Pre-harvest Field Preparation

- Tree Marking
- Exclusion Areas
- Location of Log Landings
- Location of Skid Trails
7. Pre-harvest Field Preparation

### OBJECTIVES

- To mitigate the negative impacts on biodiversity and improve the production of forests through appropriate silvicultural prescriptions.
- To minimise impacts on the residual forest stand and soil and water values.

Operations undertaken by the harvesting company must not commence in a harvest area prior to signing of the Operational Plan/Harvesting Agreement by both the Supervising Forest Authority Officer and the Company Supervisor. This should only occur after:

- a joint field inspection of the area;
- all buffer zones are marked to the satisfaction of the Supervising Forest Authority Officer;
- the contents of the Operational Plan have been discussed and are understood by the Company Supervisor.

NOTE: The Company Supervisor should be a person who will be present and responsible for the operations on the harvest area during the time that operations are in progress.

7.1 Tree Marking

Most forest harvesting in the Asia-Pacific region uses selection harvesting techniques.

### OBJECTIVES

- To ensure only appropriate trees are harvested, in a manner that is consistent with maintaining a vigorous forest.
- To maintain desirable species composition of the forest after harvesting and a viable residual stand.
- To minimise canopy openings in areas where they would allow the development of vines, weeds and lower-value pioneer species.

#### Amount of canopy disturbance

Where it is desired to promote the growth of climax species, the size of an individual canopy opening in any one position should be minimal.

#### Selecting trees

- The number of trees per hectare selected for harvesting will depend on tree marking rules and the silvicultural system (cutting limits, need for seed trees, etc.) developed for the particular forest type and stand condition.
Before felling operations commence, harvesting company operations staff (including supervisors, tree marking staff and chainsaw operators) must:

- have copies of tree marking rules; and
- understand how they are to be applied.

Minimum standards for tree retention

- Where desirable species are present in the sub-merchantable size categories:
  - identify, protect and retain sufficient numbers of stems to ensure a viable residual stand;
  - appropriate potential crop trees should be marked for retention; or
  - silvicultural prescriptions approved by the Forest Authority should be applied.

- Where desirable species do not exist in sufficient numbers, retain the original number and ensure that sufficient quality seed trees are preserved to provide for sustained regeneration.

Minimum standards for cutting

Select only those trees that will provide logs suitable for processing. These must be of suitable species and have the minimum specified log length.

### 7.2 Locating Log Landings and Skid Tracks

**OBJECTIVES**

To locate landings and skid tracks appropriately.

To minimise the size of landings to reduce the loss of productive forest area.

To construct and manage log landings and skid tracks to prevent sedimentation of watercourses.

To stabilise log landings and skid tracks after use.

#### 7.2.1 Landing Location

- Landings are to be located:
  - outside areas excluded from harvesting;
  - at least 40 metres from the edge of buffer zones (Figure 7-1);
  - at sites that accommodate skidding patterns and directions;
  - to balance site disturbance with skid distance;
  - in dry areas on ridges or benches;
  - in areas that are easy to drain;
– in areas of low slope to reduce the amount of side cutting;
– located on ridges to promote uphill skidding to disperse runoff into surrounding vegetation (Figure 7-2).

- Roadsides may be used if:
  - this reduces earthworks; and
  - landing areas and roads can be drained adequately.

- The location of all landings must be shown on the harvesting plan and inspected by the Forest Authority Officer before construction.
- The Forest Authority Officer may approve additional landings after field inspection.

**Figure 7-1: Log Landing Location**

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**Landing size**

- Log landing size applies to the working surface of the landing and does not include area for log storage.
- The size of log landings includes:
  - the total area of disturbance, including cut and fill batters;
  - half the road width if the landing is constructed at the roadside.
- Suggested maximum log landing size is 900 m².

**Landing construction**

- Landings should be located so that mud and debris do not enter watercourses.
- Landings should be located so that free drainage occurs at all times. Ideally landings should be located on gently sloping elevated areas.
Split-level landings may be used to reduce excavation. Safety must be paramount in design of split-level landings as often found with skyline yarding systems.

- Mark boundaries of the landing including cut and fill areas.
- Remove all merchantable trees.
- Construct and maintain landings to prevent the ponding of water.
- Drains must empty on to stable vegetated areas.
- Where landings are to be used in wet weather, they should be “corded” using small logs of unmerchantable species (Figure 7-3).

**Figure 7-2:** Log Landing Construction

![Figure 7-2: Log Landing Construction](image)

**Figure 7-3:** Log Loading on Corded Landing

![Figure 7-3: Log Loading on Corded Landing](image)
Landings should not be bladed off to keep them operational without the approval of the relevant Forest Authority Officer.

Debris and waste heaps should be:
- placed so as not to restrict drainage of the landing;
- stored away from standing trees;
- more than 10 metres from drainage areas.

Soil and vegetation debris should be kept separate.

**Landing rehabilitation**

- Landings should be restored so that proper drainage occurs to reduce soil erosion and runoff.
- If corded, cording should be removed.
- Landings should be drained to promote natural revegetation, or replanted with a cover crop and/or:
  - ripped at 90° to the drainage direction;
  - ripped radially;
  - a berm should be constructed around the landing.
- Bark and landing debris should be disbursed evenly across the landing to assist in stabilisation.
- The site should be cleaned of non-biodegradable material and all solid waste removed, including oil/fuel drums and wire rope.

**Skidding to landings**

Skid tracks should usually approach landings from below to avoid directing runoff of water to the landing.

**Limits on operation**

- Avoid the use of logging equipment on saturated soils to minimise erosion, ponding, mixing and compaction of the soil and minimise adverse effects on water quality.
- Avoid hauling on wet, rutted roads to reduce excessive turbid runoff that may adversely affect water quality.
- A complete closure of forest operations including hauling should be considered in extreme conditions where there is risk of environmental damage.
- The number of skid tracks and depth of rutting should be minimised.
- High-intensity skidding traffic should be confined to planned tracks that should be located on high ground so they drain naturally.
7.3
Skid Tracks

**OBJECTIVES**
To minimise the area covered by skid tracks to maintain the productive forest area.
To reduce soil damage along skid tracks.
To minimise damage to watercourses.
To minimise skid track grades (generally <20%).
To locate skid tracks to:
- minimise the number of watercourse crossings;
- improve the economics of harvesting.

7.3.1 Classes of Skid Tracks

**Major skid tracks**
Major skid tracks will have more than 10 passes of the skidding machinery along each track. Their construction may require minor earthworks. They will usually be located along spur lines (ridges) to facilitate drainage.

**Minor skid tracks**
Minor skid tracks will have less than 10 passes of the skidding machinery along each track. Their construction does not require earthworks. Litter is to be maintained on the surface of the track (Figure 7-4).

**Uphill or downhill skid**
Skidding direction should be decided by the Forest Authority Officer. However, where possible, skidding should be carried out uphill. Skid tracks are based upon assessment of the following factors:
- road and landing location (upper slope, lower slope);
- watercourse crossings (to be minimised);
- potential damage to soil caused by skidding machinery (minimise);
- safety;
- uphill skidding of large logs, with the butt end of the log raised, is likely to cause less soil damage than downhill skidding;
- soil types and conditions will affect machine traction and therefore skid direction.

**Winching**
Logs should be winched the maximum distance possible, to reduce the length of soil disturbance associated with skid tracks. Winches should be fitted to all machines with a minimum length of wire of 30 m (18-40 mm diameter).
Design

- Skidding in areas excluded from harvesting (other than at defined watercourse crossing points) should not be permitted.
- Location of landings should be undertaken prior to the location of skid tracks.
- Locate skid tracks:
  - away from waterways and unstable areas;
  - on spur lines where possible, to allow good drainage;
  - to avoid damage to residual trees;
  - in a way that makes use of “sacrificial” trees to be removed as protection for trees that are to be retained.
- Watercourse crossing points for major skid tracks should be shown in the harvesting plan and approved by the Forest Authority Officer. An increase in the number of watercourse crossings will require the approval of the Forest Authority Officer following a field inspection.
- Where major skid tracks must cross slopes, the angle of the skid track to the contour should not exceed 100%.
- Advisable maximum slope for side cutting is 50%.
- Advisable maximum allowable grades for skid tracks are:
  - Major skid tracks 25%
  - Minor skid track 45% (D7 controllable limit).
- In some instances, it may be appropriate to cord some portions, or all, of major skid tracks.

**Figure 7-4: Skid Track Construction**
Survey requirements

- Major skid track locations should be inspected and marked in the field prior to their construction and according to the Operational Plan.
- Departures from the planned alignment, which involve increased side cutting or increased watercourse crossings, are to be referred to the Forest Authority Officer for approval before construction.
- Skidder and chainsaw operators should identify and inspect the proposed skid track locations prior to commencing construction.

Timing of construction

MAJOR SKID TRACKS
Major skid tracks should be constructed close to the start of felling operations.

MINOR SKID TRACKS
Minor skid tracks should be marked prior to harvesting to assist the cutter to determine the direction of felling. They may be constructed after felling.

Construction

- No blading if slope is less than 25%.
- Construct skid tracks in dry weather.
- A maximum skid track width of 4 metres for all skid tracks (width of blade) is suggested.
- Avoid side cutting of major skid tracks whenever possible.
- Side cutting is not permitted for minor skid tracks.
- Side-cut skid tracks should have an out-slope of 2-6%.
- Box cuts should not be permitted.
- Berms on the outside edges should not be permitted.
- The radii of curves should be large enough to prevent damage to retained trees and regeneration unless a sacrificial tree is used.
- Drainage should be carried out as required to prevent the build-up of running water.

Skid track rehabilitation

As soon as skid tracks are no longer required for harvesting, proper drainage, using cross-drains, should be installed.

- Cross-drains should be constructed to divert water away from the skid track (Figure 7-5).
- The distance between cross-drains should be decreased:
  - as the gradient of the skid track increases;
  - as soil erodibility increases;
if harvesting is to be done in the wet season;
in areas of high rainfall.

**Maximum Cross-drain Spacing**

- Any watercourses inadvertently diverted into skid tracks must be restored to their original course.
- Seriously rutted skid tracks should be restored by backfilling and constructing cross-drains.

<table>
<thead>
<tr>
<th>Slope</th>
<th>Cross drain spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4%</td>
<td>Nil</td>
</tr>
<tr>
<td>5-9%</td>
<td>100 m</td>
</tr>
<tr>
<td>10-19%</td>
<td>60 m</td>
</tr>
<tr>
<td>20-24%</td>
<td>20 m</td>
</tr>
<tr>
<td>25%+</td>
<td>15 m</td>
</tr>
</tbody>
</table>

**Figure 7-5: Skid Track Cross-drain Construction**
Watercourse crossings

LOCATION

- Major skid track crossings should be shown on the harvesting plan, and approved in the field by the Forest Authority Officer.
- Skid tracks should not cross Class 1, 2 or 3 streams.
- Select crossing points on waterways in places where:
  - bank slope is less than 18% (preferably less than 9%);
  - the bed is firm.
- Skid tracks should cross watercourses at right angles.
- Temporary crossings should be provided to cross gullies, or waterways if water is flowing at the time of operation.

Construction

- Construct crossings in dry weather.
- Width of the crossing is to be less than 4 metres. Buffer vegetation is not to be otherwise disturbed.
- Use unmerchantable logs for the crossing where appropriate.
- Abutments and approaches should be higher than the stream banks.
- Cording of the approaches to the crossing may be required within 2 metres of the high bank.
- Soil should not be pushed:
  - past the high bank;
  - into watercourses;
  - onto the top of the crossing.

Removal

- Crossings should be removed in dry weather. Crossing material is to be placed more than 10 metres from the high bank.
- Removal must not disturb the watercourse banks.

Limits to construction

- Wet weather restrictions apply.
- Crossings should not be constructed during wet periods.
Implementation of Forest Harvesting Activities

- Supervision of Operations
- Harvesting
- Log Presentation
- Extraction Systems
  - Mechanical Skidding
  - Helicopter Logging
  - Skyline Yarding System
  - Draught Animal Logging
- Log Storage and Transportation Systems
- Weather Limitations
- Log Scaling/Grading
- Evaluation and Monitoring of Harvesting Operations
- Post-harvesting Activities
8. Harvesting Operations

OBJECTIVES
To prevent the entry of soil or turbid water into watercourses.
To minimise ground disturbance and traffic in the area.
To maintain the productive and regenerative capacity of the forest.
To harvest the area effectively and efficiently.
To adopt and maintain appropriate safety standards at all times.

8.1 Supervision of Operations

OBJECTIVES
To ensure that competent and experienced supervisory staff direct all harvesting operations.
To ensure that supervisory staff provide on-the-job guidance and training so that staff responsible for particular tasks understand the requirements of those tasks.
To inspect harvesting operations regularly to ensure they are being carried out safely and in accordance with the harvesting agreement, the Code of Practice for Forest Harvesting in Asia-Pacific and company requirements.

Company supervisors
Adequate numbers of supervisory staff should be deployed, with the number depending on the size of the operation and company structure.

Frequency of inspections
The company supervisor should inspect each operation on a regular basis and check compliance with the Code. Any non-conformance with guidelines should be acted on immediately.

Skills of supervisory staff
- Experienced in the planning and supervision of harvesting operations.
- Working knowledge of the Long Term and Operational Plans and the Code of Practice for Forest Harvesting in Asia-Pacific.
- Ability to communicate clearly with all harvesting crews, other company staff, Forest Authority personnel and resource owners.
- Working knowledge of all elements of harvesting operations, including occupational health and safety of the workers, machine operation, maintenance schedules and basic repairs.
Possession of current first aid knowledge as indicated in the *ILO Code of Practice on Safety and Health in Forest Work*.

**Duties and responsibilities**

- Direct involvement in all levels of pre-harvest planning.
- Train and familiarise staff with:
  - the operational and safety requirements of sound logging practice;
  - company requirements in relation to the harvesting operation.
- Co-ordinate harvesting operations.
- Direct supervision of harvesting operations to ensure compliance with:
  - *Code of Practice for Forest Harvesting in Asia-Pacific*;
  - Long-Term and Operational plans; and
  - *ILO Code of Practice on Safety and Health in Forest Work*.
- Maintain and submit accurate records as required by the Forest Authority, company and other relevant agencies.
- Render first aid if required.
- Arrange rapid evacuation to hospital of any injured worker if required.

**LIAISE WITH:**

- Forest Authority staff.
- Planning Officer of the company.
- Other forest and land management agencies with responsibilities for the proper conduct of aspects of harvesting operations.
- Landowner(s) or their representatives.

### 8.2 Harvesting

#### OBJECTIVES

To fell trees to maximise recovered log volume and value.

To directionally fell trees to:

- minimise damage to residual trees and regeneration;
- facilitate easier log extraction and minimise ground disturbance; and
- avoid disturbance to areas excluded from harvesting.

To adopt safe practices.

#### 8.2.1 Commencement of Harvesting Operations

Harvesting can commence when:

- the operational plan has been signed by the Forest Authority and Company;
- major skid track locations are known and marked prior to felling;
- tree marking—where silvicultural prescriptions require—has been completed;
- all operators are familiar with the harvest area and have discussed the operational plan with the forest supervisor.

**8.2.2 Tree Felling**

**Testing tree soundness**

- Trees suspected of being unsound should be tested before felling.

**Directional felling**

Directional felling involves marking trees with a predetermined felling direction and is required to:

- minimise damage to the felled tree as well as to standing trees intended to comprise the next harvest crop;
- facilitate easy log extraction and minimise ground disturbance (Figure 8-1);
- avoid disturbance to buffer areas, watercourses and exclusion areas; and
- prevent trees from hanging up during felling.

**Figure 8-1: Directional Felling and Skid Track Location**
Preparation

- Plan the direction in which to fell the tree to facilitate extraction and reduce damage to potential crop trees.
- Make sure that there are no dead limbs or “hung-up” branches.
- Cut any vines still attached to the stem or trailing from the canopy. Vine cutting is best undertaken a year prior to harvesting.
- Clear two alternative escape routes away from the tree to be felled (Figure 8-2).
- Clear shrubs and saplings away from the base of the tree to provide an adequate working space.
- Fellers should not feel obliged to cut trees they think are unsafe to fell.

Felling

- Scarf and back-cut properly (Figure 8-3).
- Retain hinge wood.
- Use wedge where appropriate.
- Once cutting of a tree is started, that tree must be felled.

Stump height

- Stump height should be as low as practicable (<30 cm is preferable) to maximise merchantable volume.
- Stump heights over 30 cm are acceptable:
  - where butt defect is obvious (the tree can be cut immediately above this defect); or
  - where a buttress exists (and it is not appropriate to trim), in which case the tree may be cut immediately above the buttress.

Using machines for felling and removing hung-up trees

- The use of machines to pull trees while they are being cut is prohibited.
- Machines, fitted with international standard roll-bar protection, are preferable for use in dislodging hung-up trees.
- Hung-up trees are to be removed before any more trees are harvested. If they cannot be removed immediately, the area should be well marked to signal the danger to other people.
- Using other trees to knock down a hung up tree is not permitted.
- Adopt ILO Code of Practice on Safety and Health in Forest Work.

Limitations

- Adverse weather restrictions apply.
8.3
Log Presentation

OBJECTIVES
To obtain the maximum log value possible from felled trees.
To maximise log presentation at the stump, to reduce the amount of cross-cutting needed at landings or log ponds.

8.3.1 Cross-cutting and Debranching

- Completely cross-cut (buck) logs so that splitting does not occur when the log is moved during skidding.
- Cross-cut boles and tops to obtain the maximum volume, consistent with highest value of saleable logs.
- Trim all buttress flutes and side branches flush with the main stem to:
  - gain maximum log quality and volume; and
  - reduce soil disturbance and assist skidding.
- Ensure that cross-cuts are no more than 10º from vertical (Figure 8-4).
- Use log nails or S nails on log ends to avoid end splitting and to maintain quality.

Figure 8-4: Log Cross-cutting

Cross-cutting safety

- Do not stand on the trunk of the tree being cross-cut.
- Beware of tension while cutting logs 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 chainsaw cutter bar as this can cause kickback.
- Use an appropriate wedge to avoid having the chain of the saw getting pinched or caught in the log.
- Avoid making the final cut while standing on the lower side of a tree if it is lying on a slope.
- When making the final cut always stand on the compression side of the log.
- Beware of overhead hazards.

### 8.4 Extraction Systems

#### OBJECTIVES

- To reduce soil compaction by using low ground pressure equipment.
- To minimise the area disturbed.
- To avoid damage to remaining trees, regeneration, watercourses and buffer zones.
- To implement and maintain appropriate safety standards at all times.

#### 8.4.1 Harvesting System Selection

To provide assistance in matching extraction systems to various sites, slopes and soil types, the following table is provided:

<table>
<thead>
<tr>
<th>SLOPE CLASS</th>
<th>0-15%</th>
<th>15-35%</th>
<th>35-60%</th>
<th>60%+</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>C1-5</td>
<td>C1-5</td>
<td>C1, C5, C6</td>
<td>C5, C6</td>
</tr>
<tr>
<td>MODERATE</td>
<td>C1-5</td>
<td>C1-5</td>
<td>C1, C5, C6</td>
<td>C5, C6</td>
</tr>
<tr>
<td>HIGH</td>
<td>C2-5</td>
<td>C2-5</td>
<td>C5, C6</td>
<td>No Logging</td>
</tr>
<tr>
<td>VERY HIGH</td>
<td>C2-5</td>
<td>C5</td>
<td>No Logging</td>
<td>No Logging</td>
</tr>
</tbody>
</table>

C1    Crawler Tractor  
C2    Skidder/ Forwarder  
C3    Flexible Track machines (FMC)/ Low Ground Pressure Tractors  
C4    Draught Animals/ Human Beings  
C5    Helicopter  
C6    Skyline Yarding System
8.4.2 Mechanical Skidding

- Tractor blades should be raised or removed when travelling and skidding.
- Pushing soil on skid tracks < 25% slope, other than that permitted for construction, is to be avoided.
- Retain vegetation litter along tracks.
- Reverse along skid tracks towards the log, wherever this can be done safely.
- Use winches to pull trees to skid tracks from stumps.
- Lift the end of the log off the ground, to avoid soil damage due to log drag. Logging arches will assist with this action.
- Avoid damage to soil and standing trees and regeneration along skid track edges. Sacrificial trees may be used to minimise damage.
- Cross-cut long logs to reduce skidding damage.

Prohibited skidder access within harvesting area

- Within 10 metres of road cuttings or other banks that are more than 2 metres high.
- In areas excluded from logging.
- In watercourses, except at approved and properly constructed crossing points.
- Within the limits of swamps or wet areas, except at approved crossing points.

Limitations

- Wet weather restrictions apply.

8.4.3 Helicopter Logging

Requirements

- Planning of operations should be done at the Operational Planning stage.
- Comply with the appropriate government legislation.
- Use experienced operators.
- Have well defined procedures to minimise damage and maximise safety.
- Have an effective communication system between aircraft and ground.
- Fell undergrowth trees to prevent the long line snagging as it is being lowered.
- Avoid felling future crop trees.
- 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.

**Helicopter requirements**

- A direct visual operation control window.
- A lifting cradle with an on-board weighing system.
- A long line with electronic release hooks at both ends that are operated by the pilot’s controls.
- A long line with 4 times the breaking strength of the helicopter lifting capacity.

**Personnel requirements**

- All personnel working in the vicinity of the helicopter should be familiar with the safety rules which apply when working around helicopters.
- Helmets with ear-muffs or chin straps, high visibility vests and steel capped boots must be worn by all personnel.
- To reduce the chance of injury, ground crews must work on the upslope side of felled logs (i.e. start working from the top of the slope and work downslope).

**8.4.4 Draught Animal and Human Skidding**

This may involve, but is not restricted to, the use of human beings, elephants, buffaloes and horses.

**Planning**

- Animal skidding should use short extraction distances (less than 400 m is recommended).
• Maximum recommended downhill slope of between 25 and 35% is suggested for elephant logging.
• Maximum recommended uphill slope of between 10 and 15% is suggested for elephant logging.
• It is recommended that cutting and skidding be co-ordinated and start from the back of the harvest area so that animals don’t have to walk over fallen logs that might lead to injury or reduced efficiency.
• Human skidding should mainly be used in swamp forests to transport logs to portable railway systems for transportation out of the swamp.

Operations

• Proper harnesses are essential to prevent injury to animals and human beings.
• Skidding pans, sledges and sulkies can all be used to increase skidding efficiency.
• Adequate water, food and veterinary care must be provided for animals.

8.4.5 Skyline Yarding

Requirements

• Minimise damage to the harvesting area and residual trees.
• Minimise the area of disturbed and compacted soil.
• Implement and maintain safety standards at all times.

Planning

• Skyline yarding systems are appropriate extraction systems for selection harvesting on steep sites (36% or more).
• Harvesting of any area where 90% of the slope is over 35° with a skyline cable system requires approval from a supervising officer.
• On steep sites watercourse buffer widths are to be interpreted as horizontal distance.

Operational guidelines

• Logs must be fully suspended across all buffered watercourses (i.e. streams or gullies) or exclusion areas.
• Cables may be pulled through buffers but cannot be dragged horizontally to the angle of pull.
• To reduce ground disturbance:
  – maximise log lift;
  – maximise spar height;
  – use intermediate supports; and
  – reduce log size or the number of logs per pull.
8.5
Log Storage and Transportation Systems

OBJECTIVES
To reduce log stockpiles in the forest by proper planning of the removal of logs soon after they are cut.
To avoid stockpiling logs that are susceptible to decay or insect attack.
To load and haul logs safely.

8.5.1 Log Stockpiles
- Stockpile logs at well-drained roadside landings, accessible in wet weather.

Regular inspection
- Inspect logs and apply appropriate control measures if insect or fungal attack is observed.

Limitations
- Avoid stockpiling logs for more than 2 months.
- Avoid stockpiling logs in cyclone/monsoon prone sites prior to the onset of the wet season.
- Wet weather restrictions on the operation of landings apply.

8.5.2 Water Transport
- Logs with high density should be allowed to dry out if possible to reduce weight prior to transporting by water.
- Logs tied together in rafts should be secured adequately to avoid loss and damage to other vessels on the waterway.
- Sinker logs should be transported by barge whenever possible to reduce excessive use of non-commercial buoyant species.
- As organic matter reduces oxygen demand and causes pollution, depositing log offcuts and bark in rivers should be avoided.
- Soil damage to river banks at loading ponds should be minimised.

8.5.3 Road Transport
- Grapple excavators and loader should be used for loading logs where possible.
- Trucks must not be loaded in excess of their design capacity.
- Side stanchions on trucks must be vertical after loading.
• All loads are to be secured with at least two approved load binders. Each log must be secured by at least one approved log binder.
• Protruding limbs or trailing material must be removed before the truck departs the loading point.

**Transportation**

Logging equipment can assist loaded trucks to:
• move from the landing to the road; and
• climb steep sections of road constructed according to an approved harvesting plan.

**Trucking**

• Observe posted speed limits and maximum (tare) weights for roads.
• The load should be checked regularly enroute.

**Unloading**

• Check that the side stanchions are secure before removing log binders.
• All logs are to be removed by loaders or grapple excavators where possible.
• All people other than the loader operator are to stay at least 20 metres from the truck during unloading.

### 8.6 Weather Limitations on Harvesting

The responsibility for defining when weather conditions restrict harvesting operations lies with the on-ground supervisor/manager. However, if they fail to comply with procedures, the Forest Authority Officer should take appropriate action.

**OBJECTIVES**

To avoid operations at times of high safety risk.
To prevent operations where ground conditions are so wet as to cause severe and long-lasting damage to the soil and water values.

Operating when conditions are excessively wet, causes extreme damage to soil and water. It is also inefficient and often dangerous. Areas most likely to be workable in wet weather are those with less than 25% slope on stable soil types.

Felling should cease when:

• wind strength prevents accurate and safe directional felling;
- ground conditions are too slippery to allow the chainsaw operator to move safely and quickly away from the falling tree;
- rivers are too low in the dry season to permit water transport of logs.

**Skidding and/or road construction**

Skidding and road construction should cease when:

- soils are saturated and muddy water or mud is flowing down a skid track for more than 10 metres;
- blading of mud or soil is necessary to continue skidding (the affected section of the skid track must not be by-passed by opening up a new skid track or road);
- soils are rutted to a depth of more than 30 cm below the original ground level over a section of 10 metres or longer.
- water is ponded on the surface of the log landing in any area that is being worked;
- trucks cannot move unassisted along the roads because of slippery conditions;
- muddy water or mud runs in wheel ruts, which are more than 10 cm below the road surface, for a length greater than 50 metres;
- no suitable areas are available;
- the Forest Authority has issued a provisional completion certificate.

**Provisional Harvesting Certificate**

A Provisional Harvesting Clearance Certificate may be issued by the Supervising Forest Authority Officer if operations are to be temporarily relocated or suspended. This may be due to:

- weather limitations; or
- additional road construction requirements.

**Coupe clearance**

A provisional harvesting clearance should only be issued if there are no identified breaches of the Code of Practice.

- Any breaches must be rectified prior to issuing a clearance.
- Skid tracks and landings should be drained prior to departure from the harvesting area.
Recommencement of operations

- Operations should only recommence when ground conditions permit operation without causing damage of the type described above.

Extending operations on log landings and skid tracks

- Use excavators where possible.
- Cording may be undertaken to extend operations in wet weather.
- If the cording sinks to the original rutted depth, operations should cease.

EXAMPLE ONLY

HARVESTING CLEARANCE CERTIFICATE

Harvest area Name: Location:

Reason for Issuing Provisional Clearance Certificate:

This certificate is made consequent upon agreement dated ____________________ between _________________________ (the Company) and the _____________________ Forest District (the Forestry Authority).

WHEREAS

We the undersigned have inspected the said land to check that the Company has satisfactorily carried out its obligations under the said agreement. In particular, we have established:

1. That all streams and watercourses have been cleared of obstructions, dams, temporary culverts etc.
2. That all skidding tracks on slopes have cross drains which lead off at no greater than the frequency detailed in the Code of Forest Harvesting Practice.
3. That all quarries, pits, and gravel extraction areas have been restored within the above harvesting area to a safe environmentally acceptable condition and that any areas of stagnant water created by operations around working areas have been filled or drained.
4. That thorough maintenance has been carried out on all roads leaving them properly drained and in good working condition.

THEREFORE IT IS HEREBY AGREED:

That the Company is temporarily released from obligation under the said agreement. Clearance is granted to leave the harvest area subject to harvesting being completed by ____________________:

(Insert any other retained obligations)

____________________________________________________________________________________________

____________________________________________________________________________________________

_______________________________
Harvest area/number: __________________________
Signed by: _______________________________ (The Forestry Authority Officer)

Signed by: _______________________________ (The Company Representative)

Date: __________________________
8.7 Log Scaling/Grading/Measuring

**OBJECTIVES**

To ensure that all logs are measured accurately.

To ensure that log measurements are recorded in a manner which allows easy checking of measurements and forms a basis for correct payment to owners.

---

**Measuring logs**

- Primary responsibility for accurate measurement rests with the Forest Authority or the purchaser of the logs depending on particular country procedures.
- The landowner or a representative should accompany the purchaser’s representative for log measurements. Independent recording of log measurement by owners is encouraged.
- The Forest Authority Officer may attend and/or evaluate log measuring procedures during inspections.

**Log measurement location (other than where logs are sold on a weight basis)**

- Logs must be measured before or when they reach the log landing. These measurements are the official records for the purpose of log volume and pricing calculations.
- Logs meeting the minimum specifications, but left in the forest should also be measured and charged (stumpage).
- Remeasurement of all logs, or a sample of them, at the landing or at the log pond will be done as part of Forest Authority monitoring procedure.

**Log tally sheets**

Log tally sheets, approved by the Forest Authority must be used to record log measurements.

**Log identification**

- Minimum log information and measurements to be recorded include:
  - owner brand and Forest Authority brand where appropriate;
  - individual number for each log and tree marking number;
  - log length;
  - log quality, grade, species;
  - log diameter(s).
- Use sequential numbering.
- Avoid duplication of numbers.
For the purpose of payment, other records may include:
- owner identification;
- identification of cutter/skidder/hauler;
- lines or marks showing positions of diameter measurements.

Log markings must be sufficiently durable to last at least until logs are loaded for export or processed.

8.8 Log Ownership

Ownership of logs

- Legal agreements between the parties involved in harvesting must specify precisely when log ownership is transferred. For example, specify the time of payment, or specify that log ownership is transferred when the licence agreement is signed.
- Following this transfer, the logs are owned by the purchaser.

Payment for logs

- Legal agreement between the parties involved in harvesting must specify precisely the point and time of payment for logs and other forest products.
- Payment must be made for all commercial logs felled, irrespective of whether or not they are removed from the forest unless specific exemption is given for particular uses, for example:
  - logs used in road construction (this will occur only if no suitable non-commercial durable logs are available);
  - logs provided to contractors for their own use;
  - logs used for logging camp construction and maintenance (non-commercial logs should be used in preference.)

8.9 Monitoring and Evaluation of Harvesting Operations

OBJECTIVES
To monitor compliance with the Code of Practice for Forest Harvesting in Asia-Pacific and other relevant codes.
To improve the quality of future planning and implementation of harvesting operations.

Harvesting operation evaluation

- Formal evaluation of operations will be done by staff of the Forest Authority (Figure 8-5).
Self regulation by logging companies to ensure compliance with the *Code of Practice for Forest Harvesting in Asia-Pacific* and monitoring of performance is recommended.

**Timing of evaluations**

- Forest Authority Officers will evaluate operations at each inspection.
- Maximum time between evaluations should be 3 months. Inspection at 1-month intervals is preferable.
- If the evaluation results in a suspension of operations, a further field evaluation should be carried out to verify that all the work is completed to the required standards, before the suspension is lifted.

**Evaluation procedures**

- All evaluations require ground inspection.
- The Forest Authority Officer should be accompanied by a representative of the company and other authorities as appropriate.
- Preliminary evaluations may be undertaken from small format photography/satellite images of logging areas which have been flown since the last inspection. Assessments of operations from photography need to be checked in the field.
- Areas inspected and evaluated should include a representative sample of:
  - current harvesting operations;
  - areas completed since the last inspection;
  - areas where the company was directed, at the previous inspection, to do further work.
- During the inspection, all areas of non-compliance with the Code or the harvesting contract are to be explained to the company representative.
- The company representative is requested to sign the evaluation form as a true record of the inspection (Figures 8-6).

**Evaluation inspections**

- Copies of the evaluation are to be forwarded to:
  - head office of the Forest Authority (via district or regional offices);
  - other relevant government agencies;
  - representatives of local populations;
  - the company.
Is the work satisfactory?

Yes

If a suspension order is in force it may be lifted. Notify the company.

No

Send reports of inspection to Forest Department supervisor and company

Is penalty warranted or appropriate?

No

Explain problems to company and operators.

Yes

Major breach record

Penalty applied (letter to company)

Reinspect
## HARVEST OPERATIONS EVALUATION - FORM 1

**Procedure:**
Assess and score operations as indicated on the evaluation form. If only part of the operation is to be inspected, choose areas randomly. Make sure that the assessment represents all areas of operation.

**Attach additional pages of comments if required.**

**Company**

---

**Results of previous inspections:**

<table>
<thead>
<tr>
<th>DATE</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mark for this inspection**

**Comments by the inspecting Forest Officer:**
Operations HAVE / HAVE NOT improved since the last inspection. The major problems are:

**Is major breach action necessary?**  YES / NO

**Signed:** .................................................................  **Dated:** .................................................................

**Comments by harvesting company representative:**

**Signed:** .................................................................  **Dated:** .................................................................

**Comments by Senior Forest Authority Officer:**
I SUPPORT / DO NOT SUPPORT the action recommended by the inspecting officer because:

**Signed:** .................................................................  **Dated:** .................................................................

**ACTION TAKEN**
### EXAMPLE ONLY- FORM 2

**Date:**

**Place:**

**Forest Officer:**

**Company Rep.:**

<table>
<thead>
<tr>
<th>CODE (1)</th>
<th>ACTIVITY (2)</th>
<th>NO. OF OBSERVATIONS (3)</th>
<th>MARKS DEDUCTED PER BREACH (4)</th>
<th>TOTAL MARKS (5)</th>
<th>CUM MARK (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STARTING MARK</strong></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.0 PLANNING

1.1 Harvesting plan (at the detailed coupe level) has not been completed in accordance with the Code.

Harvest operations must not commence or must be immediately suspended if the Operational Plan has not been signed by the Supervising Forest Officer and the Company Supervisor.

1.2 Exclusion areas (Special Management Zones including buffer strips) not demarcated in the field prior to operations commencing. 0

1.3 Contractor and where possible the Forest Officer has not discussed the plan with cutters and plant operators. -5

**MARK FOR PLANNING = TOTAL COLUMN 5**

#### 2.0 ROADING (Assess lengths of approximately 100 m)

2.1 For each length not located as per harvesting plan. -5

2.2 For each length with clearance beyond 30 m at widest point (40 m where gravel not available). -3

2.3 For each length with side cuts on slopes exceeding 30 degrees. -3

2.4 For each length not drained in accordance with Code and plan. -5

2.5 For each watercourse crossing not constructed to harvesting plan. -5

2.6 For each unmetalled (or uncompacted if no gravel available) length. -4

**MARK FOR ROADING = TOTAL COLUMN 5 DIVIDED BY 3**

#### 3.0 LANDINGS (Assess 3 landings)

3.1 For each landing not located as per harvesting plan. -5

3.2 For each landing not properly drained and more than 0.25 ha. -3

3.3 For each landing with 20+ m of skid track that drains onto it. -3

3.4 For each landing in an excluded or filter area. -6

**MARK FOR LANDINGS - TOTAL COLUMN 5 DIVIDED BY 3**

#### 4.0 EXCLUSION AREAS (Assess 3 lengths of filter strips, 3 historical sites)

4.1 For each length not located according to harvesting plan. -5

4.2 For each length with trees felled within it. -5

4.3 For each length with trees felled into it. -2

4.4 For each length with unauthorised machine entry. -5

4.5 For each historic site damaged. -5

**MARK FOR EXCLUSION AREAS = TOTAL COLUMN 5 DIVIDED BY 3**

#### 5.0 SKIDDING (Assess length of approximately 100 m)

5.1 For each skid track not marked and located as per harvesting plan. -5

5.2 For each track which has been bladed after initial construction. -4

5.3 For each length with blade damage to watercourse banks or soil pushed into a watercourse or filter area. -5

5.4 For each length with clearing beyond 5 m at the widest point. -4

5.5 For each inadequately drained skid track. -4

5.6 For each length with logs driven to the skid track (which could have been broken out with the winch). -3

5.4 Damage to PCTs. In residual stand based on trees only -1

5.5 Marked trees harvested. based on trees only -1

5.6 Damage to trees on skid track based on trees only -1

**MARK FOR SKIDDING = TOTAL COLUMN 5 DIVIDED BY 3**

**ASSESSMENT TOTALS = MARK FOR PLANNING + ROADING + LANDINGS + EXCLUSION AREAS + SKIDDING**

**OTHER COMMENTS:**
8.10
Post-harvesting Activities

**OBJECTIVES**
To leave the harvesting area in a condition that encourages forest regeneration and protects other environmental values.
To leave the forest area in a safe condition.
To prevent deterioration of downstream soil and water values.

### 8.10.1 Harvest Area
Any tree hang-ups should be removed.

### 8.10.2 Skid Tracks and Haul Tracks

**TEMPORARY CROSSINGS**
- Remove all temporary crossings, using an excavator where practicable.
- Avoid disturbance to the watercourse banks and buffer zones.
- Place material at least 10 metres from the watercourse.

**TRACKS**
- Do not increase the width of tracks by blading or pushing material in from the side in order to cover the track surface.
- Place cross-drains:
  - at changes in slope;
  - within 10 metres of a watercourse;
  - at other locations so that the spacing between cross-drains is equal to or less than the maximum allowed.
- Cross-drains are to have:
  - a bank height of at least 30 cm and a batter length of 1.5 m;
  - the bank is to be accompanied by a cut into the surface of the track;
  - a crossfall of 1-3%;
  - an angle of 45° to track alignment;
  - a stable vegetated disposal area, log barriers or scour pads.
- Box cuts are to be avoided if possible, but are to have earth dams (water bars) constructed at a spacing equal to or less than the maximum allowed for cross drains. The bank height is to be equal to the depth of the cut.

**Landings**
- Rip landings at right angles to the drainage direction, or construct a berm around the landing and/or replant with a forest growing crop of grass, shrub or tree species.
- Remove or bury waste.
- Stabilise the batters of cuts and fills. Drain all areas where water may pond to stable disposal points and not directly into watercourses. The grade of drains is to be 1-3%.

**Watercourses**

Remove any harvesting debris that has entered buffer zones and/or designated watercourses.

**Roads**

**PERMANENT CROSSINGS**

- Check all bridges and culverts, including decking foundations and side walls. They must be secure and safe.
- Any debris that has been pushed into the watercourse must be removed by excavator or by hand.
- Water must be able to flow freely beneath bridges.
- Clean all silt traps.

**FORMATION**

Road formations are to be in good condition. There are to be no ruts in the surface. Crossfall is to be 1-3%. Surface grading and compaction may be required to ensure the road is in a stable and well-drained condition.

**SIDE DRAINAGE**

- All table drains, side drains and cross-road drains must be left in good working condition. Surface grading may be required.
- Soil, vegetation and other material that would obstruct water flow must be cleared from road drains.

**Quarries and borrow pits**

- Remove or bury all rubbish.
- Stabilise steep cuts:
  - batters should be less than 100% slope;
  - cuts more than 3 m high should be stepped at 3 m vertical intervals.
- Re-grade the drain on the uphill side and make sure that runoff cannot enter the quarry or borrow area and is diverted to a stable disposal point.
- Drain the surface of the quarry if water is likely to pond. These drains must empty to stable disposal areas.
Log ponds and wharves

- All material able to be used by the local community should be stockpiled free of soil.
- Drainage within the log pond and on the wharf should be put in good working order so that water will not pond for extended periods of time.
- The road to the wharf should be drained to prevent runoff reaching the sea.
- All log debris (e.g., bark and log ends) should be removed from the wharf.

Refuse dumps

- Dumps should be filled in level with the surrounding areas to prevent water from ponding.
- Fill should be compacted to prevent settling.

Camp areas (base and field)

- All refuse should be removed.
- All areas where water is likely to pond should be drained. Drains should not empty directly into water bodies.
- The area should be left in a clean and tidy condition (including removal of all temporary buildings and machinery).

8.11 Completion of Operations

Upon completion of rehabilitation work, the supervising Forest Authority Officer should issue a Harvesting Completion Certificate or Provisional Harvesting Clearance Certificate. Work should not commence in another area until such a certificate has been submitted. A Harvesting Completion Certificate should only be issued when the Officer is satisfied that all requirements of the Code of Practice for Forest Harvesting in Asia-Pacific, and related codes and regulations, have been fulfilled (Figure 8-7).
This certificate is made consequent upon agreement dated ____________________ between __________________________ (the Company) and the __________________________ Forest District (the Forestry Authority).

WHEREAS

The Company has notified the Forest District Officer that it has completed operations within the land covered by the above agreement with effect from ________________________________.

We the undersigned have inspected the said land to check that the Company has satisfactorily carried out its obligations under the said agreement. In particular, we have established:

1. That all streams and watercourses have been cleared of obstructions, dams, temporary culverts etc.
2. That all skidding tracks on slopes have been water barred and drains led off at no greater than the frequency detailed in the Code of Practice.
3. That all landings have been ripped and/or replanted to break up the soil compaction and topsoil has been spread evenly back across the disturbed areas.
4. That all merchantable timber felled by the Company has been extracted and paid for.
5. That all oil, chemical or similar pollutants have been removed and all rubbish has been satisfactorily disposed of.
6. That all quarries, pits, and gravel extraction areas have been restored to a safe environmentally acceptable condition and that any areas of stagnant water created by operations around working areas have been filled or drained.
7. That a thorough final maintenance has been carried out on all roads. Those roads to be closed have been water barred and temporary crossings removed. Those roads to be retained have been properly drained and left in good working condition.
8. That all royalties, penalties, compensation or other payment due under the agreement have been duly received.

THEREFORE IT IS HEREBY AGREED:

That the Company is released from further obligation or benefit under the said agreement save as follows:

1. The Company will retain the right of access along the roads from ________________________________ to ________________________________ and shall retain the obligation to maintain these roads as provided in the said agreement until ________________________________.
2. (Insert any other retained obligations)

Harvest area/number: ________________________________

Signed by: ________________________________ (The Forestry Authority Officer)

Signed by: ________________________________ (The Company Representative)

Date: ________________________________