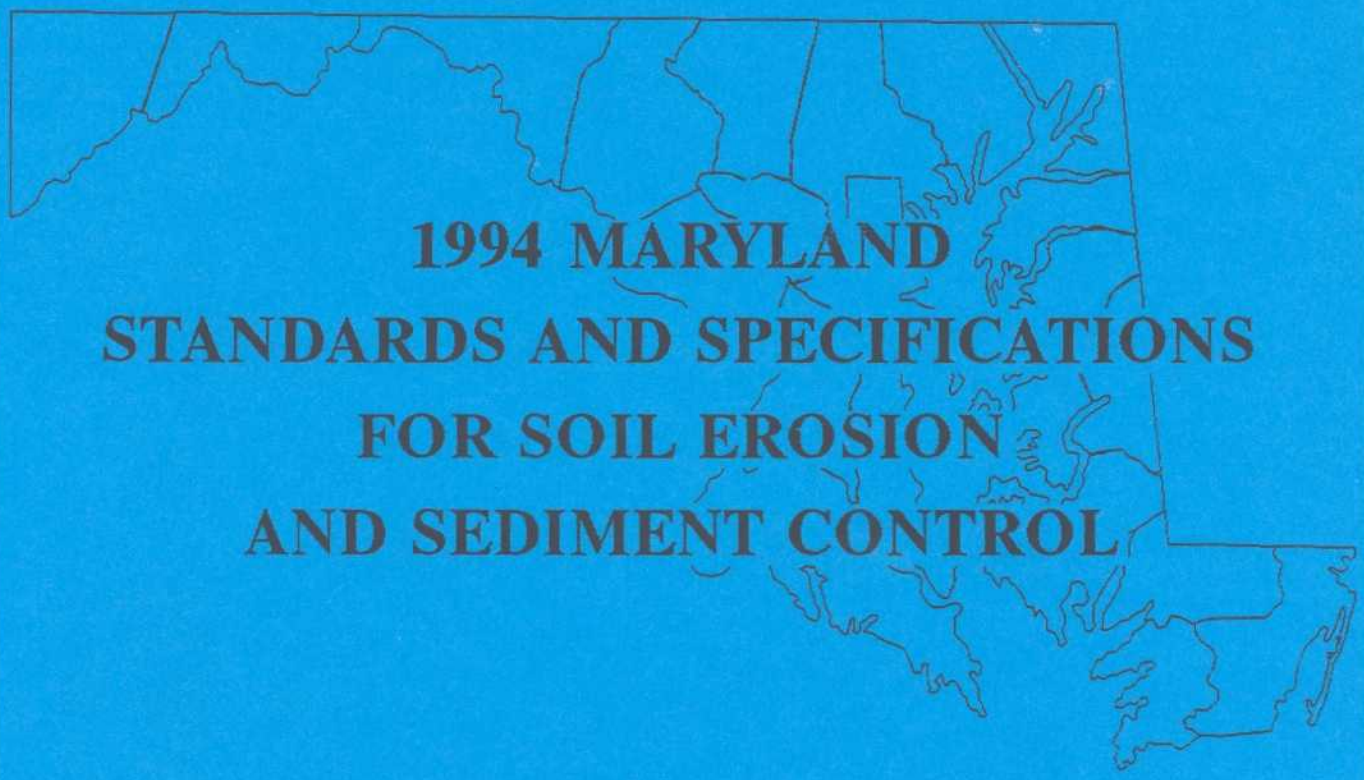

1994 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT
Water Management Administration

in association with

SOIL CONSERVATION SERVICE

and

STATE SOIL CONSERVATION COMMITTEE

FOREWORD

At the outset, it is necessary to establish the fact that soil erosion and sediment control are only part of the overall management of stormwater during and after site development. As the original ground cover of a site is disturbed and removed, the runoff characteristics are modified. Velocities of flow are increased and the total runoff volume is also increased. Limited management of runoff during the construction phase is provided by sediment control practices. Runoff control after site development is accomplished by means of permanent stormwater management practices such as infiltration trenches or ponds. The practices contained in these standards and specifications are designed to provide a protective transition from initial site disturbance until implementation of permanent stabilization and stormwater management facilities. The practices described herein are minimum requirements. Local concerns may require practices that are more restrictive than these minimum standards.

SENSITIVE AREAS

Sensitive areas are defined in State law, regulation and/or County law and/or regulation and/or Municipality law and/or regulation. Sensitive watersheds are those streams, tributaries, riparian areas, and estuary areas that are part of the critical area, Class III and Class IV streams and tidal and non-tidal wetland areas and the adjacent steep slopes to any of these areas.

Designers and reviewers should be cognizant of the sensitive nature of these areas within the State of Maryland. Additional soil erosion and sediment control provisions and measures may be required to protect these areas to the greatest extent possible.

The level of additional soil erosion and sediment controls needed in these areas will be determined during the review for the project by the Planning Agencies, Soil Conservation Districts, Resource Agencies and Environmental Commissions and Boards. The final approval of these additional measures and practices will be the responsibility of the review and approval agency. Conflicts between recommendations made by Resource Agencies, Planning Agencies, Review Boards and approval agencies and Commissions will be resolved in writing.

The standards and specifications of this manual are the minimum requirements for soil erosion and sediment control. The provision of additional soil erosion and sediment control measures and practices needed in sensitive areas may be recommended by Planning Agencies, Resource Agencies, Review Committees and Commissions.

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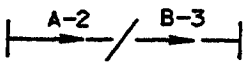
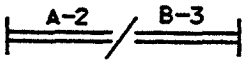
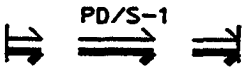
EARTH DIKE ..... 

SWALE ..... 

PERIMETER DIKE/SWALE ..... 

PIPE SLOPE DRAIN ..... 

ROCK OUTLET PROTECTION ..... 

STONE CHECK DAM ..... 

STONE OUTLET STRUCTURE ..... 

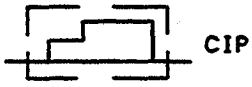
SILT FENCE ..... 

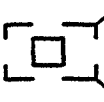
SUPER SILT FENCE ..... 

STRAW BALE DIKE ..... 

STANDARD INLET PROTECTION ..... 

AT GRADE INLET PROTECTION ..... 

CURB INLET PROTECTION ..... 

STANDARD INLET PROTECTION ..... 

GABION INFLOW PROTECTION ..... 

RIP-RAP INFLOW PROTECTION ..... 

SUMP PIT ..... 

STABILIZED CONSTRUCTION ENTRANCE ..... 

REMOVABLE PUMPING STATION ..... 

INTRODUCTION

PURPOSE

The purpose of these standards and specifications is to provide designers with a variety of measures to control sediment and stormwater related water quality problems that land development often creates. These standards are minimum criteria and must be incorporated into an overall approach for controlling runoff during construction. The successful implementation of control measures depends largely on the designer's ability to select a control strategy that is appropriate to the unique characteristics and problems posed by a specific site. The designer can make the selection and implementation of sediment and stormwater management measures considerably simpler and less costly by incorporating environmental planning methodologies into the start of the site plan development process.

PLANNING

Developing site plans begins with gathering, mapping, and analyzing information about the physical characteristics of the site. Designers must visit the proposed development site so that its topographic, vegetative, drainage and soil characteristics are clearly understood. Relying exclusively on topographic maps, soils maps, and other materials found in the office without field verification is not an acceptable planning technique.

The topography of the site, mapped at suitable contour intervals, will allow the identification of drainage patterns, slopes, and sensitive features. Mapping the flow of water onto, through, and off the site enables the delineation of drainage areas. Several interim drainage plans may be necessary to show changing drainage area boundaries as the site is graded. Concurrent phased plans will have to be developed to adjust the soil erosion and sediment controls to the changing drainage patterns. Investigating the site soil characteristics will identify areas suitable for infiltration as well as highly erodible areas, which should be left undisturbed if possible. Areas where vegetation is to be preserved, such as long or steep slopes, highly erodible soils, and buffer strips along water bodies, should be mapped. Downstream wetlands, lakes, streams, streets, or other areas particularly sensitive to damage from erosion and sedimentation should also be investigated and mapped. After the site's topographic, drainage, soils, and vegetative characteristics are mapped, a site development plan that minimizes environmental hazards can be developed.

Clearly, the most effective way to minimize the likelihood of sediment pollution is to minimize the opportunity for erosion to occur. The best way to reduce the amount of erosion that occurs is to reduce the amount of area that is exposed and the time that it is exposed. Stabilization of disturbed areas must occur as soon as work has stopped. To limit grading, plan to utilize the existing terrain by locating buildings and roads so that existing contours are followed as much as possible. Preserve natural vegetation wherever feasible. By reducing the need for grading in this fashion, the amount of erodible area, and the corresponding need for sediment control measures, is also reduced. Planning the site development so that grading is minimized facilitates the development of a soil erosion and sediment control plan that is appropriate and cost effective for the site.

SEDIMENT DAMAGE

Over four billion tons of sediment are estimated to reach the ponds, rivers and lakes of our country each year. Approximately 10 percent of this amount is contributed by erosion from land undergoing highway construction or urban land development. Roughly one billion tons of this sediment are actually carried all the way to the oceans.

Sediment yields in streams flowing from already urbanized drainage basins vary from approximately 200 to 500 tons per square mile per year. In contrast, areas undergoing urbanization often have sediment yields of from 1,000 to 100,000 tons. It is easy to comprehend the tremendous quantity of sediment reaching our streams and rivers annually since an estimated 3,000 to 4,000 acres of land in the U. S. are currently undergoing development for housing, industrial sites, and highway construction every day. For very small areas, where construction activities have drastically altered or destroyed vegetative cover and the soil mantle, sediment derived from one acre of land may exceed 20,000 to 40,000 times that obtained from an adjacent undeveloped farm or woodland in an equivalent period of time.

Deposition tends to occur as the velocity of sediment transporting streams decreases. Excessive quantities of sediment cause costly damage to water areas and to private and public lands. Obstruction of stream channels and navigable rivers by masses of deposited sediment reduces hydraulic capacity which, in turn, causes an increase in subsequent flooding and a consequent increase in flood damages - frequently with attendant personal injuries and deaths.

Sediment fills drainage channels, especially along highways and railroads, and plugs culverts and storm drainage systems thus necessitating frequent and costly maintenance. Municipal and industrial water supply reservoirs lose storage capacity, navigable channels must continually be dredged, and cost of filtering muddy water preparatory to domestic or industrial use becomes excessive and sometimes exorbitant. The added expenses of water purification in the United States amounts to millions of dollars each year.

The negative impact on aquatic organisms due to large influxes of sediment into waterways is substantial. The initial effect is a drastic reduction in the number and density of benthos. Aquatic vegetation is often destroyed, either by burial or reduction of sunlight essential for growth. Many species of fish, dependent on bottom organisms for food, or plant life for refuge, are threatened by the damaged habitat. The reduction of sunlight from suspended sediment impairs primary production (the process by which sunlight is utilized by certain organisms to produce carbon and oxygen) and may reduce oxygen levels in the water to a point where aquatic life cannot survive. The habitat destruction associated with rapid sedimentation severely impairs the ability of coastal environments to support commercially important finfish and shellfish populations. Migratory waterfowl also utilize nearshore plant and shellfish communities as a food source during their annual migration. The reduction of waterfowl in recent years has been associated, in part, with habitat destruction from sedimentation derived from development activity.

Erosion and subsequent sedimentation of waterways also impairs recreational areas. The aesthetics and the attraction of many streams, lakes and reservoirs used for swimming, boating, fishing and other water-related recreational activities maybe destroyed from excessive erosion and the resultant sedimentation.

FACTORS THAT INFLUENCE SOIL EROSION

When designing a development plan, the inherent erodibility of the proposed development site must be evaluated. The erosion potential of any area is determined by four principal factors: the erodibility of soil, vegetative cover, topography, and climate. Although the factors are interrelated as determinants of erosion potential, they are discussed separately for ease of understanding.

SOIL ERODIBILITY

The vulnerability of a soil to erosion is known as erodibility. Soil erodibility is influenced by average particle size and gradation (texture), percentage of organic matter, and soil structure. The most erodible soils generally contain high proportions of silt and very fine sand. The presence of clay or organic matter tends to decrease soil erodibility. Clays are sticky and tend to bind soil particles together, which along with organic matter helps to maintain stable soil structure (aggregates).

VEGETATIVE COVER

There are several ways in which vegetation protects soil from erosive forces of raindrop impact and runoff scour. Vegetation (top growth) shields the soil surface from raindrop impact while the root mass holds soil particles in place. Vegetation also can "filter" sediment from runoff. Thus grass "buffer strips" can be used to remove sediment from the surface runoff. Vegetation also slows the velocity of runoff and helps maintain the infiltration capacity of a soil. Maintenance and establishment of vegetation is the most important factor in combatting erosion. The goal is to expose as small an area as possible for the shortest length of time. By minimizing the time and extent of soil exposure, the erosion hazard is also minimized.

TOPOGRAPHY

Slope length and steepness are key influences on both the volume and velocity of surface runoff. Longer slopes deliver more runoff to the base of slopes and steeper slopes increase runoff velocity; both conditions enhance the potential for erosion to occur.

CLIMATE

Erosion potential is also affected by the climate of an area. Rainfall characteristics (e.g. frequency, intensity, and duration) directly influence the amount of runoff that is generated. As the frequency of rainfall increases, water has less chance between storms to drain through the soil. The soil will remain saturated for longer periods of time and stormwater runoff volume will be greater. Therefore, where rainfall events are frequent, intense, or lengthy, erosion risks are high. Seasonal variation in temperature and rainfall defines periods of high erosion potential during the year. Snow will not cause erosion as it falls, but when rapid melts occur, erosion may result.

SOIL LOSS RATES

Raindrop size, intensity of rainstorms, and amount of rainfall affect soil loss rates. Note that May through September is the period of the year when high soil loss rates are most likely to occur in Maryland. Soil erosion and sedimentation can occur when soil, vegetative, topographic, and climatic factors are not considered during the planning stage of development. Areas slated for development that are deemed environmentally sensitive (e.g., those with high soil erosion potential and/or proximity to surface water) demand added attention to proposed clearing and grading activity, soil erosion and sediment control requirements and final site stabilization. Aside from concern for potential sediment erosion, other environmental concerns exist when a site is being planned for development. These include:

1. Extensive denudation exposes underlying soils to rain and runoff.

2. Exposure of underlying soil or geologic formations less pervious and/or more erodible than original soil surface.

3. Prolonged exposure of unprotected and disturbed soils due to scheduling problems and/or delayed construction (phasing problems) may cause additional erosion.

4. The placement of impervious surfaces will reduce rain infiltration and groundwater recharge. This may affect slope stability and survival of existing and/or newly established vegetation.

5. Creation of exposures facing south and west may hinder plant growth due to adverse temperature and moisture conditions; and

6. Exposure of subsurface soils that are rocky, acidic, draughty, or poorly draining may hinder vegetative establishment.

STORMWATER RUNOFF

Whenever the land use of a watershed changes, the runoff characteristics will also change. Going from a forest to a developed condition will increase the amount of runoff coming from the land. This increase is the result of:

1.Reduced capacity of exposed soils to absorb rainfall due to compaction caused by heavy equipment may increase runoff volumes.

2.Grading operations and the placement of structures (streets, building, etc.) may enlarge existing drainage areas or concentrate surface flows with resultant increases in runoff volume and velocity.

3.Increased impervious surfaces associated with the construction of streets, building, sidewalks and paved driveways and parking lots will increase stormwater discharge by reducing on-site infiltration of rain.

BASIC PRINCIPLES OF SOIL EROSION AND SEDIMENT CONTROL

PLAN THE DEVELOPMENT TO FIT THE SITE.

Areas of high erosion potential should be left undisturbed whenever possible. Specific characteristics that could limit a site's development potential include highly erodible or acid soils, temperature extremes that inhibit vegetative stabilization, steep slopes and proximity to surface waters. For instance, some areas, such as floodplains and wetlands, should not be developed at all. Floodplains are nearly level areas adjacent to stream channels that temporarily store excess runoff. Functioning in this way, floodplains help avoid erosion and flooding in downstream areas. Ideally, these areas should be preserved in their natural state as open space or recreational areas.

EXPOSE THE SMALLEST PRACTICAL AREA OF LAND FOR THE SHORTEST POSSIBLE TIME.

When soil disturbances occur and the natural vegetation is removed, the extent and duration of exposure should be minimized. Plan the phases or stages of development so that only the areas which are actively being developed are exposed. All other areas should have a good cover of temporary or permanent vegetation or mulch. Grading should be completed as soon as possible after it is initiated. As cut slopes are made, and as fill slopes are brought up to grade, these areas should be revegetated as the work progresses. This is known as staged seeding.

APPLY EROSION CONTROL AS A FIRST LINE OF DEFENSE AGAINST ON-SITE DAMAGE.

Implementing practices that prevent or minimize erosion on a construction site is called "erosion control". "Erosion control" strategies attempt to prevent or minimize the problem of erosion on developing sites. The following guidelines apply to "erosion control" strategies:

1. Clear only what is required for construction; where possible, large projects should be cleared and graded as construction progresses; mass clearing and grading should be avoided;

2. Reestablish with vegetation as-soon-as possible after construction is completed; certain sections of large construction projects may be completed before others and be ready for stabilization before the total project is completed; waiting until the end of the project to commence all site stabilization may leave areas exposed for unnecessarily long durations;

3. Areas that have been cleared and graded, but will not be constructed on for more than 14 days (7 days for steep slopes) must be stabilized with mulch or temporary vegetation;

4. Extraneous runoff should be diverted from critical areas such as highly erodible soils and steep slopes and conveyed to stable areas; and

5. The formation of large drainage areas and the concentrating of surface runoff flow patterns should be avoided where possible.

USE SEDIMENT CONTROL PRACTICES AS PERIMETER PROTECTION TO PREVENT OFF-SITE DAMAGE.

Controls placed along the perimeter of the site to collect eroded sediments must be implemented. Diversion ditches, sediment traps, vegetative filters and sediment basins are examples of practices to control sediment. These sediment controls should be in place before clearing and grading operations begin. Generally, sediment can be retained by two methods: (a) filtering runoff as it flows through a vegetated area and (b) impounding the sediment laden runoff for a period of time so that the soil particles settle out. The best way to control sediment, however, it so prevent erosion as discussed in the third principle.

IMPLEMENT A THROUGH MAINTENANCE AND FOLLOW-UP OPERATION.

This fifth principle is vital to the success of the four other principles. A site must have thorough periodic maintenance checks of soil erosion and sediment control practices. Control practices must be maintained just as construction equipment must be maintained. An example of applying this principle would be to start a routine "end of day check" to make sure that all control practices are working properly. Also, all controls should be inspected for needed maintenance after rainfall events.

DEVELOPING THE SOIL EROSION AND SEDIMENT CONTROL PLAN

The basic principles of soil erosion and sediment control should be considered in conjunction with the environmental concerns for the proposed development site when formulating the Grading and Sediment Control Plan.

PLANNING PROCEDURES

1. Determine limits of clearing and grading. Decide exactly which areas must be disturbed in order to accommodate the proposed construction. Pay special attention to critical areas which must be disturbed. Staged clearing and grading (as an alternative to massive clearing and grading) should be considered where feasible.

2. Divide the site into natural drainage areas. Determine how runoff will travel over the site. Consider how soil erosion and sedimentation can be controlled in each small drainage area before looking at the entire site. Remember, it is advantageous to control soil erosion (prevent the problem) rather than retrofit perimeter controls to collect the end result of the problem (sediment). Maximum drainage areas to sediment controls must be clearly delineated.

3. Select soil erosion and sediment control practices. Soil erosion and sediment control practices can be divided into 3 categories: vegetative controls, structural controls, and site management. This handbook should be used for the selection and design of vegetative and structural practices. Management measures are construction management techniques and decisions which, if made with consideration of the potential erosion problems on a site, can minimize the need for designed controls.

4. Vegetative Controls - The first line of defense against off-site sediment damage is to prevent soil erosion. This is accomplished by protecting the soil surface from raindrop impact and overland flow of runoff. The best way to protect the soil surface is to preserve the existing vegetative groundcover. Where land disturbance is necessary, temporary seeding or mulching must be used on areas which will be exposed for longer than 14 days (7 days for steep slopes).

Permanent stabilization should be performed as soon as possible after the graded area is completed. Soil erosion and sediment control plans must contain provisions for permanent stabilization of disturbed areas. Seed type, soil amendments, seedbed preparation, and mulching should be described on the plans. Selection of permanent vegetation should include the following considerations:

a. establishment requirements;
b. adaptability to site conditions;
c. aesthetic and natural resource values; and
d. maintenance requirements.

5. Structural controls - Structural practices are usually required since not all disturbed areas can be promptly protected with vegetation. They are often used as a second or third line of defense to capture sediment before it leaves the site. It is very important that structural practices be selected to provide the optimum sediment control strategy and be designed and constructed according to the standards and specifications.

6. Management Measures - Good construction management is as important as physical practices for soil erosion and sediment control, and there is generally little or no cost involved. The following are some management considerations which can be employed:

a. Sequence construction so that no area remains exposed for more than 14 days (7 days for steep slopes) without stabilization.

b. Temporary or permanent seeding should be done immediately after grading.

c. On large projects, stage the construction so that one area can be stabilized before another is disturbed.

d. Develop and carry out a regular maintenance schedule for soil erosion and sediment control practices.

e. Physically mark off limits of land disturbance on the site with tape, signs or other methods, so the workers can see areas to be protected.

f. Make sure that all workers understand the major provisions of the soil erosion and sediment control plan.

g. Responsibility should be designated to one individual (Responsible Personnel) who has been certified in soil erosion and sediment control.

SOIL EROSION AND SEDIMENT CONTROL PLAN CONTENT

The soil erosion and sediment control strategy that is formulated by development planners is conveyed to the contractors through the soil erosion and sediment control plan. All plans must be easy to read and interpret if they are to be implemented correctly. To help clarify and simplify the plans, standard symbols and uniform scales have been developed. Standard symbols are used to facilitate the understanding and review of plans. They should be bold and easily discernible on the plans.

SCALE

The following scales are recommended for use on soil erosion and sediment control plans because they facilitate the plan review process: 1" = 20', 1" = 30', 1" = 40', 1" = 50'. Minimum scale will be established by plan review agency. The contour interval for these plans shall be two feet or less. Other scales or contour intervals may be favored for special types of land disturbance projects. For example, strip mine plans are often drawn to scales of 1" = 200' or 1" = 500' with contour intervals of 5 to 20 feet. Consult the appropriate plan review agency prior to finalizing the selection of plan scale.

SOURCES OF ASSISTANCE

Property owners seeking technical advice on soil erosion sediment control problems should contact officials of the Soil Conservation District in which they reside. The Department of the Environment's Water Management Administration (WMA), local county and municipal governments can all provide assistance to property owners.

AVAILABLE INFORMATION

Contact WMA for a Publication List that includes the State Sediment Control Law, The Code of Maryland Regulations, and many other useful soil erosion sediment control and stormwater management publications.

REVISING THE STANDARDS AND SPECIFICATIONS

The Standards and Specifications establish a minimum performance criteria that should be met by all techniques and devices used for erosion and sediment control in Maryland. On occasion, variations or other Standards or Specifications may be found to function better or be more desirable for erosion and sediment control by plan approval authorities. If after several tests the approval authority decides it would like to utilize this revised Standard or Specification on a regular basis, it needs to prepare a Standard and the accompanying Specifications with a cover letter to be submitted to the Maryland Department of the Environment, Water Management Administration.

The revised Standard and Specification will be reviewed by a subcommittee consisting of SCS, SCD, and MDE technical personnel to review the revised or new Standard and Specification. When the revised Standard and Specification is approved by the technical subcommittee, an approval authorization, from the Director of the Water Management Administration and the technical representative of the local approval authority will be entered on the standard. Once the revised or new Standard and Specification has received approval it can be used on a regular basis within that jurisdiction. If other jurisdictions desire to utilize the same or a similar Standard and Specification then they must seek approval from the technical subcommittee. We do not anticipate a great amount of deviation from these Standards and Specifications, but when better erosion and sediment control can be achieved, revised Standards and Specifications will generally be looked upon favorably.