

Soils

GUIDELINES
for
DEVELOPING SOIL EROSION AND SEDIMENT CONTROL PLANS

State of North Carolina
Department of Natural and Economic Resources

North Carolina Sedimentation Control Commission
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PURPOSE

The purpose of these guidelines is to provide general instructions for preparing plans for the control of accelerated erosion and sedimentation resulting from land-disturbing activities. A soil erosion and sediment control plan is a plan for carrying out land-disturbing activities in a manner that will hold accelerated erosion and sediment damages to a minimum.

An erosion and sediment control plan must define how accelerated erosion and sediment will be controlled during the construction activity, and how the disturbed area will be stabilized and maintained after construction is completed.

Plans will be reviewed for compliance with applicable state laws, rules and regulations. Standards and specifications used in developing the plans will be compared with standards and specifications of accepted erosion control and engineering handbooks. Design procedures and calculations shall conform to generally accepted engineering practices.

The plan should be prepared by a person knowledgeable in erosion and sedimentation control principles, methods, and techniques.

During the plan preparation process, consideration should be given to all factors of the specific site which relate to the causes of erosion and sedimentation.

Items which generally are relevant to all sites are listed under the PLAN CONTENT section of these guidelines as the minimum items which a plan must contain. Plan content may vary to meet the needs of each site, but should adequately address all factors which will affect accelerated erosion resulting from the planned land-disturbing activity. It is necessary to plan both for measures needed to control erosion during the land-disturbing activity, and for maintenance of the measures after the land-disturbing activity has been completed, so that erosion and sediment pollution does not occur from areas of soil left unprotected or from stream channels left unprotected against the erosive effects of increased rates of runoff.

PLAN CONTENT

Where an erosion and sediment control plan is required, certain minimum items must be included. The items described in this Section must be included in all plans unless specifically waived by the reviewing agency.

An erosion and sediment control plan basically consists of two parts:

- a. Maps and plan drawings describing the topography of the area, the proposed alteration to the area, the planned erosion and sediment control measures, and
- b. A narrative report describing the project and giving the engineering assumptions and calculations for control measures. Erosion and sediment control measures may be included on drawings with other project facilities as appropriate.

The following items must be included in the plan:

Items to include in the Narrative Section

- a. A general statement of the project consisting of:
 1. General description of the project.
 2. General description of storm water handling during and after construction.
 3. General description of accelerated erosion and sediment control provisions.
 4. Expected date project is to begin and expected date final stabilization will be completed or the expected length of time from initial disturbance of the ground to final stabilization.
- b. Calculations of the amount of runoff from the project area and the upstream watershed area affecting the project. Describe the method of calculation and the factors considered.
- c. Describe the staging of construction activities which affect the stability of the site and describe the erosion control measures to be used before and during each phase. Typical staging which may be described:
 1. Installation of preliminary control measures.
 2. Cover removal.
 3. Rough grading.
 4. Installation of additional control measures.

5. Installation of improvements.
 6. Fine grading.
 7. Installation of final control measures.
- d. Describe a maintenance program for the control measures including:
1. The method of disposal of sediment removed from the control measures or waste material from the project area.
 2. Frequency and methods of maintenance so that measures will be maintained for their designed operation to insure adequate performance.

Items to be Included in the Narrative Section or Shown on the Maps and Plan Drawings

- a. Temporary control measures for use during earth moving. Describe and/or show such things as:
1. The purpose of the measures.
 2. The types of measures to be used including, but not limited to, piping, ditches, sediment basins, diversions, paving, slope drains, silt fences, seeding mixtures and rates, types and rates of mulch, etc.
 3. Location of the measures.
 4. Dimensioned details of the measures.
 5. Design considerations and calculations.
 6. Typical drawings of control structures.
- b. Permanent control measures for restoring the stability of the site and providing long term protection. Describe and show:
1. The purpose of the measures.
 2. The types of measures to be used including but not limited to, storm water runoff control structures, retaining walls, riprap, sediment basins, seeding mixtures and rates, paving, etc.
 3. Location of the measures.
 4. Dimensioned details of the measures.
 5. Design considerations and calculations.
 6. Typical drawings of control structures.

c. Soil description and interpretations including:

1. The types and areal extent of the soils at the project site.
2. Their susceptibility to erosion.
3. The treatment needed for establishment of planned vegetative cover.

Items to be Shown on Maps and Plan Drawings

(Show scale of all maps and appropriate north arrow. All maps and plan drawings to be at a scale of not less than 100 feet to 1 inch unless otherwise specified.)

a. The topographic features of the project area including:

1. The location of the project relative to its general surroundings and identifiable landmarks.
2. Contours at an interval suitable to adequately describe the existing topography.
3. Existing soil cover, such as forest or other vegetative cover, structures, roads, etc.
4. Existing drainage pattern including streams, lakes, ponds, or other bodies of water which may be adversely affected by the project.
5. Boundary lines of the project area.
6. Other applicable physical features.

b. The proposed alteration of the area including:

1. Changes to land surface and cover.
2. Approximate size and location of areas to be graded or disturbed.
3. Structures, roads, paved areas, and buildings.
4. Storm water control facilities.

c. Title Block to include:

1. The name and address of the person preparing the plan.
2. The date on which the plan was prepared.
3. The name of the project.

d. Legend:

Show symbols used, scale of maps, etc.

GENERAL PRINCIPLES TO FOLLOW IN PLAN DEVELOPMENT

a. Select the Right Land

Effective sediment and erosion control begins with the preliminary evaluation of the suitability of a given site for the kind of development or construction to be done, based on the inventory of the prime physical features of that site. Erosion and sedimentation, as well as other development problems, can be minimized by selecting the best site for an intended use. Tracts of land vary in suitability for different uses. Knowing the kind of soil, the geology, hydrology and topography of the area will help in identifying and evaluating potential problems.

Aesthetic, social, economic, and political factors also contribute to the process of planning for erosion and sediment control. These and other factors are usually weighed against projections of the pollution potential of a given construction site.

b. Obtain and use a Soil Survey

The Soil Survey is an inventory of soil maps, soil descriptions, and soil interpretations. Soil descriptions comprise a record of observed characteristics and qualities.

Soil interpretations are statements about hazards and limitations of soils with respect to their various uses. All characteristics and qualities of the soils that affect their suitability and limitations for the project being planned should be considered. An example of the use which may be made of the soil survey is in selecting a tract for a proposed single family housing development using septic tanks and filter fields on each lot. A soil survey might indicate that the tract under consideration contained a high percentage of impermeable soils or soils having characteristics which make it very difficult to re-establish vegetative cover after the natural cover has been removed. Knowing this, an alternative tract might be selected or adequate provision made in the plan to overcome the hazardous characteristics.

c. Prepare Drawings and Specifications

The primary goal of an erosion and sediment control plan is to show or describe how the erosion and sedimentation effects of the proposed land-disturbing activity will be satisfactorily controlled. Part of this goal may be accomplished through the creation of a set of architectural and engineering drawings and specifications that spell out the necessary erosion and sediment control practices.

These drawings and specifications should be adequate to permit prospective contractors to bid and plan intelligently. Detailed designs of control measures are a necessary part of erosion and sedimentation control plans. The plans must be functionally sound.

d. Develop Construction Schedules and Maintenance Provisions

Successful plans include provisions for timely and orderly installation and maintenance of suitable structural and vegetative controls. The plan should account for the timing and sequence of installing the measures shown on the plan, and should provide for installation of many control measures early in the construction schedule. Many plans will require close scheduling and coordination of all construction activities.

BASIC CONTROL OBJECTIVES TO FOLLOW IN PLAN DEVELOPMENT

The basic control objectives which are to be considered in developing an erosion and sedimentation control plan are to:

a. Identify Critical Areas

On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

b. Limit Exposed Areas

All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time.

c. Limit Time of Exposure

All land-disturbing activities are to be planned and conducted to limit exposure to the shortest feasible time.

d. Control Surface Water

Surface water runoff originating upgrate of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.

e. Control Sedimentation

All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

f. Manage Storm Water Runoff

When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream, plans are to include measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.

PROGRESSIVE STEPS IN PLAN DEVELOPMENT

For most land-disturbing activities the planning process can be broken down into four progressive steps. For small projects several of the steps are commonly combined. In each step, erosion and sediment control should be one of the major considerations. The four progressive steps can be listed as follows:

- a. Preliminary site investigations.
- b. Preliminary design.
- c. Subsurface investigations.
- d. Final design.

Preliminary Site Evaluation

During preliminary site evaluation, sufficient information should be collected to provide sensible solutions to potential erosion and sediment control problems. The kinds of on-site protective measures needed during most construction activities may be determined at this time by consideration of such items as the following:

- (1) The topographic features of the project area.
- (2) The types, depth, erodibility potential, and areal extent of the exposed soils.
- (3) The time period of exposure of readily erodible soils.
- (4) The expected frequency and intensity of rain and wind storms.
- (5) The proposed alteration of the area.
- (6) The amount of runoff from the project area and the upland watershed.
- (7) The length, steepness and surface roughness of exposed soil slopes.
- (8) The vulnerable areas on or adjacent to the site.

The following steps outline one procedure which may be followed in completing a preliminary site evaluation as a basic step toward the development of an erosion and sediment control plan.

- (1) Assess soil limitations and suitability of the site based on soil survey, geological, and other sources of information.
- (2) Identify problem soils (soil samples from drilling operations may be necessary for final design) and classify them as to:

erosion potential; water infiltration capacity; moisture retention capacity; soil pH; available nutrients; texture; structure; and certain engineering properties depending upon the planned use of the soil.

- (3) Identify and prepare a site map showing vulnerable areas on or adjacent to the site such as woodlands, wetlands, and waterways. Also, identify and show any special areas of natural vegetative cover which may be used to supplement plans for control of erosion, sediment, and runoff.
- (4) Examine the existing and proposed drainage patterns and evaluate on-site and off-site drainage conditions.
- (5) Examine lengths and grades of existing long slopes and identify existing topographic features which may be used to supplement plans for control of erosion, sediment, and runoff.
- (6) Assess the amount of site grading needed for development and if necessary extend topography information a suitable distance beyond property lines.
- (7) Evaluate watershed problems upstream and downstream from the construction site. Take photographs of critical areas along downstream segments of waterways.

Some of these steps will not be applicable to all sites and additional steps may need to be included for other sites, depending upon the complexity of the site and the type of land-disturbing activity being planned.

Preliminary Design

During the preliminary design phase, every attempt must be made to design the project so as to minimize damage to those physical features which are critical to erosion and sediment control. Also, during this phase of the plan development various methods and practices for erosion and sediment control should be evaluated. One tool for doing this is known as the Universal Soil Loss Equation. This equation, developed by the Agricultural Research Service of the USDA, has been used for many years as a guide to approximate soil losses on farm land. Recent research developments have made it a better tool for use on construction sites.

The use of the equation is an empirical technique which combines such factors as rainfall, soil erodibility, slope length, slope gradient, extent of vegetative cover, and erosion control practices to arrive at an average annual soil loss. Adjustment factors can be developed for estimating soil losses for time increments of less than one year. Factors used in the equation must be applicable to local conditions. Soil Conservation specialist who have knowledge of the factors can provide assistance in its use.

Final Design

Using the information obtained during preliminary site evaluation, preliminary design, and subsurface investigation, the person preparing the plan can begin the actual work of putting the plan in written and graphic form. The plan should cover the areas used for soil stockpile, borrow, and waste, unless those areas are included under a separate plan. When the waste or borrow activities are carried out as separate land-disturbing activities, a separate plan would be acceptable.

The designs used for the plan must include provisions showing how the land-disturbing activity is to be conducted in compliance with the mandatory standards of the law and the performance standards in Sections 7 and 8 of the Rules and Regulations.

Some of the many factors which require consideration during the design stages of plan preparation are as follows:

- (1) Disturbance of existing ground water tables.
- (2) Construction on or near potential landslide or mudslide areas.
- (3) Installation of stream crossing structure where stream fordings are needed.
- (4) Encroachments on stream flow by land fills, culverts, dikes, and buildings.
- (5) Influences on stormwater runoff imposed by an increase in the surface area of impervious streets, parking lots, and buildings.
- (6) Changes in drainage areas caused by diversions and gradings.
- (7) Development of borrow areas.
- (8) Disposal of sediment spoil and other solid wastes.
- (9) Stream channel improvements.
- (10) Construction of access and haul roads.
- (11) Nearness of the construction site to streams, lakes, and other vulnerable water bodies.

ASSISTANCE AVAILABLE

Soil and Water Conservation Districts in North Carolina have made provisions to provide assistance to individuals in making plans for land development. This assistance is provided by the Soil Conservation Service to help the developer in making a plan which would include soils information, the use of needed erosion control measures during construction and a plan for maintenance of erosion control measures after construction is completed.

Assistance on interpretation of soil surveys is also available through the Agricultural Extension Service and the Soils Department of North Carolina State University.

Maps and Airphotos. The person responsible for developing an erosion and sediment control plan should use all available airphotos and topographic geologic and soil maps.

These documents are of particular value during preliminary site evaluation as a source of information on physical features that relate to erosion and sediment control. In addition, some of these documents may be used as base maps on which to record the locations of critical physical features and to make preliminary layouts of the potential development.

Maps and airphotos are available at a slight cost from several governmental sources. Topographic quadrangle maps are available for most areas of North Carolina by writing: Washington Distribution Section, U. S. Geological Survey, 1200 South Eads St., Arlington, Va. The maps normally have a scale of one inch = 2000 ft. and a contour interval of 10 or 20 ft. Airphotos are normally available from local county Agricultural Stabilization and Conservation Offices. Airphotos are also available from the Photogrammetry Unit, N. C. Division of Highways, Raleigh, N. C.

A very useful publication that is available for public use in many counties of the State is the County Soil Survey Report. In counties where these have been published, they are available at the County Soil and Water Conservation District Office. These reports are prepared and published by the U. S. Soil Conservation Service, in cooperation with the State Agriculture Experimental Station. The reports contain photo mosaics, generally printed at a scale of 1 inch = 1320 ft., upon which soil maps, showing soil mapping units, have been superimposed. These air photos also show major drainage patterns of the area and other information pertinent to erosion and sediment control evaluations, such as a delineation of floodplain soils and the relative locations of roadways, woodlands, and agricultural areas. The soil survey report contains tables, keyed to the soil maps, which contain estimated engineering characteristics of the various soil types and an evaluation of their suitability for various engineering usages.

Regardless of whether or not a published soil survey report is available some soil survey information is available in all counties of the State by contacting the County Soil and Water Conservation District Office.

FILING OF PLANS AND APPLICATION FOR PLAN APPROVAL

Commission Approval Required

Commission approval of erosion and sediment control plans is required prior to commencement of the land-disturbing activity for all land-disturbing activities over which the Commission, by statute, has exclusive jurisdiction. An application for such approval shall be made at least 30 days prior to the commencement of the land-disturbing activity.

Application shall include an appropriate letter of transmittal, three (3) copies of the plans, specifications and statements as outlined under the Plan Content Section of this Guide, and a certification by the person submitting the plan that the land-disturbing activity will be conducted in accordance with the plan.

Commission Approval Not Required

Prior Commission approval of plans is not required for those land-disturbing activities over which the Commission, by statute, does not have exclusive jurisdiction. Where such land-disturbing activities are planned and no local erosion control ordinance exists, two (2) copies of the erosion and sediment control plan shall be filed with the Commission 30-days prior to the commencement of the land-disturbing activity and one copy of the plan shall be available at the site of the land-disturbing activity while the activity is being conducted. An appropriate letter of transmittal shall be used to transmit the plans to the Commission.

FILING LOCATIONS

Erosion control plans and applications for plan approval shall be filed with the Chief, Department of Natural and Economic Resources Field Office in the Regional Field Office which serves the county in which the planned land-disturbing activity will be conducted.

The Regional Field Office locations and the counties which they serve are listed below:

WESTERN REGIONAL OFFICE
Asheville, North Carolina

Avery	Madison
Buncombe	McDowell
Cherokee	Mitchell
Clay	Polk
Cleveland	Rutherford
Graham	Swain
Haywood	Transylvania
Henderson	Watauga
Jackson	Yancey
Macon	

SOUTH PIEDMONT REGIONAL OFFICE
 Mooresville, North Carolina

Alexander	Iredell
Burke	Lincoln
Cabarrus	Mecklenburg
Caldwell	Rowan
Catawba	Stanley
Gaston	Union

NORTH PIEDMONT REGIONAL OFFICE
Winston-Salem, N. C.

Alamance	Guilford
Alleghany	Rockingham
Ashe	Randolph
Caswell	Stokes
Davidson	Surry
Davie	Yadkin
Forsyth	Wilkes

NORTH CENTRAL REGIONAL OFFICE
Raleigh, N.C.

Chatham	Johnston	Orange
Durham	Lee	Person
Edgecombe	Nash	Vance
Franklin	Northampton	Wake
Granville		Warren
Halifax		Wilson

SOUTH CENTRAL REGIONAL OFFICE
Fayetteville, N. C.

Anson
Bladen
Cumberland
Harnett
Hoke
Montgomery

Moore
Robeson
Richmond
Sampson
Scotland

NORTHEASTERN REGIONAL OFFICE
Washington, N. C.

Beaufort
Bertie
Camden
Chowan
Craven
Currituck
Dare
Gates
Greene
Hertford

Hyde
Jones
Lenoir
Martin
Pamlico
Pasquotank
Perquimans
Pitt
Tyrrell
Washington
Wayne

SOUTHEASTERN REGIONAL OFFICE
Wilmington, N. C.

Brunswick
Carteret
Columbus
Duplin

New Hanover
Onslow
Pender

BIBLIOGRAPHY

SOIL EROSION AND SEDIMENTATION

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The following list of references are acceptable to the North Carolina Sedimentation Control Commission for use in preparing erosion and sedimentation control plans.

Federal Agency Publications

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2. Processes, Procedures, and Methods to Control Pollution Resulting From all Construction Activity - EPA 430/9-73-007 - Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - price \$2.30.
3. Engineering Field Manual for Conservation Practices - USDA, Soil Conservation Service, 1969 - Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - price \$7.50.
4. Guidelines for Erosion and Sediment Control Planning and Implementation - EPA-R2-72-015, August 1972 - Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 - price \$1.75.
5. Rainfall, Intensity, Duration, Frequency Curves - TP 25 1955 - U. S. Weather Service, Washington, D. C.
6. Rainfall - Frequency Atlas of the United States for Durations From 30 Minutes - TP 40 1961 - U.S. Weather Service, Washington, D. C.

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2. Introduction to Hydrology - Viessman, Warren, Terence, - E.Harbaugh and John W. Knapp, Intext, 1972.
3. Open Channel Hydraulics, Chow, Vente, - McGraw-Hill, 1959.
4. Open Channel Flow, Henderson, F.M., MacMillan, 1966.
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Technical Journals

1. A Soil Erodibility Nomograph for Farmland and Construction Sites - Journal Soil and Water Conservation, September - October, 1971, p.189, Wischmeir, Wilt, C.B.Johnson and B. V. Cross.

Manufacturer's Publications

1. Concrete Pipe Design Manual, American Concrete Pipe Association, ACPA, 1501 Wilson Boulevard, Arlington, Virginia 22209, 1970.
2. Handbook of Steel Drainage and Highway Construction Products, AISI, 150 East 42nd Street, New York, N.Y. 10017, 1971.
3. Clay Pipe Engineering Manual, National Clay Pipe Institute, NCPI, Crystal Lake, Illinois, 1972