

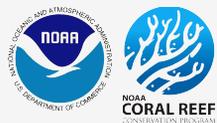


Our Islands Our Future

GUIDE TO GREEN BUILDING in the USVI

IMPLEMENTERS
Field Guide

February 2013



*Funded by NOAA's Coral Reef
Conservation Program through NOAA
Fisheries Caribbean Field Office*

Developed by The FHWGroup. Content
guided by a steering committee of federal
and VI agencies and NGOs

This guide is meant to serve as a practice manual demonstrating the concepts detailed in the accompanying classroom module for implementers. The guide follows the layout of the classroom module, moving through site preparation (before earth change), construction, and project completion (including final grading).

The guide, along with the classroom module, is meant to be a training tool for practicing the concepts of green design and construction in the field or in a classroom setting to familiarize you with how to incorporate these concepts when beginning, carrying out, and wrapping up your construction project.

The guide is divided into three sections – site preparation, construction, and project completion. You can review each of the sections in any order based on your interest.



Work Green - Site Preparation

Before Grading



WORKING GREEN Site Preparation CHECKLIST

Before Grading	Notes	
You have all required approved, stamped permits on site prior to beginning any mechanized work.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You know what natural features need to be protected. You can identify protected plants and animals and know what to do if you see them on site during construction.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You ensure the footprint of the area to be disturbed is clearly marked on site. Heavy equipment operators have done a walk-through to view limits of site disturbance and areas and vegetation to be preserved.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You ensure silt fencing is correctly installed along perimeter.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You have built temporary barriers around all vegetation to be preserved on the site.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You have studied project plans and the physical characteristics of the site and made modifications to the best management practices (BMPs) to be used as necessary based on slopes and soils.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You have studied project plans and are familiar with project phasing and the locations of temporary and permanent BMPs for sediment and erosion control and stormwater management.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You have installed all required BMPs based on the project phasing prior to commencing any mechanized work.	<input type="checkbox"/> YES	<input type="checkbox"/> NO
You have the project team's contact numbers readily available for questions that may arise as you begin grading the site.	<input type="checkbox"/> YES	<input type="checkbox"/> NO

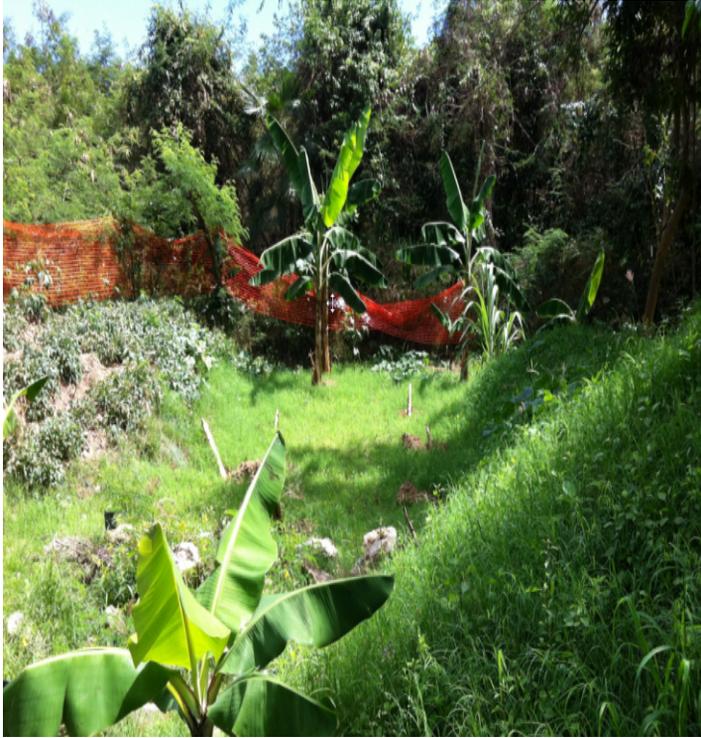
Field Exercise

On a site where no earth change has started, check:

- Project plans to be sure the physical characteristics of the site (soils, topography, hydrology, and vegetation) match the proposed best management practices (BMPs) for sediment and erosion control and management of runoff
- 150 foot buffer or setbacks adjacent to shorelines, 25 foot buffers adjacent to ghuts or 30 feet from ghut centerline, whichever is greater, and 50-150 foot setbacks from ponds and wetlands are clearly marked on site
- All trees and other vegetation to be preserved on site are clearly marked on site
- The disturbance footprint for all construction activities is clearly marked on site
- Fences or other barriers have been built around trees to protect them from heavy equipment
- All BMPs have been properly installed before beginning earth change operations

Field Exercise

Photo credit: Horsley Witten Group <http://www.horsleywitten.com/>



Location: Kingshill St. John.

This photo illustrates the use of orange fencing to demarcate area for clearing versus designated area for vegetation protection during the installation of a stormwater detention basin.

On a site where mechanical clearing hasn't begun check:

- The location of all existing storm drains and be sure temporary diversions of these have been installed
- Ensure no construction equipment or staging areas are located in areas to be preserved from site disturbance, and no equipment traverses green belts and other conservation areas



Work Green - Construction

Implementing Best
Management Practices



WORKING GREEN Construction CHECKLIST

During Construction	Notes	
<p>You have planned required excavation and other earth movement work that results in exposed soils for completion outside the rainy season. You keep heavy equipment off steep slopes during the rainy season.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You have ensured that all sediment and erosion control and stormwater BMPs are properly installed BEFORE beginning any mechanized work on-site. This includes stabilized construction entrances.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You have created berms and swales to contain runoff from cleared areas as you begin site clearing and grading. Brush from the site can be used to create berms and boulders can be used for more permanent structures such as retaining walls.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You have installed temporary diversions of existing storm drains BEFORE beginning any site clearing.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You ensure no excavation work will begin if soils will be exposed for 14 days or more.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>If there is a construction stoppage that has already lasted 14 days, you install erosion control measures IMMEDIATELY to minimize erosion of exposed soil.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You create serrated cut slopes if cuts are steeper than 50% behind buildings and next to driveways and roads.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You construct benches to break slopes of more than 20 to 40 feet and route runoff to a sediment trap or stabilize outlet to minimize sediment and runoff transport offsite.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You do not cross or store equipment, vehicles, or construction materials in setbacks, buffers, or green belts.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO

WORKING GREEN Construction CHECKLIST

During Construction	Notes	
<p>You protect vegetation by tunneling under roots to install utilities, avoiding piling excess soil on and around roots, and building retaining walls or terraces.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You ensure that all soil stockpiles are covered to prevent erosion of material during rains.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>When large areas need to be cleared, you run heavy equipment up and down slope to create grooves and channel runoff across the slope to minimize gully formation.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You compact all fill material and use fill that is free of vegetative and construction debris to ensure it can be well compacted.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO
<p>You ensure all BMPs are properly maintained as part of daily construction activities and a regular maintenance schedule.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO

Improper grading can have dire consequences

1. Newly exposed soil can erode easily, moving from areas where you want it (e.g., on the hill behind your house) to areas where you don't want it (e.g., up against your house, in a street or creek, or on a neighbor's property).
2. Excessive grading causes loss of natural vegetation and damages other natural resources for years to come.
3. Even minor grading can change the way water drains across your property, which can cause erosion problems for a neighbor (and liability for you).

Encourage Landform Grading

Notching occurs at the slope break on a horizontal bench and contributes to the formation of gullies. This is something we want to prevent because it can accelerate erosion and the transport of sediment in runoff during storms.

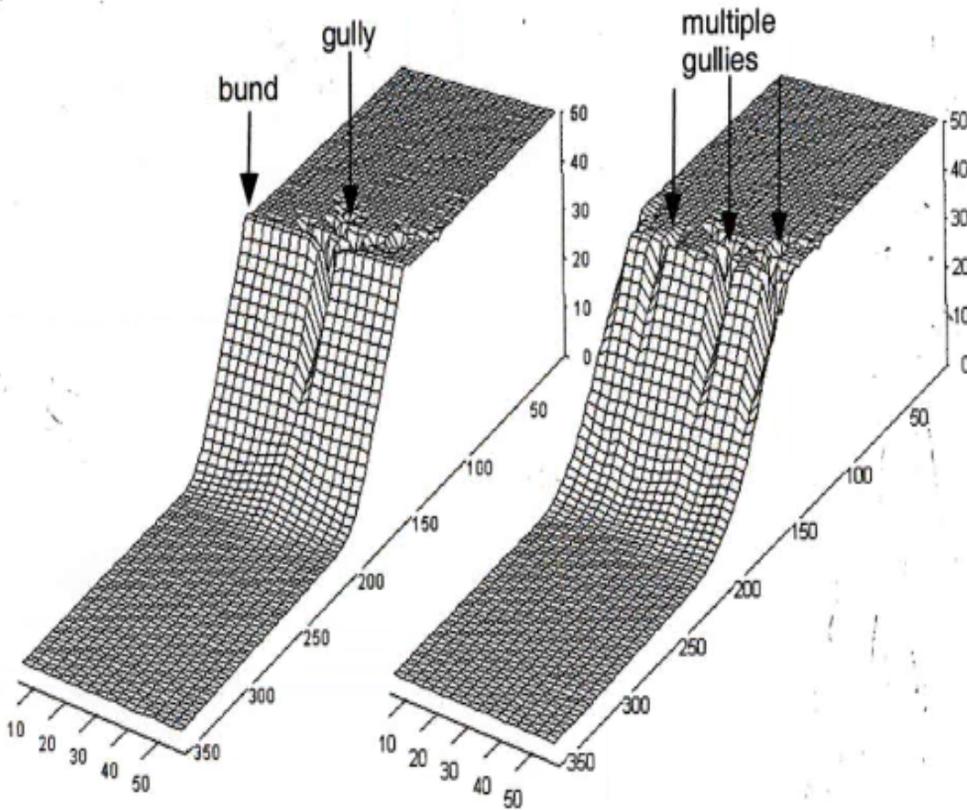


Figure Credit – Landforming: An Environmental Approach to Hillside Development, Mine Reclamation and Watershed Restoration(2010)

When larger areas are to be cleared, run heavy equipment up and down slope to create grooves perpendicular to slope. This will channel runoff across slope instead of downslope to reduce erosion from gullying.

Field Demonstration

Compare the two on a construction site – select a small plot on a slope where soils are exposed and run heavy equipment up and down the slope and across the slope to compare the patterns made on the soil.



Photo Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

Heavy equipment was run up and down the slope. However, the equipment was also operated over the silt fence resulting in damage to the silt fence and eliminating its capacity to adequately function as a sediment control measure.

In photo above, severe gullying caused by soils being exposed and subject to erosion from rainfall. It appears that clearing was done by running heavy equipment parallel to the slope thus accelerating erosion.

Field Exercise

On a site where earth change operations have begun, check:

- That exposed soils are stockpiled and temporarily seeded or covered with tarps or erosion control mats
- All fills are compacted to reduce erosion, slippage, settlement, and subsidence
- All BMPs are installed and working properly including temporary and permanent erosion, sediment, and runoff controls (silt fences, sediment traps, check dams, construction entrance/exit, etc.)



Grandview construction site in St. Thomas with erosion control blankets installed on steep slopes where soil was exposed.

*Photo credit: Horsley Witten Group
<http://www.horsleywitten.com/>*



Sediment trap at Whispering Hills Affordable Housing construction site, East End St. Thomas.

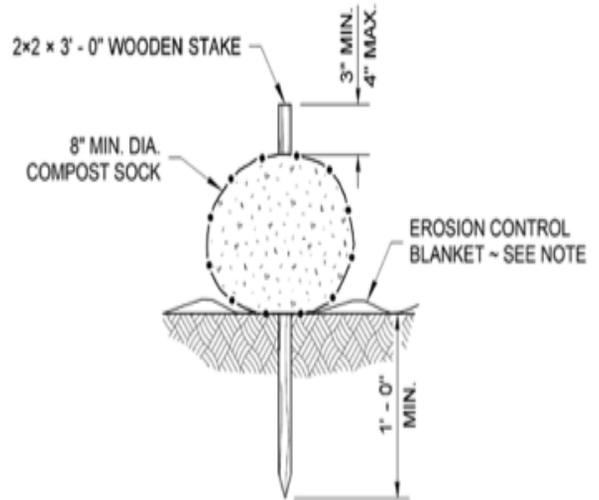
Photo credit: Frank Galdo

1. Install along contours starting at the toe of the slope, or slightly away from the toe, and every 3 to 30 feet along the slope depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the compost socks should be.

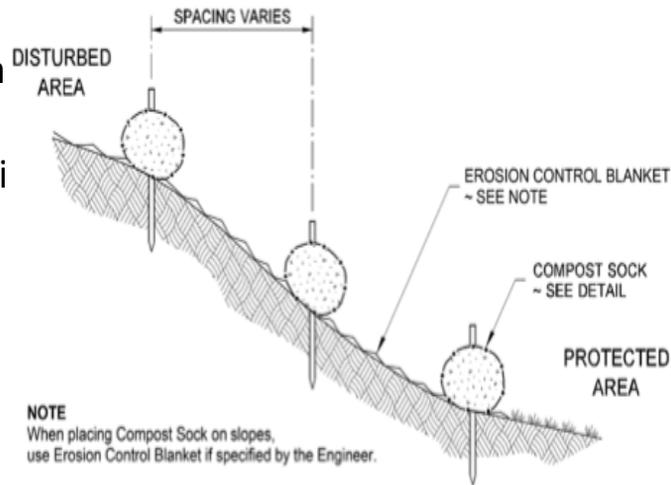
2. Compost socks shall not be used on slopes greater than 2H:1V.

3. Use only cured or finished compost.

4. Compost socks shall be filled so they are firmly packed yet flexible. Once placed on the ground, apply temporary weigh to the sock to improve contact with the underlying surface. This may cause the sock to assume an oval shape.



NOTE
When placing Compost Sock on slopes, use Erosion Control Blanket if specified by the Engineer.



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When placing Compost Sock on slopes, use Erosion Control Blanket if specified by the Engineer.

Figure: Idaho Construction Site Erosion and Sediment Control Field Guide

5. Install stakes at each end of a compost sock, and at 3-foot centers along the entire length. If required, install pilot holes through the compost sock and into the soil prior to installing stakes. Stakes should be installed perpendicular to the ground surface and on a slight angle alternating left to right. The stakes at angle prevent the sock from lifting or floating during the first rain event.
6. Wooden stakes should be 2" x 2" x 36" minimum. Cut branches or 3/4 inch rebar can also be used as stakes.
7. If more than one compost sock is installed in a row, tightly abut end to end the two adjoining socks.
8. Turn ends of compost socks uphill to prevent water from flowing around the barrier.

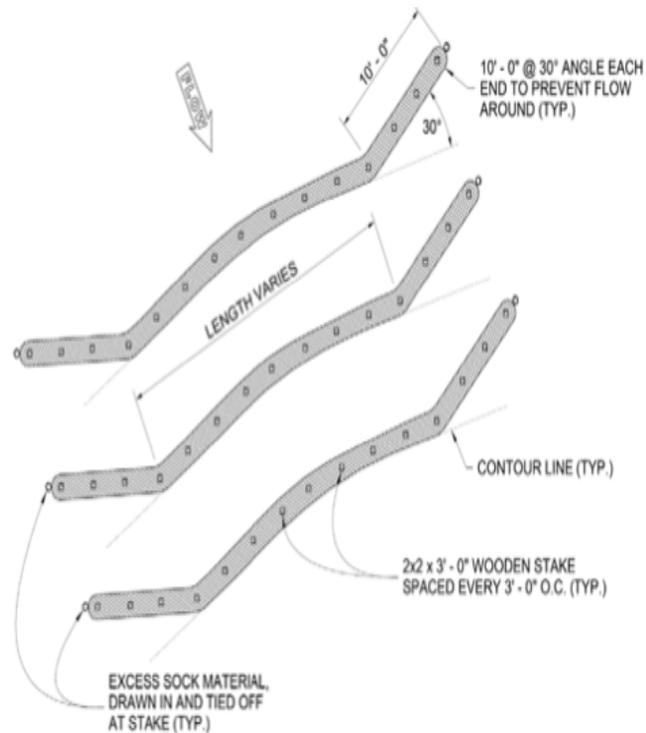


Figure Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

1. Grade, disk, and prepare seedbed. Seed the area before blanket installation. **For long slopes, install blankets up and down the slope face.** For channels, install blankets parallel to flow of the channel, as per manufacturer's directions.
2. Install the product starting from the top of the slope, anchored in a 6" x 6" trench that is backfilled and tamped firmly. Anchors/staples are "U" shaped and a minimum of 6 inches long. Longer staples are used in sandy soils.

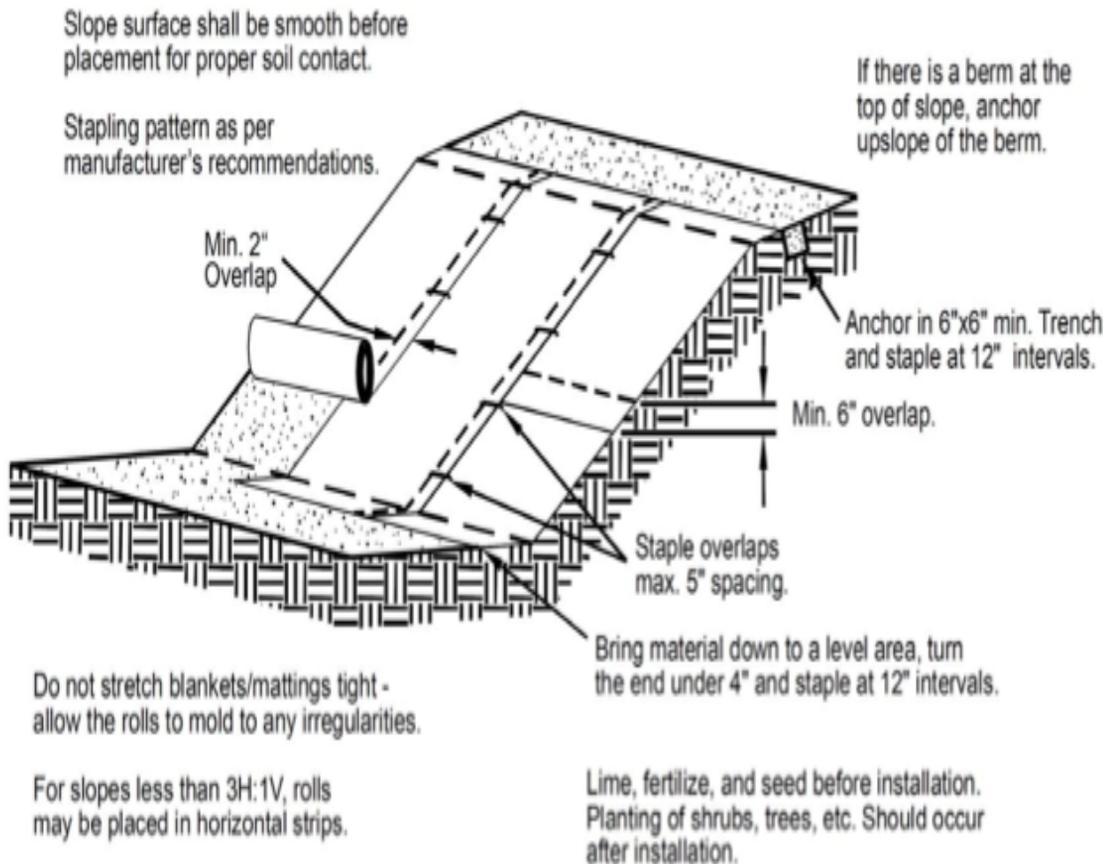


Figure Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

3. Walk blankets down slope to ensure good contact with the soil. Staple blankets every 12 inches on tops and 18 to 36 inches down the sides and in the middle or according to manufacturer's directions, whichever is more protective.
4. Do not stretch blankets.
5. Do not exceed manufacturer's directions on maximum slope angle for the product.
6. Additional staking or stapling is needed for applications in channels that carry flowing water and on steep slopes. Inspect before and after each rain event and twice monthly until the tributary drainage area has been stabilized.

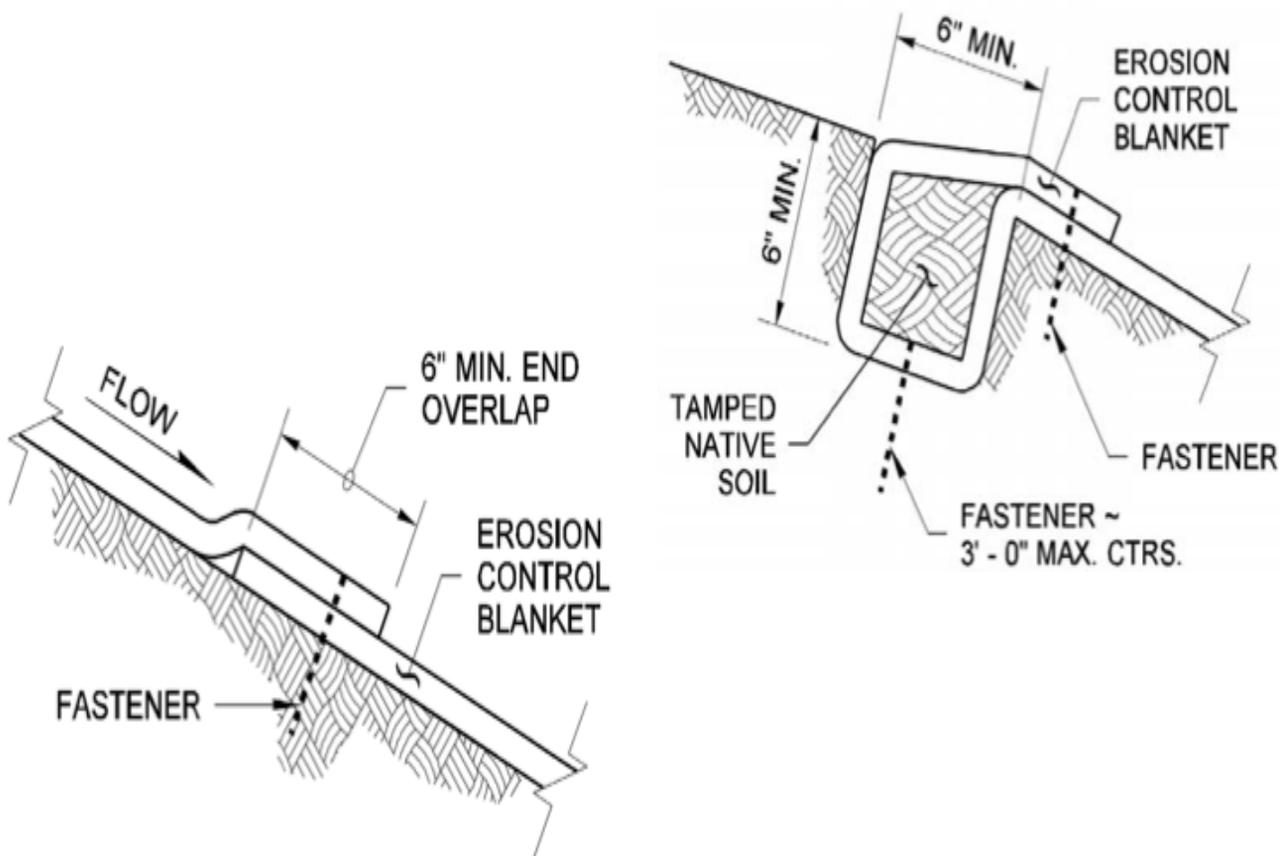


Figure Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

1. Note the location and extent of the bare soil area. Mark silt fence location just below bare soil area. Make sure fence will catch all flows from area.
2. Dig trench a minimum of 6 inches wide and deep across slope.
3. Unroll silt fence along trench. Push geotextile into trench; spread along bottom and sides.
4. Drive posts on downhill side a maximum of 6 feet apart.
5. Secure silt fence to posts with staples, wire, or as recommended by manufacturer. If needed, join fencing by rolling the end posts together. Steel posts are the most effective because they will not be damaged by insects or rot. Reinforce fences with steel posts and wire mesh backing for steeper slopes.
6. **Do not place joined sections in low spots or sump locations.** Fill trench with soil and tamp down.

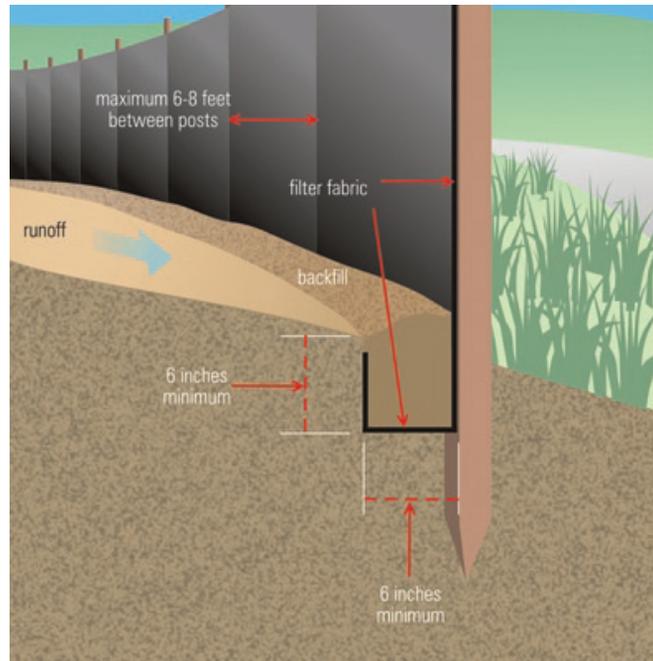


Figure: Idaho Construction Site Erosion and Sediment Control Field Guide

What are we looking for?

Properly functioning sediment and erosion controls and proper maintenance.



Photo Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

Silt fence is properly installed in the picture above. The presence of vegetation in front of the fence shows erosion control is adequate for reducing flows going to the silt fence.

Although silt fence is installed, the absence of vegetation in front of the fence shows more erosion control is needed to reduce the flow going to the silt fence.

What are we looking for?

Bottom of silt fence fabric should be buried (~6") in a trench that has then been backfilled. Silt fences should be inspected to ensure the fabric is not torn or sagging and to remove accumulated sediment (and dispose of it properly on uplands). Silt fences should not be installed across gullies or other water bodies.

Photo Credit: Idaho Construction Site Erosion and Sediment Control Field Guide



What are we looking for?

Perimeter controls must be actively maintained until final stabilization. In the picture below, the offsite transport of runoff is evidenced by the gully that has formed, signaling inadequate perimeter controls.



Photo Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

What are we looking for?

Construction entrances and exits that are properly installed to prevent tracking of sediment from the construction site onto public roads.

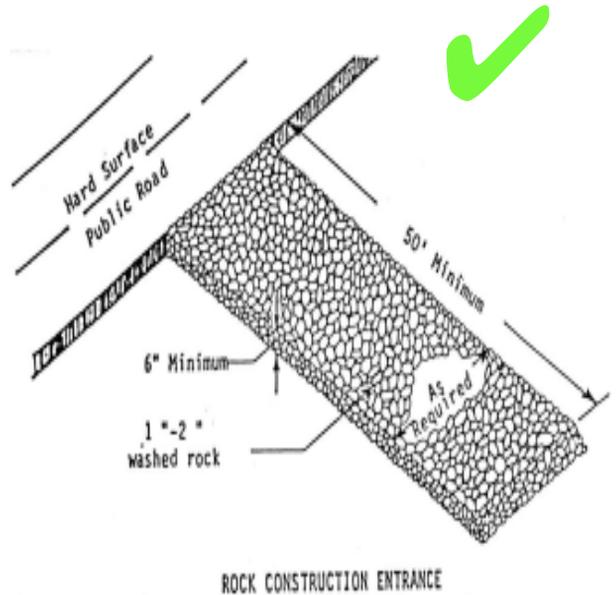


Photo & Figure Credit: Idaho Construction Site Erosion and Sediment Control Field Guide

A rock construction pad may be necessary at construction access/ egress locations to prevent the transport of soil onto paved public roads by construction vehicles. In the photo above, no pad was installed and the transport of sediment from the site to the road is clearly visible.

The rock construction entrance is a stabilized pad of aggregate installed over a geotextile fabric base. The effectiveness of the entrance in trapping sediment depends on length, depth of rock, frequency of use, and maintenance.

What are we looking for?

A properly designed sediment basin has:

1. Standpipe drawdown
2. Emergency outfall
3. Stabilized side slopes
4. Equipment access

A well-maintained sediment basin is:

1. Less than 50% full
2. Characterized by a drawdown location free of trash and debris



Photo Credit: www6.montgomerycountymd.gov/dectmpl.asp?url=/Content/dep/water/spabmps.asp (left) & epa.gov (right)

A sediment basin (examples shown above) captures sediment from stormwater runoff before it leaves a construction site and is usually used for drainage areas of 5 to 100 acres. A pool is allowed to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment. The water is released more slowly than it would be without the control structure.

What are we looking for?

Properly designed sediment controls have:

1. Side Containment Berms
2. Rock Check Berm
3. Equipment Access

Well maintained sediment traps are:

1. Less than 50% full
2. Maintained with a spillway depth a minimum of 1.5 feet below the low point of the trap embankment

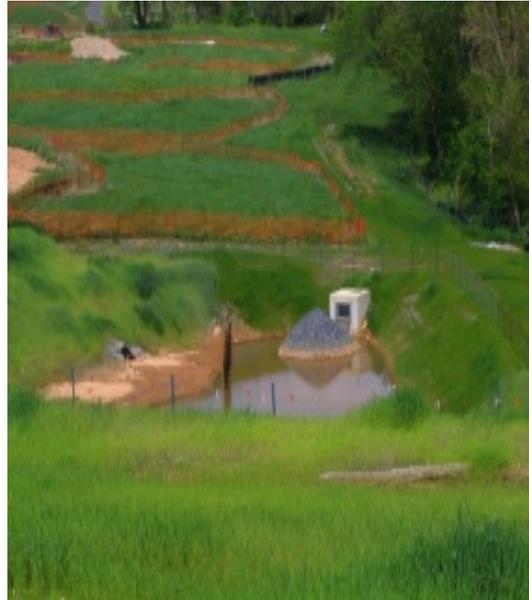


Photo Credit: www6.montgomerycountymd.gov/dectmpl.asp?url=/Content/dep/water/spabmps.asp

Sediment traps (shown above) are small impoundments that allow sediment to settle out of construction runoff. They are usually installed in a drainageway or other point of discharge from a disturbed area. In the photo on the right in particular, note the placement of rocks to filter sediment from water prior to its exit from the sediment basin.

What are we looking for?

Check inlets and outlets to determine if control measures are properly installed and are effective in preventing the introduction of contaminants and solid materials into the stormwater system.



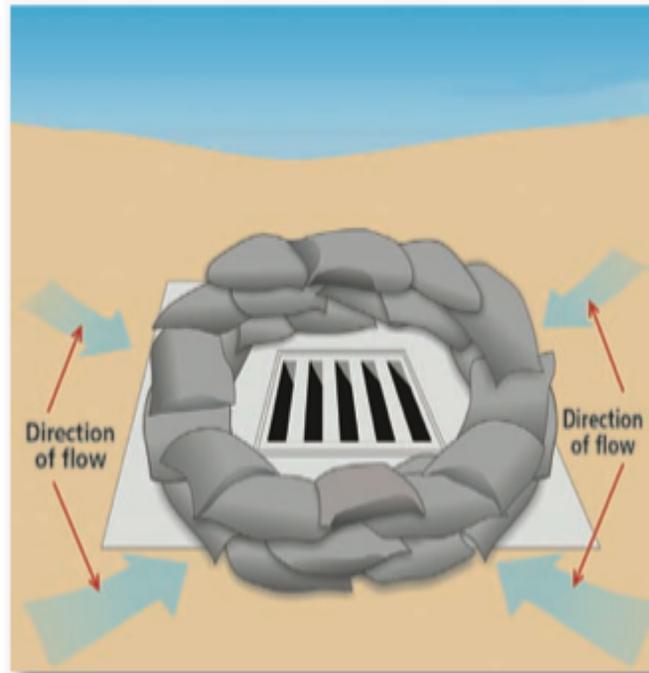
Photo Credit (all): Idaho Construction Site Erosion and Sediment Control Field Guide

What are we looking for?

Photo Credit: Idaho Construction Site Erosion and Sediment Control Field Guide



Geotextile under inlets should not be used. They can cause flooding and are difficult to remove when filled with sediment. (Source: Douglas County)



Use of gravel bags to protect a drop inlet. (Source: Idaho Construction Site Erosion and Sediment Control Field Guide)

The inlet shown above is not properly protected. The geotextile does a poor job of helping to slow and pool runoff. The material is also difficult to remove when filled with sediment.

The inlet shown above is adequately protected. Gravel bags will help to slow and pool runoff. Accumulated sediment can be easily removed.

In the field (at a site where construction is underway)

Check the BMPs on site to ensure proper maintenance is being done:

- Edges of filter strips are maintained to prevent the formation of concentrated flows, mowing, and spot repairs of vegetation
- Spot repairs are completed in temporary seeding/hydroseeding areas and grass swales and embankments are mowed
- Sediment is removed from sediment traps when accumulation is to $\frac{1}{2}$ of design depth and embankments and rock filters are in good repair
- No damage to temporary sediment basins from soil erosion and construction equipment is evident and basin does not have 50% fill by volume or sediment is within 1 inch of bottom of the principal spillway crest
- There are no failed stakes, accumulated sediments, or hay bales in poor condition around silt fences



**Work Green -
Project Completion**
After Construction



WORKING GREEN Project Completion CHECKLIST

After Construction			Notes
<p>You complete final site stabilization, including all permanent seeding and planting and the construction of final retaining walls on cut or steep slopes, as part of final site grading.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO	
<p>You remove all temporary BMPs and properly dispose of all accumulated sediments on uplands away from ghuts and other wetlands and water bodies.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO	
<p>You restore the permanent stormwater drainage system, including the removal of all storm drain diversions.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO	
<p>You have ensured the site owner is aware of the maintenance requirements for permanent BMPs and have assisted in creating a maintenance schedule for the property if one was not included as part of project design.</p>	<input type="checkbox"/> YES	<input type="checkbox"/> NO	

In the field (at a site where final grading is being completed), check:

- Temporary sediment basins and sediment traps have been removed and the areas regraded
- All permanent seeding and planting has been completed in accordance with project plans, including using the plants specified in the landscaping plan
- The irrigation system and water reuse structures and conveyances are properly installed to provide water for landscaping
- Final retaining walls have been constructed on cut or steep slopes that cannot be planted (using boulders from site clearing in walls where possible)
- The permanent storm system has been restored and all sediment has been removed and properly disposed of on uplands.

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