



Johnson County Kansas Erosion Prevention and Sediment Control Field Guide



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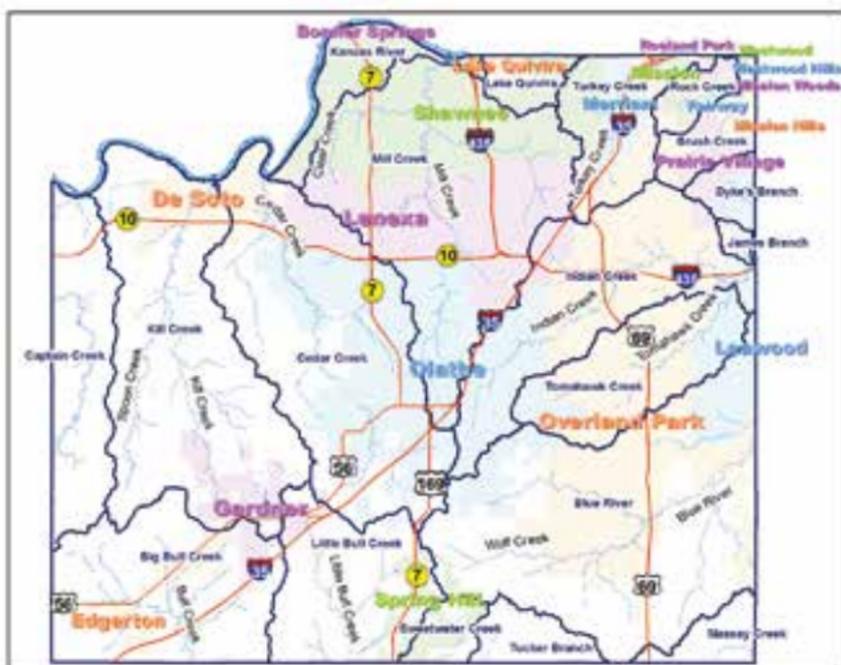
For local permits and regulations concerning erosion and sediment control projects:

De Soto	913-583-1182	Mission Woods .	913-432-1550
Edgerton.....	913-893-6231	Olathe	913-971-9079
Fairway.....	913-722-2822	Overland Park ...	913-895-3195
Gardner	913-856-7535	Prairie Village ...	913-381-6464
Lake Quivira.....	913-631-5300	Roeland Park	913-722-2600
Leawood.....	913-339-6700	Shawnee.....	913-742-6010
Lenexa.....	913-477-7500	Spring Hill.....	913-592-3317
Merriam.....	913-322-5500	Westwood.....	913-432-1550
Mission.....	913-676-8375	Westwood Hills:	913-262-6622
Mission Hills.....	913-362-9620		
Unincorporated Johnson County.....		913-715-8330	

For information about the General Construction Permit and resources contact or visit:

KDHE Industrial Programs Section—Stormwater:
913-296-5545 or <http://www.kdheks.gov/stormwater>

U.S. Environmental Protection Agency- Region 7:
<https://www.epa.gov/npdes/stormwater-discharges-construction-activities#overview>



Clean runoff starts with you.

This *Field Guide* will take you through the erosion and sediment control process. The guide starts out with sections on pre-project planning and operational activities. The rest of the guide discusses erosion prevention and sediment control by starting at the top of the hill, above the project site, and proceeding down the slope through the bare soil area, ditches and channels, traps and basins, and on down to the waterways below. The drawing below summarizes this approach.

Preserve existing vegetation

Divert upland runoff around exposed soil

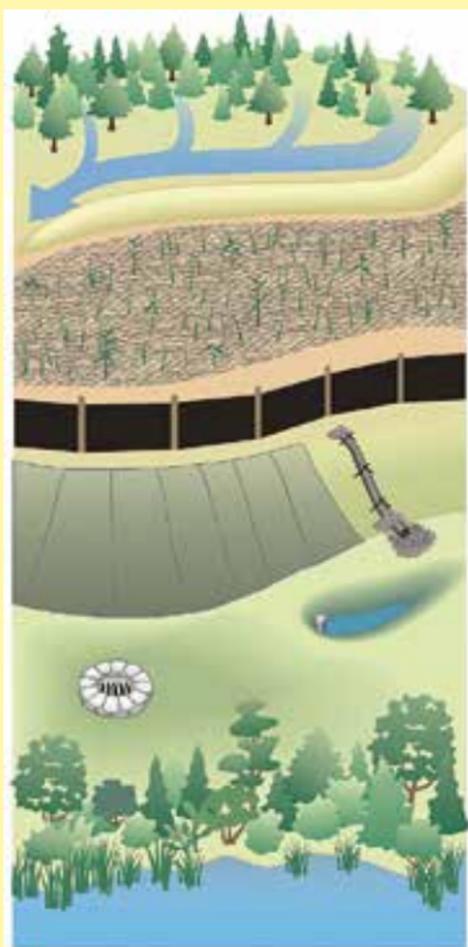
Seed/mulch/cover bare soil immediately

Use sediment barriers to trap soil in runoff

Protect slopes and channels from gullying

Install sediment traps and settling basins

Preserve vegetation near all waterways



Why do we need to control erosion and sediment losses from construction sites?

Sediment washing into streams is one of the biggest water quality problems in Kansas. Sediment muddies up the water, kills or weakens fish and other organisms, and ruins wildlife habitat. It is not difficult to reduce erosion and prevent sediment from leaving construction sites. Follow the basic approach shown above. Sites with steep slopes near waterways need more controls than flat sites farther away.

Observe basic principles such as: 1) Preserve existing vegetation as much as possible; 2) Mulch or seed bare soil immediately for the best and cheapest erosion protection; 3) Use silt fences, brush barriers, or other approaches to pond and filter sediment from runoff; 4) Install silt check dams made of rock, brush, or other products to prevent ditch erosion and remove sediment; 5) Protect inlets and outlets; and 6) Settle out soil particles in sediment traps and basins.

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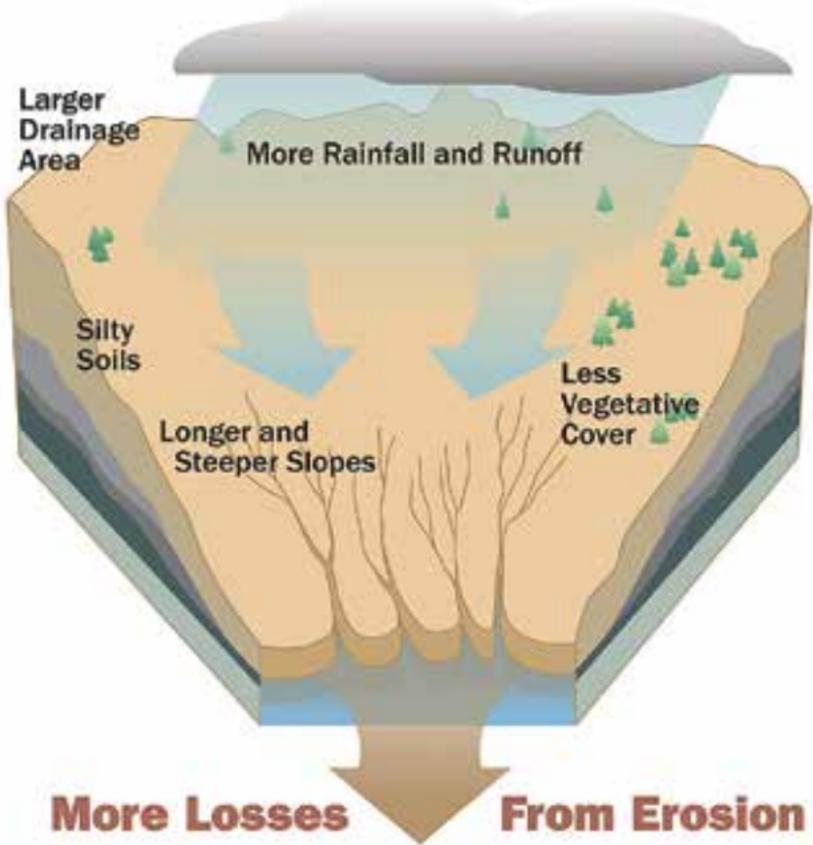
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- Storm water permits
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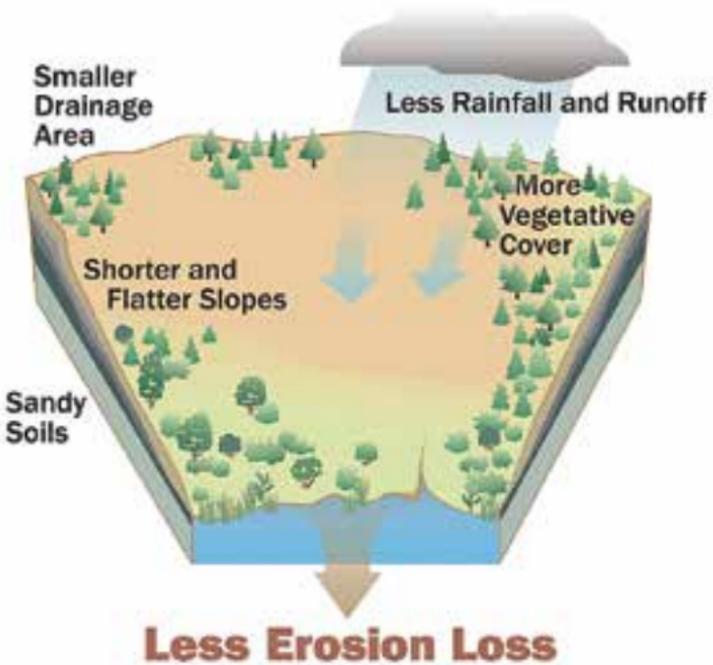
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What contributes to erosion?



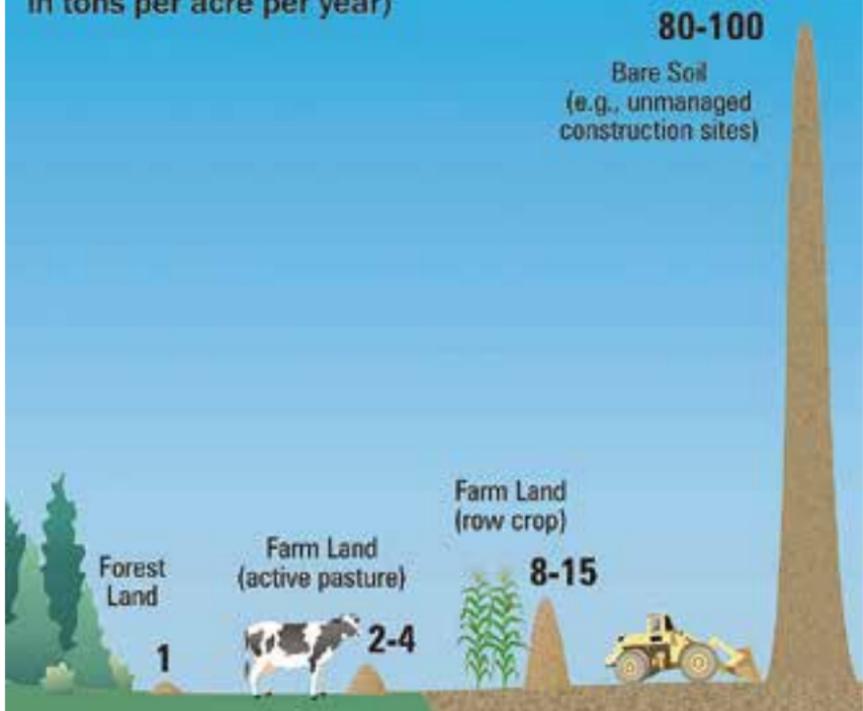
Factors influencing erosion. Heavy rainfall, steep slopes, removal of most existing vegetation, and erodible soils result in higher soil losses from erosion.



Lower rainfall amounts, flatter slopes, preserving existing vegetation, and less erodible soils result in lower soil losses from erosion.

Typical erosion rates for land-based activities

(soil loss from various land areas, in tons per acre per year)



What contributes to erosion?

- Removing vegetation
- Removing topsoil and organic matter
- Reshaping the lay of the land
- Exposing subsoil to precipitation
- Failure to cover bare soil areas
- Allowing gullies to form and grow larger
- Removing vegetation along stream banks

What other factors affect erosion?

Rainfall frequency and intensity

Slope (steep = more; flat = less)

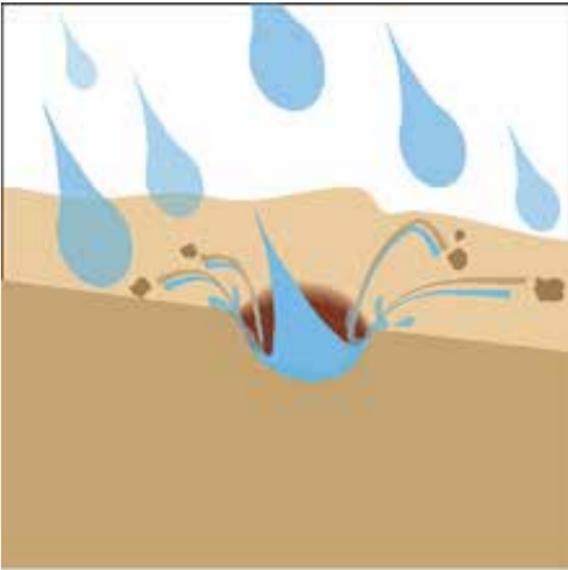
Soil structure and type of soil (silty = more erosion)

Vegetation (more vegetation = less erosion)

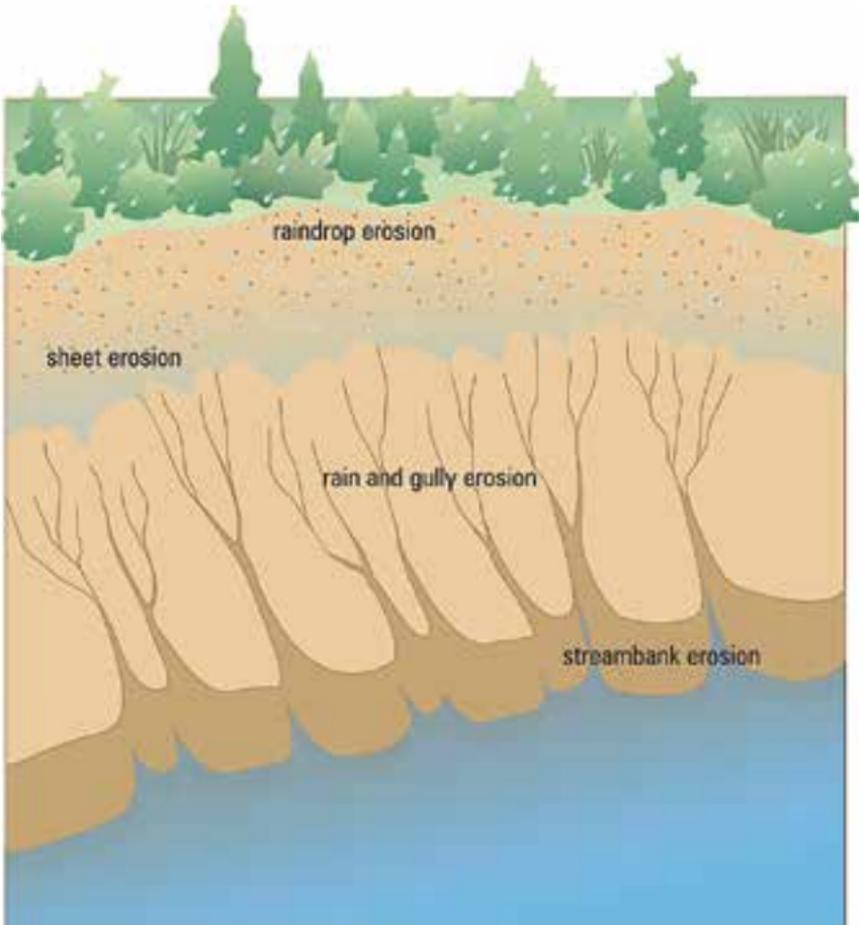
Erosion and sediment controls for muddy runoff:

- Soak it in—maximize seeding and mulching
- Slow it down—don't let gullies form
- Spread it around—break up concentrated flows
- Settle it out—use sediment traps and basins

Types of Erosion



Types of erosion. Raindrop erosion (top) breaks down soil structure. Slope runoff creates sheet erosion, which can lead to the formation of small rill channels and larger gullies (below). Erosion of unprotected stream banks can be caused by removing vegetation and higher flows caused by runoff from pavement, sidewalks, and roofs in newly developed areas.



Pre-Construction Planning

Planning your construction project can help you avoid costly mistakes in controlling erosion and sediment loss to nearby waterways. Follow the steps below before you begin clearing, grading, and excavation work. If your project is one acre or larger, you will need a storm water permit from the Kansas Department of Health and Environment (785-296- 5545, or www.kdhe.gov/stormwater). Download a copy of the state general permit at:

http://www.kdheks.gov/stormwater/download/KDHE_Construction_SW_Permit_Packet_8-1-2017.pdf

Assess soils and slopes on the construction site

If your construction site has highly erodible soils and steep slopes, you will need maximum erosion and sediment control protection. See the table below.

Need for erosion and sediment controls for various slope and soil conditions

Slope Angle	Soil Type		
	Silty	Clays	Sandy
Very Steep (2:1 or more)	Very high	High	High
Steep (2:1–4:1)	Very High	High	Moderate
Moderate (5:1–10:1)	High	Moderate	Moderate
Slight (10:1–20:1)	Moderate	Moderate	Lower

Identify nearby streams and drainage control points

Walk over the site and find where ditches or other concentrated flows leave the site. These are the final sediment control points. Sediment traps or basins should be installed just above these control points. Your site may drain to an underground storm sewer system. In this case, the storm drain inlets that drain runoff from your site are the control points and must be protected (see Section 7). These are also the compliance points for any permits issued for the site. Low spots—where rain water ponds—are good places for sediment traps (see Section 9).

Install clean water diversions, sediment traps/basins, grassed ditches, silt check dams, and sediment barriers such as silt fences *before* clearing and excavation work begins!

Preserve existing vegetation wherever possible

Only dig or grade where necessary. Existing trees, bushes, and grass help keep erosion to a minimum. Protect large trees by marking off a no-dig root protection zone that is twice as large as the outer perimeter of the branches. Plan your project to limit the amount of bare soil area exposed to the weather, and limit the amount of exposure time. Do not clear vegetation or excavate areas near streams, rivers, lakes, or wetlands without getting the required local, state, and federal permits.

Design projects to fit the lay of the land

Minimize clearing and grading to preserve mature vegetation and save money. Identify natural landscape features you want to keep, like large trees, wildflower areas, grasslands, streams, and wetlands. Plan ways to fit your project around these features, so they remain in place after construction is completed. Be sure to mark off these areas with colored ribbon or stakes and warn equipment operators of their location!

Minimize impervious surfaces

Keep the amount of roof area, parking lots, driveways, and roads to a minimum. Design these hard surfaces so that rain water they collect is directed onto landscaped or yard areas, not into ditches or streams. For example, design roads slightly higher than adjacent lawn areas, and use rain infiltration ditches (swales) rather than curbs along roadways. Porous pavement can also help soak up runoff.

Promote infiltration in project design

Moving storm water runoff from hard surfaces to landscaped or yard areas helps runoff soak into the soil. This promotes groundwater recharge, filters sediment and other pollutants from runoff, and helps to prevent flooding.



Develop Stormwater Pollution Prevention Plan (SWPPP)

If your construction site is one acre or more, a general stormwater permit must be obtained from the Kansas Department of Health and Environment (KDHE) and a stormwater pollution prevention plan or SWPPP must be prepared and filed with the state. The erosion and sediment control plan, developed as a part of the SWPPP, should show the drainage patterns and slopes, areas of disturbance (cuts/fills, grading), location of erosion and sediment control best management practices (BMPs), location of surface waters and wetlands, and the location of stormwater drainage control points for your site. This plan must include **all** BMPs to be employed on the site, including concrete washout sites, portable toilets, and waste dumpsters. The plan also must be updated as site conditions change.

Contact the local city or county where your site is located to determine if there are additional requirements related to erosion and sediment control **before** beginning any work. See contact information on inside cover of this manual.

Prioritization of erosion and sediment controls for construction sites

Practice	Cost	Effectiveness
Limiting disturbed areas through phasing	\$	
Protecting disturbed areas through mulching and revegetation	\$ \$	
Installing diversion around disturbed areas.	\$ \$ \$	
Sediment removal through detention of all site drainage	\$ \$ \$ \$	
Other structural controls to treat sediment-laden flow	\$ \$ \$ \$ \$	

The cheapest erosion and sediment controls are the most effective. For example, limiting the amount of bare soil by phasing your project and preserving existing vegetation are less expensive and work better than installing large storm water control basins or ponds.

Other Pollutants

In addition to sediment, other pollutants must also be controlled on a construction site. Some common pollutants requiring BMPs include, but are not limited to, concrete washouts, mechanical fluids, paint, stucco, and trash. Refer to the state of Kansas General Construction permit (www.kdheks.gov/stormwater) for requirements regarding other pollutants on site.



Use of a designated concrete washout is required. Wastewater from other activities (stucco, drywall and paint) also needs to be properly disposed of.



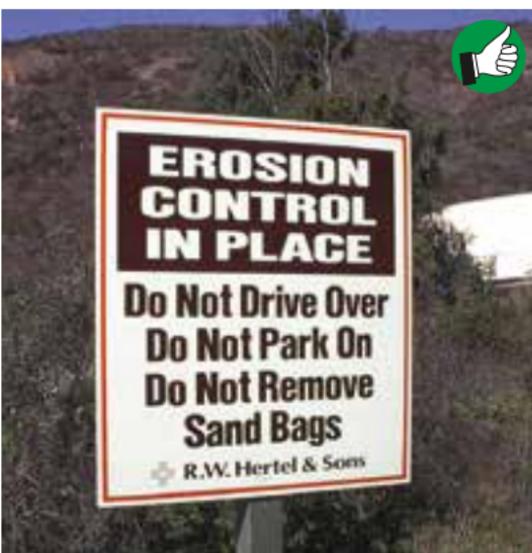
Good housekeeping practices are important to keep trash and debris from blowing or washing into the stormwater system. A dumpster or other containment needs to be available on all sites.



Limiting the amount of bare soil exposed to the weather by working in phases reduces erosion and sediment control expenses.



Preserving existing vegetation at the site makes the final development more attractive and saves money by reducing clearing, excavation, and erosion control expenses.



Erosion and sediment controls are required for all construction sites one acre or larger under new federal, state, and local regulations. Storm water pollution prevention plans (also called SWPPPs) must be filed before the project begins. Permit coverage is also required before clearing, grading, or other cut/fill activities start.



Storm water pollution prevention plans (SWPPPs) and KDHE permit coverage are required for all construction sites one acre or larger. Plans must be kept on site and available for inspection.



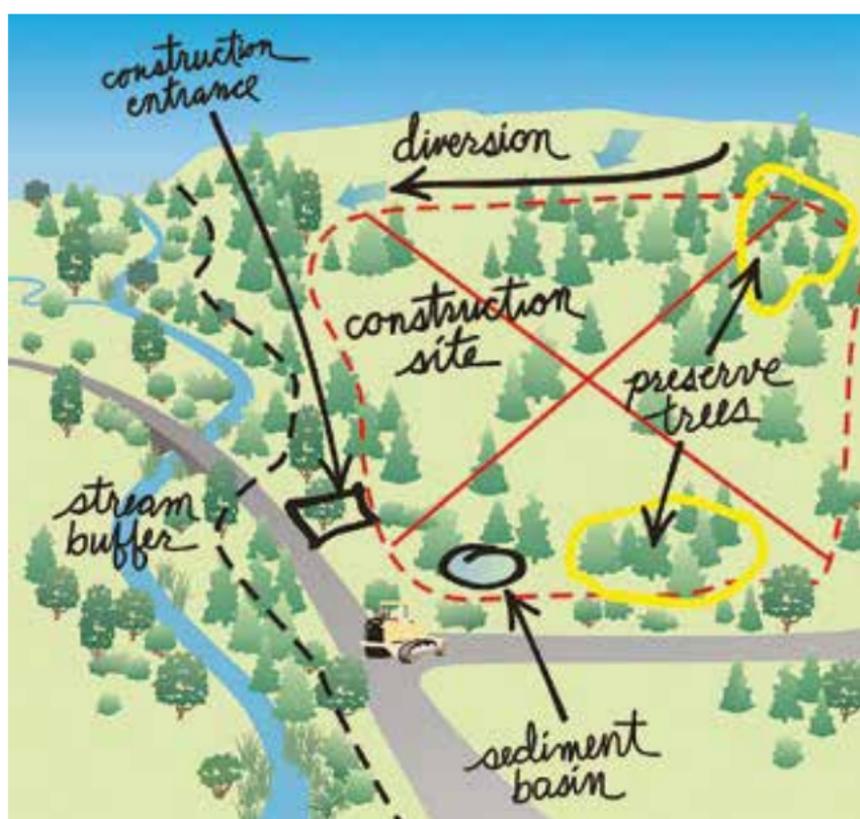
Providing primary and secondary containment for fuel and other hazardous materials at the work site helps prevent problems. Controlling non-storm water runoff, trash and other wastes, and post-construction runoff are also required under the storm water permit program.



Construction Phase Operations

Divide your construction site into natural drainage areas, so you can deal with each one individually. You will be controlling erosion on bare soil areas by applying seed, mulch, or sediment filters, and minimizing the time bare soil is exposed to the weather. Control points for sediment in runoff will be at the curb inlets or in the ditches, channels, or sediment traps/basins installed where concentrated flow leaves the site.

Install clean water diversions, sediment traps/basins and stabilize drainage channels with grass, liners, and silt check dams *before* excavation, fill, or grading work begins (see Sections 8 and 9). Install silt fences and other sediment barriers downhill from bare soil areas before clearing or excavation work begins (see Section 5).



Identify drainage areas and drainage ditches and channels. Install diversions, grassed channels, sediment traps/basins, downslope sediment barriers, and rock construction entrance before beginning work.

Phase your construction work to minimize exposed soil areas

Excavate or place fill material at the site in stages, to avoid exposing large areas of bare soil to the elements. Establish final grade quickly, then seed, mulch, or cover bare soil. Require utilities and subcontractors to grade their work sites and seed, mulch, or cover excavated areas promptly. You should require subcontractors to sign a

form assuring compliance with your erosion and sediment control plan if their work is covered under your permit.

If work will proceed over several weeks or months, apply temporary seeding or mulch until final grade work is completed. **State of Kansas regulations require immediate stabilization of bare soil areas that will not be worked for 14 days.**

Excavation and grading work should be done during dry weather if possible. Prepare for rainy weather forecasts by making sure sediment controls are in place and that mulch or grass is on bare areas that are at final grade.



Construction entrance detail. Entrance/exit pad must keep mud from tracking onto paved roads.

Install construction entrances and control dust

Mud tracked onto paved roads is the number one complaint from citizens regarding construction site operations. Consult local regulations for appropriate rock size for entrance/exit pads leading to paved roads. Pads should be 20 feet wide, 50 feet long, and 6" thick. Install filter fabric under the rock to keep it from sinking into the soil below. Rake rock with a grubbing attachment or add new rock if the pad fills with sediment.

Control dust during hot, dry weather by seeding or mulching bare areas promptly, wetting haul roads as needed, or applying approved chemical soil binders.



Rock pad was installed properly with right sized rock, but lack of filter fabric underliner is causing rock to spread and sink into the soil. Note tracking of mud onto paved road. Mud tracked on roadways violates BMP standards, and is a potential legal liability.



Rock sizing, placement, and pad sizing are good, but sediment from unprotected slopes and ditches is washing onto paved highway. Serious liability issue.



Poor construction entrance. Rock pad is poorly constructed; rock is too small. Use filter fabric under rock and larger sized rock, such as #2. No mud should be tracked onto paved roads open for traffic.

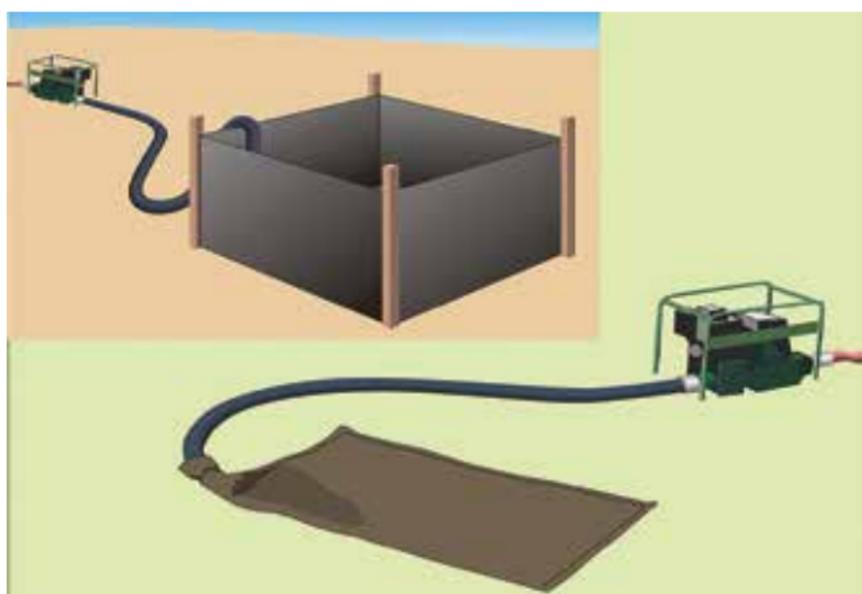


Rock sizing and placement look OK for a residential site, and very little mud appears on the pavement. The pad is a little thin, however, and it looks like some drivers are not using it—note track marks near curb.

Dewatering operations and discharges

Muddy water pumped from collection basins or other areas must not be pumped into storm sewers, streams, lakes, or wetlands unless sediment is removed prior to discharge.

Use sock filters or sediment filter bags on discharge pipes, discharge muddy water into silt fence enclosures installed in vegetated areas away from waterways, or discharge muddy water into a sediment basin. Remove accumulated sediment after water has dispersed and stabilize or seed the discharge area. Dispose of sediment in areas where it won't wash into waterways, then grade the area and seed.



Pump muddy water from dewatering operations away from waterways into a silt fence enclosure or use a bag filter or other device to remove sediment. Allow discharge to soak into the ground if possible. Do not pump discharger from dewatering operations into curb inlets, storm sewers, creeks, lakes, or rivers.

Inspection and maintenance of erosion and sediment controls

For sites one acre or larger, local, state and federal regulations require that you inspect and repair/replace silt fences, vegetated buffers, berms, silt check dams, channels, and other erosion and sediment controls regularly (see local regulations) and after rainfall of 0.5 inch or more within a 24 hour period. Remove accumulated sediment from behind silt fences before it reaches $\frac{1}{2}$ the silt fence height. Remove sediment from pipe or curb inlet ponding dams or filters as it accumulates. Clean mud off paved roads immediately. Your inspection reports must be in writing, and kept on file at the site.

Silt check dams in ditches and sediment traps/ basins also require periodic sediment removal. Remove sediment from traps and basins when 20% of capacity is filled with sediment (KDHE). Dispose of removed sediment in areas where it will not wash into waterways. Seed or mulch bare soil areas as soon as possible. Keep written records of these inspections, including dates, observations and corrective actions taken, with your erosion and sediment control plan and *Storm Water Pollution Prevention Plan (SWPPP)*. See Section 5 for information on installing and maintaining overland sheet flow sediment filters. See Sections 7, 8, and 9 for information on handling concentrated flows in ditches, channels, and other areas.

Diverting Upland Runoff Around Exposed Soils

Keep clean upland runoff from flowing through your construction site, or route it through stable ditches so it won't get muddy. Below are some simple approaches for dealing with uphill sources of runoff.

Diversion berms

A diversion berm is a long, mounded “collar” of compacted soil located uphill from the excavated area. The berm is designed to intercept overland runoff and direct it around the construction site. This prevents “clean” water from becoming muddied with soil from the construction site. Berms can be temporary or permanent landscape features of the site.

Berms should be located so that storm water flowing along their uphill face follows a gently sloping path (i.e., less than 5 percent channel slope). Turf reinforcement mats, erosion control blankets, or rock protection might be needed for berms that channel water at a slope of 5 percent or more (see Section 4). Berm side slopes should be 2:1 or flatter, 10 to 14 inches high, and seeded immediately after construction.



Berms and ditches diverting clean upland runoff around construction sites reduce erosion and sedimentation problems. Seed berms and ditches after construction.

Extend the downhill end of the berm so it directs overland flow to areas of thick vegetation or flat surfaces to promote dispersal and infiltration. Seed and mulch (See section 4 – mulch types and applications) berms after construction to minimize erosion.

Diversion ditches

Diversion ditches are similar to berms—they are designed to intercept and divert upland runoff around bare soil areas. Ditches are cut above cleared or fill areas and designed with a gentle slope to carry water away from work areas. Ditches should be 8 to 12 inches deep and seeded. Side slopes should be 2:1 or flatter.

Stabilized, lined ditches can also be used to move upland water through your site without getting muddy. Construct and line “pass-through” ditches before general clearing or grading work begins.

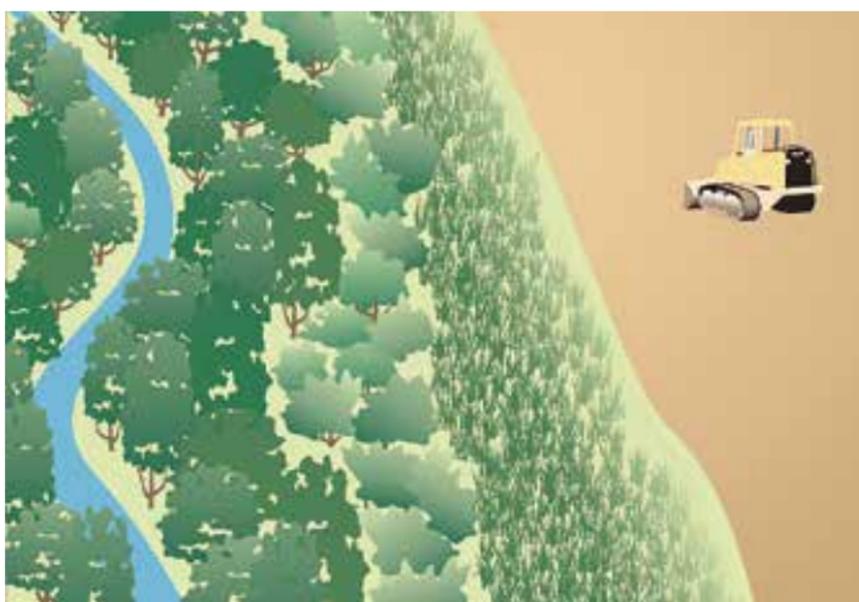
Ditches should discharge to areas with thick vegetation or flat surfaces to promote dispersal and infiltration. Gullies must be repaired as soon as they appear. Ditches with slopes less than 5 percent may be heavily seeded, mulched, and maintained without additional protection if stabilized quickly after construction. Ditches with slopes of 5 percent or more need erosion control blankets, turf mats, or rock liner protection.



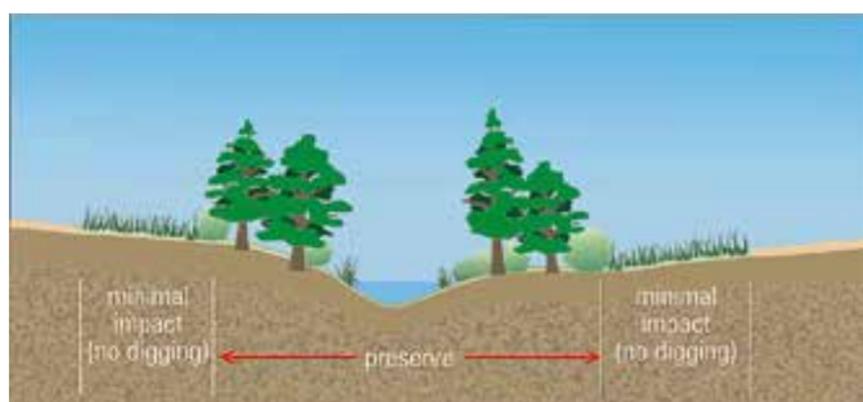
Diversion ditches should be lined with grass at a minimum, and blankets if slopes exceed 10:1 (10%) (see Section 8).

Vegetated buffers

Grass, shrubs, trees, and other vegetation located above or below excavated areas should be preserved if possible. Vegetation above construction sites prevents high volume sheet runoff flows from moving across cut or fill areas. Vegetation below the construction site helps filter and trap sediment before it can move into ditches, channels, and streams. All vegetated areas help to promote infiltration of storm water, which is a key objective in preventing erosion and controlling sediment movement off the construction site. Vegetated buffers along channels, streams, and other waterways should not be cleared.



Vegetated buffers above or below your work site are always a plus. They trap sediment before it can wash into waterways, and prevent bank erosion.



Vegetated waterways help move upland water through or past your site while keeping it clear of mud. Do not disturb existing vegetation along banks, and leave a buffer of tall grass and shrubs between stream bank trees and disturbed areas.



Good construction, seeding, and stabilization of diversion berm. Note that diversion ditch is lined with grass on flatter part of slope, and with rock on steeper part.



Good installation of rock-lined berm to divert rain runoff around residential construction site on steep slope near a river. Diversion ditches can be lined with grass if channel slopes are 20:1 or less, and with blankets or turf mats if they are steeper.



Well built vegetated berm diverting runoff from wooded stream. Diversion berms and ditches should be seeded after construction. Use blankets if slopes are steep.

SECTION 4

Protecting Soils With Seed, Mulch, or Other Products

Seeding or covering bare soil with mulch, blankets, mats, or other products as soon as possible is the cheapest and best way to prevent erosion. **Established grass and vegetation can reduce erosion by more than 90 percent.** Sod, mulch, blankets, and other products can further increase protection (see tables below).

Soil cover requirements

Bare soil in excavated or fill areas must be seeded, mulched, or covered immediately after final grading work is completed. Stockpile topsoil and spread over site prior to seeding. **Bare soil areas must be seeded, mulched, or covered as soon as possible and according to local regulations** when temporary or final grade is established if no work is planned in that area during the following 14 calendar days.

Soil cover vs. erosion reduction

Soil covering	Erosion reduction
Mulch (hay or straw) ½ ton per acre 1 ton per acre 2 tons per acre	75 percent 87 percent 98 percent
Grass (seed or sod) 40 percent cover 60 percent cover 90 percent cover	90 percent 96 percent 99 percent
Bushes and shrubs 25 percent cover 75 percent cover	60 percent 72 percent
Trees 25 percent cover 75 percent cover	58 percent 64 percent
Erosion control blankets	95–99 percent

Seed types and application

Prepare bare soil for planting by disking across slopes, scarifying, or tilling if soil has been sealed or crusted over by rain. Seedbed must be dry with loose soil to a depth of 3 to 6 inches.

For slopes steeper than 4:1, walk bulldozer or other tracked vehicle up and down slopes before seeding to create tread-track depressions for catching and holding seed. Mulch slopes after seeding or cover seed with erosion control blankets or turf mats if slopes are 2:1 or greater.

Conduct a soil test to determine fertilizer needs and fertilize accordingly.

Check seed bag tags to make sure correct seed is used. Mix seed thoroughly prior to loading seeders. Check local requirements for seeding rates and mixes. Apply seed by hand, seeder, drill, or hydroseed. Drilled seed should be ½ inch deep. Mulch immediately after seeding.

Apply more seed to channels, ditches, lawn, and landscaped areas. Apply less seed to areas that are flat or that will not be mowed very often. Water seeded areas during dry conditions to ensure seed germination and early growth. Re-seed areas that do not show growth within 14 days after rain or watering.

Type of Seed	Seeding Dates
Temporary Seeding	
Annual Ryegrass	Anytime
Millet	May 1 - Aug 15 Heat Tolerant
Winter Wheat	Sept 15 - Nov 30 Cold Tolerant
Permanent Seeding	
Cool Season Grasses (Fescue, KY Bluegrass)	Feb 15 – April 20 Aug 15 – Sept 30
Warm Season Grasses (Buffalo)	Nov 15 – June 1
Sod	
Cool Season Grasses (Fescue, KY Bluegrass)	Mar 1 – May 15 Sept 1 – Nov 15
Warm Season Grasses (Zoysia, Buffalo)	April 1 – Oct 15 May 5 – June 30

Protect bare areas during the cold season by sowing winter rye, winter wheat, or mulching. Sow permanent seed when weather permits.

Seed mixes for wildflower and native plant plots are also available. They are more expensive, but are very hardy, require little mowing or watering, and add beauty to landscaped and other areas. Most mixes require mowing only once per year, to control tree and brush growth.



Excellent soil preparation prior to seeding. Seeded development sites erode less, are cleaner, and are easier to market than muddy sites.



Erosion and sediment loss is virtually eliminated on seeded areas (left side). Rills and small gullies form quickly on unseeded slopes (right).



Good mix of sod, seed, and mulch at site of new community center. Note that inlet should be protected by installing a rock or sandbag berm to pond water before it flows into the inlet.



Poor seed establishment on slope. Use erosion control blankets or turf reinforcement mats when slopes are steep and soil quality is poor. Terracing or benching steep slopes also helps.



Poor management of bare soil areas on residential construction site. Temporary or permanent seed or mulch must be applied as soon as final grade is achieved.

Sod application

Sod reduces the potential for erosion to near zero. To install, bring soil to final grade and clear of trash, wood, rock, and other debris. Apply topsoil, fertilizer, and lime if needed.

Use sod within 36 hours of cutting. Lay sod in straight lines. Butt joints tightly, but do not overlap joints or stretch sod. Stagger joints in adjacent rows in a brickwork type pattern. Use torn or uneven pieces on the end of the row. Notch into existing grass.

Anchor sod with pins or stakes if placed on slopes greater than 3:1. Roll or tamp sod after installation and water immediately. Soak to a depth of 4 to 6 inches. Replace sod that grows poorly. Do not cut or lay sod in extremely wet or cold weather. Do not mow regularly until sod is well established.



Sod provides immediate protection around storm drain inlets, on slopes, and other areas.

Mulch types and application

Mulch by itself or applied over seed provides excellent erosion protection (see table). To apply, bring site to final grade and clear rocks, wood, trash, and other debris. Apply seed first. Straw or hay should be hand scattered or blown and crimped. Wood chips, bark, and sawdust should be applied at 5 to 8 tons per acre. Hydromulch or other tackifier should be used on slopes. In general, apply mulch so that at least 80 to 90 percent of the ground is covered.

Mulch product	Benefits	Limitations
Straw or hay	Readily available and inexpensive; very effective in controlling erosion; can be applied on large sites via blower	May carry unwanted seeds; may need tackifier or anchoring, especially on steep slopes; crimp mulch in with dozer or straight-set disk harrow to prevent blow-off
Hydraulic mulches and soil binders	Easily and rapidly applied with sprayer equipment; can include seed, fertilizer, and soil binders; many new products available	May be too expensive for small or very remote sites; must dry for at least 24 hours before rainfall.
Compost	Adds nutrients to the soil; readily available and inexpensive in some locations	Limited erosion control effectiveness; not suitable for steep slopes; may be expensive in some areas
Consult local regulations for application rates.		



Installing sod immediately after grading work is complete can reduce erosion and sediment loss to near zero.



Excellent application of hand-scattered straw mulch in new residential subdivision. Work sites must be seeded and mulched as soon as final grade is established. Crimp mulch into soil with dozer tracking or disk harrows set straight to prevent straw from blowing.



Very good treatment of roadside areas with blown straw after seeding. Straw in roadway must be cleaned up after application.



Excellent soil coverage at stream bank stabilization project using hand scattered straw, jute matting, and erosion blanket.



Good slope protection using hydromulch. Hydromulch contains a paper or wood mulch, tackifier and water. Grass seed can be planted first or included in the mix (hydroseeding). As with any mulch, good coverage is essential.

Erosion control blankets

Erosion control blankets are used to protect steep slopes, drainage ditches, and other areas where erosion potential is high (check product information sheets). Most are designed to provide temporary stabilization until vegetation is established. Blankets degrade within 6 to 24 months, depending on their makeup. They usually consist of a layer of straw, coconut fiber, wood fiber, or jute sandwiched between layers of plastic or fiber mesh. Local regulations may specify type of blanket. Install according to manufacturer instructions.

Blanket installation notes

Grade, disk, prepare seedbed.

Seed, lime, and fertilize the area first, as needed.

In ditches and channels, install horizontally (across slope) starting at ditch bottom.

On slopes install vertically (up & down hill), unrolling from top of hill if possible.

Staple down blanket center line first.

Staple & bury top in 8" deep trench.

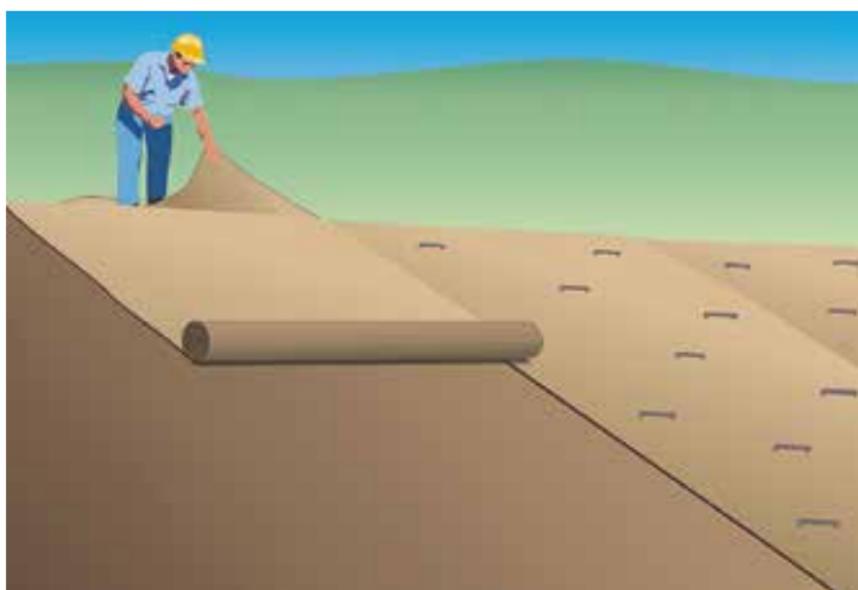
Staple according to manufacturer's instructions.

Staple thru both blankets at overlaps.

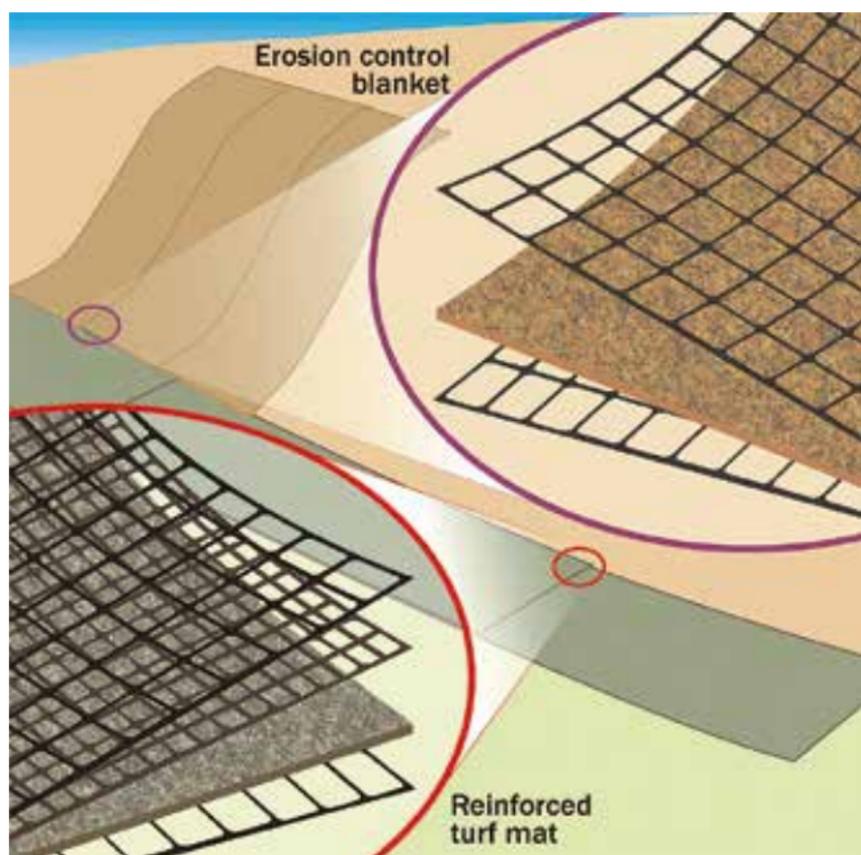
Uphill layers overlap downhill layers.

Before installing blankets, bring soil to final grade and clear of trash, wood, rock, and other debris. Clods will cause blankets to "tent", which could cause erosion under the blanket.

Walk blankets down to ensure good contact with the soil. Use plenty of staples to keep blankets flat. Overlap blankets at 6 to 8 inches on sides, tops, and bottoms. Do not stretch blankets, and do not exceed manufacturer's directions on maximum slope angle for the product.



Install blankets and mats vertically on long slopes. Unroll from top of hill, staple as you unroll it. Do not stretch blankets.



Erosion control blankets are thinner and usually degrade quicker than turf reinforcement mats. Check manufacturer's product information for degradation rate (life span), slope limitations, and installation. Remember to apply seed, fertilizer, and lime before covering with blankets or mats!

Turf reinforcement mats (TRM)

Turf reinforcement mats are similar to erosion control blankets, but are thicker and sturdier because they have more layers and sturdier fill material. Mats provide greater protection than blankets because of their heavier construction, and last longer in the field.

Mats are used for steep slopes and ditches or channels. Mats are installed just like blankets. Additional staking or stapling is needed for applications in channels that carry flowing water, and on steep slopes.

Other engineered products are available that are similar to blankets and mats. For example, bonded fiber matrices and other hydraulically applied products contain a mix of soil binders, mulch fibers, and even seed and fertilizer that can provide a stable crust that cements soil particles and prevents erosion. Apply seed prior to hydraulic mats or mulches, if seed is not included in the mix. Consult the manufacturer's installation instructions for product applicability and installation instructions.



A good example of channel stabilization using different products. The channel, which has higher flow volume and velocity, is lined with a TRM. The sides are stabilized with an erosion control blanket.



Blankets installed along stream banks or other short slopes can be laid horizontally. Install blankets vertically on longer slopes. Ensure 6 inch minimum overlap.



Excellent slope and bank protection for stream stabilization project. Note that stream bottom is not lined, to preserve rock and gravel habitat.

Good application of erosion control blanket to stabilize shoulder and protect storm drain, but too few staples used along the top edge. Trench in top edge of blanket on steep slopes.



SECTION 5

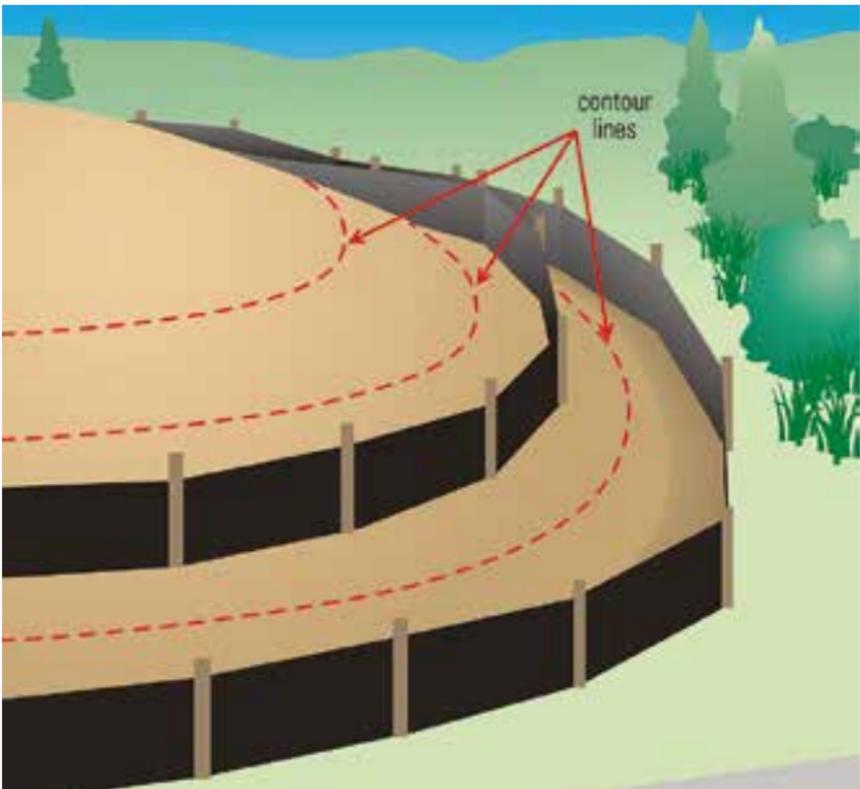
Using Silt Fence and Other Sediment Barriers

The use of silt fences and other sediment barriers involves simple observation and common sense. However, as Will Rogers once noted, “common sense ain’t so common.” The following summary provides details on how to install sediment barriers.

Sediment barrier placement

Sediment barriers are required below (downhill from) areas of bare soil. Hay or straw bales must not be used as sediment barriers due to their inherent weakness and tendency to fall apart. There are several factors to consider in placing silt fences or other commercial sediment barriers:

- Place barriers on downhill edge of bare soil areas.
- Make sure the barrier catches all the muddy runoff.
- The goal is to pond runoff and allow sediment to settle out.
- Install multiple sediment barriers on long slopes.
- Spacing on long slopes is every 60 to 100 feet and dependent on site conditions. Consult engineered plans for exact spacing.
- Put barriers across slopes, on the contour (level).



Silt fences should be installed on the contour below bare soil areas. Use multiple fences on long slopes. Consult engineering plans for spacing. Remove accumulated sediment before it reaches halfway up the fence.

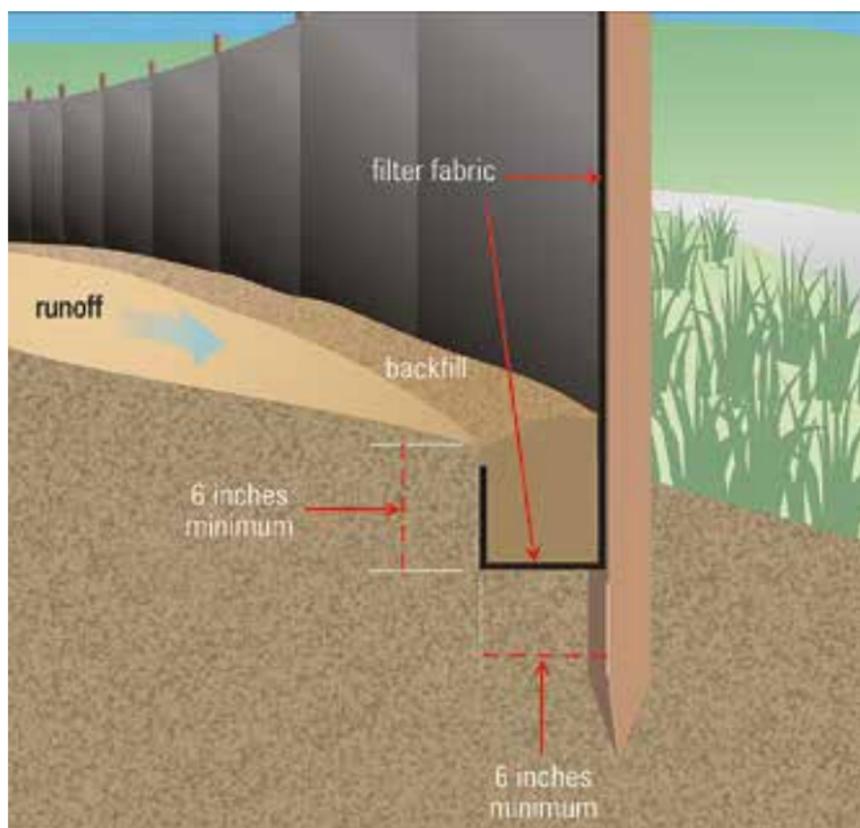
Silt fence installation

Each 100-foot section of silt fence can control runoff from about $\frac{1}{4}$ acre (about 110 feet uphill). To install a silt fence correctly, follow these steps:

- Note the location & extent of the bare soil area.
- Mark silt fence location just below bare soil area.
- Make sure fence will catch all flows from area and ends are turned uphill ("J hook").
- Dig trench 6 inches deep across slope.
- Unroll silt fence along trench.
- Join fencing by rolling the end stakes together.
- Make sure stakes are on downhill side of fence
- Drive stakes in against downhill side of trench.
- Drive stakes until a minimum of 6 inches of fabric is in trench.
- Push fabric into trench; spread along bottom.
- Fill trench with soil and tamp down.
- Securely attach fence to stakes.

Silt fencing should not be installed:

- Up and down hills.
- Above (uphill from) areas of bare soil.
- In ditches, channels, or streams.



Remember: stakes go on the downhill side. Dig trench first, install fence in downhill side of trench, tuck fabric into trench, then backfill on the uphill side (the side toward the bare soil area).

Silt fence spacing on sloping sites

Slope Angle	Soil Type		
	Silty	Clays	Sandy
Very Steep (1:1)	50 ft.	75 ft.	100 ft.
Steep (2:1)	75 ft.	100 ft.	125 ft.
Moderate (4:1)	100 ft.	125 ft.	150 ft.
Slight (10:1)	125 ft.	150 ft.	200 ft.

For silt fences treating high flows from steep slopes, reinforce the silt fence with woven wire and metal fence posts. Install wire fencing *between* the posts and the silt fence filter fabric, so pressure on the fabric from uphill flows is distributed across the wire fencing, then to the posts.

If muddy runoff flows along the uphill side of a silt fence, install “J-hooks” every 40 to 80 feet. These are curved sections of silt fence that act as small dams to stop, pond up, and settle out flows (see illustration).



Use J-hooks to trap and pond muddy runoff flowing along uphill side of silt fence. Turn ends of silt fence toward the uphill side to prevent bypassing. Use multiple J-hooks every 50 to 150 feet for heavier flows.

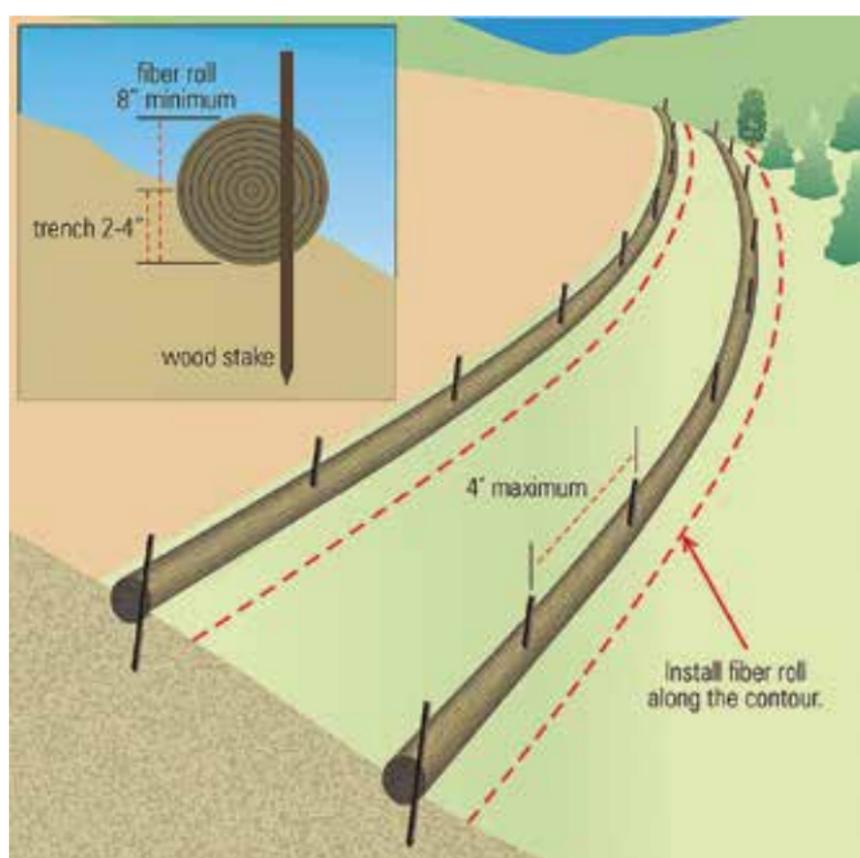
Silt fence slicing devices

Tractor-mounted equipment that “slices” silt fence into the ground can provide a better installation than the open trench method. The equipment uses a chisel-point or vibratory plow to create a narrow slit in the ground. Rolled silt fencing is pushed into the slit, creating a very tight seal that prevents water from blowing out the bottom of the fence. Posts are driven and attached to the fence after the fencing is installed.

Besides better performance, the slicing method is also faster. For slicing and all other applications, posts are spaced 6 feet apart or less.

Other sediment barriers

Other products, such as wattles, socks, fiber rolls and other commercial products made from coconut fiber, plastic, wood shavings, compost, or other material can also be used as sediment barriers. Follow manufacturers' installation instructions and ensure that sediment barrier spacing on slopes is correct. Make sure runoff does not bypass the barriers underneath or around the ends.

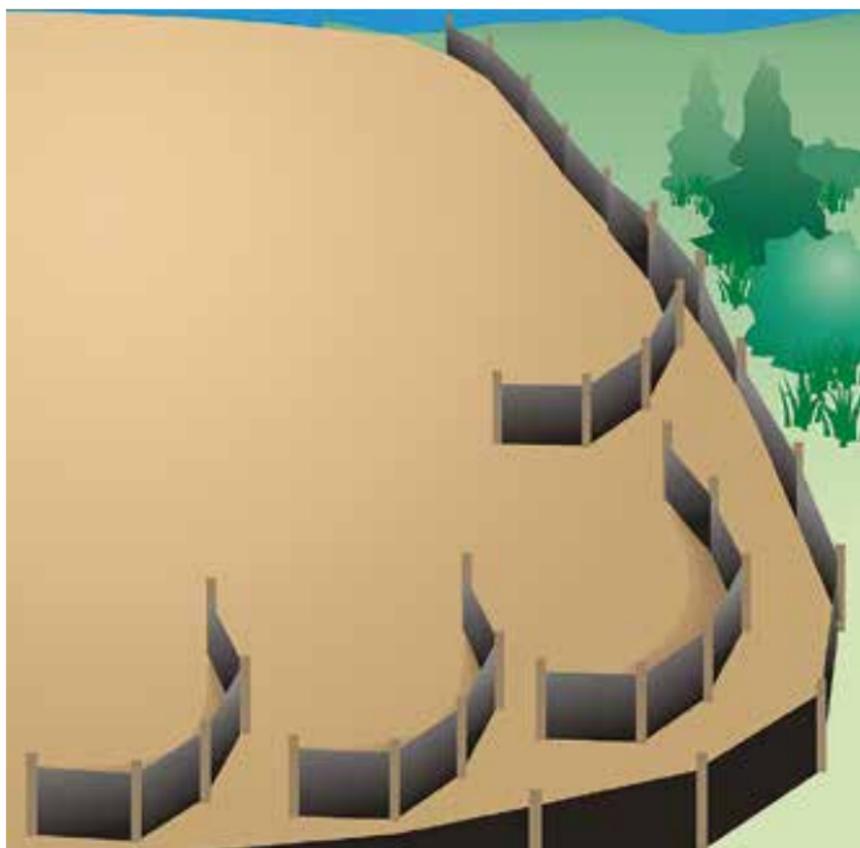


Fiber rolls can be used to break up runoff flows on long slopes. Install on the contour and trench in slightly. Press rolls firmly into trench and stake down securely. Consult manufacturer's instructions for expected lifespan of product, slope limits, etc. As always, seed and mulch long slopes as soon as possible.

Maintenance of sediment barriers

Sediment collecting behind silt fences must be removed before it is halfway up the fence. Move collected sediment to a vegetated area or other place where it will not wash into ditches, channels, or streams. Re-trench and tamp down fencing that is undercut by gullies.

Stop uphill gully formation by grading, seeding, and mulching, or filling with rock, soil, or other material. Use erosion control blankets or turf reinforcement mats to control large areas of uphill erosion. Replace broken or bent-over stakes. Inspect places where fences are joined to make sure joint is solid. Install J-hooks where water flows along silt fence if necessary. Remove all silt fences and grade and seed the area when grass is established, before the project is completed.



Silt fences don't have to be on the property line. Placing them on slopes with the ends turned up to trap sheet flow provides better performance. Stagger fence sections to ensure total coverage. Clean out before sediment reaches halfway up. Repair as needed, and remove when grass is well established.



Very good use of continuous “super” (reinforced) silt fence and shot rock sediment barrier (far side) to contain muddy runoff from commercial development site. Note that wire fencing is installed between the filter fabric and the posts.



Good use of J-hook in silt fence to trap sediment in water running along fence. Sediment must be removed before it reaches halfway to top of fence.



Good installation of silt fence at toe of slope. Do not pile soil or other material on silt fences! Also, if space is available move fence back from toe of slopes to allow room for sediment accumulation and maintenance. Leaving a strip of vegetation between bare soil and fence also improves performance.



Very good installation of multiple silt fences on long slope. Turn ends of fencing uphill to prevent bypass. Leave silt fences up until grass is well established on all areas of the slope. Re-seed bare areas as soon as possible. Remove or spread accumulated sediment and remove silt fence after all grass is up.



Poor installation where silt fences are joined. Roll end stakes together before driving in to create an unbroken sediment barrier or lap curved sections to prevent bypasses. Leaving grass strip between silt fence and bare soil area is a good idea.



Poor installation of silt fencing, fair to good seeding. Silt fence must be trenched in along bottom. Straw bales are not approved as sediment barriers.



Alternatives to silt fence are often easier to install and maintain. This straw wattle can be moved to allow access if necessary. It also won't fail if it is "accidentally" run over.



Very poor attention to silt fence maintenance. Fences and other sediment controls must be inspected and repaired weekly; activities should be logged.



Poor sediment barrier installation, no curb inlet protection. Straw bales are not allowed in most local regulations. Very good seed application.



Tractor mounted silt fence slicing devices cut a slit into the ground and push fabric in. Installation is quicker and performance is better than the open trench method, making this approach attractive for large sites.



Triangular foam products can be used as a sediment barrier for inlets or perimeter control. It can be installed with stakes or glued to hard surfaces such as parking lots.



Silt fence should not be used in concentrated flows. Silt check dams should be constructed of rock, stone fill bags or fiber rolls (see Section 8).

SECTION **6**

Protecting Slopes to Prevent Gullies

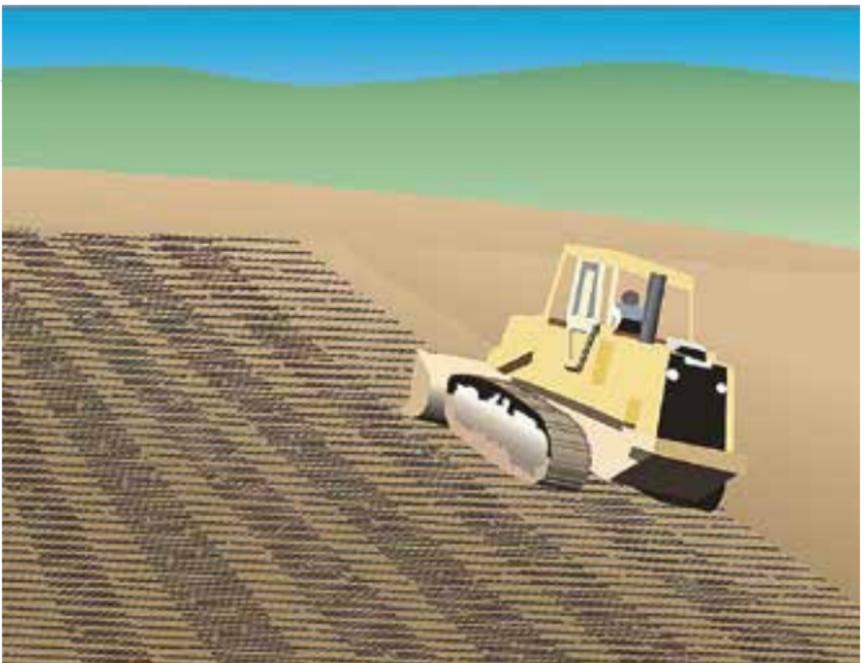
Slopes—especially long ones—must be protected to prevent sheet, rill, and gully erosion. Slopes are stabilized immediately after grading work is completed. Seeding and mulching provide the best and cheapest protection. Erosion control blankets or turf reinforcement mats are needed on most steep slopes.

Approximate slope conversions

Percent	Slope ratio	Degrees
100%	1:1	45°
50%	2:1	27°
33%	3:1	18°
25%	4:1	14°
10%	10:1	6°

Assessing slopes and soils

Steeper slopes require more protection than flatter slopes. Slopes with highly erodible soils (silty soils) need more protection than those with less erodible soils (sands and gravels). Also, long slopes (greater than 50 feet) are at greater risk for erosion than short slopes.



Tread-track slopes up and down hill to improve stability.

Slope Protection Basics

Protecting slopes from erosion requires several actions that must be taken together. No single approach will be successful, especially if the slope is long, steep, or has highly erodible soils (see table). Use one or more of the following actions to reduce erosion on slopes:

Divert upland runoff

See Section 3 for information on how to install a berm or channel above the slope to divert upland rain runoff around the bare soil area.

Control slope runoff

If slopes are broken up into benches or steps, runoff can be collected and diverted along berms or in channels to pipe or open channel slope drains with stable outlets.

Till seedbed or condition the soil

Dozer tracks up and down slopes help hold soil in place and lengthen the runoff flow path down the slope. See the table for information on how the condition of the soil surface (compacted, tracked, etc.) can increase or decrease erosion.

Seed and mulch

The best and cheapest protection by far. See Section 4 for details on seed types, application rates, and mulch, blanket, and mat products.

Silt fence or other barrier

These should be installed at the toe of the slope or slightly away from the toe, and every 60 to 100 feet apart on long slopes. Fiber rolls installed on the contour work very well in breaking up flows on long slopes.

Retaining wall

Extremely steep slopes can be leveled out and shortened into two or more steps or benches by installing retaining walls of rock, brick, block, wood, logs, or other material. If rock layers are present along the slope, use these to establish firm benches in a stair-step pattern.

Blankets, mats, or armoring

Steep slopes with highly erodible soils must be protected with erosion control blankets, turf reinforcement mats, or other products such as hydraulic soil binders or bonded fiber matrices. Rock mulch and lined down drain channels might be needed on steep slopes to control gullying.



Steep, long slopes need blankets or mats. Install blankets and mats up and down long slopes. For channels below slopes, install horizontally. Don't forget to apply seed, lime, and fertilizer (if used) before installing blanket.

Soil conditions vs. erosion

If soil is:	Erosion will be:
Compacted and smooth	30 percent <i>more</i>
Tracks across slopes	20 percent <i>more</i>
Tracks up & down slopes	10 percent <i>less</i>
Rough and irregular	10 percent <i>less</i>
Rough & loose to 12" deep	20 percent <i>less</i>

Chemical soil stabilizers and hydraulic mulch

Anionic polyacrylamide (PAM) and other chemical soil binders and stabilizers have been proven effective in controlling erosion on slopes. Do not use these products within 25 feet of natural waterways. Follow manufacturer recommendations regarding mixing and application. Keep equipment off treated areas.

Note that this protection is only temporary—repeat applications or seeding and mulching or other action is still needed for permanent slope protection. Bonded fiber matrices and other hydraulic mulch products applied after seeding or with seed in the mix can provide permanent protection if mixed and applied properly. Follow manufacturer's directions or local regulations.



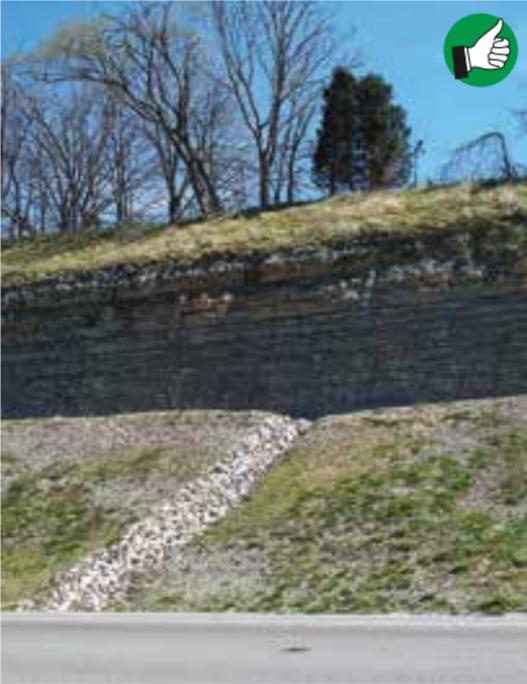
Tracking is created by running a dozer up and down the slope. This creates small ridges and depressions that act as erosion and sediment control, slowing runoff and allowing sediment to be trapped. (Photo by Shirley Morrow)



Excellent slope protection with seeding and erosion control blanket. Blankets or mats may be required on steep slopes.



Excellent use of temporary plastic covering during bridge construction to reduce slope erosion. Filter sediment from pump discharges or discharge to protected infiltration area away from waterways.



Very good application of rock lined down drain channel to carry water down slope face. Use filter fabric under rock. Install multiple drains at appropriate spacing where flows are heavy. Install flow dissipaters at outlet to absorb energy of the discharge.



Improperly installed silt fence caused runoff to collect in one area, collapsing the silt fence and causing the slope to erode.



This slope was stabilized using a variety of products including straw wattles, erosion control blanket and blown straw mulch. The area was graded and seeded prior to placement of the erosion control.



Good use of engineered retaining wall to break up slope. Development site and customer preferences will dictate type of materials used.



Poor slope protection. Seed has washed away—blankets or mats should have been used. Channel lining is poor. Silt check dam has washed out; more silt checks are needed.



Very poor slope protection. For best results, prepare soil and apply seed with mulch or blanket immediately after reaching final grade.

SECTION 7

Protecting Culvert and Ditch Inlets and Outlets

Culverts and ditches are designed to carry moderate and large flows of storm water. They can transport a lot of sediment to streams, rivers, wetlands, and lakes if they are not properly protected. In addition, culvert and ditch outlets can become severely eroded if high velocity flows are not controlled.

Culvert and storm drain ponding methods

Muddy runoff that flows toward a culvert, ditch, or storm drain inlet must be slowed down and pooled or filtered to settle out and remove sediment. This can be accomplished by placing rock, reinforced silt fencing, silt dikes, or other barrier in front of the inlet. The goal is to cause ponding of the inflow so sediment can settle out, and allow ponded water to enter the inlet only after sediment has been removed. Do not pond water on streets or other areas that may cause flooding or other traffic hazards.

Straw bales are not approved for inlet protection.

The next section describes several inlet protection devices. If the drainage area above the inlet is greater than three acres, a sediment trap or basin is needed (see Section 9). For all inlet protection approaches, seeding and/or mulching upland areas promptly will greatly reduce incoming runoff volumes and sediment loads

Inlet protection devices

Inlets can be protected with structures made of rock, reinforced silt fence, stone-filled bags, or commercial “inlet dam” products. Accumulated sediment must be removed after each rain to ensure effectiveness. Place materials to form a small dam around the inlet. Build larger dams farther away from inlets with heavy incoming flows. When using rock, mix rock of various sizes so flows can seep through the dam slowly (see photos on following pages). If spaces between rocks are too large, runoff will move through the dam without adequate settling time.

Silt fence dams can be used in low flow areas. Install a wire-reinforced silt fence dam or box around the inlet (see Section 5). Use a diagonal bracing

on sides and/or top to protect against incoming flow pressures. Make sure fence is trenched in and securely fastened to posts. Repair bypasses and undercuts promptly.

Place removed sediment in areas where it will not wash into inlets, ditches, channels, or streams. **Do not wash sediment or any other material down curb, channel, or drain inlets.**



Excellent use of concrete blocks and #57 rock for ponding dam to protect inlet. Note 2"x 4" board through blocks for stabilization. Note galvanized fencing and filter fabric between block and rocks.



Very good design and installation of inlet protection ponding dam using concrete blocks and rock. Outlet pipe in background has a rock apron to dissipate flows.



This inlet is well protected with wire reinforced silt fence and metal stakes. It does not have adequate storage area around it however, and could back water onto the street, creating a traffic hazard. –Photo by Shirley Morrow



Very good application of mixed rock for culvert inlet ponding dam. Mixing rock promotes better ponding, drainage, and settling of sediment.



Poor protection for drop inlet on concrete pad. Straw bales make good mulch but are not suited for inlet protection or silt check dams.



Poor placement of stone bag inlet dam; poor education of construction site drivers. Bags work well if used properly and maintained. Bags must form a dam around the inlet with no large gaps.



Poor placement and poor maintenance of stone bag inlet ponding dam. Accumulated sediment must be removed and dam should be repaired after each half-inch rain.



Many different products are available for inlet protection. Care should be taken when cleaning or removing the device to prevent sediment from entering the inlet.

Outlet protection methods

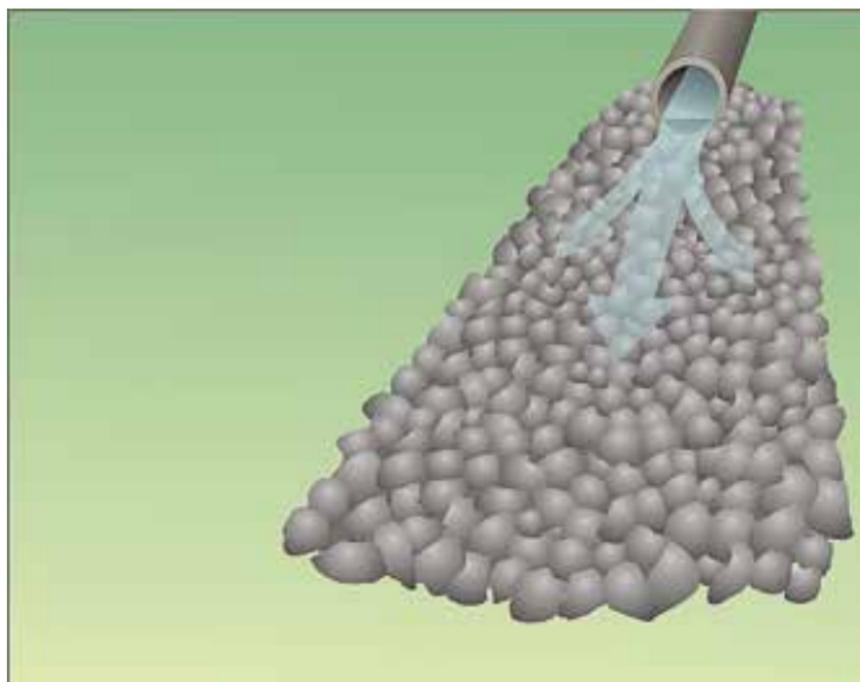
Outlets for storm drains, culverts, and paved channels that discharge into natural or constructed channels must be lined with rock or other armoring to prevent downstream bank and channel erosion when flow velocities are high.

The rock-lined “apron” at the outlet must be straight (lined up with the discharging pipe or channel) and laid in flat. Bring the sides up around outlet to prevent erosion, and up the banks a little to prevent scouring. The apron is shaped like a long triangle, with the narrow end located at the outlet and sized about 3 times the diameter of the outlet pipe. The width of the downstream end of the apron will be wider, tied into the channel, and vary according to the shape of the channel it empties into.

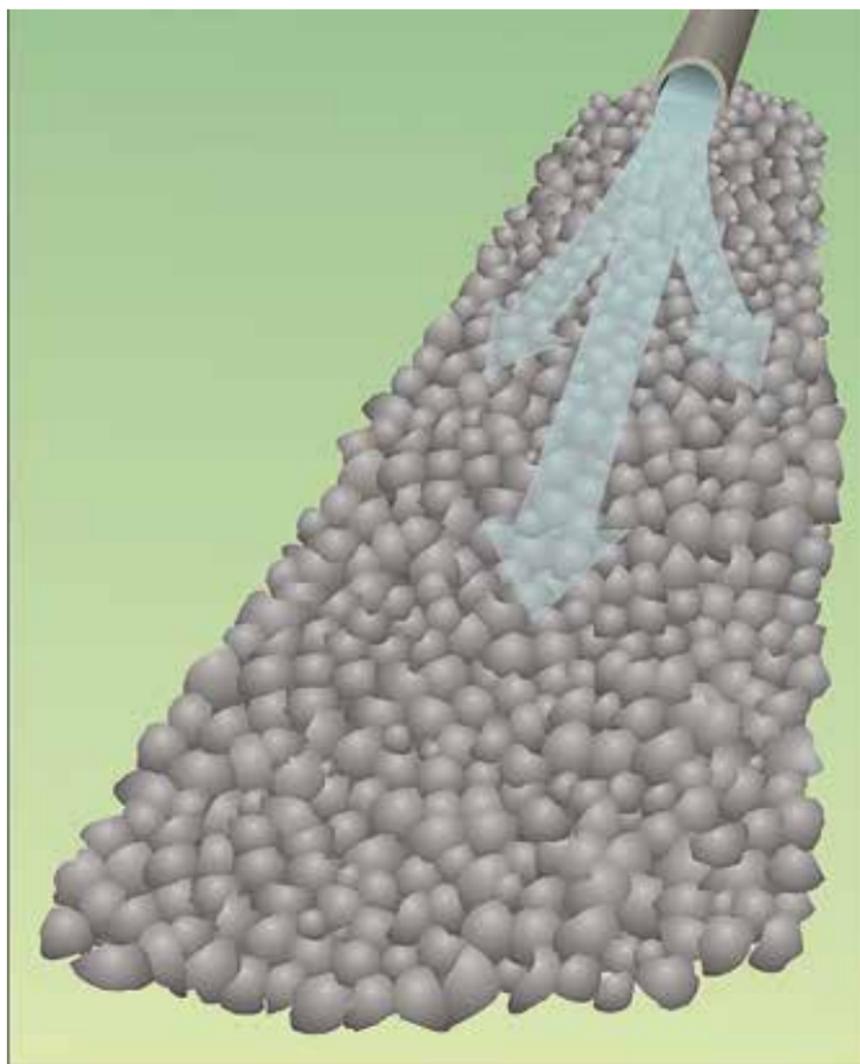
If the culvert outlet and receiving channel do not line up straight, the channel bank receiving the brunt of the outlet flow must be lined or it will erode quickly. If rock will be used, double the average diameter when sizing the rock needed. Gabion baskets—galvanized wire mesh boxes filled with rock—are often used in this situation, and can be stacked to form a wall if necessary. Mulch and soil can be mixed with the rock in the baskets to promote growth of stabilizing vegetation if desired.



Poor rock apron placement and construction at culvert outlet; poor seeding and slope protection (right side).



Low-flow energy dissipaters (above) are shorter than those for high-flow outlets (below).





Good placement and construction of rock apron at high-flow culvert outlet. If flow from culvert enters a channel, make sure channel is lined with grass, and blankets or mats, if necessary, to prevent erosion.



Excellent placement and construction of rock apron to dissipate flows from culvert outlet. Area needs seeding and mulching.



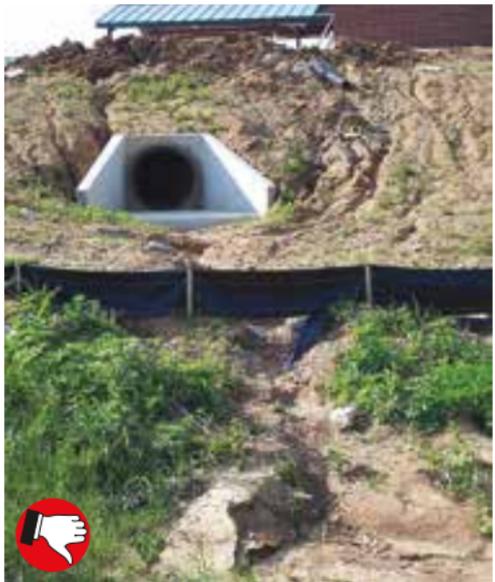
Good silt fence installation, fair seeding and mulching on slopes. Poor placement and construction of flow dissipater apron at culvert outlet.

Poor slope protection, no rock apron or flow dissipater at culvert outlet. Silt fence must not be used across ditches or channels; do not put sediment traps at culvert outlets.



Poor seed and mulch application, slopes badly eroding. No rock apron or flow dissipater at culvert outlet. Culverts clogged with sediment and rock.

Very poor outlet protection. No slope protection or seeding, no rock apron or flow dissipater at culvert outlet. Misapplication of silt fence across ditch. Flow bypass.



Stabilizing Drainage Ditches

Man-made drainage ditches with gently sloping bottoms (less than 3%) can be stabilized with thick grass seeding and erosion control blankets (see Section 4). **Natural (i.e., not “man-made”) drainage channels and creeks or streams cannot be cleared, re-routed, or otherwise altered without one or more permits from the U.S. Army Corps of Engineers and the KDHE** (see Section 10). Moderately sloping ditches (3%–6% slopes) will likely require turf reinforcement mats and perhaps some riprap if soils are silty. Steeply sloping ditches (greater than 10%) need heavier armoring with concrete, riprap, gabion baskets, geogrid, retaining walls, or other approved products.

Drainage ditch slopes and soils

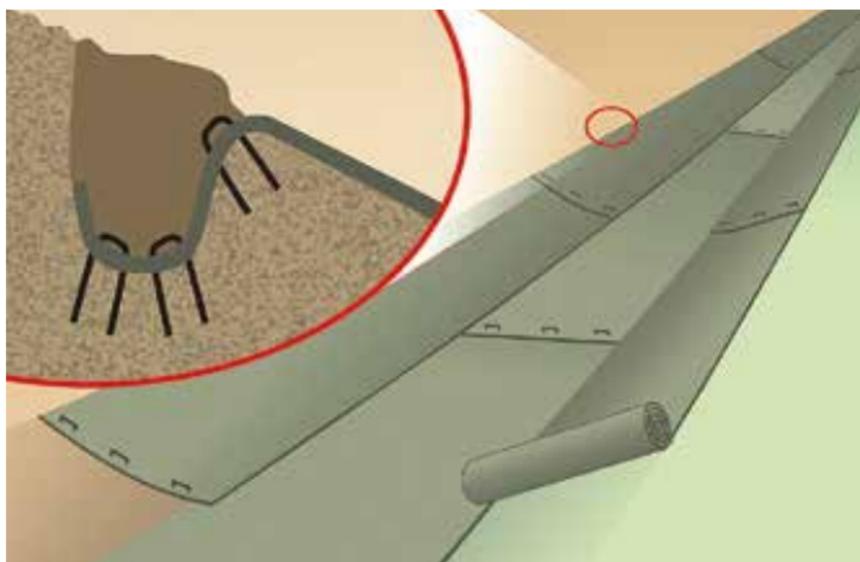
As noted in Section 6, silty soils are the most erodible and clay is the least erodible. Steeper ditches and those with highly erodible soils need more protection. Check local regulations for bank slope requirements. If tractor mowers or other equipment will cross channels in the future, bank slopes must be 3:1 or flatter. The outlet must be installed, seeded, stabilized, and protected before the ditch receives incoming flows.

Stabilization approaches for drainage ditches

Ditch Slope		Soil Type in Ditch		
		Sandy	Silty	Clays
Steep	>10%	Concrete or riprap	Concrete or riprap	Riprap
Moderate	10%	Riprap with filter fabric	Riprap or turf mats & seeding	Riprap or turf mats & seeding
Slight	5%	Riprap or turf mats & seeding	Seeding & turf mats	Seeding & turf mats
Mostly Flat	<3%	Seeding & blankets	Seeding & mulching	Seeding & mulching

Erosion control blanket and turf mat linings

All steep ditches require rock, concrete, or other armored liners and/or grade control structures. Ditches of 10% or less can be stabilized with turf reinforcement mats or erosion control blankets if they are seeded quickly. See Section 4 for installation and other information on turf reinforcement mats, erosion control blankets, and seeding/mulching applications.



Lay in ditch blankets similar to roof shingles; start at the lowest part of the ditch, then work your way up. Uphill pieces lap over downhill sections. Staple through both layers around edges. Trench, tuck, and tamp down ends at the top of the slope. Do not stretch blankets or mats.

Silt check dams of rock, brush, or other products

Drainage ditches need temporary silt check dams to capture sediment and reduce ditch bottom downcutting. Silt dikes or dams can be made of rock, stone-filled bags, or fiber rolls. They are only effective when the drainage area is 10 acres or less.

Silt fencing and straw bales are not approved for use as silt check dams, and must not be used in drainage ditches that carry flowing water. Also, do not place silt checks in creeks or streams. Sediment must be intercepted before it reaches streams, lakes, rivers, or wetlands.

Seed ditches and install silt checks before excavating, filling, or grading uphill areas. Inspect, repair, and clean out sediment from upstream side of silt checks after each rainfall exceeding ½ inch. Remove temporary silt checks after the site is stabilized and vegetation is established. Placing filter fabric under the ditch check during installation will make removal much easier. Stone bag silt checks are easiest to remove, and can be re-used.

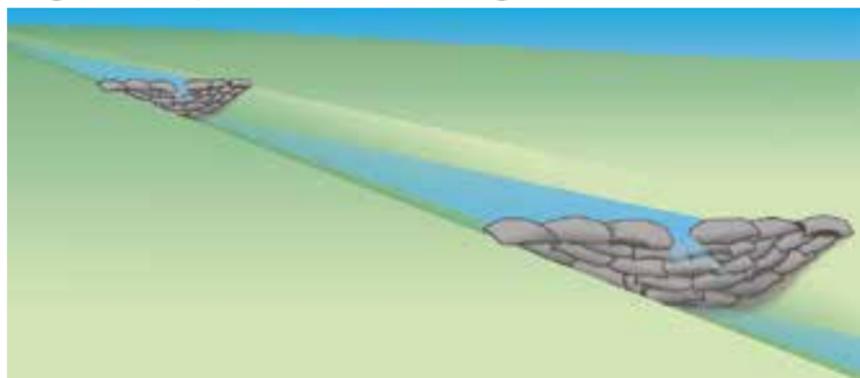
Spacing for silt check dams

Ditch slope	Silt check dam spacing	Additional information
30%	10 ft.	Calculated for 3' high silt check dams.
20%	15 ft.	
15%	20 ft.	
10%	35 ft.	Center of dam should be 6" lower than sides.
5%	55 ft.	
3%	100 ft.	Use 5" - 10" rock, stone bags, or commercial products.
2%	150 ft.	
1%	300 ft.	
0.5%	600 ft.	

Silt check dams are spaced according to the slope of the ditch bottom (see table). Extend the ends of the silt check to the top of the bank to prevent bypassing and sidecutting. Keep the middle part lower and relatively flat so overflows aren't too concentrated and bypasses are prevented.

Lining steep ditches

Riprap is used to line sides and bottoms of steep ditches. Rock used in liners is mixed so the spaces between large rocks are filled with smaller rock. See engineered plans for rock sizing.



Silt check dams of rock, stone-filled bags, or commercial products must be installed before uphill excavation or fill activities begin. See table for correct silt check spacing for various channel slopes. Tied end of bag goes on downstream side.

As ditch depth and steepness increase, rock size must also increase. Line the bare ditch bottom and sides with non-woven filter fabric to prevent undercutting and washouts. Rock must be placed along ditch bottom first, then up the sides. Replace dislodged rock after storms as needed.



Good construction of rip-rap lined ditches on road project. Good use of erosion blankets on slopes. Seed coverage on slopes is fair to poor.



Good installation of temporary rock silt checks. Remember to tie sides of silt check to upper banks. Middle section should be lower. Clean out sediment as it accumulates. Remove silt checks after site and channel are stabilized with vegetation.



Good placement and spacing of fiber-roll silt checks. Coconut fiber rolls and other commercial products can be used where ditch slopes do not exceed three percent.



Poor application of commercial silt check product. Check dam needs to be longer (tied into banks). More are needed, at correct spacing for channel slope. Area needs to be re-seeded; ditch may need blanket liner.



Poor silt check installation. Straw bales are not approved as silt checks for ditch or channel applications due to rotting, installation difficulties, and high failure potential.

SECTION 9

Installing Sediment Traps and Basins

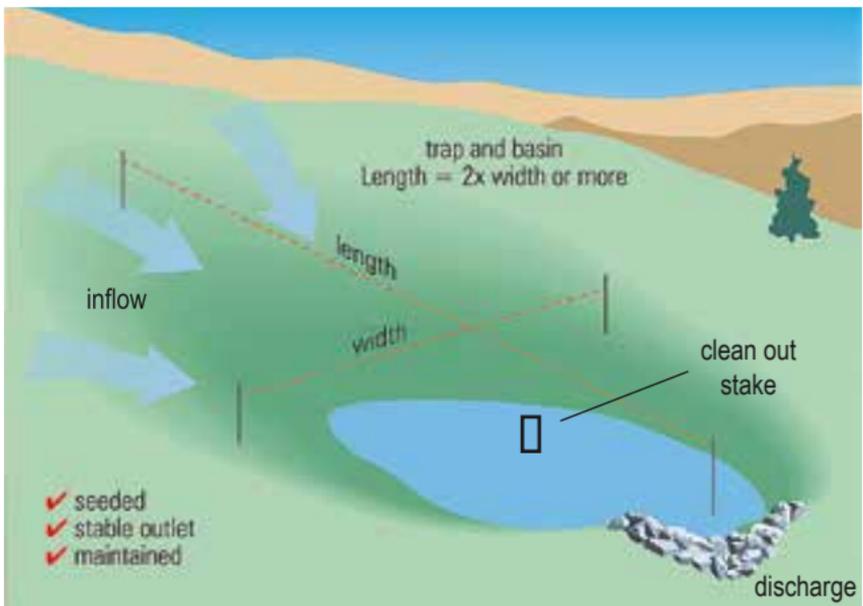
The purpose of a trap or basin is to provide an area where muddy runoff is allowed to pool, so sediment will settle out. Sediment traps and basins are installed in natural drainage areas before excavation or fill work begins. **Do not depend on sediment traps and basins alone to control sediment loss from your construction site.** Other uphill controls on bare areas, slopes, and in ditches and channels are needed to prevent overloading traps and basins.

Containment for the pooling area can be an excavated hole or a dike made of earth or stone. Straw bales and silt fencing are not approved for use as containment structures for concentrated runoff flows.

Locations for traps and basins

Low-lying sites on the downhill side of bare soil areas where flows converge are ideal places to install temporary sediment traps and basins. In general, sediment traps are designed to treat runoff from about 1 to 5 acres. Sediment basins are larger, and serve areas of about 5 to 10 acres. All basins require an engineered design.

Do not put sediment traps or basins in or next to flowing streams or other waterways. Make sure pooled water does not flood buildings, roadways, or other structures.



Sediment traps

Any depression, swale, or low-lying place that receives muddy flows from exposed soil areas can serve as a sediment trap. Installing several small traps at strategic locations is often better than building one large basin. The simplest approach is to dig a hole or build a dike (berm) of earth or stone where concentrated flows are present. This will help to detain runoff so sediment can settle out. The outlet can be a rock-lined depression in the containment berm.

Sediment basins

Sediment basins are somewhat larger than traps, but the construction approach is the same (see below). Sediment basins usually have more spillway protection due to their larger flows. Outlet structures must be designed and constructed to withdraw water from the surface of the basin, unless infeasible. If infeasible, the reason it is infeasible shall be provided as a part of the NOI and SWPP plan submittal to KDHE.



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Sizing and Design Considerations

Sediment basins are required, where feasible, for drainage areas with 10 or more acres disturbed at one time. Traps and basins are designed so that flow paths through the trap or basin are as long as possible, to promote greater settling of soil particles. Sediment basin length should be twice the width or more if possible – the longer the flow path through the basin, the better. Consult local regulations for other sizing and design criteria.

Inspection and maintenance

Inspect inlets, berms, spillway, and outlet area for erosion after each rain exceeding 0.5 inch. Repair gullied areas and any upslope areas contributing large volumes of sediment. Clean trash and plugged areas from the riser pipe. Repair and reseed bare areas. Ensure that downstream receiving area is stable.

Because sediment traps and basins are designed to collect sediment, they must be cleaned out periodically to ensure adequate capacity. No more than 20% of the basin capacity should be taken up by sediment. A ‘clean-out stake’ placed in the basin will help determine when clean-out is required. State regulations require dewatering from the surface of the basin, per KDHE (revision in manual).



Good sediment trap installation, but poor maintenance has caused trap to fill and bypass to occur. Remove sediment. Make sure containment dike has an overflow notch to control the discharge location.



Fair installation of two traps above small pond. Dikes are a little too small; placement is too close to pond. Area needs seed and mulch.



Fair sediment trap construction. Rock dike is undersized and lacks a defined overflow notch. Poor maintenance attention. Silt fence beyond rock dike is not needed—silt fence should not be used across flow channels.

Good trap location; needs cleaning out. Trap might be too small for area drained. Very good channel protection, seeding, and mulching.



Fair to poor trap installation. Dike overflow notch is too deep; basin is too small. No seed or mulch covering bare soil areas.



Sediment basins, used for larger sites, collect runoff from the site and allow sediment to settle out. Note the sides of the basin have been stabilized with seed and mulch.

SECTION **10****Protecting Stream Channels, Wetlands, and Lakes**

Streams must not have sediment control devices or stabilization structures placed into them without proper permits. Solid or dashed blue lines on a USGS topo map identify a stream. The U.S. Army Corps of Engineers defines any waterway with a defined bed and bank to be a stream and regulated by the U.S. Clean Water Act, *even if it only has water flowing in it during or immediately following rain.*

Setback requirements

Avoid activities near waterways if possible. Maintain vegetation along buffers by establishing setbacks (see table for recommendations). Flag off vegetated buffer areas to keep equipment away. Some jurisdictions have mandatory setback requirements. Check with the local planning and zoning office before working near waterways.

Need information on permits required for working in or near streams and wetlands in Kansas?

*Call the Kansas City District U.S. Army Corps of Engineers
816-389-3990*

Recommended setbacks from waterways

Bank Slope	Soil Type Along Banks		
	Sandy	Silty	Clays
Very Steep (2:1 or more)	100 ft.	80 ft.	60 ft.
Steep (4:1 or more)	80 ft.	60 ft.	40 ft.
Moderate (6:1 or more)	60 ft.	40 ft.	30 ft.
Mostly Flat (less than 10:1)	40 ft.	30 ft.	20 ft.



Stream buffers and other environmentally sensitive areas must be protected from construction equipment. Here an orange fence clearly marks where no equipment should cross. (Photo provided by David Rinne)

Vegetated buffers

Preserve existing vegetation near waterways whenever possible. Prior to beginning construction, tree preservation fencing should be installed at the limits of disturbance adjacent to waterways to keep equipment away from and out of streams. This vegetation is the last chance barrier to capture sediment runoff before it enters the lake, river, stream, or wetland. Where vegetation has been removed or where it is absent, plant native species of grasses.

Stream crossings

Note that work in and around a stream will likely require one or more permits. Environmental impacts are regulated by the U.S. Clean Water Act Sections 401 and 404. Keep equipment away from and out of streams. If a temporary crossing is needed, put it where the least stream or bank damage will occur. Look for:

- Stream bottom areas
- steeply sloping banks
- Healthy vegetation on both sides

Use one or more culverts (18 inches minimum) as needed, sized to carry the two-year 24-hour rain storm. Remove culverts and cover material when crossing is no longer needed. Grade, seed, or otherwise re-plant vegetation removed.



Good use of silt fence, straw, rock, and other practices for temporary stream crossing. Any work in stream channels—such as installation of culverts—requires a Section 404 permit from the U.S. Army Corps of Engineers.



Protect stream buffers with sediment control, such as the silt fence shown in the picture, as well as fencing to ensure no equipment is in the buffer area. (Photo provided by David Rinne)

Maintaining and Closing Out Your Construction Project

Erosion and sediment controls need to be inspected and maintained. Temporary controls must be removed and the disturbed area permanently stabilized when the project is completed. Failing to fill, grade, and seed temporary sediment traps or basins or failing to remove silt fences, silt check dams, and other controls can result in legal liabilities and KDHE storm water permit violations. See details of the storm water KDHE construction permit and the Appendices for more information on post-construction closeout requirements.

Inspecting storm water flow structures

Erosion and sediment controls must be inspected regularly and according to state and local regulations and after each rain exceeding 0.5 inch. Keep records of inspection observations and actions taken, and file with other erosion and sediment control plan paperwork.

Keep erosion and sediment controls in good working order until the project is completed. Brush and other debris should be removed from culvert and channel inlets. Rock or sediment accumulating behind silt fences or other sediment barriers should be removed regularly. All structures that have become dislodged or damaged (such as silt fences, rock aprons, etc.) should be repaired as soon as possible.

Managing trash, supplies, and materials

Keep rock entry/exit pads clean by raking/grubbing or adding new rock as needed when sediment begins to fill spaces between the rock. Make sure that waste materials, building materials, and supplies are properly tied down or contained so that wind and storm water runoff cannot carry the materials away. **Keep your site clean!** Chemicals, paints, and hazardous waste products should be stored in a trailer or other structure to avoid spills and runoff. Provide for proper sewage disposal.

Have a plan to handle fuel, oil, or other spills. Have spill kits and containment material on-site, especially near fueling or equipment service areas. Try to maintain vehicles and equipment away from the site if possible. If maintenance must occur on-site, ensure that spills are cleaned up quickly.

Vegetated cover considerations for close-out

No site is to be closed out until a uniform perennial vegetative cover with a density of 70% has been established on all bare soil areas. Check seeded areas, and reseed areas where vegetation is thin or absent. This is especially important for slopes, ditches, and channels.

Removing temporary sediment controls

When project is completed:

- Remove all silt fencing and stakes. Grade out and seed or remove accumulated sediment or broadcast over grassed areas or dispose of off-site.
- Culvert inlets should be stabilized, vegetated, and showing no visible gullies. Rock or soil that has been washed away by runoff or upstream flows should be replaced. Brush or other debris that could clog inlets should be removed.
- Check ditches and channels to make sure banks and ditch bottoms are well vegetated. Reseed bare areas and replace rock that has become dislodged.
- Check areas where erosion control blankets or matting was installed. Cut away and remove all loose, exposed material, especially in areas where walking or mowing will occur. Reseed all bare soil areas.
- Replace rock washouts near culvert and channel outlets. Fill, grade, and seed or riprap eroded areas around inlets and outlets. Make sure downstream ditches and channels are fully vegetated. Fill and seed any gullies along the banks or other slopes.
- Fill in, grade, and seed all temporary sediment traps and basins that have been removed. Double the seeding rate where runoff flows might converge or high velocity flows are expected.
- Remove temporary stream crossings and grade, seed, or re-plant vegetation removed during crossing installation.

Final site stabilization

The project is considered stabilized when either perennial vegetation, pavement, buildings or structures using man-made materials cover all areas which have been disturbed. Vegetation must have a density of at least 70 percent of undisturbed areas at the site.

Make sure all subcontractors have repaired their work areas prior to final closeout. Conduct a final inspection of all work areas, vegetation, storm water flow structures, and downstream receiving waters to make sure no visible gullies or sediment movement is evident. Notify site owner or manager after all temporary erosion and sediment controls have been removed and final stabilization has been completed. If the site is one acre or larger and covered under a KDHE Storm Water Permit, submit a Notice of Termination to the KDHE Industrial Programs stormwater section (<http://www.kdheks.gov/stormwater>). Check with local jurisdictions for final inspection and permit closure.



An example of good site establishment after the installation of roads in a subdivision.



Poor job of seeding and final stabilization. Temporary BMPs (silt fence, inlet protection, check dams) are still needed. Project should not be closed out until all disturbed areas are adequately vegetated and temporary BMPs have been removed.

SECTION **12****Regulatory Information****Storm water permits**

Construction projects one acre or larger **must** be covered by a KDHE stormwater con-

struction general permit S-MCST-1703-1 and permits required by local municipalities (see inside cover). Following the erosion and sediment control recommendations in this guidebook will help you meet most of the permit requirements. **The goal of the entire permit program is to keep sediment and other pollutants out of lakes, rivers, streams, and wetlands.**

Need information on State of Kansas Storm Water Permits?

Call 785-296-5545

Or visit this Internet site:
<http://www.kdheks.gov/stormwater>

For local jurisdictions see inside cover

Erosion protection and sediment control plans

You need to file a stormwater pollution prevention plan (SWPPP) with the state and an erosion and sediment control plan with the local government before you begin work. Some local governments also require SWPPPs on file; check local requirements. The plans require you to note which of the erosion and sediment control measures you will use during construction.

Utility construction regulations

In general, utility construction crews and other subcontractors are responsible for their own erosion and sediment controls. General contractors should make sure that all utilities and subcontractors use rock pad construction entrances. Tracking mud out onto paved roads can lead to legal liabilities. If crews disturb areas that have already been stabilized, they should replace any mulch, sod, seed, blanket, matting, rock, or other material disturbed. Failure to properly grade, seed, and stabilize work sites may violate permit requirements.

If your project is larger than one acre and covered under local and state permits, it is recommended that subcontractors and others conducting excavation or fill activities sign an agreement that they will follow the Storm Water Pollution Prevention (SWPPP) Plan. If utility projects are conducted in or near streams, Clean Water Act Section 404 permit coverage may be required; check local regulations for requirements.



A sign posted at the entrance reminds subcontractors and others entering the site that erosion and sediment controls are in place and that they are responsible for following permit requirements.

Sample Inspection Report Instructions

This sample inspection report has been developed as a helpful tool to aid you in completing your site inspections. This sample inspection report was created consistent with EPA's Developing Your Stormwater Pollution Prevention Plan. You can find both the guide and the sample inspection report (formatted in Microsoft Word) at https://www3.epa.gov/npdes/pubs/sw_swppp_inspection_form.doc

This inspection report is provided in Microsoft Word format to allow you to easily customize it for your use and the conditions at your site. You should also customize this form to help you meet the requirements in your construction general permit related to inspections. **If your permitting authority provides you with an inspection report, please use that form.**

For more information on inspections, please see Developing Your Stormwater Pollution Plan Chapters 6 and 8.

Using the Inspection Report

This inspection report is designed to be customized according to the BMPs and conditions at your site. For ease of use, you should take a copy of your site plan and number all of the stormwater BMPs and areas of your site that will be inspected. A brief description of the BMP or area should then be listed in the site-specific section of the inspection report. For example, specific structural BMPs such as construction site entrances, sediment ponds, or specific areas with silt fence (e.g., silt fence along Main Street; silt fence along slope in NW corner, etc.) should be numbered and listed. You should also number specific non-structural BMPs or areas that will be inspected (such as trash areas, material storage areas, temporary sanitary waste areas, etc).

You can complete the items in the "General Information" section that will remain constant, such as the project name, NPDES tracking number, and inspector (if you only use one inspector). Print out multiple copies of this customized inspection report to use during your inspections.

When conducting the inspection, walk the site by following your site map and numbered BMPs/areas for inspection. Also note whether the overall site issues have been addressed (customize this list according to the conditions at your site). Note any required corrective actions and the date and responsible person for the correction in the Corrective Action Log.

Stormwater Construction Site Inspection Report

General Information			
Project Name			
NPDES Tracking No.		Location	
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications		Insert qualifications or add reference to the SWPPP. (See Section 5 of the SWPPP Template)	
Describe present phase of construction			
Type of Inspection:			
<input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No			
If yes, provide:			
Storm Start Date & Time:		Storm Duration (hrs):	Approximate Amount of Precipitation (in):
Weather at time of this inspection?			
<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds			
Other:		Temperature:	
Have any discharges occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No			
If yes, describe:			
Are there any discharges at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No			
If yes, describe:			

Site-specific BMPs

- Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
13		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
14		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
15		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
16		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
18		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
19		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
20		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Is the construction exit preventing sediment from being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

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	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

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

Print name and title:

Signature: _____

Date: _____

