BEST MANAGEMENT PRACTICES for

Erosion Control on Timber Harvesting Operations in New Hampshire

2004

INTRODUCTION

Every timber harvesting operation involves some risk of soil erosion and sedimentation that may affect water quality. With a common understanding of the risks and through the use of this publication, the forest industry, landowners, and the government working together can protect our state's water resources.

This publication is primarily a reference and training tool designed to help foresters and loggers become better informed about the best management practices for reducing soil erosion and controlling sedimentation from timber harvesting activities.

When using this publication, it is important to remember that for every situation encountered, there may be more than one correct method to prevent erosion and sedimentation. Flexibility and understanding are important, since the intent of any best management practice is to **keep sediment out of the streams**.

ACKNOWLEDGMENT

The author has drawn freely from the publications listed in the reference section and received assistance and suggestions from county, state, and federal foresters as well as the forest industry. The reader is urged to consult these publications if detailed information beyond the scope of this publication is desired. When needed, help and advice for the implementation of the Best Management Practices can be obtained from any of the agencies listed in the Available Assistance Section. Your comments about this publication are welcome.

Assistance in the preparation of this publication was contributed by:

- State of New Hampshire - Department of Resources & Economic Development
  Division of Forests and Lands
- State of New Hampshire - Department of Environmental Services
  Water Supply and Pollution Control Division
  Water Resources Division
  Wetlands Bureau
- University of New Hampshire Cooperation Extension
- USDA - Natural Resource Conservation Service
- USDA - Forest Service - White Mountain National Forest
- USDA - Forest Service - State and Private Forestry
- New Hampshire Timberland Owners' Association
- Numerous professional loggers and foresters who have reviewed drafts

DEFINITIONS

Best Management Practices - Proper methods for the control and dispersal of water on truck roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams.

Bog - A low-lying area with standing water or saturated soil for a significant portion of the year that is dominated by grass-like vegetation, shrubs and dwarf trees and which has a thick vegetative mat under foot.

Erosion - Wearing away of the surface of the land, by action of water or wind due to timber harvesting operations.

Facultative Species: Trees and shrubs that are equally likely to occur in wetlands or uplands (estimated probability 34-66%).

Facultative Upland Species: Trees and shrubs that usually occur in uplands (non-wetlands) (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%).

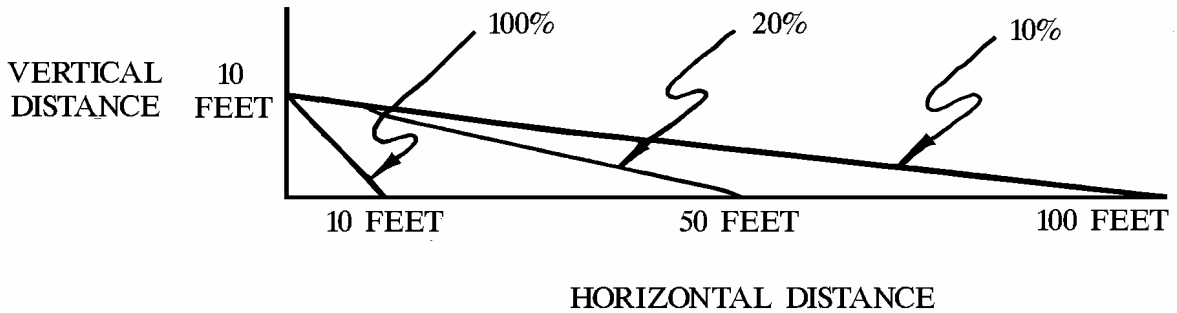
Facultative Wetland Species: Trees and shrubs that usually occur in wetlands (estimated probability 67-99%), but occasionally found in uplands (non-wetlands) (estimated probability 1-33%).

Forested Wetland - A wetland where trees are the dominant plants.

Freshwater Wetland - An area that is inundated or saturated by surface or groundwater at a frequency and duration 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. Wetland permits are required for any dredge, fill, or construction in a wetland, intermittent or perennial stream or other surface water.

Geotextile - A product used as a soil reinforcement agent and as a filter medium. It is made of synthetic fibers manufactured in a woven or loose non-woven manner to form a blanket like product.

Grade - Expressed in percent, the distance a road or trail rises or falls over a horizontal distance. For



example, a road or trail that rises or falls 10 feet over 100 feet in horizontal distance has a 10% grade.
Intermittent Stream - A water course that flows in a well defined channel during the wet periods of the year or after major storms.

Marsh - A low-lying area with standing water or saturated soil for a sufficient portion of the year that is dominated by reeds, cattails, sedge, or grasslike vegetation.

Minimum Impact Forest Management Project - A temporary wetland crossing for forest management or timber harvesting purposes which is less than 50 feet in length and requires less than 3,000 square feet of fill, and which follows the Best Management Practices.

Mulch - A natural or artificial layer of plant residue or other materials covering the land surface that conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Obligate Upland Species: Trees and shrubs that almost always occur in uplands (non-wetlands) (estimated probability >99%).

Obligate Wetland Species: Trees and shrubs that almost always occur in wetlands (estimated probability >99%).

Perennial Stream - A watercourse that flows throughout the year or nearly so (90 percent) in a well defined channel. Same as a live stream.

Riprap - Rock or other large aggregate that is placed to protect streambanks, bridge abutments, outflow of drainage structures, or other erodible sites from runoff.

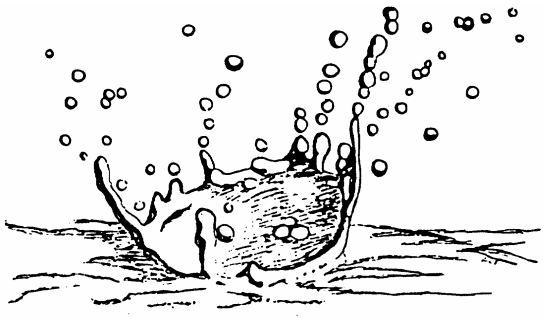
Sediment - Soil material that has been detached, transported, suspended, or settled in water.

Slope - Degree of deviation of a surface from the horizontal, measured as a numerical ratio, as a percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second number is the vertical distance (rise), as 2:1. A 2:1 slope is a 50% slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90 degree slope being vertical (maximum) and a 45 degree slope being a 1:1 slope.

Stream - Any channel for the passage of surface water having a defined bed and banks whether natural or artificial, with perennial or intermittent flow.

Swamp - A tree or shrub wetland, with standing water or saturated soils for a sufficient portion of the year, that often has a "hummocky" appearance and buttressed roots. Dominant full sized trees may include red maple, black ash, black willow, black spruce, tamarack, or white cedar.

Wetland - An area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water loving) vegetation and which has soils indicative of wet conditions.



PLANNING THE OPERATION

When the forest floor is disturbed and truck haul roads and skid trails are constructed, the natural filtering action of the soil is reduced. Trucks and skidders may compact the underlying soil. When it rains or the snow melts, surface water is not readily absorbed. Instead, the surface water flows into the roads and trails which can act as channels that increase the velocity and volume of the water as it flows downhill. As the water flows it may erode the soil and destroy the road and other capital improvements.

Water quality management through systematic planning helps prevent erosion. This kind of management can be achieved by planning and laying out the roads and skid trails correctly, and by finding ways to get the water off the roads and trails as quickly as possible, before erosion can accelerate. Careless construction leads to rebuilding, lost time, higher costs and harm to soil, water, and fish habitat.

If systematic planning does not take place before the operation begins, then there is the risk that the ditches, the crossdrains, culverts and water bars may not provide adequate drainage.

Guidelines:

Layout

- Obtain topographic maps, soils maps, aerial photographs and property maps.
- Use topographic maps, soils maps, and aerial photos to identify streams, forested wetlands, other bodies of water, steep slopes, flood plains, property boundaries, and harvest area boundaries.
- Locate the property lines and the area to be harvested on each of the maps and photographs.
- Walk the area and see how the land lays and where the stands for harvesting are located.
- Outline areas on the maps that are near streams, ponds, lakes, or wetlands, and mark very steep and very wet areas, and areas with poor timber.
- Consider the following for maximum erosion control:
    - ♦ Minimize the amount of soil disturbance
    - ♦ Minimize the amount of cut and fills
    - ♦ Minimize the number of stream crossings
    - ♦ Provide adequate drainage of the road and main skid trail area
    - ♦ Plan buffers around sensitive areas

- Draw on the maps the proposed location of your haul roads, main skid trails, and log landings. Look for the best placement on slopes, the position of streams and wetlands, possible stream crossings, and areas of soil instability.

- Walk the proposed location of haul roads and main skid trails. Establish control points along the way. These should be points you can identify on a map, aerial photograph, and on the ground.

- Flag this route as you walk in. Check skidding distances on both sides of your proposed route.

- Walk back out following your flagged route.

    1. Adjust flagging to take advantage of natural features that will make road and trail construction and drainage easier.

    2. Check the grades to make sure that they meet guidelines for truck haul roads and skid trails.

    3. Flag areas suitable for landings and borrow pits.

    4. Make sure the route provides the best access to present and future harvest areas.

- Draw on your maps the final proposed location of your truck haul roads, skid trails, stream crossings, erosion control devices, etc.

- Be aware of applicable state and local laws which relate to timber harvesting, wetlands, surface waters and fish and wildlife habitat. Obtain all necessary permits prior to any construction or timber harvesting. (See Logging and the Law)

Construction

During the construction of truck haul roads and skid trails, there are certain activities that must be planned because they directly relate to the amount of erosion that can occur.

- **Timing** - Most problems can be prevented or minimized by timing the harvesting operation to take advantage of seasonal conditions.

    1. Winter harvesting to take advantage of snow cover and frozen ground.

    2. Bridge construction and culvert installation should be done during summer when streamflow is low.

3. On streams having important fisheries value, bridge and culvert installation should be avoided during egg incubation period of October to April.

4. If construction is necessary, it should be done well ahead of time to permit disturbed soil to stabilize before the road or trail is to be used.

- **Design** - The entire road and trail system should be designed before any construction begins. This process may seem to take more time, but the system will be more efficient, less costly, and easier to maintain.

    1. **Grade** - Keep grades low except where short, steep sections are needed to take advantage of favorable topography and to avoid excessive cut and fill.

    2. **Width** - The width of the road or trail should be designed for the equipment to be used on the timber harvesting operation.

    3. **Angle** - Consider the proper angle for cuts and fills in designing roads on varying types of soils and rock materials. Make road cuts reasonably steep in order to minimize surface exposed to erosion.

    4. **Alignment** - Avoid the toes of slopes, breaks in a slope, and running parallel to a streambank.

    5. **Surface** - Crushed rock and gravel may be needed to keep the road surface from washing out during rainfall and runoff.

    6. **Drainage** - Provisions must be made for the passage of surface water from adjacent slopes, as well as for rapid drainage of the roadbed itself.

    7. **Stream Crossings** - All crossings sites should be selected at right angles to the stream and should not interfere with natural streamflow.

Retirement

A plan should be developed that provides for the retirement of truck haul roads, skid trails, and log landings.

- Smooth and shape all road and landing surfaces.

- Remove all temporary culverts and replace them with water bars, broad based dips, or ditches.

- Permanent culverts must be sized properly and provisions made for their continued maintenance.

- Remove all temporary stream and wetland crossings.

- Seed, mulch, lime, and fertilize.

ARE YOU IN A WETLAND?

Wetlands Characteristics:

Hydrology, or the presence of water in or above the soil;

Signs on the surface of the ground include:

- Waterstained (dark) or silt covered leaves;
- Lines of organic debris such as leaf litter on tree and shrub stems above soil surface;
- Water or silt stained plant stems;
- Swollen bases of tree trunks (an adaptation to wet soils);
- Exposed plant roots (an adaptation to wet soils).

Soils, which show observable features when saturated or flooded for long periods of time;

Signs in the soil include:

- Sphagnum moss on the surface;
- A thick upper layer of peaty organic matter;
- Soils mostly neutral grey in color (greyed), or grey soils with rust colored (orange-brown and yellow-brown) splotches within 18" of the surface.

Vegetation, which is usually composed of a predominance of species suited to hydric (largely anaerobic) soil habitats.

Signs in the composition of plant species include:

- More than half the plant species being those that grow most often in wetland soils. Plant species have been classified by the US Fish & Wildlife Service based on how frequently they occur in wetlands. All plants, including herbaceous groundcovers, are important in wetland determination. However, only trees and shrubs are included here because there are fewer species than herbaceous plants, they are more easily identified by most people and they can be observed and identified at all times of the year. The species are grouped into five categories, listed here from most to least wetland adapted:

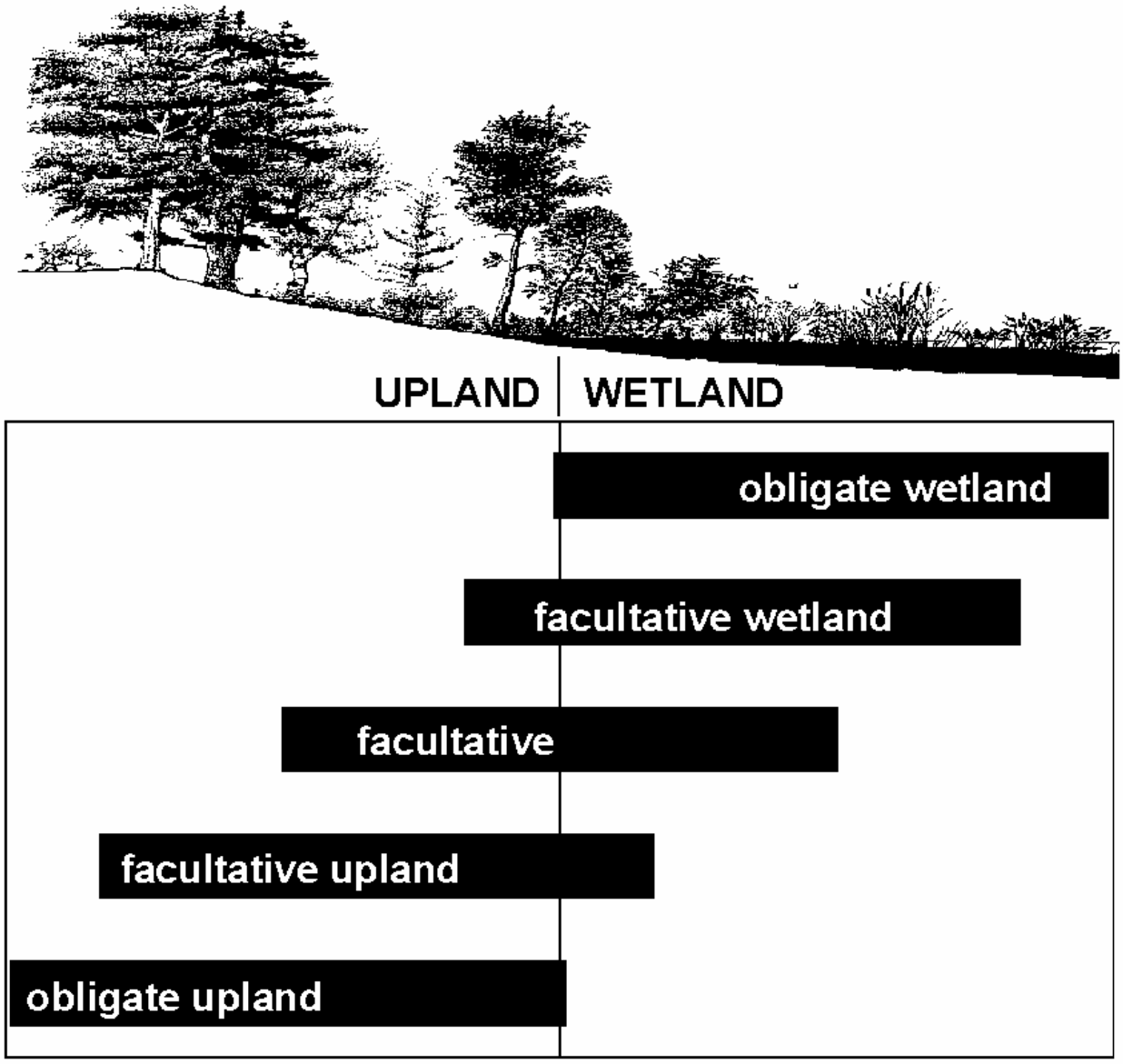
Obligate Wetland.....Species occur more than 99% of the time in wetlands.

Facultative Wetland.....Species occur between 67-99% of the time in wetlands.

Facultative.....Species occur equally in uplands and wetlands.

Facultative Upland.....Species occur between 1-33% of the time in wetlands.

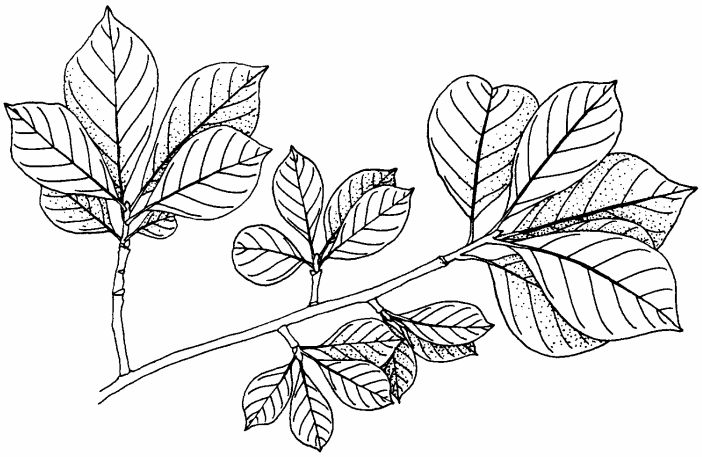
Obligate Upland.....Species occur less than 99% of the time in wetlands.



Care must be taken when estimating wetland conditions using only plants. One reason is that common trees in the most marginal (least wet) wetlands (forested wetlands) are often the facultative species Red maple and Balsam fir and the facultative upland species Eastern hemlock. Even White pine and other species more commonly found in drier sites will grow on raised hummocks in a forested wetland. In these cases, a survey of the shrubs present will often provide a better indication of wetland conditions, as will groundcovers if they are present. In many forested wetlands, Highbush blueberry and Winterberry holly are common and readily identified at any time of the year.

The technical determination of wetland boundaries incorporates all these characteristics, but is not practical for informal determination of whether you are working in a wetland. However, a rough estimate of a wetland boundary can be made using the signs given above. Begin by finding an area that seems obviously to be a wetland. Then, walk toward the upland, noting changes in vegetation as you go. If possible, sample the soil for the characteristics and look for above-ground signs noted above. When you no longer observe a majority of wetland plants or soil conditions, consider this the approximate wetland edge. This process can be repeated at intervals around the wetland edge, marking as you go.

If you're not sure about wetland determination, refer to section in this manual on Available Assistance.



FREQUENCY OF OCCURRENCE OF SELECTED NEW HAMPSHIRE *SHRUB SPECIES* IN WETLANDS AND UPLANDS

OBLIGATE WETLAND SPECIES (>99% in wetlands, <1% in uplands)

Buttonbush	*Cephalanthus occidentalis*
Cranberry, Large	*Vaccinium macrocarpon*
Cranberry, Small	*Vaccinium oxycoccos*
Labrador Tea	*Ledum groendlandicum*
Leatherleaf	*Chamaedaphne calyculata*
Mountain Holly	*Nemopanthus mucronatus*
Rose, Swamp	*Rosa palustris*
Rosemary, Bog	*Andromeda polifolia*
Sumac, Poison	*Toxicodendron vernix*
Sweetgale	*Myrica gale*

FACULTATIVE WETLAND SPECIES (67 - 99% in wetlands, 1 - 33% in uplands)

Alder, Speckled	*Alnus rugosa*
Arrow-Wood	*Viburnum recognitum*
Azalea, Swamp	*Rhododendron viscosum*
Blueberry, Highbush	*Vaccinium corymbosum*
Chokeberry, Red	*Aronia arbutifolia*
Dogwood, Red Osier	*Cornus stolonifera*
Dogwood, Silky	*Cornus amomum*
Elder, American	*Sambucus canadensis*
Maleberry	*Lyonia ligustrina*
Rhodora	*Rhododendron canadense*
Spicebush	*Lindera benzoin*
Steeple-Bush	*Spiraea tomentosa*
Winterberry Holly	*Ilex verticillata*
Withe-Rod	*Viburnum cassinoides*

FACULTATIVE SPECIES (Likely to occur equally (34 - 66%) in uplands and wetlands.)

Bayberry	*Myrica pensylvanica*
Chokeberry, Black	*Aronia melanocarpa*
Cranberry, Mountain	*Vaccinium vitis-idaea*
Ivy, Poison	*Toxicodendron radicans*
Meadow-Sweet	*Spiraea latifolia*
Nannyberry	*Viburnun lentago*
Pepper-Bush	*Clethra alnifolia*
Raspberry, Red	*Rubus idaeus*

Rhododendron, Rosebay	*Rhododendron maximum*
Rose, Virginia	*Rosa virginiana*
Sheep-Laurel	*Kalmia angustifolia*
Yew, American	*Taxus canadensis*

FACULTATIVE UPLAND SPECIES (1 - 33% in wetlands, 67 - 99% in uplands)

Barberry, European	*Berberis vulgaris*
Barberry, Japanese	*Berberis thunbergii*
Bitter-sweet, American	*Celastrus scandens*
Blackberry, Allegheny	*Rubus alleghaniensis*
Blueberry, Lowbush	*Vaccinium angustifolium*
Elder, Red	*Sambucus racemosa*
Hazel-nut, Beaked	*Corylus cornuta*
Hobble-Bush	*Viburnum lantanoides*
Juniper, Creeping	*Juniperus horizontalis*
Laurel, Mountain	*Kalmia latifolia*
Rose, Rugosa	*Rosa rugosa*
Teaberry (Checkerberry)	*Gaultheria procumbens*
Witch-Hazel	*Hamamelis virginiana*

OBLIGATE UPLAND SPECIES (< 1% in wetlands, >99% in uplands)

Juniper, Common	*Juniperus communis*
Sumac, Smooth	*Rhus glabra*
Sumac, Staghorn	*Rhus typhina*
Sweet Fern	*Comptonia peregrina*
Viburnum, Maple-leaved	*Viburnum acerifolium*

FREQUENCY OF OCCURRENCE OF SELECTED NEW HAMPSHIRE *TREE SPECIES* IN WETLANDS AND UPLANDS

OBLIGATE WETLAND SPECIES (>99% in wetlands, <1% in uplands)

Atlantic White Cedar	*Chamaecyparis thyoides*

FACULTATIVE WETLAND SPECIES (67 - 99% in wetlands, 1 - 33% in uplands)

Black Ash	*Fraxinus nigra*
Green Ash	*Fraxinus pensylvanica*
River Birch	*Betula nigra*
Northern White Cedar	*Thuja occidentalis*
American Elm	*Ulmus americana*
American Larch	*Larix laricina*
Silver Maple	*Acer saccharinum*
Swamp White Oak	*Quercus alba*
Balsam Poplar	*Populus balsamifera*
Black Spruce	*Picea mariana*
Sycamore	*Platanus occidentalis*
Tupelo (Black Gum)	*Nyssa sylvatica*
Black Willow	*Salix nigra*

FACULTATIVE SPECIES (Likely to occur equally (34-66%) in uplands and wetlands.)

Gray Birch	*Betula populifolia*
Yellow Birch	*Betula alleghaniensis*
Cottonwood	*Populus deltoides*
Slippery Elm	*Ulmus rubra*
Balsam Fir	*Abies balsamea*
Honey Locust	*Gleditsia triacanthos*
Ironwood	*Carpinus caroliniana*
Red Maple	*Acer rubrum*

FACULTATIVE UPLAND SPECIES (1 - 33% in wetlands, 67 - 99% in uplands)

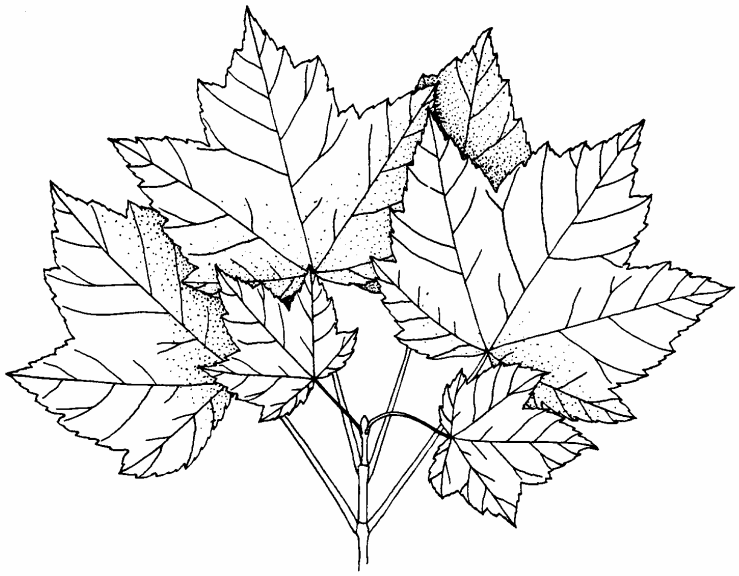
White Ash	*Fraxinus americana*
Big-tooth Aspen	*Populus grandidentata*
Quaking Aspen	*Populus tremuloides*
Basswood	*Tilia americana*
American Beech	Fagus grandifolia

Paper Birch	*Betula papyrifera*
Sweet Birch	*Betula lenta*
Butternut	*Juglans cinerea*
Red Cedar	*Juniperus virginiana*
Black Cherry	*Prunus serotina*
Choke Cherry	*Prunus virginiana*
Fire Cherry	*Prunus pensylvanica*
Flowering Dogwood	*Cornus florida*
Eastern Hemlock	*Tsuga canadensis*
Shagbark Hickory	*Carya ovata*
Hop Hornbeam	*Ostrya virginiana*
Black Locust	*Robinia pseudoacacia*
Striped Maple	*Acer pensylvanicum*
Sugar Maple	*Acer saccharum*
Red Oak	*Quercus rubra*
White Oak	*Quercus alba*
White Pine	*Pinus strobus*
Pitch Pine	*Pinus rigida*
Red Pine	*Pinus resinosa*
Sassafras	*Sassafras albidum*
Red Spruce	*Picea rubens*
White Spruce	*Picea glauca*
Black Walnut	*Juglans nigra*

OBLIGATE UPLAND SPECIES

(< 1% in wetlands, >99% in uplands)

None



TRUCK HAUL ROADS

❑ **Definition:**
A road system, temporary or permanent, installed for transportation of wood products from the landing by truck.

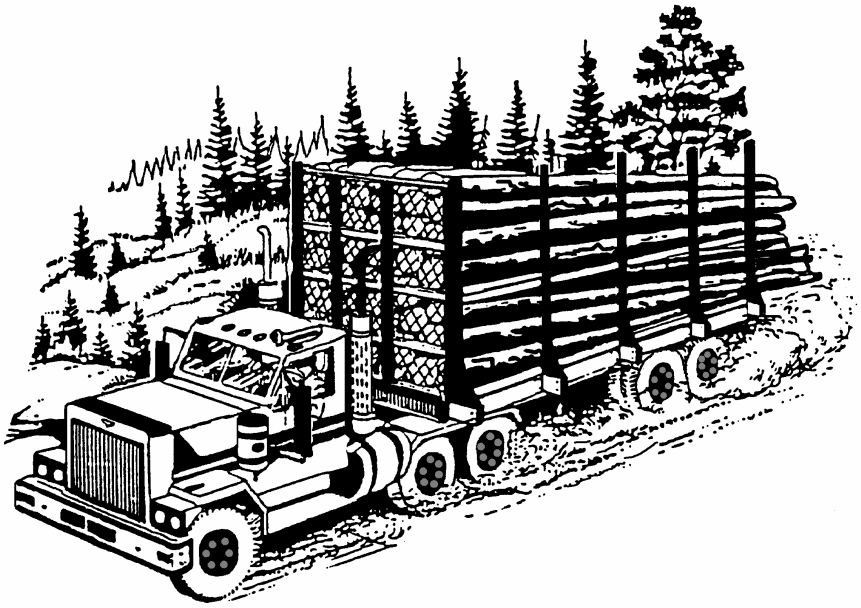
❑ **Purpose:**
To provide for an efficient transportation system for forest products from the landing while also protecting forest land and water quality, for recreation, forest fire access, or other needed forest management activities.

❑ **Condition Where Practices Applies:**
Where area and volume to be harvested makes it necessary and economically feasible to install such a road system.

Guidelines:

- A well thought out efficient transportation system will minimize the area disturbed and vulnerable to erosion.

- Keep the length of the truck road, from the log landing to a public highway, to a minimum. Have gravel or wood chips for about 200 feet prior to entering on a public highway to keep mud off of the



highway.

- Road grades should be kept to 10% or less. Steeper grades are permissible for short distances. Long level sections are difficult to drain properly. Grades between 3% and 5% are desirable.

- Place roads on high ground with gentle grades. Avoid sharp curves. Use a fifty foot minimum radius for large trucks.

- Minimum tread width is 10 feet for one-way traffic and 15 feet for two-way traffic. Increase the tread width by a minimum of 4 feet for trailer traffic.

- Use a geotextile construction fabric underlayment when constructing roads on poorly drained surface.

- Move surface water quickly off road surfaces and onto undisturbed forest floor. Ditches should be used to efficiently divert water away from the road surface. Water entering a roadway should be moved under or away from the roadway before gaining sufficient flow and velocity to erode ditches. Drainage ditches should not end where they will feed water directly into streams or other surface waters. (See Erosion Control Devices)

- If streams must be crossed, do so by the most direct route and preferably at right angles to the stream. A bridge, culvert, or food of acceptable design may be required. (See Stream Crossings)

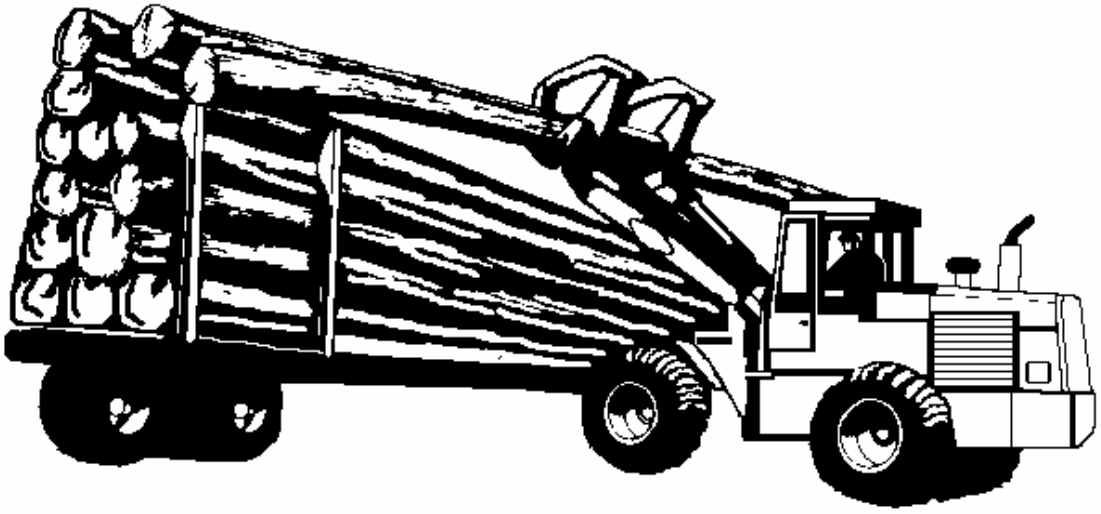
- Road grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)

- Restrict vehicle traffic on soft roads during Spring and Fall mud seasons.

- Restrict vehicle traffic during heavy rains.

- Do not allow skidding on truck roads.

- Check with the State of New Hampshire - Department of Transportation or the local town officials to determine if a driveway permit is required.



SKID TRAILS

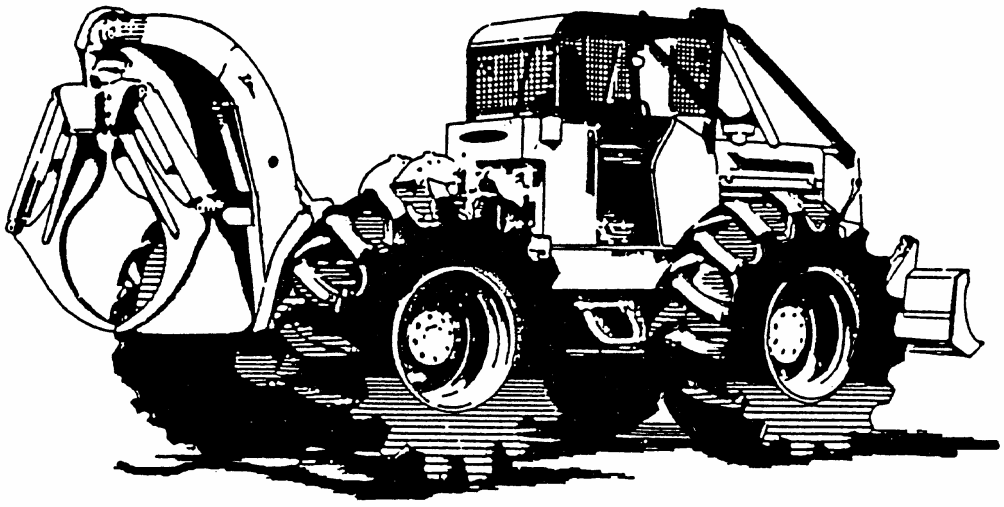
❑ **Definition:**
An unsurfaced, single lane trail system usually steeper and narrower than a truck road and used for skidding harvested products.

❑ **Purpose:**
To bring logs, tree lengths, or other roundwood products from the stump to a log landing or concentration area.

❑ **Conditions Where Practice Applies:**
Use where harvested products must be brought to one location for sawing, chipping or loading. Where topography and size of operation make this the most economical means of collecting logs, trees, or other roundwood products.

Guidelines:

- A well thought out efficient transportation system will minimize the area disturbed and vulnerable to erosion.
- Trail grades should be kept to 15% or less. Steeper grades are permissible for shorter distances.
- Plan skid trails from the top down.



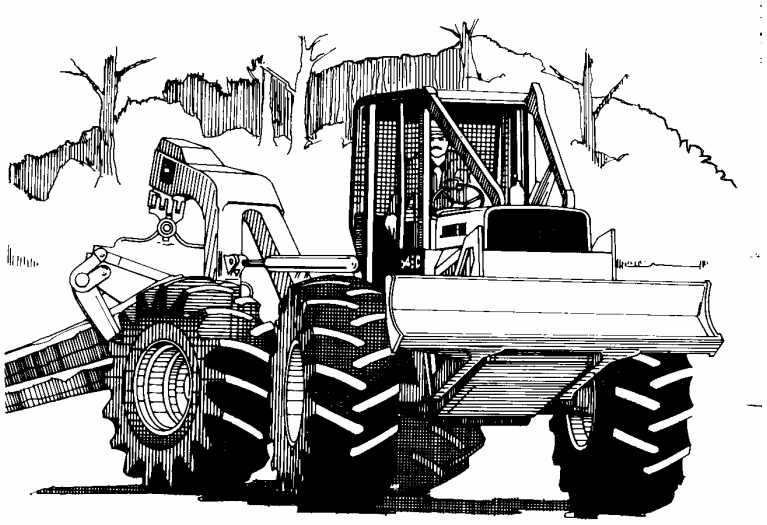
- Locate skid trails to take advantage of natural cross drainage.

- Use reverse grades and provide upgrade turns where natural reverse grades are not available. (See Erosion Control Devices - Reverse Grades)

- Major skid trails should be located away from streams, ponds, lakes, and wetlands. (See Erosion Control Devices - Streamside Management Zone)

- Move surface water quickly off trail surfaces and on to undisturbed forest floor. (See Erosion Control Devices)

- If streams must be crossed, do so by the most direct route and preferable at right angles to the stream. A bridge, culvert, or ford of acceptable design may be required. (See - Stream Crossings)



- Trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the water course. (See Erosion Control Devices)

- **At no time will logs be permitted to be skidded or equipment driven through flowing streams.**

- Skid across slope where feasible.

- Skid uphill to the log landing whenever possible so that water running in the skid trails is dispersed away from landing.

- Silt fencing, haybale erosion checks or water diversions shall be used to prevent soil from skid trails from entering streams and other surface waters.

- Use brush to minimize rutting in soft soil.

LOG LANDINGS

❑ **Definition:**
An area where harvested logs and trees are temporarily stored and assembled.

❑ **Purpose:**
To provide an area where forest products are sorted and loaded onto trucks for transport to a mill.

❑ **Conditions Where Practice Applies:**
Should be so located as to minimize the adverse impact of skidding operations in sensitive areas and on the natural drainage pattern

Guidelines:

- Landings should not be located in streamside management zone.
- Set landings back 100 feet or more from streams, ponds, lakes, and wetlands.
- If landings cannot be set back 100 feet from streams, pond, lakes, and wetlands, sediment traps should be used to minimize sedimentation from surface runoff. Adequate streamside management zone should be left between landings and water courses.
- Locate landings away from low or poorly drained areas.
- Locate landings on gently sloping ground that allows for good drainage.
- Landings should be sized to the minimum required for the area to be cut, the equipment used and the diversity of products produced.
- Construct diversion ditch around uphill side of landings where seepage and lateral flow of water may be a problem.
- Provide adequate drainage on approach trails so that drainage does not enter landing area.
- Divert water draining from landings so that it does not enter truck roads, skid trails, or flow directly into streams, ponds, lakes, or wetlands.
- Servicing of equipment on site must be done in such a way that old oil, hydraulic fluid, etc., should be properly contained and removed from the site and disposed of in accordance with proper waste disposal procedures.

STREAMSIDE MANAGEMENT ZONE

❑ **Definition:**
A protective strip of undisturbed forest soil between disturbed areas (skid trails, truck roads, and log landings) and a water course (stream, pond, lake, and wetlands).

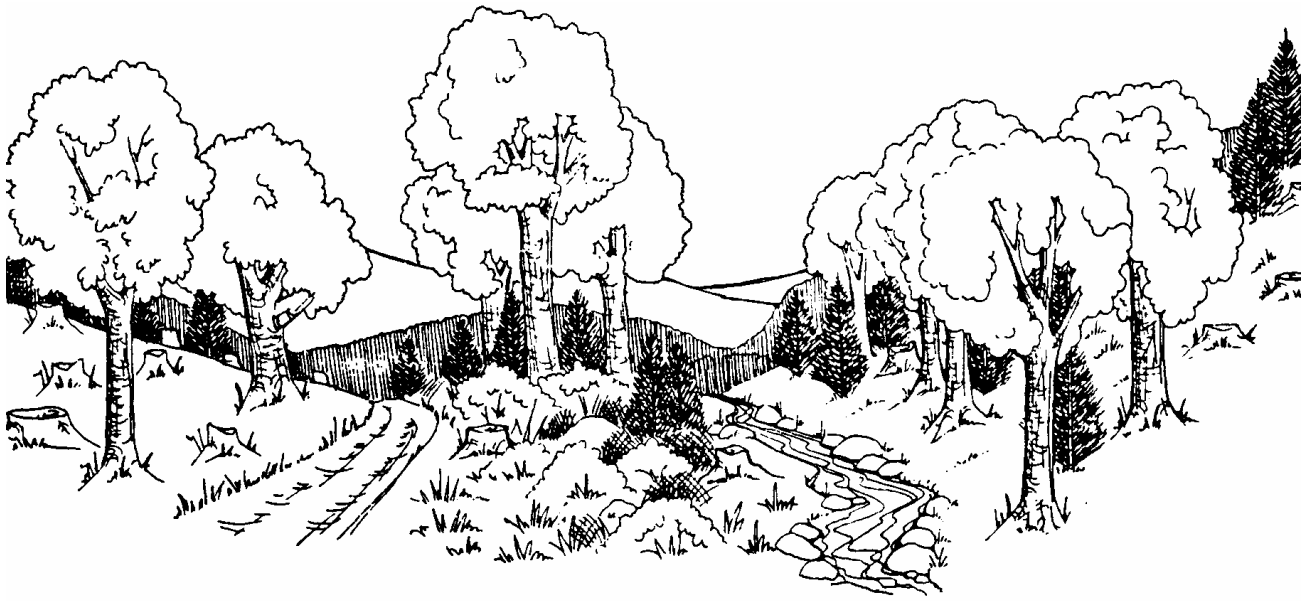
❑ **Purpose:**
To provide an undisturbed zone to slow runoff, allowing sediment to settle and be filtered out before reaching a water course.

❑ **Conditions Where Practice Applies:**
Should be maintained between all water courses and truck roads, major skid trails, or log landings where soil has been exposed.

Guidelines:

- The streamside management zone should be protected to prevent exposure of mineral soil. Equipment operation in this area should be limited. If mineral soil is exposed, it should be stabilized by seeding and/or mulching as soon as possible.

- Harvesting practices which do not expose mineral soil may take place in the streamside management zone such as felling and winching of timber.



- No log landings should be within the streamside management zone.
- Truck roads and major skid trails should not be within the streamside management zone except when entering and leaving stream crossings.
- New Hampshire law limits harvesting near surface waters and public roads.

STREAMSIDE MANAGEMENT ZONE WIDTHS

Side slope (percent)	Width (feet)
0 - 10	50
11 - 20	70
21 - 30	90
31 - 40	110

Note: Add 20 feet for each additional 10 percent of side slope.

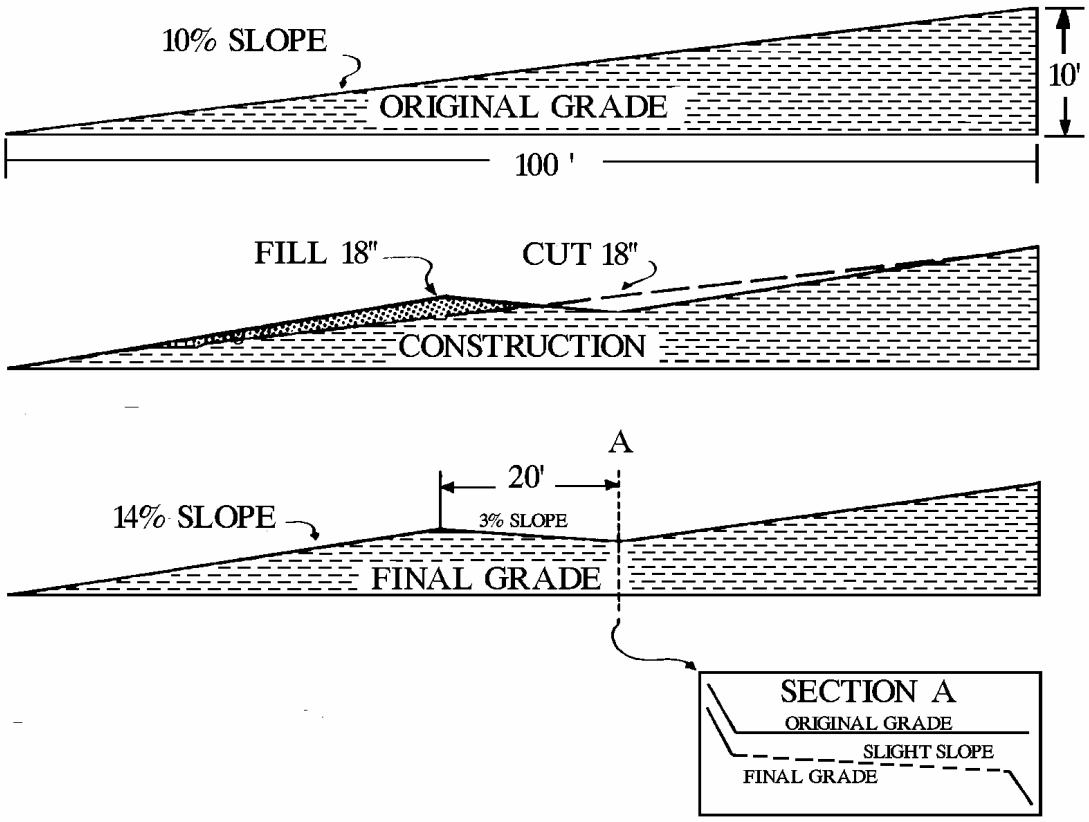
BROAD BASED DIPS

❑ **Definition:**
A dip and reverse slope in a truck road surface with an outslope in the dip for natural cross drainage.

❑ **Purpose:**
To provide cross drainage on insloped truck roads to prevent build-up of excessive surface runoff and subsequent erosion.

❑ **Conditions Where Practice Applies:**
Use on truck roads and heavily used skid trails having a gradient of 10% or less. May be substituted for other cross drainage structures where no intermittent or permanent streams are present.

Guidelines:



- Proper construction requires an experienced bulldozer operator.
- Installed after the basic roadbed has been constructed and before major hauling use.
- On grades steeper than 8%, surface dips with stone (approx. 3" diameter) or gravel.
- Use dips on approaches to steep declines in heavily used skid trails.
- Discharge area should be protected with stone, grass sod, heavy litter cover or slash and logs to reduce the velocity and filter the water.

SPACING FOR BROAD BASED DIPS

Road Grade (percent)	Spacing Between Dips (feet)
2	300
4	200
6	165
8	150
10	140
12	130

WATER BARS

❑ **Definition:**
An excavated channel with earthen or reinforced berm constructed across a truck road or skid trail.

❑ **Purpose:**
To intercept and divert water from side ditches and truck road or skid trail surfaces, minimizing erosion by decreasing the slope length of surface water flow.

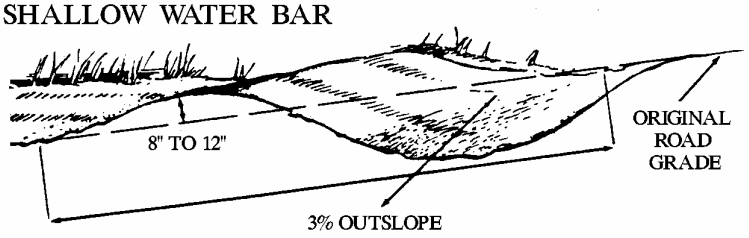
❑ **Conditions Where Practice Applies:**
On any sloping truck road or skid trail where surface water runoff may cause erosion.

Guidelines:

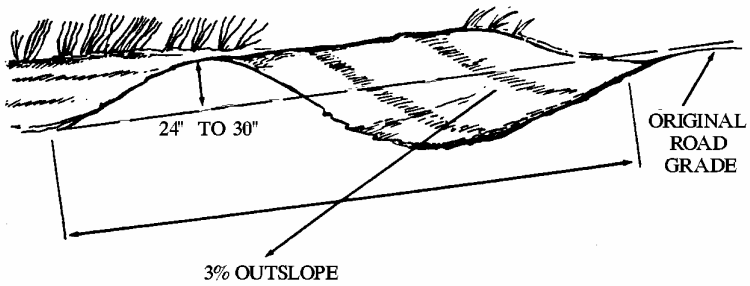
- Start placement of water bars at the farthest skid trail and work back to the log landing and then to the truck road.

- Install water bars with a skidder blade, dozer blade, excavator or by hand.

SHALLOW WATER BAR



DEEP WATER BAR



- Install water bars at the top of any sloping road or trail and at proper spacing along steep sections.
- Water bars may be shallow or deep depending on the need.
- Soil should be left along the lower side of the water bar.
- Should be constructed at a 30^{o} - 35^{o} angle downslope from a line perpendicular to the direction of the truck road or skid trail.
- Should drain at a 3% outslope onto undisturbed litter or vegetation.
- The uphill end of the water bar should extend beyond the side ditch line of the road or trail to fully intercept any water flow.
- The downhill end of the water bar should be fully open and extended far enough beyond the edge of the road or trail to disperse runoff water onto undisturbed forest floor.
- Place rocks, slash, or logs to disperse water coming from a water bar.
- If the road or trail is to be kept open after the harvesting operation, the following guidelines should be used in order to preserve effective water bars.

-Reinforce the water bars

-Keep travel to a minimum

-Use only in dry weather

-Make frequent inspections

-Maintain as needed

SPACING FOR WATER BARS

Road/Trail Grade (percent)	Spacing Between Water Bars (feet)
2	250
5	135
10	80
15	60
20	45
30	35

REVERSE GRADES

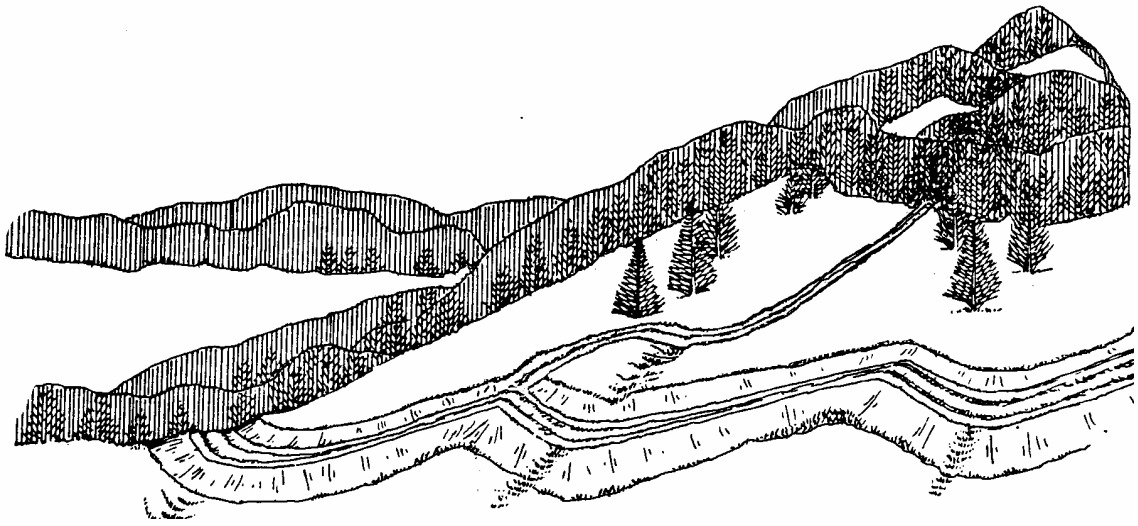
❑ **Definition:**
A short rise in a downhill skid trail that forces any water in the trail to drain off to the side. Obtained by turning the skid trail up the hill a short distance then turning downhill again.

❑ **Purpose:**
To break the grade of the skid trail as often as practical, therefore limiting slope length.

❑ **Condition Where Practice Applies:**
Where additional drainage can be provided by taking advantage of natural cross drainage on sidehill locations.

Guidelines:

- Reverse grades are commonly applied to only skid trails.
- Requires greater planning and layout of trail system.
- Use in conjunction with other water control measures.
- Requires minimum construction time and low maintenance.
- Unsuitable on very steep terrain and hardpan soils.



CROSS DRAINAGE CULVERTS

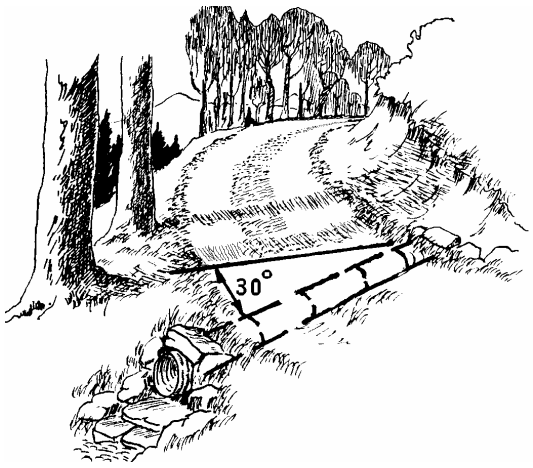
❑ **Definition:**
Corrugated pipe, well casing, dredge pipe, or other suitable material placed under a truck haul road or major skid road to transmit ditch runoff and seeps from a drainage area of less than 10 acres.

❑ **Purpose:**
To collect and transmit water flows from side ditches and seeps, under truck haul roads and major skid trails safely without eroding a drainage system or road surface.

❑ **Conditions Where Practice Applies:**
For any size operation where cross drainage of storm water is required temporarily or permanently.

Guidelines:

- This is the most expensive method of road cross drainage and should be used where heavy use is anticipated during and after the harvesting operation.
- When sizing culverts for temporary roads, allow for periods of high flow, such as spring runoff or cloudbursts.
- The minimum size culvert to be installed is 12 inch diameter and 20 feet in length.
- When constructing roads on sidehill locations, ditch the uphill side of the roadway to intercept surface runoff.
- Allow inlet end of culvert to extend into side ditch so that it intercepts water flowing in the ditch. Construct a berm across the side ditch to assist in diverting water into the culvert.
- Allow outlet end of culvert to extend beyond any fill and empty onto an apron of rock, gravel or logs.



- Space culverts according to road grade:

  On gentle slopes (1-2%).....300 feet

  On moderate slopes (3-10%).....150 feet

  On steep slopes (10%+).....100 feet or less

- Culverts should be installed at a 30-35 degree angle downgrade.

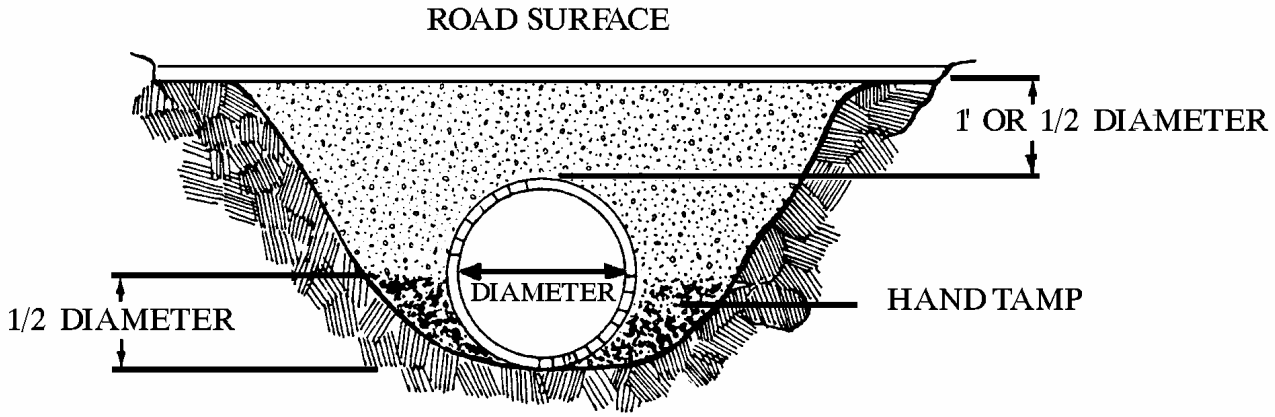
- Culverts should be sloped at least 5 inches for every 10 feet of length to permit self-cleaning.

- When harvesting operation has been completed, the road should be stabilized by installing water bars and removing all pipe culverts from truck roads which will not be maintained.

- Culverts, when not maintained, are very likely to become blocked with rocks, ice or other debris. Runoff water can become rerouted over and around the culvert and may wash out sections of road into brooks, streams, ponds or wetlands. It is important to clean culverts regularly. Check after every storm.

- Culvert size selection should be based on the size of the drainage area of the watershed and should be able to handle the largest flows.

- Estimate drainage area by taking measurements on a USGS topographic map, using contour lines to define the drainage limits. The Natural Resource Conservation Service can assist you with determination of drainage area.



OPEN TOP CULVERTS

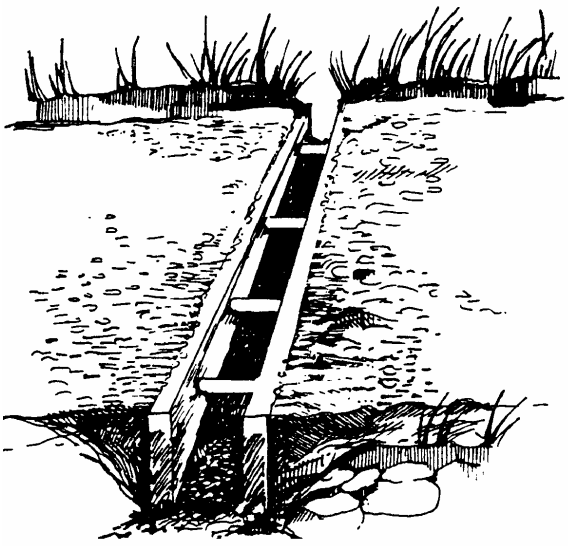
❑ **Definition:**
A wooden, concrete, or slotted steel pipe culvert placed across truck haul roads to convey surface runoff and side ditch flows across to downslope side.

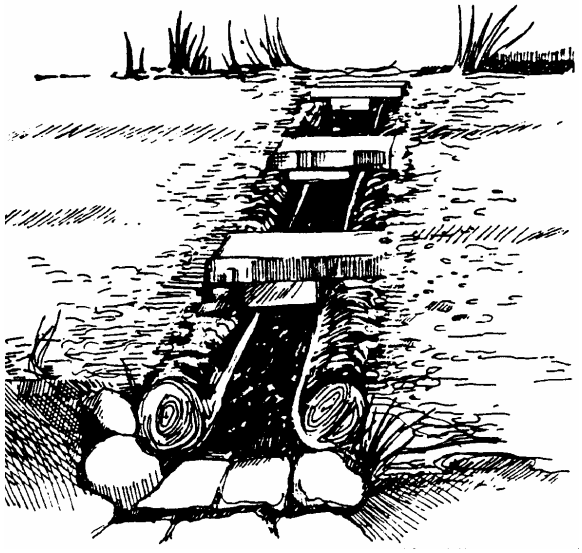
❑ **Purpose:**
To collect and direct road surface storm runoff and upslope side ditch flows across road without eroding drainage system or road surfaces.

❑ **Conditions Where Practice Applies:**
This practice is a temporary or permanent drainage structure for truck haul roads. Properly built and maintained, it can be used for cross drainage on roads of smaller operations as a substitute for a cross drainage culvert. This practice should not be used for handling intermittent or live streams or skid trail cross drainage.

Guidelines:

- Can be constructed of cull logs or from sawn lumber. If made of durable wood or treated material, these culverts will give many years of service.
- Install flush with the road surface and skewed at an angle not less than 30 degrees downgrade.



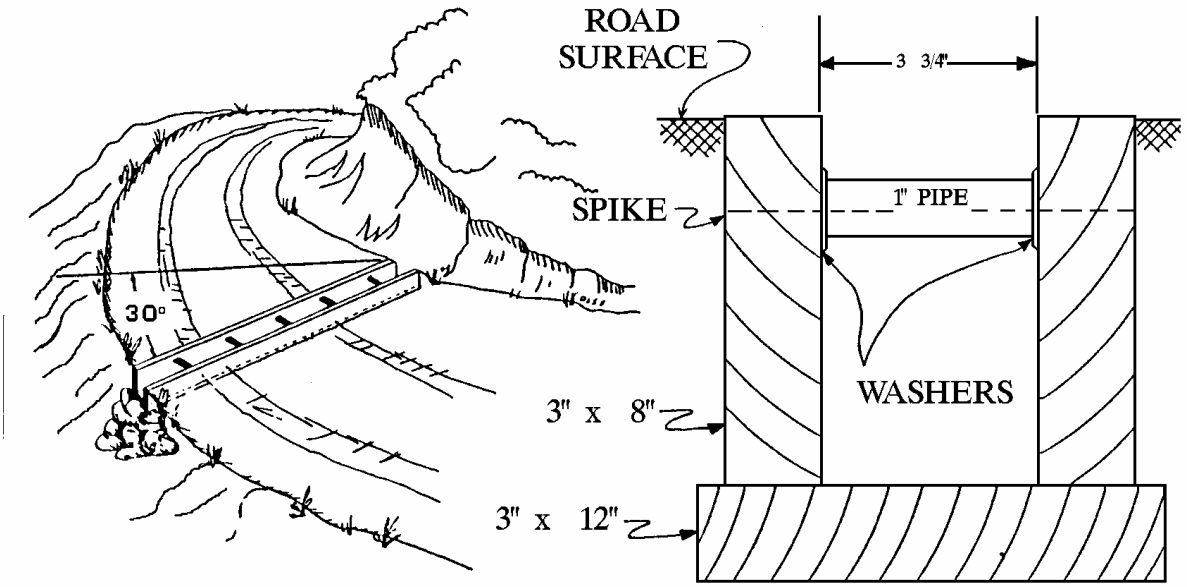


- Allow the inlet end to extend into the cut slope or side ditch so that it intercepts water.

- Allow outlet end to extend beyond any fill and empty onto an apron of rock, gravel or logs.
- Open top culverts must be cleaned regularly to remove sediments, gravel, and logging debris to allow normal function of structure at all times.

SPACING FOR OPEN TOP CULVERTS

Road Grade(percent)	Spacing Between Culverts(feet)
1 - 2%	300
3 - 10%	150
10%+	100 or less

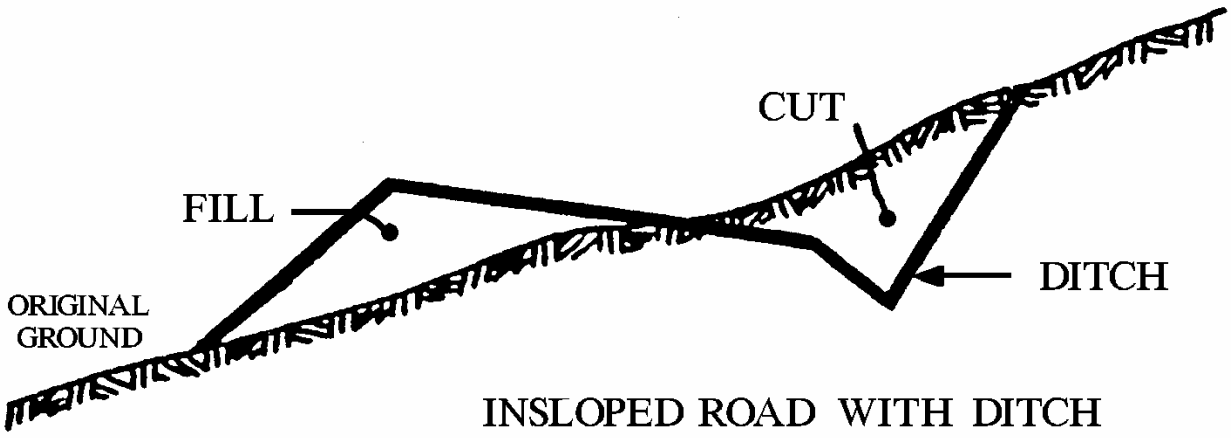


INSLOPING

❑ **Definition:**
A section of road is sloped slightly (1-3%) toward the cut bank.

❑ **Purpose:**
Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly to the inside ditch which will carry the water into a culvert.

❑ **Condition Where Practice Applies:**
Used when the soils are easily saturated or highly erodible. This will limit the amount of ditch water which will flow on to unstable fills.



INSLOPED ROAD WITH DITCH
(cross section)

OUTSLOPING

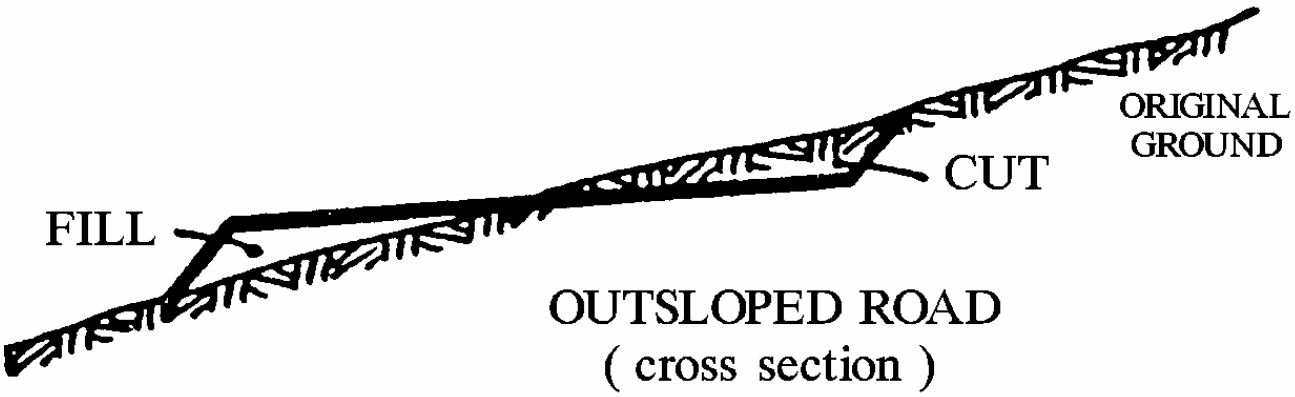
❑ **Definition:**
A section of road sloped slightly (1-3%) from the cut bank to the outside edge of the road bed.

❑ **Purpose:**
To prevent erosion by diverting runoff from a road surface on to undisturbed forest floor.

❑ **Condition Where Practice Applies:**
Used when the area is entirely rock, or when water can be diverted on to undisturbed forest floor.

Guidelines:

- Outsloping on fill is not desirable.
- For safety, do not use for trucking during freezing weather.
- Do not use on silty or hardpan soils when wet or if seeps are present.



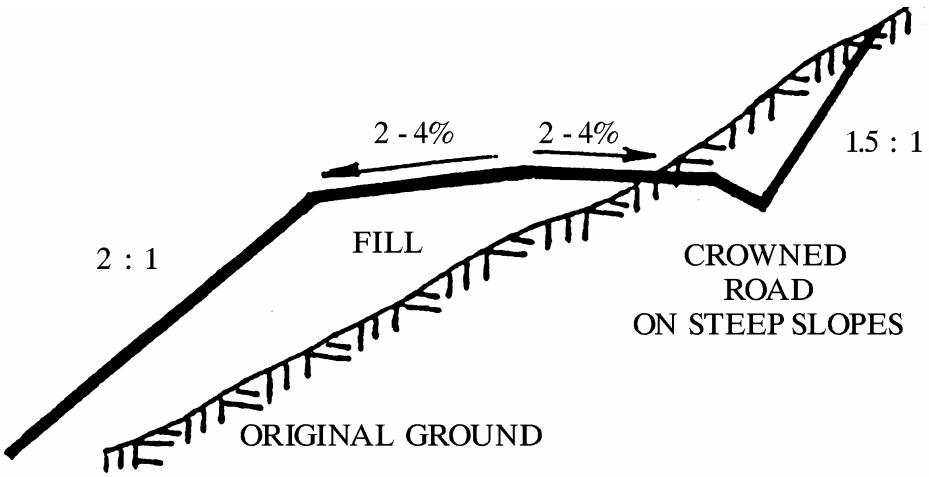
OUTSLOPED ROAD
(cross section)

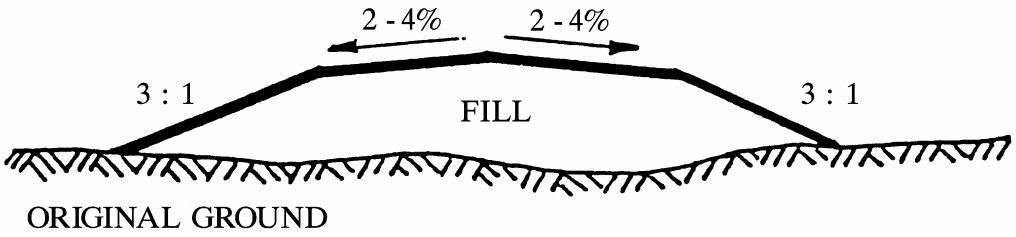
CROWNING

❑ **Definition:**
A section of road is sloped slightly (2-4%) from the center line of the road to the outside edges of the roadbed.

❑ **Purpose:**
Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly onto the forest floor or into a ditch which will carry the water into a culvert.

❑ **Conditions Where Practice Applies:**
Used when soils are easily saturated or highly erodible when adjacent areas are relatively level with roadbed or on steep side hills.





CROWNED ROAD

Guidelines:

CORDUROY

❑ **Definition:**
Crossing of a wet area where there is not a defined channel using poles or cull logs as a roadbed.

❑ **Purpose:**
To be used as a wet area crossing by a skid trail where it is necessary to provide soil stability.

❑ **Conditions Where Practice Applies:**
To be constructed on wet soils subject to rutting and extreme compaction by timber harvesting equipment

Guidelines:

- Use geo-textile fabric or other appropriate bedding.
- Place 8 - 10 inch diameter poles or cull logs side by side in wet area to serve as a roadbed.
- Place poles or cull logs perpendicular to the direction of travel across wet area.
- The top width of corduroy roadway should be at least 10 feet.
- Shall not be crossed when they are overtopped with water.
- After corduroy roadway has been overtopped with water, repair and maintenance will be required.
- Corduroy roadway should be inspected regularly.
- May be left in place after harvesting operation has been completed.

TEMPORARY BRIDGE

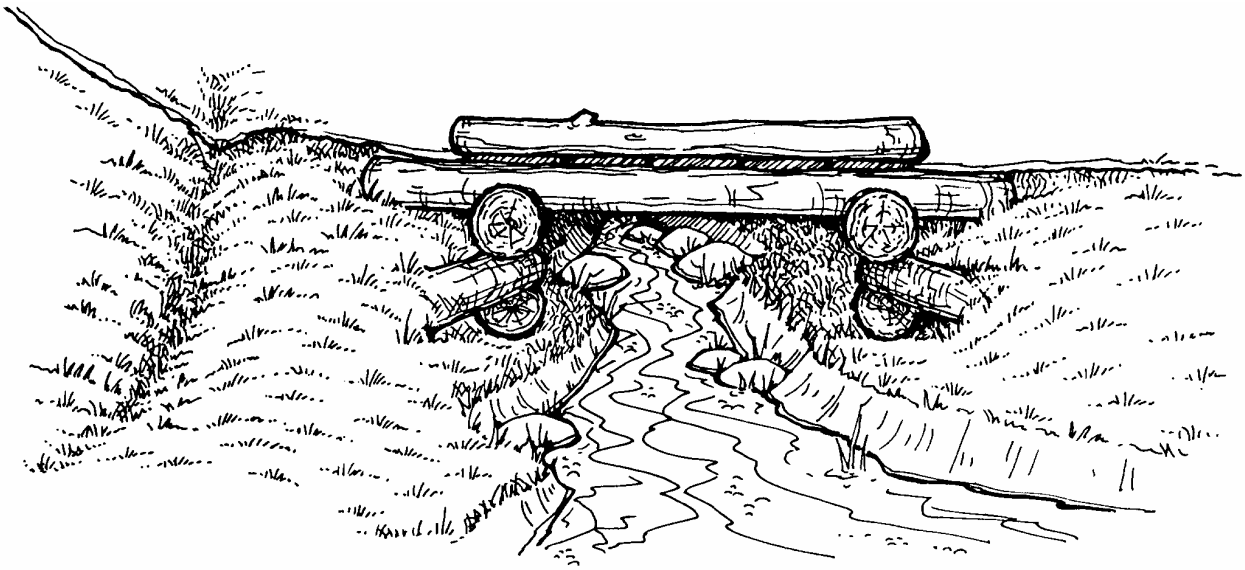
❑ **Definition:**
A structure of wood and steel materials installed across a natural or constructed channel or stream.

❑ **Purpose:**
To carry a single lane haul road or skid trail over a stream to enable more direct routing while keeping equipment and products out of the water.

❑ **Conditions Where Practice Applies:**
Where restrictions such as topography or property lines make it necessary to cross a stream. Stream crossings are a major concern in the construction and use of a truck haul roads and skid trails because of the potential for large amounts of sediment to enter a stream. Keep the number of stream crossings to a minimum.

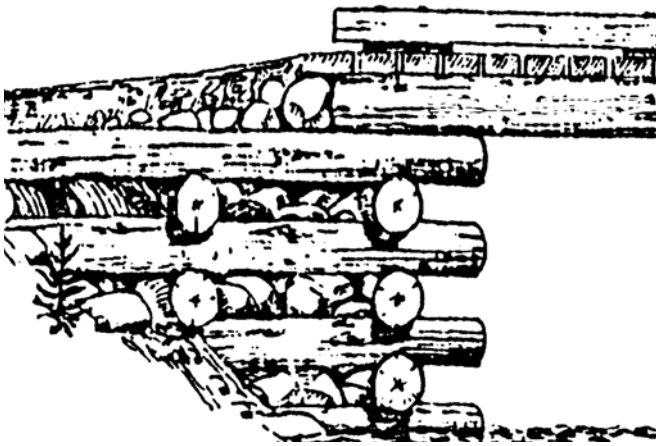
Guidelines:

- Install bridges at right angle to the stream. A maximum of 15 degree skew may be allowed as an exception where approach conditions are difficult.
- Align approach and exit with the bridge's center line with as little curvature as possible.
- Stream alignment should be straight at the point of crossing and of uniform profile.

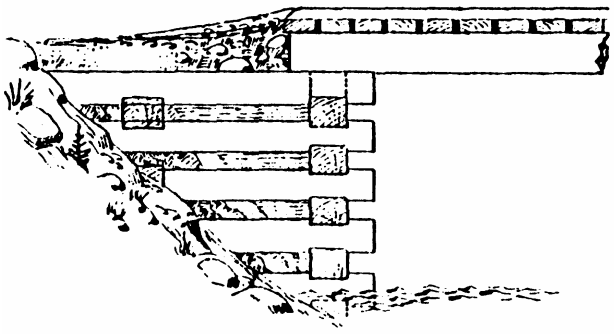


- Minimum acceptable bridge width is 10 feet.

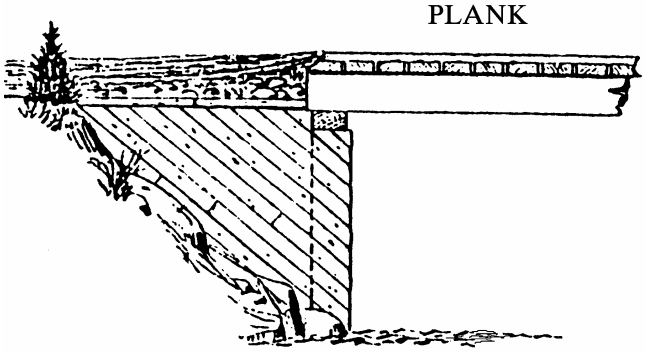
- Firmly anchor abutments out of the water in stable bank material and parallel to the stream channel. Do not narrow stream channel with abutments.



PREFABRICATED CRIB



PLANK



- Acceptable abutment materials can be rock, logs, sawn timbers or a combination of any of the above. (See Logging and The Law)

- Place abutment aprons or approaches as close to gradient of bridge surface as possible. Avoid abrupt rises and drops from bridge gradient to apron gradient. (See Logging and The Law)

- Stringer material may be either logs, sawn timbers or steel.

- Match center line gradients of span and stringers with that of the road or trail.

- It is recommended that a registered engineer be contacted to design the bridge.

- Log stringers should have a flat upper bearing face to accept a plank deck as well as a flat bearing surface on abutments. Placement of log stringers on abutments should alternate small and large ends.

- Deck material shall be placed perpendicular to the stringer direction and be tight.

- A curb shall be installed along the outer sides of the deck and be fastened tight to the deck. Minimum size will be 6" x 6" and will run the entire length of the span. Pole timbers can also be used, but must be straight and of sound quality.

- The bridge must be anchored so that it will not wash out during high water.

- Old trailer beds make excellent temporary bridges over small streams.

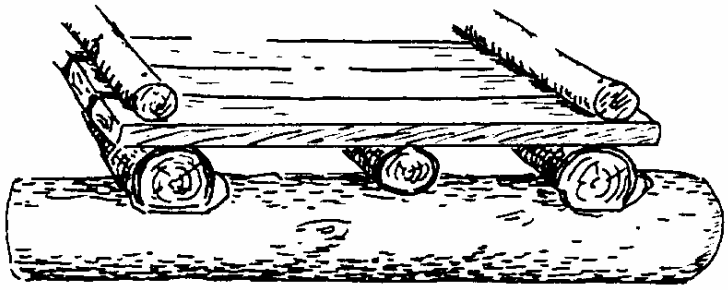
- Placement of bridges that require work in the stream should be done when the water level is low and in as short a period of time as possible. (See Logging and The Law)

- Do not gravel the deck. The gravel holds moisture that will cause the deck to rot.

- When the harvesting operation has been completed, stabilize the area by removing all bridges from truck haul roads and skid trails which will not be maintained.

- Road and trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)

- Find stream banks that are firm and level and approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.



STONE FORDS

❑ **Definition:**
Stream crossing using the stable stream bottom or stone fill as the roadbed.

❑ **Purpose:**
To be used on a truck haul road as a stream crossing rather than a bridge or culvert.

❑ **Conditions Where Practice Applies:**

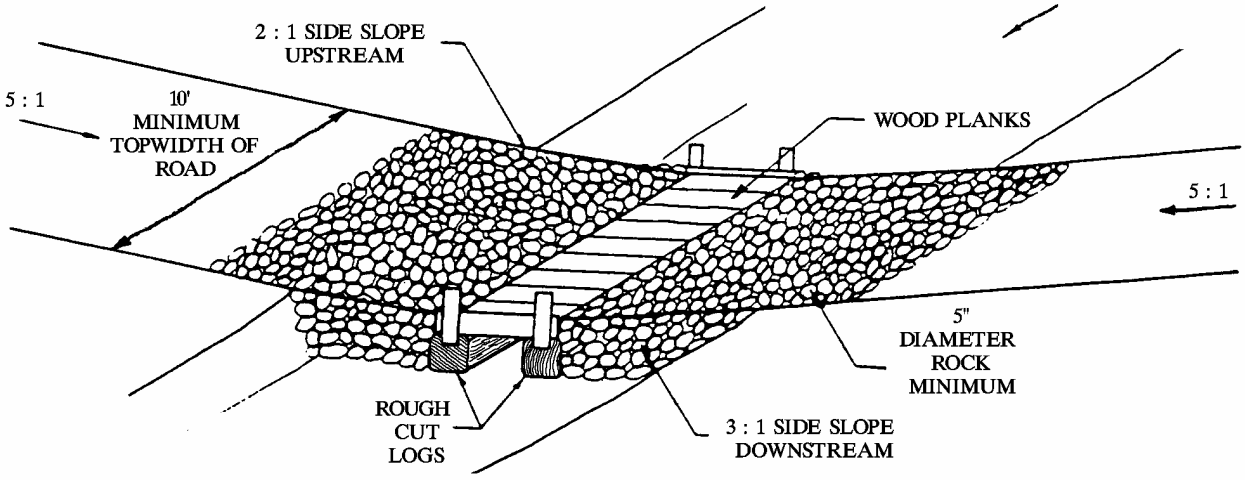
Perennial Stream Ford - Can be constructed and used during periods of low flow. When drainage area exceeds one square mile, a log box culvert should be installed.

Guidelines:

- Installation of fords is permissible only when it is not feasible to construct a bridge or install a pipe culvert, i.e. streams having no or low banks.
- Fords are prohibited on all streams in watersheds tributary to drinking water intakes or reservoirs for public and private water supplies, where the ford is within 2,000 feet of such intake or reservoir.
- Shall not be crossed when they are overtopped with water.
- **Skidding across stone fords is prohibited.**
- Construct on sound stable stream bottoms, whenever possible.
- Use geotextile fabric or other appropriate bedding for approaches. Do not use in stream.
- Use angular rock fill material of at least 75% greater than 5 inches in diameter. Use larger sizes for large drainage areas.
- Use 2 inch round stone on surface of ford to protect tires from sharp edges of angular rock.
- Height of fill should be at least 1/2 foot above low flow water level. However, total fill should not to exceed 2 feet above stream bottom.
- The top width of the fords should be at least 10 feet.
- Side slopes of fords should be greater than or equal to; 2:1 upstream and 3:1 downstream.
- After fords have been overtopped with water, repair and maintenance will be required.

- Do not place gravel or fill on the top of stone fords.
- The log box culvert may float during overtopping and should be anchored.
- Large stones or boulders on the downstream face of a stone ford will increase its life.
- Roads and trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the stream. (See Erosion Control Devices)
- Find stream banks that are firm and level with approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.

Number of 15"x15" Log Box Culverts	**Drainage Area (Square Miles)**	
	Shallow/High Elevation Soils	Normal Soils
1	1 - 5	1 - 8
2	5 - 10	8 - 17
3	10 - 15	17 - 20
4	15 - 20	



POLED FORDS

❑ **Definition:**
Temporary stream crossing in a defined channel using poles or cull logs as the roadbed.

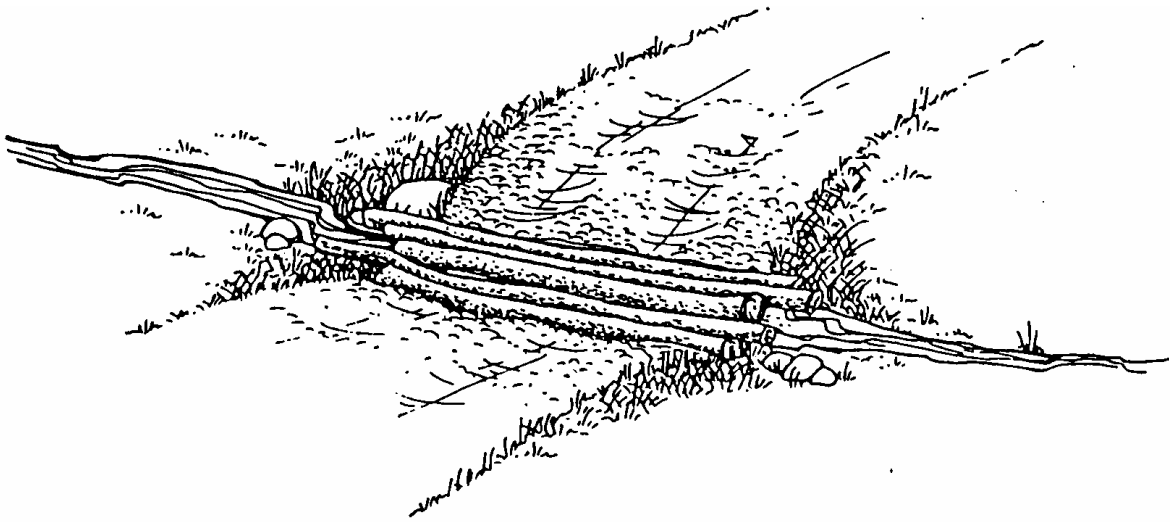
❑ **Purpose:**
To be used as a stream crossing rather than a bridge or culvert.

❑ **Conditions Where Practice Applies:**

Can be constructed and used during periods of no or low flow. Fords are used for crossing streams with light use truck haul roads and skid trails where there is limited potential for sedimentation of the stream.

Guidelines:

- Installation of fords is permissible only when it is not feasible to construct a bridge or install a pipe culvert, i.e. streams having no or low banks.
- Fords are prohibited on all streams in watersheds tributary to drinking water intakes or reservoirs for public and private water supplies, where ford is within 2,000 feet of such intakes or reservoir.
- Shall not be crossed when they are overtopped with water.
- Constructed on sound stable stream bottoms.



- Use geo-textile fabric or other appropriate bedding if needed to stabilize the approaches to the crossing.
- Find stream banks that are firm and level with approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.
- Place 8 - 10 inch diameter poles or cull logs side by side on the stream bed to serve as the roadbed.
- The top width of these fords should be at least 10 feet.
- Poles and logs must be removed immediately after use.
- After fords have been overtopped with water, repair and maintenance will be required.
- Poled fords should be inspected regularly to make sure the stream is not becoming turbid.
- Do not gravel or fill over poled fords.

STREAM CULVERTS

❑ **Definition:**
Corrugated pipe, well casing, dredge pipe or wooden box culvert placed under a truck haul road or major skid road to permit crossing of an intermittent or live stream.

❑ **Purpose:**
To transmit water flow of intermittent or live streams under truck haul roads and major skid trails. To carry a single lane haul road or skid trail over a stream to enable more direct routing while keeping equipment and products out of the water.

❑ **Conditions Where Practice Applies:**
Where restrictions such as topography or property lines make it necessary to cross a stream. Stream crossings are a major concern in the construction and use of truck haul roads, major skid roads, and skid trails because of the potential for large amounts of sediment to enter a stream.

Guidelines:

- Keep the number of stream crossings to a minimum.
- Culvert size selection should be based on the size of the drainage area of a forested watershed and should be able to handle the largest stream flows.
- Estimate drainage area by taking measurements on a USGS topographic map, using contour lines to define the drainage limits. The Natural Resource Conservation Service can assist you with determination of drainage area.
- Install a culvert/emergency spillway when the expected life of the stream crossing is greater than the duration of the harvesting operation.
- Construct during periods of no or low flow and in as short a period of time as possible.
- Install culvert crossing at right angle to the stream. A maximum of 15 degree skew is allowed as an exception where approach conditions are difficult.
- Align approach and exit with culvert crossing center line with as little curvature as possible.
- Road and trail grades approaching stream crossings should be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)

SIZING PIPE CULVERTS FOR STREAM CROSSINGS

Acres of Drainage		
Shallow and High Elevation Soils	Normal Forest Soils	Recommended Pipe Culvert Diameter in Inches
2	9	12
4	16	15
7	25	18
12	40	21
16	55	24
27	84	30
47	130	36
64	190	42
90	260	48
120	335	54
160	400	60
205	550	66
250	640	72

- Stream alignment should be straight at the point of crossing and of uniform profile so as not to obstruct the flow of water.
- Find stream banks that are firm and level and approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.
- Minimum acceptable culvert crossing top width is 10 feet.
- Place culverts in the natural drainage channel.
- Place culverts on the same grade as the stream bed. The minimum culvert grade is 2-4%.

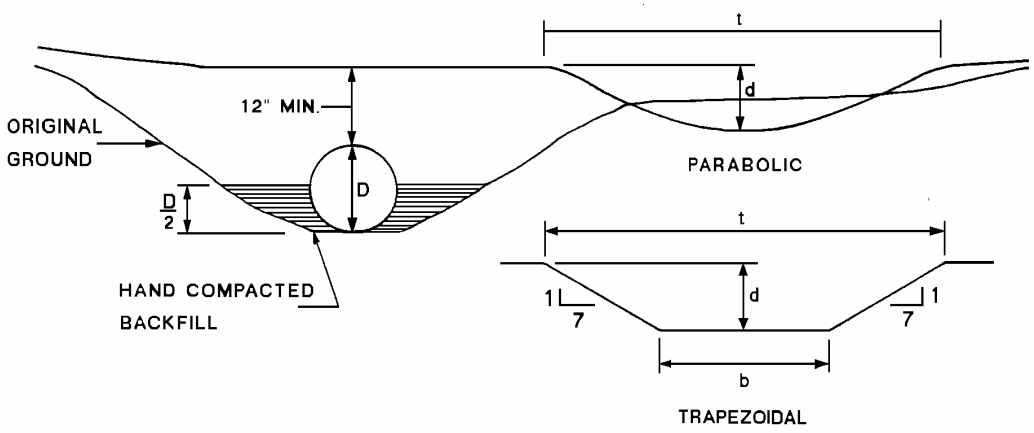
Pipe Culvert Diameter in Inches	Suggested Emergency Spillway Dimensions				
	Parabolic (ft.)		Trapezoidal (ft.)		
	d	t	d	t	b
12	0.5	12.0	0.5	11.5	4.5
15	0.5	12.0	0.5	11.5	4.5
18	0.5	17.0	0.5	15.0	8.0
21	0.75	12.0	0.75	13.5	3.0
24	0.75	22.0	0.75	19.5	9.0
30	1.0	23.0	1.0	22.5	8.5
36	1.0	33.0	1.0	29.0	15.0
42	1.0	44.0	1.0	36.0	22.0
48	1.0	55.0	1.0	44.0	30.0
54	1.5	45.0	1.5	44.0	24.0
60	1.5	52.0	1.5	48.5	27.5
66	2.0	49.0	2.0	54.0	26.0
72	2.0	55.0	2.0	58.0	30.0

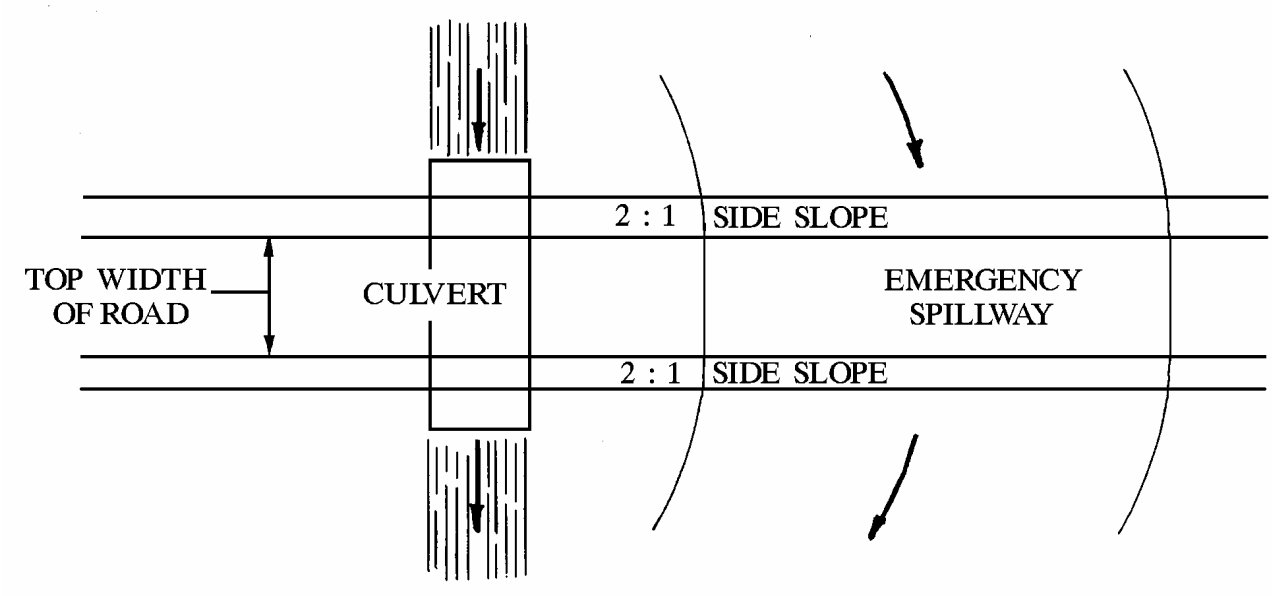
Design Assumptions:

- Entire drainage is forested
- Culverts sized for (2) year storm flow
- Emergency spillway sized for (10) year storm flow

- Inlet should be located on or below the stream bed, not above it.

- Avoid placing fill under the culvert to obtain the desired grade.





- Seat the culvert(s) and pack with clean washed stone; fill to half the diameter of the culvert and hand tamp.

- Cover culvert with a minimum of (1) foot of clean stone material or one-half the culvert diameter, whichever is greater. If adequate cover cannot be achieved, then (2) smaller culverts should be installed.

- Allow inlet and outlet ends of the culvert to extend at least (1) foot beyond the toe of the fill.

- Protect the upstream end of the fill around the culvert from erosion by placement of a rock header.

- Protect the downstream end of the fill around the culvert from erosion by seeding and mulching and providing riprap.

HAUL ROAD, SKID TRAIL, AND LOG LANDING STABILIZATION

❑ **Definition:**
Planting vegetation such as grasses and legumes on exposed mineral soil and erodible segments of truck haul roads, skid trails, or log landings.

❑ **Purpose:**
To permanently stabilize the site; to reduce damages from sediment and runoff, provide wildlife food value and habitat; enhance natural beauty; maintenance of the right-of-way is desired.

❑ **Conditions Where Practice Applies:**
Areas of exposed mineral soil that are subject to erosion and where a permanent vegetative cover is needed.

Guidelines:

- Old or new water diversion structures such as water bars, culverts, broad based dips, etc., must be operative before stabilization is initiated.

- Where feasible, prepare a seedbed by grading, removing debris, and scarifying the soil to a minimum

depth of 3 inches. When the area to be seeded has been recently loosened to the extent that an adequate seedbed exists, no additional treatment is required.

- Lime and fertilizer should be thoroughly applied to the seedbed as indicated by soil test.

  1. Lime to a pH of 6.0, but in the absence of a soil test, apply a minimum of 2 ton/acre of ground agricultural limestone (high magnesium).

  2 Fertilize at the rate of 500 pounds of 10-10-10 per acre.

- Mulch, such as straw, hay, woodchips, or bark, retains soil moisture, important for seed germination, and protects the soil surface from erosion due to runoff. Mulch can be used to: (1) promote natural revegetation or (2) protect seeds that have been spread over an area. If you seed, apply mulch immediately afterward.

- Seeded areas should be closed off from all use until cover is adequately established.

- Inspect all seeded areas for failures and make necessary repairs.
- Grasses and other herbaceous cover can stabilize bare mineral soil and minimize erosion. It is a good practice to seed disturbed areas following harvesting.

- Close off vehicle access with a gate, fence, boulders, or with a large tree felled across the road.

- Mulch seedings and anchor on slopes or where subjected to concentrated flow.

- Track in seed with a dozer whenever possible to improve germination and establishment, especially when seeding flatpea or crownvetch and on sandy, droughty sites.

Seeding Mixtures for Permanent Seedings[1]

Area/Purpose	Drainage Class	Soil pH	Shade	Appropriate Mixture[2] (lbs./Ac)	
Winter Roads Landings Wildlife	Poorly	5.0-7.5	Moderate to None	Reed Canarygrass Birdsfoot Trefoil Redtop	15 10[3] 2
Roads Trails Landings Burned Over	Excessively to Somewhat Poorly	4.5-7.5	Heavy to None	Creeping Red Fescue Tall Fescue Redtop	20 20 2
Roads Trails Landings Burned Over Brush Control	Excessively to Somewhat Poorly	5.5-7.5	Moderate to None	Flatpea Tall Fescue Redtop	20[3] 15 2

Roads Landings Wildlife	Well to Moderately Poorly	5.0-7.5	Moderate to None	Creeping Red Fescue Birdsfoot Trefoil Redtop	20 8[3] 2
Roads Landings Wildlife	Well to Moderately Well	5.5-7.5	Moderate to None	Crownvetch Tall Fescue Creeping Red Fescue Redtop	15[3] 15 10 2

[1]Seeding Dates. Seed disturbed areas as soon as possible. Seed early in the spring as soon as the ground can be worked and in the late summer - early fall based on local recommendations.

[2]Include 10-20 lbs.\ac. of winter rye when seeding after Sept. 15th. On critical areas or droughty sites, apply hay or straw mulch at the rate of 90 lbs./1000 sq. ft. Anchor mulch on steep slopes or where subjected to concentrated flow.

[3]Inoculate legumes separately with an inoculant which is specifically recommended for the legume being seeded.

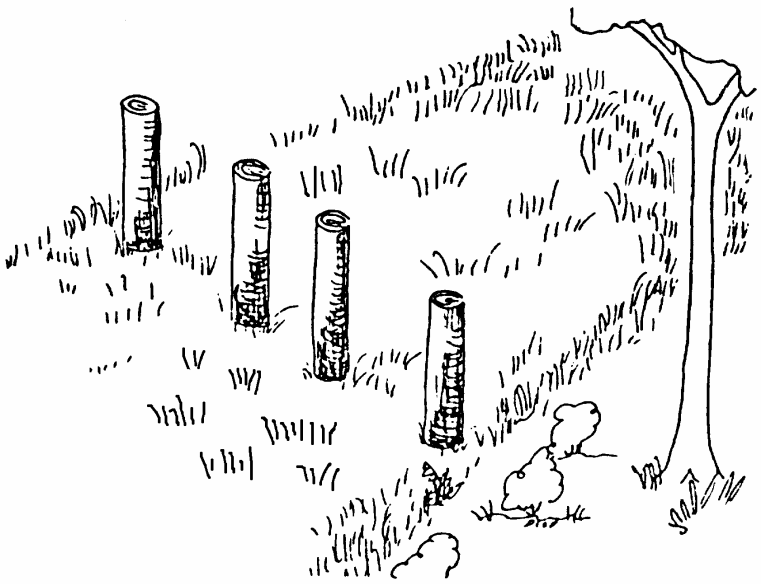
Seeding Mixtures for Temporary Seedings[1]

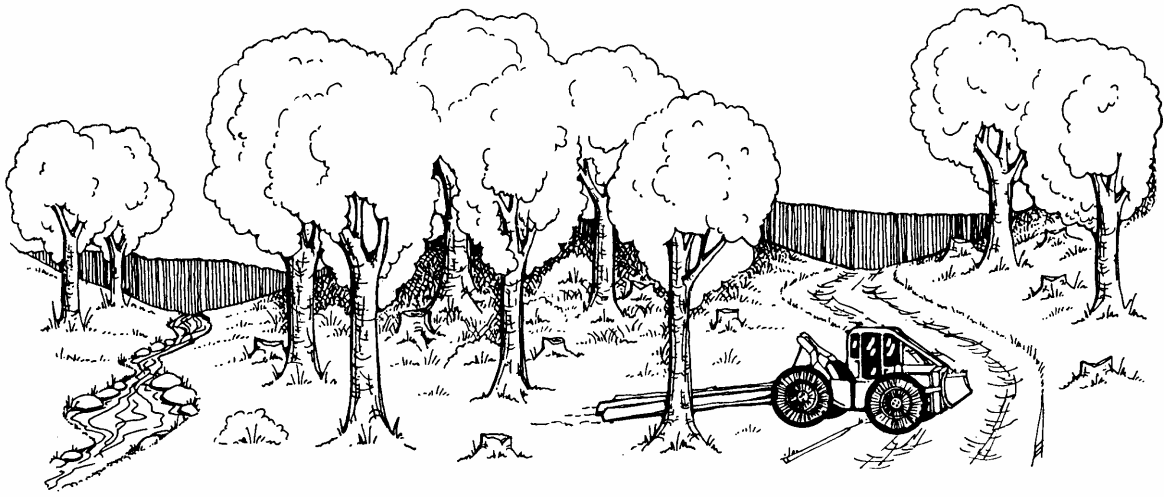
For Excessively Well to Somewhat Poorly Drained Soils

Area/Purpose	Soil pH	Shade	AppropriateMixture[2](lbs./Ac.)	
Roads Trails Landings Burned Over	4.5-7.5	Heavy to None	Creeping Red Fescue Redtop	40 2
Roads Trails Landings	5.5-7.5	Heavy to None	Annual Ryegrass	40
Roads Trails Landings Wildlife	5.5-7.5	Moderate to None	Winter Rye	112

[1]Seeding Dates. Seed disturbed areas as soon as possible. Seed as early in the spring as the ground can be worked and in the late summer - early fall based on local recommendations.

[2]On critical areas or droughty sites, apply hay or straw mulch at the of 90 lbs./1000 sq. ft. Anchor mulch on steep slopes or where subjected to concentrated flow.





WETLANDS PERMITTING

Timber harvests which involve stream or wetland crossings require a wetlands permit. The level of harvesting impacts on a wetland dictates the type of wetland permit required. There are three types of actions: minimum, minor, and major.

MINIMUM IMPACT WETLANDS PERMIT

The minimum impact wetlands permit is attached to the intent to cut form. A minimum impact wetlands permit is only allowed under the following circumstances:

- Forest management harvests only - land conversion projects require a separate dredge and fill permit;
- Wetland impacts of less than 3,000 square feet;
- Permanent culverts or rock fords which do not exceed 15 feet in width and 50 feet in length;
- Stream crossings up to 10 feet in width;
- Wetland crossings of up to 50 feet in width.

To complete the minimum impact wetlands permit, simply fill in the one page questionnaire, prepare a map of the harvest area using a USGS topographic map showing all wetland crossings and pay an

additional fee of $25. Forest harvesting can begin as soon as local officials sign the intent to cut.

EXCAVATING AND DREDGING PERMIT

If the timber harvest has minimum impacts but the land is being converted to other than non-forest uses, or if a logging operation will result in wetland impacts greater than those described above, a dredge and fill permit from the New Hampshire Wetlands Bureau will be required. Applications for these permits are available at town and county conservation district offices. Permit applications, a detailed plan, proof of notification of abutters and fees based on the square footage of impacted wetlands are required. When the application and accompanying materials are submitted to the Bureau, four copies of each must also be provided to the town clerk. The town clerk keeps one and sends the other copies to the selectmen, planning board, and conservation commission. Town clerks may charge an administrative fee of up to $10.

RSA 482-A:3 Excavating And Dredging Permit; Certain Exemptions

I. No person shall excavate, remove, fill, dredge or construct any structures in or on any bank, flat, marsh, or swamp in and adjacent to any waters of the state without a permit from the wetlands board. The permit application together with a detailed plan and a map showing the exact location of the proposed project, along with 4 copies of the permit application, plan and map, shall be submitted to the town or city clerk, accompanied by a filing fee in the form of a check made out by the applicant to the New Hampshire wetlands board. The permit application fee shall be $50 for minimum impact projects. Fees for minor and major projects shall be assessed based on the area of dredge or fill proposed and the number of boat slips requested. The rates shall be $100 per boat slip and $0.025 per square foot. At the time the permit application is submitted to the city or town clerk, the applicant shall provide postal receipts or copies, verifying that abutters, as defined in the rules of the wetlands board, and except as further provided in said rules, have been notified by certified mail. The postal receipts or copies shall be retained by the municipality. The town or city clerk shall immediately sign the application and forward by certified mail, the application, plan, map and filing fee to the wetlands board. The town or city clerk shall then immediately send a copy of the permit application, plan and map to the local governing body, the municipal planning board, if any, and the municipal conservation commission, if any, and may require an administrative fee not to exceed $10 plus the cost of postage by certified mail. One copy shall remain with the city or town clerk, and shall be made reasonably accessible to the public. The foregoing procedure notwithstanding, applications and fees for projects by agencies of the state may be filed directly with the wetlands board, with 4 copies of the application, plan and map filed at the same time with the town or city clerk to be distributed as set forth above.

MINIMUM SHORELAND PROTECTION STANDARDS

RSA 483-B:9

V. The following minimum standards shall apply to the protected shoreland provided that forestry, involving water supply reservoir watershed management or agriculture conducted in accordance with best management practices, shall be exempted from the provisions of this chapter:

(a) Natural Woodland Buffer

(1) Where existing, a natural woodland buffer shall be maintained within 150 feet of the reference line. The purpose of this buffer shall be to protect the quality of public waters by minimizing erosion, preventing siltation and turbidity, stabilizing soils, preventing excess nutrients and chemical pollution, maintaining natural water temperatures, maintaining a healthy tree canopy and understory, preserving fish and wildlife habitat, and respecting the overall natural condition of the protected shoreland.

(2) Within the natural woodland buffer of the protected shoreland under conditions defined in RSA 483-B:9,V the following prohibitions and limitations shall apply:

(A) Not more than a maximum of 50 percent of the basal area of trees, and a maximum of 50 percent of the total number of saplings shall be removed for any purpose in a 20-year period. A healthy, well-distributed stand of trees, saplings, shrubs and ground covers and their living, undamaged root systems shall be left in place.

(B) [REPEALED 1992, 235:28, I.]

(C) Trees, saplings, shrubs and ground covers which are removed to clear an opening for building construction, accessory structures, septic systems, roadways, pathways, and parking areas shall be excluded when computing the percentage limitations under subparagraph (a)(2)(A).

(D) Dead, diseased, unsafe, noxious or fallen trees, saplings, shrubs, or ground cover may be removed. Their removal shall not be used in computing the percentage limitations under subparagraph (a)(2)(A).

(E) Stumps and their root systems which are located within 50 feet of the reference line shall be left intact in the ground.

(F) Dead and living trees that provide dens and nesting places for wildlife are encouraged to be preserved.

(G) Planting efforts that are beneficial to wildlife are encouraged to be undertaken.

ALTERATION OF TERRAIN

An alteration of terrain permit application must be filed if the harvest is being done to clear and stump land for non-forest uses. The permit is required if and more than 100,000 square feet (a little more than 2 acres) or 50,000 square feet in the shoreland protection zone (RSA 483-B:9, V) of land are affected. Alteration of Terrain permits are available at county conservation district offices and the Water Supply and Pollution Control Division of the New Hampshire Department of Environmental Services (DES).

485-A:17 Terrain Alteration

I. Any person proposing to dredge, excavate, place fill, mine, transport forest products or undertake construction in or on the border of the surface waters of the state, and any person proposing to significantly alter the characteristics of the terrain, in such a manner as to impede the natural runoff or create an unnatural runoff, shall be directly responsible to submit to the division detailed plans concerning such proposal and any additional relevant information requested by the division, at least 30 days prior to undertaking any such activity. The operations shall not be undertaken unless and until the applicant receives a permit from the division. The division shall have full authority to establish the terms and conditions under which any permit issued may be exercised, giving due consideration to the circumstances involved and the purposes of this chapter, and to adopt such rules as are reasonably related to the efficient administration of this section, and the purposes of this chapter, Nothing contained in this paragraph shall be construed to modify or limit the duties and authority conferred upon the division of water resources under RSA 482 and RSA 482-A.

II. The division shall charge a fee for each review of plans, including project inspections, required under this section. The fee shall be based on the extent of contiguous area to be disturbed. Except for RSA 483-B:9, the fee for plans encompassing an area of at least 100,000 square feet but less than 200,000 square feet shall be $100. For the purposes of RSA 483-B:9, the fee for plans encompassing an area of at least 50,000 square feet but less than 200,000 square feet shall be $100. An additional fee of $100 shall be assessed for each additional area of up to 100,000 square feet to be disturbed. No permit shall be issued by the division until the fee required by this paragraph is paid. All fees required under this paragraph shall be paid when plans are submitted for review and shall be deposited in the treasury as unrestricted funds.

III. Normal agricultural operations shall be exempt from the provisions of this section. The division may exempt other state agencies from the permit and fee provisions of this section provided that each such agency has incorporated appropriate protective practices in its projects which are substantially equivalent to the requirements established by the division under this chapter. Timber harvesting operations shall be exempt from the provisions of this section. Permits shall be granted for timber harvesting operations provided that the department of revenue administration's intent to cut form is completed.

485-A:32 Prior Approval; Permits

III. No person required to submit subdivision plans pursuant to paragraph I shall commence the construction of roads within the lot, tract or parcel proposed to be subdivided, by clearing the land thereof of natural vegetation, placing any artificial fill thereon, or otherwise altering the land, nor shall he do any other act or acts which will alter the natural state of the land or environment, unless the subdivision plan relating thereto has been submitted and approved in accordance with the requirements of this chapter. Nothing in this paragraph shall be construed to prevent the taking of test borings, the digging of test pits, or any other preliminary testing and inspection necessary to comply with the requirements of the division of water supply and pollution control relative to information necessary for review and approval of the subdivision plans.

REFERENCES

Barto, J. and Babcock, E.J., *Forest Laws of New Hampshire*, 1984, Society for the Protection of New Hampshire Forests, Concord, New Hampshire.

Brown, Darlene B., *Best Management Practices for Silvicultural Activities in Pennsylvania's Forest Wetlands*, 1993, Pennsylvania State University and Pennsylvania Hardwood Development Council, State College, Pennsylvania.

Clinch, B. and Logan, B., *Montana Forestry Best Management Practices*, 1991, Montana Department of State Lands, Missuola, Montana.

Finlay, J.C. Brandt, R.C., Clifton, W., and Piper, R., *Controlling Erosion and Sedimentation from Timber Harvesting Operations*, 1986, Pennsylvania State University, Cooperative Extension Service, University Park, Pennsylvania and The Commonwealth of Pennsylvania, Department of Environmental Resources, Harrisburg, Pennsylvania.

Goodhue, S., *Twelve Ways to Reduce Soil Erosion and Stream Pollution on Logging Jobs*, 1975, New Hampshire Division of Forests and Lands, Department of Resources and Economic Development, Concord, New Hampshire.

Goodhue, S., Kinder, R., and Stuart, G., *Timber Harvesting Practices for Controlling Erosion*, 1979, New Hampshire Water Supply and Pollution Control Commission, Concord, New Hampshire.

Hartung, R.E., and Kress, J.M., *Woodlands of the Northeast - Erosion and Sediment Control Guides*, 1977, USDA Soil Conservation Service, NETSC, Broomall, Pennsylvania and USFS State and Private Forestry, Upper Darby, Pennsylvania.

Haussman, R.F., and Pruett, E.W., *Permanent Logging Roads for Better Woodlot Management*, 1978, USDA Forest Service, State and Private Forestry, Broomall, Pennsylvania.

Holaday, Steve, *Wisconsin's Forestry Best Management Practices for Water Quality - Field Manual*, 1995, Wisconsin Department of Natural Resources, Bureau of Forestry, Madison, Wisconsin.

Kent, B., Nelson, K., Todd, F., *The Land Use Handbook - Section 6, Erosion Control on Logging Jobs*, 1981, Land Use Regulation Commission, Department of Conservation, Augusta, Maine.

Kittredge, David B., Jr., and Parker, Michael L., *Massachusetts Best Management Practices Timber Harvesting Water Quality Handbook*, 1989, University of Massachusetts Cooperative Extension, Amherst, Massachusetts.

Kochenderfer, J.N., Wendel, G.W. and Kidd, W.E. Jr., *Woodlot Management: Building Roads*, 1987, West Virginia University, Extension Service, Parsons, West Virginia.

Lants, R.L., *Guidelines for Stream Protection in Logging Operations*, 1971, Oregon State Game Commission, Portland, Oregon.

Magee, Dennis W., *Freshwater Wetlands - A Guide to Common Indicator Plants of the Northeast*, 1981,The University of Massachusetts Press, Amherst, Massachusetts.

Mississippi Forestry Association, *Mississippi's Best management Practices Handbook*, 1989, Jackson, Mississippi.

McEvoy, T., *Proceeding - Forest Water Qaulity and Erosion Control in Vermont*, 1986, School of Natural Resources, UVM, Burlington, Vermont.

Murphy, A. and Connick, J., *Forest Transportation Systems - Roads and Structures Manual*, 1985, Seven Islands Land Company, Bangor, Maine.

Paff, W.D., *Lean Streams Handbook for Loggers*, 1982, West Virginia Department of Natural Resources, Charleston, West Virginia.

State of Florida, *Silviculture - Best Management Practices*, 1993, Florida Department of Agriculture and Consumer Services, Tallahassee, Florida.

State of Maryland, *Forest Harvest Access Practices*, 1988, Department of Natural Resources, Forest Park and Wildlife Service, Annapolis, Maryland, Maryland Forest Association, Salisbury, Maryland, Maryland Lumbermen's Association, Baltimore, Maryland.

State of Maryland, *Maryland's Guide to Forest Harvest Operations and Best Management Practices*, 1992, Department of Natural Resources, Resource Conservation Service, Annapolis, Maryland.

State of Maryland, *Soil Erosion and Sediment Control Guidelines for Forest Harvest Operations in Maryland*, 1993, Department of Natural Resources, Annapolis, Maryland.

State of Minnesota, *Water Quality in Forest Management - "Best Management Practices in Minnesota"*, 1989, Minnesota Department of Natural Resources, Division of Forestry.

State of Minnesota, *Protecting Water Quality and Wetlands in Forest Management: Best Mangement Practices in Minnesota*, 1995, Minnesota Department of Natural Resources, Division of Forestry.

State of New Hampshire, *Information on Timber Harvesting Laws in New Hampshire*, 1986, New Hampshire Division of Forests and Lands, Department of Resources and Economic Development, Concord, New Hampshire.

State of Texas, *Texas Best Management Practices for Silviculture*, 1993, Texas Forestry Association, Lufkin, Texas.

State of Texas, *Forestry Best Management Practices for Water Quality - Circular 286*, 1993, Texas Forest Service, College Station, Texas.

State of Vermont, *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*, 1987, Department of Forests, Parks, and Recreation, Waterbury, Vermont.

Tiner, Ralph W. Jr., *Field Guide to Nontidal Wetland Identification*, 1988, Institute For Wetland and Environmental Education and Research, Sherborn, Massachusetts.

U.S. Fish and Wildlife Service, *List of Plant Species That Occur in Wetlands: Northeast (Region 1),* Biological Report 88(26.1), 1988 - 1995 Supplement, Hadley, Massachusetts.

Van Ryn, Tammara, *A Guide to the Forest Laws of New Hampshire*,1995, Society for the Protection of New Hampshire Forests, Concord, New Hampshire.