SECTION 4.3.2

CONSTRUCTION SITE RUNOFF CONTROLS

CS – Construction Site Runoff Controls

EPA Requirements and Guidance:

The designated city/county must develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to a small MS4 from construction activities that disturb one or more acres. Reduction of stormwater discharges from a construction activity disturbing less than one acre must be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. At a minimum, the program must include the development and implementation of the following: An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State, Tribal, or local law.

Construction site operators must implement appropriate erosion and sediment control (ESC) best management practices and must (1) control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality; (2) establish procedures for site plan review which incorporate consideration of potential water quality impacts; (3) establish procedures for receipt and consideration of information submitted by the public; and (4) establish procedures for site inspection and enforcement of control measures.

Examples of sanctions to ensure compliance include non-monetary penalties, fines, bonding requirements, and/or permit denials for non-compliance. EPA recommends that procedures for site plan review include the review of individual pre-construction site plans to ensure consistency with local (ESC) requirements. Procedures for site inspections and enforcement of control measures could include steps to identify priority sites for inspection and enforcement based on the nature of the construction activity, topography, and the characteristics of soils and receiving water quality. The designated city/county is encouraged to provide appropriate educational and training measures for construction site operators and may wish to require a stormwater pollution prevention plan for construction sites within their jurisdiction that discharge into their system.

Listed below are the most common BMP's associated with Construction Site Runoff Control. Design criteria for these BMP's can be found in this section or in the "Planning and Design Manual for the Control of Erosion, Sediment and Stormwater" (ESC Manual) published by the Mississippi Department of Environmental Quality, Mississippi Soil & Water Conservation Commission and the USDA Soil Conservation Service. BMP's denoted by an asterisk (*) shall be designed according to ESC Manual design standards.

CS-01

BMP Inspection and Maintenance

Benefits:

- *Regular inspection and maintenance ensure BMPs are properly functioning and effective. This may be the single most important and most overlooked practice for construction site stormwater management.*

Limitations:

- *The only real limitation to inspection and maintenance program is that to be effective, a sincere effort is required by the contractor.*

Costs:

- *Costs associated with time.*

Discussion:

BMP inspection and maintenance programs involve requirements for checking and repairing stormwater management practices. Inspection and maintenance of BMPs are essential for the effectiveness of stormwater management measures. Program requirements should include schedules for routine inspections (such as after every significant rainfall), time frames for repair of damaged or failing measures, and provide guidance (such as inspection forms tailored to the types of practices being implemented). Inspection and maintenance requirements should be suited to the types of BMPs that are being used, and providing inspector training is an effective means of ensuring proper inspection and maintenance. Documentation including inspection forms, dates, rainfall data, conditions observed, deficiencies noted, and corrective actions taken should be maintained.

Brush Barrier

Benefits:

- *Brush barriers are inexpensive methods used to reduce stormwater velocities and filter suspended particles from runoff.*

Limitations:

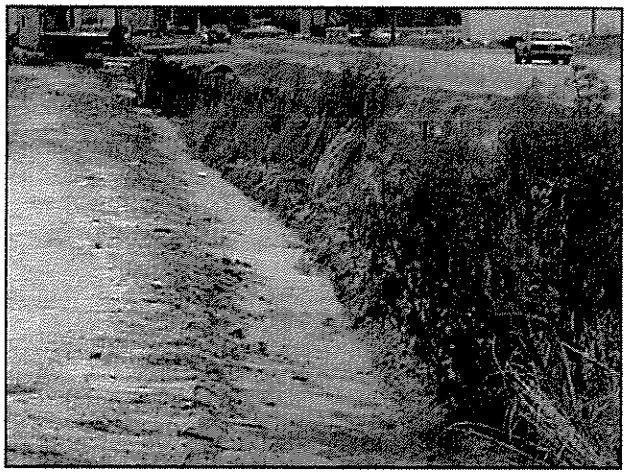
- *Brush barriers are not effective for high velocity flow. Brush barriers may not be applicable for sites where little useable brush material is generated during clearing. Material used to create brush barriers will have to be removed upon completion of construction. The materials used to construct brush barriers will decompose.*

Costs:

- *USEPA estimates brush barriers can be constructed for a cost ranging from $390 to $620 (no size indicated).*

Effectiveness:

- *Brush barriers are not effective for high velocity flows and may become clogged with sediment.*



Discussion:

Brush barriers are sediment control structures constructed of materials such as tree limbs, roots, stone, or other such debris produced during site clearing. This material is piled together along the perimeter of a site to provide for reduction of stormwater flow and removal of sediments. Brush barriers are often constructed of fragmented plant materials and covered with a geotextile material for stabilization and improved efficiency. Brush barriers are typically limited to sites where sufficient material is produced from clearing and to sites with small drainage areas and slopes less than 2:1 and less than 100 feet long. Brush barriers are not intended to manage high velocity runoff. Brush barriers often become clogged with sediments quickly and also decompose; limiting the amount of time the measure is effective.

EPA Stormwater Phase II BMP Inventory

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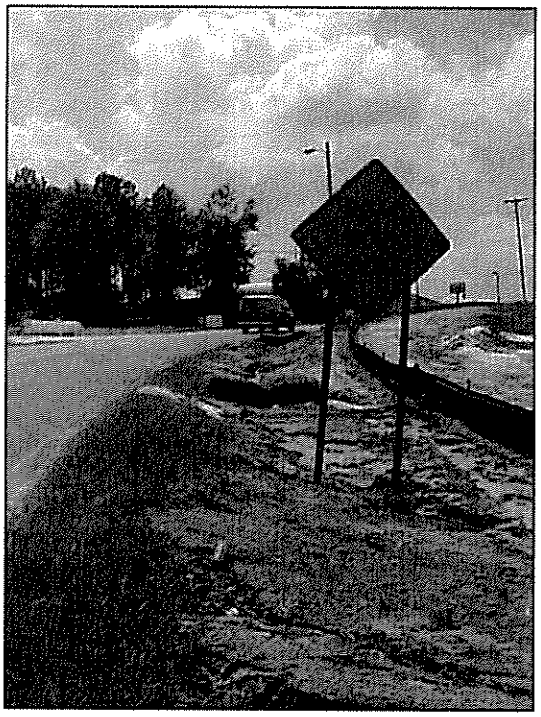
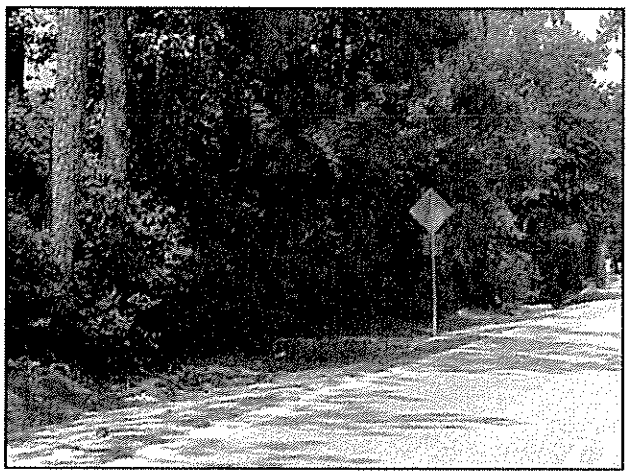
Check Dams





Discussion:

Check dams are small, temporary dams constructed across a swale or channel and are designed to reduce stormwater flow velocity. Although gravel dams have proven to be the most effective at stabilizing channels, they can be constructed of various materials such as stone, gravel, logs, and straw bales. Long channels should use multiple dams spaced appropriately for the slope and channel flow. Placing dams in live channels should not be used unless approved by the appropriate regulatory agency. Dams should be used in conjunction with other BMPs such as grassed channels, and should be inspected after each storm. Improperly designed dams may not be adequate for the stormwater velocity, and failure can exacerbate erosion.

Benefits:

- *Check dams have been shown to provide greater stabilization for stormwater ditches than silt fence or straw bales.*
- *Check dams are characterized as having low costs and easy installation.*

Limitations:

- *Check dams are designed to slow stormwater runoff velocity and are not intended to be used alone as they provide primarily quantity benefits and little improvement to water quality. If improperly installed, check dams may lead to accelerated erosion. Check dams are used as a temporary practice until permanent stabilization measures are installed.*

Costs:

- *Costs of check dams will depend on necessary size and availability of material. USEPA estimates check dams constructed of rock to average about $100 per dam. Other materials such as logs or sandbags may be used. All methods will require regular inspection and possible maintenance.*

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Chemical Stabilization

Benefits:

- *Chemical stabilization can reduce erosion from slopes where vegetation cannot be established.*

Limitations:

- *Chemical stabilization can create impervious surfaces resulting in increased runoff. The potential environmental impacts of the chemicals used are unknown. Chemical stabilization is typically more expensive than vegetative practices. Chemical stabilization provides a temporary solution to erosion control.*

Costs:

- *Costs depend on chemicals used and methods of application. EPA reports costs for a common chemical stabilizer to range from $4 to $35 per pound, which will cover one acre and does not include costs for application.*

Discussion:

Chemical stabilizers are materials used to provide temporary soil stabilization and are typically composed of vinyl, asphalt, and rubber. The chemical stabilizers, also called palliatives or soil binders, are sprayed onto the surface of exposed soils to protect against erosion from stormwater runoff or wind. Chemical stabilizers can provide immediate erosion control and can be applied in situations where establishment of vegetation is not effective. Chemical stabilizers may be used in conjunction with seeding in some cases. Chemical stabilizers offer temporary soil stabilization. Manufacturer's recommendations for application should be followed closely to avoid developing an impermeable coat or result in adverse environmental effects resulting from over-application.

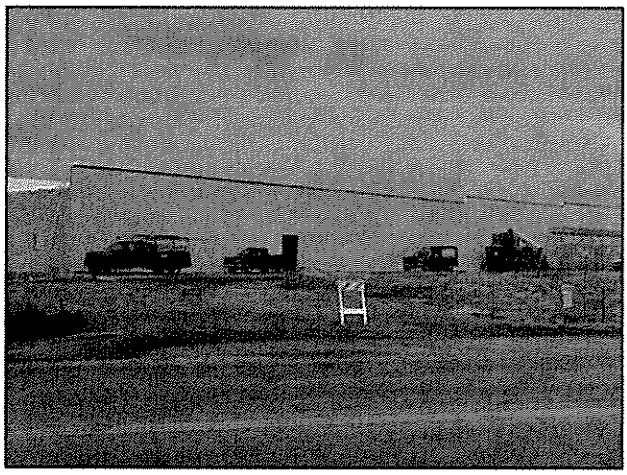
Construction Entrances

Benefits:

- *Removal of mud from construction vehicles can reduce the amount soils and sediments leaving a site. Off-site tracking of mud by construction vehicles can contribute to significant particulate inputs into the storm drain system, especially in urban areas where curbs and gutters are present.*

Limitations:

- *Stabilization of entrances and exits with gravel or grating may be only minimally effective at removing mud from vehicles. Washing operations are the most effective method for removing mud from vehicles before leaving a site, but require a water source and collection area for the used wash water. Some sites may require multiple entrances and exits to accommodate adequate access and high*



Costs:

Stabilized construction entrance	$1,000-4,000
Annual maintenance	$1,500
Entrance with wash rack	$1,000-5,000
Annual maintenance	$2,200

(Source: USEPA, 1993)

Discussion:

Construction entrances consist of graveled or grated areas located where vehicles enter and leave a site and are designed to provide a buffer to reduce the amount of mud and soil transported from the site to adjacent roadways. This measure is best used where wet conditions or long-term projects are anticipated and should be used with other access measures such as maintaining construction paths, building paths out of low areas, and restricting vehicle access in wet areas. An effective construction entrance reduces muddy roadways, reduces transport of sediments and improves site appearance. This measure may require vehicle washing and additional construction costs.

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Construction Reviewer

Benefits:

- *Construction reviewer programs can ensure implementation and maintenance of stormwater BMPs. Construction reviewer programs can provide measures for enforcement of regulations. Construction reviewer programs often use third party personnel are hired by the contractor and who report to the regulatory agency on the findings of regular inspections, thereby reducing the work load for the government agency.*

Limitations:

- *Agency staffing is often inadequate to provide sufficient numbers of inspections at all construction sites.*

Costs:

- *Costs are minimal but include additional staff time to ensure proper implementation and maintenance.*

Construction reviewers periodically inspect construction sites to ensure that contractors have installed and maintained their erosion and sediment controls properly (Source: University of Connecticut Cooperative Extension System, 2000)

Discussion:

Construction reviewer programs involve providing personnel to inspect construction sites, prepare reports of the inspection findings, and refer the project to the proper enforcement agency if problems are not corrected. Construction reviewers provide for enforcement of construction site stormwater management programs, which is an essential element of successful stormwater management programs. Construction reviewer programs should ensure the program personnel are educated on the proper methods of sediment and erosion controls. Many states and municipalities do not have the resources to provide a sufficient number of reviewers to implement an effective construction reviewer program. Some local governments have adopted programs to certify third party inspectors to conduct site inspections and report to the local authority. In most cases, the cost for providing inspectors is paid for by the contractor or developer. These third party reviewer programs have proven successful at reducing the workload for the agencies in charge of construction inspections and reducing downtime for developers.

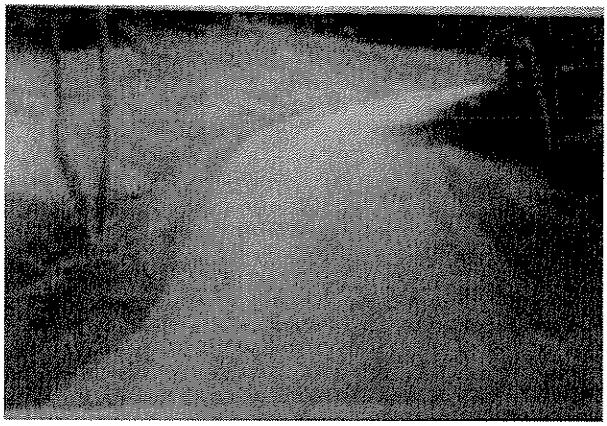
Construction Road Stabilization

Benefits:

- *Properly located and stabilized construction roads can significantly reduce on-site erosion during construction.*

Limitations:

- *For rural areas of low traffic volume.*



Costs:

- *Costs vary and depend on the materials used for road stabilization. With proper grading and stabilization with stone, a contractor can save money by reducing erosion, avoiding dust problems, and improving overall efficiency of the construction operation.*

Discussion:

Ensure that construction routes follow the natural contour of the terrain where possible. Avoid steep slopes, excessively wet areas, and highly erodible soils. Controlling surface runoff from the road surface and adjoining area is a key erosion control consideration. Construction traffic routes are especially susceptible to erosion because they become compacted and rutted and collect and convey runoff water along their surfaces, often at erosive velocities. Provide surface drainage and divert excess runoff to stable areas. This practice is also applicable to logging roads, travel lanes, access roads, etc.

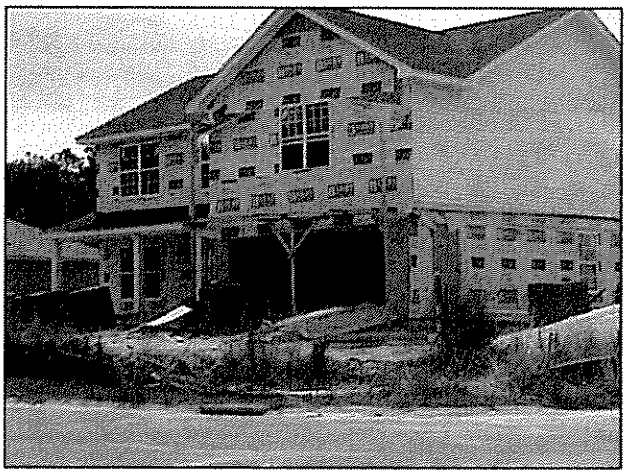
Construction Sequencing

Benefits:

- *Construction sequencing helps prevent erosion and sediment problems from occurring. Construction sequencing can provide erosion control by planning in advance to implement management practices when and where appropriate. Construction sequencing can be used during any land disturbance activity.*

Limitations:

- *Weather and contractor/materials availability may cause interruptions in construction schedules.*



Costs:

- *Costs are typically low and include labor costs associated with developing the plan.*

Discussion:

Construction sequencing is a nonstructural practice involving a planned work sequence to coordinate the timing of disturbance activities and installation of control practices. Key runoff points are identified, existing vegetation to be preserved is identified, and the most effective BMP methods are identified. Costs associated with this measure are typically low and include labor costs associated with developing a written plan for the coordination of construction activities and stormwater management practices.

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Contractor Certification And Inspector Training

Benefits:

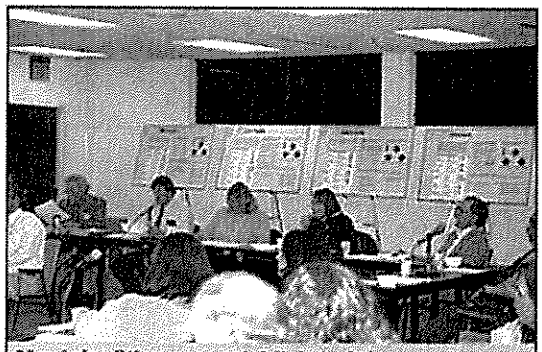
- *Contractor education can result in improved awareness of stormwater management programs and procedures. Inspector training can help enforce compliance and reduce the burden on local agencies.*

Limitations:

- *Contractor and inspector training and certification programs require considerable effort on the part of the regulators or government agencies concerned.*

Costs:

- *Costs are minimal but may include costs associated with time and with training materials.*



Municipalities can establish training programs to educate contractors about erosion and sediment control practices

Discussion:

One of the most important factors to successfully implementing construction site stormwater management controls is the knowledge and experience of the contractor. Contractor certification programs that require contractors to meet education requirements for supervisory personnel are often used to provide the knowledge necessary to implement a successful stormwater management at their construction sites. Many municipalities utilize construction inspectors to ensure that the appropriate stormwater control measures are being utilized at construction site. Training and education for inspectors is essential to the performance of their duties as well. Inspectors are typically employed by the contractor to provide routine inspection of stormwater management systems at construction sites. Contractor certification and construction inspector programs can be built-in requirements of erosion and sediment control programs for permitted land disturbance and construction projects. Contractor certification and inspector training programs will require the development of the curriculum for training courses, staff to teach the courses, and staff to review reports and inspect sites to ensure contractors and inspectors are complying with the erosion and sediment control program.

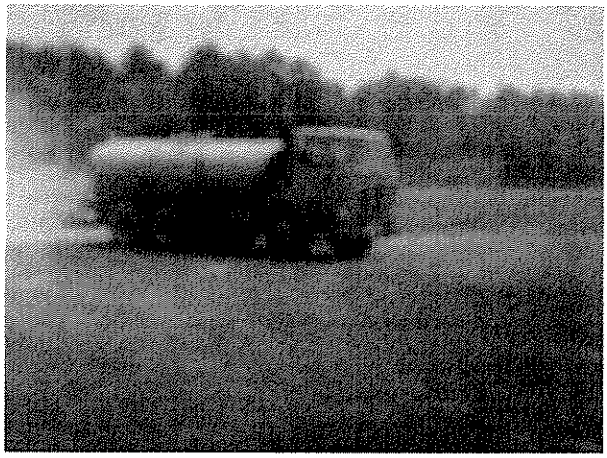
Dust Control

Benefits:

- *Provides immediate protection in dry areas.*

Limitations:

- *Must be periodically applied and is not a long term solution.*



Costs:

- *Costs vary and depend on the size of the construction site, method used and weather conditions.*

Discussion:

Large quantities of dust can be generated during land grading activities for commercial, industrial, or subdivision development, especially during dry, windy weather. In planning for dust control, it is important to schedule construction activities so that the least area of disturbed soil is exposed at one time. Install temporary or permanent surface stabilization measures immediately after completing a land grading unit. For disturbed areas not subject to traffic, vegetation (temporary or permanent) provides the most practical and effective means of dust control. Other control measures include mulching, sprinkling, spraying adhesive or calcium chloride, wind barriers, and surface roughening by tillage. Maintain dust control measures properly through dry weather periods until all disturbed areas have been permanently stabilized.

Filter Berms

Benefits:

- *Filter berms can be an effective method for removing sediments from runoff if properly implemented. Filter berms can slow runoff and encourage sheet flow of runoff.*

Limitations:

- *Filter berms are temporary measures and do not have a long life span. They require regular maintenance in areas where inputs of mud and sediments are high. They are not intended for use on steep slopes or for areas with high velocity flows.*

Costs:

- *Costs for filter berms are typically low and will depend on size and availability of materials. Costs for labor to construct and maintain the practice are the majority of the costs.*

Discussion:

Filter berms are typically gravel or stone ridges that are designed as temporary methods to slow stormwater flow from traffic areas (roadways). Filter berms allow sediments to settle or be filtered out of runoff. Berms should be spaced across a slope according to the steepness of the slope (spaced closer together for steeper slopes) and are intended for use on gently sloping areas. Berms should be inspected after each storm and must be replaced once sediments build up in the voids. Failing filter berms can actually increase erosion and can concentrate flows at the point of failure.

General Construction Site Waste Management

Benefits:

- *Waste management is applicable to all construction sites and is easily and inexpensively implemented. Waste management can achieve reductions in pollutant sources before they are carried away by stormwater runoff.*

Limitations:

- *Time will be required for employee training and for supervisory inspections to ensure that waste management practices are being followed at a work site.*

Costs:

- *Costs associated with site waste management are relatively low. Some costs will be incurred to train employees and inspect site.*

Discussion:

Construction site waste management involves proper use, storage, and disposal of surplus and waste building materials such as concrete and demolition debris, etc., and hazardous materials such as fuels, lubricants, and paint products. Construction wastes can pose a potential threat to the general environment, which includes the threat of impacts to water quality from material transported from construction sites by stormwater runoff. Effective waste management programs require employee training and supervision to ensure that storage, handling, and disposal requirements are being adequately met. Frequent inspections of waste storage and disposal areas should be conducted to ensure proper procedures are being followed.

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Geotextiles

Benefits:

- *Geotextiles can aid in stabilizing disturbed soils and in establishment of permanent vegetative cover. Geotextiles can provide greater protection than vegetation alone in areas of high velocity runoff such as channels.*

Limitations:

- *Some types of geotextiles (non-biodegradable) may ultimately need to be removed and disposed of. Improper installation can cover up erosion underneath the fabric.*

Costs:

- *Costs for geotextiles vary depending on the type of materials chosen and can range from $0.50 to $10.00 per yd^2 (Source- SWPRC, 1991). Costs for installation will vary depending on site conditions. Maintenance costs will include regular inspection and costs will depend upon type of material chosen and whether it will need to be removed.*

Discussion:

Geotextiles are porous fabrics used to stabilize disturbed soils. Geotextiles are often used to aid in the establishment of vegetation by holding seeds, fertilizers, and soils in place and by providing protection from the forces of winds, rains, and runoff. Geotextiles are typically constructed of woven or bonded materials. Some use synthetic materials such as polypropylene, polyester, nylon, polyvinyl chloride, glass, and various mixtures of these materials. Some use biodegradable materials such as mulch matting constructed by binding wood, paper, cotton, or coconut fibers into sheets. Geotexfile matting can be used in place of mulch and is useful for aiding in establishment of vegetation on highly erosive surfaces such as steep slopes and stream channels. Geotextile netting can be used to hold matting and mulch in place. Geotextiles can also be used as temporary cover for erosion control, as well as an intermediate layer between riprap and soil to prevent soil from eroding from underneath the riprap. One limitation associated with geotextiles are that improperly applied matting that does not maintain contact with the soil may allow for erosion underneath and away from view. Additionally, some synthetic geotextiles may need to be removed and disposed of eventually. Costs for geotextiles are low to moderate but require labor costs for installation and inspection.

Gradient Terraces

Benefits:

- *Gradient terraces can reduce erosion of disturbed soils by redirecting runoff away from steep slopes and onto stabilized outlets. Gradient terraces can slow runoff across a site.*

Limitations:

- *Gradient terraces are not useful for slopes that are excessively steep or for soils that are sandy, rocky, or shallow. Gradient terraces are not effective if adequate outlets are not provided.*

Costs:

- *Costs are low and typically involve labor and equipment to construct and maintain terraces.*

Discussion:

Gradient terraces are earthen embankments or ridge-and-channel systems that are designed to reduce erosion from steep slopes by redirecting stormwater flow. Careful design is essential to the success of gradient terraces. Planning must take into account the outlet points for stormwater, as well as adequate spacing and ridge height. Soils that are sandy or rocky are not suited for this measure. Gradient terraces are useful in areas where high erosion rates are expected and where vegetation establishment is not possible. Gradient terraces can direct stormwater flow from unvegetated areas to areas where vegetation can provide filtration and velocity reduction for sediment-laden runoff.

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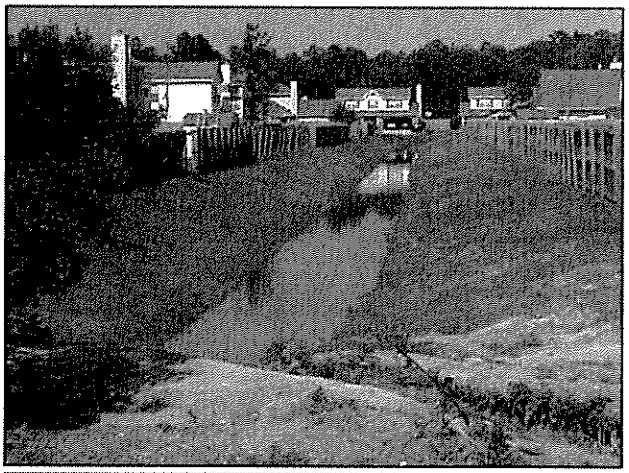
Grass-Lined Channels

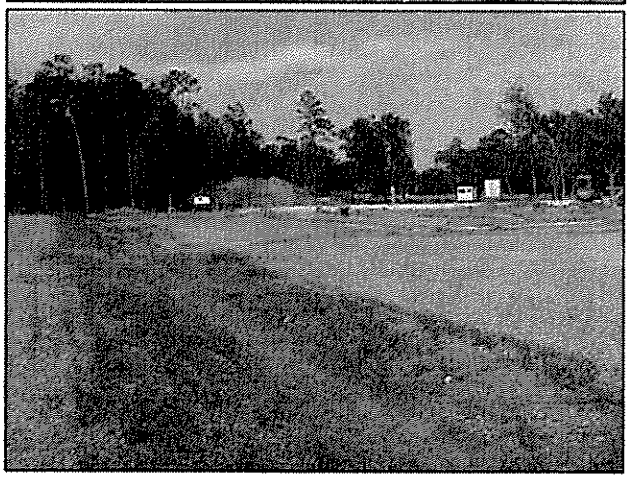
Benefits:

- *Grass-lined channels provide stabilization of channel soils, slow runoff, provide for settling of sediments, and increase infiltration.*
- *By providing a stabilized method for conveyance of stormwater runoff, grass-lined channels can reduce the need for additional downstream management and treatment measures.*
- *Grass lined channels are aesthetically pleasing.*

Limitations:

- *Grassed channels primarily provide transport of runoff and can be used along with additional stormwater management practices in order to provide improved pollutant removal efficiencies.*
- *Improper design can cause elevated velocities and volumes of runoff resulting in changes in hydrology of receiving waters as well as failure and erosion of the channel.*
- *Establishment and maintenance of a dense growth of vegetation may require regular inspection and some maintenance in the beginning.*





Costs:

- *Costs are typically lower than other methods of stabilization, but will vary according to size and methods used for establishment of vegetation.*
- *Maintenance costs typically consist of mowing and removal of accumulated sediments and debris.*

Discussion:

Grass lined channels use established vegetation for erosion control, velocity reduction, water quality improvement, and infiltration. This measure is useful for directing stormwater flow around or across a site, thus reducing gully erosion and sediment levels in runoff. Grass lined channels are often used to convey runoff to other BMPs, thus providing a pretreatment measure. Grass-lined channels are also aesthetically pleasing. Grass-lined channel should not be used where slopes are steep (>5%) or where flow rates are high (>5 ft/second).

EPA Stormwater Phase II
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Land Grading

Benefits:

- *Land or site grading is useful for reducing steep slopes and is useful in planning for runoff management. Land grading typically requires minimal costs to implement.*

Limitations:

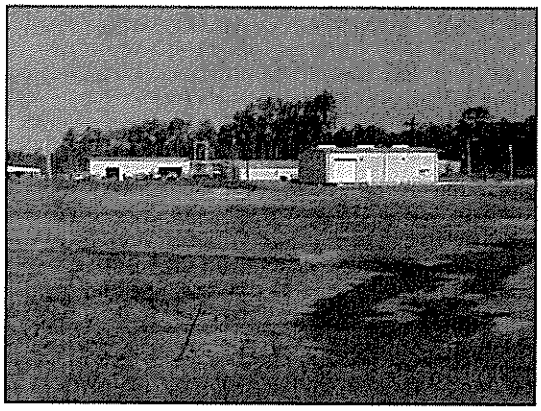
- *Improper grading can disrupt natural stormwater runoff patterns and may cause poor drainage, high runoff velocities, and increased peak flows. Time is required to design grading plans to incorporate stormwater runoff management measures.*

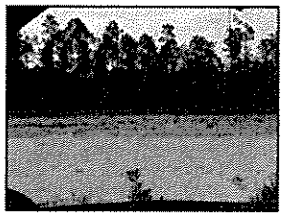
Costs:

- *Costs involve time for planning grading measures to include stormwater management and erosion control, which may result in additional excavation/fill activities to implement.*

Discussion:

Land grading involves reshaping the ground surface to planned grades and currently is a common practice at most construction sites. Land grading is used to provide suitable topography for the intended development and can also be used to aid in the management of stormwater runoff during and after construction. Stormwater flow management should be incorporated into the initial site design and should seek to maintain predevelopment flow patterns and hydrology to the maximum extent practicable. Clearing and grading should be limited to the areas necessary for building activities and equipment traffic.





Lined Waterway Outlet

Benefits:

- *Reduces flow velocities in channels where grass would be ineffective*

Costs:

Riprap is cheaper and less expensive to repair. Costs vary and depend on site requirements.

Discussion:

Where flow velocities exceed allowable limits for grassed waterways, more durable liners such as riprap or paving should be used. Riprap liners are considered flexible and are usually preferred to rigid liners. Riprap is less costly, adjusts to unstable foundation conditions, is less expensive to repair, and reduces outlet flow velocity. Paved channels are preferred where space is limited, slopes are very steep, or the channel setting warrants the use of special paving materials. Care must be taken to see that foundation conditions are stable and high exit velocities can be controlled to protect the receiving stream. Riprap or paved channels can be constructed with grass-lined side slopes where site conditions warrant. Riprap will be installed over the proper filter (geotextile) or bedding unless the soil investigation indicates otherwise.

EPA Stormwater Phase II BMP Inventory

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Model Ordinances

Benefits:

- *Regulatory means to enforce best management practices to improve water quality and reduce stormwater runoff.*

Limitations:

- *Must be enforced with penalties.*

Costs:

- *Costs vary and depend on ordinance requirements. Costs are associated with training employees and with inspection and enforcement.*

Erosion and Sediment Control/Grading Model Ordinance

Section I. Introduction/ Purpose

During the construction process, soil is the most vulnerable to erosion by wind and water. Eroded soil endangers water resources by reducing water quality and causing the siltation of aquatic habitat for fish and other desirable species. Eroded soil also necessitates repair of sewers and ditches and the dredging of lakes. In addition, clearing and grading during construction causes the loss of native vegetation necessary for terrestrial and aquatic habitat and to provide a healthy living environment for citizens of *(Municipality)*.

As a result, the purpose of this local regulation is to safeguard persons, protect property, and prevent damage to the environment and promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land in _____ *(Municipality)*.

Section II. Definitions

Certified Contractor - A person who has received training and is licensed by _____ (*state or local environmental agency*) to inspect and maintain erosion and sediment control practices.

Clearing - Any activity that removes the vegetative surface cover.

Drainage Way - Any channel that conveys surface runoff throughout the site.

Erosion Control - Measures that prevents erosion.

Erosion and Sediment - A set of plans prepared by or under the direction of a licensed professional engineer.

Control Plan - indicates the specific measures and sequencing to be used controlling sediment and erosion on a development site both before, during and after construction.

Grading - Excavation or fill of material, including the resulting conditions thereof.

Perimeter Control - A barrier that prevents sediment from leaving a site by filtering sediment-laden runoff or diverting it to a sediment trap or basin.

Phasing - Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.

Sediment Control- Measures that prevent eroded sediment from leaving the site.

Site - A parcel of land or a contiguous combination thereof, where grading work is performed as a single unified operation.

http://www.stormwatercenter.net/Model%20Ordinances/erosion_model_ordinance.htm

Discussion:

Municipalities can adopt model ordinances in order to establish requirements for utilization of recommended stormwater management practices. These local regulations are intended to safeguard the public, protect property, and prevent damage to the environment. Ordinances can require permit submittal and approval for land disturbing activities, stormwater management plans, specific design requirements, inspections, and enforcement. Site inspection and enforcement actions are often essential to ensure the effectiveness of ordinances. Ordinances must clearly define the roles and responsibilities of each involved agency to ensure the goals set forth in the ordinances are achieved.

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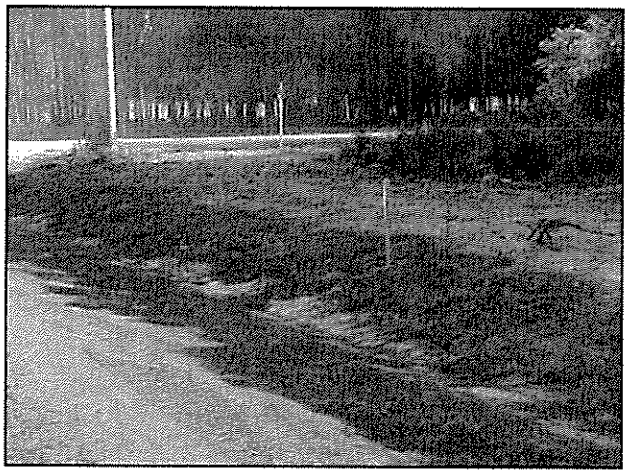
Mulching

Benefits:

- *Mulching is a low cost method of soil stabilization. Mulches can provide stabilization of soils and prevent erosion during seed stabilization. Mulching can be used for temporary protection of disturbed soils. It provides immediate protection to soils that are exposed. It also helps retain moisture.*

Limitations:

- *Mulching may be washed away during storms. Mulching must be maintained and periodically replaced if intended for use as long term soil stabilization. Mulching is a temporary method used until permanent cover is established. Mulching may delay seed germination due to reducing soil surface temperatures.*



Costs:

- *Costs for mulching will depend upon materials used. Maintenance requirements and costs may vary according to slope, soil types, and rainfall. USEPA estimates costs for seed and mulch to average $1,500/acre.*

Effectiveness:

- *Use of mulch varies according to material used. Mulch has been shown to reduce soil erosion from 53 to 99.8 percent over bare soil and to reduce water velocity from 24 to 78 percent.*

Discussion:

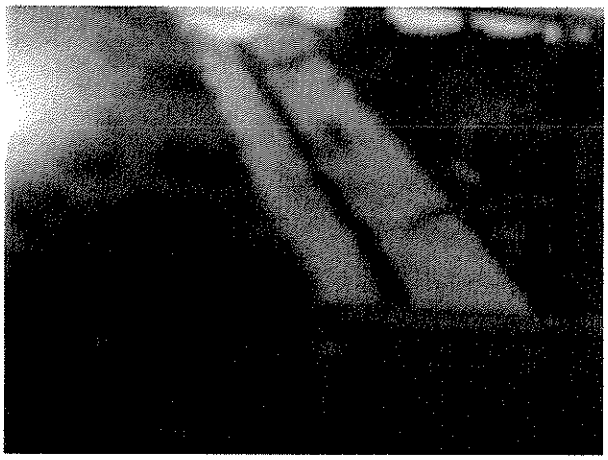
Mulching is a temporary erosion control practice in which materials such as grass, hay, wood chips, wood fibers, straw, or gravel are placed onto exposed or recently planted soils. Mulching is most often used in conjunction with revegetation measures such as seeding. Mulch can aid in holding seed, soil moisture, and fertilizer in place during establishment of vegetation. Mulch materials may be applied loose or formed into mats for greater stability. Mulch matting can be anchored in place and can be constructed completely of biodegradable materials. Matting application on slopes requires secure contact to the soil to avoid erosion underneath the mating. Netting can be used to hold loose mulch in place; however, non biodegradable materials may need to be removed eventually.

CS-20

Paved Flume

Benefits:

- *Can be readi;y installed in most locations*
- *Offer large freeboard capacity at a low cost*
- *Less subject to failure from blockage then closed drains*
- *Require little maintenance*



Costs:

- *Costs vary and depend on site conditions.*

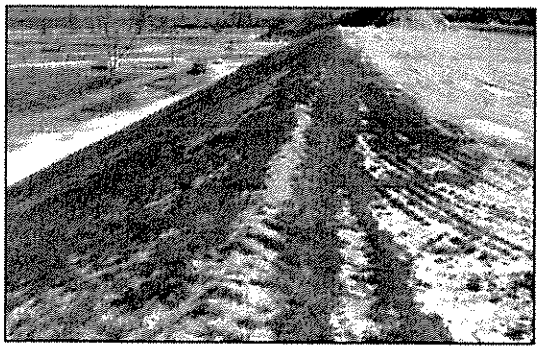
Discussion:

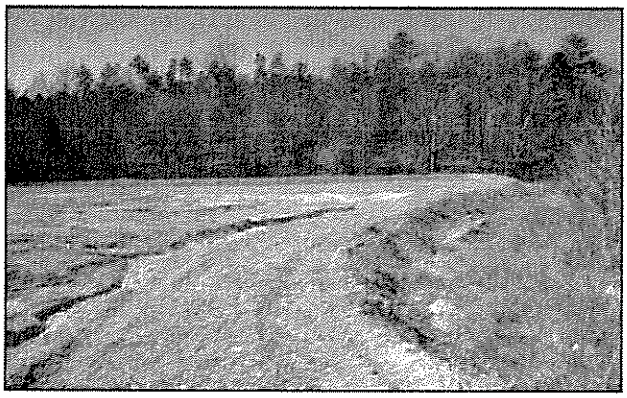
Paved Flumes are small concrete-lined channels designed to convey storm runoff down steep slopes. They are part of the permanent erosion control system for the development. In planning paved flumes, give special attention to flow entrance conditions, stability of the foundation, outlet energy dissipation, and freeboard capacity. The upper portion of the side slopes may be grassed to improve appearance and reduce cost.

EPA Stormwater Phase II
BMP Inventory

CS-21

Permanent Diversions





Benefits:

- *Diversions can eliminate sources of runoff pollution by redirecting stormwater runoff away from erodible soils or other pollutant sources.*
- *High level of effectiveness.*
- *If planned properly, diversions can be installed during site and land grading activities.*

Limitations:

- *Stormwater diversion berms must be stabilized to avoid erosion of the channel and may require additional time and labor for design, construction, and maintenance.*
- *Diversions concentrate stormwater runoff necessitating a stable outlet.*

Costs:

- *Costs for diversions are generally low and would include design, construction, and maintenance.*

Discussion:

Permanent diversion berms and structures control stormwater runoff by using a channel and an earthen ridge to divert flow around areas sensitive to erosion. Diversions are most often constructed of earthen materials with vegetative cover and are best used with channel linings such as vegetation or matting. Diversions are typically used wherever the direction and velocity of runoff from up slope areas need to be controlled. Channels must be designed to manage peak storm flow and must be stabilized to prevent erosion of the channels. Design considerations are adaptable to site conditions; however, all designs should provide adequate outlets to manage the concentrated stormwater flows created.