NOVA SCOTIA

Transportation and Public Works

APPENDIX E

CONSTRUCTION SPECIFICATIONS FOR ACCESS ROADS
(January 2005)

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1.0 INTRODUCTION

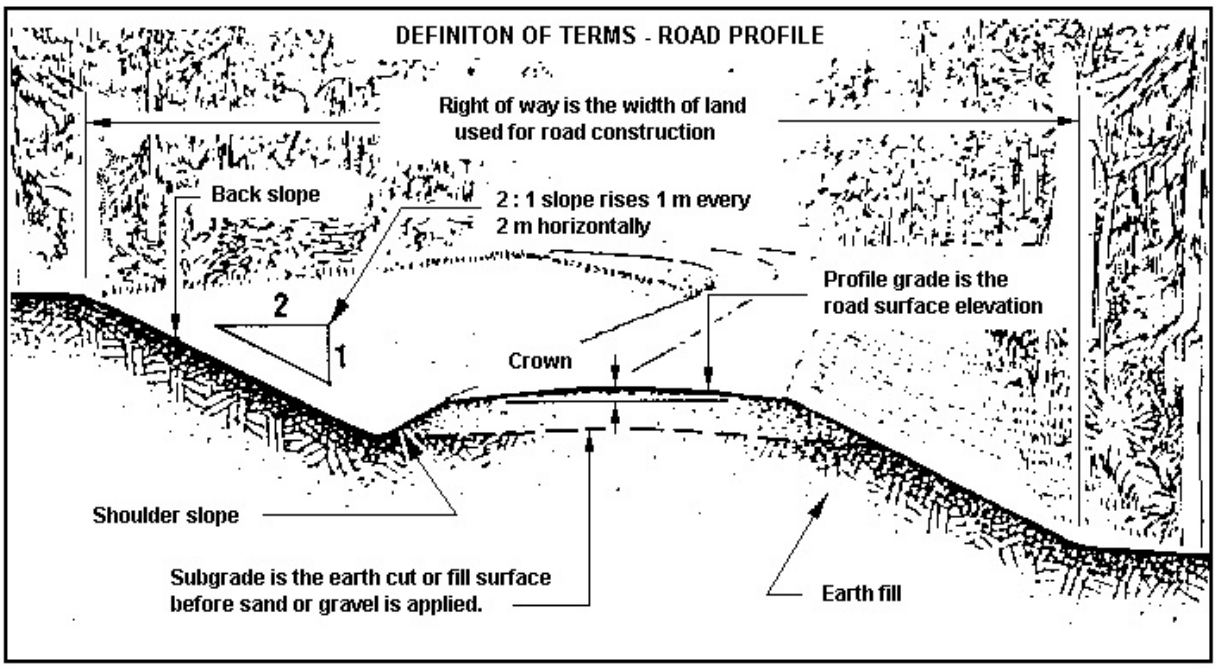
Good practice guidelines are provided for each component of planning, constructing, maintaining and abandoning access roads and water crossings - flexibility is expected in their application, however they should be followed to the extent reasonably possible through the entire length. Approval for water crossings must be received from DFO and DEL prior to any work commencing.

2.0 CONSTRUCTION SPECIFICATIONS FOR ACCESS ROADS

Specifications:

1. ROW width..... 20 m
2. Grubbing width..... varies
3. Grubbing depth..... 15-30 cm.
4. Subgrade width (top)..... 6.8 m
5. Subgrade depth..... grade as per profile drawings.
   - approx. 50 cm above ditch.
   - approx. 30 cm above 300-1000 mm culvert.
   - approx. 50 cm above 1100-1900 mm culvert.
   - approx. 60 cm above 2000 mm culvert
   - approx. 60 cm above top of swamp.

6. Finished top width (gravel) 6.0 m
7. Gravel Thickness..... 200 mm
8. Type of Gravel..... Type II (125 mm) and Type I (75 mm)
9. Grading
   Tangents..... 15 cm crown.
   Curves..... Superelevated (0.020 m/m max.)



3.0 PLANNING AND LOCATION

The location of a particular access road has an important influence on the impact the road will have on the natural environment. The following are good planning processes:

- Ensure areas of concern such as canoe routes, erosion control, aesthetics, osprey nests, etc. are protected.
- Avoid hilly terrain (*i.e*. steep grades; 10% or more), deep swamps, bedrock, erodible soils and shallow soil areas.
- Road alignments should follow the contours of the land as much as possible.
- Gentle grades (1-4%) are desirable for proper drainage and economical construction.
- Long, sustained grades should be avoided since they allow excessive run-off build up in ditches that can lead to erosion.
- Buffer zones of undisturbed vegetation between the access roads and water bodies should be maintained and should increase in width proportionally to the increase in slope of land entering the waterway.
- Minimize the number of water crossings.
- The preferred crossing method in streams which are used for fish migration or contain spawning habitat is a method that will not disturb the stream bottom such as a bridge or arch culvert.
- Openings shall be sized to minimize the risk of culvert or bridge washout during the life of the structure.
- Culverts with slopes greater than 0.5% may require baffles to permit fish passage. Bridges or arch culverts are an acceptable alternative.

4.0 CONSTRUCTION PRACTICES

4.1 Clearing

Clearing consists of cutting trees within the designated right-of-way. The following are good construction practices:

- Do not clear an area larger than necessary.
- Reduce clearing width to the minimum needed for construction within the designated buffer zone of a watercourse or water body identified by the regulatory agencies as being sensitive.
- Away from water crossings, a minimal width of 20 m should be cleared to ensure the road will dry out, and provide sight lines for safety..
- If possible access roads should be cleared during winter months to reduce rutting.

The cut-off height of trees shall be 300 mm (or less) above the ground level unless otherwise approved. Clearing shall not be carried out where shrub is less than 1.5 m in height.

Following approved disposal of merchantable timber, the remaining non-salvageable material such as standing trees, brush, slashings, limbs, fallen branches and other surface litter shall be cut and disposed of by chipping.

Trees of mercantile timber shall be cut to a minimum length of 2.5 m and shall be neatly piled on abutting properties off the right-of-way (ROW) unless otherwise approved. Arrangements will be

made with the abutting property owners with respect to the cutting and piling of such trees. All timber with a butt diameter greater than 100 mm and with a minimum diameter of 100 mm at a length of 2.5 m shall be considered merchantable timber. **The merchantable timber shall only be piled on level areas with no piles located within the buffer zone of any watercourse or wetland.**

Additional environmental protection measures for clearing activities are provided in TPW's *Environmental Protection Plan for Construction of 100 Series Highways*

4.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots, brush, small trees, embedded logs and organic overburden. The following are good construction practices:

- Full width grubbing is done where road-building material is expected to come from within the right of way area.
- In deeper fills grubbing is not necessary.
- To ensure that trees on the bush line are not under-cut, a cleared but not grubbed buffer zone should be left along the edge of the ROW.
- Grubbing shall not be piled where it could block drainage courses.
- Swamps should not be grubbed.
- Grubbing should be minimized in areas of fine grained soils. Grubbing in fine grained soils should be avoided during wet weather.

On sections other than wet topsoil, grubbing shall be just deep enough to remove the stumps and the black humus layer, usually about 15 cm in softwood and 30 cm in hardwood.

If wet topsoil is greater than 15 cm deep, the topsoil shall be removed to firm ground. The grubbed width generally will be 2 m wider than the subgrade width and may extend to within 1.5 m of the edge of the ROW in areas of "Borrow Pits." If the Contractor elects to get borrow from within the ROW, grubbing of borrow pits shall only be done by an excavator. Borrow pits will be grubbed no wider than required for the excavation.

The grubbed material is first "parked" before it is placed in the Borrow Pit. The area under the grubbing pile is also grubbed when the material is pushed out into the pit. When dozing grubbed material into the pit, the front section is to be filled and leveled first. If there is not enough material to fill the pit, the front section should at least be filled and the back part may be left open.

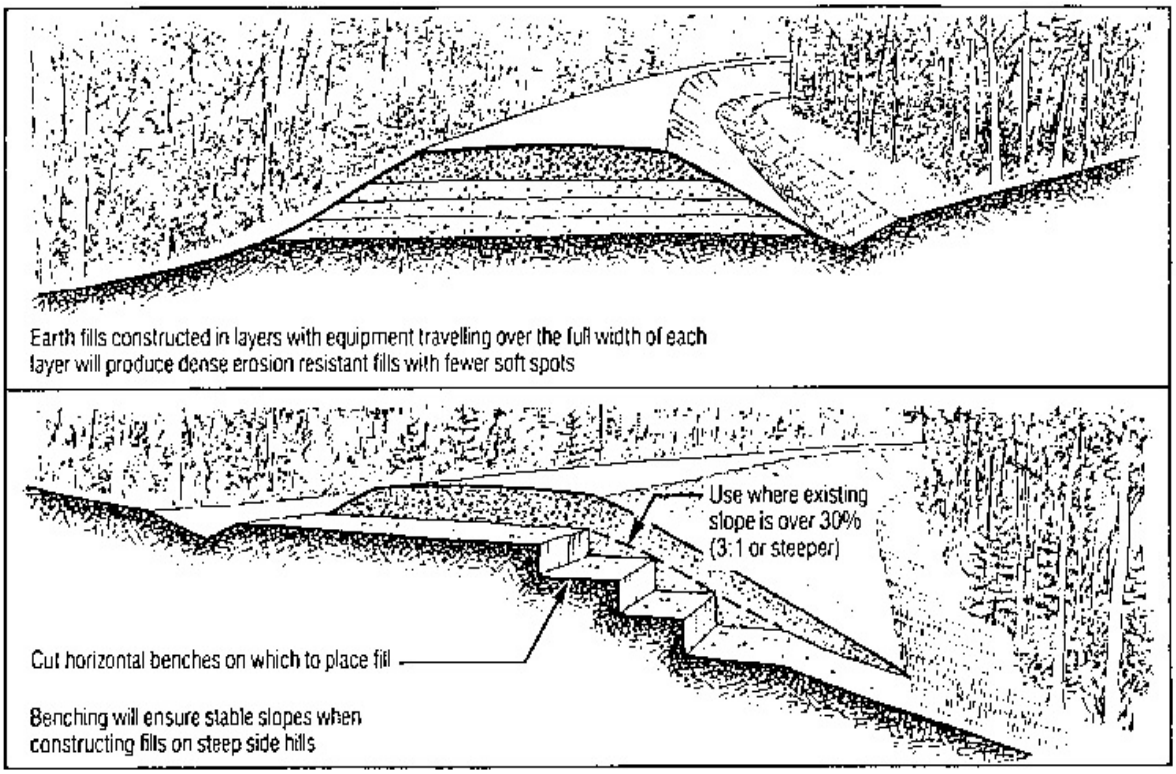
Grubbing is not required under embankments which cover stumps by 0.5 m. **For environmental purposes, grubbing will only be allowed to advance 200 metres in advance of the subgrade construction.**

Additional environmental protection measures for grubbing activities are provided in TPW's *Environmental Protection Plan for Construction of 100 Series Highways*.

4.3 Construction of Subgrade

The following are good subgrade construction practices:

- In poorly drained areas, backhoes should be used to construct fills by pulling in material from within the ROW. It allows for better material selection and creates less disturbance and gives the fill a chance to dry out and consolidate.
- Retain natural vegetation near water crossings as long as possible, to reduce the time the soil is exposed.
- Do not dump waste material in areas that may block the flow of water.
- Fill in and around water bodies should be constructed with earth-free rock or clean, well graded, granular material.
- Keep earth fills and earth cuts as shallow as possible. A desirable road surface is about 0.6 - 1.0 m above the original ground
- When building fills on side slopes, benching into the original ground will prevent slippage along the interface.



- The subgrade should be graded and crowned as it is being constructed to shed the water and minimize ponding in ruts.
- When obtaining material by excavation within or adjacent to the ROW; try to drain the low pockets as standing water might create a problem.
- Where ditches leading downhill from rock cuts pass over common material, rip rap should be used at the earth/rock interface to prevent erosion.
- Where bedrock projects out into the roadside ditch, either construct an offtake ditch into the natural vegetation, or install a cross culvert or excavate the rock.

The subgrade shall be constructed to the lines and grades as set by the Project Engineer. Material used to construct the subgrade can be obtained from the "Borrow Pits" within the 20 m right-of-way at depths up to 3 m below the ground level. If not, borrow will have to be obtained outside the 20 m ROW. If the Contractor elects to select his Borrow outside the ROW then the source of Borrow shall meet the approval of the Project Engineer and shall adhere to the Pit and Quarry Regulations in effect at the time of the award of the contract.

If the access road crosses a sharp knoll or ridge, the top shall be grubbed off and pushed into low areas of the roadway at the foot of the slope, provided it is covered with 0.5 m of good material. Large stumps shall be removed or turned over and used in the fill.

In the case of sidehills the grubbed material shall be placed under the lower side of the fill and the subgrade constructed from material cut from the up-hill ditch and backslope. Sidehill embankments shall be constructed by dumping successive loads in uniformly distributed layers until the embankment is wide enough to permit the use of compacting equipment.

Compaction shall be done before rain penetrates the fill. Embankment material placed below 300 mm from the top of subgrade shall be compacted to 95% Proctor Density. All embankment material and material within the top 300 mm depth of the subgrade shall be compacted to 98% Proctor Density.

If the material is too wet for compaction it shall be left to become sufficiently dry before being compacted.

The following environmental protection measures apply to subgrade construction:

- For environmental purposes, once work on the construction of subgrade begins, the subgrade shall be completed in 200 m sections. Subgrade shall be built to final grade, slopes dressed and hydroseeded and covered in straw/hay mulch before subgrade construction on the next 200 m is allowed to commence. In the case where the Contractor elects to get borrow from within the ROW, then the construction of subgrade will mean to include all borrow pits within the ROW.

- All exposed slopes shall be covered with straw/hay mulch at a rate of approximately 25 m^2 per bale. For the purpose of this specification, the size of a bale is considered to have approximate dimensions of 0.3 m x 0.45 m x 1.0 m and an approximate mass of 20 kg.

- Prior to the placement of the straw/hay mulch all exposed areas shall have lime, fertilizer and seed placed.

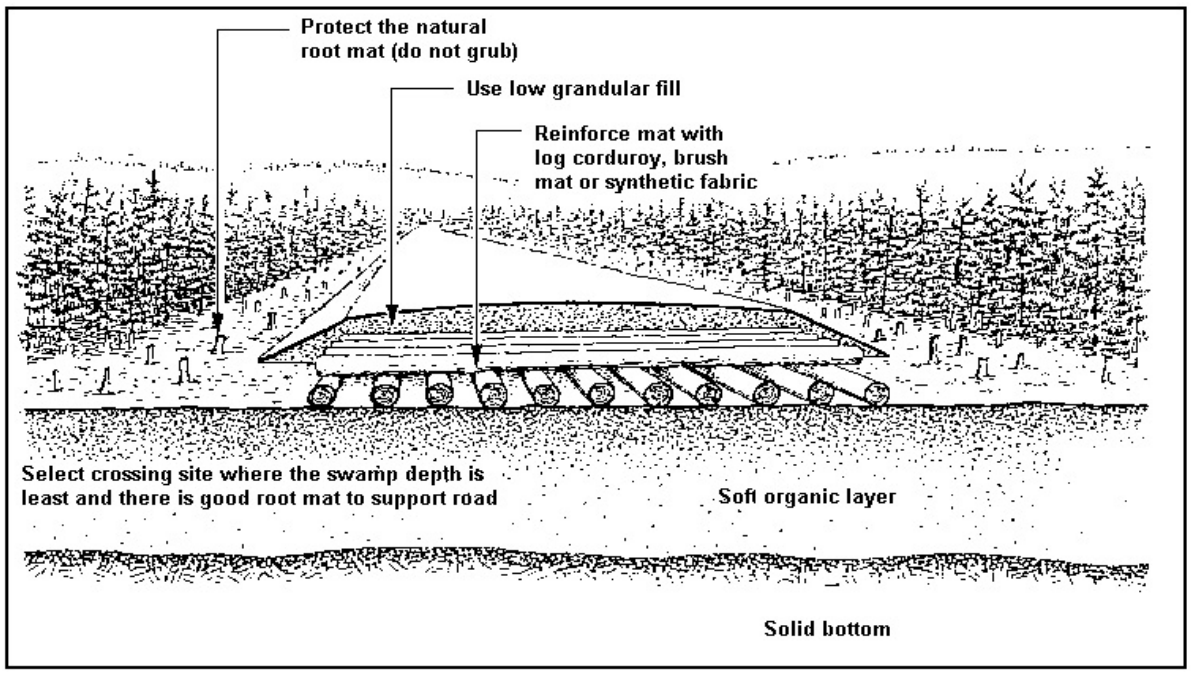
- The lime shall be spread at a rate of 2200 kg/ha and 15-25-15 fertilizer at a rate of 625 kg/ha. The seed shall be a mixture of 40% Creeping Red Fescue, 15% Timothy, 15% Tall Fescue, 10% Kentucky Blue Grass, 10% Alsike Clover, 5% Red Top, 5% Perennial Rye, at a rate of 100 kg/ha. For seeding after September 1, the fertilizer shall be 10-20-20.

Further details on stabilization is provided in TPW's *Environmental Protection Plan for the Construction of 100 Series Highways.*

4.4 Construction in Swamps

Good construction practices involving swamp treatments include:

- Deep swamps should be avoided.
- Select a crossing location where there is a well developed root mat supporting tree growth.
- Construction through a swamp area is preferable during the winter; heavier equipment can cross without being bogged down or disturbing the root mat; and, construction can proceed beyond the swamp without having to wait for the completion of treatment.



- The most common swamp treatment involves floating the material on the natural root mat.
- If possible, limit fill depths over swamps to 1.3 metres.
- If the placement of fill on the natural mat is not practical, use reinforcing materials such as geotextiles or log corduroy. If a geotextile is required it shall be non woven and shall be applied at the Manufacturer's Specifications. Seam strength shall be a minimum of 90% of the grab tensile strength of the geotextile and the geotextile shall meet the following average roll values:

Grab Tensile Strength	N	1100
Mullen Burst	kPa	3000
Filtration Opening Size	µm	70-200
Hydraulic Conductivity	cm/s	0.1

- Before placement of the geotextile over the swamp, the area to be covered must be cleaned of all rocks, sticks, branches or other objects that could cause a break in the textile when a load is placed on it. The area under the textile is not to be grubbed. All joints in the geotextile shall be overlapped as per the Manufacturer's Specifications. Equipment of any type must not be permitted to travel over the placed geotextile. Fill material shall be end dumped and spread out over the geotextile by machine. Fill used on swamp crossings, where the road is floated on the natural mat, should be free of large boulders or rocks that can puncture the mat.

- Enough culverts should be provided to ensure that the surface water is equalized on both sides of the road. The culvert(s) should be located where the organic deposit thickness is the least (less settlement).

4.5 Graveling

The subgrade shall be shaped, compacted and crowned before the placement of the gravel layer. This will allow subgrade to shed water seeping through porous gravel during wet periods. Gravel Type II shall be applied at a thickness of 125 mm; then covered with Gravel Type I to a thickness of 75 mm. For environmental purposes, as each 200 m section of roadway is completed then Gravel Type II must be applied within 72 hours of completion of subgrade.

4.6 Drainage Ditches and Culverts

The following are good construction practices:

- It is important to differentiate between cross drain culverts and instream culverts. Cross drain culverts are those required to pass local surface flows channelized by the road construction. There is no defined channel prior to construction and there are no fish in these channels. Instream culverts are those required where the road crosses a natural watercourse that has a defined channel.
- All culverts shall be installed in a manner which minimizes sedimentation as the down steam receiving water will eventually be fish bearing.
- Installation should be done in the driest possible time of the year (*i.e.*, June 1 to September 30).
- The ground vegetation should not be disturbed within 30 m of any stream crossing until after all environmental controls associated with the crossing are installed.
- Whenever possible instream culverts shall be placed on the natural stream gradient which should not exceed 1%. At any location where fish may be present and the slope of the culvert exceeds 1% fish passage facilities will be required.
- The bottom of the instream culverts shall be between 150 mm and 300 mm below the stream bed.
- If more than one culvert is set side by side, only one culvert needs to be set below the stream bottom.
- Where cross drain culverts are used on down grades to divert flow and minimize ditch erosion, they should be angled across the road.
- The minimum size of culverts used on roads needed for 10 years should be 500 mm in diameter.
- Rip Rap should be placed on the upstream fill slope of the culvert inlet, to the top of pipe to prevent scour during high flow periods. Rip Rap protection should be provided downstream of culvert if high flow velocities are expected to act as an energy dissipator.

Culvert Size	Length of Rip Rap Protection
> 600 mm	1.0 m
< 600 mm	1.5 m

The minimum rip rap wall thickness shall be 400 mm.

- For in-stream culverts, the following two conditions must be satisfied prior to commencement of culvert installations.

  1. A buffer zone of 30 m or greater shall be maintained on both sides of the water course within which no grubbing or infilling is to take place until the culvert and erosion control devices are installed.

  2. C2 Gravel (100-150 mm Clear Stone) and C1 Gravel (5-20 mm Clear Stone) shall be placed at the proposed ends of the culvert before any excavation is allowed.

- The in-stream bottom and banks at the outlet of all instream culverts shall be protected from scour from water leaving the culvert. Special Gravel 150 mm in size shall be placed at the downstream end of the culvert at the distances indicated below.

Culvert Size	Length of Rock Protection	Thickness
500 mm	2 m	300 mm
600 mm	2.7 m	300 mm
750 mm	3.3 m	300 mm
900 mm	4.0 m	300 mm
1200 mm	5.5 m	450 mm
1500 mm	7.0 m	450 mm
1800 mm	10.0 m	450 mm

- Water Control for in-stream culverts will be carried out using one of the following methods:
  1. For structures that span most or all of the streambed, install sheetpile barriers or cofferdams, pump the water to an adjacent vegetated area or settling pond, and complete the footings and culvert installation in the dry (Note: rescue any trapped fish by netting or electrofishing as per DFO requirements)
  2. Dam the stream and pump the flow around the site (ensure continuous monitoring to maintain flow to downstream areas).
  3. Divert the flow around the site in a stabilized channel until the new culvert is completely installed.
  4. Build the new culvert in the dry and divert the stream into it upon completion.

- Ditches should be constructed uphill, to avoid trapping of water. All roadside ditches should flow to an outlet downstream of the ROW.
- Cross culverts and offtake ditches are required to ensure adequate roadside drainage. The recommended spacing of these depend on ground soil type, as indicated in the following table.

Ground Slope	Erodible Silt - Clay	Normal Soils Loam	Rock Soil, Sand and Gravel
Gentle, Under 5%	300 m	600 m	No Limit
Moderate, 5-10%	150 m	300 m	600 mm
Steep, Over 10%	100 m	150 m	300 mm

- Off-take ditches shall divert flow into the bush so the water filters through natural vegetation before entering the watercourse. Off-take ditches are to be constructed 30 metres back from any watercourse.
- Interceptor ditches may be necessary to divert water away from steep cuts or fill slopes.
- Long roadside ditches on slopes over 2% (two percent) may require check dams, intermediate cross culverts or off-take ditches to reduce flow velocity and water quantity if erosion is a problem.
- To ensure that drainage ditches are not blocked, side roads should have entrance culverts installed.

In some contracts, bridges may be required for sensitive watercourse crossings. In these cases, a site- or project-specific EPP will be prepared to summarize the design and environmental protection measures.

Further details on environmental protection measures for culvert installations are provided in TPW's *Environmental Protection Plan for the Construction of 100 Series Highways.*

5.0 ROAD MAINTENANCE

Road Maintenance can be broken down into two main groups: routine and non-routine. Routine include day-to-day activities to maintain traffic using it (grading, snow plowing, maintenance of drainage i.e., cleaning blocked culverts and ditches. Non-routine maintenance includes major repairs and restoration. These roads may require major maintenance or reconstruction every 10 - 20 years (Brush control, replacement of gravels, repair of flood damage, replacement of sub-standard bridges). If a road is not maintained it should be abandoned.

Maintenance shall include:

- Regular inspection of drainage structures and ditches and upkeep if necessary.
- Loose gravels shall be graded back to the center of road to prevent creation of berms that could channelize water down road and erode the fill slopes.
- Grading of road surface to minimize rutting.
- Management or removal of nuisance beaver.
- Heavy equipment (should not be allowed on roads during spring break up).
- Snow banks shall be winged back to minimize spring saturation and erosion of roadbed.
- Roadside vegetation that prevents drying of road and restricts safe visibility should be removed.
- If a herbicide is used, a 30 m buffer zone should be maintained adjacent to all water bodies.
- Following timber management operations along the roadside, the roadway cross section should be restored by repairing damaged slopes, culverts and ditches.

6.0 ROAD ABANDONMENT

There are two types of abandonment:

Physical Abandonment
This occurs when there is a deliberate attempt to render a road unusable by vehicular traffic. Physical steps may be taken to minimize the environmental impacts of non-maintenance.

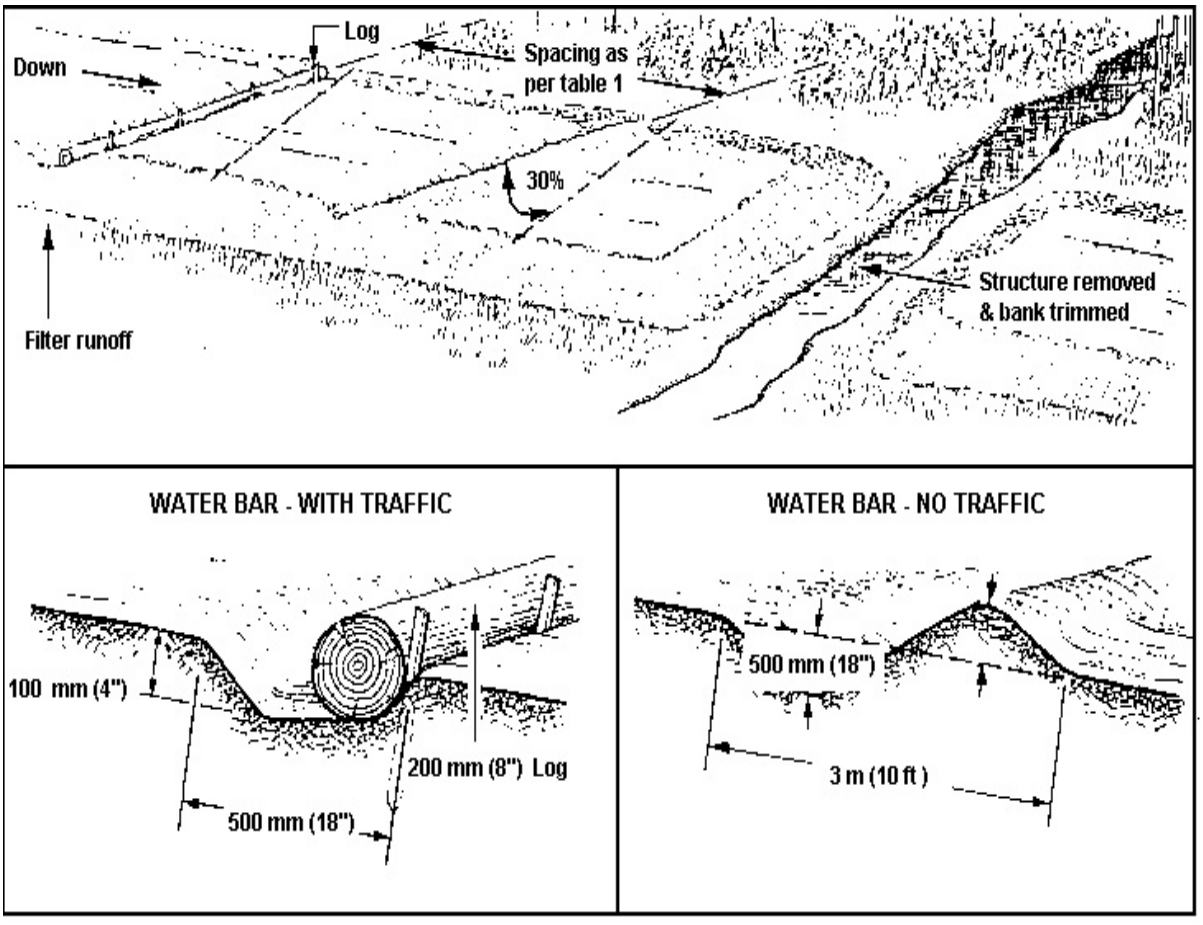
Natural Abandonment
This occurs when road maintenance has ceased, yet steps have not been taken to prevent the use of the road by vehicles. With natural abandonment, no physical changes are made to the road.

In either case, abandonment should be carried out in an environmentally sound manner. When a road is not maintained, frost and runoff will lead to loosening and erosion of fill and road surfaces. In the area of watercourses, water can flow down the road and erode the road surface and underlying fill. Preventative measures can be taken to minimize erosion of the roadfill and subsequent sedimentation of the watercourse.

Water bars can be used to control surface runoff and minimize erosion of the road surface and fill. Water bars are traverse ditches excavated across the road surface to intercept runoff and deflect it towards the ditch instead of flowing along the road surface. The outlet of the water bar shall be extended into an area that is erosion resistant and that will filter out sediment.

There are two types of water bars:

1. One uses a log to divert water while still permitting passage of vehicles over it.
2. The other would be used where there is no traffic on the road.



Water bars should be spaced closer together in steeply sloping terrain. Water crossing structures that have required on-going maintenance to keep functioning, or which have deteriorated with time and may collapse into a waterway should be removed when the road is abandoned. It is not necessary to excavate stable bridge abutments and erosion protection work. The banks and approaching fills should be graded to a stable angle similar to the adjacent natural river banks and provided with erosion control treatment to prevent erosion. Exposed soil on banks should be seeded and fertilized to speed re-vegetation.