

MOORE COUNTY, NORTH CAROLINA  
CONSTRUCTION & DEMOLITION LANDFILL  
(SWP # 63-01-CDLF-1992)  
ABERDEEN, NORTH CAROLINA

TECHNICAL SPECIFICATIONS  
FOR  
CELL 6 CONSTRUCTION & DRAINAGE IMPROVEMENTS

Prepared for:



SOLID WASTE

Moore County Solid Waste Department  
1 Courthouse Square  
Carthage, NC 28327

Prepared by:



Golder Associates NC, Inc.  
5B Oak Branch Drive  
Greensboro, NC 27407



SECTION 000110

TABLE OF CONTENTS

**DIVISION 00 – Bidding and Contract Requirements**

000110 TABLE OF CONTENTS

**DIVISION 01 – General Requirements**

011100 SUMMARY OF WORK  
012000 MEASUREMENT AND PAYMENT  
013119 PROJECT MEETINGS  
014000 QUALITY REQUIREMENTS  
015713 EROSION AND SEDIMENT CONTROL  
017123 FIELD ENGINEERING AND SURVEYING  
017700 CONTRACT CLOSEOUT  
018913 SITE PREPARATION

**DIVISION 31 – Earthwork**

310000 EARTHWORK  
310516 COARSE AGGREGATE  
310519 GEOTEXTILES  
311100 CLEARING AND GRUBBING

**DIVISION 32 – Exterior Improvements**

329219 SEEDING

APPENDIX A ENVIRONMENTAL PERMITS AND COMPLIANCE DOCUMENTS

\*\*\*\*\* END OF SECTION \*\*\*\*\*

## SECTION 011100

### SUMMARY OF WORK

#### PART 1 - GENERAL

##### 1.01 Description

- A. Provide all labor, materials, and equipment to construct a new waste disposal area known as Cell 6 as depicted on the Drawings titled "Moore County Construction and Demolition Landfill – Cell 6 Construction & Drainage Improvements", dated October 2020, and as described in the Project Manual containing, but not limited to, the Technical Specifications and the General Conditions – Standards & Specifications Manual.

##### 1.02 Work Covered by Contract Documents

- A. Project Description and Scope of Work: Project consists of the construction of Cell 6, an approximately 5.6-acre, unlined C&D landfill cell, including but not necessarily limited to: mass grading to establish cell base grades, perimeter channel grading and/or cleaning for improved site drainage, soil stockpiling, sediment pond rehabilitation (sediment removal, regrading, etc.), offsite hauling from borrow site (if required), subbase replacement and compaction (if required), construction erosion and sediment control, stormwater control improvements, and site restoration and stabilization.
- B. Project Location: Moore County Landfill, Aberdeen, North Carolina  
OWNER: Moore County Solid Waste Department
- C. OWNER'S ENGINEER Identification: The contract technical documents were prepared by Golder Associates NC, Inc., 5B Oak Branch Dr, Greensboro, NC 27407.
- D. The Work includes but is not limited to:
  - 1. Mobilization and demobilization.
  - 2. Site preparation and construction layout and control.
  - 3. Installation and maintenance of appropriate erosion and sediment control measures and maintenance for duration of project.
  - 4. Clearing and grubbing in areas designated for earthwork.
  - 5. Mass grading including cut and fill, both areal and in embankments, and deposition of excess cut material in multiple on-site stockpiles.
  - 6. Miscellaneous excavation and backfill, if requested by Owner.

7. Replacement of landfill base subgrade soil with offsite borrow, if required, to meet regulatory requirement for soil type (up to 2 feet deep). Includes site preparation, installation and maintenance of erosion and sediment controls, excavation, hauling, soil conditioning, and restoration of offsite borrow area.
8. Rehabilitation of three (3) sediment basins adjacent to the landfill, including sediment removal and on-site stockpiling, embankment erosion repair, and restoration of inlet and outlet works and basin accessories.
9. Replacement of up to two (2) roadway culverts with outlet protection.
10. Construction of new landfill perimeter stormwater channels (west and south), including seed, soil amendments and channel lining, and cleaning of the roadside stormwater channel north of the landfill.
11. Supply and installation of stone rip-rap to construct and/or restore scour protection in areas of concentrated stormwater flow, including supply and installation of separator geotextile as needed.
12. Construction of gravel access road inside completed landfill disposal area.
13. Final stabilization of disturbed areas with permanent seeding and other controls as determined by the OWNER and ENGINEER.

#### 1.03 Use of Premises

- A. CONTRACTOR shall have full use of premises for construction operations, including use of project site, during construction period. CONTRACTOR's use of premises is limited only by OWNER's right to perform work or to retain other contractors for work related or unrelated to this project.

#### 1.04 Specification Formats and Conventions

- A. Specification Format: The Specifications are organized into Divisions and Sections using CSI/CSC's "MasterFormat" numbering system.
- B. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by CONTRACTOR. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by CONTRACTOR or by others when so noted.
  3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
- D. Reference to Standard Specifications: Reference to standard specifications such as ASTM, ANSI, AWWA, etc. shall be the specification in effect at the date of advertisement unless otherwise stated.
- E. Intent of Drawings:
1. The drawings are diagrammatic only, intending to show general features and locations of piping, equipment, fixtures and specialties, and do not necessarily show all required offsets and details. All work shall be accurately laid out with reference to the drawings and in cooperation with other trades to avoid conflicts and to obtain a neat and workman-like installation.
  2. The drawings are not intended to be rigid in specific details and where they may be in conflict with requirements of the other drawings, or of any applicable code or ordinance, or with recommendations of the manufacturers of any equipment actually furnished, installed or connected, the work hereunder includes the making of such adjustments as may be required to cause all such equipment to be installed and connected in conformance with such codes, ordinances or recommendations for the safe, proper and efficient operation of the equipment.
- F. Discrepancies on Plans and Specifications: If the CONTRACTOR observes that the drawings and specifications are at difference therewith, they shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the CONTRACTOR performs any work knowing such differences occur, or that the work is contrary to any laws, ordinances, rules and regulations, and without such notice to the ENGINEER, they shall bear all cost arising there from.

- G. Tools, Plant and Equipment: If at any time before the commencement or during the progress of the work, tools, plant or equipment appear to the OWNER to be insufficient, inefficient, or inappropriate to secure the quality of the work required or the proper rate of progress, the OWNER may order the CONTRACTOR to increase their efficiency, to improve their character, to augment their number or to substitute new tools, plant, or equipment as the case may be, and the CONTRACTOR must conform to such order, but the failure of the OWNER to demand such an increase of efficiency, number or improvement shall not relieve the CONTRACTOR of his obligation to secure the quality of work and the rate of progress necessary to complete the work within the time allowed and to the satisfaction of the OWNER.
- H. Maintenance of Service, Prior Use by OWNER: All existing utilities, both public and private, including sewer, gas, water, electrical services, etc., shall be protected and their operation shall be maintained throughout the course of the work. Any temporary shutdown of an existing service shall be arranged between the CONTRACTOR and the responsible agency. The CONTRACTOR shall assume full responsibility and hold the OWNER harmless from the result of any damage that may occur as a result of the CONTRACTOR's activities. Prior to completion of the work, the OWNER (by agreement with the CONTRACTOR) may take over the operation and/or use of the completed project or portions thereof. Such prior use of facilities by the OWNER shall not be deemed as acceptance of any work or relieve the CONTRACTOR from any of the requirements of the Contract Documents.
- I. Codes, Laws, and Regulations:
1. It is intended herein that all work to be performed under this section be in compliance with the latest editions of all applicable Federal, State and local codes, laws and regulations governing standards of design, construction workmanship, materials, types of equipment, and methods of installation in Moore County, North Carolina. If the CONTRACTOR performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the ENGINEER, he shall bear all cost arising therefrom.
  2. It shall be the CONTRACTOR's responsibility to comply with the OWNER'S Erosion and Sediment Control Plan for his part of this work and to otherwise comply with the prevailing Erosion and Sediment Control Law.
- J. Safety and Health Requirements: The CONTRACTOR shall comply with the Department of Labor's Safety and Health Requirements for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54) and all amendatory requirements thereof.

- K. Accidents: The CONTRACTOR shall provide, at the site, such equipment and medical facilities as necessary to supply first-aid service to anyone who may be injured. The CONTRACTOR must promptly report in writing to the OWNER all accidents whatsoever arising out of, or in connection with the performance of the work whether on, or adjacent to, the site and which caused death, personal injury, or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone, text message, or messenger to both the ENGINEER and OWNER. If any claim is made by anyone against the CONTRACTOR or any subcontractor on account of any accident, the CONTRACTOR shall promptly report the facts in writing to the OWNER, giving full details of the claim.

## PART 2 - PRODUCTS

### 2.01 Submittals

- A. Submittals for all products/materials used on the project shall be provided by the CONTRACTOR for the OWNER's and ENGINEER's review. The submittals shall include, but not be limited to: pipes, valves and appurtenances, geosynthetics, earth and stone materials, channel linings, seed mixes, and pond outlet works.

## PART 3 - EXECUTION

### 3.01 General Responsibilities of the CONTRACTOR

- A. CONTRACTOR shall execute all construction work stated in this Section and in the manner specified or illustrated in the Contract Documents and Drawings. Any omission in these Specifications does not release the CONTRACTOR from the responsibility to complete the work or any part of the work to the satisfaction of the OWNER or his representative.
- B. The CONTRACTOR shall provide construction support facilities including, but not limited to, an office trailer (optional), waste dumpsters, temporary utilities, etc., as necessary to support all construction activities throughout the duration of the project.
1. The CONTRACTOR shall provide telephone and sanitary systems for its employees and these structures as required.
  2. The CONTRACTOR may provide and maintain a furnished office trailer with electricity and sanitary facilities (men and women) for use by the OWNER and the ENGINEER during the project.
    - a. Offices and sanitary facilities shall be cleaned regularly.
    - b. Offices and trailers shall meet all federal, state, and local requirements.
    - c. Supplier shall obtain all necessary permits for these facilities. The OWNER shall have right of access to these facilities.

3. The size, quantity, appearance, and location of support facilities shall be approved by the OWNER before such facilities may be brought on site or erected.
  4. Upon completion of the Work, Supplier shall promptly remove all support facilities from OWNER property.
  5. The CONTRACTOR shall be responsible for distribution, operation, and maintenance of temporary power from utility supplied points.
- C. CONTRACTOR shall develop, and submit to the OWNER, a Spill Prevention Control and Countermeasure (SPCC) Plan for the fuels and oils stored and used on site during the project. The SPCC plan must cover storage tanks, tank trucks, and equipment used on site during the project. The SPCC plan shall be certified by a professional engineer licensed in the State of North Carolina.
- D. The OWNER has obtained the necessary E&S, NPDES, and stormwater permits for the project from the North Carolina Department of Environmental Quality (NCDEQ). The CONTRACTOR shall ensure that all special and general permit conditions affected by the Work herein are complied with during all phases of construction, and shall be responsible for any repairs, corrective actions, or additional work required resulting from the Work as needed to fulfill the permit requirements at CONTRACTOR's sole expense.
- E. CONTRACTOR shall provide Field Surveying and Construction Quality Control (CQC) testing as necessary to comply with the Construction Drawings and Technical Specifications. All project materials, labor, and equipment necessary to comply with all conditions identified in the project documents and incidental to the project shall be included in CONTRACTOR's lump sum and/or unit prices contained on the CONTRACTOR's Bid Form.
- F. The CONTRACTOR shall provide all measures to maintain, control, and protect traffic at the intersections of any public or private roads and access roads to and on the site.

### 3.02 General Responsibilities of the OWNER

- A. The OWNER will supply available water for dust control and soil compaction, which can be drawn from on-site sources, subject to approval by the OWNER.
- B. The OWNER will supply third-party Construction Quality Assurance (CQA) to confirm that the work performed by the CONTRACTOR(s) complies with the approved Construction Drawings and Technical Specifications.
- C. The OWNER will supply surveying for construction documentation and pay quantities only.

### 3.03 General Work Tasks

- A. Material Storage

1. The CONTRACTOR shall arrange for the storage and protection of materials, equipment, and debris. Locations and configurations of such facilities shall be as designated by the OWNER.

B. Erosion and Sediment Controls

1. CONTRACTOR shall be responsible for protecting the project's disturbed areas from erosion in accordance with the existing site E&S Control Plan.
2. CONTRACTOR shall supply and install any additional required erosion and sediment control measures deemed necessary by the OWNER and ENGINEER.
3. CONTRACTOR shall be responsible for maintaining erosion and sediment control measures, such as silt fence, erosion control matting, etc., in the project areas.
4. Under no circumstances will the CONTRACTOR be allowed to disturb areas outside the Project's permitted limits of disturbance.

C. Clearing and Grubbing

1. CONTRACTOR shall be responsible for removing and disposing of trees, brush, stumps, and debris in project areas.
2. Clearing and grubbing should be conducted, where appropriate, to provide sufficient space for trenching, earthworks, etc. Clearing and grubbing should not extend more than 15 feet across proposed pipeline routes.

D. Dewatering

1. Dewatering may be required to remove ponded stormwater or exfiltrating groundwater. Dewatering will typically be accomplished by ditching or pumping to and through a permitted outfall structure unless stated otherwise by the OWNER or ENGINEER.
2. CONTRACTOR shall supply dewatering and filtering equipment and measures, such as pumps, hoses, filter bags, settling ponds, etc.
3. Dewatering shall be conducted in a manner that minimizes the risk of accidental effluent releases or other environmental contamination. This includes adequate erosion and sediment controls.
4. CONTRACTOR is responsible for dewatering in accordance with the site's existing discharge requirements. Filter bags or other treatment methods should be employed to prevent releases of sediment or other pollutants.

E. Earthwork

1. CONTRACTOR is responsible for conducting earthwork, such as grading and trenching, in a manner that reduces the potential for erosion and the spread of contaminants such as dust and leachate.
2. CONTRACTOR shall locate utilities in the work area to determine the presence of underground utilities prior to commencing earthwork activities.
3. CONTRACTOR shall coordinate with OWNER to determine on-site soil stockpile and borrow areas as needed.

F. Geosynthetics

1. The CONTRACTOR shall be responsible for unloading and storing all geosynthetic materials for the project.
2. The OWNER will arrange for geosynthetic conformance testing by an independent laboratory, if required.
3. The CONTRACTOR shall supply and install all required geotextiles associated with erosion and sediment control, access roads, stormwater control structures, leachate collection systems, etc.

G. Pipes, valves, fittings, and other appurtenances

1. CONTRACTOR shall supply, unload, store, and install all pipes, valves, fittings, and other appurtenances. CONTRACTOR shall store materials in accordance with manufacturer specifications to reduce the likelihood of damage.
2. CONTRACTOR shall install the pipe, valves, fittings, and other appurtenances in accordance with the Design Drawings and these Specifications. CONTRACTOR shall promptly notify OWNER and ENGINEER, in writing, of conditions which may impact installation in accordance with the Design Drawings.
3. CONTRACTOR shall perform quality control testing of installed materials and submit the results to the OWNER.
4. The OWNER will arrange for third party quality assurance testing of installed materials as needed.

H. Final Stabilization

1. CONTRACTOR shall supply and install stabilization measures such as soil stabilization blankets, seeding, mulch, lime, and fertilizing as deemed appropriate by the OWNER and ENGINEER.
2. All vegetation shall be covered under a one-year warranty to guarantee adequate cover.

3. CONTRACTOR shall remove and dispose of construction debris.

3.04 Inspections and Tests

A. The following tests of Work in place are specified for work under this Title and shall be successfully completed prior to substantial completion.

1. Not Applicable

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 012000

### MEASUREMENT AND PAYMENT

#### PART 1 - GENERAL

##### 1.01 Section Includes

Procedures for measurement and payment for the work to be done under the respective items listed in the itemized quantity listing for this project. Refer to Bid Form.

##### 1.02 General

- A. The following paragraphs describe measurement of and payment for the work to be done under the respective items listed in the itemized bid for this contract.
- B. Each lump sum and unit price stated in the itemized bid shall constitute full compensation for not only all labor, equipment and materials necessary and required to complete all work specified under that particular item including clean up, but also all costs for doing related work as set forth in these Specifications and/or on the Contract Drawings or implied in carrying out their intent.

##### 1.03 Computation of Quantities

- A. Computation of quantities expressed as area shall be based on the installed two-dimensional (2D) plan view and the purchased three-dimensional (3D) surface area of the final completed items. Installation of matting, geosynthetics, and other ground covering shall be measured from the completed outside limits. Unit prices are to take into account waste, overlay, and anchoring, where applicable.
- B. Measurement of quantities expressed as volume shall be based upon comparison of topographic surveys performed both prior to and upon completion of each item. Computation of the volume shall be by volumetric surface comparison or other methods approved by the OWNER. Unit prices shall account for any waste or loss due to transportation and compaction, and shall include costs for handling, transportation, and permitting of source material. Units will be in cubic yards and survey will be certified by a RLS or PE.
- C. Payment for items which have been tested and approved by the OWNER shall be based upon actual in-place quantities as determined by record surveys and drawings. No payment shall be made for items which have not been tested and approved.
- D. Progress payments for items by weight (ton) shall be as weighed at a certified weigh facility as may be approved by OWNER minus the tare weight of the vehicle.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

\* \* \* \* \* END OF SECTION \* \* \* \* \*

SECTION 013119  
PROJECT MEETINGS

PART 1 – GENERAL

1.01 Required Meetings

A. Preconstruction Meeting

1. CONTRACTOR's representative shall attend the Preconstruction Meeting and present the following information for acceptance by the OWNER and ENGINEER.
  - a. Construction Schedules
  - b. Schedule of Values (if required)
  - c. Shop Drawings, Samples, and Manufacturer's Data
2. The Preconstruction Meeting shall take place as indicated in the Modified Standard General Conditions of the Construction Contract.

B. Progress Meetings

1. Progress Meetings shall be held once each week, unless otherwise approved by the OWNER. Progress Meetings may be held via telephone or video conference as directed by OWNER. The ENGINEER's representative, the OWNER's representative, and the CONTRACTOR's Superintendent shall attend. Additional Progress Meetings may be scheduled as needed.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

- 3.01. Meeting minutes shall be prepared by the ENGINEER's or OWNER's representative and distributed to the attending parties within two (2) business days of the meeting for approval. Additions or revisions to the meeting minutes shall be presented to the ENGINEER and OWNER within two (2) business days for review and incorporation. Otherwise, the meeting minutes will stand approved as issued. Revised meeting minutes will be distributed within two (2) business days for additional comment. Approved minutes will be distributed at the subsequent meeting.
- 3.02. OWNER shall schedule Meetings at OWNER's convenience.

- 3.03. OWNER shall maintain a chronological file of all Meeting notes or minutes and have available at each Meeting.
- 3.04. The CONTRACTOR shall have up-to-date as-built (redline) drawings available at each Meeting.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 014000

### QUALITY REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 Summary

- A. This section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve CONTRACTOR of responsibility for compliance with the Specification requirements.
  - 1. Specific quality control and quality assurance requirements for individual construction activities are specified in the sections that specify those activities. Requirements in those sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit CONTRACTOR's quality control procedures that facilitate compliance with the requirements.
  - 3. Requirements for CONTRACTOR to provide quality control services required by ENGINEER, OWNER, or authorities having jurisdiction are not limited by provisions of this Section.

##### 1.02 Definitions

- A. Quality Control Services: Activities, actions, and procedures performed before and during execution of the Work by CONTRACTOR to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality Assurance Services: Tests, inspections, procedures, and related actions during and after execution of the Work by OWNER to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by OWNER.
- C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

##### 1.03 Submittals

- A. Testing agencies shall prepare and submit certified written reports that include the following:

1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Ambient conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and re-inspecting.
- B. Permits, Licenses, and Certificates: For OWNER's records, CONTRACTOR shall submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.04 Quality Control

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance.

### 1.05 Quality Assurance

- A. OWNER Responsibilities: Where quality assurance services are indicated as OWNER's responsibility, OWNER will engage a qualified testing agency to perform these services.
  - 1. OWNER will furnish CONTRACTOR with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Documents will be charged to CONTRACTOR.
- B. Retesting/Re-inspecting: Regardless of whether original tests or inspections were OWNER's or CONTRACTOR's responsibility, provide quality assurance services, including retesting and re-inspecting, for construction that revises or replaces Work that failed to comply with requirements established by the Documents.
- C. Coordination: CONTRACTOR shall coordinate sequence of activities with OWNER to accommodate required quality assurance services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 – PRODUCTS

NOT USED

## PART 3 - EXECUTION

### 3.01 Testing and Inspection Log

- A. ENGINEER or OWNER shall prepare a record of tests and inspections. Include the following:
  - 1. Date of test or inspection was conducted.
  - 2. Description of the work tested or inspected and results of testing or inspection.
  - 3. Identification of testing agency or special inspector conducting test or inspection.

3.02 Repair and Protection

- A. On completion of testing, inspecting, sampling, and similar services, CONTRACTOR shall repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality assurance service activities.
- C. Repair and protection are CONTRACTOR's responsibility, regardless of the assignment of responsibility for quality assurance services.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 015713

### EROSION AND SEDIMENT CONTROL

#### PART 1 - GENERAL

##### 1.01 Description of Work

- A. The CONTRACTOR shall provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with all applicable federal, state, and local enforcing agency guidelines and these Specifications. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.
- B. The work shown on the Contract Drawings and working drawings shall be considered a minimum requirement. What is shown shall not relieve the CONTRACTOR of the responsibility to actively take all steps necessary to control soil erosion and sedimentation.
- C. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.
- D. Pipeline work, including trenching, pipe-laying, etc., is considered "utility work" and does not require specific erosion and sediment control practices. However, the CONTRACTOR should limit disturbances outside the Project's permitted limits of disturbance to 2,000 square feet and shall not exceed disturbances of 5,000 square feet or more. Utility work disturbed areas shall be limited to the amount of work which can be accomplished and stabilized in a single day and shall be stabilized by the end of the work day.
- E. CONTRACTOR shall repair any material or existing surface conditions damaged by erosion or covered with sedimentation at the CONTRACTOR's expense.
- F. CONTRACTOR shall maintain at least 20% overstock of erosion control items stockpiled on-site or have ready access to needed items via a supplier for ease of use to replace installed items as deemed necessary.
- G. The temporary erosion control features installed by the CONTRACTOR shall be maintained by the CONTRACTOR until no longer needed as determined by the OWNER, or permanent erosion control methods are installed.
- H. It shall be the sole responsibility of the CONTRACTOR to properly schedule and coordinate all necessary labor, equipment, and materials such that the specified work is performed in accordance with the project schedule and the Contract requirements. At the discretion of the OWNER, the OWNER may reject or direct the CONTRACTOR to repair (at the CONTRACTOR's sole expense) those items which are detrimental to the project or not in compliance with the Contract Documents. Such direction or rejection by the OWNER shall not relieve the CONTRACTOR of his obligation to properly schedule and perform other specified work items in conformance with the Contract Documents.

## 1.02 Submittals

- A. At the preconstruction conference, the CONTRACTOR shall submit for OWNER's approval, a schedule and construction drawing for accomplishment of temporary and permanent erosion control work, as applicable for clearing and grubbing, grading, structures at watercourses, and general construction. No work shall be started until the erosion control schedules and methods of operations for each phase of construction have been accepted by the OWNER. This plan will be referred to as the CONTRACTOR's Soil Erosion and Sediment Control Plan.

## PART 2 - PRODUCTS

### 2.01 Silt Fence

- A. Silt fence shall be Filter X, Mirafi 100X, Stabilinka T140N, or approved equal.

### 2.02 Straw Bales

- A. Straw bales shall be clean, seed-free oat or wheat type.
- B. Use of straw bales should be minimized. Straw bales should not be placed immediately upstream or downstream of stormwater drainage pipes, spillways, or other stormwater management structures.

### 2.03 Seed

- A. Temporary and permanent seeding shall meet the requirements of Section 329219 "Seeding".

### 2.04 Temporary Erosion Control Matting

- A. Temporary Erosion Control Matting shall be either a natural or synthetic material that is photo- and bio-degradable matting suitable for seed establishment and capable of offering erosion protection for at least one growing season. CONTRACTOR shall supply information on proposed material to the ENGINEER for approval.

### 2.05 Gabions and Reno Mattresses

- A. Gabions and Reno Mattresses shall be constructed of welded wire mesh. The mesh material shall be galvanized steel.

## PART 3 - EXECUTION

### 3.01 General

- A. The project-specific erosion and sediment construction sequence outlined on the project's construction drawings and the CONTRACTOR's Soil Erosion and Sediment Control Plan (see paragraph 1.02) shall contain specific items tailored for the construction activity, including required pre-construction meetings and inspections.

- B. Conduct earthwork and excavation activities in such a manner to fit the topography, soil type, and condition.
- C. Minimize the area being disturbed and the duration of exposure to erosion elements.
- D. Stabilize disturbed areas as soon as appropriate. Utility work shall be stabilized by the end of the work day on which it is disturbed.
- E. Prevent silt and sediment from entering any watercourse if soil erosion cannot be prevented. Prevent silt and sediment from migrating downstream in the event it cannot be prevented from entering the watercourse.
- F. Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.
- G. The OWNER has the authority to limit the surface area of erodible material, and to direct the CONTRACTOR to provide immediate temporary or permanent control measures to prevent sediment impact on adjacent watercourses.
- H. Where erosion is likely to be a problem, operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the Project conditions permit; otherwise, erosion control measures may be required between successive construction stages.
- I. The OWNER will limit the area of excavation, and embankment operations in progress commensurate with the CONTRACTOR's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measure shall be taken immediately to the extent feasible and justified.
- J. In the event that additional temporary erosion and sedimentation control measures are required due to the CONTRACTOR's negligence, carelessness, or failure to install permanent controls as a part of the work schedule, and are ordered by the OWNER, such work shall be performed by the CONTRACTOR at the CONTRACTOR's expense, and no time extension shall be given.

### 3.02 Temporary Erosion and Sedimentation Controls

- A. Temporary erosion control measures shall be used to correct conditions that develop during construction that lead to soil erosion or deposition of waterborne sediments; that are needed prior to installation of permanent erosion control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features on the Project.
- B. Temporary erosion and sedimentation control devices shall be installed and maintained prior to the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

- C. The CONTRACTOR shall coordinate the installation of temporary erosion and sedimentation control provisions contained herein with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.
- D. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt, and sediment from entering the watercourses. The preferred method is to provide an undisturbed natural buffer, extending a minimal 5 feet from the top of the bank, to filter the run-off.
- E. Silt fences, barriers, temporary sedimentation basins and other temporary measures and devices shall be installed, and shall be maintained until no longer needed, as determined by the OWNER. At that time, the items shall be removed by the CONTRACTOR. All temporary items and devices must be removed with the OWNER's approval prior to final demobilization from the Site.
- F. Where permanent vegetation is not appropriate, and where the CONTRACTOR's temporary erosion and sedimentation control practices are inadequate, the CONTRACTOR shall provide temporary vegetative cover. Such temporary vegetative cover shall be provided by the CONTRACTOR in compliance with Section 329219 "Seeding" of these specifications.
- G. All erosion and sedimentation control devices shall be inspected by the CONTRACTOR at least weekly and after each rainfall occurrence and cleaned out and repaired by the CONTRACTOR as necessary.

### 3.03 Erosion and Sediment Control Techniques

#### A. Temporary Diversion Berms

- 1. A temporary diversion berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes.
- 2. These diversion berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.
- 3. A temporary diversion berm shall be constructed of compacted soil, with a minimum width of 24-inches at the top and a minimum height of 12-inches with or without a shallow ditch. Side slopes shall be three horizontal to one vertical (3H:1V) or flatter.

#### B. Sediment Control Structures

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

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

C. Riprap

1. Unless shown otherwise on the Contract Drawings, riprap shall be placed where ordered by the OWNER and at all points where banks of streams or drainage ditches are disturbed by excavation. Fill or backfill shall be carefully compacted and riprap placed to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing a stream or drainage ditch.

D. Straw Bales

1. Straw bales are temporary measures to control erosion and retain the suspended silt particles in the runoff water leaving disturbed areas. Bales shall contain five cubic feet or more of material.
2. Straw bales shall be embedded in the ground 4 to 6-inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales shall be removed after they have served their purpose, as determined by the OWNER.
3. The CONTRACTOR shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.
4. Use of straw bales should be minimized. Straw bales should not be placed immediately upstream or downstream of stormwater drainage pipes, spillways, or other stormwater management structures.

E. Silt Fences

1. Silt fences are temporary measures utilizing woven wire or other approved materials attached to posts with filter cloth attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.
2. Temporary silt fences shall be placed on the natural ground, at the toe of fill slopes, in ditches or other areas where siltation is a problem. Temporary silt fences shall be anchored as indicated on the Contract Drawings.
3. The CONTRACTOR shall be required to maintain the silt fence in a satisfactory condition for the duration of the Project or until its removal is requested by the OWNER. The silt accumulation at the fence must be removed and placed on Site as directed by the OWNER.

F. Gabions and Reno Mattresses

1. Gabions and Reno Mattresses shall be used for the construction of permanent downchutes where called for on the plans.
2. Gabions and Reno Mattresses shall be placed over an 8-oz geotextile to provide separation between the baskets/mattresses and the subgrade soil.
3. Installation of gabions and Reno mattresses shall comply with manufacturer recommendations.

G. Temporary Vegetation

1. Temporary vegetation measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All slopes shall be seeded when and where necessary to eliminate erosion. Disturbed or bare soil areas shall not be left without stabilization for more than 30 days.
2. Seeding, mulching and fertilizing shall be performed in accordance with Section 329219 "Seeding" of these Specifications.
3. If late fall completion prevents germination, disturbed areas shall be protected by mulching without application of seed as a minimum. Seeding shall then be performed no later than April 15<sup>th</sup> of the following spring.

H. Permanent Vegetation

1. All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 329219 "Seeding" of these specifications.

3.04 Permanent Erosion and Sediment Control

- A. The CONTRACTOR shall incorporate all permanent erosion control features into the Project at the earliest practicable time as outlined in the CONTRACTOR's Soil Erosion and Sediment Control Plan accepted schedule or as land disturbance for each segment of the Project has been completed.
- B. Restore the work site to its original contours, unless shown otherwise on the Drawings or directed by the OWNER.
- C. All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 329219 "Seeding" of these specifications.
- D. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized, and mulched in an effort to restore to a protected condition. Areas that are not stabilized with seed and mulch shall be sodded as approved or directed by the OWNER.

- E. Specified permanent vegetation shall be established at the first appropriate season following establishment of final grading in each section of the Site.
- F. Where sod is removed or damaged, such areas shall be replanted using sod of the same species of grass at the first appropriate season.
- G. Permanent vegetative cover activities shall comply with local soil and water conservation guidelines.
- H. Where permanent vegetative cover cannot be immediately established (due to season or other circumstances), the CONTRACTOR shall provide temporary vegetative cover.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 017123

### FIELD ENGINEERING AND SURVEYING

#### PART 1 - GENERAL

##### 1.01 Description of Work

- A. Work under this Section includes all surveying services for accurate location of all features of construction and establishing proposed grades.

##### 1.02 Quality Control

- A. CONTRACTOR is responsible for all surveying necessary for control of its work at the site. CONTRACTOR's Surveyor shall be a qualified and Registered Land Surveyor in the State of North Carolina. This Surveyor shall also have a minimum of two years of experience in Construction Surveying layout and maintenance of as-built construction drawings with a record of performing horizontal and vertical control requirements as stated in the contract.

##### 1.03 Submittals

- A. Name, address, and telephone number of Surveyor shall be submitted to OWNER before starting survey work by CONTRACTOR.
- B. On request, documentation verifying accuracy of survey work shall be submitted to OWNER by CONTRACTOR.

##### 1.04 Survey Requirements

- A. CONTRACTOR shall utilize existing control points and same reference grid as OWNER's surveyor (presumed North Carolina State Plane). CONTRACTOR shall establish new control points as needed to complete work under this section.
- B. CONTRACTOR shall provide field engineering services and use recognized engineering survey practices.
- C. Establish elevations, lines, and levels. Locate and layout by instrumentation and similar appropriate means site improvements including roadways, stakes for grading and fill placement, utility locations, slopes, and invert elevations.
- D. Periodically verify layouts by same means.

##### 1.05 Survey Tolerances

- A. Grading Tolerances shall be as defined in the individual specifications of Divisions 2 and 3, as applicable.

1.06 As-built Record Surveys for Documentation and Certification

- A. As-built record surveys for the purpose of documentation and certification of the project shall be provided by the OWNER's surveyor.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 Inspection

- A. CONTRACTOR shall verify locations of site reference and survey control points prior to starting work. OWNER must be promptly notified of any discrepancies discovered.

3.02 Survey Reference Points

- A. CONTRACTOR shall take measures to protect site reference and survey control points prior to starting site work and must preserve permanent reference points during construction. Site reference points may not be relocated without prior written notice to and approval of OWNER.
- B. The OWNER shall be immediately notified of loss, damage, or destruction of any reference point, or relocation required because of changes in grades or other reasons. CONTRACTOR shall replace disturbed survey control points based on original survey control at no extra cost.
- C. X, Y, and Z coordinates of benchmarks and survey control points shall be determined (and recorded) with a maximum permissible error of 0.01 feet ( $\pm$ ) in any coordinate direction.
- D. All X and Y coordinates are to be referred to the North Carolina State Plane coordinate system with an accuracy of 0.01 feet ( $\pm$ ).
- E. All Z coordinates are to be referred to nearest NGVD benchmark with an accuracy of 0.10 feet ( $\pm$ ).

3.03 Survey Requirements

- A. CONTRACTOR shall reference survey and data reference points to permanent benchmarks and record locations of survey control points, with horizontal and vertical data.
- B. CONTRACTOR shall re-verify layouts periodically during construction by same means.

\*\*\*\*\* END OF SECTION \*\*\*\*\*

SECTION 017700  
CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Procedures:

1. After substantial completion, when the CONTRACTOR considers the work is complete, submit an Application for Final Payment to the OWNER.
2. A Final Inspection meeting shall be held at the site to determine completeness.
3. A final list of items to be completed (punch list) shall be prepared by OWNER, ENGINEER and CONTRACTOR at this meeting.
4. Notify OWNER and ENGINEER upon completion of all items on this list.
5. Complete and submit to OWNER and ENGINEER three (3) complete sets of record (as-built) documents acceptable to the ENGINEER prior to receiving OWNER's payment of final pay request.
6. OWNER's payment of final application shall terminate the Contract except as provided for Bonds and Warranties for the guarantee period.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 018913

### SITE PREPARATION

#### PART 1 - GENERAL

##### 1.01 Description of Work

- A. The CONTRACTOR shall furnish all materials, labor, equipment, tools, and appurtenances required to complete the work.
- B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.
- C. Remove and dispose of all debris, bulky items, waste materials, etc. existing in the area to be constructed and encountered on the surface. All bulky items such as large debris, stumps, old fencing, etc. are to be disposed of off-site at CONTRACTOR's expense.
- D. Protect and maintain benchmarks, monuments, and other reference points. Re-establish, at no cost to the OWNER, any such reference points if disturbed or destroyed. The CONTRACTOR's surveyor shall conduct a survey of all monuments and property markers within proposed cover areas prior to any disturbance such as they can be re-established after completion of the cover by the CONTRACTOR as part of this Contract.
- E. Remove, demolish, excavate, haul, and dispose of any on-site structures, pavement, roads, drainage pipes, utilities, etc. per paragraph "C" above.

#### PART 2 - PRODUCTS

##### 2.01. Limit of Disturbance Markers

- A. Markers shall consist of 48-inch wood lathes or equivalent with bright survey tape streamers or painted tops to assure visibility for the duration of the project.

#### PART 3 - EXECUTION

##### 3.01. Site Inspection

- A. Prior to work described in this Section, carefully inspect the entire site and objects designated to be removed and to be preserved.

##### 3.02. Clarification

- A. The drawings do not propose to show all objects existing on the site. Before commencing work, verify with the OWNER objects not clearly identified to be removed or to be preserved and discrepancies not fully resolved.

##### 3.03. Prior Conditions Inspections

- A. Prior to work of this Section, carefully inspect the existing conditions. In the event of discrepancy, immediately notify the OWNER and do not proceed with installation in non-conforming areas until identified discrepancies have been fully resolved.
- 3.04. Protection and Safety
- A. Verify required protection devices are in place and operational.
- 3.05. Preparation and Layout
- A. Install Limit of Disturbance markers at maximum 100-foot intervals, or less as needed for clear visibility, along the Limit of Disturbance (LOD) line indicated on the drawings. Portions of the LOD may be excluded from marking in areas where work will not be performed in proximity to the LOD.
  - B. Establish extent of site work by area and elevations; designate and identify datum elevation.
  - C. Set required lines and levels.
  - D. Maintain bench marks, monuments and other survey reference points.
- 3.06. Excess Water Control
- A. Do not place, spread, or roll fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory.
  - B. Provide berms or channels to intercept run-on into and direct run-off away from work areas; promptly remove water collecting in depressions or sumps. Confirm proposed diversion and discharge locations and conditions with Owner prior to implementing.
  - C. Provide and maintain during construction, ample means, and devices with which to promptly remove and/or dispose of water from sources entering excavations and work areas. Dewater promptly using means that will maintain dry excavations and the preservation of the final lines and grades of excavations.
- 3.07. Surplus Materials
- A. Remove surplus backfill materials from site, or as otherwise directed by OWNER.
  - B. Stockpile surplus soils as directed by the ENGINEER.
- 3.08. Removal of Debris
- A. Promptly remove cleared debris from site, or as otherwise directed by OWNER.
  - B. Remove surplus equipment and tools from the site.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 310000

### EARTHWORK

#### PART 1 – GENERAL

##### 1.01 Work Included

- A. The work under this section includes the furnishing of all labor, equipment, and materials, and completing all operations in connection with excavating, backfilling, compacting, grading, and placing soil materials and all other incidental work necessary for construction according to the Construction Drawings and Technical Specifications.
- B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state, or federal authorities having jurisdiction.
- C. The CONTRACTOR shall locate all existing active and abandoned utilities and structures in work areas prior to commencing any excavation activities and shall protect from damage those utilities and structures which are to remain in place
- D. Grading tolerance for the landfill base grade shall be -0.0 to +0.2 feet. Grading tolerance for all fill and backfill shall be  $\pm 0.1$  feet. Protective cover soil and vegetative support layer thickness tolerances shall be -0.0 to +0.2 feet.
- E. Definitions
  - 1. Excavation shall mean the removal from place of all materials and shall include soil; facilities; structures above and below ground; rock; pavements; topsoil; boggy waste; rubbish; tree stumps; boulders; logs; ashes; cinders; organic material such as peat, humus, or organic silt; softened or disturbed soils; or other unsuitable bearing materials determined in the field by the ENGINEER.
  - 2. Mucking or mucking-out shall mean excavation, as defined herein before, without prior dewatering.

##### 1.02 References

- A. Construction Quality Assurance Plan
- B. Latest Version of American Society for Testing and Materials (ASTM) standards:
  - 1. D6913 Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis
  - 2. D698 Laboratory Compaction Characteristics of Soil Using Standard Compaction Effort
  - 3. D2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
  - 4. D8167/D8167M-18a Standard Test Method for In-Place Bulk Density of Soil and Soil-Aggregate by a Low Activity Nuclear Method (Shallow Depth)
  - 5. D6938-17a Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

6. D2937-17e2 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
7. D2216-19 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
8. D4959-16 Standard Test Method for Determination of Water Content of Soil by Direct Heating
9. D422 Standard Test Method for Particle Size Analysis of Soils
10. D3080 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions
11. D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
12. D5321 Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Interface Friction by the Direct Shear Method
13. D4767 Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
14. D2166 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

### 1.03 Submittals

#### A. Borrow Sources

1. All backfill and fill materials, unless otherwise specified, shall consist of suitable, selected, and approved (by the OWNER) soil from borrow areas.
2. The CONTRACTOR shall provide the OWNER or ENGINEER samples from each borrow source to be used as fill. From each borrow source, representative composite sample(s) shall be tested for the following, at a minimum depending on proposed uses:
  - a. USCS Soil Classification (ASTM D2487, including Grain Size Analysis - ASTM D422 (or D6913) and Atterberg Limits - ASTM D4318); two per source or material type
  - b. Compaction Testing (Standard Proctor) (ASTM D698); two per source or material type
3. If the OWNER or ENGINEER determines that the source contains more than one soil type, as determined by the Unified Soil Classification System (USCS), the tests listed shall be completed for each soil type.
4. Soils from borrow sources with potential exposure to contamination (such as petroleum or TCLP metals) may be subject to environmental testing at the discretion of the OWNER.

B. Shoring and Bracing

1. In cases where the excavation cannot be open cut to a safe working angle in accordance with applicable requirements or where excavation may jeopardize adjacent site areas or the stability of nearby structures or facilities, the CONTRACTOR shall submit drawings, computations and substantiating data, prepared, signed, and sealed by a Professional Engineer licensed in the State of North Carolina, showing his proposed shoring and bracing design and method of construction for the information of the OWNER prior to the start of such construction.
2. Shoring and bracing systems shall be designed such that removal shall not jeopardize work already performed. Shoring and bracing systems shall not remain permanently in place without the written approval of the OWNER.
3. Any review or comments by the OWNER shall not relieve the CONTRACTOR of his responsibility for sheeting and bracing.
4. In trenches, the sheeting shall be designed so that the lowest brace is no closer than 12 inches above the base of the structure to be installed.

C. The CONTRACTOR shall submit the technical data sheet for the proposed compaction equipment to the OWNER or ENGINEER for review and approval.

D. Employ a professional land surveyor licensed in North Carolina to conduct an as-built topographic survey of the subbase, top of the bottom liner, and protective cover subgrades, as appropriate, and prepare a survey drawing showing contours at maximum two-foot intervals. Furnish the ENGINEER with three (3) copies of the topographic survey drawings. These drawings shall become part of the record drawings required by this contract.

1.04 Prequalifications

- A. The CONTRACTOR shall be an experienced earthwork CONTRACTOR who has at least five years of experience. The CONTRACTOR shall have completed at least three projects with the same material and of similar scope as that indicated for this project with a successful installation and maintenance record of in-service performance.
- B. The CONTRACTOR is required to demonstrate compliance to the above requirements to the satisfaction of the ENGINEER and OWNER.

1.05 Quality Assurance Program

- A. CONTRACTOR shall participate in and conform to the items and requirements of the quality assurance program as outlined in this Specification and the Construction Quality Assurance Plan.
- B. The OWNER will engage and pay for the services of a CQA Consultant and testing laboratory to monitor the earthworks operations and complete conformance testing.

1.06 Protection of People and Property

- A. The CONTRACTOR shall plan and conduct operations in accordance with OSHA and local codes and ordinances so as to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, protect the structures to be installed, and provide safe working conditions.

- B. The CONTRACTOR shall control stormwater such that run-on and run-off do not affect the quality of receiving wetlands, brooks, streams, or rivers. The CONTRACTOR shall be responsible for cleaning (removal of silt) sedimentation and stormwater structures (swales, culverts, basins) as needed during construction, after stabilization of project areas, and at the conclusion of work prior to demobilization.
- C. The CONTRACTOR shall be responsible for protecting existing environmental monitoring devices such as groundwater monitoring wells within the limits of work. Any damage to existing environmental monitoring devices resulting from construction activities shall be the responsibility of the CONTRACTOR to correct at no additional cost to the OWNER.
- D. Excavations, except as specified, shall be adequately shored and braced. Where the installation of shoring is impractical or might cause damage, as a result of, but not limited to, vibration, settlement, or lateral movement, the CONTRACTOR shall utilize other methods.
- E. CONTRACTOR shall be solely responsible for proper excavation procedures including, but not limited to, safe slope angles and the design and use of properly designed and installed shoring and bracing systems in accordance with OSHA and other applicable standards and requirements. As required, shoring and bracing shall be designed by the CONTRACTOR's engineer who is a registered Professional Engineer in the State of North Carolina. Remove all shoring and bracing without disturbing backfill, bedding, haunching, pipes, or structures. The presence of the ENGINEER shall not relieve the CONTRACTOR of his responsibility to properly design, install, and maintain shoring and bracing. The OWNER shall not be the competent person on the Site.
- F. In cases where excavation without shoring and bracing is not permissible solely because of protection of workers, trench boxes may be used.
- G. The CONTRACTOR shall not stockpile any excavated material without OWNER approval. Stockpile location shall be approved by the ENGINEER or OWNER.

## PART 2 – PRODUCTS

### 2.01 General

- A. No frozen earth shall be used for fill or backfill, and no fill or backfill shall be placed over frozen surfaces. All fill and backfill materials shall be free from perishable and objectionable (as described below) materials. All fill shall be protected from frost if the ENGINEER judges frost will prevent the material from performing as required.
- B. All required fill materials shall be free from objectionable materials which may be compressible, or which cannot be properly compacted. It shall not contain rock fragments, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted to the specified density. Snow, ice, and frozen soil shall be removed from fill material prior to placement.
- C. Compact fill material to a minimum percentage of the maximum dry density as determined by a Standard Proctor Compaction Test (ASTM D698) as shown in the table below. Do not compact frozen fill material or onto frozen surfaces. Compacted fill material in place that does not meet the density requirements shall be removed, reworked and recompacted to meet or exceed density objectives.

Material Type / Use	Compaction Requirement	Moisture Content
Structural Fill (General)	95%	-3% to +3%
Structural Fill (Road Subgrade)	98%	-2% to +2%
Structural Fill (Embankments)	95%	-3% to +3%
Structural Fill (Foundations)	95%	-3% to +3%
Trench Backfill & Stockpile	90%	-4% to +4%
Landfill Base Grade (modified)	95%	-2% to +2%
Final Cover Low Permeability_Soil	TBD	TBD
Vegetative Support Soil	TBD	TBD

## 2.02 Structural Fill Materials

- A. Structural fill materials shall be used as general fill, clean backfill, pipe bedding, and as other material as shown on the Construction Drawings.
- B. Structural fill materials shall be classified according to the USCS as GM, GC, SM, SC, ML, or CL (ASTM D2487).
- C. Structural fill shall be free of rubble, wood, stumps, brush, metal, cinders, trash, demolition debris, garbage, topsoil, organic soil, loam, sludge, and other deleterious materials. The maximum stone size shall be two inches in any dimension and shall not comprise more than five percent of the total soil mass.
- D. Structural fill shall be approved by the ENGINEER for each application.

## 2.03 Subgrade Materials

- A. Landfill Base Grade
  - 1. The landfill base grade shall consist of the top 24 inches of earth materials (in-situ or modified) present at the grades established on the design drawings.
  - 2. Base grade materials shall consist of in-situ soils having a Unified Soil Classification of SC, SM, ML, CL, MH, or CH, or shall be replaced with same and compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698 (Standard Proctor).
  - 3. The finished subgrade shall be free of rubble, wood, stumps, brush, standing water, metal, cinders, trash, demolition debris, garbage, topsoil, organic soil, loam, sludge, and other deleterious materials.
  - 4. The base grade surface shall be rolled with a smooth-drum compactor of sufficient weight to remove most wheel ruts, footprints, or other abrupt grade changes prior to the as-built topographic survey to confirm conformance with design base grades.
  - 5. The finished subgrade shall be inspected by a qualified geologist or engineer provided by the OWNER when excavation is completed, and compliance with these specifications shall be documented by the inspector. If not in compliance, the subgrade shall be reworked until any deficiencies have been corrected, including replacement of unsuitable soils as noted in sub-item A.2 above. The CONTRACTOR shall provide the OWNER at least 48 hours' notice of readiness for inspection so that the inspector can be scheduled and the OWNER can notify the NC Division of Waste Management's hydrogeologist at least 24 hours before the subgrade inspection.

B. Final Cover Subgrade (Soil Cap Option)

1. The final cover subgrade (cap subgrade) shall consist of the top six (6) inches of material comprising intermediate cover in completed landfill cells.
2. Final cover subgrade materials shall consist of soils having a USCS classification of SC, SM, ML, CL, MH, or CH, and shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698 (Standard Proctor).
3. Final cover subgrade shall be free of rubble, wood, stumps, brush, standing water, metal, cinders, trash, demolition debris, garbage, topsoil, organic soil, loam, sludge, and other deleterious materials.
4. The final cover subgrade surface shall be rolled with a smooth-drum compactor of sufficient weight to remove most wheel ruts, footprints, or other abrupt grade changes prior to the topographic survey to establish initial grades for comparison to subsequent layer surveys to determine conformance with design cap layer thicknesses.

C. Final Cover Subgrade (Geosynthetic Cap Option)

1. The final cover subgrade (cap subgrade) shall consist of the top six inches of material underlying a geomembrane liner.
2. Final cover subgrade materials shall consist of soils having a USCS classification of SC, SM, ML, CL, MH, or CH, and shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698 (Standard Proctor).
3. Final cover subgrade shall be free of rubble, wood, stumps, brush, standing water, metal, cinders, trash, demolition debris, garbage, topsoil, organic soil, loam, sludge, and other deleterious materials. The maximum stone size shall be 1/2 inches in any dimension (unless otherwise approved by ENGINEER).
4. The interface friction angle between the final cover subgrade and the overlying geosynthetics shall be greater than or equal to 25.8° as determined by ASTM D5321 or as required by the ENGINEER.
  - a. Each direct shear test shall determine interface strength at normal stresses of 100 pounds per square foot (psf), 300 psf, and 500 psf. Tests shall be completed under fully saturated conditions (saturation time of 15 minutes), have a seat time of 15 minutes, and have a shear rate of 0.04 inches per minute (in/min).
  - b. The direct shear test shall be completed using installation procedures used under actual field conditions.
  - c. Additional samples shall be collected and tested if the material does not meet the minimum requirements of this Technical Specification.
5. The final cover subgrade surface shall be rolled with a smooth-drum compactor of sufficient weight to remove most wheel ruts, footprints, or other abrupt grade changes. Minor irregularities on the surface are acceptable as long as protrusions, rocks, etc. extending more than 1/2-inch from the subgrade are removed, crushed, or pushed into the surface with the smooth-drum compactor.

#### 2.04 Final Cover Low Permeability Soil (Soil Cap Option)

- A. The final cover low permeability layer shall consist of at least 18 inches of pre-approved soil placed over the final cover subgrade.
- B. Final cover low permeability soil shall consist of soil materials having a USCS classification of ML, CL, or MH and shall be compacted to a moisture content and density within a specified window relative to optimum moisture content and maximum dry density as determined by ASTM D698 (Standard Proctor). The window (acceptable moisture and density\_ranges) will be set forth in the construction specification after permeability testing of the approved low permeability soil. The window will be established from moisture-density data correlating to compacted permeabilities less than or equal to  $1 \times 10^{-5}$  cm/sec.
- C. The measured cohesion for the low permeability soil in a remolded (compacted) condition must meet or exceed 45 lb/sf, which is equivalent to a minimum unconfined compressive strength of 90 lb/sf, as determined by ASTM D2166. Alternatively, the minimum required angle of internal friction of the low permeability soil in a remolded (compacted) condition is 25 degrees, as determined by ASTM D4767. The minimum strength criteria will establish the acceptable compaction criteria for the low permeability soil layer along with the permeability criterion designated above.
- D. Remediated contaminated soil shall not be permitted as low permeability layer material.

#### 2.05 Final Cover Vegetative Support Soils (Topsoil)

- A. The vegetative support layer materials shall consist of the minimum six (6) inches of vegetation-supporting soil placed directly over the protective cover soils. The vegetative support layer soils shall be compacted to the minimum acceptable value determined in Item C below to facilitate root penetration for plant growth.
- B. Vegetative Support Layer shall be free of rubble, wood, stumps, brush, metal, cinders, trash, demolition debris, garbage, loam, sludge, and other deleterious materials. The maximum stone size shall be 1 inch in any dimension (unless otherwise approved by ENGINEER).
- C. The measured cohesion for the vegetative support soil in a remolded (compacted) condition must meet or exceed 45 lb/sf, which is equivalent to a minimum unconfined compressive strength of 90 lb/sf, as determined by ASTM D2166. Alternatively, the minimum required angle of internal friction of the vegetative support soil in a remolded (compacted) condition is 25 degrees, as determined by ASTM D4767. The minimum strength criteria will establish the acceptable compaction criteria for the vegetative support soil layer.
- D. Remediated contaminated soil shall not be permitted as vegetative support layer material.

### PART 3 – EXECUTION

#### 3.01 General

- A. Construct project features to the lines and grades shown on the Construction Drawings.
- B. Excavation
  - 1. Excavation shall be performed, at a minimum, to the lines and grades indicated on the Construction Drawings. Additional excavation shall only be performed to achieve a stable working base or to "bridge" over weak subgrade materials if approved by the ENGINEER. The limits of additional excavation shall be determined by the OWNER and ENGINEER.

2. For the purposes of identifying, verifying, measuring and paying for bedrock or ledge rock ("rock") removal, non-rippable rock shall be defined as material occurring in open excavations that cannot be dislodged using a CAT D-8 or equivalent size dozer equipped with a single-tooth ripper and making 3 or more passes in orthogonal directions and producing less than 0.5 cubic yard of loosened rock.
3. Excavated materials shall be transported to stockpile or placement locations, as indicated on the Construction Drawings or as directed by the OWNER.

C. Grading/Fill

1. Uniformly grade areas to a smooth surface, free of irregular surface changes, to the lines and grades indicated on the Construction Drawings. Provide a smooth transition between existing grades and new grades.
2. Prepare areas to receive fill by grading the area to a uniform surface. Scarify the surface as directed by the CQA Consultant or ENGINEER. Dry or wet the area to establish acceptable moisture content. Do not place fill until the subgrade has been approved by the CQA Consultant.
3. Unless otherwise specified, place fill and trench backfill material in lifts of not more than nine inches in compacted depth for material compacted by heavy construction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers. Compact fill and trench backfill material as specified in Section 2.01.

3.02 Preparation

- A. The CONTRACTOR shall establish and identify required lines and levels.
- B. The CONTRACTOR shall maintain benchmarks, monuments, and other reference points and reestablish them if disturbed or destroyed, at no cost to OWNER.
- C. Before commencing grading, the CONTRACTOR shall establish the location and extent of utilities in the work areas. The CONTRACTOR shall notify utilities to remove and relocate lines that are in the way of construction and are not to be relocated as a part of the work covered by these Technical Specifications.
- D. The CONTRACTOR shall maintain, protect, reroute, or extend as required existing utilities to remain in place that pass through the work area.
- E. The CONTRACTOR shall clear and grub the proposed work area within the limits of construction and in accordance with the Construction Drawings.
  1. In areas to be cleared, remove all stumps, roots ½-inch or larger, organic material, and debris to a depth of approximately one foot below existing grade, or one foot below the proposed subgrade elevation, whichever is lower.
  2. Grub areas within a 10-foot zone bordering all proposed structures and pipelines.
  3. Useable topsoil collected during clearing and grubbing shall be stockpiled onsite in areas designated by the OWNER.

- F. The CONTRACTOR shall install adequate erosion and sediment controls to prevent erosion in the vicinity of the planned earthworks operations. The CONTRACTOR shall maintain the erosion and sediment controls for the duration of construction. Accumulated sediment shall be disposed of by the CONTRACTOR in a manner approved by the OWNER.
- G. Diversion ditches, either permanent or temporary, shall be constructed in accordance with the Construction Drawings and as necessary to control surface water. The CONTRACTOR shall be responsible for constructing diversion ditches as required to divert run-on around the construction area and maintain the diversions until approved by the OWNER or ENGINEER.
- H. The CONTRACTOR shall install barriers and other devices to protect areas adjacent to construction.
- I. The surfaces of final cover subgrade and infiltration/protection soil layers must be scarified prior to placement of subsequent layers to ensure bonding between the layers.

### 3.03 Stripping and Stockpiling

- A. Excavated materials classified suitable for use as fill material shall be stockpiled in designated areas free of incompatible soil, debris, or other objectionable materials. Stockpile areas shall be approved by the OWNER.
- B. Excavated material classified as topsoil shall be segregated from fill and stockpiled as specified by the OWNER.
- C. Stockpiles of fill or topsoil shall be no steeper than 3:1 (horizontal: vertical), graded to drain, sealed by tracking (vertically) with a dozer or other means approved by the ENGINEER, and dressed daily during periods when fill is taken from the stockpile. Adequate erosion and sediment controls shall be employed to manage potential erosion of the stockpiles.

### 3.04 Trench Excavation and Backfill

- A. Trenching and backfilling shall comply with all OSHA and other applicable safety requirements.
- B. During filling and backfilling operations, pipelines will be checked by the OWNER or CQA Consultant to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displaced pipe or any other defects, the defects designated by the OWNER or CQA Consultant shall be remedied in a satisfactory manner by the CONTRACTOR at no additional expense to the OWNER. Any pipe that is damaged shall be replaced at the CONTRACTOR's expense.
- C. Excavation
  - 1. Excavation for all drainage, piping, and other structures shall conform to the lines and grades shown on the Construction Drawings. Excess or unsuitable material removed from the excavations shall be replaced with approved material.
  - 2. Slope sides of excavations shall comply with OSHA and local codes and ordinances having jurisdiction.
    - a. The CONTRACTOR will be responsible for all shoring, bracing, trench boxes, etc., necessary to complete the excavation and pipe installation in a safe manner.



- F. After backfilling, the CONTRACTOR shall maintain the filled surfaces in good condition with a smooth surface level with adjacent undisturbed surfaces. Any subsequent settling shall be immediately repaired by the CONTRACTOR in a manner satisfactory to the OWNER or CQA Consultant. Such maintenance shall be provided by the CONTRACTOR for the remainder of this contract at no additional expense to the OWNER.

3.05 Quality Assurance

- A. Soil tests shall be performed by the CQA Consultant and an approved geotechnical laboratory to ensure adequate placement and compaction of material. Soil testing shall be performed at the minimum frequencies presented below, unless in conflict with the CQA Plan, in which case the CQA plan minimum frequencies will govern.

Property (1)	Test Method	QA Testing Frequency
USCS Soil Classification (2)	ASTM D2487	1 per 5,000 yd <sup>3</sup>
Moisture Content (3)	ASTM D2216-19	1 per 10,000 yd <sup>3</sup>
Moisture-Density Relationship (Standard Proctor) (3)	ASTM D698	1 per 10,000 yd <sup>3</sup>
In-place density	ASTM D2937-17e2 ASTM D8167/D8167M-18a ASTM D6938-17a	1 per 10,000 ft <sup>2</sup> /lift
In-place moisture content	ASTM D4959-16 ASTM D6938	1 per 10,000 ft <sup>2</sup> /lift
Layer Thickness - Survey	Grid survey	1 per 10,000 ft <sup>2</sup>
Layer Thickness - Direct	Direct measurement	1 per acre (min)

1. The CQA Consultant shall prepare a drawing showing the horizontal and vertical locations of all test locations.
2. Includes grain size (ASTM D422 or D6913) and Atterberg Limits (D4318) as appropriate.
3. Additional tests may be required when soil gradation tests indicate that there has been a change in the material being supplied
4. Testing of trench backfill material will involve in-place moisture content and density tests in accordance with ASTM D6938 at one test per 100 linear feet of trench in lieu of the moisture and density frequencies listed above.

- B. The CONTRACTOR shall cooperate with the CQA Consultant in obtaining samples for testing and conducting in-situ tests during the construction period. The CONTRACTOR shall provide all necessary labor, equipment, and material to refill sample locations.
- C. If the tests conducted on a particular lift of the placed material do not meet required specifications, the CONTRACTOR shall be responsible for any expenses incurred performing additional tests following replacement, relocation or re-compaction of the material until passing test results are achieved.

3.06 Protection and Acceptance

- A. Protect the finished surface from erosion, desiccation, or other damage.
- B. Develop a contingency plan for responding to construction deficiencies due to inclement weather, defective materials, and construction inconsistent with the Technical Specifications. The plan shall provide a methodology for selecting and implementing corrective action.

- C. Portions of the work damaged due to exposure shall be reworked to meet the Technical Specifications or, at the discretion of the CQA Consultant, removed and replaced with conforming material at no additional cost to the OWNER.

3.07 Removal of Shoring and Bracing Materials

- A. Where the CONTRACTOR is permitted and elects not to remove shoring and bracing material, all such material shall be removed to the extent that the top of the material shall be a minimum of 5 feet below the proposed finished grade. No shoring or bracing may remain in place within the limits of the proposed geomembrane or GCL placement.
- B. Removal of shoring and bracing shall be carried out in a manner such that no structure shall be disturbed or damaged during or after removal. Protection of structures during the removal of shoring and bracing shall be the sole responsibility of the CONTRACTOR, and any disturbance or damage shall be rectified at no expense to the OWNER.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

SECTION 310516

COARSE AGGREGATE

PART 1 - GENERAL

1.01 Description of Work

- A. CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing, placing and compacting the stone as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.
- B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 Material

- A. Coarse aggregate shall be clean washed gravel composed of a hard, non-calcareous mineral such as quartz (<15% soluble residue). Soluble residue shall be determined using ASTM D4373-14, Standard Test Method for Rapid Determination of Carbonate Content of Soils.
- B. The material shall be clean, sound, tough, durable, angular, subangular, subrounded, or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Subangular, angular, subrounded, and round shall be as defined in ASTM D2488 entitled "Standard Practice for Description and Identification of Soils [Visual-Manual Procedure].
- C. CONTRACTOR shall maintain a uniform gradation of coarse aggregate.
- D. Aggregate shall be stored in designated areas approved by the OWNER. The CONTRACTOR is responsible for maintaining the stone free of contamination, and any stone determined by the OWNER to be contaminated shall not be incorporated into the work.
- E. Coarse Aggregate shall meet the following grading requirements unless otherwise specified in the construction plans.

<u>Sieve Size</u>	<u>NCDOT No. 57</u>	<u>NCDOT No. 4</u>	<u>NCDOT No. 5</u>
	% Passing by Weight		
2 inch		100	
1-1/2 inch	100	90-100	100
1 inch	95-100	20-55	90-100
3/4 inch		0-15	20-55
1/2 inch	25-60		0-10
3/8 inch		0-5	0-5
No. 4	0-10		
No. 8	0-5		

## 2.02 Testing

- A. The CONTRACTOR shall submit to the CQA Consultant certification that the materials proposed for use as coarse aggregate comply with specification for the proposed application. The certification shall include, but not necessarily be limited to testing provided by the material supplier including one or more of the following tests:
  - 1. Grain Size Distribution, ASTM C136
- B. Additional confirmatory testing may be required by the CQA Consultant to confirm compliance with the specifications.

## PART 3 - EXECUTION

### 3.01 Placement

- A. A uniform layer of coarse aggregate shall be placed to the lines, depths, and grades as shown on the Drawings.
- B. Backfilling of coarse aggregate shall be performed by the CONTRACTOR in a manner such that the material is kept clean and free of foreign materials.
- C. For pipe bedding, the bedding and backfill shall be compacted with the compaction effort acceptable to the CQA Consultant. The compaction effort shall be applied to both the bedding and the backfill around the pipes. The method of compaction shall not damage the pipe, geotextile or the geomembrane liner.
- D. The CQA Consultant will at any time inspect the stone in the trenches or in stockpile on-Site for contamination and, if necessary, reject all or portions of the stone.
- E. The CONTRACTOR shall use extreme care in the placing of the material over geosynthetics. The material shall be placed in a manner to maintain a minimum thickness of eighteen inches between the geosynthetics and the spreading equipment. All coarse aggregate, placed within the limits of the geosynthetics, shall be placed by low pressure equipment. Equipment with ground pressure less than 5 psi may travel on a minimum 18-inch thick coarse aggregate layer. Equipment with a ground pressure equal to or greater than 5 psi must travel on a minimum 36-inch thick coarse aggregate layer.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 310519

### GEOTEXTILES

#### PART 1 - GENERAL

##### 1.01 Description of Work

- A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, and placing geotextiles, complete with appurtenances, as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.
- B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state, or federal authorities having jurisdiction.

##### 1.02 References

- A. Construction Quality Assurance Plan
- B. Latest Version of American Society for Testing and Materials (ASTM) standards
  - 1. D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
  - 2. D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
  - 3. D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
  - 4. D4751 Standard Test Methods for Determining Apparent Opening Size of a Geotextile
  - 5. D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles
  - 6. D6241 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
  - 7. D7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
- C. Geosynthetic Research Institute (GRI) Standard Specifications and Test Methods
  - 1. GT-12 Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials
  - 2. GT-13 Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate

##### 1.03 Submittals

- A. The CONTRACTOR shall furnish a mill certificate from the company manufacturing the woven and non-woven geotextile attesting that the geotextile meets the chemical, physical, and manufacturing requirements specified. Geotextiles shall be rejected by the ENGINEER and replaced by the CONTRACTOR if they are found to have defects, rips, holes, flaws, deterioration, or other damage.

- B. The contractor shall submit shop drawings to the CQA Consultant showing proposed construction methods: geosynthetics panel arrangements; and tie-in details between geosynthetics, drainage structures, fill materials, and the like.

1.04 Product Handling

- A. The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.
- B. The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120 degrees F, mud, dirt, dust, debris, and other deleterious sources. Geotextiles shall be maintained, wrapped in a heavy-duty protective covering until it is installed.
- C. If the CQA Consultant determines material is damaged or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

PART 2 - MATERIALS

2.01 Nonwoven Geotextile

- A. Nonwoven geotextile shall meet the requirements of AASHTO M288 Survivability Class 2 (Moderate Survivability) and be suitable for fines in excess of 50% in the surrounding material.
- B. Each roll of geotextile will have the product identification, roll number, lot number, date of manufacturer, and manufacturer name clearly marked.
- C. Nonwoven geotextile shall meet the following properties.

Property (1)	Test Method	8-oz Filter GT	10-oz NW GT	12-oz NW GT	Manufacturer's QC Testing Frequency
Mass/Unit Area (min avg)	ASTM D5261	8 oz/yd <sup>2</sup>	10 oz/yd <sup>2</sup>	12 oz/yd <sup>2</sup>	1 per 100,000 ft <sup>2</sup>
Grab Tensile Strength	ASTM D4632	158 lb	230 lb	300 lb	1 per 100,000 ft <sup>2</sup>
Grab Tensile Elongation	ASTM D4632	50%	50%	50%	1 per 100,000 ft <sup>2</sup>
Trapezoidal Tear Strength	ASTM D4533	56 lb	95 lb	115 lb	1 per 100,000 ft <sup>2</sup>
Puncture Strength	ASTM D6241	320 lbs	700 lb	800 lb	1 per 100,000 ft <sup>2</sup>
Apparent Opening Size (AOS)	ASTM D4751	0.024 in	N/A	N/A	1 per 5400,000 ft <sup>2</sup>
Permittivity	ASTM D4491	0.02 sec <sup>-1</sup>	N/A	N/A	1 per 5400,000 ft <sup>2</sup>
UV Stability (min) (2)	ASTM D7238	50%	70%	70%	1 per resin formulation

1. All values are minimum average roll values (MARV) except AOS, which is a maximum average roll value.
2. Evaluation to be on 2.0-inch strip tensile specimens per ASTM D5035 after 500 lt. hrs. exposure.

- D. Heat-burnished, non-woven geotextile
1. For geotextile material requiring heat burnishing, the required testing will be performed prior to heat burnishing the material.
  2. Heat-burnishing shall be performed by the manufacturer prior to delivery at the site.

3. Heat-burnished, non-woven geotextile shall be installed with the heat-burnished side down.

**PART 3 - EXECUTION**

**3.01 Site Preparation**

- A. Site subgrade preparation shall conform to the requirements of this Section, and Section 310000 - Earthwork.
- B. The surface to receive geotextile shall be cleared of sharp objects, boulders, stumps, or any materials that may contribute to fabric punctures, shearing, rupturing, or tearing to the satisfaction of the ENGINEER.
- C. The base surface or surface of embankments shall be graded as smooth as possible and compacted with a smooth – drum roller. The subgrade shall be inspected for unstable areas or soft spots, before the geotextile is placed and additional fill shall be placed and compacted to eliminate those unstable areas.

**3.02 Conformance Testing**

- A. Filter geotextiles will be tested prior to shipment to ensure that the properties of the finished product are in accordance with the construction specifications. Geotextile samples will have test results for the properties and to the requirements given in Section 2.01.
- B. Prior to or upon delivery of the geotextile to the Site, the ENGINEER shall obtain certifications for the materials.
- C. Upon delivery of woven geotextile to the Site, the CQA Consultant shall obtain representative samples of the furnished product for conformance testing. The required material properties, test methods, values, and units are presented below. CQA conformance testing is not required for woven geotextiles.

<b>Property (1)</b>	<b>Test Method</b>	<b>QA Testing Frequency</b>
Mass/Unit Area (min avg)	ASTM D5261	1 per 250,000 ft <sup>2</sup>
Grab Tensile Strength	ASTM D4632	1 per 250,000 ft <sup>2</sup>
Grab Tensile Elongation	ASTM D4632	1 per 250,000 ft <sup>2</sup>
Trapezoidal Tear Strength	ASTM D4533	1 per 250,000 ft <sup>2</sup>
Puncture Strength	ASTM D6241	1 per 250,000 ft <sup>2</sup>
Apparent Opening Size (AOS)	ASTM D4751	1 per project
Permittivity	ASTM D4491	1 per project

1. All values are minimum average roll values (MARV) except AOS, which is a maximum average roll value.

**3.03 Installation**

- A. The geotextile shall be placed in the manner and at the locations shown. Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

- B. Woven geotextile will be overlapped a minimum of 2 feet, with the upgradient roll lapped over the downgradient roll, prior to placing stone.
- C. All filter geotextile seams shall be continuously sewn or heat bonded by means approved by the ENGINEER. Spot sewing is not allowed. Filter geotextiles will be overlapped a minimum of 6 inches prior to seaming.
- D. No vehicles shall be permitted on the geomembrane or non-woven geotextile prior to placement of at least 12 inches of cover material. Equipment with ground pressure less than 5 psi may travel on a minimum 12-inch layer. Equipment with ground pressure greater than 5 psi must travel on a minimum 36-inch thick layer.
- E. Soil, stone, or drainage collection material shall be spread in the direction of the geotextile overlap (i.e., upgradient to downgradient).
- F. If geotextile is damaged during any step of installation, a piece of geotextile material shall be cut and placed over the damaged area and overlap the undamaged material a minimum of 3 feet in each direction.
- G. If necessary, the geotextile shall be positioned by hand after being unrolled to minimize wrinkles. The geotextile shall not be placed in the horizontal direction (i.e. across the slope) on slopes steeper than 10 (horizontal): 1 (vertical), except as part of a patch.

3.04 Protection

- A. After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.
- B. Any geotextile damaged during its installation or during placement of cover material, as deemed by the CQA Consultant, shall be replaced by the CONTRACTOR at no additional cost to the OWNER.
- C. The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile at no additional cost to the owner.
- D. When spot-repairing geotextile with patches, a 3-foot lystered overlap will be used or by a means approved by the ENGINEER.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 311100

### CLEARING AND GRUBBING

#### PART 1 - GENERAL

##### 1.01 Description Of Work

- A. The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. CONTRACTOR shall provide a Competent Person to implement and supervise all work.
- B. Site clearing includes, but is not limited to, removing from the limits of work and disposing of trees, stumps, roots, brush, structures, abandoned utilities, trash, asphalt, debris and all other materials found on or near the surface of the ground in the construction area. Precautionary measures that prevent damage to existing features to remain are part of the work.
- C. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.
- D. No clearing and grubbing will be allowed without adequate erosion and sedimentation control measures in place and to the satisfaction of the OWNER or ENGINEER.

##### 1.02 Job Conditions

- A. Location of the Work: The area to be cleared and grubbed includes all areas so designated on the construction plans.

#### PART 2 - PRODUCTS

The CONTRACTOR shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, dozers, shears, skidders, loaders, root rakes, chipping equipment, and stump grinders.

#### PART 3 - EXECUTION

##### 3.01 Scheduling Of Clearing

- A. CONTRACTOR shall install all temporary Erosion and Sediment Control measures per CONTRACTOR's plan to the acceptance of OWNER and ENGINEER prior to start up of clearing operations.
- B. CONTRACTOR shall maintain all survey controls.

##### 3.02 Construction Area Clearing And Grubbing

- A. Materials to be cleared, grubbed, and removed from the construction areas include, but are not limited to, the following: all trees, stumps, roots, brush, trash, organic matter, miscellaneous structures, debris, and abandoned utilities.

- B. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all graded areas so that surface material is free of roots and debris. Surface material is to be left sufficiently clean so that further picking and raking will not be required.
- C. All stumps, roots, foundations, and planking embedded in the ground shall be removed and disposed.
- D. Surface rocks and boulders shall be grubbed from the soil and removed to the area on Site as directed by the OWNER.
- E. All construction areas shall be grubbed by tractors with root rakes.
- F. Where tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility. The CONTRACTOR shall be responsible for damages to utilities and shall replace/repair damaged utilities at no cost to OWNER.
- G. Any work pertaining to utility poles and guy wires shall comply with the requirements of the appropriate utility.
- H. After removing small growth less than 6 inches in diameter in the staging area, the CONTRACTOR shall protect all existing growth larger than 6 inches in diameter. Any potential growth damaged by the CONTRACTOR shall be replaced with vegetation of similar species and size as approved by the OWNER at no cost to the OWNER.
- I. Stumps and roots shall be grubbed and removed to a depth not less than two feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with on-site soil, compacted to a similar density as the surrounding material.
- J. The CONTRACTOR shall exercise special precautions for the protection and preservation of trees and shrubs situated adjacent to the limits of the construction area. The CONTRACTOR shall be held liable for any damage the CONTRACTOR's operations have inflicted on such property.
- K. The CONTRACTOR shall be responsible for all damages to existing structures and/or improvements resulting from CONTRACTOR's operations.

### 3.03 Overhead Utility Line Right of Way Clearing

- A. All tree trimming operations within the right of way of overhead utility lines shall be completed in accordance with the requirements of the Utility Owner.
- B. Brush shall be chipped and windrowed out of right of way, or ground up with a brush hog in the right of way.
- C. No wood shall be left in right of way (stack it out of right of way).

\* \* \* \* \* END OF SECTION \* \* \* \* \*

## SECTION 329219

### SEEDING

#### PART 1 – GENERAL

##### 1.01 Work Included

- A. Furnish all labor, materials, equipment and incidentals required to establish seeding. This work shall include maintenance of established vegetation until final acceptance. The CONTRACTOR shall be expected to provide and place all vegetative support soil necessary to complete the work.
- B. CONTRACTOR shall revegetate all areas disturbed by his operations. All areas disturbed or not having sufficient vegetation to prevent erosion shall be revegetated.

##### 1.02 Quality Assurance

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

##### 1.03 Maintenance Data

- A. Submit maintenance data for continuing OWNER maintenance.
- B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

##### 1.04 Delivery, Storage, And Handling

- A. Transport and handle products in accordance with the Manufacturer's instructions.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging will not be acceptable.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- D. Store and protect products in accordance with the Manufacturer's instructions with seals and labels intact and legible.

## 1.05 Temporary and Permanent Vegetation

- A. Reference Ch. 6-II of the NC Erosion and Sediment Control Planning and Design Manual and NC Stormwater General Permit No. NCG-010000. When earth moving activities are completed more than 15 days prior to installation of permanent control measures, or final grading is completed during a season not favorable for immediate establishment of permanent vegetation, stabilize with rapid growing annual grasses of a seasonally appropriate species. Provide species that allow quick protective cover and are compatible with future permanent measures.

## 1.06 Warranty

- A. CONTRACTOR shall provide a one-year warranty on all permanent seeding. If after a one-year period, a mature stand of grass vegetation is not established to the satisfaction of the OWNER, the CONTRACTOR shall be responsible for re-topsoiling, fertilizing, seeding, and mulching any denuded areas. At such time, another one-year warranty shall be provided to the OWNER by the CONTRACTOR on the repaired areas. Retainage as specified in Section 012900 - Application for Payment, withheld on seeding, shall not be released until the warranty period is over and the OWNER is satisfied with the final stand of vegetation.

## PART 2 – PRODUCTS

### 2.01 Soil Materials

- A. Vegetative Support Layer: Soils capable of sustaining vegetative growth either excavated from site or imported material and free of weeds as specified in Technical Specification Section 310000.

### 2.02 Accessories

- A. Mulching material: Seed-free oat or wheat straw, dry, free from weeds and foreign matter detrimental to plant life.
- B. Lime: Lime shall comply with applicable state laws and shall be delivered in unopened bags or other convenient standard containers, each fully labeled with the Manufacturer's guaranteed analysis. Lime shall be ground limestone containing not less than 85 percent total carbonates and shall be ground to such fineness that 90 percent by weight will pass through a No. 20 mesh sieve and 50 percent by weight will pass through a No. 100 mesh sieve.
- C. Fertilizer: Fertilizer shall comply with applicable state laws and shall be delivered in unopened bags or other convenient standard container, each fully labeled with the manufacturer's guaranteed analysis. Fertilizer shall contain not less than 10 percent nitrogen, 10 percent available phosphoric acid and 10 percent water soluble potash (N-P-K, 10-10-10). Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable and shall be immediately removed from the job site.

## PART 3 – EXECUTION

### 3.01 General

- A. Areas to be seeded include all areas disturbed during construction that are not to be paved.
- B. Verify that prepared soil base is ready to receive the work of this section.

### 3.02 Fertilizer and Lime

- A. Apply lime and fertilizer according to soil tests or apply lime at the rates specified below.
- B. Mix thoroughly into upper six (6) inches of topsoil.
- C. Lightly water to aid the dissipation of fertilizer and lime.

### 3.03 Seedbed Preparation

- A. Prepare seedbed to a depth of four to six inches.
- B. Remove loose rocks, roots, and other obstructions so that they will not interfere with the establishment and maintenance of vegetation.

### 3.04 Temporary Seeding

- A. Provide temporary seeding on any cleared, non-vegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year or when seeding dates will prevent the establishment of vegetative cover if permanent seeding is attempted.

Seed in accordance with the following schedule and application rates:

<b>Seeding Dates</b>	<b>Seeding Mixture Species and Application Rate</b>
Jan 1 – May 1	Rye Grain at 120 lbs/acre, or Kobe Lespedeza at 50 lbs/acre
May 1 – Aug 15	German Millet at 40 lbs/acre
Aug 15 – Dec 31	Rye Grain at 120 lbs/acre

- B. To amend soil, follow recommendations of soil tests or apply 2,000 lbs/acre ground agricultural limestone and 750 lbs/acre 10-10-10 fertilizer.
- C. Mulch with three inches of straw applied at the rate of 4,000 lbs/acre, and anchor by tacking with netting or a mulch anchoring tool.

- D. Refertilize if growth is not fully adequate.
- E. Reseed, refertilize, and mulch immediately following erosion or other damage.

3.05 Permanent Seeding

- A. Seed in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
April 15 – Aug 31	Common Bermudagrass at 25 lb/acre
Sep. 1 – April 15	KY Tall Fescue at 100 lb/acre

- B. Apply lime and fertilizer according to soil tests or apply 3,200 lbs/acre ground agricultural limestone and 850 lbs/acre 10-20-20 fertilizer.
- C. Mulch with three inches straw applied at the rate of 4,000 lbs./acre. Anchor straw by tacking with netting, roving, or by crimping with a mulch anchoring tool.
- D. Refertilize in the second year unless growth is fully adequate. Reseed, refertilize, and mulch damaged areas immediately.

\* \* \* \* \* END OF SECTION \* \* \* \* \*

**APPENDIX A**  
**ENVIRONMENTAL PERMITS**  
**AND**  
**COMPLIANCE DOCUMENTS**

STATE OF NORTH CAROLINA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES  
**GENERAL PERMIT NO. NCG010000**

TO DISCHARGE STORMWATER UNDER THE  
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

for:

**Construction Activities that are also Subject to the  
North Carolina Sedimentation Pollution Control Act of 1973**

In compliance with the provisions of North Carolina General Statute (G.S.) 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission and the Federal Water Pollution Control Act, as amended, this permit is hereby issued to all owners or operators, hereinafter permittees, which are covered by this permit as evidenced by receipt of a Certificate of Coverage by the Environmental Management Commission to allow the **discharge of stormwater to the surface waters of North Carolina** or to a separate storm sewer system conveying discharges to surface waters in accordance with the terms and conditions set forth herein.

**Coverage under General Permit No. NCG010000, hereafter referred to as NCG01, is applicable to:**

All owners or operators of stormwater point source discharges associated with construction activities including clearing, grading, or excavation activities resulting in the disturbance of land greater than or equal to one acre, or that are part of a common plan of development of that size **that are also subject to the North Carolina Sedimentation Pollution Control Act of 1973 (SPCA)**, are hereby authorized to discharge stormwater to the surface waters in accordance with the terms and conditions set forth herein. Failure to receive coverage under this permit or violations of any of the conditions listed may result in assessment of state or federal civil or criminal penalties for each day of each violation.

The General Permit shall become effective on April 1, 2019.

The General Permit shall expire at midnight on **March 31, 2024**.

Signed this day March 29, 2019.

*Original signed by Danny Smith*

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S. Daniel Smith  
Interim Director, Division of Energy, Mineral and Land Resources  
By the Authority of the Environmental Management Commission

## TABLE OF CONTENTS

### **PART I NCG01 PERMIT COVERAGE**

### **PART II STORMWATER POLLUTION PREVENTION PLAN**

#### **Section A: Required Components of the Erosion and Sedimentation Control Plan**

1. Location Information
2. Narrative and Construction Sequence
3. General Site Features
4. Site Drainage Features
5. Plans Showing E&SC Measures
6. Calculations
7. Vegetative Stabilization Shown on Plans
8. Documentation

#### **Section B: Design and Construction Standards for Erosion and Sediment Control Measures**

1. Objective of E&SC Measures
2. Area to Be Covered by the E&SC Plan
3. Angle for Graded Slopes
4. Upslope Areas
5. Design Standard for E&SC Measures
6. Calculation Method
7. Stormwater Outlets
8. Stormwater Conveyances
9. Sediment Basin Outlet Structures
9. Lower Portions of the Site

#### **Section C: Additional Design and Construction Standards in High Quality Water (HQW) Zones**

1. Extent of the HQW Zone
2. Disturbed Area Limits in HQW Zones
3. Additional Sediment Basin Requirements in HQW Zones
4. Open Channels in HQW Zones

#### **Section D: Construction Activity Buffers**

1. Buffers in Non-Trout Waters
2. Buffers in Trout Waters

**Section E: Ground Stabilization**

1. Ground Stabilization Timelines
2. Permanent Ground Stabilization Timeline

**Section F: Materials Handling**

1. Polyacrylamides (PAMS) and Flocculants
2. Equipment Fluids
3. Waste Materials
4. Herbicide, Pesticide, and Rodenticides
5. Concrete Materials
6. Earthen Material Stock Piles

**Section G: Operation and Maintenance**

1. Plan Deviations
2. Operation and Maintenance
3. Corrective Actions
4. Maintenance of Sediment Basins
5. Bypass of E&SC Measures
6. Upset of E&SC Measures
7. Compliance with the Turbidity Standard

**PART III SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**Section A: Self-Inspection**

**Section B: Recordkeeping**

1. E&SC Plan Documentation
2. Additional Documentation to be Kept on Site
3. Documentation to be Kept for Three Years

**Section C: Reporting**

1. Occurrences that Must be Reported
2. Reporting Timeframes and Other Requirements

**PART IV STANDARD CONDITIONS FOR NPDES STORMWATER GENERAL PERMITS**

**Section A: Compliance and Liability**

1. Continuation of Previously Permitted Projects
2. Projects Submitted Prior to this Permit's Effective Date
3. Duty to Comply
4. Non-Stormwater Discharges

5. Test Procedures
6. Duty to Mitigate
7. Need to Halt or Reduce Not a Defense
8. Civil and Criminal Liability
9. Oil and Hazardous Substance Liability
10. Property Rights
11. Severability
12. Duty to Provide Information
13. Inspection and Entry
14. Penalties for Tampering
15. Penalties for Falsification of Reports
16. Onshore or Offshore Construction
17. Duty to Reapply
18. Planned Changes
19. Anticipated Noncompliance

**Section B: Permit Administration**

1. General Permit Expiration
2. Transfers
3. When an Individual Permit May be Required
4. When an Individual Permit May be Requested
5. Impacts or Potential Impacts to Surface Waters or Wetlands
6. Signatory Requirements
7. General Permit Modification, Revocation and Reissuance, or Termination
8. Certificate of Coverage Actions
9. Annual Administering and Compliance Monitoring Fee Requirements
10. Availability of Reports
11. Omissions

**PART V**

**DEFINITIONS**

## PART I – NCG01 PERMIT COVERAGE

This permit applies to all owners or operators of stormwater discharges associated with construction activities such as clearing, grading, and excavation, that result in the disturbance of a land area greater than or equal to one acre, or that are part of a common plan of development of that size or greater ***that are also subject to the North Carolina Sedimentation Pollution Control Act of 1973 (SPCA)***. This permit may also be issued to stormwater discharges from like activities deemed by the Division of Energy, Mineral, and Land Resources (DEMLR) to be similar to these operations in process or stormwater discharges. This permit shall not apply to land-disturbing activities that are covered under the NCG020000 (Mining Activities) permit or the NCG120000 (Landfills) permit.

The SPCA requires that the persons engaged in subject construction activities develop and adhere to an Erosion and Sedimentation Control (E&SC) Plan. The Sedimentation Control Commission and DEMLR have created and adopted a [North Carolina Erosion and Sediment Control Planning and Design Manual](#) describing recommended sedimentation control techniques for construction activities.

A person seeking coverage under this permit shall take the following steps in the following order:

1. Develop an E&SC plan that adheres to the SWPPP requirements of this permit, the SPCA and 15A NCAC 04B .0101-.0132. The [North Carolina Erosion and Sediment Control Planning and Design Manual](#) shall be used as guidance in meeting the applicable requirements.
2. Obtain approval of the E&SC plan by either DEMLR or the appropriate state delegated local entity (hereafter known as the “E&SC plan authority”).
3. Submit an electronic Notice of Intent (e-NOI) to DEMLR with documentation of the E&SC plan approval scanned and uploaded. The e-NOI is available at <https://deq.nc.gov/NCG01>. In addition, pay the general annual permit fee provided for in § 143-215.3D. DEMLR shall email the COC within three business days (or 24 business hours for a project being reviewed under DEMLR’s Express review program) after the submittal of a complete and correct e-NOI and the receipt of the general permitting fee.
4. Commence the construction activity after receipt of the COC.
5. Abide by the conditions of both the NCG01 permit and the E&SC plan until completion of the construction activity and establishment of permanent ground stabilization.
6. Contact the E&SC plan authority after construction is complete and the site is permanently stabilized, contact the E&SC plan authority for the final/close out inspection of the E&SC plan.
7. Submit an electronic Notice of Termination (e-NOT) with a scan of the close-out inspection report uploaded. The e-NOT is available at <https://deq.nc.gov/NCG01>. DEMLR shall email confirmation of the close-out of the COC within three business days after the submittal of a complete and correct e-NOT.

The discharges allowed by this General Permit shall not cause or contribute to violations of North Carolina Water Quality Standards for surface waters and wetlands (15A NCAC 02B .0200). Discharges allowed by this permit must meet all applicable water quality certification or permit requirements as outlined in 15A NCAC 02H .0500 and 02H .1300. This permit does not relieve the permittee from responsibility for compliance with any other applicable federal, state, or local law, rule, standard, ordinance, order, judgment, or decree. This General Permit does not cover any other point source discharge to surface waters of the state, nor does it cover activities or discharges that are covered by an individual NPDES permit.

Any owner or operator of a subject construction activity not wishing to be covered or limited by this General Permit may apply for an individual NPDES permit in accordance with NPDES procedures in 15A NCAC 02H .0100, stating the reasons supporting the request. Any application for an individual permit

should be made at least 180 days prior to the time the permit is needed unless waived by the Director (see Part IV Section B of this permit).

## PART II – STORMWATER POLLUTION PREVENTION PLAN

The Stormwater Pollution Prevention Plan for this permit shall include the approved **Erosion and Sedimentation Control (E&SC) Plan** as well as any requirements in this Part that exceed the approved E&SC Plan. Items that are required in the SWPPP but are not part of the approved E&SC Plan may include, at a minimum, Section E, Item (2) [*Required Timeframes for Temporary Ground Stabilization*], Section F [*Materials Handling*]. DEMLR provides two sample plan sheets that permittees may add to their E&SC Plan set to fulfill Sections E(2) and F of this permit at <https://deq.nc.gov/NCG01>.

Recommendations for preparing the E&SC plan as well as for designing, constructing, and maintaining the erosion and sedimentation control practices are contained in the [North Carolina Erosion and Sediment Control Planning and Design Manual](#).

### SECTION A: REQUIRED COMPONENTS OF THE STORMWATER POLLUTION PREVENTION PLAN

The E&SC Erosion and Sedimentation Control Plan shall include, at a minimum, the following components and **those components shall be in compliance with all conditions of this permit**. Hard and/or digital copies shall be submitted in accordance with the specifications of the E&SC plan authority.

#### 1. Location Information

- \_\_\_\_\_ Project location & labeled vicinity map (roads, streets, landmarks)
- \_\_\_\_\_ North arrow and scale
- \_\_\_\_\_ Identification of the River Basin
- \_\_\_\_\_ A copy of site disturbed area located on applicable USGS quadrangle and hardbound copy of the NRCS Soils maps to scale
- \_\_\_\_\_ Latitude and longitude (in decimal degrees) at the project entrance

#### 2. Narrative and Construction Sequence

- \_\_\_\_\_ Narrative describing the nature & purpose of the construction activity
- \_\_\_\_\_ Construction sequence related to erosion and sediment control (including installation of critical measures prior to the initiation of the land-disturbing activity & removal of measures after areas they serve are permanently stabilized). Address all phases of construction and necessary practices associated with temporary stream bypasses and/or crossings
- \_\_\_\_\_ Estimated start and end dates

#### 3. General Site Features

- \_\_\_\_\_ Property lines
- \_\_\_\_\_ Existing and proposed contours (topographic lines)
- \_\_\_\_\_ Stockpiled topsoil or subsoil locations
- \_\_\_\_\_ Limits of disturbed area (with acreage labeled) within which all construction, material storage, grading, and related activities occur, including the following items as applicable:
  - Access to E&SC measures, lots that will be disturbed, and utilities that may extend offsite.
  - Temporary access and haul roads, other than public roads, constructed or used in connection with the land-disturbing activity

- Borrow and waste areas created by the applicant. If the land-disturbing activity and any related borrow or waste activity are not conducted by the same person, they shall be considered separate land-disturbing activities
- Offsite borrow pits if the borrow pit is a construction support activity to the development

- \_\_\_ Planned and existing building locations and elevations, if applicable
- \_\_\_ Planned & existing road locations & elevations, including temporary access roads, if applicable
- \_\_\_ Profiles of streets, utilities, and permanent ditch lines, if applicable
- \_\_\_ Lot lines and/or building numbers, if applicable
- \_\_\_ Easements and drainageways, particularly required for offsite affected areas, if applicable
- \_\_\_ Location and details associated with any onsite stone crushing or other processing of material excavated, if applicable. A mining permit will be required if the affected area associated with excavation, processing, stockpiles and transport of such materials comprises one or more acres, and materials will be leaving the development tract

**4. Site Drainage Features**

- \_\_\_ Existing and planned drainage patterns (include off-site areas that drain through project and address temporary and permanent conveyance of stormwater over graded slopes)
- \_\_\_ Drainage area map
- \_\_\_ Surface waters, including the limits of wetlands, streams, lakes and ponds and all required local or state buffer zones as well as impact maps by the construction activity to these sensitive areas.
- \_\_\_ Method used to determine acreage of land being disturbed and drainage areas to all proposed E&SC measures (e.g. delineation map)
- \_\_\_ Size, pipe material and location of culverts and sewers
- \_\_\_ Soil information throughout the site and below culvert storm outlets, including soil type and special characteristics
- \_\_\_ Name and classification of receiving water course where discharges are to occur

**5. Plans Showing E&SC Measures**

- \_\_\_ Legend (provide appropriate symbols for all measures and reference them to the construction details)
- \_\_\_ Location of temporary and permanent E&SC measures
- \_\_\_ Location of permanent stormwater quality and quantity control measures
- \_\_\_ Construction drawings and details for temporary and permanent measures, including outlet structures. Show measures to scale on plan and include proposed contours where necessary. Ensure design storage requirements are maintained through all phases of construction.
- \_\_\_ Specifications for ground stabilization
- \_\_\_ Maintenance requirements for measures
- \_\_\_ Contact person responsible for maintenance, if the permittee wishes to designate one. If not, the financially responsible organization will be the contact for maintenance.
- \_\_\_ A note stating that material handling procedures for the items required in Part II, Section F will be followed.
- \_\_\_ Standard details for structural BMPs to be installed to manage the anticipated materials listed in Part II, Section F such as construction debris management, concrete washout, paint washout, petroleum product storage and pesticide/herbicide handling, along with spill prevention practices.

**6. Calculations**

- \_\_\_ Calculations for peak discharges of runoff from each outlet at pre-development, during construction and at completion. Provide all supporting data for the computation methods used (rainfall data for required storm events, time of concentration/storm duration, and runoff coefficients).

- \_\_\_ Design calculations for culverts and storm sewers (include headwater, tailwater and outlet velocities)
- \_\_\_ Discharge and velocity calculations for open channel and ditch flows (easement & rights-of-way)
- \_\_\_ Design calculations for cross sections and method of stabilization for existing and planned channels (include temporary linings). Include appropriate permissible velocity and shear stress.
- \_\_\_ Design calculations and construction details for energy dissipaters below culvert and storm sewer outlets (include stone/material specs & apron dimensions). Avoid discharges on fill slopes.
- \_\_\_ Design calculations and dimensions for sediment traps and basins
- \_\_\_ Total and disturbed drainage areas for silt fencing and other sediment controls

**7. Vegetative Stabilization Shown on Plans**

- \_\_\_ Area & acreage to be stabilized with vegetation
- \_\_\_ Method of soil preparation
- \_\_\_ Seed type & rates (temporary & permanent)
- \_\_\_ Fertilizer type and rates
- \_\_\_ Mulch type and rates (include mulch anchoring methods)

**8. Documentation**

- \_\_\_ Completed, signed & notarized **Financial Responsibility/Ownership Form**
- \_\_\_ Certificate of assumed name, if the owner is a partnership
- \_\_\_ Name of Registered Agent (if applicable)
- \_\_\_ Copy of the most current Deed for the site. Please make sure the deed(s) and ownership information are consistent between the plan sheets, local records and this form.
- \_\_\_ Provide latitude & longitude (in decimal degrees) at the project entrance.
- \_\_\_ Army Corps 404 permit and Water Quality 401 certification, if required for project, or a complete application if these items are not yet issued.
- \_\_\_ DWR Buffer Authorization, if required for project
- \_\_\_ Copies of any recorded easements and/or agreements with adjoining property owners for landlocked parcels

**SECTION B: DESIGN AND CONSTRUCTION STANDARDS FOR EROSION AND SEDIMENT CONTROL MEASURES**

**1. Objective of E&SC Measures**

E&SC Measures shall be designed and constructed to prevent off-site sedimentation damage.

**2. Area to Be Covered by the E&SC Plan**

The E&SC plan shall include the limits of disturbed area within which all construction, material storage, grading, and related activities occur, including the following items as applicable:

- (a) Access to E&SC measures, lots that will be disturbed, and utilities that may extend offsite,
- (b) Temporary access and haul roads, other than public roads, constructed or used in connection with the land-disturbing activity
- (c) Borrow and waste areas created by the applicant. If the land-disturbing activity and any related borrow or waste activity are not conducted by the same person, they shall be considered separate land-disturbing activities
- (d) Offsite borrow pits if the borrow pit is a construction support activity to the development

**3. Angle for Graded Slopes**

The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other erosion control devices or structures. (NCGS 113A-57(2))

**4. Upslope Areas**

Runoff originating upslope of the disturbed areas shall be either diverted away from the construction activity or E&SC measures shall be sized sufficiently to handle the runoff. Any diversion measures shall be shown on the plans.

**5. Design Standard for E&SC Measures**

Plans shall include measures necessary to prevent erosion at the limit of disturbance during the 10-year storm or the 25-year storm in HQW Zones and the Falls Lake Watershed.

**6. Calculation Method**

Hydrologic calculations for designing E&SC measures shall be in accordance with the procedures in the United States Department of Agriculture, Natural Resources Conservation Service's "National Engineering Field Manual Handbook 630" which is herein incorporated by reference including subsequent amendments and editions, and may be accessed at:

<https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/hydrology/?cid=stelprdb1043063> or according to procedures adopted by any other agency of this state or the United States or any generally recognized organization or association.

**7. Stormwater Conveyances**

Any increase in stormwater runoff velocity resulting from a land-disturbing activity shall not result in accelerated erosion of the receiving stormwater conveyance during the 10-year storm or the 25-year storm in HQW Zones. The following additional requirements apply to stormwater conveyances:

- (a) The velocity in the receiving stormwater conveyance shall not exceed the maximum permissible velocity per Table 1 except for sinuous channels. For sinuous channels, multiply allowable velocity in Table 1 by 0.95 for slightly sinuous, by 0.9 for moderately sinuous channels, and by 0.8 for highly sinuous channels

**Table 1: Maximum Permissible Velocities**

Stormwater conveyance in-situ material	Maximum Permissible Velocity	
	Feet per second	Meters per second
Fine sand (noncolloidal) Sandy loam (noncolloidal)	2.5	0.8
Silt loam (noncolloidal)	3.0	0.9
Ordinary firm loam Alluvial silts (noncolloidal)	3.5	1.1
Fine gravel Stiff clay (very colloidal) Alluvial silts (colloidal)	5.0	1.5
Graded, silt to cobbles (colloidal) Cobbles and shingles	5.5	1.7
Coarse gravel (noncolloidal) Shale and hard pans	6.0	1.8

- (b) Conveyances may be stabilized by planting vegetation, enlarging cross sections, and/or providing erosion-resistant lining. Any erosion-resistant linings shall be shown on the plans.

**8. Sediment Basin Outlet Structures**

Sediment basins and traps with drainage areas of one acre or greater shall use outlet structures that withdraw water from the surface.

**9. Lower Portions of the Site**

Portions of a site that are lower in elevation than adjacent discharge locations and are not expected to discharge during construction may be exempt from the temporary ground cover requirements if identified on the approved E&SC plan or added by the E&SC plan authority.

**SECTION C: ADDITIONAL DESIGN AND CONSTRUCTION STANDARDS IN HIGH QUALITY WATER (HQW) ZONES**

**1. Extent of the HQW Zone**

HQW Zones are those areas in the 20 Coastal Counties that are within 575 feet of High Quality Waters and for the remainder of the state, areas that are within one mile of and drain to HQWs.

**2. Disturbed Area Limits in HQW Zones**

Disturbed areas in HQW zones shall be limited at any time to a maximum total area within the boundaries of the tract of 20 acres. Only the portion of the construction activity within a HQW zone shall be subject to the 20-acre limit. Larger disturbed areas may be allowed with the written approval of the Director upon providing adequate engineering justification with a specific construction sequence that addresses phasing, limited exposure, weekly submitted self-inspection reports and/or more conservative design than the 25-year storm. The Director may also include other conditions as necessary based on specific site conditions.

**3. Additional Sediment Basin Requirements in HQW Zones**

Sediment basins that discharge to HQW Zones shall be designed and constructed to meet the following criteria unless the permittee demonstrates to the E&SC plan authority that meeting each of the basin design conditions below would result in design or operational hardships. Alternative control measures, such as quicker application of ground cover or use of sediment flocculants, shall be allowed as a substitute on a case-by-case basis if it can be shown that use of the alternate practices is expected to result in an equal or better sediment discharge reduction from the site.

- (a) Use a surface withdrawal mechanism except when the basin drainage area is less than 1.0 acre.
- (b) Have a minimum of 1800 cubic feet per of storage area per acre of disturbed area.
- (c) Have a minimum surface area of 325 square feet per cfs for the peak flow from the 25-year storm.
- (d) Have a minimum dewatering time of 48 hours.
- (e) Incorporate three baffles unless the basin is less than 20 feet in length, in which case two baffles are sufficient.

**4. Open Channels in HQW Zones**

Newly constructed open channels in HQW zones shall be designed and constructed with side slopes no steeper than two horizontal to one vertical if a vegetative cover is used for stabilization unless soil conditions permit a steeper slope or where the slopes are stabilized by using mechanical devices, structural devices or other acceptable ditch liners. The angle for side slopes shall be sufficient to restrain accelerated erosion.

## SECTION D: CONSTRUCTION ACTIVITY BUFFERS

The requirements in Section D below shall not apply to a land-disturbing activity in connection with the construction of facilities to be located on, over, or under a lake or natural watercourse (NCGS 113A-57).

### 1. Buffers in Non-Trout Waters

Unless wider buffers are required per NC rules or statutes, the width of the buffer shall be sufficient to confine visible sedimentation to the 25 percent of the strip closest to the land-disturbing activity. The width of a buffer adjacent to a non-trout water shall be measured from the edge of the water to the nearest edge of the disturbed area.

Recommended buffer widths to achieve this standard are shown in Table 2 below.

**Table 2: Recommended Buffer Widths**

Slope of Buffer (%)	Recommended Width of Undisturbed Vegetation Adjacent to Non-Trout Waters
0-1	15 feet
1-3	20 feet
3-5	25 feet
>5	25 feet + (% of slope - 5)

### 2. Buffers in Trout Waters

Unless wider buffers are required per NC rules or statutes, the minimum width for an undisturbed buffer adjacent to trout waters shall be 25 feet. The width of a buffer adjacent to a trout water shall be measured horizontally from the top of bank to the nearest edge of the land-disturbing activity. However, the Sedimentation Control Commission may approve plans that include land-disturbing activity along trout waters when the duration of said disturbance would be temporary and the extent of said disturbance would be minimal. (NCGS 113A-57(1)).

## SECTION E: GROUND STABILIZATION

### 1. Ground Stabilization Timelines

Ground stabilization shall be achieved on any area of a site where land disturbing activities have ceased within the timeframes listed in Table 3 below. It is recommended to stabilize the ground more quickly if practicable. Extensions of time may be approved by the E&SC plan authority based on weather or other site-specific conditions that make compliance impracticable. Portions of a site that are lower in elevation and not expected to discharge during construction may be exempt from the temporary ground cover requirements if identified on the E&SC plan and approved by the E&SC plan authority.

**Table 3: Required Ground Stabilization Timeframes**

Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe Variations
 (a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
 (b) High Quality Water (HQW) Zones	7	None
 (c) Slopes steeper than 3:1	7	<ul style="list-style-type: none"> <li>If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed</li> </ul>
 (d) Slopes 3:1 to 4:1	14	<ul style="list-style-type: none"> <li>7 days for slopes greater than 50' in length and with slopes steeper than 4:1</li> <li>7 days for perimeter dikes, swales, ditches, perimeter slopes, and HQW Zones</li> <li>10 days for the Falls Lake Watershed</li> </ul>
 (e) Areas with slopes flatter than 4:1	14	<ul style="list-style-type: none"> <li>7 days for perimeter dikes, swales, ditches, perimeter slopes, and HQW Zones</li> <li>10 days for the Falls Lake Watershed unless there is zero slope.</li> </ul>

## 2. Permanent Ground Stabilization Timeline

After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

## SECTION F: MATERIALS HANDLING

Any structural controls installed to manage construction materials stored or used on site shall be included in the field copy of the E&SC plan. Requirements for handling materials on construction sites shall be as follows:

### 1. Polyacrylamides (PAMS) and Flocculants

Polyacrylamides (PAMS) and flocculants shall be:

- stored in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures designed to protect adjacent surface waters,
- selected from the *NC DWR List of Approved PAMS/Flocculants* list, available at: [https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/ATU/ApprovedPAMS4\\_1\\_2017.pdf](https://files.nc.gov/ncdeq/Water%20Quality/Environmental%20Sciences/ATU/ApprovedPAMS4_1_2017.pdf), and

- (c) used at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.

## 2. Equipment Fluids

- (a) ***Fuels, lubricants, coolants, and hydraulic fluids, and other petroleum products*** shall be handled and disposed of in a manner so as not to enter surface or ground waters and in accordance with applicable state and federal regulations. Equipment used on the site must be operated and maintained properly to prevent discharge of fluids.
- (b) ***Equipment, vehicle, and other wash waters*** shall not be treated in a sediment basin or sediment trap. Alternative controls should be provided such that there is no discharge of soaps, solvents, or detergents.

## 3. Waste Materials

- (a) ***Building material and land clearing waste*** shall be disposed of in accordance with North Carolina General Statutes, Chapter 130A, Article 9 - Solid Waste Management, and rules governing the disposal of solid waste (15A NCAC 13B). Areas dedicated for managing building material and land clearing waste shall be at least 50 feet away from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available.
- (b) ***Paint and other liquid building material waste*** shall not be dumped into storm drains. It is recommended to locate paint washouts at least 50 away from storm drain inlets unless there is no alternative. Other options are to install lined washouts to use portable, removable bags or bins.
- (c) ***Hazardous or toxic waste*** shall be managed in accordance with the federal Resource Conservation and Recovery Act (RCRA) and NC Hazardous Waste Rules at 15A NCAC, Subchapter 13A.
- (d) ***Litter and sanitary waste*** shall be managed in a manner to prevent it from entering waters and shall be disposed of offsite.

## 4. Herbicide, Pesticide, and Rodenticides

Herbicide, pesticide, and rodenticides shall be stored and applied in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act and label restrictions.

## 5. Concrete Materials

Concrete materials onsite, including excess concrete, shall be controlled and managed to avoid contact with surface waters, wetlands or buffers. No concrete or cement slurry shall be discharged from the site. (Note that discharges from onsite concrete plants require coverage under a separate NPDES permit - NCG140000.) Any hardened concrete residue will be disposed of, or recycled on site, in accordance with local and state solid waste regulations.

## 6. Earthen Material Stock Piles

Earthen material stock piles shall be located at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.

# SECTION G: OPERATION AND MAINTENANCE

## 1. Modifications to the E&SC Plan

Modifications to the approved E&SC plan that require changes to the E&SC measure designs, the drainage areas, or the disturbed areas draining to E&SC measures shall be approved by the E&SC plan authority. Deviations from the approved E&SC plan, or approved revised E&SC plan, shall constitute a violation of this permit unless the deviation is to correct an emergency situation where sediment is being discharged off the site. The E&SC plan authority may allow deviations from the E&SC plan on a case-by-case basis if the deviations are minor adjustments to

address minor deficiencies. A minor adjustment shall be the addition of E&SC measures (e.g., silt fence, inlet protection, check dams, rolled erosion control practices, etc.), or the relocation of E&SC measures that would improve the overall stormwater management and sediment control onsite. Minor adjustments shall be noted on the approved E&SC plan and maintained at the job site.

## 2. Operation and Maintenance

The permittee shall install and maintain all temporary and permanent E&SC measures as required by this permit and the approved E&SC plan.

## 3. Corrective Actions

If self-inspections required by this permit identify a need for maintenance of control measures, modifications or additions to control measures, or corrective actions to control sediment or other pollutants, these actions shall be performed as soon as possible considering adverse weather and site conditions.

## 4. Draw Down of Sediment Basins for Maintenance or Close Out

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

- (a) The E&SC Plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
- (b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
- (c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
- (d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item(c) above,
- (e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
- (f) Sediment removed from dewatering treatment devices described in Item(c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

## 5. Bypass of E&SC Measures

Diversions of stormwater from E&SC measures *when the design storm has not been exceeded* are not allowed. Bypasses of E&SC measures shall be reported in accordance with Part III, Section C, Item (2)(c) and (d) of this permit.

## 6. Unavoidable Bypass for Public Safety

A bypass may be allowed by the Director if the Director determines that all of the following conditions were met:

- (a) The bypass is unavoidable to prevent loss of life, personal injury or severe property damage,
- (b) There were no feasible alternatives to the bypass, such as the use of auxiliary control facilities, retention of stormwater or maintenance during normal periods of equipment downtime or dry weather. This condition is not satisfied if adequate backup controls should have been installed in the exercise of reasonable engineering judgement to prevent a bypass

which occurred during normal periods of equipment downtime or preventative maintenance, and

- (c) the permittee submitted a notice of the bypass per the record-keeping requirements in Part III, Section C, Item (2)(c) and (d) of this permit.

**7. Upset of E&SC Measures**

Diversions of stormwater from E&SC measures may be considered as an upset if the permittee can demonstrate that all of the following conditions have been met. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

- (a) The permittee submitted notice of the upset as required in this general permit and identifies the cause(s) of the upset.
- (b) The permittee demonstrates that the upset was not caused by operational error, improperly designed treatment or control facilities, lack of preventive maintenance, or careless or improper operation.
- (c) The permittee agrees to take remedial measures if necessary.

## PART III

### SELF-INSPECTION, RECORDKEEPING AND REPORTING

#### SECTION A: SELF-INSPECTIONS

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

**Table 4: Self-Inspection Requirements**

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those unattended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event $\geq$ 1.0 inch in 24 hours	<ol style="list-style-type: none"> <li>1. Identification of the measures inspected,</li> <li>2. Date and time of the inspection,</li> <li>3. Name of the person performing the inspection,</li> <li>4. Indication of whether the measures were operating properly,</li> <li>5. Description of maintenance needs for the measure,</li> <li>6. Description, evidence, and date of corrective actions taken.</li> </ol>
(3) Stormwater discharge outfalls (SDOs)	At least once per 7 calendar days and within 24 hours of a rain event $\geq$ 1.0 inch in 24 hours	<ol style="list-style-type: none"> <li>1. Identification of the discharge outfalls inspected,</li> <li>2. Date and time of the inspection,</li> <li>3. Name of the person performing the inspection,</li> <li>4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration,</li> <li>5. Indication of visible sediment leaving the site,</li> <li>6. Description, evidence, and date of corrective actions taken.</li> </ol>
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event $\geq$ 1.0 inch in 24 hours	<p>If visible sedimentation is found outside site limits, then a record of the following shall be made:</p> <ol style="list-style-type: none"> <li>1. Actions taken to clean up or stabilize the sediment that has left the site limits,</li> <li>2. Description, evidence, and date of corrective actions taken, and</li> <li>3. An explanation as to the actions taken to control future releases.</li> </ol>
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event $\geq$ 1.0 inch in 24 hours	<p>If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made:</p> <ol style="list-style-type: none"> <li>1. Description, evidence and date of corrective actions taken, and</li> <li>2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit of this permit.</li> </ol>

(6) Ground stabilization measures	After each phase of grading	<ol style="list-style-type: none"> <li>1. The phase of grading (installation of perimeter E&amp;SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover).</li> <li>2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.</li> </ol>
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NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

**SECTION B: RECORDKEEPING**

**1. E&SC Plan Documentation**

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The items listed in Table 5 pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

**Table 5: Recordkeeping Requirements**

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC Plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

**2. Additional Documentation to be Kept on Site**

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspections at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

- (a) This General Permit as well as the Certificate of Coverage, after it is received.
- (b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records

in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records

**3. Documentation to be Retained for Three Years**

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

**SECTION C: REPORTING**

**1. Occurrences that Must be Reported**

Permittees shall report the following occurrences:

- (a) Visible sediment deposition in a stream or wetland.
- (b) Oil spills if:
  - They are 25 gallons or more,
  - They are less than 25 gallons but cannot be cleaned up within 24 hours,
  - They cause sheen on surface waters (regardless of volume), or
  - They are within 100 feet of surface waters (regardless of volume).
- (c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act Ref: 40 CFR 110.3 and 40 CFR 117.3) or section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.
- (d) Anticipated bypasses and unanticipated bypasses.
- (e) Noncompliance with the conditions of this permit that may endanger health or the environment.

**2. Reporting Timeframes and Other Requirements**

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed in Table 6 below. Occurrences outside normal business hours may also be reported to the Department’s Environmental Emergency Center personnel at (800) 858-0368.

**Table 6: Reporting Requirements**

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis.</li> <li>• If the stream is named on the <a href="#">NC 303(d) list</a> as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.</li> </ul>
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.</li> </ul>
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	<ul style="list-style-type: none"> <li>• <b>A report at least ten days before the date of the bypass, if possible.</b> The report shall include an evaluation of the anticipated quality and effect of the bypass.</li> </ul>

<p>(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]</p>	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that includes an evaluation of the quality and effect of the bypass.</li> </ul>
<p>(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]</p>	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6).</li> <li>• Division staff may waive the requirement for a written report on a case-by-case basis.</li> </ul>

## PART IV    STANDARD CONDITIONS FOR NPDES STORMWATER GENERAL PERMITS

### SECTION A: COMPLIANCE AND LIABILITY

#### 1. Continuation of Previously Permitted Projects

Projects and their corresponding activities permitted under the previous version of the NC general permit for construction activities will automatically be considered covered under this general permit without the submittal of a Notice of Intent form. In addition, an annual general permit fee shall not be required for projects covered under the previous version of the NC general permit for construction activities.

#### 2. Projects Submitted Prior to this Permit's Effective Date

Complete project applications that were received prior to the effective date of this permit, but not approved by the E&SC plan authority until after approval of this NPDES permit, can rely on design and management practices effective at the time of application submittal.

#### 3. Duty to Comply

The permittee must comply with all conditions of this general permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit upon renewal application. [40 CFR 122.41]

- (a) The permittee shall comply with standards or prohibitions established under section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the general permit has not yet been modified to incorporate the requirement. [40 CFR 122.41]
- (b) The CWA provides that any person who violates section[s] 301, 302, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any such sections in a permit issued under section 402, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed \$37,500 per day for each violation. [33 USC 1319(d) and 40 CFR 122.41(a)(2)]
- (c) The CWA provides that any person who negligently violates sections 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of \$2,500 to \$25,000 per day of violation, or imprisonment of not more than 1 year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than \$50,000 per day of violation, or by imprisonment of not more than 2 years, or both. [33 USC 1319(c)(1) and 40 CFR 122.41(a)(2)]
- (d) Any person who *knowingly* violates such sections, or such conditions or limitations is subject to criminal penalties of \$5,000 to \$50,000 per day of violation, or imprisonment for not more than 3 years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than \$100,000 per day of violation, or imprisonment of not more than 6 years, or both. [33 USC 1319(c)(2) and 40 CFR 122.41(a)(2)]
- (e) Any person who *knowingly* violates section 301, 302, 303, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than \$250,000 or imprisonment of not more than 15 years, or both. In the

case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than \$500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than \$1,000,000 and can be fined up to \$2,000,000 for second or subsequent convictions. [40 CFR 122.41(a)(2)]

- (f) Under state law, a civil penalty of not more than \$25,000 per violation may be assessed against any person who violates or fails to act in accordance with the terms, conditions, or requirements of a permit. [North Carolina General Statutes § 143-215.6A]
- (g) Any person may be assessed an administrative penalty by the Administrator for violating section 301, 302, 306, 307, 308, 318 or 405 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act. Administrative penalties for Class I violations are not to exceed \$20,628 per violation, with the maximum amount of any Class I penalty assessed not to exceed \$51,570. Penalties for Class II violations are not to exceed \$20,628 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed \$257,848. [33 USC 1319(g)(2) and 40 CFR 122.41(a)(3)]

#### **4. Non-Stormwater Discharges**

If a storm event monitored in accordance with this general permit coincides with a non-stormwater discharge, the permittee shall separately monitor all parameters as required under all other applicable discharge permits and provide this information with the stormwater discharge monitoring report.

#### **5. Test Procedures**

Test procedures for the analysis of pollutants shall conform to the EMC regulations published pursuant to NCGS 143-215.63 et. seq, the Water and Air Quality Reporting Acts, and to regulations published pursuant to Section 304(g), 33 USC 1314, of the Federal Water Pollution Control Act, as Amended, and Regulation 40 CFR 136.

To meet the intent of the monitoring required by this general permit, all test procedures must produce minimum detection and reporting levels and all data generated must be reported down to the minimum detection or lower reporting level of the procedure. If no approved methods are determined capable of achieving minimum detection and reporting levels below general permit discharge requirements, then the most sensitive (method with the lowest possible detection and reporting level) approved method must be used.

#### **6. Duty to Mitigate**

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this general permit which has a reasonable likelihood of adversely affecting human health or the environment. [40 CFR 122.41(d)]

#### **7. Need to Halt or Reduce Not a Defense**

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the condition of this general permit. [40 CFR 122.41(c)]

#### **8. Civil and Criminal Liability**

Except as provided in Part II, Section B of this general permit regarding bypassing of stormwater control facilities, nothing in this permit shall be construed to relieve the permittee from any responsibilities, liabilities, or penalties for noncompliance pursuant to NCGS 143-215.3, 143-215.6A, 143-215.6B, 143-215.6C, or Section 309 of the Federal Act, 33 USC 1319. Furthermore, the

permittee is responsible for consequential damages, such as fish kills, even though the responsibility for effective compliance may be temporarily suspended.

**9. Oil and Hazardous Substance Liability**

Nothing in this general permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under NCGS 143-215.75 et seq. or Section 311 of the Federal Act, 33 USC 1321.

**10. Property Rights**

The issuance of this general permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations [40 CFR 122.41(g)].

**11. Severability**

The provisions of this general permit are severable, and if any provision of this general permit, or the application of any provision of this general permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this general permit, shall not be affected thereby [NCGS 150B-23].

**12. Duty to Provide Information**

The permittee shall furnish to the Division, within a reasonable time, any information which the Division may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the general permit issued pursuant to this general permit or to determine compliance with this general permit. The permittee shall also furnish to the Division upon request, copies of records required to be kept by this general permit [40 CFR 122.41(h)].

**13. Inspection and Entry**

The permittee shall allow the Director, an authorized representative (including an authorized contractor acting as a representative of the Director), or an authorized representative of a municipal operator or the separate storm sewer system receiving the discharge (if applicable), upon the presentation of credentials and other documents as may be required by law, to:

- (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this general permit;
- (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this general permit;
- (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this general permit; and
- (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location. [40 CFR 122.41(i)]

**14. Penalties for Tampering**

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this general permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than 4 years, or both [40 CFR 122.41].

**15. Penalties for Falsification of Reports**

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this general permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or by both [40 CFR 122.41].

**16. Onshore or Offshore Construction**

This general permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

**17. Duty to Reapply**

Dischargers covered by this general permit need not submit a new Notice of Intent (NOI) or renewal request unless so directed by the Division. If the Division chooses not to renew this general permit, the permittee will be notified to submit an application for an individual permit. [15A NCAC 02H .0127(e)]

**18. Planned Changes**

The permittee shall give notice to the Director as soon as possible of any planned changes at the permitted facility which could significantly alter the nature or quantity of pollutants discharged [40 CFR 122.41(l)]. This notification requirement includes pollutants which are not specifically listed in the general permit or subject to notification requirements under 40 CFR Part 122.42 (a).

**19. Anticipated Noncompliance**

The permittee shall give advanced notice to the Director of any planned changes at the permitted facility which may result in noncompliance with the general permit. [40 CFR 122.41(l)(2)]

**SECTION B: PERMIT ADMINISTRATION****1. General Permit Expiration**

General permits will be effective for a term not to exceed five years, at the end of which the Division may renew them after all public notice requirements have been satisfied. If a general permit is renewed, existing permittees do not need to submit a renewal request or pay a renewal fee unless directed by the Division. New applicants seeking coverage under a renewed general permit must submit a Notice of Intent to be covered and obtain a Certificate of Coverage under the renewed general permit. [15A NCAC 02H .0127(e)]

**2. Transfers**

This general permit is not transferable to any person without prior written notice to and approval from the Director in accordance with 40 CFR 122.61. The Director may condition approval in accordance with NCGS 143-215.1, in particular NCGS 143-215.1(b)(4) b.2., and may require modification or revocation and reissuance of the Certificate of Coverage, or a minor modification, to identify the new permittee and incorporate such other requirements as may be necessary under the CWA [40 CFR 122.41(l)(3), 122.61] or state statute. **The Permittee is required to notify the Division in writing in the event the permitted facility is sold or closed.**

**3. When an Individual Permit May be Required**

The Director may require any owner/operator authorized to discharge under a certificate of coverage issued pursuant to this general permit to apply for and obtain an individual permit or an alternative general permit. Any interested person may petition the Director to take action under this paragraph. [15A NCAC 02H .0127(i)-(j)] Cases where an individual permit may be required include, but are not limited to, the following:

- (a) The discharger is a significant contributor of pollutants;
- (b) The receiving stream is of a unique quality and the standard conditions may not provide adequate protection;
- (c) Conditions at the permitted site change, altering the constituents and/or characteristics of the discharge such that the discharge no longer qualifies for a general permit;
- (d) The discharge violates the terms or conditions of this general permit;
- (e) A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source;
- (f) Effluent limitations are promulgated for the point sources covered by this general permit;
- (g) A water quality management plan containing requirements applicable to such point sources is approved after the issuance of this general permit;
- (h) The Director determines at his or her own discretion that an individual permit is required.

#### 4. When an Individual Permit May be Requested

Any permittee operating under this general permit may request to be excluded from the coverage of this general permit by applying for an individual permit. When an individual permit is issued to an owner/operator the applicability of this general permit is automatically terminated on the effective date of the individual permit. [15A NCAC 02H .0127(h)]

#### 5. Impacts or Potential Impacts to Surface Waters or Wetlands

If evidence indicates that the stormwater discharges from the site are impacting or have the potential to impact surface waters or wetlands, then the Division may take appropriate actions including any or all of the following:

- a) take compliance and enforcement action;
- b) require the permittee to include and implement appropriate control and restoration measures;
- c) require the permittee to develop and implement additional site-specific stormwater pollution prevention measures;
- d) require the permittee to obtain an individual permit.

#### 6. Signatory Requirements

All applications, reports, or information submitted to the Permitting Issuing Authority shall be signed and certified. [40 CFR 122.41(k)]

- (a) All Notices of Intent to be covered under this general permit shall be signed as follows:
  - **For a corporation:** by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
  - **For a partnership or sole proprietorship:** by a general partner or the proprietor, respectively; or

- **For a municipality, State, Federal, or other public agency:** by either a principal executive officer or ranking elected official. [40 CFR 122.22]
- (b) All reports required by the general permit and other information requested by the Director shall be signed by a person described in paragraph a. above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
- The authorization is made in writing by a person described above;
  - The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or well field, superintendent, a position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and
  - The written authorization is submitted to the Director. [40 CFR 122.22]
- (c) If an authorization under paragraph (b) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this section must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative. [40 CFR 122.22]
- (d) Any person signing a document under paragraphs a. or b. of this section shall make the following certification [40 CFR 122.22]. NO OTHER STATEMENTS OF CERTIFICATION WILL BE ACCEPTED:

*"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

**7. General Permit Modification, Revocation and Reissuance, or Termination**

The issuance of this general permit does not prohibit the Division from reopening and modifying the general permit, revoking and reissuing the general permit, or terminating the general permit as allowed by the laws, rules, and regulations contained in Title 40, Code of Federal Regulations, Parts 122 and 123; Title 15A of the North Carolina Administrative Code, Subchapter 2H .0100; and North Carolina General Statute 143-215.1 et al.

After public notice and opportunity for a hearing, the general permit may be terminated for cause. The filing of a request for a general permit modification, revocation and reissuance, or termination does not stay any general permit condition. The **Certificate of Coverage** shall expire when the general permit is terminated.

**8. Certificate of Coverage Actions**

The general permit may be modified, revoked and reissued, or terminated for cause. The notification of planned changes or anticipated noncompliance does not stay any general permit condition [40 CFR 122.41(f)].

**9. Annual Administering and Compliance Monitoring Fee Requirements**

The permittee must pay the administering and compliance monitoring fee within 30 (thirty) days after being billed by the Division. Failure to pay the fee in timely manner in accordance with 15A NCAC 2H .0105(b)(2) may cause this Division to initiate action to revoke coverage under the general permit.

**10. Availability of Reports**

Except for data determined to be confidential under NCGS 143-215.3(a)(2) or Section 308 of the Federal Act, 33 USC 1318, all reports prepared in accordance with the terms shall be available for public inspection at the offices of the Division. As required by the Act, analytical data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NCGS 143-215.6B or in Section 309 of the Federal Act.

**11. Omissions**

Where the Permittee becomes aware that it failed to submit any relevant facts in a Notice of Intent to be covered under this general permit, or submitted incorrect information in that Notice of Intent application or in any report to the Director, it shall promptly submit such facts or information. [40 CFR 122.41(l)(8)]

## PART V DEFINITIONS

1. **Act**  
See Clean Water Act.
2. **Adverse Weather**  
Climate conditions that are dangerous or create inaccessibility for personnel, such as local flooding, high winds, electrical storms, winter weather conditions, or situations that otherwise make inspections impractical. When adverse weather or site conditions prevent or restrict access to complete a regular or rain event inspection, this should be clearly documented on the next issued report. Documentation should include the inspector's name, the date and time, and a written narrative of the adverse weather or site condition. Adverse weather or site conditions do not exempt the permittee from having to file an inspection report in accordance with Section II. B of this permit.
3. **Allowable Non-Stormwater Discharges**  
This general permit regulates stormwater discharges. Non-stormwater discharges which shall be allowed in the stormwater conveyance system are:
  - (a) All other discharges that are authorized by a non-stormwater NPDES permit.
  - (b) Uncontaminated groundwater, foundation drains, air-conditioner condensate without added chemicals, springs, discharges of uncontaminated potable water, waterline and fire hydrant flushings, water from footing drains, and irrigation waters, flows that do not result in a water quality standards violation.
  - (c) Discharges resulting from fire-fighting or fire-fighting training, or emergency shower or eye wash as a result of use in the event of an emergency.
4. **Best Management Practices (BMPs)**  
Measures or practices used to reduce the amount of pollution entering surface waters. BMPs may take the form of a process, activity, or physical structure
5. **Bypass**  
The known diversion of stormwater from any portion of a stormwater control facility including the collection system, which is not a designed or established operating mode for the facility.
6. **Certificate of Coverage**  
The cover sheet that accompanies a general permit upon issuance and lists the facility name, location, receiving stream, river basin, effective date of coverage under the general permit and is signed by the Director.
7. **Clean Water Act**  
The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), as amended, 33 USC 1251, et. seq.
8. **Common Plan of Development**  
A contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times and on different schedules under one common plan. The "common plan" of development or sale is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities are planned to occur on a specific plot regardless of ownership of the parcels..

**9. Concrete Washout**

Wastewater resulting from the washing of equipment such as trucks, chutes, hoses, mixers, hoppers, wheelbarrows, and tools that are used to produce, handle, or store concrete and other cementitious materials such as mortar, plaster, stucco, or grout.

**10. Control Measure**

Any BMP or other structural or non-structural practice or procedure used to prevent or reduce the discharge of pollutants including practices to control erosion and sedimentation.

**11. Division or DEMLR**

The Division of Energy, Mineral, and Land Resources of the NC Department of Environmental Quality (DEQ).

**12. Director**

The Director of the Division of Energy, Mineral, and Land Resources of the NC Department of Environmental Quality (DEQ).

**13. EMC**

The North Carolina Environmental Management Commission.

**14. Erosion and Sedimentation Control (E&SC) Plan**

A plan developed in compliance with the North Carolina Sedimentation Pollution Control Act of 1973 in G.S. 113A-50 et seq. to prevent sediment resulting from accelerated erosion from being transported off the site of the land-disturbing activity or in waters.

**15. Erosion and Sedimentation Control (E&SC) Plan Authority**

The entity responsible for reviewing and approving the Erosion and Sediment Control Plan. Within some local governments' jurisdictions, this will be a delegated program. Elsewhere, it will be the Division.

**16. Erosion and Sediment Control (E&SC) Measure**

Temporary and permanent practices and devices to prevent sediment resulting from accelerated erosion from being transported off the site of the land-disturbing activity or in waters of the State of North Carolina. E&SC measures, include, but are not limited to, sedimentation traps, sedimentation ponds, rock dams, temporary diversions, temporary slope drains, rock check dams, sediment fence or barriers, all forms of inlet protection, storm drainage facilities, energy dissipaters and stabilization methods of open channels.

**17. Ground Cover**

Any vegetative growth or other material which, when applied to the soil surface, renders the soil surface stable against accelerated erosion.

**18. Hazardous Substance**

Any substance designated under 40 CFR Part 116 pursuant to Section 311 of the Clean Water Act.

**19. Landfill**

A disposal facility or part of a disposal facility where waste is placed in or on land and which is not a land treatment facility, a surface impoundment, an injection well, a hazardous waste long-term storage facility or a surface storage facility.

**20. Normal Business Hours**

These are generally considered to be between the hours of 6 a.m. and 6 p.m., or when workers are normally present on the construction site. Weekends, state and federal holidays are not considered normal business hours unless construction activities are taking place on the site during those times.

**21. Notice of Intent**

The state application form which, when submitted to the Division, officially indicates the facility's notice of intent to seek coverage under a general permit.

**22. Permanent Stabilization**

When all soil disturbing activity is completed and exposed soils have been stabilized with a vegetative cover with a density of at least 80% or covered with a structural stabilization method. Permanent perennial vegetation may include the use of sod, shrubs and ground cover plants mixed with mulching, aggregate or other landscaping techniques. Structural methods include concrete, asphalt, retaining wall or other stabilization techniques.

**23. Permittee**

The person, firm or organizational entity that signed as the financially responsible party on the Erosion and Sedimentation Control Plan.

**24. Point Source Discharge of Stormwater**

Any discernible, confined and discrete conveyance including, but not specifically limited to, any pipe, ditch, channel, tunnel, conduit, well, or discrete fissure from which stormwater associated with industrial activity is or may be discharged to waters of the state.

**25. Secondary Containment**

Spill containment for the contents of the single largest tank within the containment structure plus sufficient freeboard to allow for the 25-year, 24-hour storm event.

**26. Section 313 Water Priority Chemical**

A chemical or chemical category which:

- (a) Is listed in 40 CFR 372.65 pursuant to Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, also titled the Emergency Planning and Community Right-to-Know Act of 1986;
- (b) Is present at or above threshold levels at a facility subject to SARA title III, Section 313 reporting requirements; and
- (c) Meets at least one of the following criteria:
  - Is listed in appendix D of 40 CFR part 122 on Table II (organic priority pollutants), Table III (certain metals, cyanides, and phenols) or Table IV (certain toxic pollutants and hazardous substances);
  - Is listed as a hazardous substance pursuant to section 311(b)(2)(A) of the CWA at 40 CFR 116.4; or
  - Is a pollutant for which EPA has published acute or chronic water quality criteria.

**27. Soil Stabilization**

The use of vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.

**28. Stormwater Discharge Outfall (SDO)**

The point of departure of stormwater from a discernible, confined, or discrete conveyance, including but not limited to, storm sewer pipes, drainage ditches, channels, spillways, or channelized collection areas, from which stormwater flows directly or indirectly into waters.

**29. Stormwater Runoff**

The flow of water which results from precipitation and which occurs immediately following rainfall or as a result of snowmelt.

**30. Stormwater Associated with Industrial Activity**

The discharge from any point source which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing or raw material storage areas at an industrial site. Facilities considered to be engaged in "industrial activities" include those activities defined in 40 CFR 122.26(b)(14). The term does not include discharges from facilities or activities excluded from the NPDES program.

**31. Stormwater Pollution Prevention Plan (SWPPP)**

The elements of the State's stormwater pollution prevention program that provide the technology-based requirements designed to protect the state's waters from the adverse impacts of sediments. In North Carolina, the SWPPP for construction activities includes the Erosion and Sedimentation Control Plan, Ground Stabilization, Materials Handling, and Disturbed Area Limit for Special and Threatened Waters.

**32. Temporary Stabilization**

When the establishment of ground cover over all disturbed areas (such as mulching, rolled erosion control products, vegetation, or other material) renders the surface stable against accelerated erosion. Stabilization shall be achieved with the establishment of a uniform and evenly-distributed (i.e., without large bare areas) ground cover with a cover density of at least 80%.

**33. Toxic Pollutant**

Any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act.

**34. Upset**

An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment or control facilities, inadequate treatment or control facilities, lack of preventive maintenance, or careless or improper operation.

**35. Visible Sedimentation**

Solid particulate matter, both mineral and organic, that has been or is being transported by water, air, gravity, or ice from its site of origin that can be seen with the unaided eye.

**36. 25-year, 24-hour Storm Event**

The maximum 24-hour precipitation event expected to be equaled or exceeded, on the average, once in 25 years.

**INSPECTION AND MONITORING RECORDS FOR ACTIVITIES UNDER STORMWATER GENERAL PERMIT NCG010000  
AND SELF-INSPECTION RECORDS FOR LAND DISTURBING ACTIVITIES PER G.S. 113A-54.1**

<b>Project Name</b>			<b>Land Quality or Local Program Project/Permit #</b>	
<b>Approving Authority</b>		<b>Date of Plan Approval</b>		<b>Expiration Date, if applicable</b>
<b>NCG010000 Certificate of Coverage Number</b>				<b>Date of COC Issuance</b>
Coverage under the NCG010000 permit must be renewed annually, if issued after April 1, 2019 until Notice of Termination is filed and approved.				

**PART 1A: Rainfall Data**

	<b>Rain Amount (inches) Daily Rainfall Required. If no rain, indicate with a "zero"</b>
<b>M</b>	
<b>T</b>	
<b>W</b>	
<b>Th</b>	
<b>F</b>	
<b>Sat (Inspection Optional)</b>	
<b>Sun (Inspection Optional)</b>	

**PART 1B: Phase(s) of the Plan**

<b>Check ALL applicable box(es) that apply to completed &amp; current phases</b>	<b>X</b>
Initial installation of erosion and sediment control measures	
Clearing and grubbing of existing ground cover	
Completion of any grading that requires ground cover	
Completion of all land-disturbing activity, construction or development	
Permanent ground cover sufficient to restrain erosion has been established	

<b>Are there any site or project conditions that limit completion of inspection?</b> If yes, explain conditions and areas of site that were inaccessible.	
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**PART 2: STORMWATER PLANS AND CONTROLS:** For each question below, mark the corresponding box as Yes, No or N/A. For all items marked “No”, note in Part 3A the Reference letter and provide the Corrective Action and location of the deficiency, the original date noted, and the date it was noted as being corrected. NOTE: Reference letters may be used multiple times.

Reference	Part 2A: Storm Water Plans and Related Documents	Yes	No	N/A
A	Is the approval letter or certificate, COC and a copy of the NPDES Construction General Permit (CGP) on site? (Readily available electronic copy of CGP is acceptable)			
B	Is the approved plan on site and current?			
Reference	Part 2B: Stormwater Pollutant Controls	Yes	No	N/A
C	Are erosion and sediment controls that are shown on the approved plan installed and operating properly with no repairs needed?			
D	Are stormwater controls that are shown on the approved plan installed and operating properly with no repairs needed?			
E	Vehicle Tracking: Are construction entrances operating properly with no repairs needed?			
F	Soil Stabilization: Are areas of the site where construction activities have ceased been properly stabilized within the required timeframes?			
G	Are earthen stockpiles stabilized or otherwise protected from sediment loss, and located at least 50 feet away or downhill from drain inlets and surface waters?			
Reference	Part 2C: Non-Storm Water Pollutant Controls	Yes	No	N/A
H	Concrete, stucco, paint, etc. washouts: Are washouts installed, properly located, posted and operating with no repairs needed?			
I	Solid & hazardous wastes: Are trash, debris, and hazardous materials properly managed?			
J	Sanitary waste: Are portable toilets properly located and operating with no visible repairs needed?			
K	Equipment and stored fluids: Are fuels, lubricants, hydraulic fluids, etc. contained so as not to enter surface and ground waters?			
<b>Report oil spills and the release of hazardous substances to the appropriate DEQ Regional Office via phone call or email within 24 hours of discovery. <a href="https://deq.nc.gov/contact/regional-offices">https://deq.nc.gov/contact/regional-offices</a></b>				

For any items listed in the section below, a full description of sedimentation is required in Part 3A. This includes, but may not be limited to: location, estimated amount of sediment that has left the site and/or entered waters, apparent causes of the sediment loss, and what corrective actions need to be taken to prevent this from recurring.

Reference	Part 2D: Sedimentation	Yes	No	N/A
L	Are sediment or other pollutants noted beyond the approved or permitted limits of disturbance?			
M	Are BMPs detected as releasing sediment or other pollutants into receiving waters?			
<b>Report visible sedimentation into streams or wetlands to the appropriate DEQ Regional Office via phone call or email within 24 hours of discovery. <a href="https://deq.nc.gov/contact/regional-offices">https://deq.nc.gov/contact/regional-offices</a></b>				



**PART 3C: GROUND STABILIZATION:** Must be recorded, at a minimum, after each phase. *Add rows as needed.*

Site area description and location where construction activities have temporarily or permanently ceased	Time Limit for Ground Cover (see table below)	Have stabilization measures been installed? (Y/N)	Temporary or Permanent Stabilization (T/P)	Is Ground Cover Sufficient to Restrain Erosion? (Y/N)	Original Inspection Date	Describe Actions Needed <u>Corrective actions should be performed as soon as possible and before the next storm event</u>	Date Previous Action(s) Observed as Corrected

GROUND STABILIZATION TIMEFRAMES		
Site Area Description	Stabilization	Timeframe Variations
Perimeter dikes, swales and slopes	7 Days	None
High Quality Water (HWQ) Zones	7 Days	None
Slopes Steeper than 3:1	7 Days	7 days for perimeter dikes, swales, slopes and HWQ zones 14 days for slopes 10 ft or less in length and not steeper than 2:1 10 days for Falls Lake Watershed
Slopes 3:1 to 4:1	14 Days	7 days for perimeter dikes, swales, slopes and HWQ zones 7 days for slopes greater than 50 ft in length 10 days for Falls Lake Watershed
All other areas with slopes flatter than 4:1	14 Days	7 days for perimeter dikes, swales, slopes and HWQ zones 10 days for Falls Lake Watershed

**PART 3D: NEW OR REVISED MEASURES:** Erosion and sedimentation control measures omitted or installed, at a minimum since the last inspection, shall be documented here or by initialing and dating each measure or practice shown on a copy of the approved erosion and sedimentation control plan. Alterations and relocations of measures shall also be documented if they significantly deviate from the approved plan. The removal of measures should also be documented. List dimensions of measures such as Sediment Basins and Dissipator Pads. Add rows as needed. Corrective actions should be included in Part 3A.

Measure ID or Location and Description	Proposed Dimensions (ft.)	Actual Dimensions (ft.)	Significant Deviation* from Plan? (Y/N)	Date measure observed as installed, altered, relocated or removed	Installed (I) Altered (A) Relocated (R) Removed (X)

\*Significant deviation means any omission, alteration or relocation of an erosion or sedimentation control measure that prevents it from performing as intended.

**PART 4: Signature of Inspector**

<b>Financially Responsible Party (FRP) / Permittee</b>				<b>County</b>	
<b>INSPECTOR</b>		Name	Employer		
<b>Inspector Type (Mark)</b>	<input checked="" type="checkbox"/>	Address			
<b>FRP/Permittee</b>	<input type="checkbox"/>				
<b>Agent/Designee</b>	<input type="checkbox"/>	Phone Number	Email Address		
<b>By this signature, I certify in accordance with the NCG010000 permit &amp; G.S. 113A-54.1 that this report is accurate and complete to the best of my knowledge.</b>					
Financially Responsible Party / Permittee or Agent / Designee			Date & Time of Inspection		

**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION A: SELF-INSPECTION**

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDCs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION B: RECORDKEEPING**

**1. E&SC Plan Documentation**

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

**2. Additional Documentation to be Kept on Site**

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

- (a) This General Permit as well as the Certificate of Coverage, after it is received.
- (b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

**3. Documentation to be Retained for Three Years**

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION C: REPORTING**

**1. Occurrences that Must be Reported**

Permittees shall report the following occurrences:

- (a) Visible sediment deposition in a stream or wetland.
- (b) Oil spills if:
  - They are 25 gallons or more,
  - They are less than 25 gallons but cannot be cleaned up within 24 hours,
  - They cause sheen on surface waters (regardless of volume), or
  - They are within 100 feet of surface waters (regardless of volume).
- (c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.
- (d) Anticipated bypasses and unanticipated bypasses.
- (e) Noncompliance with the conditions of this permit that may endanger health or the environment.

**2. Reporting Timeframes and Other Requirements**

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis.</li> <li>• If the stream is named on the <a href="#">NC 303(d) list</a> as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.</li> </ul>
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.</li> </ul>
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	<ul style="list-style-type: none"> <li>• <b>A report at least ten days before the date of the bypass, if possible.</b> The report shall include an evaluation of the anticipated quality and effect of the bypass.</li> </ul>
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that includes an evaluation of the quality and effect of the bypass.</li> </ul>
(e) Noncompliance with the conditions of this permit that may endanger health or the environment [40 CFR 122.41(l)(7)]	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6)].</li> <li>• Division staff may waive the requirement for a written report on a case-by-case basis.</li> </ul>

**PART II, SECTION G, ITEM (4)  
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT**

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

- (a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
- (b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
- (c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
- (d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,
- (e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
- (f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.



**GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT**

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

**SECTION E: GROUND STABILIZATION**

Required Ground Stabilization Timeframes		
Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe variations
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

**GROUND STABILIZATION SPECIFICATION**

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
<ul style="list-style-type: none"> <li>Temporary grass seed covered with straw or other mulches and tackifiers</li> <li>Hydroseeding</li> <li>Rolled erosion control products with or without temporary grass seed</li> <li>Appropriately applied straw or other mulch</li> <li>Plastic sheeting</li> </ul>	<ul style="list-style-type: none"> <li>Permanent grass seed covered with straw or other mulches and tackifiers</li> <li>Geotextile fabrics such as permanent soil reinforcement matting</li> <li>Hydroseeding</li> <li>Shrubs or other permanent plantings covered with mulch</li> <li>Uniform and evenly distributed ground cover sufficient to restrain erosion</li> <li>Structural methods such as concrete, asphalt or retaining walls</li> <li>Rolled erosion control products with grass seed</li> </ul>

**POLYACRYLAMIDES (PAMS) AND FLOCCULANTS**

- Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
- Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
- Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
- Provide ponding area for containment of treated Stormwater before discharging offsite.
- Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

**EQUIPMENT AND VEHICLE MAINTENANCE**

- Maintain vehicles and equipment to prevent discharge of fluids.
- Provide drip pans under any stored equipment.
- Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
- Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
- Remove leaking vehicles and construction equipment from service until the problem has been corrected.
- Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

**LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE**

- Never bury or burn waste. Place litter and debris in approved waste containers.
- Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
- Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
- Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
- Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
- Anchor all lightweight items in waste containers during times of high winds.
- Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
- Dispose waste off-site at an approved disposal facility.
- On business days, clean up and dispose of waste in designated waste containers.

**PAINT AND OTHER LIQUID WASTE**

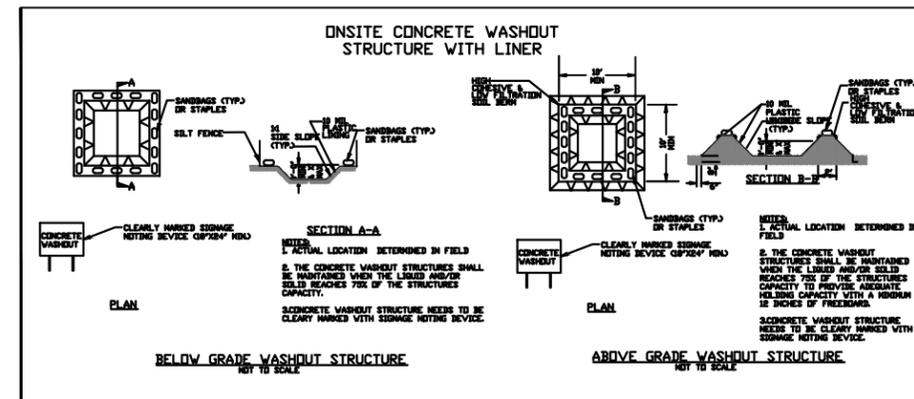
- Do not dump paint and other liquid waste into storm drains, streams or wetlands.
- Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
- Contain liquid wastes in a controlled area.
- Containment must be labeled, sized and placed appropriately for the needs of site.
- Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

**PORTABLE TOILETS**

- Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
- Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
- Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

**EARTHEN STOCKPILE MANAGEMENT**

- Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
- Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
- Provide stable stone access point when feasible.
- Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.



**CONCRETE WASHOUTS**

- Do not discharge concrete or cement slurry from the site.
- Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
- Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
- Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
- Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
- Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
- Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
- Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
- Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
- At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

**HERBICIDES, PESTICIDES AND RODENTICIDES**

- Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
- Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
- Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
- Do not stockpile these materials onsite.

**HAZARDOUS AND TOXIC WASTE**

- Create designated hazardous waste collection areas on-site.
- Place hazardous waste containers under cover or in secondary containment.
- Do not store hazardous chemicals, drums or bagged materials directly on the ground.



North Carolina Department of Environment and Natural Resources

**Division of Land Resources**

**Land Quality Section**

James D. Simons, PG, PE  
Director and State Geologist

Beverly Eaves Perdue, Governor  
Dee Freeman, Secretary

November 25, 2009

**LETTER OF APPROVAL**

Moore County  
Attn: Dennis Brobst, DPW Director  
P.O. Box 1927  
Carthage, NC 23327-

RE: Project Name: Moore County Construction and Demolition Landfill  
Acres Approved: 37.2  
Project ID: MOORE-2010-010  
County: Moore Aberdeen Turning Leaf Way  
River Basin: Lumber Stream Classification: Other  
Submitted By: HDR Engineering, Inc.  
Date Received by LQS: 10/29/2009  
Plan Type: New

Dear Mr. Brobst:

This office has reviewed the subject erosion and sedimentation control plan. We find the plan to be acceptable and hereby issue this Letter of Approval. The enclosed Certificate of Approval must be posted at the job site. This plan approval shall expire three (3) years following the date of approval, if no land-disturbing activity has been undertaken, as is required by Title 15A NCAC 4B .0129.

Title 15A NCAC 4B .0118(a) requires that a copy of the approved erosion control plan be on file at the job site. Also, this letter gives the notice required by G.S. 113A-61.1(a) of our right of periodic inspection to insure compliance with the approved plan.

North Carolina's Sedimentation Pollution Control Act is performance-oriented, requiring protection of existing natural resources and adjoining properties. If, following the commencement of this project, the erosion and sedimentation control plan is inadequate to meet the requirements of the Sedimentation Pollution Control Act of 1973 (North Carolina General Statute 113A-51 through 66), this office may require revisions to the plan and implementation of the revisions to insure compliance with the Act.

The developer is responsible for obtaining any and all permits and approvals necessary for the development of this project prior to the commencement of this land disturbing activity. This could include agencies such as the Division of Water Quality's stormwater regulations, their enforcement requirements within Section 401 of the Clean Water Act, the Environmental Protection Agency and/or the U.S. Army Corps of Engineers' jurisdiction of Section 404 of the Clean Water Act, the Division of Solid Waste Management's landfill regulations, local County or Municipalities' ordinances, or others that may be required. This approval cannot supersede any other permit or approval; however, in the case of a Cease and Desist Order from the Corps of Engineers, that Order would only apply to wetland areas. All upland areas would still have to be in compliance with the N.C. Sedimentation Pollution Control Act.

If any area on site falls within the jurisdiction of Section 401 or 404 of the Clean Water Act, the developer is responsible for compliance with the requirements of the Division of Water Quality, the Corps of Engineers and the Environmental Protection Agency (EPA) respectively. Any erosion control measures that fall within jurisdictional wetland areas must be approved by the aforementioned agencies prior to installation. The Land Quality Section must be notified of a relocation of the measures in question to the transition point between the wetlands and the uplands to assure that the migration of sediment will not occur. If that relocation presents a problem or contradicts any requirements of either DWQ, the Corps, or the EPA, it is the responsibility of the developer to inform the Land Quality Section regional office so that an adequate contingency plan can be made to assure sufficient erosion control remains on site. Failure to do so will be considered a violation of this approval.

Please be aware that your project will be covered by the enclosed NPDES General Stormwater Permit NCGO1000 (Construction Activities). You should first become familiar with all of the requirements for compliance with the enclosed general permit.

Please note that this approval is based in part on the accuracy of the information provided in the Financial Responsibility Form, which you provided. You are requested to file an amended form if there is any change in the information included on the form. In addition, it would be helpful if you notify this office of the proposed starting date for this project. Please notify us if you plan to have a preconstruction conference.

Your cooperation is appreciated.

Sincerely,

A handwritten signature in black ink, appearing to read "Jodi Pace".

Jodi Pace, EI  
Land Quality Section

Letter of Approval  
Moore County  
November 25, 2009  
Page 3 of 3

Enclosures: Certificate of Approval  
NPDES Permit

cc: HDR Engineering, Inc.  
Tim Combs, Building Inspector  
Belinda Henson, Division of Water Quality  
Land Quality Section - Fayetteville Regional Office File

**EROSION AND SEDIMENT CONTROL PLAN**

**for the**

**MOORE COUNTY**

**CONSTRUCTION & DEMOLITION LANDFILL**

**CELLS 1 through 5**

*Prepared for:*



Moore County  
Solid Waste Management  
5227 US Hwy 15/501  
Carthage, North Carolina 28327

*Prepared by:*



HDR Engineering, Inc. of the Carolinas  
128 S. Tryon Street, Suite 1400  
Charlotte, NC 28202-5001  
HDR Project #07625-50815-018

**September 2009**



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**Appendix D**  
**DRAWINGS**

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**HDR**

HDR Engineering, Inc.  
of the Carolinas

N.C.B.E.L.S. License Number: F-0116  
128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

Permit Drawings For

# Moore County Construction and Demolition Landfill

## Erosion and Sediment Control Plan

Issued for NCDENR Approval  
September 2009

Project No.  
07625-58015-018

Moore County, North Carolina

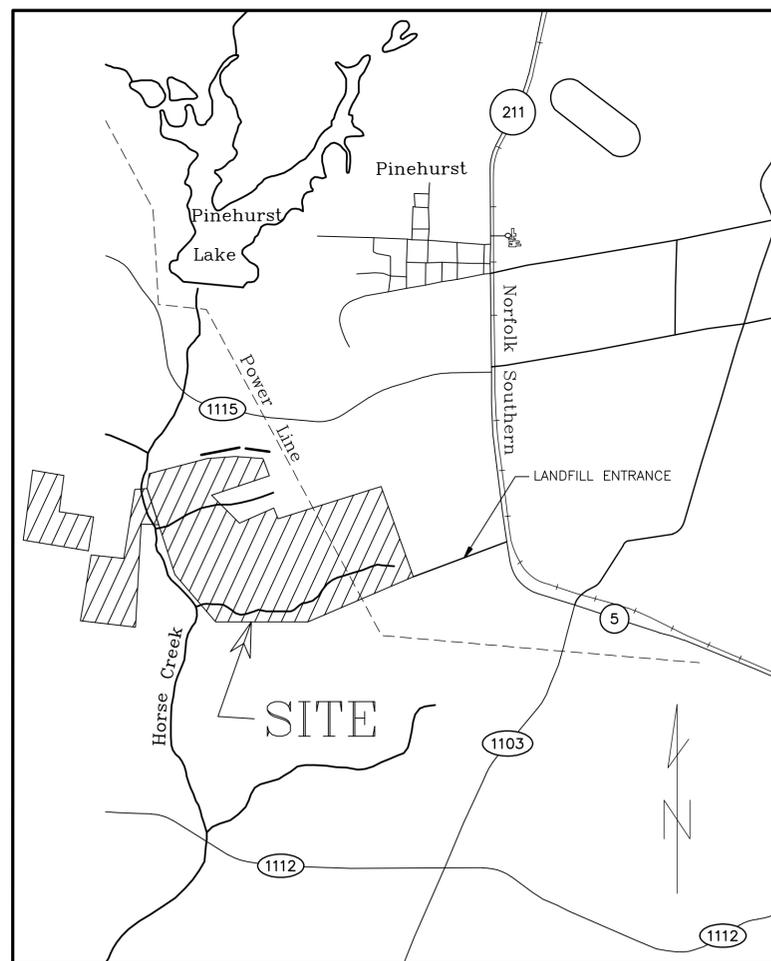
### INDEX OF DRAWINGS

#### GENERAL

- G-00 COVER
- G-01 OVERALL SITE PLAN

#### PERMIT

- C-01 EXISTING CONDITIONS
- C-02 EROSION AND SEDIMENT CONTROL PLAN
- C-03 CELL 5 BASE GRADES
- C-04 GRADING AND DRAINAGE PLAN
- C-05 SEDIMENT BASIN DETAILS
- C-06 MISCELLANEOUS DETAILS
- C-07 CLOSURE DETAILS



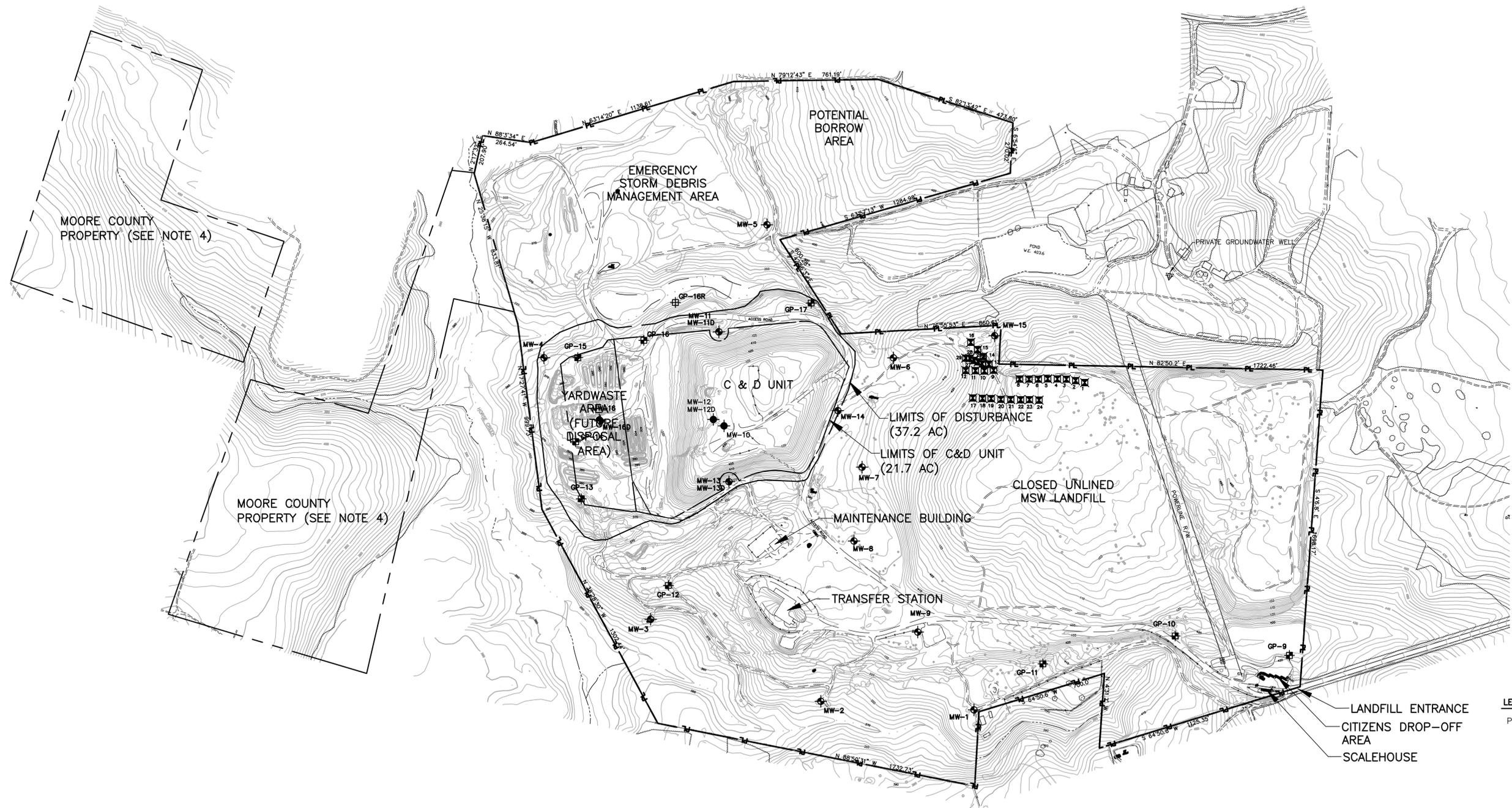
VICINITY MAP - NTS





**NOTES:**

- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY PHOTOCGRAMMETRIC METHODS BY CARTOGRAPHIC AERIAL MAPPING FOR BRADY SURVEYING COMPANY DATED JUNE 13, 2008.
- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY LANDAIR SURVEYING, INC. DATED MARCH 24, 2000.
- PROPERTY BOUNDARY SURVEY BY JAMES L. WRIGHT DATED NOVEMBER 1984. ITS LOCATION RELATIVE TO TOPOGRAPHY APPROXIMATED BY HDR ENGINEERING, INC. (SEE LEGEND)
- ADJACENT PROPERTY BOUNDARY LINEWORK FROM MOORE COUNTY GIS WEBSITE AS OF SEPTEMBER 16, 2008.
- MONITORING WELLS 6 THROUGH 16 SURVEYED 4/5/95, 9/19/96 AND APRIL 2003 BY HDR ENGINEERING, INC./ED BUCKNER RLS.
- LOCATION OF PRIVATE GROUNDWATER WELL IS APPROXIMATE.



**LEGEND**

PROPOSED	ACTIVE	ABANDONED	
			METHANE PROBES (GP)
			GROUNDWATER WELLS (MW)
			GAS VENTS
			EXISTING CONTOURS
			PROPERTY LINE (SEE NOTE 1 AND 3)
			PROPERTY LINE (SEE NOTE 2 AND 4)
			CELL LIMITS
			LIMITS OF C&D UNIT

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HDR Engineering, Inc.  
of the Carolinas

N.C. B.E.L.S. License Number: F-0110  
120 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
A	8/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E.
PROJECT NUMBER	07625-58015-018



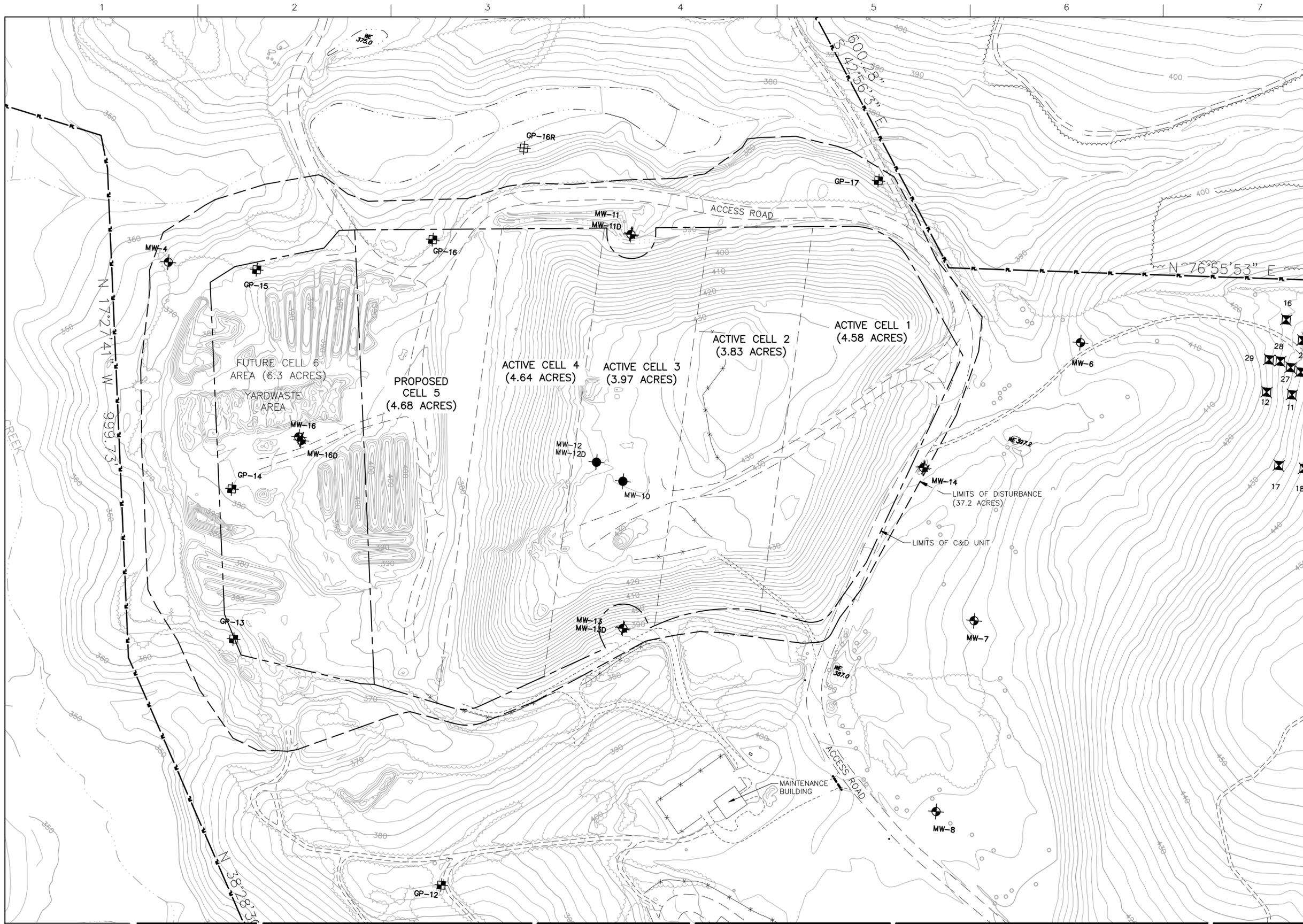
**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

**OVERALL SITE PLAN**

0 1" 2"  
SCALE 1"=300'

FILENAME	00G-01.dwg	SHEET
SCALE	1"=300'	<b>G-01</b>



- NOTES:**
- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY PHOTOGAMMETRIC METHODS BY CARTOGRAPHIC AERIAL MAPPING FOR BRADY SURVEYING COMPANY DATED JUNE 13, 2008.
  - PROPERTY BOUNDARY SURVEY BY JAMES L. WRIGHT DATED NOVEMBER 1984. ITS LOCATION RELATIVE TO TOPOGRAPHY APPROXIMATED BY HDR ENGINEERING, INC. (SEE LEGEND)

**LEGEND**

	EXISTING CONTOURS
	PROPERTY LINE (SEE NOTE 1 AND 2)
	CELL LIMITS
	LIMITS OF C&D UNIT
	LIMITS OF DISTURBANCE
	PROPOSED METHANE PROBES (GP)
	ACTIVE METHANE PROBES (GP)
	ABANDONED METHANE PROBES (GP)
	PROPOSED GROUNDWATER WELLS (MW)
	ACTIVE GROUNDWATER WELLS (MW)
	ABANDONED GROUNDWATER WELLS (MW)
	PROPOSED GAS VENTS
	ACTIVE GAS VENTS
	ABANDONED GAS VENTS



ISSUE	DATE	DESCRIPTION
A	9/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

	FILENAME 00C-01.dwg SCALE 1"=100'	SHEET <b>C-01</b>
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- NOTES:**
- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY PHOTOGRAMMETRIC METHODS BY CARTOGRAPHIC AERIAL MAPPING FOR BRADY SURVEYING COMPANY DATED JUNE 13, 2008.
  - PROPERTY BOUNDARY SURVEY BY JAMES L. WRIGHT DATED NOVEMBER 1984. ITS LOCATION RELATIVE TO TOPOGRAPHY APPROXIMATED BY HDR ENGINEERING, INC. (SEE LEGEND)
  - EXISTING GROUND MONITORING WELLS (MW) AND EXISTING GAS PROBES (GP) WILL BE RELOCATED AS NECESSARY.

- EROSION CONTROL NOTES:**
- EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED TO COMPLY WITH ACCEPTABLE STANDARDS.
  - ALL STORM WATER MANAGEMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED AND MADE OPERATIONAL IN EACH WORK ZONE PRIOR TO COMMENCEMENT OF EARTHWORK ACTIVITIES WITHIN THAT WORK ZONE.
  - ADDITIONAL TEMPORARY DITCHES AND/OR DIVERSIONS MAY BE REQUIRED TO PERFORM CONSTRUCTION, WHERE SUCH MEASURES ARE REQUIRED, THEY SHALL BE CONSTRUCTED SO AS TO DIRECT RUNOFF FROM DISTURBED AREAS TO APPROPRIATE TEMPORARY CONTROL FEATURES.
  - ALL SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND AFTER ANY STORM EVENT OF GREATER THAN ONE-HALF INCH OF PRECIPITATION DURING ANY 24 HOUR PERIOD. REPAIR AS NEEDED. ALL SEDIMENT CONTROL FEATURES SHALL BE MAINTAINED UNTIL FINAL STABILIZATION HAS BEEN OBTAINED.
  - ACCUMULATED SEDIMENT IS TO BE REMOVED FROM THE EROSION AND SEDIMENT DEVICES WHEN 1/2 OF THE HOLDING CAPACITY IS DEPLETED.
  - REMOVE SILT FENCE AND OTHER TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES UPON ESTABLISHMENT OF VEGETATIVE COVER.
  - PROVIDE GROUND COVER ON EXPOSED SLOPES WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING; PERMANENT GROUND COVER FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION OR DEVELOPMENT. REFER TO SPECIFICATION 02485 FOR SEEDING.
  - STABILIZE AND SEED ALL BASIN SLOPES IMMEDIATELY AFTER CONSTRUCTION.
  - UPON STABILIZATION OF THE DIVERSION DITCHES, REMOVE THE TEMPORARY PLUGS AND SKIMMER. PLUG THE SKIMMER INLET WITH A PVC CAP OR APPROVED EQUAL.

- CONSTRUCTION SEQUENCE:**
- ESTABLISH LIMITS OF DISTURBANCE.
  - INSTALL SILT FENCE IN LOCATIONS AS SHOWN AND CONSTRUCTION ENTRANCE.
  - CLEAR AND GRUB ONLY THE AREA FOR THE PERMANENT SEDIMENT BASINS SB#1, #2, AND #3.
  - INSTALL THE PERMANENT SEDIMENT BASINS.
  - AFTER THE PERMANENT SEDIMENT BASINS ARE OPERATIONAL, INSTALL THE NORTH CHANNEL, SOUTH CHANNEL, AND CHANNELS IN THE YARD WASTE AREA TO DIRECT FLOW TO THE PERMANENT SEDIMENT BASIN.
  - CLEAR AND GRUB THE REMAINING AREA WITHIN THE LIMITS OF DISTURBANCE.
  - PERFORM GRADING OF CELL 5 AS SHOWN ON DRAWING C-03.
  - PERFORM FILLING OF AS SHOWN ON DRAWING C-04.
  - INSTALL THE FINAL CAP AS SHOWN ON DRAWING C-07.

**LEGEND**

	400	PROPOSED CONTOURS
	400	EXISTING CONTOURS
		PROPERTY LINE (SEE NOTE 1 AND 2)
		CELL LIMITS
		LIMITS OF C&D UNIT
		LIMITS OF DISTURBANCE
		SOUTH CHANNEL
		SILT FENCE
		PROPOSED METHANE PROBES (GP)
		ACTIVE METHANE PROBES (GP)
		PROPOSED GROUNDWATER WELLS (MW)
		ACTIVE GROUNDWATER WELLS (MW)
		PROPOSED GAS VENTS
		ACTIVE GAS VENTS



ISSUE	DATE	DESCRIPTION
	11/2009	REVISED PER NCDENR COMMENTS 11/20/09
A	9/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

**EROSION AND SEDIMENT CONTROL PLAN**

0 1" 2"

FILENAME: 00C-02.dwg SHEET: C-02

SCALE: 1"=100'

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**NOTES:**

- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY PHOTOGRAMMETRIC METHODS BY CARTOGRAPHIC AERIAL MAPPING FOR BRADY SURVEYING COMPANY DATED JUNE 13, 2008.
- PROPERTY BOUNDARY SURVEY BY JAMES L. WRIGHT DATED NOVEMBER 1984. ITS LOCATION RELATIVE TO TOPOGRAPHY APPROXIMATED BY HDR ENGINEERING, INC. (SEE LEGEND).
- GRADING WITHIN THE PROPOSED CELL 5 REPRESENT SUBGRADE.

**LEGEND**

- 400 PROPOSED CONTOURS
- 400 EXISTING CONTOURS
- PROPERTY LINE (SEE NOTE 1 AND 2)
- CELL LIMITS
- LIMITS OF C&D UNIT
- LIMITS OF DISTURBANCE
- SOUTH CHANNEL
- SILT FENCE
- PROPOSED METHANE PROBES (GP)
- ACTIVE METHANE PROBES (GP)
- PROPOSED GROUNDWATER WELLS (MW)
- ACTIVE GROUNDWATER WELLS (MW)
- PROPOSED GAS VENTS
- ACTIVE GAS VENTS

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**HDR**  
HDR Engineering, Inc.  
of the Carolina

N.C. B.E.L.S. License Number: F-0110  
128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
A	9/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

**CELL 5 BASE GRADES**

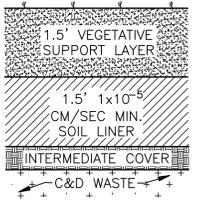
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SCALE 1"=100'

FILENAME 00C-03.dwg SHEET  
**C-03**



**NOTES:**

- EXISTING TOPOGRAPHY WITHIN THE PROPERTY LINE (SEE LEGEND) PROVIDED BY PHOTOGRAMMETRIC METHODS BY CARTOGRAPHIC AERIAL MAPPING FOR BRADY SURVEYING COMPANY DATED JUNE 13, 2008.
- PROPERTY BOUNDARY SURVEY BY JAMES L. WRIGHT DATED NOVEMBER 1984. ITS LOCATION RELATIVE TO TOPOGRAPHY APPROXIMATED BY HDR ENGINEERING, INC. (SEE LEGEND)
- PROPOSED GRADES WITHIN THE CELLS 1-5 REPRESENT TOP OF INTERMEDIATE COVER FOR A FIVE YEAR PERMIT.
- PROPOSED SIDESLOPES ARE 3H:1V OR FLATTER.
- THE SLOPE TRANSITIONS FROM 3H:1V TO 8% AT APPROXIMATELY ELEVATION 440.



**CAP SYSTEM**  
1" = 2'

**LEGEND**

- 400 — EXISTING CONTOURS
- 400 — PROPOSED CONTOURS
- - - SD - 18" SLOPE DRAIN
- - - - - PROPERTY LINE (SEE NOTE 1 AND 2)
- - - - - CELL LIMITS
- - - - - LIMITS OF C&D UNIT
- - - - - LIMITS OF DISTURBANCE
- ← ← ← SOUTH CHANNEL
- — — SILT FENCE
- PROPOSED ACTIVE
- ⊕ ⊕ METHANE PROBES (GP)
- ⊗ ⊗ GROUNDWATER WELLS (MW)
- ⊠ ⊠ GAS VENTS

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N.C. B.E.L.S. License Number: F-0110  
128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
A	9/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



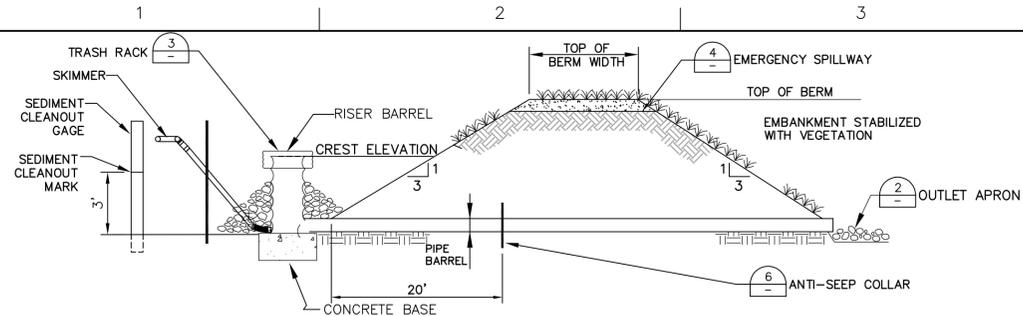
**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

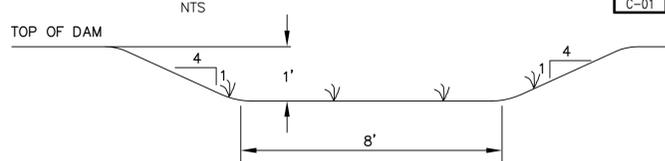
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**C-04**

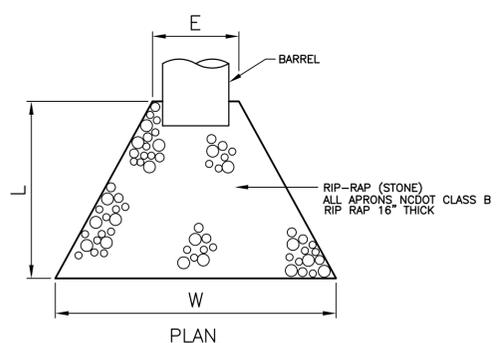


**RISER/BARREL**  
NTS

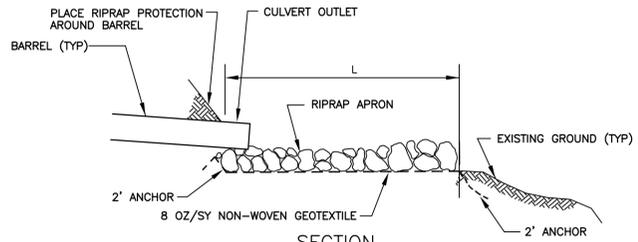


**EMERGENCY SPILLWAY**  
NTS

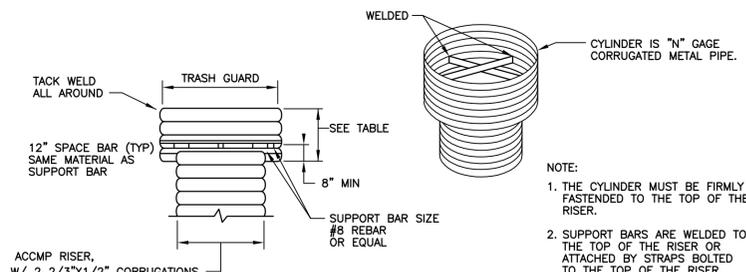
NOTES:  
1. EMERGENCY SPILLWAY IS GRASS LINED.



**PLAN**

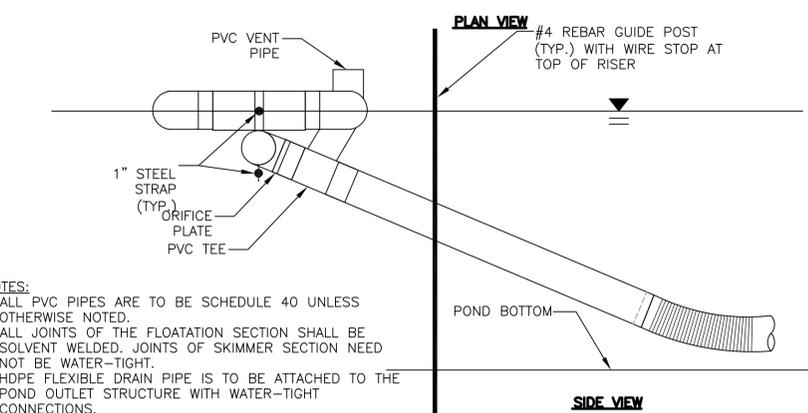
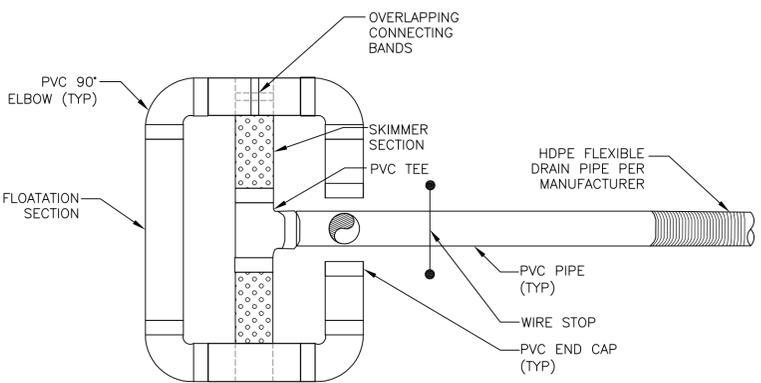


**APRON OUTLET**  
NTS



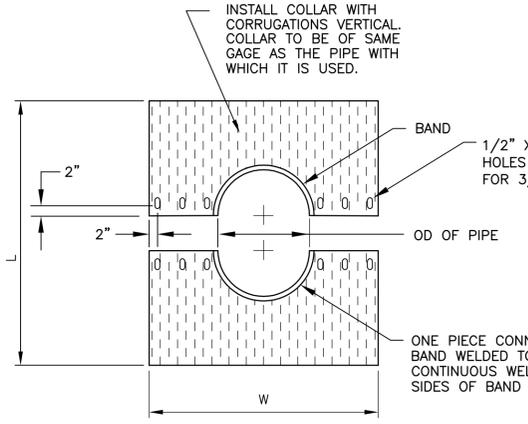
**TRASH RACK/ANTI-VORTEX DEVICE**  
NTS

NOTE:  
1. THE CYLINDER MUST BE FIRMLY FASTENED TO THE TOP OF THE RISER.  
2. SUPPORT BARS ARE WELDED TO THE TOP OF THE RISER OR ATTACHED BY STRAPS BOLTED TO THE TOP OF THE RISER.



**SKIMMER**  
NTS

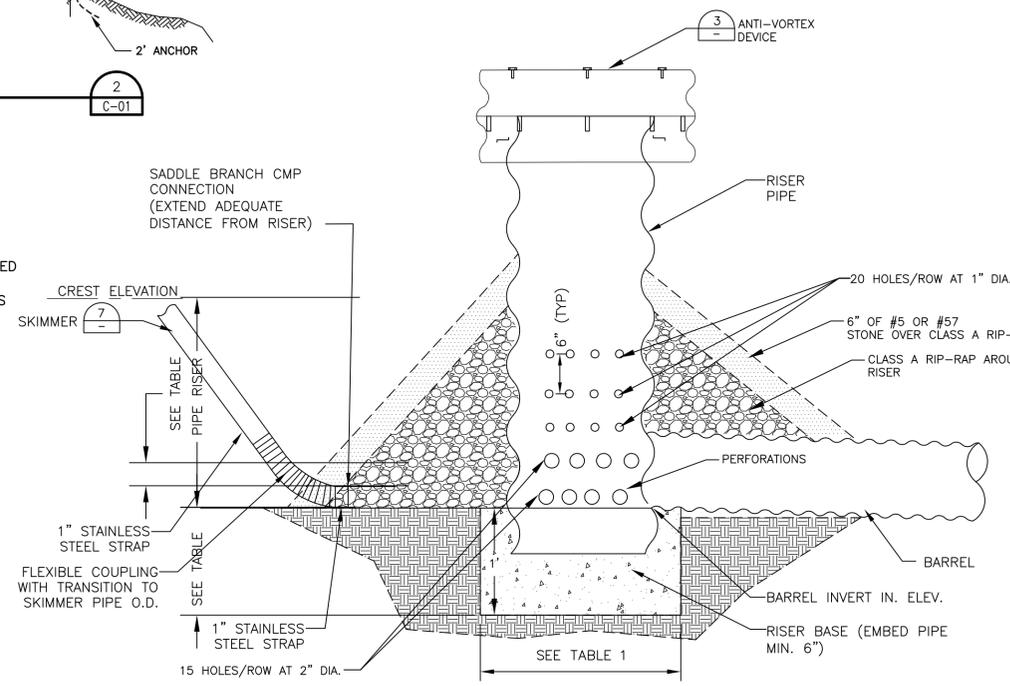
NOTES:  
1. ALL PVC PIPES ARE TO BE SCHEDULE 40 UNLESS OTHERWISE NOTED.  
2. ALL JOINTS OF THE FLOATATION SECTION SHALL BE SOLVENT WELDED. JOINTS OF SKIMMER SECTION NEED NOT BE WATER-TIGHT.  
3. HDPE FLEXIBLE DRAIN PIPE IS TO BE ATTACHED TO THE POND OUTLET STRUCTURE WITH WATER-TIGHT CONNECTIONS.  
4. SEE SCHEDULE FOR ORIFICE SIZE.  
5. FAIRCLOTH TYPE OR EQUIVALENT SKIMMER TO BE USED.



**ANTI-SEEP COLLAR**  
NTS

**MAINTENANCE AND INSPECTION**

1. INSPECT SEDIMENT BASINS AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT AND REPAIR IMMEDIATELY.
2. REMOVE SEDIMENT AND RESTORE THE BASIN TO ITS ORIGINAL DIMENSIONS WHEN IT ACCUMULATES TO ONE-HALF THE DESIGN DEPTH. PLACED REMOVED SEDIMENT IN AN AREA WITH SEDIMENT CONTROLS
3. CHECK EMBANKMENT, SPILLWAYS, AND OUTLET FOR EROSION DAMAGE, AND INSPECT THE EMBANKMENT FOR PIPING AND SETTLEMENT. MAKE ALL NECESSARY REPAIRS IMMEDIATELY. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE RISER AND POOL AREA.



**RISER**  
NTS

NOTES:  
1. INITIALLY ALL 2 INCH PERFORATIONS TO BE PLUGGED USING A 2 INCH T-PLUG MANUFACTURED BY STOCKCAP, PART #850997 OR APPROVED EQUAL AND ALL 1 INCH PERFORATIONS TO BE PLUGGED USING A 1 INCH T-PLUG MANUFACTURED BY STOCKCAP, PART #760546 OR APPROVED EQUAL.  
2. UPON STABILIZATION OF THE STOCKPILE AND DIVERSION DITCHES, REMOVE THE TEMPORARY PLUGS AND SKIMMER. PLUG THE SKIMMER INLET WITH A PVC CAP OR APPROVED EQUAL.

NOTES:  
1. ALL CMP SHALL BE FULLY ASPHALT COATED, 16 GA. OR HEAVIER  
2. DO NOT PLACE STONE OVER SKIMMER CONNECTION AND FLEXIBLE PIPING

NOTES:  
1. ALL CMP SHALL BE FULLY COATED, 16 GA. OR HEAVIER  
2. DO NOT PLACE STONE OVER CONNECTION AND FLEXIBLE

NOTES:  
1. PERFORATIONS:  
- VERTICAL SPACING: 6"  
- HORIZONTAL SPACING: UNIFORM  
- FIRST ROW IS 1/2" FROM THE BOTTOM

**TABLE 1 - SEDIMENT POND DATA**

SEDIMENT BASIN #	BOTTOM ELEVATION (MSL)	TOP OF BERM ELEVATION (MSL)	TOP OF BERM WIDTH (FT)	EMERGENCY SPILLWAY		CONCRETE BASE DIMENSIONS (FT.)	PIPE RISER			PIPE BARREL			APRON OUTLET			ANTISEEP COLLAR		SKIMMER	
				ELEV. (MSL)	WIDTH (FT.)		DIAMETER (IN.)	CREST ELEVATION (MSL)	TRASH GUARD DIAMETER (IN.)	DIAMETER (IN.)	INVERT IN. ELEV. (MSL)	INVERT OUT. ELEV. (MSL)	E (FT)	L (FT)	W (FT)	L (FT)	W (FT)	SIZE (IN)	ORIFICE (IN)
1	360	368	10	367	8	4x4x1	24	366	36	18	360	359.5	4.5	18	20	3	3	5	4.3
2	385	390	8	389	8	4x4x1	24	389	36	18	385	384.5	4.5	14	16	3	3	4	3.2
3	362	369	12	368	8	5.5x5.5x1	36	366.5	54	24	362	361.5	6	21	23	4	4	5	4.4

NOTES:  
1. MSL = MEAN SEA LEVEL  
2. ALL PIPES ARE ASPHALT COATED 16GA OR HEAVIER



ISSUE	DATE	DESCRIPTION
A	9/2009	ISSUED FOR NCDENR APPROVAL
	11/2009	REVISED PER NCDENR COMMENTS 11/20/09

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

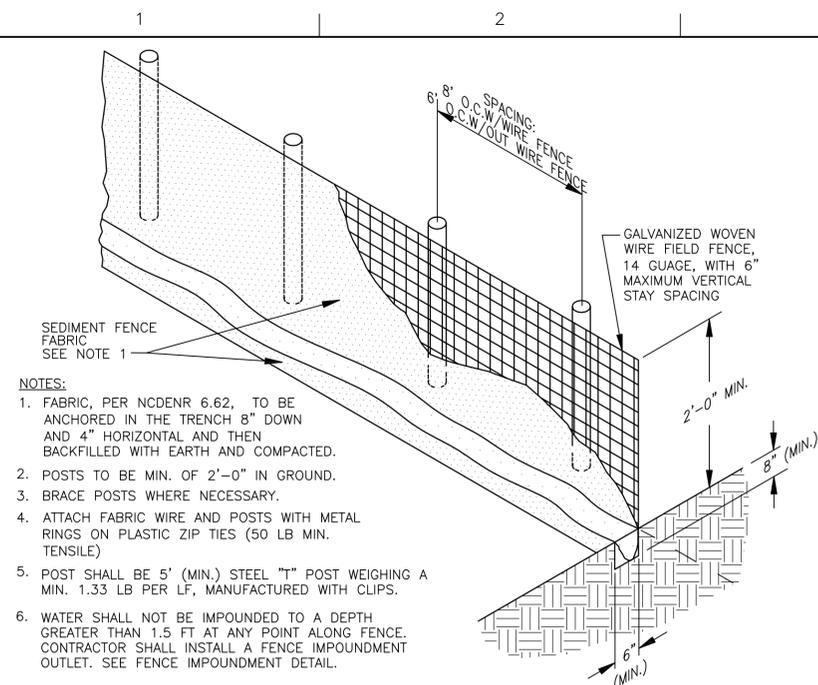
**SEDIMENT BASIN DETAILS**

0 1" 2"

FILENAME: 00C-05.dwg SHEET: C-05

SCALE: AS SHOWN

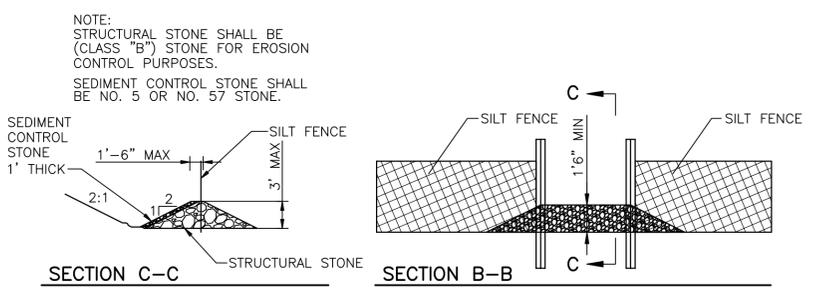
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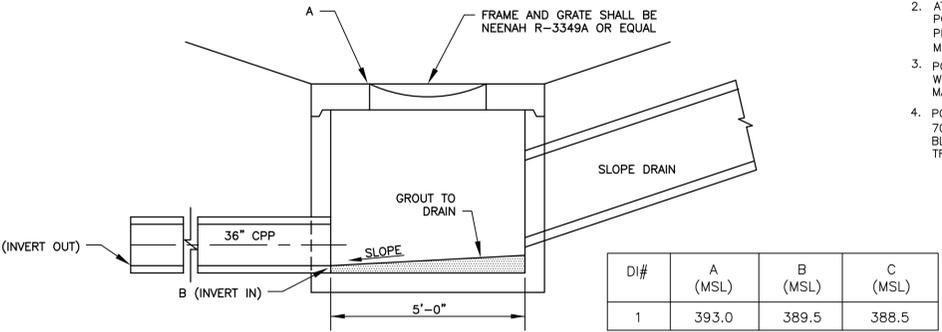
- NOTES:**
- FABRIC, PER NCDENR 6.62, TO BE ANCHORED IN THE TRENCH 8" DOWN AND 4" HORIZONTAL AND THEN BACKFILLED WITH EARTH AND COMPACTED.
  - POSTS TO BE MIN. OF 2'-0" IN GROUND.
  - BRACE POSTS WHERE NECESSARY.
  - ATTACH FABRIC WIRE AND POSTS WITH METAL RINGS ON PLASTIC ZIP TIES (50 LB MIN. TENSILE)
  - POST SHALL BE 5' (MIN.) STEEL "T" POST WEIGHING A MIN. 1.33 LB PER LF, MANUFACTURED WITH CLIPS.
  - WATER SHALL NOT BE IMPOUNDED TO A DEPTH GREATER THAN 1.5 FT AT ANY POINT ALONG FENCE. CONTRACTOR SHALL INSTALL A FENCE IMPOUNDMENT OUTLET. SEE FENCE IMPOUNDMENT DETAIL.

- MAINTENANCE AND INSPECTION**
- INSPECT AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
  - SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
  - REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND REDUCE PRESSURE ON THE FENCE.

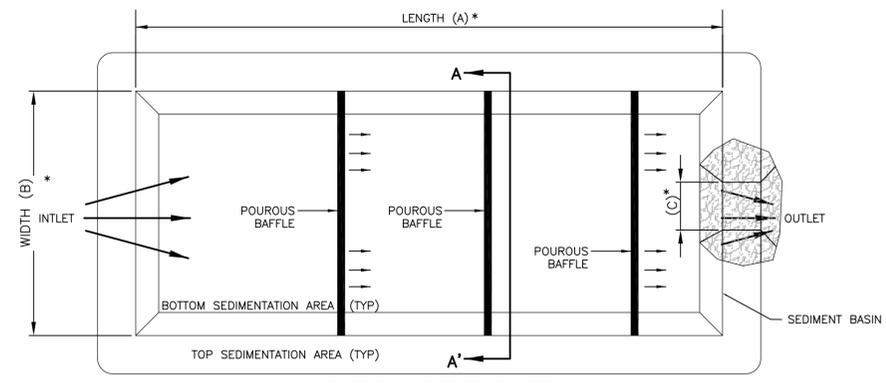
**SILT FENCE DETAIL**  
NTS NCDENR 6.62 C-02



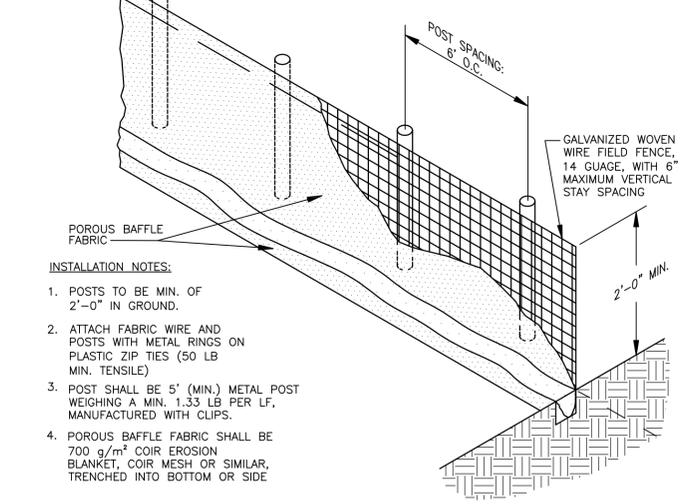
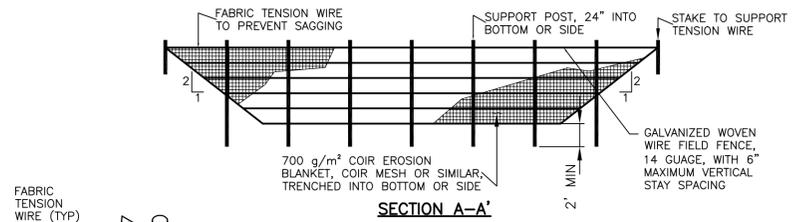
**SILT FENCE IMPOUNDMENT OUTLET**  
NTS C-02



**DROP INLET**  
NTS C-02

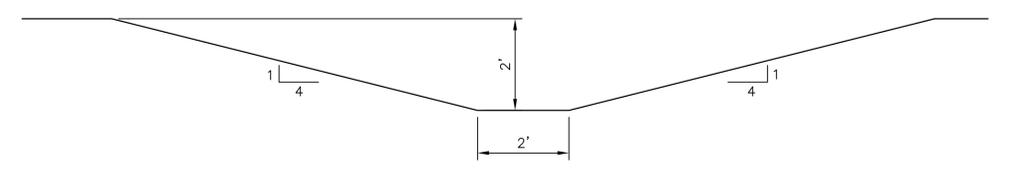


- NOTES:**
- BAFFLE SPACING SHOWN IS AN ILLUSTRATION OF TOTAL SURFACE AREA IN A RECTANGULAR CONFIGURATION.
  - BAFFLES SHALL BE SPACED TO CREATE 4 SURFACE AREAS OF 35%, 25%, 25%, AND 15% OF THE TOTAL SURFACE AREA OF THE BASIN.

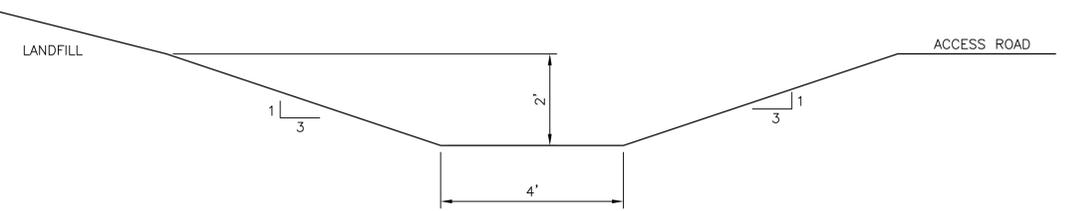


- INSTALLATION NOTES:**
- POSTS TO BE MIN. OF 2'-0" IN GROUND.
  - ATTACH FABRIC WIRE AND POSTS WITH METAL RINGS ON PLASTIC ZIP TIES (50 LB MIN. TENSILE)
  - POST SHALL BE 5' (MIN.) METAL POST WEIGHING A MIN. 1.33 LB PER LF, MANUFACTURED WITH CLIPS.
  - POROUS BAFFLE FABRIC SHALL BE 700 g/m<sup>2</sup> COIR EROSION BLANKET, COIR MESH OR SIMILAR, TRENCHED INTO BOTTOM OR SIDE

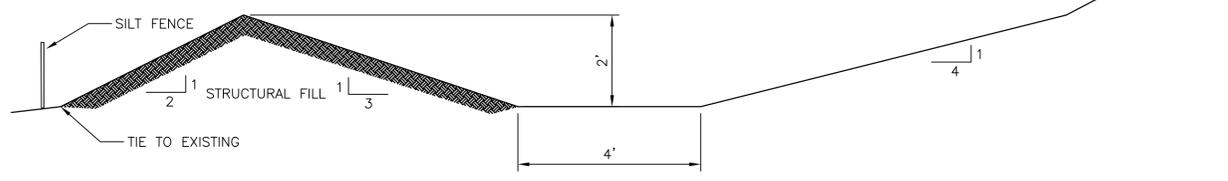
**POROUS BAFFLE DETAIL**  
NTS C-02



**YARD WASTE CHANNEL**  
1"=2' C-02



**NORTH CHANNEL**  
1"=2' C-02



**SOUTH CHANNEL**  
1"=2' C-02

- SEEDING SPECIFICATIONS:**
- TEST SOIL TO DETERMINE NUTRIENT CONTENT.
  - LOOSEN SURFACE TO MINIMUM DEPTH OF FOUR (4) INCHES.
  - INCORPORATE NEEDED NUTRIENTS AS DETERMINED AS DETERMINED FROM SOIL TEST INTO SOIL.
  - SEEDING REGIME:
    - PERMANENT SEEDING
      - SPRING / SUMMER (MARCH 1-AUGUST 14)
        - COMMON BERMUDA (HULLED): 90 LBS/AC
        - BROWN TOP MILLET: 30 LBS/AC
        - SERICA LESPEDEZE (HULLED): 30 LBS/AC
      - FALL / WINTER (AUGUST 15 - FEBRUARY 28)
        - COMMON BERMUDA (UNHULLED): 100 LBS/AC
        - SERICA LESPEDEZE (HULLED): 80 LBS/AC
        - WINTER RYE: 20 LBS/AC
    - TEMPORARY SEEDING
      - SPRING / SUMMER (APRIL 1-AUGUST 15 30)
        - ANNUAL SUDAN GRASS: 40 LBS/AC
        - BROWN TOP MILLET: 50 LBS/AC
      - FALL / WINTER (AUGUST 16 - MARCH 31)
        - WINTER RYE: 224 LBS/AC
  - CULTIPACK SEEDED AREAS.
  - GRADE SEEDED AREAS TO SMOOTH, EVEN SURFACE WITH LOOSE, UNIFORMLY FINE TEXTURE.
  - MULCH WITH WHEAT STRAW @ 3,000 LBS/ACRE.
  - ANCHOR MULCH WITH EMULSION OR APPROVED EQUAL ANCHORING METHOD.
- CHANNEL MAINTENANCE AND INSPECTION:**
- DURING THE ESTABLISHMENT PERIOD, CHECK CHANNELS AFTER EVERY RAINFALL. AFTER GRASS IS ESTABLISHED, PERIODICALLY CHECK THE CHANNEL; CHECK IT AFTER EVERY HEAVY RAINFALL EVENT. IMMEDIATELY MAKE REPAIRS. REMOVE ALL SIGNIFICANT SEDIMENT ACCUMULATIONS TO MAINTAIN THE DESIGNED CARRYING CAPACITY. KEEP THE GRASS IN A HEALTHY, VIGOROUS CONDITION AT ALL TIMES.

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ISSUE	DATE	DESCRIPTION
B	11/2009	REVISED PER NCDENR COMMENT 11/20/09
A	9/2009	ISSUED FOR NCDENR APPROVAL

PROJECT MANAGER	E.A. WRIGHT, P.E. P. WESTMORELAND, P.E. E.L. HARTWICK
PROJECT NUMBER	07625-58015-018



**Construction and Demolition  
Landfill  
Erosion and Sediment Control Plan**

MOORE COUNTY NORTH CAROLINA

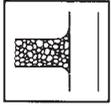
**MISCELLANEOUS DETAILS**

0 1" 2"

FILENAME	OOC-06.dwg	SHEET	<b>C-06</b>
SCALE	AS SHOWN		

6.06

**TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT**



**Definition** A graveled area or pad located at points where vehicles enter and leave a construction site.

**Purpose** To provide a buffer area where vehicles can drop their mud and sediment to avoid transporting it onto public roads, to control erosion from surface runoff, and to help control dust.

**Conditions Where Practice Applies** Wherever traffic will be leaving a construction site and moving directly onto a public road or other paved off-site area. Construction plans should limit traffic to properly constructed entrances.

**Design Criteria** **Aggregate Size**—Use 2-3 inch washed stone.

**Dimensions of gravel pad—**

Thickness: 6 inches minimum

Width: 12-foot minimum or full width at all points of the vehicular entrance and exit area, whichever is greater

Length: 50-foot minimum

**Location**—Locate construction entrances and exits to limit sediment from leaving the site and to provide for maximum utility by all construction vehicles (Figure 6.06a). Avoid steep grades, and entrances at curves in public roads.

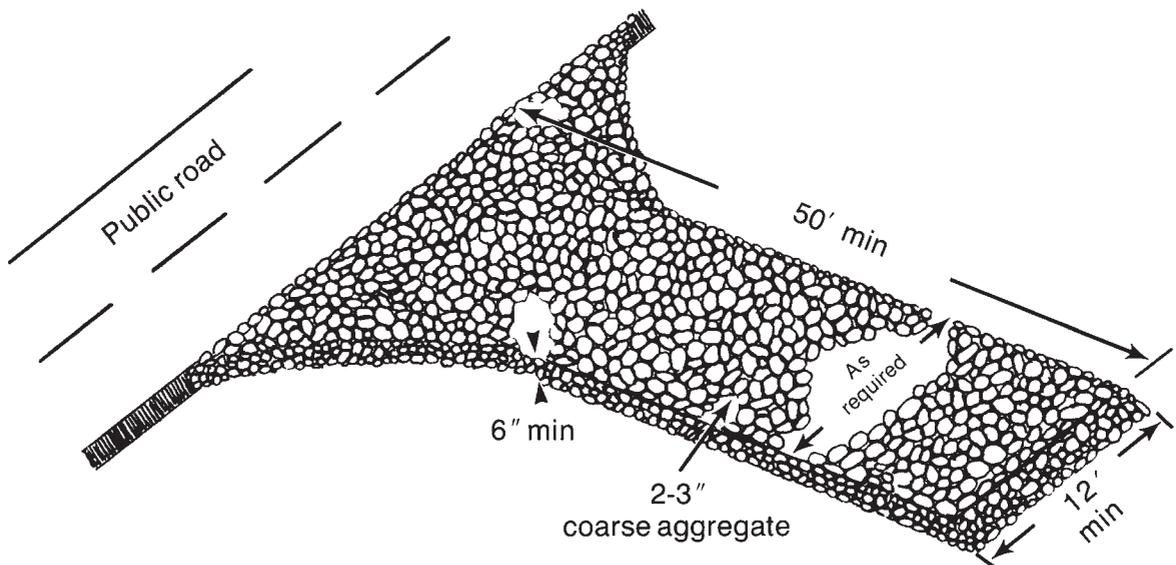


Figure 6.06a Gravel entrance/exit keeps sediment from leaving the construction site (modified from Va SWCC).

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**Washing**—If conditions at the site are such that most of the mud and sediment are not removed by vehicles traveling over the gravel, the tires should be washed. Washing should be done on an area stabilized with crushed stone that drains into a sediment trap or other suitable disposal area. A wash rack may also be used to make washing more convenient and effective.

### Construction Specifications

1. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
2. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
3. Provide drainage to carry water to a sediment trap or other suitable outlet.
4. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water table.

### Maintenance

Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

### References

*Runoff Conveyance Measures*  
6.30, Grass-lined Channels

*Sediment Traps and Barriers*  
6.60, Temporary Sediment Trap

6.10



## TEMPORARY SEEDING

**Definition** Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.

**Purpose** To temporarily stabilize denuded areas that will not be brought to final grade for a period of more than 21 calendar days.

Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established. In addition, it provides residue for soil protection and seedbed preparation, and reduces problems of mud and dust production from bare soil surfaces during construction.

**Conditions Where Practice Applies** On any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than 1 year. Applications of this practice include diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles.

**Planning Considerations** Annual plants, which sprout and grow rapidly and survive for only one season, are suitable for establishing initial or temporary vegetative cover. Temporary seeding preserves the integrity of earthen sediment control structures such as dikes, diversions, and the banks of dams and sediment basins. It can also reduce the amount of maintenance associated with these devices. For example, the frequency of sediment basin cleanouts will be reduced if watershed areas, outside the active construction zone, are stabilized.

Proper seedbed preparation, selection of appropriate species, and use of quality seed are as important in this Practice as in Practice 6.11, *Permanent Seeding*. Failure to follow established guidelines and recommendations carefully may result in an inadequate or short-lived stand of vegetation that will not control erosion.

Temporary seeding provides protection for no more than 1 year, during which time permanent stabilization should be initiated.

**Specifications** Complete grading before preparing seedbeds, and install all necessary erosion control practices such as, dikes, waterways, and basins. Minimize steep slopes because they make seedbed preparation difficult and increase the erosion hazard. If soils become compacted during grading, loosen them to a depth of 6-8 inches using a ripper, harrow, or chisel plow.

### SEEDBED PREPARATION

Good seedbed preparation is essential to successful plant establishment. A good seedbed is well-pulverized, loose, and uniform. Where hydroseeding methods are used, the surface may be left with a more irregular surface of large clods and stones.

**Liming**—Apply lime according to soil test recommendations. If the pH (acidity) of the soil is not known, an application of ground agricultural limestone at the

rate of 1 to 1 1/2 tons/acre on coarse-textured soils and 2-3 tons/acre on fine-textured soils is usually sufficient. Apply limestone uniformly and incorporate into the top 4-6 inches of soil. Soils with a pH of 6 or higher need not be limed.

**Fertilizer**—Base application rates on soil tests. When these are not possible, apply a 10-10-10 grade fertilizer at 700-1,000 lb/acre. Both fertilizer and lime should be incorporated into the top 4-6 inches of soil. If a hydraulic seeder is used, do not mix seed and fertilizer more than 30 minutes before application.

**Surface roughening**—If recent tillage operations have resulted in a loose surface, additional roughening may not be required, except to break up large clods. If rainfall causes the surface to become sealed or crusted, loosen it just prior to seeding by disking, raking, harrowing, or other suitable methods. Groove or furrow slopes steeper than 3:1 on the contour before seeding (Practice 6.03, *Surface Roughening*).

### PLANT SELECTION

Select an appropriate species or species mixture from Table 6.10a for seeding in late winter and early spring, Table 6.10b for summer, and Table 6.10c for fall.

In the Mountains, December and January seedings have poor chances of success. When it is necessary to plant at these times, use recommendations for fall and a securely tacked mulch.

### SEEDING

Evenly apply seed using a cyclone seeder (broadcast), drill, cultipacker seeder, or hydroseeder. Use seeding rates given in Tables 6.10a-6.10c. Broadcast seeding and hydroseeding are appropriate for steep slopes where equipment cannot be driven. Hand broadcasting is not recommended because of the difficulty in achieving a uniform distribution.

Small grains should be planted no more than 1 inch deep, and grasses and legumes no more than 1/2 inch. Broadcast seed must be covered by raking or chain dragging, and then lightly firmed with a roller or cultipacker. Hydroseeded mixtures should include a wood fiber (cellulose) mulch.

### MULCHING

The use of an appropriate mulch will help ensure establishment under normal conditions, and is essential to seeding success under harsh site conditions (Practice 6.14, *Mulching*). Harsh site conditions include:

- seeding in fall for winter cover (wood fiber mulches are not considered adequate for this use),
- slopes steeper than 3:1,
- excessively hot or dry weather,
- adverse soils (shallow, rocky, or high in clay or sand), and
- areas receiving concentrated flow.

If the area to be mulched is subject to concentrated waterflow, as in channels, anchor mulch with netting (Practice 6.14, *Mulching*).

**Maintenance** Reseed and mulch areas where seedling emergence is poor, or where erosion occurs, as soon as possible. Do not mow. Protect from traffic as much as possible.

**References** *Site Preparation*  
6.03, Surface Roughening  
6.04, Topsoiling  
  
*Surface Stabilization*  
6.11, Permanent Seeding  
6.14, Mulching  
  
*Appendix*  
8.02, Vegetation Tables

**Table 6.10a**  
**Temporary Seeding**  
**Recommendations for Late**  
**Winter and Early Spring**

**Seeding mixture**

<b>Species</b>	<b>Rate (lb/acre)</b>
Rye (grain)	120
Annual lespedeza (Kobe in Piedmont and Coastal Plain, Korean in Mountains)	50

Omit annual lespedeza when duration of temporary cover is not to extend beyond June.

**Seeding dates**

Mountains—Above 2500 feet: Feb. 15 - May 15

Below 2500 feet: Feb. 1- May 1

Piedmont—Jan. 1 - May 1

Coastal Plain—Dec. 1 - Apr. 15

**Soil amendments**

Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.

**Mulch**

Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.

**Maintenance**

Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.

**Table 6.10b  
Temporary Seeding  
Recommendations for  
Summer**

<b>Seeding mixture</b>	
<b>Species</b>	<b>Rate (lb/acre)</b>
German millet	40
<p>In the Piedmont and Mountains, a small-stemmed Sudangrass may be substituted at a rate of 50 lb/acre.</p>	
<b>Seeding dates</b>	
Mountains—May 15 - Aug. 15	
Piedmont—May 1 - Aug. 15	
Coastal Plain—Apr. 15 - Aug. 15	
<b>Soil amendments</b>	
Follow recommendations of soil tests or apply 2,000 lb/acre ground agricultural limestone and 750 lb/acre 10-10-10 fertilizer.	
<b>Mulch</b>	
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.	
<b>Maintenance</b>	
Refertilize if growth is not fully adequate. Reseed, refertilize and mulch immediately following erosion or other damage.	

**Table 6.10c**  
**Temporary Seeding**  
**Recommendations for Fall**

<b>Seeding mixture</b>	
<b>Species</b>	<b>Rate (lb/acre)</b>
Rye (grain)	120
<b>Seeding dates</b>	
Mountains—Aug. 15 - Dec. 15	
Coastal Plain and Piedmont—Aug. 15 - Dec. 30	
<b>Soil amendments</b>	
Follow soil tests or apply 2,000 lb/acre ground agricultural limestone and 1,000 lb/acre 10-10-10 fertilizer.	
<b>Mulch</b>	
Apply 4,000 lb/acre straw. Anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blades set nearly straight can be used as a mulch anchoring tool.	
<b>Maintenance</b>	
Repair and refertilize damaged areas immediately. Topdress with 50 lb/acre of nitrogen in March. If it is necessary to extend temporary cover beyond June 15, overseed with 50 lb/acre Kobe (Piedmont and Coastal Plain) or Korean (Mountains) lespedeza in late February or early March.	

6.11



**PERMANENT SEEDING**

**Definition** Controlling runoff and erosion on disturbed areas by establishing perennial vegetative cover with seed.

**Purpose** To reduce erosion and decrease sediment yield from disturbed areas, to permanently stabilize such areas in a manner that is economical, adapts to site conditions, and allows selection of the most appropriate plant materials.

**Conditions Where Practice Applies** Fine-graded areas on which permanent, long-lived vegetative cover is the most practical or most effective method of stabilizing the soil. Permanent seeding may also be used on rough-graded areas that will not be brought to final grade for a year or more.

Areas to be stabilized with permanent vegetation must be seeded or planted within 15 working days or 90 calendar days after final grade is reached, unless temporary stabilization is applied.

**Introduction** During the initial phase of all land disturbing projects, the protective layer, either natural or man-made, is removed from the earth's surface. As the protective layer is removed, the resulting bare areas are exposed to the natural forces of rainfall, freezing, thawing, and wind. The result is soil erosion that leads to sediment pollution of North Carolina streams, rivers, lakes, and estuaries.

This design manual presents many alternative strategies for preventing erosion and reducing sediment loss during the construction process. Establishment of protective vegetative cover during the construction project, however, is the crucial step in achieving soil stabilization, controlling soil erosion, and preventing sedimentation of waterways. Without a sufficient amount of root mat and leaf cover to protect and hold the soil in place, large volumes of soil will be lost and waterways will be degraded long after projects are considered complete.

Sections of this practice standard address many of these various situations and set forth selection criteria for the appropriate cover based on purpose and adaptability. Some sediment and erosion control practices recommended in earlier editions of the manual may no longer be applicable. For example, many popular and commonly used seed and plant varieties have been identified as invasive. Invasive plants are defined as species that aggressively compete with, and displace, locally adapted native plant communities. In select cases where no practical alternative is available, these plants may be considered on a limited basis for soil stabilization, understanding that the goal is to eliminate the use of all invasive plants in favor of non-invasive native and/or introduced species that will provide an equally acceptable vegetative cover. Where there is no alternative to the use of invasive species, measures need to be incorporated in the installation and maintenance of these plants to limit their impacts.

It is imperative that disturbed soils be totally protected from erosion and sediment loss during construction and before a project is considered complete and acceptable. Installing appropriate vegetation in an immediate and timely fashion is the optimal means of achieving this stabilization. Vegetative specifications for most exposed soil conditions across North Carolina are provided in this section of the manual. It should be noted however, that no two sites in the State are exactly alike; therefore the protective vegetative cover for individual sites should be carefully selected. Each requires its own investigation, analysis, design and vegetative prescription as set forth in this section of the manual.

This practice standard describes three stages of vegetative cover; immediate, primary and long term. Effective and acceptable stabilization can be provided only when the optimum combination of immediate, primary, and long term vegetative practices are applied.

The vegetative measures presented in this chapter include application of seed, sod and sprigs. Use of field and container grown plants are not addressed in this manual. Planting of these types of vegetation is typically at spacing and intervals that will not provide the required protective cover. However, the design professional is encouraged to utilize these larger plants to compliment the required protective cover, particularly where these types of plants will provide seed for continued long term cover and wildlife habitat.

## **PLANNING CONSIDERATIONS**

### **SOILS**

Test and analyze the type(s) and quality of the existing soils on a site, their pH ranges, and their nutrient levels. Taking soil samples from the different areas of the project site and having them tested at a state or independent lab will provide a baseline for determining the pH modifiers and additional nutrients required for the selected plant varieties.

Disturbed conditions on a site may produce a variety of soil communities. Nutrient and pH levels in deeply cut soils will be quite different from those soils found on the original surface. When sites are highly disturbed through mechanical means such as grading, the soils become mixed together in many different ratios. These areas should be identified and tested.

Results from soil tests will usually include recommended application rates of soil modifiers such as lime and fertilizer for the selected plant species in the particular soils. Application rates will be itemized in the report.

The texture of the soil on a site, which is the proportion of sand, silt, and clay in the soil, is an important physical indicator of the site's ability to support vegetation. In heavy clay soils amendments may be necessary to provide an adequately drained planting medium. Conversely, in extremely sandy soils, amendments may be required to provide for moisture and nutrient retention.

Soil tests will indicate the texture of the given soil but will not provide recommendations for amendments that will improve the soil texture. Generally, the addition of organic materials will improve the porosity of heavy clay soils and improve the water holding capacity of extremely sandy soils. On sites where these different soil conditions exist, it is recommended that a design professional with experience in soil modification be employed to recommend the proper amendments.

For more information visit the NCDA Agronomic Services Soil Testing web page <http://www.agr.state.nc.us/agronomic/sthome.htm>

### **SOIL PREPARATION**

Proper soil preparation is necessary for successful seed germination and root establishment. It is also necessary for establishment of rooted sprigs, sod and woody plants. Heavily compacted soils prevent air, nutrients and moisture from reaching roots thereby retarding or preventing plant growth. The success of site stabilization and reduction of future maintenance are dependent on an adequately prepared soil bed. Following are the requirements for preparation of areas to be vegetated by grassing, sprigging, sodding, and/or planting of woody plants:

#### **General Requirements:**

- Preparation for primary/permanent stabilization shall not begin until all construction and utility work within the preparation area is complete. However, it may be necessary to prepare for nurse crops prior to completion of construction and installation of utilities.
- A North Carolina Department of Agriculture Soils Test (or equal) shall be obtained for all areas to be seeded, sprigged, sodded or planted. Recommended fertilizer and pH adjusting products shall be incorporated into the prepared areas and backfill material per the test.
- All areas to be seeded or planted shall be tilled or ripped to a depth specified on the approved plans, construction sequence and/or construction bid list. Ripping consists of creating fissures in a criss-cross pattern over the entire surface area, utilizing an implement that will not glaze the side walls of the fissures. Site preparation that does not comply with these documents shall not be acceptable. The depth of soil preparation may be established as a range based on the approval of the reviewing state or local agency. Once tilled or ripped according to the approved plan, all areas are to be returned to the approved final grade. pH modifiers and/or other soil amendments specified in the soil tests can be added during the soil preparation procedure or as described below.
- All stones larger than three (3) inches on any side, sticks, roots, and other extraneous materials that surface during the bed preparation shall be removed.

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**Areas to be Seeded:**

- Till or disc the prepared areas to be seeded to a minimum depth of four (4) inches. Remove stones larger than three (3) inches on any side, sticks, roots and other extraneous materials that surface. If not incorporated during the soil preparation process, add pH modifier and fertilizers at the rate specified in the soil test report.
- Re-compact the area utilizing a cultipacker roller. The finished grade shall be a smooth even soil surface with a loose, uniformly fine texture. All ridges and depressions shall be removed and filled to provide the approved surface drainage. Seeding of graded areas is to be done immediately after finished grades are obtained and seedbed preparation is completed.

**Areas to be Sprigged, Sodded, and/or Planted:**

- At the time of planting till or disc the prepared areas to a depth of four (4) to six (6) inches below the approved finished grade. Remove all stones larger than three (3) inches on any side, sticks, roots and other extraneous materials that surface. If not incorporated in the ripping process, add pH modifier, fertilizer, and other recommended soil amendments.
- Re-compact the area utilizing a cultipacker roller and prepare final grades as described above. Install sprigs, sod and plants as directed immediately after fine grading is complete. Mulch, mat and/or tack as specified.

**VEGETATION**

Availability of seed and plant materials is an important consideration of any construction stabilization effort. Throughout North Carolina, climate, economics, construction schedule delays and accelerations, and other factors present difficult challenges in specifying the different vegetation needed for site stabilization. To help resolve this issue, vegetative stabilization requires consideration in three categories:

- Immediate Stabilization – nurse crop varieties (Note: temporary mulching may be utilized for immediate stabilization if outlined on the approved plans and construction sequence.)
- Primary Stabilization – plant varieties providing cover up to 3 years with a specified maintenance program
- Long Term Stabilization – plant varieties providing protective cover with maintenance levels selected by the owner

An adequate job in one of these areas does not guarantee success in the later phases. Horticultural maintenance must be included in the plans.

Immediate vegetative cover will always require additional fertilization, soil amendments, soil tests, overseeding and/or other horticultural maintenance until primary vegetative cover is established.

Where provisions are made for regular maintenance, primary vegetative cover may be the end result. An example of primary vegetative cover being acceptable as an end use would be lawns in residential and commercial developments that are established, monitored and complimented with regular and approved horticultural maintenance practices. (See Example 6.11.a.)

In projects where continual maintenance will not be provided or scheduled following the primary stabilization of a project, long-term stabilization will be necessary. Maintenance of initial and long-term stabilization can cease only after the long-term cover has established and hardened to local climatic conditions. Maintenance of long-term vegetation must be included in the project construction sequence and on the approved plans. Examples of areas suitable for long term vegetation include roadsides, reforestation areas, restored flood plains, restored riparian areas, phased closing of landfills, and mining reclamations.

Complete stabilization requires using at least two, and most times, all three vegetative phases. The design professional must clearly communicate this point in their specifications, construction sequence, and in direct communications to owners and installers. The charts in tables 6.11.a through 6.11.d provide information to assist the design professional in this task. The tables are not inclusive and are presented only as alternatives. The professional is expected and required to provide design and specifications that combine the information in the manual with knowledge of the particular sites and their constraints.

#### **pH AND NUTRIENT AMENDMENTS**

Determining the nutrients that enable seed and container plants to grow, flourish, and become established after planting are critical elements of the design and stabilization process. The soils tests previously described will provide a recipe for amendments based on particular plants and particular soils. The test results will recommend the amounts of base elements (nitrogen, phosphorous, potassium), pH modifiers and other trace elements that should to be added to the soil for selected species of seeds and plants.

The acid/base characteristic of the soil is a primary component of soil fertility. If the soil acidity is not in the proper range, other nutrients will be ineffective, resulting in less productive plant growth. Most plants grow best in a pH range of 6.5 – 7.0 (slightly acidic to neutral). The soil tests will recommend the specific amendments and application rates required to achieve this range. These amendments must be incorporated into the soil (not applied on the surface) to be effective. (See the General Requirements for soil preparation specifications and timing for incorporation of soil amendments.)

The base elements are easily found in bulk quantities. Lime can also be obtained in large quantities. They all must be thoroughly incorporated into the soil through appropriate mechanical means. Ground surface applications without proper soil mixing will result in poor results.

In addition to the base fertilizers, other trace elements are needed to produce healthy and vigorous growth. These include but may not be limited to sulfur, manganese, zinc, boron, chlorine and molybdenum. If not already included with bulk mixes of the base elements, they can be obtained from commercial suppliers.

Provisions for soils test during and/or after initial grading is complete shall be included on the approved plan, in the approved construction sequence, and on the bid item list utilized for the project. *If you did not obtain a soil test:* Follow these recommendations for all grasses except centipedegrass.

1. Apply 75 pounds of ground limestone per 1,000 sq. ft.
2. Apply a starter type fertilizer (one that is high in phosphorus) based on the type of grass and planting method. Fertilizer bags have a three-number system indicating the primary nutrients, such as 8-8-8 or 5-10-10. These numbers denote the N-P-K ratio—the percentage of each nutrient in a fertilizer. The percentages are always noted in the following order:

N Nitrogen for green color and growth.

P<sub>2</sub>O<sub>5</sub> Phosphorus for good establishment and rooting.

K<sub>2</sub>O Potassium to enhance pest and environmental stress tolerance.

Some common examples of starter type fertilizers required for a 1,000 sq. ft. area include 40 pounds of 5-10-10, 20 pounds of 10-20-20, or 16 pounds of 18-24-6. For sandy soils, typical to coastal plain and sandhills of North Carolina, fertilizer rates should be increased by 20 percent.

Where available, it is recommended that the design professional specify organic compounds that meet the fertilization requirements, pH and other element requirements. Initial studies have indicated that these compounds have a more positive effect on the environment than some of the synthetic compounds used to manufacture inorganic fertilizers. These materials are readily available in the commercial trade as well as found in recycled yard waste debris, sewerage sludge, lime-stabilized sludge and animal manures. Materials proposed for use must be industry certified and/or privately tested and certified to be acceptable for proposed areas of use and application prior to approval.

#### **MULCHES AND TACKING AGENTS**

Mulches and tacking agents may be required or necessary to protect a seedbed's disturbed surface until the seed can germinate and provide the required protection from erosion. Selection of the materials used in this application should be based on their ability to hold moisture in the soil, as well as protect exposed soil from rainfall, storm water runoff, and wind. The availability of the selected material and the means to apply it are critical factors to consider when planning for the stabilization of any disturbed area. The mulch must cover a minimum of eighty (80) percent of the soil surface and must be secured by a tacking agent, crimping, or protective biodegradable netting. Netting that incorporates plastic mesh and/or plastic twine should not be used in wetlands, riparian buffers or floodplains due to the potential of small animal mortality. See Section 6.14 for detailed specifications and product applications.

#### **SOIL BLANKETS**

Soil blankets can be an acceptable and effective method of temporary sediment and erosion control in lieu of nurse crops. See Section 6.17 of the manual for descriptions of this product and how it can be used in conjunction with this section. In absence of mulches and tracking agents other means of protection may be necessary and required.

## **PROTECTIVE MATTING**

Protective matting consists of an impervious cover secured to the soil surface in lieu of vegetative cover. It is used to protect and stabilize the surface where the process of seeding or planting forms of vegetation may cause more erosion and off-site sedimentation than application of the mat. It is also used where a disturbed area is intended to lay fallow for a period of time before additional construction or land disturbance takes place. If a pervious matting is selected, a combination of vegetation and matting is required. Seeds can be applied prior to installation of the matting only after proper seedbed preparation has been provided. Also, live stakes, dormant sprigs, and other vegetation forms can be inserted in the pervious matting once it has been installed. Pre-seeded pervious matting may be used for quicker root establishment and stabilization only if certified dating and germination guarantees are provided. The reviewing agency must approve all pre-seeded matting on site prior to installation. Matting that incorporates plastic mesh and/or plastic twine should not be used in wetlands, riparian buffers or floodplains due to the potential of small animal mortality. See Section 6.17 for detailed specifications and recommended product applications.

## **STABILIZATION IN WETLANDS, RIPARIAN BUFFERS, AND FLOODPLAINS**

Land disturbing activity involving streams, wetlands or other waterbodies may also require permitting by the U.S. Army Corps of Engineers or the N.C. Division of Water Quality. Approval of an erosion and sedimentation control plan is conditioned upon the applicant's compliance with federal and State water quality laws, regulations, and rules. Additionally, a draft plan should be disapproved if implementation of the plan would result in a violation of rules adopted by the Environmental Management Commission to protect riparian buffers along surface waters. Care should be taken in selecting vegetative stabilization of wetlands and riparian buffers to comply with permitting requirements of other agencies, as well as provide adequate ground cover.

### **Planning Considerations for Land Disturbing Activities Within Wetland, Riparian, and Floodplain Areas**

Wetlands, riparian areas, floodplains, and/or terrestrial areas between streams and uplands, serve to buffer surface water and provide habitat for aquatic and terrestrial flora and fauna. When cleared and disturbed, these sensitive areas are difficult to protect. Because of their proximity to water courses, relatively high ground water tables, and flooding potential, detailed analysis and design is necessary to determine the appropriate erosion control measures during construction. Determining the appropriate and most expeditious means of permanent vegetative stabilization in these areas requires equally detailed analysis and design. The following considerations for erosion control and stabilization should be taken into account during the design phase of the land disturbing project where sensitive areas are involved:

- Obtain soil tests to determine the soil type, pH, texture and available nutrients.
- Based on the soil tests provide a schedule of nutrients and other soil amendments that will be required.

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- Select a seeding mix of non-invasive species that will provide immediate stabilization (a short-term environment that will support and compliment permanent vegetative stabilization) and include a selective native species mix that will eventually provide a permanent cover (a long-term environment that, with minimal maintenance, will provide adequate root and leaf cover).
  - Invasive species are to be avoided. If native species and introduced non-invasive seed sources are not available, protective matting that will hold and foster the development of native cover from adjacent seed sources should be used. Continuous maintenance must be employed until the selected species have matured and are no longer susceptible to competition from invasive plants. If no alternative to the use of invasive seeds and plants is available, invasives approved on the plans may be utilized only with strict containment measures outlined in detail on the plans, in the construction sequence and in the maintenance specifications.
  - A quickly germinating nurse crop of non-invasive, non-competitive annual grass species can be used along with native seeding and/or matting. These temporary systems should be planted at minimal density so that they do not inhibit the growth and establishment of the permanent, native species. (See the plant chart in Table 6.11.a for recommended native and nurse crop species.)
  - Seed bed preparation is key to successful establishment of seeds. Particular care should be taken, however, when working in wetlands, riparian areas, or floodplains due to their sensitive nature. Careful consideration should be given to the types and placement of large equipment working in these areas. This process must be outlined in detail on the plan's construction sequence.
  - Installation techniques vary and should be planned for accordingly.
  - A maintenance plan must be established for optimal plant establishment, submitted with the plans and included in the bid list for the project.

Like all construction sites, wetlands, riparian areas, and floodplains will vary widely in physical makeup across North Carolina. Different conditions will dictate specific treatment, design and plant selection within the Mountains, Piedmont, and Coastal Plain regions. Soil tests, seedbed preparation, mulching, matting, and maintenance will be critical for successful vegetative establishment and long-term protection of these environmentally sensitive areas. Unavoidable impacts to these areas during land disturbing activities need to be addressed in detail on the plan sheets and construction sequence.

**Native Seed and Plant Selection for Stabilization of Wetlands, Riparian Areas, and Floodplains**

Upon the completion of the land disturbing activity, vegetative cover must be established on all areas not stabilized by other means. If work in these areas stops for more than 15 working days, temporary vegetative cover and/or matting must be applied to all disturbed areas. The goal is to protect these areas from erosion and to prevent sedimentation of adjacent streams, wetlands, lakes, and other water bodies.

Planning considerations for wetlands, riparian areas and floodplains will require additional research, detail and specifications. Native grasses are usually required as a condition of a 401 Water Quality Certification or a trout buffer variance.

Native vegetative species are plant species that naturally occur in the region in which they evolved. These plants are adapted to local soil types and climatic variations. Because most native species do not germinate and establish as readily as some introduced species, it is necessary to provide a non-native nurse crop or matting to stabilize the soil until the native crop can become established as the dominant cover. Once established, the native plants will produce an extensive root structure that, if properly maintained, will stabilize soils and reduce erosive forces of rainfall and overland stormwater flow. Many of these plants also possess characteristics that, when established, allow them not only to survive, but also to thrive under local conditions.

Seeding a mixture of perennial native grasses, rushes, and sedges is a way to establish permanent ground cover within wetlands, riparian areas and floodplains. The use of propagated plants is another method of reestablishing natives in these environments. Selecting a seed mixture and/or propagated plants of different species with complimentary characteristics will provide vegetation to fill select niches on sites with varying physical conditions. The design professional should note that because most native species do not germinate and establish as readily as some introduced species, it is necessary to provide a non-native nurse crop or matting to stabilize the soil until the native crop can become established as the dominant cover. For additional information about acceptable nurse crop varieties, consult the planting list in Appendix 8.02, local seed and plant suppliers, the North Carolina Cooperative Extension Service or a qualified design professional to assure the proper selection and plant mix.

Permanent native seed species within the seed mixture should be selected based on natural occurrence of each species in the project site area. Climate, soils, topography, and aspect are major factors affecting the suitability of plants for a particular site and these factors vary widely across North Carolina, with the most significant contrasts occurring among the three major physiographic regions of the state – Mountains, Piedmont, and Coastal Plain. Sub-regions of the state should also be considered. For example, the Triassic Basin in the Piedmont region may have characteristics that call for special soil treatment, limited plant selection, and special maintenance. Even within the riparian area, there may be need for different species depending on site conditions (i.e., dry sandy alluvial floodplains with wet pockets). Therefore, thoughtful planning is required when selecting species for individual sites in order to maximize successful vegetation establishment.

Native seed and plant species are included on the plant list in Appendix 8.02 of this manual.

The design professional should note that regardless of the benefits and advantages of native seeds and plants, there are potential issues if proper planning, installation and maintenance do not occur. These may include:

- Potential for erosion or washout during the establishment stage;
- Seasonal limitation on suitable seeding dates and availability of seed and plants;
- Adaptability of species at specific sites;
- Availability of water and appropriate temperatures during germination and early growth; and
- Lack of maintenance to control invasive plants and undesirable competition.

#### PLANTING

- **Seed** – Prepare the seed bed as described above in soil preparation. Apply seed at rates specified on the plans, and/or as recommended in Tables 6.11a-c of this manual, with a cyclone seeder, prop type spreader, drill, or hydroseeder on and/or into the prepared bed. Incorporate the seed into the seed bed as specified. Provide finished grades as specified on the approved plan and carefully culti-pack the seedbed as terrain allows. If terrain does not allow for the use of a cultipacker, the approved plans and construction sequence must provide an alternative method of lightly compacting the soil. Mulch immediately.
- **Sprigs and Sod** – Install onto the prepared seed bed per the most current guidance in Carolina Lawns, NCSU Extension Bulletin AG-69, or Practice 6.12 *Sodding*.

- **Woody plants (liners, container, B&B)** – These materials are typically used to complement an herbaceous protective cover. They eventually are major components of long-term, permanent stabilization and should be chosen and planned in conjunction with immediate and long-term maintenance. The plants should be selected and specified by the design professional for each individual project. See Practice 6.13 *Trees, Shrubs, Vines, and Ground Covers*.

#### **MAINTENANCE**

The absence of or an incomplete landscape management specification and/or complete maintenance schedule shall constitute grounds for disapproval of the plans. Proper maintenance is critical for the continued stabilization once vegetative cover is established. Although maintenance strategies for different sites may be similar, no two construction sites in North Carolina have been or will be able to be controlled or protected in identical ways. Variations in climate, topography, soils, available moisture, size and many other conditions will dictate the maintenance methodology to be used. A detailed schedule of maintenance will be required on the plans. This schedule will illustrate how the initial planting will be maintained to assure immediate, short term and permanent protection. The schedule will address topics such as appropriate irrigation of plants during the early establishment phase, drought conditions, excessive rainfall, mulch replacement, supplemental seeding, supplemental soils tests, application of nutrients and amendments, control of competitive and invasive species, disease and insect control, and corrective maintenance, measures to address failure of vegetation to become established. Contractual responsibility for maintenance after initial establishment of vegetative cover will be provided on the plans, in the construction sequence and on the bid list for the project. Maintenance bonds and/or warranty guarantee may be required of the responsible party, especially for areas in or adjacent to environmentally sensitive sites such as wetlands, riparian buffers, floodplains, and waters of the State. See Example 6.11a for a sample maintenance specification and a minimum maintenance check list that shall be provided on all plans.

#### **RECOMMENDED BID LIST**

(These items should be itemized on documents utilized to obtain pricing for planting pertaining to vegetative stabilization of land disturbing projects in North Carolina.)

- Soil test prior to grading (price per each test).
- Soil test during grading operations (price per each test).
- Soil test at completion of grading and/or prior to seeding, sprigging, sodding and application of fertilizer, lime, and other soil amendments (price per each test).
- Ripping/subsoiling to a depth of six (6) inches. (Provide an alternate for ripping to a depth greater than six (6) inches.) (price per acre)
- Tilling/discing ripped area to a depth of four (4) inches and re-compacting with a cultipacker roller (include in seeding price).

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- Seeding (price per square foot).
  - Mulching (price per square foot).
  - Repair seeding (price per square foot).
  - Repair mulching (price per square foot).
  - Matting (price per square yard).
  - Watering (price per thousand gallons).
  - Mowing (price per square foot).

### **SEEDING RECOMMENDATIONS**

The following tables list herbaceous plants recommended for use as nurse crops for immediate stabilization and primary crops for initial and long-term stabilization. Nurse crops are expected to develop in two to five weeks and, with adequate maintenance, be an effective method of soil stabilization for a period of six months to one year. Nurse crops are not effective as primary long-term cover, however if properly maintained they can be an adequate cover and protection for the development of primary crops.

The goal for a primary crop is for it to develop over a three-week to one-year period and be effective up to three years with a well-defined maintenance program. The long-term goal for a primary crop is the initial step toward a sustainable protective cover without the need of maintenance. Where the primary crop is intended for a managed lawn and landscape aesthetics, the effective period can be extended by a more intense maintenance program. Where native species are utilized and become established during the planned maintenance program, a permanent cover that will support future succession species should exist and require little or no additional maintenance or management.

In uses of both nurse and primary crops, the development periods listed on the tables are optimal based on normal climatic conditions for the planting dates listed. The sediment and erosion control maintenance program must recognize that optimum temperatures and rainfall are the exception rather than the rule. The design professional needs to provide flexibility in the stabilization plan to address the potential ranges of temperature and moisture conditions we experience in North Carolina.

Information is provided for seeding rates, optimum planting dates in the state's three regions, sun and shade tolerance, invasive characteristics, compatibility in wetlands and riparian buffers, and installation maintenance considerations. By going through the lists the design professional can select the nurse and primary seed varieties and maintenance characteristics they feel are best suited for their site conditions, vegetation management expertise and maintenance capabilities.

To use the information in the seeding charts the plan preparer must:

- Determine what nurse crop best fits their site, soil conditions, and permanent seed mix.
- Obtain soil tests for all areas to be seeded.
- Know the site's region: mountains, piedmont, or coastal plain.
- Know if the areas to be seeded are sunny, part shade, or full shade.
- Know if the areas are well or poorly drained.
- Know if wetlands or riparian buffers are included in the areas to be seeded.
- Know if a chosen crop is invasive and if so, what potential impacts it will have on the site and adjacent properties.

With this knowledge the plan preparation may proceed utilizing the charts provided to provide the several seed mixes that will be applicable to the different areas requiring stabilization.

**HERBACEOUS PLANTS-Seeding recommendations for immediate stabilization/nurse crops**  
 (2 to 5 weeks for development; effectiveness goal: 6 months to 1 year stabilization)

**Table 6.11.a**

**NURSE CROP SPECIES**

Common Name	Botanical Name	Native / Introduced	Seeding Rates lbs/acre	Fertilization/ limestone lbs/acre	Optimal Planting Dates			Sun/Shade tolerant	Wetlands	Riparian Buffers	Invasive Yes or No	Installation / Maintenance Considerations	Other information, commentary
					Mountains	Piedmont	Coastal Plains						
Rye Grain	<i>Secale cereale</i>	I	40 lbs	By soil test	11/1 - 4/30	8/15 - 4/15	8/15 - 4/15	Sun	Yes	Yes	No	Must be mown to reduce competitiveness with permanent or long term vegetation	
Wheat	<i>Triticum aestivum</i>	I	30 lbs	By soil test	11/1 - 4/30	8/15 - 5/15	8/15 - 4/15	Sun	Yes	Yes	No	Must be mown to reduce competitiveness with permanent or long term vegetation	Not water tolerant. May be used in wetlands that are not continuously saturated.
German Millet	<i>Setaria italica</i>	I	10 lbs	By soil test	5/11 - 9/30	5/15 - 8/15	4/15 - 8/15	Sun	Yes	Yes	No	Crop should be cut / disc prior to planting primary or long term vegetation	Not water tolerant. May be used in wetlands that are not continuously saturated.
Browntop Millet	<i>Urochloa ramosa</i>	I	10 lbs	By soil test	5/11 - 9/30	5/15 - 8/15	4/15 - 8/15	Sun	Yes	Yes	No	Crop should be cut / disc prior to planting primary or long term vegetation	Not water tolerant. May be used in wetlands that are not continuously saturated.
Sudangrass (hybrids)	<i>Sorghum saccharatum</i> <i>S. bicolor ssp. Drummondii</i>	I	15 lbs	By soil test	NR	NR	4/15 - 8/15	Sun	No	No	Yes	Crop should be cut / disc prior to planting primary or long term vegetation	Use only where plants and seed can be contained and controlled.
Kobe Lespedeza	<i>Kummerowia striata v. kobe</i>	I	10 lbs	By soil test	5/1 - 9/1	5/1 - 9/1	5/1 - 9/1	Sun	No	No	No	Consult qualified horticulturalist or extension agent for over-seeding with primary cover	Use in Coastal Plain
Korean Lespedeza	<i>Kummerowia stipulacea</i>	I	10 lbs	By soil test	5/1 - 9/1	5/1 - 9/1	5/1 - 9/1	Sun	No	No	No	Consult qualified horticulturalist or extension agent for over-seeding with primary cover	Use in Piedmont and Mountains. May become invasive

NOTES:

1. Seeding rates are for hulled seed unless otherwise noted.
2. Fertilizer & Limestone - rates to be applied in absense of soils tests. Recommended application rate assumes significantly disturbed site soils with little or no residual value.
3. NR means Species not recommended for this region or application area.
4. Invasive designation as determined by the N.C. Exotic Pest Pant Council and N.C. Native Plant Society .
5. Sprigging is not recommended for immediate stabilization unless terrain is flat heavy mulch is applied and no other immediate stabilization method is practical.



**HERBACEOUS PLANTS-Seeding recommendations for primary stabilization**

Successful development depends on planting date (effectiveness goal: 6 mo. - 3 yrs. without an ongoing maintenance program)

**Table 6.11.b**

**NON-NATIVE SPECIES**

Common Name	Botanical Name / Cultivar	Native / Introduced	Broadcast Seeding Rates lbs/acre	Fertilization/ limestone lbs/acre	Optimal Planting Dates			Sun/Shade tolerant	Wetlands	Riparian Buffers	Invasive Yes or No	Installation / Maintenance Considerations	Other information, commentary
					Mountains	Piedmont	Coastal Plains						
Sericea Lespedeza	<i>Lespedeza cuneata</i> <i>Dumont'</i>	I	15 lbs	By soil test	9/1 - 6/1	9/1 - 5/1	10/1 - 4/1	Sun	NR	NR	Yes	Responds well to controlled burns	Severe Threat Invasive species
Crown Vetch	<i>Securigera varia</i> <i>(Coronilla varia)</i>	I	15 lbs	By soil test	3/15-4/30	NR	NR	Sun	NR	NR	Yes	Highly competitive, not recommended unless an acceptable alternative is not available.	Prefers neutral soils
Centipede Grass	<i>Eremochloa ophiuroides</i>	I	5 lbs 10 lbs. for road shoulders	By soil test	NR	Eastern only	9/1 - 5/1	Sun	NR	NR	No	Significant maintenance may be required to obtain desired cover	Does not tolerate high traffic. Acceptable for sodding
KY 31 Tall Fescue	<i>Schedonorus phoenicifolius</i> <i>(Festuca arundinacea)</i>	I	100 lbs	By soil test	8/15-5/1	9/1-4/15	9/30 - 3/15	Sun / mod. Shade	NR	NR	Yes	If utilized, it is imperative that maintenance includes a containment plan	Acceptable for sodding
KY Blue Grass	<i>Poa pratensis</i>	I	15 lbs	By soil test	8/15-5/1	NR	NR	Sun	NR	NR	Yes	If utilized, it is imperative that maintenance includes a containment plan	Prefers neutral soils, highly competitive, not recommended unless an acceptable alternative is not available. Acceptable for sodding
Hard Fescue	<i>Festuca brevipila</i> <i>(Festuca longifolia)</i>	I	15 lbs	By soil test	8/1 - 6/1	NR	NR	Shade	NR	NR	No	Not recommended for slopes greater than 5%	Low growing, bunch grass
Bermuda Grass	<i>Cynodon dactylon</i>	I	25 lbs	By soil test	NR	4/15-6/30	4/15-6/30	Sun	NR	NR	Yes	If utilized, it is imperative that maintenance includes a containment plan	Extremely aggressive, not recommended and should be avoided unless an acceptable alternative is not available. May be sodded or sprigged

**HERBACEOUS PLANTS-Seedling recommendations for primary stabilization**  
 Successful development depends on planting date (effectiveness goal: 6 mo. - 3 yrs. without an ongoing maintenance program)

**Table 6.11.c**

**NATIVE SPECIES**

Common Name	Botanical Name / Cultivar	Native / Introduced	See Table 6.11.d for variety seedling rates	Fertilization/ limestone lbs/acre	Optimal Planting Dates				Wetlands	Riparian Buffers	Invasive Yes or No	Installation / Maintenance Considerations	Other information, commentary
					Mountains	Piedmont	Coastal Plains	Sun/Shade tolerant					
Switchgrass	<i>Panicum virgatum</i> / Cave-in-Rock	N	A	By soil test	12/1-4/15	NR	NR	Sun	NR	Well drained only	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Switchgrass	<i>Panicum virgatum</i> / Blackwell	N	A	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	NR	Well drained only	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Switchgrass	<i>Panicum virgatum</i> / Shelter	N	A	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	NR	Well drained only	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Switchgrass	<i>Panicum virgatum</i> / Carthage	N	A	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	Yes	Yes	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Switchgrass	<i>Panicum virgatum</i> / Kanlow	N	A	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	No	Poorly drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Switchgrass	<i>Panicum virgatum</i> / Alamo	N	A	By soil test	NR	12/1 - 5/1	1/1 - 5/1	Sun	No	Poorly drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Indiangrass	<i>Sorghastrum nutans</i> / Rumsey	N	B	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Western coastal plain only
Indiangrass	<i>Sorghastrum nutans</i> / Osage	N	B	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Western coastal plain only



**HERBACEOUS PLANTS-Seedling recommendations for primary stabilization**  
 Successful development depends on planting date (effectiveness goal: 6 mo. - 3 yrs. without an ongoing maintenance program)

**Table 6.11.c (con't)**

**NATIVE SPECIES**

Common Name	Botanical Name / Cultivar	Native / Introduced	See Table 6.11.d for variety seedling rates	Fertilization/ limestone lbs/acre	Optimal Planting Dates				Wetlands	Riparian Buffers	Invasive Yes or No	Installation / Maintenance Considerations	Other information, commentary
					Mountains	Piedmont	Coastal Plains	Sun/Shade tolerant					
Indiangrass	<i>Sorghastrum nutans</i> / <i>Cheyenne</i>	N	B	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Western coastal plain only
Indiangrass	<i>Sorghastrum nutans</i> / <i>Lomenta</i>	N	B	By soil test	NR	12/1 - 5/1	1/1 - 5/1	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Only Indiangrass adaptable to Eastern coastal plain (Zone 8)
Deertongue	<i>Dichanthelium clandestinum</i> / <i>Tioga</i>	N	C	By soil test	5/1-4/15	5/1 - 4/1	NR	Sun & Shade	Yes	Poorly drained to drought	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	
Big Bluestem	<i>Andropogon gerardii</i> / <i>Rountree</i>	N	D	By soil test	12/1-4/15	12/1 - 4/1	NR	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass
Big Bluestem	<i>Andropogon gerardii</i> / <i>Kaw</i>	N	D	By soil test	12/1-4/15	12/1 - 4/1	NR	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass
Big Bluestem	<i>Andropogon gerardii</i> / <i>Earl</i>	N	D	By soil test	12/1-4/15	12/1 - 4/1	12/1-5/1	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass
Little Bluestem	<i>Schizachyrium scoparium</i> / <i>Aldous</i>	N	E	By soil test	12/1-4/15	NR	NR	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass
Little Bluestem	<i>Schizachyrium scoparium</i> / <i>Cimmaron</i>	N	E	By soil test	12/1-4/15	12/1 - 4/1	NR	Sun	NR	Well drained	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass

**HERBACEOUS PLANTS- Seeding recommendations for primary stabilization**

Successful development depends on planting date (effectiveness goal: 6 mo. - 3 yrs. without an ongoing maintenance program)

**Table 6.11.c (con't)**

**NATIVE SPECIES**

Common Name	Botanical Name / Cultivar	Native / Introduced	See Table 6.11.d for variety seedling rates	Fertilization/ limestone lbs/acre	Optimal Planting Dates						Riparian Buffers	Invasive Yes or No	Installation / Maintenance Considerations	Other information, commentary
					Mountains	Piedmont	Coastal Plains	Sun/Shade tolerant	Wetlands					
Little Bluestem	<i>Schizachyrium scoparium / Common</i>	N	E	By soil test	NR	NR	12/1-4/1	Sun	NR	Well	No	Responds well to controlled burns. Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations.	Warm season grass	
Sweet Woodreed	<i>Cinna arundinacea</i>	N	F	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun & mod. Shade	Yes	Poorly to well drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations	Warm season grass	
Rice Cutgrass	<i>Leersia oryzoides</i>	N	G	By soil test	12/1-4/15	12/1 - 4/1	12/1-4/1	Sun	Yes	Poorly drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations	Warm season grass	
Indian Woodoats	<i>Chasmanthium latifolium</i>	N	H	By soil test	3/1 - 5/15 7/15-8/15	2/15 - 4/1 8/15 - 10/15	2/15-3/20 9/1 - 11/1	Sun & mod. Shade	NR	Well drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations	Cool season grass	
Virginia Wild Rye	<i>Elymus virginicus</i>	N	I	By soil test	3/1 - 5/15 7/15-8/15	2/15 - 4/1 8/15 - 10/15	2/15-3/20 9/1 - 11/1	Sun & mod. Shade	NR	Well drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations	Cool season grass	
Eastern Bottlebrush Grass	<i>Elymus hystrix</i>	N	J	By soil test	3/1 - 5/15 7/15-8/15	2/15 - 4/1 8/15 - 10/15	NR	Sun & mod. Shade	NR	Well drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations	Cool season grass	
Soft Rush	<i>Juncus effusus</i>	N	K	By soil test	12/1 - 5/15 8/15-10/15	12/1 - 5/1 9/1 - 11/1	12/1-4/15	Sun	Yes	Poorly drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations		
Shallow Sedge	<i>Carex lurida</i>	N	L	By soil test	12/1 - 5/15 8/15-10/15	12/1 - 5/1 9/1 - 11/1	12/1-4/15	Sun	Yes	Poorly drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations		
Fox Sedge	<i>Carex vulpinoidea</i>	N	L	By soil test	12/1 - 5/15 8/15-10/15	12/1 - 5/1 9/1 - 11/1	12/1-4/15	Sun	Yes	Poorly drained	No	Mix with 3 to 5 other seed varieties that have similar soil drainage adaptations		

NOTE:

1. Seeding rates are for hulled seed unless otherwise noted.
2. Fertilizer & Limestone - rates to be applied in absense of soils tests. Recommended application rate assumes significantly disturbed site soils with little or no residual value.
3. NR means Species not recommended for this region or application area.
4. Native, warm season grasses require six or more months to germinate under optimum conditions. If they are planted in the summer, then a whole year will have to pass before they germinate.
5. Invasive designation as determined by the N.C. Exotic Pest Pant Council and N.C. Native Plant Society .
6. Sprigging is not recommended for immediate stabilization unless terrain is flat, heavy mulch is applied and no other immediate stabilization method is practical.
7. Sodding for immediate stabilization - see primary stabilization charts (other information column) and Section 6.12.
8. Long term stabilization can only be accomplished with an adequate, immediate, and primary stabilization program. To achieve long term protective cover with the species listed in



Table 6.11.d

**Seed Mixes for Native Species (lbs/ac)  
When Mixed with 3, 4, or 5 Other Native Species  
(See Table 6.11.a for nurse crop species to be added to these mixes)**

	<b>3 Other (total 4 species)</b>	<b>4 Other (total 5 species)</b>	<b>5 Other (total 6 species)</b>
Switch Grasses (A)	3.5 lbs.	3.0 lbs.	2.5 lbs.
Indian Grasses (B)	7.0 lbs.	6.0 lbs.	5.0 lbs.
Deertongue (C)	6.0 lbs.	5.0 lbs.	4.0 lbs.
Big Bluestem (D)	7.0 lbs.	6.0 lbs.	5.0 lbs.
Little Bluestem (E)	7.0 lbs.	6.0 lbs.	5.0 lbs.
Sweet Woodreed (F)	2.5 lbs.	2.0 lbs.	1.5 lbs.
Rice Cutgrass (G)	6.0 lbs.	5.0 lbs.	4.0 lbs.
Indian Woodoats (H)	2.5 lbs.	2.0 lbs.	1.5 lbs.
Virginia Wild Rye (I)	6.0 lbs.	5.0 lbs.	4.0 lbs.
Eastern Bottlebrush Grass (J)	2.5 lbs.	2.0 lbs.	1.5 lbs.
Soft Rush (K)	2.5 lbs.	2.0 lbs.	1.5 lbs.
Sedges (L)	2.5 lbs.	2.0 lbs.	1.5 lbs.

**NOTE:**

With the native varieties, the seed mix should be in the range of 15 pounds per acre. Depending on availability of native seeds adaptable to North Carolina, the percentage of a particular variety used may be reduced or increased accordingly. Although diversity is desirable, it is imperative that the primary crop develop and become an effective protective cover. In addition to the native species mix, additional nurse crop species must be included to provide immediate stabilization and an adequate ground cover.

## Example 6.11.a GUIDELINES FOR WRITING MINIMUM LANDSCAPE MANAGEMENT SPECIFICATIONS

Following is an outline that demonstrates what should be included in specifications that will insure the long term stabilization of disturbed sites in North Carolina. As noted before in this manual, each construction site in the state is unique and has features that will require special provisions for revegetation and stabilization. The outline provided below cannot address these individual sites. It is the responsibility of the design professional and the financially responsible party to see that the specifications are edited to fit their site and to assure that permanent stabilization is achieved.

#### General Provisions

##### A. Intent:

1. These specifications are prepared with the intent of promoting outstanding performance in long-term stabilization. They are to be used as guidelines in establishing sediment control and vegetative standards for the sites. Final technical decisions such as herbicides, fertilizer ratios, times of application and schedules are to be determined by the Contractor, who has the responsibility to obtain soil test and to manage the vegetation to achieve the desired results. The maintenance specifications must address maintenance for sediment and erosion control vegetation during construction and for permanent/long-term stabilization.

##### B. Description of Work:

1. Perform all work necessary and required for the (insert period of contract) maintenance of the project as indicated on the drawings, in the project manual, and specified herein.
2. Licensing:
  - a) Contractor shall provide verification of current, applicable pesticide applicator licensing for each applicator that will handle pesticides on the contracted sites.
3. Contract Administration
  - a) Staffing: The Contractor shall provide adequate staffing, with the appropriate expertise, to perform all required work.
  - b) Monthly Site Review meetings will be held. Attendees will include the Contractor's Project Manager and Site Foreman and the property manager or other representative designated by the financially responsible party. Result of site reviews will be documented and circulated to the attendees and the owner by the contractor.
  - c) The Contractor will communicate with the proper person on a monthly basis to summarize work performed and immediately notify the project manager of any failure of the site to remain stabilized.

##### II. Materials

- A. Soil Additives: Additives are to be applied per soils test taken prior to, during and after construction. **(Use this section to provide the types and quantities of fertilizers, lime, and other soil amendments called for in the soils report. Include all soils test reports in the specifications document. This narrative or list should include quantities, rates, mixes, organic information, manufacturer, sources, and other information suggested in the soils test.)**

A. Pesticides:

1. Establish an Integrated Pest Management (IPM) program for the site that relies on targeted insect and disease control coupled with sound stabilization management and water management practices.
2. These specifications do not include pesticide treatments for infestations of Southern Pine Beetle, Gypsy Moth, or Fire Ants. The contractor shall notify the Owner if these pests are observed on site.
3. All pesticides shall be applied by a North Carolina licensed applicator in accordance with all State and Federal regulations and per manufacturer's recommendations.

B. Mulches: Mulch for areas not subject to erosion and over wash by storm water should be called out in this section addressing its maintenance, replacement, removal and conversion to other uses. Those subject to erosion and over wash by storm water must be addressed on the plans and in the calculations.

III. Execution

A. General:

1. Good long term stabilization is based on the proper maintenance, management and balance of nutrients, soil moisture and general cultural practices. It is recognized that fewer fungicide and pesticide treatments as well as lower fertility rates are required with a well managed, balanced landscape. The following section is meant to promote this balance and therefore do not highlight specific quantitative standards. **(Quantitative standards should be addressed as site specific by the design professional in conjunction with the owner and contractor.)** Calendar references are general and are to be used only as a guide. Weather and soil conditions that are most appropriate for a given process, procedure and/or area of the state shall be the determining factor in scheduling work.

B. Soil Tests:

1. After the soil test prior to stabilization, tests shall be made yearly in the fall to determine the required soil additives for all stabilized areas. If known nitrogen requirements are not specified by previous test, they need to be determined by the subsequent soils test and the proper applications made. Fertilizer ratios may be determined through analysis of the soil tests coupled with the contractor's experience and knowledge of the site.

C. Mowing

1. Mowing for maintained turf/lawns

- a. Mow areas intended for "groomed appearance" on a schedule during the growing season and as required throughout the year to provide the desired appearance. **(Establish a mowing frequency here that addresses the specific plant species used and their growing habits.)** This frequency will be a minimum standard. Particular properties and their peculiar characteristics as well as individual plant species may require mowing more often than the stated minimum may be required. This should be noted in this section.
- b. The range of turf species suggested for lawns in the three growing regions of North Carolina vary as to optimum maintained height. The selected species should be maintained at a height recommended by the seed producer. Do not cut too short and do not allow the turf to attain a height that will cause the crop to decline or die. Consult individual seed producers and/or packaging for recommended mowing heights.
- c. Mow with a mulching mower to limit the amount of clippings removed, or mow and blow in such a manner that clippings are not evident and not to adversely effect the growing capacity

and/or health of the existing vegetation turf. It is important clippings are allowed to remain spread throughout the lawn area, to the extent possible, so that they might aid in building a more productive soil profile and root zone.

2. Mowing other stabilized areas to promote continued growth. Include mowing specification here for other stabilized areas which require maintenance but not a “groomed” appearance. Also include specifications for mowing areas where it is desirable for woody native volunteer vegetation to become established. This should include attention to mowing stakes or other way of protecting the desired woody natives from the mowing operation.

#### D. Watering

1. Irrigation System Maintenance and Monitoring: If stabilized areas are to be irrigated the design professional should include specifications for the system, its maintenance and its operation in this section.
2. In the absence of an automatic or manual irrigation system, provisions for providing adequate water to stabilized areas should be addressed in this section.
3. **(Provisions should be made in this section for adjustments to application rates of water during times of regulated droughts and/or periods of excessive rainfall.)**

**E. CONTROL OF INVASIVES:** Competition from invasive species can be detrimental to the establishment of the permanent vegetative cover. Left unchecked, these invasives can undermine a revegetation process in a short period of time and eventually lead to unprotected soil and sediment damage. Make site observations monthly to check for the presence of such species and, if found, treat them immediately with the appropriate cultural practices and/or by the use of seasonally-appropriate and site appropriate herbicides.

F. Maintenance items including fertilization, mowing, continued soils testing, repair, mulching, matting and soil preparation are to be addressed in the approved construction sequence and on the project bid list.

6.17



## ROLLED EROSION CONTROL PRODUCTS

**Definition** Rolled erosion control products are manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation. Examples of RECP's are blankets, nets, and matting.

**Purpose** Erosion control mats and blankets are intended to protect soil and hold seed and mulch in place on slopes and in channels so that vegetation can become well established. Turf reinforcement mats can be used to permanently reinforce grass in drainage ways during high flows. Nets are made of high tensile material woven into an open net which overlays mulch materials. Blankets are made of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

### Conditions Where Practice Applies

Rolled Erosion Control Products (RECP's) should be used to aid permanent vegetated stabilization of slopes 2:1 or greater and with more than 10 feet of vertical relief. RECP's should also be used when mulch cannot be adequately tacked and where immediate ground cover is required to prevent erosion damage.

RECP's should be used to aid in permanent stabilization of vegetated channels when runoff velocity will exceed 2 ft/sec on bare earth during the 2-year rainfall event that produces peak runoff. The product selected must have a permissible shear stress that exceeds the shear stress of the design runoff event.

### Planning Considerations

- Good ground contact is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Nets must be used in conjunction with mulch. Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances. In general, most nets (e.g. jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after the installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

- Biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a fiber mesh and stitching which may last up to a year.

**Design Criteria** The following discussion and examples of design are adapted from “*Green Engineering, Design Principles and Applications Using Rolled Erosion Control Products*” by C. Joel Sprague.

**Slope Protection: Reducing raindrop and overland flow erosion.** The Revised Universal Soil Loss Equation (RUSLE), as shown below, is commonly used to estimate erosion due to rainfall and sheet runoff.

$$A = R * K * LS * C * P$$

where:

A = soil loss in tons/acre/year

R = rain factor

K = soil erodibility

LS = topographic factor

C = cover factor

P = practice factor

The United States Department of Agriculture’s handbook, “Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE), 1997,” provides agriculture-oriented values for all of these variables. Yet, when the equation is used to estimate construction-related erosion, the following unique C- and P-factors developed specifically for these applications should be used.

**The C-Factor**—C-factors are equal to the reduction in soil loss when using a specific erosion control system when compared to the comparable bare soil (control) condition. The designer will require C-factors representing various conditions from unvegetated to fully vegetated, including vegetation, which has been mulched or, alternatively, protected by an RECP, in order to determine an appropriate factor to be used to represent the design condition. (See Table 6.17a for a range of C-factors.)

**Table 6.17a C-Factor for Various Slope Treatments**

Treatment	Dry Mulch Rate		C-Factor for Growing Period*			
	kg/m <sup>3</sup>	Slope %	<6 Weeks	1.5-6 Months	6-12 Months	Annualized**
No mulching or seeding	—	all	1.00	1.00	1.00	1.00
Seeded grass	none	all	0.70	0.10	0.05	0.15
	0.22	<10	0.20	0.07	0.03	0.07
	0.34	<10	0.12	0.05	0.02	0.05
	0.45	<10	0.06	0.05	0.02	0.04
	0.45	11 - 15	0.07	0.05	0.02	0.04
	0.45	16 - 20	0.11	0.05	0.02	0.04
	0.45	21 - 25	0.14	0.05	0.02	0.05
	0.45	26 - 33	0.17	0.05	0.02	0.05
Second-year grass	—	all	0.01	0.01	0.01	0.01
	—	all	0.07	0.01	0.005	0.02
Organic and Synthetic Blankets	—	all	0.07	0.01	0.005	0.02
Composite Mats	—	all	0.07	0.01	0.005	0.02
Synthetic Mats	—	all	0.14	0.02	0.005	0.03
Fully Vegetated Mats	—	all	0.005	0.005	0.005	0.005

\* Approximate time periods for humid climates: Conversion: kg/m<sup>3</sup> x 4.45 = tons/acre.

\*\* Annualized C-Factor = (<6 weeks value x 6/52) + (1.5-6 months value x 20/52) + (6-12 months value x 26/52).

**Table 6.17b Permissible Shear Stress,  $\tau_p$ , of Various RECP's**

Category	Product Type	Max. Permissible Shear Stress (lb/ft <sup>2</sup> )	Slopes* Up To
Degradable RECP's (Unvegetated)	Nets and Mulch	0.1 - 0.2	20:1
	Coir Mesh	0.4 - 3.0	3:1
	Blanket - Single Net	1.55 - 2.0	2:1
	Blanket - Double Net	1.65 - 3.0	1:1
Nondegradable RECP's	Unvegetated TRM**	2 - 4	1:1
	Partially Vegetated TRM	4 - 6	>1:1
	Fully Vegetated	5 - 10	>1:1

\* Steeper slope limits may apply. For further information, contact the manufacturer.

\*\* Turf Reinforcement Mat.

**The P-Factor**—when examining erosion by itself, is commonly taken as 1.0, since this assumes that no special “practices” (i.e. terracing, contouring, etc.) will be used. Yet, the use of silt fences or other storm water management/ sediment control practices may be integrated into the RUSLE using a P-factor that is less than 1.0, which reflects the effectiveness of the sediment control practice in removing sediment from runoff.

### Sample Problem 6.17a

A steep slope is to be protected from erosion using RECP. The 3H:1V slope is 100 feet long and comprised of silty loam. The RUSLE will be used to evaluate the effectiveness of RECP in limiting annual soil loss. Following are the inputs to the RUSLE equation from the U.S. Department of Agriculture:

R = 250  
K = 0.33  
LS = 6.2  
P = 1.0 (assuming no sediment control)

From Table 6.17a:

$C_{\text{unprotected}} = 1.00$   
 $C_{\text{protected, year 1}} = 0.03$   
 $C_{\text{protected, year 2+}} = 0.005$

$A_{\text{unprotected}} = 250 \times 0.33 \times 6.2 \times 1.0 \times 1.0 = 511 \text{ tons/acre/year}$

$A_{\text{protected, year 1}} = 250 \times 0.33 \times 6.2 \times 0.03 \times 1.0 = 15 \text{ tons/acre/year}$

$A_{\text{protected, year 2+}} = 250 \times 0.33 \times 6.2 \times 0.005 \times 1.0 = 3 \text{ tons/acre/year}$

This example shows that vegetation, protected by an RECP, is 97 percent effective in reducing erosion in the first year and 99.5 percent effective in the longer-term.

Table 6.17b aids in selecting an appropriate type of RECP for the project-specific slope.

**Drainage Channels Concepts**—Permissible shear design is commonly used to determine if a channel liner is stable. This method requires the input of an appropriate expected flow rate (discharge) as well as the determination of flow depth. A broader presentation of channel design is located in Appendix 8.05, *Design of Stable Channels and Diversions*.

The design flow rate will be based on local storm frequency design standards and flow depth is calculated - commonly using Manning’s equation. With these inputs the designer can then perform a permissible shear design, which compares the permissible shear of the prospective liner materials to the expected flow-induced shear as calculated using the equation below.

$$\tau_c = Y D S$$

where:

Y = unit weight of water (62.4lb/ft<sup>3</sup>)

D = depth of flow (ft)

S = channel slope (ft/ft)

If the permissible shear stress,  $\tau_p$ , is greater than the computed shear,  $\tau_c$ , the lining is considered acceptable. Values for permissible shear stress,  $\tau_p$ , for linings are based on research conducted at laboratory facilities and in the field. Typical values are given in Table 6.17b. The permissible shear stress,  $\tau_p$ , indicates the force per unit area resulting from flowing water required to create instability of the lining material and/or adjacent soil.

**Manning’s Equation and Roughness Coefficient, n**—The condition of uniform, steady flow in a channel at a known discharge is computed using the Manning’s Equation below. Numerous computer programs are available to facilitate the use of this equation since a trial-and-error solution relating channel width, B, and depth, D, is required.

$$Q = (1.49/n) (A) (R)^{2/3} (S)^{1/2}$$

Manning’s equation for determining velocity:

$$V = (1.49/n) (R)^{2/3} (S)^{1/2}$$

where:

- Q = discharge (cfs)
- V = average velocity in cross section (ft/s)
- n = Manning’s roughness coefficient
- A = cross-sectional area (ft<sup>2</sup>)
- R = hydraulic radius = A/P (ft)
- P = wetted perimeter (ft)
- S = energy gradient (commonly taken as equivalent to the channel bed slope, ft/ft)

The appropriate Manning’s “n” to use when designing with RECP’s depends on whether one is designing for bare soil retention and vegetation establishment (short-term) or for fully grassed conditions (long term), or both. The “n” values for RECP’s can vary significantly with material type and flow depth, but they typically range from 0.02 to 0.04 and are usually provided by the manufacturer.

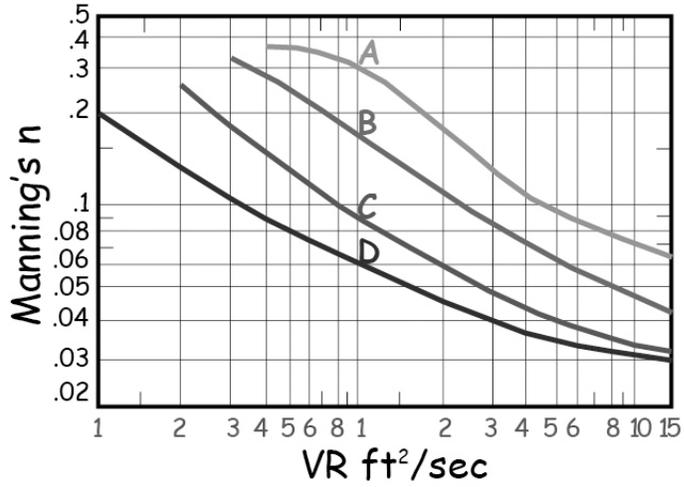
In lieu of product-specific information, the following values can be used as approximations.

- $n_{unvegetated} = 0.02$
- $n_{vegetated}$  = refer to Table 6.17c and Figure 6.17a
- $n_{lined}$  = refer to Table 8.05e

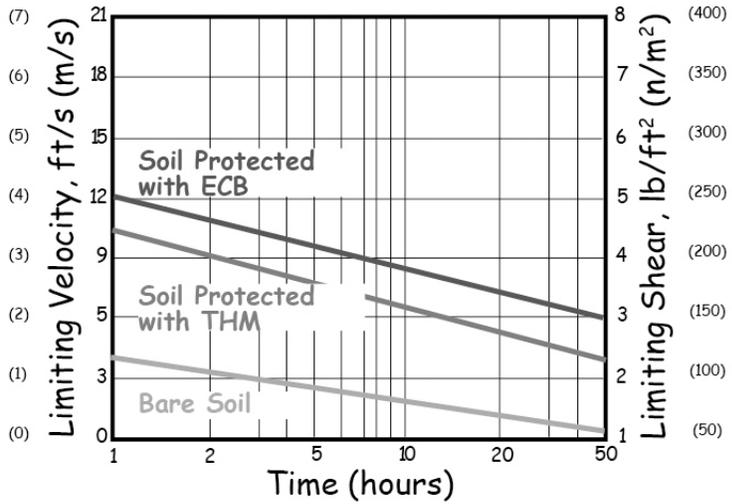
**Table 6.17c Grass Retardance Categories**

Average Grass Length	Retardance
>24 in.	A
10 in. to 24 in.	B
6 in. to 10 in.	C
2 in. to 6 in.	D
Less than 2 in.	E

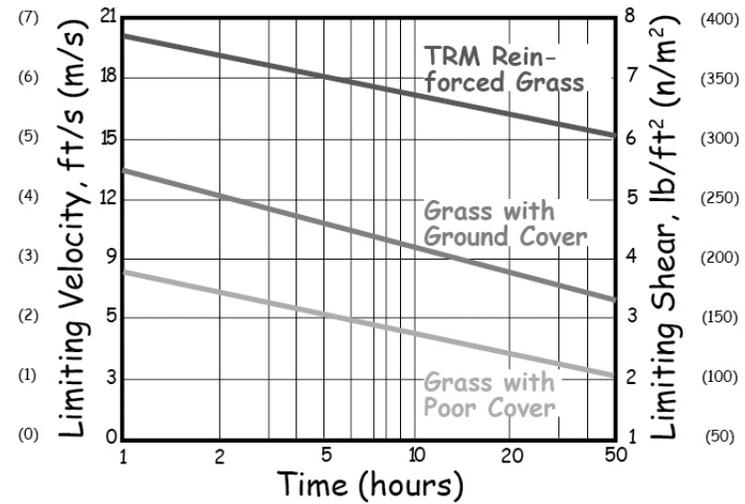
**Figure 6.17a** Hydraulic roughness of grass



**Figure 6.17b** Limiting values for bare and TRM protected soils



**Figure 6.17c** Limiting values for plain and TRM reinforced grass



Sample Problem  
6.17b

Determine if an RECP-lined drainage channel will be stable for a long-term peak flow (10-year design storm) of 70 cfs down a 20:1 slope ( $S=0.05$ ) with a 4 foot bottom width and 1:1 side slopes. The duration of flow is 50 hours for long-term and one hour for short-term design. The grass cover is expected to be in retardance group D. Short-term stability can be checked using the two-year design storm, which produces a short-term peak flow of 45 cfs.

**Long-term design** = vegetated channel stability

- Use  $Q_{\text{peak}} = Q_{10\text{-year}} = 70$  cfs
- From Figure 6.17c: Limiting shear = 6 lb/ft<sup>2</sup>
- Assume  $n_{\text{vegetated}} = 0.05$

Solve for the depth of flow using iterations of Manning's equation. An Excel spreadsheet located on the internet at <http://www.dlr.enr.state.nc.us/pages/sedimenttecassist.html> or commercially available channel software is recommended.

For trapezoidal channels:

$$(bd + zd^2) \left[ \frac{(bd + zd^2)}{b + 2d(z^2 + 1)^{1/2}} \right]^{2/3} = \frac{Qn}{1.49S^{1/2}}$$

From trial-and-error,  $d = 1.7$ ft

Determine area of flow A, from  $A = (bd + zd^2)$   
 $= 9.8$ ft<sup>2</sup>

Since slope < 1:10, calculate VR using:

$$V_{\text{estimate}} = 7.1\text{ft/s};$$

$$VR = (7.1\text{ft/s})(1.11) = 7.88\text{ft/s}$$

From Figure 6.17a: Use  $n = 0.032$ . Recalculate  $d = 1.34$ ft

$$A = 7.14\text{ft}^2$$

Check shear stress  $\tau_c = YDS$

$$= (62.4)(1.34)(0.05)$$

$$= 4.18 \text{ lb/ft}^2$$

$4.18 < 6 \text{ lb/ft}^2$ , therefore acceptable

Sample Problem  
6.17b con't.

**Short-term design** = bare soil channel stability

- Use  $Q_{\text{peak}} = Q_{2\text{-year}} = 45$  cfs
- From Figure 6.17b: Limiting shear = 4.5 lb/ft<sup>2</sup>
- For mat on bare soil,  $n = 0.03$

Determine depth of flow via trial-and-error using Manning's Equation:

For trapezoidal channels:  $(bd + zd^2)$

$$(bd + zd^2) \left[ \frac{(bd + zd^2)}{b + 2d(z^2 + 1)^{1/2}} \right]^{2/3} = \frac{Qn}{1.49S^{1/2}}$$

From trial-and-error,  $d = 1.0$ ft

Check shear stress  $\tau = YDS$

$$= (62.4)(1.0)(0.05)$$

$$= 3.12 \text{ lb/ft}^2$$

$3.12 < 4.5 \text{ lb/ft}^2$ , therefore acceptable

Construction  
Specifications

**Construction**

Even if properly designed, if not properly installed, RECP's will probably not function as desired. Proper installation is imperative. Even if properly installed, if not properly timed and nourished, vegetation will probably not grow as desired. Proper seed/vegetation selection is also imperative.

Grade the surface of installation areas so that the ground is smooth and loose. When seeding prior to installation, follow the steps for seed bed preparation, soil amendments, and seeding in *Surface Stabilization*, 6.1. All gullies, rills, and any other disturbed areas must be fine graded prior to installation. Spread seed before RECP installation. (**Important:** Remove all large rocks, dirt clods, stumps, roots, grass clumps, trash, and other obstructions from the soil surface to allow for direct contact between the soil surface and the RECP.)

Terminal anchor trenches are required at RECP ends and intermittent trenches must be constructed across channels at 25-foot intervals. Terminal anchor trenches should be a minimum of 12 inches in depth and 6 inches in width, while intermittent trenches need be only 6 inches deep and 6 inches wide.

**Installation for Slopes**— Place the RECP 2-3 feet over the top of the slope and into an excavated end trench measuring approximately 12 inches deep by 6 inches wide. Pin the RECP at 1 foot intervals along the bottom of the trench, backfill, and compact. Unroll the RECP down (or along) the slope maintaining direct contact between the soil and the RECP. Overlap adjacent rolls a minimum of 3 inches. Pin the RECP to the ground using staples or pins in a 3 foot center-to-center pattern. Less frequent stapling/pinning is acceptable on moderate slopes.

**Installation in Channels**— Excavate terminal trenches (12 inches deep and 6 inches wide) across the channel at the upper and lower end of the lined channel sections. At 25-foot intervals along the channel, anchor the RECP across the channel either in 6 inch by 6 inch trenches or by installing two closely spaced rows of anchors. Excavate longitudinal trenches 6 inches deep and wide along channel edges (above water line) in which to bury the outside RECP edges. Place the first RECP at the downstream end of the channel. Place the end of the first RECP in the terminal trench and pin it at 1 foot intervals along the bottom of the trench.

**Note:** The RECP should be placed upside down in the trench with the roll on the downstream side of the bench.

Once pinned and backfilled, the RECP is deployed by wrapping over the top of the trench and unrolling upstream. If the channel is wider than the provided rolls, place ends of adjacent rolls in the terminal trench, overlapping the adjacent rolls a minimum of 3 inches. Pin at 1 foot intervals, backfill, and compact. Unroll the RECP in the upstream direction until reaching the first intermittent trench. Fold the RECP back over itself, positioning the roll on the downstream side of the trench, and allowing the mat to conform to the trench.

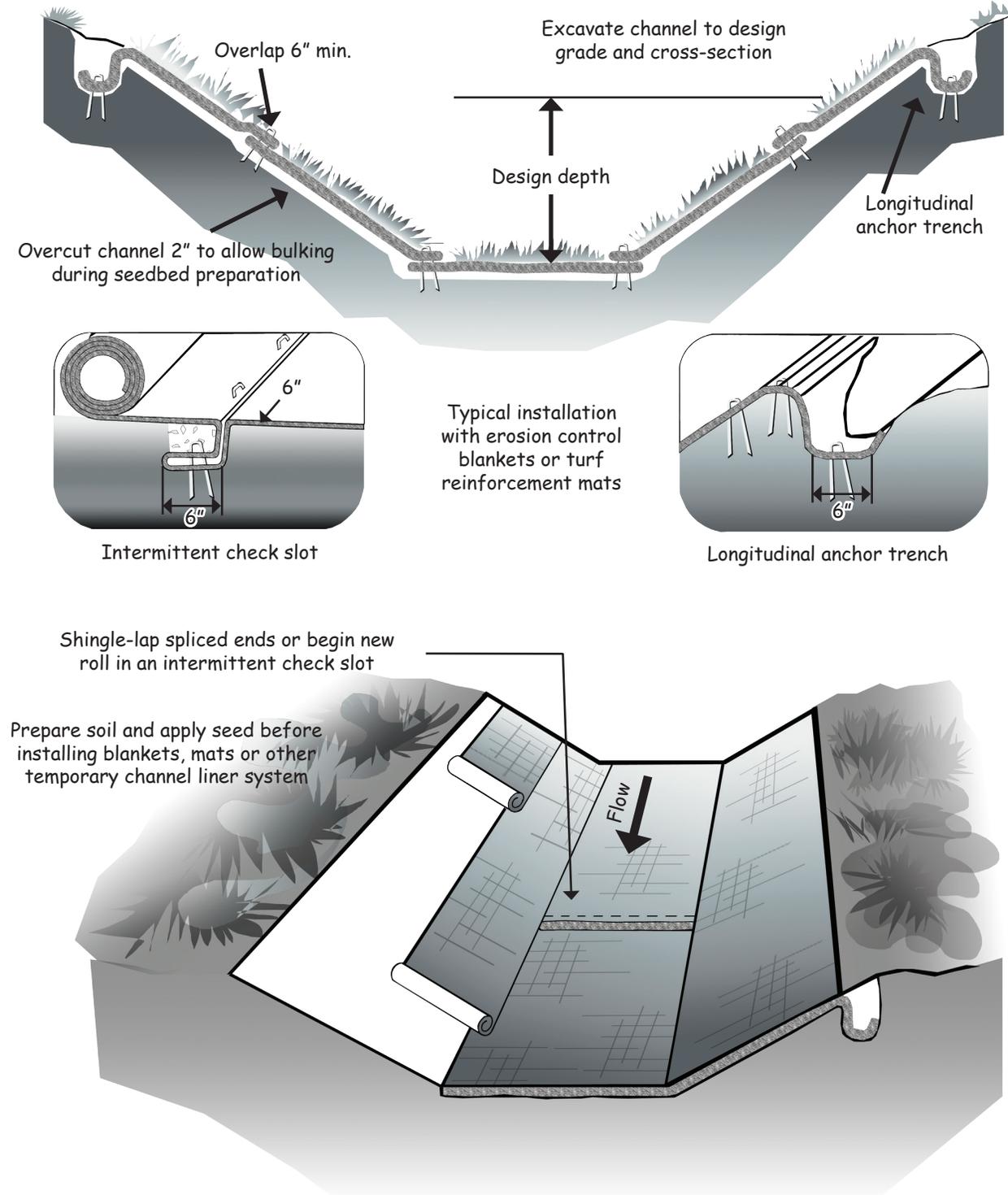
Then pin the RECP (two layers) to the bottom of the trench, backfill, and compact. Continue up the channel (wrapping over the top of the intermittent trench) repeating this step at other intermittent trenches, until reaching the upper terminal trench.

At the upper terminal trench, allow the RECP to conform to the trench, secure with pins or staples, backfill, compact and then bring the mat back over the top of the trench and onto the existing mat (2 to 3 feet overlap in the downstream direction), and pin at 1 foot intervals across the RECP. When starting installation of a new roll, begin in a trench or shingle-lap ends of rolls a minimum of 1 foot with upstream RECP on top to prevent uplifting. Place the outside edges of the RECP(s) in longitudinal trenches, pin, backfill, and compact.

**Anchoring Devices**—11 gauge, at least 6 inches length by 1 inch width staples or 12 inch minimum length wooden stakes are recommended for anchoring the RECP to the ground.

Drive staples or pins so that the top of the staple or pin is flush with the ground surface. Anchor each RECP every 3 feet along its center. Longitudinal overlaps must be sufficient to accommodate a row of anchors and uniform along the entire length of overlap and anchored every 3 feet along the overlap length. Roll ends may be spliced by overlapping 1 foot (in the direction of water flow), with the upstream/upslope mat placed on top of the downstream/downslope RECP. This overlap should be anchored at 1 foot spacing across the RECP. When installing multiple width mats heat seamed in the factory, all factory seams and field overlaps should be similarly anchored.

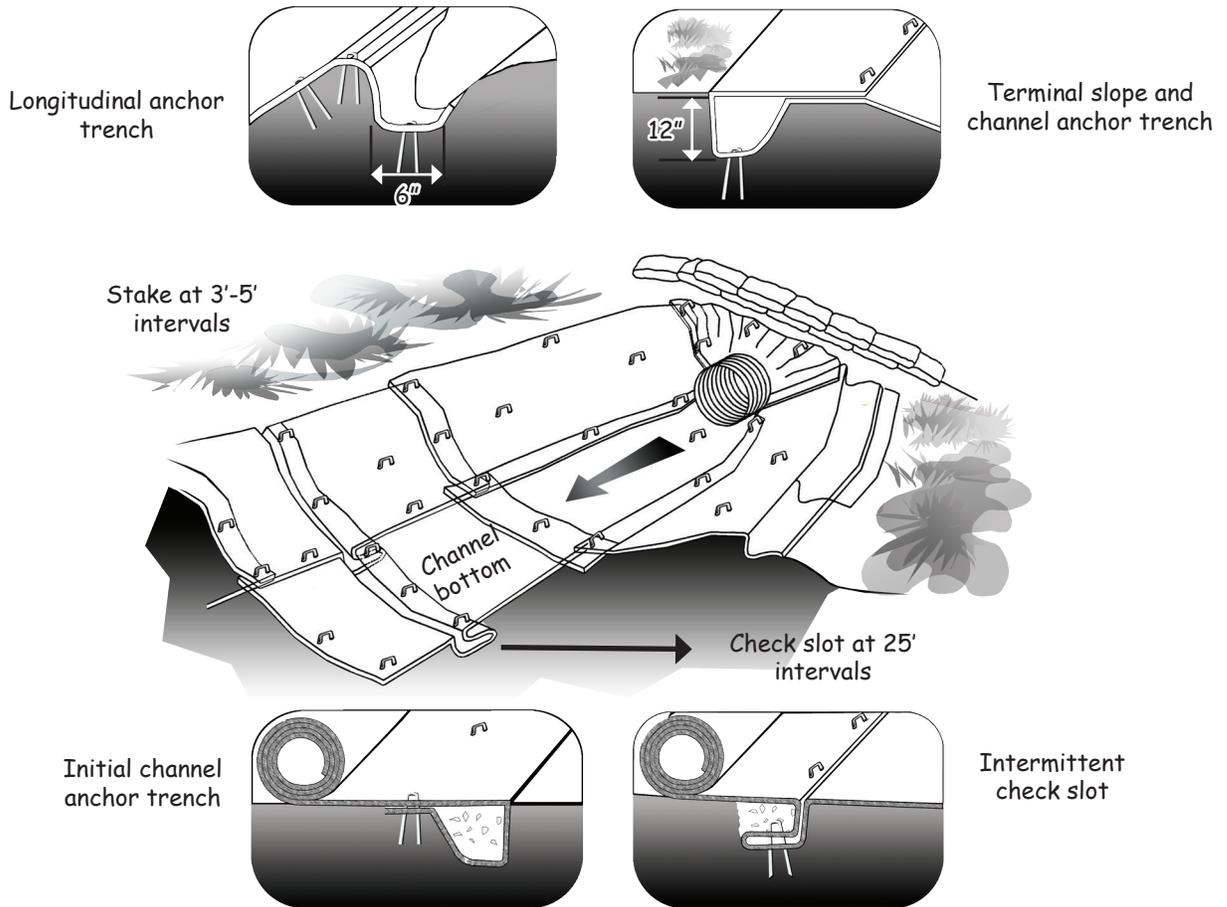
Figure 6.17d Temporary Channel Liners; Washington State Department of Ecology



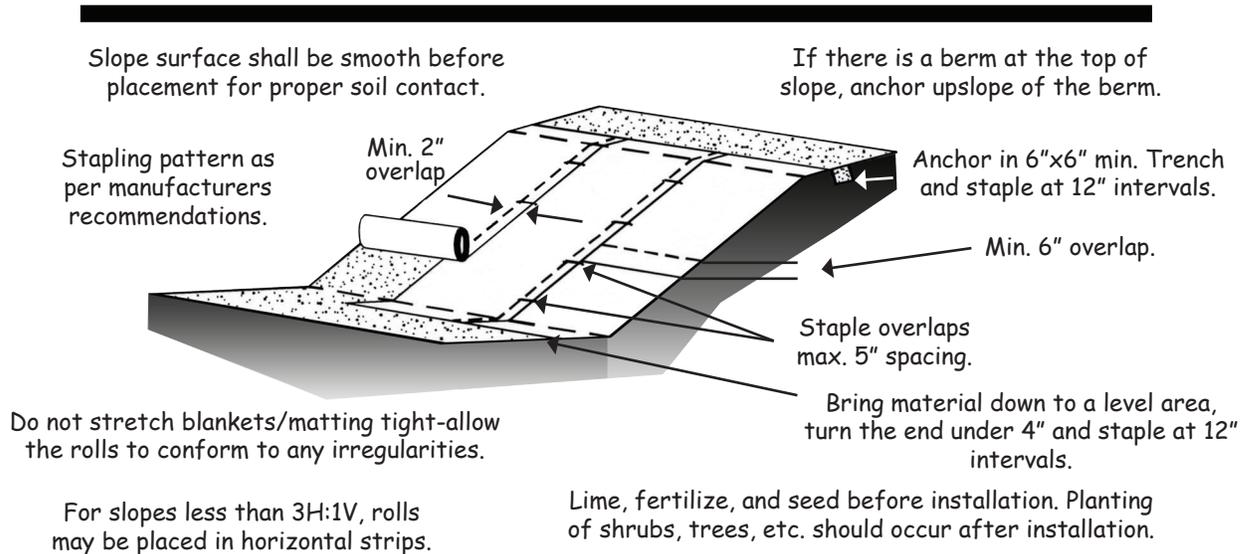
NOTES:

1. Design velocities exceeding 2 ft/sec require temporary blankets, mats or similar liners to protect seed and soil until vegetation becomes established.
2. Grass-lined channels with design velocities exceeding 6 ft/sec should include turf reinforcement mats

Figure 6.17e Channel Installation and Slope Installation; Washington State Ecology Department



- NOTE:
1. Check slots to be constructed per manufacturers specifications.
  2. Staking or stapling layout per manufacturers specifications.



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**Maintenance**

1. Inspect Rolled Erosion Control Products at least weekly and after each significant (1/2 inch or greater) rain fall event repair immediately.
2. Good contact with the ground must be maintained, and erosion must not occur beneath the RECP.
3. Any areas of the RECP that are damaged or not in close contact with the ground shall be repaired and stapled.
4. If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.
5. Monitor and repair the RECP as necessary until ground cover is established.

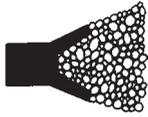
**References**

Sprague, C. Joel. TRI/ Environmental, Inc. "Green Engineering, Design principles and applications using rolled erosion control products"

Storm Water Management Manual for Western Washington, Washington State Department of Ecology, Water Quality Program  
<http://www.ecy.wa.gov/programs/wq/stormwater/index.html>

Erosion Control Technology Council, <http://www.ectc.org>

6.41



## OUTLET STABILIZATION STRUCTURE

**Definition** A structure designed to control erosion at the outlet of a channel or conduit.

**Purpose** To prevent erosion at the outlet of a channel or conduit by reducing the velocity of flow and dissipating energy.

**Conditions Where Practice Applies** This practice applies where the discharge velocity of a pipe, box culvert, diversion, open channel, or other water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.

**Planning Considerations** The outlets of channels, conduits, and other structures are points of high erosion potential because they frequently carry flows at velocities that exceed the allowable limit for the area downstream. To prevent scour and undermining, an outlet stabilization structure is needed to absorb the impact of the flow and reduce the velocity to non-erosive levels. A riprap-lined apron is the most commonly used practice for this purpose because of its relatively low cost and ease of installation. The riprap apron should be extended downstream until stable conditions are reached even though this may exceed the length calculated for design velocity control.

Riprap-stilling basins or plunge pools reduce flow velocity rapidly. They should be considered in lieu of aprons where pipe outlets are cantilevered or where high flows would require excessive apron length (Figure 6.41a). Consider other energy dissipaters such as concrete impact basins or paved outlet structures where site conditions warrant.

Alternative methods of energy dissipation can be found in Hydraulic Design of Energy Dissipaters for Culverts and Channels, Hydraulic Engineering Circular No. 14, U.S. Department of Transportation, Federal Highway Administration.

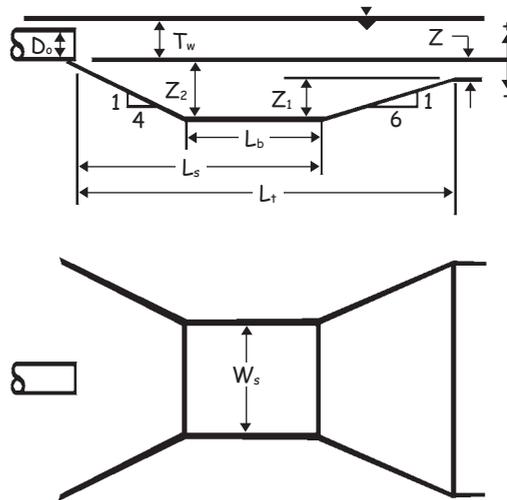
The installation of a culvert in a stream is subject to the conditions of a U.S. Army Corps of Engineers 404 Permit and a N.C. Division of Water Quality 401 Certification. These permit conditions may not allow the use of a riprap apron, and may require that the bottom of the culvert be buried below the natural stream bed elevation. A pre-formed scour pool or plunge pool should be considered in these situations. Plunge pool designs in streams should not use a cantilevered outlet because it would pose a barrier to migration of aquatic life through the culvert. Reducing the outlet velocity may require a combination of techniques, including a culvert with a flat bottom, a downstream cross vane to create tail-water at the pipe outlet, and/or a preformed scour pool.

**Design Criteria** **Capacity**—10-year, peak runoff or the design discharge of the water conveyance structure, whichever is greater.

**Tail-water depth**—Determine the tail-water depth immediately below the culvert or pipe outlet based on the design discharge. The ratio of tail-water depth to pipe diameter must be determined in order to select the appropriate riprap apron or plunge pool design method.

**Plunge Pools**—Two plunge pool methods are presented in Appendix 8.06, the USDA Plunge Pool Design at Submerged Pipe Spillway Outlets, and the USDA Riprap Lined Plunge Pool for Cantilevered Outlet. Software from the Federal Highway Administration can be downloaded at <http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm>. Excel spreadsheets for the USDA methods are available through the Land Quality web-site at <http://www.dlr.enr.state.nc.us/pages/links.htm>.

**Figure 6.41a** Typical plunge pool design showing variable dimensions.



**Riprap Aprons size**—The apron length and width can be determined according to the tail-water condition. If the water conveyance structure discharges directly into a well-defined channel, extend the apron across the channel bottom and up the channel banks to an elevation of 0.5 foot above the maximum tail-water depth or to the top of the bank, whichever is less (Figure 6.41c).

Determine the maximum allowable velocity for the receiving stream, and design the riprap apron to reduce flow to this velocity before flow leaves the apron. Calculate the apron length for velocity control or use the length required to meet stable conditions downstream, whichever is greater.

**Grade**—Ensure that the apron has zero grade. There should be no overfall at the end of the apron; that is, the elevation of the top of the riprap at the downstream end should be the same as the elevation of the bottom of the receiving channel or the adjacent ground if there is no channel.

**Alignment**—The apron should be straight throughout its entire length, but if a curve is necessary to align the apron with the receiving stream, locate the curve in the upstream section of riprap.

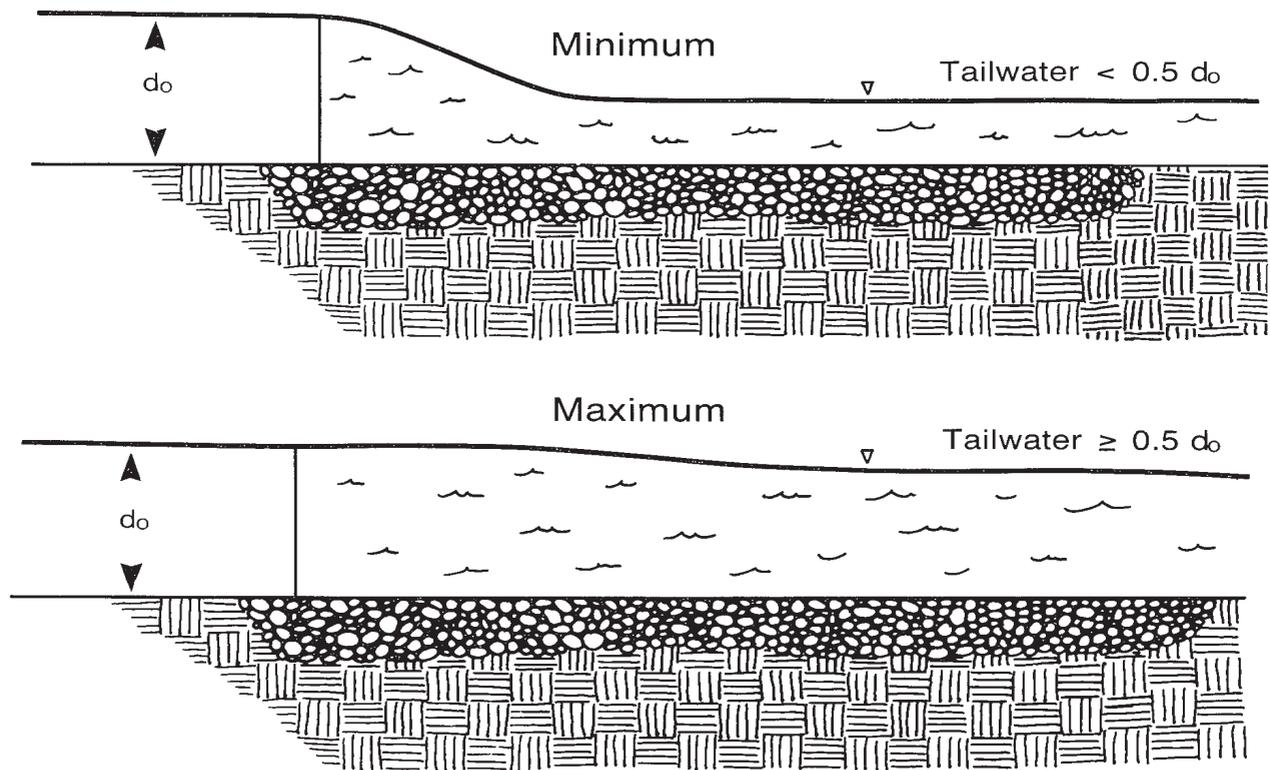


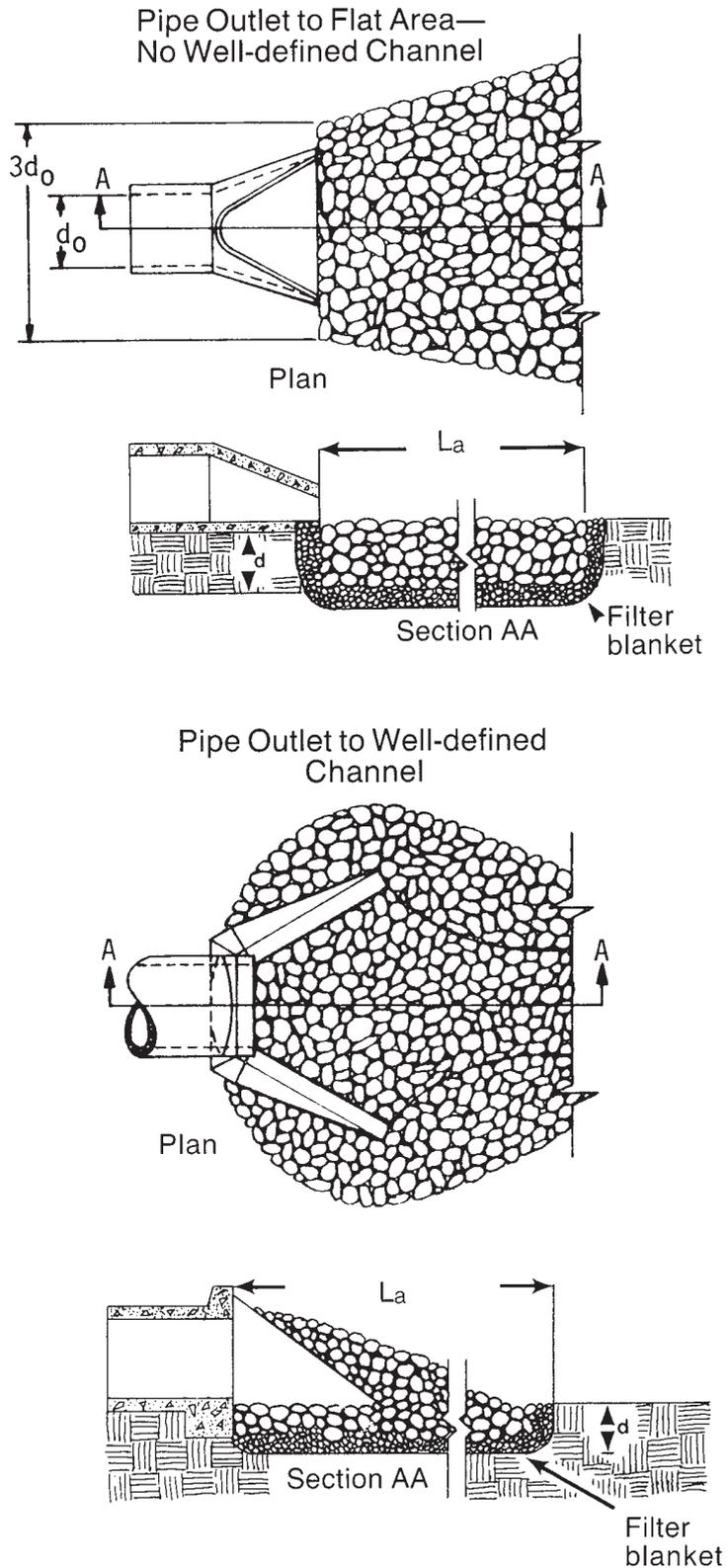
Figure 6.41b Stage showing maximum and minimum tailwater condition.

**Materials**—Ensure that riprap consists of a well-graded mixture of stone. Larger stone should predominate, with sufficient smaller sizes to fill the voids between the stones. The diameter of the largest stone size should be no greater than 1.5 times the  $d_{50}$  size.

**Thickness**—Make the minimum thickness of riprap 1.5 times the maximum stone diameter.

**Stone quality**—Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly weather-resistant. The specific gravity of the individual stones should be at least 2.5.

**Filter**—Install a filter to prevent soil movement through the openings in the riprap. The filter should consist of a graded gravel layer or a synthetic filter cloth. Design filter blankets by the method described in Practice 6.15, *Riprap*.



## Notes

1.  $L_a$  is the length of the riprap apron.
2.  $d = 1.5$  times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Figure 6.41c Riprap outlet protection (modified from Va SWCC).

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**Construction Specifications**

1. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.
2. The riprap and gravel filter must conform to the specified grading limits shown on the plans.
3. Filter cloth, when used, must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap so the top layer is above the downstream layer a minimum of 1 foot. If the damage is extensive, replace the entire filter cloth.
4. Riprap may be placed by equipment, but take care to avoid damaging the filter.
5. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.
6. Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.
7. Construct the apron on zero grade with no overfill at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.
8. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
9. Immediately after construction, stabilize all disturbed areas with vegetation (Practices 6.10, *Temporary Seeding*, and 6.11, *Permanent Seeding*).

**Maintenance**

Inspect riprap outlet structures weekly and after significant (1/2 inch or greater) rainfall events to see if any erosion around or below the riprap has taken place, or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

**References**

*Surface Stabilization*  
6.10, Temporary Seeding  
6.11, Permanent Seeding  
6.15, Riprap

*Appendix*  
8.06, Design of Riprap Outlet Protection

Rice, C.E., Kadavy, K.C. "Riprap Design for Pipe Spillways at  $-1 \leq TW/D \leq 0.7$ " Presented at the December 13, 1994 International Winter Meeting, American Society of Agricultural Engineers, Paper Number 942541.

Rice, C.E. and K.C. Kadavy. 1994, Plunge Pool Design at Submerged Pipe Spillway Outlets. Transactions of the ASAE 37(4):1167-1173.

FHWA. 1983. Hydraulic Design of Energy Dissipaters for Culverts and Channels. Hydraulic Engineering Circular Number 14.

6.62



## SEDIMENT FENCE

**Definition** A temporary sediment control measure consisting of fabric buried at the bottom, stretched, and supported by posts.

**Purpose** To retain sediment from small disturbed areas by reducing the velocity of sheet flows to allow sediment deposition.

**Conditions Where Practice Applies** Below small-disturbed areas that are less than  $\frac{1}{4}$  acre per 100 feet of fence. Where runoff can be stored behind the sediment fence without damaging the fence or the submerged area behind the fence.

**Do not install sediment fences across streams, ditches, or waterways, or other areas of concentrated flow.**

Sediment fence should be placed along topographic elevation contours, where it can intercept stormwater runoff that is in dispersed sheet flow. Sediment fence should not be used alone below graded slopes greater than 10 feet in height.

**Planning Considerations** A sediment fence is a system to retain sediment on the construction site. The fence retains sediment primarily by retarding flow and promoting deposition. In operation, generally the fence becomes clogged with fine particles, which reduce the flow rate. This causes a pond to develop behind the fence. The designer should anticipate ponding and provide sufficient storage areas and overflow outlets to prevent flows from overtopping the fence. Since sediment fences are not designed to withstand high water levels, locate them so that only shallow pools can form. Tie the ends of a sediment fence into higher ground to prevent flow around the end of the fence before the pool reaches design level. Curling each end of the fence uphill in a “J” pattern may be appropriate to prevent end flow. Provide stabilized outlets to protect the fence system and release storm flows that exceed the design storm.

Deposition occurs as the storage pool forms behind the fence. The designer can direct flows to specified deposition areas through appropriate positioning of the fence or by providing an excavated area behind the fence. Plan deposition areas at accessible points to promote routine cleanout and maintenance. Show deposition areas in the erosion and sedimentation control plan. A sediment fence acts as a diversion if placed slightly off the contour. A maximum slope of 2 percent is recommended. This technique may be used to control shallow, uniform flows from small disturbed areas and to deliver sediment-laden water to deposition areas. The anchoring of the toe of the fence should be reinforced with 12 inches of NC DOT #5 or #57 washed stone when flow will run parallel to the toe of the fence.

Sediment fences serve no function along ridges or near drainage divides where there is little movement of water. Confining or diverting runoff unnecessarily with a sediment fence may create erosion and sedimentation problems that would not otherwise occur.

# 6

Straw barriers have only a 0-20% trapping efficiency and are inadequate. Straw bales may not be used in place of sediment fence. Prefabricated sediment fence with the fabric already stapled to thin wooden posts does not meet minimum standards specified later in this section.

Anchoring of sediment fence is critical. The toe of the fabric must be anchored in a trench backfilled with compacted earth. Mechanical compaction must be provided in order for the fence to effectively pond runoff.

## Design Criteria

Ensure that drainage area is no greater than ¼ acre per 100 feet of fence. This is the maximum drainage area when the slope is less than 2 percent. Where all runoff is to be stored behind the fence, ensure that the maximum slope length behind a sediment fence does not exceed the specifications shown in Table 6.62a. The shorter slope length allowed for steeper slopes will greatly reduce the maximum drainage area. For example, a 10–20 % slope may have a maximum slope length of 25 feet. For a 100-foot length of sediment fence, the drainage area would be 25ft X 100ft = 2500sq.ft., or 0.06 acres.

**Table 6.62a Maximum Slope Length and Slope for which Sediment Fence is Applicable**

Slope	Slope Length (ft)	Maximum Area (ft <sup>2</sup> )
<2%	100	10,000
2 to 5%	75	7,500
5 to 10%	50	5,000
10 to 20%	25	2,500
>20%	15	1,500

Make the fence stable for the 10-year peak storm runoff.

Ensure that the depth of impounded water does not exceed 1.5 feet at any point along the fence.

If non-erosive outlets are provided, slope length may be increased beyond that shown in Table 6.62a, but runoff from the area should be determined and bypass capacity and erosion potential along the fence must be checked. The velocity of the flow at the outlet or along the fence should be in keeping with Table 8.05d, Appendix 8.05.

Provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment fence, such as natural depressions or swales. Ensure that the maximum height of the fence at a protected, reinforced outlet does not exceed 2 feet and that support post spacing does not exceed 4 feet.

The design life of a synthetic sediment fence should be 6 months.

## Construction Specifications

### MATERIALS

1. Use a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or supplier as conforming to the requirements in ASTM D 6461, which is shown in part in Table 6.62b.

Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120° F.

2. Ensure that posts for sediment fences are 1.25 lb/linear ft minimum steel with a minimum length of 5 feet. Make sure that steel posts have projections to facilitate fastening the fabric.
3. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

**Table 6.62b Specifications For Sediment Fence Fabric**

<b>Temporary Silt Fence Material Property Requirements</b>					
	Test Material	Units	Supported <sup>1</sup> Silt Fence	Un-Supported <sup>1</sup> Silt Fence	Type of Value
Grab Strength	ASTM D 4632	N (lbs)			
Machine Direction			400 (90)	550 (90)	MARV
X-Machine Direction			400 (90)	450 (90)	MARV
Permittivity <sup>2</sup>	ASTM D 4491	sec-1	0.05	0.05	MARV
Apparent Opening Size <sup>2</sup>	ASTM D 4751	mm (US Sieve #)	0.60 (30)	0.60 (30)	Max. ARV <sup>3</sup>
Ultraviolet Stability	ASTM D 4355	% Retained Strength	70% after 500h of exposure	70% after 500h of exposure	Typical
<sup>1</sup> Silt Fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm (6 inches), or prefabricated polymer mesh of equivalent strength. <sup>2</sup> These default values are based on empirical evidence with a variety of sediment. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests in accordance with Test Method D 5141 should be performed by the agency to confirm suitability of these requirements. <sup>3</sup> As measured in accordance with Test Method D 4632.					

**CONSTRUCTION**

1. Construct the sediment barrier of standard strength or extra strength synthetic filter fabrics.
2. Ensure that the height of the sediment fence does not exceed 24 inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
3. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with 4 feet minimum overlap to the next post.
4. Support standard strength filter fabric by wire mesh fastened securely to the **upslope** side of the posts. Extend the wire mesh support to the bottom of the trench. Fasten the wire reinforcement, then fabric on the upslope side of the fence post. Wire or plastic zip ties should have minimum 50 pound tensile strength.
5. When a wire mesh support fence is used, space posts a maximum of 8 feet apart. Support posts should be driven securely into the ground a minimum of 24 inches.
6. Extra strength filter fabric with 6 feet post spacing does not require wire mesh support fence. Securely fasten the filter fabric directly to posts. Wire or plastic zip ties should have minimum 50 pound tensile strength.

7. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier (Figure 6.62a).
8. Place 12 inches of the fabric along the bottom and side of the trench.
9. Backfill the trench with soil placed over the filter fabric and compact. Thorough compaction of the backfill is critical to silt fence performance.
10. Do not attach filter fabric to existing trees.

#### **SEDIMENT FENCE INSTALLATION USING THE SLICING METHOD**

Instead of excavating a trench, placing fabric and then backfilling trench, sediment fence may be installed using specially designed equipment that inserts the fabric into a cut sliced in the ground with a disc (Figure 6.62b).

### Installation Specifications

1. The base of both end posts should be at least one foot higher than the middle of the fence. Check with a level if necessary.
2. Install posts 4 feet apart in critical areas and 6 feet apart on standard applications.
3. Install posts 2 feet deep on the downstream side of the silt fence, and as close as possible to the fabric, enabling posts to support the fabric from upstream water pressure.
4. Install posts with the nipples facing away from the silt fabric.
5. Attach the fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1 inch vertically apart. Also, each tie should be positioned to hang on a post nipple when tightened to prevent sagging.
6. Wrap approximately 6 inches of fabric around the end posts and secure with 3 ties.
7. No more than 24 inches of a 36 inch fabric is allowed above ground level.
8. The installation should be checked and corrected for any deviations before compaction.
9. Compaction is vitally important for effective results. Compact the soil immediately next to the silt fence fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first, and then each side twice for a total of 4 trips.

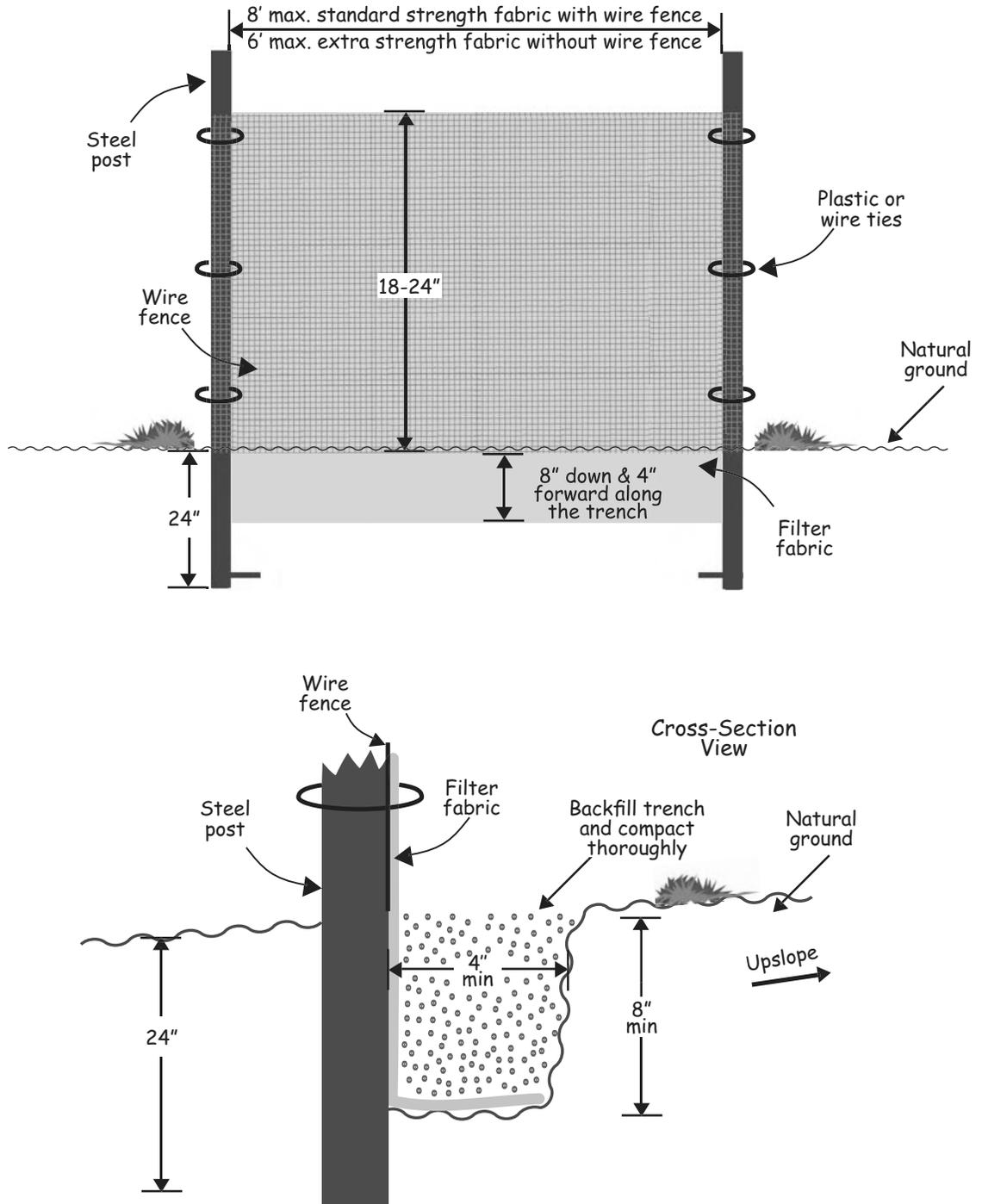
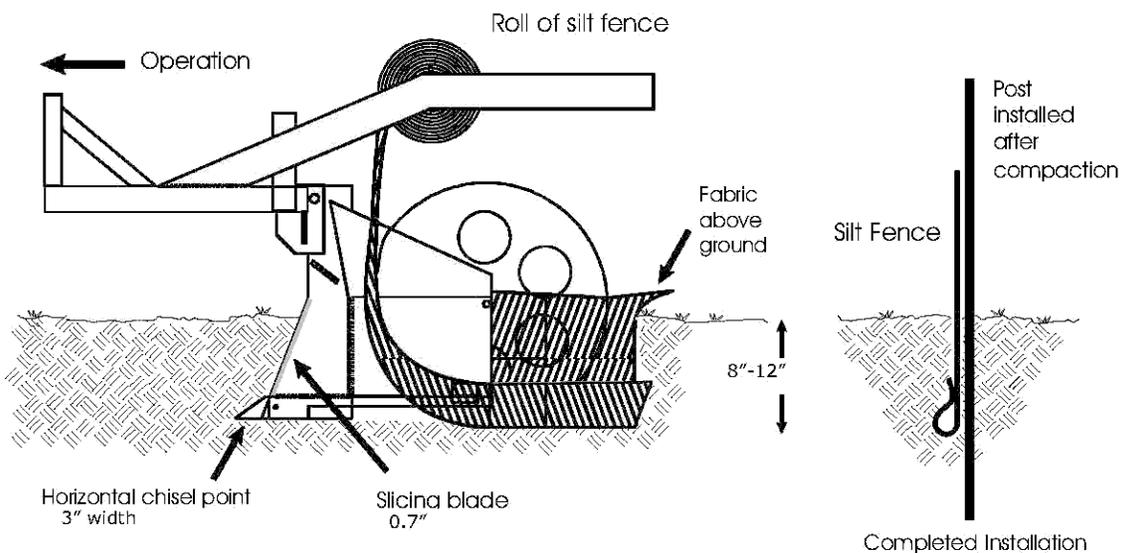
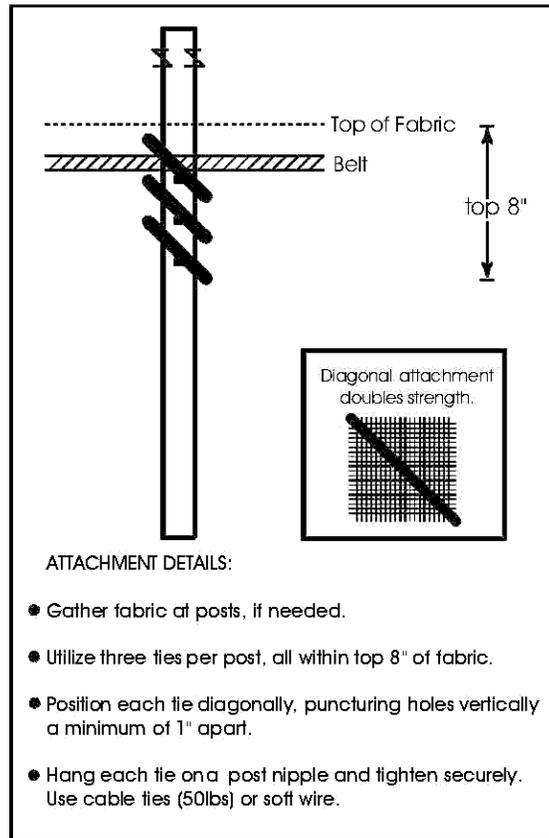
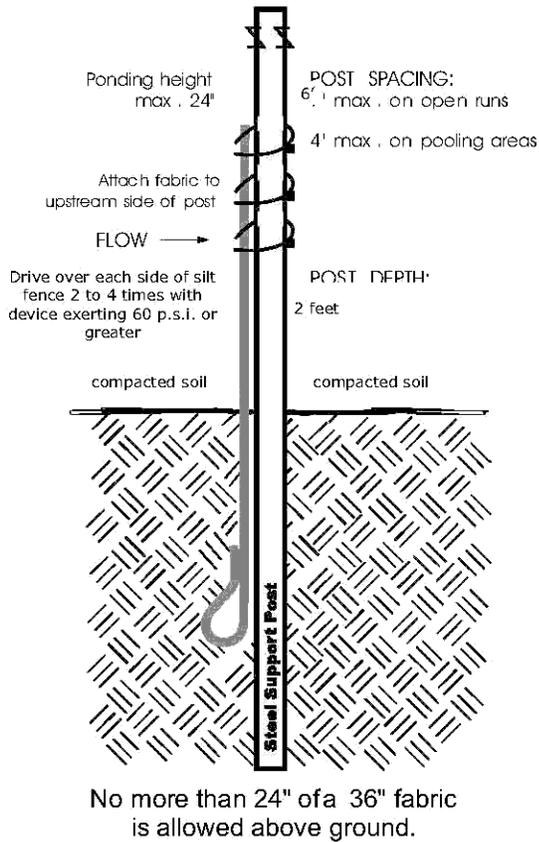


Figure 6.62a Installation detail of a sediment fence.

# The Slicing Method



Vibratory plow is not acceptable because of horizontal compaction

Figure 6.62b Schematics for using the slicing method to install a sediment fence. Adapted from *Silt Fence that Works*

**Maintenance** Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

Should the fabric of a sediment fence collapse, tear, decompose or become ineffective, replace it promptly.

Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

**References** ASTM D 6461 – 99. “Standard Specification for Silt Fence Materials” ASTM International. For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard’s Document Summary page on the ASTM website.

ASTM D 6462 – 03. “Standard Practice for Silt Fence Installation” ASTM International. For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard’s Document Summary page on the ASTM website.

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*Runoff Control Measures*  
6.20, Temporary Diversions

*Outlet Protection*  
6.41, Outlet Stabilization Structure

*Appendix*  
8.03, Estimating Runoff

## 6.65



## POROUS BAFFLES

**Definition** Porous barriers installed inside a temporary sediment trap, skimmer basin, or sediment basin to reduce the velocity and turbulence of the water flowing through the measure, and to facilitate the settling of sediment from the water before discharge.

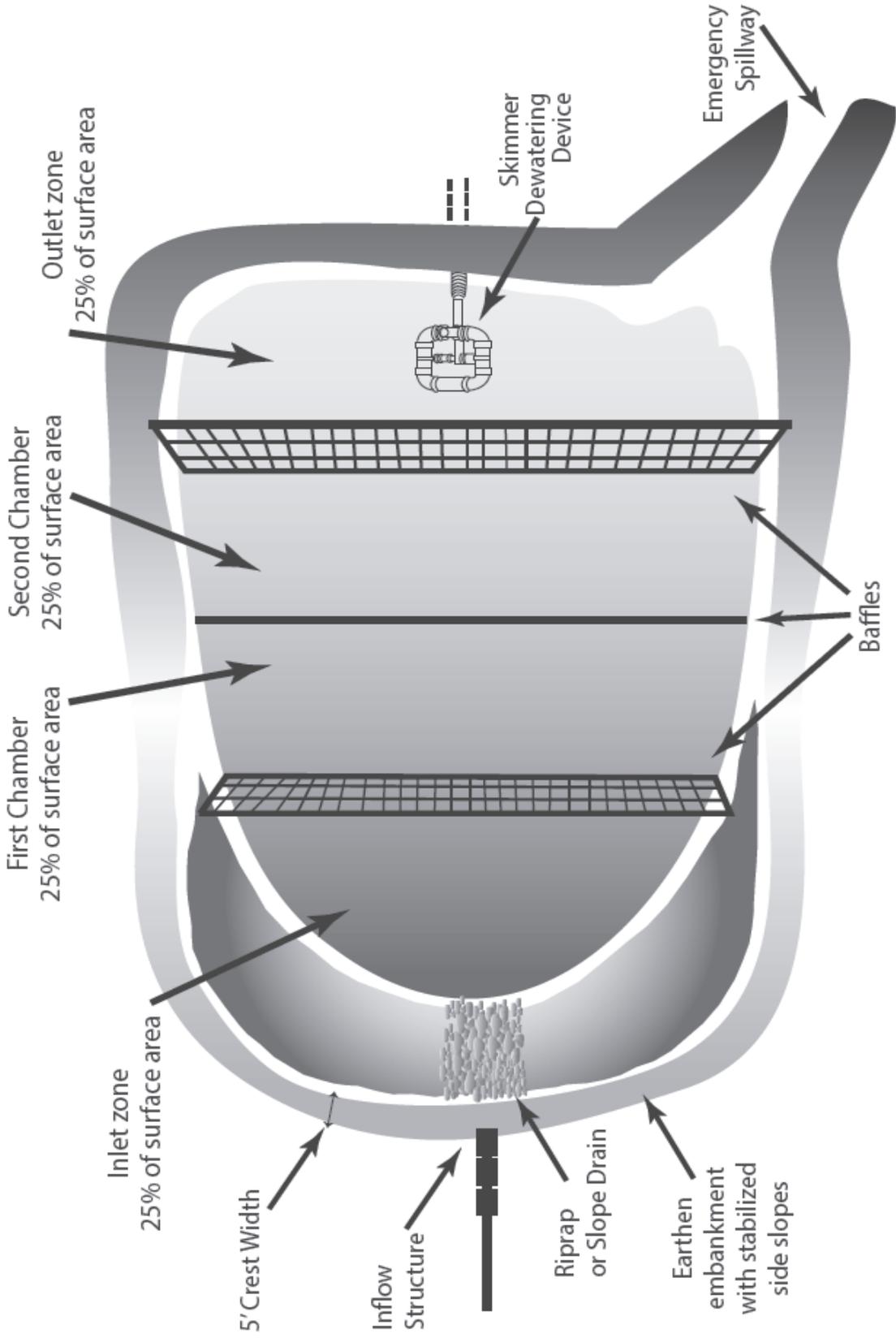
**Purpose** Sediment traps and basins are designed to temporarily pool runoff water to allow sediment to settle before the water is discharged. Unfortunately, they are usually not very efficient due to high turbulence and “short-circuiting” flows which take runoff quickly to the outlet with little interaction with most of the basin. Porous baffles improve the rate of sediment retention by distributing the flow and reducing turbulence. This process can improve sediment retention.

**Conditions Where Practice Applies** This practice should be used in any temporary sediment trap, skimmer basin, or temporary sediment basin.

**Planning Considerations** Porous baffles effectively spread the flow across the entire width of a sediment basin or trap. Water flows through the baffle material, but is slowed sufficiently to back up the flow, causing it to spread across the entire width of the baffle (Figure 6.65a).

Spreading the flow in this manner utilizes the full cross section of the basin, which in turn reduces flow rates or velocity as much as possible. In addition, the turbulence is also greatly reduced. This combination increases sediment deposition and retention and also decreases the particle size of sediment captured.

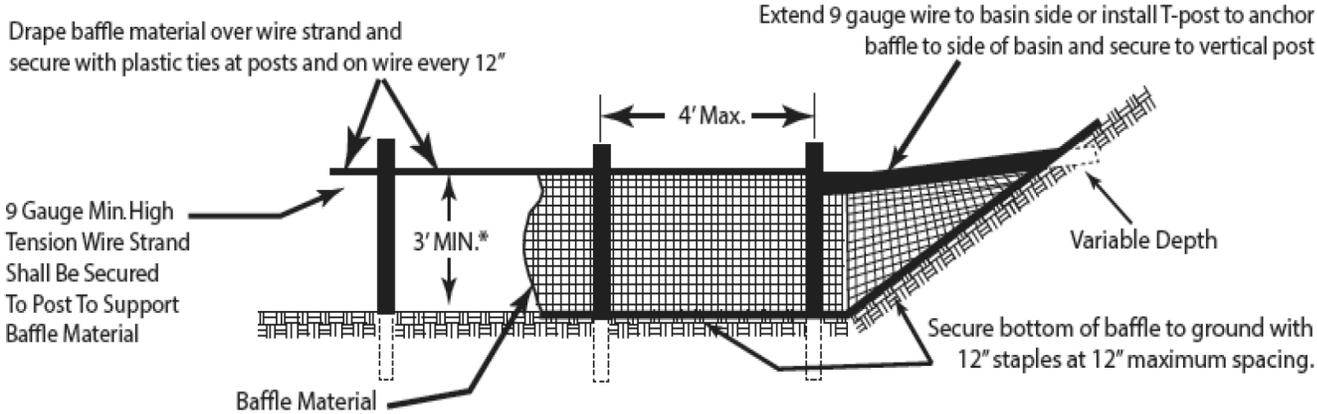
The installation should be similar to a sediment fence (Figure 6.65b). The fabric should be 700 g/m<sup>2</sup> coir erosion blanket (Figure 6.65c) or equal. A support wire across the top will help prevent excessive sagging if the material is attached to it with appropriate ties.



**Figure 6.65a** Porous baffles in a sediment basin. The flow is distributed evenly across the basin to reduce flow rates and turbulence, resulting in greater sediment retention.

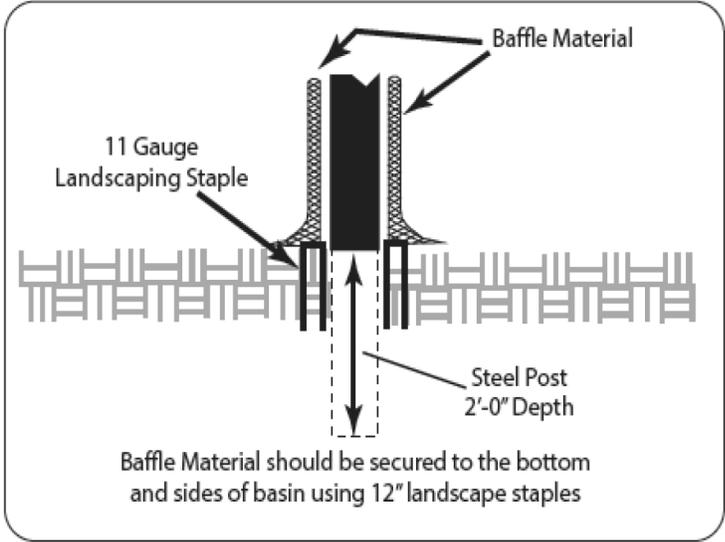
Baffles need to be installed correctly in order to fully provide their benefits. Refer to Figure 6.65b and the following key points:

- The baffle material needs to be secured at the bottom and sides using staples.
- Most of the sediment will accumulate in the first bay, so this should be readily accessible for maintenance.



\* If the temporary sediment basin will be converted to a permanent stormwater basin of greater depth, the baffle height should be based on the pool depth during use as a temporary sediment basin.

**Note:** Install three (3) coir fiber baffles in basins at drainage outlets with a spacing of 1/4 the basin length. Two (2) coir fiber baffles can be installed in the basins less than 20 ft. in length with a spacing of 1/3 the basin length.



**Figure 6.65b Coir Fiber Baffle Detail**  
Cross section of a porous baffle in a sediment basin.



**Figure 6.65c** Example of porous baffles made of 700 g/m<sup>2</sup> coir erosion blanket as viewed from the outlet.



**Figure 6.65d** Close-up of a porous baffle.

**Design Criteria** The temporary sediment trap or temporary sediment basin should be sized using the appropriate design criteria.

The percent of surface area for each section of the baffle is as follows:

- inlet zone: 25%
- first cell: 25%
- second cell: 25%
- outlet zone: 25%

Baffle spacing in future permanent stormwater basins is beyond forebay.

Be sure to construct baffles up the sides of the trap or basin banks so water does not flow around the structures. Most of the sediment will be captured in the inlet zone. Smaller particle size sediments are captured in the latter cells. Be sure to maintain access to the trap for maintenance and sediment removal.

The design life of the fabric is 6-12 months, but may need to be replaced more often if damaged or clogged.

## Construction Specifications

### MATERIALS

1. Use matting made of 100% coconut fiber (coir) twine woven into high strength matrix with the properties shown in Table 6.65a.
2. Staples should be made of 0.125 inch diameter new steel wire formed into a 'U' shape not less than 12 inches in length with a throat of 1 inch in width. The staples anchor the porous baffles into the sides and bottom of the basin.
3. Ensure that steel posts for porous baffles are of a sufficient height to support baffles at desired height. Posts should be approximately 1-3/8" wide measured parallel to the fence, and have a minimum weight of 1.25 lb/linear ft. The posts must be equipped with an anchor plate having a minimum area of 14.0 square inches and be of the self-fastener angle steel type to have a means of retaining wire and coir fiber mat in the desired position without displacement.
4. Use 9-gauge high tension wire for support wire.

**Table 6.65a Specifications for Porous Baffle Material**

Coir Fiber Baffle Material Property Requirements	
Thickness	0.30 in. minimum
Tensile Strength (Wet)	900 x 680 lb/ft minimum
Elongation (Wet)	69% x 34% maximum
Flow Velocity	10-12 ft/sec
Weight	20 oz/SY (680 g/m <sup>2</sup> ) minimum
Minimum Width	6.5 feet
Open Area	50% maximum

### CONSTRUCTION

1. Grade the basin so that the bottom is level front to back and side to side.
2. Install the coir fiber baffles immediately upon excavation of the basins.
3. Install posts across the width of the sediment trap (Practice 6.62, *Sediment Fence*).
4. Steel posts should be driven to a depth of 24 inches and spaced a maximum of 4 feet apart. The top of the fabric should be a minimum of 6 inches higher than the invert of the spillway. Tops of baffles should be a minimum of 2 inches lower than the top of the earthen embankment.
5. Install at least three rows of baffles between the inlet and outlet discharge point. Basins less than 20 feet in length may use 2 baffles.
6. Attach a 9 gauge high tension wire strand to the steel posts at a height of 6 inches above the spillway elevation with plastic ties or wire fasteners to prevent sagging. If the temporary sediment basin will be converted to a permanent stormwater basin of a greater depth, the baffle height should be based on the pool depth during use as a temporary sediment basin.

**7.** Extend 9 gauge minimum high tension wire strand to side of basin or install steel T-posts to anchor baffle to side of basin and secure to vertical end posts as shown in Figure 6.65b.

**8.** Drape the coir fiber mat over the wire strand mounted at a height of 6 inches above the spillway elevation. Secure the coir fiber mat to the wire strand with plastic ties or wire fasteners. Anchor the matting to the sides and floor of the basin with 12 inch wire staples, approximately 1 ft apart, along the bottom and side slopes of the basin.

**9.** Do not splice the fabric, but use a continuous piece across the basin

**10.** Adjustments may be required in the stapling requirements to fit individual site conditions.

## Maintenance

Inspect baffles at least once a week and after each rainfall. Make any required repairs immediately.

Be sure to maintain access to the baffles. Should the fabric of a baffle collapse, tear, decompose, or become ineffective, replace it promptly.

Remove sediment deposits when it reaches half full, to provide adequate storage volume for the next rain and to reduce pressure on the baffles. Take care to avoid damaging the baffles during cleanout, and replace if damaged during cleanout operations. Sediment depth should never exceed half the designed storage depth.

After the contributing drainage area has been properly stabilized, remove all baffle materials and unstable sediment deposits, bring the area to grade, and stabilize it.

## References

### *Sediment Traps and Barriers*

6.60, Temporary Sediment Trap

6.61, Sediment Basins

6.62, Sediment Fence

6.64, Skimmer Sediment Basin

McLaughlin, Richard, "Soil Facts: Baffles to Improve Sediment Basins."  
N.C. State University Cooperative Extension Service Fact Sheet AGW-439-59, 2005.

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