Section III: BMP'S FOR RUNOFF COLLECTION

Contents and Applicability

Best Management Practices (BMP's):

III.1 Diversion Dike/Ditch. Diversion dikes/ditches should be used whenever it is necessary to dispose of concentrated surface water without causing erosion. Diversions should be used in conjunction with a silt fence or sediment ponds.

III.2 Interceptor Trench. Used to interrupt long slope faces on gentle slopes (less than 3:1) and to allow diversion and infiltration of collected runoff and retention of sediment.

III.3 Open Top Box Culverts. A temporary or permanent drainage collection system. Should be used in conjunction with a silt fence and riprap.

III.4 Siltation Berm. A temporary impermeable berm for use on construction sites to retain runoff water on site.

III.5 Waterbars. A berm constructed across the roadway to divert storm runoff away from unpaved surfaces or other disturbed areas.

III.6 Culverts. Corrugated metal pipes used for runoff collection and conveyance.

III.7 Drain Fields. A drainage system constructed of rock or rock and perforated pipe, used to drain water away from construction sites.

III.8 Stream Alteration. The diversion of a stream into a new channel, pipe, or culvert.

III.9 Drop Structures. Natural materials such as rocks and trees that are put in streams for stabilization, controlling water velocities, and creating fish habitat.

III.10 Rolling Dips. Structures that are designed into a road surface when it is being surveyed that are intended to divert water off the road surface. Rolling dips are the result of gradual grade changes along a length of road.

III.11 Road Sloping. Selectively constructing or grading a road surface to direct surface water runoff in a desired direction, usually to the outside of the road.

III.12 Roadway Surface Water Deflectors. A roadway surface water deflector is a runoff interceptor built of treated wood and conveyor belt. The deflector is installed across the roadbed to convey surface water off the roadbed.

III.1 Diversion Dike/Ditch

A diversion dike/ditch is a runoff interceptor built to divert surface water away from un-vegetated areas on to adjacent vegetated ground. Diversions are also used to divert creeks or streams away from mine areas.

Purpose: Diversion dikes should be used to route surface waters around structures such as tailings impoundments, settling ponds, or any other mine facility.

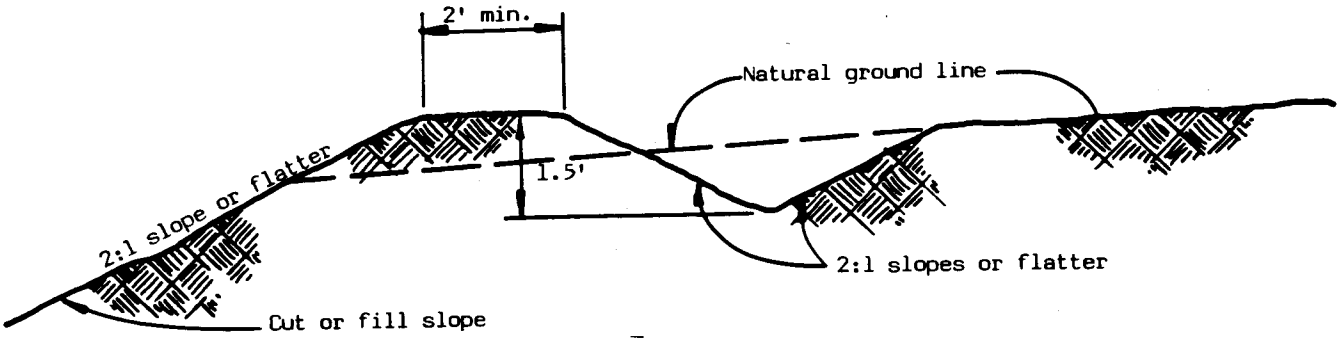
Specifications: (See Figure III-1 and III-2)

1. Height: 1.5 feet or greater.
2. Width at top: two (2) feet minimum.
3. Side slope of dike: 2:1 or flatter.
4. Compaction: should be adequate to ensure a stable dike that will not erode or wash out easily.
5. Grade: for grades in excess of 2% or where large flows are anticipated the diversion channel may need to be mechanically stabilized with a concrete or riprap lining.

The diversion dike consists of a trench and dike. The trench can be constructed by using either heavy equipment or hand tools. The bottom and sides of the ditch should be riprapped with rocks or lined with a geotextile fabric. This will help stabilize the sides of the ditch and reduce sediment loading in the water caused by the bare ditch banks. Dike banks above the water line should be seeded.

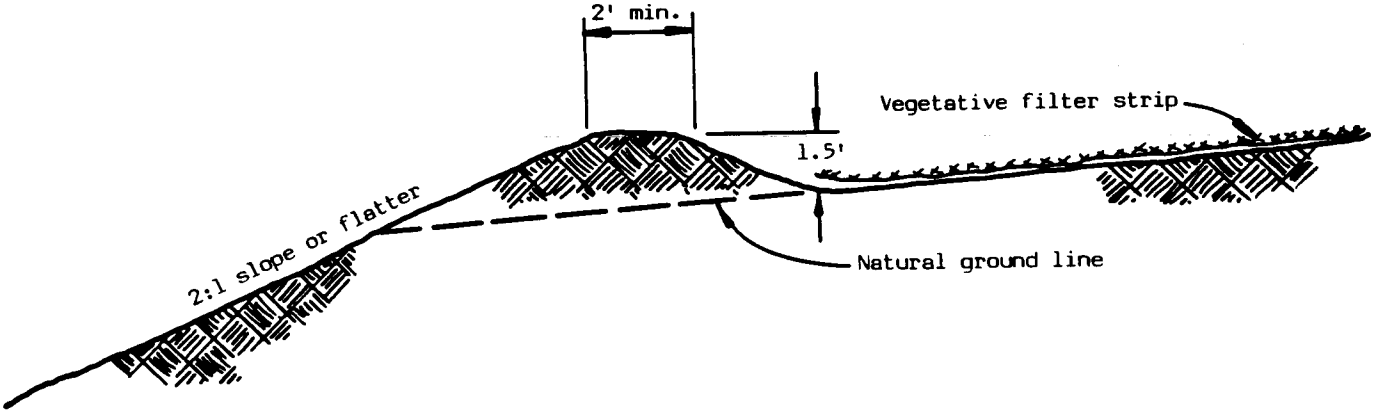
Diversion dikes should be designed large enough to carry normal runoff volumes, as well as additional water from a major storm event.

Maintenance: Diversion dikes should be inspected regularly and repaired if damaged.



NOTE: Bed of dike to be riprapped.

SECTION



NOTES: 1) Dike constructed by dozer moving soil upslope and dumping at top of slope.
2) Outlet to stabilized vegetated soil.

SECTION

III.2 Interceptor Trench

An interceptor trench is a trench built along the contour of a slope to store and/or divert surface runoff. An interceptor trench is smaller and less permanent than a diversion dike/ditch. In addition, it is designed to carry surface runoff only, not streams.

Purpose: Interceptor trenches can be used to divert water around mining structures such as stockpiles, waste dumps, pits, settling ponds, or tailings impoundments. Interceptor trenches are effective on gentle slopes (3:1 or less) with long, uninterrupted expanses.

Specifications: (See Figure III-1, III-2)

Locate and construct the interceptor trench so that it lies along the contour of the slope and can discharge onto stable, preferably vegetated, ground. The trench should be large enough to carry normal volumes of water as well as additional precipitation from a major storm event. Excess material should be cast on the downhill side of the trench. The trench banks (above the water line) and adjacent disturbed ground should be seeded immediately after construction is completed. The slope of the trench must not exceed two (2) percent in order to prevent erosion of the trench.

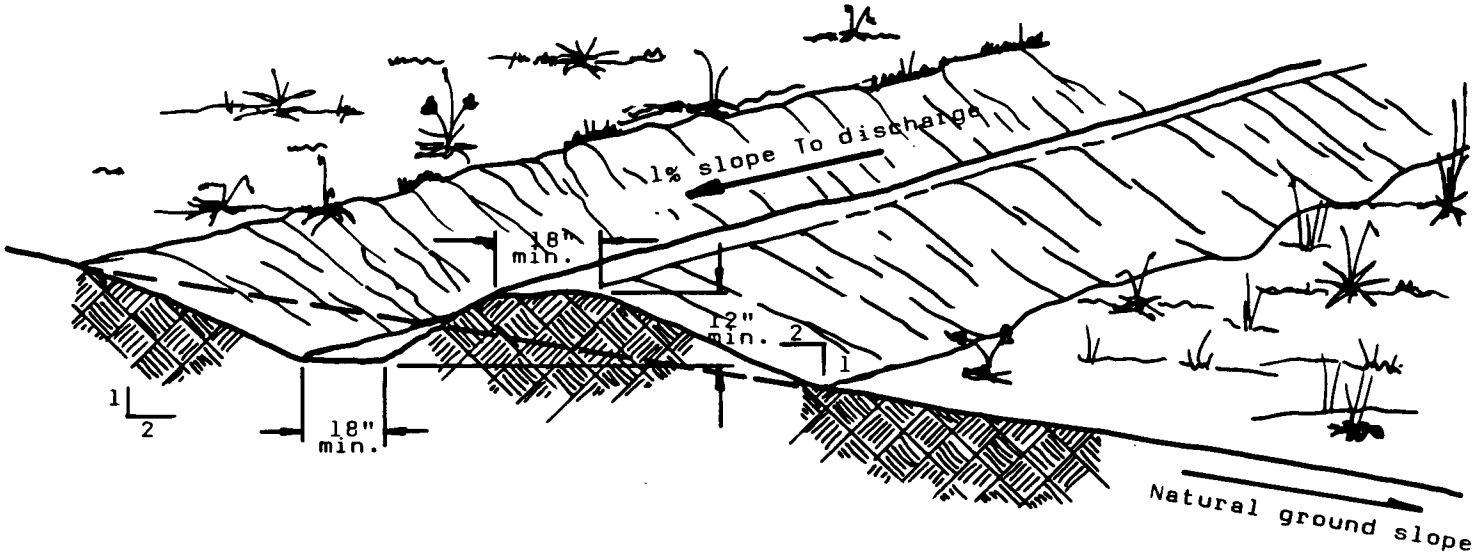
1. Depth of trench: twelve (12) inches minimum at downslope side.

2. Width at bottom of trench: eighteen (18) inches minimum.

3. Slope of sides of trench: 2:1 or flatter.

The bottom of the trench should be riprapped with rocks or lined with a geotextile fabric. This will help reduce sediment load in the water caused by the eroding of the ditch banks.

Maintenance: Interceptor trenches should be inspected regularly and repaired if damaged.



INTERCEPTOR TRENCH

FIGURE III-2

III.3 Open Top Box Culverts

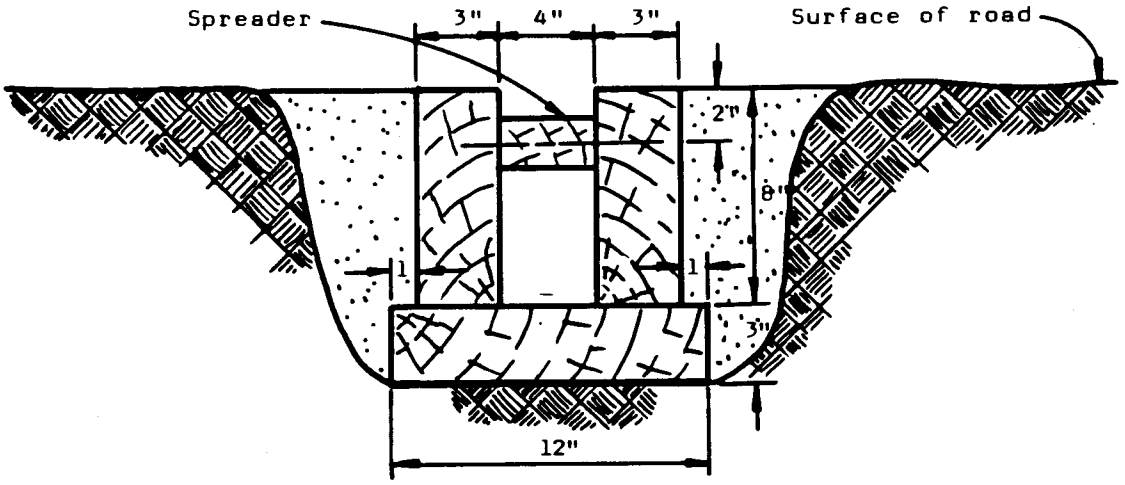
An open top box culvert is a wooden culvert installed across the roadbed to convey surface runoff and flow from inside ditches onto the downhill slope of the road.

Purpose: The open top box culvert can be installed on lightly used, unpaved roads with steep grades (greater than 6%). This type of culvert can be used as a substitute for pipe culverts.

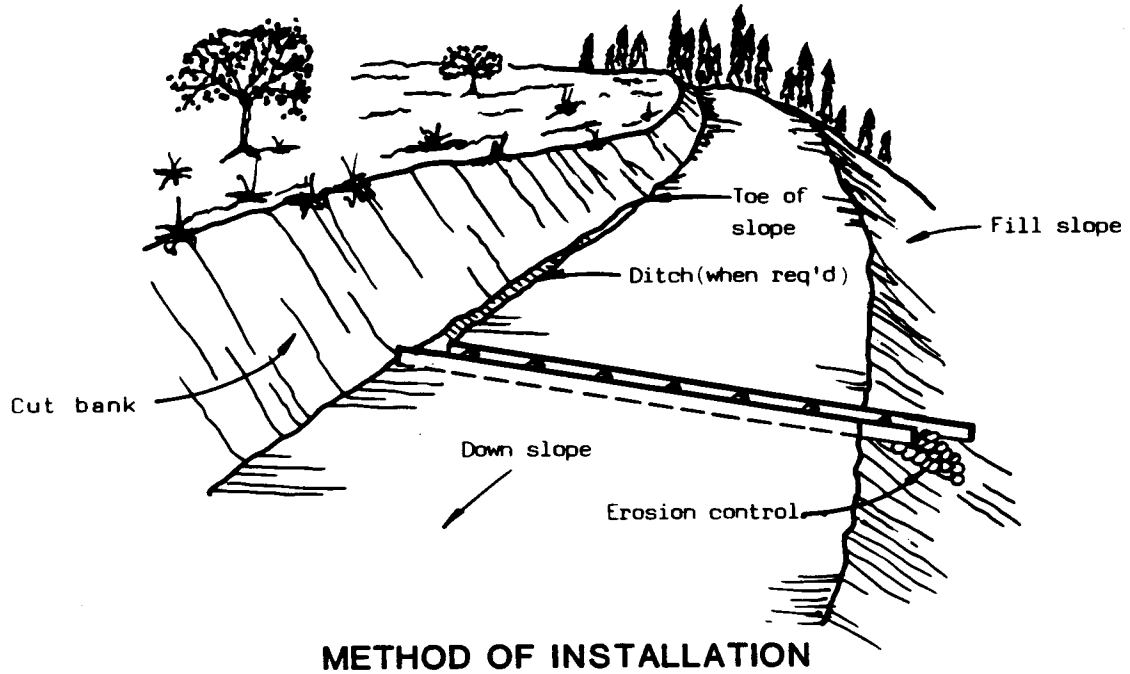
Specifications: (See Figure III-3)

Box culverts can be constructed with logs, lumber, guardrails, or corrugated steel. They consist of open-top, three-sided, box-like frames installed flush with the road surface and angled downward across the roadway. The inflow end should be at the same grade as the side ditches on the road and should extend into the cut bank. The discharge end should extend six (6) to twelve (12) inches beyond the surface of the roadbed and should be directed onto vegetated ground, riprap or into another erosion control structure such as a sediment trap or catch basin.

Maintenance: Open top box culverts should be inspected, cleaned, and repaired on a regular basis as needed.



END VIEW



METHOD OF INSTALLATION

OPEN TOP BOX CULVERT
FIGURE III-3

III.4 Siltation Berm

A siltation berm is an impermeable barrier placed around a disturbed site to capture and contain surface runoff so that sediment can be filtered prior to discharging the water. Siltation berms should be placed on the downslope side of the disturbed ground.

Specifications (See Figure III-4)

1. Berms should be large enough to control runoff water from a major storm event.

2. The berm should be constructed of the following materials:

   a) 3/4 to 1 1/2 inch gravel, or other, similar coarse material;

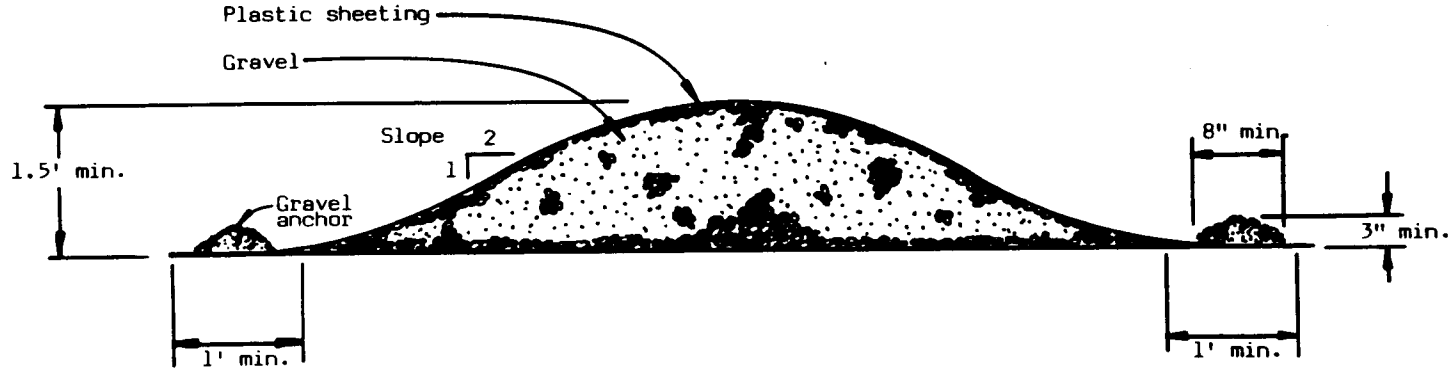
   b) plastic sheeting, at least six millimeters thick, and wide enough to cover the berm and allow a two foot overlap on each side of the berm.

3. The berm should be located along the contour of the slope at the downhill boundary of the disturbed ground.

4. Gravel or another coarse material should be mounded into a ridge, with a slope not to exceed 2:1, of sufficient height to contain runoff water from a design storm event.

5. Plastic sheeting should be placed over the berm and anchored down as indicated in Figure III-4.

Maintenance: Siltation berms should be inspected regularly and repaired immediately when damaged.



SILTATION BERM

FIGURE III-4

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III.5 Waterbars

A waterbar is a berm built at a downslope angle, extending across the length of the roadway.

Purpose: Waterbars reduce erosion by diverting runoff away from the road surface. These erosion control structures can be either permanent or temporary for lightly used unimproved roads.

Specifications: (See Figure III-5)

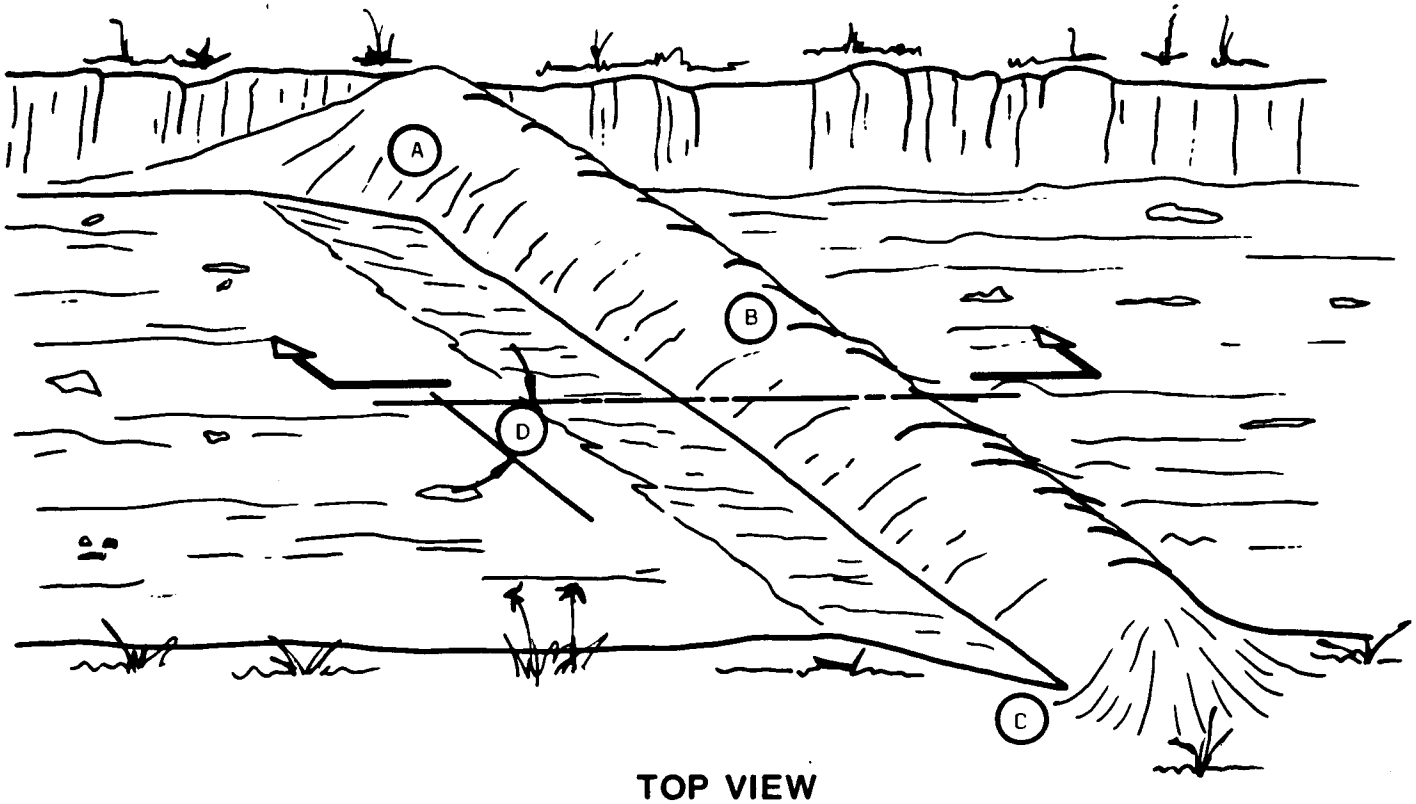
1. Waterbars should extend from the cutbank side of the road across to the fillslope side.

2. Berm height should be twelve (12) to twenty-four (24) inches above the roadbed.

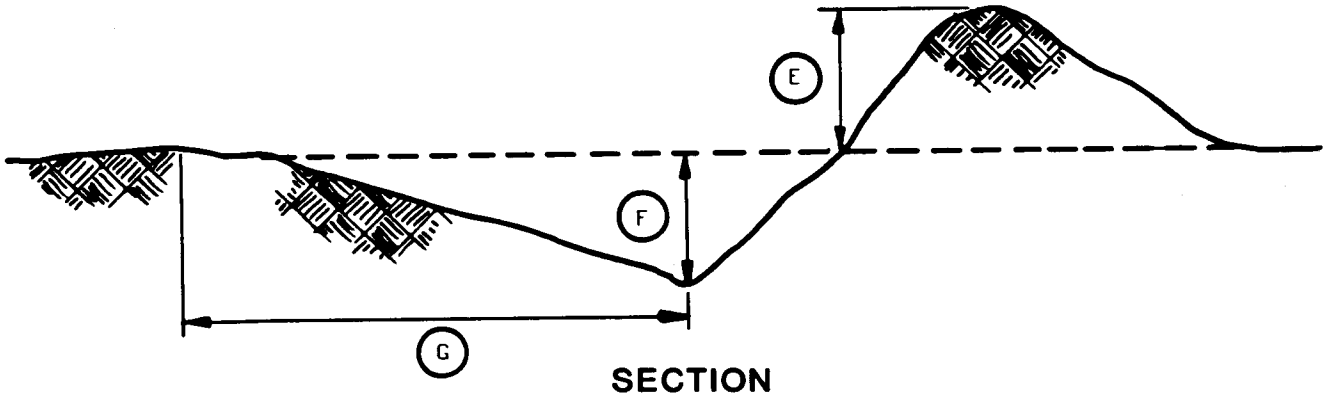
3. Berms should have a downslope angle of between 30% and 40%.

4. Waterbars can be built with a dozer or by hand.

Maintenance: Properly constructed waterbars should require little or no maintenance. They should be kept open at the discharge end so that water can flow away from the roadway. Silt fence, riprap, or a slash filter windrow may need to be installed below the discharge end of the waterbar to control erosion and trap sediment.



TOP VIEW



SECTION

WATERBAR (CROSSDITCH). Construction for unpaved forest roads with limited or restricted traffic. Specifications are average and may be adjusted to gradient and other conditions. A, bank tie-in point cut 6 to 12 in. into roadbed; B, cross drain berm height 12 to 24 in. above roadbed; C, drain outlet cut 8 to 16 in. into roadbed; D, angle drain 30 to 40 degrees downward with road centerline; E, height up to 24 in; F, depth to 18 in; G, 36-48 in.

III.6 Corrugated Metal Culverts

Purpose: Corrugated metal culverts are used to remove water from roadways. They can also be used to divert water around areas or structures.

Application: Corrugated metal culverts are permanent water conveyance structures that can be used on all types of roadways.

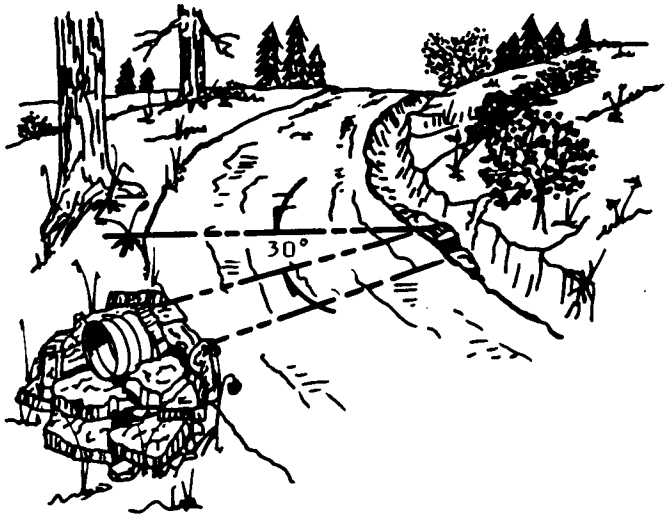
Specifications: (See Figure III-6)

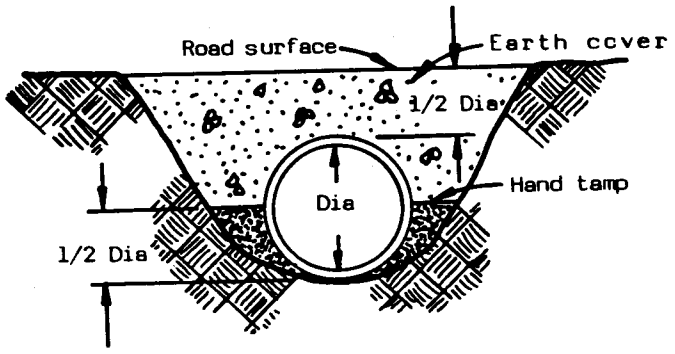
1. Culverts should be long enough to reach across the roadway and extend beyond the fill slope. In addition, culvert outlets must have erosion control structures installed below them to prevent erosion.

2. When installed to convey a stream under a roadway, they should be large enough to carry the maximum stream volume as well as any additional seasonal runoff. Note: Culvert size should comply with the Idaho Department of Water Resources requirements. (See Appendix A)

3. Install the culvert in firm, compacted soil with a minimum cover of twelve (12) inches of soil.

Maintenance: Culverts need to be inspected on a regular basis. They should be cleaned and/or repaired when necessary.





SECTION

CULVERT INSTALLATION

FIGURE III-6

III.7 Drain Fields

A drain field is a drainage system that is designed to discharge infiltrating water and/or ground water away from a site.

Purpose: Drain fields can also be used to intercept and divert seeps. Drain fields must be designed with either a gravity flow outlet or the water must be discharged from the drainage system by pumping.

Application: Drain fields can be used under waste dumps, stockpiles, and tailings impoundments to transport water away from the site. By reducing the water volume and amount of time that it is in contact with potential pollution forming materials, the potential for water quality impacts can be reduced.

Specifications: (See Figure III-7)

1. Drain fields can either be constructed with clean, graded rock (rock of several different sizes), or by using perforated pipe and graded rock. Rocks and piping can also be used in conjunction with geotextile fabric.

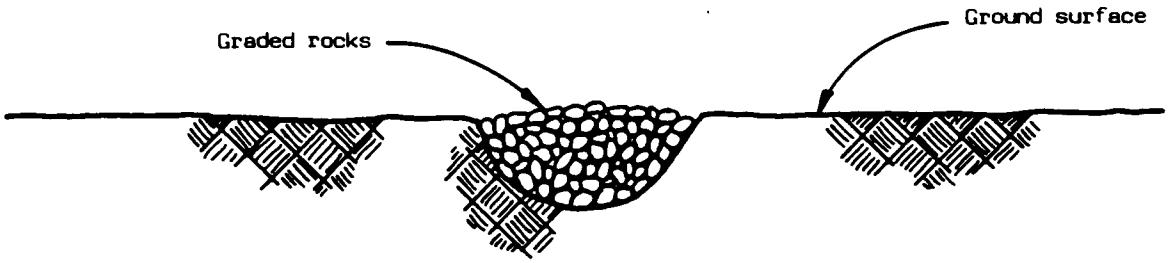
2. Drain field constructed of graded rock: Dig a trench. Line it with coarse rock or a geotextile fabric covered with coarse rock. Fill the remainder of the trench with smaller rock free of sand or soil.

3. Drain field constructed of graded rock and perforated pipe: Dig a trench. Line it with coarse rock or a geotextile fabric covered with coarse rock. Put a section of perforated pipe in the trench. (The minimum diameter of the pipe should not be less than 4 inches.) Fill the remainder of the trench with smaller rock free of sand or soil.

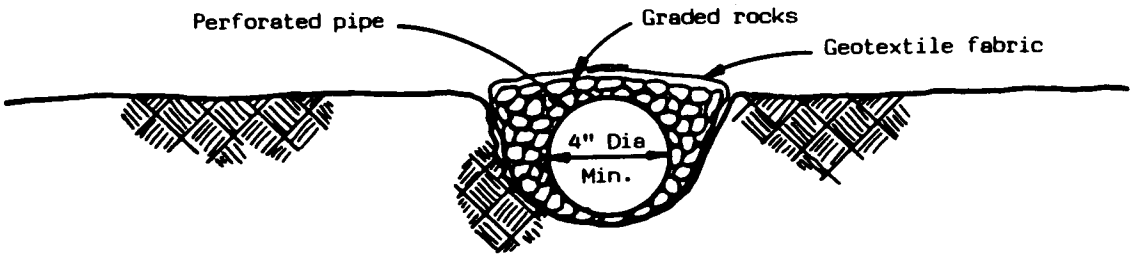
4. Do not allow fine soil, silt, or sand to come in contact with the graded rock or graded rock and perforated pipe, as it could clog the drain field and reduce its effectiveness.

5. Drain fields could be a system of interconnected , branched trenches feeding into a central drainage discharge trench.

6. The size of the drain field as well as the depth and width of the trenches is dependant on the volume of water the system must transmit. This is a site specific condition that must be determined by a qualified engineer before the drain field is built.

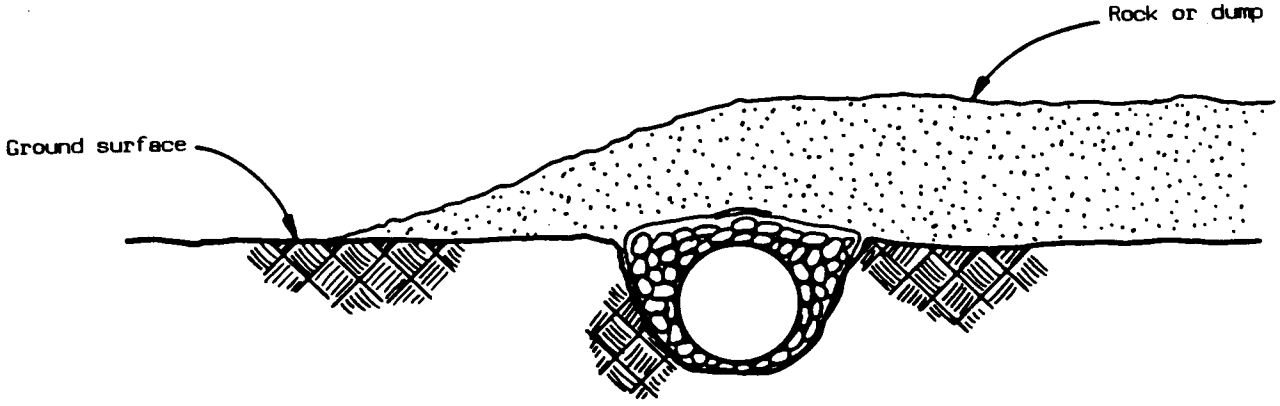


DRAIN FIELD TRENCH LINED WITH GRADED ROCKS



NOTE: Diameter of pipe to be based on the amount of water to be drained.

TRENCH LINED WITH GEOTEXTILE FABRIC, GRADED ROCK AND PERFORATED PIPE



SURFACE WASTE OR DUMP TO BE PLACED OVER UNDERDRAIN AFTER CONSTRUCTION

III.8 Stream Alteration

Stream alteration/diversion should be considered when streams flow through economically minable areas or to divert live water away from a pit, quarry, pond or adjacent impacted area. Stream Alterations can reduce potential water quality impacts caused by mining by routing water away from the area being actively mined. A stream diversion can either be a temporary or permanent measure. Refer to the Idaho Department of Water Resources **Rules and Regulations and Minimum Standards for Stream Channel Alterations.**

Planning:

The following information should be considered and may be required when planning a stream channel diversion:

1. Inventory the following existing stream conditions:

   a. Develop a Plan view map of the stream or streams to be relocated. Show the present and final location, of the stream, within the valley in relation to access roads, forest roads, land forms at a scale of 1" = 40' with 10' contour intervals. Show location of pools, riffles, transition zones, and natural drop structures in both channels.

   b. For the stream to be altered, inventory and list the following:

Total pools	Channel length
Total riffles	Valley bottom length
Pool: riffle ratio	Sinuosity

Gradient
Fish count or available fisheries data
Cross-section through entire stream length, showing gradient for each reach. Scale 1" = 40'.

   c. Develop cross-sections for each stream reach on a scale of 1" = 2', extending at least 10' beyond mean high water mark. If a reach is greater than 200' long, show a cross-section for every 200' length of reach or portion thereof.

   For each stream reach, inventory and list the following:

Type of reach	Gradient
Average depth	Area of reach
Average width	Average size of bed material

Width/depth ratio
Cobble embeddedness
Volume of large organic debris
Bank stability and form description

d. Obtain or calculate flow data for the following storm events:

2 year - 24 hour (Bankfull discharge)
10 year - 24 hour
25 year - 24 hour
50 year - 24 hour

Show a representative riffle cross-section overlaid with flood water elevations for the specific storm events.

2. Develop a reclamation plan, based on the stream channel inventory, that will provide comparable or improved stream channel characteristics, based on stream stability and fisheries habitat.

Construction Specifications:

1. Plan to relocate the stream where no mining will occur.

2. Excavate the new stream channel to specifications outlined in the stream reclamation plan and stream channel alteration permit.

3. Install erosion control, channel stabilization structures, and fisheries improvements. These items will be outlined in the stream reclamation plan and/or stream channel alteration permit.

4. Downstream control structures should be installed to help break the stream's velocity. This will enhance fish habitat, providing there are fish in the stream. (Refer to BMP III.9 Drop Structures)

5. Establish vegetative cover such as grass and willows on the banks above the water line.

6. There should be no stream diversion until a new channel has been constructed to standards specified in the stream reclamation plan.

Maintenance:

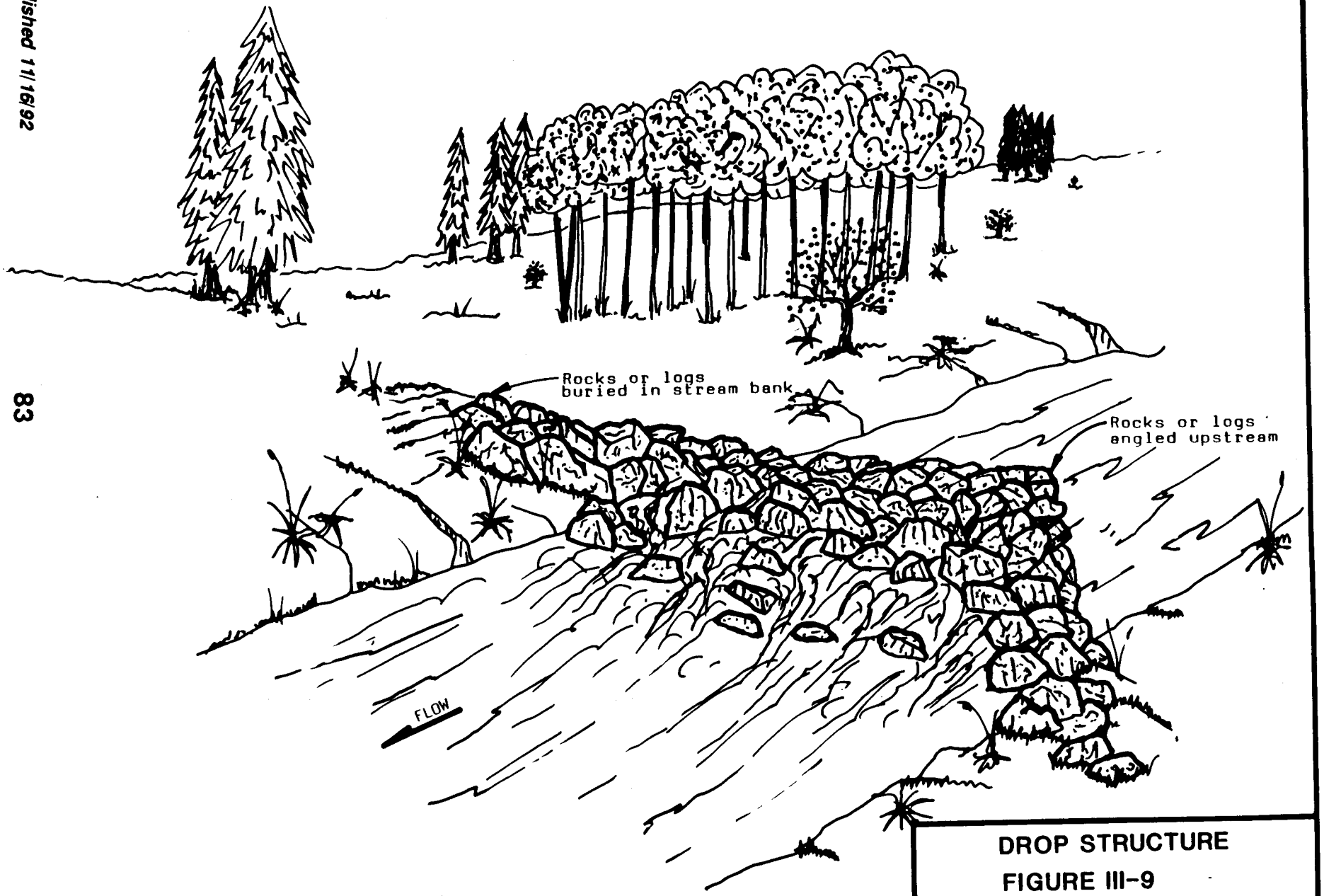
1. Monitor conditions at the altered stream and complete repair work on the channel as needed.

2. The reconstructed channel should be allowed to function for at least one year before mining is conducted in the original channel location. If serious stability problems develop in the new stream channel, flows can be returned to the original stream channel.

III.9 Drop Structures

Specifications: (See Figure III-9)

Place large, hard, angular rocks in an V shaped pattern across the width of the stream. Note: Rocks must be large enough that the water velocity does not dislodge them and carry them downstream.



DROP STRUCTURE
FIGURE III-9

III.10 Rolling Dips

Rolling dips are built into the road, during construction, using the natural contours of the land.

Purpose: Rolling Dips are designed to divert surface runoff off road surfaces.

Specifications: (See Figure III-10)

1. The dip should be approximately one (1) foot in depth from the surface plane of the road. The upgrade approach to the bottom of the dip should be approximately sixty (60) feet. The downgrade approach to the bottom of the dip should be approximately twenty (20) feet in length.

2. The dip should cross the road at nearly a 90 degree angle and should be outsloped approximately five percent.

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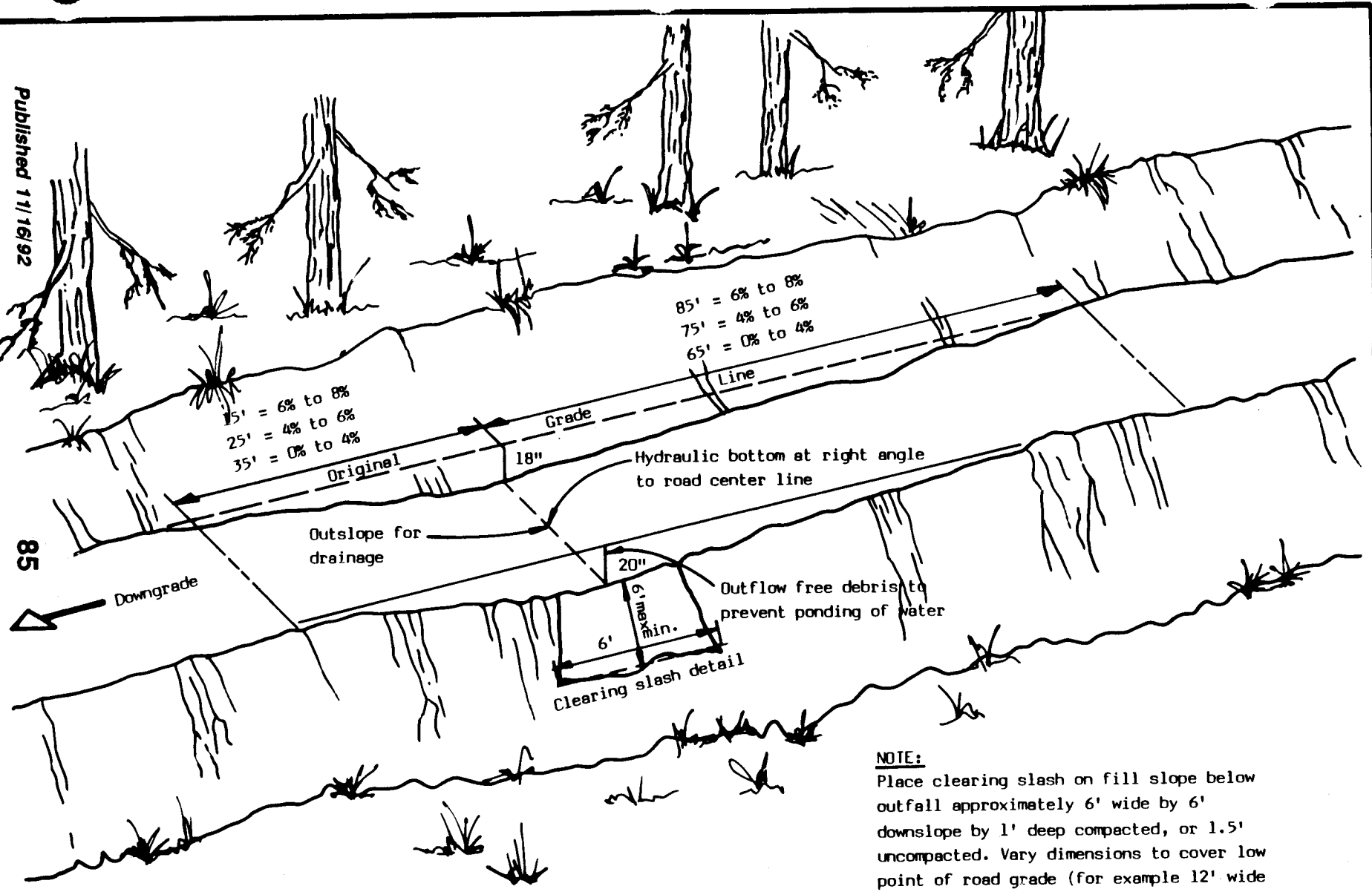


NOTE:
Place clearing slash on fill slope below outfall approximately 6' wide by 6' downslope by 1' deep compacted, or 1.5' uncompacted. Vary dimensions to cover low point of road grade (for example 12' wide by 3' long by 1' deep).

ROLLING DIP DETAIL
FIGURE III-10

BMP'S FOR RUNOFF COLLECTION

III.11 ROAD SLOPING

Road sloping is built into the road during construction.

Purpose: Sloped roads are designed to divert surface water off the entire road surface so that water does not concentrate in any specific location.

Specifications: (See Figure III-11)

1. The slope should be approximately 1-2% from the cut slope to the fill slope.
2. Berms on the outside of the road should be limited or removed to allow water to flow off the road surface.
3. A slash filter windrow should be used at the toe of the fill slope to prevent excessive erosion and sediment transport. (See BMP V.7)

ROAD SLOPING

FIGURE III-11

III.12 Roadway Surface Water Deflectors

A roadway surface water deflector is a runoff interceptor built of treated wood and a conveyor belt. The deflector is installed across the roadbed to convey surface water off the roadbed.

Purpose: To deflect surface water off roadways to reduce erosion. The deflector can be installed on lightly used, unpaved roads with steep grades (greater than six percent).

Specifications: (See Figure III.12)

1. Obtain a section of two-ply rubber conveyor belt 12 inches (wide) x 20 feet (long) x 1/4 inch, more or less, 1/16 inch (thick) and (2) 2 inch x 6 inch x 20 feet pieces of treated lumber.

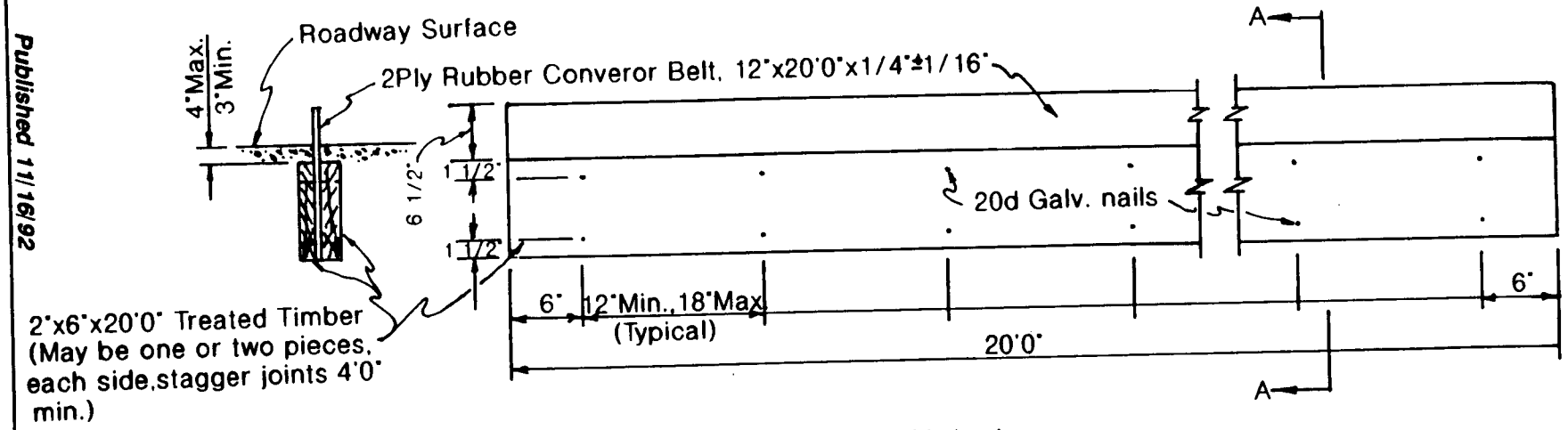
2. "Sandwich" the conveyor belt between the two pieces of treated lumber so one edge of the conveyor belt is flush with the bottom of the treated lumber. Nail the treated lumber together with 20 d galvanized nails. The conveyor belt should extend 6 inches, more or less, above the top of the nailed together treated lumber.

3. Excavate cut in roadway at a 30° angle to the road surface.

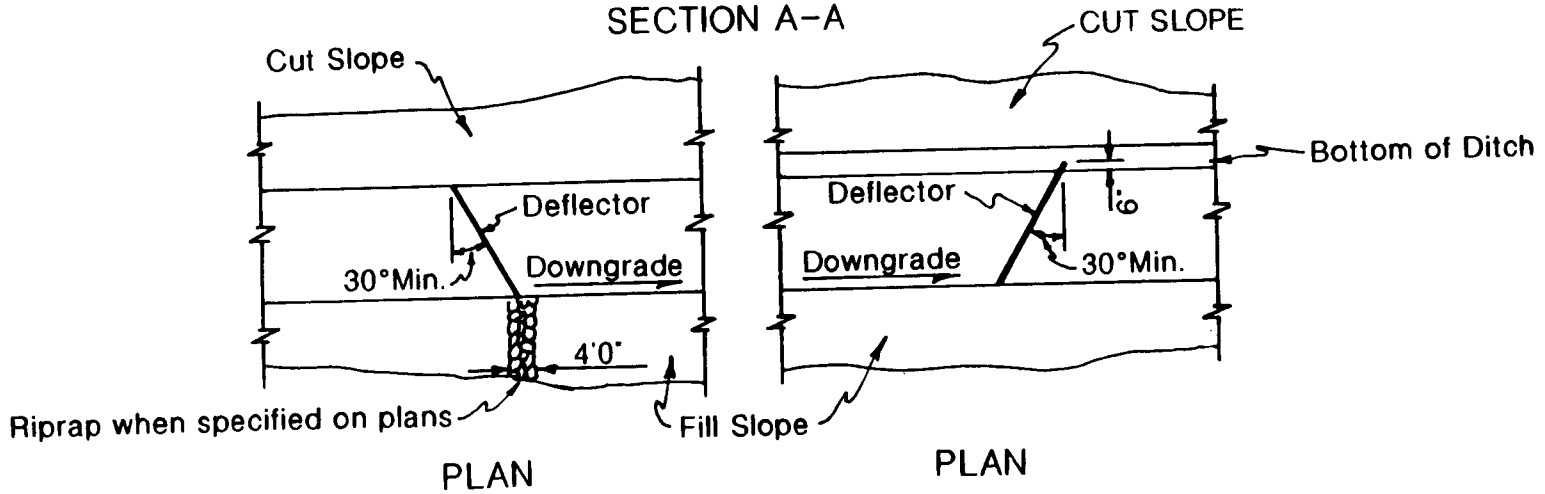
4. Install deflector so that the treated lumber is 3 inches - 4 inches below the surface of the road (this will allow 2½ inches - 3½ inches of the conveyor belt to project above the road surface). Burying the lumber as specified will help prevent damaging it when the road is graded.

Maintenance: These water deflectors should be inspected on a regular basis and should be repaired or replaced as needed.

ROADWAY SURFACE-WATER DEFLECTOR SPECIFICATIONS



SECTION A-A



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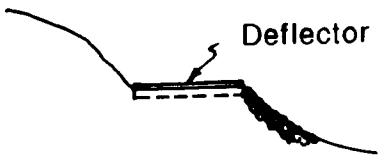
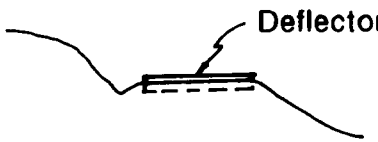
PLAN



ELEVATION
ROAD WITHOUT DITCH



ELEVATION
ROAD WITH DITCH

SURFACE WATER DEFLECTOR
FIGURE III-12