ROLLING DRAIN DIP

State Forester Forum

Purpose and Application

Rolling drain dips are installed in secondary roads to reduce road surface and fill slope erosion by intercepting storm and seasonal runoff and diverting it to a safe disposal area. Dips provide temporary or permanent drainage control on roads where grades do not exceed 8 percent. When properly installed, they do not increase wear on vehicles and will accommodate speeds up to 10 miles per hour.

Dips are commonly used on low standard outsloped roads, but can be used on insloped sections if proper inside ditches and cross drain culverts are installed. The bottom of dips should be oriented at a right angle to the road centerline and should have a slope of 2 to 3 percent to be self-cleaning.

Rolling drain dips are normally built into the road at the time of construction as a permanent drainage feature, suitable for continued traffic over a long-term management period. They are more costly to build than cross-ditches. Rolling drain dips should not be confused with cross-ditches which are put in a road after temporary use and/or closure. Cross-ditched roads are only suitable for occasional or rare vehicle use.

Rolling Drain Dip Options

There are two basic kinds of construction for rolling dips; depending on vehicle use, road grade and surface erosion potential.

Option A: On road grades exceeding five percent where intended road use does not include low-clearance vehicles and long low-clearance trailers or recreation vehicles, the shorter more abrupt dips illustrated as Option A can be used.

Option B: On road grades less then or equal to 5 percent, and roads where long low-clearance vehicles and trailers will be used, the dips constructed with sag and crest vertical curves, nearly equal in length, can be used. This type of dip is described by B. W. Kramer (2001) and illustrated as Option B on page 3. Driving downhill into the sag curve, the point of cross drain is approximately 70 feet from the uphill start of the structure. The easy roll of the structure then extends downhill up to an additional 140 feet with a crest curve about 100 feet long at the lower end.

Planning Considerations

1. Rolling drain dips can be used as the primary drainage system on low standard roads and may be mixed with outsloped or insloped systems. Crowned roads with engineered ditches, berms and culvert or other cross-drain systems do not need rolling dips except as supplemental, special locality features.
2. When the road is intended to accommodate long, low-clearance trailers, low boys or recreational vehicles, use the long dimensions with careful control of the cross-drain depth.
3. If the soils at the planned dip location are soft and of low strength, which are subject to rutting and displacement by the intended traffic, woven geotextile fabric and rock lift surfacing are needed to protect the entire structure. Dip structures with soft, low-strength soils lacking a mix of native rock can also be obliterated by maintenance blading if allowed to become dry/dusty in summer or when unfrozen in winter. Rock armoring is advisable.

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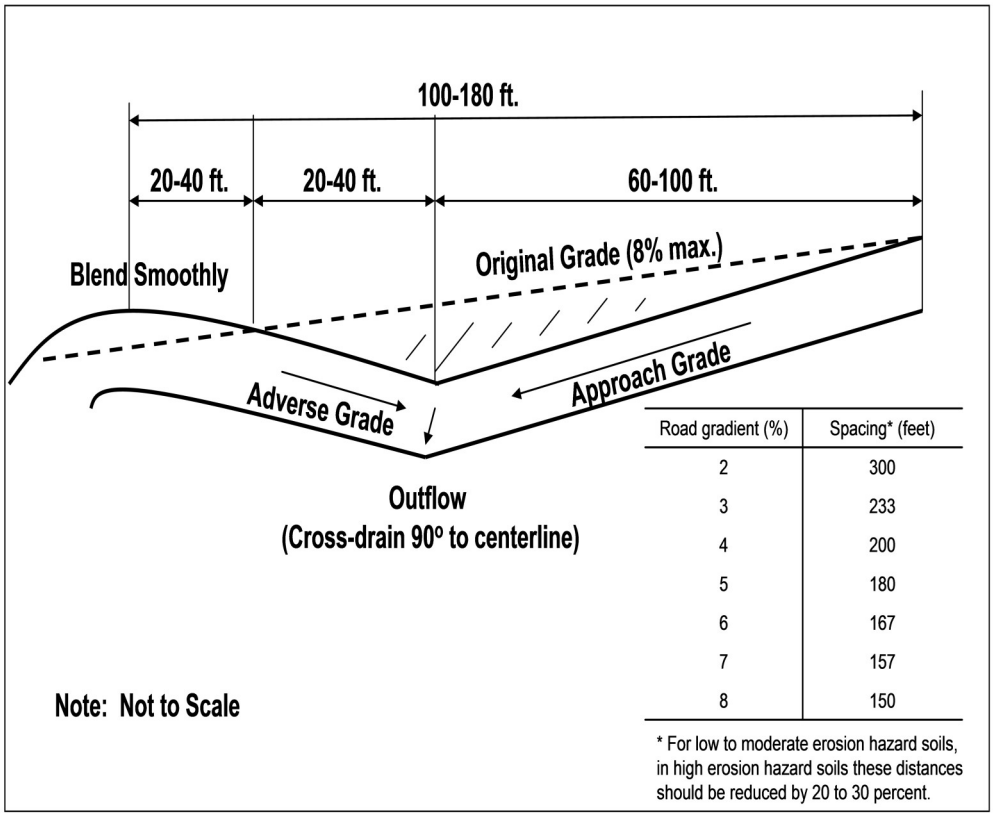
OPTION A: Rolling Drain Dip profile



Road gradient (%)	Spacing* (feet)
2	300
3	233
4	200
5	180
6	167
7	157
8	150

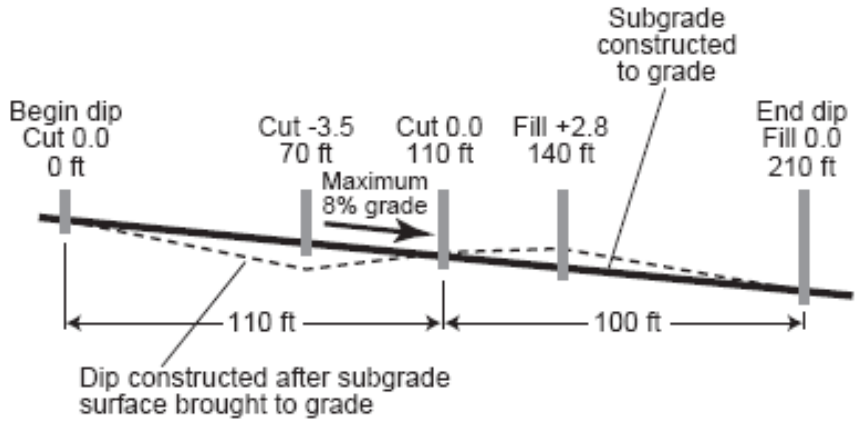
* For low to moderate erosion hazard soils, in high erosion hazard soils these distances should be reduced by 20 to 30 percent.

4. It is important that cross-drains be oriented at right angles (90 degrees) relative to the road centerline to maintain vehicle speeds of up to 10 mph and to eliminate twisting strain on vehicle axles, frames and loads. The cross-drain should slope across the entire road at 3 percent, which is about 6 inches on a 16-foot wide road bed.
5. The structure must be built across the entire road bench from toe of cut slope to edge of fill slope. In the case of insloped structures that drain into an inside ditch, additional ditch relief drainage structures must be installed. For outsloped roads, when the fill material consists of erosive material, crushed rock should be placed on the fill slope below the drain dip to prevent erosion.
6. In the illustration shown as Option B there are three important advantages:

   A. The long horizontal drain dip transition permits log trucks, passenger buses and lowboys easy passage.

   B. The length, depth, and height of the dips are large, obvious features of the road grade, so road maintenance operators can see and feel the grade and are less likely to inadvertently

OPTION B



Example road surface drainage spacing (ft)

	Road gradient (%)	
Soil composition	2-4	5-8
Granitic or sandy	400	300
Clay or loam	500	400
Shale or gravel	600	500

Drain dip construction staking data.

Road grade (%)	Drain dip construction stake data (ft) 0 Cut	70 Cut	110 Cut	140 Fill	210 Fill
2-3	0.0	-1.30	0.0	+1.0	0.0
4	0.0	-2.00	0.0	+1.4	0.0
5	0.0	-2.30	0.0	+1.8	0.0
6	0.0	-2.70	0.0	+2.0	0.0
7	0.0	-3.00	0.0	+2.3	0.0
8	0.0	-3.50	0.0	+2.8	0.0

From Kramer, B.W. 2001. Forest Road Contracting, Construction, and Maintenance for Small Forest Wooland Owners. Oregon State University, College of Forestry, Research Contribution 35, 84p

obliterate the structures.

C. Staking drain dips to the standards described in the table is easy after the initial road subgrade profile is constructed.

7. Spacing for Option A rolling dips in low to moderate erosion hazard soils can be calculated by using the formula below. This provides the distance between points of cross drain for a series of dips. Also, see chart in Option A figure.

$$\text{Spacing in feet} = \frac{400}{\text{Road Grade \%}} + 100$$

8. Roads on high-erosion hazard soils generally require rock lifts (surfacing) in the dip structures. Roads might be drained at less cost with road crowning, surfacing with rock, inside ditches, and culvert cross drains. A careful planning cost comparison should be done before choosing the drainage method.

FOR MORE INFORMATION CONTACT
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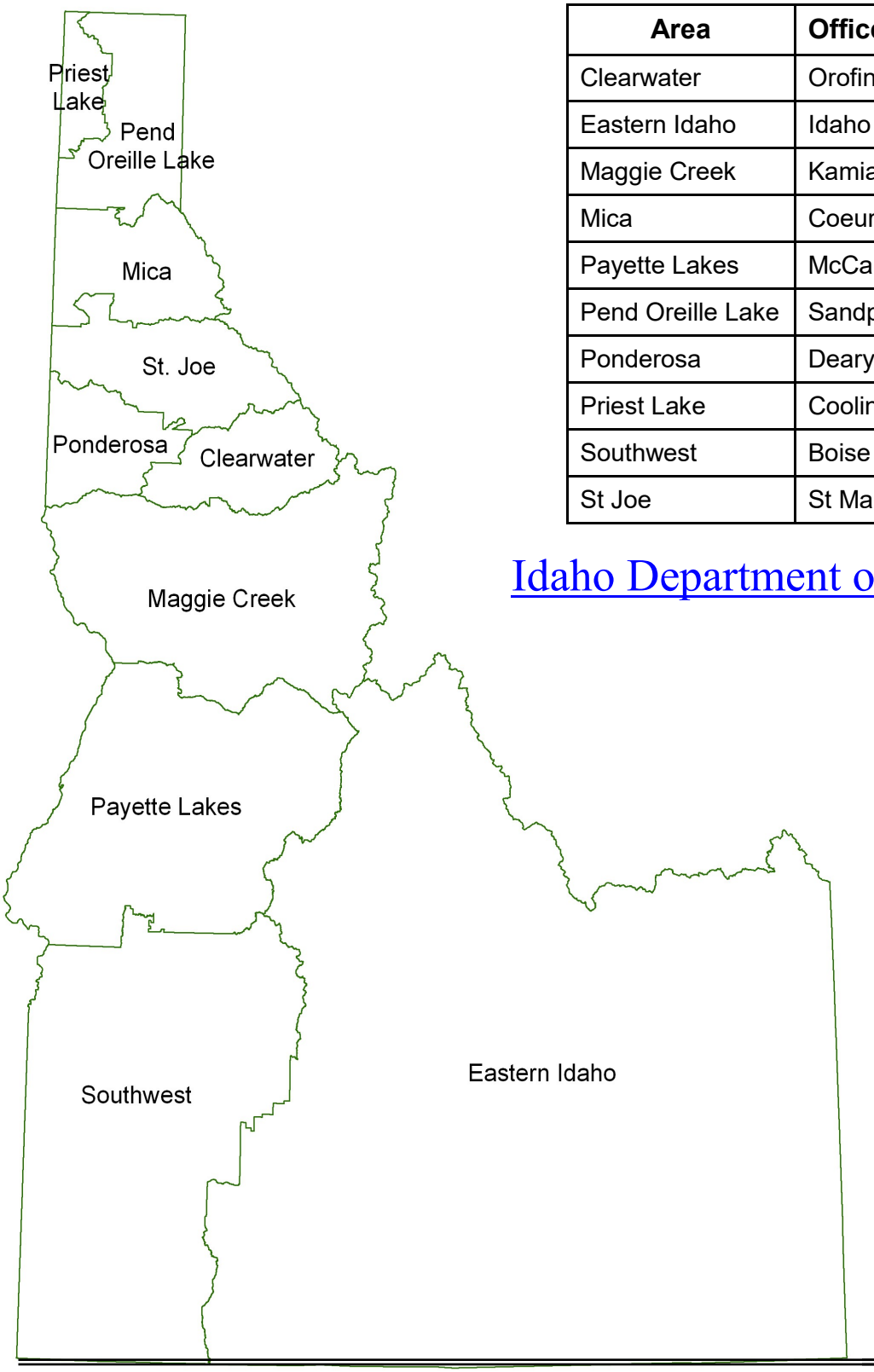

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