BMPs for Erosion Control for Logging and Forestry Practices in Ohio

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PURPOSE

Ohio Revised Code 1503.51 requires the Chief of the Ohio Department of Natural Resources-Division of Forestry to:

"Establish technically feasible and economically reasonable standards to achieve a level of management and conservation practices in silvicultural operations that will abate wind or water erosion of the soil or abate the degradation of the waters of the state by soil sediment, including attached substances, from silvicultural operations and establish criteria for determination of the acceptability of such management and conservation practices."

Developed in consultation with professionals in the fields of soil and water conservation and forestry, this handbook serves as written documentation of those established standards and acceptable practices.

The practices described in this book are broad-reaching and based on currently available tools and technology. However, this book is not intended to stifle creativity or the development of new techniques or practices. Ohio Administrative Code 1501:3-12-2 provides a mechanism for the Chief of the Division of Forestry to approve the use of practices not included in this book, if needed, effective and appropriate.

The person(s) responsible for the logging operation or other silvicultural activity should consult with the ODNR-Division of Forestry or the Soil and Water Conservation District (SWCD) in the county where the forestry activity is to occur to assist in the approval of alternative measures. The proposed alternative BMPs should be thoroughly described and included as part of the Forestry Pollution Prevention Plan (FP^3) developed for the site and be approved by either the Chief of the Division of Forestry or the SWCD Board of Supervisors in the county where the silvicultural activity is to occur.

ACKNOWLEDGEMENTS

This handbook was developed by the Ohio Forestry BMP Advisory Committee through consultation with state and local agencies and the forest industry. The committee consisted of the following individuals: Dave Apsley, Ohio State University Extension; Dean Berry, Woodland Management Services Ltd.; Tom Brown, Brown Forest Products; Danielle Gill, Hocking Soil and Water Conservation District; Jason Good, Superior Hardwoods of Ohio; Greg Guess, ODNR Division of Forestry; Bob Mulligan, ODNR Division of Forestry; Nathan Paskey, Ashtabula Soil and Water Conservation District; Brad Perkins, Ohio Forestry Association.

Edited by Bob Mulligan, ODNR Division of Forestry, Danielle Gill, Hocking Soil and Water Conservation District and Dave Apsley, Ohio State University Extension.

Topographical map in the Pre-Harvest Planning Section courtesy of Dean Berry, Woodland Management Services Ltd. All other photos in this publication were provided by Pete Woyar, Hocking College (retired), Pixelle Specialty Solutions, American Electric Power, Ashtabula SWCD, Hocking SWCD, Mahoning SWCD and ODNR Division of Forestry.

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INTRODUCTION

The quality of Ohio's lakes, rivers, streams, and wetlands depends upon sound land management. Currently over 30 percent of Ohio's land base is in forest cover. Well managed forests provide countless benefits to water quality. They help to slow runoff, reduce flooding, purify water, and replenish our aquifers. Temporary soil disturbances such as the construction of logging roads or tillage associated with tree plantings can create disruptions to these water quality benefits. Without proper planning and mitigation, soil erosion and water degradation can quickly take place. This not only has a detrimental effect on Ohio's waters but can also lead to legal liabilities for landowners and operators responsible for these operations.

Best Management Practices (BMPs)

Fortunately, we have the knowledge, tools, and techniques needed to minimize soil erosion and protect our waters. These methods are called "Best Management Practices" for preventing forestry pollution. Throughout this book you will see them referred to as "BMPs" and they are the key to maintaining water quality, minimizing the negative effects of soil erosion, and helping individuals stay in compliance with laws that regulate water quality from forestland. BMPs are methods, structures and techniques that have been scientifically proven to reduce and control soil erosion and prevent sediment from reaching ditches, streams, lakes, and other water bodies.

Legal Responsibility

Under Ohio law, landowners, operators (ex. loggers, tree planters, etc.), and other individuals responsible for a forestry operation (ex. consulting forester, prescribed fire burn boss, etc.) share a legal responsibility to ensure that BMPs are being used when conducting silvicultural activities.

Ohio Administrative Code 1501:3-12-02 states:

Each owner, operator, or person responsible for a silvicultural operation shall prevent pollution caused by wind or water erosion. Silvicultural operations shall apply conservation practices in accordance with "BMPs for Erosion Control for Logging and Forestry Practices in Ohio," which are available to all Ohio county soil and water conservation districts, or other appropriate methods or management practices approved by the chief or the chief's designee.

The utilization of BMPs is required by Ohio Administrative Code for all silvicultural activities including, but not limited to, logging, tree planting, and prescribed fires. It is your responsibility to ensure that BMPs are used!

KEEPING SOIL FROM BECOMING A POLLUTANT

There are three basic phases to the soil erosion process: detachment, transport, and deposition.

Phase 1: Detachment

Soil detachment occurs when bare soil is dislodged from the ground by the force of falling raindrops (*Figure 1*) or flowing water. The easiest and most economical way to reduce detachment is to minimize the amount of bare soil on the site at any given time. This can be done by:

- Minimizing the number of skid trails to match site conditions.
- Minimizing trail/road widths and log landing size.
- Phasing trail and road construction. (Delay construction until they are needed).
- Revegetating all bare areas as soon as the trail, road or log landing is no longer in use. *See Section 10, Sale Closing*, for further guidance.

Figure 1. The impact of a single raindrop striking bare soil.

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Phase 2: Transport

Runoff water moving down-slope can keep the eroded soil particles suspended in water. The velocity of the flowing water can also scour the ground and create even more soil detachment, particularly on steeper slopes. There are multiple BMPs that can help to disrupt this process; most common are water bars and rolling dips. These divert water from compacted skid trails and roads onto undisturbed soil adjacent to the trail, where the water can easily infiltrate, leaving the sediment on the ground surface and out of water bodies. *See Section 7, Skid Trails*, for installation instructions.

Phase 3: Deposition

If the soil detachment and transport phases are not disrupted by proper BMPs, soil sediment may eventually find its way to streams, lakes, ditches, etc., (*Figure 2*) becoming a pollutant and a violation of Ohio's Forestry Pollution Abatement Rules (OAC 1501:3-12-2) and may also be a violation of Ohio's Water Pollution Control Laws (ORC 6111). To prevent sediment discharges, landowners, loggers, and others responsible for the forestry operation must utilize BMPs such as sediment control barriers (as needed) to keep detached sediment from entering "waters of the state".

Figure 2. Sediment as a pollutant in a headwater stream.

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CONTROL WHERE SEDIMENT GETS DEPOSITED

Once suspended in moving water, it becomes difficult to capture and remove soil particles. The most practical way to control where this soil is deposited is to create small pools of still or slow-moving water and allowing the soil particles time to fall out of suspension under their own weight. In a forestry scenario this generally means constructing a series of temporary sediment control barriers across a slope or at the base of a slope. There are several types of barriers that can be used including hay or straw bale barriers, filter socks, and silt fences.

With straw bales (*Figures 3, 4 and 5*), silt fences (*Figures 6 and 7*), or filter socks (*Figures 8 and 9*), the ground level at the ends of barrier must be higher than the top of the lowest point of the barrier to adequately contain the water.

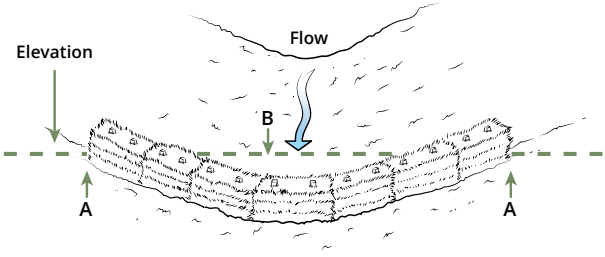


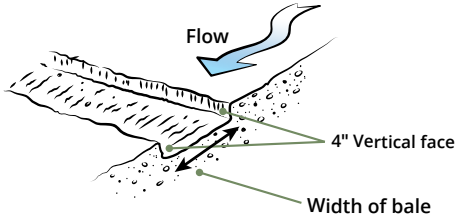
Figure 3. Proper installation of a sediment barrier.

Construction Guidelines for Sediment Barriers

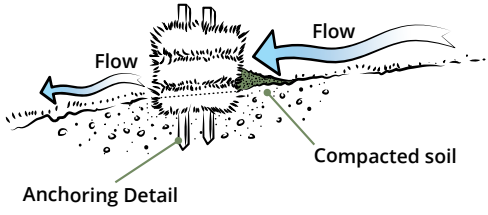
1. **Bale Barriers:** Install hay or straw bales in a row along the contour (i.e., perpendicular to the slope). Anchor each bale with two metal or wood stakes. Wood stakes should be at least 2" x 2" x 30" and driven in the ground a minimum of 1 foot. Bales should be buried in the ground at least 4 inches to prevent water from flowing under the bales. Use bales that have been baled with steel wire or nylon string only. Sisal twine should be avoided due to its tendency to rot and break.

Straw Bale Dike

❶ Dig trench 4" deep x width of straw bale.



❷ Fit straw bales into trench and secure with 2 re-bars, steel pickets, or 2" x 2" stakes 1' to 2' in ground.



❸ Wire or nylon bound bales placed on the contour.

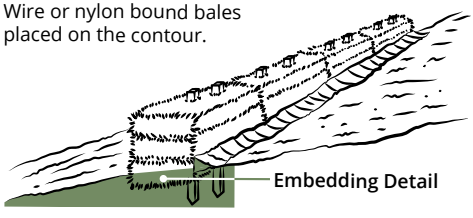


Figure 4. Temporary sediment barriers: hay or straw bales.

Figure 5. An effective straw bale barrier.

2. **Silt Fence:** Place silt fences on the contour. Wood stakes are generally pre-installed by the manufacturer and should be no more than 10 feet apart. The silt fence should be installed with the wood stakes on the downhill side of the fabric. If hog panels or a wire fence is used for reinforcement, fasten the wire fence securely on the uphill side of steel t-posts or wood fence posts greater than 4 inches in diameter. Silt fence should then be installed directly against the uphill side of the hog panels or wire fence. Fabric must be entrenched 6 to 8 inches into the ground to prevent water from passing under the barrier.

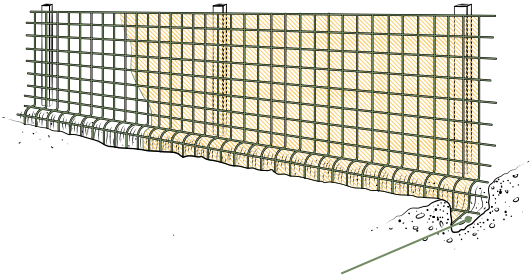
On longer bare slopes, multiple sediment barriers are often needed; spacing between each row of sediment barriers is governed by slope steepness. Use the following guidelines:

Slope	Distance between barriers
2–8 %	110–92 ft.
8–12 %	92–75 ft.
12–18 %	80–60 ft.
18–24 %	60–52 ft.

Table 1. Sediment barrier spacing guidelines.

❶ Excavate a 6 to 8 inch-deep trench with the contour of the ground. Set the factory installed posts on the downhill side of the trench with the filter fabric on the uphill side of the stakes.

❷ If utilizing wire fencing (such as hog panels), fasten wire fencing to steel t-posts or wood fence posts and Install silt fence directly against the uphill side of the wire fence. Otherwise, skip to step 3.



❸ Place the bottom edge of the fabric into the trench and ensure that no water can flow under the filter fabric.

❹ Backfill and compact excavated soil.

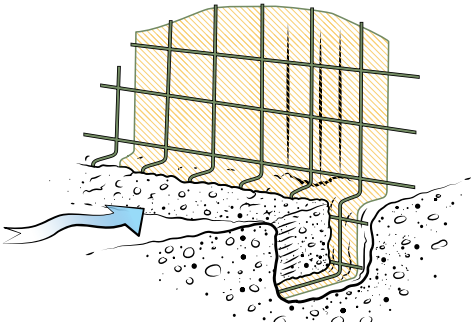


Figure 6. Temporary sediment barriers: silt fence.

Figure 7. A properly installed silt fence is a cost-effective way to control sedimentation from large, disturbed areas, such as log landings.

3. **Filter Sock:** Place the compost filter sock on the contour. Ensure that the entire filter sock is making solid contact with the ground surface. Drive wood stakes into the sock to secure it in place. Stakes should generally be 2 inches by 2 inches and placed no more than 10 feet apart. Stakes should be driven at least 8 inches into the ground. In sandy soil the depth should be increased to at least 12 inches.

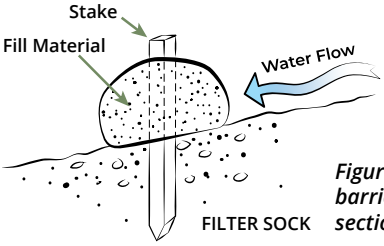


Figure 8. Temporary sediment barriers: filter sock (cross section view).

Figure 9. A temporary composting filter sock sediment barrier that is filled with wood chips. Filter socks generally require less labor to install than bales or silt fence since they can be placed directly on the ground without a trench. This also makes them a good choice when the ground is frozen or rocky.

PRE-HARVEST PLANNING

Pre-harvest planning is critical to the overall success of the operation. A well-planned harvesting operation will allow for the efficient removal of forest products while also protecting water quality, maintaining soil health, and minimizing damage to the residual stand of trees.

Failure to plan for and correctly implement BMPs when conducting logging or other silvicultural activities can lead to detached soil entering water bodies. This is a form of Non-Point Source (NPS) pollution. This not only degrades water quality but can also lead to regulatory action against the landowner, logger, forester, or other individuals responsible for the forestry pollution.

Many of these legal risks can be minimized by developing and filing a voluntary, written Forestry Pollution Prevention Plan (FP^3) with the SWCD in the county where the logging or other activity is to occur.

Ohio Administrative Code 1501:3-12-05 states:

(1) If the chief or the chief's designee determines that any person owning or responsible for a silvicultural operation is managing such operation in accordance with a timber harvest plan [*Forestry Pollution Prevention Plan (FP^3)*] currently approved by the chief or the chief's designee, the person shall be considered **in compliance** with the state rules for forestry pollution abatement. In a private civil action for nuisances involving forestry pollution, it is an **affirmative defense** if the person owning, operating, or otherwise responsible for silvicultural operations is operating under and in substantial compliance with an approved timber harvest plan.

Protect Yourself...
Develop a FP^3,
the benefits are EXPONENTIAL!

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The **Forestry Pollution Prevention Plan (FP^3)** form is a valuable and useful tool to document your pre-harvest planning decisions. Before cutting, loggers should meet with the landowner and their forester to decide the location of log landings, haul roads, skid trails, and stream crossings (if needed). The FP^3 plan should also include specific BMPs which will need to be implemented on the site. Please note that the FP^3 has historically been referred to as a "Timber Harvest Plan" (THP) in the Ohio Revised Code and Ohio Administrative Code.

Once completed, the FP^3 plan should be submitted to the Soil and Water Conservation District (SWCD) in the county where the operation is to occur. This should take place prior to the start of the harvest. Ohio SWCD Boards of Supervisors generally meet once per month, so plans should be submitted well in advance of the harvest, when possible, to allow the SWCD adequate time to review and approve the plan.

Figure 10. Landowners, loggers, and foresters should work cooperatively to develop a sound pre-harvest FP^3 plan.

In addition to the completed FP^3 form, please include a topographical map (*see Figure 11*) identifying:

1. Property and harvest boundaries
2. Streams and drainages
3. Critical areas
4. Proposed haul road and skid trail locations
5. Proposed stream and drainage crossings
6. Log landing and sawmill seat locations
7. Streamside Management Zones (SMZs)
8. Obstructions, such as rock outcroppings

Also, consider and perhaps make notes on the following items on the FP^3:

1. Road and trail specifications
2. Logging contract specifications
3. Any needed permits to comply with Federal, State, and Local Government Regulations
4. Other environmental concerns
5. Soil information (websoilsurvey.sc.egov.usda.gov)
6. Determine if utilities are present on site by contacting Ohio 811 (It's the LAW!)

OHIO811.org Before You Dig

Plan all stream crossings.

Stream crossings are critical areas that require thorough and thoughtful planning. Much of the soil leaving logging jobs is a result of poorly planned stream crossings. (*See Section 8, Stream Crossings*).

Consider distribution and volume of timber to be removed.

The more timber that is hauled from an area, the better the road that is needed. Loads at landings are computed from the estimate of timber that will be skidded to each landing. Where timber is uniformly distributed, this can be determined from the area served by each landing.

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Expressing the proposed use of a logging road in terms of number of loads that will be hauled over it can serve as a guide to the design and standards to which the various sections and spurs need to be constructed.

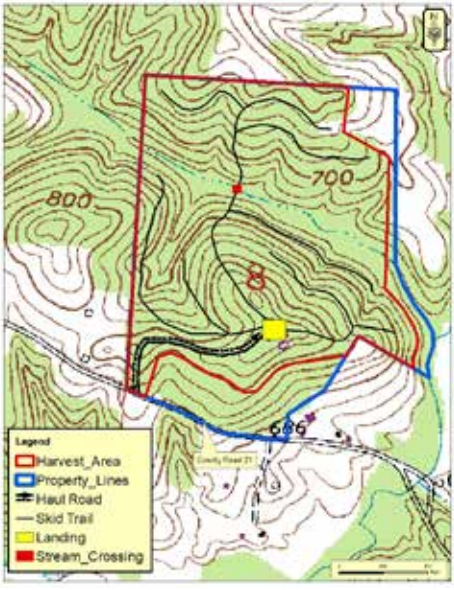

Figure 11. Topographic map with details of road systems, landings and other pertinent information marked.

For more information concerning pre-harvest planning or to request the assistance of the ODNR Division of Forestry (ODNR-DOF) Forest Hydrology Manager or a DOF State Forester, contact:

The Ohio Department of Natural Resources

Division of Forestry
2045 Morse Rd. Bldg. H-1
Columbus, Ohio 43229
614-265-6694 or 1-877-247-8733
forestry.ohiodnr.gov

Soil and Water Conservation Districts (SWCDs)

There is a SWCD office in each county of Ohio. To find contact information for the SWCD in your area call 614-265-6610 or go to the following web site: **agri.ohio.gov/divisions/soil-and-water-conservation/find-a-local-swcd/swcd-list**

Consulting Foresters

The Ohio Society of American Foresters maintains a list of industry, government, and private foresters at **osafdirectory.com**.

The Ohio Chapter of the Association of Consulting Foresters maintains a list of consulting foresters at **ohioacf.com**

Ohio Environmental Protection Agency's (Ohio EPA) 401 Program

Contact 401 Program Manager at: **epa.ohio.gov/divisions-and-offices/surface-water/permitting/water-quality-certification-and-isolated-wetland-permits**

Maps and Aerial Photos

- U.S. Geological Survey topographic (topo) maps can be obtained from the U.S Geological Survey's website at **store.usgs.gov/maps**. Many SWCDs carry printed topo maps or can assist you in downloading a map electronically.
- Several phone apps are available on the market that can be helpful in developing high quality topo maps.
- Aerial photos can be obtained from USDA Farm Service Agency offices located throughout the state or by searching Google Earth or other online resources.

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STREAMSIDE MANAGEMENT ZONES

A Streamside Management Zone (SMZ) is a protective strip of undisturbed forest soil adjacent to a stream. The SMZ separates areas that have been disturbed down to mineral soil from an adjacent water body. It provides a relatively undisturbed zone to trap and filter suspended soil particles before they can reach the stream.

SMZs should be clearly identified before constructing the log landing or any roads or trails. Temporary flagging can be used to establish the edge of the SMZ and other critical areas that need to be avoided with heavy equipment.

A SMZ of no less than 50 feet must be maintained on each side of all perennial and intermittent streams, as measured from the top of the stream bank. SMZs should be no less than 25 feet from the edge of the channel of ephemeral streams, to provide adequate filter area.

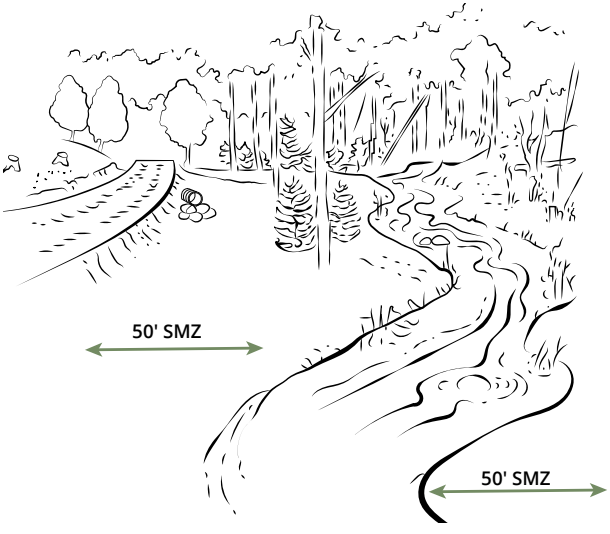


Figure 12. A minimum 50' filter strip must be maintained along perennial and intermittent streams.

Equipment operation within SMZs must be avoided, when possible. Logs should be extracted by cable with the skidder, dozer or other equipment remaining outside the SMZ. If mineral soil within the SMZ becomes exposed, it should be seeded and mulched to reestablish vegetation.

Skid trails and haul roads should not be located within the SMZ except when crossing streams. No landings should be constructed, and no skidding should take place within the SMZ unless site conditions make it impossible to avoid. In those circumstances, mitigating BMPs, such as silt fence, filter socks, wood mats, etc., must be installed and maintained throughout the operational period.

Figure 13. An improperly placed skid trail that has damaged the SMZ and created a water quality violation. Note the absence of any mitigating BMPs.

Logging slash in a stream or river can deflect flowing water, causing streambank erosion. While the goal should be to remove all logging slash from all stream channels, logging slash greater than 6 inches in diameter must be removed from the channel of perennial and intermittent streams as identified on U.S.G.S. 7.5-minute quadrangles. In the event slash falls in a body of water, removal should take place as soon as possible. Tops must be removed within 7 days of the felling of the tree. Slash must be pulled a sufficient distance away from channels and banks to prevent re-entry into channels! This distance may vary greatly based on watershed size and site conditions.

Judgement should be used on treatment of slash as to its likelihood to cause streambank erosion for all streams, including ephemeral channels. Management of logging slash in SMZs should be a part of the Forestry Pollution Prevention Plan (FP^3).

When logging along perennial and intermittent streams, it is recommended that an adequate number of trees be left to provide shade over the stream, which helps maintain satisfactory water temperatures. Elevated stream temperatures can lead to depleted oxygen levels and reduced aquatic habitat.

LOG LANDINGS

Log landings should be planned before harvesting starts (s*ee Section 3, Pre-Harvest Planning*), taking into consideration the location, volume of timber to be harvested, predicted ground conditions and seasonal weather patterns. The following things should also be taken into consideration:

- Haul road location
- Skid trail locations
- Drainage and topography
- Safe access to the highway
- Size and expected duration of the operation
- Stream and wetland locations

Landings must be located outside of the Streamside Management Zone (SMZ), when possible. If site conditions make it physically impossible to locate the landing outside of the SMZ, pollution risks must be mitigated by using artificial sediment barriers such as silt fence, straw bale barriers, filter sock, or other approved methods, throughout the entire operational period. (*See Section 2, Keeping Soil from Becoming a Pollutant* for installation guidelines).

Figure 14. A poorly located log landing can pose a threat to public safety and water quality. Here, mud is impacting the road ditch, a nearby stream and the public roadway. Landings of this type are unacceptable.

When possible, locate the log landing on a dry site with a slight slope to allow for drainage. Water originating from skid trails and haul roads should be diverted to prevent it from flowing onto the landing. Ideally, a haul road should be used to place the landing well back from the public road or road ditches.

Runoff from the log landing must not impact public roads, road ditches or other water bodies.

TRUCK HAUL ROADS

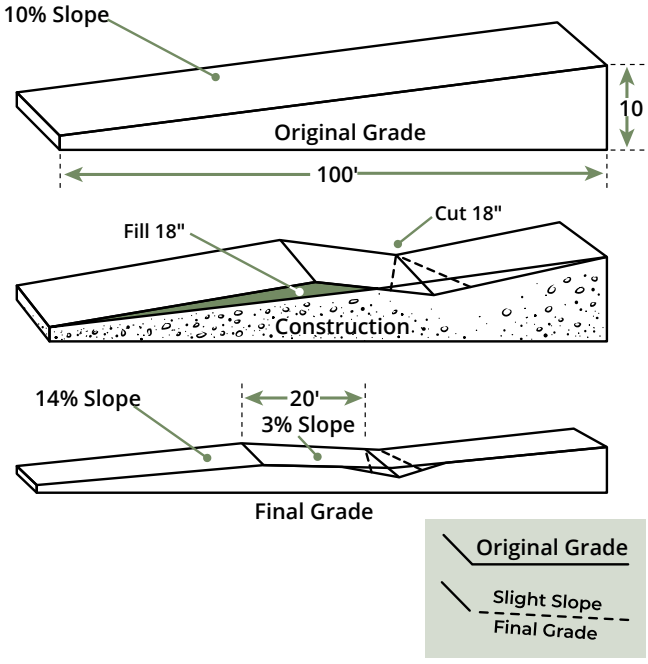
The purpose of a truck haul road is to provide for efficient transportation of wood from the log landing to a public road. A good haul road (*Figures 15 and 19*) should:

- Have a slight grade
- Be well drained
- Enter public road at right angle (90 degrees) for good driver visibility
- Enter public roads on a long straight stretch of road
- Have a firm base to withstand heavy loads
- Have a culvert at the entrance to the public road (where applicable)

Design Standards

Design the road so that it can safely accommodate the weight of fully loaded trucks. Haul roads should have a firm base to prevent rutting and to ensure mud is kept off public roads. At minimum, the first 100 feet of the haul road must be adequately armored with stone, temporary mud mats, or other equivalent material to reduce the risk of soil and debris entering the public roadway or road ditch.

Figure 15. A well-designed haul road. Note the use of culverts for water diversion. Culverts should cross the road at approximately 30-degree angle downgrade to ensure adequate fall (see Figure 18 for installation details).



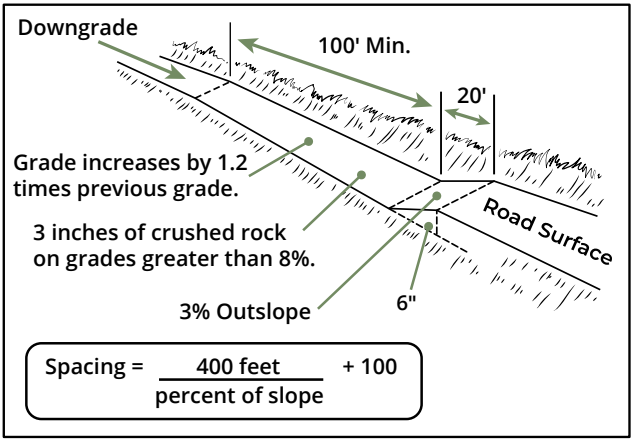


Figure 16. Construction guidelines for broad-based dips.

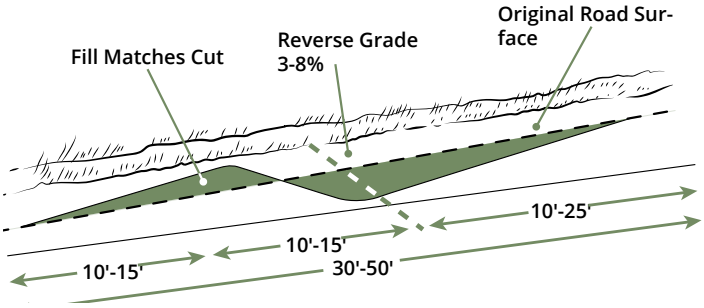
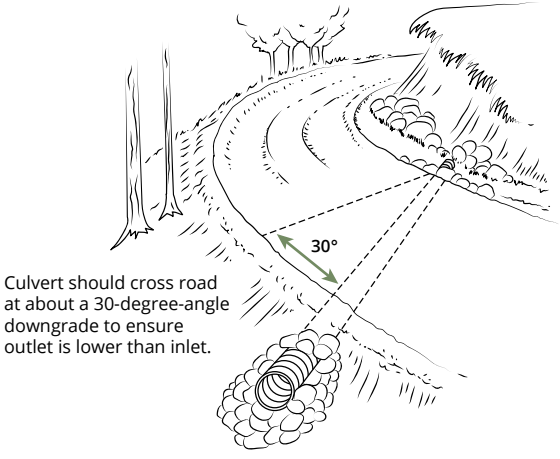


Figure 17. Rolling dip.



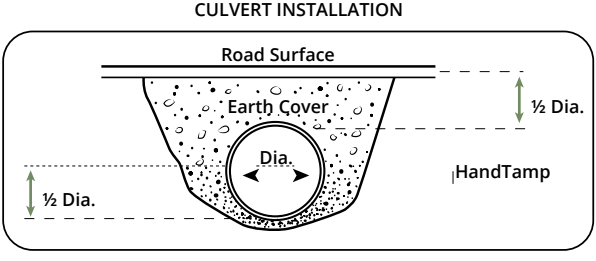


Figure 18. Correct installation of a pipe culvert.

Design Guidelines

1. For safety, the minimum recommended roadbed width is 14 feet for a single lane and 20 feet for two-way traffic.
2. Side slopes for excavated cuts may be straight up, stepped or sloped. Up to a 5-foot vertical cut is acceptable; cuts greater than 5 feet tall should not exceed a slope of 1.5:1 to reduce the risk of hillside slippage. **Soil type, drainage and site conditions should always be considered when making this decision.**
3. Side slopes for earthen fill slopes should be no steeper than 2:1.
4. Drainage ditches may be necessary to drain subsurface water and maintain the load bearing strength of the underlying soil.
5. Use water diversion devices such as rolling dips or broad-based dips to slow runoff water and safely drain it from the surface of the haul road (*See Figure 16 and Figure 17*).

Slope	Distance between culverts
0-2 %	500-300 ft.
3-5 %	250-180 ft.
6-10 %	165-140 ft.
11-15 %	135-130 ft.
16-20 %	125 120 ft.
21-25 %	100-65 ft.
>26 %	50 ft.

Table 2. Culvert spacing chart.

Daylighting

Some trees may need to be removed from along the sides of the road to allow adequate sunlight to reach the road's surface to dry the road or to prevent ice accumulation on sloped roads.

Stream Crossings

1. Cross streams at right angles (90°).
2. Stream bottoms and banks should be stable to prevent soil detachment and may require some form of temporary armoring to achieve stabilization.
3. Break grade at both approaches.
4. Use culverts and bridges where appropriate (*see Section 8, Stream Crossings*).

Wet and Critical Areas

Avoid placing haul roads in wet and critical areas, when possible. Utilize gravel or crushed rock over Geo-Textile fabric, slabs, or pole-sized logs to create a stable road base. Wooden mats, planking, or other appropriate material can be used to create short term protection.

If wetland soils are present, you must follow the additional guidance and restrictions found in Section 11, Wetlands, of this book.

Figure 19. Portable wood mud mats being used to create a temporary road surface through a wet area.

Maintenance

During the construction and harvest operation periods, haul roads and their drainage systems should be maintained to remain functional. Activities that will cause adverse erosion and sediment problems should not be conducted in times of extreme weather conditions. (*See Section 9, Maintenance*).

SKID TRAILS

Skid trails are unsurfaced single-lane trails or narrow roads (often steeper and narrower than a truck haul road) used for skidding harvested products from the stump to a log landing.

Locate log landings first and lay out approaches with low grades. Primary skid trails should be planned and located to minimize damage to the residual stand, minimize soil erosion and sedimentation, and provide an efficient path for skidding logs.

Existing Skid Trails: Repair or Relocate?

Many forested tracts in Ohio already have pre-existing skid trails. Often, these existing trails are eroding or washed-out due to lack of maintenance or poor location and design. Old trails or roads often do not meet current BMP guidelines for design or location. Consider the effects of construction, continued use, and maintenance when making decisions regarding the reuse of existing trail systems. Severely entrenched skid trails should generally not be reused unless positive drainage can be restored.

Minimize Trail Width

Skid trails should be constructed to a width that matches the equipment to be used and the anticipated log load. Avoid unnecessarily wide trail widths. The skidding of whole trees (with limbs still attached) should be avoided. Removing limbs prior to skidding helps to minimize trail widths and reduces the unnecessary soil disturbance and raking effect created by skidding trees with limbs still intact.

Drainage and Slope Considerations

Avoid long, continuous grades that can lead to entrenched skid trails. Take advantage of natural cross drainage by locating skid trails on hillsides and changing (breaking) grade as the slope changes.

Where no natural grade breaks exist, breaks can be obtained by turning the skid trails up the hill a few feet then turning downhill again. By reversing grade in this way, water will run off the downhill side of the skid trails. Rolling dips and temporary water bars can also be employed to control drainage during the harvest.

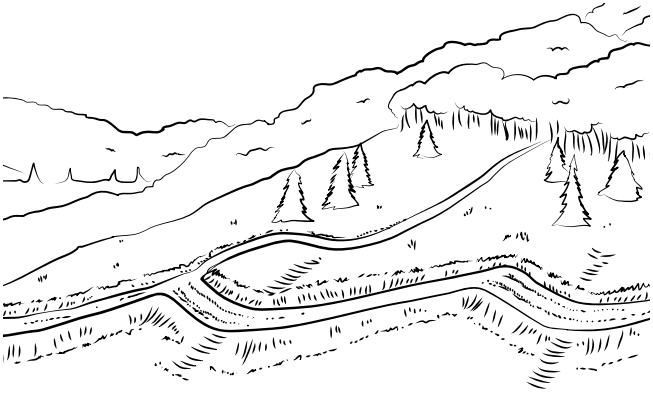


Figure 20. Using grade breaks to divert water.

Skid trail slopes should generally not exceed 20 percent. Steeper grades are only acceptable for short distances when other practices, such as water diversions or temporary water bars, are used to prevent channelized water from flowing down the skid trail during the logging operation as well as sale close-out. To achieve a grade of less than 20 percent, it may be necessary to construct a slightly longer trail in a diagonal pattern up the hill or create switchbacks.

Skid trails with a slope of 20% or greater must be revegetated with seed and straw or hay mulch at close-out in addition to water bars.

Other Considerations

When constructing skid trails, avoid stream channels, rock outcrops, springs, seeps, buried utilities and wet areas.

Stream Crossings

1. Avoid crossing streams with skid trails when at all possible. Consider all the alternatives first. If a crossing is necessary, follow the following guidelines:
2. Cross streams at right angles (90°).
3. Stream bottoms and banks should be stable to prevent soil detachment and may require some form of stabilization.
4. Break grade at both approaches.
5. Use culverts and bridges where appropriate. (*See Section 8, Stream Crossings for more details*).

Streamside Management Zones (SMZs)

Skid trails should be located outside of the Streamside Management Zone (SMZ). At a minimum, an undisturbed 50-foot-wide buffer should be maintained between skid trails and the top of the bank of all perennial and intermittent streams. A minimum undisturbed buffer of 25 feet should be maintained on all ephemeral channels. If site conditions make it physically impossible to locate the skid trail completely outside of the SMZ, pollution risks must be mitigated by using artificial sediment barriers such as silt fence, straw bale barriers, filter sock, or other approved method, throughout the entire operational period. (*See Section 2, Keeping Soil from Becoming a Pollutant, for installation guidelines*).

CLOSING SKID TRAILS

Temporary Shutdown

Weather conditions should be monitored daily, and temporary shutdown measures must be installed prior to predicted rainfall or storm events. If a temporary shutdown is needed, skid trails should receive proper erosion control treatments such as temporary water bars. For non-weather-related shutdowns lasting longer than 7 days, temporary measures should also be installed prior to leaving the site.

Permanent Closure

Upon completion of the silvicultural activity, skid trails must receive proper erosion control measures. BMPs can vary from site to site but generally include removing berms along the edges of all skid trails, out-sloping trails (when possible) to restore natural drainage and installing water bars or rolling dips, as needed, to control surface runoff on sloped sites. Rolling dips should be used when vehicle traffic (such as ATVs and UTVs) is proposed for the site. Ground cover such as straw or woody debris must be used to aid in the reduction of sediment detachment and transport on slopes greater than 20%.

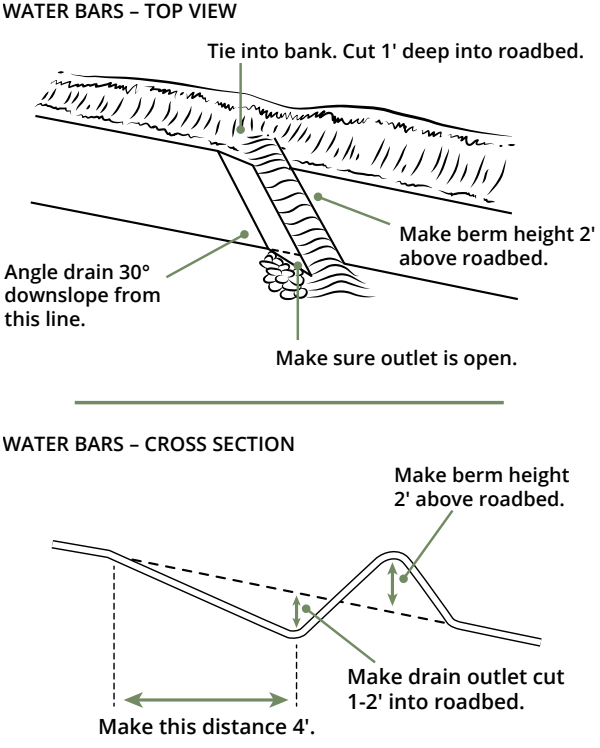


Figure 21. Constructing water bars with mechanized equipment.

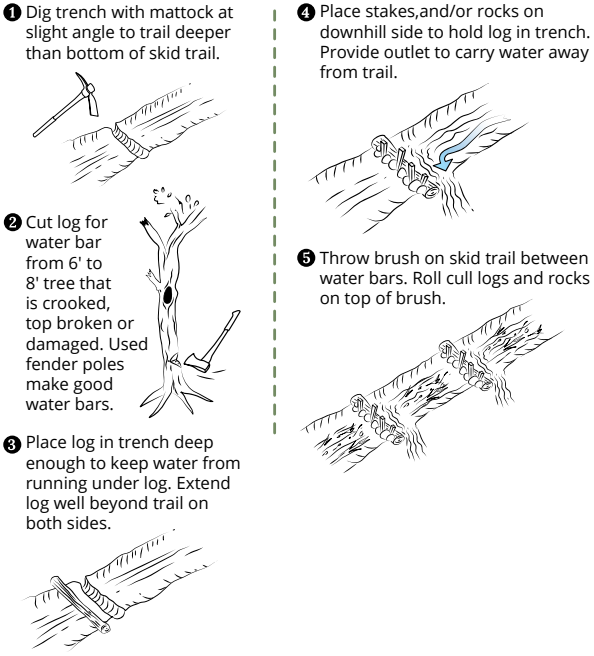


Figure 22. Alternative water bars: hand construction.

Woody debris can be used as an erosion control treatment in conjunction with water bars on skid trails. This technique is referred to as “brushing in”. Brush and logs need to be limbed sufficiently so there is enough ground contact to break the flow of water. Large limbs and small logs should lay perpendicular to the slope of the hill to maximize their effectiveness.

Streambanks should be restored to their natural shape and grade and crossings must be clear of poles, tops, and other logging debris. (*Refer to Section 4, Streamside Management Zones*).

Figure 23. Water bars for water diversion.

STREAM CROSSINGS

Stream crossings can be a major source of sediment pollution and should be avoided when possible and practicable. If you must cross, a bridge is often the best way to minimize impacts to the stream.

There is generally one BEST place to cross the stream...Find it! This BEST place is usually at the upper end of the watershed, where streams are smaller and have less flow. Bridges should be located where streams have well-defined channels and stable banks. Trails and roads should be planned to minimize the amount of disturbed soil within the Streamside Management Zone (SMZ).

Stream crossings, regardless of method, should be restored to their natural shape as soon as they are no longer in use. Temporary bridges, mud mats and other materials must be promptly removed when no longer needed. Bare soil within the SMZ must be seeded and mulched within 7 days of the final pass. (See Section 4, Streamside Management Zones, for more information).

Characteristics of Good Stream Crossings:

1. Cross streams at right angles (90°).
2. Adequately armor or stabilize approaches.
3. Break grade or install water diversions at both approaches.
4. Use bridges where possible.
5. Use temporary culverts or pole crossings for smaller drainages, where appropriate.

Haul Road Crossing Considerations

Haul road stream crossings must be designed with the safety of the truck driver in mind. Consider using bridges with guardrails when possible. Approaches must be stable and provide adequate traction and load bearing strength to support the truck and prevent rutting. Culverts should generally only be considered for ephemeral channels and small intermittent streams and care should be taken to properly size the culvert.

A stream ford may be considered if a rock bottom already exists, or the site is not conducive to bridge installation. If a ford is necessary and a rock bottom does not exist, utilize mud mats or other suitable material to temporarily harden the bottom to support truck traffic. Mats should be secured to prevent them from being swept away during high water events and promptly removed at sale closing or during extended shut down periods (longer than 7 days or when high flow is anticipated).

Placing stone or other permanent fill material within a stream is strongly discouraged. However, there may be occasions when it is the only practical way to protect the stream. In these situations, care should be taken to keep the stone at or near the stream bed's natural elevation. The stone must not obstruct water flow or the migration of aquatic life. Use only clean stone or rock (no asphalt, construction debris, etc.).

Caution: Although forest road construction and maintenance for "on-going silvicultural activities" are generally exempt from the requirement to obtain Section 401/404 permits, improper construction of stream crossings that create obstructions, reroute streams or are installed for non-silvicultural (or non-agricultural) purposes may require a permit through the Ohio EPA. Contact the Ohio EPA for further information regarding permit requirements and silvicultural and agricultural exemptions.

Skid Trail Crossing Considerations

1. Use a portable skidder bridge when possible (*Figure 25 and 26*).
2. Culverts are not recommended for crossing large streams. They are best suited for crossing ephemeral channels and smaller intermittent streams. (*See Table 3 for culvert sizing*).
3. Pole wood crossings should only be used when crossing ephemeral channels. Utilize long poles (with a minimum 6-inch diameter at the small end) to fill the channel level with the banks; culverts may need to be installed under the wood to facilitate adequate water flow.
4. Utilize standing bumper-trees on both banks, when available, to keep wood and logs behind the skidder.
5. Approaches should be stabilized up through the first break in grade or first water diversion device to minimize rutting and collapsing of the banks.

Guidelines for Bridge Installation

- Bridges are an effective way to keep equipment out of streams.
- Utilize a bridge design that will provide safe access and minimize disturbance to the streambank, channel, and the streamside management zone.
- Use temporary or portable bridges instead of culverts to access areas where permanent structures are not needed, or the drainage area exceeds culvert capacity. (*See culvert sizing chart, Table 3*).
- Place bridges so as not to unduly constrict stream channels or impede flood waters.
- Anchor temporary bridges on one end with a cable or other device so they do not float away during high water events.
- Install so they can be removed easily and promptly when they are no longer necessary.

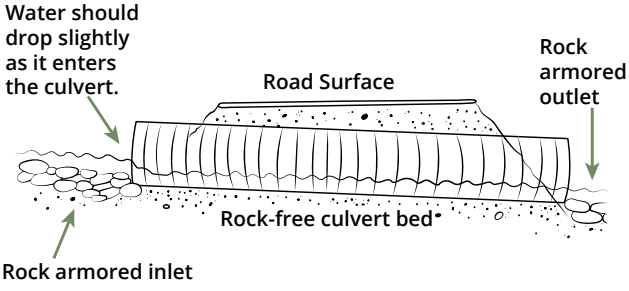
Figure 24. A properly installed haul road bridge. Note the use of wood mud mats to armor the approach.

Figure 25. A steel skidder bridge under construction. After placing and securing the steel panels, filter fabric was placed over the panels to keep sediment from falling into the stream. Wood mats were then placed over the fabric as a wear surface.

Figure 26. Completed bridge installation. Note the use of bumper logs to keep the skidded logs and sediment on the bridge.

Pole crossings should not be used in perennial streams or in large intermittent streams (only small streams and ephemeral channels). Do not place soil on top of the poles! Pole crossings are temporary and must be removed within 7 days of final use.

Figure 27. Temporary pole crossing used to cross an ephemeral drainage.



- Inlet set too deep increases the risk of plugging.
- Inlet not deep enough lets water undercut culvert.
- Outlet set too high undercuts road fill and stream bed.

Figure 28. Culvert stream crossings:culvert slope.

When crossing low wet areas where no channeled water flow exists, use tops, brush, mud-mats, etc., to temporarily armor the area. Break grade on both sides and daylight if possible. Refer to the Section 11, Wetlands, for further guidance.

Minimum culvert diameters based on drainage area

Pipe Diameter	Area Above Pipe
15 inches	4 or less acres
18 inches	7 acres
21 inches	12 acres
24 inches	16 acres
30 inches	27 acres
36 inches	47 acres
42 inches	64 acres
48 inches	90 acres
54 inches	120 acres
60 inches	160 acres
66 inches	205 acres
72 inches	250 acres
78 inches	350 acres

Table 3. Culvert sizing chart.

Stream Crossing Restoration

1. All stream crossings must be restored within 7 days of their final use.
2. Remove bridge, culvert, soil, and all wood from temporary crossings.
3. Carefully restore stream bottom and banks to original contour where necessary.
4. Install water bars or maintain grade breaks to divert water from the crossing.
5. Grade roads to minimize rutting.
6. Seed, fertilize, lime, and mulch all disturbed soil up through break in grade or first water diversion device.

MAINTENANCE

Best Management Practices (BMPs) are effective only if they are maintained during the entire logging operation. Below are some simple maintenance techniques that can be employed during a logging operation.

During Road Construction

Care needs to be given during periods of new road and landing construction to keep soil movement out of the waterways. *Refer to Section 2, Keeping Soil from Becoming a Pollutant*, for temporary measures for reducing soil erosion.

During Logging

During logging, identify and promptly address any obstructions, washouts or other maintenance issues that are found to prevent them from becoming severe. Maintain the crown of haul roads and skid trails to help prevent water accumulation and rutting.

Figure 29. A dozer addressing maintenance issues on a skid trail.

Much maintenance can be accomplished by one individual and some basic hand tools such as a shovel and mattock!

Horses and other Draft Animals

When using draft animal power for logging or other forestry work, it is important to monitor and maintain the lot or grazing paddock where the animals are housed. Care should be taken to limit and control soil erosion in these areas. Temporary animal paddocks should be treated similarly to log landings and other high impact areas. They should be located outside of the Streamside Management Zone (SMZ). However, a controlled access point may be used for watering the animals, if properly maintained. Use sediment filters as needed and properly close-out and revegetate any bare soil upon completion of the logging or other activity.

Figure 30. Draft horses in a temporary paddock on a logging site.

Collected manure may be land-applied at a safe distance from streams and other waters or hauled off-site for proper land application or disposal. Consult with your local Soil and Water Conservation District (SWCD), Natural Resources Conservation Service (NRCS) or the Ohio Department of Agriculture (ODA) for further guidance on the proper storage and handling of animal waste.

Proper Storage and Handling of Materials

Fuel/Tank Storage: Fuel tanks stored on-site should be double walled or placed in a secondary containment unit (plugged dike) to prevent leakage. Absorbent pads should be used to remove oil sheens before draining stormwater from a dike.

Sawdust from Portable Sawmills

Sawdust at a portable sawmill should be adequately contained and/or covered to prevent leachate and suspended solids from entering waters of the state. If sawdust or leachates (liquids formed through break down of sawdust pile over a prolonged period) reach waters of the state, regulatory action by the Ohio Environmental Protection Agency (OEPA) may occur.

Trash/Debris/Broken Equipment Parts

All sites where forestry activities are occurring should be kept free of trash, broken equipment parts and other debris (ex: empty oil jugs). All equipment should be regularly inspected for leaks and repaired promptly.

Chemicals (Pesticides/Fertilizers/Oils)

All chemicals must be properly stored and disposed of according to the manufacturer's recommendations!

Chemical application equipment used as part of a tree planting or timber stand improvement (TSI) project should be regularly inspected and calibrated. Any leaks should be addressed immediately.

Oil or chemical spills must be promptly cleaned up. A spill kit containing oil absorbents and a waste receptacle should be readily available when operating equipment such as portable sawmills, logging equipment, tractors, etc. Chemical and oil storage and spills are under the regulatory authority of Ohio EPA.

Additionally, the Occupational Safety and Health Administration (OSHA) requires all employers ensure that Safety Data Sheets (SDSs) are readily accessible to employees for all hazardous chemicals in their workplace. SDSs provide critical information about the content of pesticides, petroleum products, and other potentially hazardous products commonly used in forest management or logging. SDSs may be stored in a binder or stored electronically as long as employees can easily access the information without leaving their normal work area. Refer to OSHA, 29 CFR 1910.1200 for more information on this federal requirement and the important role of SDSs in protecting worker safety.

Figure 31. Leaky equipment and improperly placed trash can negatively impact water quality and the public's perception of logging operations and the forest industry.

SALE CLOSING

The timber sale closure will determine the site's future soil erosion and sedimentation potential. The main purpose of the timber sale closure is to stabilize the soil to prevent future soil erosion. However, improved wildlife habitat and aesthetics may also result from proper closeout.

Close-out BMPs should be completed as soon as each section of the timber harvest area is completed. Reclaiming logging trails in phases reduces soil erosion risks!

Water Bars

Earthen water bars should be built on skid trails and haul roads that will not have vehicular traffic (*Figures 21, 22, 23*) after closing. If vehicle traffic is expected, alternative water diversion methods should be considered. This could include broad-based dips, rolling dips, rubber conveyor belt diversions, open top box culverts (*Figures 16, 17, 32 and 33*) etc.

Figure 32. An open-top box culvert used as an alternative to a water bar on a closed trail. These structures are very effective but require routine maintenance to remove leaves and other obstructions.

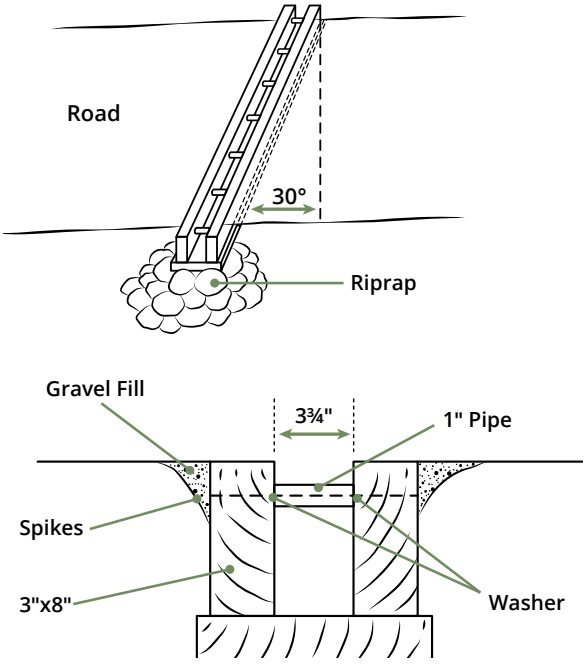


Figure 33. Water diversion open-box culvert.

Water bars should have an angle to the road of about 30 degrees and an out-slope of 2 to 3 percent to provide proper outflow of runoff. The water bars should be spaced according to Table 4 although soil conditions may warrant closer spacing.

The uphill end of the water bar should tie into the bank. The downhill outlet of the water bar should only extend a short distance beyond the trails edge to divert water into the undisturbed forest floor. Avoid unnecessary excavation far beyond the trail's edge.

Slope	Distance between water bars
2 %	250 ft.
5 %	135 ft.
10 %	80 ft.
15 %	60 ft.
20 %	45 ft.
25 %	40 ft.
30 %	35 ft.

Table 4. Determining water bar spacing.

Water bars should be constructed with a trench and berm with sufficient height and depth to allow for adequate water capacity after the berm has fully settled. To prevent failure, water bars may need to be placed closer together and vehicular traffic restricted. If future vehicle traffic is proposed on haul roads and skid trails, it is recommended that broad-based or rolling dips be installed in lieu of water bars.

Shallow water bar construction increases the risk of overtopping and failure. If shallow water bars are utilized, place them closer together and increase the trough width to ensure adequate water capacity.

Re-vegetation of Landings, Skid Trails, and Roads

Vegetation should be re-established on all landings, as well as on unpaved haul roads and skid trails in excess of 20% slope. The goal should be to have at least 70 percent ground cover within 45 days of sale closing. Lime, fertilizer, seed, and mulch may need to be applied to achieve this goal.

Seeding: Seeding to re-vegetate sites keeps the disturbed soil stabilized. Some various seed mixtures can also benefit wildlife (*Table 6*).

Lime and Fertilizer: Lime and fertilizer application may be necessary to ensure the success of the new seeding and may reduce the number of return trips necessary to re-establish vegetative cover. (*Tables 5 and 7*). Consider soil testing to determine appropriate amounts of lime and fertilizer to prevent overapplication of fertilizer that could negatively affect waters of the state.

Figure 34. A properly closed log landing with vegetation established. Note the water bar to divert runoff from the approaching skid trail. Landings such as this are a low risk for environmental issues and promote a positive image of the forest industry.

Mulching

Mulch is extremely important on new seedings, especially those on steep slopes, regardless of soil conditions.

Immediately after seeding, mulch all seeded areas steeper than 20 percent with straw or clean hay. Spread uniformly at the rate of 1.5 to 2 tons per acre, or 100 pounds (2–3 bales) per 1,000 square feet and cover lightly 75–90 percent of the surface area. Twenty-five bales is typical per ¼-acre landing.

Figure 35. Properly closed and re-vegetated logging skid trail.

When practical, anchor mulch with one of the following methods:

1. Mulch anchoring tool: This tool has a series of flat, notched disks that punch and anchor the mulch material into the soil.
2. Mulch netting made of lightweight, fibrous materials.
3. Prefabricated erosion control blankets may be used in lieu of other mulch in ditches or other areas of concentrated runoff.

All mulches provide some degree of:

1. Erosion control
2. Moisture conservation
3. Weed control
4. Reduction of soil crusting

When applying seed outside of the normal growing season (dormant seedings), mulching rates should be increased 50 percent.

Figure 36. A steep skid trail that has been seeded and mulched. Note the water bar in the foreground.

Figure 37. Properly installed mulch on new seeding.

200 lbs.	14-14-14 Fertilizer per acre
400 lbs.	Pelletized Lime per acre

Table 5. Suggested starter fertilizer and lime rates.

February 1 to May 1

25 lbs.	Spring Oats per acre
10 lbs.	Orchard Grass per acre
15 lbs.	Perennial Rye Grass per acre
10 lbs.	Red Clover per acre

May 1 to August 15

20 lbs.	Annual Rye Grass per acre
5 lbs.	Orchard Grass per acre
10 lbs.	Red Clover per acre
15 lbs.	Perennial Rye per acre

August 16 - November 15

50 lbs.	Winter Wheat or Rye per acre
10 lbs.	Orchard Grass per acre
15 lbs.	Perennial Rye Grass per acre
10 lbs.	Red Clover per acre

November 16 to January 31

30 lbs.	Annual Rye or Winter Wheat per acre
10 lbs.	Orchard Grass per acre
15 lbs.	Perennial Rye per acre
5 lbs.	Red Clover per acre

Table 6. Suggested grass seed mixtures for disturbed sites.

The above seed mixtures are acceptable for sun and shade conditions and may also be regarded as a wildlife mixture.

There are a wide variety of seed mixtures that could be used, as long as they are adapted for local site and soil conditions. For additional seed mixture recommendations, contact your local SWCD, USDA Natural Resource Conservation Service (NRCS) or local university extension office.

How to Calculate Seed and Fertilizer Needs for Trails, Roads, and Disturbed Areas

Road or Trail Areas (acres)

TRAIL LENGTH	TRAIL WIDTH (FEET)					
	8'	10'	12'	14'	18'	20'
50 ft.	0.01	0.01	0.01	0.02	0.02	0.02
100 ft.	0.02	0.02	0.03	0.03	0.04	0.05
250 ft.	0.05	0.06	0.07	0.08	0.10	0.11
500 ft.	0.09	0.11	0.14	0.16	0.21	0.23
750 ft.	0.14	0.17	0.21	0.24	0.31	0.34
1,000 ft.	0.18	0.23	0.28	0.32	0.41	0.46
1,500 ft.	0.28	0.34	0.41	0.48	0.62	0.69
2,000 ft.	0.37	0.46	0.55	0.64	0.83	0.92
5,000 ft.	0.92	1.15	1.38	1.61	2.07	2.30
5,280 ft.	0.97	1.21	1.45	1.70	2.18	2.42

Table 7. Calculating seed and fertilizer needs.

Multiply the number of acres by the pounds of seed recommended per acre (*from Table 6*). Use the result to purchase the appropriate pounds of seed.

Irregular Areas

1. To determine acreage and pounds of seed needed for irregularly shaped areas, such as log landings, sawmill seats, turnouts, etc., use the following formula: **Average length x average width = square feet. Square feet x 0.000023 = acres**. Multiply the answer by the pounds per acre as recommended in the seed mixture tables (*Table 6*) to determine the total number of pounds of seed needed.
2. To determine fertilizer and mulch needs, use the acreage that you calculated in the previous seed calculation.

Example:

An access road is 12 feet wide and 500 feet long. The landing site is 100 feet wide and 120 feet long. What is the total area?

Area of Road (from Chart) _____ 0.14 acres

Area of Landing Site_____ 0.28 acres

Total Area _____ 0.42 acres

In this example, we could use 0.42 (acres) x recommended seeding rates per acre to determine the total pounds of seed needed for this site.

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WETLANDS

Wetlands play a vital role in protecting and maintaining water quality. They serve to reduce flooding, provide shoreline protection for many of Ohio's lakes, recharge groundwater, filter pollutants and provide unique animal and plant habitat. Although each wetland is unique, all wetlands share three common features:

1. **Hydric Soils.** The oxygen that would normally be present in the soil is displaced by the water that frequently or constantly saturates a wetland soil. As a result, these hydric (very wet) conditions often leave the soil with an easily identifiable mottled gray color.
2. **Hydrology.** For a wetland to develop or be supported, the area must receive adequate surface water runoff or water table recharge to support hydrophytes, which are plants that can survive and thrive in continuously wet conditions.
3. **Vegetation.** Wetlands are also characterized by the visible presence of hydrophytic plants such as cattails, rushes, sedges, and willows, although non-hydrophytic plants may be present as well.

Many of Ohio's wetlands are highly productive forest ecosystems, capable of producing marketable timber. Often, these wetlands do not have visible, standing water during portions of the year. As a result, they may not be obvious to the casual observer. Wetland inventory maps, which are available from the USDA Natural Resources Conservation Service (NRCS) or the US Fish and Wildlife Service Wetland Inventory Wetland Mapper (***fws.gov/wetlands***) can be very helpful when determining if a wetland may be present.

The NRCS also has Soil Survey maps and descriptions to help identify the location of hydric soil units. Many (but not all) NRCS offices in Ohio are co-located with the local Soil and Water Conservation District (SWCD). You can locate your local NRCS office by using the Directory of USDA Service Centers. (***nrcs.usda.gov/contact/find-a-service-center***)

It should be noted that while mapping is helpful, not all wetlands are mapped and actual conditions on the site should be evaluated. A wetland delineation may need conducted to verify presence or absence of wetlands.

Federal Regulations and Exemptions

Silvicultural activities, including the construction and maintenance of forest roads (in accordance with BMPs), are exempt from the requirement to obtain a Section 404 permit from the United States Army Corps of Engineers ***IF*** the activities:

- Qualify as "normal silviculture" and are part of an "established" silvicultural operation.
- Do not support the intent to convert any waters of the U.S. to a use that it was not previously subject, for example conversion from forestry to agriculture.
- Contain no toxic pollutant listed under Section 307 of the Clean Water Act in the discharge of dredge or fill materials into waters of the United States.
- Comply with the mandated road construction BMPs found in Part 323 in Section 33 of the Code of Federal Regulations (CFR).

If silvicultural practices are not part of an "established silvicultural operation", a Clean Water Act Section 401 and Section 404 permit may be required. Please contact Ohio EPA 401 Program Manager (614-644-2020) and US Army Corps of Engineers (see map on the next page) for more information and to determine if a permit is required.

Additional information regarding the 404 Permit exemption for silviculture (and it's limitations) can be found at: ***epa.gov/cwa-404/exemptions-permit-requirements-under-cwa-section-404***

U.S. ARMY CORPS OF ENGINEERS REGULATORY BOUNDARIES IN OHIO

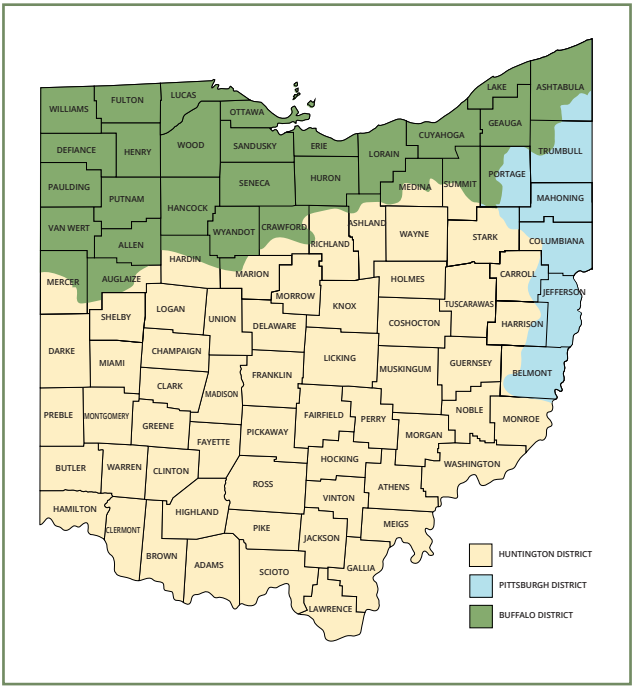

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Figure 38. A tracked log forwarder designed to minimize impact to poorly drained soils.

Special Considerations and Requirements

1. Unnecessary filling and dredging must be avoided when conducting a timber harvest or other forest management activity in a wetland. Harvests should ideally be timed to coincide with dry or frozen periods. Ground disturbance must not result in significantly altered hydrology. Construction of subsurface drainage is prohibited.
2. Roads and trails constructed for a timber harvest or other forest management activity, within a wetland, must be constructed and maintained in full compliance with the U.S. Army Corps of Engineers (USACE). If USACE standards cannot be met, the operator must contact the USACE or USDA-NRCS to request a "jurisdictional determination" to determine if a Section 404 permit is required.

For more information refer to Appendix A Baseline Provisions for Road Construction in Wetlands.

PORTABLE SAWMILLS

Portable sawmills offer the flexibility to move milling operations from one property to another. Logs can be skidded from the woodlot directly to the sawmill without the need to load the logs on a truck for transportation to a sawmill, via public roads. This can create tremendous advantages in efficiency but can also create some unique challenges.

Planning BMPs for the Milling Operation

Since portable sawmills are typically operated in conjunction with an active logging job, it's often difficult to make a clear distinction between the two activities. For example, the log landing of the logging operation often doubles as the staging area for the sawmill. For this reason, it is imperative that the portable sawmill and logging operations coordinate efforts for BMP planning and implementation to control soil erosion and other pollutants. When developing a Forestry Pollution Prevention Plan (FP3) for the logging site, it is important to also indicate the sawmill location on the topographic (topo) map.

Potential Environmental Challenges

Portable sawmills can generate large amounts of sawdust. If left in place for a prolonged period, sawdust piles will decay, creating leachate. This leachate contains nutrients that can cause algae growth in the water and lead to depleted oxygen levels. Low oxygen levels have a detrimental impact on aquatic life. Tannins from sawdust are also released that may cause discoloration of the water. Any unauthorized discharge of sawdust or leachate is subject to the enforcement provisions of Ohio Revised Code 6111 through Ohio EPA.

Sawmills should be operated outside of the Streamside Management Zone (SMZ). If topography or other conditions don't allow for the operation to be located outside of the SMZ, mitigating BMPs must be used to prevent sawdust from entering streams, lakes, wetlands, or other waters. In these situations, sawdust should be routinely removed from the SMZ or properly contained.

Figure 39. Portable sawmill in operation.

REGULATION OF PORTABLE SAWMILLS

NPDES Permits

Sawmills that are operated at a fixed location, separate from the property where the trees were grown, are generally required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) and follow a National Pollution Discharge Elimination System (NPDES) permit approved by the Ohio Environmental Protection Agency (EPA). However, when a portable sawmill is operated on the same property where the trees were grown and harvested, it is generally considered to be an "agricultural" activity, exempt from the requirement to apply for a NPDES Permit.

Discharges of suspended solids, oil sheen, materials that cause discoloration, odor or other nuisance conditions are considered unauthorized discharges and are subject to enforcement under the Ohio Revised Code 6111.

For more information regarding maintenance of equipment and storage of fuels and chemicals, refer to Section 9, Maintenance.

Sawdust piles and related portable sawmill activities may require permits from the USACE or Ohio EPA's 401 and Isolated Wetland Program if impacts occur to wetlands or streams.

Sawdust Piles and Slab Piles

Ohio's Forestry Pollution Abatement Program does not directly regulate sawdust piles produced by portable sawmills. These issues are regulated by the Ohio EPA. Although most portable sawmills are exempt from the requirement to apply for a NPDES Permit, this exemption does not apply to portable sawmills who are discharging or plan to discharge pollutants such as sawdust or nutrients from sawdust leachate into waters of the state.

Sawdust piles should not be placed in wetlands, streams, or other water resources. If sawmill operations are located near surface waters, BMPs (silt fence, filter socks, etc.) must be used to prevent sawdust from reaching water. Sawdust entering waters of the state is considered an unauthorized discharge.

Sawdust piles can be used on-site to lightly cover **upland** roads and trails, to aid in erosion control, or can be moved off-site for animal bedding or wood product manufacturing. Please be advised that sawdust is high in carbon which can tie up soil nitrogen and inhibit grass growth.

Sawdust should not be applied in areas where revegetation of grass is planned.

To maintain the NPDES permit exemption, it is vital that all portable sawmill operators implement the following BMPs:

- Locate and operate all portable sawmills outside of the Streamside Management Zone (SMZ) and the anticipated floodway of the stream.
- All sawdust piles must be located outside of the SMZ and floodway and have an adequate buffer strip to prevent migration of sawdust and leachate into waters of the state. Artificial sediment barriers, such as silt fence, straw bales or filter socks should be utilized to contain the sawdust piles. Tarp coverings are also beneficial to prevent leachate production. Sawdust should be routinely removed from the mill site to prevent excessive accumulations.
- When practicable, sawdust and sawmill slabs may be distributed in thin layers on **upland** skid trails and landings, to improve ground cover and reduce soil erosion potential.

Figure 40. Sawmill slabs used to armor a forwarder trail.

Air Quality and Fire Safety

Sawdust generated by portable sawmills can consist of small particulates that may affect workers' breathing as well as others near the mill. Questions and issues related to air quality should be directed to the Ohio EPA.

The burning of slab piles and sawdust is strongly discouraged. However, if slabs or sawdust are to be burned, all fires must be done in full compliance with Ohio's Fire Laws. These can be found in Ohio Revised Code (ORC) 1503.18, Ohio Administrative Code (OAC) 3745-19 and OAC 1301-7-7. *Also refer to Section 13, Prescribed Fire, for more details.*

Outdoor burning is prohibited statewide in unincorporated areas during the months of March, April, May, October, and November between the hours of 6 a.m. and 6 p.m.

Materials containing rubber, grease, asphalt or made from petroleum are never to be burned at any time or any place in Ohio!

PRESCRIBED FIRE

Prescribed fire refers to fires that are intentionally lit, under predetermined conditions, to meet various resource management objectives. Prescribed fire can be used as a tool to control undesirable vegetation and reduce hazardous fuel levels. When managed carefully, prescribed fire can stimulate the growth of native vegetation and reduce fire hazards brought on by the accumulation of dead vegetation.

Figure 41. Prescribed fire in a woodland.

Risks and Mitigation

Prescribed fires that burn too intensely (above a moderate temperature) are more likely to consume the forest litter layer and expose bare soil. Extremely high soil temperatures can also create a condition where the soil becomes hydrophobic or water repellent. These conditions can lead to increased rainfall runoff and soil erosion risks but are relatively easy to prevent through proper planning and implementation.

Prescribed fire is not a tool for every forest! If not used correctly, it can negatively impact timber quality of existing trees, just like a wildfire. Prescribed fire can be used as a management tool to achieve multiple objectives, such improving habitat and plant diversity, reducing hazardous fuels, and influencing tree regeneration.

The following measures are required to maintain compliance with the Forestry Pollution Abatement Rules:

- Large fire lines constructed with heavy equipment must be constructed in a manner that minimizes the potential for soil erosion. If possible, construct lines on the contour, but if constructed up and down a slope, adequate water breaks must be installed after the fire.
- Sediment barriers must be used if constructing fire line through the SMZ or when intersecting streams, ephemeral channels, or other waterbodies. Any flammable barriers, such as straw bales or silt fence, should only be installed after completion of the prescribed burn and risks of re-ignition have passed. All bare soil within the SMZ must be properly revegetated (*Refer to Section 10, Sale Closing, for seed and mulch recommendations*).

Never leave excavated fire lines open for more than 7 days. If the line is to remain unused for more than 7 days prior to a fire, temporary close-out measures must be used.

Other laws and restrictions

The above requirements apply to the silvicultural pollution abatement law. There are two other state laws that all citizens must follow for compliance.

1. Ohio Revised Code 1503.18 (c) restricts burning (6:00 am and 6:00 pm during the months of March, April, May, October, and November) which covers most of the time period for prescribed burning. This restriction is in place to limit the potential for damaging wildfires that threaten public safety. Violation of this statute is a criminal misdemeanor punishable by up to 60 days in jail and a fine of three thousand dollars. Waivers to this law can only be granted by the chief of the division of forestry. Granting of waivers is limited to Ohio Certified Prescribed Fire Managers or in limited cases, landowners burning their own property without significant assistance. For more information refer to the ODNR: Prescribed Fire in Ohio web page.

2. Ohio Administrative Code 3745-19 restricts "open burning" in a variety of settings to limit smoke that causes human health impacts. In general, the requirement for prescribed fires is to submit a "notification" to the Ohio EPA regional air quality agency at least 2 weeks in advance of the planned fire. For more details visit **epa.ohio.gov/divisions-and-offices/air-pollution-control/permitting/open-burning**.

3. Ohio Administrative Code 1301:7-7 (Ohio Fire Code) allows the local fire code official to require a permit for any open burning should they choose to do so. Local fire code officials, along with the state fire marshal, are also authorized to issue burning bans. The local fire department is the best contact for this information.

Local units of government may impose additional restrictions and requirement in relation to prescribed burning.

It is the responsibility of landowners and operators to become aware of these regulations and comply accordingly.

In addition to the legally required measures mentioned above, the following are general guidelines that should also be followed:

- Only utilize prescribed fire when it is consistent with the land management objectives that are identified in a forest management plan. It should truly be "prescribed" by a qualified natural resource professional.
- A burn boss should be hired to oversee the burn. They will assess environmental factors to determine if a fire should be done on a certain day/time. A burn boss will also determine the proper fire suppression needed for a specific burn.

- Overhead hazards such as leaning trees, branches, etc. that are likely to fall across the fire control line should be removed prior to initiating the prescribed fire.
- Always contact Ohio811 to check for underground utilities prior to a burn.
- All personnel should be properly trained and have adequate Personal Protective Equipment (PPE).
- Never put more fire on the ground than you can control with resources available on-site!
- Coordinate with the local fire department and law enforcement agencies to make them aware of your plans to conduct a prescribed fire. This should be **done well in advance of the burn date** as well as the day the fire will be conducted.
- Consider using water pumps, hoses (wet line) and sprinklers to protect high value assets or environmentally sensitive areas where excavation would be undesirable.

Figure 42. A prescribed fire being ignited with a drip torch.

MECHANICAL AND CHEMICAL SITE PREPERATION FOR TREE PLANTING

When converting grass covered fields to silviculture, chemical vegetation control may be adequate to control competition and aid in the establishment of the new tree seedlings. This no-till method allows the dead grass to remain on the ground surface, reducing the risk of soil erosion. However, when attempting to establish seedlings with a mechanical tree planter in an area that has previously been wooded, it is often necessary to clear stumps, re-sprouts, brush, and other potential obstacles from the site. The bare soil created by this land preparation can be a source of erosion and potential water pollution and BMPs must be utilized to mitigate this risk.

Site preparations should be planned to coincide with the anticipated tree planting date. Avoid long delays between any excavation, tillage, raking, etc. and tree planting. If delays are unavoidable, temporary ground cover, such as an annual cover crop or grass should be established. *Refer to Section 10, Sale Closing, for seeding recommendations.*

Following the guidelines listed below will help to mitigate unnecessary soil erosion:

- Consider herbicide vegetation control treatments instead of mechanical methods, when practicable. This will reduce the risk of soil displacement by maintaining vegetative residue on the soil surface.
- On steeper slopes, consider a low-intensity prescribed burn in place of mechanical tillage to remove or control plant competition. If woody material is to be burned, Ohio's open burning law must also be adhered to. (*See Section 13, Prescribed Fire, for more details*).
- If using a mechanical tree planter, plant tree rows on the contour, when possible. This will assist in slowing surface water runoff.

- Consider using strip tillage instead of denuding the entire site. Strip tillage creates narrow, tilled rows that are suitable for tree establishment, while maintaining soil cover between the tilled strips, to provide ground cover.
- Any logging slash, stumps, brush, and other materials that have been raked from the area must be deposited outside of the Streamside Management Zone (SMZ), any wetlands and the floodway, to prevent this woody material from entering the stream channel.
- If a new tree planting is to be conducted within the SMZ, it is recommended that stumps be left in place and no excavation be conducted (due to the risk of soil erosion and loss of streambank stability). New trees established within the SMZ should generally be hand planted, with minimal soil disturbance.
- Suspend site preparation operations during wet periods to prevent equipment from creating excessive ruts or uncontrolled runoff. Temporary BMPs must be used during the shut-down period.

Figure 43. A tractor pulling a mechanized tree planter.

Special Considerations for Chemical Vegetation Control

- Federal law requires that chemical users follow the manufacturer's label on the product container.
- Choose herbicides that are labeled as appropriate for the specific site and conditions.
- When working around streams, ponds, and other water bodies, only use chemicals that are labeled as safe for aquatic sites.
- Consider using spot injection ("hack and squirt") techniques or cut stump treatments when possible and appropriate, to minimize the amount of chemicals needed.
- Follow all state and federal regulations regarding both general use (unclassified) and restricted use pesticides.
- Chemicals such as herbicides should only be applied by individuals who are properly trained and licensed (if applicable) or under their direct control.
- Beware of wind conditions to avoid chemical spread by drift; Using a dye with pesticides can help the applicator monitor drift.
- Only mix chemicals in areas outside of the SMZ and away from wellheads and other water sources.
- Maintain all chemical application equipment and repair any leaks.
- Calibrate equipment frequently to avoid potential over-applications.
- Properly store chemicals when not in use and have a spill containment and cleanup kit available onsite.

Figure 44. Chemical spot spraying of herbicide.

APPENDIX

A. Baseline Provisions for Road Construction in Wetlands

The following is an excerpt from the Code of Federal Regulations regarding forest road construction in wetlands (33 CFR § 323.4):

> (6) Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining equipment, where such roads are constructed and maintained in accordance with best management practices (BMPs) to assure that flow and circulation patterns and chemical and biological characteristics of waters of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized. These BMPs which must be applied to satisfy this provision shall include those detailed BMPs described in the State's approved program description pursuant to the requirements of 40 CFR 233.22(i), and shall also include the following baseline provisions:
>
> i. Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;
>
> ii. All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;
>
> iii. The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;
>
> iv. The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

v. Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

vi. In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

vii. The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

viii. Borrow material shall be taken from upland sources whenever feasible;

ix. The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

x. Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

xi. The discharge shall not be located in the proximity of a public water supply intake;

xii. The discharge shall not occur in areas of concentrated shellfish production;

xiii. The discharge shall not occur in a component of the National Wild and Scenic River System;

xiv. The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts;

xv. All temporary fills shall be removed in their entirety and the area restored to its original elevation.

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GLOSSARY

best management practices (BMPS) - methods, structures and techniques that have been scientifically proven to reduce and control soil erosion and prevent sediment from reaching ditches, streams, lakes, and other water bodies.

broad-based dip - water diversion structure used on haul roads, shaped to facilitate the passage of trucks and equipment, collect water from the road surface and ditches and direct it across the road to a stable outlet.

contour lines - lines on a topographic map that identify elevation (feet above sea level). contour lines make it possible to easily estimate the slope of the topography.

critical areas - areas subject to erosion due to soil type or slope including stream crossings.

daylighting - removing trees along roads or trails to allow sunlight to reach the road surface.

drainage - directing surface water away from road and trail surfaces by natural or artificial means.

erosion - the movement of soil through the action of wind or water.

fireline - a break in fuel, made by cutting, leaf blowing, scraping, or digging, to expose bare, mineral soil and minimize the risk of fire spreading beyond a predetermined point.

floodway - the portion of the flood plain needed to convey rapidly moving flood waters, while the remainder of the flood plain may be characterized by stagnant or low velocity flow.

forestry pollution prevention plan (FP^3) - a written course of action to ensure that bmps are incorporated into any silvicultural practice to maintain water quality.

geo-textile fabric - woven, non-woven, or knitted fabric that is water permeable and usually non-biodegradable used to separate, filter, and reinforce aggregate.

grade - measure of a road or trails' steepness as it rises and falls along its route; often expressed as percent slope.

groundwater - water below the land surface in a zone of saturation.

haul road - a constructed road used to connect a public road with a log landing.

hydric soils - soils formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (federal register, 1994). these soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

hydrophytes - plants that can survive and thrive in continuously wet soil conditions.

landings - an area designated for the collection of merchantable forest products, such as logs and firewood, for potential processing and loading for transport.

mitigation - the use of management practices to compensate for or reduce the negative impact of a silvicultural operation.

mulching - the application of material, such as straw, hay, wood chips, etc. as a protective layer over the soil to reduce soil erosion or conserve soil moisture to foster plant growth.

nonpoint source pollution (NPS) - pollution that occurs without a single point of origin or outlet. they are usually the result of land use activities or disturbances of the stream or aquifer system.

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open burning - the burning of any materials wherein air contaminants resulting from combustion are emitted directly into the ambient air without passing through a stack or chimney.

pesticides - substances used to control pests. there are many types of pesticides such as: herbicides (plant), insecticides (insects), rodenticides (rodents), and fungicides (fungus/mold).

phasing - completing logging activities on only a portion of a property (including closeout measures) before initiating logging on another portion of a property.

portable sawmill - a sawmill that is not permanently affixed to a parcel of land and can be moved from one site to another. the sawmill is transported to the site where the timber has been harvested and will be sawn on site.

prescribed fire - refers to fires that are intentionally lit, under predetermined conditions, to meet various resource management objectives.

rip-rap - a layer of boulders or rock fragments placed over soil to protect it from the erosive forces of flowing water or wind. often placed on banks, at culvert outlets or in channels.

sediment - soil particles that are either in suspension, are being transported or have settled elsewhere on the landscape, by means of wind or water erosion.

silt fence - a temporary sediment barrier consisting of a synthetic filter fabric stretched across and attached to supporting posts and entrenched, used to prevent sediment from leaving a site and becoming a water pollutant.

silviculture - the theory and practice of planning, planting, thinning, pruning, growing, and harvesting of trees.

silvicultural operation - forest management activities including but not limited to harvesting of timber, including the felling, skidding, on-site processing, and loading of trees or logs onto trucks; construction, maintenance and closure of forest roads and trails; thinning of trees; and planting of trees, including preparation and maintenance.

skid trail - unsurfaced single-lane trails or narrow roads, usually steeper and narrower than a truck haul road, used for skidding logs or other harvested products from the stump to a common landing or concentrated area.

slash - logs, branches, treetops, or brush created as a result of logging.

slope - often expressed as 'percent slope', slope is defined as rise-over-run and describes the steepness of a hill or section of road or trail surface.

stream - a body of water running or flowing on the earth's surface, or channel in which such flow occurs. they are generally classified into three sizes:

- ***perennial stream*** - identified by well-defined banks and natural channels and having continuously flowing water most of the year. they are usually shown on a topographic map as a solid blue line.
- ***intermittent stream*** - has well-defined banks and natural channels, but typically has flowing water from a headwater source for only a portion of the year. they are usually shown on a topographic map as broken blue lines.
- ***ephemeral channel*** - a flow as a result of wet weather conditions when the ground is saturated. not shown on topographic maps.

stream crossings - for purposes of discussion in this book, stream crossings are defined as a dedicated area used to cross the stream providing a travel way for silvicultural purposes from break in grade on opposing sides of the stream.

streamside management zone (smz) - land adjacent to perennial and intermittent streams, ephemeral channels, ponds, or lakes requiring special attention during forestry operations. they are to be treated in a way that meets water quality standards for nonpoint source pollution.

topographical map (topo map) - a map of the earth's contours and features such as elevations above sea level, perennial, and intermittent water courses, and other water bodies.

water bars - water diversion structures typically used on skid trails to divert water onto undisturbed soil.

watershed - an area of land that drains all rainfall and stream flow to a common outlet such as a lake, river or any point along a stream channel.

wetlands – areas that are inundated or saturated by surface or ground water at a frequency and duration that are sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. wetlands generally include swamps, marshes, bogs, and similar areas (33 cfr 328.3 (c)(16)).

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NORTHEAST OHIO LOGGERS CHAPTER
SOUTHEAST OHIO LOGGERS CHAPTER
SOUTHERN OHIO LOGGERS CHAPTER
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