Alpena-Montmorency Conservation District

DIVERTING WATER FROM WOODLAND ROADS

FOREST STEWARDSHIP MANAGEMENT NOTE #6

INTRODUCTION

Soil erosion and sedimentation of streams are arguably the worst environmental impacts of logging, and poor road design is the main cause of these problems. Runoff problems can often be avoided in the first place by careful route selection (FSMN #5), but roads must sometimes be built in less-than-ideal locations. In such cases, roads should be constructed using one or more of the many techniques that are available for diverting water from the roadbed. If proper techniques are used, logging roads need not cause environmental problems (#7). To be sure road work is properly done, landowners should insist that specifications be clearly spelled out in a written contract (FSMN #18).

This Note summarizes the primary techniques available for diverting or otherwise dealing with water on woodland roads and explains the situations in which they are applicable. Further sources of information are listed.

FILLING WET SPOTS

1. GRAVEL - Minor wet spots may be cured by simply spreading gravel. By filling holes and raising the roadbed, gravel can help keep water off roads. Gravel also reduces rutting by increasing water infiltration and by improving traction. Ideally, the gravel should contain few rocks larger than 3 inches in diameter (i.e., No. 2 gravel). However, if gravel can be obtained on the landowners' property at substantially reduced cost, lower quality gravel is often acceptable.

   Where ruts are to be filled, care should be taken to disturb firm soil as little as possible. However, it is best to dig out loose and/or mucky soil before placing gravel. "Geotextile mats" (special fabric for construction purposes) can provide an effective and inexpensive solution for wet, muddy roads (#5,9,11). The use of geotextile mats strengthens soft areas that cannot be completely dug out and allow up to 50% less gravel to be used.

2. WOOD - Logs and/or brush cut on site can also be used to fill wet spots, but this approach does not improve drainage and is only temporary.

GRADING ROADBEDS TO DRAIN WATER

1. OUTSLOPING the entire width of the road slightly (1/4 to 3/8 inches per foot of width) toward the downhill side is a good way to drain roads if steep slopes and/or slippery conditions will not cause hazards to vehicles.

2. INSLOPING the entire width of the road toward the uphill side can also drain road surfaces and provide safer driving conditions, but side ditches on the uphill side and relief culverts that discharge collected water across the road to the downhill side are needed (see below) unless the roadbed is very pervious.

3. CROWNING the road so the center is higher than the sides can be used to force water into stabilized vegetation or ditches on flat ground where other methods will not work.

Illustrations and detailed specifications regarding outsloping, insloping, and crowning are available from the Michigan Department of Natural Resources (#8 page 20, #9).

4. BROAD-BASED DIPS are gradual breaks in the lengthwise grade of the road that force collected water to run off to the side without hindering vehicles.

5. WATER BARS are steep, ditch-and-bump structures angled across the road that force collected water to run off to the side. They are a cheaper and easier create than broad-based dips, but they hinder vehicles and generally only suitable for little-used roads.

Illustrations and detailed specifications regarding broad-based dips and water bars are available from the Michigan Department of Natural Resources (#8 pages 21-25, #9).

DITCHES

1. SIDE DITCHES can be used on the uphill side of roads to intercept runoff and seepage from upslope or to collect water from insloped roads (as described above). Such ditches require relief culverts to discharge collected water under the road (see below). Illustrations and detailed specifications regarding side ditches are available from the Michigan Department of Natural Resources (#8 page 20, #9).

2. DIVERSION DITCHES, also called water turnouts, serve to channel water directly off the roadbed or out of side ditches. The runoff water can be filtered through brush, spread over vegetation, or allowed to infiltrate slowly from dugout collecting basins where the terrain is level. On steep slopes, diversion ditches may need to be stabilized with rock or other resistant material. Ditches should not flow directly into streams. Illustrations and detailed specifications regarding diversion ditches are available from the Michigan Department of Natural Resources (#8 pages 31-32, #9).

CULVERTS

1. OPEN-TOP CULVERTS - Open-top culverts are relatively inexpensive to make from lumber (box culvert) or small logs (pole culvert) and easy to install. Where water volumes are low, such as in side ditches, they are more cost-effective than closed pipe culverts. And because they are flush with the road surface, they can be used over shallow bedrock with much less fill than can pipe culverts, which must be well buried. If purchased wood is used, it should be pressure-treated. If site-cut poles are used, try to use decay-resistant species such as cedar (FSMN #23). The design is flexible as long as the result is functional and durable.

   Install culverts at a grade of not less than 1/2 inch per foot to prevent clogging and at an angle across the road of about 30 degrees (outlet downgrade about 1/2 the road width) to provide a better entrance for runoff and to facilitate vehicle crossing. Thus, for a 12-foot roadway, the total length of the culvert should be about 16 feet. The outlet should be protected from erosion with an apron of rock (rip rap). Open-top culverts must be cleaned out periodically.

   Illustrations and detailed specifications regarding open-top culverts are available from the Michigan Department of Natural Resources (#8 pages 29-31, #9).

2. PIPE CULVERTS - Buried pipe culverts are a more permanent, but more expensive, means of directing water under roads. Corrugated metal pipe is stronger, more permanent, and more expensive than plastic pipe. To be effective, either type must be properly sized and installed (#2-4,6,13). Road drainage culverts should aligned 30-45^{o} across the road and should slope 2-4% downgrade to reduce clogging. Culverts should be long enough so both ends extend 1 foot beyond the side slopes of the road. Erosion protection (rip-rap, etc.) is required at the outflow and sometimes the inflow. Culverts should be buried 1/2 the diameter of the pipe or a minimum of 1 foot.

   Illustrations and detailed specifications regarding pipe culverts are available from the Michigan Department of Natural Resources (#8 pages 26-29, #9).

REFERENCES

FSMN #'s refer to other Forest Stewardship Management Notes in this series.

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#7 Martin, C.W. and J.W. Hornbeck. 1994. Logging in New England need not cause sedimentation of streams. Northern Journal of Applied Forestry 11(1):17-23.

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