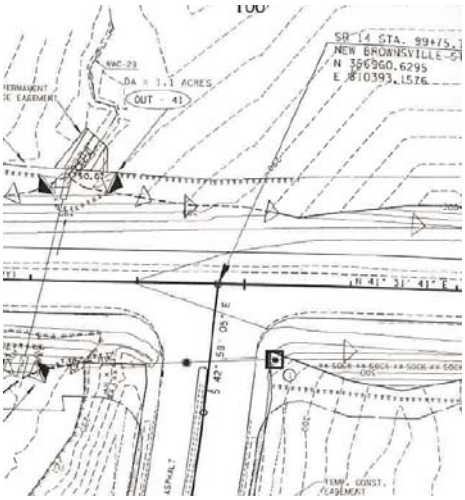
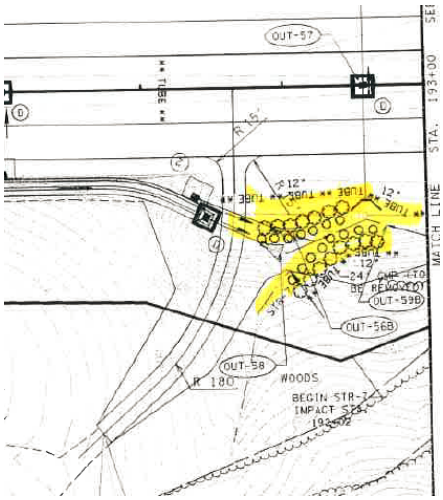
Slope Devices – Sediment Tubes



Slope Devices – Sediment Tubes



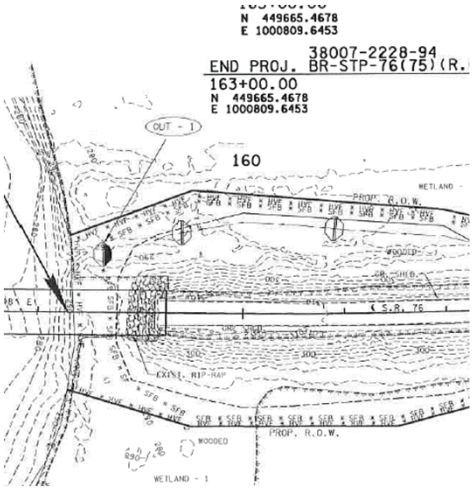
Slope Devices – Sediment Tubes

- Slope and ditch use during final EPSC Stage

Slope Devices – Sediment Tubes

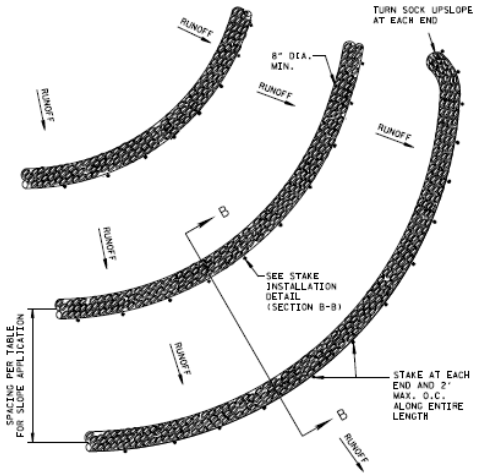
- Diversion berm use

Slope Devices – Sediment Tubes



Slope Devices – Filter Sock

- Similar applications, drainage area and sizing requirements to sediment tubes, except
  - Can be used on rocky or paved areas
- Minimum installed height (single or stacked) for ditch = 19-inches
- TDOT Std. Dwg. EC-STR-8
- Pay Item No.:
  - 209-03.20 – 209-03.23 (LF)
  - 209-08.09 (EA check dam)
  - Include quantities for replacement & overlap, and sediment removal

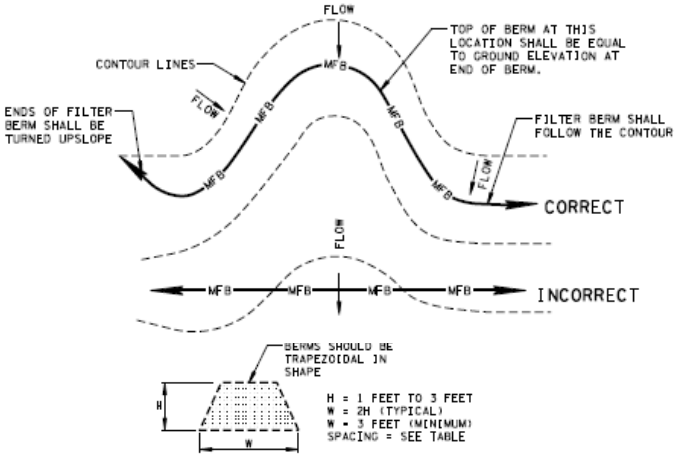


Slope Devices – Filter Sock

Slope Devices – Filter Sock

Slope Devices – Filter Berm

- Sheet flow applications
- Drainage area = ¼ acre per 100 linear feet
- Design layout:
  - Locate berm at least 10-feet away from toe of slope
  - Parallel to contour
  - Do not use for concentrated flow
- TDOT Std. Dwg. EC-STR-35
- Pay Item Nos.:
  - 209-01.30 (CY compost)
  - 209-01.31 (CY mulch)
  - Include sediment removal



BERM DETAILS

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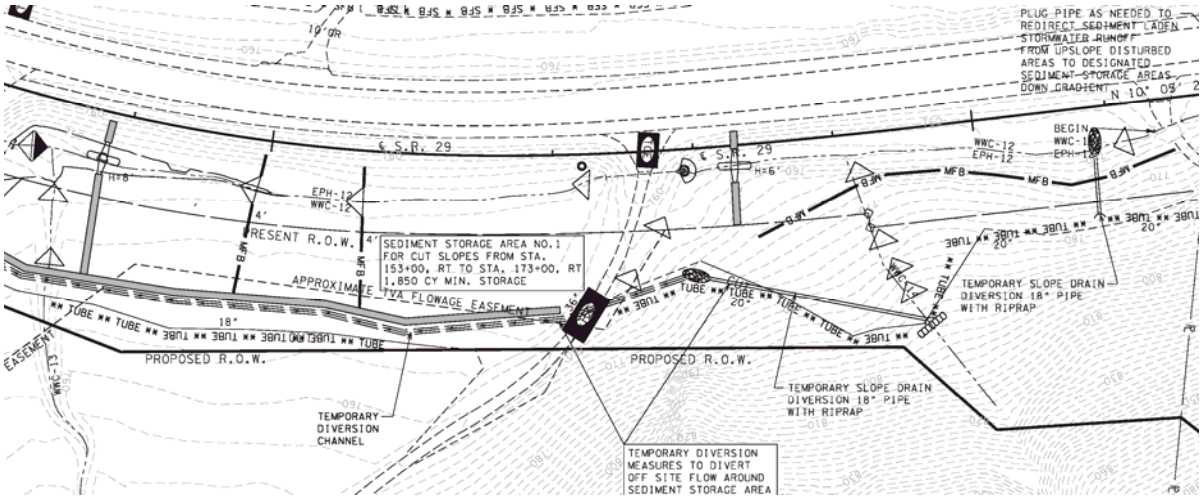
Slope Devices – Filter Berm



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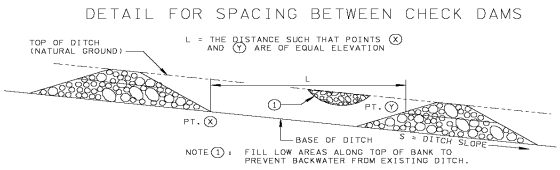
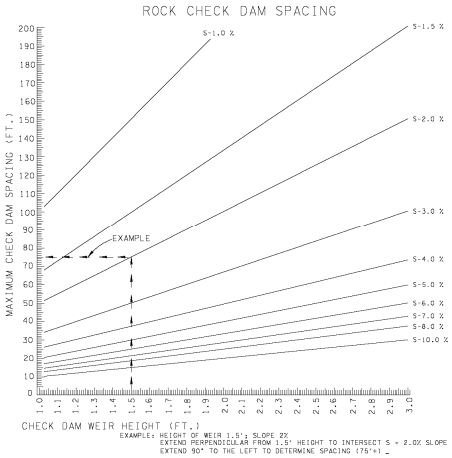
Slope Devices – Filter Berm

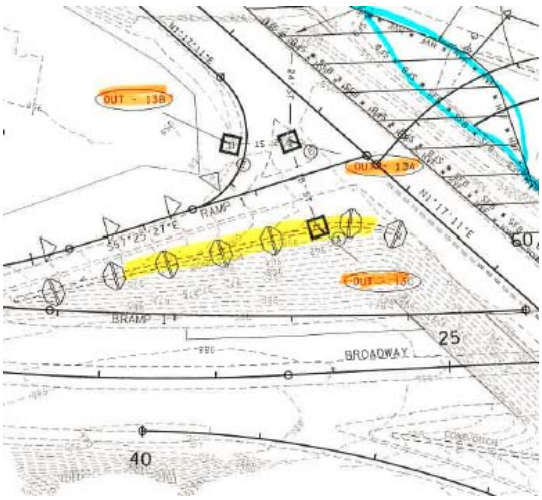
Ditch Devices – Rock Check Dam

- Applications:
  - Concentrated flow
  - Reduce velocities
  - Not to be used for sediment control
- Drainage area = 10 acres max.
- Check spacing vs. height
- TDOT Std. Dwg. EC-STR-6
- Pay Item No.: 209-08.07 (EA)
  - Include sediment removal





Ditch Devices – Rock Check Dam



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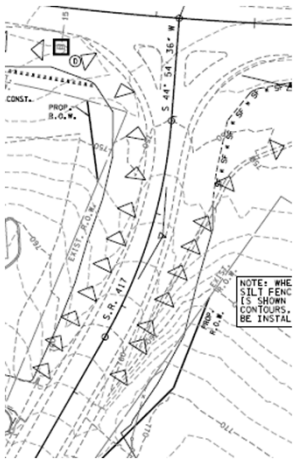
Ditch Devices – Rock Check Dam



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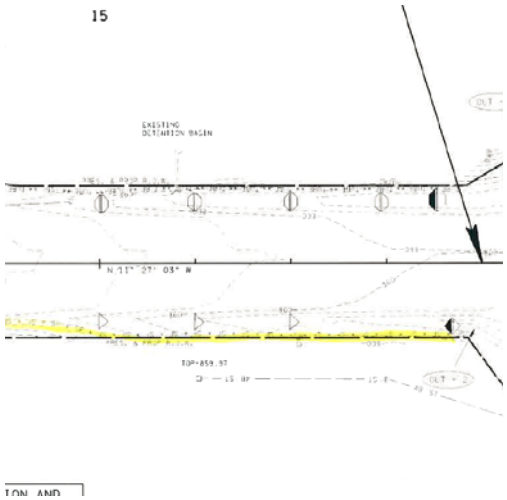
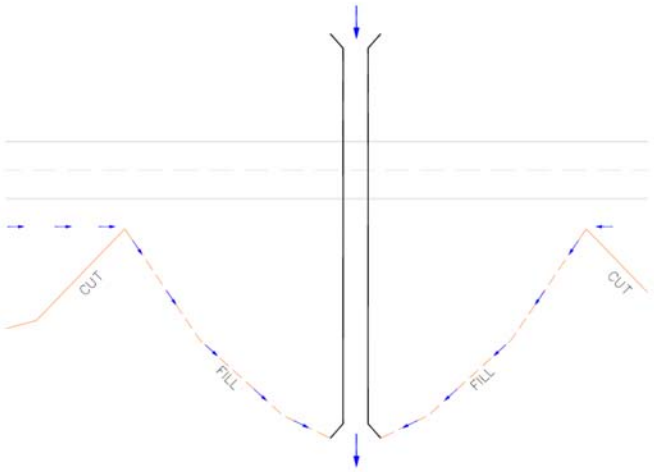
Ditch Devices – Rock Check Dam



Ditch Devices – Rock Check Dam

- Toe Ditch or Special Ditch
  - Formed where fill meets existing ground
  - Becomes a “v-ditch”
  - Steep slope
  - Concentrated flow
  - High velocities
  - Protection needed
    - During construction
    - Post construction

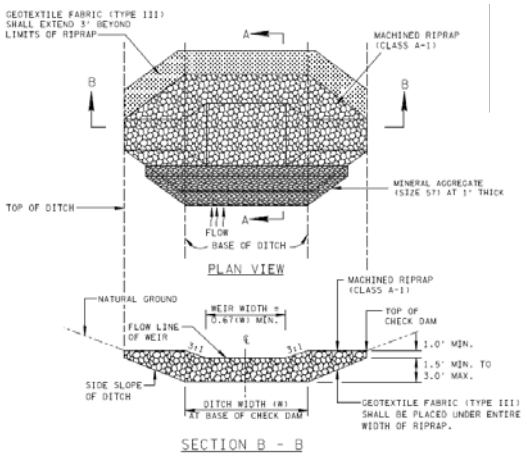


Ditch Devices – Rock Check Dam

Ditch Devices – Rock Check Dam

Ditch Devices – Enhanced Rock Check Dam

- Applications:
  - Concentrated flow
  - Reduce velocities
  - Can be used for sediment control
  - Used at outfall points
- Drainage area =
  - 20 acres max. for impaired or ETW waters
  - 30 acres max. otherwise
- TDOT Std. Dwg. EC-STR-6A
- Pay Item No.: 209-08.08 (EA)
  - Include sediment removal



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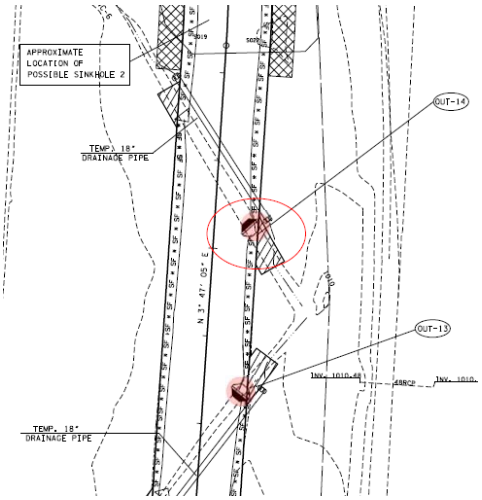
Ditch Devices – Enhanced Rock Check Dam



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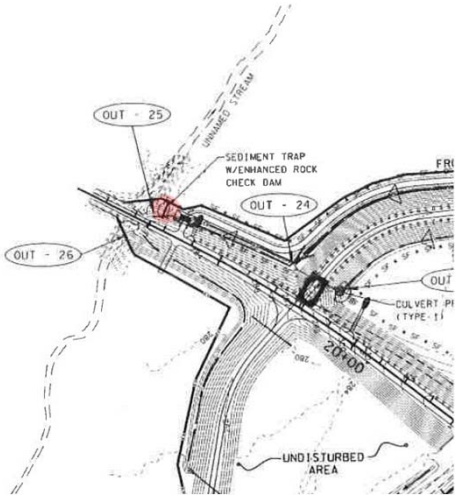
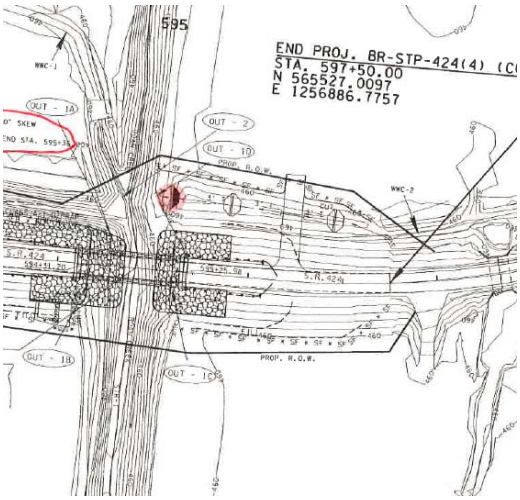
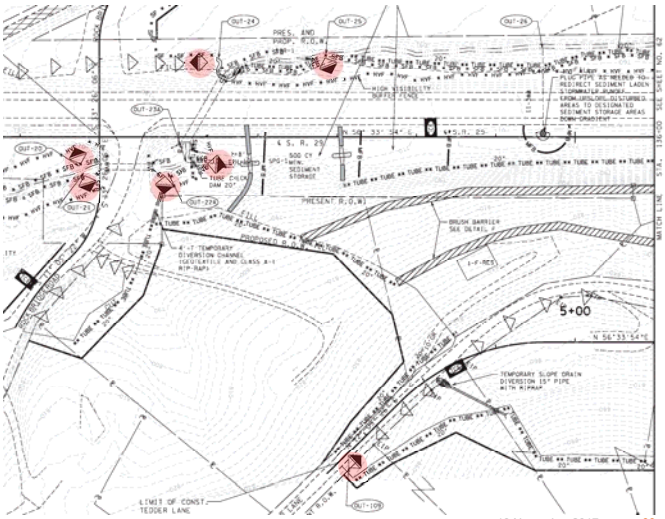
Ditch Devices – Enhanced Rock Check Dam



Ditch Devices – Enhanced Rock Check Dam

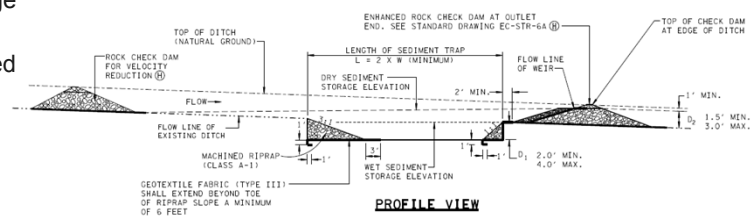


Ditch Devices – Enhanced Rock Check Dam

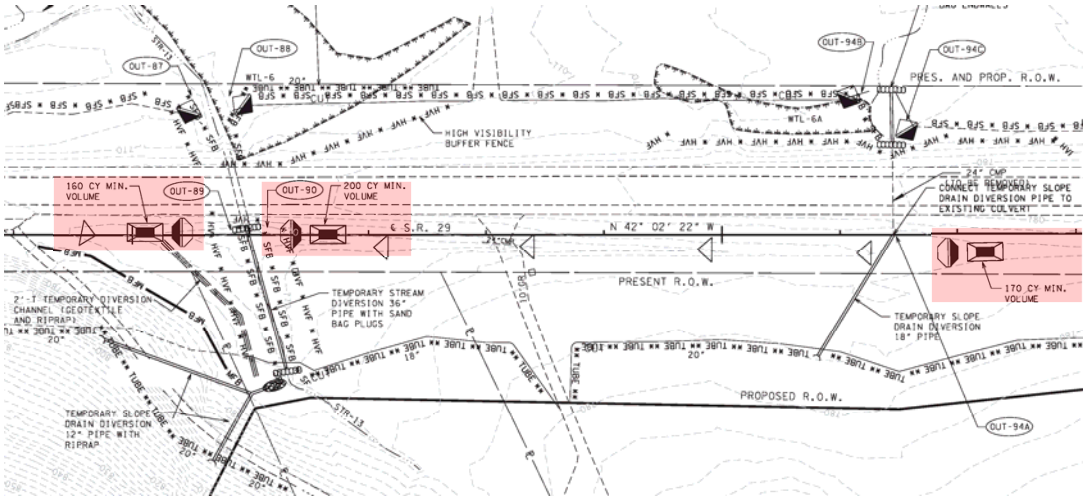


Ditch Devices – Sediment Trap with Check Dam

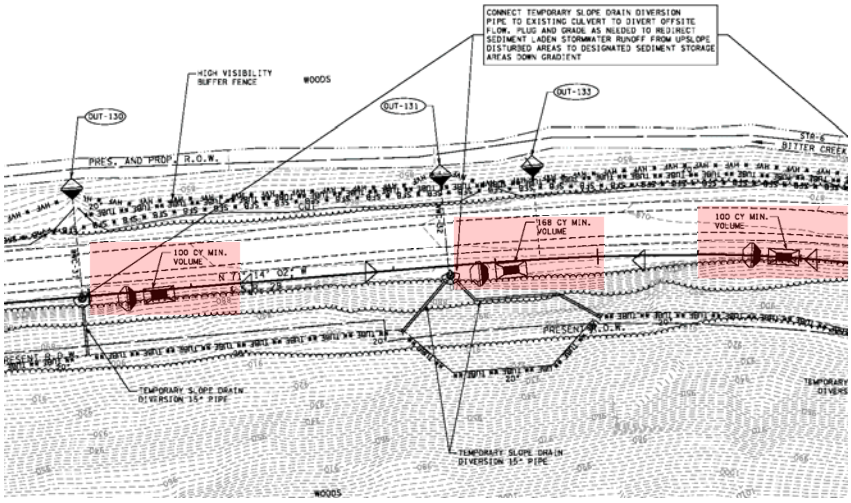
- Applications:
  - Trap sediment from small drainage areas
  - Used in ditches with high expected sediment loads
- Drainage area = 3 acres max.
- TDOT Std. Dwg. EC-STR-7
- Pay Item No.: 209-10.20 (CY)
  - ERCD paid separately
  - Include sediment removal
- Requires H&H analysis and design
  - Label total storage volume (CY) on EPSC plans



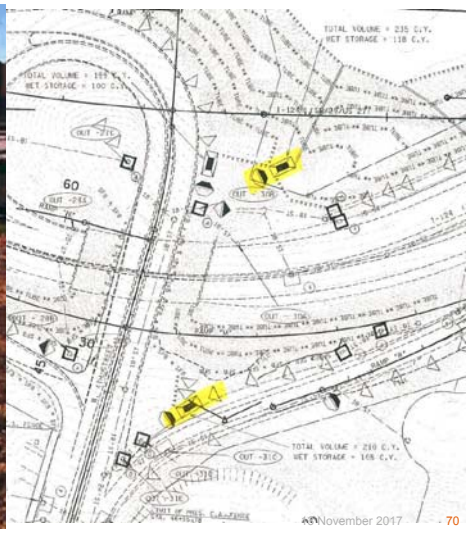
Ditch Devices – Sediment Trap with Check Dam



Ditch Devices – Sediment Trap with Check Dam

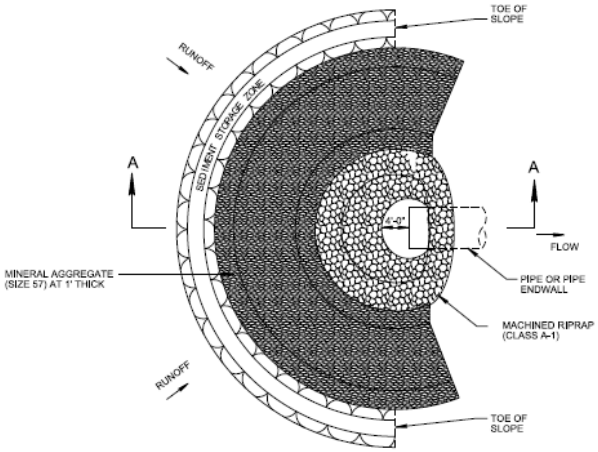


Ditch Devices – Sediment Trap with Check Dam



Inlet Protection – Culvert Protection Type 1

- Applications:
  - Reduce velocities
  - Trap sediment at culvert inlets
  - Do not use on culvert outlets
  - Used when most inflows are generate on site
- Drainage area
  - 20 acres max. for impaired or ETW waters
  - 30 acres max. otherwise
- Culvert size = 36-inch max
- TDOT Std. Dwg. EC-STR-7



Inlet Protection – Culvert Protection Type 1

- Pay Item Nos.:
  - 203-01 (CY earthwork)
  - 303-10.01 (TON #57 stone)
  - 709-05.05 (TON A-3 rip-rap)**
  - 709-05.06 (TON A-1 rip-rap)
  - 740-10.03 (SY geotextile type III)
  - Include sediment removal

Item Number	Item Description	Unit of Measure	Quantity	
			15" to 24" Pipe	27" to 36" Pipe
303-10.01	Mineral Aggregate (Size 57)	Ton	4.2	12.4
709-05.06	Machined Rip-Rap (Class A-1)	Ton	22.7	123.2
740-10.03	Geotextile (Type III)	SY	53.8	222.3

Table 10SC-3
Typical Quantities for Culvert Protection Type 1

** For high sediment loads:

A-3 rip-rap may be used in lieu of A-1 rip-rap for pipes up to 24-inches in dia. and a drainage area < 3 ac.

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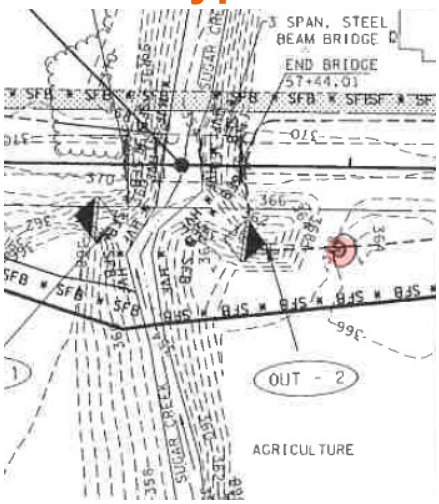
Inlet Protection – Culvert Protection Type 1



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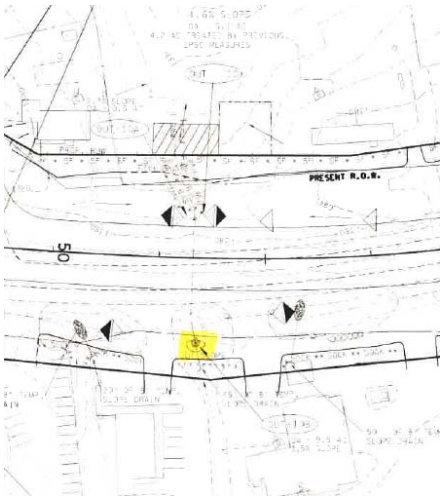
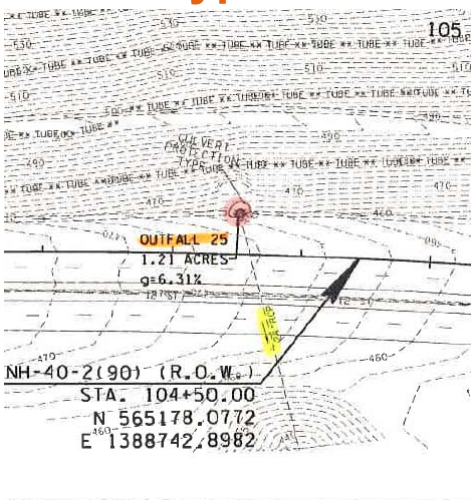
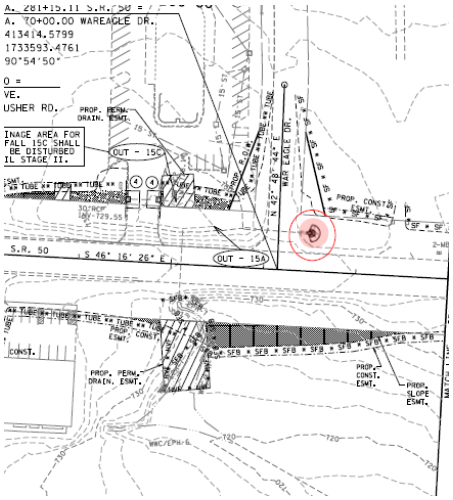
Inlet Protection – Culvert Protection Type 1



Inlet Protection – Culvert Protection Type 1

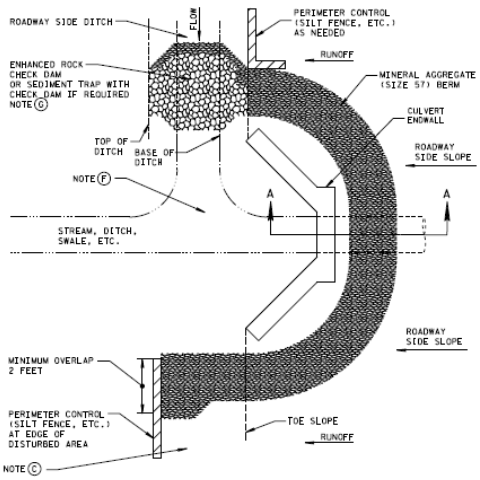


Inlet Protection – Culvert Protection Type 1



Inlet Protection – Culvert Protection Type 2

- Applications:
  - Protect culvert end walls/wing walls
  - Can be used on culvert inlets & outlets
  - Used when most inflows are generate off-site or undisturbed
- Drainage area =
  - No size restrictions
  - For larger area needs, consider a sediment basin
- TDOT Std. Dwg. EC-STR-7
- Pay Item Nos.:
  - 303-10.01 (TON #57 stone)
  - 740-10.03 (SY geotextile type III)
  - Include sediment removal

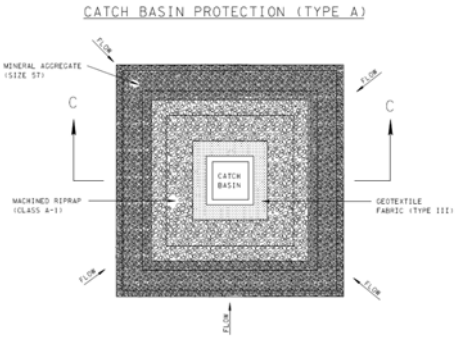


Inlet Protection – Culvert Protection Type 2

Inlet Protection – Catch Basin Protection

- Applications:
  - Prevent sediment from entering closed drainage systems
  - Side or median inlets
  - Curb inlets prior to placement of pavement
- Multiple types (A – D)
- Locations
  - Unpaved areas Types A, B, C & D
  - Paved areas Types A & D
- Drainage area
  - 2 ac. max. Type A
  - 1 ac. max. Types B, C & D
- TDOT Std. Dwg. EC-STR-19
- Pay item Nos.
  - 209-40.30 (EA Type A)
  - 209-40.31 (EA Type B)
  - 209-40.32 (EA Type C)
  - 209-40.33 (EA Type D)
  - Include sediment removal

Inlet Protection – Catch Basin Protection



- For paved or unpaved areas
- Max. drainage area = 2 acres

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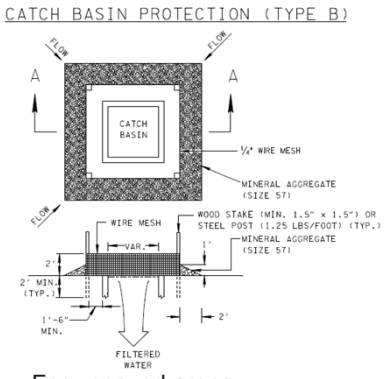
Inlet Protection – Catch Basin Protection



- For unpaved areas
- Max. drainage area = 1 acre

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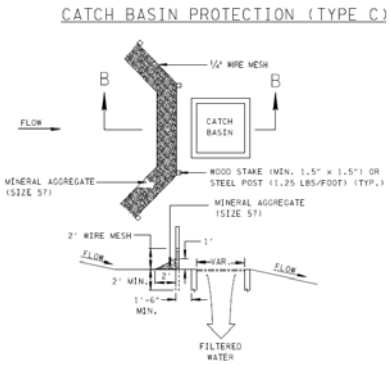
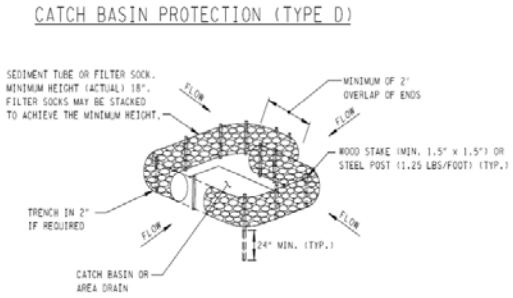
Inlet Protection – Catch Basin Protection



- For unpaved areas
- Max. drainage area = 1 acre

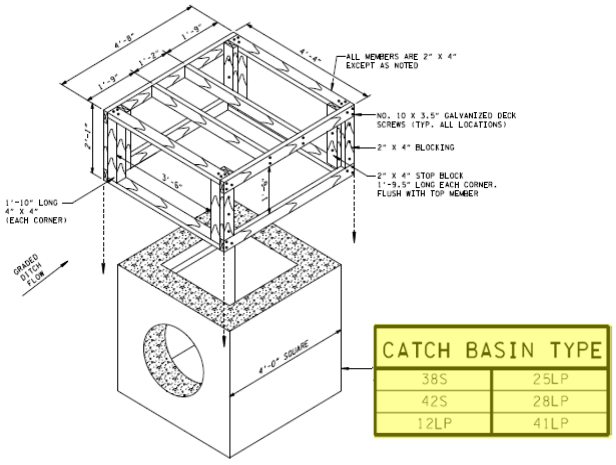
Inlet Protection – Catch Basin Protection



- For paved (Filter Sock) or unpaved areas
- Max. drainage area = 1 acre

Inlet Protection – Catch Basin Filter Assemblies

- Applications:
  - Prevent sediment from entering closed drainage systems
  - Used after drainage structure is installed, but before top is complete and surrounding area is vegetated or pavement installed
  - Area/median drains, curb inlets and manholes
- Multiple types (1-11) based on proposed structure
- TDOT Std. Dwg. EC-STR-40 through EC-STR-51A
- Pay Item No.:
  - 209-40.41 – 209-40.51 by type (EA)



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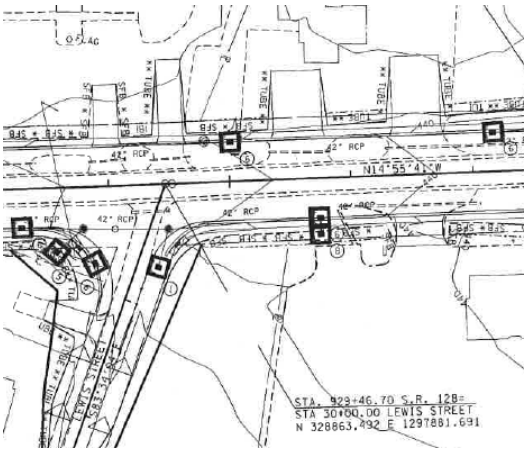
Inlet Protection – Catch Basin Filter Assemblies



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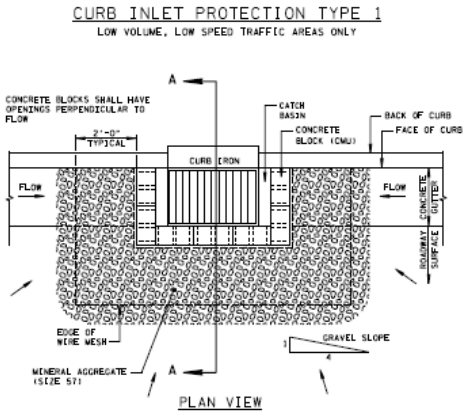
Inlet Protection – Catch Basin Filter Assemblies

Inlet Protection – Catch Basin Filter Assemblies

Inlet Protection – Curb Inlet Protection, Types 1-4

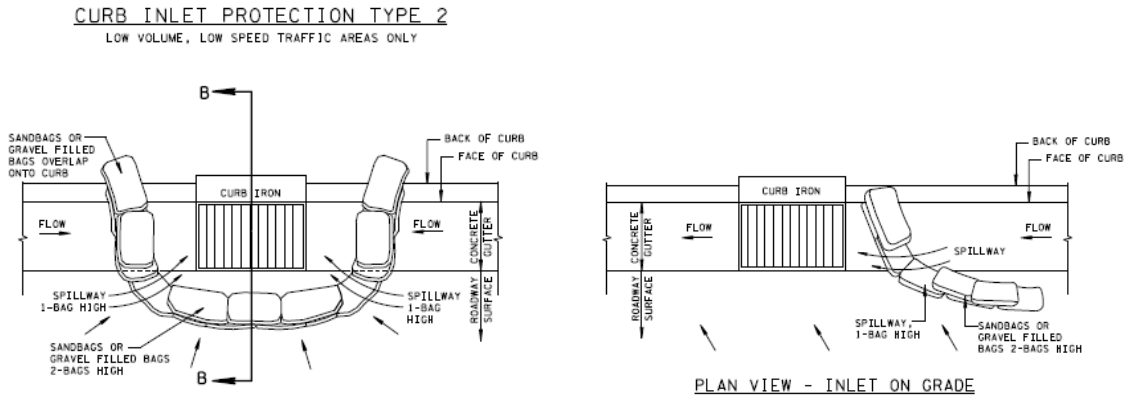
- Applications:
  - Prevent sediment from entering closed drainage systems
  - Used on existing curb inlets or new curb inlets after grate/frame installed and roadway placed
- Multiple types (1 – 4)
- Type varies based on:
  - Amount of ponding allowed
  - On-grade vs. sag location
- TDOT Std. Dwg. EC-STR-39 & 39A
- Pay Item No.:
  - 209-09.40 – 209-09.43 by type (EA)
  - Include sediment removal

Inlet Protection – Curb Inlet Protection, Type 1



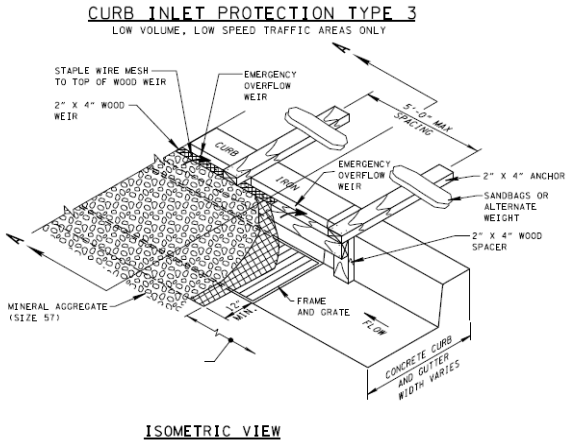
Pay Item No. 209-09.40

Inlet Protection – Curb Inlet Protection, Type 2



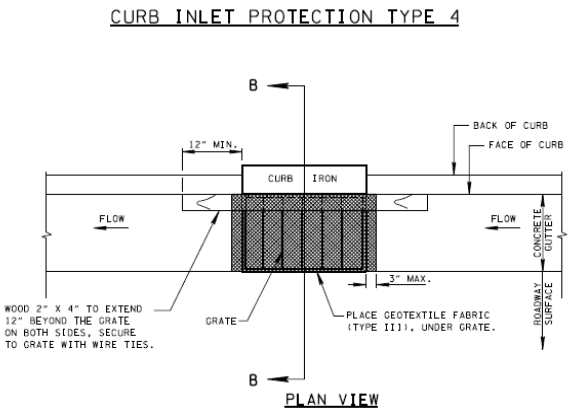
Pay Item No. 209-09.41

Inlet Protection – Curb Inlet Protection, Type 3



Pay Item No. 209-09.42

Inlet Protection – Curb Inlet Protection, Type 4



Pay Item No. 209-09.43

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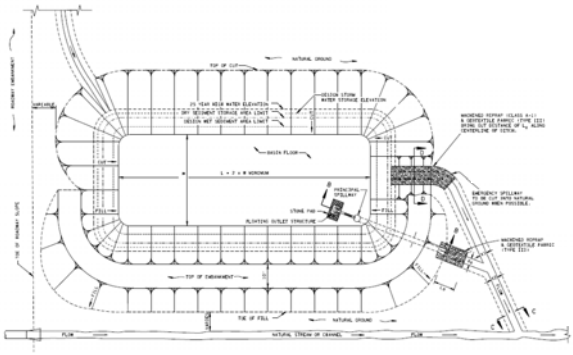
Detaining Devices – Sediment Basins

- Applications:
  - Large disturbed areas
  - High sediment loads
  - Detains runoff for an extended period of time
- Generally not suitable for steep terrain
- Where possible, divert undisturbed and off-site areas away from basin
- Drainage area
  - 5 acres min. for impaired or ETW waters
  - 10 acres otherwise; 50 acres max.
- TDOT Std. Dwg. EC-STR-15, 16, 17 & 18
- Multiple Pay Item Nos.:



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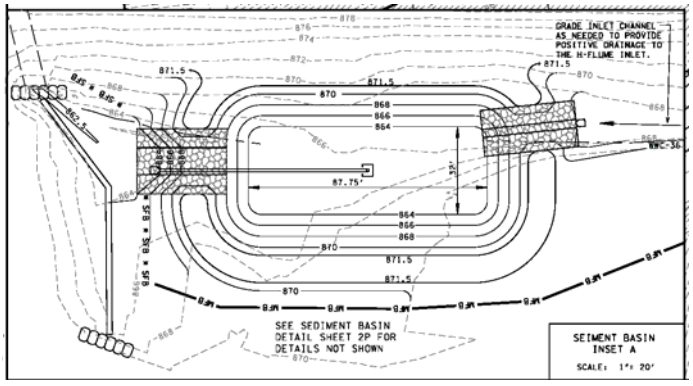
Detaining Devices – Sediment Basins

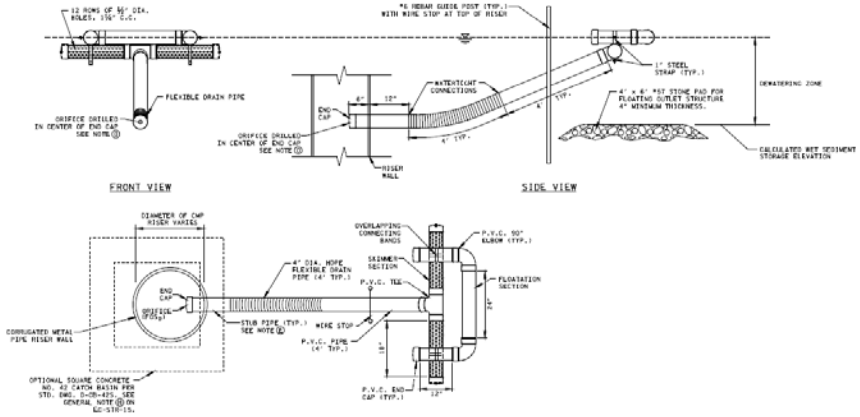
- Follow TDOT Drainage Manual for sizing of basin and outlet structure
- Ensure adequate information is on plans for contractor to build



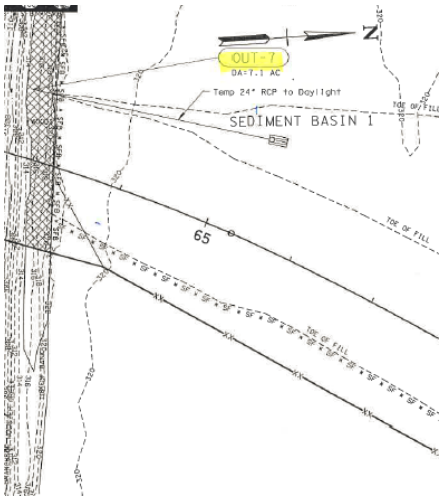
SEDIMENT BASIN 1		
LENGTH OF BASIN FLOOR	65	ft
WIDTH OF BASIN FLOOR	30	ft
SIDE SLOPE OF BASIN (INTERIOR)	3	H:1V
SIDE SLOPE OF BASIN (EXTERIOR)	3	H:1V
BASIN FLOOR EVELATION AT RISER	316	ft
SEDIMENT CLEANOUT ELEVATION	317	ft
WET SEDIMENT STORAGE ELEVATION	318	ft
DRY SEDIMENT STORAGE ELEVATION	320	ft
DESIGN STORM WATER STORAGE ELEVATION	320	ft
RISER CREST ELEVATION	321	ft
EMERGENCY SPILLWAY ELEVATION	322.5	ft
25-YEAR STORM HIGHWATER ELEVATION	322.5	ft
TOP OF EMBANKMENT ELEVATION	323.5	ft
FLOATING OUTLET STRUCTURE ORIFICE DIAMETER	2	in
RISER PIPE DIAMETER	30	in
OUTLET PIPE DIAMETER	24	in
OUTLET PIPE LENGTH	250	ft
OUTLET PIPE INLET INVERT ELEVATION	316	ft
OUTLET PIPE OUTLET INVERT ELEVATION	315.25	ft
OUTLET PIPE SLOPE	0.30%	
LENGTH OF RIPRAP APRON	15	ft
BOTTOM WIDTH OF OUTLET DITCH	2	
DEPTH OF OUTLET DITCH	2	
OUTLET DITCH LINING	Type III Geo	
WIDTH OF EMERGENCY SPILLWAY	10	ft
DEPTH OF EMERGENCY SPILLWAY	1	ft
LENGTH OF RIPRAP APRON	15	ft
BOTTOM WIDTH OF OUTLET DITCH	2	ft
DEPTH OF OUTLET DITCH	2	ft
OUTLET DITCH LINING	Type III Geo	

Detaining Devices – Sediment Basins

- A floating outlet structure (or skimmer) should be utilized on the outlet structure



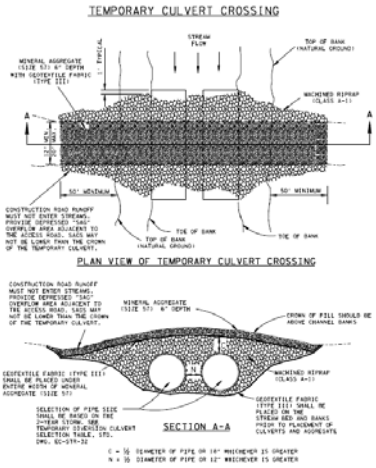
Detaining Devices – Sediment Basins



Detaining Devices – Sediment Basins

In Stream Devices – Temporary Culvert Crossing/ Construction Exit

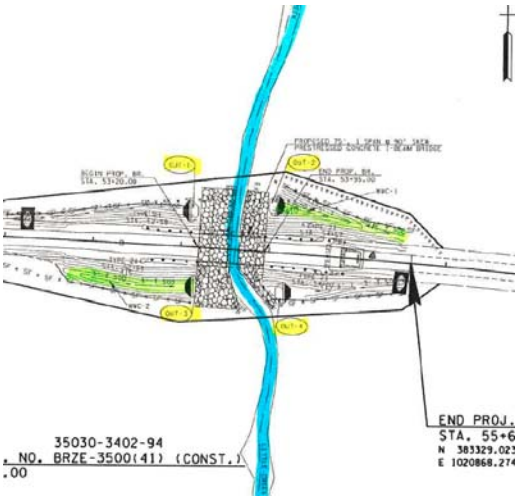
- Applications:
  - Prevent sediment tracking from ingress/egress of construction areas
  - Temporary stream crossings
  - Passage of concentrated flow
- Ensure that pipes are adequately sized and that size and quantity are provide on plans
- TDOT Std. Dwg. EC-STR-25
- Multiple Pay Item Nos.



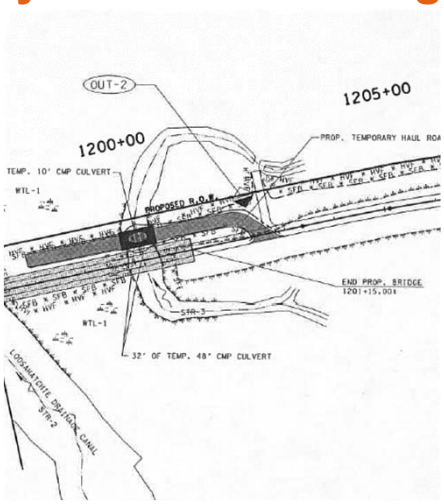
In Stream Devices – Temporary Culvert Crossing/ Construction Exit

- Show placement in EPSC stages (including clearing and grubbing)
- Show on side road crossings as needed
- Ensure that item numbers and quantities are included
- Ensure drainage pipes under entrances, if used, are sized with quantity and size provided on plans

In Stream Devices – Temporary Culvert Crossing



In Stream Devices – Temporary Culvert Crossing



In Stream Devices – Temporary Culvert Crossing

In Stream Devices - Construction Exit

- No entrance provided, tracking on road noted

In Stream Devices – Example (Lessons Learned)

- Stream crossing installed per plan (pipe information was not provided)
- Precipitation event washed out exit

In Stream Devices – Example (Lessons Learned)

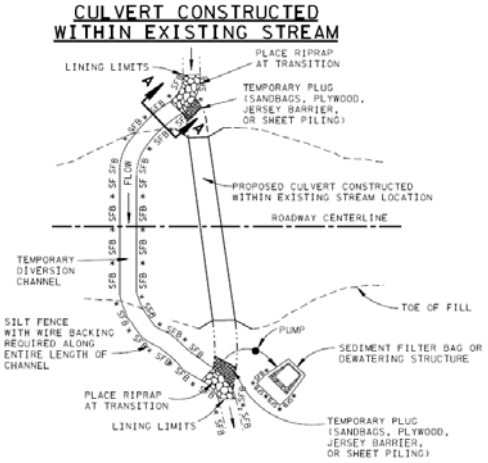
- Construction exit re-installed with same pipe design
- Steel plates added to top of exit

In Stream Devices – Example (Lessons Learned)

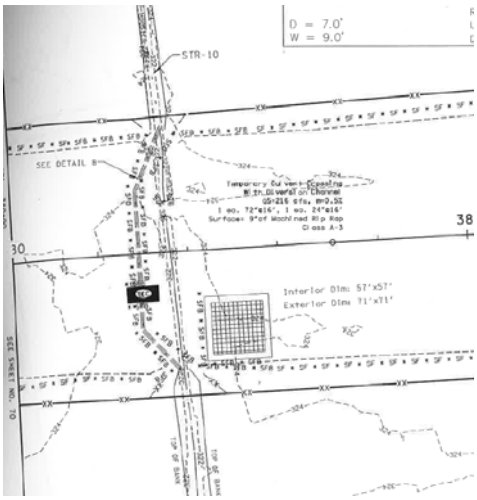
- Washout repeated during next precipitation event

Instream Devices – Temporary Diversion Channel

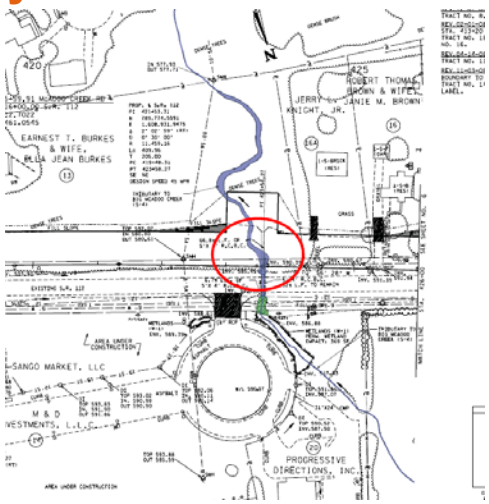
- Applications:
  - To divert stream flow or offsite drainage through or around a construction area
  - To convey normal stream flow around instream construction (bridges, culverts or box culverts)
  - May be needed for wet weather conveyances
- Cannot cross an existing roadway where traffic should be maintained
- Requires H&H analysis and design
- Drainage area = 1,280 acres max.
- TDOT Std. Dwg. EC-STR-31 & 31A
- Multiple Pay Item Nos.



Instream Devices – Temporary Diversion Channel



Instream Devices – Temporary Diversion Channel



Instream Devices – Temporary Diversion Channel

- Temporary stream diversion lined with plastic and rip rap in the bottom

Instream Devices – Temporary Diversion Channel

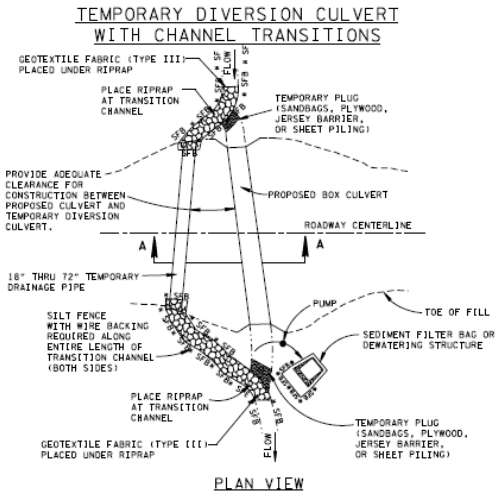
- Channel lining should be able to handle storm velocities

Instream Devices – Temporary Diversion Channel

- Size and lining material provided on plans

Instream Devices – Temporary Diversion Culvert

- Applications:
  - To divert stream flow or offsite drainage through or around a construction area
  - To convey normal stream flow around instream construction (bridges, culverts or box culverts)
- Used where diversion crosses roadway where traffic must be maintained
- Requires H&H analysis and design
- Drainage area = 1,280 acres max.
- TDOT Std. Dwg. EC-STR-32
- Multiple Pay Item Nos.:
  - Temporary drainage pipe



Instream Devices – Temporary Diversion Culvert

- Project Commitments
- Special design with baffles for trout passage

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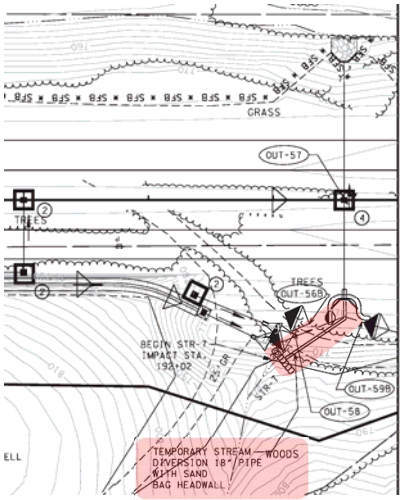
Instream Devices – Temporary Diversion Culvert

- Temporary pipe culvert diversion stream diversion



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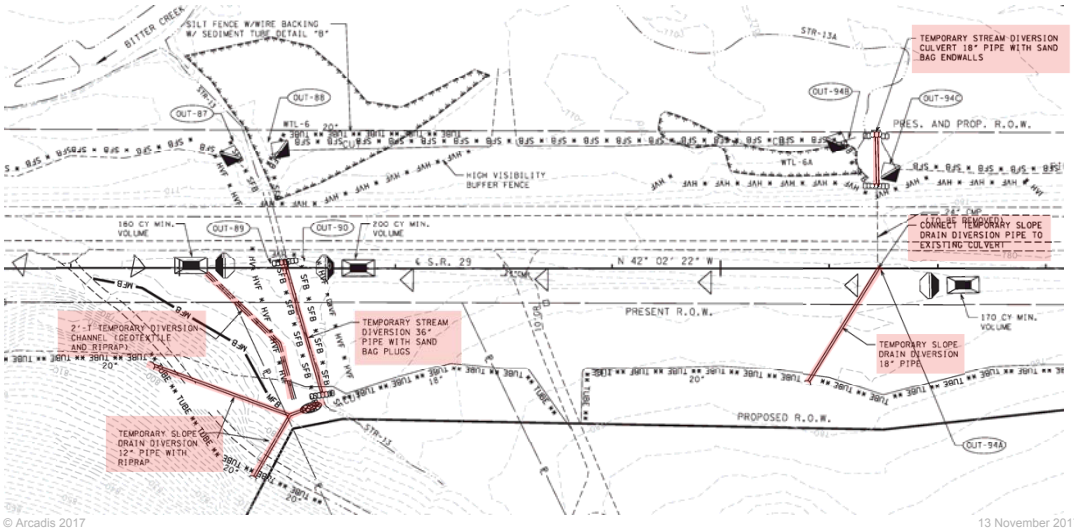
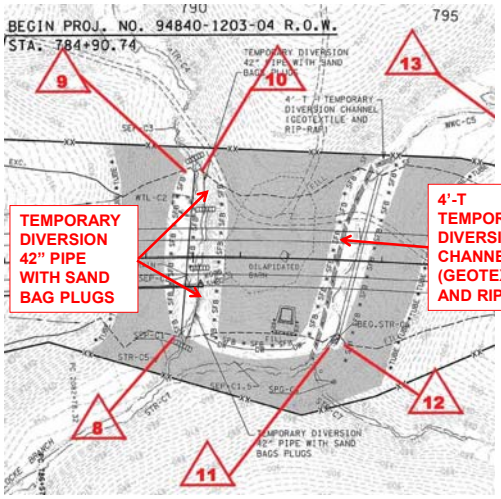
Temporary Diversions

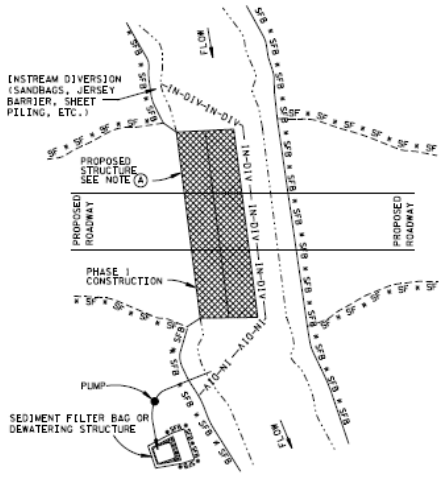


Temporary Diversions



Instream Devices – Instream Diversion

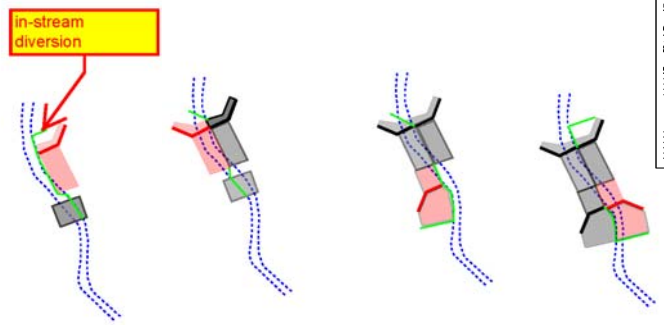
- Applications:
  - To convey stream flow within the existing channel around instream "staged" construction (slab bridge, multi-barrel culverts or box bridges)
  - Allows instream work to be completed in the dry
- Used with or without traffic
- Analysis required to determine height of diversion
- Actual phasing of construction is responsibility of contractor
- Drainage area = 1,280 acres maximum
- TDOT Std. Dwg. EC-STR-30 & 30A
- Pay Item No.: 209-65.04 (LF)



Instream Devices – Instream Diversion

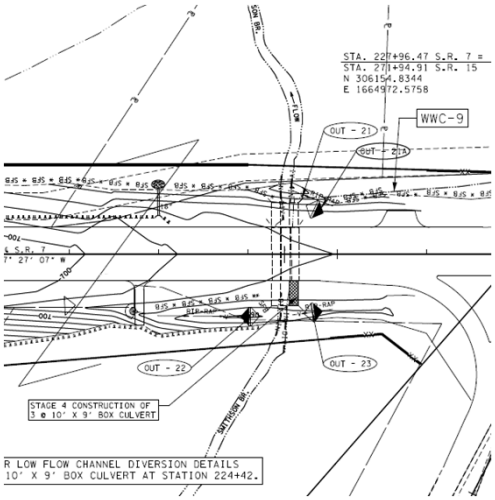
- May require multiple phases
- Sequence of construction needed
- Better estimate of quantity needed

SEQUENCE OF CONSTRUCTION FOR STR-1 CONCRETE BOX BRIDGE
1. INSTALL THE TEMPORARY INSTREAM DIVERSION ALONG THE EAST SIDE OF KERNS BRANCH FROM THE UPSTREAM ROW TO UNDER THE EXISTING SR-131 BRIDGE.
2. CONSTRUCT EAST BARREL OF BOX BRIDGE AND UPSTREAM WING WALL FROM INLET TO NEAR THE SR-131 EXISTING BRIDGE.
3. INSTALL RIP-RAP ON UPSTREAM END OF EAST BARREL.
4. REMOVE AND REINSTALL THE TEMPORARY INSTREAM DIVERSION ON THE INLET END TO DIVERT FLOW INTO THE NEWLY CONSTRUCTED EAST BARREL. REMOVE AND REINSTALL THE TEMPORARY INSTREAM DIVERSION ON THE OUTLET END CONTINUING IT UNDER THE EXISTING SR-131 EXISTING BRIDGE TO REDIRECT FLOW BACK INTO STR-1 AND PREVENT WATER FROM BACKING UP INTO THE WORK AREA.
5. CONSTRUCT WEST BARREL OF BOX BRIDGE AND UPSTREAM WING WALL FROM INLET TO NEAR THE SR-131 EXISTING BRIDGE.
6. INSTALL RIP RAP ON UPSTREAM END OF WEST BARREL.
7. FOLLOW TRAFFIC CONTROL PLAN AND REMOVE EXISTING BRIDGE.
8. KEEP UPSTREAM TEMPORARY INSTREAM DIVERSION IN PLACE AND ADJUST TEMPORARY INSTREAM DIVERSION AS NEEDED ON THE OUTLET END.
9. CONSTRUCT THE REMAINING PORTION OF THE WEST BARREL AND DOWNSTREAM WING WALL.
10. INSTALL RIP-RAP OUTLET PROTECTION FOR WEST BARREL.
11. REMOVE AND REINSTALL THE TEMPORARY INSTREAM DIVERSION ON THE INLET END TO DIVERT FLOW INTO THE COMPLETED WEST BARREL. REMOVE AND REINSTALL INSTALL THE TEMPORARY INSTREAM DIVERSION ON THE OUTLET END TO REDIRECT FLOW BACK INTO STR-1 AND PREVENT WATER FROM BACKING UP INTO THE WORK AREA.
12. CONSTRUCT THE REMAINING PORTION OF THE EAST BARREL AND DOWNSTREAM WING WALL.
13. INSTALL RIP-RAP OUTLET PROTECTION FOR EAST BARREL.
14. REMOVE ALL TEMPORARY INSTREAM DIVERSIONS.



PHASE 1 PHASE 2 PHASE 3 PHASE 4

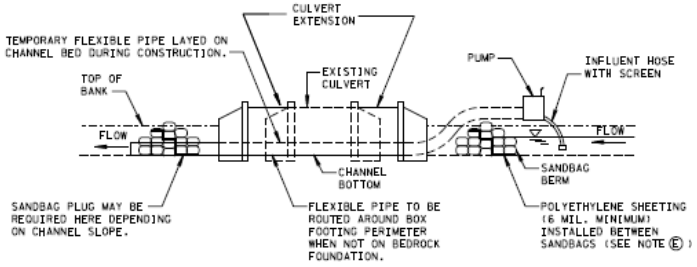
Instream Devices – Instream Diversion



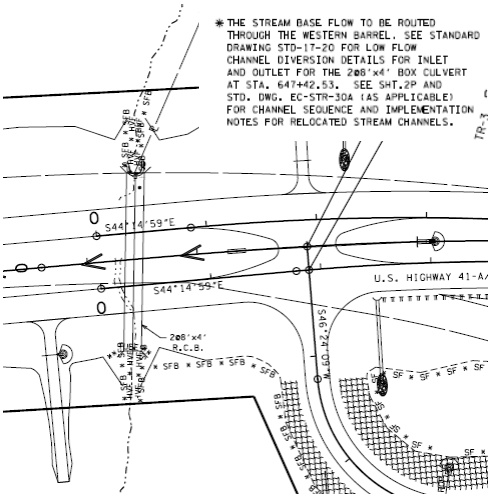
Instream Devices – Instream Diversion

Instream Devices – Suspended Pipe Diversion

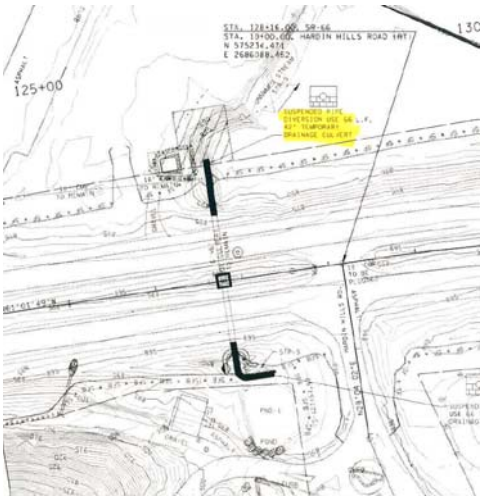
- Applications:
  - To convey stream flow within the pipe suspended above floor of box culvert or slab bridge
  - Allows instream work to be completed in the dry
- Typically used for extensions of existing structures
- Requires H&H analysis and design
- Drainage area = 1,280 acres max.
- TDOT Std. Dwg. EC-STR-33 & 33A
- Multiple Pay Item Nos.
  - Temporary drainage pipe



Instream Devices – Suspended Pipe Diversion



Instream Devices – Suspended Pipe Diversion



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Instream Devices – Suspended Pipe Diversion

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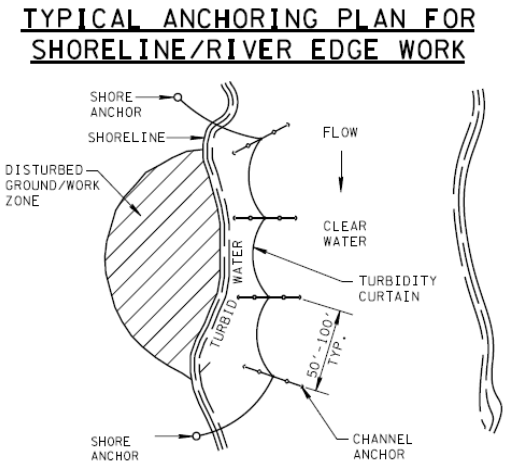
Instream Devices – Suspended Pipe Diversion

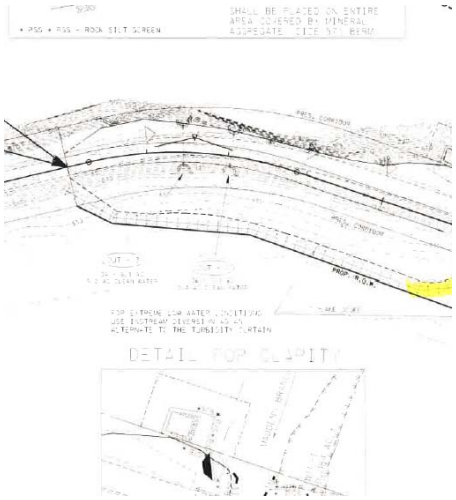
- By-pass pumping is an option. Is this the best option for this location?

Instream Devices – Turbidity Curtain

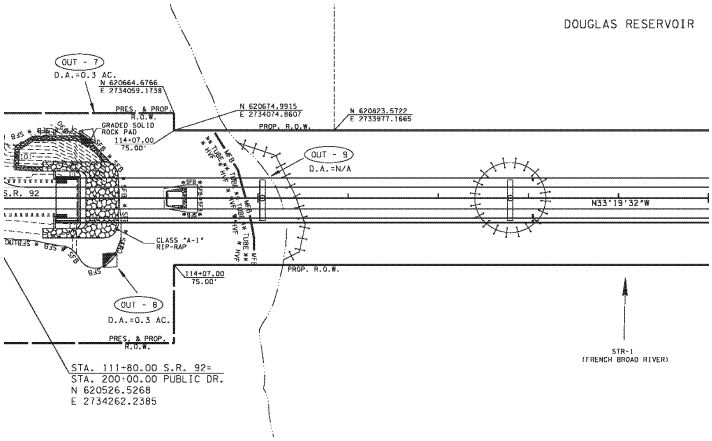
- Applications:
  - To isolate construction areas within or adjacent to a body of water to minimize the migration of sediments
- Do not install perpendicular across main flow path.
- Use in backwater low flow/velocity areas
- TDOT Std. Dwg. EC-STR-38
- Pay Item Nos.: 209-13.04 – 209-13.08 (LF)



Instream Devices – Turbidity Curtain



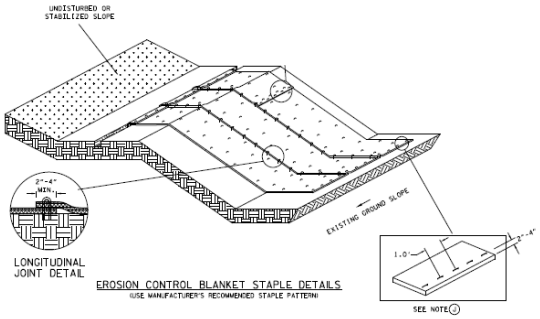
Instream Devices – Turbidity Curtain



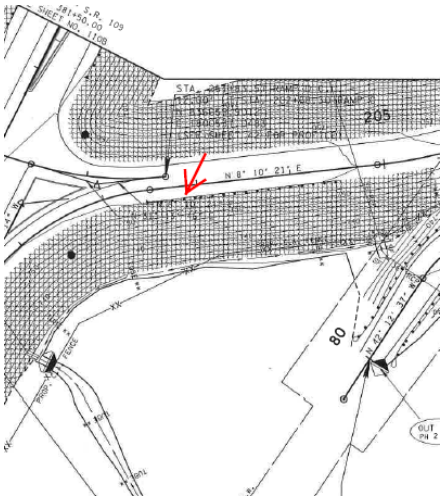
Instream Devices – Turbidity Curtain

Stabilization – Erosion Control Blanket

- Applications:
  - Use as an intermediate mulch cover for disturbed slopes that have been temporarily or permanently stabilized
  - Especially effective on cut or fill slopes where immediate cover is needed, on steep slopes (greater than 3:1) or on highly erodible soil
  - Can be used in constructed channels with low maximum shear stress
- Types I through IV available – based on soil type, slope steepness and slope length
- TDOT Std. Dwg. EC-STR-34
- Pay Item Nos.: 805-12.01 – 805-12.04 (SY)
  - Include overlap & trenching in quantities



Stabilization – Erosion Control Blanket

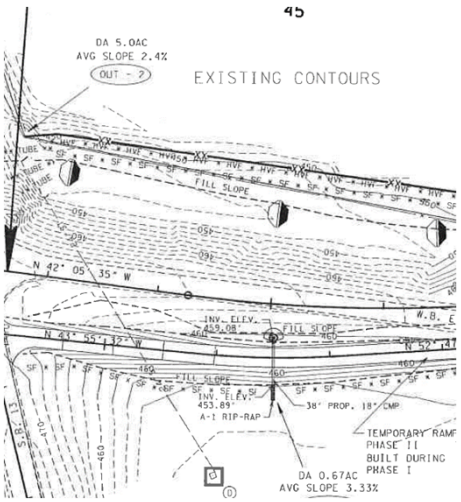


Stabilization – Erosion Control Blanket

Stabilization – Sod

- Applications:
  - Permanent Control Measure
  - Immediate cover on cut/fill slopes (> 3:1)
  - Especially effective in urban areas, small bridge projects or environmentally sensitive areas where immediate stabilization is needed
  - Can be used in constructed channels with low maximum shear stress
- Does not require mulch for steeper slopes
- Pay Item No.: 803-01 (SY)
  - Include cost for water
  - Future amendments may include addition of fertilizer and topsoil

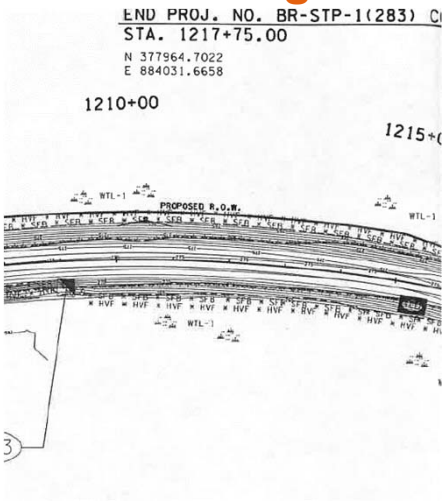
Stabilization – Sod



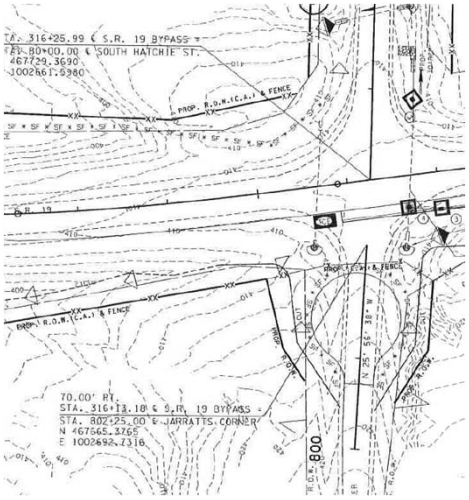
Stabilization – Temporary vs. Permanent Seeding

- Temporary – Used for quick establishment in exposed areas that will be disturbed later in the project
  - Applicable when disturbed areas will lay dormant for at least 14 days
  - Winter stabilization
  - Combine temporary seeding and mulch
- Permanent – Applied when area has reached final grade and will not be re-disturbed
  - Seasonal
- Both quantities will be installed with mulch or erosion control blanket
- Depict permanent stabilization method (seed or sod) on all typical sections with vegetated areas
- Multiple Pay Item Nos. and units (SY, ACRE or UNIT)
  - Ensure fertilizer (soil amendments), water and topsoil and included in quantities

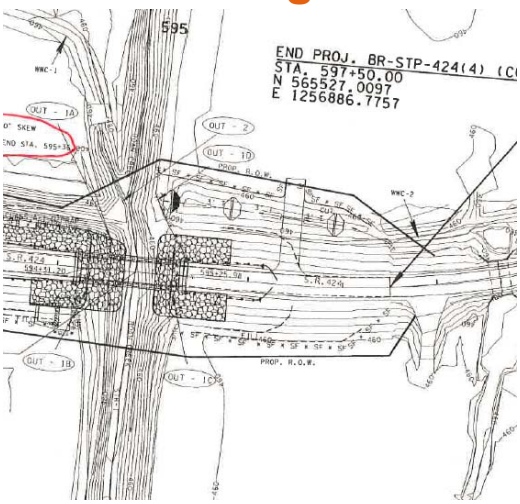
Stabilization – Temporary Mulch & Seeding



Stabilization – Temporary Mulch & Seeding



Stabilization – Mulch & Permanent Seeding



Stabilization – Hydromulch

- Applications:
  - Temporary or Permanent Control Measure
  - Immediate cover on cut/fill slopes (> 2:1)
- Method of soil stabilization to prevent displacement of mulch by floatation or wind or to provide erosion protection for graded areas left idle for a few days
- Includes seed, mulch, tackifier and soil amendments (fertilizer, lime, etc.)
- Not for use in areas of concentrated flow
- Multiple Pay Item Nos. and units (SY or UNIT)

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Stabilization – Hydromulch

Photo source: http://abc.eznettools.net/D300003/X382460//EZ-PhotoAlbum/Album02/10-Heyburn-State-Park-hydromulching-project.html

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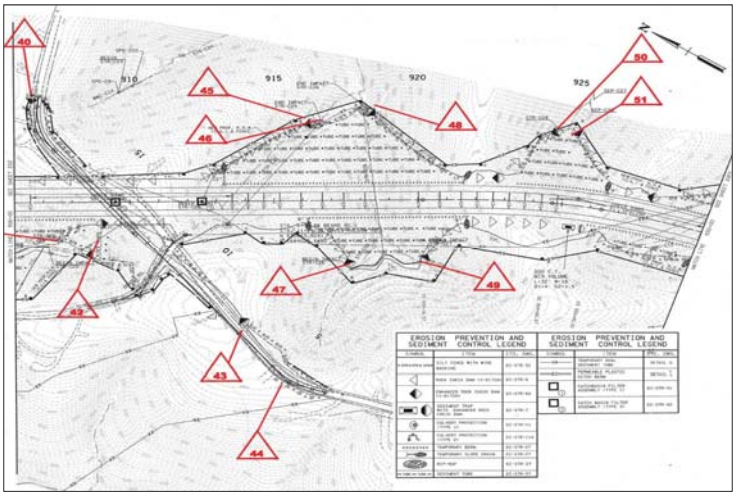
Questions?

TDOT Roadway Design Division



Module 8:

Staged EPSC Plans

Staged EPSC Plans

- EPSC staging:
  - One sheet depicting all EPSC that will be used during the life of the project will not be considered complete
- Sites disturbance:
  - < 5 acres – minimum of 2 stages of EPSC
  - ≥ 5 acres - minimum of 3 stages of EPSC

Staged EPSC Plans

- The same EPSC devices may be depicted during more than one Stage
- Not all areas of project will be at same Stage during construction
- Additional Stages added for unusual conditions affecting the entire length
- Sub-stages for specific areas may be utilized (i.e. at box culvert)

Clearing and Grubbing Stage - Objectives

- Divert off-site runoff around or through the construction site
- Protect existing drainage features and outfalls
- Establish perimeter control
- Control sediment that may have been eroded from exposed areas from leaving the site
- Protection of existing water resources and off site property

Clearing and Grubbing Stage – Common Measures

- Silt fence and silt fence with wire backing
- Inlet protection for existing storm sewers and culverts
- Sediment traps
- Sediment tubes/Filter socks
- Temporary diversions
- Rock and enhanced rock check dams
- Temporary construction exits
- Temporary stream crossings

Intermediate Grading Stage - Objectives

- Interim mass grading controls (existing to proposed finished grade)
- Protect proposed drainage features and outfalls
- Protect proposed pipe and drainage structure inlets
- Diversion of water resources and offsite drainage
- Control sediment from graded areas from leaving the site

Intermediate Grading Stage – Common Measures

- Dewatering structures and sediment filter bags
- Diversion channels, berms, and culverts
- Rock check dams and enhanced rock check dams
- Sediment traps
- Culvert protection
- In-stream diversions
- Suspended pipe diversions
- Turbidity curtains
- Catch basin filter assemblies

Final Construction Stage - Objectives

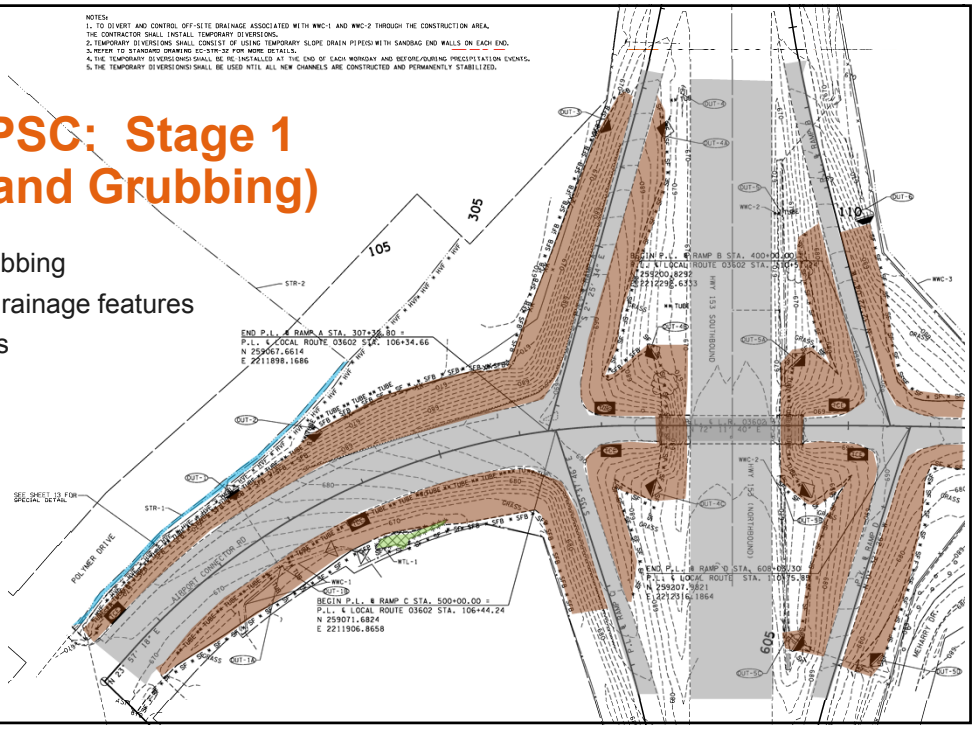
- Major grading complete or nearly complete
- Measures to address final grading, shaping, topsoil operations, base stone and paving, slope and ditch stabilization, permanent drainage features (detention basin)

Final Construction Stage – Common Measures

- Erosion control blankets and TRMs
- Filter socks and sediment tubes
- Sediment tubes
- Catch basin protection (e.g. Type D)
- Curb inlet protection
- Riprap basin energy dissipaters and riprap outlet protection
- Culvert protection (or slope protection)
- Slope drains and berms

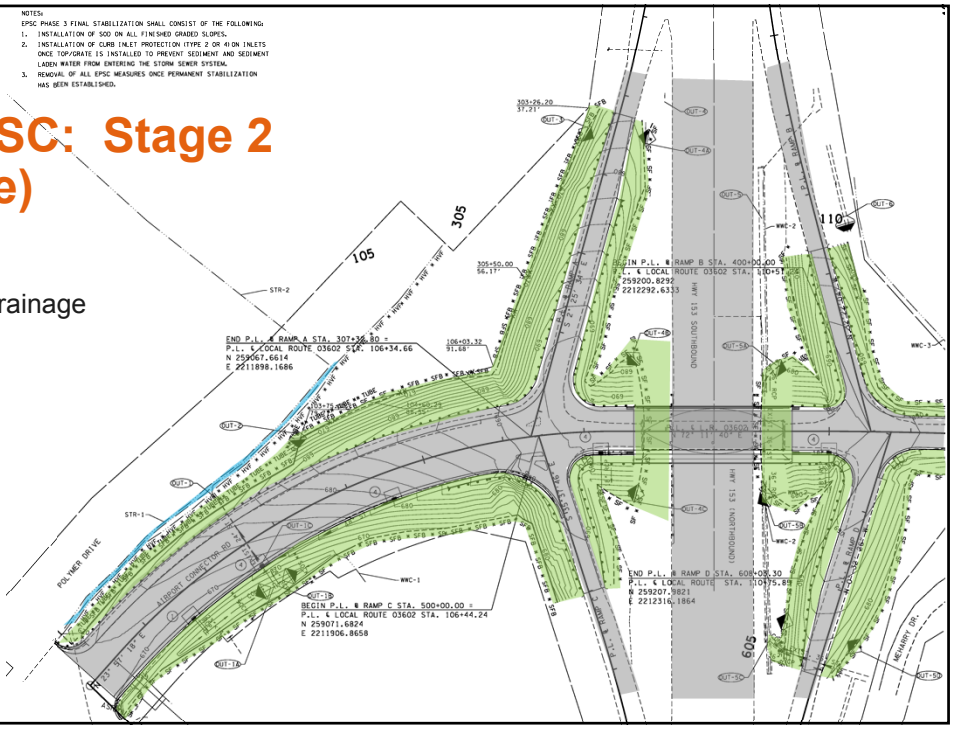
2 Stage EPSC: Stage 1 (Clearing and Grubbing)

- Clearing and Grubbing
- Protect existing drainage features
- Construction exits
- Special notes



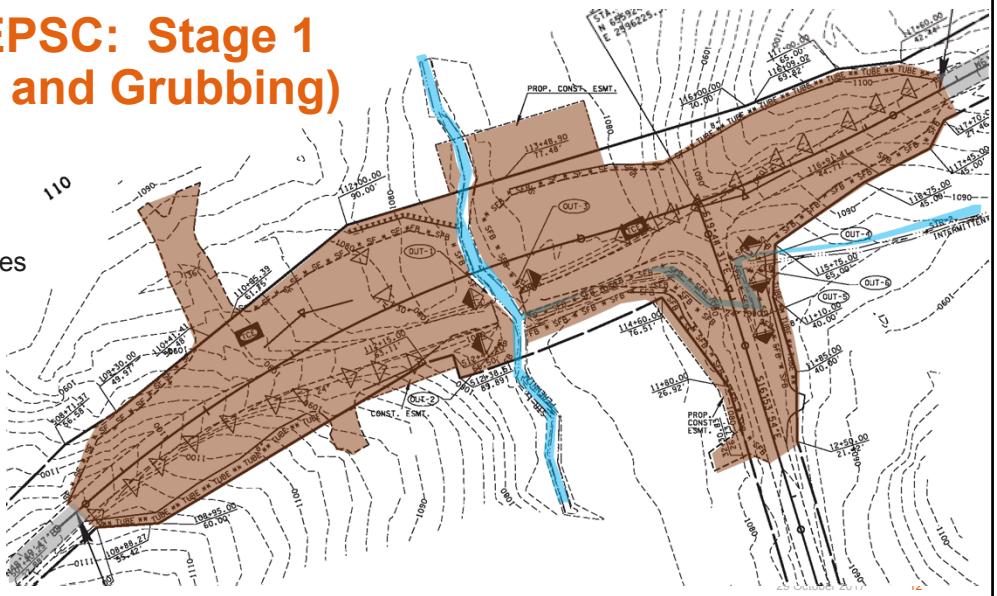
2 Stage EPSC: Stage 2 (Final Stage)

- Final Grading
- Protect proposed drainage features
- Final Stabilization
- Special notes



2 Stage EPSC: Stage 1 (Clearing and Grubbing)

- Clearing and Grubbing
- Protect existing drainage features
- Construction entrances



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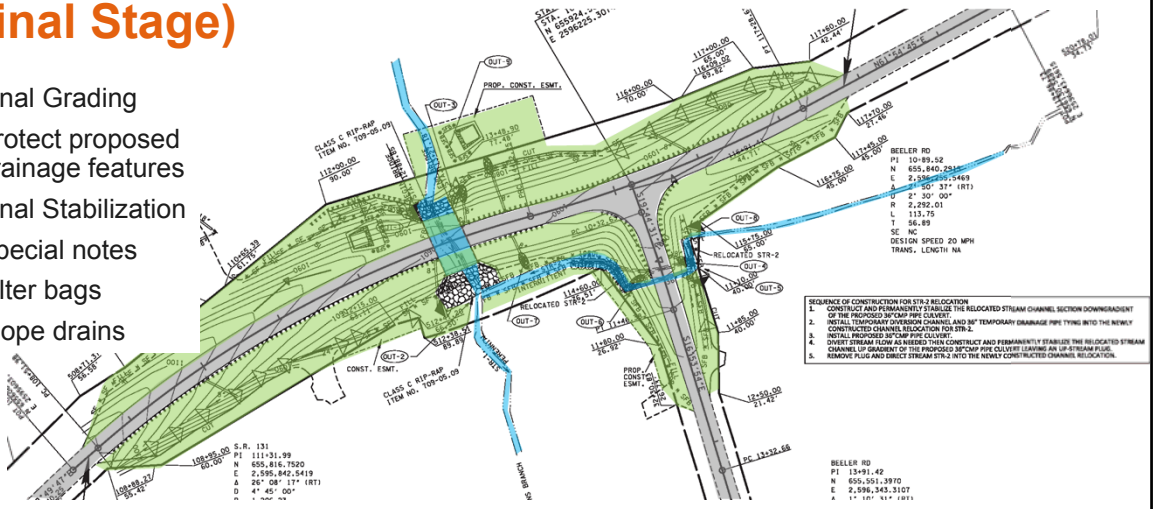
2 Stage EPSC: Stage 2 (Final Stage)

- Final Grading
- Protect proposed drainage features
- Final Stabilization
- Special notes
- Filter bags
- Slope drains



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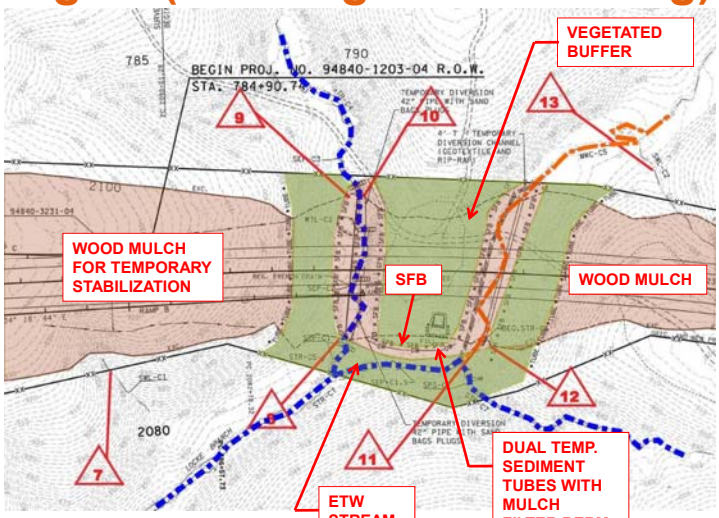
3 Stage EPSC: Stage 1 (Clearing and Grubbing)

- Buffer Protection
- Diversions for Culvert Installations
- Perimeter Measures



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3 Stage EPSC: Stage 1 (Clearing and Grubbing)

- Clearing and Grubbing
- Buffer equivalent measures

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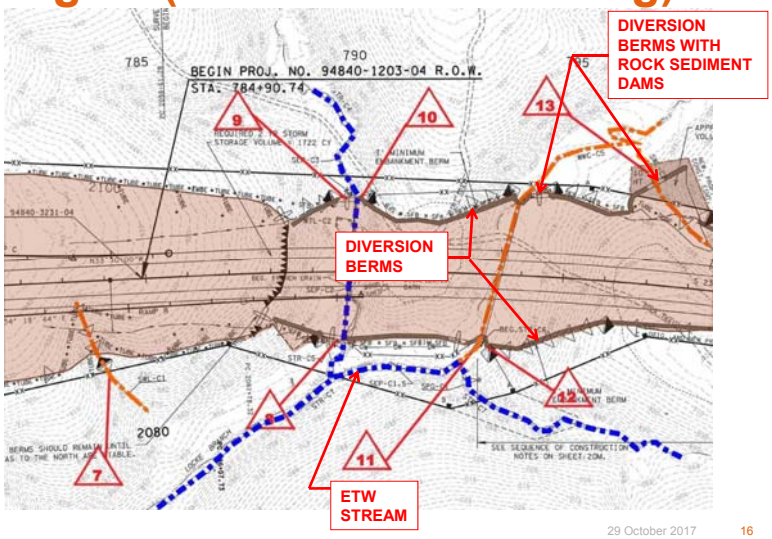
3 Stage EPSC: Stage 2 (Intermediate Grading)

- Mass Grading Special Techniques
- Diversion Berms
- Sediment Control Structures
- Runoff Control Measures



3 Stage EPSC: Stage 2 (Intermediate Grading)

- Example Notes and Details
  - Listed sequence of construction for specific areas

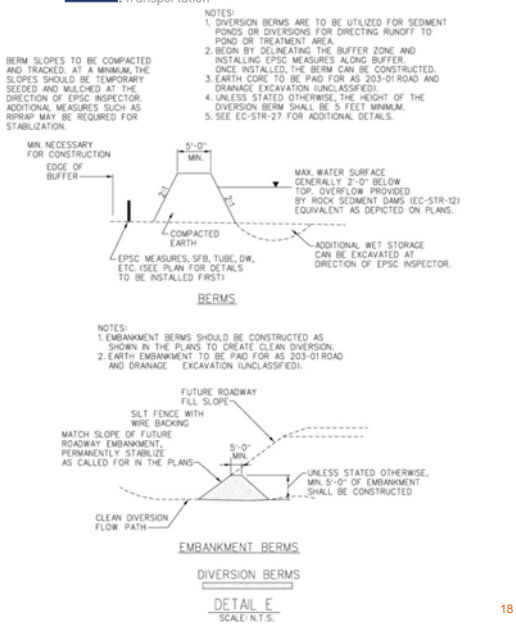
NOTE:
SEDIMENT TUBES, ROCK CHECK DAMS AND ENHANCED ROCK CHECK DAMS SHALL BE UTILIZED WITHIN THE RELOCATED STREAM CHANNEL DURING STREAM CHANNEL CONSTRUCTION. ALL EPSC MEASURES LOCATED WITHIN THE RELOCATED STREAM CHANNEL SHALL BE REMOVED PRIOR TO DIVERTING STREAM FLOW INTO THE RELOCATED CHANNEL.

STREAM CHANNEL
SEQUENCE OF CONSTRUCTION:

1. CONSTRUCT BOX CULVERT BENEATH ROCK BRIDGE ROAD.
2. CONSTRUCT AND STABILIZE PROPOSED STREAM CHANNEL LOCATION UPSTREAM OF BOX CULVERT BENEATH ROCK BRIDGE ROAD. MAINTAIN UPSTREAM PLUG.
3. CONSTRUCT AND STABILIZE PROPOSED STREAM CHANNEL LOCATION BETWEEN BOX CULVERTS.
4. INSTALL SUSPENDED PIPE DIVERSION FROM EXISTING BOX CULVERT INLET TO RELOCATED STREAM CHANNEL UP SLOPE OR OUTLET OF BOX CULVERT BENEATH ROCK BRIDGE ROAD.
5. REMOVE PLUG AND DIVERT FLOW INTO STABILIZED RELOCATED STREAM CHANNEL, AND SUSPENDED PIPE DIVERSION BOX CULVERT BENEATH ROCK BRIDGE ROAD.
6. CONSTRUCT BOX CULVERT INLET EXTENSION.

3 Stage EPSC: Stage 2 (Intermediate Grading)

- Example Notes and Details
  - Diversion and Embankment Berms



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3 Stage EPSC: Stage 2 (Intermediate Grading)

- EPSC plans dictated proposed grade to be tilted away (part of an EPSC phased approach)

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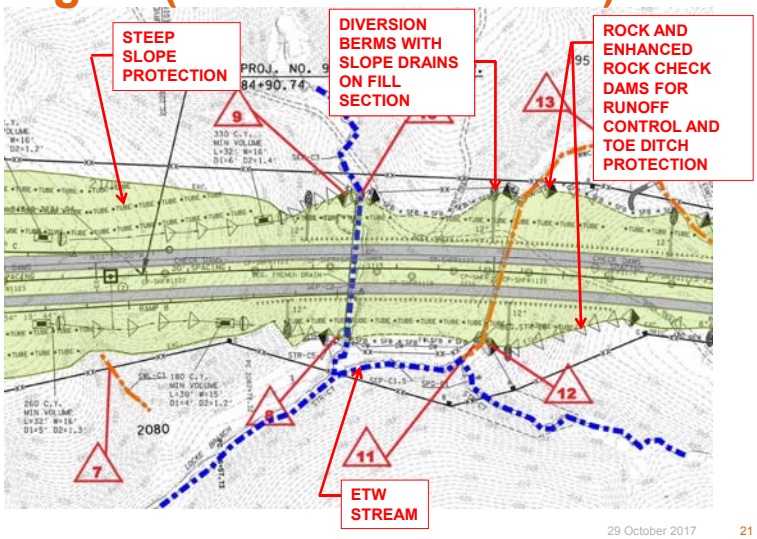
3 Stage EPSC: Stage 2 (Intermediate Grading)

- Grade tilted to drain to sediment traps

3 Stage EPSC: Stage 3 (Final Construction)

- Runoff Control
- Slope protection
- Final Stabilization

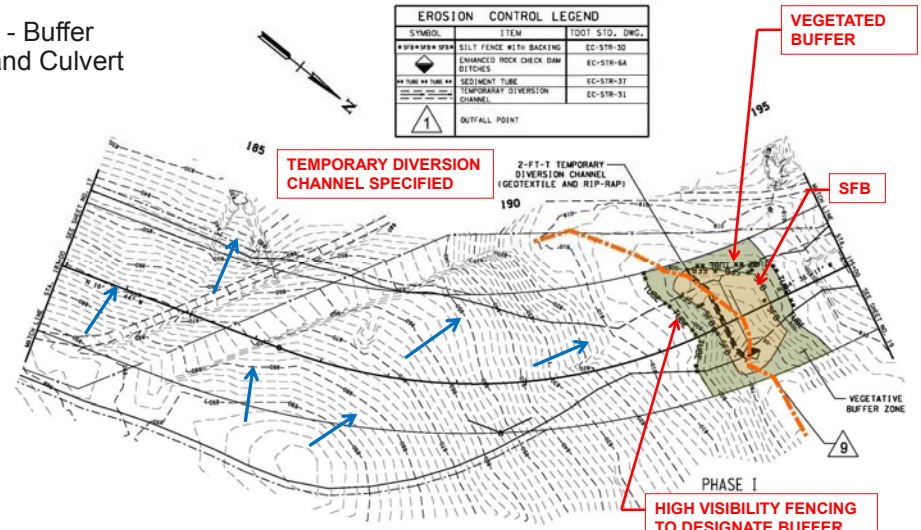


3 Stage EPSC: Stage 3 (Final Construction)

- Runoff controls

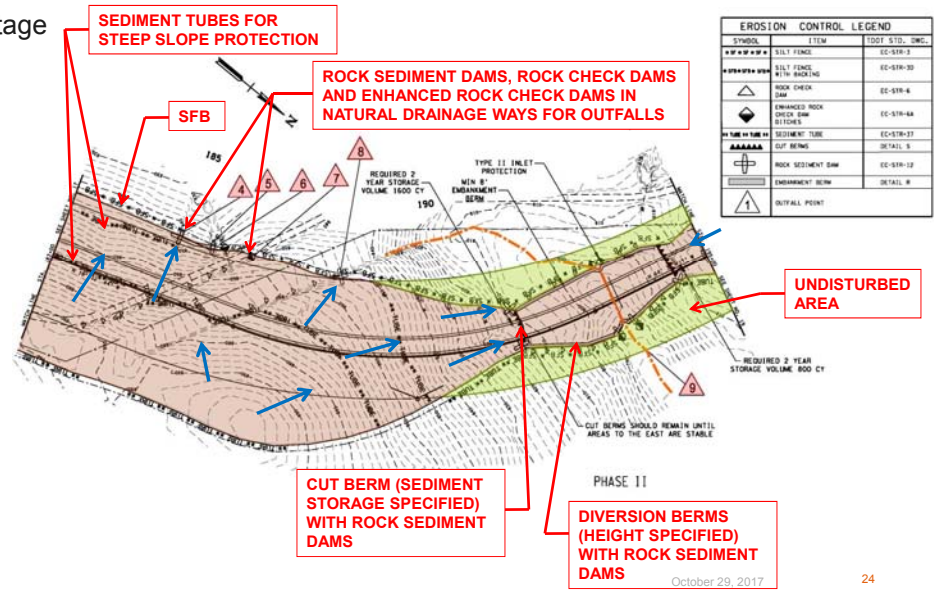
EPSC Stage 1:

- Initial Stage - Buffer Protection and Culvert Installation



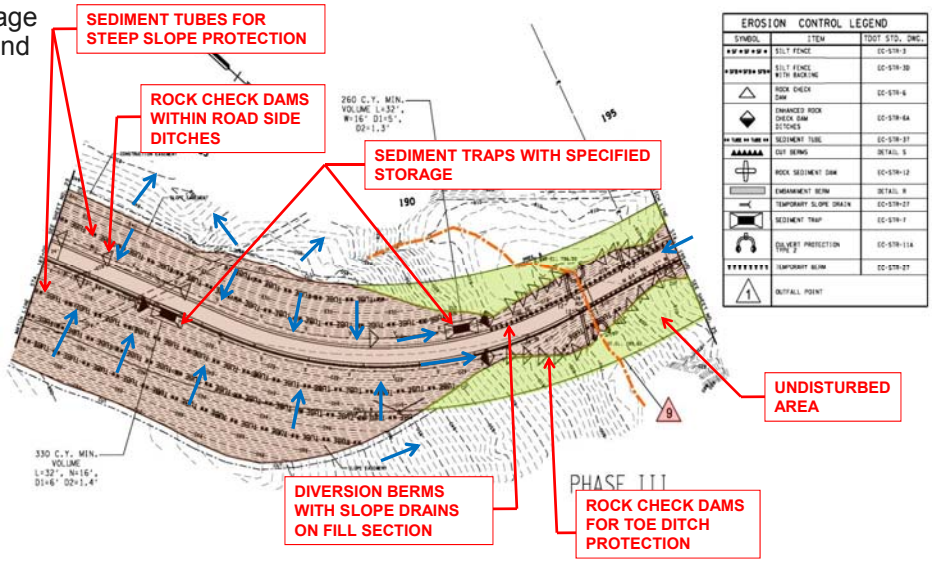
EPSC Stage 2:

- Intermediate Stage Clearing & Grubbing
- Mass Grading Operations



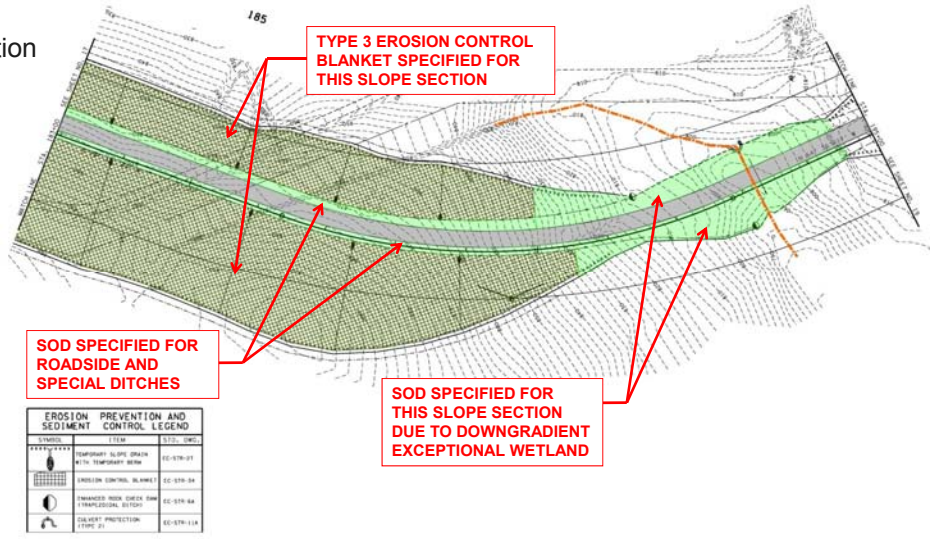
EPSC Stage 3:

- Intermediate Stage Mass Grading and Runoff Control



EPSC Stage 4:

- Final Stage Final Stabilization



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