PAPUA NEW GUINEA

FOREST AUTHORITY

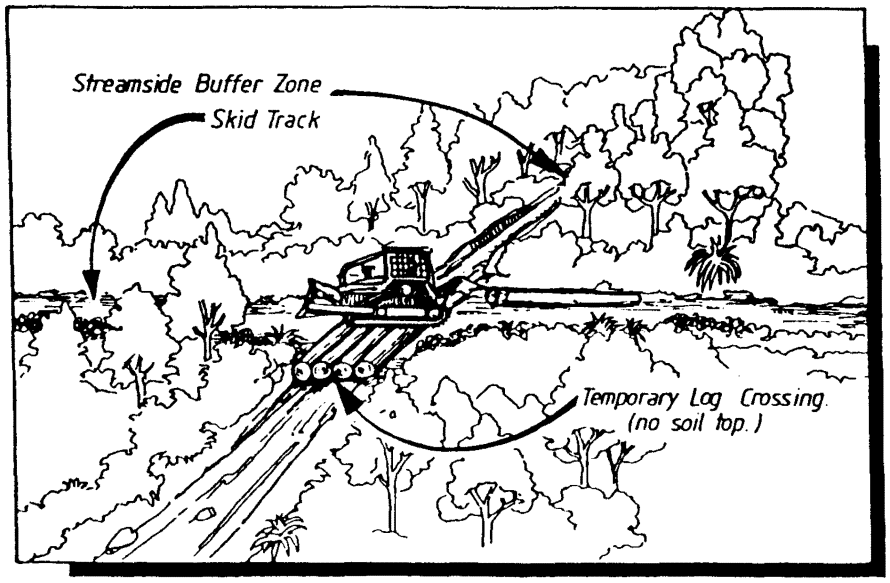
DEPARTMENT OF

ENVIRONMENT AND

CONSERVATION

PAPUA NEW GUINEA

LOGGING CODE OF PRACTICE



First Edition - April 1996

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INTRODUCTION

The Department of Environment and Conservation and the PNG Forests Authority believe the implementation of this ***Papua New Guinea Logging Code of Practice***, in association with regulations, offers practical guidance to reduce the adverse impact of logging on the forest and the communities living in them. The code allows for the protection of the environment and maintenance of forest productivity through economically viable operations within acceptable safety standards.

Historically many of the conditions in this code were incorporated into a range of documents including: Timber Permits and associated permit conditions; Project Agreements; Five Year Forest Working Plans; and the Environmental Plan and associated permit conditions. This has created confusion for all the parties involved. This ***Papua New Guinea Logging Code of Practice*** aims to address these shortcomings by combining agreed standards, prescriptions and best management practices for selection logging into one document.

The ***Papua New Guinea Logging Code of Practice*** has been prepared by an environmental working group with representatives from the Department of Environment and Conservation (Division of Environment and the Bureau of Water Resources), and the PNG Forest Authority. It incorporates responses to a draft version distributed widely amongst logging companies, Non-Governmental Organisations, training institutions and other Government Departments.

It is recognised that full implementation of the standards and operating practices set out in the code will take time. As a starting point the working group identified a minimum set of 24 Key Standards, and the PNG Forest Authority requires full compliance with these in its "Planning, Monitoring and Control Procedures for Natural Forest Logging Operations Under Timber Permit" (November 1995). Over time additional standards from the code will be formally added to the Planning, Monitoring and Control procedures until such time as the full code is being implemented. The initial 24 Key Standards are identified throughout the code. A separate booklet entitled ***Key Standards for Selection Logging in Papua New Guinea, April 1995*** is available.

The ***Papua New Guinea Logging Code of Practice*** was formally adopted by the National Executive Council in March 1996.

It is accepted that in the future this document will require review and amendment as both operational findings from its implementation, and research, add new information.

DEFINITION OF AREAS FOR SELECTION LOGGING

Generally the Department of Environment and Conservation (DEC) and the Papua New Guinea Forest Authority (PNGFA) have agreed that selection logging in PNG may be practiced in forest areas which are not excluded by the following criteria:

- slopes steeper than 30 degrees
- in areas of high relief on slopes steeper than an average of 25 degrees
- permanently inundated land
- limestone country (karst)
- mangrove areas

The PNGFA uses the above criteria to define the areas to be logged within the gross areas it acquires from forest resource owners under a Forest Management Agreement (FMA). As noted in the following table, the slope limitation may be relaxed for helicopter logging subject to trials and the setting of appropriate limitations and standards of operation.

The application of this Papua New Guinea Logging Code of Practice (PNGLCOP) , and the acceptability of the various log extraction systems, are as shown in the following table:

	Slopes from 0 to 30 degree	**Slopes steeper than 30 degrees**
Selective Logging Extraction System	**Generally PNGLCOP Applies**	**Note: Generally prohibited under the terms and conditions of the Timber Permit**
Ground-based Wheeled or tracked skidder	PNGLCOP applies	Prohibited
High Lead Cable System	Prohibited	Prohibited
Skyline Cable System	May be approved with specific permission of DEC and PNGFA but not covered by PNGLCOP	Prohibited
Helicopter	PNGLCOP applies	May be approved with specific permission of DEC and PNGFA - this may require variation of the Timber Permit

Merchantable Trees

Selectively harvest merchantable trees greater than 50 cm in diameter at breast height, or above fluting, and excluding reserved and special trees as prescribed in the Timber Permits and Environmental Plans.

LEGAL

All conditions imposed by the PNG Logging Code of Practice will be in compliance with the requirements of:

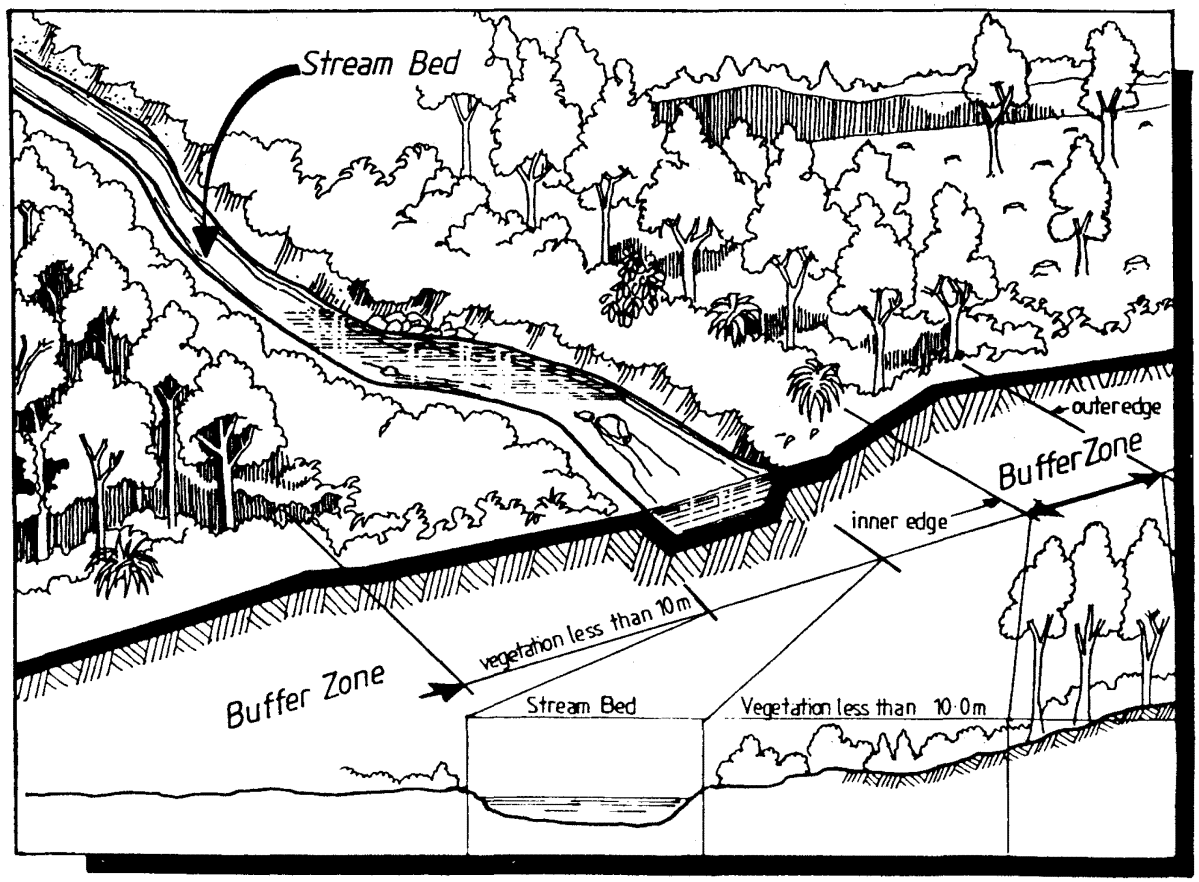
1. Forestry Act 1991 as amended
2. Environmental Planning Act, Chapter 370
3. Water Resources Act, Chapter 205
4. Environmental Contaminants Act, Chapter 368
5. Conservation Areas Act 1978
6. Investment Promotions Act, No. 8 of 1992
7. Public Health Act, Chapter 226 and its regulations (Drinking Water 1984)
8. PNG Labour Law: Industrial Safety, Health and Welfare Act, Chapter 175 and its orders and regulations
9. Land Transport Board Act as amended No. 11 of 1991
10. Civil Aviation Act, Chapter 239
11. Public Works Committees Act, Chapter 28
12. Land Groups Incorporation Act, Chapter 147

The above Acts are binding on all parties and individuals involved in selective logging in Papua New Guinea.

A. WATERCOURSE DEFINITIONS AND MINIMUM BUFFER ZONE WIDTH

1. Key Standard Number 1: Watercourse Definitions

1a	**Permanent watercourses** have water flowing for part or all of the year for most years. The beds have no vegetation growing on them. The beds may consist of water-washed sand, silt, stone, gravel or exposed bed rock materials.. **Class 1 Stream** Bed width = more than **5** metres **Class 2 Stream** Bed width = less than **5 and greater than 1** metres
1b	**Non-permanent watercourses or drainage channels** are usually stable, non-incised depressions which carry surface water during times of high rainfall. The beds are of soil and will usually be covered with leaf litter and vegetation.
1c	**Swamps** have surface water present for 6 months of the year.
1d	**Stream Buffer Zone start point (adjacent to the stream).** Delineation of the buffer zone will start where the vegetation is 10 metres high or greater.



2. Key Standard Number 2: Minimum Buffer Zone Widths

No.	Category	Minimum Width	Comments
2a	Cultural sites, reserves, conservation and garden areas	100 metres	The local community must be given the opportunity to decide on the width of the buffer zone. If different from the minimum, notification must be in writing to the PNGFA Project Supervisor who, if necessary, must ensure that the decision is representative of all interested parties.
2b	Village areas	500 metres	The local community must be given the opportunity to decide on the width of the buffer zone. If different from the minimum, notification must be in writing to the PNGFA Project Supervisor who, if necessary, must ensure that the decision is representative of all interested parties.
2c	Lakes, lagoons, coastal shoreline, swamps (as defined in the Annual Logging Plan from time to time)	100 metres	From the water body, high tide mark, or edge of the mangroves
2d	Class 1 permanent stream (as defined in Key Standard No 1)	50 metres	Each side of the watercourse
2e	Class 2 permanent stream (as defined in Key Standard No 1)	10 metres	Each side of the watercourse
2f	A stream (permanent or non-permanent) of any width used by the community	50 metres	Each side of the watercourse Buffer zones for culturally significant water sources require careful consideration. This may include the exclusion of logging to protect the catchment area of the water source. If there is doubt, it should be evaluated on a site specific basis.
2g	Non-permanent watercourses and streams less than 1 metre not used by the community	no buffer	
2h	Log pond and wharf	no buffer, maximum shoreline clearance 100m	No buffer ie log pond may be at the edge of the water. Vegetation clearance maximum is 100 metres of shoreline.

2i Marking in the Field

All buffer zones are to be marked in the field before approval to log a set-up is given. The buffer zones and water crossing points for the roads must be shown on the Set-up Logging Plans and approved in the field by the PNGFA Project Supervisor as part of the set-up approval procedure.

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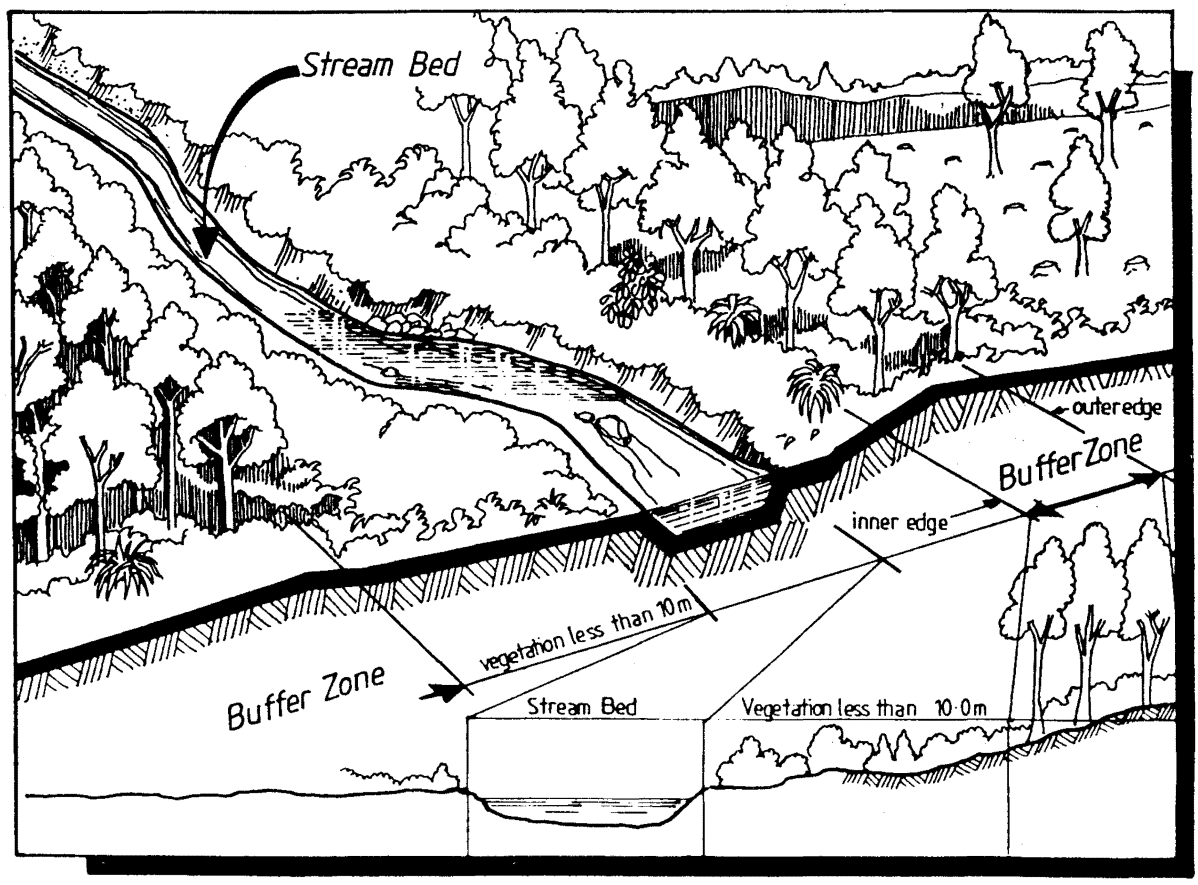


B. FOREST ROADS (NOT PROVINCIAL OR NATIONAL HIGHWAYS)

Objective
Roads and water crossings should be planned and built taking into account:
- the road use and the economics of transporting logs from the skid site
- soil, water and other environmental factors
- social aspects

1. Planning and Design

Objective
To ensure that roading system is planned ahead of logging taking account of:
- road use and its economics
- minimising soil and debris entering watercourses to ensure their integrity and to minimise impact on water quality
- availability of appropriate equipment and trained operators
- topography and catchment
- soil and climate
- social aspects including village feeder roads
- minimising disturbance outside the logging operation

1.1 Practices:

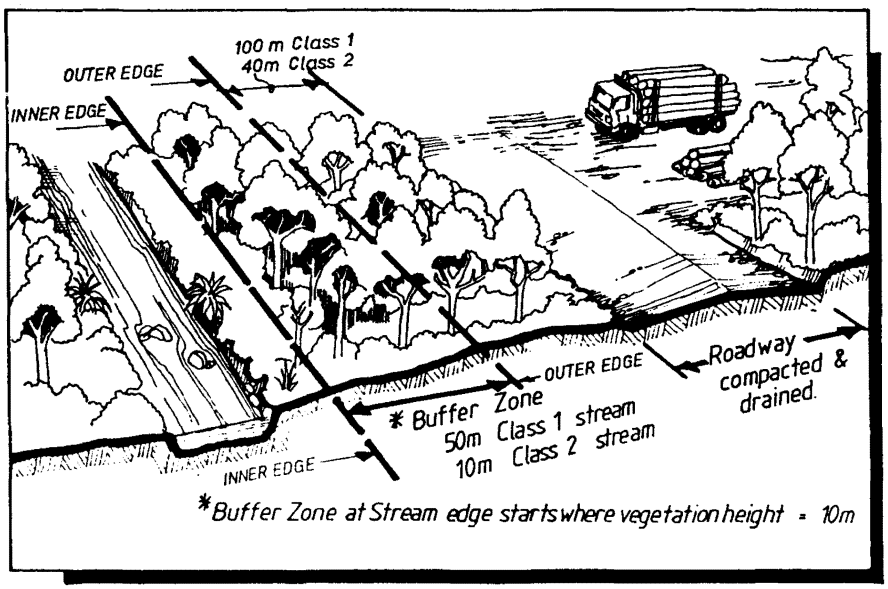
1 A logging plan, including roads and water crossings, should be prepared after consultation with the landowners concerned and to allow for pre-logging inspection and approval.

2 Design roads to follow natural topography and to avoid:
- steep and unstable areas
- gullies
- swamps and mangroves
- wetlands
- watercourses
- stream buffer areas
- village buffer zones
- garden zones
- water supply areas
- cultural sites
- reserve areas
- wildlife corridors and refuge areas; and
- other special or environmental features.

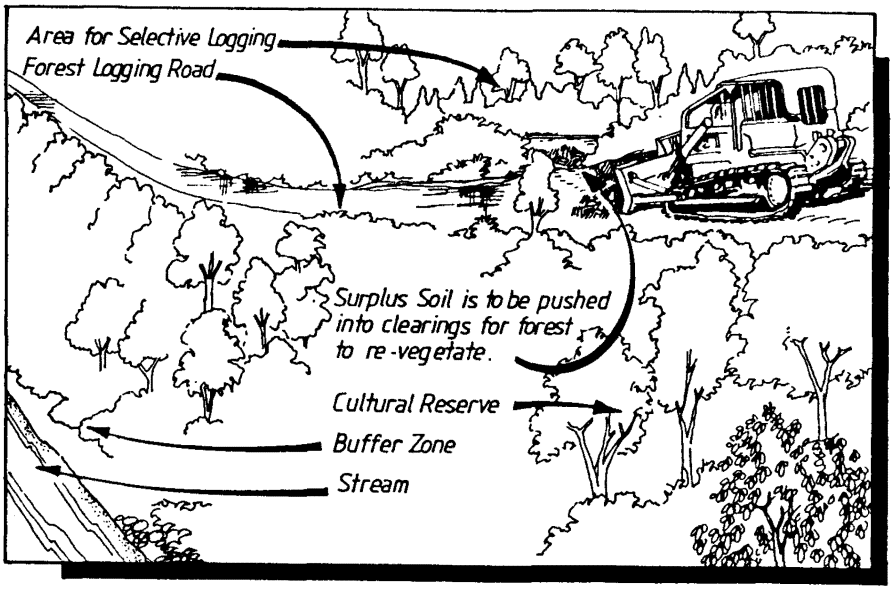
3 On the map identify control points such as ridges, streams, saddles, rock outcrops, gravel supplies/quarries, unstable areas and reserves and use these to define a corridor of interest for closer attention when assessing in the forest.

4 Minimise the number of stream crossings. Cross streams and stream buffer zones at right angles wherever possible. If the road crosses a flood zone special precautions may be required.

5 **Key Standard No. 3: Buffer zones and location of roads and log landings** Place roads and log landings 100m away from the outer edge of the buffer zones of Class 1 streams and 40m away from Class 2 streams and excluded areas (reserves and cultural sites) to minimise disturbance to the buffer zone If this is not practically possible it should be identified in the set-up plan or be the subject of specific approval.



6 **Key Standard No. 6: Disposal of excess soil** Do not dispose of excess soil into watercourses or areas excluded from logging. Identify areas which could be used for the disposal of excess soil.



7 Minimise the use of borrow pits and soil dumps by careful road design to balance earthwork quantities.

8 Forest roading networks which will be used for more than a limited time should minimise gradients steeper than the preferred maximum (Table 1). Vertical curves should be provided to maintain minimum sight distances (Table 2). Additional widths will be required to allow for heavy vehicle off tracking on curves (Table 3).

9 Plan to construct roads during the dry season. Avoid major earthworks during the wet season. Plan to maintain during both the wet and dry seasons.

10 **Key Standard No. 7: Use compaction equipment (rollers) during road construction.** Plan for and use compaction equipment (rollers) on both formation earthworks and surfacing layers during road construction.

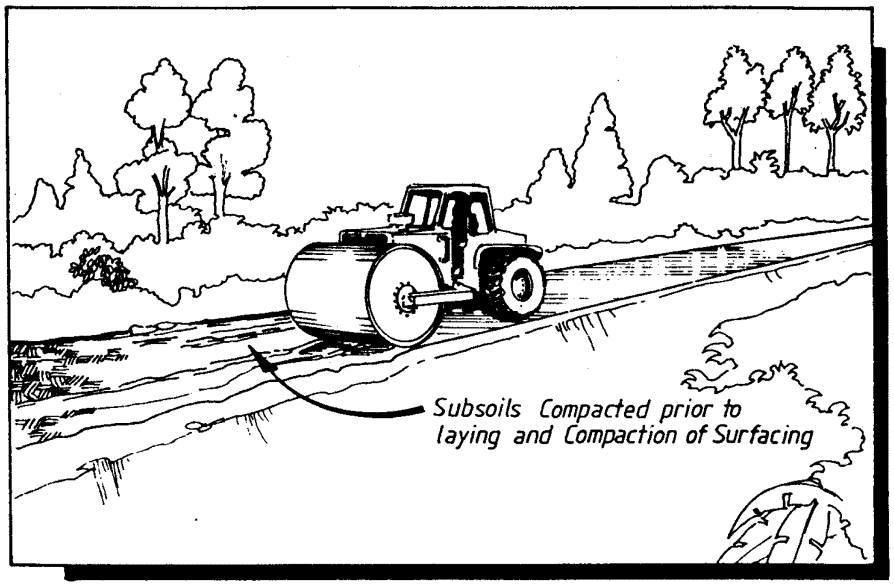


TABLE 1 - Road Width, Gradient And Visibility

Road Type	MAIN ROAD 2 way	MAIN ROAD 1 way	FEEDER ROAD 1 way
Traffic Volume (heavy vehicles per day)	More than 20	More than 20	Less than 20
Roadway width incl. shoulders:			
• **Gravel surfacing** (compacted suggested minimum depth 150mm)	10.0m	6.3m	6.0m
• **Compacted clay** (where no surfacing material is available)	15.0m	11.0m	7.3m
Preferred maximum grade	10% (5.7°)	10% (5.7°)	15% (8.5°)
Preferred maximum length at maximum grade	1000m	1000m	750m
Absolute Maximum grade and the length over which it applies	20% (11.3°) - 200m 15% (8.5°) - 300m 13% (7.4°) - 500m	20% (11.3°) - 200m 15% (8.5°) - 300m 13% (7.4°) - 500m	20% (11.3°) - 500m 15% (8.5°) -750m 13% (7.4°) - 1000m
Preferred minimum side drain or water table grade	2%	2%	2%
Absolute Minimum side drain grade	1%	1%	1%

NOTES:

1 Roadway width is based on a truck with overall width of 2.5m. If the truck is wider the roadway width can be increased by the difference between actual width and 2.5m. For a 2 lane roadway twice the difference should be added to the roadway width. Low speed use will enable a small reduction in roadway width. Heavy vehicles are logging trucks or logging road construction machines - not pickup or utility vehicles. (Common Nissan truck = 2.5 to 2.8 m wide. Mercedes truck (Doll trailer) = 3.4 m wide)

2 Any two sections of road at absolute maximum gradient must be separated by at least 100 m of level or favourable gradient.

3 The use of maximum gradients for other than short sections of road seldom leads to the most economic road construction cost or the most economic log transport cost.

4 Curve widening on corners will be required to allow for off tracking (Table 3).

TABLE 2 - Minimum Radius And Visibility

DESIGN SPEED	30 kph	50 kph	80 kph
Minimum Radius (use may require signs)	25m	30m	55m
Desirable Minimum Radius	35-75m	75-120m	140-300m
Minimum Sight Distance required	30m	64m	120m
Meeting Sight Distance	50m	100m	220m

TABLE 3 - Offtracking On Curves (Metres v/s Radius of Curvature)

Radius (m)	25	30	40	50	60	75	100	150	200
Offtracking	1.65	1.20	0.95	0.80	0.70	0.55	0.40	0.35	0.20

NOTES:

1. Offtracking is calculated for a vehicle with overall length of 14 meters. Many loaded logging trucks exceed this length. This does not affect the wheel offtracking.
2. Offtrack at minimum turn circle (12.2m) = 3.9 metres
3. Additional width is required in each lane. i.e. A two lane road requires a total widening to the roadway width of twice the tabulated value.

2. Survey and Setout

Objective
To ensure that roading is marked in the field, in accordance with the planning and design, and to facilitate accurate and cost effective construction while preserving environmental values.

2.1 Practices:

1 Global Positioning System instruments can be used to assist in field marking. Their use is sensible and economic and it is suggested that they should be part of any operation's normal survey equipment. Topographic maps (1:50,000 with 20 metre contour intervals) will be necessary to accurately plan roading systems which can then be marked in the field. Clinometer, tape measure and compass and the ability to use them sensibly is required.

2 The road, spoil dump areas, culverts and water crossings (this should include stream buffer zones) should be clearly setout with appropriate markers, pegs and flags.

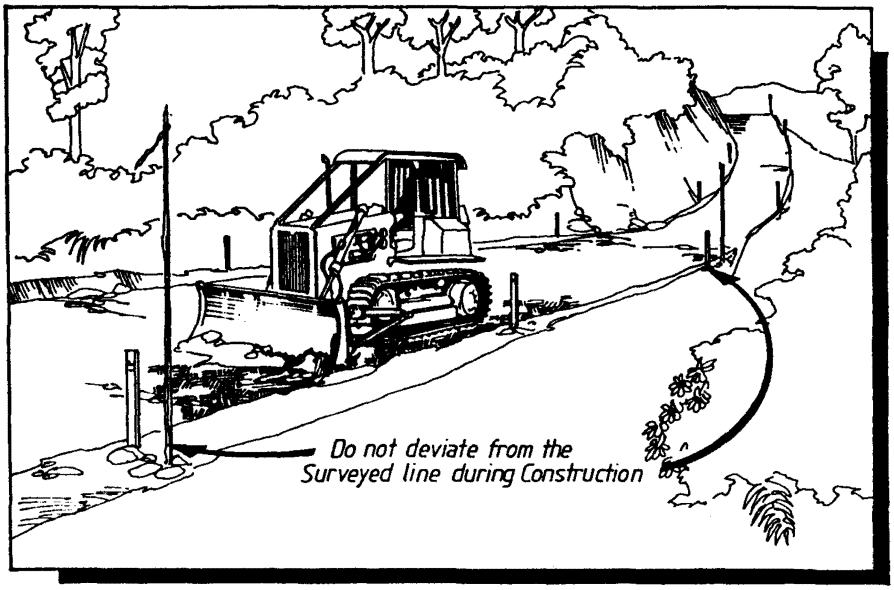
3 Gradients and roadline marking should be confirmed by the person who is responsible for roading, as part of a final check to ensure that the road is located where it should be.

3. Construction

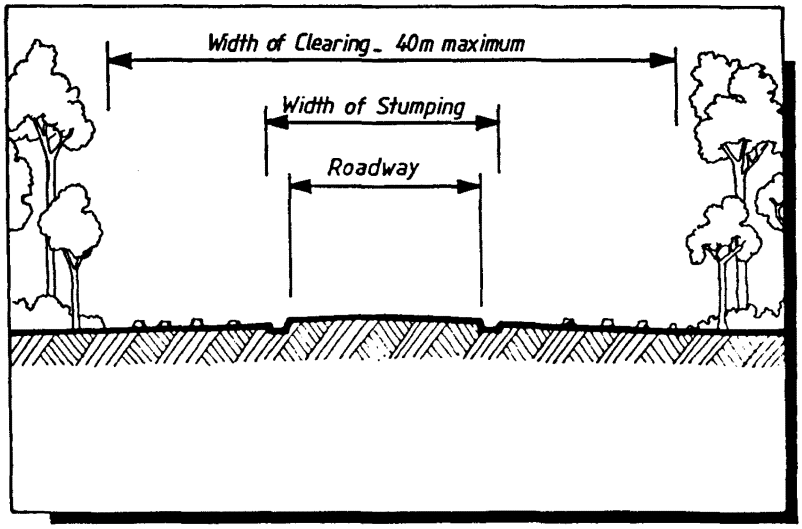
Objective
To construct a road which fulfils the design objectives and which minimises vegetation and watercourse disturbance and soil erosion.

3.1 Practices:

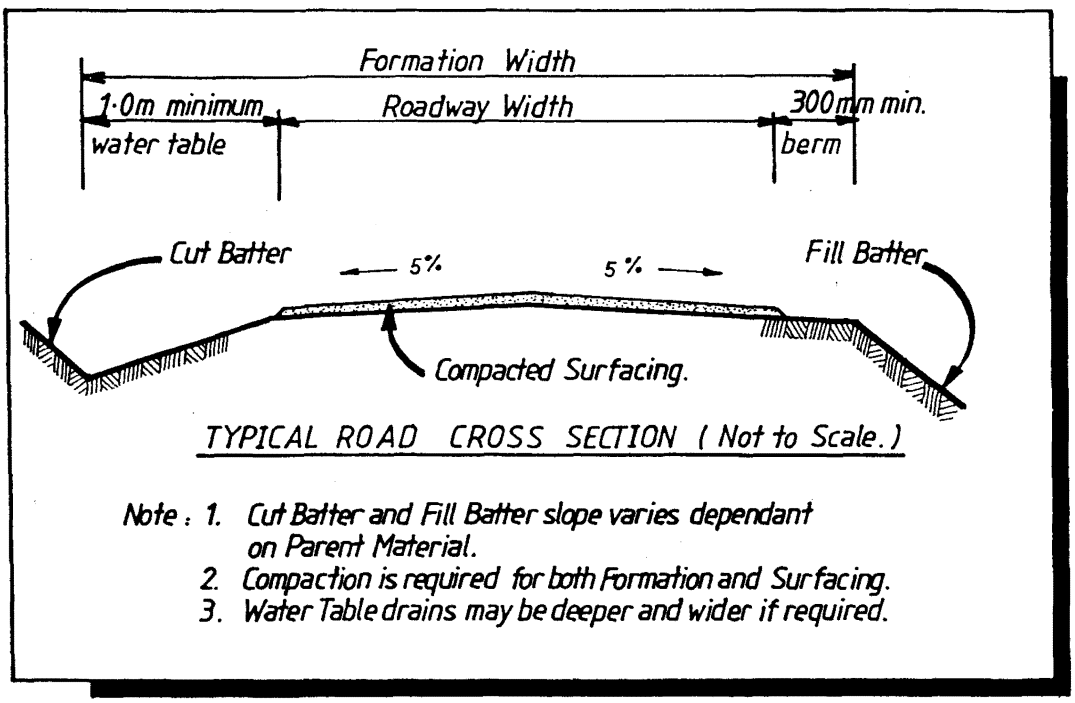
1 **Key Standard No. 8: Follow surveyed roadline** Follow the surveyed road line during construction. Do not deviate from the line. If changes are required for practical reasons they should be approved by the PNG Forest Authority Project Supervisor.



2 **Key Standard No. 9: Maximum cleared forest road width is 40 metres.** The maximum cleared forest edge to cleared forest edge width on main roads is 40m. Trees cleared for roading should be felled directionally along the road corridor. to avoid canopy damage to the standing forest at the edge of the corridor. Minimise the amount of vegetation cleared during road construction to assist wildlife passage and minimise canopy clearance.



3 **Typical Road Cross Section**: Roadway and daylighting can almost always be accommodated within a maximum cleared edge to cleared edge width of 40 m. Excessive road clearance does not enhance drying from the sun.



TYPICAL ROAD CROSS SECTION (Not to Scale.)

Note : 1. Cut Batter and Fill Batter slope varies dependant on Parent Material.
2. Compaction is required for both Formation and Surfacing.
3. Water Table drains may be deeper and wider if required.

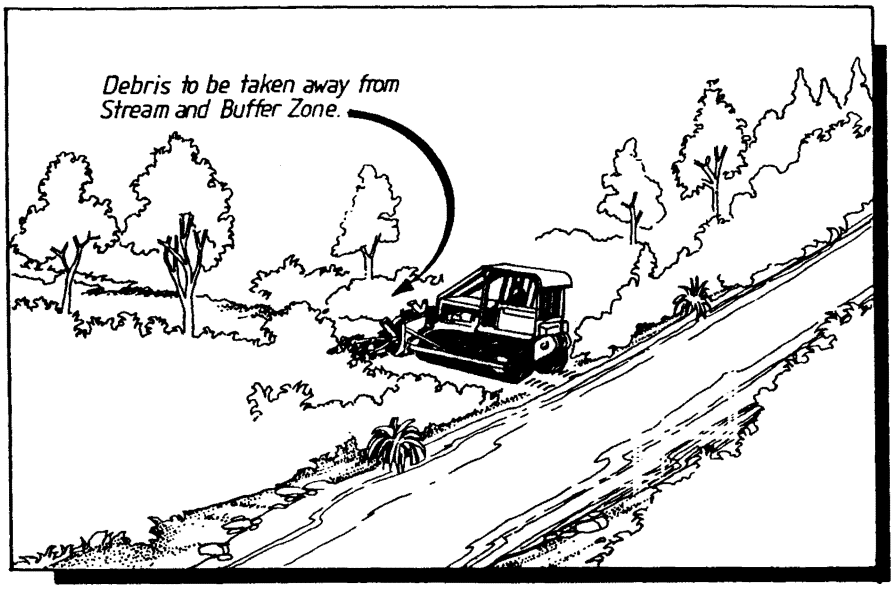
4 Where possible strip and stockpile topsoil for use in rehabilitation or place it outside the road formation work.

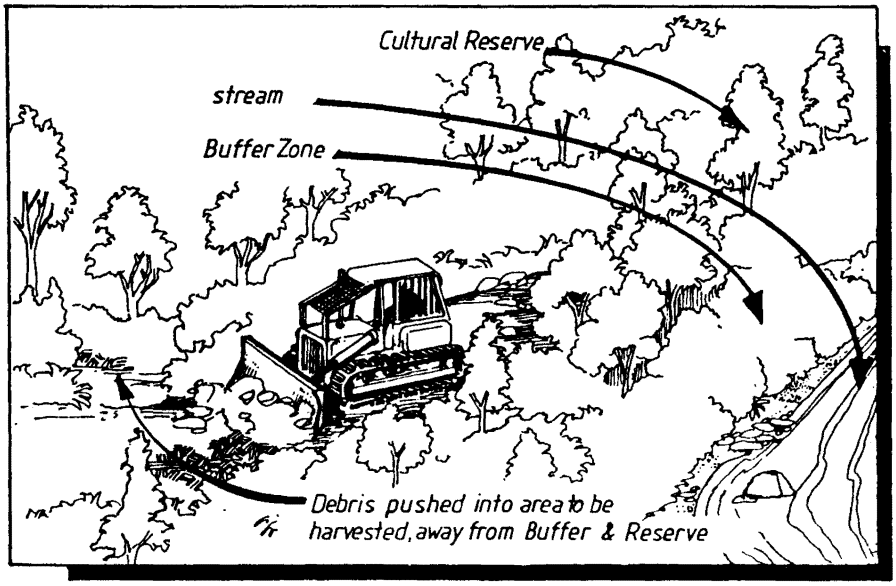
5 Roads should be constructed from the best engineering material. If organic material is used, such as peat or wood, special precautions may be required.

6 Construct roads during the dry season. Avoid working in wet weather.

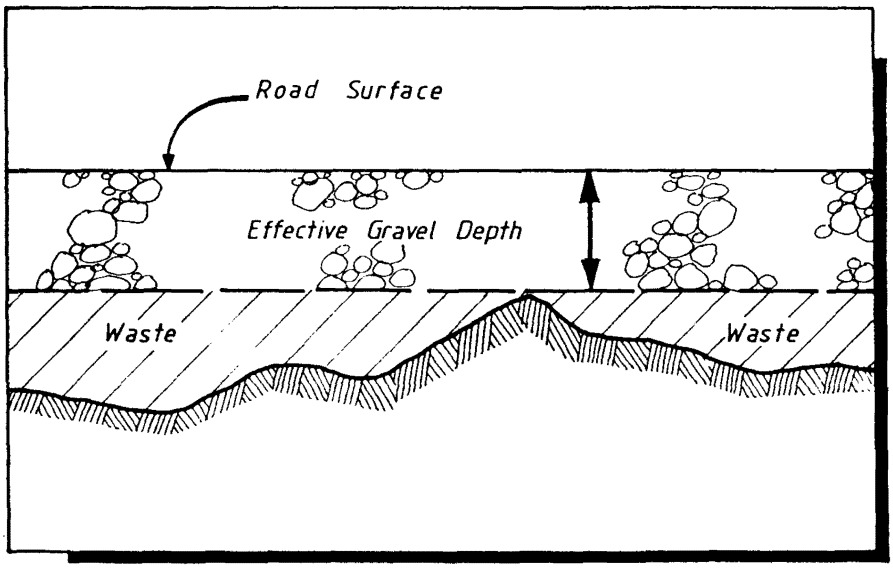
7 Use appropriate machinery. Excavators as a prime earthmover, are a particularly useful and versatile machine in road construction and maintenance. Graders should be used during construction to shape roads. Use bulldozers for bulk earthworks and excavators for work in wet areas, streams and where minimal soil disturbance is important.

8 **Key Standard No. 10: No soil in streams from road construction or skid tracks** No soil from road construction or skid tracks should enter any stream nor should any material be left in a position where it could be expected, in the normal course of events, to enter a stream.





9 **Avoid wasting the gravel surfacing by achieving a good formation shape.** Stabilise formation and surfacing layers of the road by following good compaction practice. Track rolling with a bulldozer is not compaction, although rubber tyred trucks, loaders and graders are effective. Soil compaction using soil compaction machinery should be carried out on both formation earthworks and the roadway surfacing or pavement.



10 Use revegetation and seeding on bare soil areas after construction.

11 Provide adequate drainage during construction by maintaining a good road shape, and camber, to keep the site free draining.

12 Install adequate drains, water tables, water cutouts, culverts, fluming and sediment traps to prevent scour. Traps can be made of logs, branches, bales, rocks, tyres etc.

13 Where borrow pits will have walls higher than 4m advice should be sought, from an experienced person, on stepping, battering and drainage before the pit is opened. Drainage must be provided to avoid ponding and possible sudden water release causing soil erosion.

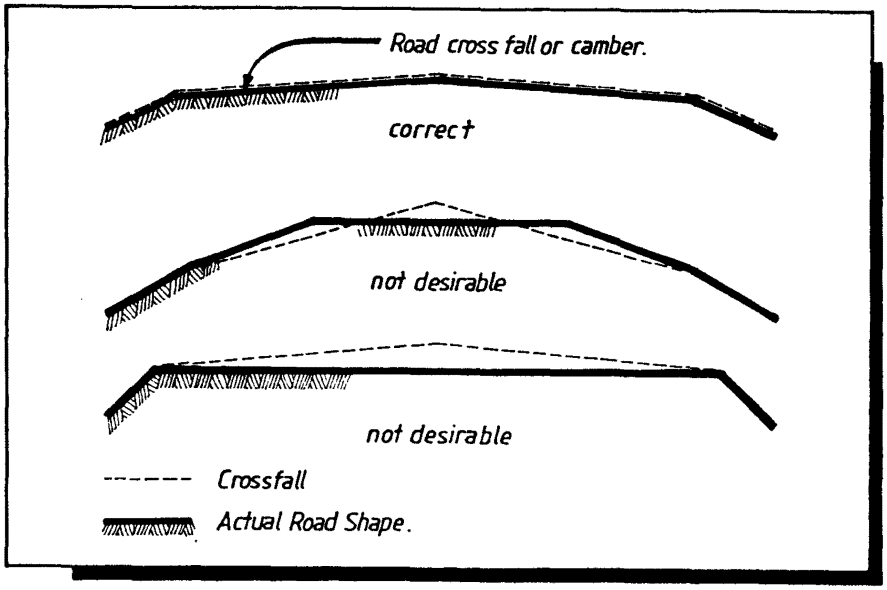
14 **Key Standard No. 23: Remove rubbish from log landings and roads** Remove debris from the log landings and roads (waste oil, lubricants, fuel, old wire rope, oil drums, oil filters). Bury rubbish at an approved land fill disposal site (waste pit) away from the high water table and watercourses.

4. Road Surface Drainage

Objective
To provide the best road possible and to avoid or mitigate soil loss and reduced water quality.

4.1 Practices:

1 Road cross fall or camber should be provided.



2 Culverts should be placed across the roadway, where required, for water table drainage. Points to note include:

- Minimum fall on cross road culverts should be 5%.
- Skew the culvert to allow easy entry of the drain or water table flow.
- Discharge the culvert or water cutout on to hard ground using vegetation as a filter.
- Old car tyres held in position with stakes can provide cheap and easy scour protection for permanent roads.
- If road dips are used for cross drainage, precautions may be required to maintain the road structure under the action of scour or increased moisture content.

3 If culverts are placed in roadway fill the outfall will require fluming or scour protection to protect the fill material. Avoid discharging culverts directly into a waterway.

4 **Key Standard No. 11: Road Drainage** Culverts or turnouts must be provided on all roads. Where it is possible to use turnouts rather than culverts, the advantages are:

- they are cheaper to construct and maintain
- they are generally more difficult to block with debris
- they easier to maintain and are very visible when problems occur

TABLE 4 - Culvert/Turnout Maximum Average Spacing (metres)

Road Gradient	Clay-silt-fine sand-ash	sand-very fine gravel-pumice	gravel with some sand	clean gravel
5%	200	300	400	500
10%	100	150	200	250
15%	67	100	133	167
20%	50	75	100	125

NOTES:

1 Material differentiation is on the basis of particle size. Mixtures of materials should be assessed to provide the maximum spacing for the predominant water transportable particles.

2 Maximum spacings are in metres for either culvert pipes or turn outs.

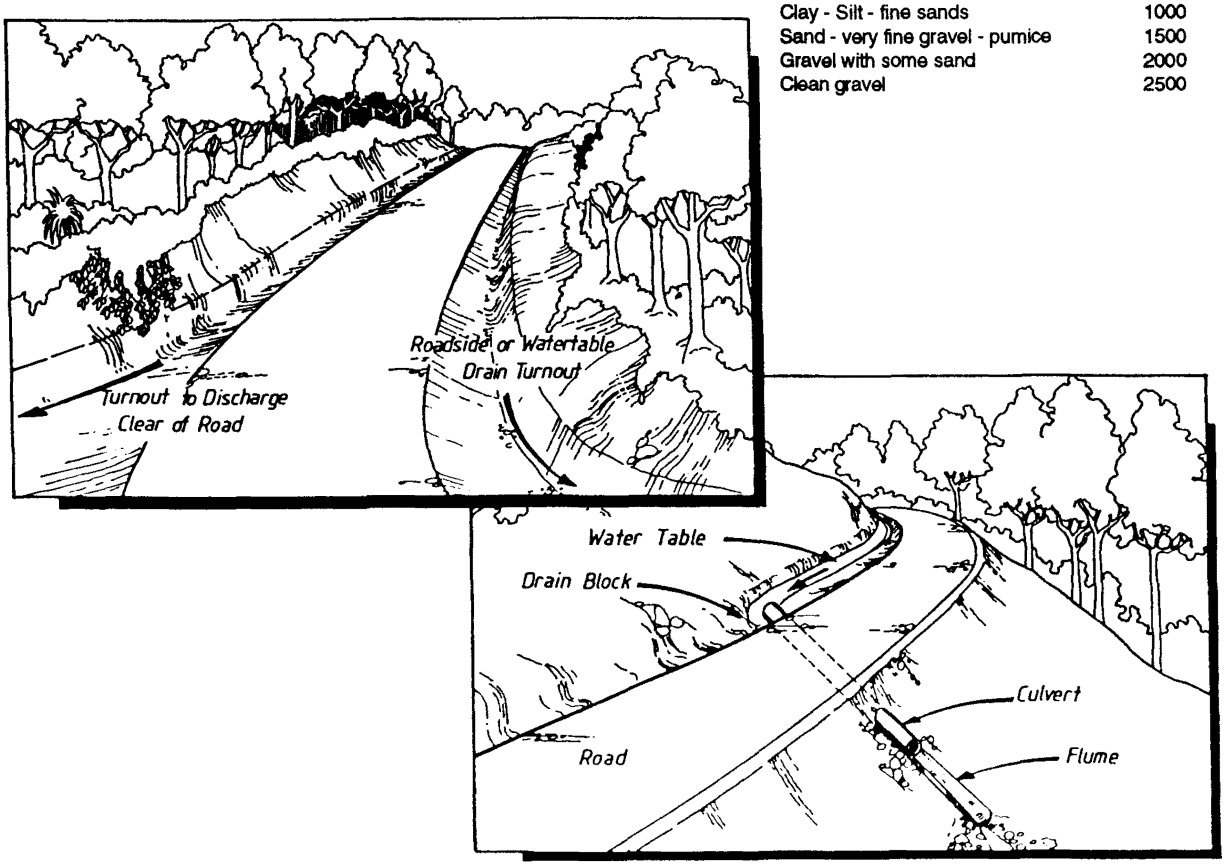
3 The maximum spacing for 300 mm pipe culverts is 185m. The maximum spacing for 375 mm pipe culverts is 325m.

4 Culvert and turn out spacings (maximum average) can be calculated from the formula:

spacing (metres) = **factor** / road gradient (%)

The **factors** are:

Clay - Silt - fine sands	1000
Sand - very fine gravel - pumice	1500
Gravel with some sand	2000
Clean gravel	2500



5 Log clusters (three logs or more) are not to be used as road culverts. Log culverts (hollow logs) require care to keep them open.

6 Provide adequate cover between the top of the culvert pipe and the road surface. Use the manufacturers recommendations (or provide 1.5 times the pipe diameter).

7 Compact the fill around the culvert pipe or log culvert.

8 Use of an excavator is preferred to place culverts - not a bulldozer.

9 Consider the impact of the water flow if the pipe blocks. If it is a critical culvert it will require frequent inspection and maintenance.

10 Provide additional culverts if required to divert water from sensitive areas such as:

- fill slopes or unstable ground
- bridge approaches
- water supply areas

11 Subsoil drainage to lower the water level may be required in some situations such as a spring in the middle of the road formation.

12 Roadside water table drains must be constructed and maintained. Water table blocks or small wall structures can limit water velocity (speed and scour ability) on steep gradients. Head and outlet walls should be provided if needed to prevent scour or soil erosion.

5. Road Maintenance

Objective
To ensure that the road performs its function.

5.1 Practices:

1 Grader maintenance of the road running surface should be performed as needed to maintain the cross fall and road shape (without overgrading).

- Don't push all the good surfacing gravel material to the road edges or into roadside drains.
- The grader blade angle is important and varies depending on the type of material.
- Compaction after grading is an ideal to aim for.
- Some hand work with a shovel clearing drains and cut outs is always required during grader maintenance.

2 Regular inspections should help identify trouble spots and allow quick and easy remedial measures to be taken - for example blocked culvert pipes.

3 Where maintenance gravel is used to maintain a smooth running surface it should have a maximum size of approx. 30mm. Screening of oversize material at the source is desirable to avoid costly trucking of unsuitable gravel. Crushed gravel for the road running surface is an ideal which is, in most cases, economic.

4 Trim roadside vegetation for visibility and safety.

5 Keep culverts clean and free of obstructions. Clean with a high pressure hose if necessary. Mark culvert pipes with a marker post to assist identifying them for maintenance.

6 Drains, pipes, culverts and bridges are to be kept in good working order.

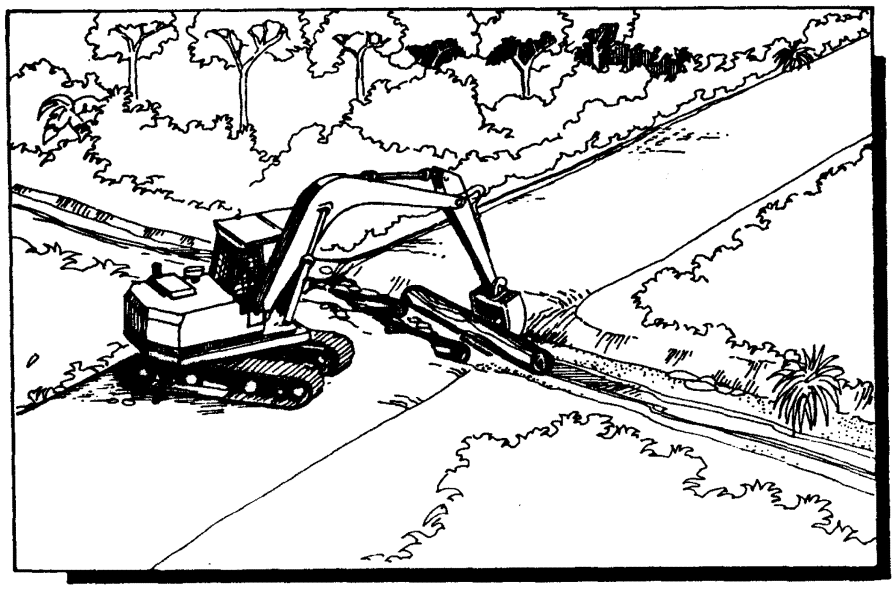
6. Road Decommissioning

Objective
To close a road to normal traffic and leave it in a state that maintains soil and water values, but leaves the road formation intact for reopening if required.

6.1 Practices:

1 **Key Standard No. 19: Decommissioning forest roads.** Remove log culverts, culverts and temporary bridges to allow unobstructed water flow where the decision is made to decommission a forest road.

As a general rule all feeder forest roads (not village feeder roads) should be decommissioned. The decommissioning of a main forest road will require consultation with the landowners. If the road is to be kept open there is a need to decide who will maintain the road.



2 Restore stream beds and banks to aid unimpeded water flow in more or less natural conditions.

3 Out slope roads and remove any edge berms to allow cross road water flow without concentration. When out sloping is not possible provide water bars (**Key Standard No. 21:**).

4 **Key Standard No. 23: Remove rubbish from log landings and roads.** Remove debris from the log landings and roads (waste oil, lubricants, fuel, old wire rope, oil drums, oil filters). Bury rubbish at an approved land fill disposal site (waste pit) away from the high water table and watercourses.

5 Consider the impacts of decommissioning the road where uses other than logging have developed during it's life.

7. Water Crossings

Objective
To provide safe, economic water crossings which do not compromise soil and water values and which maintain the visual quality.

7.1 General:

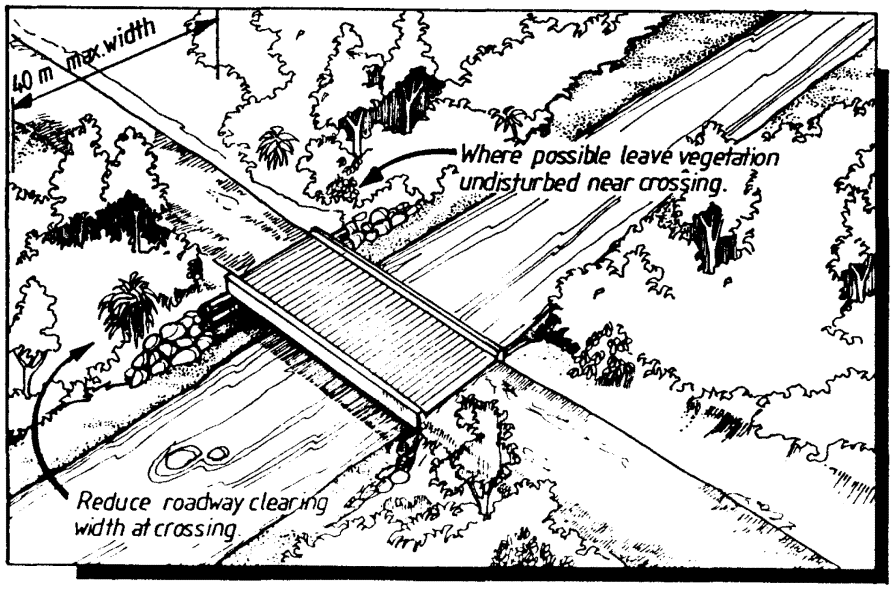
1 Any permanent flowing stream crossed by a forest road requires a water crossing i.e. bridge, culvert, low level crossing, ford. Bridges and culverts over 2m in diameter require a technical plan showing the methods of construction, flood considerations, alternative water supplies (if disturbed flows will affect village supplies), stream bank protection, scour protection etc.

2 Use an experienced person to design the water crossing for the flood return period and risk. Some defined permanency is required and it should be approved as part of an annual logging plan.

3 Check known flood levels from local inhabitants, Bureau of Water Resources, or calculations.

4 Select the site for the lowest cost water crossing with minimum impact on its surroundings.

5 **Stream bank vegetation clearance and stream bed disturbance should be minimised at the water crossing.** There is no need for the same clearance which would be used for roadway drying. River bank stabilisation measures may be required including revegetation. Remove debris and clean up river banks at completion of the construction.



6 Excavators are the generally preferred construction machinery for water crossings. During construction no soil should enter any watercourse nor should any material be left in a position where it could be expected in the normal course of events to enter a watercourse.

7 Minimise waterway restrictions and remove logs and debris from waterway if they pose a threat to the crossing.

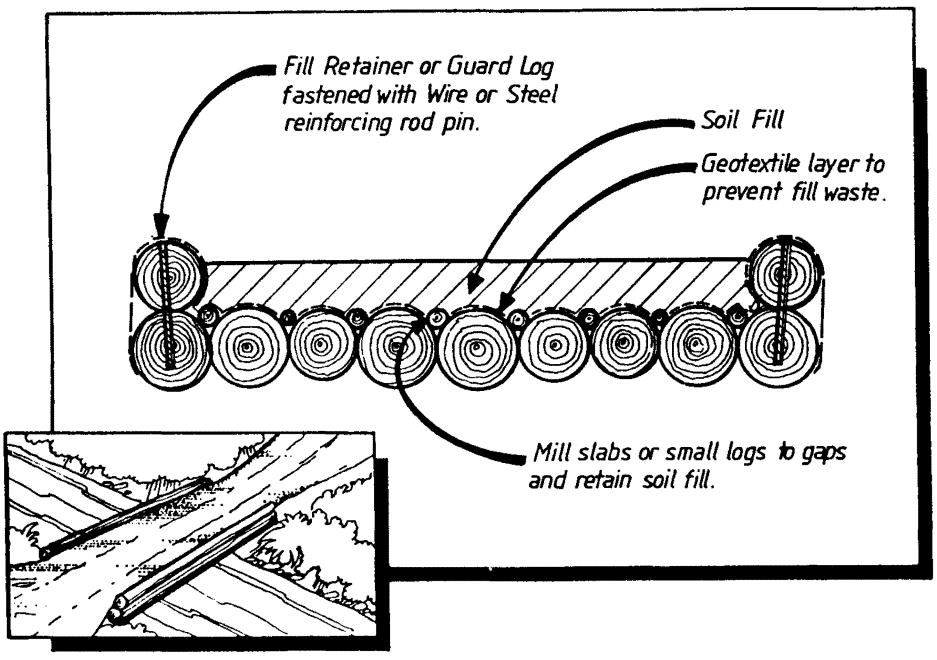
7.2 Bridges:

1 Provide sufficient headroom between flood level and the underside of the bridge to allow for the passage of floating debris.

2 Log bridges should be constructed from the most durable timber species.

3 **Key Standard Number 12: Soil on log bridges**
Where soil or gravel is used as decking material, guard/side logs should be used to contain the soil or gravel. The spaces between stringers should be filled with slab or small logs and covered with rot resistant fabric before the fill material is placed.

If soil is used as a decking material, rather than sawn timber, it is essential that guard logs and rot resistant fabric are used to prevent the soil entering the stream. It has the added advantage of helping to compact the soil better, and therefore giving the decking more strength as well as reducing rot in the log bridge and extending its life.



4 Abutments need to be protected from scour by the main river as well as water which may travel down the roadway. Retaining wing walls are likely to be required where fill construction is used near the bridge abutments.

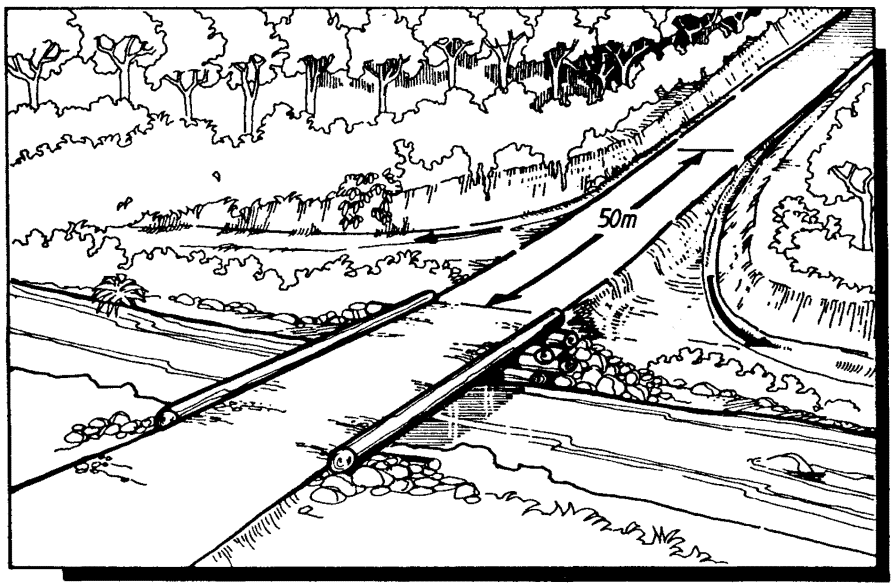
5 Weight limit signs should be used if the bridge cannot safely carry the maximum load to which it may it will be subjected.

6 Align bridges to cross streams at right angles unless special needs dictate otherwise. The roadway should also cross buffer zones at right angles to minimise disturbance.

7 Keep roadway level for some distance either side of bridge to prevent higher than normal impact load.

8 Provide passing bays on the roadway near one way bridges to allow opposing traffic to pass.

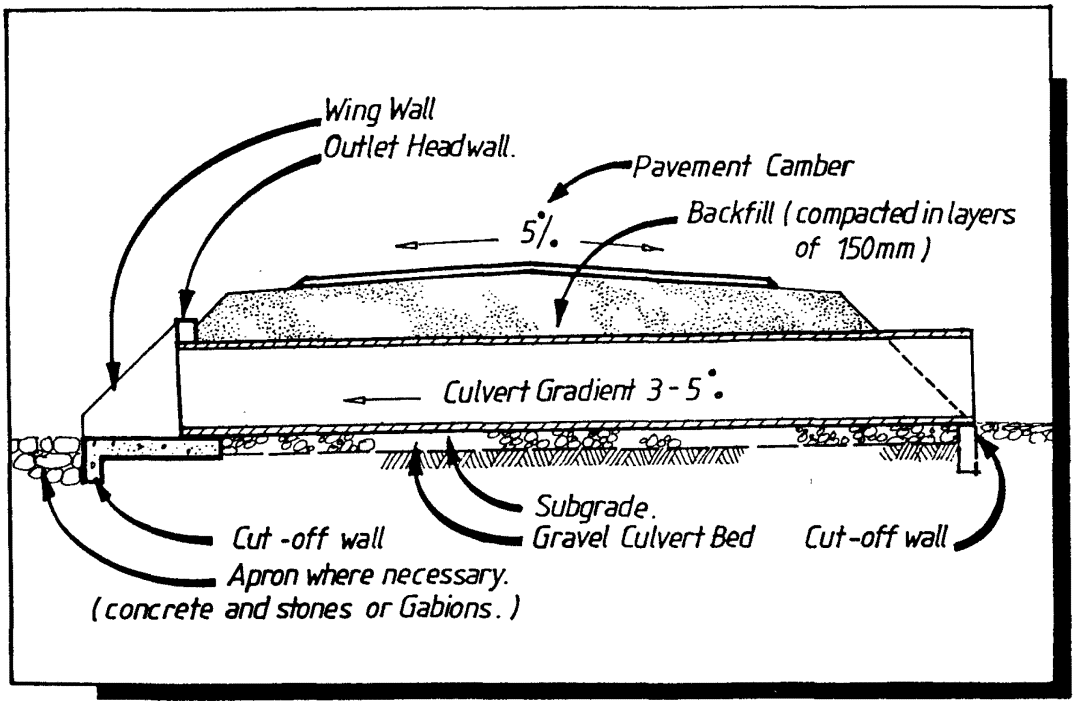
9 **Key Standard No. 14: Road drainage at water crossings**
Ensure that the roadway 50 m either side of a water crossing is well compacted or gravelled, and that drainage from this part of the road is diverted away from the stream. On clay roads gravel the roadway 50 metres back from bridge abutments to assist vehicle safety during braking.



7.3 Culverts:

1 Culverts over 2m in diameter should be designed by an experienced person to ensure they have the required waterway and design features.

2 **Culvert Construction:** concrete pipe, armco or log (but note Key Standard No. 13). Provide head and exit walls to retain road fill or extend the pipe to allow for the angle of the fill slope. Protect with head or exit stones if required to prevent scour/fill material entering the watercourse and to avoid scour damage to the culvert.



3 Provide a scour pad at the culvert outlet if the culvert size and/or stream character requires it. Scour pads are generally required for:

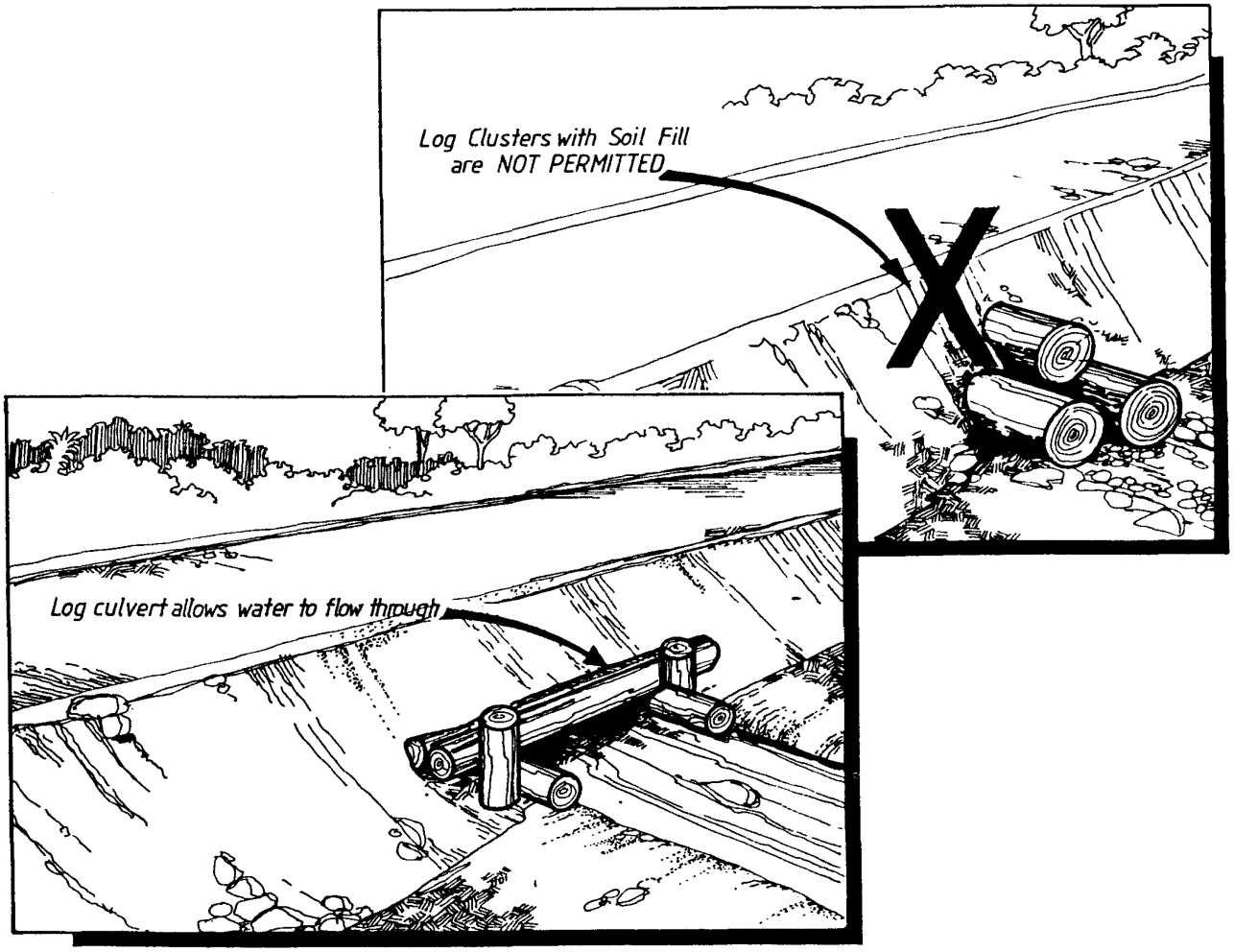
- pipes over 2m in diameter
- fine stream bed material
- high energy streams

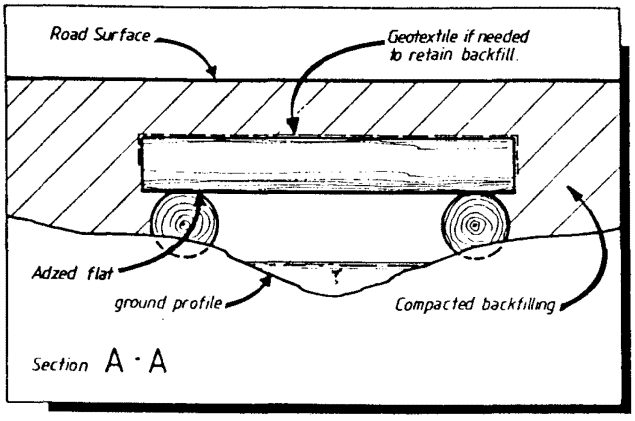
4 200 litre oil drums are only acceptable as culverts on roads with a life of less than 12 months. After this time they must be replaced with permanent culverts or removed.

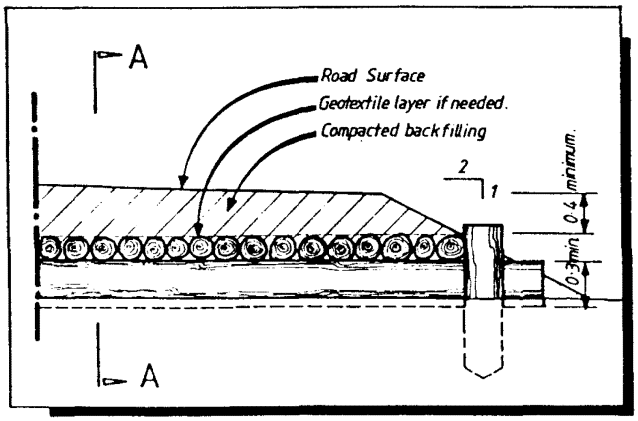
5 Ensure pipes are watertight to prevent "piping". Proper compaction when installing the culvert will minimise the risk of "piping" occurring.

6 Provide deflector bars in culverts which are required to allow fish passage (refer to 7.4.4).

7 **Key Standard No. 13: Log Clusters are not permitted.**
Log clusters with earth fill are not permitted to be used as culverts. Log clusters should be replaced with a log culvert constructed according to the diagram below. Log clusters with soil on top do not allow adequate drainage. In most situations they are more like dams than culverts. The soil around the logs enters the stream and is a constant source of sediment.





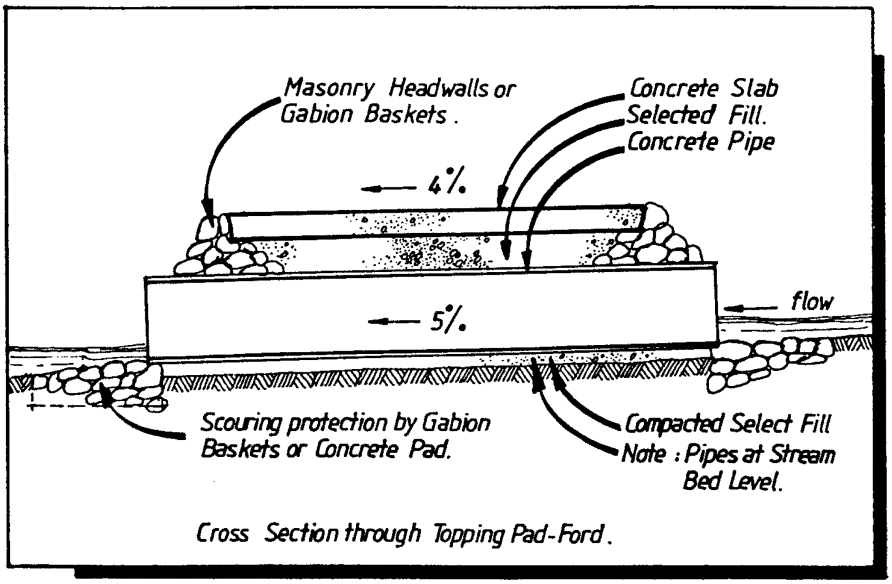


7.4 Low Level Crossings and Fords:

1 Minimise earth moving and changes to the stream bed during construction.

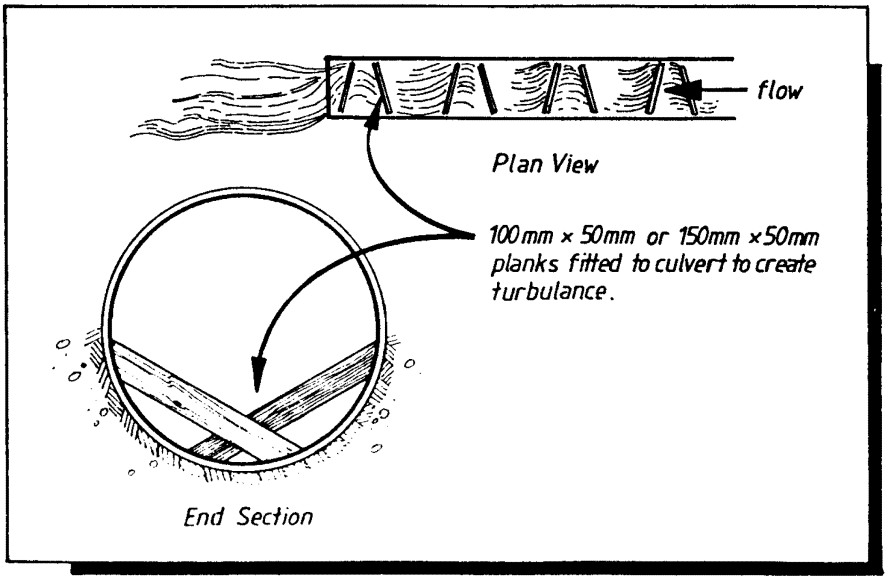
2 Provide scour protection to all low level crossings.

3 **Keep crossing as low as possible to minimise disturbance to normal and flood flows.**



Cross Section through Topping Pad-Ford.

4 **If pipes are used provide debris deflectors upstream and provide turbulence deflectors to assist fish passage, where this is required.**

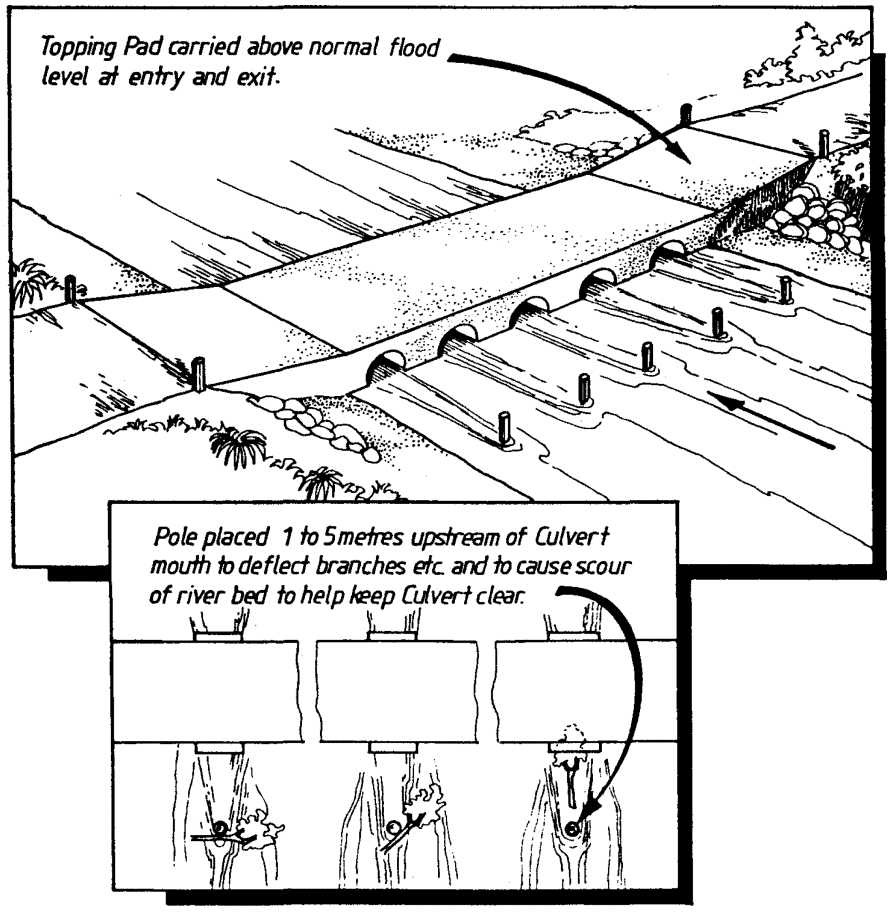


End Section

5 **Scour protection for the entry and exit road should go above flood level.**

6 A depth pole is required to allow an estimate of the water depth over the crossing. Low level crossings can become very treacherous with flow depths exceeding 300mm.

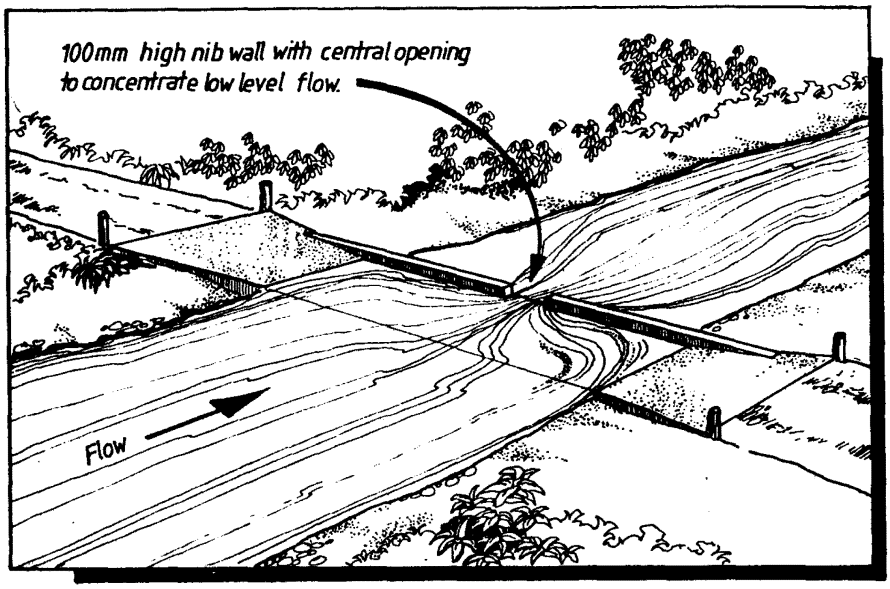
7 **Provide upstream debris deflectors.**



8 Upstream gravel deposits should be removed regularly - they make good road gravel.

9 **Key Standard No. 14: Road drainage at water crossings**
Ensure that the roadway 50 m either side of a water crossing is well compacted or gravelled, and that drainage from this part of the road is diverted away from the stream. On clay roads gravel the roadway 50 metres back from the crossing to assist vehicle safety during braking.

10 **Keep the top level of the crossing level to distribute the water flow over the widest possible area. A downstream nib with central opening can assist fish passage in low flow periods if pipes are not used through the crossing.**



11 Where a concrete pad is not used place a log downstream of the ford to prevent scouring and to keep the bed level.

7.5 Temporary Water Crossings:

1 Removable bridges can be as cost effective as log bridges when the road is temporary and there is no intention to maintain the road long term.

7.6 Maintenance:

1 Clean dirt and gravel from bridge decks and from within the drainage cracks. It causes rot.

2 Maintain scour protection at bridge abutments and low level crossing entry and exit points.

3 Check log bridges, 12 monthly, for safety and load ability. Inspection and maintenance records should be kept for future reference.

4 Culverts and low level crossings require regular maintenance to keep them open.

8. Road Transport of Logs (and Timber Produce)

Objective
The safe and economic transport from origin to destination.

8.1 Practices:

1 Load securing devices should be designed for the operation. They should be provided and used. Examples include side stanchions for logs, and cover sheets for loose materials such as chips and sawdust.

2 All vehicles should operate within the manufacturers ratings for the vehicle. These ratings should be displayed in the vehicle cab.

3 Realistic speed limits should be set, observed and enforced.

4 Regular maintenance should be performed in accordance with the manufacturers recommendation to achieve registered road-worthy standards and a safety sticker.

5 Keep a safe distance from truck during loading and unloading to avoid the risk of falling loads and particularly flying chains and ropes during fastening and unfastening loads.

9. Gravel Extraction and Quarrying

Objective
To provide suitable roading and construction material at an economical cost while minimising forest disturbance and visual impact, and maintaining soil and water values.

9.1 Practices:

1 These sites are to be identified in the annual logging plan.

2 Extraction of road construction material from road cuttings during road formation is preferred to the development of large quarries.

3 Development of any quarry requires experienced advice and a development plan. The production of a development plan is good practice and should cover issues such as:

- Location (within or outside FMA), topography, climate, contour, drainage - estimated life, quantities, quality of material, landowner and royalty issues
- benching, the order of working, maintenance and decommissioning details such as rehabilitation of the top soil, spoil areas and overburden.

4 Extraction of more than 1000 m3 of stream gravel requires a Water Use Permit from the Bureau of Water Resources. Development information would need to cover issues such as:

- community use of the stream e.g. drinking, washing, fishing
- precautions to avoid siltation and river contamination. Gravel extraction can occur above or below the water table level but not in the flowing stream
- quantities to be extracted over what time period
- location of screening and crushing operation
- show efficiency of resource use -e.g. crushed road gravel is a better use of resource than "run of river" and screened gravel is better than unscreened, as less material is extracted to waste.
- clean up and decommissioning procedures
- stabilisation of slopes and revegetation

5 The use of river, quarry or coral rock material from outside the FMA may require specific approval and is likely to require a development plan as outlined above. Locate, following discussion and approval with landowners.

10. Log Ponds

Objective
To provide an area for the efficient preparation and loading of logs (for shipping), while minimising its size and impact (particularly sedimentation) on the river/marine environment.

10.1 Location and Planning:

1 Locate, following discussion and approval with landowners. Locate to provide the best sheltered access to both ships and incoming road transport taking into account the existing uses of the area and its importance to river/marine ecology i.e. fish breeding ground. The log pond must be located 500m from a village.

2 The area should be elevated at least 1 metre above the highest tide level and should be graded to provide drainage. Typically areas will require a cross fall of 5% to have adequate drainage. Swampy and flat areas will have problems. Pre-construction planning should be undertaken for all facilities, giving particular attention to drainage and log pond effluent discharging into the body of water.

3 All land-based or water-based "log ponds" require a Water Use Permit from the Bureau of Water Resources if they take or discharge water.

4 Any alteration of the shoreline including the reclamation or excavation of inter tidal or marine areas, including coral reefs, mangroves and seagrass beds, requires specific approval from Department of Environment and Conservation.

5 Accessways through these coastal buffer zone should be marked and should have a maximum cleared width of 40 metres. The access route should not purposely take an indirect route unless it is sensible to do so to avoid an obvious obstacle.

6 Storm water drains must be kept clean and operating at all times. If it is possible for oil, fuel, chemicals to enter the drain special provision, such as filters and/or oily water separators, must be made before the drain discharges to a body of water.

10.2 Construction and Maintenance:

1 For minimum disturbance to the site use excavators during construction. Compact the log storage areas to ensure the surfaces remain in good working condition.

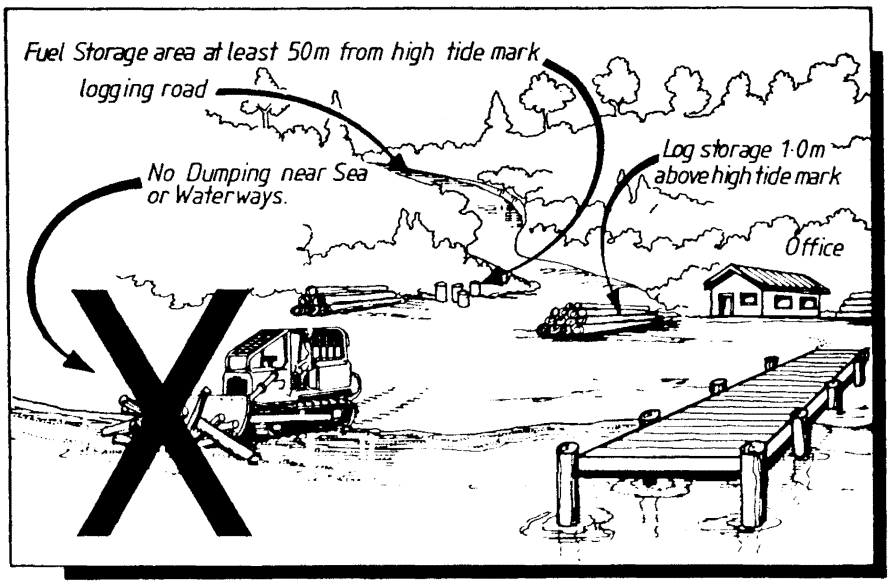
2 Surface drainage requires a minimum drainage of 5%. A storm water drainage system is required .

3 Logs should be stacked to prevent them rolling onto the shoreline.

4 Loading machinery should not operate on the shoreline.

5 **Key Standard Number 24: Waste management on log ponds** Prevent logs, off cuts or trimmings from entering the sea or river. Remove debris from the log ponds (drums, oil filters, ropes etc.) and bury at an approved land fill disposal site (waste pit) away from the high water table and watercourses, as detailed in the Waste Management Plan.

Logs, off cuts and trimmings cause problems for landowners as they either float or sink in the shallow water and obstruct dingys and canoes. Log off cuts should be used wherever possible or disposed of on dry land in a tidy manner above the high tide mark.



10.3 Decommisioning:

1 Ensure the drainage system is left in a manner which requires minimal maintenance to avoid stormwater runoff flows combining into a stream which may cause scouring. Provide water bars if needed.

2 Restore any stream beds and banks to aid unimpeded water flow in more or less natural conditions.

3 **Key Standard No. 24: Waste management on log ponds** Waste oil, lubricants, fuel, old wire rope, oil drums and all other rubbish, should be disposed of in an approved area.

4 Consider the impacts of decommissioning the log pond where uses other than logging have developed during its life.

11. Barging/Loading off Beaches

11.1 Practices:

1 Loading machinery operating on the shoreline or in the water should be minimised.

2 **Key Standard No. 24: Waste Management on log ponds** Solid and toxic waste disposal - fuel drums, lubricants, sewage, batteries, insecticide cans, machinery parts etc. must not enter the river/coastal drainage system. They should be should be disposed of in an approved area. Prevent off cuts or trimmings from entering the sea. Log off cuts should be disposed of on dry land in a tidy manner.

3 Ensure the area is left in a manner which avoids water concentration. Provide water bars if needed.

4 Restore any stream beds and banks to aid unimpeded water flow in more or less natural conditions.

5 Lost logs should be recovered.

C. SELECTION LOGGING

Objective
To achieve sustained yield management by using selection harvesting systems to fell merchantable trees and move logs to the log landing for scaling within acceptable costs. To maintain forest productivity, by identifying and protecting future crop trees (residuals) and excluded trees, while minimising the impacts on soil, water and other environmental values.

1. Annual Logging Plans

Objective
To prepare annual logging plans in a concise and understandable format, for company supervisors and government officers, to maximise logging productivity while assisting post harvest management, by reducing disturbance to the forest and minimising impacts on soil, water and other environmental values.

1.1 Practices:

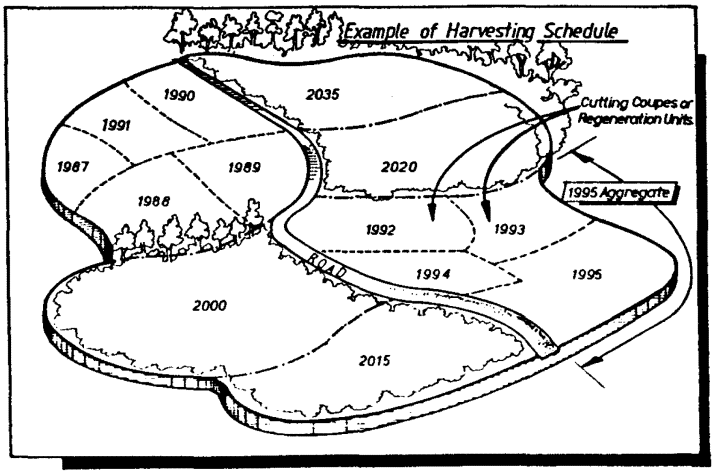
1 Design major access, after consultation with the landowners concerned, to provide the most direct route on the best gradient and minimise the area of forest clearance.

2 Minimise watercourse crossings by making the buffer zones of the Class 1 and 2 streams (refer to Section A: 1 and 2) the boundaries for harvesting areas.

3 Locate and mark logging set-ups, log landings, and major skid tracks on the plan.

4 Mark quarries, gravel pits and other earthworks.

5 **Disperse logging areas** (coupes) to minimise disturbance to the habitat and provide a range of operational sites to allow for adverse weather.



6 Mark cultural sites and other excluded areas including reserves and buffer strips on the plan.

2. Set-up Logging Plans

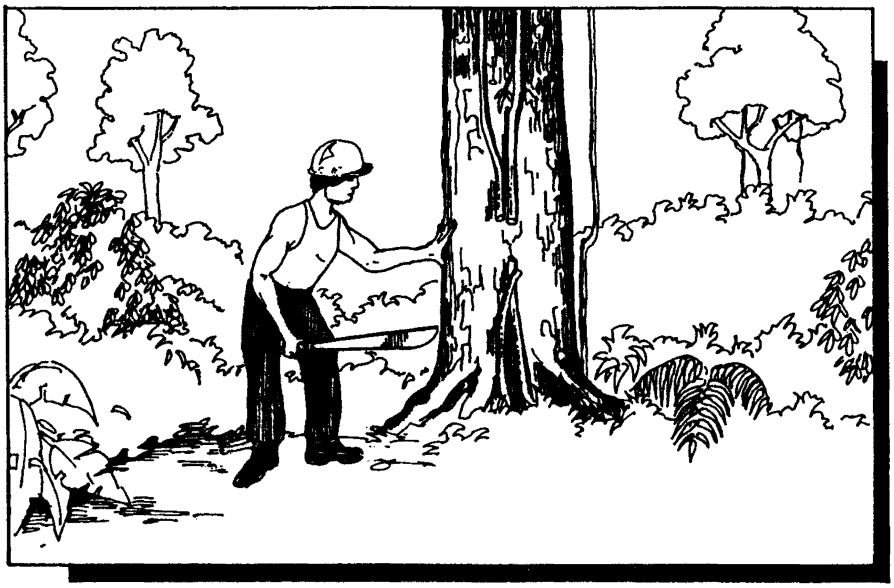
Objective
To control the progress of contractors. To ensure that boundaries are marked and that the preparations for harvesting are in place. To gather information on the forest and tree crop.

2.1 Practices:

1 Mark set-up boundaries, access and buffer zones (e.g. cultural sites, villages, gardens and streams).

2 Mark the log landing locations and major skid tracks on the ground.

3 **Key Standard No. 5: Cut vines during set-up marking**
Cut vines during set-up marking and at the same time assess the tree for soundness. Cutting vines as far ahead of felling as possible will reduce damage to the forest canopy and fewer future crop trees will be pulled over and damaged. Weakened vines will increase the safety of the feller.



4 Assess all merchantable trees suitable for harvesting and
- mark below the cut the preferred felling direction (so it remains on the stump after felling) by taking into account future crop trees, existing canopy gaps and lean;
- mark the stump height as low as practicable;
- mark excluded trees and reserved/special trees (e.g. food, medicinal, magical, building, artefact and canoe) in consultation with the landowners

5 Provide contractors (chainsaw operators, skidder and tractor drivers) with clear instruction on boundaries and performance requirements such as:

- respecting buffer zones, reserve and excluded areas
- retention of future crop trees
- no skidding along roads or in watercourses
- avoid fuel and lubricants spills
- removal of felled logs from the forest
- clearing streams after logging
- clearing hang-ups
- rehabilitating tracks and log landings

6 Apply for set-up inspection and approval by the PNGFA Project Supervisor.

3. Log Landing

Objective
To locate log landings in the most convenient location for skidding, scaling, log storage and loading. To minimise the clearing of forest and earth movement; and sediment laden runoff entering watercourses.

3.1 Location:

1 Locate log landings adjacent to spurs planned to be used for major skid tracks.

2 Use roadsides for additional log storage.

3 Locate log landings on both sides of the road to avoid pulling logs across or along the road.

4 Locate log landings in well drained areas such as saddles and ridges.

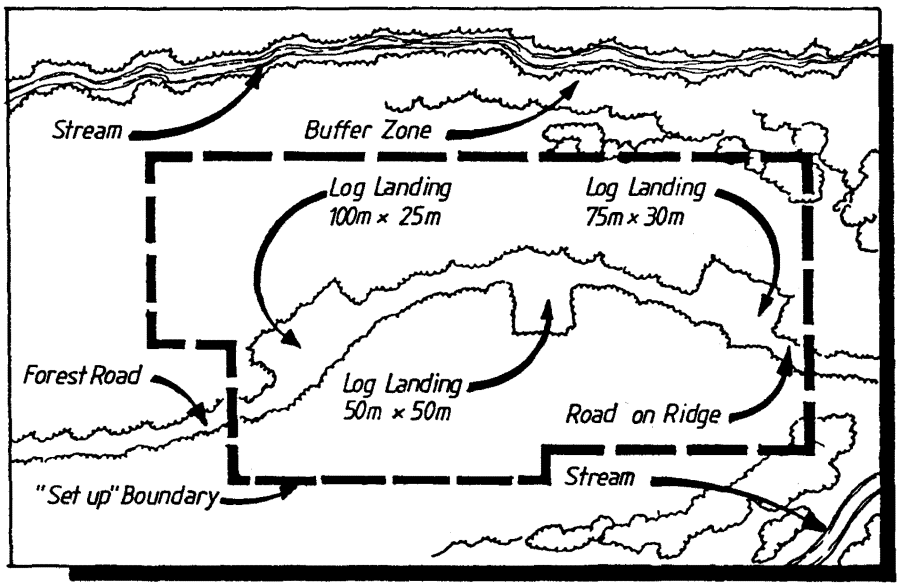
5 Avoid sites which require earthworks.

6 **Key Standard No 3: Buffer zones and location of roads and log landings** Place roads and log landings 100m away from the outer edge of the buffer zones of Class 1 streams and 40m away from Class 2 streams and excluded areas (reserves and cultural sites) to minimise disturbance to the buffer zone If this is not practically possible it should be identified in the set-up plan or be the subject of specific approval.

7 Locate log landings to reduce average skidding distance.

8 **Key Standard No 4: No more than 3 log landings per set-up, maximum size 2500 sq. metres each** Control the size of log landings to a maximum of 2500 sq metres (0.25 ha). Not more than 3 log landings per set-up.

Controlling the number and size of log landings reduces the area of forest canopy cleared.



3.2 Construction:

1 Mark the boundaries of the log landing and harvest all merchantable trees including "Super small" logs.

2 Push topsoil and stumps onto already cleared areas such as roadlines.

3 **Key Standard No 6: Disposal of excess soil** Do not push trees and soil into the forest edge with the bulldozer.

4 Crown the log landing or provide a 2-3% slope back into the forest.

5 Direct drainage into vegetation or sediment traps, not directly into a watercourse. Prevent runoff from major skid tracks entering onto the log landing.

6 Cording of log landings is a short term solution that wastes future crop trees (residuals) and encourages logging traffic when it would be better to relocate to a drier log landing.

4. Skid Tracks

Objective
To provide efficient access to logs within a set-up while minimising damage to soil and water values, future crop trees and respecting other environmental values.

Major skid tracks carry the highest number of machine passes within the forest. The major skid track ends at the log landing and may begin from a stumping (bush) landing where logs are accumulated by tractors.

4.1 Major Skid Tracks:

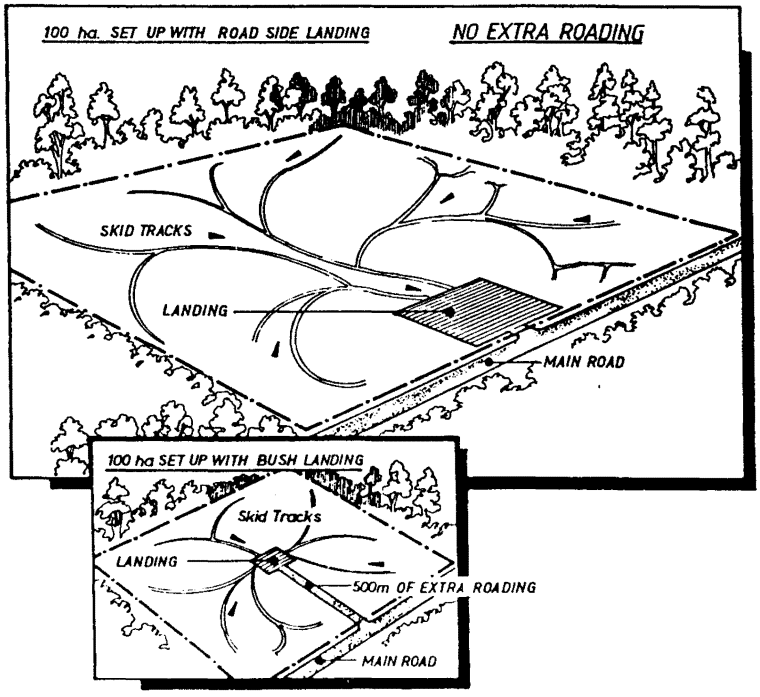
1 Locate major skid track routes on ridges and mark them. Use ridges with favourable grades in preference to side cutting.

2 Form major tracks to the minimum standard (including gradient) required for the chosen machine.

3 Minimise damage to future crop trees along the route by restricting track width and avoiding blade damage.

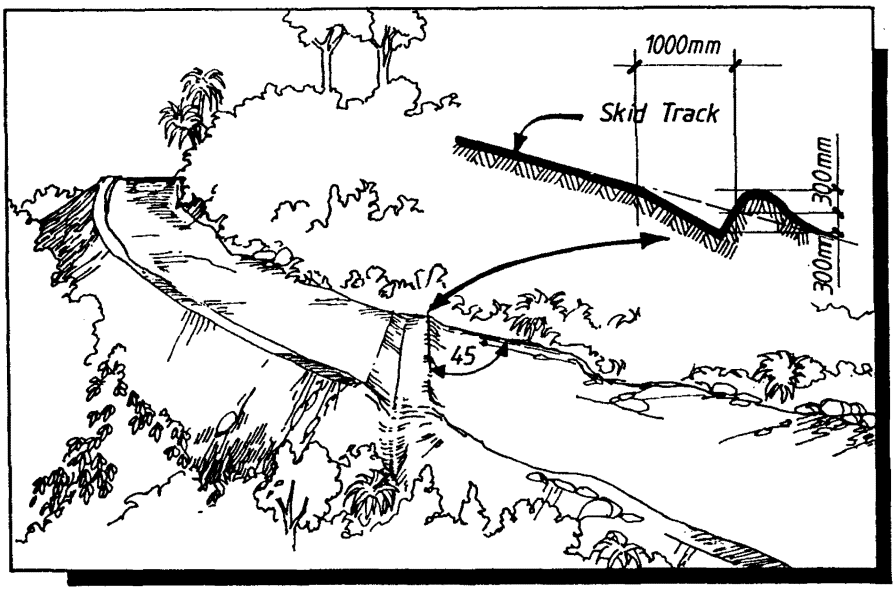
4 Leave strategically placed large sacrificial trees to protect future crop trees. Remove them on completion.

5 **Create stumping log landings, if necessary, for "two staging" rather constructing a road into the middle of the set-up.** There is a trade-off between average and maximum skidding distances, and extra roading. In the diagram below, 500 metres of extra roading is required. This is a more expensive option and requires more forest clearance than a roadside landing.



6 **Key Standard No 21: Construct water bars on skid tracks and decommissioned roads.** Do not have skid tracks and decommissioned roads shedding water on to a log landing or into a watercourse. Construct water bars to divert the water off the track or road into the vegetation. Construct sediment traps if runoff can enter a watercourse.

The water bar is constructed by digging into the surface of the skid track as shown in the diagram. A mound of loose soil on a skid track, or decommissioned road, will not work as a water bar as it will wash away.



4.2 Minor Skid Tracks:

1 Use tractor to brush track location ahead of the chainsaw operator to indicate where minor skid tracks will be located. This indicates the required felling direction and helps to protect the future crop trees.

2 Liaise with chainsaw operator and tractor/skidder operator to locate prepared logs and the best route to the log.

3 Manoeuvre the tractor to minimise damage to the best future crop trees.

4 Manoeuvre the tractor to minimise damage to soil and prevent soil from entering watercourses.

5 Do not blade soil off the track or move soil without a good reason. Minor skid tracks may require movement of soil (tracking) to negotiate grades over 20 degrees. Minimise tracking wherever possible.

5. Felling

Objective
To fell merchantable trees in a safe manner to: assist skidding production; minimise waste; and protect future crop trees and excluded trees, buffer zones and watercourses.

5.1 General:

1 Felling can commence after the set-up is approved and the major skid track routes are known.

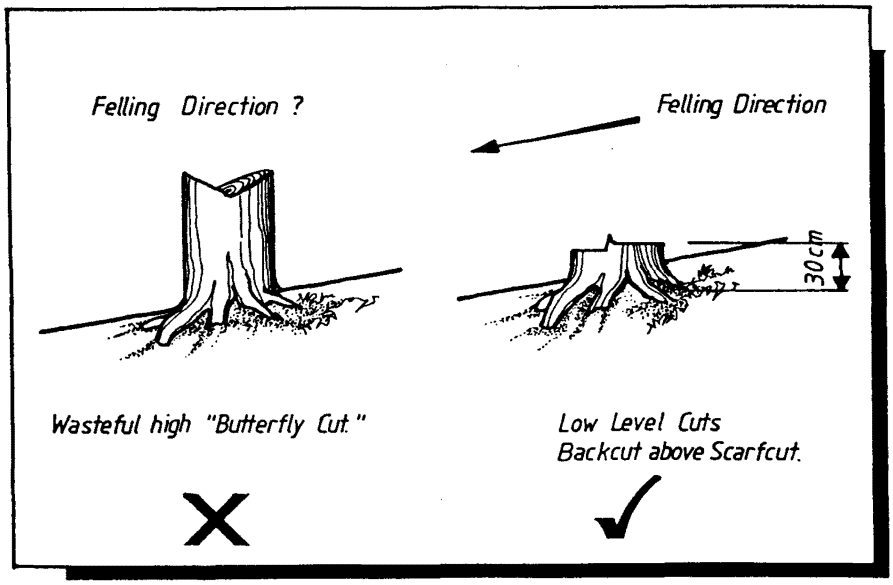
7 Minimise wastage by timing the felling and extraction of species susceptible to insect or fungus attack.

2 Ensure that chainsaw operators understand the felling objectives and set-up logging plan.

3 Adopt efficient work patterns and work to a pattern that the tractor operator and all others in the crew understand.

4 Increase safety by:
- checking for dead limbs
- cutting vines
- clear an escape route
- work as a team
- scarf and back cut properly

5 **Key Standard No 16: Reduce waste and keep stump height low** Keep the stump height as low as practicable to avoid waste. Make making cuts level and complete backcuts to reduce pulled wood. Where fluting does not occur, and the species is usually sound at the butt, stump height should not be greater than 30 cm.

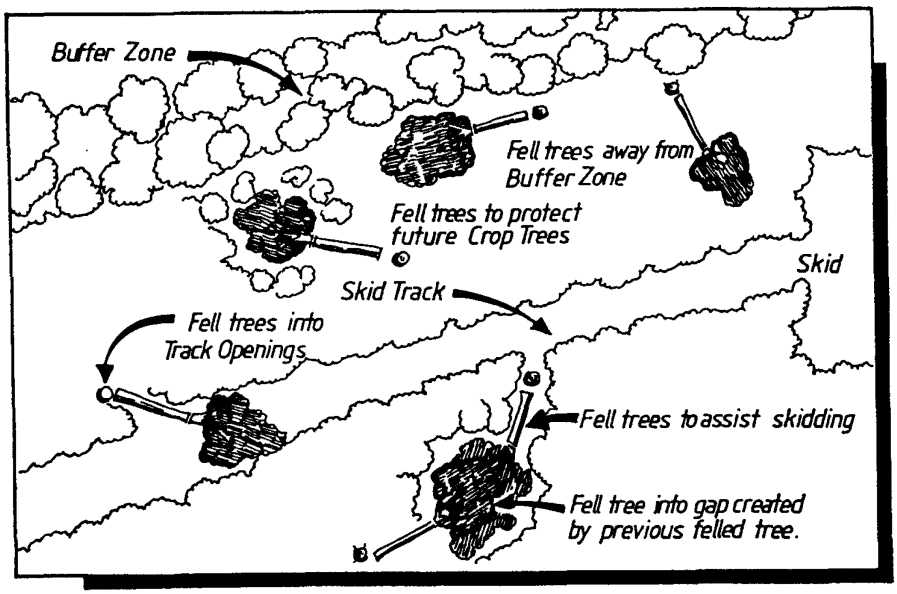


6 Remove hang ups. Once started, complete felling of unsound trees. If in doubt about the soundness, drill the tree first.

5.2 Directional Felling:

1 Check the marked felling direction and cut vines if not cut prior to set-up approval. Modify the direction of felling, if needed, to meet the objectives.

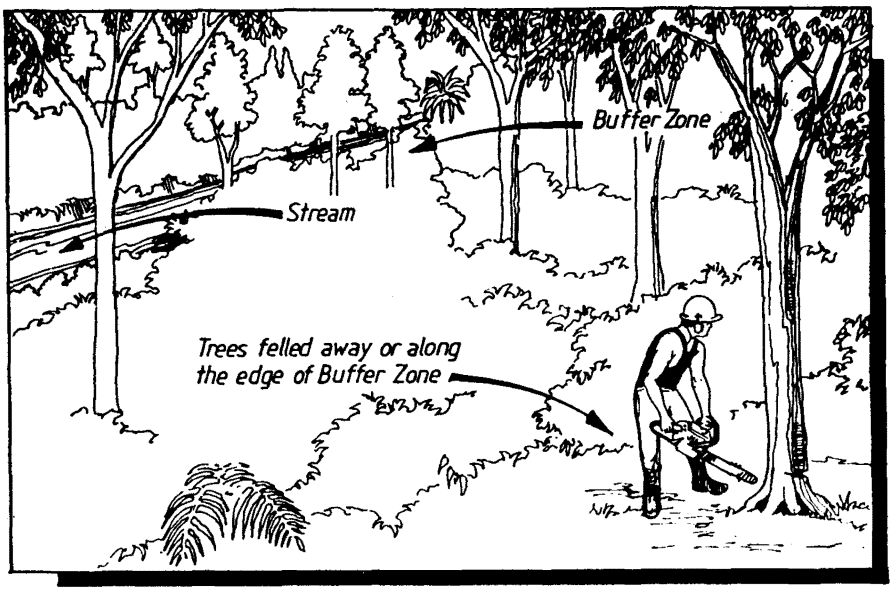
2 **Key Standard No 15: Directionally fell trees into canopy gaps.** Directionally fell trees into canopy gaps, for example into roadlines, skidding tracks or gaps made by previously felled trees. Directional felling requires that the feller makes the backcut above the scarf cut and wedges are used where required.



3 Directionally fell trees into areas containing predominantly non merchantable vegetation i.e. not future crop trees (residuals) and excluded trees.

4 Fell trees to assist skidding i.e. butt or head towards skid tracks. This avoids the need for the skidder/bulldozer to turn the log around before skidding.

5 **Key Standard No 17: Do not fell into or skid inside buffer zones or excluded areas.** Do not fell trees into buffer zones or excluded areas. Directional felling is needed to ensure trees are felled away from or along the edge of the buffer zone.



6. Cross Cutting In The Bush

Objective
To maximise the merchantable wood from fallen trees and prevent damage during breakout.

6.1 Practices:

1 Cross-cut logs to leave waste sections, such as flutes and decay, in the bush.

2 Cross-cut logs completely to ensure that they are totally severed to prevent breakage during breakout.

3 **During cross cutting with a chainsaw**:

- beware of tension and if necessary make a cut on the compression side to reduce the tension before making the final cut
- avoid using the tip of the bar as this can cause kickback
- avoid pinching the chain or twisting the saw as this can cause recoil
- switch off the saw if it jams
- avoid making the final cut while standing on the lower side of a tree if it is lying on a slope
- do not stand on the tree being crosscut
- when making the final cut always stand on the compression side of the log

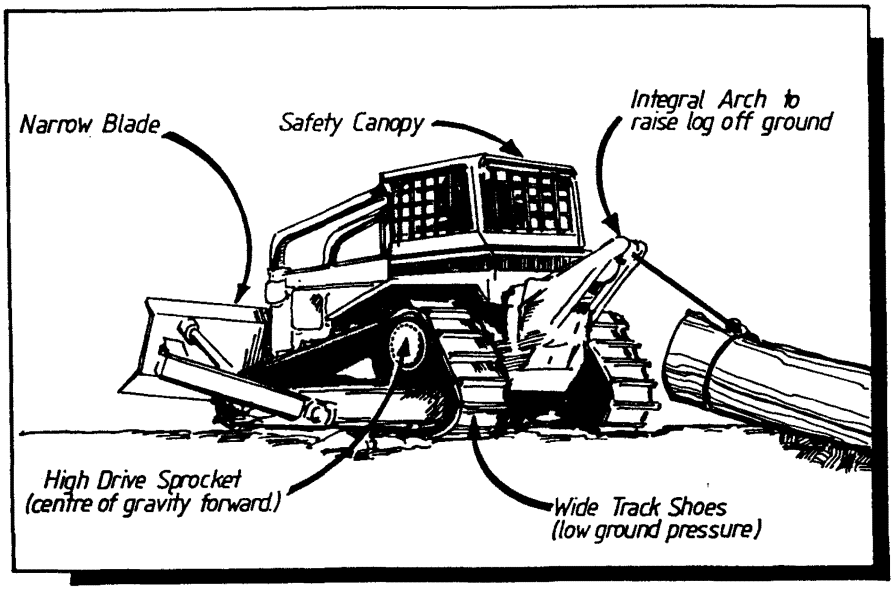
7. Ground-Based Extraction Systems

Objective
To cost effectively move logs from the stump to the log landing with minimal damage to the forest, future crop trees, logs, soil, water and other environmental values.

This Code does not cover high lead cable systems for selective logging as experience has shown that damage to the remaining forest is too great. Skyline cable systems may be used to transport logs over difficult terrain provided the logs are fully suspended above the forest canopy.

7.1 General:

1 **Use appropriate machinery.** Preferred machinery options include: a safety canopy; a narrow blade; an integral arch; and wide track shoes to reduce soil compaction.



2 Use the topography to avoid having to form tracks. In most situations it is better to skid up or down a short, steep gradient rather than cut a skid track across a slope .

3 Use gravity where possible to assist skidding. This will result in some downhill skidding.

4 Minimise track width.

5 Do not blade soil off tracks and do not side cut unnecessarily. If unavoidable provide cutoffs.

6 **Key Standard No. 10: No soil in streams from road construction or skid tracks** Do not push soil into a watercourse.

7 Plan tractor access to the next log and the main skidding track to minimise damage to future crop trees (residuals). Do not damage future crop trees with the tip of the blade

8 Where possible have the wire-boy locate the next log. Do not prospect with the tractor.

9 Where the log can have the winch rope attached to either the head or the butt without having to move the log first, take winch rope to the log rather than the tractor to the log.

10 Do not skid inside buffer zones or excluded areas.

7.2 Wet Weather:

1 During (or following) wet weather, when operations may damage the soil, the following best management practices should be considered:

- in steep areas and soils sensitive to compaction restrict ground-based logging to dry weather only
- move to another log landing
- move to an area where logs can be skidded downhill
- move to a production area reserved for wet weather logging
- consider alternative methods such as helicopter logging

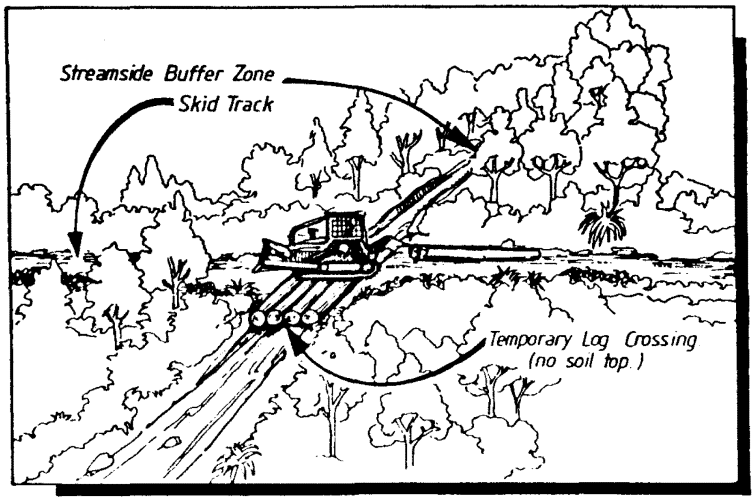
2 An indication that conditions are too wet occurs when soil has to be repeatedly bladed from the track to retain traction.

7.3 Crossing Watercourses:

1 Avoid stream crossings.

2 Do not skid logs up or down the watercourse bed or along roads.

3 **Key Standard No. 18: Use temporary log bridges to cross flowing water within a set-up: do not cover with soil and remove immediately after use.** Where it is necessary for logging equipment to cross flowing water use a temporary log bridge formed from unmerchantable logs (preferably from the heads of felled trees rather than future crop trees). Do not cover with earth fill and remove as soon as skidding of the set-up is completed.

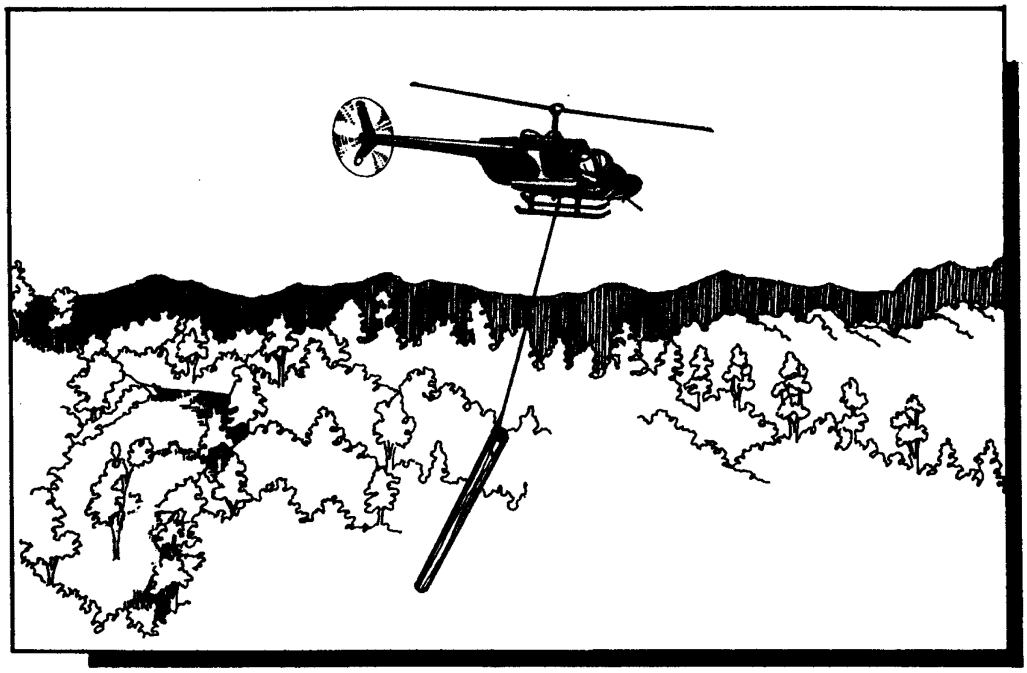


8. Heli-Logging Extraction Systems

Objective
To cost effectively move logs from the stump to the log landing with minimal damage to the forest, future crop trees, logs, soil, water and other environmental values.

Extraction covers ground-based and heli-logging systems. It does not cover high lead cable systems for selective logging as experience has shown that damage to the remaining forest is too great. Skyline cable systems may be used to transport logs over difficult terrain provided the logs are fully suspended above the forest canopy.

8.1 General:



1 Heli-logging systems need:
- experienced operators
- well defined procedures
- an effective communication system
- to comply with the Civil Aviation Act and regulations

2 A viable heli-logging operation requires intensive operational and human resource planning through every operational stage.

3 Machine size is less important than optimising payloads and minimising the total cycle time.

4 Reduce the basic aircraft weight by removing extras and restrict the fuel load.

5 Aircraft maximum payload also depends on the weather conditions and altitude.

6 Minimum helicopter requirements are a:
- direct visual operation control windows
- a lifting cradle with an on board weighing system for hourly and daily productive levels as well as safety
- a long line with electronic release hooks at both ends which are operated by the pilot's controls

7 Long (lifting) line length depends on forest canopy height and terrain. The longer the line , the more time required to place it.

8 A safe working load (breaking strength) for a long (lifting) line is four times the lifting capacity of the helicopter.

9 All personnel working round the helicopter should be familiar with the safety rules which apply when working around helicopters.

10 They should always wear helmets with ear-muffs or chin straps.

11 To reduce the chance of injury, stropping crews should work on slopes above felled logs ie start working from the top of the slope and work down.

8.2 Felling and Log Preparation:

1 Planning needs to take account of worker safety in steep and isolated places.

2 Good log preparation, presentation and cross-cutting maximise the payload and increase productivity

3 Maximise payload by calculating log weights in the forest using cylindrical volume tables with a built in weight conversion factor for the appropriate tree species.

4 Use a marker to help visibility of the log extraction area from the air.

5 If it is necessary to fell undergrowth trees, to prevent the long line snagging as it is being lowered, avoid felling future crop trees.

6 Fell dead spars and other hazards prior to extraction as the rotor downwash, or contact with the extracted log, can dislodge crowns and dead spars.

8.3 Breaking Out:

1 Stropping crews should work in pairs and wear high visibility vests:
- one locating, stropping up logs and calling in bunches of strops;
- the other (the hook catcher) calls in the helicopter and attaches strop(s) to the helicopter long (lifting) line.

2 Each ground crew should be in radio contact with the helicopter and other ground crews.

3 Log weights need to be recorded on the logs so the hook catcher can maximise the helicopter's payload at each turn.

8.4 Landing Location and Size:

1 Landing construction, maintenance and decommission are subject to the same practices as for ground-based extraction systems.

2 If heavy lift helicopters (external lift over 1000 kg) may require landings above the limit of 2500 square metres (0.25 ha). Where larger landings are required permission should be sought through the Annual Logging Plan approval procedure.

3 Locate as close as practical to give the shortest average haul cycle.

4 Landings beside main forest roads provide the greatest cleared area for the helicopter to lower the load.

5 The height of the surrounding vegetation and the size of the landing determine the ability of the helicopter to lower the load.

6 Landing layout, suitable machinery and effective truck scheduling are the key to maintaining effective wood flow and reducing production costs and delays.

7 The landing should be free of any loose material which could be blown up by the downdraft of the rotors.

8.5 Refuelling area:

1 Locate refuelling area at an independent site.

2 The site should be at least four times the rotor diameter length and width.

3 Fuel tankers located on site should have bunds surrounding them to contain any possible fuel spills.

9. Completion of logging

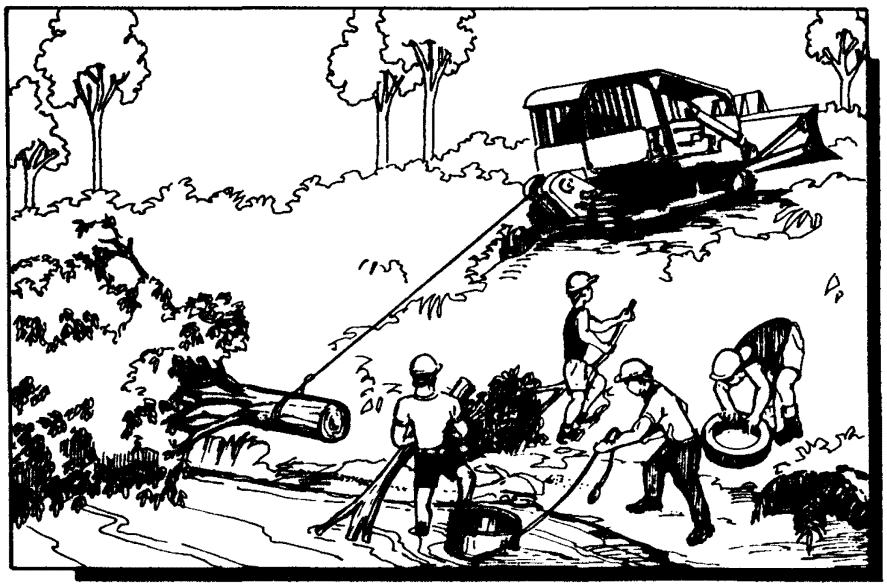
Objective
To close a set-up at the completion of logging leaving it in a safe condition which encourages forest recovery and protects soil, water and other environmental values.

9.1 Practices:

1 Fell scarfed trees and remove "hang-ups".

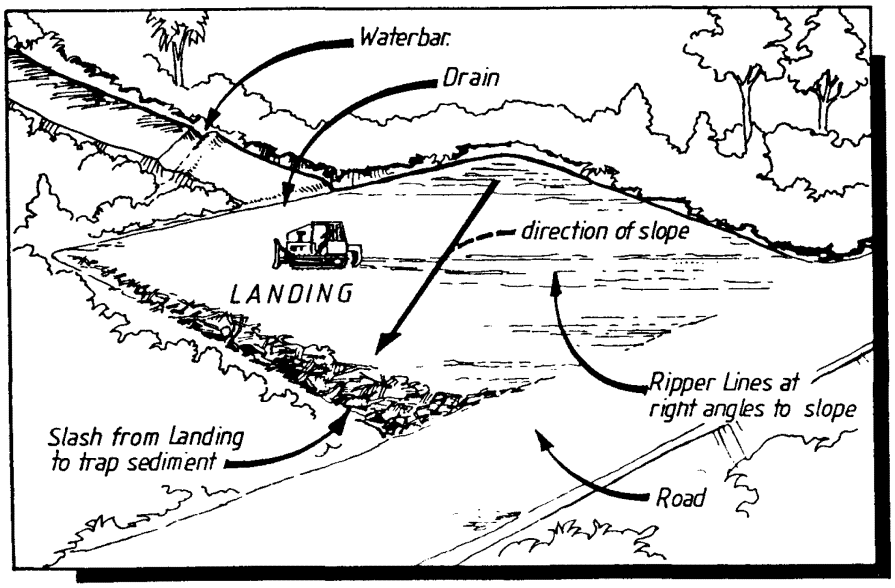
2 **Key Standard No. 18: Use temporary log bridges to cross flowing water within a set-up: do not cover with soil and remove immediately after use.** Remove temporary stream crossings

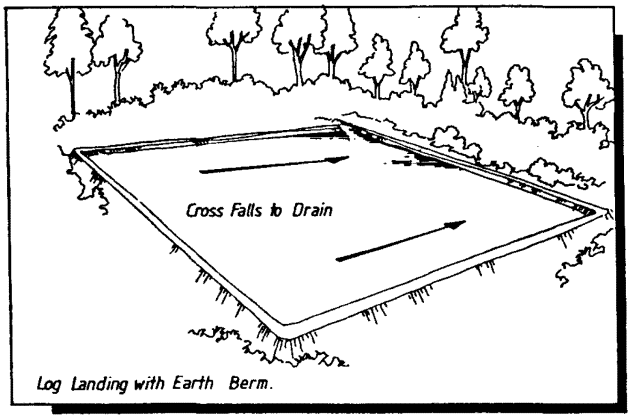
3 **Key Standard No. 20: Remove logging debris from streams.**

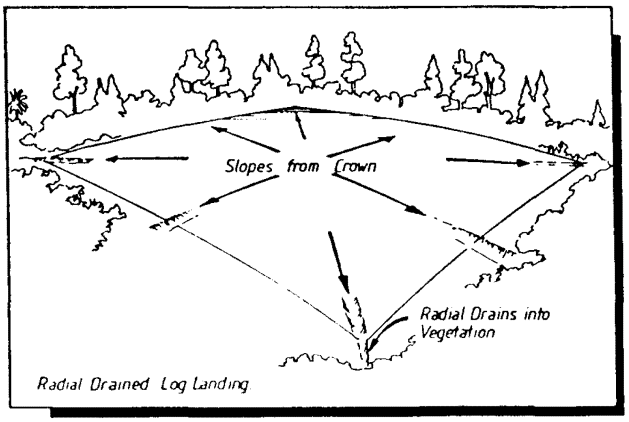


4 **Key Standard No. 21: Construct water bars on skid tracks and decommissioned roads** Construct water bars on skid tracks near log landings and watercourses.

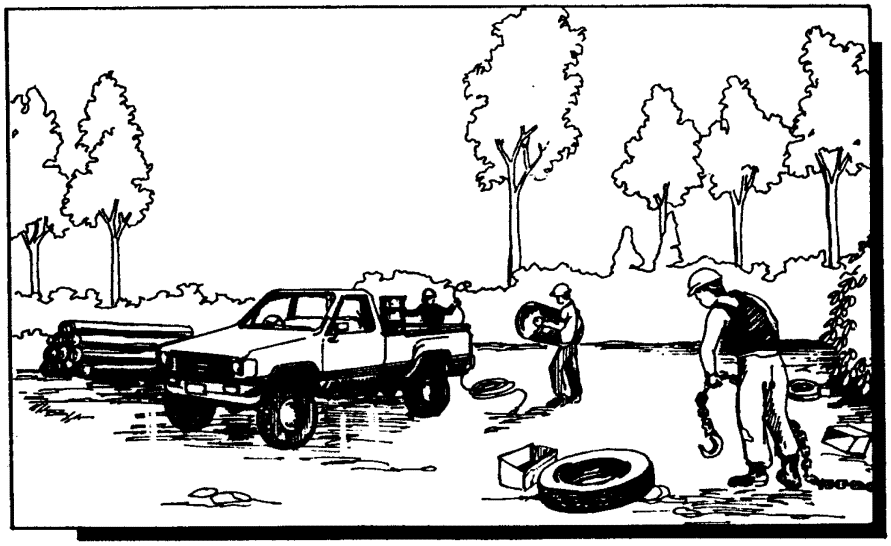
5 **Key Standard No. 22: Rip log landings** Rip log landings at right angles to the drainage direction or drain log landing by radial drains or build a berm. Ripping breaks up the compacted soil and allows vegetation to grow. By ripping at right angles to the drainage direction, or out from the centre, the water is not able to scout the skid site.







6 **Key Standard No. 23: Remove rubbish from log landings and roads.** Remove debris from the log landings (drums, oil filters, ropes etc.) and all other rubbish. Bury rubbish at the main waste pit away from the high water table and watercourses.



7 Do not re-enter a closed set-up to harvest trees before the planned date. This will cause substantial damage to the regenerating forest.

D. WASTE MANAGEMENT

Objective
To manage waste in a way which provides for safe and hygienic storage and disposal as described in the Waste Management Plan (part of the Environmental Plan).

1. Sewage

Objective
To achieve water quality after mixing over a distance of 50 metres that is the same as the water quality upstream.

1.1 Practices:

1 Toilets: Wet toilets, chemical toilets, long drops (pit); septic tanks and chemical toilet waste disposal sites must be located at least 1 metre above maximum groundwater table and situated at least 100m from all watercourses and at least 50m from maximum inundation.

2 Wet toilets require regular inspection & maintenance to ensure no leaks with primary treatment in adequately sized septic tank with discharge through adequately sized soakaways.

3 Chemical toilets should be used where there is no alternative. All chemicals are to be handled with care to avoid spills & leaks. Chemicals to be stored in bunded and secure toxic materials storage area.

4 Do not discharge raw sewage into the sea or a waterbody where shellfish are eaten.

5 All drains are to be covered.

2. Solid Waste Disposal

Objective
To achieve hygienic, secure and benign long term storage.

2.1 Practices:

1 All biodegradable solids eg food are to be covered in secure containers and incinerated; aerobically composted in bins or other containment; recycled as stockfeed; or buried in a waste pit.

2 Strict enforcement of "no littering".

3 All non-burnable solid wastes and ash are to be buried in waste pits (land fill) covered with at least 0.5m of soil. These waste pits are to be at least 100m from maximum inundation by water and at least 1m above maximum groundwater height.

3. Toxic Materials

Objective
The safe, long term containment, storage, treatment and disposal of toxic materials.

3.1 Practices:

1 Spent hydraulic and refrigeration fluid, oil, fuel (petrol, diesel), workshop wastes, oily water separator sludge and residues, industrial cleaners, paints and resins, preservatives (including timber treatment chemicals), distillates, lubricants, insecticides, and biocides are to be collected in containers securely sealed and preferably returned to municipal/township dumps/tips, returned to the manufacturer or buried in the waste pit.

2 Where on-site burial of toxic materials **& their containers** is the only alternative, the location of the pit must be clearly indicated (including signs in all the local languages), and the pit securely fenced.

3 All waste pits are to be covered with at least 0.5m of soil and located at least 100m from maximum inundation by water and at least 1m above maximum groundwater height.

4 The use of toxic substances to be minimised and wherever possible biodegradable substitutes used.

5 All toxic materials will be handled in a manner which avoids any unnecessary or accidental release.

6 **All toxic materials will be stored in secure bunded areas.** Contingency plans for spillage or loss will be given in the Waste Management Plan.

E. WORKSHOP, FUEL STORAGE AND FIELD SERVICING

Objective
To prevent pollution of water resources and maintain a safe and tidy operation.

1. Permanent Workshops

Objective
To locate permanent workshops and manage wastes to prevent pollution of water sources.

1.1 Practices:

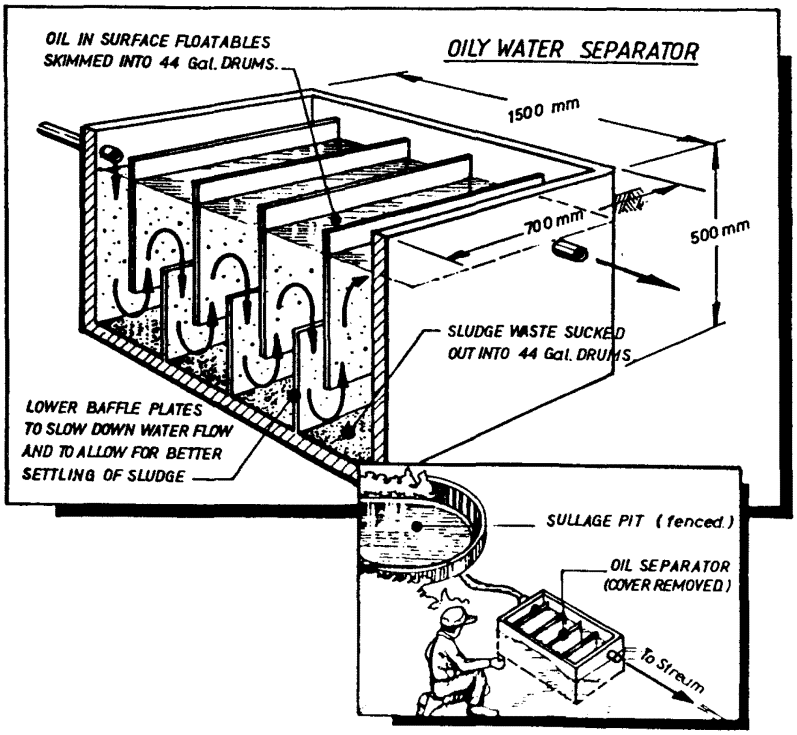
1 Locate, following discussion and approval with landowners. Permanent workshops should be located on high ground at least 50 metres from the maximum inundation of any water body or watercourse. The workshop floor is to be made of non-porous material.

2 Refer to Field Servicing and Maintenance (E3) for temporary workshops.

3 Ensure **the liquid waste (fuel and oil waste)** from the workshop area does not directly enter a watercourse by either:

a) collection and removal to the main waste pit in a sealed container; or

b) drain it into a sullage pit(s) and use an oily water separator to collect the waste before disposal, as in a).



4 Sullage pits have a capacity of 1 to 2 cubic metres (1m deep by 1m high by 1 to 2 m long) and must be constructed so that;
- they are above the watertable,
- runoff water does not enter the pit (to prevent mixing the waste with water),
- securely fenced off', stable and safe,
- they are at least 50 metres from a waterbody or course

5 Ensure the stormwater runoff and washwater drainage from the workshop area is not contaminated by fuel and oil waste and drains into collection to small settlement ponds to hold any accidental spillage and then direct discharge, via flowbreakers, to watercourse or via a flow-dispersal system to ground as described in the Waste Management Plan.

6 Dispose of solid workshop wastes in an approved waste pit located at least 100m from maximum inundation by water, at least 1m above maximum groundwater height and covered with at least 0.5m of soil.

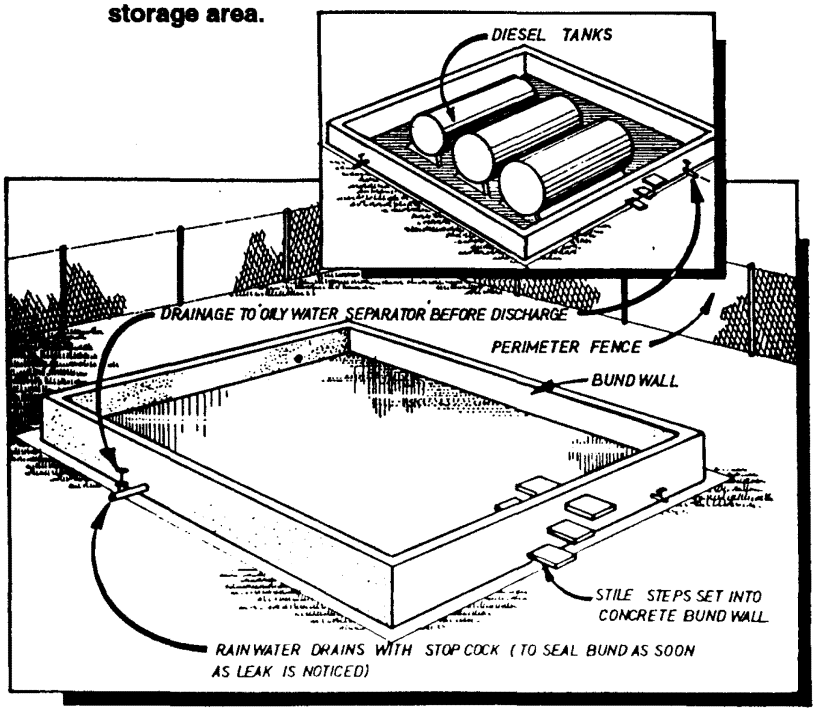
7 Strictly enforce "no littering".

2. Permanent Fuel Storage

Objective
To locate fuel storage sites and manage fuel to prevent pollution of water sources.

2.1 Practices:

1 **Site fuel storage sites at least 50 metres from any office, living quarters, water body or watercourse. Bunds (preferably concrete) with a capacity to hold the storage capacity must be provided around the fenced and secured storage area.**



2 Where main fuel storage areas must be located on a **wharf** they are to be located as far away from the river/sea as the fuel pumping lines will permit and be fitted with a bund from where any spill can be pumped to a standby sullage pit at least 50 metres from a water body.

3 Ensure the stormwater drainage from the fuel storage area does not directly enter a watercourse by providing a pond and oily water separator to collect fuel and oil waste.

4 Avoid spilling fuel during refilling or transferring operations.

3. Field Servicing and Maintenance - Temporary Workshops

Objective
To manage servicing and refuelling in the field to prevent spills and pollution of water sources.

3.1 Practices:

1 Field fuel tanks, re-fuelling points and maintenance areas are to be located at least 50 metres from any water body or watercourse, outside buffer zones and reserve and excluded areas, and in well drained areas such as log landings and road junctions.

2 Avoid spilling fuel during refilling or transferring operations from large field tanks and 200 litre (44 gallon) drums.

3 Prevent leakage from pipes and hoses by fitting bowsers and taps to pipes and hoses and a valve to the tank. Replace bowsers to an upright position rather than allowing the hose to drip.

4 Sump oil and hydraulic fluid are not to be dumped in the logging area. They are to be collected in securely sealed containers and either removed to the main waste pit, or shipped out to a municipal dump or recycled.

5 Spills can be soaked up by materials such as sawdust, wood chips, coconut husks or dry soil and then burnt or disposed of properly.

6 All equipment is to be washed thoroughly before it is moved to a new operation area to prevent the spread of weeds and diseases.

F. CAMP HYGIENE

Objective
To provide safe and healthy living conditions for camp personnel.

1. All Campsites

1.1 Practices:

1 Camps must be supplied with **potable water**. Rainwater may be collected in tanks fed from galvanised iron roof drainage to provide water used for drinking and food preparation.

2 Rainwater collection tanks must be properly screened to prevent the breeding of mosquitos.

3 For non-degradable wastes and litter provide adequate covered bins with regular emptying.

4 Strictly enforce "no littering".

5 Ensure camp personnel are trained to take the necessary precautions to prevent fire, especially from kerosene stoves and electrical equipment. Back this up with fire wardens and equipment to suppress any fires.

6 Ensure camp personnel are aware they are not able to garden, hunt, fish or erect buildings for personal use on land, river or sea.

7 Revegetate exposed soil as soon as possible.

2. Permanent Base Camps

2.1 Practices:

1 **New base camp areas** are to be detailed in the Environmental Plan and its supplements. This information should include the location, the number of occupants and the proposed dwellings.

2 New base camp areas proposed for construction or expansion are to adhere to the designs for sewage, water supply, waste water and rubbish disposal as set out in the **Waste Management Plan**.

3 All **stormwater runoff from buildings and roads etc. and domestic washwater** will drain into collection drainage ditches/canals to small settlement ponds to allow removal of solids & floating material and then direct discharge via flowbreakers to watercourse or via flow-dispersal system to ground as per the Waste Management Plan.

4 All camps are to be located 100 metres from a watercourse/high tide mark.

5 **Hygiene and construction requirements** are to meet or exceed the minimum standards in all existing and new base camp areas.

3. Temporary Campsites

3.1 Practices:

1 **Temporary camps** are those occupied for less than 12 months.

2 No temporary camps within buffer zones.

3 Remove all debris from the temporary campsite (drums, oil filters, ropes etc.) and all other rubbish. Bury rubbish at the main waste pit.

G. SAFETY

Objective
To provide safe and healthy working conditions for personnel.

1. Protective Clothing and Safety Equipment

Objective
To provide effective protective clothing and equipment for personnel.

1.1 Practices:

1 **All personnel** to be provided with and wear:
- steel capped footwear;
- a high visibility jacket; and
- a first aid kit (for the team or group).

2 **Chainsaw and logging operators** are to be provided with and wear:
- a safety helmet of International Standards Office (ISO) standard/or equivalent;
- ear muffs/defenders which are capable of providing hearing protection for sound at over the 100 decibel level (dB),
- leg protection (eg. chainsaw chaps, leg piece)

3 **Logging operators** also require gloves when handling wire rope and cables.

4 **Equipment operators** require a safety helmet and ear muffs/defenders.

5 **Workshop operators** require protective clothing, ear defenders, eye protection and gloves (when handling chemicals) as appropriate for the equipment being used. Respirators are required when painting and using industrial fluids.

2. Equipment safety

Objective
To provide and maintain all equipment in accordance with international safety standards. To train staff in the safe operation of equipment.

2.1 Practices:

1 All **chainsaws** held directly by hand must have at least one of the following securely attached:
(a) safety mitt
(b) rigid-type hand guard
(c) chain brake

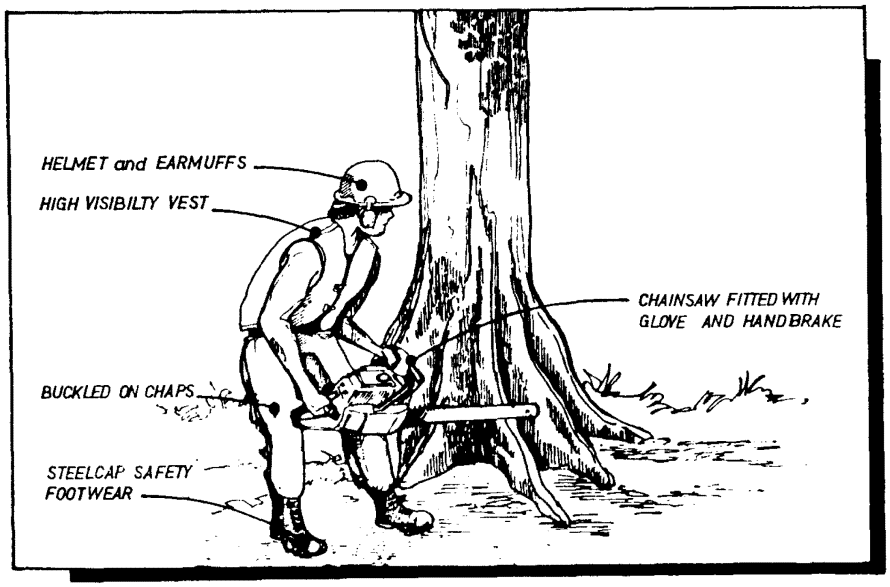
2 **Chainsaw exhaust systems** must direct the fumes away from the operator.

3 **Chainsaw tool kit** should be provided for corrective and preventative maintenance.

4 **Logging and Roading equipment** require:

- regular maintenance to achieve registered road-worthy standards and a safety sticker
- Roll Over Protection Structure (ROPS) and Falling Object Protection Structure (FOPS) cab or frame conforming to international standards securely mounted with high tensile nuts and bolts specified in fitting instructions
- securely mounted seat and seat belt conforming to international standards
- rear of cab or frame fitted with protective wire mesh
- reverse alarms
- securely guarded pulleys, shafts, belts and fan blades
- positive, non-returning engine stopping device which is accessible from normal operating position and clearly marked with operating instructions
- suitable fire extinguisher firmly fixed and easily retrievable
- exhaust system fitted with a spark arrestor
- first aid kit

5 All staff must be trained to follow safe working practices in the use and operation of all plant, equipment or substances they may handle or use. **This includes wearing appropriate safety clothing.**



H. GLOSSARY

Absolute Maximum Grade	The maximum road gradient permitted - a length is associated with this gradient so that it is not too long.
Abutment	An end support of a bridge or similar structure.
Aerobically composted	Composting involves putting biodegradable material in a heap or container, protected from the weather, to allow natural processes to breakdown the material. For aerobic composting, the heap is turned every few days to ensure thorough mixing in the air to speed up the process of breakdown.
Average skidding distance	The distance that the average log has to be skidded from stump to skid. Some logs are closer than others, for instance for a square 100 hectare area with sides 1000 metres long and a skid in the centre the average skidding distance is 350 metres.
Backcut	The final chainsaw cut involved in felling a tree. The backcut should be above the scarf.
Ballast Water	Water loaded into a ship to weigh it down when sailing without a cargo.
Batter	The uniform side slope of walls, banks, cuttings, etc.
Berm	See Edge Berm
Biodegradable	Breaks down to simple substances by natural processes.
Borrow Pit	An excavation outside the limits of the formation for obtaining filling to use for a roadway or engineering work.
Bowser	A trigger operated fuel tap which must be placed in an upright position to prevent dripping
Breaking-out	Connecting trees or logs to the strop to move the log away for branches, felling debris and break the contact with the soil. This process requires more force than keeping the log moving during skidding.
Breaking strength	The greatest load that a rope will withstand without breaking.
Brushing	The process of indicating a track alignment by cutting undergrowth to improve access and visibility, in this case by driving the bulldozer with the blade raised a few centimetres above ground level.
Buffer zones	Area of vegetation retained around a sensitive area or site. Logging and disturbance is excluded from these areas.

Bunds	An impermeable wall constructed to hold back or contain liquids.
Butt	The stump end of a log, usually larger in diameter than the other end of the log known as the head.
Cable Logging	Any hauling using a machine with powered drum(s), spars, blocks, wire rope and butt rigging to haul logs from the felling site to an assembly point or skid site.
Camber	The amount of cross fall (or side slope) on a crowned road, from the centre line to the road side. This is sometimes used to represent the amount of sideways slope on a road regardless of the presence of a crown.
Canopy gap	A break in the canopy of leaves and branches of a forest. The canopy gap controls the light reaching the lower layers of the forest and the ground and plays an important part in the regeneration process.
Carriageway Width	The portion of a road devoted to the use of vehicles. Same as roadway width.
Catchment	The area that yields run-off water to a given point.
Chainbrake	A safety device on a chainsaw designed to stop the chain in the event of a kickback
Chaps	Strap-on safety leggings for chainsaw operators - gives ankle to groin protection.
Compacted clay	A colloidally fine grained engineering soil (formed by the natural decomposition of rock) which has been rolled to increase its density and strength and to reduce its permeability.
Conservation areas	Special management and conservation zones including; fauna and flora conservation/protection areas, watercourse buffer zones, scientific study areas, water supply catchment areas, gene pool areas and sensitive habitat areas.
Contour tracking	Skidding tracks which roughly follow the contour of the land
Cording	The process of laying vegetation on a road or log landing to support traffic. Thin logs or sawmill waste slabs are often used.
Coupe	A harvesting unit of variable size usually used to refer to an annual logging area. Can be used loosely instead of block, set-up or cutting circle.
Cross Drainage	Drainage provided across and underneath a roadway to take side drain or watertable water to another point.

Cross-cut	The process of manufacturing logs from a tree, similar to the North American term "bucking".
Crown	a) The leaves and branches which make up the top of an individual tree; b) To shape a log landing, road or track so that it is higher in the centre than the outside so that water runs to the sides.
Cultural sites	All historical, archaeological, ethnographic sites and sites of contemporary significance.
DBH	Diameter at breast height
Deflector Bars	Short sawn timbers of approx. 150mm x 50mm cross section fitted in the invert of a culvert to provide turbulent areas suitable for fish passage and resting.
Directional felling	The process of felling a tree in a specific direction.
Downhill skidding	The process of using gravity to increase the efficiency of logging operations. A useful technique to reduce soil damage as an alternative to skidding uphill in wet weather.
Drilling	The process of testing the soundness of a potentially merchantable tree by inserting a vertical cut into the stem with a chainsaw looking for discoloured sawdust or soft wood indicating internal defect. This cut does not significantly weaken the tree. When compared with a tree found to be unsound after the scarf cut is made, it is not mandatory for it to be felled.
Edge Berms	A formed upstand of compacted fill material. Usually used to direct water runoff.
Excluded area	A term embracing all the areas where logging is not permitted, including cultural sites, buffer strips, conservation areas and water reserves.
Feeder road	A road serving to collect logs from landings and provide access to a main road.
Flagging ribbon	Also known as flagging tape. Brightly coloured 25 mm (usually) wide plastic ribbon used for marking road lines, main skid tracks, log landings, boundaries, exclusion areas and trees. Flagging ribbon is less expensive than aerosol paint.
Flexible track skidder	A tracked machine developed in the early 1970's by FMC from military tank designs. Known earlier as the FMC tracked skidder the machine is now manufactured by Kootenay Tractor Co., Canada and known as a "KMC tracked skidder".

Flowbreakers	Obstructions incorporated in the construction of flow channels and culverts to break the force of the flow and reduce scouring and/or generate turbulence.
Flow dispersal system	A system constructed to disperse a liquid flow over a wide area
Fluming	An open channel or conduit of metal concrete or timber bedded in natural ground or supported on trestles to carry water run-off from the road surface clear of embankment slopes to discharge in a safe place.
Fluting	The supporting buttresses on the stump of some species of rainforest trees. Usually the felling cuts are made above the flutes to reduce the width of the cut.
FMA	Forest Management Agreement.
Formation Width	The entire width of a road excluding batters.
Future crop trees	The trees which survive a logging operation (also known as residuals) and contribute much of the growth for the next harvesting cycle. For many species these trees have a head start on regeneration from seed.
Geographic Information Systems (GIS)	A computerised graphical layer system and database able to be interrogated and used to display particular combinations of information.
Global Positioning Systems (GPS)	This usually refers to the terrestrial electronic instrument used to display a geographic position obtained from earth orbiting satellites.
Groundwater	The naturally occurring water present in the ground at depths which depend on soil and rock type, topography and the presence of surface water bodies (rivers, lakes) in the area.
Guard Side log	The side log, of a log bridge, raised above the main stringer logs to provide side protection and containment of gravel or soil log bridge decking.
Handrail	The rail on the side of a bridge, provided at about waist height to provide lateral security to foot traffic near the edge.
Hang-up	A tree which has not fully reached the ground following the felling cuts. The tree constitutes a danger to those who use the forest until it falls.
Head	The small (top) end of a log nearest the branches. Opposite to the butt.
Headwall	A retaining wall at the inlet end of a culvert.

Heavy Vehicle Per Day	One heavy vehicle past a point. A round trip to collect logs from a landing would be 2 Vehicle movements.
Highlead Logging System	A hauler logging system in which a lead block is hung on a spar or tower to provide lift to the front end of the logs being hauled. The back end drags along the ground.
Integral arch	An extension to the winch of a logging tractor which effectively gives lift to one end of the log thereby reducing the friction forces involved in skidding. The weight removed from the log by this action is transferred to the tractor usually resulting in better traction.
Inundation	Inundation occurs when the volume of surface water is greater than the rate of drainage and excess water is present on the ground surface.
Kerb	A raised border of rigid material formed at the edge of a carriageway or bridge.
Kickback	Sudden force acting through the bar of a chainsaw, causing it to move at a very high speed in an uncontrolled manner
Kph	Kilometres per hour
Landing	Also known as a skid or ramp. Skid is the preferred term (for PNG) for the usually roadside clearing where logs are prepared, accumulated for scaling, and loading onto transport.
Log Cluster	Three or more logs placed in a more or less triangular fashion to act as a culvert.
Log Pond	Main storage area for logs awaiting shipment or processing
Logging debris	Smashed and broken branches, vines and other canopy material created as the result of tree felling and skidding.
Logging operations plan	A plan prepared by a logging company providing details of forward logging operations.
Main Road	A permanent or semi permanent road. Many factors influence the decision to designate a main road (risk, all weather or not, traffic volume and size, importance to operational factors etc.).
Major skid track	A skid track which carries the highest number of machine passes within the forest. The major skid track will end at the skid and may begin from a bush landing where logs are accumulated by tractors.
Maximum grade	The steepest desirable gradient.

Meeting Sight Distance	The sight distance required to allow 2 vehicles travelling on the road time to react, apply the brakes and stop before a collision occurs.
Merchantable	A log or tree of a readily marketable species which will yield a saleable product
Off tracking	The amount by which the rear wheels of a truck, or truck and trailer combination, follow inside the curved path taken by the front wheels, while the truck is negotiating a corner.
Oily water separator	A small tank containing baffle plates which separates oil and other floating wastes from a liquid waste stream. (See page 54)
One Lane Road	A road with sufficient width for only one vehicle at the design speed.
Outlet Wall	The retaining wall placed at the outlet end of a culvert.
Out-slope	Sloping the surface of a road or track to shed water to the down hill side.
Permanent Road	A road which is expected to have more than a limited life. Usually a road which is not provided just for a limited number of vehicle movements. A road which will provide access to blocks for a number of years. A road which because of its traffic volume justifies proper culvert and bridge installation.
Piping	The formation of holes or scour between the walls of a culvert and the surrounding soil.
Potable water	Water of a standards suitable for human consumption
PNGRIS	Papua New Guinea Resource Information System.
Primary Treatment	The removal of solids from a waste stream by settlement or flotation. The process may be assisted by the use of coagulant (causes to clump together) chemicals.
Prospect	To search for the next log to be skidded by cruising around the forest in the tractor.
Pulled wood	Wood fibres pulled from the butt of a log during the felling process. Usually due to insufficient backcutting, pulled wood results in downgrading the valuable butt portion of a log.
Rehabilitate	To improve the condition in which a track or log landing is left following use for harvesting.
Residuals	Potential future crop trees which survive the processes involved in harvesting.

Reserves	including hunting and gathering, gardening, residential, cultural, sacred and archaeological sites.
Rip	The process of drawing bulldozer rippers through the soil to improve internal drainage or shatter compacted soil.
Road Crossfall	The slope of a road at right angles to the main direction of the alignment. The term camber is sometimes used, but usually only when the fall is across the road from one side to the other rather than when it has a crown near the centreline and a fall to each side.
Road Dip	The depression provided to allow the cross road flow of water. Not a culvert and much more gentle than a cut off.
Roadway Width	The width of the traffic portion of a road including shoulders.
ROPS/FOPS	Roll Over Protection Structure and Falling Object Protection Structure. A canopy to protect the operator in the event of machine rollover and an object falling onto the machine.
Runoff	High volumes of surface water which are generated under heavy rainfall conditions.
Sacrificial tree	A tree on a track bend or other exposed situation which purposely takes the damage caused by logs being skidded to the landing in order to protect many more trees. This tree may be a merchantable tree removed on completing the set-up.
Saddle	A low point on a ridge or spur where drainage on two sides is usually possible and the contributing drainage from the other two sides is small. Saddles are key points for landing locations and roadline routes.
Safety mitt	A protective glove attached to the front handle of a chainsaw to keep the hand on the saw in case of kickback.
Scarf cut	The front or face cut in the tree felling operation. This is the cut which indicates the direction that the tree may fall in.
Scour Protection	Protection to prevent the formation of ruts, channels and holes by the erosive action of water flow.
Sediment trap	a purpose built hole designed to trap sediment by reducing water velocity. Usually located near watercourses or other discharge points to reduce sediment content. These are usually only effective at trapping coarse to medium sediment and require periodic clearing to remain effective.

Separator residues	The floating wastes collected and removed from oily water separators.
Separator sludge	The sludge that is collected and removed from oily water separators.
Septic-tank	A large underground tank, usually several cubic metres in capacity, which receives waste flows from wet toilets. The solid material in the sewage settles to the bottom of the tank where natural processes break it down. The liquid material flows out of the tank through a soakaway near the top.
Settlement Ponds	Relatively large ponds, up to 2 metres in depth and 20 metres or more in area, which allow solid material in drainage waters to separate out under gravity before discharge.
Set-up	The smallest defined harvesting unit, usually about 100 to 150 hectares in size. Not to be confused with a setting which usually refers to the area that can be accessed by a cable machine from one skid.
Shoulder	The portion of the road construction continuous and flush with the pavement or surfacing on each side of the road but is not normally used by the travelling vehicle.
Side cast	Pushing spoil to one side. Usually over a road edge or bank. Nearly always associated with hill country side roads where the spoil is wasted.
Side cut	A cut into the slope to remove soil to make a track level.
Sight Distance	The distance measured along the roadway over which visibility occurs between a driver and a specified object (another vehicle or a body on the road).
Skid	see landing
Skidder	An extraction machine with wheels or tracks specifically designed to partly support logs during skidding
Skidding/Snigging	The process of dragging logs from stump to skid.
Skyline Logging System	A logging system in which a block or carriage rides on a skyline - a rope extending between the cable hauler and the tailhold to provide lift. The log is fully suspended.
Soakaway	An underground, gravel lined (or other porous material) drainage channel which allows biodegradable liquid waste to disperse through the ground over a wide area, sufficient to allow natural processes to break it down.

Solvents	Organic liquids used for removing oily wastes, paints and other organic based substances during cleaning operations.
Spur road	A dead end road serving the collection of logs from landings and provide access to a main road.
Spur	A small ridge or area of elevated ground off a main ridge.
Standards	Measurable and enforceable practices applied consistently, this can include a simple "yes" or "no" assessment.
Stormwater runoff	High volumes of surface water which are generated under heavy rainfall conditions.
Strop/Choker	Short length of wire rope, chain or synthetic fibre rope, with hooks or other connecting devices. One end forms a noose round the end of the log, and the other is used to connect logs to the main extraction rope.
Stumping landing	A term used by at least one PNG company for a bush skid.
Sullage pit	A relatively small pit (about 1 to 2 cubic metres capacity) which collects all waste material, solid and liquid, from workshop, mill, fuelling and fuel storage areas. Overflow from the sullage pit is directed through an oily water separator before going for further treatment or discharge.
Surfacing	A layer of compacted, wear resistant material, usually gravel, coral rock, pumice or similar, placed on the road formation to provide a load distribution layer between vehicle wheels and the soil.
Temporary log crossing	A watercourse crossing made for the express purpose of skidding logs from one side of the watercourse to the other. Designed for short-term use, limited passes by off road traffic and will usually be a cluster of logs which should not be covered with soil and should be removed when finished with and certainly before set-up completion approval.
Temporary Road	A road which is expected to be used for a limited time. It would not be a through road.
Turn Out	The water channel provided at the edge of the road formation to ensure water from watertables or side drains is discharged clear of the road.
Two Lane Road	A road with sufficient width to take a lane of traffic in each (opposing) direction.

Two-staging	The use of more than one machine type to skid a log from stump to skid. For instance, the breakout phase may be done by a tractor and the long distance skidding by a rubber tyred skidder.
Uphill skidding	The method of skidding sometimes recommended for reasons such as avoiding streams, easier to pull winch rope downhill, dispersed drainage.
Vertical Curve	A curve in the longitudinal profile of a carriageway to provide a gradual transition from one gradient to another.
Waste Pit	Pit dug in the ground which should be at least 1 metre above maximum groundwater table and at least 100 metres from the nearest surface water into which waste material can be placed. When the pit contains waste to within half a metre of the surface, no more waste should be put in the pit, and the pit should be filled to form a mound rising above the surface to help rainwater runoff away from the pit area. The pit should be clearly marked as a waste pit site.
Water Bars	Mounds of soil created by digging into the surface of the track to provide a water barrier in channels or across closed/decommissioned roads and tracks. A cross drain designed to slow down or deflect water from a track, skid or road.
Washwater	Drainage water from washing operations which may be contaminated by toxic cleaning materials, residues or solvents.
Water Table	A surface side drain more or less parallel to and between the roadway and the cut batter or fill slope. Sometimes referred to as a table drain.
Wedge	A high impact plastic or aluminium sliver inserted into the back cut to help ensure the tree falls in the direction of the scarf cut. The wedge can be "driven" into the backcut with a mallet to push the tree in a desired direction.
Wet Toilet	Toilets flushed with water from a cistern and discharged into septic tanks or other sanitary treatment systems
Winch rope	Usually 29 mm flexible wire rope about 20 to 50 metres in length used for winching a log towards a tractor.
Wingwall	The side walls provided at culvert or bridge structures to retain road filling material.