



WV DIVISION OF FORESTRY

**West Virginia Silvicultural Best Management
Practices for Controlling Soil Erosion and
Sedimentation from Logging Operations**

West Virginia
WEST VIRGINIA



West Virginia Silvicultural
Best Management Practices
for Controlling Soil Erosion and Sedimentation
from Logging Operations

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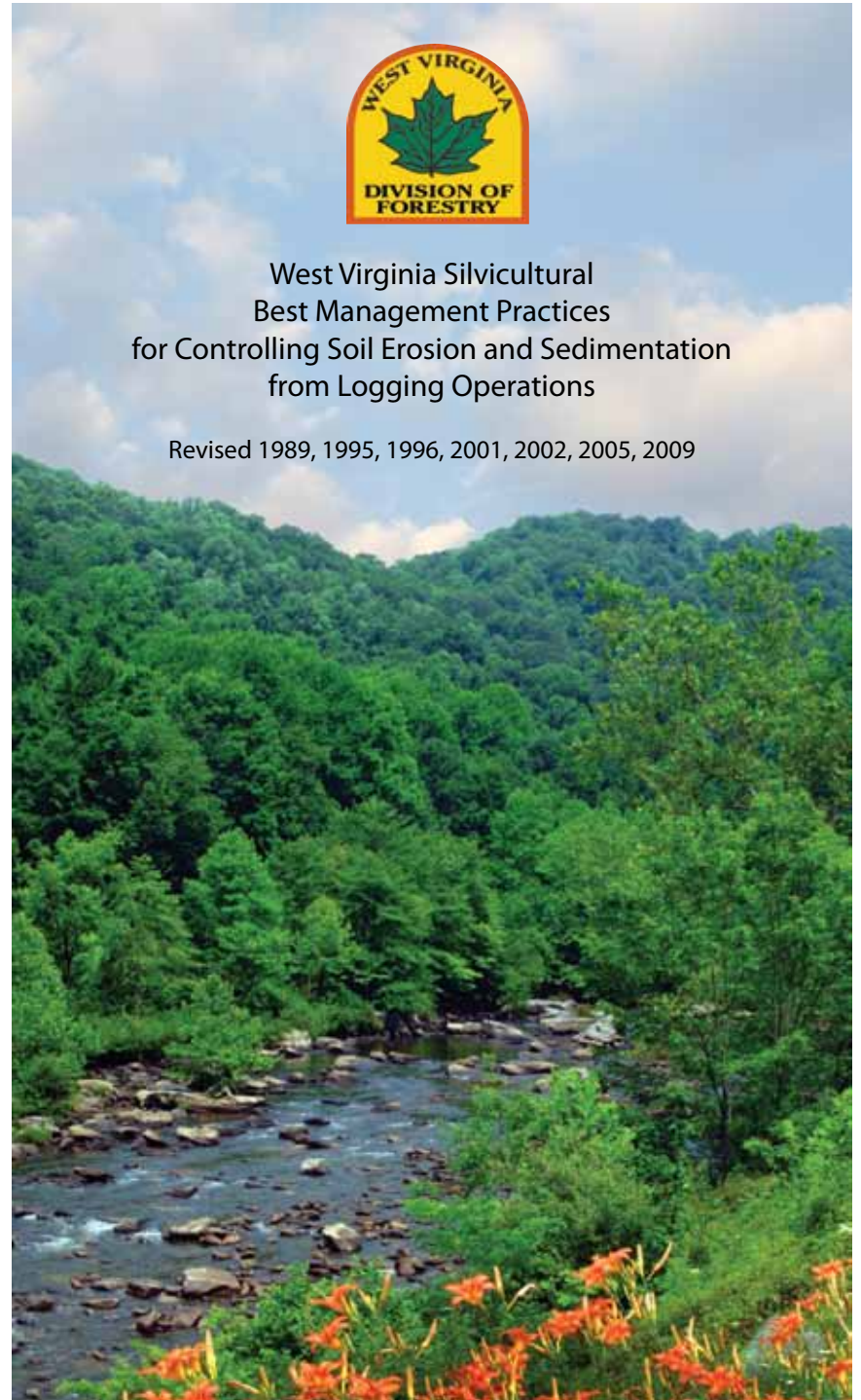


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Introduction

West Virginia is the second most forested state in the nation and produces some of the highest-value hardwoods in the country. The state's timbering industry is a major component of West Virginia's economy. Although it is a proven fact that cutting trees does not cause erosion, if done incorrectly logging operations and related activities can contribute to erosion and sedimentation.

The federal Clean Water Act of 1972, amended in 1977, specified under section 208 that states must reduce silvicultural non-point source (NPS) pollution. This law led West Virginia to enact the Logging Sediment Control Act (LSCA), West Virginia Code 19-1B in 1992. The LSCA mandates the use of Best Management Practices (BMPs) to limit and control erosion and soil movement into streams.

The silvicultural BMPs recommended in this booklet are the most commonly utilized. Although situations will arise that require custom or alternative practices to minimize erosion and sedimentation as mandated by the LSCA, West Virginia Code 19-1B-7(g), requires that BMPs be used to control erosion and soil movement into streams. The primary goal of BMPs is to limit erosion and sedimentation by handling water in small amounts.

The West Virginia Division of Forestry (DOF) will assume that the logging operation will be complete on the date specified on the notification form unless otherwise informed. Reclamation needs to be completed before the operation can be considered completed. The operator needs to keep the DOF notified of any changes in the completion date so the inspecting forester can schedule a final inspection. The final inspection will be comprehensive, and a final inspection report will indicate that BMPs required to limit and prevent erosion and sedimentation have been satisfactorily installed.

BMPs have sometimes been rendered ineffective after final inspection by the breaching of water bars by ATVs, tractors or trucks, or by the destruction of the stabilization materials and seed. If such occurrences result in stream sedimentation, it is then the responsibility of the landowner to correct these situations, and such violations may be enforced by the West Virginia Department of Environmental Protection (DEP) under WV State Code Chapter 22C.

Logging Sediment Control Act Summary

1. Logger Licensing
2. Logger Certification
3. Timbering Operation Notification
4. Logging Operation Posting
5. Enforcement for activities causing erosion and/or stream sedimentation or the potential thereof.
6. Reclamation to be complete within seven days of the planned completion date on the notification form. If it can not be done within seven days, the DOF must be contacted. (See Page 29)

The DOF was designated by the West Virginia Legislature as the agency responsible to carry out the mandates and provisions of the LSCA.

The law provides that anyone conducting a logging operation, buying timber or buying logs for resale after Sept. 1, 1992, is required to be licensed by the DOF. The annual licensing fee is \$50. This fee covers any single or combination of the above three categories stated. Any individual or business entity applying for a license must be registered and in compliance with the West Virginia Department of Tax and Revenue and Worker's Compensation and Unemployment Compensation laws. Acceptance of the license implies that the operator will protect environmental quality through the judicious use of silvicultural BMPs.

Another provision of the LSCA is for the certification of loggers. The annual fee for certification also is \$50. The requirement for certification is the satisfactory completion of courses in tree felling safety and personal equipment, first aid, and silvicultural BMPs. An initial certification or recertification can be renewed for two successive years, provided the logger training is less than three years old. Retraining is required every three years.

Each logging crew is required to be supervised by a certified logger any time the timbering operation is being conducted. The certified logger must be on-site to observe and supervise logging crew personnel while engaged in logging activities, including the severing and delimiting of trees, cutting and delimiting of logs, preparation of skid and haul roads, repairing and fueling equipment, installation of BMPs and administering first aid procedures.

A third LSCA stipulation states that loggers must submit a timbering operation notification form within three days of starting a new harvesting operation. Along with this notification, the timber operator is required to post the operation with a sign listing the timber operator's name and license numbers in letters that are at least three inches high. A posted sign must remain on each active log landing of the operation.

The law empowers the DOF to issue compliance orders to correct problems,

and when necessary, suspend a logging operation until specified corrections are made. Instances for suspension include when human life is endangered, uncorrectable erosion or sedimentation or the potential thereof is present, an operation is not licensed, no notification has been submitted for the operation or when no certified logger is present and supervising the operation. Licenses may be suspended if the person is found to be in violation twice in any two-year period. Licenses may be revoked if the logger is found in violation for a third time in any two-year period.

The DOF also may issue citations to any person who commits one of the following violations of the LSCA. If found guilty in magistrate court that person shall be fined not less than \$250 and not more than \$500 for each violation.

1. Conducts timbering operations or purchases timber or buys logs for resale without holding a valid license from the Director/State Forester of the DOF
2. Conducts timbering operations or severs trees for sale at a location in this state, without providing the Director/State Forester of the DOF notice of the location where the timbering harvesting operation is to be conducted
3. Conducts a timbering operation in this state that is not supervised by a certified logger who holds a valid certificate from the Director/State Forester of the DOF.
4. Continues to conduct timbering operations in violation of an existing suspension order or revocation order that has been issued by the Director/State Forester of the DOF or a conference panel.

The Director/State Forester of the DOF also may seek civil penalties for violations of the law in the circuit court of the county in which the violation occurred, in an amount not to exceed \$2,500 for the first offense and \$5,000 for any subsequent offense. All penalties collected are deposited in the Timbering Operations and Enforcement Fund for use in administering the law.

The law provides that all state agencies shall cooperate with the Director/State Forester of the DOF in administering the law and that the Director/State Forester of the DOF shall cooperate with all other state agencies in the enforcement of their related responsibilities and duties.

There are exceptions provided in the law for forestry activities not directly related to the severing or removal of standing trees from the forest as a raw material for commercial processes or purposes. These exemptions include:

- The severing of evergreens grown for and severed for the traditional Christmas holiday season
- The severing of trees incidental to ground-disturbing construction activities, including well sites, access roads and gathering lines for oil and natural gas operations
- The severing of trees for maintaining existing, or during construction of, rights-of-way for public highways or public utilities

- Any company subject to the jurisdiction of the federal energy regulatory commission unless the trees so severed are being sold or provided as raw material for commercial wood product purposes
- The severing of trees by an individual on the individual's own property for the individual's use provided that the individual does not have the severing done by a person whose business is the severing or removal of trees.

An exemption from licensing and certification may be obtained from the DOF provided that a person who severs or removes standing trees from his or her own land, or hires or contracts with someone else to do so, is specifically exempted from the timbering operations licensure requirement of this section. The collective stumpage value for all trees severed or removed by or for this owner during any calendar year must not exceed \$15,528.

Also, a person who has been hired or contracted to sever or remove standing trees from someone else's land is specifically exempted from the timbering operations licensure requirement of this section as long as the collective stumpage value for all trees severed or removed by this person during any calendar year does not exceed \$15,528. This exemption does not remove liability for any damage to water quality or exempt the use of BMPs as defined in this manual. To apply for an exemption contact one of the DOF offices listed on Page 28.

Streamside Management Zones (SMZ)

Definitions

Perennial Stream - Identified by well-defined banks and natural channels. Has continuously flowing water in all but severe drought years. Usually shown on a topographic map (USGS 7.5 minute series) as a solid blue line.

Intermittent Stream - Has well-defined banks and natural channels but typically has flowing water only for a portion of the year. Usually shown on a topographic map as a broken blue line.

Ephemeral Stream - A channel that lacks a base flow (groundwater) and only flows as a result of wet weather. Definition may vary depending on soil type, but all show evidence of repeated water flow and scouring of soil. Not directly shown on a topographic map.

Streamside Management Zone (SMZ) - Forestland adjacent to perennial, intermittent, ephemeral streams, ponds, lakes or any other body of water requiring special attention during forestry operations. This area of undisturbed forest soil provides a protective zone to filter out suspended sediments from water movement before it reaches the stream. Forestry operations should seek to protect and enhance this area while meeting the landowner's objectives. This



Stream Bed

Stream Bank

SMZs

Log Haul Road

is not to be confused with a shade strip as defined below.

Shade Strip - Also known as a buffer strip, this area is a no- or limited-cut area along a body of water that provides adequate shading of the water's surface to prevent thermal contamination which could modify or change the biological composition of the water body. Shade strips currently are not required by the West Virginia LSCA.

Conditions Where SMZs Apply

SMZs, should be maintained along all watercourses with nearby truck haul roads or skid roads or other locations where soil has been exposed and water movement could potentially carry sediment to the stream. SMZs should be no less than 100 feet wide on either side of a perennial or intermittent stream, and no less than 25 feet on either side of an ephemeral stream.

SMZ Requirements

- The minimum SMZ width or distance between exposed or disturbed soil and a perennial or intermittent stream should be no less than 100 feet slope distance on either side of the stream from the top or edge of the channel. On ephemeral streams it should be no less than 25 feet slope distance on each side from the edge of the channel or visible scour.
- The SMZ should be protected to prevent exposure of mineral soil and subsequent erosion. Equipment operation in this area should be limited to points where the stream must be crossed. Pulling cut trees from this area is permitted by cable. When mineral soil is exposed it shall be stabilized immediately by seeding and mulching, as well as any other

additional measures that may be necessary to prevent sediment from entering the stream.

- Log landings will be located outside the SMZ where practical. If circumstances do not allow or prevent alternative placement of the landing, then the location will be treated as a sensitive area and additional protective measures such as a silt fence, wooden mats and additional gravel will be used.
- Any mineral soil disturbed within the SMZ by the timbering operation will be seeded, mulched and stabilized immediately after the disturbance.
- Roads should not be permitted to be located within the SMZ except when entering and leaving stream crossings.
- Truck haul roads built under specific circumstances and reasons within the SMZ should be graveled and the fill slopes seeded, mulched and stabilized immediately after construction.
- Existing roads within the SMZ may be utilized only if their use will cause less damage than constructing a new road. Existing roads will be maintained in accordance with all requirements of haul and skid roads meant to reduce soil erosion and sedimentation.
- Recommended spacing of drainage structures such as culverts, water bars, turn outs and broad-based dips should be used on truck and skid roads to intercept and properly discharge runoff in small quantities so the filtering capacity of the SMZ will not be exceeded.
- Rip Rap erosion control will be installed at culvert outlets or discharge points into or within the SMZ. (See Page 21)
- To minimize erosion sources, cut and fill slopes within the SMZ should be minimized in accordance with other safety and design criteria.
- Skid road fill slopes within the SMZ will be seeded, mulched and stabilized immediately after construction.
- Sediment barriers, such as a silt fence and/or hay/straw bales, shall be used between streams and disturbed areas to prevent sediment from entering streams.
- Wooden mats can be used on roads and landings to control rutting. These mats should be placed before trucking begins.
- Keep the water from your road system separate from the aquatic system. All drainage devices and ditches should be constructed to filter the contaminated water into the filter strip in small quantities. Do not construct drainage ditches or devices that directly input runoff from disturbed soil into the stream.

Logging Debris and Tops in Streams

Directional felling will be used to minimize stream disturbance. Felled tops in streams will be pulled from the stream channel on all perennial or intermittent streams.



Encroachment on SMZ with silt fence for control



Temporary bridge installation in SMZ

Truck Haul Roads

Definition- A road system, temporary or permanent, utilized for transportation of wood products by truck from the harvest site.

Purpose- Haul roads should provide for an efficient, safe transportation system to effectively protect forestland and water quality when removing forest products from the harvest site. After harvest these roads may be used for recreation, wildfire control or other forest management activities.

Conditions Where Practice Applies

Haul roads are constructed or reopened when a road system is necessary to provide vehicular access for the purpose of harvesting and removing forest products.

Specifications

- Final center line road grade should be 10 percent or less. Final center line gradients not exceeding 15 percent are permissible for distances no more than 200 feet. By breaking or changing grade frequently, erosion problems can be lessened in comparison with long straight continuous grades. There should be a minimum running surface of 12 feet on the cut surface (not fill.)



Haul road with use of timber mats for stabilization.



*Haul Road fording creek.
Note significant limestone surfacing.*

- Streams should be crossed as close to a right angle as possible. Bridges or culverts should be sized to not impede the stream flow, in keeping with good drainage practices. (See "Pipe Culverts" on Page 20) Stream fords are permissible only as a last resort only when the stream bottom is rock-based or stabilized with added limestone rock. Approaches to the stream should be graveled for a minimum of 100 feet on either side.
- Road gradients approaching water crossings should be broken and surface water dispersed so that it will not flow directly into the stream. Roads should be located (with the exception of stream crossings) a minimum of 100-foot slope distance or more from perennial or intermittent streams, and 25-foot slope distance or more from ephemeral streams. Distance is measured from the disturbed soil at the toe of the fill to the top of the stream bank. (See "Streamside Management Zone Requirements" on Page 4) If the recommended SMZ distances cannot be maintained then alternative practices will be used, such as placing gravel on the road surface and immediately seeding, mulching and stabilizing all fill areas.
- Roads may be out-sloped for cross drainage. On side hills where a curb, fender or berm is necessary to protect the fill slope, the road should be in-sloped with cross drainage installed. (See "Pipe Culverts" on Page 20 or "Broad-based Drainage Dip" on Page 26) Where roads

are in-sloped, cross drain interception of surface water is necessary.

- Truck haul roads should not be located on level areas with wet flood-plain soils or where drainage is difficult to establish.
- Truck roads that intersect public roads should have gravel or other aggregate up to 200 feet to keep mud from being tracked onto the highway. (Check county Division of Highways requirements for entering public roads.)

Maintenance

- During construction, road surfaces must be adequately drained on a day to day basis using temporary cross drainage, turn-outs or water bars. This must be done in the event of storm flows prior to completion and the permanent installation of drainage devices.
- During the harvest operation, roads and their drainage systems should be maintained to perform to standard. This may include additional seeding and mulching of fill slopes within the SMZ.
- Operations that are likely to cause adverse erosion and sediment problems should be stopped in times of extreme weather conditions.

Post-Harvest

If roads are to be used after logging, broad-based dips, culverts and bridges, should be left intact and be periodically maintained by the landowner. If not to be used, drainage structures should be removed and road surfaces restored to a natural drainage by smoothing and out-sloping the road surface to a three percent grade. Leave existing dips and establish water bars.

Skid Roads and Trails

Definition- An unsurfaced trail or road, as narrow as safety will allow, used for skidding harvested products.

Purpose- To skid logs, tree lengths or other wood products from the stump to a common landing or concentration area.

Conditions Where Practice Applies

This practice is used where harvesting products requires concentration of wood products for sizing or loading onto trucks or trailers and where topography and size of the operation make skidding the primary means of collecting trees, logs or other wood products.



Well-constructed skid road

Specifications

Locate the landings first and then lay out skid road approaches with minimum grade. Major skid roads should have planned locations to reduce erosion and sedimentation, minimize damage to the residual stand and provide the most desirable method for skidding products.

- Roads should be planned and laid out to maintain an average spacing of about 200 feet. Less soil disturbed is less potential for erosion and less reclamation.
- Gradients should be no steeper than 15 percent, with the exception of short, steep segments not exceeding 20 percent.
- Cross-drainage, including turn-outs, water bars or grade breaks for dispersing road surface water, should be installed at least every 100 feet and maintained daily during logging operations.
- Skid roads should be located away from streams according to the SMZ requirements starting on Page 6.
- Any skid road necessitating the crossing of a stream will require a bridge or culvert of acceptable design. Logs will not be skidded through any stream. Plan your roads to eliminate or minimize stream crossings.
- Approaches to stream crossings will be as near to right angles as the conditions and topography allows.
- Never skid in or directly through a stream.

Skid road in process of being properly reclaimed. Note that it is smoothed and water-barred and berms on outslope have been removed.



- When skidding is completed on a road, the logger should stabilize and retire that road before commencing skidding on others. This should be done by first removing the outer berm, out sloping and smoothing the skid road. Next, establish water bars as recommended on Page 17. Water bars should be installed at a near 30-40 degree angle down slope, with ends open to prevent water accumulation behind them. Scattered logging slash should be used to supplement water bars and assist in road stabilization.

Log Landings

Definition- An area where logs and other roundwood products are concentrated for the purpose of sawing, sorting or loading onto trucks for transportation.

Specifications

This practice, though necessary, almost always results in the disturbance of mineral soil. Extra care should be taken to locate areas properly in order to minimize the chance of erosion and sedimentation.

Poor landing location



Properly reclaimed landing



- Do not locate log landings inside the SMZ unless there is no other alternative. See SMZ requirements starting on Page 6 for more detail.
- Log landings should be located on dry, firm sites and have a slight slope to allow for drainage.
- Provide for adequate draining on approach roads. Whenever possible design roads so that they come upslope slightly into the landing to avoid road drainage entering the landing area.
- Install a diversion ditch around the uphill side of landings where seepage or lateral flow of water could be a problem. The only water that should be on the landing is the water that falls there.
- When servicing equipment on-site, drain old oil, etc., into containers and dispose of it properly in accordance with environmentally safe disposal procedures.
- Seed and mulch landings immediately following completion of operations or use of the landing. See reclamation requirements on Page 16.
- Landing size should be kept to the minimum needed to accommodate the equipment and work safely. Smaller landings mean less disturbed soil and less potential for erosion and sedimentation problems. A smaller landing also means less reclamation costs.



Reclaimed SMZ

The importance of soil stabilization with mulch



Properly reclaimed landing



Reclaimed haul road entrance



Properly reclaimed skid road

Reclamation

Definition- The proper restoration of disturbed soil to ensure proper drainage and to eliminate the potential for erosion and sedimentation problems from the harvest site. The goal of reclamation is to protect the forest soils and water quality, while returning the site to a condition as good as or better than it was before logging began.

All reclamation will be done within seven days of the closure of the job. If reclamation cannot be completed within this seven-day time frame, notification shall be given to the relevant DOF office. Ideally, reclamation should be an ongoing procedure during the day-to-day operation of the job.

Seeding and Mulching Specifications

- All landings will be seeded and mulched.
- All mineral soil disturbed within the SMZ will be seeded and mulched. Road fills and other disturbed soil that are not part of a road surface should be seeded and mulched immediately after construction.
- Any road that exceeds 15 percent slope and is not effectively stabilized with an alternate material must be seeded and mulched.
- All areas seeded and mulched must develop a vegetative cover of 50 percent of the disturbed surface area. Lime and fertilizer are not required but proper application may reduce the number of return trips to ensure vegetative catch.
- Compacted soils should be scarified to a depth of two to three inches to ensure good seed germination and rooting.
- Straw is the preferred mulch. Use of hay is permissible but not encouraged due to the risk of spreading invasive or exotic species.
- For each section of the planned logging operation, all exposed mineral soil areas that are to be seeded and mulched should have the high berms removed, out sloped, smoothed, water barred and then seeded and mulched immediately after they are no longer needed. Don't wait!

Recommended Seed Mixtures (Rates per Acre)

Shaded Areas

1. 30 lbs. lathco flat pea, 20 lbs. perennial ryegrass
2. 30 lbs. creeping red fescue, 10 lbs. perennial ryegrass
3. 20 lbs. tall fescue (endophyte-free), 20 lbs. lathco flat pea
4. 50 lbs. winter wheat, 8 lbs. orchard grass, 10 lbs. tall fescue (endophyte-free)

Wildlife Mix for Landings

1. 8 lbs. bird's foot trefoil, 3 lbs. red top, 4 lbs. orchard grass
2. 8 lbs. tioga deer tongue, 6 lbs. ladino clover
3. 25 lbs. physter fescue or johnstone fescue, 2 lbs. ladino clover
4. 25 lbs. physter fescue or johnstone fescue, 5 lbs. annual rye grass, 2 lbs. orchard grass, 3 lbs. tioga deer tongue, 2 lbs. bird's foot trefoil, 4 lbs. foxtail millet
5. 50 lbs. winter wheat, 8 lbs. orchard grass, 4 lbs. ladino clover, 6 lbs. timothy

Erosion Control for Grassland or Pasture

1. 8 lbs. bird's foot trefoil, 4 lbs. timothy
2. 1 lbs. white clover, 6 lbs. Kentucky bluegrass, 2 lbs. timothy
3. 10 lbs. orchard grass, 2 lbs. ladino clover, 3 lbs. redtop
4. 50 lbs. winter wheat, 8 lbs. orchard grass, 6 lbs. timothy

Sensitive Areas

1. 25 lbs. tall fescue (endophyte-free), 5 lbs. ladino clover
2. 50 lbs. winter wheat, 25 lbs. tall fescue (endophyte-free)

Seeding Dates and Recommendations

- Best months to ensure seeding success are March through June and late August to early October.
- The worst months to seed are July, early October, November, December and January. Seeding can be done during these times, but weather conditions may hinder vegetative establishment.
- Frost seeding or seeding on snow is more likely to succeed in February or early March.
- All legume seeds must be inoculated before seeding.
- Add 8 lbs./acre of annual rye grass, or 50 lbs./acre of winter wheat to seed mixtures to help provide quick ground cover and soil stabilization.
- Lime and fertilizer, though not required, will help to ensure vegetative cover on exposed subsoil and dry sites.

Temporary Water Bars

Definition- A water control structure that is constructed across a skid road at a 30-45 degree angle to intercept and divert water from the road surface. A temporary water bar is usually cut into the road surface from six inches to one foot in depth.

Conditions Where Practice Applies

Temporary water bars should be used on any sloping road where surface runoff may cause erosion of the exposed road during construction or active use of a road.

Specifications

- Installation should be at a 30-45 degree down slope or more to turn surface water from the road or trail.
- Spacing for temporary water bars should not exceed 100 feet.
- The depth of a temporary water bar should be six inches to one foot. It is especially important that this be cut into the road surface to minimize the effect of wheel compaction.
- Temporary water bars will be used for temporary shut down of an operation and should be installed and maintained daily on an active operation and during construction.



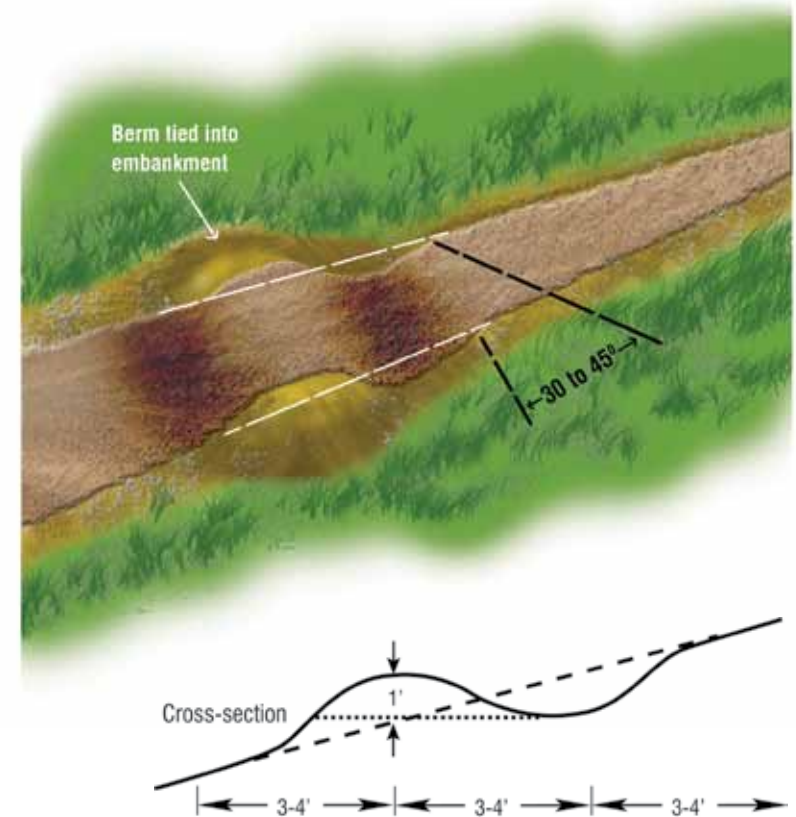
A good water bar. Note outflow end is open and proper construction angle across road.

Permanent Water Bars

Definition- A water control structure that is constructed across a skid road at a 30-45 degree angle to intercept and divert water from the road surface. A permanent water bar is cut into the road surface at least eight inches in depth.

Conditions Where Practice Applies

Permanent water bars should be used on any sloping road where road surface runoff may cause erosion of the exposed road after use is complete.



Specifications

- Installation should be at a 30-45 degree down slope or more to turn surface water from the road or trail.
- Proper spacing of permanent water bars can be determined in the following table. As a general rule if you are seeing evidence of water scour or sheet erosion between your water bars they are too far apart.
- Additional water bars may need to be installed to handle water sources such as spring seeps or drains.
- Fill dirt from the cut water bar should be pushed up onto the road surface and left intact.
- The uphill side of the water bar should extend beyond any cut ditch lines to fully intercept any ditch flows.
- The outflow end of the water bar should be fully open and allow road surface runoff to be directed onto the undisturbed forest floor.

Permanent Water Bar Spacing

Minimum Grade %	Maximum Distance Feet
Less than 5%	100
5%-20%	50
Greater than 20%	40

Always install a water bar at least 25 feet uphill from a stream crossing or landing to divert surface water.

*Cross drainage
pipe culvert*



Pipe Culverts for Cross Drainage

Definition- A hollow pipe or tube of suitable material that is placed under haul roads or skid roads to carry water from the uphill side under the road surface to the downhill side.

Conditions Where Practice Applies

Cross drainage culverts are commonly used in combination with ditch lines where water from in-sloped roads or spring seeps needs to be gathered and passed under the road surface to be filtered on the undisturbed forest floor. On skid roads they are commonly used to gather water from seeps and small drains to keep the road base from becoming saturated and unstable.

Specifications

- Pipe length should be long enough to extend beyond the side slope toe. The accepted minimum is 25 feet on truck haul roads and 20 feet on skid roads and trails, though longer lengths are commonly needed to achieve the desired result.
- The minimum diameter pipe for use is 15 inches, although 18-inch pipe is strongly recommended. Smaller diameter pipes may be used for temporary installations as long as they are adequately sized to carry expected peak flows.
- When used in conjunction with a ditch line, the culvert gradient should match the gradient of the ditch line to avoid pooling of water and possible blockage.
- Installation should be skewed at a downhill angle of about 30-45 degrees, similar to a water bar.
- Erosion protection such as rip rap should be used on the downhill end of the pipe to break up the force of the water and keep it from eroding the fill. It also may be necessary to install rip rap or construct a head wall on the intake side of the pipe to help avoid blockage and properly channel storm flows.
- Water turn-outs and diversion ditches can be constructed to help move water from roadbeds and ditches.
- When the pipe is placed into the roadbed it should be hand tamped to approximately half the depth of the pipe and then covered to a depth of at least one foot or half the diameter of the pipe, whichever is greater.
- For proper spacing of culverts for ditch drainage refer to the table below:

Culvert Spacing Guide for Cross Drainage (Ditch Drainage)

Minimum Grade %	Maximum Distance Feet
2	400
4	350
6	300
8	250
10	200
12	150
14	100
16	50



Open Top Pipe Culvert

Open Top Pipe Culvert

Definition- An eight- to 10-inch diameter steel-walled pipe with three-inch by 24-inch slots cut along the top at six-inch intervals for use in handling surface drainage, ditch drainage or both.

Conditions Where Practice Applies

Open top pipe culverts are best used on firm, well-maintained haul roads where grades are steeper than 10 percent and the use of broad-based dips is impractical. They are capable of handling both ditch water and surface runoff.

Specifications

- Recommended spacing is the same as for a broad-based dip: at least 100 feet apart, but not greater than 150 feet.
- Open top pipe culverts should be installed at a 30-45 degree down slope angle across the road surface, with the top being level with the road surface.
- Open top pipe culverts will require far more maintenance than most other types of cross drainage and should not be used for situations where maintenance may be unlikely or infrequent.



Pipe Culverts for Stream Crossings

Definition- A plastic or metal pipe of suitable material and design to carry stream water underneath a road surface without impeding the natural flow of the stream.

Conditions Where Practice Applies

Culverts may need to be used for stream crossings on haul roads to avoid creating a ford and where a bridge is not practical. They also are necessary on skid roads where avoiding stream crossings simply is not possible. Note that the specifications in this section are meant for temporary crossings only that will be removed after the operation is complete. Permanent installations will require permitting and possibly other special requirements. Please contact a DOF office to obtain more information.

Specifications

- Plan the road system to avoid or minimize places where a stream crossing is needed. These are the points of greatest risk for introduction of sediment into a stream.
- Culverts should only be installed if a bridge is not available or practical as the installation of culverts and soil into the stream channel could potentially be damaging to the natural flow.
- If the stream is a perennial stream you should seek special advice from your local DOF office. See SMZ section starting on Page 4 for the definition of a perennial stream.



Haul road bridge



Simple but effective skid road bridge

- Pipe length should be long enough to ensure that both ends extend beyond both side slope toes. The accepted minimum is 25 feet on truck haul roads and 20 feet on skid roads and trails, though longer lengths are commonly needed to achieve the desired result.
- The pipe should be sized large enough to handle the maximum high-water flow. A good rule of thumb is that the pipe should be the same size as the stream channel. See the following drainage table for more specific guidelines.
- The pipe should be installed to match the natural direction and slope of the channel with as little alteration to the stream channel as necessary.
- Multiple pipes are to be used only as a last resort when a single pipe can not be installed to handle the flow. A temporary bridge may be a better solution.
- Multiple culverts must be sized carefully. For example, it takes two 18-inch pipes to equal the carrying capacity of one 24-inch pipe, and it takes two 36-inch pipes to handle the carrying capacity of one 48-inch pipe. In multiple pipe-crossing installations the pipes must be placed at least half the diameter of the pipe apart.
- When the pipe is placed into the stream channel it should be hand tamped to approximately half the depth of the pipe and then covered to a depth of at least one foot or half the diameter of the pipe, whichever is greater.

Drainage Table*

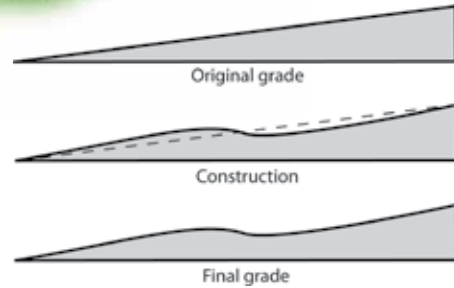
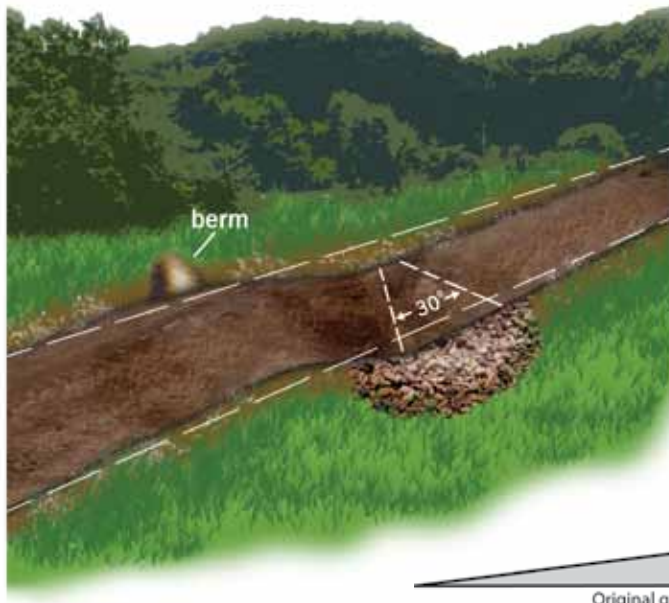
Estimated culvert diameter needed to carry storm flow from forested areas ranging from 10 to 400 acres at probable storm recurrence intervals of 50 years. Accuracy of values for areas exceeding 100 acres is uncertain. Land use, disturbance and soil types above culvert locations can affect water flow peak levels and therefore should be considered when using this table.

Area Acreage	Inches in Diameter
2-8	15
10	18
20	20
30	24
40	26
50	28
60	28
70	30
80	30
90	32
100	34
125	36
150	38
175	40
200	42
250	26
300	48
350	54
400	54

*Table modified from: Helvey, J. David, and Kochenderfer, James N., 1988.

Culvert Sizes Needed for Small Drainage Areas in the Central Appalachians.

USDA Forest Service, Northeastern Forest Experiment Station, Parsons, WV. Areas with clay soil may require larger diameter pipes if used as a permanent structure.



Broad-based Drainage Dip

Definition- A dip and reverse slope in a road surface that is out-sloped to provide for natural cross drainage of the road surface. They are not meant to handle stream flow.

Conditions Where Practice Applies

Broad-based dips can be used on truck haul roads and heavily used main skid trails having a gradient of 10 percent or less. They are not to be used for cross draining live streams. This practice may be used in place of, or in combination with, other cross drain procedures such as ditching and culverting on permanent road systems for easier long-term maintenance.

Specifications

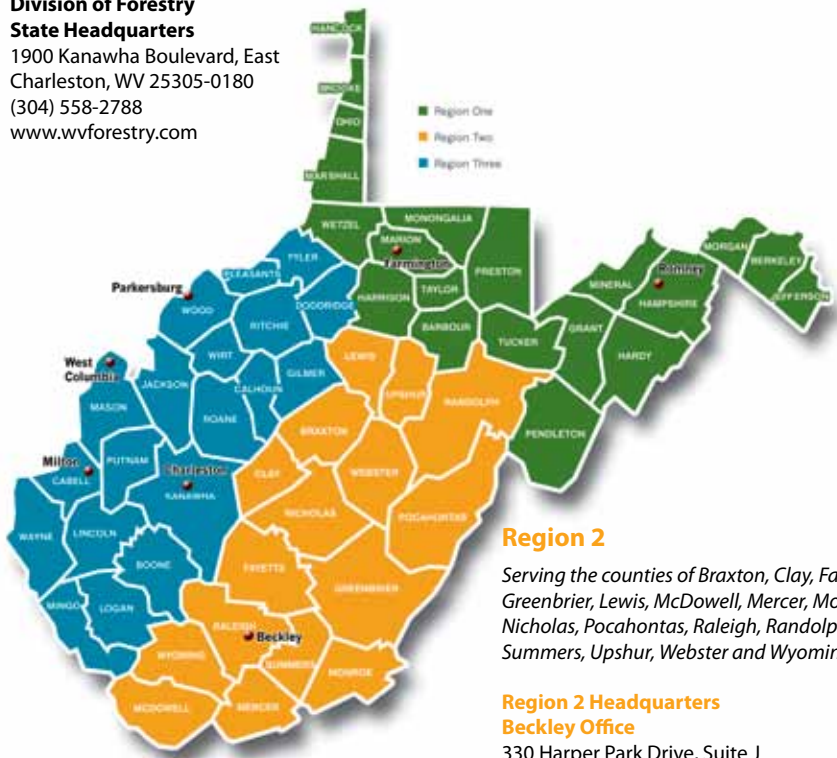
- Installation takes place following roadbed construction.
- A 20-foot, 3 percent reverse grade is cut into the existing roadbed by cutting from upgrade of the dip location and using cut material for the reverse grade section.
- Spacing should be approximately 100 feet apart but never more than 150 feet.
- The cross drain out slope will be approximately 2 percent -3 percent in the lowest portion of the dip.
- The dip and reverse grade section requires bedding with 20 tons of three- inch crushed stone to avoid rutting of the road surface.
- Rip rap is used to control erosion on the loose fill below the dip.
- Broad based dips are not maintenance-free, especially during active use, and will require additional maintenance, stone and grading to keep the roadbed in the dip from rutting.



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Logging Sediment Control Act Review

The following information is to provide you a basic understanding of the law. Questions can be directed to the nearest DOF office.

- All logging companies, timber buyers, buyers of logs for resale or other contractors working on a timbering operation **MUST HAVE** a “Timbering License” for their company. This license costs \$50 annually and can be obtained at the DOF State Headquarters at Guthrie. Allow two weeks for processing.
- All companies and individuals doing business in West Virginia **MUST**:
 - Be registered with the State Tax Department and have a West Virginia business number;
 - Be in compliance with West Virginia Worker’s Compensation laws and supply proof of coverage with the timbering license application;
 - And be in compliance with the West Virginia Unemployment Compensation Division and include an original letter of compliance with the timbering license application.
- Each logging operation **MUST** be supervised by a “Certified Logger.” To become a certified logger, an individual needs to have successfully completed training classes in First Aid, Best Management Practices, and Tree Felling and Logging Safety. Retraining is required each three years or after the second renewal. A photo card, similar to a driver’s license, will be issued to all Certified Loggers in West Virginia. The cost of logger certification is \$50 annually, payable to the DOF State Headquarters at Guthrie. This certification is in addition to the Timbering License. The law requires only one certified logger per logging operation but does stipulate that one must be on the job at all times.
- A “Timbering Operation Notification Form” **MUST** be sent to the appropriate DOF office for EACH logging operation no more than three days from the start of operations. A topographic map with the harvest area specifically outlined, including the location of haul roads, landings and stream crossings is a required part of the notification.
- Each logging operation **MUST** have a sign at the active landing showing the company name and license number. Lettering on the sign must be at least three-inches tall and visible at all times.
- The DOF must be notified if operations are stopped or completed more than seven days before the predicted finish date listed on the notification form. Notification also is needed if the finish date is changed.

- Reclamation should be completed within seven days of the completion of logging on the job. If reclamation will be delayed, notify the appropriate DOF office of the new date.
- Logging operations are required to use BMPs to control soil erosion and prevent sediment pollution of streams. Violations can result in enforcement actions being taken against your company up to and including suspension, citations and fines.



Citation being issued



DOF employees giving advice



Skidder hard at work





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