



Island County

Best Management Practices

Field Manual for Small Construction Sites



February, 2003

CONTACTS

Local Permits (Building, Clearing and Grading, Shoreline, Critical Areas, Utilities, Access, Land Use)	
Island County Planning and Community Development 360 679 7339 www.islandcounty.net/community	Island County Public Works 360 679 7331 www.islandcounty.net/publicworks
Timber Harvest, Forest Practices Washington Department of Natural Resources, Sedro Woolley 360 856 3500	
Bald Eagle Habitat Washington Department of Fish and Wildlife, Mill Creek 425 379 2301	
Streams, Lakes, Shorelines – Hydraulic Project Approvals (HPA) Washington Department of Fish and Wildlife, LaConner 360 466 4345	
Wetlands, Shorelines Washington Department of Ecology, Bellevue 425 649 7000 US Army Corps of Engineers, Seattle 206 764 3495	
Land Clearing of more than 5 acres (more than 1 acre after 3/03) National Pollutant Discharge Elimination System (NPDES) Permits Washington Department of Ecology, Bellevue 425 649 7000	
Archaeological Sites Washington State Office of Archaeological and Historic Preservation 360 586 3065 Tulalip Tribes (South Whidbey) (360) 651-4480 Swinomish Tribal Community (North Whidbey and Camano) (360) 466-1236	
General Environmental Permit Information Washington Department of Ecology Permit Assistance Center 1 800 917 0043 http://www.ecy.wa.gov/programs/sea/pac/index.html	
Report a Spill Washington Department of Ecology 1-425-649-7000	
Stormwater Management Manual for Western Washington Washington Department of Ecology www.ecy.gov/programs/wq/stormwater	
CALL 24 HOURS BEFORE YOU DIG! 1 800 424 5555	

**ISLAND COUNTY
BEST MANAGEMENT PRACTICES FIELD MANUAL
FOR SMALL CONSTRUCTION SITES**

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PREFACE

Commercial, industrial, and other non-residential construction, while highly visible, represents only a fraction of the development activity on Whidbey and Camano Islands. Such development is typically subject to strict requirements for engineered drainage and erosion control plans and facilities.

Cumulatively, residential construction and other small development activity accounts for the majority of earth disturbance, and hence erosion potential, in Island County.

This manual was prepared to address primarily residential construction and other small development activity on Whidbey and Camano Islands, though is also intended to be used by utility operators and road maintenance crews. The most commonly used and practical BMPs are listed in this manual. They should address most, but probably not all, impacts from small construction projects. The intent is to pare down material from previous Island County comprehensive and field manuals to a workable and useful document. There are many other useful BMPs besides those listed in this manual.

Additionally, this field manual is updated with the latest BMP knowledge and technology as represented by the August 2001 Washington Department of Ecology *Stormwater Management Manual for Western Washington*.

February, 2003

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All photos on the front cover and in the text of the document were taken at Island County locations by Island County Public Works staff.

ISLAND COUNTY BEST MANAGEMENT PRACTICES FIELD MANUAL FOR SMALL CONSTRUCTION SITES

INTRODUCTION

The *Island County Best Management Practices Field Manual for Small Construction Sites* (the Field Manual) is intended for use by:

- **contractors,**
- **utility operators and installers,**
- **County road and maintenance crews, and**
- **homeowners.**

The Field Manual is intended primarily for use by these workers during **small** development, construction and maintenance activities such as, but not necessarily limited to:

- **residential construction,**
- **maintenance of roads, ditches, utilities, and other existing facilities,**
- **residential landscaping,**
- **minor land clearing, and**
- **utility installation.**

The Field Manual is NOT INTENDED FOR USE ON LARGE OR COMPLEX CONSTRUCTION PROJECTS OR PROJECTS WITHIN SENSITIVE AREAS. More intense development activities, such as commercial development or clearing of large areas, require detailed engineered erosion and sediment control plans. Work within sensitive areas, such as wetlands, streams, shorelines, unstable bluffs, or habitat areas may often require measures beyond the scope of this manual. See ICC 11.03 and contact Island County development review staff for information on requirements for large or complex development activities. See ICC 17.02 and contact Island County critical areas staff for more information on sensitive areas. Referral to the Washington Department of Ecology's *Stormwater Management Manual for Western Washington* (August, 2001) and the *Island County Critical Areas Best Management Practices Comprehensive Manual* (November 1999), along with consultation with a professional engineer or similarly qualified professional experienced in BMP selection and use, is recommended for large or complex projects. The Ecology manual contains updated information based on advances in technology and practical experience. **NOTE:** Island County has NOT, as of the date of publication of this field manual, adopted the Ecology manual. At this time, use of the BMPs as presented



in the Ecology manual is recommended, but not required.

WHEN ARE BEST MANAGEMENT PRACTICES REQUIRED?

The Island County Stormwater and Surface Water Ordinance, Chapter 11.03 Island County Code (ICC), requires that all development activity use appropriate stormwater Best Management Practices (BMPs) to protect water quality. "Development activity" includes any development, construction, earth moving, or clearing which either requires a permit from Island County or is proposed by a public agency.

The Island County Critical Areas Ordinance (ICC 17.02) protects sensitive areas such as wetlands, streams, and fish and wildlife habitat conservation areas. Certain activities, such as repair and maintenance of existing drainage, irrigation, or utility facilities and other structures, or installation of utilities within improved road rights-of-way, are exempt from Critical Areas Permit requirements, provided appropriate BMPs are used (see ICC 17.02.107.E). **Failure to comply with the regulations, including installation and use of appropriate BMPs, may result in costly delays and other problems.**

All applicants for small development activities, including new residential construction, are required to:

- **Minimize erosion and movement of sediment on and from the site.**
- **Protect properties and water courses downstream from erosion and sediment originating on the site.**
- **Minimize the transport of sediment onto paved surfaces, and clean any sediment from roads at the end of each day.**
- **Stabilize denuded areas and soil stockpiles.**
- **Maintain temporary erosion and sedimentation control measures until final site stabilization, such as paving, lawn, or landscaping.**
- **Route storm water runoff to remove sediment via an approved sediment retention facility.**

(ICC 11.03.230, Erosion and Sedimentation Control Requirements.)

KNOW ALL OF YOUR PERMIT REQUIREMENTS!

The Field Manual is intended to help you comply with the regulations outlined above during small development activities. **Other requirements may apply!** Before conducting any work, you should check with Island County development review staff to determine whether permits are



needed or if other requirements apply. The landowner and all workers on the property are responsible for knowing permit requirements and what sensitive lands may be present. The inside front cover of the Field Manual lists contact information for agencies that may require permits. To avoid compliance problems, call or contact them to find out if a permit is needed and whether any sensitive areas may be involved before you work.

Also, be aware that use of the BMPs listed in the field manual does not necessarily guarantee compliance. If erosion, sediment discharge, or other problems are occurring on your site, you may be out of compliance even if you are using the BMPs listed in this field manual. **You are responsible for taking care of your site!**

PLANNING, INSTALLING AND MAINTAINING BEST MANAGEMENT PRACTICES

The following general principles should also be followed in development of a construction site erosion control plan.

- The duff layer, native topsoil, and natural vegetation should be retained in an undisturbed state to the maximum extent practicable. ***The single most effective means of limiting stormwater impacts during and after construction and minimizing costs of implementing BMPs is to retain existing soil and vegetation to the maximum practical extent.***
- Prevent pollutant release. Select source control BMPs as a first line of defense. Prevent erosion rather than treat turbid runoff.
- Select BMPs depending on site characteristics (topography, drainage, soil type, ground cover, and critical areas) and the construction plan.
- Divert runoff away from exposed areas wherever possible. Keep clean water clean.
- Limit the extent of clearing operations and phase construction operations.
- Understand seasonal restrictions for earthmoving and exposed soil established by ICC 11.03 and any conditions of permit approval. The construction schedule should take these restrictions into account.
- Schedule installation of BMPs. Some temporary BMPs should be installed before earthmoving activities begin.
- Schedule regular inspections of the site and the stormwater BMPs throughout the construction process. Repair or replace BMPs as needed. Maintain the BMPs as necessary. ***Without proper***



maintenance, all BMPs will fail.

- Before reseeding a disturbed soil area, amend all soils with compost wherever topsoil has been removed.
- Incorporate natural drainage features whenever possible, using adequate buffers and protecting areas where flow enters the drainage system.
- Minimize slope length and steepness.
- Reduce runoff velocities to prevent channel erosion.
- Prevent the tracking of sediment off-site.
- Select appropriate BMPs for the control of pollutants other than sediment.
- Be realistic about the limitations of controls that you specify and the operation and maintenance of those controls. Anticipate what can go wrong, how you can prevent it from happening, and what will need to be done to fix it.
- Make sure that bids and estimates include costs of purchase of materials and manpower for installation, maintenance, and removal of BMPs.
- Be sure that it is understood which party is responsible for BMPs.
- Schedule removal of the temporary BMPs (or retrofit them for permanent use) at the end of the construction project.

TYPES OF BEST MANAGEMENT PRACTICES

In general, there are two types of BMPs for stormwater pollution control. **Source control** practices focus on minimizing or eliminating the source of the pollution so that pollutants are prevented from contacting runoff or entering the drainage system. Examples of source control BMPs include limiting vegetation disturbance, reduction of sediment tracking by vehicles, erosion control blankets, and mulch.

Treatment controls are designed to remove the pollutants after they have entered runoff. They tend to be more expensive and less effective than source controls. Treatment BMPs include silt fences and oil/water separators.

Most source control practices tend to be non-structural, and most treatment BMPs tend to be structural, although there can be exceptions. For example, a roof over a materials storage area at a construction site



would be considered a structural source control.

Either source control or treatment BMPs can be temporary or permanent. **Temporary BMPs** are used before and during construction, and are maintained following construction until the site is completely stabilized and permanent BMPs have been installed. **Permanent BMPs** remain following construction, and require ongoing maintenance.

ORGANIZATION OF THE FIELD MANUAL

The Field Manual contains a selection of BMPs typically appropriate for small development projects in Island County. BMPs addressing Critical Areas, Agriculture, and Upland Animal and Plant Habitat are contained in the *Island County Critical Areas Best Management Practices Comprehensive Manual* (November 1999). The Washington Department of Ecology's *Stormwater Management Manual for Western Washington* (August, 2001) includes not only the BMPs described in this field manual, but also includes BMPs appropriate for larger sites and more complex development projects. The Ecology manual contains updated information based on advances in technology and practical experience. NOTE: Island County has NOT, as of the date of publication of this field manual, adopted the Ecology manual. At this time, use of the BMPs as presented in the Ecology manual is recommended, but not required. Island County development review staff should be consulted if there is any question about requirements or the applicability of any particular BMP.

Some general activities are listed and organized a bit differently than use-specific BMPs. These include:

- Landscaping, Lawn, and Vegetation Management
- Utility Installation and Utility Corridor Maintenance
- Maintenance of Roadside Ditches

The following describes the primary organization of the BMPs in the manual. General categories are indicated as follows: **TS – Temporary Source Control, TT – Temporary Treatment, PS – Permanent Source Control, and PT – Permanent Treatment**. Each BMP is given an identifying number unique to the Field Manual. Associated with each BMP is a reference to the corresponding BMP(s) from the Washington Department of Ecology's *Stormwater Management Manual for Western Washington* (August, 2001), if applicable.



BMP #	DESCRIPTION	TYPE	ECOLOGY BMP
1	Preservation of Existing Vegetation	TS, TT, PS, PT	C101, C102, C103, C104
2	Spill Control and Waste Management	TS	
3	Management of Vehicle Tracking of Sediment	TS	C105, C106, C107
4	Dust Control	TS	C140
5	Stockpile Management	TS	C123
6	Blankets, Nets, and Mats	TS, PS	C122
7	Inlet Protection	TS	C220
8	Check Dams	TT, PT	C207
9	Silt Fence	TT	C233
10	Brush, Mulch, or Compost Barrier	TT	C231
11	Straw Bale Barrier	TT	C230
12	Silt Dike	TT	C208
13	Vegetated Buffer Strip	TT, PT	C234
14	Seeding of Exposed Soils	TS, PS	C120
15	Mulch	TS, PS	C121
16	Landscaping, Lawn, and Vegetation Management	TS, PS	Vol IV, pg 2-23
17	Maintenance and Installation of Utilities	TS, PS	Vol IV, pg 2-36
18	Maintenance of Ditches	TS, PS	Vol IV, pg 2-38



BMP 1. PRESERVATION OF EXISTING VEGETATION

PURPOSE

Preservation of existing vegetation and limiting site disturbance is the single most effective means of limiting erosion and transport of sediment off-site. Vegetation catches and holds rainfall, slows and filters runoff, and holds soils in place.

Marking clearing limits with highly visible flagging, fencing, or other suitable materials can help minimize inadvertent damage to areas designated for preservation.

➡ ***If it doesn't need to be cleared, then DON'T CLEAR IT!!***

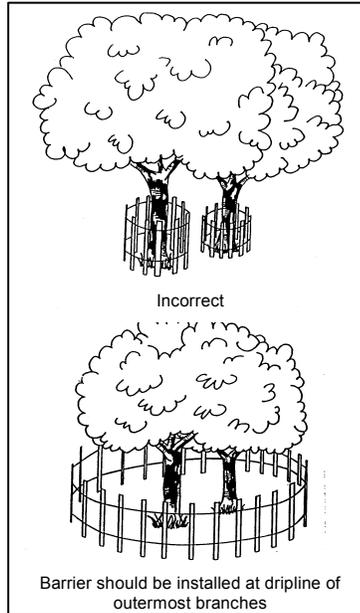
USE AND INSTALLATION GUIDELINES

1. Be aware of any buffers or natural areas required by local regulations or conditions of permit approval.
2. Check the project plans for areas designated for preservation of natural vegetation.
3. Identify the minimum area which must be cleared for the development project, including room for construction equipment to maneuver, areas for stockpiling, and areas for installation utilities, including septic system components.
4. Identify trees, shrubs, or clumps of vegetation which are to be preserved.
5. All areas outside the minimum clearing area should be marked with temporary fencing.
6. A temporary fence can consist of T-posts with rope or wire strung between them, with highly visible surveyor's flagging wrapped around the rope or wire.
7. A more substantial fence, such as 48" high-density polyethylene webbing, may prove necessary if the simple one described above suffers repeated damage or otherwise fails to discourage impacts to the areas designated for preservation.
8. Trees to be preserved should be flagged around the drip line.



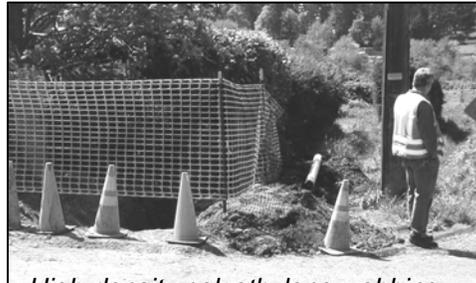
Excavation or fill should not occur within the drip line.

9. Keep all construction equipment, materials, and waste out of the designated areas. Avoid compaction of soil and damaging bark, roots, or limbs with heavy equipment.
10. Do not modify existing drainage patterns through or into any vegetated area unless specifically directed by the approved plans.
11. Perform maintenance activities as needed to ensure that the vegetation remains healthy and able to aid in erosion control and sediment collection.



MAINTENANCE

Inspect at regular intervals to make sure the preserved vegetated areas remain undisturbed and are not being overwhelmed by sediment. Implement maintenance or restorative actions as needed. Vigilance against pets, vandalism, drought, pests, and crowding by undesired plants is important to ensure healthy vegetation that can control erosion remains intact. Different species, soil types, and climatic conditions will require different maintenance activities such as mowing. Maintenance should be performed regularly, especially during construction. Vegetation buffers should be protected with silt fencing to prevent sedimentation.



High-density polyethylene webbing and traffic cones form an effective visual barrier, keeping construction activities away from areas to be left undisturbed.



BMP 2. SPILL CONTROL AND WASTE MANAGEMENT

PURPOSE

Limit introduction of harmful or hazardous materials into surface and ground water. Manage waste generated at construction sites.

USE AND INSTALLATION GUIDELINES

Storage

1. **The best way to avoid polluting runoff from outside material storage areas is to prevent stormwater run-on or rain from coming in contact with the materials.** Methods that can be utilized to accomplish this are:
 - storing the material indoors
 - covering the area with a roof
 - covering the material with a temporary covering
2. Identify, control, and enforce storage and disposal/stockpile areas
3. Dumpsters should be covered to prevent rain from leaching waste out of drainage holes in bottom.
4. Provide a barrier such as a liner, concrete pad or berm.
5. Use drip pans or absorbent materials under equipment when not in use.



Sealant has been sloppily applied and spilled. It is running off directly into surface waters. No attempt at clean-up was made.

Fueling and Vehicle Maintenance

1. Install vapor recovery nozzles on fueling equipment.
2. If fueling and maintenance must occur off-site, do it away from watercourses.
3. Do not "top off" tanks



while fueling.

4. Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

Spill Treatment

1. Place a stockpile of spill cleanup materials where it will be readily accessible. When working near waterways have spill containment booms at hand.
2. On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material (such as kitty litter) for larger spills.
3. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
4. Never hose down or bury dry material spills.

Concrete Trucks

1. Clean-out must take place where slurry will not enter surface waters.
2. **Flushing tanks into County ditches or other surface water conveyances is prohibited!**



MAINTENANCE

1. Don't leave full drip pans lying around. Promptly transfer used fluids to the proper waste or recycling drums.
2. Check waste management areas for leaking containers and spills.
3. Note any corroded or damaged containers.



BMP 3. MANAGEMENT OF VEHICLE TRACKING OF SEDIMENT

PURPOSE

Minimize the transport of sediment off-site due to tracking by vehicles.

USE AND INSTALLATION GUIDELINES

Construction of Temporary Internal Roads and Parking Areas

1. Construct and stabilize access routes and parking areas within the site as early as possible.
2. Place a 6-inch deep layer of 2-4 inch crushed rock on internal roads and parking areas. Placing geotextile directly on the graded surface prior to the crushed rock will help keep the roadway intact and stable.
3. If possible, slope temporary roads so that runoff sheet flows into existing dense vegetation, rather than into ditches where it may cause more problems.
4. If necessary, install fencing (see BMP 1) to guide traffic flows to stabilized roads, parking areas, and access areas.

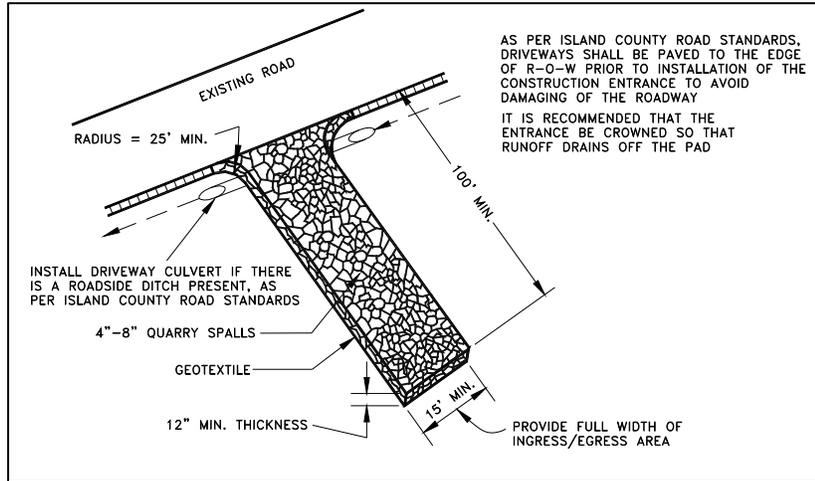
Construction of Stabilized Construction Entrances

1. Ensure the access is in a location approved through an Access Permit issued by Island County. Read and follow all conditions of Access Permit approval.
2. Clear all vegetation, roots, and all other obstructions in preparation for grading.
3. Construction on a firm, compacted subgrade will drastically increase the effectiveness and useful life of a construction entrance.
4. To reduce maintenance and loss of aggregate, place geotextile over the graded and compacted surface prior placing the stone for the entrance.
5. Place a 4- to 8-inch layer of quarry spall over the entire width and length of the entrance.
6. Place a 4-inch layer of 2-inch crushed stone over the base layer.
7. Construct driveway culverts as required by Access Permit conditions for existing ditch flows.
8. If the construction entrance is not preventing sediment from being tracked onto the paved roadway, then an increase in the size of the construction entrance, or other alternative measures, such as a wheel wash and regular sweeping, may be necessary.
9. All materials spilled, dropped, washed, or tracked from vehicles onto



roadways or into storm drains must be removed immediately.

10. Disturbed soil areas resulting from removal of the construction entrance, wheel wash, or other temporary facilities must be permanently stabilized.
11. The stabilized construction entrance may be removed after final site stabilization is achieved or after the temporary BMPs are no longer needed.



Wheel Wash

1. Heavily mudded vehicle wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way.
2. When washing is required, it shall be done on an area stabilized with aggregate.
3. Establish a wheel-wash location where silt-laden runoff can pond in a sediment trap for later removal or treatment; where it will pass through dense vegetation for filtering; or where it can be infiltrated.

Street Sweeping

1. Any sediment tracked onto the paved roadway must be removed by sweeping or shoveling at least daily, and more if necessary.
2. To limit dust during sweeping, the sediment-covered roadway may be **slightly** moistened. **Never** remove sediment from the roadway by hosing or washing.

MAINTENANCE

1. Maintain temporary roads, parking areas, and construction entrances



- in a condition which will prevent tracking or flow of mud onto public rights-of-way.
2. The entrance must be maintained through periodic top dressing with additional rock (as conditions demand) and repair or clean-out of any sediment.
 3. Geotextile placement prior to placement of the rock will reduce maintenance needs.



Mud is being tracked onto pavement and is running into the adjacent ditch. The ditch empties directly into marine waters.

This access will function temporarily, but would last longer if larger rock were placed and if underlain by geo-textile.



BMP 4. DUST CONTROL

PURPOSE

Minimize the wind-borne transport of sediment off-site and onto roadways, drainage features, and other surface waters.

USE AND INSTALLATION GUIDELINES

1. Limit clearing to the minimum area necessary. Minimize amount of ground disturbance at one time, and limit it to areas where construction or other activity will occur immediately.
2. Cover exposed soils with mulch or vegetation. Establish vegetation at the earliest possible opportunity (using irrigation if necessary to ensure survival).
3. Use gravel or other larger materials to stabilize roadways and other areas where mulch or vegetation is impractical.
4. Chemical treatment using calcium chloride or PAM could be cost effective, depending on the size of the site and the extent of the problem. Use only in recommended amounts and follow application instructions.
5. Establish alternate routes where possible.
6. Lower speed limits on the site.
7. Install barriers and windbreaks to protect vulnerable areas and prevent dust from blowing off site.
8. During dry periods, keep haul roads, detours, and other bare areas moist by sprinkling them with water several times per day or as necessary. Do not apply so much water that it runs off the site.

MAINTENANCE

1. Regularly check areas protected by mulch, adhesive emulsions, or barriers.
2. Remove sediments that accumulate behind any sediment fence or barrier.
3. Dispose of the sediments only in an approved location.



BMP 5. STOCKPILE MANAGEMENT

PURPOSE

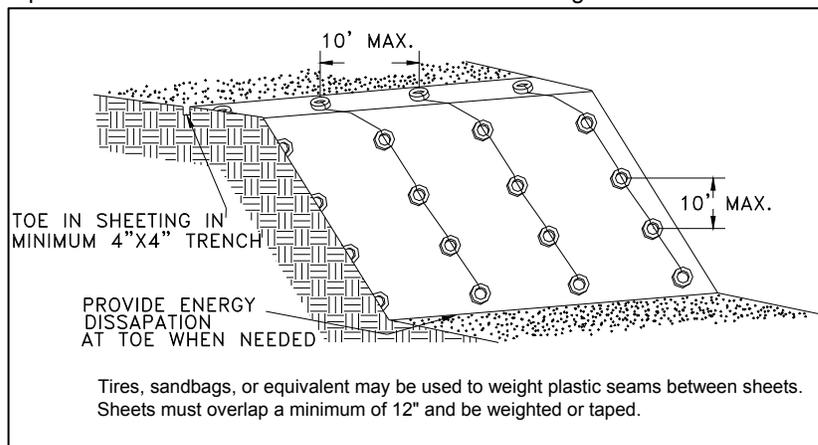
Stockpiled material can be highly vulnerable to erosion. Appropriate management will ensure materials stay where they are supposed to and can be used for backfill or landscaping when the project nears completion.

USE AND INSTALLATION GUIDELINES

Any stockpiled material, such as excavation spoils from a foundation or trench, imported topsoil, or material to be exported from a site must be protected from erosion. Coarse materials like gravels pose less of a threat than clays, till, or topsoil, but still need to be protected.

Use mulch (**BMP 15**), seeding (temporary or permanent) (**BMP 14**), or nets or blankets (**BMP 6**) to protect stockpiled material from erosion.

A less desirable though potentially effective protection is temporary plastic cover. Used improperly, plastic sheeting can cause serious erosion problems. Use and installation should follow these guidelines:



1. Appropriate protection **MUST** be installed at the toe of the sheeting to prevent the high-velocity runoff from eroding materials at the base of slopes or stockpiles. This can be 12" gravel piled on the lower 3' of the sheeting, or surrounding the pile with appropriately installed silt fence (**BMP 9**).
2. Because polyethylene plastic sheeting breaks down relatively quickly, it should not be used to cover sites for more than 30 days.
3. Sheeting should not usually be placed over areas where vegetation is



desired. An exception is areas where seeding has occurred late in the year, and clear sheeting is placed to provide a greenhouse effect to aid in grass establishment.

4. NEVER allow clean runoff from the plastic sheeting to run into ditches or other areas of disturbance or exposed soils.
5. While plastic is inexpensive to purchase, the additional cost of proper installation, maintenance, removal and disposal make this a relatively expensive means of stockpile or slope protection. Mulch is usually cheaper in the long run.
6. The plastic sheets should run up and down the slope, not across it. Overlap sheets by at least 12". Seams should be taped.
7. Place top of plastic sheets in a trench at the top of the slope to prevent water from running underneath it.
8. Use tires or sandbags every 3 to 6 feet along seams. Pound stakes to hold weights in place.

MAINTENANCE

1. Inspect plastic covering, nets, blankets, mulch, or seeding regularly, especially after high winds or heavy rains.
2. Exposed soils should be covered immediately.
3. Rills, gullies, or other evidence of concentrated water flow should be repaired immediately, and appropriate steps taken to redirect and disperse flows.
4. Torn sheets or open seams must be repaired immediately.
5. If the plastic begins to deteriorate from UV radiation, it must be completely removed and replaced.



Improperly installed and poorly maintained plastic sheeting on a soil stockpile, inadequate depth of straw mulch, and an unprotected storm water inlet.



BMP 6. BLANKETS, NETS AND MATS

PURPOSE

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows.

USE AND INSTALLATION GUIDELINES

Erosion control nets and blankets are very effective in ditches and swales. They protect soil from erosion, slow water velocities, and trap sediment due to their open porous structure.

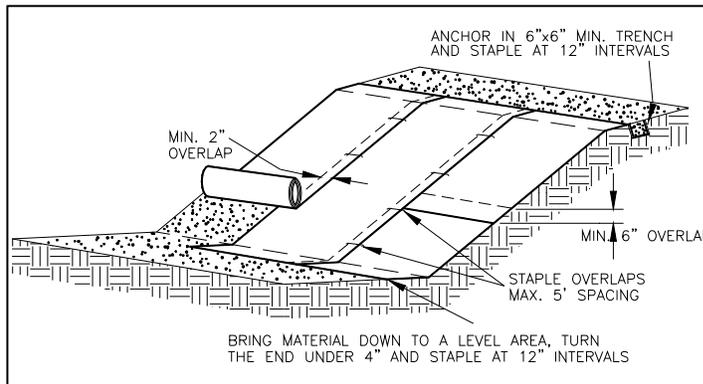
While the initial costs of these materials can be expensive, and some ground preparation is needed, they have many advantages. They are simple to install, and need no special equipment or extensively trained personnel. Organic materials, such as burlap or coconut fiber (coir), can be left in place. Synthetic materials can be removed once soils have stabilized and reused in another area. The material can be installed in phases as needed. These materials have proven to be very effective in emergency situations, where weather conditions demand immediate control of erosion.

1. The diagrams are for illustrative purposes only. Consult the material manufacturer's recommendations and installation instructions.
Proper installation is generally simple, but is critical to the performance of these products.
2. The soil must be smooth. Be sure the fabric makes uniform contact with the slope face underneath, molding the material to any irregularities in the slope. Don't stretch the material tight. Don't "bridge" rills or gullies fill and compact instead. Remove protruding rocks and other obstructions. **Proper ground contact is essential – otherwise, runoff can concentrate under the material and cause severe erosion.**
3. Materials with more open structure, such as jute matting, generally require that mulch be placed first. More dense material, including some synthetic geotextile blankets, do not require mulch. If the area is to be seeded or mulched, place the mulch, seed, or both on the exposed soils prior to installation of the blanket or net.
4. The top edges of the material must be appropriately keyed into a shallow trench. The trench must be backfilled and tamped.
5. Apply the individual rolls up and down the slope, from the top to the



bottom--not along the contour. The exception is on slopes of less than 3H:1V, where rolls may be placed horizontally along the slope.

6. Overlap the sides of rolls at least 4 inches. Make sure there is at least a 3 foot overlap when an uphill roll joins to a downhill roll. The uphill roll should overlie the downhill roll.
7. Apply seed and fertilizer (if required) prior to installing the nets or blankets. Plant any trees and shrubs after installation by cutting holes in the material and keying in any loose edges.
8. Extend the fabric beyond the edge of the mulched or seeded area at least 1 foot at the sides and 3 feet at the top and bottom of the area. If existing vegetation or structures mark the boundaries of the area, the fabric should continue into the stable vegetated area or to the edge of the structure.
9. Staples should be driven perpendicularly into the slope face. Place them approximately 5 feet apart down the sides and center of the roll, and not more than 1 feet apart at the upper end of a roll or at the end overlap of two rolls (or per manufacturer's instructions).



MAINTENANCE

To assure proper functioning:

1. Complete one inspection during the first runoff-producing event after installation. After initial inspection, inspect monthly and within 24 hours after large storms.
2. If fabric is damaged or missing, replace it immediately to restore full protection. If channelization and erosion is occurring underneath fabric (sediment outwash is the most visible sign of this) re-anchor upstream edge, ensure the material makes good ground contact in



any rills or gullies, and repair any eroded areas.



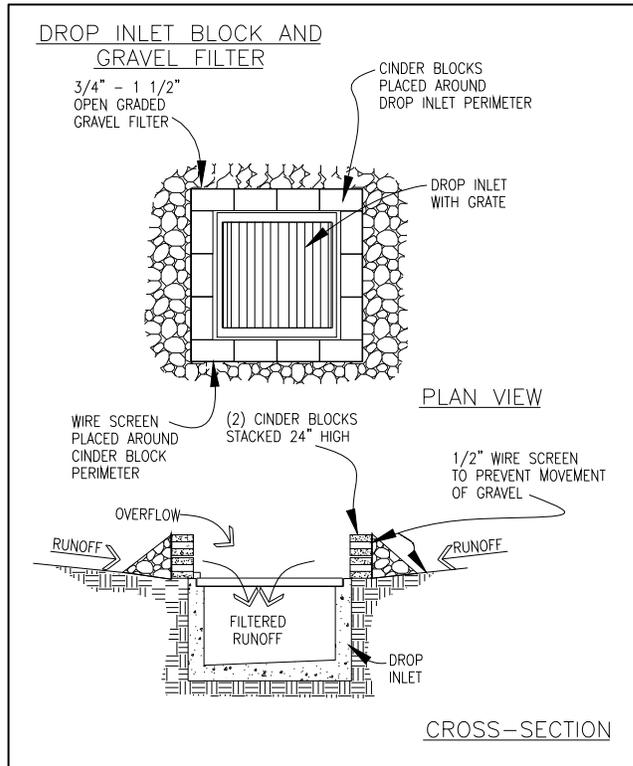
3. If adjacent to a road or other traveled surface, the top of frame (weir) must be at least 6 inches below edge of roadway adjacent to inlet.
4. Stretch filter cloth tightly over wire mesh. The cloth must extend from top of frame to 18 inches below inlet notch elevation. Fasten securely to frame. Ends must meet at post, be overlapped and folded, then fastened down.
5. Backfill around inlet in compacted 6" layers until a layer of earth is even with notch elevation on ends and top elevation on sides.
6. If the inlet is not in a low point, construct a compacted earth dike in the ditch line below it. The top of the dike is to be at least 6 inches higher than the top of frame (weir).
7. This structure must be inspected frequently and the filter fabric replaced when clogged.

Block and Gravel Filter

A barrier formed around the storm drain inlet with standard concrete blocks and gravel.

1. Height 1 to 2 feet above inlet.
2. Recess the first row 2 inches into the ground for stability.
3. Support subsequent courses by placing a 2x4 through the block opening.
4. Do not use mortar.
5. Lay some blocks in the bottom row on their side for dewatering the pool.
6. Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
7. Place gravel just below the top of blocks on slopes of 2:1 or flatter.
8. An alternative design is a gravel donut.
9. Inlet slope of 3:1.
10. Outlet slope of 2:1.
11. 1-foot wide level stone area between the structure and the inlet.
12. Inlet slope stones 3 inches in diameter or larger.
13. Outlet slope use gravel ½- to ¾-inch at a minimum thickness of 1-foot.





MAINTENANCE

1. Inspect regularly and after every storm. Make any repairs necessary to ensure the measure is in good working order.
2. Remove accumulated sediment and restore the trap to its original dimensions when sediment has accumulated to half the design depth of the trap. All sediments removed must be disposed of properly.
3. On gravel-and-mesh devices, clean (or remove and replace) the stone filter or filter fabric if it becomes clogged.
4. On filter fabric devices, replace the fabric immediately if it becomes clogged.
5. Make sure the stakes are firmly in the ground and that the filter fabric continues to be securely anchored.
6. Inlet protection should remain in place and operational up to 30 days



after the drainage area is completely stabilized.



BMP 8. CHECK DAMS

PURPOSE

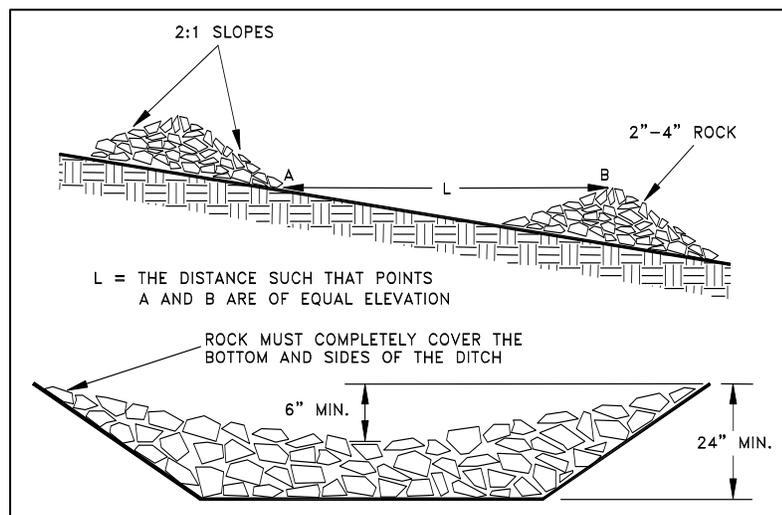
Check dams should be used within temporary channels or permanent channels when the channels are not yet vegetated or channel lining is infeasible. Construction of small dams across a swale or ditch reduces the velocity of concentrated flow and dissipates energy at the check dam.

USE AND INSTALLATION GUIDELINES

Whatever material is used, the dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the dam rather than falling directly onto the ditch bottom.

Check dams in association with sumps work more effectively at slowing flow and retaining sediment than just a check dam alone. A deep sump should be provided immediately upstream of the check dam.

In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.



1. Check dams can be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose.



They tend to be re-usable, quick and easy to install, effective, and cost efficient.

2. Check dams should be placed perpendicular to the flow of water.
3. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
4. Keep the maximum height at 2 feet at the center of the dam.
5. Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
6. Keep the side slopes of the check dam at 2:1 or flatter.
7. Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.
8. Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, this is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
9. Rock check dams shall be constructed of appropriately sized rock. The rock must be placed by hand or by mechanical means (no dumping of rock to form dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges. The rock used must be large enough to stay in place given the expected design flow through the channel.
10. In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
11. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.
12. Regardless of the type of check dam, riprap may be necessary on the downstream side of the dam to protect the streambed from scour.

MAINTENANCE

1. Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall.
2. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam.
3. If significant erosion occurs between dams, install a protective riprap



liner in that portion of the channel.

4. Inspect the check dams regularly and after every runoff-producing storm. Make any repairs necessary to ensure the measure is in good working order.
5. Remove accumulated leaves and sediments from behind the dam when they reach a depth of one-half the original height of the dam or sump depth. Dispose of all materials properly so they don't contribute to pollution problems at the disposal site.
6. Restore stone as necessary for the dams to maintain their correct height.
7. On sandbag dams, inspect the sandbag fabric for signs of deterioration.



An undersized and poorly maintained check dam. The excessive accumulation of sediment should be removed. Note the water flowing past the upper right corner of the check dam

The check dams in this picture are sized and located properly. The rip-rap between the two check dams protects the outlet of a culvert.



BMP 9. SILT FENCES

PURPOSE

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow. It will NOT prevent the transport of fine suspended silt and sediment.

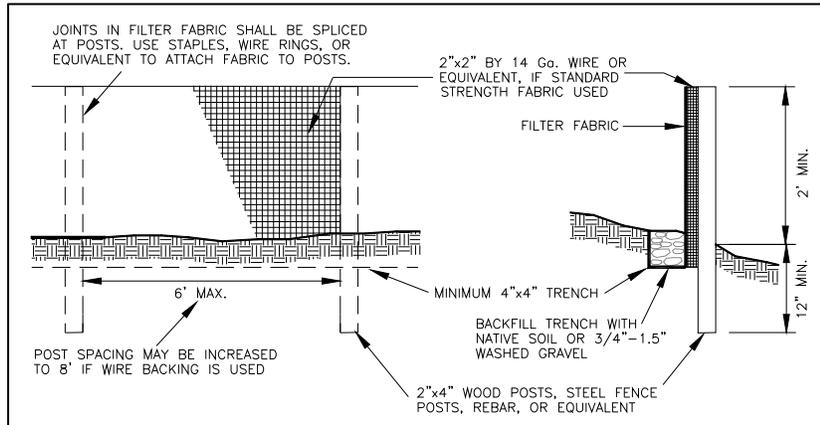
Silt fences are one of the most overused BMPs. They can be effective when properly installed on the right site, but are not right for every site.

USE AND INSTALLATION GUIDELINES

1. Silt fence may be used downslope of all disturbed areas.
2. Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond.
3. The only circumstance in which overland flow can be treated solely by a silt fence, rather than by a sediment pond, is when the area draining to the fence is one acre or less and flow rates are less than 0.5 cfs.
4. **Silt fences should not be constructed in streams or used in V-shaped ditches. They are not an adequate method of silt control for anything deeper than sheet or overland flow.**
5. Maximum slope steepness (perpendicular to fence line) 1:1.
6. Maximum slope length above the fence should not exceed 100 feet.
7. Silt fences shall be located on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
8. If the fence must cross contours, with the exception of the ends of the fence, gravel check dams placed perpendicular to the back of the fence should be used to minimize concentrated flow and erosion along the back of the fence. The gravel check dams should be approximately 1-foot deep at the back of the fence, and should be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence. The gravel check dams should consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Locate the gravel check dams every 10 feet along the fence where the fence must cross contours. The slope of the fence line where contours must be crossed should not be steeper than 3:1.



9. Posts should be spaced 8 feet apart when a wire mesh support fence is used and no more than 6 feet apart when using extra-strength filter fabric (without a wire fence). The posts should extend at least 16 inches into the ground.
10. If standard strength filter fabric filter is to be used, fasten the optional wire mesh support fence to the upslope side of the posts using heavy duty wire staples, tie wires, or hog rings. Extend the wire mesh support to the bottom of the trench. The filter fabric should then be stapled or wired to the fence.
11. Extra strength filter fabric does not require a wire mesh support fence. Staple or wire the filter fabric directly to the posts.
12. Do not attach filter fabric to trees!
13. Where joints in the fabric are required, splice it together only at a support post, with a minimum 6 inches overlap, and securely seal the joint.
14. Backfill the trench with gravel to anchor the fabric.



MAINTENANCE

1. Silt fences should be inspected periodically for damage (such as tearing by wind, animals, or equipment) and for the amount of sediment which has accumulated.
2. Silt fences should be inspected immediately after each rainfall and at least daily during prolonged rainfall. Required repairs should be made immediately.
3. Sediment deposits should be removed when the deposit reaches



approximately one-third the height of the silt fence, or whenever heavy rain or high water is anticipated.

4. It is important to check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
5. If concentrated flow occurs after installation, take corrective action by placing rock berms or other corrective measures in the areas of concentrated flow.
6. The sediment deposits should be placed in an area where there is little danger of erosion.
7. The silt fence should not be removed until adequate vegetative growth ensures no further erosion of the slopes. Generally, the fabric is cut at ground level, the wire and posts are removed, then the sediment is spread, seeded, and protected (mulched) immediately.



This silt fence was put up “just for show”, but it didn’t fool anybody. The bottom is not keyed into the soil. It is totally ineffective and a waste of the owner’s money.

A properly installed silt fence.



BMP 10. BRUSH, MULCH, OR COMPOST BARRIER

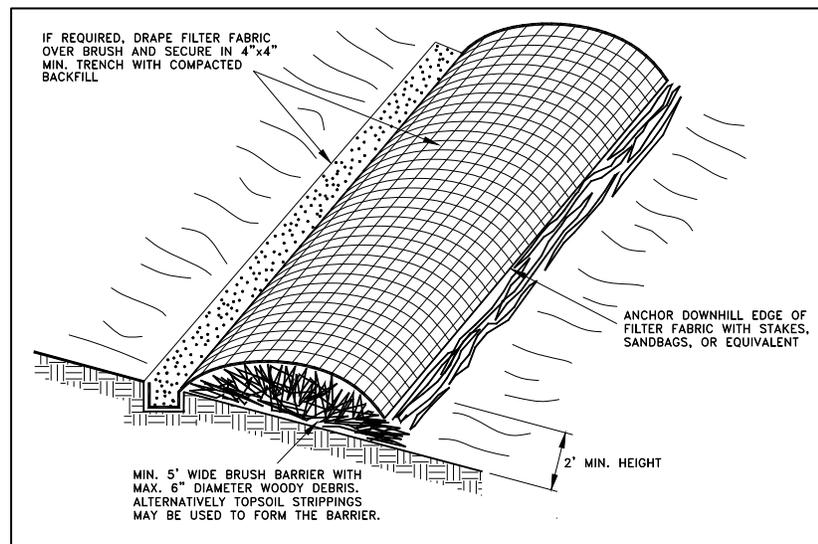
PURPOSE

The purpose of brush, mulch, or compost barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

USE AND INSTALLATION GUIDELINES

Brush, mulch, or compost barriers may be used downslope of all disturbed areas of less than one-quarter acre.

Brush, mulch, or compost barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a barrier, rather than by a sediment pond, is when the area draining to the barrier is small.



1. Brush, mulch, or compost barriers should only be installed on contours.
2. Height 2 feet (minimum) to 5 feet (maximum).



3. Width 5 feet at base (minimum) to 15 feet (maximum).
4. Filter fabric (geotextile) may be anchored over the brush, mulch, or compost berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric, and has the advantage of being biodegradable.
5. Chipped site vegetation, composted mulch, or wood-based mulch (hog fuel) can be used to construct brush barriers.
6. A 100 percent biodegradable installation can be constructed using 10-ounce burlap held in place by wooden stakes.

MAINTENANCE

1. There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.
2. The dimensions of the barrier must be maintained.



BMP 11. STRAW BALE BARRIER

PURPOSE

To decrease the velocity of sheet flows and intercept and detain small amounts of sediment from disturbed areas of limited extent, preventing sediment from leaving the site.

USE AND INSTALLATION GUIDELINES

➤ ***Straw bales are among the most used and least effective BMPs. THEY JUST DON'T WORK!! A silt fence (BMP 9), silt dike (BMP 12), or a brush or compost berm (BMP 10), are much more effective barriers.***

slope gradient behind the barrier is 2:1.

1. Install below disturbed areas subject to sheet and rill erosion. Where the size of the drainage area is no greater than 1/4 acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum
2. Do not use if effectiveness is required for more than three months.
3. **Under no circumstances should straw bale barriers be constructed in streams, channels, or ditches.**
4. Straw bale barriers should not be used where rock or hard surfaces prevent the full and uniform anchoring of the barrier.
5. Bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.
6. All bales should be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order

➤ ***The best use of a straw bale is to feed horses or to hand spread it on the site!***



to prevent deterioration of the bindings.

7. Dig a trench the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. The trench must be deep enough to remove all grass and other material that might allow underflow. After the bales are staked and chinked (filled by wedging), the excavated soil should be backfilled against the barrier on the downhill side and should be built up to 4 inches against the uphill side of the barrier.
8. Each bale must be securely anchored by at least two stakes or re-bars driven through the bale and deep enough into the ground to securely anchor the bales. The first stake in each bale should be driven toward the previously laid bale to force the bales together.
9. The gaps between the bales should be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Wedging must be done carefully in order not to separate the bales.
10. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency (see BMP 15).

MAINTENANCE

1. Straw bale barriers shall be inspected immediately after each runoff-producing rainfall and at least daily during prolonged rainfall. Look for damaged bales, end runs, and undercutting beneath bales.
2. Sediment deposits should be removed after each runoff-producing rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.
3. Any sediment deposits remaining in place after the straw bale barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.
4. Straw bales used as a temporary barrier must be removed after project completion and stabilization to prevent sprouting of unwanted vegetation.

A typical failing straw bale barrier. Water is running around it, and it is serving no purpose.



BMP 12. SILT DIKE

PURPOSE

Triangular silt dikes may be used as check dams, for perimeter protection, for temporary soil stockpile protection, for drop inlet protection, or as a temporary interceptor dike.

USE AND INSTALLATION GUIDELINES

Silt dikes are triangular foam devices wrapped in a geotextile fabric. The fabric extends 2-3 feet beyond the edges of the dike, and can be used as a skirt or apron to anchor the dike or overlap two or more dikes. Sleeves at the end allow attachment of additional sections as needed.



A typical length is 7 feet, but several may be put end to end. They weigh only a few pounds apiece, so are easily handled by a single worker.

Triangular silt dikes may be used on soil or pavement with adhesive or staples in a variety of ways, but they are better at filtering the flow than diverting it. They may be used for temporary check dams in ditches of any dimension. They can also be used in temporary sediment ponds, diversion ditches, concrete wash out facilities, curbing, water bars, level spreaders, and berms.

1. Install with ends curved up to prevent water from flowing around the ends.
2. The fabric flaps and check dam units should be attached to the ground with wire staples. Wire staples should be No. 11 gauge wire and should be 200 mm to 300 mm in length.
3. When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled.
4. Check dams should be located and installed as soon as construction will allow.
5. Check dams should be placed perpendicular to the flow of water.
6. When used as check dams, the leading edge must be secured with rocks, sandbags, or a small key slot and staples.



MAINTENANCE

1. Triangular silt dams should be monitored for performance and sediment accumulation during and after each runoff producing rainfall.
2. Sediment should be removed when it reaches one half the height of the dam.
3. Anticipate submergence and deposition above the triangular silt dam and erosion from high flows around the edges of the dam.
4. Immediately repair any damage or any undercutting of the dam.



A silt dike used in outlet protection.



Silt dikes used as check dams.



BMP 13. VEGETATED BUFFER STRIP

PURPOSE

Vegetated buffer strips reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow. They can also be used as permanent water quality treatment features in areas of low pollutant generation.

USE AND INSTALLATION GUIDELINES

Vegetated strips may be used downslope of all disturbed areas.

Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a strip, without use of additional treatment, is when the following slope and reach conditions apply:

Average Slope	Slope Percent	Flowpath Length
1.5H:1V or less	67% or less	100 feet
2H:1V or less	50% or less	115 feet
4H:1V or less	25% or less	150 feet
6H:1V or less	16.7% or less	200 feet
10H:1V or less	10% or less	250 feet

1. The vegetated strip should consist of a minimum of a 25-foot wide continuous strip of dense vegetation with a permeable topsoil.
2. Grass-covered landscaped areas are generally not adequate because the volume of sediment overwhelms the grass.
3. Ideally, vegetated strips should consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff. Areas of heavy clay soils that will not support good vegetative growth do not make suitable vegetated strips. When establishing new vegetative strips, or enhancing existing vegetated areas, it may be necessary to import good topsoil and till it into the existing soil.
4. The slope within the strip should not exceed 4H:1V.
5. During construction on the site, the uphill boundary of the vegetated



strip should be delineated with clearing limits.

MAINTENANCE

1. Any areas damaged by erosion or construction activity must be seeded immediately and protected by mulch. Installing sod may be necessary in severely damaged areas.
2. If there are indications that concentrated flows are traveling across the vegetated strip, surface water controls must be installed to reduce the flows entering the buffer, or additional perimeter protection must be installed.



If a few more feet of undisturbed vegetation had been left on this site, no silt fence would have been necessary, and time and money could have been saved.



BMP 14. SEEDING OF EXPOSED SOILS

PURPOSE

Seeding is intended to reduce erosion by temporarily or permanently stabilizing exposed soils. **A well-established vegetative cover is one of the most effective methods of reducing erosion.**

USE AND INSTALLATION GUIDELINES

Seeding may be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

Channels that will be vegetated should be installed and hydroseeded before major earthwork. The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the seed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch over hydromulch and blankets.

Retention/detention ponds should be seeded as required.

Mulch protects seeds from heat, moisture loss, and transport due to runoff, and should be applied over seed immediately following seeding.

All seeding should be completed by the end of September. Otherwise, vegetation will usually not establish itself enough. Some specialized grass seeds can sometimes germinate and become established during particularly mild winters. This should not be counted on, however, and appropriate contingencies, such as mulch or blankets, should be readily at hand.

At final site stabilization, all disturbed areas not otherwise vegetated or stabilized should be seeded and mulched. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1. Seeding that occurs between July 1 and August 30 will likely require irrigation until 75 percent grass cover is established. Seeding that occurs between October 1 and March 30 may require a mulch or plastic cover until 75 percent grass cover is established.

To prevent seed from being washed away from areas to be permanently



vegetated, all required surface water control measures should be installed prior to seeding.

The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes or occurs inadvertently, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 should not occur if they are to be seeded.

New and more effective restoration-based landscape practices rely on deeper incorporation of organic soil amendments than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas of poor soils should use soil amendments to increase organic matter and permeability performance.

Organic matter is the most appropriate form of "fertilizer" because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2-10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.

In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts.

There are numerous products available on the market that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal is a good source of long-term, slow-release, available nitrogen.

Hydroseed applications should include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. Mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and kenaf; compost; or blends of these. Tackifier should be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers. Any mulch or tackifier product should be used per manufacturer's instructions. Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Application of mulch can vastly increase the success of seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.

Seed that is installed as a temporary measure may be installed by hand if it will be covered by straw, mulch, or topsoil. Seed that is installed as a permanent measure may be installed by hand on small areas (usually less than 1 acre) that will be covered with mulch, topsoil, or erosion



blankets.

The seed mixes listed below include recommended mixes for both temporary and permanent seeding. These mixes, with the exception of the wet area mix, should be applied at a rate of 120 pounds per acre. The wet area mix should be applied at the rate of 60 pounds per acre. These rates can be reduced if soil amendments or slow release fertilizers are used.

The following seed mixes recommendations should be used as general guidelines only. Selection of seed mixes should be based on location, exposure, soil type, slope, and expected foot traffic, and will depend on local availability. Local suppliers or the local conservation district may have recommendations specific to the type and use of the areas to be seeded.

Temporary Erosion Control Seed Mix

Use this seed mix for rapid establishment of vegetation on a site. It is a good mix for a temporary cover and it can also be used as permanent cover.

Species	% weight
Chewings fescue or annual blue grass <i>Festuca rubra var. commutata</i> or <i>Poa annua</i>	40
Perennial rye <i>Lolium perenne</i>	50
Redtop or colonial bentgrass <i>Agrostis alba</i> or <i>Agrostis tenuis</i>	5
White dutch clover <i>Trifolium repens</i>	5

Permanent Landscape Seed Mix

The following is a common mix for western Washington landscaping purposes. It establishes quickly and tolerates the wet winters and droughty summers of the region.

Species	% weight
Perennial rye <i>Lolium perenne</i>	70
Chewings fescue or red fescue blend <i>Festuca rubra</i> or <i>Festuca rubra var. commutata</i>	30



Low-growing, Low Maintenance Seed Mix

This mix may not have the aesthetic qualities of other turf mixes, but it grows slowly, requires little watering, and requires less mowing than other mixes.

Species	% weight
Dwarf tall fescue (several varieties) <i>Festuca arundinacea</i> var....	45
Dwarf perennial rye <i>Lolium perenne</i> var. <i>barclay</i>	30
Red fescue <i>Festuca rubra</i>	20
Colonial bentgrass <i>Agrostis tenuis</i>	5

Bioswale Seed Mix

This mix is good where occasional ponding or flooding of short duration is likely. It tolerates occasional wet conditions, while cleansing water it contacts through physical filtration and nutrient uptake.

Species	% weight
Dwarf or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	75
Creeping bentgrass <i>Agrostis stolonifera</i>	15
Redtop bentgrass <i>Agrostis gigantea</i>	10



Wet Area Seed Mix

An appropriate mix for wetter areas. It is relatively non-invasive and low-growing. It is not a native mix, however, and **should not be used in or adjacent to regulated wetlands**. A professional wetlands ecologist should be consulted before selecting plantings for regulated wetlands.

Species	% weight
Dwarf or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	75
Creeping bentgrass <i>Agrostis stolonifera</i>	15
Redtop bentgrass <i>Agrostis gigantea</i>	10

Meadow Seed Mix

This mix is appropriate in areas that will not be regularly maintained or where eventual dominance by native plants is desired or encouraged. September and early October is the best time to plant this mix. If native plant colonization is the ultimate goal, the clover should be left out of the mix as it can be somewhat invasive and may out-compete the desirable native plant species. As with all legumes, clover helps increase available nitrogen in the soil, and if it is not included in the seed mix then soils should be amended with organic mulch or compost to increase available nitrogen.

Species	% weight
Red fescue <i>Festuca rubra</i>	70
Redtop bentgrass or Oregon bentgrass <i>Agrostis gigantea</i> or <i>Agrostis oregonensis</i>	20
White dutch clover <i>Trifolium repens</i>	10

MAINTENANCE

1. Any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) should be reseeded. If reseeding is ineffective, an alternate method, such as sodding, mulching, or nets/blankets, should be used.



2. After adequate cover is achieved, any areas that experience erosion should be reseeded and protected by mulch. If the erosion problem is drainage related, the problem should be fixed and the eroded area reseeded and protected by mulch.
3. Seeded areas must be supplied with adequate moisture, but not watered to the extent that it causes runoff.



Hydro-seeding an exposed slope.



BMP 15. MULCH

PURPOSE

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. A variety of types of mulch are available. The most common types are discussed in this section.

USE AND INSTALLATION GUIDELINES

As a temporary cover measure, mulch should be used:

1. On disturbed areas that require cover measures for less than 30 days.
2. As a cover for seed during the wet season and during the hot summer months.
3. During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.
4. At any time of the year, but must be refreshed periodically.

Use the following to select the type and thickness of mulch.

Mulch Type: Straw

Quality considerations: Should be air-dried and free from undesirable seed and coarse material.

Application Rate: 2"-3" thick; 5 bales per 1000 sf, or 2-3 tons per acre

Remarks: Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting.

Straw has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. Straw should be used only if mulches with long-term benefits are unavailable locally.

Mulch Type: Composted mulch; compost

Quality considerations: Should have no visible water or dust



during handling.

Application Rate: 2"-3" thick; 100 tons per acre

Remarks: Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.

Mulch Type: Chipped vegetation from on-site

Quality considerations: Average size should range from fines to 6 inches in length for texture, variation, and interlocking properties.

Application Rate: 2"-3" thick; 100 tons per acre

Remarks: This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above around 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. Decomposition of chipped vegetation can tie up nutrients important to grass establishment. Therefore, if seeding is planned during or after mulch application, additional soil amendment or fertilizer may be necessary.

Mulch Type: Wood-based mulch (hog fuel)

Quality considerations: Should have no visible water or dust during handling.

Application Rate: 2"-3" thick; approximately 100 tons per acre

Remarks: This material is often called "hog or hogged fuel." It is usable as a material for stabilized construction entrances (see BMP 3) and as a mulch. The use of mulch ultimately improves the organic matter in the soil, but may deplete nutrients during decomposition. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so look for and minimize residual vegetation or other indications of inclusion of weed plants or seeds.

MAINTENANCE

1. The thickness of the cover must be maintained.
2. Any areas are eroding should be remulched or protected with a net or blanket. If the erosion problem is drainage related, then the source of



the problem must be fixed.



BMP 16. LANDSCAPING, LAWN, AND VEGETATION MANAGEMENT

PURPOSE

Minimize generation of pollutants during routine maintenance of landscaping.

Description of Pollutant Sources

Landscaping can include grading, soil transfer, vegetation removal, pesticide and fertilizer applications, and watering. Stormwater contaminants include sediment, toxic organic compounds, heavy metals, oils, total suspended solids, coliform bacteria, fertilizers, and pesticides.

Lawn and vegetation management can include control of objectionable weeds, insects, mold, bacteria and other pests with chemical pesticides and is conducted commercially at commercial, industrial, and residential sites.

Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; sap stain and insect control on lumber and logs; rooftop moss removal; killing nuisance rodents; fungicide application to patio decks; and residential lawn/plant care. Poor management of the vegetation and poor application of pesticides or fertilizers can cause appreciable stormwater contamination.

Management Practices

1. Conduct mulch-mowing whenever practicable.
2. Dispose of grass clippings, leaves, sticks, or other collected vegetation, by composting, if feasible.
3. Use mulch or other erosion control measures when soils are exposed for more than one week during the dry season or two days during the rainy season.
4. If oil or other chemicals are handled, store and maintain appropriate oil and chemical spill cleanup materials in readily accessible locations.
5. Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
6. Use manual and/or mechanical methods of vegetation removal rather than applying herbicides, where practical.
7. Use pesticides and herbicides sparingly, and use extreme caution near surface waters.



BMP 17. MAINTENANCE AND INSTALLATION OF UTILITIES

PURPOSE

Minimize generation of pollutants during installation or routine maintenance of utilities.

Description of Pollutant Sources

Typical problems associated with installation of utilities and utility corridor maintenance include generation of silt and sediment from exposing soils and from unpaved access roads. Management of vegetation in utility corridors has impacts similar to those described in BMP 16, Landscaping, Lawn, and Vegetation Management.

Management Practices

1. When installing linear utilities in trenches, such as underground power, communication, water, or sewage lines, expose no more than 500' of trench at any one time (see ICC 11.03.230.A.10).
2. Place excavated material on uphill side of trenches, unless inconsistent with safety or site constraints.
3. Roadway surfaces should be kept clean when installing utilities. Sweep dirt and debris remaining on the pavement at the completion of each day and at the completion of installation.
4. Clear only the vegetation that has immediate or foreseeable threats to the utility facilities. For example, under power lines, cut the trees and high shrubs, but leave the low shrubs, grasses, and other ground cover intact.
5. Within utility corridors, consider preparing maintenance procedures and an implementation schedule that provides for a vegetative, gravel, or equivalent cover that minimizes bare or thinly vegetated ground surfaces within the corridor, to prevent the erosion of soil.
6. Provide maintenance practices to prevent stormwater from accumulating and draining across and/or onto access roadways within utility corridors. Stormwater should be conveyed through roadside ditches and culverts. The road should be crowned, sloped, water barred or otherwise left in a condition not conducive to erosion. Appropriately maintaining grassy roadside ditches discharging to surface waters is an effective way of removing some pollutants associated with sediments carried by stormwater.
7. Maintain ditches and culverts at an appropriate frequency to ensure that plugging and flooding across the roadbed, with resulting overflow



erosion, does not occur.

8. When water or sediments are removed from electric transformer vaults, determine whether contaminants might be present before disposing of the water and sediments. This includes inspecting for the presence of oil or sheen, and determining from records or testing if the transformers contain PCBs. If records or tests indicate that the sediment or water are contaminated above applicable levels, manage these media in accordance with applicable federal and state regulations. See inside the front cover for contact information for hazardous waste handling.



Ditch spoils have been placed in the roadway, causing hazards to traffic as well as causing potential for erosion.



BMP 18. MAINTENANCE OF DITCHES

PURPOSE

Minimize generation of pollutants during routine maintenance of utility corridors.

Minimize introduction of common road debris including eroded soil, oils, vegetative particles, and heavy metals into storm or surface waters.

Description of Pollutant Sources

Typical problems associated with ditch maintenance include generation of silt and sediment from exposing soils.

Management Practices

Roadside ditches should be maintained to preserve the condition and capacity for which they were originally constructed, and to minimize bare or thinly vegetated ground surfaces.

1. Inspect and clean ditches on a regular basis, as needed. Ditches should be kept free of rubbish and debris.
2. Vegetation in ditches often prevents erosion and cleanses runoff waters. Remove vegetation only when flow is blocked or excess sediments have accumulated. Conduct ditch maintenance (seeding, fertilizer application, harvesting) in late spring and/or early fall, where possible. This allows vegetative cover to be re-established by the next wet season thereby minimizing erosion of the ditch as well as making the ditch effective as a biofilter.
3. Do not clean the entire ditch during a single season. Stagger sections of ditch cleaning from season to season, so that where possible there is always a section of vegetated ditch of at least 200' in length downstream from the portion being cleaned.
4. In the area between the edge of the pavement and the bottom of the ditch, commonly known as the "bare earth zone," use grass vegetation wherever possible. Vegetation should be established from the edge of the pavement if possible, or at least from the top of the slope of the ditch.
5. Roadway surfaces should be kept clean when cleaning or reshaping ditches. Sweep dirt and debris remaining on the pavement at the end of each day and at the completion of ditch cleaning operations.
6. Examine culverts on a regular basis for scour or sedimentation at the inlet and outlet, and repair as necessary. Give priority to those culverts conveying perennial and/or salmon-bearing streams and culverts near streams in areas of high sediment load, such as those



near subdivisions or near areas of construction.

