FOREST TRAILS AND LANDINGS

Rhode Island Conservation Practice Job Sheet 655

Example of temporary access trail.

Definition

Forest trails and landings are routes, travel ways, or cleared areas within a forest to provide access on a periodic basis. Generally, forest trails are used to carry or drag trees to the landing while a forest road is used to transport logs, firewood, etc. from the landing to a public road. Landings are cleared or open areas where trees are sorted and processed.

Criteria

This practice will be used to minimize on and off-site damage to resources, including forest soils and water bodies, by controlling erosion on forest trails and landings. This will often require the use of heavy equipment to shape trails or install structural measures to manage runoff and reduce soil erosion and sedimentation. Water flows will be controlled using techniques such as waterbars, crowning, rolling (broad-based) dips, insloping and outsloping, and culverts. Areas of exposed soil must be seeded and mulched within the stream protective buffer strip for maintaining water quality on logging jobs. Trails that do not concentrate water and have adequate cover usually do not require treatment. New plantings must be protected from traffic with some form of use exclusion.

Purpose

- Provide infrequent access to forest stands for management activities
- Provide periodic access for removal and collection of forest products.
- Minimize on-site and off-site damage to resources during periods of access by controlling erosion during construction, use, and upon completion of use.

Waterbars

Waterbars are one of the most basic and commonly used forest practices to minimize erosion on forest trails (Figure 1). Waterbars shall be installed at a downslope angle of 30 degrees or less depending on the grade of the trail (Figures 1 & 4). Steeper trail grades require less downslope angle. Waterbars shall be at least 8” deep and installed with a 2-4 degree gradient when ledge and rock permit. Deep waterbars (24-30”), should be used on roads that will be closed to traffic.

The outlet of the waterbar should drain at a slight outslope away from the road and onto undisturbed litter or vegetation. Waterbars can be constructed with hand tools, but bulldozers are most commonly used. It is best to start at the end of the forest trail and work toward the landing so that completed work is not damaged by the construction equipment. Waterbars and dips should be created by digging into soil by a bulldozer pushing downhill.

Waterbars and other drainage measures should be spaced according to Table 1 as outlet conditions allow.

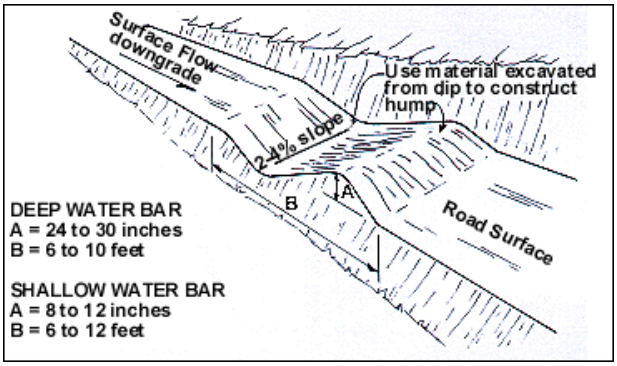


Figure 1. Water bars are narrow structures that may be shallow or deep. Deep water bars are usually used on roads that will be closed for extended periods (USFS).

Table 1 - Recommended Distances Between Drainage Structures on Logging Roads

% Road Grade	Distance Between Water Bars (feet)	Distance Between Culverts (feet)	Distance Between Culverts, Dips, & Deflectors (feet)
1	400	450	500
2	250	300	300
5	135	200	180
10	80	140	140
15	60	130	130
20	45	120	120
25	40	65	-
30	35	60	-
40	30	50	-

Outsloping

Outsloping a road means building the road surface so that it is tilted outward 4-6 percent so water can run off the road surface. Outsloping works well on moderate slopes with short back slopes (above the road). Outslopes become a problem if maintenance is not performed or when ruts begin to form. The ruts will then act as channels. The following conditions are favorable for use of outsloped roads with no ditch:

- Short back slopes (above road)
- Terrain slope less than 20 percent
- Road grades steeper than 3 percent
- Seasonal road use
- Light traffic
- Fast revegetation of cut and fill slopes.

Insloping

Insloping a road means building the road surface so that it is tilted inward towards the slope of the land 4-6 percent so that water can run off the road and collect in a shallow ditch. At the first opportunity available, the ditch is turned out into a vegetated buffer area to prevent runoff from coming back onto the road. If physical constraints prevent this, install cross-drainage structures on the road. The following conditions are favorable for use of insloped roads with ditch section:

- Long and/or steep back slopes
- Terrain slope greater than 20%
- Areas with fine textured soils
- Winter logging
- Areas where drainage is necessary.

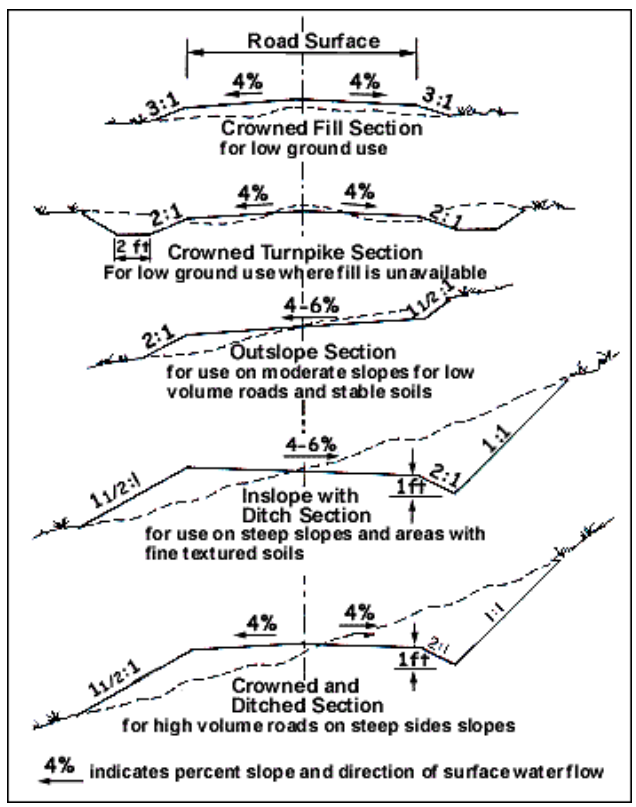


Figure 2. The choice of cross-section for a road or section of a road depends on drainage needs, soil stability, slope, and expected traffic volume. Dashed lines indicate natural land contours, and solid lines indicate constructed road. (USFS).

Crowning

To crown a road means to create a high point that runs lengthwise along the center line of the road. Either side of this high point is sloped at a 4% grade away from the center toward the outer edge of the road. Surface runoff is diverted into a vegetated buffer area or a ditch.

Rolling (Broad-based) Dips

Broad-based dips are shallow, wide diversions usually constructed on forest roads but may also be used on trails having a gradient of less than 10 percent. Proper construction usually requires a trained equipment operator. Dips can be constructed with a bulldozer or excavator by cutting a few feet out of the skid trail and bulldozing a fill area to build up grade on the lower side. Spacing of dips used for drainage shall be determined according to Table 1.

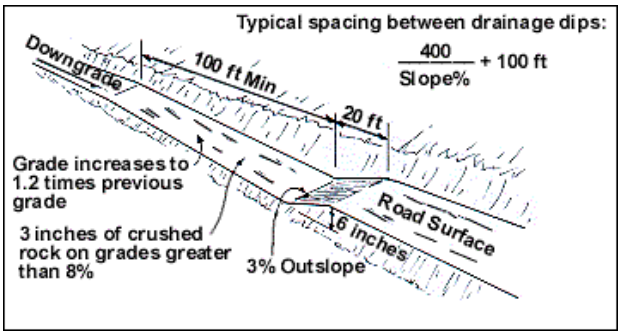


Figure 3. Drainage dips are broad structures used on roads with grades of 10 percent or less. (USFS)

Ditches and Culverts

Ditches and culverts are primarily associated with forest roads but they may also be used on larger forest trails depending on the topography and frequency of use. Pipe culverts are used to move water under the road before it gains sufficient flow to erode the ditch on the uphill side of the road.

Spacing of culverts used for ditch drainage shall be determined according to Table 1. (above). Culverts should be installed at a 30 degree angle down grade, should angle downhill at least 4 degrees when ledge and rock permit for self-cleaning and should outlet onto rock, gravel or logs to dissipate energy. A minimum of 12 inches of soil should be used to cover culverts. Use NRCS design procedures for sizing culverts. Ditches should be properly stabilized.

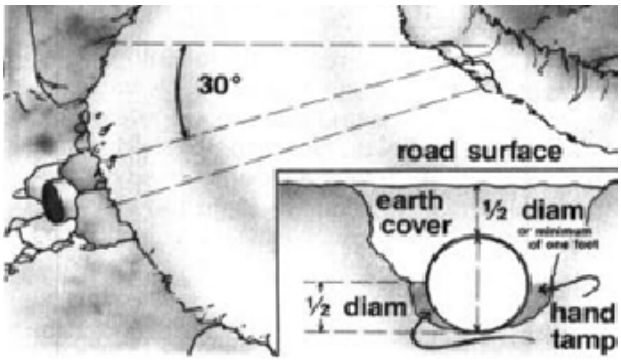


Figure 4.Culvert must be at a 30° angle vs. the road and topped with ½ diameter of Earth Cover.

Open Top and Pole Culverts

Open top and pole culverts can be used in place of any of the above-mentioned road drainage methods except outsloping. Open top culverts and pole culverts are inexpensive and easy to construct. They work well when maintained, but are easily filled with sediment and rendered ineffective within a short period of time when not maintained. **Open top and pole culverts are not recommended for crossing live or intermittent streams**, and should not be used in lieu of pipe culverts. They are recommended for ongoing operations only, and should be removed upon completion of activities. Spacing of culverts used for ditch drainage shall be determined according to Table 1.

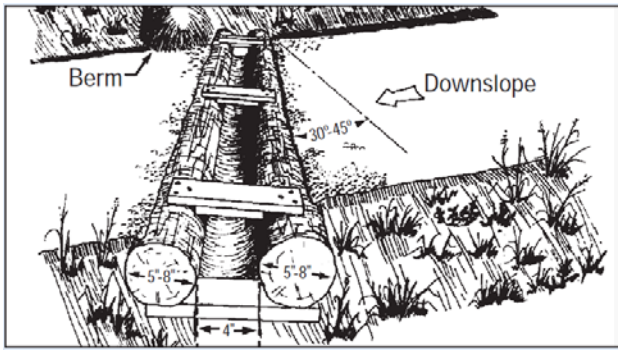


Figure 5. Installed view of log culvert. Open Top Culverts require a high level of maintenance. See References for more information.

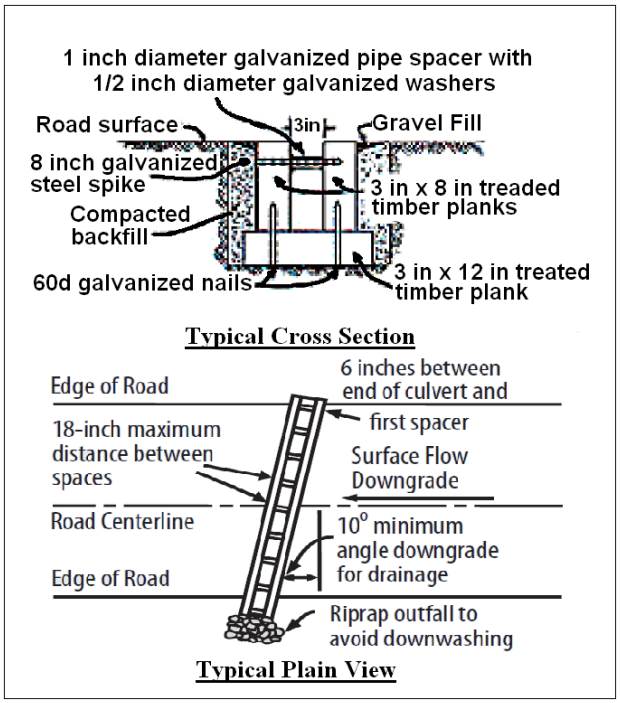


Figure 6. For an open-top culvert to function properly, careful installation and regular maintenance are necessary. (USFS)

Deflectors

The water deflector is a low cost, low maintenance method to deflect surface water from a roadway, which works as well as an open top culvert. It is generally used on low volume and low maintenance forest roads as it will not withstand skidding of logs.

The deflector is simply a piece of rubber belting 5/16 inch to ½ inch thick fastened between treated timbers. Different widths of belting can be used depending on availability. The timbers are installed in the same way as an open top culvert. The only thing showing above the road surface is 3 inches of belting, which deflects the water from the road surface.

Because there is no abrupt grade change, water deflectors can be used on grades over 10 percent. On roads where farm equipment may have some trouble negotiating broad-based drainage dips, water deflectors would pose no difficulty. Spacing of deflectors shall be determined according to Table 1.

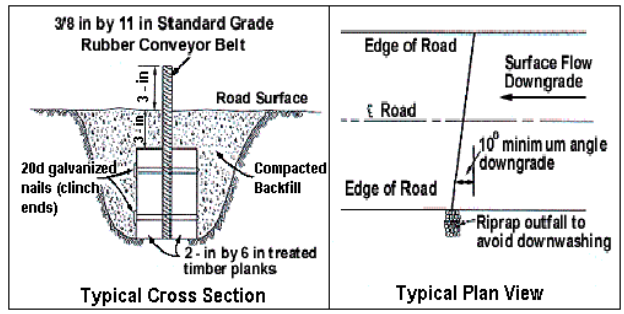


Figure 7. Water deflectors are installed so that only 3 inches of belting extend above the road surface to turn water aside. (USFS)

Corduroy Crossings

Corduroy crossings are useful on most wetland soils and wet areas on a haul road with road grading up to 4 percent. They are simple low cost construction that increases the load bearing of an area and can be made from on-site materials. It is generally recommended to cover the crossing with nonwoven geotextile which prevent material from mixing with the soil below it, yet allow will water to flow through. Size individual pieces of corduroy to meet anticipated loads, soil strength, and installation equiptment. Use longer corduroy on very weak soils that have a low bearing strength (e.g., muck or peat), to spread the weight over a large area. Layer the material for additional strength if needed.

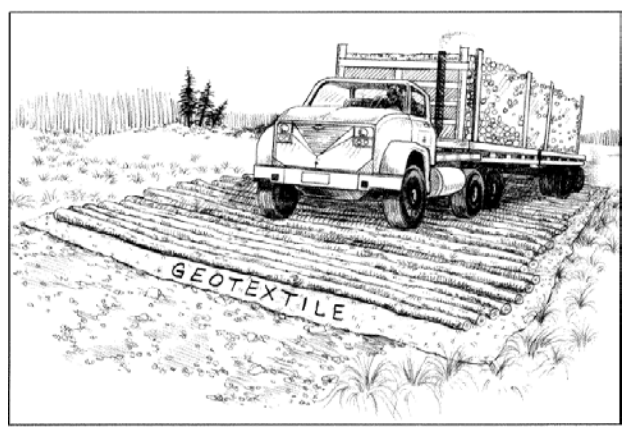
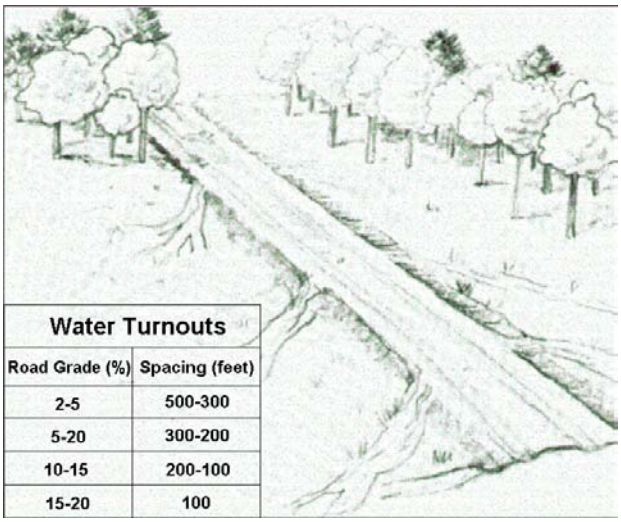


Figure 8. Corduroy Crossings are beneficial to wetland health and minimize the impact of hauling operations.

Water Turnouts

Water turnouts should be used whenever you have a safe outlet site for excess water to flow from the road. Adding brush barriers or riprap at the dispersal area will help absorb heavy flow and filter sediment from the run off. Turn-outs should be placed at the exit side of every drainage outlet and every opportunity along the road. For spacing see chart in Figure 9.



Water Turnouts

Road Grade (%)	Spacing (feet)
2-5	500-300
5-20	300-200
10-15	200-100
15-20	100

Figure 9. The size of turnouts should be at least as wide at the entrance to the turn-out as the width of the water bar or ditch that feeds water into it. This prevents any bottleneck in the flow of water from the water bar or ditch to the turn-out.

Rock riprap

Rock riprap is often used to protect critical areas from erosion. They may be equipment placed or stacked & pinned depending on design requirements. Rock riprap is required for complimentary use with, waterbars, deflectors, culverts, dips and turnouts on the down slope edge to protect critical areas from erosion. See example Fig. 10

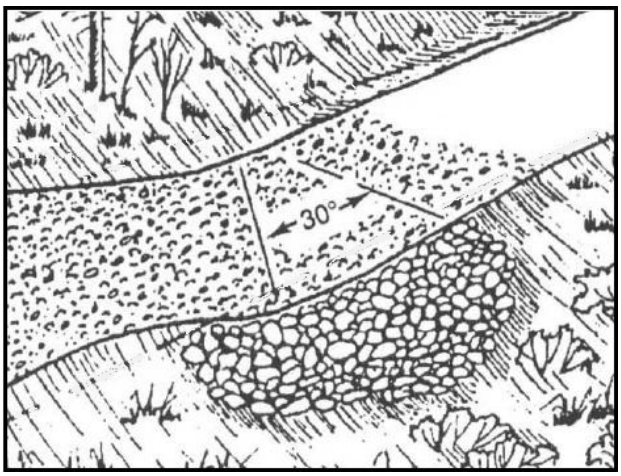


Figure 10. Ripraps should be installed in conjunction with drainage structure or where applicable.

Landings

Landings are areas where forest products are collected for processing, loading, transport and are one of the most visible and impacted parts of any timber harvest. If landings are not properly located and maintained the concentration of activities may cause compaction, erosion or sedimentation.

Locate landings on firm, well-drained soils with a slight slope (not to exceed 6%), or crown, to promote efficient drainage. Locate residue piles such as slash, sawdust or chips away from drainages where runoff may wash residue into streams, lakes or wetlands.

Figure 11. Example of a restored landing. Graded, seeded, mulched and fertilized.

Operation and Maintenance

Upon completion of logging, temporary measures should be eliminated or replaced with permanent bars, trails properly graded and out sloped if needed, and the entire disturbed area seeded following the recommendations on the attached specifications sheet. Trails should be inspected during the establishment period to ensure that drainage systems and structures for water control are properly functioning and that vegetation has attained full coverage where specified.

Wildlife Considerations

Abandoned trails and landings offer an opportunity to provide additional wildlife habitat such as "bugging" areas for birds and shrubs for food (browse, soft mast, etc.) and nesting cover. Areas selected for wildlife plantings may include log landings and gently sloping sections of trails with open canopy where the soil is suitable for establishing vegetation with normal farming practices. Log landings may be managed as early successional habitats.

References :

- A Landowner's Guide to Building Forest Access Roads. USFS.
- RI Conservation Management Practices Guide Book
- RI Soil Erosion and Sediment Control Handbook
- WI Forest Management Guidelines
- Connecticut Best Management Practice
- RIDEM-Division of Forest Environment

For:	***Tract #:*** ***Land Unit(s):***
Designed By:	***Approved By:*** ***Signature:***
Date:	***Date:***

Purpose	
Forest Management Logging	Wildlife Habitat Erosion Control

Practice Use Matrix						
	Open Top Culvert	**Deflectors**	**Water Bars**	**Water Turnoffs**	**Broad Base Dips**	**Corduroy Crossings**
Trail Life/Use						
Permanent Seasonal		x	x	x	x	
Temporary	x	x	x			x
Road Grade (Slope %)	10-45	10-30	2-30	20-30	2-10	2-4
Riprap Required	x	x	x	x	x	

Layout and Dimensions – Indicate treatment for each separate section of forest trail				
Site #	Section ID	Length feet	% Grade	Prescription – Include number (e.g. waterbars), spacing, type (e.g. culvert), size, cut and fill, width and length depending upon treatment)

Additional specifications:

Is a Permit required?	If Yes, has it been obtained?
Permit Number:	Type:

Plant Materials Information

Species	Seed lbs./ac. or lbs./ 1000Ft.^{2}	Lime Lbs./ac. or lbs./ 1000Ft.^{2}	Fertilizer lbs./ac. or lbs./1000Ft.^{2}	Mulch lbs./ac. or lbs./1000Ft.^{2}	Planting Dates

Additional planting specifications:

Site Preparation & Planting Method

Operation & Maintenance Requirements

Inspect trails periodically to be sure the measures are functioning as intended. If problems are found, take corrective actions to maintain the measures.