

Section 3: Erosion and Runoff Control

Ways to Prevent Erosion and Sedimentation:

- Retain groundcover vegetation.
- Disperse surface flow of runoff -- Don't let it funnel or concentrate.
- Keep sediment from moving.
- Promptly re-vegetate critical bare soil areas.
- Minimize overall soil disturbance.

Controlling runoff can be as easy to remember as:
Slow it down... and, Spread it out...

Slow down the flow...before it can pick up speed. Running water is a tremendous erosion force. If you slow the runoff, soil erosion will be greatly reduced.

Spread out the runoff...to keep it from concentrating or funneling together. Spreading out the force of the water runoff will make it more likely to soak into the soil, instead of forming gullies or trenches atop the ground surface.

4 Steps for Controlling Erosion and Runoff:

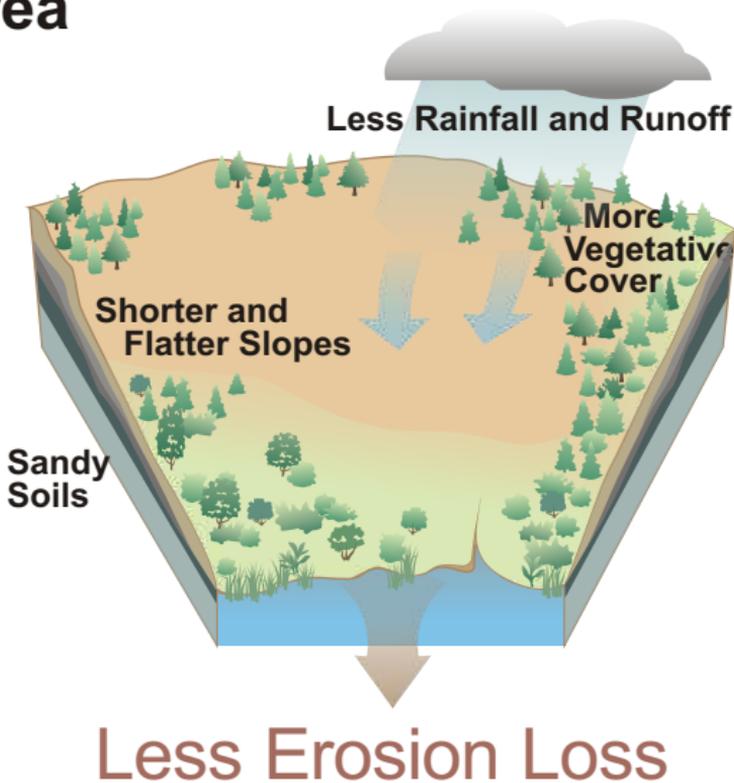
1. Maintain groundcover so runoff can soak into the soil.
2. Prevent runoff and erosion.
3. Control runoff as it moves.
4. Capture sediment contained within the runoff.

Bottomline:

Keep the sediment and associated nonpoint source pollution out of the water!

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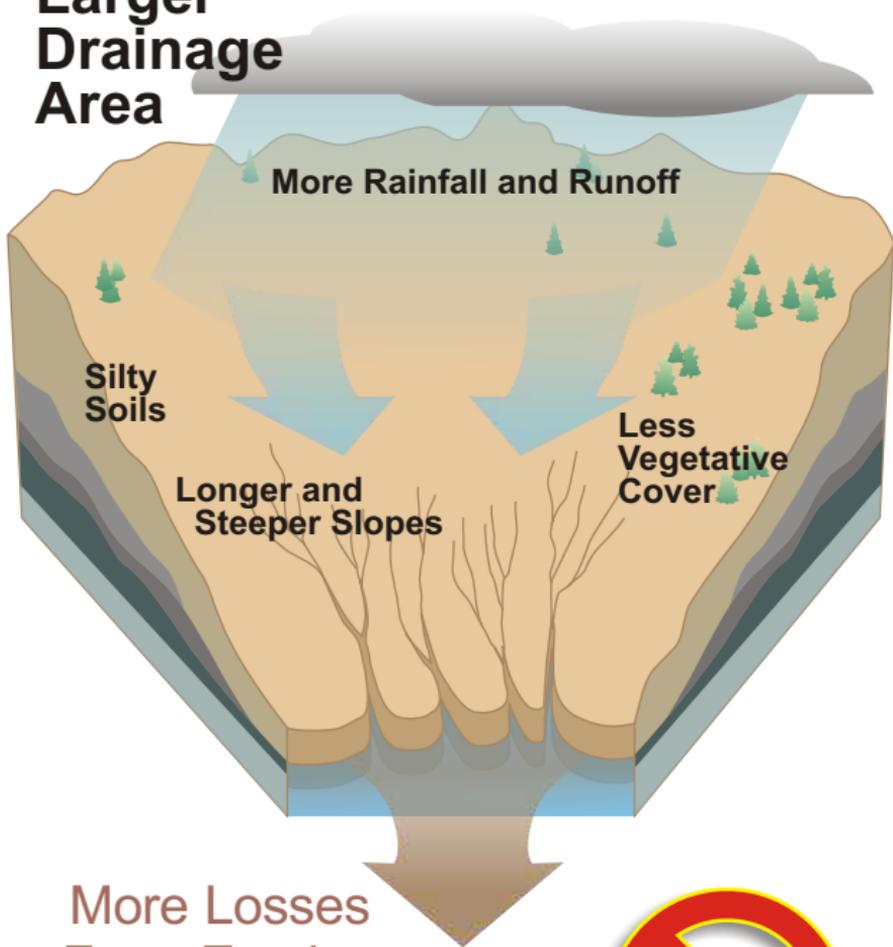
Smaller Drainage Area



*Illustration developed and provided by Tetra Tech, Inc.
in cooperation with the Kentucky Division of Water.*



Larger Drainage Area



*Illustration developed and provided by Tetra Tech, Inc.
in cooperation with the Kentucky Division of Water.*

Overall Erosion Control Goals

- Keep overall bare soil exposure to a minimum.
 - Maintain groundcover vegetation on the soil.
 - “Break the grade” on your slopes. Divide slopes into smaller sections that are more easily managed.
 - Avoid long, continuous stretches of roads, skid trails, firelines or ditchlines.
 - Install erosion control structures during dry times when possible.
 - When a drainage outlet is needed on an erosion control structure, locate the outlet on stable soils with established groundcover.
 - Monitor and maintain structures to insure function. Promptly repair, improve or enhance as needed.
 - If sediment builds up or accumulates at a structure, look upslope to locate and control the sediment source(s). Install additional BMPs as needed to further reduce erosion and sediment movement.
- ⊗** *Avoid diverting runoff into streams or directly into gullies.*

Remember: *Refer to the forestry BMP manual for detailed, technical specifications and further recommendations for erosion control structures and information on soils.*

You can obtain free technical assistance from: N.C. Forest Service; Soil & Water Conservation District; USDA-Natural Resources Conservation Service (NRCS); and Cooperative Extension Service.

Examples of erosion control structures are shown.

Caption text explains important points.

You should use these erosion control structures as pairs, picking one from each column to successfully control runoff and erosion:

Controlling Runoff	Capturing Sediment
Broad-based dip Check Dam Cross-drain Inside Ditchline Turnout (wing ditch) Waterbar	Brush barrier Hay or straw bale Sediment pit or silt trap Silt fence

Suggested Spacing Ranges
for Erosion Control Structures

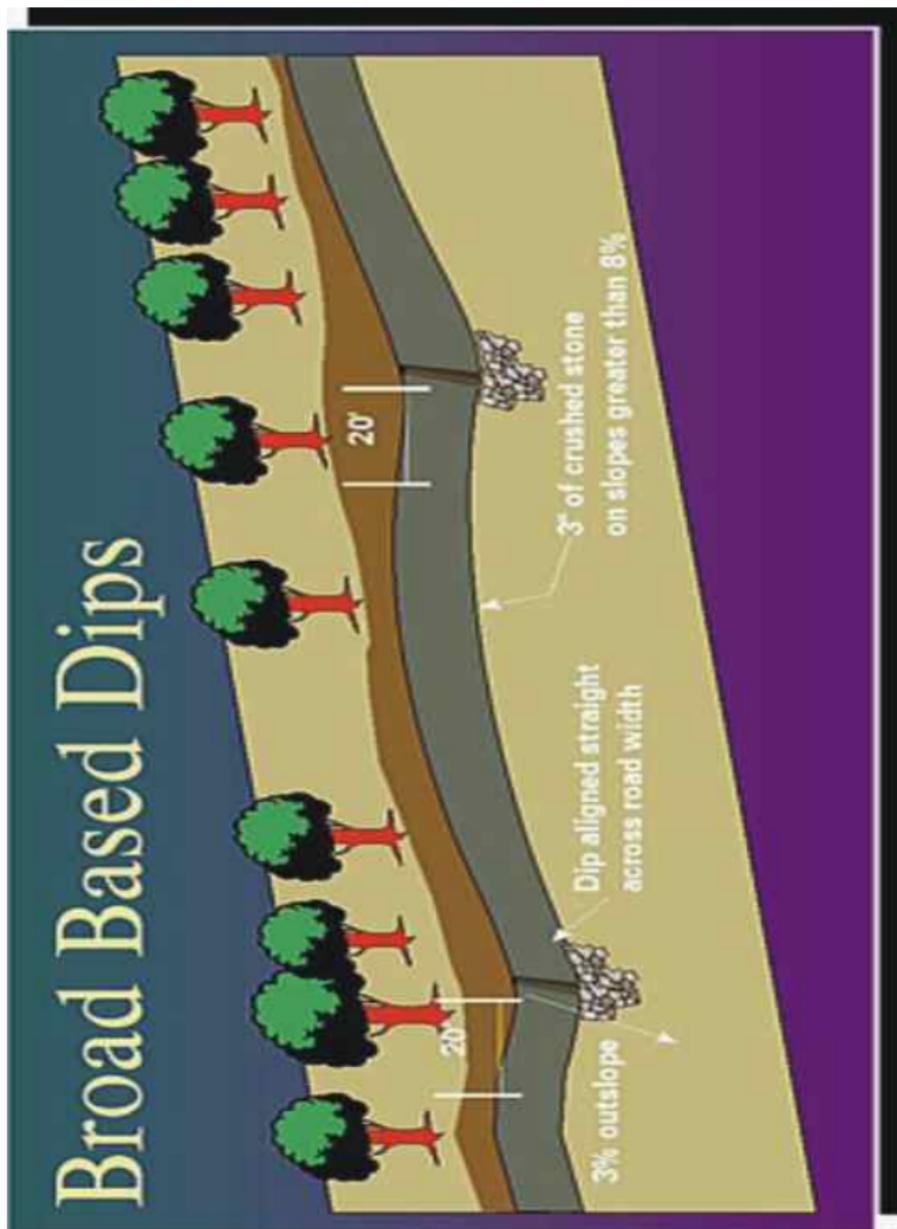
Slope Grade (%)	Broad-based dips Turnouts Cross-drains (Ft)	Waterbars (Ft)
20+	60-40	40-30
16-20	100-60	60-40
11-15	140-100	80-60
6-10	180-140	100-80
0-5	250-180	120 -100

This table may first appear to be backward.

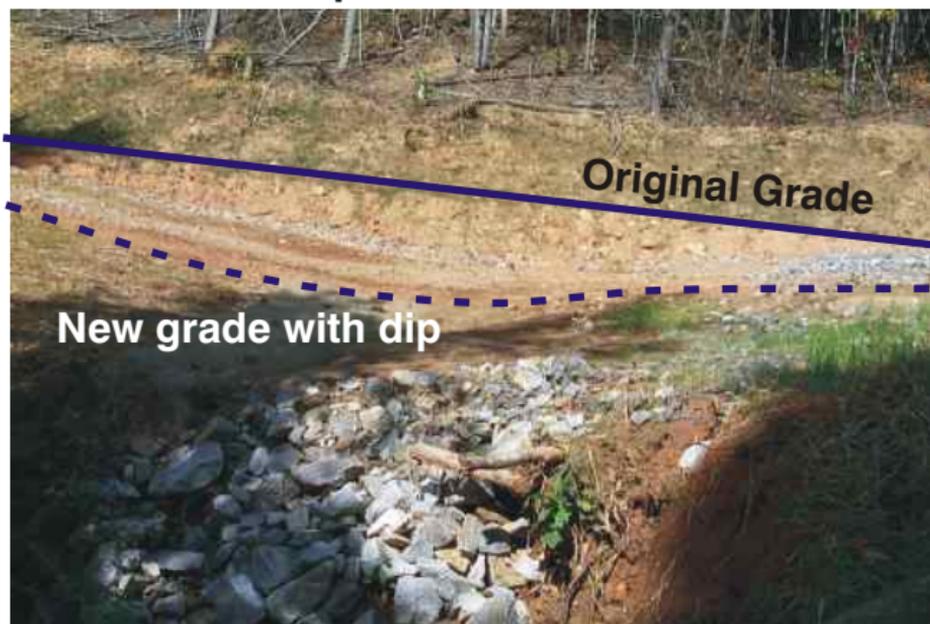
But, it is laid out this way to remind you that steeper slopes usually require closer spacing between erosion control structures.

Following this pattern of closer spacing along steeper slopes will help you “slow it down and spread it out.”

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Broad-based dip



Side view of a broad-based dip.

- It is a gentle, rolling drainage structure excavated into the roadbed.
- Proper angling outwards promotes drainage of the road surface in a controlled manner.
- Outlet is stabilized with large stone.
- Dip is excavated completely across the road surface and is angled at nearly 90 degrees to the direction of the road so runoff will easily drain off the surface.
- The reverse-grade hump is packed down firmly and capped with crushed stone.

Broad-based dip



The long sloping grade of this mountain road is divided into shorter sections with broad-based dips.

- Broad-based dip is located underneath the rear wheels of the truck.
- Road surface is stabilized with stone.
- Roadside edge is well vegetated with grass.
- Silt fence is installed at the outlet of the broad-based dip to help filter any sediment in the runoff.

Brush barrier



*Brush barrier is situated along the crest of the roadbed to capture sediment before it can move downslope. (arrow)
The brush pile should tightly conform to the ground surface.*

Check dam



Check dams can be made of large stones, tightly stacked within a turnout or along a roadside to slow runoff and capture sediment. Erosion blankets can help reduce erosion potential. Multiple check dams may be needed to control runoff speed, as shown above.

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Check dam



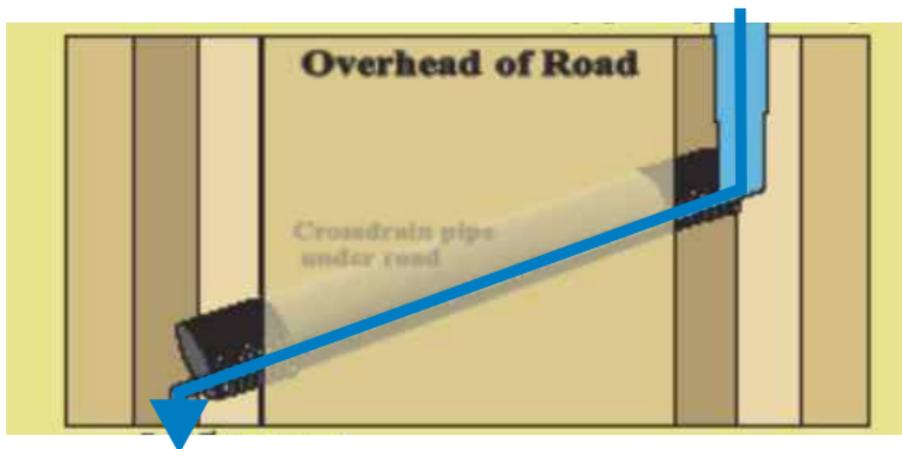
CAUTION: Clean out accumulated sediment. Investigate why so much sediment is being produced. More check dams or turnouts are needed further upslope.

Cross drain



Outlet extends past the road travel surface. Pipe is installed diagonally through the road to promote drainage.

Cross drain



Cross drains remove water from within an inside ditchline.

- Install cross drains diagonally, at a slight downslope grade through the roadbed to promote drainage.
- Protect the inlet and outlet from scouring or eroding.
- Extend the pipe well beyond road travel surface.
- Stabilize the outlet area.
- Keep debris from building up on the inlet and outlet.

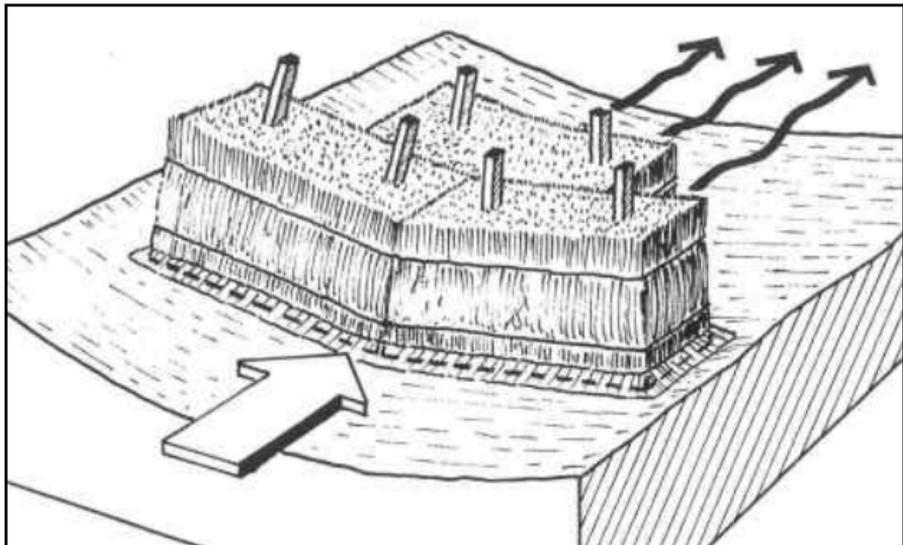
✗ Open-top cross drains should not be used.

Remember:

Cross drains can require frequent maintenance to remain effective. An out-sloped road that does not need either cross drains or inside ditchlines may be a cheaper long-term solution for permanent roads.

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Hay / straw bales



(Illustration provided with permission and courtesy of the Maine Forest Service.)

- Set the bales so their bottom conforms tightly against the ground surface.
- Stagger joints between the bales, like bricks.
- Secure the bales to the ground as needed. Stakes or wire fencing may be needed.

NOTE: Hay / straw bales are for temporary use. They will not last for a long period of time.

Inside ditchline



This inside ditchline appears to be well maintained, (arrow) but groundcover should be applied to the slope.



This ditchline is quickly eroding and becoming a gully. The road surface needs grading and groundcover vegetation. Turnouts or check dams are needed in the ditchline to control the runoff.

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Sediment pit / silt trap

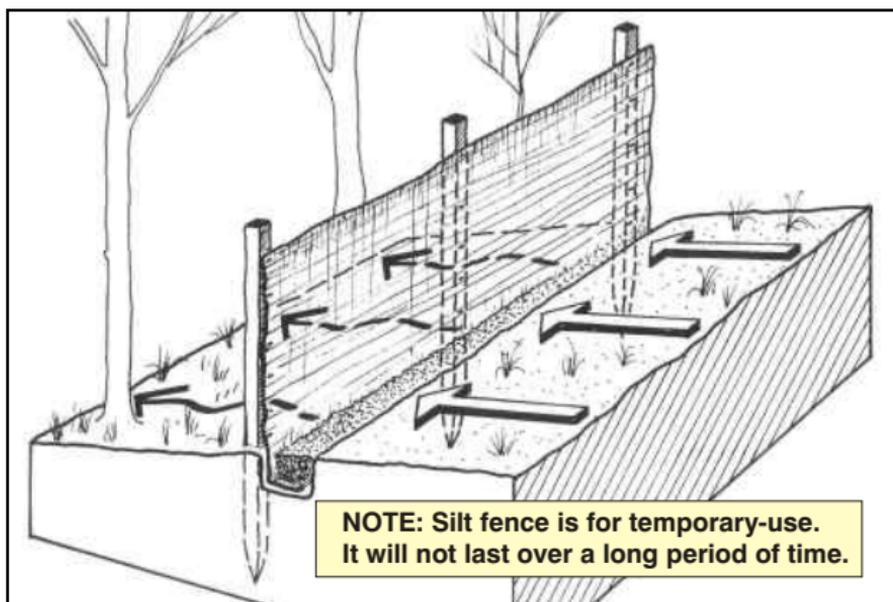


This pit is positioned correctly, with a shallow broad-based dip in the road to direct runoff into the pit. The pit head-wall should be reinforced with stone, or sloped back to prevent the pit wall from caving in.



This shallow silt trap can hold a small amount of runoff and sediment. A series of similar silt traps could work well along a road, skid trail or around a log deck.

Silt fence



(Illustration provided with permission and courtesy of the Maine Forest Service.)

Bury at least the bottom 6 to 8 inches of the silt fence along the upslope side. Securely stake the downslope side of the silt fence to keep it upright and tight.

Slope(%)	Max. Slope Length between Fence Rows (feet)
0 to 2	100
2 to 5	75
5 to 10	50
10 to 20	25
20+	15

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Silt fence



- X** *The base of this silt fence is not buried. Only a few pieces of wood are holding it down. Heavy runoff can easily wash underneath the fencing, taking sediment into the creek behind it.*
- X** *Avoid sharp turns when laying out and staking a silt fence. These can be weak points that are easily breached.*

Remember:

You need to bury at least 6 to 8 inches of the bottom of the silt fence securely in the soil, so runoff and sediment will not seep underneath. The buried flap should point towards the direction that the runoff is coming from.

Turnout (wing ditch)



Turnout on a closed skid trail with a waterbar installed to direct runoff into the turnout. Note the additional waterbars further downslope on the trail.



This turnout (wing ditch) along the road carries runoff gathered from the road surface into a filter area. Note the hump in the road to direct runoff into the wing ditch.

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Turnout (wing ditch)



Turnout is installed at the crest of the grade-change on this road. Runoff is turned off the road by a shallow dip.



Runoff collects in this deep turnout at the bottom of a road grade, at the end of a curve in the road.

Waterbars

A waterbar is somewhat like an angled speed bump that is installed diagonally across closed roads, skid trails or firelines. Waterbars are a good choice for controlling erosion and runoff, but can be tricky to correctly construct and install.

Tips and suggestions when building waterbars:

- Construct the waterbar from the uphill side.
- Angle the waterbar diagonally, from 15 to 30 degrees downslope toward the outfall edge of the road or trail.
- Excavate a shallow trench alongside the base of the upslope face of the waterbar to carry the runoff.
- Extend waterbar completely across the road or trail travel pathway.
- Tie-in the upper end of the waterbar with the adjoining slope bank, if there is one.

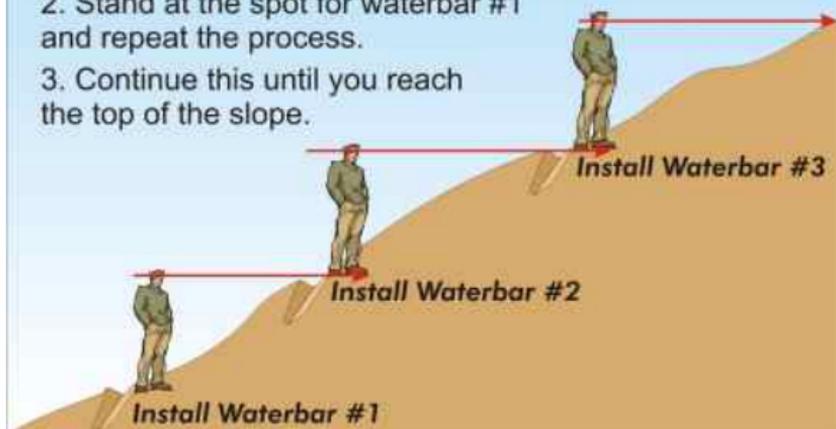
⊗ Do not drive over a waterbar once it is installed.

Remember:

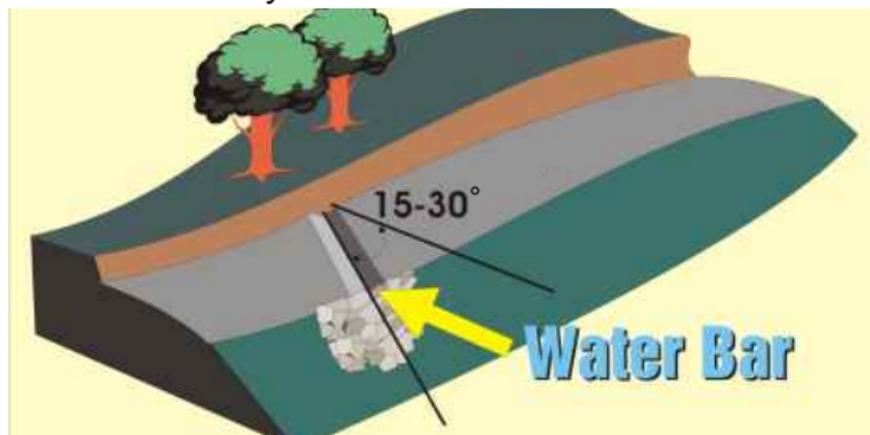
A correctly-built waterbar should not act like a dam. Waterbars divert runoff into a stable filter area.

Locating Waterbars using the "eye level" method:

1. Stand at the bottom of the slope, look straight ahead and locate a waterbar where your sight-line meets the slope.
2. Stand at the spot for waterbar #1 and repeat the process.
3. Continue this until you reach the top of the slope.



Also refer to the spacing table found earlier in this section and in the forestry BMP manual



Waterbars



Start working while coming from the uphill side.



Clear a stable outlet area for the runoff.

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Waterbars



Angle the waterbar diagonally across the travel path and create a shallow trench along the uphill face.



Waterbars



Tie-in the upslope end of the waterbar with the adjoining roadside bank (circled) and extend the waterbar across the travel path to a stable vegetated outlet area.



These waterbars are not effective since runoff will simply flow past them along the base of the bank because they are not tied-in.

Waterbars



Pack down the soil mound of the waterbar. Avoid excessive amounts of woody debris within the mound.



X ***This waterbar has no outlet for the runoff.***

Waterbars should divert runoff onto a stable area and not pool water behind them.

Waterbars



X *This is not a waterbar.*

Simply curling-up a strip of soil will not effectively control runoff or prevent erosion



These waterbars are breached and no longer fully functioning due to traffic. Additional work is needed to control runoff.

Keep traffic off waterbars.