



**FORESTERS'
MANUAL**

INTRODUCTION

Prepared under the direction of
B.J. Beggs Conservator of Forests

**FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA**

INTRODUCTION

Technical advances and new management skills result in frequent changes of Departmental administrative methods and operational procedures. Frequent amendments of the Foresters' Manual therefore become necessary.

The increasing need for changes of Departmental instructions has led to the format under which this and future issues of the Foresters' Manual will be released. It takes the form of a series of loose-leaf Parts, which will be amended as necessary by folio replacement rather than by Head Office circulars.

The revised Manual will contain the following parts:

1. Acts and Regulations
2. Field Administration
3. Personnel
4. Accounts
5. Safety
6. Forest Engineering - Roads and Bridges
 - Surveys
 - Buildings
7. Communications
8. Plant and Equipment
9. Fire Protection
10. Disease Protection
11. Environment Protection
12. Mining in Forest Areas
13. Multiple Use of Forest Areas and Recreation
14. Hardwood Silviculture
15. Hardwood Utilisation
16. Pine Plantations
17. Softwood Utilisation

These Parts will be issued as they are completed.

Copies will be issued initially to Regional and Area Offices and Specialist Branches. However, all officers may obtain personal copies of the Manual or its Parts relevant to their duties. Future amendments will be distributed to all officers, who will be expected to note changes affecting their duties.

It will be the responsibility of Regional Offices, Area Offices and Specialist Branches to maintain an up-to-date copy of the Manual in its entirety.

PART 1

FORESTERS'
MANUAL

ACTS AND REGULATIONS

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

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PART 1 - ACTS AND REGULATIONS

FORESTS ACT 1918-1976

- 1.001 The Forests Act 1918-1976 provides for the better management and protection of forests.
- Officers to be conversant with Forests Act and Regulations
- 1.002 Every forest officer is required to be conversant with the Forests Act and Regulations.
- Current copy of Forests Act to be maintained
- 1.003 Each Regional Office, Area Office and Specialist Branch is responsible for maintaining an up-to-date copy of the Forests Act and Regulations.
- Officers to note amendments to Forests Act and Regulations
- 1.004 It is the individual responsibility of every forest officer to note changes made to the Forests Act and Regulations. Amendments will be advised periodically by Head Office.
- Breaches of Forests Act and Regulations to be reported
- 1.005 Immediately any breach of the Forests Act comes to his notice, a forest officer must forward a report to Head Office through the Area Officer in Charge. The report is to be made on form FD 259, and should set out concisely the facts of the case with a recommendation as to whether the offender should be prosecuted. It is important to state how the offence was first detected. Where a permit- or licence-holder is considered responsible for an offence committed by a timber worker the forest officer should recommend whether action be taken against one or both of the offenders.
- Instructions for prosecution issued by Head Office
- 1.006 If it is decided to prosecute, the papers will be forwarded from Head Office to the Crown Law Department. All action will then be taken by that Department. If the person charged pleads guilty and it is inconvenient for a solicitor to attend the court it may be necessary for an officer of the Forests Department to attend and outline the case to the magistrate.
- In the instance of a first offence, Head Office will decide whether to take legal proceedings or issue a warning.
- Seizure of forest produce
- 1.007 If a forest officer believes that any forest produce has been illegally obtained he may take possession of it on behalf of the Crown until the ownership is established. Whether acting under instructions or on his own initiative, a forest officer who seizes forest produce must immediately advise his senior officer that such action has been taken. His senior officer or the Area Officer in Charge will then advise Head Office of the action taken.

- Seizure from a permit- or licence-holder 1.008 If forest produce is illegally felled or illegally obtained by a permit- or licence-holder or a timber worker employed by the permit- or licence-holder, a forest officer may take possession of it on behalf of the Crown.
- General procedure for seizure 1.009 To comply with the provisions of Section 55 of the Forests Act, any forest produce seized on behalf of the Crown must be stamped and/or marked as follows.
- (a) Broad arrow-marks will be made with crayon (or charcoal if crayon is not available) on as many pieces of forest produce as is considered necessary; the word "seized" should be written where practical, along with the date and the signature of the seizing officer.
 - (b) Broad arrow punch-marks will be made on as many pieces of the forest produce as to make the seizure obvious.
 - (c) A duly completed label (FD 148) will be attached in a conspicuous place on the forest produce. Labels may be dispensed with, however, if crayon markings are adequate.
- Procedure for seizure of forest produce on private property 1.010 If it is necessary to seize forest produce on private property, a complaint must be made on oath before a Justice of the Peace by the forest officer, stating his belief that forest produce liable to the payment of royalty, dues or charges is held on the private property in question. The Justice of the Peace may issue a warrant to the police to search for the produce and the forest officer should accompany the police officer. The police officer, NOT the forest officer, must take possession of the forest produce.
- Procedure following seizure of forest produce from a permit or licence area 1.011 If a forest officer takes possession of forest produce which is suspected of having been illegally felled or illegally taken from a permit or licence area, the following procedure shall apply.
- (a) Full particulars of any forest produce seized will be recorded.
 - (b) The quantity and the value of the forest produce seized should be assessed and the best means of selling it recommended.

- Procedure for assessing volumes of logs that have already been removed
- 1.012 If it is suspected that logs have been illegally removed, the underbark diameters of the remaining stumps and crowns and the log lengths removed should be measured. When the full length of the log has not been measured the log length remaining and the log length removed should be measured.
- If the illegal felling has been extensive and the work involved in measuring is likely to take several days, the forest officer should advise the Area Officer in Charge and await further instructions.
- Interviews and signed statements
- 1.013 Immediately after interviewing a person concerning a forest offence, a forest officer should record the date and place of the interview and details of the conversation. Where possible, signed statements should be obtained from witnesses and persons involved in the offence. A correct procedure for taking a written statement is provided in Appendix I.
- Holding of seized forest produce
- 1.014 If any forest produce is seized in instances where
- (a) costs, such as demurrage, will not accumulate through holding,
 - (b) no serious deterioration is likely to take place through holding,
 - (c) the risk of loss through pilfering is not serious,
- the seized forest produce should be held until the charge has been dealt with, unless instructions to the contrary are issued by Head Office. If forest produce cannot be held where seized, for any reason, Head Office should be advised and recommendations made as to the method of disposal. Head Office should also be advised of any offers for its purchase that have been received. Alternatively, measures for safe storage should be recommended pending further investigations.
- Release of seized forest produce
- 1.015 A forest officer may release forest produce seized by him without Head Office approval if ownership has been clearly established to be not that of the Crown. The forest officer should advise Head Office immediately of the circumstances surrounding the seizure and release of the produce.
- Head Office approval necessary for sale of forest produce
- 1.016 A forest officer must not sell seized forest produce without authority from Head Office. Forest produce may then be disposed of according to the instructions issued. An official receipt must be given for any payments

received and the proceeds of sales must be accounted for on the cash abstract in the normal manner. A record of all confiscations will be maintained at Head Office. Sufficient information must be given on the cash abstract to enable the payment to be reconciled with the respective item.

- Disposal of forest produce seized for non-payment of royalty (Section 60) 1.017 Persons from whom forest produce has been seized for non-payment of royalty dues or charges must be allowed ten days in which to pay such dues or charges. If payment has not been made by the end of this period, the forest produce may be disposed of according to instructions issued from Head Office. Section 60 of the Forests Act deals with this matter and has been legally interpreted as applying to sawn produce or partly processed produce from logs upon which royalty has not been paid.
- Procedure for recovery of royalty, fees, etc. 1.018 The Conservator may sue for and recover royalties, fees and charges payable under the Forests Act. When it is decided to recover an outstanding debt, the matter will be dealt with by the Crown Law Department.

TIMBER INDUSTRY REGULATION ACT 1926-1969

- Timber Industry Regulation Act 1.019 The Timber Industry Regulation Act provides for inspection and regulation of the Timber Industry. The authority of the Act includes all felling, hewing, sawing, splitting, cutting, peeling, slicing, chipping, hogging, grinding, compressing, charring, removing, transporting, treating with preservative, extracting, or otherwise fashioning or processing timber on a timber holding.
- Working knowledge of Timber Industry Regulation Act and Regulations necessary 1.020 Forest officers are required to have a working knowledge of the Timber Industry Regulation Act and Regulations.
- Current copy of Timber Industry Regulation Act and Regulations to be maintained 1.021 Each Regional and Area Office is responsible for maintaining an up-to-date copy of the Timber Industry Regulation Act and Regulations.
- Controlling Officer 1.022 The Conservator is the controlling officer appointed by the Minister. Matters of detail relating to the Timber Industry Regulation Act are administered by the Chief of Division of Operations, Bunbury, on behalf of the Controlling Officer.

- | | | |
|---|-------|--|
| Correspondence | 1.023 | All correspondence should be directed to the <u>Controlling Officer</u> . |
| Inspection of mill machinery, plant, etc. | 1.024 | Two District Inspectors and one workmen's Inspector appointed under the Act are required to examine and report on the condition of mills, mill machinery, plant and equipment, bush and mill landings, bush operations and log transport, and generally all things relating to the safety and well-being of persons employed in the timber industry. |
| Forest officers to report unsafe conditions | 1.025 | Forest officers are required to inform the Controlling Officer or the District Inspector of any unsafe machinery, working conditions or work methods which are likely to lead to accidents. |
| Forest officers to assist T.I.R. Inspectors | 1.026 | Forest officers are required to assist Timber Industry Regulation Inspectors in obtaining prompt compliance with the provisions of the Act. |

NATIVE FLORA PROTECTION ACT, 1938

- | | | |
|--|-------|---|
| Forests Department administers Native Flora Protection Act | 1.027 | The Native Flora Protection Act currently provides for the protection of native flora in Western Australia.

Pending proclamation of amendments to the Wildlife Conservation Act and Regulations which will place administration of wildlife conservation in the hands of a Conservator of Wildlife and the Department of Fisheries and Wildlife, the Forests Department continues to be responsible for the administration of the Native Flora Protection Act, 1938. |
| Working knowledge of Native Flora Protection Act necessary | 1.028 | Forest officers are required to have a working knowledge of the Native Flora Protection Act. |
| Current copy of Native Flora Protection Act to be maintained | 1.029 | Each Regional Office and Area Office is responsible for maintaining an up-to-date copy of the Native Flora Protection Act. |

OTHER ACTS

- | | | |
|--|-------|--|
| Forest Officers to refer to other Acts | 1.030 | The importance of other Acts impinging on the Forests Act must be recognised, and reference should be made to them when necessary. This is particularly important when making recommendations at policy level. The Acts include the following. |
|--|-------|--|

Alumina Refinery Agreement Act
Alumina Refinery (Pinjarra) Agreement Act
Alumina Refinery (Muchea) Agreement Act
Alumina Refinery (Worsley) Agreement Act
Bush Fires Act
National Parks Authority Act
Wesply (Dardanup) Agreement
Authorisation Act
Wildlife Conservation Act
Wood Chipping Industry Agreement Act
Wundowie Charcoal Iron Industry Sale
Agreement Act
Aerial Spraying Control Act
Agriculture and Related Resources
Protection Act
Agriculture Protection Board Act
Country Areas Water Supply Act
Environmental Protection Act
Land Act
Local Government Act
Main Roads Act
Metropolitan Water Supply Sewerage
and Drainage Act
Mining Act
Soil Conservation Act
State Energy Commission Act
Town Planning and Development Act
Acts Amendment (State Energy Commission)
Act

APPENDIX I

CORRECT PROCEDURE WHEN TAKING WRITTEN STATEMENT

1. All statements from persons likely to be charged should be taken in duplicate, and in triplicate if the offender wants a copy.

The statement must be in the actual words of the offender. Each copy must be signed in ink by the offender and by the corroborating witnesses. The original copy is to be held by the officer taking the statement for court evidence, if required.
2. Persons present as corroborating witnesses should be present the whole of the time the statement is being taken.
3. When taking a statement, the obligation rests upon the forest officer to put all questions fairly and to refrain from any attempt to extort a statement, i.e. no threats, violence, bribes, promises etc. are to be used to obtain a statement.
4. Points to be included in the statement are:
 - (a) Exact location (6 figure reference) and time of apprehension.
 - (b) Registration, make, type and colour of the offender's vehicle.
 - (c) Name and address of the offender.
 - (d) The section or sections of the Forests Act or other acts that have been infringed.
 - (e) Whether the offender knew that he had infringed any of the above acts. Whether there was evidence to tell the offender that he had illegally entered a Quarantine Area, i.e. whether there was any 'No Entry' sign on the roads upon which he travelled.
 - (f) Particulars of how and why the infringement occurred.
 - (g) Names and addresses of all persons present (including forest officers).
5. The written statement should commence as follows -

"I have been warned by (officer's name and rank) that I am not obliged to make a statement (or say anything) unless I wish to do so, and whatever I do say will be taken down in writing and may be given in evidence".

The statement should end as follows - (in offender's own handwriting, if possible).

"I have read this statement through, and it is true and correct in detail and given at my own free will without any threat, promise or inducement, and I do not desire to make any corrections".

FORESTS DEPARTMENT
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FORESTS DEPARTMENT

Please find enclosed Part 2 of the Foresters' Manual
Field Administration. Paragraphs 2.001-2.042, Land
Inspection Procedures.

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Distribution List B

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PART 2

FORESTERS' MANUAL

FIELD ADMINISTRATION

Prepared under the direction of
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FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

Part 2 - Field Administration

LAND INSPECTION

Reasons for
land
inspection

2.001 Land inspection reports (Form F.D. 89, Appendix 1) may be requested by Regional Offices or State Headquarters for the following reasons :-

- (a) The purchase of private property for addition to State forest. Private property may be purchased when it is required for one or more of the Department's land use objectives, i.e. catchment management, timber production, conservation, recreation or scientific purposes.

The procedure for purchase of land suitable for growing *Pinus radiata* is laid out in the Foresters' Manual, Section 5, 106-110.

- (b) The exchange of a section of State forest for private property (refer to 2.038 for exchange guidelines).
- (c) After an application for the alienation of Crown land has been made.
- (d) Where the Department has been asked to recommend the land use for a particular area

PROCEDURES

Land
inspection
procedure

2.002 For all land inspections other than those involved in the acquisition of areas for growing *P. radiata*, a complete report on Form F.D. 89 is required (Appendix 1). If available, any additional information or local circumstances which may affect the case should be included in the report.

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- Examine existing information
- 2.003 A considerable amount of the information required for Form F.D. 89 can be obtained from existing information, e.g. tenure plans, Aerial Photography.
- Interpretation (A.P.I.) plans and aerial photography, all of which should be examined before any field work is carried out. Inventory and Planning officers should be consulted as they may hold assessment data for the area involved.
- Amount of field work required
- 2.004 The amount of field inspection needed will vary according to the reason for the land inspection report, and the reliability of available information. For example, if recent aerial photography is available and the same area has just been assessed by Inventory and Planning crews, the only field work necessary may be a general reconnaissance. Where existing information is likely to be out of date or suspected as being unreliable, a complete field inspection should be carried out. In all cases though, a minimum of a field reconnaissance should be used to establish that information obtained from previous reports is reasonably correct.
- Plans to accompany the Land Inspection Report
- 2.005 The Land Inspection Report (F.D. 89, Appendix 1) should normally be accompanied by six plans. These can be photocopies of existing plans in many cases, provided that they are coloured with the appropriate legend and inserted into the report.
- Plans required are :-
- (a) Tenure plan: The tenure plan should preferably be on a 1:50,000 scale to show surrounding land type and tenure, leases, mining claims, etc.

Part 2 Field Administration

- (b) Land use plan : The land use plan should preferably be at a 1:50,000 scale, to show management priority areas, influence zones, recreation areas, etc.
- (c) Aerial Photography Interpretation plan: Use most recent aerial photography or field inspection to adjust, if necessary, the boundary of clearing in the case of private property.
- (d) Forest type plan: The forest type plan is to be submitted when a field assessment is carried out and the results clearly differ from the A.P.I. plan.
- (e) Dieback plan: A photocopy of the current dieback risk category plan will be sufficient if a field assessment is not carried out. When assessment lines are run, the plan should be based on field information using the legend indicated.
- (f) Soil plan: When field assessments are made, the soil plan should be prepared from information obtained in the field. If information, other than that from the field, is used, then the source should be quoted.

Field
assessment
procedure

Setting of
Classification
lines

2.006 Once the decision to carry out a full field assessment has been made, the following approach should be used:-

Carry out a preliminary reconnaissance to determine the distance to set between classification lines. This distance may vary from 200 m to 800 m depending on the size of the area to be inspected, the topography of the country, the value of the forest in the area, and the time and manpower

Part 2 Field Administration

- available. The Inventory and Planning section should be consulted when determining the spacing of classification lines, and the width of survey lines.
- Use of field notes log sheet 2.007 Officers inspecting land should use the field notes log sheet provided in Appendix 2, (see 2.042).
- Assessment of forest products 2.008 Which products to assess must be decided in advance. Assessment criteria are merchantability, and the quantity in which a particular product occurs. The Regional Office should be consulted if there is any doubt about whether a particular product should be assessed. Minimum specifications according to local utilisation standards should be defined before inspecting the land.
- Product codes 2.009 The following product code will be used on the field notes log sheet, and part C of the F.D. 89, (see 2.041). :-
- | | |
|--------------------|---|
| Peeler logs : | 1 |
| S.E.C. poles: | 2 |
| Sawlogs: | 3 |
| Mining timber: | 4 |
| Chipwood | 5 |
| Firewood: | 6 |
| Fencing material : | 7 |
| Sleepers : | 8 |
| Minor products: | 9 |
- Product Volumes 2.010 Sketch the features along the survey line such as creeks, tracks, cut-over bush, and soil boundaries, on the right hand side of the field notes log sheet. The inspecting officer should also pace the inspection line, and using 20 m intervals, record the following details on the field notes log sheet if changes occur.

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Sketch to
be entered
in field
notes log
sheet

2.011 Sketch the features along the survey line such as creeks, tracks, cut-over bush, and soil boundaries, on the right hand side of the field notes log sheet, The Inspecting Officer should also pace the inspection line, and using 20 m intervals, record the following details on the field notes log sheet if changes occur.

Field
notes
required

- (a) Forest type, co-dominant height, stocking, and fire damage.
- (b) Regrowth, understorey and vegetation.
- (c) Soil types.
- (d) Dieback occurrence and site susceptibility.
- (e) For private property, describe improvements such as buildings, dams and fencing. Also the type of farming that takes place.
- (f) The topography.
- (g) The salinity risk.
- (h) Suitability of the area for recreation.

Examples

Mature jarrah forest with a co-dominant height of 25 m. Well stocked with stems from 50 cm to 65 cm diameter at breast height over bark (d.b.h.o.b.). Few large trees.

An open, stunted, jarrah forest with a co-dominant height of 15 m, growing on sandy soils. Little or no regrowth, and a general lack of vigour. Unlikely to produce merchantable timber of any quality.

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- Age class distribution required 2.012 Details of the age class distribution must be given. For example:
- Open pole stand;
 - Mainly large and over-mature trees;
 - All classes present;
 - Open, malformed forest mainly below 25 cm d.b.h.o.b. ;
 - appears to be mature.
- Fire damage details required 2.013 The extent to which the forest has suffered from fire must be indicated. For example : Epicormic shoots on all stems; crowns severely damaged; good crowns and no evidence of fire damage.
- An estimate of the date the area was last burnt should also be given.
- Vegetation details required 2.014 Note the presence or absence of advanced growth, or regeneration, and also the species amongst which they occur. Where there are a great number of understorey and ground vegetation species it is not necessary to list all of them. The list should be sufficient to indicate the type of site and vegetation, and should include any species of particular interest.
- Abbreviations which can be understood are acceptable, such as :-
- Grass Tree - King
 - Blackboys - B'boys
 - Bull banksia - B. grandis
 - Waterbush - Netic
 - Sheoak - Cas. fras.
 - Karri Oak - Cas. decuss.
 - Bracken Fern - Bkn.
- Soil type 2.015 The soil description should include colour, intensity, texture and the presence of stone, according to the following key :-

Part 2 Field Administration

Soil
type
abbreviations

SOIL ABBREVIATIONS

<u>Intensity</u>		<u>Colour</u>	
Light	- l	Red	- R
Dark	- dk	Yellow	- Y
Dull	- dl	Brown	- B
Bright	- bt	Grey	- G
Pale	- p	Black	- Bl
		White	- W
		Chocolate	- choc
<u>Texture</u>		<u>Gravel and Stone</u>	
Sand	- S	Gravel	- g
Loam	- Lm	Rubble	- ru
Clay	- C	Floaters	-fltrs
Silt	- Si	Massive sheets	- m

Light red sandy gravel : l.R.S.g. on field notes log sheet. In coastal areas, the sands are broadly classified as follows :

- (a) Limestone Zone - Yellow or brown sands over limestone, the depth of the limestone varying from outcrops to depths below 4 m.
- (b) Transitional Sand - some yellow colouration present, which often becomes more pronounced with depth.
- (c) Bassendean series - deep grey, strongly leached sands, with or without coffee rock at depth.
- (d) Swamps and other poorly drained soils.

Report
suitability
for farming
or growing pine

2.016 It is important to report whether the soils are suitable for cultivation or not (arable), and to indicate any cleared area which may be capable of supporting *P. radiata*.

Dieback
categories

2.017 Note the extent of dieback infection using the following categories :-

- (a) Uninfected.
- (b) Understorey only infected.
- (c) Some jarrah deaths.
- (d) Majority of jarrah trees dead from dieback disease.

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- (e) Indicate whether dieback disease is likely to have a high or low impact on the site if it was introduced.
- Private property improvements 2.018 Provide enough detail on improvements to private property to assist in price evaluation.
- Topography 2.019 Estimates of slope should be given e.g. steep; one in four or greater; moderately steep: one in five to one in ten; gently undulating or flat.
- Salinity risk Downstream vegetation as indicators. 2.020 The following guidelines may be used as a guide to catchments with low or high salt accumulation.
- (a) If the nearest downstream swamp vegetation consists of *Agonis linearifolia*, *Grevillea diversifolia*, *Trymalium spathulatum* or *Oxylobium lanceolatum* there is little or no chance of salinity problems.
- (b) If the nearest swamp vegetation consists of *Melaleuca viminea*, *Melaleuca depauperata*, *Hakea varia* and *Hakea ceratophylla* there is a very real danger of salinity problems.
- Recreation 2.021 Briefly describe any features of the area which would make it attractive for recreation. Record any evidence of extensive recreational use, and any man-made features which may be of historical significance (e.g. saw-pits) as well as any areas of scenic beauty.
- Record use and features
- Completion of F.D. 89 2.022 Calculate volumes for each forest product on the field notes log sheet. There should be a total volume for each product, for each forest type. These individual totals are then combined to give a total merchantable volume for the land under inspection. Enter this on Form F.D. 89, part C,

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and then forward the completed F.D. 89 to the Regional Office. If necessary, a supplementary report should also be included.

- D.F.O.'s responsibilities
Staff training
- 2.023 The Divisional Forest Officer (D.F.O.) is responsible for training staff to carry out land inspections in his Division and to enter their reports on the F.D. 89. The D.F.O. is personally responsible for facts presented on the F.D. 89 and must sign the report. He should carry out field checks himself to verify the facts presented in the report.
- Land ownership transfer
- 2.024 Recommendations for land ownership transfer should be made on the F.D. 89 by the D.F.O. The following alternatives may be used:
- D.F.O.'s recommendations
- (a) Permanent dedication as State forest.
 - (b) Exchange State forest for private property, or vice versa.
 - (c) Purchase land under inspection as an addition to State forest.
 - (d) Alienation of State forest. This will very rarely be contemplated, unless exceptional circumstances exist.
 - (e) Issue of a Forest Lease.
- Forest leases
- 2.025 In special cases, the D.F.O. may recommend the issue of a Forest lease in lieu of alienation (or exchange) and such cases, should give:
- (a) His reason for the recommendation
 - (b) Form of lease proposed.
 - (c) Special Conditions to be inserted
 - (d) Boundary of proposed lease.
- Recommendations must incorporate multiple land use objectives.
- 2.026 D.F.O.s making a recommendation must bear in mind the Department's multiple land-use objectives. In addition to timber production potential, the value of the land for water production, conservation,

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recreation and scientific study must be carefully considered. The D.F.O. should check sections of the F.D. 89 dealing with these values.

Research
Branch to be
consulted in
areas of doubt.

2.027 If there is any uncertainty about the salinity risk in water production areas, the Research Branch at Dwellingup should be consulted, and if necessary, asked to submit a separate report.

If inspecting officers do not possess the specialized botanical and zoological knowledge necessary to assess an area for its conservation and scientific values, the Regional Research Branch should be consulted.

Effect of
recommendation
on management
boundaries to
be considered.

2.028 In making his recommendations, the D.F.O. must also consider the effects of the recommendation on management boundaries, fire control and forest access.

Conditions and
procedure for
purchase of
private
property

2.029 The procedure for negotiating the purchase of private property for addition to State forest (for purposes other than acquiring land suitable for growing *P. radiata* is as follows :

- (a) The property must be on the open market.
- (b) Approval by the Regional Office or State Headquarters is required to start negotiations.
- (c) Obtain a written offer from the owner, indicating the price and giving permission for the Forests Department to carry out an inspection of the property and a soil survey. The written offer and permission to survey should be sent to the Regional Office, who will advise the owner if an inspection of the property is to be carried out.

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- (d) If approval is given, an inspection is to be carried out and the F.D. 89 completed.
 - (e) A valuation of the property is to be completed according to the format in Appendix I, part B.
 - (f) The F.D. 89, parts A, B and C are to be sent to State Headquarters via the Regional Office, with a request for approval to negotiate within a specific price range.
- Land exchange procedure. 2.030 Land exchange will usually only be considered in one or more of the following circumstances.:
- (a) If an area to be acquired contains soils suitable for growing *P. radiata*, or contains good hardwood forest or re-growth.
 - (b) If significant improvements to State forest boundaries can be achieved.
 - (c) If the area is required for one or more of the Department's land use objectives.
- Forests Department purchase
- Alienating land must not interfere with land management procedures 2.031 It is important that good quality suitably situated forest be retained for dedication as State forest, particularly in the case of forest growing in soils resistant to *Phytophthora cinnamomi*. The alienation of land must not interfere with the economic management of State forest by the creation of more difficult boundaries, or the loss of necessary water supplies, or access ways. Alienation must not adversely affect fire protection or any other land use.
- Approval required from Ministers, etc. 2.032 The approval of the Minister for Forests, the Lands Department, the Town Planning Department and Parliament is required. Where

Part 2 Field Administration

State Forest is involved, the consent of both Houses of Parliament is also required. Mineral claims and any other leases or entitlements must be checked.

Equal area as
basis for
exchange

2.033 Exchange of land should be on the basis of equal area. Under no circumstance should a greater area of State forest be exchanged unless the relative values are approved by the Land Valuation Board.

Cash
settlement

2.034 In all land exchanges, the Lands Department carries out valuations of the two areas involved, based on taxation valuations, and these values are binding on the Forests Department. In cases where the State forest area has a higher value than the private property with which it is being exchanged, the owner of the private property is required to pay, in cash, an amount equivalent to the difference in values before the exchange can proceed. In the reverse situation, the Forests Department is required to pay the private property owner a cash settlement. It is important that persons wishing to negotiate an exchange are advised of this condition early in the proceedings.

Share
expenses

2.035 All survey expenses incurred must be shared equally between the parties involved in the land exchange.

Remove
merchantable
timber

2.036 If farmland is being obtained for regrowth purposes, or in exchange for hardwood forests, all merchantable timber must be removed from the State forest area before the transfer. No removal of timber from private property is permitted once the agreement is complete.

Part 2 Field Administration

Clearing
costs

2.037 In most cases, private property will contain cleared land. An allowance may be paid to the owner to compensate him for the cost of clearing he has already undertaken. This allowance should be tied to the cost which the Forests Department would have had to incur if the land had been forested.

Applications from
private persons,
for the alienation
of Crown land

2.038 The following procedure must be adopted in cases where a farmer, or any other person, wishes to exchange private land for an area of State forest.

(a) After the initial enquiry, the local Forest officer may indicate a general area where suitable land is situated. Strategic regional plans should be consulted.

(b) The farmer must have an option to purchase, on the property he wishes to exchange, for a minimum of one month.

(c) In cases where the land offered to the Forests Department is suitable for growing *P. radiata* a soil survey must be carried out as soon as possible, after obtaining Head Office approval to do so. In other cases, a land inspection must be completed as soon as possible. (see 2.002, Land Inspection Procedure).

In either case, the results on Form F.D. 89, are to be sent immediately to Head Office via the Regional Office.

A decision can then be taken on whether the exchange will proceed, within the option period.

Part 2 Field Administration

- (d) Before the option to purchase expires, the farmer is to be notified that the Forests Department either favours exchange, or that the property is unsuitable. If the exchange is favoured, the farmer is to be informed that negotiations can commence when the property is held by him in free and unencumbered title.

Part 2 Field Administration

2.039

APPENDIX 1

PART A

LAND INSPECTION REPORT

1. DESCRIPTION

- (a) Owner/Land Manager Location
- (b) Land District Shires
- (c) Forests Dept. 1:50,000 scale plan & ref. squares
- (d) Aerial Photo coverage (Date, Scale, Run No., Photo No.'s)
.....
- (e) API Type Plan (Numbers & Date of Information)

AREA	SPECIES	TYPE &	OTHER) Add changes to
	& CLASS	STRATA) clearing since
) A.P.I. from
) photos and field
) inspection.

Total

2. MANAGEMENT INFORMATION

- (a) Land uses ex L.U.M.P. Plan
- (b) Past cutting information (ex H.O.C.S. & decades of cutting)
.....
- (c) Proposed future cutting (ex forward logging plans)
- (d) Present stand condition
- (e) Dieback disease situation, including quarantine status
- (f) HYDROLOGICAL VALUES
 - Is the area part of a harnessed catchment?
 - Is the area in a P.W.D. restricted clearing water catchment zone?
 - Does the area support a permanently running stream?

Part 2 Field Administration

APPENDIX 1

Part A (cont.)

Would acquisition or release be likely to lead to improvement or deterioration of water quality?

(g) FIRE PROTECTION VALUES

Would acquisition or release be an advantage or disadvantage?

(h) CONSERVATION VALUES

Describe main values
Is the area close to, or within a Conservation M.P.A. or buffer zone?
Would acquisition or release be an advantage or disadvantage?

(i) RECREATION VALUES

Describe main values
Would acquisition or release be an advantage or disadvantage?

(j) CONSTRAINTS

Describe briefly any known constraints not already listed, e.g. Forest Leases, public access, mining leases, Shire Town Planning, Schemes conditions, historic homes, noxious weeds responsibility.

3. VALUATION

Briefly describe any improvements, e.g. houses, fences, dams. Detailed information to be included in Appendix 3

4. COMMENTS AND RECOMMENDATION

(where an exchange is proposed, all the supporting reasons should be listed plus a comment on the impact which will be made on forest boundaries and any other strategic values)

Part 2 Field Administration

APPENDIX 1

Part A (cont.)

INSPECTING OFFICER

.....
.....
.....
.....
.....
.....
.....

O.I.C DIVISION

.....
.....
.....
.....
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.....
.....

REGIONAL LEADER

.....
.....
.....
.....
.....
.....
.....

To be accompanied by:

- (a) Tenure plan
- (b) Land use plan
- (c) A.P.I. plan
- (d) Forest type plan
- (e) Dieback plan
- (f) Soil plan

See Foresters' Manual Part 2, 2.005

Part 2 Field Administration

2.040

APPENDIX 1

PART B.

LOCATION NO. OWNER

ASKING PRICE (IF KNOWN)

SOIL VALUES

SOIL TYPE	SOIL TYPE VALUE	AREA	VALUE
TOTAL SOIL VALUE			

CLEARING VALUES

AREA CLEARED	VALUE/HA. OF CLEARING	VALUE
TOTAL CLEARING VALUE		

IMPROVEMENT VALUES

TYPE OF IMPROVEMENT	VALUE
TOTAL IMPROVEMENT VALUES	

OTHER VALUES

TYPE	VALUE
TOTAL VALUE OTHER	

TOTAL VALUE

SOIL VALUE	
CLEARING VALUE	
IMPROVEMENT VALUE	
OTHER VALUES	
TOTAL VALUE	

Appropriate Regional Office may be consulted as to the amount of the above values.

Part 2 Field Administration

2.041

APPENDIX 1

PART C

LAND INSPECTION REPORT
FOREST VALUES - DERIVED FROM FIELD NOTES

FOREST TYPE	AREA HA.	STANDING VOLUME* (INSERT PRODUCT TYPE)	TOTAL VOLUME M ³ /HA.	ADVANCE GROWTH NO./HA.
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
TOTAL				

* All product volumes to be based on local utilization standards.

Part 2 Field Administration

2.041

APPENDIX 1

PART C (cont.)

**LAND INSPECTION REPORT
FOREST VALUES - DERIVED FROM FIELD NOTES**

PREDOMINANT UNDERSTOREY SPECIES	REMARKS ON STAND QUALITY*
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

*Notes on stand quality should indicate evidence of fire or pathogen damage.

Part 2 Field Administration

2.042

APPENDIX 2

FIELD NOTES LOG SHEET

LINE NO.

WIDTH ASSESSED

ASSESSMENT LINE DISTANCE INTERVAL M	FOREST TYPE (see 2.039)	CODOM HT M	LIST PRODUCT CODES AND TYPE OF TIMBER (see 2.036)	FOREST STOCKING (see 2.040)
A				
B				
C				
D				
E				
F				
G				

Part 2 Field Administration

2.042

APPENDIX 2 (cont.)

FIELD NOTES LOG SHEET

INTERVAL	FIRE DAMAGE (see 2.041)	REGROWTH	UNDER-STOREY (see 2.042)	SOIL TYPE (see 2.043)	DIEBACK TYPE (see 2.045)	TOPOGRAPHIC SKETCH (NOTE THE SLOPE)
A						
B						
C						
D						
E						
F						
G						

IMPROVEMENTS: _____

SALINITY RISK: _____

VALUE FOR RECREATION: _____

OTHER OBSERVATIONS: _____

ASSESSOR'S SIGNATURE: _____

FORESTS DEPARTMENT
50 HAYMAN ROAD
COMO W.A. 6152

FORESTS DEPARTMENT

Please find attached Part 7 of the Foresters Manual -
Communications (Radio) - updated as at August 1982.

B. J. Beggs.
Conservator of Forests *CR.*

Distribution: Distribution List B

PART 7

FORESTERS'
MANUAL

COMMUNICATIONS (Radio)

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

COMMUNICATIONS (Radio) MANUAL

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PART 7 - COMMUNICATIONS (Radio)

- Introduction 7.001 The notes that follow provide a working description of the Forests Department's Radio Communications Network. The success of a radio network depends on several factors:
- (a) well constructed equipment;
 - (b) a vigorous maintenance organization;
 - (c) operator training;
 - (d) radio discipline.
- Divisional liaison 7.002 At each area headquarters a field officer is to be appointed, with responsibilities for liaison with Communications branch. His duties are to ensure that operators are fully conversant with the operation of radio equipment, and that all tele-communications equipment in the area is maintained in a serviceable condition.
- Faults in radios to be advised to Communications branch 7.003 When equipment requires attention, the field officer must advise Communications branch to arrange provision of replacements.
- New liaison officer to be trained 7.004 When a new radio liaison officer is appointed, Communications branch must be notified so that he can be trained in radio operation and maintenance procedures.
- Organization of Communications branch 7.005 The Communications branch of the Forests Department is situated at Como. It is equipped to maintain and repair all radio and associated apparatus, including modification, installation and manufacture of minor ancillary equipment used on the network.
- Officer in charge is personally responsible for equipment. 7.006 The O.I.C. is held personally responsible for the proper care and

safety of radio and associated equipment. Where articles of equipment are damaged or lost, particulars must be submitted in writing with an explanation stating the manner in which the damages or loss was incurred. Thefts must be reported to the police.

Transfers and surplus radio equipment.	7.007	It is the responsibility of Area O.I.C.'s to ensure that any surplus equipment, to which they are not entitled, is despatched promptly to Communications branch, Como. Equipment increases, reductions and transfers are only made on the authority of Head Office.
--	-------	---

MAJOR TELECOMMUNICATION NETWORKS

Strategic Fixed Station Network.	7.008	This network operates on high frequency, single side band (H.F./S.S.B.), and five divisional offices are able to transmit on this network. It is an extremely valuable link for passing messages relating to weather and bush fire information.
Kalgoorlie network.	7.009	Also operating on H.F./S.S.B., the Kalgoorlie network consists of a base station at Kalgoorlie and three mobiles. The mobiles are fitted with Royal Flying Doctor Service (R.F.D.S.) frequencies for emergency use only.
Kununurra and Karratha networks.	7.010	Similarly, two vehicles operating on H.F./S.S.B. are stationed at the Kimberley, Pilbara area and fitted with the Strategic Fixed Station network frequencies which will enable communication with Como. The local chatter channel and R.F.D.S. for Wyndham and Derby are fitted for emergencies.

Tactical network (V.H.F.)

7.011

Mobile radios that operate in the low band of the Very High Frequency (V.H.F.) range, provide communication from vehicle to vehicle, vehicle to office, vehicle to aircraft and office to aircraft. Two hundred and forty mobiles, 20 Divisional offices and 13 aircraft use this network. There is no restriction on the messages that may be passed.

Smoke reporting network (V.H.F.)

7.012

A Very High Frequency network in the high band is confined to lookout towers, aircraft and Divisional offices. It is mainly used in summer to report suspected fires.

V.H.F. Packs and Citizen Band portables.

7.013

Lightweight portable packs in the V.H.F. range are used in certain cases to extend the mobile network coverage over ground inaccessible to vehicles. The Citizen Band transceivers are used mainly for pumper control and short-range foot patrols.

Licensing conditions

7.014

All telecommunications equipment must be licensed with Telecom Australia, and the type of licence varies from one network to another as shown on the following table:

	Network	Nature of Service	Stations with which communication is permitted.
(a)	Strategic Fixed Station	The exchange of messages relating to the activities of the Department.	Other fixed stations operated by the Department
(b)	Tactical	The exchange of messages relating to the activities of the Department.	Mobile and fixed stations operated by the Department

	Network	Nature of Services	Stations with which communications is permitted.
(c)	Smoke reporting	Messages relating to fire fighting and control of forest fires.	Other authorized stations of the licensee.
(d)	Portables	Private correspondence.	Other authorized stations in the south-west forest area.
(e)	Kalgoorlie Kununurra Karratha	Private correspondence.	Fixed or mobile stations.

Communications in emergency situations.

7.015

In emergencies, when life or property is endangered, and when it is certain from experience that the use of the Telecom telephone system would cause unacceptable delay, the Strategic Fixed Station Network may be used to pass messages. During periods of failures with the Telecom telephone lines, the Strategic Fixed Station Network may be used for passing Departmental messages.

Frequencies in use.

7.016

The sections of the frequency spectrum allocated to the Department are in the following bands:

Frequency Band	Application
medium frequency	beacons*
high frequency	S.S.B/C.B.
very high frequency	tactical/smoke reports
super high frequency	transponders*

*beacons and transponders are described in paragraphs 7.037, 7.038 and 7.039.

Details of frequency allocation. 7.017 Full details for allocation of frequency and for channel grouping are given in Appendix I.

RADIO WAVE PROPAGATION

The means for wave propagation. 7.018 Radio waves may be propagated from the transmitting antenna to the receiving antenna through or along the surface of the earth through the atmosphere, or by reflection or scattering from a natural or artificial reflector.

Electro-magnetic energy. 7.019 Radio waves are electro-magnetic energy and consist of two component fields, magnetic and electric, both in phase and at right angles to each other.

Types of radiowaves. 7.020 There are two basic types of wave propagation: (detailed in Appendix II).
(a) Ground waves (surface and space waves)
(b) Sky waves

TECHNICAL ASPECTS OF THE RADIO NETWORK

Strategic network (H.F./S.S.B.) 7.021 This system is used for inter-divisional communication and operates in the high frequency band from three to thirty megahertz (3.0 to 30.0 MHz). The transceivers are Single Side Band (S.S.B.) and Audio Modulated (A.M.), and can operate over distances up to and greater than 200 km depending on conditions. This range is achieved by sky wave reflection (see Appendix II).

All stations operate in a quiet base mode and are selected by a coded station call.

Divisional and regional offices fitted with H.F. on this network are:

Tactical network
(V.H.F. low
band).

7.022

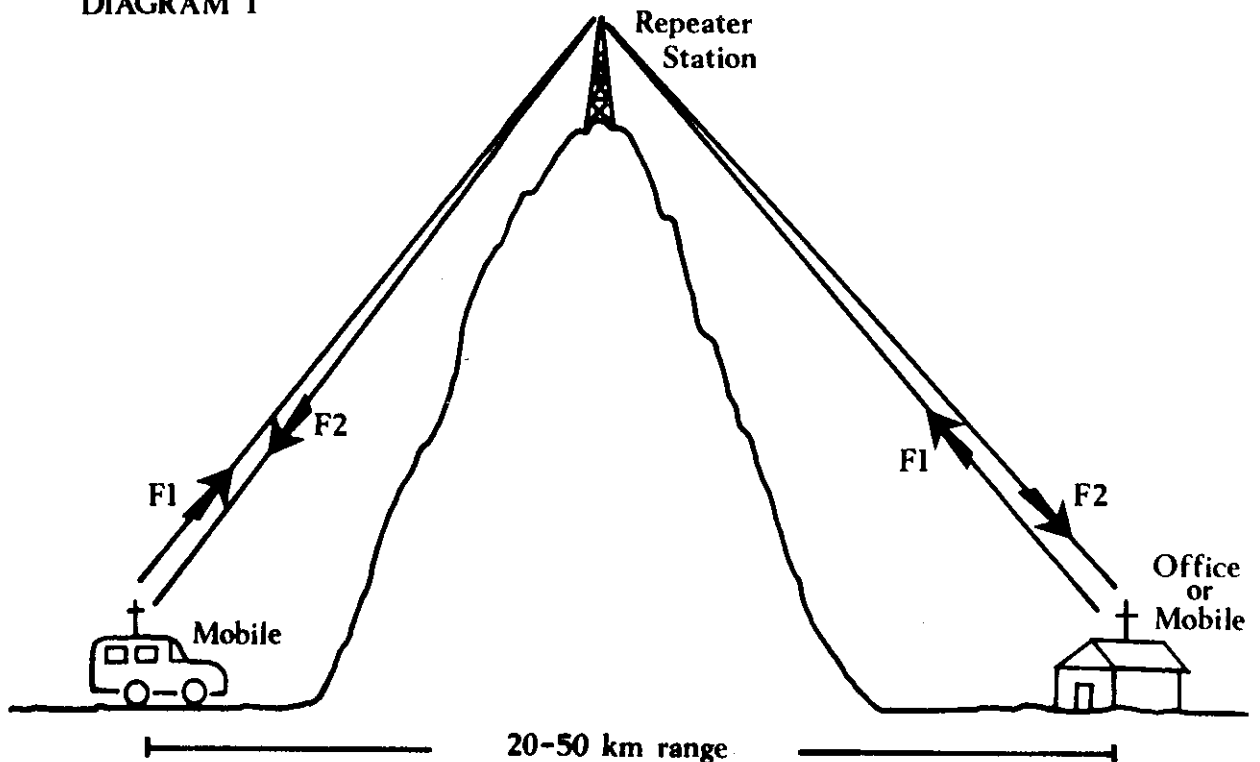
This is the Department's major radio communication network. V.H.F. radio waves largely, though not altogether, follow a 'line of sight' (see Appendix II). Range is increased by the use of Automatic Repeater Stations. This means that signals from mobiles in poor locations are received by the repeater station and re-broadcast from an elevated point. The result is generally strong signals in forest areas for a range of 20-50 km. This operation is called Duplex, because two frequencies are required:

F1 = mobile transmit and repeater receive.

F2 = repeater transmit and mobile receive.

(See Diagram 1)

DIAGRAM 1



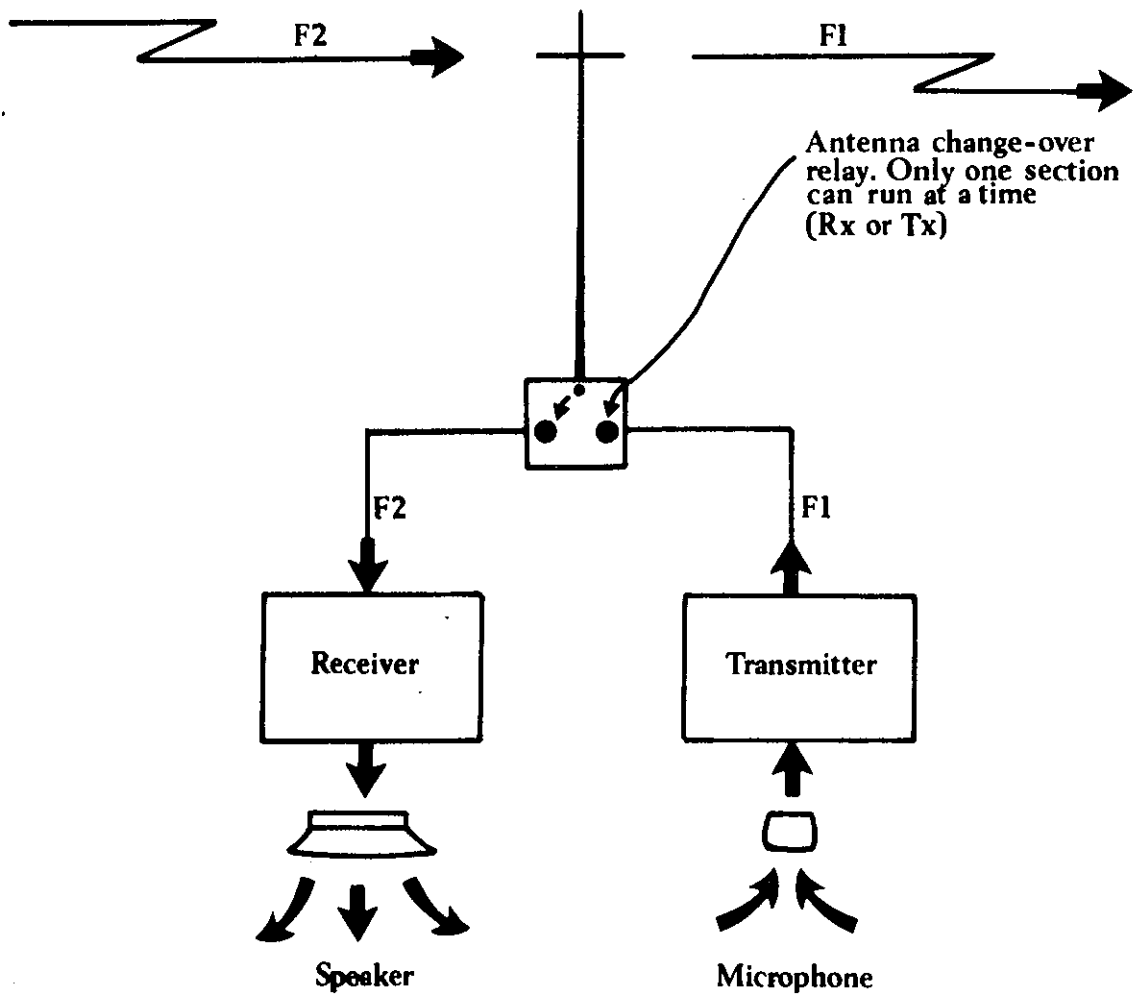
Mobile radio
operation.

7.023

The V.H.F. radio consists of a receiver and a transmitter. The receiver detects modulated radio waves F2. on a certain frequency and converts them into audio speech signals. The transmitter works in reverse, converting audio (speech) into radio waves (R.F.), which are transmitted F1. to a distant receiver.

(See Diagram 2)

DIAGRAM 2



Four stages of
repeater station
operation.

7.024

The repeater operation occurs in
four stages:

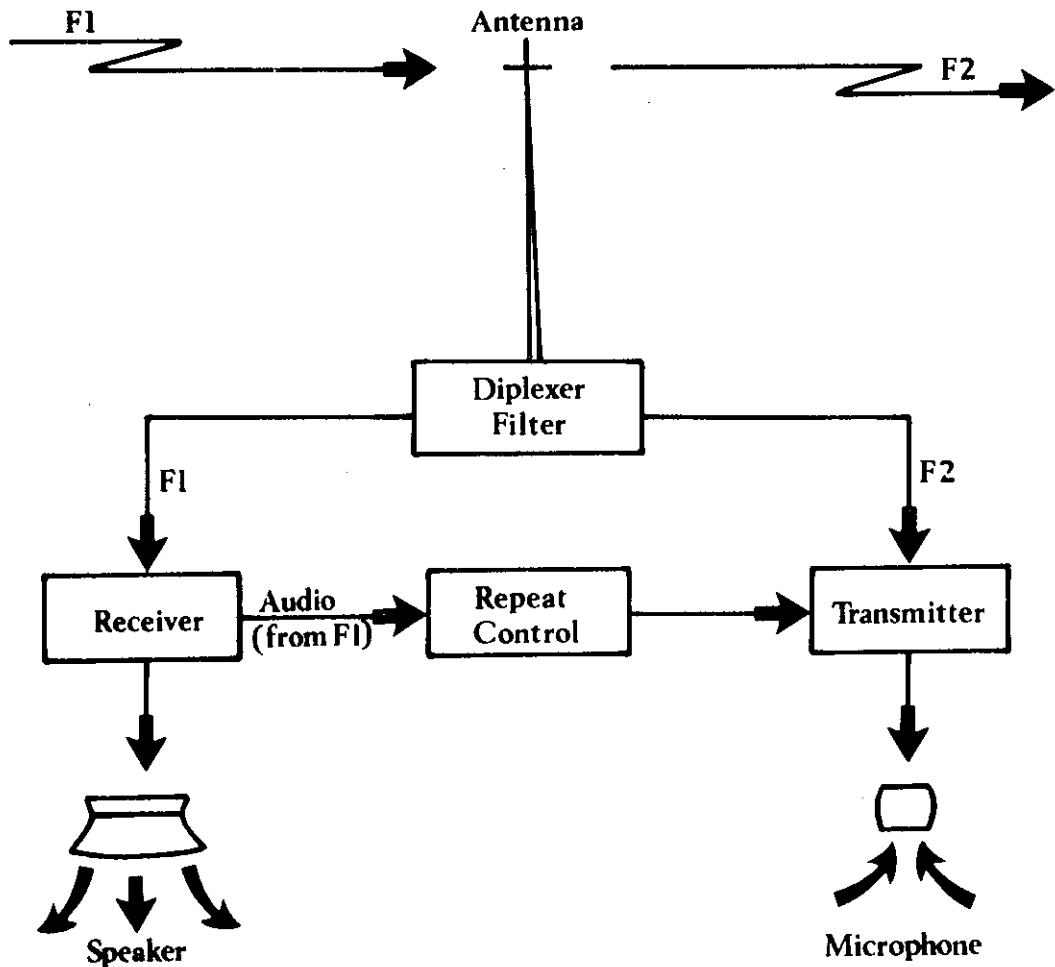
- (a) the receiver detects radio signals F1;
- (b) the transmitter sends radio signals F2;
- (c) repeat control, which occurs when a signal is received by the receiver F1, and automatically switches on the transmitter, which re-broadcasts the information F2;
- (d) the diplexer filter, which is required to prevent the received and transmitted signals from interfering with each other.

(See Diagram 3)

The repeater uses a single common antenna known as a ground plane.

Note: Receiver and transmitter operate at the same time and have alarm circuits. (see paragraph 74).

DIAGRAM 3



Other equipment
at a fixed
repeater station.

7.025

A fixed repeater station has other essential equipment for its operation. The equipment is battery powered with solar panels for charging these batteries. A small building is required for equipment housing, and a tower is needed for the antenna.

Advantages
of a repeater
system.

7.026

The advantages of this system are:

- (a) the repeater station usually commands the highest location, thus giving greater range;
- (b) it automatically re-broadcasts this signal instantaneously from an unmanned station;
- (c) it allows communication between mobiles in the service area up to a range of 20-50 km, dependent upon terrain.

Disadvantages
of a repeater
system.

7.027

There are some disadvantages of the repeater system that should be understood:

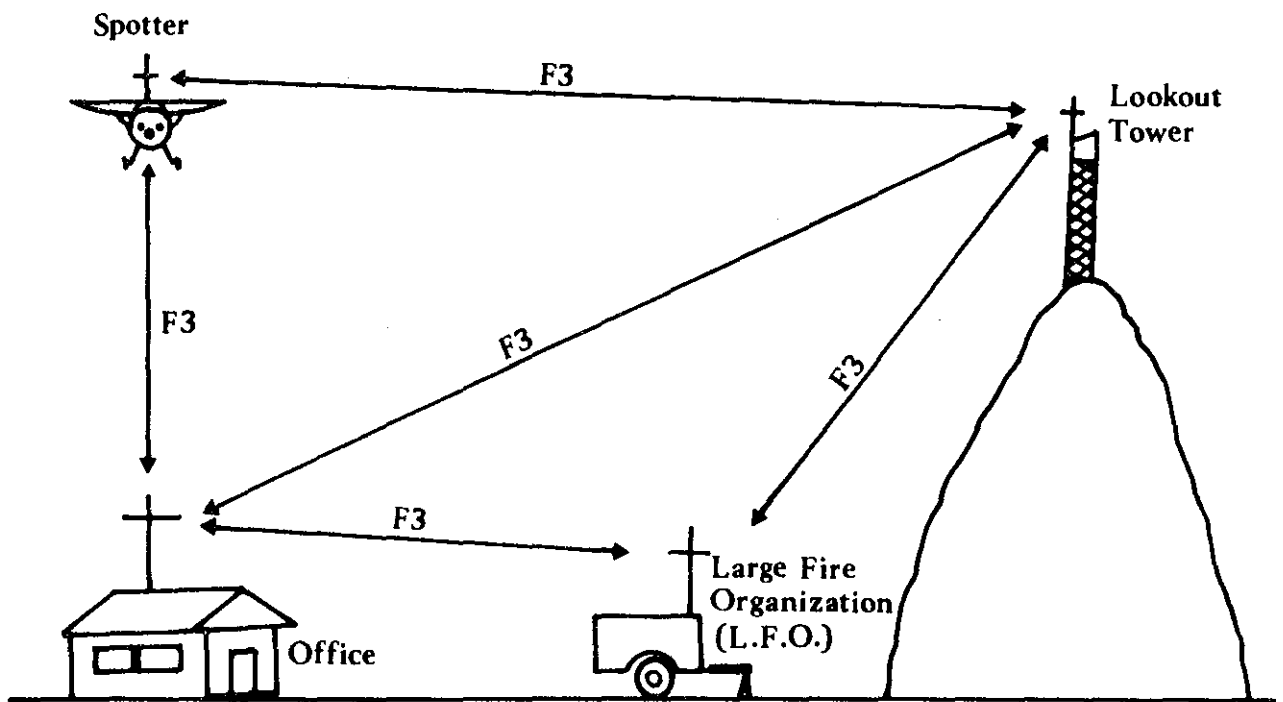
- (a) if the repeater fails, communications cease. Two mobiles standing side by side in the bush cannot make contact.
- (b) If two repeaters are triggered simultaneously to a listening mobile, speech quality will be degraded, owing to the inability of the receiver to accept more than one signal, even though they are on the same channel. This is called signal 'flutter'.

Smoke reporting network (V.H.F./R.T.).

7.028

This network is used for smoke reporting information only, and is confined to Divisional offices, lookout towers, Large Fire Organizations, trailers and spotter aircraft. This system requires one frequency for operation (Simplex) and is widely known in the Department as the Radio Telephone (R.T.). (See Diagram 4).

DIAGRAM 4



Spotter
aircraft
radio
network.

7.029

Aircraft used for smoke detection are provided with the following facilities:

- (a) A tactical network V.H.F. with five channels on the same frequency as the repeater stations, presenting direct communication with mobiles on this radio network.
 - (b) A smoke reporting network (R.T.), with three channels that are used to communicate with towermen, Large Fire Organization (L.F.O.) trailers, and Divisional offices for fire reports.
 - (c) An intercom amplifier for pilot and observer communication.
 - (d) The V.H.F. radio in the spotter aircraft, which may also be operated as a repeater if required, but this function should only be used when normal repeater stations are unserviceable, or if the vehicle and office are out of range or in a difficult service area. It may be used in a large fire situation to provide a second V.H.F. channel operation.
- Note: When operating the repeater, the transmit output power is cut down, this will reduce the normal range considerably. Do not operate the aircraft repeater on the same repeater channel if the ground station is still functioning.

Radio in
twin-engined
aircraft.

7.030

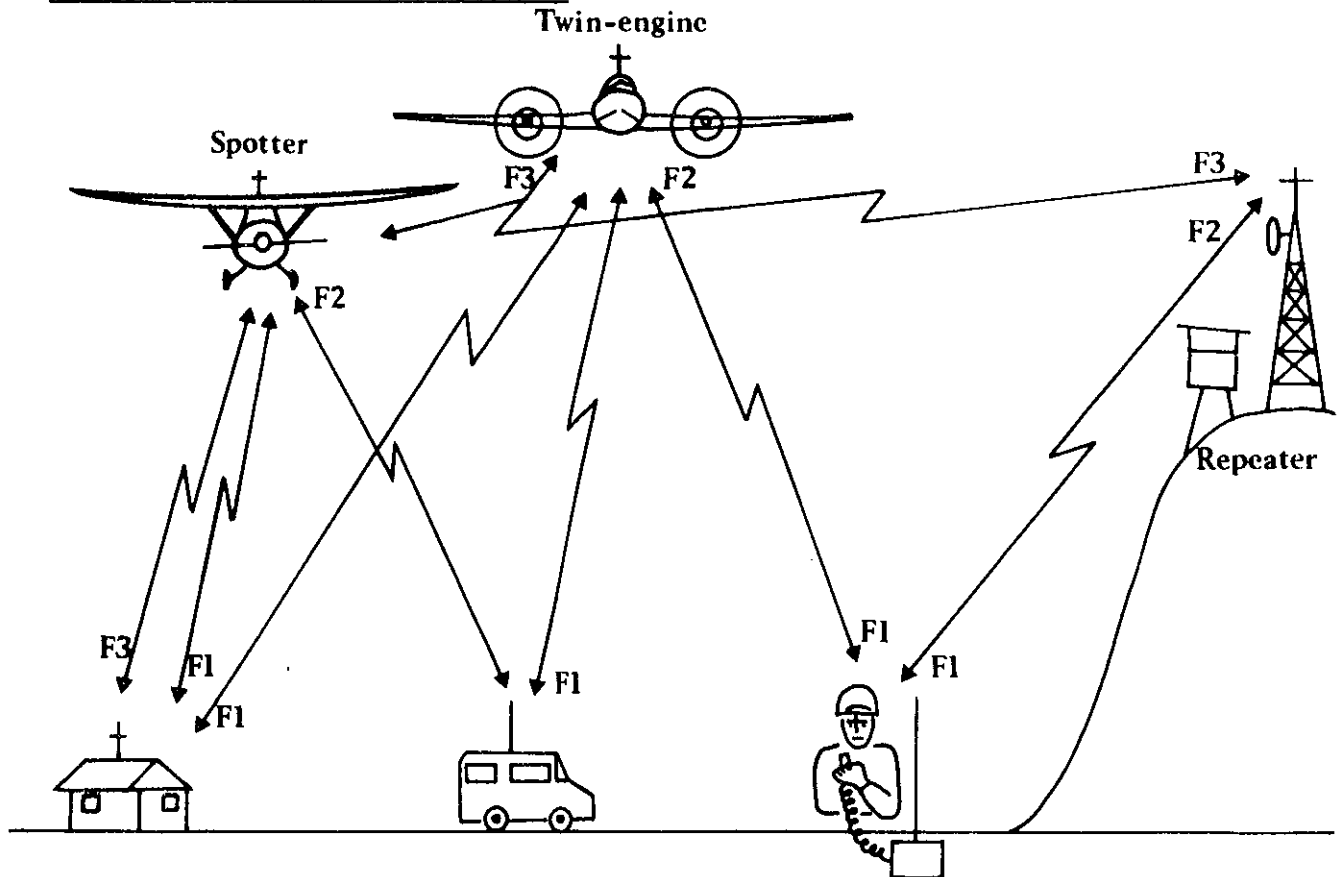
This aircraft has V.H.F. and R.T. radios with an intercom facility to six positions.

Note: Direct conversation by Departmental radio between spotter and twin-engined aircraft is only possible on R.T.

(See Diagram 5).

DIAGRAM 5

Divisional V.H.F. and R.T. Operation



- V.H.F. F1. Can talk to F2
 F1. Can talk to F1 via repeater
 F2. CANNOT talk to F2
- R.T. F3. Can talk to F3

Portable V.H.F. "carry-pack".

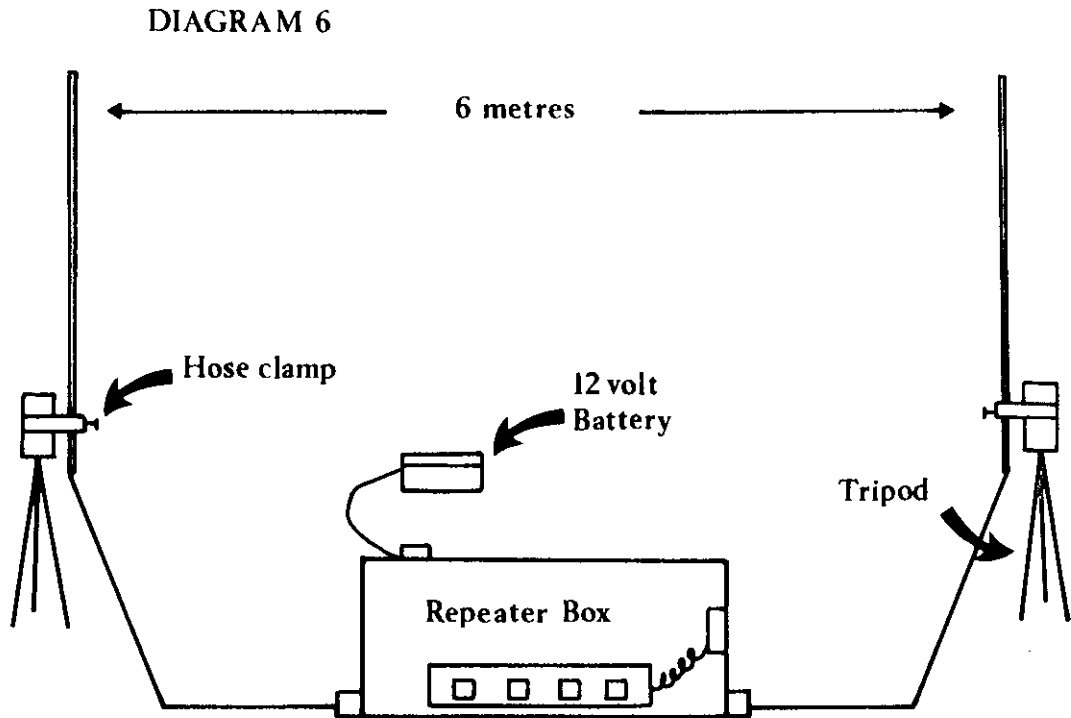
7.031

The V.H.F. portable kit uses the same radio as the mobile, but the radio is not supplied. This pack is fully portable with a solid paste type battery built in, and comprises:

- carry case (including battery);
- flexible antenna;
- A.C. mains regulated 12 volt
- D.C. battery charger.

- Range of carry-pack. 7.032 When carried the portable V.H.F. pack has approximately the same range as when fitted into a vehicle.
Note: This pack may be used in a vehicle in conjunction with a magnetic antenna or in an aircraft not fitted with Forests Department radios.
- Portable Citizen Band radio (C.B.) 7.033 Two types of C.B. radio are currently used by the Department:
 (a) National R.J. 38;
 (b) Handic 65C.
 Two or more radios are required for operation and have a short range, up to 5 km depending on the terrain and vegetation.
- Portable V.H.F. repeater. 7.034 The portable repeater has been developed for the following reasons:
 (a) In case one of the fixed repeater stations goes out of service;
 (b) To cover areas not serviced by existing fixed repeater stations, as in the case of a wild fire outside the main forest zone;
 (c) To provide a second V.H.F. channel at prescribed burns, leaving the normal channel free.
 This repeater equipment has been made as simple as possible with minimum installation procedure, as described below.
- Installation of portable repeater. 7.035 (a) Select an elevated site, preferably overlooking the proposed area of operation;
 (b) Secure antennas to tripods with hose-clamps;
 (c) Place equipment as shown in Diagram 6;

- (d) Operate the repeater as a normal mobile. Signals heard in receiver speaker will be automatically re-broadcast. (See Diagram 6).



Equipment
for portable
repeater.

7.036

The following equipment should be with the portable repeater kit:

- 1 only repeater box
- 2 antennae and cables
- 2 tripods
- 1 only 12 volt battery (60 amps per hour)
- 1 only A.C. battery charger.

Aerial burn
radio beacons.

7.037

A beacon is a radio transmitter operating on a stable fixed frequency and coupled to a non-directional vertical antenna. The antenna radiates an omni-directional pattern to enable aircraft to locate their exact position from the beacon. During prescribed burning two beacon radios are used. They are carried in either utilities or four-wheel drive officer transports.

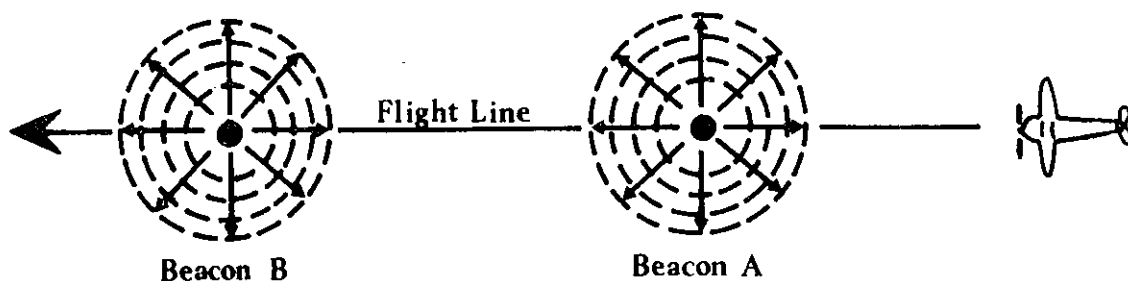
Operating
beacons

7.038

The operation is relatively simple. The flight lines are predetermined and the beacons are located at each end of the first flight line. The beacon at point A is switched on and the aircraft is lined up to fly towards the beacon at point B. The navigator will request B switched on and A switched off. (See Diagram 7). The range of the beacons (5 to 30 km) will depend on several factors

- (a) Height of the aircraft;
- (b) Location of the vertical antenna with respect to trees etc;
- (c) Battery condition of vehicle.

DIAGRAM 7



RADIO OPERATING PROCEDURE

Report of
signal
strengths.

7.039 Operators must remember that the signal strength given is a measure of readability, not the amount of speech issuing from the radio set.

(a) If a signal is readable, report of signal strength is NOT required.

e.g. Alpha November from Mike
Alpha over.

Reply

Alpha November, over.

NOTE: Always indicate the station you are calling first, followed by your call sign.

(b) If signals are just readable, some indication should be given to the caller.

e.g. Alpha November from Mike Alpha,
over.

Reply

Mike Alpha from Alpha November
you are ... difficult, over
you are ... unreadable, over
you are ... noisy, over.

At the completion of an exchange of messages, the last station to transmit, instead of saying 'over' says "ROGER, OUT".

NOTE: It is recommended that the numerical system for rating signal strengths be discontinued owing to the wide disparity in interpretation.

The phonetic
alphabet.

7.040

The phonetic alphabet adopted by the British Commonwealth and the North Atlantic Treaty Organization (N.A.T.O.) is shown in APPENDIX III.

Operations
schedules for
H.F. network.

7.041

During the fire season, Protection branch will broadcast weather information daily at the following times:

0745 1000 and 1615 hours.

At 0900 and 1500 hours, Protection

branch will receive information from Dwellingup, Manjimup and Kirup, or any other station which may from time to time be nominated.

Information on direction and strength of winds will be passed to Protection Branch, Como by certain stations in summer, at 0930, 1100 and 1445 hours, on the H.F. network.

Other H.F.
Schedules

7.042

Area O.I.C.'s wishing to set up H.F. schedules (e.g. Kalgoorlie, Karratha and Kununurra) during the fire season, should avoid the times mentioned above. Divisions should make suitable arrangements to re-transmit the daily forecast over the V.H.F. network without unnecessary overlaps.

Operation
schedules
for V.H.F.
network.

7.043

The V.H.F. network will operate on a 24-hour basis throughout the year. Watchkeeping on this network will normally be continuous during working hours and during fires. Officers in the field who find it necessary to be 'out of earshot' of the mobile radio, for various reasons, should inform their headquarters of the approximate length of absence. Field mobiles can be on call at scheduled times depending on the Fire Danger Index.

Use of
written
messages.

7.044

Messages passed by radio are mainly oral (e.g. are not recorded written messages) but provision has been made with form F.D.3 to handle written messages. The following procedure should apply to written messages:

- (a) messages passed between fixed stations must not infringe the licensing conditions;
- (b) two copies are made, and the original is delivered to the addressee. The duplicate should be filed by the operator for post-fire investigation;

(c) The text of written messages shall be concise and not padded with unnecessary words.

Test calls at frequent intervals.

7.045

Operators in the field should check their radios with a test call to base, at least once a day when the fire hazard is high. When the fire hazard becomes 'dangerous', gang trucks should test radio communication each time they halt for any length of time at a working location, and if necessary make location changes until signals are satisfactory.

Radio call signs.

7.046

A call sign allocated to a place is used on all networks, i.e. S.S.B., V.H.F. and R.T. However, for convenience in answering, it is the usual practice to use letters only for S.S.B., the phonetic alphabet for V.H.F., and place-names for R.T. communications. Call signs for mobiles, Divisional offices, repeater stations, aircraft and portables can be found in APPENDICES IV and V.

The disposition of radio equipment.

7.047

The quantity and types of radio equipment issued to a Division are based on approval of the Conservator. Where an increase in the number of radio sets or spares is considered necessary in a Division, a request should be made through the regional leaders. APPENDIX V should be consulted for equipment at office, Divisional repeater station, Aircraft and Tower and spares allocation.

Records and storage of radio equipment.

7.048

All Telecommunication equipment records are kept at the Communication branch. At the Divisional office, a register of the distribution of

radio transceivers, within the Division, should be kept. The register and the Divisional Disposition Board should show information on the serial number and the vehicle in which they are installed. Every three months F.D. 692 is sent to Divisions for clarification and acknowledgement of equipment held.

Advice of despatch of equipment.

7.049

Communications branch will mail Despatch Advice form 200 with each parcel sent to a Division. The original should be filed, after noting the date received, and the duplicate returned to Communications branch. A form 200 is also required when a Division sends equipment to Communications branch.

Method of radio equipment storage.

7.050

Space in a lined store or room is to be made available for the storage of equipment. This store should be free from dust and excessive variation of temperature and humidity. Equipment that comprises more than one component should be stored together to prevent loss or misplacement. It is the Radio Officer's responsibility to ensure that the batteries and equipment are kept in a serviceable condition.

MAINTENANCE OF RADIO EQUIPMENT

General.

7.051

All staff are reminded that modern radio equipment requires specialist knowledge for its installation and maintenance. Untrained personnel attempting these functions may cause considerable damage to the installation and equipment.

Maintenance of radios in vehicles.

7.052

Service on the battery is the only vehicle maintenance which can be carried out by the field staff. The

battery should be checked for electrolyte level and terminal corrosion once a week. Where radios are not installed in a wired vehicle, the coaxial connector and battery lead should be coiled and tied up under the dash or radio cradle, to prevent damage. The Communication staff will check all vehicle installations at least once a year.

Maintenance
of radios
in offices.

7.053

All Divisional office radio equipment should be checked for serviceability each day during the fire season. V.H.F. and R.T. outlets, which are not in normal daily use, should be periodically checked by the insertion of a remote extension. Offices are now wired to include a 90 amp hours battery for standby power. This minimum maintenance battery is kept charged by a voltage-regulated A.C. pack. In the event of a loss of S.E.C. power, the battery will maintain communication equipment in an operational condition for approximately two days.

Maintenance
of repeater
stations.

7.054

There are 20 repeater stations in the main forest zone, placed on high sites and usually directed at lookout towers. Operation is automatic on battery power, but equipment and site inspections are required weekly. A folder is kept at each repeater station which explains maintenance instructions for the efficient operation of the station.

Report of
repeater
inspections.

7.055

A weekly report should be compiled by the inspecting officer. This report should be sent immediately to the Area O.I.C., who will pass it to the Communications branch by radio. If in

doubt on any point during an inspection, the inspecting officer should request his Divional headquarters to immediately relay the message, by radio, to Communications branch for an answer to the query or problem. Quite a few repeaters can contact Communications branch directly, and this should be done wherever possible.

Typical report on repeater stations.

7.056

A typical report is as follows:

Repeater report Alco:

Power	22	
S.W.R.	1.2	
Volts	14	
Amps	5	
Solar	1	light cloud
S.G.	1250	(if possible)
ALL OK.		

Staff detailed to attend repeater stations need basic training, which can be given by visiting technicians. Untrained personnel must not be allowed to carry out repeater station maintenance.

Repeaters inspected daily during L.F.O.s.

7.057

It is recommended that during Large Fire Organizations (L.F.O.s) repeater inspections are made daily.

Maintenance of V.H.F. Portables.

7.058

A maintenance-free 6 amp hour battery is contained within the V.H.F. portable, and, apart from charging, requires no attention. Charging is usually undertaken overnight. An indication of battery condition is given by a flashing light, which goes out on transmit if the battery is low. The battery charger is a mains input charger and is regulated to prevent overcharging. This battery can be left on charge continually when not in use.

Maintenance of C.B. portables. 7.059 Maintenance for C.B. portables is confined to charging of batteries where rechargeable batteries are used, or replacement when the battery condition shows low voltage. Dry batteries should be removed when equipment is not in use.

RADIO USE DURING LARGE FIRE ORGANIZATION

Heavy load on radio system during L.F.O. 7.060 During large fire organizations, the telecommunication system is intensively used and any weakness in the system will show up quickly. These notes are intended to reduce the percentage of communication failures.

Restraint in voice levels and length of messages 7.061 In the early stages of dangerous fire outbreaks there is a natural tendency to raise the level and the pitch of the voice, and to make radio interchanges longer than normal. These tendencies decrease telecommunication efficiency and are to be avoided. Always practice speaking into a microphone in a level, clear manner with deliberate pronunciation of words and phrases. Don't use superfluous words and try not to overload the microphone. Operators should be instructed in the use of the microphone to achieve good quality voice transmissions.

Fire reports to be brief. 7.062 The reports should be short, about 30 words, given at dictation speed for log entry. Controllers wanting greater detail should talk to the operator personally over the air when traffic density is low.

Procedure for difficult conditions. 7.063 When radio conditions are made difficult, by static or other forms of interference, immediately introduce 'difficult working

conditions', i.e. say all phrases twice, spell out place-names, speak slowly and clearly.

Repeat messages twice if no response.

7.064

Mobile and fixed station operators should be given firm instructions to broadcast messages TWICE through if they cannot read or even hear the station with which they wish to make contact. Many times mobiles have been heard at readable strengths calling a fixed station, but because they could not hear any reply, went off the air without sending a report.

Weak mobiles and faulty microphones.

7.065

Operators should be trained to become conversant with the "twice for yes" procedure. Should a mobile be unable to modulate his transmitter owing to a faulty microphone, or some defect in the transmitter modulating system, the radio carrier can be switched on and off to indicate message understood. Valuable information can be passed using this method.

GENERAL INFORMATION ABOUT TELECOMMUNICATIONS

Map of Departmental radio network F.D. 1425.

7.066

The Departmental telecommunication network map F.D. 1425 is displayed in the radio room at each Divisional office. This illustrates the disposition of all repeater stations, Divisional offices, and their call signs and frequency allocation.

Radio paging device.

7.067

The Department has now acquired six radio pagers for the use of senior Head Office staff (2), Como headquarters (1), Protection (1) and Communications (1) branches. The pagers have a range extending from Yanchep, to east of Kalamunda to Rockingham. Each pager has its own Telecom telephone number.

It can be alerted by contacting the Mundaring duty officer. For protection details, refer to the Protection 'on call' telephone list. The equipment is simple to operate and pocket-size, and has an option to defer the alert tone until a more convenient time.

Wireless amplifier for outdoor seminars etc.

7.068

A wireless amplifier is available for use within the Department and is ideally suited for meetings, training and outside gatherings. This equipment consists of several radio microphones, a fixed microphone, and the amplifier. It operates off mains or batteries and has a ten watt audio output.

Navigation system for dieback photography (transponders).

7.069

The Department has undertaken a ten-year programme of dieback photography and mapping. To achieve the accuracy required (3 metres in 74 kilometres) a specialized navigation microwave ranging system is required for aircraft guidance.

The equipment consists of an airborne distance range computer, pilot-tracking indicator and two reference stations with antennas mounted on known high points on the ground.

It is not intended in this manual to go into the principles of operations, but if further information is required, it can be gained from Protection branch, Planning & Inventory, Manjimup or Communications branch.

Anemometer installations.

7.070

An anemometer is an instrument used for measuring the force of wind and its direction. There are 12 anemometers in the Department, installed at strategic Divisional offices. In most cases these instruments are mounted on masts at a high location some 2 km from the office,

and connected by a 10-pair telephone cable. A remote weather station has been developed by the Communications branch using V.H.F. radio. This system is currently on trial between Mt William and the Harvey office, measuring windspeed and direction on interrogation at Mt William.

Teleprinters.

7.071

Teleprinters are electro-mechanical devices that are used to pass information via land lines or radio systems.

The messages can be transmitted by activation of the keyboard or by passing through an auto-head paper tape copy, which contains the information in punched code form (Murray code).

At each terminal, a hard page copy of the message is produced.

When messages are transmitted by tape, the automatic speed is approximately 66 words per minute.

Radio
facsimile
machine.

7.072

A facsimile machine is a method of transmitting drawings, printed material or the like, by means of radio or telegraph.

Handwritten messages, mapping, etc., are all capable of being received on A4 size paper, at speeds varying from six minutes to 20 seconds per sheet. The unit contains complete solid-state electronic circuits, with only one moving item: the paper-roller feed.

Repeater Fail
Alarm.

7.073

Fixed Repeater Stations are now fitted with a protective device which closes the transmitter down should the mute fail or should a mobile in range hold the button down for a long time; the action is as follows:

0 - 5 minutes transmitter on, carrier only;
5 - 10 minutes transmitter carrier plus continuous pip, pip, pip modulation, then closure.

When the cause of the trouble keeping the repeater on is removed, the repeater will function normally. Prior to the fitting of this protection, the end result meant flat batteries and a burnt out repeater transmitter.

L.F.O. Trailers.

7.074

There are five trailers which can be taken to fire control points to act as portable offices. These trailers can be fitted with V.H.F. and R.T. radios. Their location can be found in Appendix V.

Office and
repeater
report book.

7.075

Each office and repeater station has a work report book. Divisions are required to write in any communication work requiring attention. Communication branch staff will record work attended to and inspection reports.

RADIO FREQUENCIES IN USE:

(a) Beacon Radios (M.F.)
Channel 1 1.696 MHz

(b) Strategic Fixed Station Network (H.F./S.S.B.)
Channel 1 2.488 MHz
Channel 2 5.833 MHz

(c) Tactical Network (V.H.F.): mobiles, offices and portables.

	<u>Transmit</u>	<u>Receive</u>
Channel 1	75.62 MHz	80.82 MHz
Channel 2	75.65 MHz	80.85 MHz
Channel 3	75.68 MHz	80.88 MHz
Channel 4	75.71 MHz	81.03 MHz
Channel 5	75.635 MHz	80.835 MHz
Channel 10	75.695 MHz	75.695* Kimberley radios only

(d) Repeater Stations and Aircraft

Channel 1	80.82 MHz	75.62 MHz
Channel 2	80.85 MHz	75.65 MHz
Channel 3	80.88 MHz	75.68 MHz
Channel 4	81.03 MHz	75.71 MHz
Channel 5	80.835 MHz	75.635 MHz

(e) Smoke Reporting Network

Channel 1	168.91 MHz
Channel 2	168.97 MHz
Channel 3	168.715 MHz

(f) Portable Radios

(i) V.H.F. Portables - as for (c) Tactical Network
(ii) Citizen Band (C.B.)
Channel 27.24 MHz

(g) Kalgoorlie Network

	<u>Purpose</u>
Channel 1 2.488 MHz	Forests Department
Channel 2 5.833 MHz	Forests Department
Channel 3 5.360 MHz	Royal Flying Doctor
Channel 4 2.656 MHz	Service (R.F.D.S.)

(h) Karratha-Kununurra

	<u>Purpose</u>
Channel 1 2.488 MHz	Forests Department
Channel 2 5.833 MHz	Forests Department
Channel 3 2.020 MHz	Local chatter channel
Channel 4 2.792 MHz	R.F.D.S. Derby/Wyndham
Channel 5 5.300 MHz	R.F.D.S. Derby/Wyndham
Channel 6 12.200 MHz	Forests Department

Tactical Network - office grouping

<u>Channel 1</u>	<u>Channel 2</u>	<u>Channel 3</u>	<u>Channel 4</u>	<u>Channel 5</u>
Dwellingup	Como	Wanneroo	Mundaring	Jarrahdale
Ludlow	Wanneroo	Yanchep	Jarrahdale	Kirup
Busselton	Gnangara	Narrogin	Walpole	Grimwade
Pemberton	Harvey	Collie	Harvey	Walpole
	Kirup	Manjimup	Bunbury	
	Nannup	Margaret River	Nannup	
	Manjimup			

APPENDIX I (Continued)

Repeater Stations Grouping

<u>Channel 1</u>	<u>Channel 2</u>	<u>Channel 3</u>	<u>Channel 4</u>	<u>Channel 5</u>
Wells	Gnangara	Wabling	Mornington	Solus
Seaview	William	Narrogin	Burnside	East Kirup
Pemberton	Stewart	Mungalup	Dale	Mowen
	Kepal	Alco	Carlotta	Frankland
		Mowen		

Smoke Reporting Network Grouping

Channel 1		Channel 2	
<u>Office</u>	<u>Towers</u>	<u>Office</u>	<u>Towers</u>
Como	Dale*	Wanneroo	Wanneroo
Mundaring	Solus*	Gnangara	Gnangara
Jarrahdale	Wells	Yanchep	Wabling Hill
Dwellingup	William	Manjimup	Burnside
Harvey	Hampden	Pemberton	Gloucester
Collie		Walpole	Frankland
Bunbury			
Channel 3			
<u>Office</u>	<u>Towers</u>		
Kirup	Stewart		
Grimwade	Munro		
Nannup	Milward		
Busselton	Dickson*		
Ludlow	Seaview		
Margaret River	Collins		

* When required

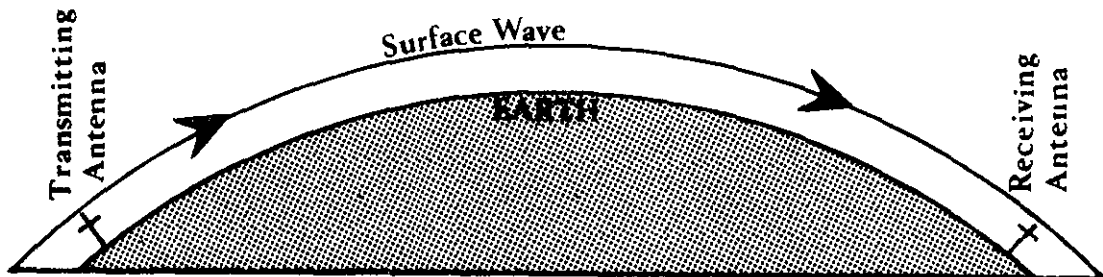
WAVE PROPAGATION

The term propagation by ground wave is applied to waves that stay close to the earth and do not reach the receiving point by reflection or refraction from the much higher region of the atmosphere known as the ionosphere.

The ground wave can therefore be a wave travelling in actual contact with the ground, or a wave that goes directly from the transmitting antenna to the receiving antenna when the two antennas are high enough to "see" each other.

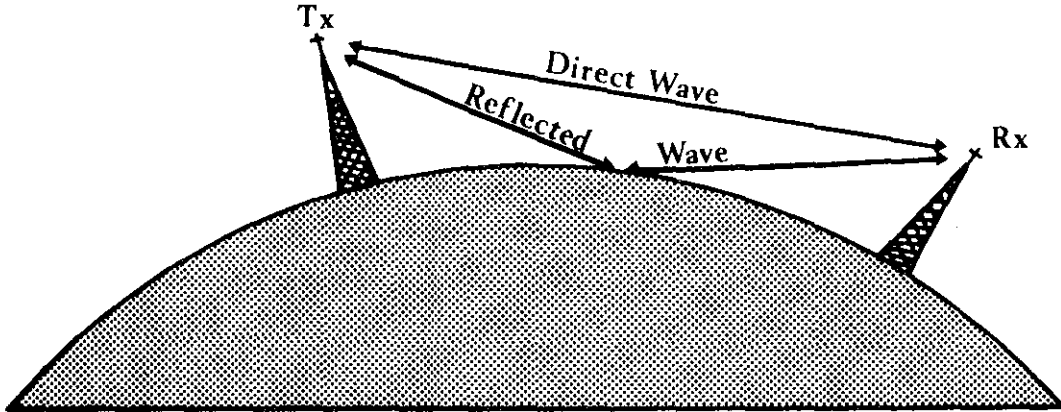
(1.1) The Surface Wave

The wave that travels in contact with the earth's surface is called a surface wave. The attenuation of this type of wave is high, so the intensity decreases rapidly with distance from the transmitter. The transmitting and receiving antennas must generate and receive vertically polarized waves if they are to be used to their best advantage. In general terms both antennae must be vertical.



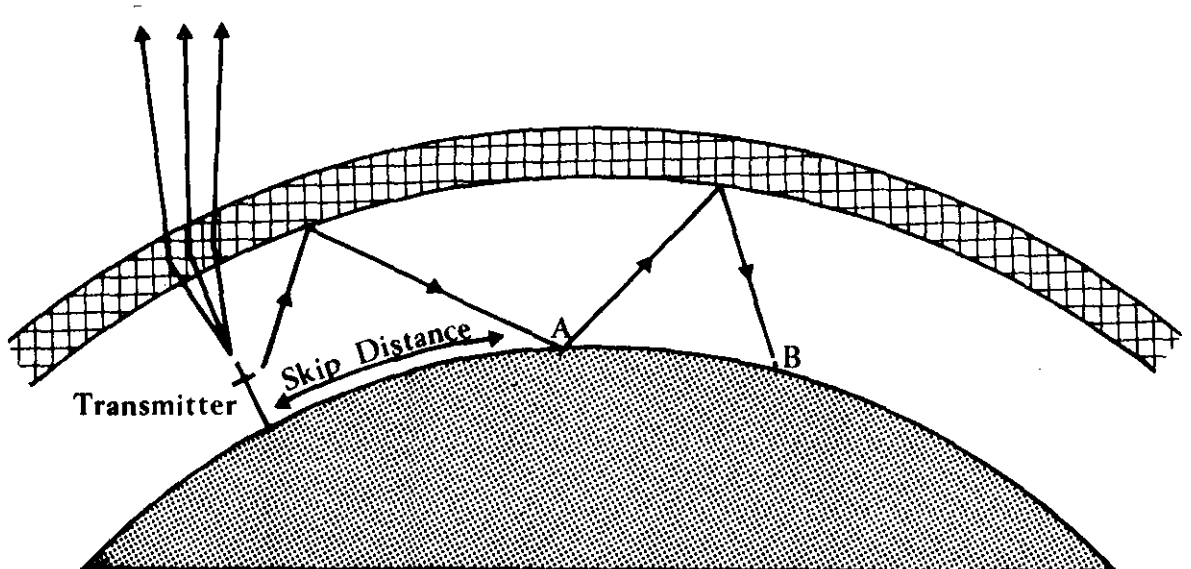
(1.2) The Space Wave

The space wave occurs under conditions that exist when the transmitting and receiving antenna are within sight of each other. The space wave will consist of the direct wave and the reflected wave. As the frequency is raised, the space wave becomes increasingly important. It is the dominating factor in ground wave communication at V.H.F. and U.H.F.



(2.0) The Sky Wave

At frequencies below 30 megahertz, practically all communication over 80 kms is carried on by means of the sky wave. This is a wave which would travel from the transmitting antenna into space if, under certain conditions, it can be sufficiently reflected or refracted, high up in the earth's atmosphere, to reach the earth again at distances varying from zero to about 3 000 kms from the transmitter. By successive reflections at the earth's surface and in the upper atmosphere, communications can be established over the maximum possible terrestrial distance.



PHONETIC ALPHABET

<u>Letter</u>	<u>Phonetic</u>	<u>Approximate Pronunciation</u>
1. A	Alpha	Al - fah
2. B	Bravo	Brah - voh
3. C	Charlie	Char - lee
4. D	Delta	Dell - tah
5. E	Echo	Eck - oh
6. F	Foxtrot	Foks - trot
7. G	Golf	Golf
8. H	Hotel	Hoh - tel
9. I	India	In - dee - ah
10. J	Juliet	Jew - lee - ett
11. K	Kilo	Key - loh
12. L	Lima	Lee - mah
13. M	Mike	Mike
14. N	November	No - vem - ber
15. O	Oscar	Oss - cah
16. P	Papa	Pah - pah
17. Q	Quebec	Keh - beck
18. R	Romeo	Ro - me - oh
19. S	Sierra	See - air - rah
20. T	Tango	Tang - oh
21. U	Uniform	You - nee - form
22. V	Victor	Vik - tah
23. W	Whiskey	Wiss - key
24. X	X-ray	Ecks - ray
25. Y	Yankee	Yang - key
26. Z	Zulu	Zoo - loo

When numerals are transmitted, the following rules for their pronunciation should be observed:

<u>Numerals</u>	<u>Spoken as</u>
1.	Wun
2.	Too
3.	The - ree
4.	Forer
5.	Five
6.	Six (hard x)
7.	Se - ven
8.	Ate
9.	Niner
0.	Zero

Radio Call Signs

(a) Mobiles

Mobile call signs using the V.H.F. network are allotted by the Forests Department and consist of two letters.

The first prefix letter will, whenever possible, provide easy identification of the Division to which the mobile is attached.

<u>Division</u>	<u>Letter</u>	<u>Phonetic</u>
Wanneroo - Metropolitan	W.	Whiskey
Jarrahdale	J.	Juliet
Mundaring	T.	Tango
Dwellingup	D.	Delta
Harvey	H.	Hotel
Collie	C.	Charlie
Kirup-Grimwade	K.	Kilo
Nannup	N.	November
Busselton - Ludlow - Margaret River	B.	Bravo
Manjimup	M.	Mike
Pemberton	P.	Papa
Walpole	V.	Victor
Narrogin	R.	Romeo
Protection, Communications Branch, National Parks, Shires	X.	X-ray
Research and Working Plans	L.	Lima
Bush Fires Board	Z.	Zulu
Regional Group	E.	Echo
P. and M.E. Utilization .	A.	Alpha
Kalgoorlie, S.S.B.	1.2.3.4.5.	Forest Mobile 1 etc.
Kununurra, S.S.B.	7.	Forest Mobile
Karratha, S.S.B.	10.	Forest Mobile

APPENDIX IV

The second letter of the call sign will, where possible, identify the officer rank, e.g. gangs, pumpers, etc.

A	Area O.I.C.	N	Forest Guard 2
B	A.D.F.O.	O	Forest Guard 3.
C	District Forester	P	Forest Guard 4.
D	Forester	Q	Gang 1.
E	Assistant Forester 1.	R	Gang 2.
F	Assistant Forester 2.	S	Gang 3.
G	Assistant Forester 3.	T	Gang 4.
H	Forest Ranger 1.	U	Gang 5.
I	Forest Ranger 2.	V	Heavy Duty 1.
J	Forest Ranger 3.	W	Heavy Duty 2.
K	Forest Ranger 4.	X	Heavy Duty 3.
L	Forest Ranger 5.	Y	Heavy Duty 4. Cadets.
M	Forest Guard 1.	Z	Low Loader. Cadets.

Divisional Offices: Repeater Stations and Towers

Fixed station call signs are allocated by Telecom Australia and consist of two letters denoting the country and service, followed by a figure representing the State, then two letters indicating the call sign:

e.g. VL6.AA

Where V = Australia L&Z = Government Service 6 = W.A. AA = Call Sign

(See Appendix V For Divisional offices & towers call signs).

Aircraft:

The Forests Department uses single-engined aircraft for fire spotting, and twin-engine aircraft for aerial photography and fire ignition. For convenience they are identified thus:

(i) Spotters: Using place name of the circuit, e.g. Dwellingup spotter, Jarrahdale spotter.

(ii) Twin-engine aircraft: The Department of Transport call sign is used:

e.g. I.S.A. India Sierra Alpha No. 1 Aircraft

or

C.P.G. Charlie Papa Golf No. 2 Aircraft

Portable Stations:

Portable pack sets are not issued with a call-sign, but may be identified by numerals:

Pack one, Pack two etc., followed, if necessary, by a place name.

Appendix V
Divisional equipment allocation and Call Signs

Division	Call Sign VL.6-	OFFICE EQUIPMENT				Vehicles		VHF		Magnetic Aerials	Horn Speakers	Work Shop VHF	Portable Repeater	Beacon Radios	CB Radios	LFO Vehicle	LFO R/T	Spares			STATION	Repeater Stations and Towers					Solar Panel								
		R/T	SSB	BEB	VHF	R/T	SSB	Kits	Kit									RPT	R/T	25M		Call Sign VL.6-	Lookout	RPT	VHF	R/T		G40	ED	250					
Wanneroo	I.D.	2	1		21		4	2	3					4						Wanneroo	Z.B.	Yes	1	1											
Gnangara	O.N.	1	1								1									Gnangara	F.H.	Yes	1	1	1				2						
Yanchep	Q.G.	1	1								1									Wobling Hill	W.H.	Yes	1	1					1						
Jarrahdale	M.R.	2	1		11		2	1	2			1	1	3	1	1				Mt Solus	I.E.	Yes	1						1						
Mundaring	F.C.	1	1		10		2	1	1				1	2						Mt Dale	I.J.	Yes	1		1				1						
Dwellingup	A.E.	1	1	1	2	22	4	2	3				1	4	1	1				Mt Wells	I.G.	Yes	1	1	1				2						
Harvey	A.G.	2	1		17		2	1	2				1					1		Mt William	I.F.	Yes	1	1	1				2						
																				Hampden	H.T.	Yes		1											
Collie	A.D.	1	1		16		2	1	3			1	1	4	1	1	1	1		Mornington	L.T.	Yes	1												
Kirup	P.A.	2	1	1	18		3	2	1			1		4			1	1		Mungalup	Y.C.	Yes	1						2						
Grimwade	F.E.	1	1																	East Kirup	Y.D.	No	1		1				1						
																				Munro	L.U.	Yes		1					1						
Mannup	G.B.	2	1		18		3	2	3			1	2	6	1	1	1	1		Stewart	T.O.	Yes	1	1					1						
																				Carlotta	C.T.	Yes	1						1						
Busselton	I.B.	1	1		19		2	1	5					4			1	1		Milward	Y.B.	Yes	1	1					2						
Ludlow	F.D.	1																		Dickson	M.N.	Yes	1		1				1						
Margaret River	F.Q.	1	1																	Sea View	I.K.	Yes	1	1	1				1						
Manjimup	A.N.	2	1	1	1	35	3	3	5			1	2	3			2	1	1	Collins	L.Z.	Yes		1		1			1						
																				Mowen	C.W.	Yes	1						1						
Pemberton	G.A.	2	1		15		3	2	3					4			1	1		Alco	I.W.	Yes	1						1						
																				Kepel	I.X.	Yes	1		1				1						
Walpole	F.B.	2	1		13		2	2	3			1		4	1	1	1	1		Gloucester	I.Y.	Yes		1					1						
																				Pemberton	G.A.	No	1						1						
Narrogin	A.H.	1		2	5		2	1	2					2			1		2	Mt Frankland	I.S.	Yes	1	1					1						
																				Mt Burnside	I.Z.	Yes	1	1					1						
Bunbury	H.Z.	1	1	1	7		1													Narrogin	A.H.	No	1						1						
Kelascott					1															Dryandra	P.O.	Yes		1					1						
SHQ Protection	D.E.	IR	IR	IR	4	1	1	1																											
SHQ Research					1																														
SHQ Northern Region	D.E.	IR			1																														
SHQ Plant					1																														
SHQ Communications	D.E.	2	1	2	4	4	1																												
Kalgoorlie	N.J.			1			3																												
Karratha	W.E.			1			1																												
Kununurra	K.B.			1			2																												
Totals		29	19	10	5	239	5	7	36	22	36	2	6	9	44	5	5	9	8	1	2									21	2	14	8	2	28

Abbreviations:-
VHF = Very High Frequency radios
R/T = Radio Telephone radios
SSB = Single Side Band radios
BEB = Bush Fire Brigade/Shire radios
CB = Citizen Band radios
LFO = Large Fire Organization
25M = ANA radios
G40 = Honda Generators
ED250 = Honda Generators
RPT = Repeater
SHQ = State Headquarters

APPENDIX V (Continued)

Aircraft

(i) Spotter

<u>Division</u>	<u>Aircraft Numbers</u>	<u>V.H.F.</u>	<u>R/T</u>	<u>Spares</u>	
				<u>V.H.F.</u>	<u>R/T</u>
Dwellingup	2	2	2	1	1
Collie	1	1	1	1	1
Nannup	2	2	2	1	1
Manjimup	3	3	3	1	1

(ii) Twin-engine aircraft

<u>Aircraft Identification</u>	<u>V.H.F.</u>	<u>R/T</u>	<u>Spares</u>	
			<u>V.H.F.</u>	<u>R/T</u>
I.S.A.	1	1	2	2
C.P.G.	1		2	

PART 8

FORESTERS'
MANUAL

PLANT and EQUIPMENT

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

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NEW PLANT AND EQUIPMENT	8.067

PART 8 - PLANT AND EQUIPMENT

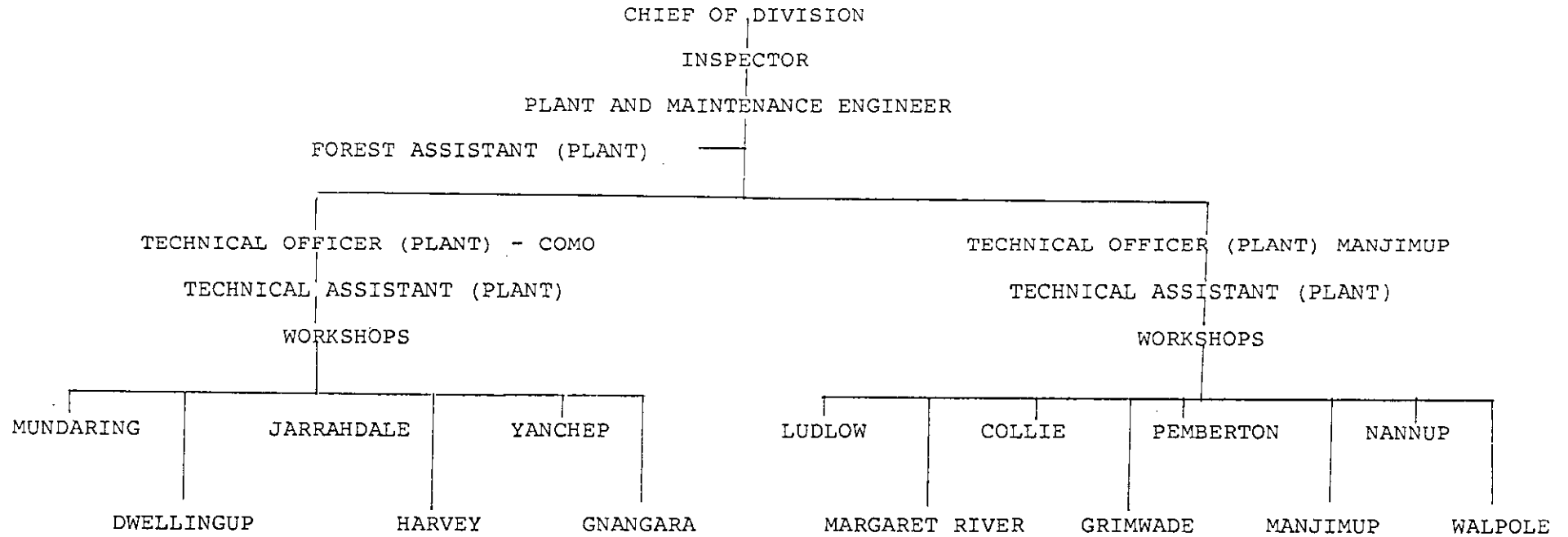
AIM AND ORGANISATION OF PLANT BRANCH

- | | | |
|--|-------|--|
| Aim | 8.001 | The aim of the Plant Branch is to provide safe, work-matched plant and equipment and trained operators, and to maintain the ability to develop new specialist equipment in the most economical manner. |
| Organisation and Administration Design | 8.002 | The organisation chart of the Plant and Maintenance Branch has been revised to include the newly created positions of Technical Officers (Plant) and Technical Assistants (Plant). It is shown on page 2. Page 3 shows the design for administration and hence communication within Divisions. |

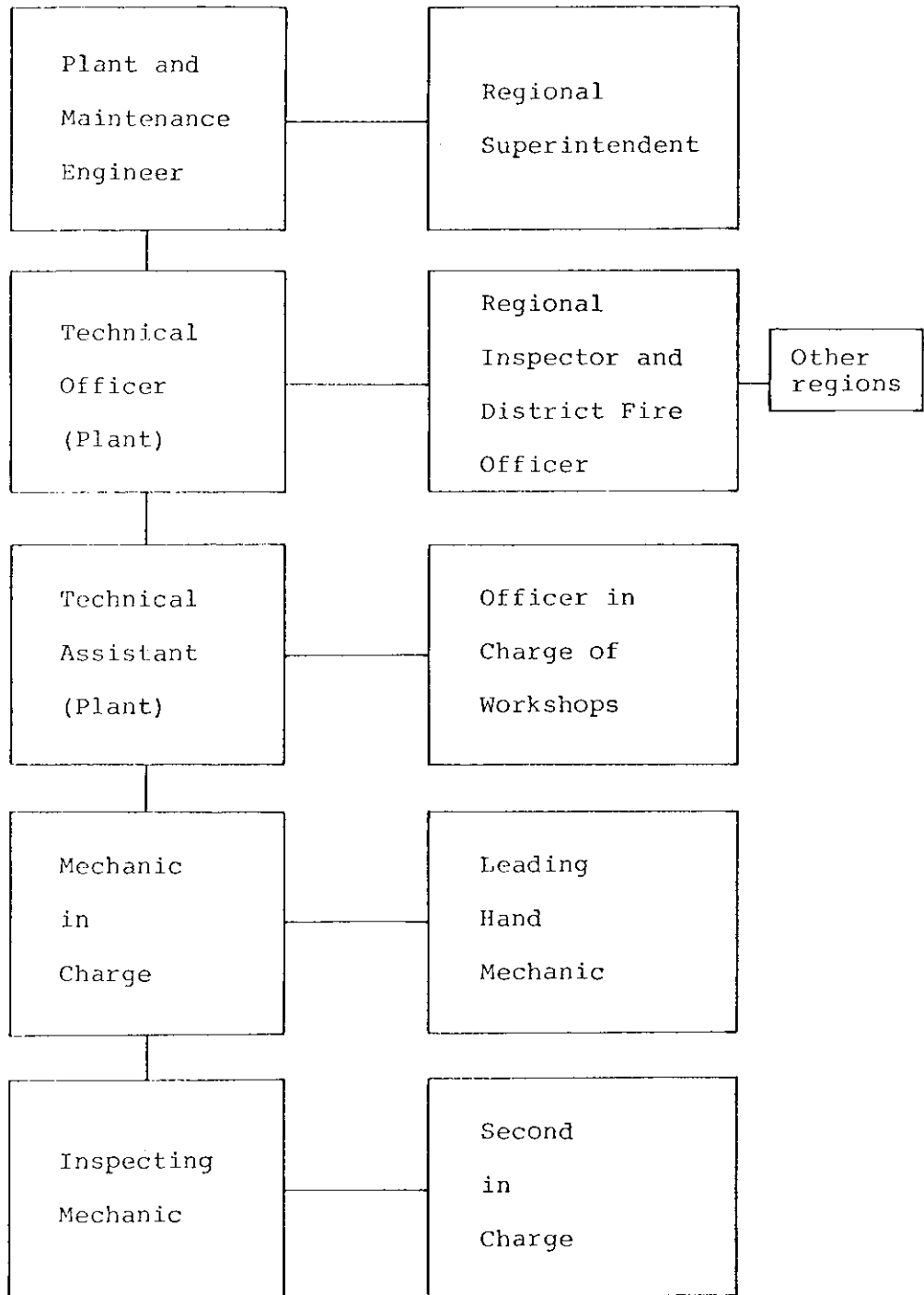
DUTIES OF STAFF

- | | | |
|--------------------------------|-------|--|
| Plant and Maintenance Engineer | 8.003 | The Plant and Maintenance Engineer is technical adviser to the administrative staff on the purchase and maintenance of plant and equipment, fabrication, modifications and workshop operations, including personnel. |
| Technical Officer (Plant) | 8.004 | Assists the Plant and Maintenance Engineer in the preparation and control of expenditure estimates; insurance; disposal; liaison with other government departments and firms; design, development and testing of plant and equipment; diagnosis of faults; and supervision of plant operations. Ensures comparability of repair and maintenance standards within all departmental workshops. Keeps the Officer in Charge (O.I.C.) informed of the movements of workshop personnel. |
| Technical Assistant (Plant) | 8.005 | Assists the Technical Officer (Plant) in making regular technical inspections, ensuring efficient workshop operation, and reporting in detail on departmental vehicles and plant. Liaises with the area O.I.C.s and the Automotive Store. Follows up supply with outside firms. |
| Forest Assistant (Plant) | 8.006 | Is responsible to the Plant and Maintenance Engineer for all administrative and personnel matters, including insurance, licensing, disposals and accident reports for all departmental vehicles and plant. Liaises with other departments, area O.I.C.s and outside firms when necessary. |
| Divisional Plant Officer | 8.007 | Within each division or branch, the area O.I.C. will designate a Divisional Plant Officer to be responsible to him. He carries out the following duties. Ensures the maintenance and operation of vehicles and plant and |

Structure and Organisation
of the Plant Branch



WORKSHOP ADMINISTRATION



the maintenance of inspection records (form FD 662). Receives requests for repairs or maintenance from individuals in charge of vehicles, and liaises with the workshop O.I.C. in this regard. Arranges inspection of vehicles and plant before their transfer, and forwards the Inspection Job Card (Form FD 662) with the unit. Ensures that repairs are not attempted without an Inspection Job Card first being prepared and authorised. Sets job priorities for the workshop. Ensures that vehicles and plant are cleaned and available to the workshop. Is available for discussion with the Technical Officer (Plant). Ensures that unauthorised personnel do not enter the workshop. Reports all accidents to the Technical Officer (Plant).

DUTIES OF WAGES EMPLOYEES

Mechanic in Charge

8.008 Prepares a weekly and monthly work programme in consultation with the Divisional Plant Officer. Prepares reports and estimates of the cost of maintenance repairs and overhaul of plant and equipment, including machinery and fabrication. Liaises with field officers and district workshops with regard to breakdowns and major repairs. Supervises mechanics, welders, machinists, inspecting mechanics, apprentices and storeman. Advises plant operators on servicing and maintenance. Plans itineraries and work for inspecting mechanics. Inspects and reports on problems concerning the operation of plant in the field to the Divisional Plant Officer and the Technical Officer (Plant). Orders spare parts and materials and ensures their supply. Organises workshop personnel for fire suppression and training. Compiles, checks and certifies workshop personnel time-sheets. Is responsible for the apprentice training programme. Gives instruction in driver training and in the application of plant and equipment. Must understand and comply with the Department's safety programme.

Leading Hand
Mechanic

8.009 Regional workshop: assists the Mechanic in Charge and carries out his duties in his absence.
Divisional and district workshop: in conjunction with the Divisional Plant Officer, prepares a weekly and monthly work programme. Supervises mechanics and apprentices under his control. Is responsible for all personnel employed in the workshop. Instructs on the operation and maintenance of plant. Orders spare parts and material and

follows up their supply. Inspects vehicles and plant as required, and records relevant information on Inspection Job Cards (form FD 662). Must understand and comply with the Department's safety programme.

Inspecting Mechanic 8.010 Inspects plant, vehicles and equipment, records the details on an Inspection Job Card (form FD 662) and maintains the schedule of inspections. Carries out minor repairs on plant and equipment in the field. Gives instruction in driver training and in the application of plant and equipment. Must understand and comply with the Department's safety programme.

WORKSHOP FUNCTION

Regional workshops 8.011 In the regional workshops at Gngangara, Collie and Manjimup major overhauls of all plant and machinery can be carried out. Such equipment as fire pumper units, planting machines, plantation nursery implements and irrigation systems, logging plant and equipment, and items for research and experimental activities can also be constructed or modified.

Divisional workshops 8.012 Divisional workshops are maintained to service and repair divisional plant equipment, items on temporary transfer or loan, and visiting departmental vehicles or equipment.

ANNUAL ESTIMATES (FUND 15)

Estimates 8.013 Although the management of vehicles, plant and equipment and the operation of workshops are divisional functions, they are of such a specialised nature that constant liaison between divisional management and officers of the Plant Branch is essential. This liaison commences with preparation of the estimates, which cover all aspects of plant operation.

Technical investigation and specification 8.014 The Plant Branch is responsible for technical investigation and specification in the purchase of all plant, vehicles and equipment.

Vehicle replacement 8.015 Divisions and specialist branches are required to submit requests for replacement of vehicles and plant annually in May on Plant Estimate - Approval and Action Sheet (form FD 636) Schedule 2. The basic criterion for replacement is the economic life as determined by age, kilometres driven, engine hours and general condition. The Approval and Action Sheet will only cover purchase of vehicles, plant and

equipment that carries a hire rate. Items such as ploughs, pruners, planting machines, workshop tools and so on, for which no hire charges are raised, will be shown against the fund for which they will be used.

Although the cost of items requested by divisions and specialist branches will be allocated to the appropriate fund, the Plant Branch will be responsible for specifying, preparing tenders, purchasing and accepting delivery for all mechanical equipment and will provide prices or expenditure limits.

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| Additional vehicles
or plant | 8.016 | Requests for additional vehicles, plant or equipment are to be supported by adequate information to substantiate them. |
| Field equipment | 8.017 | <p>When requesting field equipment, divisions and specialist branches must support each request with adequate information and justification. All requests for the fabrication of field equipment are to be included in the Plant Estimate - Approval and Action Sheet (form FD 636) Schedule 1. The Plant Branch will either fabricate the requested equipment or investigate the possibility of fabrication by outside contract.</p> <p>The division doing the work will order the materials and allocate costs to the division for which the work is being done. All workshop expenditure to be incurred outside Fund 15 is to be charged to the appropriate item under Fund 11, 12, 13, 14, 35, 36, 37, 38 or to the specialist branch item. All fabrication and repairs involving licensed equipment are to be identified by a job fund and an item number.</p> <p>It is the responsibility of the area O.I.C. for whom the work is to be done to supply the O.I.C. in the workshop with details of the job fund and the item number to which the expenditure is to be allocated. The costs of all work for which no estimate has been made will be allocated to the appropriate division or specialist branch fund and item number.</p> |
| Workshop tools | 8.018 | Minor workshop tools and equipment are purchased by requisition. Requests for major items must be included in the annual Plant Estimate - Approval and Action Sheet (form FD 636) Schedule 2. |
| Chainsaws | 8.019 | Divisions are required to submit requests for replacement of chainsaws annually on Plant Estimate - Approval and Action Sheet (form FD 636) Schedule 2. As a general guideline, chainsaws can |

generally be expected to have an economic life of three years. Therefore, one third of the complement is to be replaced annually.

- Other workshop expenditure 8.020 Allowance is to be made in the estimates for work that is carried out on behalf of other divisions, sections and specialist branches and whose cost is allocated to funds other than Fund 15.
- Requisition of automotive stores 8.021 Every requisition for automotive stores is to be initialled by the Technical Officer (Plant) before being forwarded to Stores Branch (Como).
- Requisitions (form FD 238) are to be completed in neat printing. The original and duplicate are sent to Stores Branch, Como, and the triplicate is retained in the requisition book for reference.
- Requisitions must include sufficient detail about the vehicle for which the stores are required, including licence or FD number of the vehicle, make, model, year of manufacture, engine number and chassis serial number.

LOCAL PURCHASE ORDERS

- 8.022 Approval has been granted by the Treasury Department to use local purchase orders as follows:
- (a) All mechanical repairs done outside the departmental workshops are to be restricted to \$150, unless otherwise approved by a Technical Officer (Plant).
 - (b) Technical Officers (Plant) are permitted to authorise repairs to vehicles and plant costing in excess of \$150 up to \$3000.
 - (c) Repairs in excess of \$3000 are to be referred by Technical Officers (Plant) to Head Office for approval.
 - (d) Purchases under \$5 are to be paid for out of petty cash.
 - (d) All other supplies and services, apart from those already approved for direct payment by cash order, should be requisitioned through Stores Branch, Como.
- Issue of local purchase orders 8.023
- (a) Yellow copy: remains in book.
 - (b) Green copy: is given to supplier. Must be endorsed to indicate where the account is to be forwarded for payment. A second endorsement is required to show that the items are for departmental use and are exempted from sales tax.
 - (c) White and blue copies: If payment is to be made locally, the blue copy is to be marked "to be paid

locally" and forwarded to Head Office (Out-Station Expenditure Clerk). The white copy is to be marked "paid", endorsed with a cash order number, and forwarded to Head Office with form FD 167. If payment is to be made by Head Office, both copies are to be marked "to be paid by Head Office" upon receipt of the invoice from the supplier, and forwarded to Head Office.

Use of Treasury
Form 10

- 8.024 Treasury Form 10 must be submitted in support of each cash order payment. It should be made out in ink or ball-point pen. The cash order number must be entered on the form to avoid dual payment. Procedures with regard to supporting vouchers and method of payment are contained in Part 4 of the Foresters' Manual.

DISPOSAL OF PLANT

Vehicles and
Plant

- 8.025 Vehicles and plant are disposed of through the Tender Board. The forms used are FD 4, A, B, C and D. The procedure is as follows:
Form FD 4: is prepared by Technical Officer (Plant) in triplicate and submitted to the Plant and Maintenance Engineer.
Form A: is prepared in triplicate by Plant Branch on departmental letterhead, and is forwarded with Form FD 4 as follows:
Original: Secretary, Tender Board.
Duplicate: Forest Assistant (Management), Head Office.
Triplicate: Technical Officer (Plant).
Form B: on receipt at Head Office of the Tender Board Schedules and the Tender Board Secretary's recommendations, the Forest Assistant (Management) in Head Office sends Form B to the area O.I.C. for completion of Part B (Form B). The duplicate must be returned to Plant Branch by time stated in Part A (Form B).
Form C: is prepared by Plant Branch when the contracts are completed, and is then forwarded to the Forest Assistant (Management), Head Office.
Form D: is prepared by Plant Branch if the contracts have not been completed and is submitted to the Secretary, Tender Board. Tenders declined by the Adjudicating Committee are referred to the Plant and Maintenance Engineer for reconsideration.

Other equipment

- 8.026 The procedures for disposing of chainsaws and field equipment are described in FD Circular 10/75 (August 18, 1975).

TRAINING OF PERSONNEL

Trade Apprentices

- Terms of employment 8.027 It is policy to employ and train apprentices in the sections of the engineering trades appropriate to the Department's needs.
- Terms of employment of apprentices are in accordance with the regulations of the Department of Labour and Industry
- Technical college courses 8.028 Where technical colleges are established within convenient travelling distance from the departmental workshop, apprentices will be permitted to attend lectures, subject to the approval of the Conservator of Forests.
- Correspondence courses 8.029 Where a workshop is located too far from a technical college, educational and technical training is provided by correspondence through the Technical Extension Service of the Department of Education. Technical Officers (Plant) are to supervise and report periodically on the progress of apprentices.
- Assignments are to be submitted to the Mechanic in Charge or the Leading Hand Mechanic for checking before being forwarded to the Technical Extension Service, Department of Education.
- Officers in Charge of divisions are to ensure that apprentices submit their correspondence assignments regularly and that the required number of assignments are completed annually. The Technical Officer (Plant) is to be advised of failure to comply.
- Intensive courses 8.030 Under the current training programme of the Department of Labour and Industry's Technical Training Division, an intensive 3 months course is provided for trade apprentices, usually in the first year of their apprenticeship. Apprentices attending an intensive course will be paid from Forests Department, Como, by the Forest Assistant (Plant).
- Plant operators 8.031 Untrained personnel are not permitted to operate plant.
- Introductory training 8.032 Plant operators must attend organised introductory training sessions on the operation and maintenance of plant, including all safety aspects, before taking responsibility for plant. This training must be at a level satisfactory to the Technical Officer (Plant).

- Driving licence 8.033 Driving licences must be inspected on engagement and thereafter annually by the O.I.C. Details are to be recorded and held by the divisional office.
- Operating techniques and safety 8.034 On delivery to any division or specialist branch, both new and used vehicles and plant are not to be used until the Technical Officer (Plant) or his representative certifies that they are satisfactory and until the operator nominated for each unit is fully trained in maintenance procedures and understands safety precautions and operating techniques.

Workshop Personnel

- Training 8.035 Provision will be made for workshop personnel to attend practical trades schools offered by either private or governmental organisations. Other on-the-job training is provided in the workshops.
- Terms of engagement 8.036 All applicants for workshop positions must be interviewed by Technical Officers (Plant) and are required to serve a probationary period. In all trade positions, preference will be given to indentured tradesmen.
- Review of workshop personnel 8.037 The number of workshop personnel is reviewed annually and no additional personnel are to be employed or replaced without reference to the Technical Officer (Plant) or the Plant and Maintenance Engineer.

LEGISLATION AND INDUSTRIAL AWARDS

- 8.038 All departmental officers are to acquaint themselves with the following Acts and Regulations.
- Plant, vehicles and machinery
- (a) Road Traffic Act No. 59 (1974): controlled by the Chief Executive Officer, Road Traffic Authority.
 - (b) Machinery Safety Act No. 74 (1974) and Machinery Regulations (1978): controlled by the Chief Inspector, Machinery Branch, Department of Labour and Industry.
 - (c) Noise Abatement Act No. 100 (1972): controlled by the Commissioner of Public Health, Public Health Department.
 - (d) Explosives and Dangerous Goods Act No. 38 (1961): controlled by the Chief Inspector of Explosives, Mines Department.
- The following regulations issued under this Act should also be noted:
- Explosives Regulations (1963): a guide to precautions to be observed

in the handling of explosives.
Flammable Liquids Regulations
(1967): a guide to the
construction and location of drum
depots.

- Apprenticeship 8.039 The General Apprenticeship Regulations (1978) issued under the Industrial Training Act (1975) prescribe the conditions of apprenticeship. Attention is drawn to the following paragraphs of the Regulations: Paragraph 17, which requires the apprentice's satisfactory progress in his training.
Paragraph 18, which states that attendance at all technical training classes is compulsory.
- Engineering Trades (Government) Award 8.040 The award is published and controlled by the Public Service Board. It is amended frequently, and all personnel should make sure that they are aware of changes that are made.

HIRING OF OUTSIDE PLANT

- Hiring policy 8.041 In all cases, departmental plant must be used in preference to hired plant. Where a division is unable to provide a required item of plant, assistance must be sought from adjacent divisions. If unsuccessful, arrangements may then be made to hire plant from contractors.
- Insurance 8.042 Particulars of the insurance cover on units of plant to be hired must be obtained before the plant is hired. Plant not covered by comprehensive insurance (as distinct from third party insurance) must not be hired. Approval is then to be sought from the Regional Superintendent or Officer in Charge (Protection Branch).
All units of hired plant are to conform with the current requirements of the Bush Fires Act and Regulations.
- Assistance of Technical Officer (Plant) 8.043 Technical Officers (Plant) are available to advise on specifications and the mechanical safety standards required of hired plant.

INSURANCE OF VEHICLES AND PLANT

- SGIO 8.044 The State Government Insurance Office (S.G.I.O.) is the Department's Insurance Agent.
- Claims and procedures 8.045 In the event of accidents that may or may not involve third party, loss by fire or theft, motor insurance trust

claims, licensing and worker's compensation, the procedure given in the Insurance Manual and Claims Procedures (Forests Department of Western Australia, 1978) must be followed. The manual includes definitions and instructions for the use of S.G.I.O. forms.

VEHICLE AND PLANT MAINTENANCE

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| Inspection | 8.046 | It is the responsibility of the area O.I.C. to maintain vehicles and plant schedules of inspection. Inspection of plant is controlled by the divisional Mechanic in Charge, who may liaise with the Technical Officer (Plant) if necessary. |
| Frequency of inspection | 8.047 | Mechanical inspections will be carried out as follows:
Light transport (sedans, utilities, vans and SWB 4 x 4): every 5000 km or every two months, whichever occurs first
Light Plant (all trucks, millyard equipment, wheel tractors and cranes): monthly.
Heavy Plant (bulldozers, graders, fire trucks, shovel loaders, logging equipment, low loaders and prime movers): every 100 hours or monthly, whichever occurs first. |
| Mechanical inspection procedures | 8.048 | The inspecting mechanic will inspect bulldozers, graders and loaders in the field, preferably with the driver or operator, whilst motor vehicles will be inspected in the workshop, where hoist and ramp facilities are available. Inspections are to include the following.
(a) <i>General</i> - Note any damage to the body. Check functioning of lights and trafficators, tyre condition and pressures, and external equipment.
(b) <i>In seat</i> - Note the record of maintenance. Check that all instruments, lights and rear vision mirror are functioning correctly. Check the condition of safety belts, wind-up windows and door locks, the general condition of the interior, brake and clutch pedal travel, and the bonnet release catch.
(c) <i>Under bonnet</i> - Check radiator water; condition of hoses, core plugs, water pump and so on; brake and clutch fluid level and condition; engine mountings; windscreen washer tank fluid level; engine oil level and condition, noting any engine oil leaks; fan belt condition and tension; battery water level, cables |

- and security; air cleaner security and condition, including the P.V.C. valve where fitted; fuel pump sediment bowl for dirt or water; generator or alternator security.
- (d) *Test drive* - Check condition of motor, clutch, transmission, steering, suspension, brakes (including hand brake), and seat belts.
- (e) *Vehicle on ramp* - Check any fault evident during the test run; suspension and front and rear shock absorbers; universal joints and flange bolts; steering (for damage to and security of components); oil leaks, and in particular leaks at the bottom of the brake plates; brake pipes and hoses; spare tyres and inner walls of all tyres; tools.

If the inspecting mechanic is in any doubt about any technical matters, he must consult the Technical Officer (Plant).

Use of FD 662
Job Card

8.049 One card is used for each vehicle; successive inspections or jobs are added to the relevant card until it is filled. The card includes the following details.

Date: of inspection.

Distance: total kilometres or hours shown at the date of inspection.

Inspector: initials of the inspecting mechanic.

Repair estimate: repairs required on vehicle.

Parts required: parts that obviously need to be ordered, as noted during the inspection.

Estimated hours: amount of time the inspecting mechanic expects the repair to take. An estimate is required for each entry.

Actual hours: amount of time the repair mechanic spends on each fault.

Work completed: tick if the work has been done exactly to the inspector's entry. This column is also to be used for the entry of any additional repairs.

Date completed: date when the mechanical repairs were completed.

Mechanic's initials: initials of the mechanic who carried out the repairs.

Period ending: the date of the end of the pay period when the work was done is to be noted against each entry. Successive entries may be bracketed together if necessary.

Wages cost: expenditure incurred on form FD 466 is to be entered each pay period in the column. Where work is

not completed during the pay period, expenditure is to be recorded as N.C. (not complete). Regardless of the number of entries in the "period ending" column, only one entry must be used to record mechanics' costs (N.W.). If casual assistance is incurred this can be entered as C.A.

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| Vehicle allocation | 8.050 | Responsibility for ensuring that a vehicle is serviced and cleaned and that faults are reported lies with the person to whom the vehicle has been allocated by the area O.I.C. This does not preclude staff to whom a vehicle is not permanently allocated from using vehicles, but it clearly indicates responsibility when it is necessary for more than one person to use the same vehicle. |
| Servicing procedure | 8.051 | Personnel are to adhere strictly to the servicing procedures as set out above. Every opportunity must be taken to improve driver attitude to operation, vehicle cleanliness and maintenance, particularly when inducting and instructing new staff. |
| Daily maintenance | 8.052 | Persons to whom vehicles are allocated will check daily the engine oil level and radiator water level, superficially inspect the vehicle daily for dents and scratches and tyre condition, advise the Plant Officer of any faults and record them in the running book, and advise the Plant Officer when vehicles are due for inspection. |
| Vehicle cleanliness | 8.053 | <p>Departmental vehicles must be kept clean and presentable. The following standards are to be observed:</p> <p>External surfaces of cabs and bodies are to be washed down as required to maintain good appearance, and chassis and engine compartments are to be cleaned as necessary.</p> <p>Cab interiors are to be brushed out regularly, and cushions, interior trims, facias and so on are to be cleaned using a damp cloth and approved cleaners.</p> <p>No dogs, animals or obnoxious materials are to be carried in the cabs or other seating space of any vehicle.</p> <p>No guns, rifles, ammunition or explosives are to be carried in any vehicle without the Conservator's approval.</p> <p>Rear trays of utility-type vehicles are to be kept free of litter and unnecessary equipment.</p> |

Workshop repairs	8.054	All vehicles are to be thoroughly cleaned before being taken to workshops for repair.
Damage to vehicles	8.055	<p>All superficial damage to vehicles is to be reported by the driver to the divisional Plant Officer on the day it occurs.</p> <p>The officer to whom the vehicle is allocated is to inspect the damage with the driver responsible and note the cause of the damage.</p> <p>All instances of damage or neglect on the part of a driver are to be reported to the Technical Officer (Plant) by the Divisional Plant Officer.</p>
Cannibalising, changing engines, and repairs	8.056	<p>No vehicle or plant is to be cannibalised without the permission of the Plant and Maintenance Engineer. No engine is to be changed without the permission of the Technical Officer (Plant).</p> <p>Serious operational failure that cannot be repaired within 24 hours is to be reported to the Technical Officer (Plant).</p> <p>No local construction of trailers, caravans or other plant is to be undertaken without reference to the Plant and Maintenance Engineer.</p> <p>No work on private vehicles is to be undertaken unless authorised by the Conservator.</p> <p>Where a vehicle has been altered in chassis or body type, or where the engine has been changed it may be necessary to present it to the relevant licensing authority for reassessment. The Technical Officer (Plant) will advise on this matter.</p>
Additional accessories	8.057	<p>External attachments in the form of water bag carriers, protective bars and trailer tow hitches may be approved following recommendation by the area O.I.C. and endorsement by the Technical Officer (Plant).</p>
Position of decals	8.058	<p>Decals are not required on sedans, station sedans or certain other vehicles as approved by the Conservator. In cases where they are required, however, a 70 mm decal is to be fitted on the bottom right-hand corner of the rear window. On other commercial vehicles a 210 mm decal is to be placed centrally on each front door, 150 mm below the glass, with the word "Conservation" at the bottom.</p>

SAFETY PROGRAMME

- Definition of safety 8.059 "Safety" means the control of men, machines, materials and methods to provide a working environment in which people will not be injured or property damaged.
- Machinery safety 8.060 Regulations for the safe use of machinery are provided in the Machinery Safety Act (1974). The term "machinery", as used in the Act, includes any boiler, pressure vessel, engine, motor crane, conveyor, hoist, lift, escalator, machine, gearing or mechanical appliance, constructed of any material and worked or capable of being worked by any kind of power, and any supporting structure stressed by its operations.
- Workshop safety 8.061 Good housekeeping, cleanliness and orderliness are to be observed at all times within the workshop perimeter.
- Safe practice is to be observed in workshops. Special attention must be paid to securing and lifting heavy components, jacking and supporting vehicles and machines, guarding powered machine tools, welding in close proximity to fuel or other flammable liquids, storing and using acids and other dangerous chemicals, and handling gas cylinders and other vessels under pressure.
- Gas cylinders are to be stored in a cool area, and the contents are to be clearly identified by colour code marking.
- Portable electric and other hand tools are to be maintained free of electrical and mechanical defects.
- Only authorised, certificated personnel are to operate cranes, hoists, forklifts, and all other workshop equipment, including vehicle hydraulic hoists.
- When the tyre on a wheel removed from a vehicle is to be pressurised, the wheel must be placed in a safety cage.
- First aid equipment is to be maintained to an approved standard (currently that set out in the St. John Ambulance manual) and checked and replenished regularly. It must be placed in conspicuously located cabinets marked with a red cross.
- Safety during crane operations 8.062 The following points should be noted carefully to ensure maximum safety.
- Machines should not be moved with the boom upright. Wherever possible, an angle of 45° is considered safest.

This does not apply if the machine is being moved down a steep incline, when the boom should be raised, or up a sharp slope, when the boom should be lowered.

When operating a machine with the boom at maximum or near maximum vertical position, great care should be taken that slings of the correct size are used and that the load is slung in a safe manner, so that the boom is not thrown back over the cab if the slings break or slip.

When lifting capacity loads the operator should be careful to keep the boom well inside the safety limit, taking into account the fact that when the machine is swinging the load around, centrifugal force takes the load outwards, and this has the same effect as lowering the boom. He should also be aware that there can be considerable variation in successive loads.

No machine should be operated unless the ground pad is considered safe for purposes of stability.

When starting the engine all power trains should be disengaged and all controls correctly positioned.

Drivers must work to signals from the dogman where one is assigned. On machines where no permanent dogman is engaged, signals must be taken from only one man in each gang covering the particular operation. This ensures safety for all workers.

When the crane boom is being extended with a heavy load on the hook, the load should be kept as close to the ground as possible so that in the event of the machine tipping, the risk of injury to personnel and plant is minimal.

Any defect in the crane, its operation or the associated equipment should be reported immediately.

The safe working load (S.W.L.) rating of slewing and boom cranes is usually calculated as at the hook. The addition of other attachments such as grapples and rotators reduces this rating by the weight of each attachment. Operators are to ascertain the S.W.L. rating of the crane when the attachments are added. The S.W.L. rating of each crane is to be painted on the boom at the hook position.

NO PART OF A CRANE SHOULD BE PERMITTED TO APPROACH CLOSER THAN THREE METRES TO ELECTRIC POWER LINES, UNLESS THE POWER IN THE LINES IS SWITCHED OFF.

Transporting of Vehicles and Plant	8.063(a)	When transporting bulldozers, wheeled tractors and various vehicles and machinery etc. on Departmental trucks, care must be taken to ensure that the loads are adequately secured by chains or ropes. The Officer-in-Charge is held responsible for ensuring that drivers carrying such loads must not leave the loading place until the load is properly secured.
Conveyance	(b)	Regulations for the quantity and manner of conveyance of explosives, and precautions for the prevention of accident by fire or explosion are given in the Explosives Regulations (1963).
Storage of fuel	8.064	All flammable liquids in drums must be stored at approved distances from buildings and workshops. Storage requirements depend on the type and quantity stored. A guide to the construction and location of drum depots is contained in the Flammable Liquids Regulations (1967).
Fire prevention	8.065	The Officer in Charge of each workshop must ensure that high fire-prevention standards are maintained.
		All workshops and buildings are to be furnished with the requisite number of approved fire extinguishers, visible to any person entering these areas. They are to be mounted on walls to avoid any risk of being damaged, and are to be maintained in accordance with the regulations and standards of the Western Australian Fire Brigades Board.
		Vehicles are to be kept clean of forest litter, used packaging materials, waste oil rags and other combustible materials that may be a fire risk. Special attention is to be given to removal of litter and fuel-impregnated soil from the under-body plates of bulldozers. Vehicles are to be parked at a safe distance from flammable liquids, dangerous chemicals and welding operations.

VEHICLE COLOUR CODES

Light transport	8.066	Standard colour codes for vehicles and plant are as follows:
		Cars, station sedans, utilities, buses and other personnel-carrying vehicles are purchased in colours of white or cream. Other colours may be approved where standard colours are not available.
Commercial vehicles		The cab and body of all commercial vehicles from SWB 4 x 4 through to trucks are painted orange (Dulux shade 393-00017 F/A 6313).

Chassis, mudguards	The chassis, mudguards and wheels are painted black (Dulux shade 393-00070-A35290).
Industrial vehicles	Industrial-type vehicles and implements will be purchased in the manufacturer's colours.
Fire equipment	All fire equipment is painted red (Dulux shade 393-05302-E66829).
New fabrications	New fabrications, substantially modified equipment and machines that have been overhauled are to be repainted machinery yellow (Dulux shade 393-04501-J46809-H22).
Portable workshop machines	Fixed and portable workshop machines are to be painted in the maker's original colours where possible.

NEW PLANT AND EQUIPMENT

Delivery	8.067	All new plant and equipment is to be delivered by the suppliers to the Mechanical and Plant Engineer, Public Works Department, East Perth, for checking and licensing prior to being delivered to the Forests Department. The Plant Branch will notify the relevant division or district of the date for collection.
Warranties	8.068	Warranties and service periods on all new plant and equipment are to be claimed where convenient or economically practicable, at the discretion of the Technical Officer (Plant). Claims on defective components are to be made in all instances with the manufacturer's agent.
Special reports	8.069	Special reports may be requested on new equipment.
Transfer of vehicles or plant	8.070	The area O.I.C. is responsible for notifying the Plant Branch of the permanent transfer of any vehicle or item of plant. Form FD 198 is to be used.
Division/Branch Vehicles and Plant Fleet List	8.071	Divisions and Branches are to prepare a Division/Branch Fleet List which must be submitted to the Plant Engineer's Branch, Como by 31st March each year.
"Writing Off" of Unservicable Equipment	8.072	Any equipment, tools, plant or machinery which may be considered unserviceable must be retained and accounted for until an inspection has been made by an authorised Senior Professional Officer who will decide what steps should be taken for the disposal of such items. An authorised Senior Professional Officer is one who has been specifically advised by the Conservator of his duties in this matter.

- Lost or Stolen
Equipment, Vehicles
and Plant
- 8.073(a) Where equipment, vehicles and plant are lost, stolen or missing, particulars of same must be submitted in writing to the Conservator, with an explanation stating the manner in which the loss was incurred, and any action taken for their recovery.
- (b) Theft must be reported to the Police. Items on charge which are lost or missing may only be written off with the approval of the Honourable Minister for Forests.
- (c) Certain items which are part of tool kits and are lost or stolen may be replaced on a requisition, supported by an explanation from the Officer-in-Charge or Technical Officer.
- Disposal of Equipment
after Inspection
- 8.074 Articles of equipment are not be written off until written approval from Head Office has been received. This approval will not be given until a certificate on Form FD 338 is received regarding the disposal of the articles.

ACCOUNTING

- Fund 15
- 8.075 Fund 15 accounts for the expenditure incurred to provide and maintain vehicles and items of plant and equipment employed on Departmental operations.
- Hire
Charge
- 8.076 Fund 15 is used solely to account for those vehicles and items of plant for which a hire charge is raised; it is axiomatic that Fund 15 will not finance the purchase, maintenance or fabrication of any unit which does not carry a hire charge.
- Suspense
Fund
- 8.077 Fund 15 is a Suspense fund by which all expenditure incurred is recouped through a hire charge for the individual units. It follows that Fund 15 is designed neither to produce a surplus or a deficit over the year.
- Accounts
Classification
- 8.078 To assist with the preparation of estimates and with the correct allocation of expenditure. An expanded description of The Accounts Classification is listed below. This expanded description of the individual items which compose the Fund is intended to ensure uniformity of expenditure allocation within the Department.
- Usage Items
- 8.079 By definition, Fund 15 is the financial source for providing and maintaining vehicle and plant which carry a hire charge; it is not the financial source for providing and maintaining all items of a mechanical nature, such as motorised equipment, nor of items which can only be fabricated in Departmental Workshops, such as scrub

crushers, cattle grids or water bag carriers.

Estimates and accounting of expenditure for maintenance and fabrication of these items are to be prepared and debited to the usage items. It follows, that once expenditure is incurred, it will be debited to the usage item and become the responsibility of the Division/Branch concerned.

Head Office/
Divisional

8.080

A Head Office or a Divisional code number is prefixed to each item. Thus Head Office will estimate and allocate expenditure to items showing the 00 prefix and Divisions will estimate and allocate expenditure to their own Divisional prefix. Expenditure allocation against items with the Head Office prefix may be permitted but not without prior Head Office approval.

CAPITAL

00-15-101

PURCHASE OF VEHICLES AND PLANT

- 1) Purchase of vehicles or items of plant which will require licensing and issue of license plate by R.T.A., and for which a hire charge will be raised, or
- 2) Purchase of options which will become an integral part of the vehicles or item of plant, such as power steering, tractor roll bars etc, are to be included here.

00-15-102

FABRICATION OF VEHICLES AND PLANT

Fabrication of vehicle and plant which will require licensing and issue of license plate by the R.T.A., and for which a hire charge is to be raised, is to be included here.

MAINTENANCE

15-201

WORKSHOP WAGES

Wages paid to any member of the Workshop Staff covered by Schedule 4, including Mechanic in Charge, leading hands, mechanics, welders, machinists, apprentices general assistants or storemen, incurred while working on a vehicle or item of plant carrying a hire charge, are to be included here.

Wages paid to the above when they are working on equipment for which no hire charge is raised, will be allocated to the usage item on which the equipment is being used.

15-202

WORKSHOP SUPERVISION - WAGES

Wages incurred during supervision or assistance, such as preparing requisitions, are to be allocated, as far as possible, directly to the individual vehicles and accounted under 15-201. Where this is not possible, wages should be allocated to 15-202.

15-203

STOREMAN AND GENERAL ASSISTANTS WAGES

Wages paid to storemen or general assistants, which cannot be allocated directly to a vehicle or item of plant carrying a hire charge, are to be allocated to 15-203. This item is for storeman and general assistants covered by Schedule 4, not casual Divisional/ other employees.

15-205

WORKSHOP LEAVE

Sick leave, long service leave and annual leave for any workshop employee are to be included here.

15-206

ALLOWANCES FOR CAMPING, LIVING AWAY FROM HOME AND TRAVELLING

Allowances for camping, living away from home and travelling for any workshop employee, but not for apprentices attending trade schools, which is allocated to 15-308, are to be included here.

15-207

ARREARS WAGE INCREASES FROM PREVIOUS YEAR

15-211

MATERIALS

Only items of material which cannot be directly allocated to a vehicle are to be included here. For example steel to fabricate a bulldozer canopy will be funded for 15-212 and allocated to the bulldozer.

Materials for units which do not carry a hire charge, such as ploughs or planting machines, are to be allocated to the usage item.

15-212

SPARE PARTS

Parts for repair or replacement are to be included here and allocated to the vehicle number.

If materials are ordered for an individual vehicle they are to be included here. See 15-211.

Parts for units for which no hire charge is raised are to be allocated to the usage item.

15-213

TYRES AND TUBES

Tyres and tubes purchased for vehicles with a hire charge are admitted here. Tyres and tubes for units with no hire charge are to be charged directly to the usage item.

15-214

TOOLS AND EQUIPMENT

Allocation to cover:

1. Addition and replacement of workshop hand tools;
2. Addition and replacement of workshop machine tools such as grinders, lathes, welders;
3. Repair and maintenance of workshop tools such as lathes, welders and milling machines.

NOTE: Tool kits for use by employees are to be allocated to Divisional Stores 14-206.

15-215

POWER, WATER, ETC.

Electricity, water, fuel used to power motorised equipment such as welders and petrol/kerosene used for cleaning parts are to be included here.

15-216

FUEL

Petrol, distillate used to power motor vehicles and plant carrying a hire charge are to be included here.

Kerosene or distillate for prescribed burning is to be allocated to 11-202, manual prescribed burning.

15-217

OILS AND LUBRICANTS

Oils for the engine, differential and gearbox; grease; and hydraulic fluids which are used in vehicles or plant carrying a hire charge are to be included here.

However, for motorised equipment without a hire charge, expenditure is to be allocated to usage item.

15-219

MISCELLANEOUS COSTS

Expenditure is to be allocated directly and use of this item avoided. For example, tidying up the workshop is to be allocated against the work in progress at the time.

- 15-221 WORK DONE OUTSIDE DEPARTMENTAL WORKSHOP
- Repairs to vehicles and plant carrying a hire charge processed outside Departmental workshops are to be allocated here.
- 15-222 CASUAL WORKSHOP ASSISTANTS WAGES
- Intermittent assistance in the workshop by employees other than workshop staff is to be included here.
- NOTE: Daily maintenance, such as checking tyres, oil, battery and radiator, is to be allocated to usage item.
- 15-223 PLANT BRANCH VEHICLE HIRE
- Hire charges incurred by vehicles allocated to Plant Branch officers are allocated to this item only. This item is not for allocation of hire charges incurred by Divisional vehicles, neither is it for vehicle testing or reclaiming vehicles for repair or transfer; these charges are to be allocated to a Divisional usage item.
- 15-224 VEHICLE TESTING (AT HIRE CHARGES)
- Periodic testing of vehicles and testing before and after repairs are to be included here.
- 15-225 ACCIDENT DAMAGE
- Expenditure incurred to repair a vehicle damaged by an accident for which an SGIO claim form was submitted, or not submitted only because the claim was less than \$2 000, is to be included here under two headings:
- 01 Parts
- 02 Labour
- 00-15-301 WORKERS COMPENSATION INSURANCE
- SGIO Workers Compensation Premiums apply to workshop staff. This is a Head Office item only, to which Divisions have no access.
- 00-15-302 PAYROLL TAX
- Payroll Tax, paid on behalf of workshop personnel, mechanics, welders, apprentices etc, is to be included here.
- This is a Head Office item, to which Divisions have no access.
- 00-15-303 VEHICLE INSURANCE
- S.G.I.O. Comprehensive and Third Party Property Premiums on vehicles and plant is to be included here.
- This is a Head Office item, to which Divisions have no access.

00-15-304

THIRD PARTY INSURANCE

Motor Vehicle Insurance Trust. Third Party Insurance Premiums on Vehicles and Plant is to be included here.

This is a Head Office item, to which Divisions have no access.

00-15-305

APPRENTICES IN SERVICE TRAINING

Fees paid to training schools, travelling fares, and living away from home allowance for apprentices in service training are to be included here.

00-15-306

DEPRECIATION

15-401

BUSSELTON DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Busselton Division and effected in a Departmental workshop other than Busselton are to be included here.

15-402

MUNDARING DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Mundaring Division and effected in a Departmental workshop other than Mundaring are to be included here.

15-403

DWELLINGUP DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Dwellingup Division and effected in a Departmental workshop other than Dwellingup are to be included here.

15-404

COLLIE DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Collie Division and effected in a Departmental workshop other than Collie are to be included here.

15-405

KIRUP DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Kirup Division and effected in a Departmental workshop other than Kirup are to be included here.

15-406

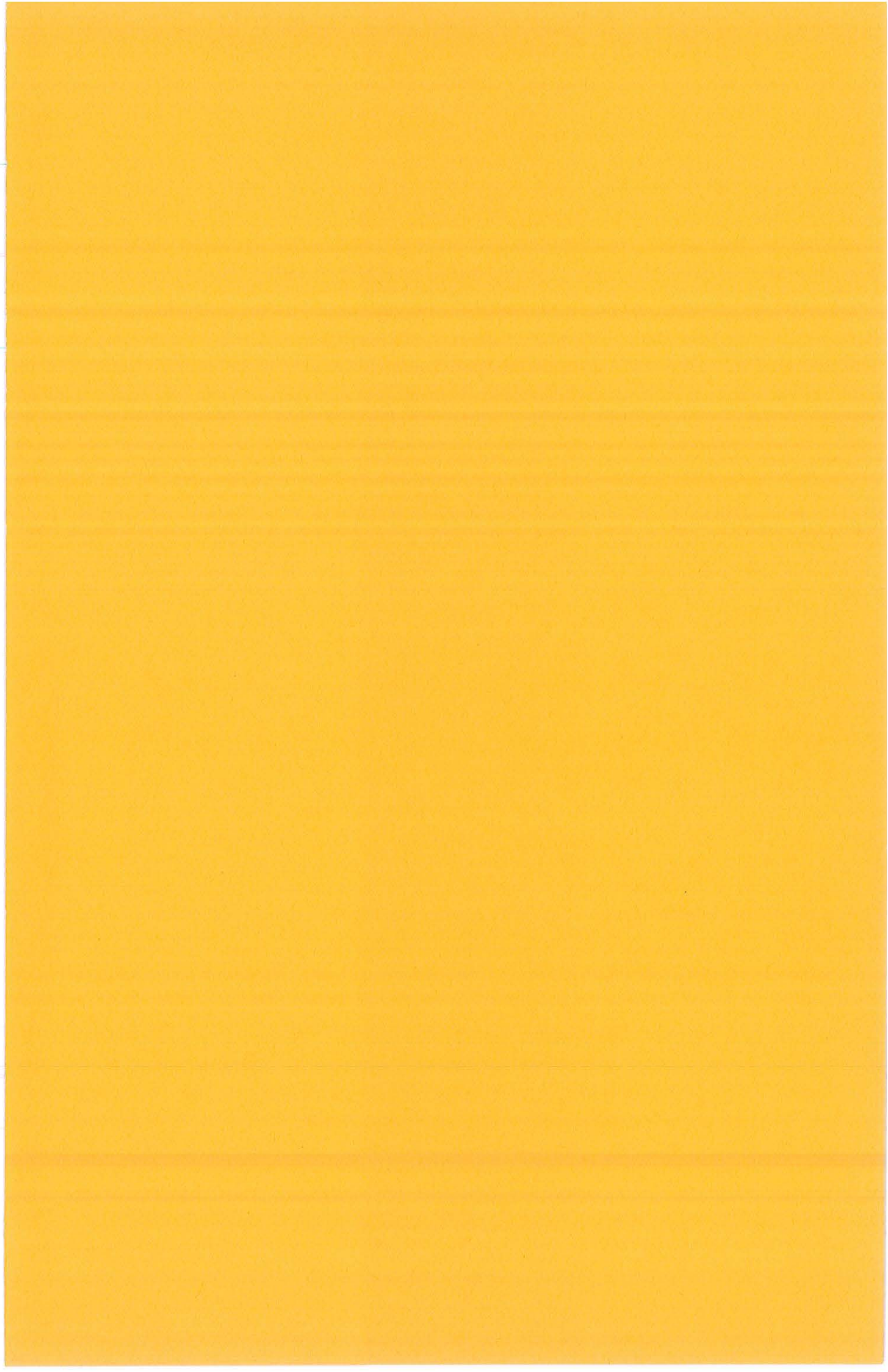
MANJIMUP DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Manjimup Division and effected in a Departmental workshop other than Manjimup are to be included here.

- 15-407 NARROGIN DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Narrogin Division and effected in a Departmental workshop other than Narrogin are to be included here.
- 15-408 KELMSCOTT DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, is to be allocated to the Kelmscott Division and effected in a Departmental workshop other than Kelmscott are to be included here.
- 15-409 COMO DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Como Division and effected in a Departmental workshop other than Como are to be included here.
- 15-410 HARVEY DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Harvey Division and effected in a Departmental workshop other than Harvey are to be included here.
- 15-411 PEMBERTON DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Pemberton Division and effected in a Departmental workshop other than Pemberton are to be included here.
- 15-412 NANNUP DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Nannup Division and effected in a Departmental workshop other than Nannup are to be included here.
- 15-413 WALPOLE DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Walpole Division and effected in a Departmental workshop other than Walpole are to be included here.
- 15-414 KALGOORLIE DIVISION
- Wages for mechanical repairs to vehicles, for which a hire charge is raised, is to be allocated to the Kalgoorlie Division and effected in a Departmental workshop other than Kalgoorlie are to be included here.

WANNEROO DIVISION

Wages for mechanical repairs to vehicles, for which a hire charge is raised, allocated to the Wanneroo Division and effected in a Departmental workshop other than Wanneroo are to be included here.



FIRE CONTROL FORESTERS MANUALOCTOBER 1981

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PART 9 - FIRE PROTECTION

INTRODUCTION

Fire problems

- 9.001 The problem of fire control is intimately connected with the questions of reforestation and afforestation, and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.

Of equal importance is the proper use of controlled fires to regenerate and protect the forest and its associated flora and fauna, and to guard adjoining communities from wildfire.

The eucalypt forests of Western Australia have evolved in a fire environment. Both flora and fauna have adapted to hot dry summers and the associated fires started by lightning and, more recently, by man. It is, therefore, natural and advisable to undertake hazard reduction by the intelligent use of fire of prescribed intensity and frequency to minimise damage caused by intense summer wild-fires.

HISTORY

Historical background

- 9.002 Before the passing of the Forests Act, 1918, the northern half of the State forests had been ravaged by unrestricted cutting and uncontrolled fires.

Since 1919 roads have been increasingly constructed within the forest and, until the early 1950's, the aim of the Forests Department was to provide complete protection to the forest. During this period, the extension of group settlement and other farming ventures resulted in heavy damage from indiscriminate firing of the southern forest area where forestry organization was not yet established.

Protection problems

It was found that after 15 or 20 years' protection, the accumulation of combustible material was such that even very heavy expenditure on men and equipment could not control a fire under the severe weather conditions that occur periodically in Western Australia. Other states have learned this lesson with equal force. Effective fire control can only be achieved in the south-west forest through regular reduction of fuel hazards by prescribed burning and maintaining an efficient detection and suppression system capable of rapid and effective attack on fires before severe damage occurs.

OBJECTIVE OF MANAGEMENT

- 9.003 The Department's objective is to provide a fire control system capable of protecting recognised forest values from serious damage. The system is to be compatible with the dominant land use in any area, with the cost of protection not exceeding the value of the loss prevented.

POLICY

Fire policy

9.004

Present fire control policy results from six decades of experience and research, and may be summarised as follows:

Continue the investigation of fire effects on each major land use to determine losses and benefits in relation to fire intensity, frequency and season, and prescribe the use or exclusion of fire accordingly.

Provide for public education, warning and control in relation to fire risk, and ensure liaison with other fire protection organisations.

Provide a detection system which will ensure rapid, effective attack of all wildfires in State forest.

Reduce fuels systematically in the indigenous forest to levels at which wild-fire can be readily contained under normal weather conditions.

Systematically reduce fuels on buffer strips throughout pine plantations to limit major spread of wildfire.

Provide a well-trained and well-equipped suppression organisation capable of suppressing several simultaneous wildfires under severe weather conditions.

Assist authorities responsible for fire control on neighbouring land on the basis of mutual aid, where this does not conflict with forest protection objectives.

Continue research programmes into technological, ecological and managerial aspects of fire protection, particularly in respect of changing patterns of land use.

Ensure effective liaison with individual neighbours, fire brigades, shires and other organisations with fire protection responsibilities, particularly at a local level.

STRATEGIES AND PROCEDURES FOR FIRE MANAGEMENT
Law Enforcement

Bush Fires Act

9.005

Every forest officer must acquaint himself with the Bush Fires Act and Regulations and make sure that his copy of the Act is kept up to date by entering any amendments that are gazetted. A simple summary of the major sections of this Act is contained in the pamphlet Fire Law.

The following sections of the Bush Fires Act are of particular significance to forest officers:

Prohibited Burning Times/
Restricted Burning Times

Prohibited and Restricted
Burning Times Declaration

Servicing Notice to Burn	Regulations Part IV
Bush Fire Emergency	Section 21
Burning during prohibited and restricted burning times	Section 18 Regs. Part IV
Suppression of Bush Fires	Section 28
Disposal of Cigarettes and Matches	Section 30
Wilful Lighting of Fires	Section 32
Shire Authority to Require Fire Breaks	Section 33
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Conservator's Authority to Require Firebreaks	Section 34 (2)
Appointment of Bush Fire Control Officers	Section 38
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Fire Weather Officer	Section 38 (6)
Special Powers of Bush Fire Control Officer	Section 39 (1) Section 59 and Regulations
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Power to Stop Fires Being Lit Bush Fire Control Officers' Forest Officers'	Section 46 (1) Section 46 (1)
Requests for Coroner's Inquiry	Section 49
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Recovery of Expenses	Section 58 (3)
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Regulations Part IV Part VII Part VIII

Prescription section summarizes powers and responsibilities of Bush Fire Control Officers, Brigade Officers and members of the Police and Forest Officers under the Bush Fires Act.

Forests Act

9.006 Besides the provisions of the Bush Fires Act, the attention of all forest officers is drawn to the following fire provisions of the Forests Act and Regulations:

Penalty for unlawfully lighting fires -
Section 46.

Forest officers calling for suppression
assistance - Section 47.

Setting fire to bush without notice to forest
officers - Section 48.

Mill protection - Regulation 140.

Responsibilities of licensees and permit
holders - Schedules.

Prohibited
burning period

9.007 The Bush Fires Act provides for a period each
year during which the lighting of fires,
except for certain specific purposes, is
prohibited. The dates for the prohibited
periods for different zones are published in
the Government Gazette from time to time and
area O.I.C.'s should acquaint all officers
with the dates of local zone restrictions.

Provision is also made for this Department to
obtain a suspension of the prohibited period
to enable us to carry out protective burning.

Suspension of
prohibited
burning period

9.008 Applications for suspension of the prohibited
burning season must be lodged with the O.I.C.
of Protection Branch, Como, at least one week
before the closing date of the restricted
period. Except for special regeneration and
clearing burns, suspension will normally only
be granted by the Bush Fires Board to enable
burns already commenced to be completed.

The area O.I.C. is required to submit
applications for suspension through the
Regional Leader and supported by the following
information:

Reason the suspension is required.

Period for which the suspension is required
(dates).

Area of each job to be burnt.

Prohibited burning zone for each job.

Maps showing each job area with fuel within
the burn and for a 4 km width outside the
burn boundary. Values at risk in the event
of an escape must be shown on these plans,
e.g. farm crops, plantations, buildings etc.

Before submitting any request, the area O.I.C.
will be required to contact shires wherein the
proposed burns are located and obtain the
endorsement of the Chief Fire Control Officer
for the extension. This endorsement must be
specified in the above application.

Where suspension is requested for several jobs
(e.g. karri regeneration burns) the applica-
tion must show constraints imposed to avoid
too many burns lit at once and over-commitment
of forces.

Once Departmental requirements have been satisfied, the O.I.C. Protection Branch will arrange for the suspension through the Bush Fires Board.

Fire investigation

9.009 In every case of fire the local officer must take immediate steps to ascertain the cause. From his local knowledge, the forester will generally have a good idea of the cause of most fires which occur. Where it is obvious that it is directly due to human agency, immediate steps should be taken to obtain more specific information concerning the identity of the culprit with a view to possible law enforcement. Some points on how to go about such an investigation are given in Prescription Section.

Frequent sources of uncontrolled fires are escapes from settlers' burning-off operations.

Most of these are due to ignorance and lack of experience, so that discussion with farmers and bush fire brigades should go far to minimise this trouble.

Some of these escapes are due to inadequate safeguards and, where people persist in ignoring the provisions of the Bush Fires Act, prosecution should be recommended.

Prosecution by local authority

9.010 Where a breach of the Bush Fires Act occurs on private property outside the boundary of State forest, the local authority, which is charged with the policing of the Act, should carry out the prosecution.

The forester may assist officers of the local authority to obtain evidence, but as far as possible should leave prosecutions to the local authority if the breach occurs on private property.

Failure by local authority to prosecute

Where a local authority fails to take legal action against flagrant breaches of the Bush Fires Act, particularly if there are several cases of such failure, immediate advice of the incidents, together with full details, should be sent to the O.I.C., Protection Branch, Como.

Fire notifications to local authorities

9.011 When any illegal burning outside State forest boundaries is located, the local authority should be notified immediately by telephone of the fire's position and a record made in the office log book.

Fires reported to or detected by the Forests Department will be advised to the shire or appropriate Fire Control Officer for initial action.

Form FD 573

Once a week, written advice using form FD573 should be sent to the Shire Clerk listing all the fires located in their area during the week, including those already notified by telephone. A copy should be sent to the O.I.C. Protection Branch.

Advice to
Head Office

If the local authority is known to be taking disciplinary action in any case, advice of this should also be sent to O.I.C. Protection Branch, Como without delay.

Legal Actions

9.012 Your attention is drawn to the need to provide prompt, comprehensive and accurate information on fires which are likely to involve the Forests Department in legal action, to -

Recover costs or damages by the Department
or

Recover costs or damages from the
Department

In either circumstance the Officer in Charge of Protection Branch requires prompt advice so that the necessary investigations and advice to Crown Law can be initiated. Initial advice should be given by telephone, followed immediately by a written report along the lines set out below.

Recovery of
fire fighting
or fire damage
costs

If there is reasonable justification, the Department will undertake action to recover the costs for suppressing fires illegally lit on forest land, where the culprit can be identified. The report must clearly set out the basis of justification for recovering costs i.e.:

Cost of recovery action by the Department must not result in damage to its public relations and would be expected to provide a deterrent or warning effect.

A fire started with maliciousness or negligence must be weighed sensibly against the different circumstances of an honest mistake. The circumstances of the person involved must be considered. Cost recovery against an impecunious person is most unlikely to succeed and may well appear to be persecution. In these circumstances some other deterrent action will be more appropriate.

It is important that the report contains full background information on these matters.

If the Department is likely to have legal action taken against it for recovery of costs or damages resulting from a fire, the report must be comprehensive enough to decide appropriate action.

Such legal actions can result from any fire originating in State forest or from fires involving the Department as an agent, e.g. in aerial burning of Crown lands.

In these circumstances additional information (see page 7 last paragraph) will be required on the extent of damages to the property involved.

Report

In the event of anticipated legal action

by or against the Department for costs arising from a fire, a report should be compiled immediately using the headings below:

Background Information

Full name and address, for serving notices, of the owner or occupier of the land on which the fire burnt and where it originated and details of the property locations.

Full name and address, for serving notices, of person or persons suspected of lighting the fire, with a signed statement if possible, or:

If the fire escaped from State forest or any other fire lit by the Forests Department, full details of the escape under confidential advice. No statement is to be made outside the Department that could lead to any admission of liability.

Provide a plan of the area showing:

Fire's origin

Final boundary

Section of boundary suppressed by Forests Department

Tenure of the land where the fire started and where it extended, e.g. State forest, private property, National Park, etc.

Circumstances of the fire, i.e. a close approximation of the time the fire started. The source of escape, e.g. from a burn, deliberate lighting etc., and notification of the escape given by the occupier with background information concerning the presence of the fire which may have led to the escape. Subsequent action to suppress the fire by Forests Department and others, and precautions (if any) taken by any party to prevent the escape of the fire. Sections of the Bush Fires Act or Forests Act, that in your opinion were infringed. In cases of suspected deliberate lighting, define the motive if possible. An estimate of Departmental cost involved in the fire to be followed by accurate figures as soon as possible.

Any proposed legal action by shire, property owner or other occupier that you have become aware of.

In circumstances of likely recovery action against the Department add your estimate of damage to the property involved e.g. fence posts, pasture, etc., burnt and the likely replacement costs.

There are a number of legal avenues open to the Department for recovering costs. The procedure in each case must be decided on its merits and requires consideration by Crown Law before any direct action takes place. Local action such as a direct

approach to shires or landowners for fire fighting costs is to be avoided except in circumstances where prior formal agreements on cost payments have been reached. The Department has, for example, formal agreements for fire fighting in certain Fisheries and Wildlife Department reserves on a recoup basis. Casual agreements for fire fighting may be entered into locally for reasons of urgency but recoups should be arranged through Head Office.

In the case of costs recouped by the Department as a result of legal action, only direct charges, i.e. wages and vehicle mileages or hours are admissable. When recouping costs other than as a result of legal action, overheads will be charged in addition to wages and mileage.

Salaries and officer transport will not be recouped when expended on investigation of fires within 3 km of State forest.

Forest officers must be most punctilious in the observance of all provisions of these Acts.

LIAISON WITH PUBLIC PRIVATE PROPERTY OWNERS AND OTHER ORGANISATIONS

Fire reduction
through
education

9.013 The most effective means of fire prevention is through education. The objective is to make everyone fire conscious, and to make the general public realise the value and necessity of fire control.

Taking the long view, special attention should be given to the training of the younger members of society. Children are more receptive than adults, the child in the classroom today can be the responsible citizen of tomorrow. Moreover, the child will take the doctrine of fire prevention from the schoolroom to the home. Every effort should be made by the forest officer to introduce the subject of fire prevention into the schools of his district.

Fire danger
signs

9.014 Posters advocating fire prevention should be displayed at places throughout the forest frequented by the public. Signboards showing the daily fire weather forecast are an effective means of educating the travelling public. The information on the board must be kept up to date, particularly when the forecast indicates extreme fire weather. Signs are to display fire danger as defined by the McArthur forest fire danger meter and the colours of these signs should conform to the following standard

Advice to Head
Office

If the local authority is known to be taking disciplinary action in any case, advice of this should also be sent to O.I.C. Protection Branch, Como without delay.

Legal Actions 9.012

Your attention is drawn to the need to provide a prompt, comprehensive and accurate report on all fires or accidents associated with fire control likely to involve the Department in action to:

Recover costs or damages from the Department, or

Recover costs or damages by the Department.

In either situation the OIC will:

- Provide immediate advice of the event to OIC Protection and Region.
- Initiate an immediate investigation by the most senior officer available.
- Follow-up with a comprehensive written report to OIC Protection and Region, no later than five days after the incident.

Rapid investigation and reporting is required to allow Departmental and SGIO assessors (if necessary) to gather evidence and appraise damage before the facts are obscured by the passage of time.

Report

The written report is to include the following information:

- Full name and address (for serving notices) of the owner or occupier of the land on which the fire burnt and details of property locations.
- Where the Department is plaintiff, full name and address (for serving notices) of persons(s) suspected of lighting the fire with a signed statement by them where possible.

*Pages
6, 7, 8, 9, 8b.
INSERTED
SEPT 85.*

- Where the Department is defendant, full details of where the fire escaped or other explanations of what happened. In these circumstances reports are to be confined to statements of fact and are not to offer opinions or conclusions.
- Plan of the area showing origin of the fire, fire boundary and land tenure where the fire burnt.
- Circumstances of the fire or accident including the date, time of occurrence and when reported, source of escape (e.g. haystack), cause, initial action by occupier or plaintiff and Department, subsequent action, sections of Bushfires Act or other Acts infringed and costs incurred by the Department.
- Details of property damage and assessment of damage. When damage is extensive, the assessment will need to be carried out by the SGIO or other experts but should not hold up the report.
- Proposed legal action (by a shire or any other person) which is relevant to the incident and which is known at the time.

Legal Action Against
the Department

Where a fire lit by the Department escapes into private property or the Department carries out any other action which causes damage, it is possible that legal action to recover the cost of damages may follow.

There are definite constraints on negotiations between the Department's staff and the plaintiff to ensure the Department's legal position is not jeopardized. These are based on:

- The Department's public liability insurance policy with SGIO.

- SGIO's sole prerogative to decide the Department's legal liability for payment of claims under the policy. The company will make its own judgement on settlements and whether it is prepared to contest a claim in court.
 - Under no circumstances are staff and employees to make statements which can be construed as admitting liability by the Department.
- NB
- A claim for damages is unlikely to succeed in court unless liability can be proven.
 - Proof of liability depends on evidence of negligence or malpractice.
 - Negligence or malpractice is unlikely to be demonstrated if accepted practices (such as those set out in the manual for fire protection) have been implemented in a reasonable time and a responsible manner.

Staff and employees are not to make statements which can be construed as an admission inferring negligence or malpractice. In particular, they must not:

- Discuss circumstances of the fire or accident associated with fire control with the plaintiff or any other member of the public.
- Surmise, or in any way indicate to the plaintiff or any other member of the public, that procedures or precautions were not fully observed. These judgements remain the prerogative of the Executive Director and SGIO.

Dealings with the plaintiff will be restricted to the most senior officer available who may:

- Advise the plaintiff that the circumstances of the fire incident or accident associated with fire control have or will be reported to the Executive Director and SGIO;
- refer the plaintiff to SGIO in respect to the fire incident or accident associated with fire control.

**Legal Action by the
the Department**

If there is reasonable justification, the Department will undertake action to recover the costs for suppressing fires illegally entering or lit on forest land, where the culprit can be identified. The report must clearly set out the basis of justification for recovering costs.

There are a number of legal avenues open to the Department for recovering costs. (e.g. Section 58 Bush Fires Act). The procedure in each case must be decided on its merits and requires consideration by the Executive Director and Crown Law office before any direct action takes place. Local action such as a direct approach to shires or landowners for fire fighting costs is to be avoided except in circumstances where prior formal agreements on cost payments have been reached. The Department has, for example, formal agreements to fight fires in certain areas on a recoup basis. Casual agreements for fire fighting may be entered into locally for reasons of urgency, but recoups should be arranged through Head Office.

Cost of recovery action by the Department must not result in damage to its public relations and would be expected to provide a deterrent or warning effect.

A fire started with maliciousness or negligence must be weighed sensibly against the different circumstances of an honest mistake. The circumstances of the person involved must be considered. Cost recovery against an impecunious person is most unlikely to succeed and

may well appear to be persecution. In these circumstances some other deterrent action may be more appropriate.

In the case of costs recouped by the Department as a result of legal action, only direct charges, i.e. wages and vehicle mileages or hours are admissible. When recouping costs other than as a result of legal action, overheads will be charged in addition to wages and plant.

LIAISON WITH PUBLIC PRIVATE PROPERTY OWNERS AND OTHER ORGANIZATIONS

Fire reduction through education 9.013

The most effective means of fire prevention is through education. The objective is to make everyone fire conscious, and to make the general public realise the value and necessity of fire control.

Taking the long view, special attention should be given to the training of the younger members of our society. Children are more receptive than adults, the child in the classroom today can be the responsible citizen of tomorrow. Moreover, the child will take the doctrine of fire prevention from the schoolroom to the home. Every effort should be made by the forest officer to introduce the subject of fire prevention into their local schools.

Fire danger signs 9.014

Posters advocating fire prevention should be displayed at places throughout the forest frequented by the public. Signboards showing the daily fire weather forecast are an effective means of educating the travelling public. The information on the board must be kept up to date, particularly when the forecast indicates extreme fire weather. Signs are to display fire danger as defined by the McArthur forest fire danger meter and the colours of these signs should conform to the following standard.

Forest fire danger index	Forest fire danger index	Forest fire danger index	Forest fire danger index	McArthur Index	Colour	Code No.
SDI 0-200	SDI 200-500	SDI 500-1000	SDI >1000			
0-70	0-50	0-20	0-20	Low	Verdigris Green	280
70-100	50-90	20-70	21-40	Moderate	Arctic Blue	112
100-180	90-170	70-160	41-140	High	Canary Yellow	309
180-260	170-250	160-240	141-230	Very High	Traffic Yellow	368
>260+	>250	>240	>230	Extreme	Rail Red	593

The colour name and code number conforms with British Standards

Pamphlets 9.015 Pamphlets giving information concerning fire effects on the forest, provisions of the Bush Fires Act, etc., are prepared by Head Office and the Bush Fires Board from time to time, and should be distributed among local residents and settlers, by forest officers.

Personal discussions at the time these pamphlets are distributed are of considerable value. Alternatively, pamphlets may be sent with notification of intention to burn, etc.

Recommendations for the printing of new pamphlets and requisitions for supplies of pamphlets and posters should be submitted in April each year.

Departmental assistance for private property or vacant Crown Land Fires 9.016 When Departmental assistance is requested for suppression of fires which do not threaten State forest, timber reserves or land vested in the Conservator, the following policy will apply:

Assistance can only be given when it will not prejudice other Departmental commitments.

Assistance should only be given following a request through the Chief Fire Control Officer or, in the event of such officer not being available, through a responsible shire officer, Fire Control Officer or Bush Fire Brigade Officer. Requests from individuals will be discouraged in all cases except where there are breakdowns in communication within the rural fire organisation.

Recoup of costs Assistance as neighbour to neighbour should be the keynote of decisions to provide help. This assumes local fire brigades have been called upon for maximum effort. Circumstances will then decide where recoups are warranted.

Where a recoup is proposed, provide early advice of the details to Head Office.

Policy defined to shires This policy was clearly defined to shires in February 1971, and they were asked to disseminate the information to their communities through their own officers,

Advisory Councils, Fire Control Officers and Brigade Captains. Occasional follow-up should be undertaken by Divisional Officers and Regional Leaders to ensure continued community awareness.

Bush Fires Board
Liaison Officers

- 9.017 For large fires involving both State forest and private property, the Bush Fires Board will provide liaison officers to assist in co-ordinating the fire fighting efforts of Forests Department forces, Bush Fires Brigades and any other organisation helping to suppress the fire.

Liaison officers will be equipped with radios covering F.D. V.H.F. and brigade frequencies, and can provide communication to produce marked improvements in joint fire fighting operations. It is imperative that Departmental officers and employees are fully informed of the role of liaison officers and provide full co-operation.

Bush Fire
Brigades

- 9.018 Farmers outside the boundary of the forest should be helped and encouraged to form Bush Fire Brigades to combat fires likely to sweep in on the forest, and to assist in prescribed burning around the boundaries.

Isolated farmers living within the forest can often be incorporated in regular Departmental Gangs. Such association and training is of greater assistance to the farmer himself, than a policy of isolationism, and at the same time helps to augment our gangs. It is important that there be close liaison with the Bush Fires organisations, particularly at a local level. Meetings should be attended and every assistance given to the Shire Advisory Councils. Information concerning our past and programmed burning should be disseminated to them and arrangements made for mutual assistance and training when applicable. Good personal relations with Fire Control officers and Brigades is essential.

Burning of
lands other
than State
Forest

- 9.019 The Department undertakes prescribed burning of lands other than State forest on behalf of various organisations. Where formal arrangements have been made, it can be assumed the Department has been vested with the necessary authority to burn the area.

Where no formal arrangements exist, the Department or a forest officer has no legal authority to burn these lands without the written approval of the organisation concerned. This provision extends to areas of unvested vacant Crown land.

The area O.I.C. is required to check each year's burning programme and list reserves or areas vested in other organisations which should be included. The following information is to be forwarded each year, before the 1st August, to

the O.I.C. Protection Branch, Como, who will arrange the necessary approval:

Reserve number (if applicable) and area to be burnt;

Owner or occupier of the reserve or land;

Map reference for the reserve or land;

Proposed season for burning;

Reason for burning.

Burning road verges

Approval for burning road verges under the control of the Main Roads Department will be arranged as described above.

For road verges controlled by shires, the area O.I.C. will be responsible for obtaining approval to burn from the shire concerned.

Public warnings

9.020 The need to publicise the locality of extensive aerial burns for the sake of travellers, surveyors, fishermen etc., cannot be over-emphasised. Prior to burning operations, advertisements are to be placed in local newspapers and warnings arranged over public radio stations on the morning of each burn. Maps showing proposed aerial burning will be forwarded to S.E.C. and Metropolitan Water Supply Sewage and Drainage Board (M.W.S.S.D.B.) and Beekeepers' Association by Head Office.

Road signs

Road signs warning the public shall be erected on roads around or within areas to be burned as follows:-

"Burning Imminent" signs placed three or four days before aerial burn.

"Prescribed Burning" signs placed from the start of all prescribed burns until patrol work ceases.

A list of fire control signs available through O.I.C. Protection Branch is given in Prescription Section.

All warning signs must be removed as soon as their purpose has been achieved.

Specialist Officers

9.021 Specialist officers in research, working plans, soil surveying etc., are to check burning programmes for their areas of operations. Where burns are programmed in these areas, specialist officers will be responsible for checking burning programmes daily with the local Divisional Office to ensure the safety of their staff.

Safety of persons and property during prescribed burning and notification to neighbours

9.022 Each prescription is to be accompanied by PAFSOU form FD 659 which specifies notifications and field checks to ensure the safety of property and persons during burning. This form must be strictly observed.

The Department is required to observe provisions of Section 18 of the Bush Fires Act providing

notification to neighbours of intention to burn. Notifications are to be given in writing on form FD 243 at least four days before the burn, and dates for burning specified on the form are to be not less than 4 days or more than 28 days from the date of the notice.

- Notification to beekeepers 9.023 In order that beekeepers can plan their operations and protect apiary sites, the area O.I.C. must ensure that individual beekeepers affected by the burning programme are adequately forewarned. Written notifications on FD 622 are to be forwarded before 31 August for spring burning and before 31 January for autumn burning.
- Westrail locomotives 9.024 It is the policy and practice of the Railways Commission to fit all Westrail locomotives with spark arresters during the summer months. Forest officers have no authority to stop or inspect any Westrail locomotive suspected of being faulty, however, officers must maintain close liaison with local Westrail officers in all matters of fire prevention.
- Any fire having been lit by a Westrail locomotive should be reported immediately to O.I.C. Protection, Bunbury, with the following information:
- Number of the locomotive
 - Locality
 - Date and time
 - Direction of travel
 - Any other relevant information
- S.E.C. and Telecom 9.025 To minimise the risk of fires from powerlines, close liaison with the S.E.C. must be maintained in all matters of fire prevention.
- Where a fire has started from or threatens a powerline, the S.E.C. must be notified immediately.
- Extreme caution must be exercised when fighting fires in the immediate proximity of powerlines.
- High tension powerlines The locality of all Telecom and S.E.C. lines in State forest and other areas where the Department is carrying out prescribed burning must be recorded on plans for easy reference when programming burns. Where lines are not adequately protected, the organisation concerned must be given ample notice of proposed burns, as this Department may otherwise be held responsible for damage.
- Any accident or incident concerning H.T. powerlines is to be reported immediately to the nearest S.E.C. office, Regional Leader and O.I.C. Protection Branch.

Burning around schools etc.	9.026	<p>Protective burning should be carried out in the forest surrounding permanent settlements and associated buildings such as schools, etc.</p> <p>Details of any school or other government buildings not adequately protected must be forwarded to the area O.I.C. for advice to Head Office, so that the Departments concerned can be advised of the position.</p>
Recoup of costs		<p>Where special protective burning is done at the request of a government department or other organisation and costs are to be recouped O.I.C. Protection Branch will issue a Recoup Works Order. The area O.I.C. will be responsible for ensuring costs for such burns are accurately recorded and returns are forwarded promptly to Protection Branch at the end of each financial quarter.</p>
Mill villages and townships	9.027	<p>For the protection of mill villages and townships against the danger of loss of life or material damage from uncontrolled forest fires, the area O.I.C. should prepare details of any precautionary measures considered necessary and discuss them with the respective mill managers or shire clerk, or local Bush Fire Control Officer in the case of townships.</p> <p>Around each mill, town or settlement in the forest, it will be necessary to select or construct tracks to facilitate provision of a burnt buffer around the settlement at least 1000 m deep from the perimeter.</p> <p>It is of great importance to the economy of the State that the risk of damage or destruction of sawmills by fire be reduced to the absolute minimum, and the prescribed burning programme must ensure that mills are protected from bush fires. Occasional fires may arise in the grounds of mill towns and action should be taken in conjunction with the mill management to reduce the hazards responsible.</p>
Responsibilities of sawmill owners		<p>The area O.I.C. is to ensure sawmill owners comply with fire control provisions of the sawmill permit document and that all sawmills conform to requirements under Section 25.1(g) of the Bush Fires Act.</p>
Sawmill employees		<p>Timber industry employees and mine workers in the forest form a considerable body of men who should be available for fire control.</p> <p>The local forester should make it his business to encourage interest in the protection of the forest. Selected men from large towns in the forest can be a potential source of auxiliary manpower.</p> <p>Every possible precaution must be taken to ensure that all forest settlements are safe from damage by forest fires. This is the direct obligation of the O.I.C. of the settlement, who should draw the attention of</p>

his area O.I.C. to any cases of exceptional hazard or risk.

SERVICES AND ADMINISTRATION

Fire prevention 9.028

Fire prevention, a most important branch of fire control, can be divided into the following:

Risk Reduction -

- (a) General provisions
- (b) Education
- (c) Law enforcement

Area O.I.C. to examine fire causes

A study of fire causes is of value as an indicator of possible points of attack in the campaign against future outbreaks.

Area O.I.C.'s should examine local fire causes and occurrence annually to determine where prevention emphasis is needed.

The percentage incidence of fires from various causes, throughout State forest, over the years 1970 to 1977 is as follows:

<u>Cause</u>	No. of Fires	% of Total
Deliberately lit by members of the public	387	21.9
Escapes from private property	265	15.0
Unknown	246	13.9
Escapes from prescribed burning	204	11.5
Lightning	130	7.3
Children	127	7.2
Travellers	118	6.7
Other causes e.g. SEC powerlines	67	3.8
Hunters, fishermen	55	3.1
Mill surrounds	39	2.2
Tractors, machinery	32	1.8
Other government employees	29	1.6
Westrail locomotives	27	1.5
Firewood cutters	14	0.8
Householders	10	0.6
Bush workers	10	0.6
Mine surrounds	<u>9</u>	<u>0.5</u>
	1,769	100.0

The statutory body for formulation of the Bush Fires Act is the Bush Fires Board, of which the Forest Department is a member.

Planning for divisions fire control

9.029

This Department should co-operate with the Bush Fires Board in developing and implementing district fire plans and hazard reduction schemes.

In the implementation of this policy it has been found necessary to divide the forest into three zones indicating the degree of fire protection by forest values. Threats to life or property could override forest values.

"A" Zone

"A" Zone : This will comprise all country on which fires will be attacked as soon as they become known. Included will be regenerated or planted forest as well as the greater part of the prime forest. Within this zone there will be a proportion of sub-marginal forest, unforested country and private property where fires pose a direct threat to high-value areas.

"B" Zone

"B" Zone : This will include forest on which protection is provided by prescribed burning and where suppression of uncontrolled fires may be delayed when commitments on Zone "A" or "B" require the postponing of immediate attack. Certain areas of private property adjacent to State forest will be included.

"p" Zone

"Priority" Zone : This will comprise areas on which exotic or indigenous species have been established, areas cleared or part-cleared awaiting planting, areas under regeneration, paired catchments or other nominated areas. Where necessary a protective buffer should be provided, not less than 1 km in width.

"Priority" zone fires will be attacked as soon as they become known. They will be given precedence for fire attack and will be defined for planning and fire suppression action. Despatch action for each of these areas will be detailed in Divisional standing orders under the title of Red Action Order (see Prescription Section).

The boundaries of these zones will be reconsidered annually by the area O.I.C. and where necessary, will be revised after discussion with the Regional Protection officer.

All fire reports dealing with damage to the forest will refer to the area in terms of these zones.

Detailed fire organisation responsibility of area O.I.C.

The Forests Department's organisation covers a large area and a wide range of activities. It therefore must train, organise and prepare for periods of extreme effort. The detailed organisation of fire control within Divisions is the responsibility of the area O.I.C. or other officers in charge and the Regional Leader (Operations). Officers of the Protection Section and the Fire Research Officer are available to help with planning of pre-suppression measures and maintenance of standards in all fire control operations.

Fire duties associated with position rather than with rank

Within such organisations, the clear definition of duties and responsibilities is emphasized. These definitions and responsibilities are laid down in this part of the manual and all officers must clearly understand that such duties are associated with the position rather than the rank of the officer.

For example, where the duties of an area O.I.C. are defined, it follows that in his absence, even temporarily, such duties pass to the officer acting in that position.

Divisional fire officers

To increase effective liaison between Divisions and Protection Branch, one competent and trained field officer is to be selected in each Division and allocated responsibilities for ensuring proper standards are maintained in fire control. This officer will be responsible to the area O.I.C. of Division for maintaining standards laid down or acceptable to Protection Branch.

Fire control checklist

The nominated Divisional Protection Officer and area O.I.C. will be responsible for reviewing and updating fire control procedures at the commencement of each fire season using the checklist provided.

The work of fire control falls into three main categories:

Fire Prevention

Fire Pre-suppression

Fire Suppression

Fire Control Working Plans

9.031

All Divisions must prepare Fire Control Working Plans. These Working Plans will give regular local checks, of the general organisation within other Divisions. They will also provide officers from other Divisions, relieving in an emergency, with a quick reference to available manpower and equipment, and to the general situation concerning prevention and pre-suppression measures in the Division concerned. Fire Control Working Plans are required at Division, Region and Departmental level. They are to be prepared according to specifications in the Prescription Section and updated each November.

FIRE WEATHER FORECASTING

Distribution and Areas

9.032

Weather forecasts are distributed directly from the forecasting service via the Departments computer network daily at 0745 hours, 1015 hours and 1615 hours during the fire season. In early spring and late autumn there will be a period during which forecasts will only be delivered for the following day after a request prior to 1630 hours.

Divisions will be advised of these periods.

Points for which forecasts are supplied will change from time to time. The current situation will be shown on the 1:500,000 plan -

FORESTS BLOCKS OF THE SOUTH WEST
WEATHER FORECAST AREAS ("DATE")

distributed to Divisions. This plan also shows:

- (i) The grid reference to be used for requesting spot forecasts
- (ii) Approximate application boundaries of the point forecasts supplied.

The 0745 forecast must be obtained by all Divisions each morning. Should Divisions not be able to receive the forecast from the computer network they must obtain it by telephone from a neighbouring Division. Where total computer failure occurs Como will distribute the forecasts by radio.

In addition to the area forecasts distributed on a daily basis at 0745 hours, 1015 hours and 1615 hours spot forecasts will be available for prescribed burning operations or running fires. They will be provided by telephone from the forecasting service on request. The location for which the spot is required must be defined by the Grid reference on the Weather Forecast Area plan.

Weather
Observations
Required

To assist the preparation of and verification of forecasts selected weather observations will be required at 0700 hours, 0900 hours and 1500 hours from stations nominated at the commencement of the fire season by the O.I.C. Protection Branch.

F.D.I. to be
calculated

The Fire Danger Index should be calculated for each major forest type in a Division using the 0745 hours forecast and updated with the 1015 hours amendments. This will provide the basis for all fire control planning and should be displayed prominently at Headquarters.

The local fire danger must be calculated for each fire at the time it is reported.

S.D.I. to be
calculated

Soil Dryness Index must be calculated at Divisional Headquarters and used for planning operations such as prescribed burning. The limits to be observed are :-

Recommended SDI	Burn Type and Fuel Type
50 - 180	Top disposal Pine burning Flats burning
80 - 250	Jarraah edging
120 - 500	Nth Jarraah prescribed burning
160 - 550	Sth Jarraah, Karri 3 & 6 prescribed burning
200 - 600	Karri 4 & 5 prescribed burning
300 - 700	Karri 1 & 2 prescribed burning
500 +	Karri regeneration burns

Officers should ensure they are conversant with and able to interpret the effects of weather on fire behaviour. This is to ensure all days suitable for prescribed burning are utilised and suppression operations are conducted with safety and efficiency.

Factors affecting fire behaviour

9.033 Fire behaviour characteristics, including intensity and rate of spread, are controlled by weather, fuel and forest conditions.

Past weather - rain and drying conditions.

Present weather - temperature, relative humidity, wind.

Fuel - quantity, moisture content, type, distribution.

Forest - density, height, species, understorey scrub.

Topography - slope and aspect.

Forest fire danger tables

The Forest Fire Danger Tables are provided as a basis for prediction of fire behaviour. Predictions from Table C assume level topography, 60 per cent crown cover and standard fuel quantities for each forest type e.g. jarraah seven to nine tonnes per ha. They also assume lateritic soil type and 10-20% low scrub. Variations from these standard conditions must be given due allowance when predicting local fire behaviour.

A fire burning up a slope or with a wind blowing rapidly assumes a long oval shape and has three distinct parts:

- The head fire;
- The flank or side fire;
- The tail fire.

The head fire is the most forward portion of the fire, usually narrow, travelling fast and very hot. It causes the greatest damage and, if possible, must be controlled first.

The flank fires spread more slowly but have greater length and can rapidly develop into head fires with change of wind or topography. One side is usually more dangerous than the other due to weather trends, topography or threat to high value areas, and this dangerous flank must be controlled simultaneously with the head fire or very soon after it.

The tail fire is normally controlled last, but must on no account be entirely neglected.

COMMUNICATION SYSTEM

9.034 Effective means of communication are vital, not merely in fire control but in the successful administration of the Department.

There are five "legs" to the communication system for fire control.

1. Aircraft or lookout to Headquarters;
2. Headquarters to fire gang;
3. Fire gang back to Headquarters;
4. Point to point around the fire;
5. Fire to aircraft for reconnaissance information.

Aircraft
radio

Spotter aircraft are equipped with radio telephone for communication with Divisional officers and with VHF for around the fire communication. Spotter VHF radios are equipped to act as mobile repeaters in emergencies.

Communication
systems

Tower communication to Headquarters will be by telephone line or radio-telephone. VHF radio should only be used when there is no alternative. The second, third, fourth and fifth legs will normally be by VHF radio. However, when a major fire organisation is instituted, either telephone, HF radio or an alternative VHF channel must be established for the third leg, to spread the communication load.

Radio
messages

In all cases where radio is used, messages must be kept concise and traffic kept to an essential minimum. The men selected as runners or messengers must be reliable and intelligent.

Portable
repeaters

Where the use of radio from point to point around the fire proves to be difficult, portable repeaters and portable radios are available through Radio Branch.

Full details of radio procedure are laid down in the Foresters' Manual - Radio Communications and every officer must be conversant with the subject matter of the orders.

It is the area O.I.C.'s duty to see that his lines of communication are functioning efficiently. Every failure must be investigated as soon as possible and the fault rectified.

Before the spring burning season commences, the area O.I.C. must arrange a thorough maintenance of all communications systems.

If an L.F.O. is called, the Controller must consider calling for a Communication Branch technician to be

available to service radio equipment operating on the fire. These requests are to be made direct to O.I.C. Communication Branch.

DETECTION SYSTEM

Detection required when FDI greater than 20

9.035

Early detection and accurate location of fires is paramount to successful fire suppression. The main detection system is provided by spotter aircraft. Adequate tower or aircraft coverage is to be maintained when FDI is greater than 20.

Spotter aircraft

The Department employs managers, pilots and aircraft to cover surveillance circuits between Walpole and Mundaring.

Managers

The Managers will arrange for the supply and maintenance of aircraft, supervision, and initial training and rostering of pilots. They will also ensure the provision of ancillary supplies, e.g. fuel, and assist in maintaining and improving detection standards.

Responsibilities of Regional Leaders and area O.I.C.s

The regional Leaders and area O.I.C.s have the prime responsibility for ensuring proper functioning of the detection system, and that standards are maintained. Area O.I.C.s will be responsible for day to day supervision of pilots covering the Division circuits and ensure that pilots are properly briefed and daily work sheets completed. In conjunction with Protection Branch officers, the area O.I.C. of each Division is to draw up a training programme for pilots to ensure field aspects of fire control are covered.

A competent field staff officer from each Division, operating spotter circuits, is to accompany each pilot on a flight at least once a week to confirm smokes are safe, to point out hazardous areas to the pilot, and to provide on-job training in detection standards for the pilot. The area O.I.C. is to ensure field staff are trained in aerial detection systems and familiar with the operations manual for pilots, the spotter aircraft and its equipment.

Bases for spotter aircraft will be nominated before commencement of the fire season. Area O.I.C.s are to arrange pilots' accommodation in Forests Department houses or single quarters, and to arrange basic furniture (beds, wardrobes, table, chairs, refrigerator) where such facilities are not already available. Details of the number of pilots to be accommodated at each base can be obtained from the Managers.

Rental will be paid by pilots for their accommodation as specified by O.I.C. Protection Branch.

Area O.I.C.s are to ensure airstrips are in good condition before commencement of the fire season (i.e. graded where necessary, approaches and verges cleared, and windsock fitted), and to assist with day-to-day operational requirements during the season e.g. arranging fuel cartage, maintaining records of pilot and aircraft hours for the Managers and providing follow-up training for pilots.

Pilots

9.037 Spotter pilots - Payment of Wages and Allowances:

Pilots will be employed under contract to the Department and payment of wages, travelling allowances etc., will be in accordance with the Pilots' General Aviation Award.

Where pilots are based area O.I.C.s will be responsible for ensuring payment of pilots' wages.

Pilots' wages will be paid fortnightly (with other employees) utilising the existing system for payment of employees' wages, time sheets, local cost orders, etc. Time sheets can be simplified as pilots will be paid a fixed fortnightly wage and the only deduction will be for taxation.

Pilots' fortnightly wage will be determined under the Award according to previous fire spotting experience. The Manager will advise the rate to be paid for each individual pilot, and thereafter Divisions will automatically pay the pilots each fortnight until completion of service.

Payment of travelling allowance and other entitlements under the Award will be made by Head Office. Pilots will submit claims on PS 10 for verification by the Managers before payment is made.

The area O.I.C. is to appoint an officer within the Division to be responsible for ensuring payment of pilots' wages, including preparation of time sheets.

Pilots' wages are to be costed against Item 00.17.531 for fire spotting and against 00.17.535 for dieback patrol.

Pilots should be shown as "pilot contractors" on FD 394.

Search and rescue watch

9.038

The area O.I.C. is responsible for ensuring a Search and Rescue (S.A.R.) watch is maintained whenever an aircraft is working on the Department's Operations in the Divisions' area. The pilot will call on taxiing from the airstrip, take-off, landing approach, after landing and at half hourly

intervals during the flight, giving "operation normal" and position. These calls are to be acknowledged and recorded in a daily log book by the Division concerned.

Tower maintenance

9.039

Towers are to be maintained and the area O.I.C. shall arrange the inspection of all towers to ascertain what repairs are necessary and to see that the area around the tower is clear of debris.

He shall see that equipment for key towers is installed and working at the beginning of the fire season. In the case of small articles, they shall be available in the Divisional Office.

Tower to be inspected

He shall arrange for towers to be visited at regular intervals, and any officer carrying out an inspection should satisfy himself that all equipment is being correctly handled and cared for and the tower log book properly maintained.

Inspecting officers should initial the log book on the day of their visit.

Tower equipment

The equipment required in the tower is shown in Prescription Section.

Selection of Towermen

Prior to the need for the manning of towers the area O.I.C. shall make sure the towermen are available when required.

The area O.I.C. must make sure that he has an efficient towerman and should take some trouble in teaching him the requirements of the job and the layout of the country he is to guard.

Towermen should possess the qualifications set out in Prescription Section and should be tested for them.

PRESCRIBED BURNING IN HARDWOOD FOREST

All areas of hardwood forest which do not require complete protection will be burned systematically by fires of prescribed intensity.

Types of prescribed burning

9.040

There are six types of prescribed burning that are standard practice:

Buffer burning of strips or firebreaks around areas of high risk - that is, to contain fires in areas where they frequently start or occur more or less regularly, e.g. external boundaries, railway lines, main roads, and certain areas of private property.

Buffer burning of strips or firebreaks around areas of high value - that is, to keep fires out of places such as sawmills, schools, townsites, isolated settlements, plantations, research areas, regeneration, etc.

Prescribed burning of large areas on a rotational system. The length of rotation will depend primarily on the rate of fuel build-up together with seasonal weather, manpower availability and other local circumstances.

Advance burning - prior to logging operations.

Slash burning, for regeneration or hazard reduction, following logging operations.

Burning under pine canopy for the purpose of subdividing extensive plantation areas to minimise loss in the event of wildfires.

Areas to be protected 9.041 Except for those areas where specific approval for burning has been obtained from Head Office, complete protection will be afforded to:

Pine and hardwood plantations.

Karri tops or scrub-rolled areas being held for regeneration burning and areas programmed for cutting within three years

Regenerated karri areas where crop saplings are less than 15 m tall.

Regenerated jarrah areas where crop saplings are less than 6 m tall.

Areas required for research and investigation.

ROTATIONAL PRESCRIBED BURNING

Master plans 9.042 Area O.I.C.'s must draw up prescribed burning master plans. These plans will show:

Hardwood areas which will be burnt as buffer areas.

Hardwood areas for prescribed burning on a rotational basis for protection of timber, flora, fauna or recreational values. Rotation length should depend on the average rate of fine fuel accumulation for each forest type, unless defined management objectives dictate otherwise for a particular area. As our suppression organisation can be expected to handle wildfires in fuels up to eight tonnes/ha in jarrah fuel types and up to 19 tonnes/ha in karri fuels, this should generally be used as the criterion to decide rotation length.

The prescribed conditions for burning an individual area will be decided by the primary land use objective for that area. Where timber values and preservation of flora and fauna are paramount, the following limits will apply:

Standard for prescribed burning 9.043 (a) Management Priority Areas and other areas where primary land use requires mild prescribed burning.

Jarrah Forest:

Burning cover in the range 60 to 80% with minimal crown scorch to crop or potential crop trees.

Karri Forest :

Burning cover in the range 60 to 80%. Up to 10% scorch in small clumps or individual crop trees.

Flats :

Burning under mild conditions only to give a mosaic pattern with 40 to 60% cover.

Poor Quality Forest :

Burning cover in the range 40 to 60% carried out under mild conditions.

- (b) Wherever possible, planning must aim to use aerial ignition techniques and be designed for aircraft ignition.
- (c) Where more intense fires are specified for management objectives, the desired fire intensity and level of acceptable crown damage must be defined in the prescription.

Annual burning
plan and
notification to
Protection Branch

The area O.I.C. shall draw up a current burning plan each year setting out the proposed programme. He should also ensure that environmental conditions can be met by completing FD 713 for each job.

All hardwood burning (hand and aerial) proposals are to be shown on a 1:50,000 plan with job numbers and areas. These plans will be used to provide :

- (a) Detail to the Department of Agriculture for the benefit of beekeepers.
- (b) Protection Branch with records.
- (c) Mapping Branch with necessary information for the preparation of flight plans.

These will be submitted, after vetting, by the Regional Protection Officer and the Regional Leader, to the O.I.C. of Protection Branch by the following dates:

Hardwood - 15 May
Plantation - 15 March

Prescription and preparation for burns in hardwood forest susceptible to dieback disease must be completed before 1 March, during the dry summer months, to maximise hygiene.

Prescriptions
to be prepared
for all burns

9.043 A prescription is to be prepared for all burns whether hand, aerial, karri regeneration or clearing burns. Job specifications have been prepared describing the methods of fuel sampling and proper recording for the prescription form, i.e.:

FD 655 for hardwood

FD 574 for burning under pine canopy

FD 657 for clearing or regeneration burns

Where applicable, burning prescriptions are to include constraints on vehicle movements and wash-down to prevent the spread of dieback. These specifications should cover each phase of the operation, i.e.:

Preparation of boundary roads

Edge burning

Main burn and mop-up

Prescription
to ensure
protection
from damage

9.044 When the inspection and prescription are being prepared for each prescribed burn, every object, operation or establishment within the area which may suffer damage must be identified and action taken to ensure protection. The position of anything liable to be damaged must be recorded on the inspection form so that protection is not overlooked, see PAFSOU and Environmental Check List forms.

Bush Operations

Identify the precise location of sawlog, pole and firewood operations and relate them to prescribed burning plans. Advise the operators of burning to be carried out near the site of their operations or on their access routes. Plan and take precautions to avoid damage from the prescribed burn or from "hop-overs".

Dieback
quarantine
area

9.045 In dieback quarantine areas road preparation will be restricted to log removal and slashing or brushing litter from spatially safe road surfaces. No grading is to be carried out in these areas without the written approval of the Regional Superintendent.

Type of
burning
prescription

9.046 The fire intensities prescribed for each area will be determined by the primary land use objective for that area. Normal prescribed burning will be carried out in the FDI range of up to 40 metres per hour (m/hr).

The application of more intense fires for special management objectives (e.g. regeneration of Acacia thickets for dieback control) may be prescribed after vetting by The Regional Protection Office and Regional Leader.

Hardwood prescriptions

9.047 Prescriptions for hardwood burning will be based on 1:25,000 scale API plans.

Preparation of hardwood prescriptions should follow guidelines set out below:

Use the API plan for separating each job into similar forest types based on species, height and density.

Examine cutting records to determine top disposal requirements, sapling age, likely height of regeneration and changes to canopy density since aerial photography. In karri forest proposed cutting will be noted. Where top disposal cleaning is necessary it is to be shown in the prescription and works programme.

Records of past burning will be used to identify the number of leaf falls since the last burn and whether it was patchy or clean.

From the number of leaf falls and canopy density, fuel quantities are estimated from fuel accumulation tables.

Inspect sufficient check points to confirm the predictions of fuel type and weight, and height of potential crop tree regeneration. Record scrub type, density and height. Techniques for assessing fuel quantity are available from fire research. Note topography.

See job specifications "Measurement of Forest Fuels".

The prescription must nominate the fire danger index and number of lightings for each job.

Number of lightings will be decided from range of forest types and fuel quantities in the area. Where fuel quantity range is sufficient to introduce a variation in FDI of 10 m/hr or more, two lightings should be prescribed. The fire danger index prescribed for any one lighting should be within a range of 5 m/hr.

As a guideline:

Flats should be burnt at FDI	11 to 16 m/hr
Saplings over 5 m in height	12 to 17 m/hr
Poles and mature trees	20 to 25 m/hr
Mature trees	30 to 35 m/hr

Environmental controls to be observed

9.048 The area O.I.C. is to ensure prescribed burning conforms with required environmental standards, i.e.:

Strips fronting onto major tourist routes and surrounding tourist attractions are not burnt during the main floral display of the wildflower season.

Prescribed burns, and particularly aerial burns, in the vicinity of major towns or airstrips, should not be carried out unless weather conditions are suitable for proper smoke dispersal, and the Department's smoke prediction services consulted to ensure heavy fuel accumulations do not occur in key areas.

Appropriate warning signs must be set up without fail where smoke is likely to impair visibility for road traffic through forest area.

Burning on
water
catchments

Large-scale aerial burning of the slopes adjacent to holding dams and reservoirs for MWSSDB may result in contamination of stored water by ash, particularly when water levels are low. Clearance for any such burn should be obtained from the O.I.C. Protection Branch before they are implemented.

Fauna
habitat

For fauna refuges it is important that swamps are patch burnt and left in an uneven-aged condition. Patch burning of swamps can normally be achieved early in spring, providing special lightings are not undertaken later in the season to ensure they burn out. Special burning of swamps should be avoided unless they pose problems in perimeter control.

Records of
prescribed burning

9.049 The area O.I.C. is to ensure proper records of prescribed burning are maintained.

Overseers or officers directly in charge of burning operations must daily mark on the plan in the Divisional office the area considered to have been burnt. These areas will not be finally 'washed in' on the Divisional burning plan until they have been inspected and burn quality verified.

A summary of burning is to be prepared on a weekly basis during the restricted season. This summary is to be forwarded to O.I.C. Protection Branch at 1100 hours each Monday morning, or the first working day for the week. The summary is to show:

Progressive total area of hand burning for season (ha).

Progressive total area of aerial burning for season (ha).

Burning plans must be updated daily during the restricted season to show progress of burning by settlers or other organisations in land adjoining forest estate.

GENERAL PROVISIONS

- No burning without firebreaks 9.050 An area prescribed for burning must be completely enclosed by firebreaks and cleared to mineral soil at least 3 m wide or by a safe edge as approved by the area O.I.C. Such firebreaks will usually be roads or firelines, but may be fuel moisture barriers in mixed forest types. In the latter case, the burn must be completed at the earliest opportunity and should take precedence over any new job. Care should be taken to ensure grass is removed from firebreaks adjoining private property (p.p.).
- Area to be burnt out in one day 9.051 The area so enclosed must be completely burnt out before the following day, except where multiple lightings have been prescribed. No fire should be running out of control on the second day even "inside" the burn.
- Leeward edge safe 9.052 Under all circumstances and by whatever method an area is burnt, the officer in charge must ensure that the leeward edge is safe before proceeding with the remainder of the burn. Expensive mop-up and control of "hop-overs" along this edge are to be avoided through proper use of early edge burning.
- Conditions for edge burning 9.053 To strengthen roads and firelines acting as boundaries of a burn and avoid time-consuming mop-up and patrol, edging is allowed in late autumn, winter and early spring when subsequent weather will not allow the edge burn to flare up and continue running. Re-ignition is unlikely and edging reasonably safe whilst the Soil Dryness Index is under 300.
- Local fire danger should not exceed twenty metres per hour, and unstable conditions ahead of lows and fronts associated with strong and gusty north-westerly winds should be avoided. Flame throwers may be used but operators must be trained in the method of lighting, i.e., when to spot, when to use continuous lighting and when to stop lighting. The area within edging burns must be burnt out before the summer to prevent uncontrolled fire damage. Dieback hygiene requirements must be strictly observed during edge burning operations, especially in early spring.
- Control of scorch 9.054 The design of large-area burning should take into account all information and experience so that levels of scorch are maintained within prescribed limits. The prescribed limits will be decided from the condition and height of the youngest crop stems. These must not have their crowns fully scorched. The scorch height is correlated with the flame height and rate of fire spread. More intense burns may be undertaken where management objectives specify and the burn has been discussed with the Protection Officer.

Index table	9.055	The area O.I.C. must select the day on which weather and fuel conditions will give a rate of spread and flame height maintaining scorch within the prescribed limits and yet satisfactorily reduce the hazard over a high proportion of the area. To guide this selection all prescriptions must be summarised in an Index Table. It should list each job number and the fire danger prescribed for burning.
Job selection from 0745 hrs forecast	9.056	Selection of daily jobs must be based on the 0745 hours fire weather forecast. Local values for rainfall, wind, temperature and relative humidity should be used for calculating local fire danger. Operational spot forecasts are available on request.
1015 hrs check	9.057	The daily check of actual conditions at 1015 hours is to be the criterion for implementing aerial prescribed burns. This check is to be based on temperature, relative humidity and fuel moisture content at the site of the burn and wind strength and direction from adjacent towers to nearby headquarters or field meteorological stations. Any queries on the forecast should be referred to Protection Branch, Como or the meteorological service employed by the Department. The "forecast" local fire danger index must match that prescribed before a job is programmed for lighting.
Lighting technique to be employed	9.058	The officer or overseer in charge at the burn must then calculate the least amount of fire he is able to put into the area to ensure that it will burn out in the available time, on the day.
Detection during burning	9.059	Detection and weather stations which give adequate coverage and weather data must be manned while prescribed burning is being carried out.
Heavy duty at burns	9.060	A heavy-duty outfit must be taken to every burn except where otherwise directed by the area O.I.C.
Mopping up	9.061	The perimeter of prescribed burns must be mopped up to the standard set out Fire Suppression section (9.105). The Senior Forester Protection may approve a lesser standard of mop-up where the burn perimeter is adjacent to recently burnt fuels less than 2.5 tonnes/ha.
Patrol of burn edges	9.062	Patrol must be regarded as a very important duty. The officer responsible for the burn should also be responsible for the final patrol of the edge. It is essential that subsequent patrols are carried out daily until the edge is completely safe. Foot patrols may be necessary to check for dangerous burning trees likely to affect roads, railway lines, walking trails, etc.

The frequency of patrol and length of time for which it is continued should be decided after accessing the risk of breakaway, i.e. by considering adjacent fuel, conditions of the fire edge, width of break and weather conditions.

Daily burning properly recorded

9.063 Area O.I.C.s must see that the day to day work of prescribed burning is properly reported and recorded.

Assistance to adjoining landholders

9.064 There is no objection to assisting adjoining landholders in burning breaks, either on their own property or on adjoining State forest, timber reserves or land vested in the Conservator. In many cases, this assistance is most desirable and it may be necessary for the area O.I.C. to roster settlers' burning, ensuring that there is not an excessive number of fires burning simultaneously.

Landholders' responsibilities

The settler's responsibilities must be clearly understood and impressed upon him. Burning must only be done on private property following receipt of a written request. The landholder must be in attendance and should at least commence the lighting. He must understand that future patrol is entirely his responsibility.

FCO to attend burning in Crown Land

9.065 Similarly, a Fire Control Officer or a Bush Fire Brigade Officer must at least commence the lighting where Departmental personnel are assisting shire councils by burning Crown Lands (other than forest land) at the shire's request. It must be remembered that a forest officer has no legal protection when burning on other than forest land unless written authorisation is obtained from the occupier and permits have been obtained.

Notification to land holders

9.066 When a break is burned in State forest, timber reserves or land vested in the Conservator, which adjoins private property, the landholder should be notified of the time of the burn, irrespective of the time of the year, to maintain good public relations.

When a request is received from a settler for assistance in carrying out any form of burning, it should be acknowledged in writing, stating the settlers' obligations.

When any burning is to be carried out by the Department within 3 km of private property during the "restricted period" (See Bush Fires Act), notice of our intention to do such burning must be given on Form FD 243 to all adjoining landholders as required by the Bush Fires Act.

Air Transport Group Regulations

9.067 The Department of Transport: Air Transport Group requires that approval be obtained from private property holders where aircraft operate above their holding at heights below 600 m. The Form FD 562 should be used for this purpose where private properties are close to aerial burning operations.

We are looked upon as the main exponents of fire control and it is essential that all forest officers be most careful to comply with the provisions of the Bush Fires Act.

- Advance burning 9.068 In principle, advance burning aims to minimise the fuel hazard when fire risk is markedly increased by trade operations, and to protect the operators and equipment.
- Not usually necessary in jarrah In jarrah forests where rotational prescribed burning is applied, the fuel quantity is not likely to exceed 7 t/ha at the time of cutting, and advance burning is only warranted when heavier fuels exist. The rotational burn may be advanced or postponed a year to minimise risk.
- Undesirable in karri Karri forest. The advance burn, which is standard practice in jarrah forest, has been discontinued in karri forest where its advantages are outweighed by detrimental effects such as :
- (a) the difficulty of securing a uniform burn without scorching of canopy and damage to buds and blossom, or release of seed which should ideally remain on the tree until after logging;
 - (b) adverse affect on the regeneration burn which becomes discontinuous and may destroy seedlings developing from the advance burn;
 - (c) dense establishment of fire weeds which inhibit development of karri.
- Plantations (Refer to 9.088)
- Top disposal burning 9.069 Burning of tops is carried out to reduce fine fuel hazard and to dispose of as much limb wood as possible. It may also be essential for regeneration.
- Jarrah tops Burning of jarrah tops must reduce fine fuel and heavy wood effectively. Tops must be held unburnt for at least two summers after cutting so that large wood has dried. The burn should be undertaken in late spring or autumn after a dry spell and in weather conditions which prevent damage to retained trees. As the leaves will have fallen from the tops after two years, the burn may be combined with rotational hazard reduction work giving due consideration to heavy fuels present. The tops may be held an extra year or the rotation burn varied the length of a year to achieve this combination and reduce costs.
- Karri tops Burning of karri tops is tied completely to silvicultural requirements. The Regional Leader Operations will determine the time of burning. This will depend upon the particular regeneration method to be employed.

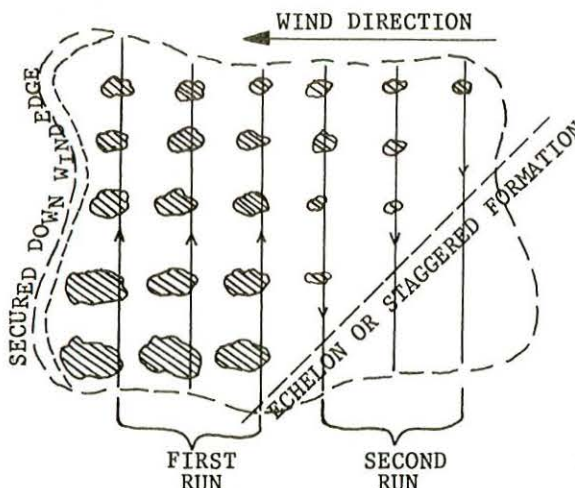
Karri regeneration	9.070	<p>Karri regeneration areas. The following principles must be followed;</p> <p>Exclude fire from areas to be cut over for a sufficient time which will ensure a clean regeneration burn (not less than 3 years).</p> <p>Cutting sections are to be surrounded by prescribed burns, where possible, to protect the regeneration area and provide safe boundaries to the regeneration burn. A comprehensive job specification has been prepared for planning and carrying out karri regeneration burns, and should be followed.</p> <p>Regeneration must be protected until saplings can safely withstand prescribed burning, usually after crop trees reach 15m.</p>
Method of burning	9.071	<p>All recognised methods of burning large areas involve "stripping". (This refers to the lighting of roughly parallel lines of fire at set spacings between the lines).</p>
Lines of fire or spots		<p>The lines will be lines of spot fires, or lines of continuous fire, depending on conditions and the method of burning used.</p>
Lighting by aircraft or ground crew		<p>Lighting may be done from aircraft or by a ground crew. In each case the selection of strip width and spotting distance must be determined from the Forest Fire Behaviour Tables on the day of the burn.</p>
Safety of men	9.072	<p>Safety of the men must be given detailed consideration. All men engaged in hand burning must have read and signed the back of Bulletin 71. When ground crews are used and the men are in visual contact or have portable radio communication, immediate action can be taken to protect anyone who has an accident. In other circumstances where the line length exceeds 3 km or in scrub fuels and rough topography, fire presents a real threat to individuals working alone. Pairs of lighters will run each strip to avoid this risk.</p>
Dress		<p>All personnel engaged on prescribed burning are to be properly dressed with helmet, long-sleeved shirt, trousers, boots and eye protection.</p>
Bulletin 71		<p>Officers must ensure that all members of the Department under their control have read and understood Bulletin 71, "Safety in Prescribed Burning".</p>
Gang organisation		<p>It is essential that the direction of ignition strips be maintained as planned and that ground crew members hold their positions in the formation. When crew members are in contact, the most capable and experienced person acts as marker on one end of the formation. He may use a compass, direction finder or his natural skill as a bushman to maintain direction. When crew members are</p>

not in contact, each pair must be equipped with compasses or direction finders. With aerial ignition, the aircraft uses automatic direction finding radio beacons, flares, or marker fires. It is essential that marker crews are adequately trained each season.

Burning with strips across the wind.

Across wind method

9.073 This is the fundamental method used for prescribed burning. The direction of the strip lines is approximately at right angles to the wind direction. When using ground crews the lighters must move in "echelon" formation with the lighter on the leeward side leading the staggered group. This allows the fire from one strip to run for the prescribed distance with the wind until it runs into the burn of the previous line.

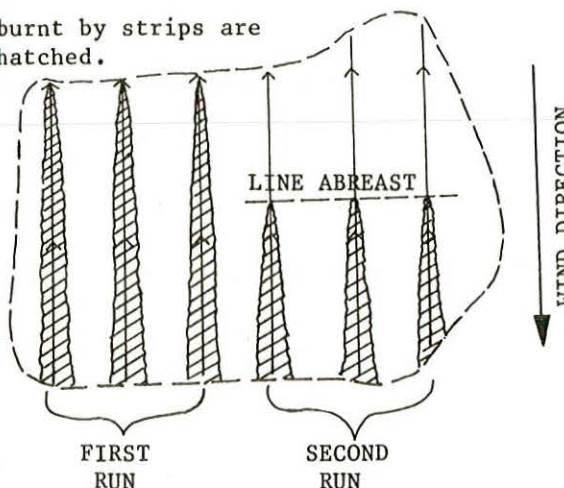


Strips are started on the down-wind edge of the burn and move progressively up-wind. Hatching illustrates area burnt.

Into the wind method

9.074 Burning with strips straight into the wind is a secondary method, only to be used in small areas and light winds. Continuous lines of fire are lit *STRAIGHT* into the wind. All fires burn as flank fires. Lighters must move strictly in "line abreast" formation and must return to the same baseline to start each new strip, unless there is a change in wind direction.

Areas burnt by strips are shown hatched.



Fire behaviour
and weather to
be recorded

- 9.075 The fire behaviour must be observed at each burn to see that prescriptions are followed. Lighting patterns must be varied or even stopped in the light of unexpected weather changes. Weather conditions, particularly wind, must be checked frequently. If weather changes require lighting to be stopped, immediate action must be taken to secure all edges with firebreaks.

Briefing
the men
(hand burning)

- 9.076 The overseer (or officer) directly in charge of a hand burn must ensure that the gang members are fully briefed on the job ahead. They must know:
- (a) The whole area to be burned and its boundaries. The most satisfactory procedure to achieve this is to drive the gang around the boundary tracks dragging a marker behind the vehicle where this can be done without risk of spreading dieback;
 - (b) The method of lighting. They must be told the formation to be used and their individual places in it;
 - (c) The direction and approximate distance of each strip line.

AERIAL BURNING

Controller
to direct
aerial burn

- 9.077 At each aircraft burn there will be a Controller and he will direct the aircrew, markers and suppression crews. A Fire Boss will assist the Controller.

The Controller will usually be the area O.I.C. and his duties are as follows:

- (a) Maintain liaison with officers responsible for aircraft movements and daily jobs;
- (b) Provide warning notices to the public on each day of an aerial burn;
- (c) Ensure flight plans are prepared and that aircrew and markers are fully briefed;
- (d) Direct use of suppression forces through the Fire Boss;
- (e) Check the weather forecast;
- (f) Check fire danger regularly and assess fire behaviour by obtaining reports from aircraft navigator and ground crew;
- (g) Direct the aircrew;
- (h) Determine starting and stopping of lighting.

The aircrew will consist of a pilot, navigator and bombardier. The navigator directs movement of ground markers and reports on fire behaviour to the Controller.

Communication. To ensure full communication around an aerial burn the Controller may establish a two-channel operation on Very High Frequency (V.H.F.) radio i.e.:

Normal Divisional channel for fire boss and crews;

Second channel for Controller to aircraft and aircraft to beacon.

Operation of aircraft

9.078 Regional Leaders, in consultation with area O.I.C.'s, will be responsible for nominating the daily programme of aerial burning during the burning season. This programme must be consistent with the capacity of aircraft to cover the nominated jobs and leave sufficient time for burning out that day. Under no circumstances are aerial burns to be started when fire danger tables or aircraft performance indicates little chance of the burn being completed on the day, with the likelihood of a patchy burn and re-ignition at a later date.

Aircraft performance

9.079 Guidelines on expected performance by aircraft in area coverage per hour are given in job specification.

Strip width and spotting distance must be calculated from the fire danger tables on the morning of the burn and for aerial ignition a flight plan will be prepared.

Flight plans

9.080 Copies of flight plans are to be distributed to aircrew, markers, suppression forces and controlling officers. Flight plans should show:

- (a) The lighting pattern;
- (b) Distances to be moved by markers;
- (c) Forecast and provision for weather readings and fire danger calculations;
- (d) Names and call signs of officers and crews
- (e) Location of suppression forces and equipment and areas where special protection is required, e.g. SEC lines or research plots;
- (f) Navigation plan should show ground features obvious from the air;
- (g) The Controller's copy of the flight plan, showing weather data and fire behaviour, should be retained for record purposes.

Post burn inspection

9.081 The area O.I.C. or a senior officer is to examine the results of burning and, if necessary, the aircraft may be used for this purpose. From such examinations follow-up action will be decided.

Beacon vehicles

9.082 The following rules apply to beacon vehicles operating near powerlines during aerial burns:

Beacon vehicles are to be preferably fitted with whip aerials.

If beacon vehicles are fitted with long aerials they are not to approach within 40 metres of the powerlines.

In addition to risks of an electrical discharge where long beacon aerials reach within close proximity to the powerlines, it must be realised that loss of signal

strength and false bearings can result.

Any accident or incident concerning high tension powerlines is to be reported immediately to the nearest SEC office, Regional Leader and O.I.C. Protection Branch.

Verrey pistol
usage

9.083 Verrey pistols are used by crews marking strip lines for aircraft. The following safety rules must be followed by those firing the pistols:

Notify Head
Office of pistol
operators by
1 September

Pistols may only be handled by staff and employees who have been fully briefed and authorised to use them. Police authority is required for each person using the pistols. For this purpose Divisions must provide Protection Branch Como with the names of likely operators not later than 1 September each year.

Pistols must not be loaded until the operator is in a firing position. Loaded pistols must not be carried in vehicles.

The muzzle must be pointed down until ready to fire and must never be pointed at another person. Do not cock the pistol till ready to fire.

Pistols must only be fired from a standing position on the track and at an elevation and direction which projects the flare above the canopy into the area to be burnt. The elbow should be slightly bent to absorb recoil.

In the event of a misfire the pistol should be cocked and refired. If another misfire occurs it should not be broken for fifteen seconds to avoid the risk of flash-back.

Pistols are to be cleaned and oiled after each burn.

Flares are to be kept in the box provided and not loose in the vehicle. They must not be jarred or bumped, especially near the detonator cap.

A copy of 9.083 to be displayed in chart form in each beacon vehicle as a memory jog.

Equipment
for aerial
burns

9.084 Equipment issued for use by marker crews during aerial prescribed burning will be handled as follows:

Marker vehicles will be fully equipped and checked before each season by a Protection Officer, who will issue a list of equipment with the vehicle.

Area O.I.C.s will be responsible for marker vehicles whilst operating in their Division. They will ensure vehicles and equipment are checked and signed for on receipt and despatch. Deficiencies are to be noted.

At the completion of the burning season, vehicles and equipment with signed lists are to be returned through the Protection Officer for checking.

Maintenance

The area O.I.C.s must ensure that the operators assigned to the vehicles are adequately trained and instructed to operate, service and maintain the equipment as follows:

- (a) Regularly service and recharge batteries;
- (b) Regularly inspect and check distance measuring meter and speedo cable. Know prescribed travelling speeds and not exceed them when his meter is engaged;
- (c) Tune and operate the H.F. radio and aerial system. Fire the Verey pistol and know associated safety precautions and maintenance procedure;
- (d) Locate by map reading, the location of flight lines. Adjust flight line plans in the field as directed.

Aircraft Insurance

9.085 It is the responsibility of every officer and employee engaged on aircraft flights to check that personal insurance has been arranged through the Department's policy. The following procedure must be implemented by the area O.I.C. on a daily basis.

A list of personnel on aircraft flights is to be kept in each Divisional office on SGIO Form 323 and filled in daily as required.

Form SGIO 323 is to be kept on four-week periods from the 16th of each month until 15th day of the following month.

The monthly forms are to be forwarded after the 15th day to Head Office for the attention of O.I.C. Registration Branch.

It is the responsibility of the area O.I.C. to ensure forms are properly filled in and forwarded on time. If forms are not so provided, personal insurance will automatically lapse, therefore staff should be aware, in their own interests, of the importance of ensuring returns are made accurately and promptly.

Areas of responsibility for the recording of insurance and submission of returns to Head Office will be as follows:

- (a) For spotter flights, the Division or centre at which the aircraft are based;

(b) For aerial burning or any other aircraft operations, Manjimup, Bunbury and Como will cover aircraft operating from Manjimup, Bunbury and Jandakot airstrips respectively.

Aircraft
passengers

The O.I.C. of aircraft base may authorise flights for passengers in the Department's aircraft providing they are employed by the Department and providing, are undertaking legitimate Departmental business, and insurance has been arranged.

Under no circumstances are passengers not employed by the Forests Department to be carried without the approval of O.I.C. Protection Branch.

Passengers who are not employed by the State Government cannot be covered by the Department's insurance policy. These persons must provide evidence they have aircraft insurance before being eligible as passengers.

It is the responsibility of O.I.C. of aircraft base to ensure pilots are properly briefed on the above requirements for carrying passengers and that requirements are observed.

FUEL REDUCTION SOFTWOOD PLANTATIONS

Fire
Management
Plan

9.086 Fire management plans covering fuel reduced buffers, fire breaks, access, water points, etc. are to be prepared for each plantation. Specifications are given in Part 16 Foresters Manual Pine Plantations.

Fuel reduction can be achieved by:

Prescribed burning

Grazing

Appropriate harvesting method

Mechanical crushing of debris

Grazing
Leases

9.087 This method of fuel reduction has considerable application in the Blackwood Valley and Sunkland plantations. Lease specifications are to be compiled by the O.I.C. assisted by the Grazing Manager. These leases will cover the fuel reduced buffer system wherever practicable. Management of stock, pasture and facilities will be the joint responsibility of the lease holder, O.I.C. and Grazing Manager. The objective for fuel reduced buffers will be to graze grass to an average height of 3 cms by 1 December each year.

Prescribed
Burning

9.088 Rotational prescribed burning may be approved by Supt. Protection Branch for small plantations and plots where available detection and suppression facilities cannot ensure adequate fire protection.

Generally prescribed burning in pine plantations will be confined to high risk areas and fuel reduced buffers. Special approval may be obtained from Supt. Protection Branch to burn tops where alternative fuel reduced buffer areas are required.

Rotational burning of the entire unit will be considered for small plantations, or plots where normal detection and suppression arrangements cannot ensure a reasonable level of protection.

Proposals for
15 March

Proposals will be submitted for approval by 15 March to O.I.C. Protection Branch after vetting by Regional Protection Officers and Regional Leader. Prescriptions will list objectives.

Burn
objectives to
be recorded

To produce a fuel bed of not more than 6-8 t/ha, i.e. 12-15 mm of needlebed.

Burn without scorching green crowns (scorch produces needle fall which could defeat the purpose of the burn).

Burn only where total fuel exceeds 12 t/ha i.e. 25-30 mm of needlebed.

Prescriptions

Prescriptions, as described for hardwood burning, are to be prepared for each proposed burn in plantations. These burns will be carried out to meet the objectives above and under conditions which minimise risk of crown and bole damage. These conditions will generally require a F.D.I. (pines) less than 25 m/hr. Other constraints are to be observed as listed below.

Every burn
to be
supervised

Every pine burn is to be supervised and controlled by an officer or overseer trained and experienced in procedures for pine burning.

Constraints

9.089

The minimum age at which burning can be undertaken in a pine stand will be determined by the time taken for trees to attain thick plated bark structure to 4 m. Usually this is not before age 11 in either P. pinaster or P. radiata.

No burning may be undertaken unless the fuel profile has first been completely saturated and is drying from the top. This requires a physical check before lighting commences at each burn.

Burning must not be started or continued while the open wind velocity exceeds 40 km/hr.

Burning must not be started or continued while the surface moisture content (SMC) of the needlebed is less than 16% for P. radiata or 18% for P. pinaster, or the relative humidity is below 40%.

No burning to be done where total fuel is less than 8 t/ha, i.e. 15 mm of needlebed, except in special circumstances such as areas for protection of settlements, picnic sites and recreation areas.

No burning to start until the hazard has peaked for the day.

O.I.C. responsible

O.I.C.'s will be responsible for the daily decision to burn, having taken into account past and present weather.

Moisture readings

Surface moisture readings must be taken using Speedie Moisture Meter before and during each burn.

Method of Burning

9.090

Test fires must be lit in each burning unit before overall lighting starts. They should be lit where fire intensity is expected to be greatest, e.g. more exposed sites, northern aspects, upper topography, poor quality etc. Their performance will indicate whether fire intensity will be acceptable under the prevailing conditions. Head fire flame height above 0.7 to 1.0 m is unacceptable except for occasional flare-ups.

Test fires

Spacing of spots

Test fire performance will not illustrate the effect of multiple ignition points. Therefore, strip width and spotting distance should be calculated using at least double the rate of spread shown by the flank and head of the test fire for the first run, and thereafter adjusted on actual fire performance (create as few junction zones as possible).

Compartment edges

Compartment edges within 20 m of breaks must be treated as separate fuel types and burned under minimum conditions where necessary, according to the prescribing officer.

SOIL DRYNESS INDEX

The Soil Dryness Index (SDI) should be used as a guide to recognizing the potential for fires to "re-burn", or for hardwood logs to smoulder. No burning is to be carried out at SDI greater than 250.

Recording

9.091

The following information will be recorded for each burn:

Date, time of commencement and duration;

Area burned and detailed costing;

Weather and fuel conditions;

Fire behaviour notes and results obtained.

As burning is completed, each area should be hatched and dated on Divisional records. At the end of each season a tracing of this information is to be forwarded to Protection Branch Como.

Area O.I.C. responsible

For burning under pine canopy, area O.I.C.'s will be responsible for the daily decision to burn, having taken into account past and present weather.

Approval by
O.I.C. Protection
Branch

Approval of the O.I.C. Protection Branch must be obtained each year for any burning after 15 September, under pine canopy.

Burning
pine tops

Burning of pine tops from thinning requires the utmost caution and experience of fire behaviour in this fuel type to avoid damage to retained trees.

Each proposal for disposal of slash from thinning must be referred to the Senior Forester Fire Control.

Burning
near private
pines

9.092 Aerial Burns

Planning for aircraft burns should generally follow the same principles as for our own plantations.

Aim to have the burn boundary about an average of 1 km from the plantation boundary and take advantage of established roads and forest type more suited to clean edge burning.

In some cases it will be necessary for the aerial burn and plantation to share a common boundary. Where this occurs the burn boundary must be clearly defined for navigation purposes.

Burns to be planned on the normal rotation for the area.

The burn prescription must highlight any likely danger areas and special requirements for the burn.

Advance mop-up should be programmed for difficult sections of the common boundary. Conditions for burning should be selected to ensure a clean burn.

Arrange flight lines to ensure that the bombing aircraft *WILL NOT* overfly part of *ANY* plantation during the ignition phase of the burn. This must include turning at the end of flight lines.

Buffer Burns

These will normally be either spring or autumn hand burns covering the area between plantation boundary and aircraft burn.

Planning for these should consider the following:-

Rotation to be same length as for aerial burns in the area, with timing offset to be not more than two years ahead of the adjoining aircraft burn.

Where small isolated areas (10 - 20 ha) adjoining the pines are too difficult or dangerous to prescribe burn, leave unburnt and treat as part of the plantation.

Buffer burns are to be organised on a neighbour assisting neighbour basis wherever feasible.

Plantation owners must be advised that the Department's resources for burning out small pockets alongside their pine plantations is limited, and without the plantation owners' participation on a neighbour assisting neighbour basis, it will not be possible to maintain regular burning of all buffer areas.

Plantation owners are to be informed of proposals well in advance of the burn and invited to participate. These notifications must be in writing.

Involve the local Bush Fire Brigade with the burn whenever possible.

Use the "Interagency Agreement" form to ensure all parties involved understand who is responsible for the various tasks and cost associated with the burn.

Training of
manpower

9.093 The area O.I.C. shall see that his gangs receive regular training in handling equipment, fire suppression methods and organisation of fire fighting gangs. Each member of a regular fire gang should be trained so that as far as possible he is capable of taking charge of a gang, and should be fully instructed in the policy of the Department in fire control. A job specification has been compiled to assist with the training programme.

Training may be possible during the winter, but the early spring burning season should be a time of intensive training in preparation for the fire season.

The area O.I.C., assisted by the Fire Control Forester, must see that his gangs get ample opportunity for training. The overseer in charge of the gang can carry out the training as a routine part of his work, but the Forester should exercise an overall supervision of this training.

Disposition of
gangs, officers
and equipment

9.094 The area O.I.C. must arrange the work of his gangs and heavy plant machinery such as dozers, low-loaders, etc., in the fire season, so that on days of high fire danger they are in continuous communication and working in strategically selected areas as specified in the Working Plans. The location and communication means for all gangs, officers and key fire fighting equipment, must be shown on the Disposition Board in the office, and also whether each unit is working in a dieback area.

Fire Risk reduction	9.095	A study of fire causes will give some indication of the risks to be reduced or eliminated. Fire risk reduction can be achieved through education, law enforcement or where appropriate, through maintenance of machinery.
Smoking in plantations		Smoking will be prohibited in all plantations except on fire lines, where butts and spent matches must be deposited on bare mineral soil and buried.
Lighting billy fires		When it is necessary to light a billy fire, it must be lit on an area cleared down to mineral soil and the remains of the fire doused with water and covered with soil.
Mechanical equipment in plantations		Whenever mechanical equipment is used in plantations, the following procedure must be followed during summer months: Chainsaws must be fitted with an efficient spark arrester which will be inspected periodically. Chainsaws must not be used for at least 60 minutes prior to the operator leaving the area. Pack sprays must be kept in the immediate work area, full of water, tested frequently and ready for instant use. The area worked over each day must be closely inspected by the operator before leaving. Vehicles must be in reasonable condition and particular attention given to exhaust systems and brakes. For large logging operations the "Code of Softwood Logging Practice" specifies additional conditions. All new employees must be instructed in above precautions.
Fire attack		No two bush fires can be fought in exactly the same manner; each one calls for a different approach depending on weather conditions, men and equipment available, fuel-bed and topography.
Early attack and aggressiveness essential	9.096	The two essentials for all fires are early attack and aggressiveness. The earlier the fire is attacked the sooner it is brought under control. Once a fire is allowed to develop a long perimeter, the task of controlling it is increased tremendously. The man in charge of the fire gang must take the offensive from the outset; he must realise he has the strength and training to stop any fire he is sent to deal with. Officers can do much to foster this idea in the minds of their gangs.

If a defensive attitude is adopted, the fire is master of the situation, the gangs have a feeling of frustration, hesitate to attack the fire face directly, and tend to fall back on fire-lines or tracks and wait for better conditions. By this time the fire has increased in size and needs many more men and equipment to bring it under control. The safety of men and equipment must, however, be carefully planned, together with the attack method, and all those involved in fire fighting must be taught the principles of self protection and given detailed briefing at each fire, in the light of local circumstances and suppression plans.

Action related to fire danger

9.097 Speed of attack is essential and will depend to a considerable extent on the despatcher, who will usually be the officer responsible for co-ordination of fires.

Part B of the Divisional Fire Control Working Plan sets out the action required against fires according to the fire danger of the day.

Sequence of action

9.098 The following sequence of action will be taken in the event of a fire endangering State forest:

Check reports from spotter aircraft, including fire behaviour, fuels and access.

Locate the smoke on a grid reference and record.

Controller and despatcher checklist

The most senior officer present will take charge and despatch forces laid down in the operation orders or despatcher tables, ensuring that dieback checklists are followed as set out in Job Specification No. 3.

Record the time and despatch action taken.

Re-calculate the local fire danger for the area of the fire and amend forces despatched if necessary.

If rate of spread exceeds 140 metres per hour or if three or more gangs are required, set up a Large Fire Organisation.

Advise the area O.I.C. as soon as possible.

Action by overseer

Each gang overseer must advise the despatcher of departure time and proceed directly by the nominated route to the nearest location of the head fire, at a safe speed.

If first to arrive at the fire the overseer will:

On arrival make a quick reconnaissance of the fire while the gang:

Reports arrival.

Unloads equipment and arranges for its protection

Proceeds to forward section of the fire and commences suppression under control of No. 1 pack-spray man.

After reconnaissance, report to despatcher:

- Position of fire;
- Area and details of fire size;
- Fuel type in and around fire;
- Time estimated to gain control of the fire;
- Additional assistance required;
- Cause;
- Communication arrangements.

Until an officer arrives, assume control of suppression action using his own gang and subsequent gangs arriving.

Report to despatcher at half-hourly or pre-arranged intervals and without fail if the fire is proving difficult to control.

Report when the fire is under control and estimated time of mopping up.

Report when the fire is safe and gang leaving.

Advise despatcher what further patrol action is necessary.

If other than first to arrive at the fire, the overseer will:

On arrival report to the fire boss or overseer directing suppression, for briefing and instructions concerning attack priorities.

In the absence of a control point, advise Headquarters of arrival at the fire.

Proceed with suppression.

For Large Fire Organisations, assume responsibility for filling in and handing the gang unit card (FD 661) to the Control Point Officer.

Action by
area O.I.C.

The area O.I.C. will:

Inspect the fire during, or as soon as possible, after suppression.

Check efficiency of gang's work.

Enquire into cause (see Prescription Section)

Complete Fire Report Form FD 304 and forward copies to the Divisional Officer.

Fire in
Crown Land

9.099 When a fire is detected on Crown Land or alienated land within 3 Km of State forest, timber reserve or land vested in the Conservator, action should be as follows:

Advise the appropriate Fire Control Officer and shire.

Check whether the Forests Department has been notified of intended "controlled" burning.

Investigate or despatch suppression forces as the situation requires.

Where assistance is requested, refer to section on liaison with private property owners.

Red Action 9.100 A Red Action is used to describe certain fires occurring in high risk plantation areas that trigger an automatic response by suppression forces.

The term Red Action applies to a set of instructions on the pre-arranged strength of forces and equipment from neighbouring Divisions which will be automatically despatched when a Red Action is called.

Red Action Area The boundaries of areas where automatic despatch action will take place will be defined annually by the officer in charge of each Division.

The yearly amendments will reflect changes of forests values or forces available, such as increases in plantation areas or changes in fire hazards.

The Red Action areas will be shown in office co-ordination boards.

A buffer zone round the high value area will be included in the Red Action area, sufficient to expect suppression activity to be successful before the fire enters the plantation.

Despatch If a smoke is reported in the Red Action Area, a Red Action must automatically be called by the most senior officer present at the time in the Divisional Office.

Prior to the commencement of each fire season, orders are to be drawn up outlining the automatic despatch procedure that will take place within the Division.

Automatic assistance from neighbouring Divisions will be forthcoming. It is the responsibility of the officer in charge to ensure the neighbouring Division is aware of its responsibilities.

These despatch orders will be prominently displayed near the co-ordination board with a copy kept in the fire control working plan.

Training

Annual training sessions will be carried out to familiarise staff likely to be involved in calling a Red Action, with the procedure to be followed.

Wages staff will be appraised of the fastest and safest routes from their home base to Red Action areas and familiarisation tours of plantations will be carried out where necessary.

All Red Actions called are to be notified to Protection Branch, Como who in turn will alert the Conservator.

Direct Attack

9.101 The advancing edge of the fire is attacked directly and stopped, either by the use of water, mineral soil, beating or raking the burning fuel back on the burnt ground, or by raking a narrow strip clear of fuel one or two metres ahead of the fire and letting the main fire burn up to the raked strip.

This raked strip should be constructed as near the fire face as the heat of the fire will permit.

If the area of unburned fuel is more than one or two metres wide, it should be lit up and burned out immediately, but care must be taken not to prepare the strip too far back from the advancing fire.

The method of direct attack should be used whenever possible.

Indirect Attack

9.102 Indirect attack will necessitate back-firing, where the fire fighters fall back some considerable distance from the advancing fire, usually to a prepared fire line or track, and there set "back-fires" which are allowed to run back towards the main fire with the object of burning out a wide strip of country ahead of the main fire.

This method should never be used if any of the direct attack methods are likely to succeed and dieback hygiene requirements can be met.

Back-firing is always risky since, if the main fire is too hot to handle directly, the back-fire will also be very hot.

If the fire fighters fall back to an area that can be burned easily, then the main fire could be handled easily in this fuel type.

One of the main dangers in back-firing is the tremendous updraft that frequently occurs when the two fires meet, leading to showers of burning debris being carried over ahead of the main fire beyond the line where the back-fire started. The greatest care must be taken in setting back-fires. As little face as possible should be lit at a time. Never back-fire from anything but a good break line which is long

enough to ensure that a back-fire does not escape round the ends of the fire line.

Always light close to the fire line so that the back-fire has no opportunity to gain any forward momentum and only burns back slowly towards the main fire.

Rules for
back-firing

9.103 General rules for back-firing:

Assess the back-firing possibilities and proposed base line carefully before spending much time clearing the break.

Rake around dangerous trees well back from the edge. It is often advisable to burn heaps of debris separately before the back-fire reaches them.

Never light a longer line than can be held; special care is necessary if choppy winds are likely.

Always burn clear to the line and well in towards the main fire.

If burning on a slope, start at the top and burn down.

If the main fire is coming up a slope, back-fire from the lee of the top, that is, just over the top from the direction of the main fire.

Patrol continuously.

Keep as close to the main fire as is commensurate with safety.

Back-fire against the head fire and attack the flanks and tail directly.

Fire
appreciation
to be carried
out

9.104 The method of fire fighting, particularly in areas managed to prevent the spread of dieback disease, requires the Controller to carry out and implement a fire appreciation based on FD613. This involves considering alternative fire fighting strategies to achieve the best compromise between successful fire suppression and dieback hygiene requirements.

The Controller will decide priorities and make an objective assessment of the time to suppress the fire, based on the fire line constructed by the available fire fighting forces compared with the rate of perimeter spread for the fire.

Mopping up and
patrol

9.105 Mopping up is the term used for the work done in rendering a fire safe after it has been brought under control.

Mopping up means completely extinguishing every piece of burning material that might permit the fire to escape.

Standard of
mopping up

A strip at least one metre wide must be cleared to mineral earth around every fire, strictly following its edge.

Within 20 m of unburnt fuel around the edge, all low stumps or logs must be extinguished with water or mineral soil, or both. Heaps of smouldering debris must be broken up and dispersed to prevent too great a flame close to the edge.

Heaps of debris around the butts of trees, close to the edge, must be cleared away.

Within 100 m of unburnt fuel around the edge, all burning sparks or trees must be extinguished, felled or burnt around to provide an adequate safety margin. Green crowns of trees felled near the fire edge must be either isolated or burnt to avoid unexpected ignition once the leaves dry. Piles of logs or tops must be separated and dampened down and, if necessary, covered with earth.

In mopping up, power pumpers should be brought right into the fire face so that water can be applied to burning trees and stumps. Trees that cannot be extinguished by pumpers are to be felled. If mopping up is done during the heat of the day, the pumpers should go around fairly rapidly damping down the more dangerous areas and then return to consolidate the position.

Spot fires should be clearly marked to ensure they are not missed by replacement crews.

Fire
retardant

Mop up operations are greatly improved by the use of fire retardant. The area O.I.C. is to ensure pumper crews are trained in its use and that supplies are available at the fire. (see relevant job specification)

Patrolling of all stopped fires is essential and should follow the instructions laid down under prescribed burning.

Staff and
headquarters
organisation -
Large Fires

9.106 A Divisional Large Fire Organisation will be implemented when :

Three or more gangs are committed

or

The predicted rate of spread exceeds 140 m/hr when the fire is burning in forest, or 1.5 km/hr when the fire is burning in grassland.

Calling an
L.F.O.

The Duty Officer will promptly advise:

Area O.I.C.;

O.I.C. Protection Branch or Como Duty Officer;

Regional Leader (Operations) or Regional Duty Officer.

Controller
duties

9.107 The Officer in Charge of the Division will assume the position of Controller until relieved. Following an initial check of action taken, his primary function will be as Intelligence Officer to determine the probable rate of spread, and from this revise the despatch requirements and arrange necessary supplies.

The Controller will make immediate arrangements for the despatch of:

Supply Officer,
Plans Officer,
Field Control Point Staff,
Fire Boss,
Plant Officer.

as set out in the Fire Control Working Plan, until relieved. On arrival at the Divisional centre, the Relief Controller will assume the role of controller and ensure that all Headquarters positions are functional.

The statement of duties for each position in the organisation is detailed in the booklet "Large Fire Organisation".

Relief of
L.F.O.
personnel

9.108 The relieving of all personnel, including officers at the fire and Headquarters, must be planned and enforced according to plan. Award conditions must not be overlooked when planning shift changes. Nobody should exceed 20 hours on their first relief or 12 hours on subsequent reliefs. Crew and staff changeovers should be completed between 0500 and 0700 or 1700 and 1900 hours. Staff should hand over and carry out briefing before crews change.

Controllers must specify any personal effects needed when outside forces are requested.

Naming and
training of
L.F.O. personnel

9.109 Although general titles are used in the organisation set out in the booklet, each Division must name and train the actual officers and their reliefs under these titles, at the beginning of each season.

Helmet
markings

9.110 The rank of officers at the fire face may be recognised by distinguishing colour stripes on their protective helmets. The colours used are:

Professional Officers	-	Black stripe on White helmet;
Fire Protection Branch	-	Red stripe on White helmet;
Assistant Foresters	-	Red stripe on Yellow helmet;
Forest Guards and Rangers	-	Green stripe on Yellow helmet;
Field Officer Cadets	-	Pale blue stripe on Yellow helmet;

Overseers

- Black stripe on
Yellow helmet.

Regional and
Departmental
Fire Control
Centres

9.111 Whenever one or more Large Fire Organisations are established requiring support of men and equipment drawn from within and outside the Department, a fire control support organisation will be established at Regional Level and at Departmental level. The roles of the Regional and Departmental controls in supporting Divisional Large Fire Organisations are explained in the booklet. The Regional Control will decide fire priorities and allocation of resources at Regional level, while Departmental Control will, where necessary, represent the Conservator in deciding Inter-Regional priorities, allocation of resources on a Departmental basis and provide press releases, public safety warnings and liaison with other organisations. In addition, both Regional and Departmental Controls have a considerable role in the supply of equipment or other resources not available at Divisional level, advising on fire strategies and developing forward planning for earliest control of all fires.

Layout of
H.Q. yard

9.112 The yard layout of a headquarters will vary from place to place, but the following broad features must be ensured:

Straight-through or circular access should prevent bottlenecks caused by incoming and outgoing traffic using the same road or gateway.

Assembly points for vehicles and manpower should be within relatively easy reach of the Despatcher, but not close enough to allow unnecessary cluttering of the control room approaches or interference to the radio.

Assembly points should not block the through or circular roads, but should be big enough to hold approximately six normal gangs with vehicles.

Fuel bowsers, drum dumps, water points, loading ramps and gantries should be well removed from the office and assembly points, but should also be easily accessible.

A roped-off space should be allowed near the assembly points for the dumping, sorting and issue of hand equipment.

A parking area should be set aside for the private vehicles of men going to the fire in Departmental trucks.

Signposts should be prepared, prior to the fire season, to allow strangers to find their way through the yard and to various points within it.

Office facilities

9.113 For day-to-day use, each control headquarters must have:

A wall plan (with plotting facilities) situated close to the tower communications terminals;

An "Office Daily Log" (FD 596) kept near the wall plan and communications mentioned above;

A staff movement board which will consist essentially of a blackboard prominently displayed in the office and carrying information under the following headings:

Date, weather forecast, officers' duties, location, means of communication and estimated time of return to H.Q.

It should be extended to include this information for gangs and equipment, as well as individual officers.

Forest Assistant duties

9.114 The Forest Assistant, who is vital to the fire organisation, will handle, direct or supervise the correct entering of details on the above board.

He will also in some cases, be expected to act initially as Despatcher, and must therefore be fully conversant with standing and operation orders.

He will be responsible for relaying the 0745 hours forecast within his Division and will also supervise communications.

Staff movement board

9.115 The Staff Movement Board must be brought up to date each morning and as changes occur, otherwise it becomes misleading, useless, and therefore dangerous.

Messages to be recorded

9.116 All messages dealing with fires must be recorded either in the office log or on message pads. When message pads are used they will be treated as permanent records and are to show the action taken by the person to whom they are directed.

If it is an instruction, it should be written out in duplicate and the original handed to the person concerned, or sent on to him with an appropriate endorsement, should it be relayed by telephone or radio. This lessens the possibility of error.

Duplicate messages are of considerable value to a relieving officer, enabling him to follow the progress of the organisation at the fire.

Messages should be written out before transmission by radio or telephone. This is particularly important for radio transmission, to prevent unnecessary traffic.

Control
centre
facilities

9.117 When a Large Fire Organisation is put into effect, it is necessary to set up an Operations Room as a control centre.

This space need not be permanently allocated for this purpose alone, but should be available for such use at short notice.

It should be cut off from the noise of radio and telephones where possible and should provide the following facilities:-

Wall space, on which plans covering the fire area can be fastened and covered with clear plastic (a progressive record of fire spread will be kept in this way, where it is available for study at any time by the headquarters officers).

A fuel age plan showing at least the previous four years' burning. This must also be prominently displayed.

A tactical dispositions board which will show the current distribution of all men and heavy equipment concerned in the suppression of the fire.

This information will include:

Men resting, on stand by, on duty, at headquarters, in transit, at sectors (numbers) and miscellaneous.

The board should be a large section of peg board and the men and equipment designated by standard plastic tags as follows:

Individual officers	-	orange diamond
Overseers and gangs	-	orange rectangle
Heavy duty outfits	-	yellow rectangle
Bulldozers	-	grey rectangle
Miscellaneous	-	green rectangle

A plan table for the spreading of loose plans and the marking up of field copies.

A large desk for use by the Recorder, and if necessary the Despatcher.

Fire record
to be
maintained

9.118 A complete record of events, instructions, reports and messages must be maintained. Depending on fire size and type, this may be in the form of a diary or appropriate recording forms and message sheets filed together in chronological order, once they have received attention.

Every item recorded must be dated, and the time of initiation and receipt entered, using the 24 hour system. Later this provides a basis on which to conduct a fire study from which much vital information may be obtained.

A fire plan kept in conjunction with the written records completes the picture of the situation.

- Fire Reports
Fire Report form FD 304
- 9.119 At the first opportunity after a fire, the area O.I.C. shall fill in the fire report form FD304 while details are fresh in mind. A copy of the completed form must be forwarded to Protection Branch, Como within 14 days.
- Pine fires requiring report to Regional Leader
- 9.120 All fires in plantations must be reported immediately by radio or telephone to the Regional Leader (Operations) during weekdays and to the Regional Duty Officer at other times.
- Daily fire reports
- 9.121 All centres will submit to Protection Branch, Como at 0815 hours on the next working day, a report covering any wildfires of the previous day or days stating:

Division

Serial No.

Location

Cause

Size (ha)

Date and time of starting

Date and time of suppression

Where no fires have occurred a NIL report is also required.

All fires still running at 1600 hours must be reported to Protection Branch, Como on weekdays and to the Regional Duty Officer on weekends and holidays by 1615 hours of the same day stating:

Division

Serial No.

Location

Cause

Size (ha)

Date and time of starting

Date and time of suppression.

Reports on L.F.O.

9.122 In the event of either:

Large Fire Organisation

or

Red Action

or

A fire which may draw comment from the media (these will usually be fires affecting the public)

or

Fire causing claims for damage

the area O.I.C. or duty officer is required to notify on weekdays:

Regional Duty Officer, and Protection
Branch, Como,

and on weekends and Public Holidays

Regional Duty Officer, and Como Duty
Officer.

The initial report of a Large Fire Organisation
or Red Action should include:

Size of fire in hectare units

Location

Fuel type and amount

Form FD 693

Large Fire Organisation Situation Report
Both Departmental and Regional Controllers
have overseeing and review areas of
responsibility, and therefore require
comprehensive and accurate fire reports
(see Large Fire Organisation Booklet).

Large Fire Organisation reports are to be
channelled from:

(a) Divisional Controller to Regional
Controller

(b) Regional Controller to Departmental
Controller.

The Regional Controller will forward a
composite report for the Region at 0900,
1630 and 2100 hours daily.

In order to simply report procedures, a
standard form FD 693 is to be used by either
Divisional Controller or Regional Controller.

Other reports are to be confined to
information on changes in fire situation or
fire damage, and to be Controller-to-
Controller basis only.

Annual
Fire Report

9.123 Immediately on the close of the fire season,
but not later than the end of the June quarter,
the Annual Fire Report, with the Fire Plan,
must be forwarded to the O.I.C., Protection
Branch, Como.

The Annual Fire Report shall be in the form
set out in Prescription Section.

EQUIPMENT

Listing in
Working Plan

All sources of auxiliary manpower and equipment
must be listed in the Working Plans.

Area O.I.C.
responsible for
equipment and
records

9.124 The Area O.I.C. will ensure provision is made
on the annual estimate for equipment he
considers necessary for his Division and will
be responsible for seeing that it is obtained
and efficiently maintained.

This equipment will be sufficient for his gangs, as well as replacements and additional equipment for the auxiliary gangs he is likely to pick up under normal conditions.

Divisions will maintain a card for each pumping unit, containing the following information:

- Unit Number
- Engine - make and number
- Pump - make and size
- Water tank - capacity and material of construction
- Division to which unit is issued
- Details of subsequent transfers

Attached to each card will be a list of equipment carried on the unit as shown in Prescription Section. A copy of this list shall also be carried in the vehicle on which the unit is mounted.

In the event of a unit being transferred, the reel and suction hose will be considered as part of the unit.

Each area O.I.C. shall check the cards annually prior to 1 October and ensure there are sufficient components in stock to equip each unit.

Divisions'
colours

9.125 Equipment should be clearly distinguished by some painted mark to indicate the gang or district to which it belongs. This facilitates collection after a fire.

The following colours have been allocated:

Wanneroo	-	Orange
Mundaring	-	Red
Jarrahdale	-	Light Green
Dwellingup	-	Yellow
Harvey	-	Pink
Collie	-	Light Blue
Kirup	-	Brown
Nannup	-	Purple
Busselton	-	Dark Blue
Manjimup	-	Black
Pemberton	-	White
Walpole	-	Dark Green
Forest Cadets	-	Grey

The colour allocated to a Division should be applied as a patch, which serves as a background for codes adopted locally to identify gang or outstation equipment. When the colour coincides with that already on equipment, e.g. red on tankers, the patch should be outlined with a narrow border of white or black.

Equipment checks and maintenance	9.126	After every fire all equipment must be checked to replace losses and effect repairs to damaged items.
Insurance claims for lost or damaged equipment		In the case of equipment burnt or damaged in or at a fire, a claim for insurance must be submitted immediately. Any undue delay may result in the claim being disallowed. SGIO form number 220 should be completed for each claim. This is supplied following the initial damage report. This Department accepts no responsibility for any loss of non-essential personal items carried on Department vehicles and employees should be advised accordingly.
End of season equipment check		At the end of the fire season all equipment is to be checked, maintained and stored away ready for the next fire season.
Pumper winter storage and maintenance		Pumpers are to be stored and maintained in accordance with circular 14/75.
U/S equipment for write off		Any articles of fire equipment which may be considered useless or obsolete shall be listed on Form FD 338 and sent through the Regional Leader to O.I.C. Protection Branch, Bunbury, who will arrange for write-off to be carried out.
Surplus equipment		Where articles of fire equipment are considered to be surplus to requirements, a list should be forwarded to O.I.C. Protection Branch, Bunbury, so that transfer to another Division or Collie Fire Store can be arranged.
Lost or stolen equipment		Articles of fire equipment that are lost or missing should be listed on Form FD 338. This list, supported by a letter stating the manner in which the loss was incurred, should be forwarded through the Regional Leader, to O.I.C. Protection Branch, Bunbury, who will take the necessary steps to complete the write-off procedure.
		Where theft is suspected, it must be reported to the Police.
		Before the commencement of the spring burning season, all equipment must be thoroughly checked to ensure it is in good working order.
		The area O.I.C. is responsible for ensuring pumper units receive weekly and daily maintenance during the fire season as required and kept in <i>PEAK</i> condition.
Fire retardant	9.127	Proprietary brands of chemical fire retardants such as Phoschek, Firetrol, Metagrad, Amgard, etc., use either di ammonium phosphate, ammonium sulphate or ammonium polyphosphate as the basic active ingredient.
		This basic ingredient, when applied to cellulous fuels, alter the combustion reactions of the fuel. See Prescription Section.

Plastic containers 9.128 Officers are to ensure that plastic not to be used for flammable liquids containers are not being used to carry flammable liquids, and regular checks are to be made to see this practice is avoided. However, they may be used by men for carrying kerosene on prescribed burning, but must be emptied and placed in closed boxes when on trucks.

Carrying petrol TIR Regulations The Timber Industry Regulations Act (T.I.R.) requires that, except as provided in sub-clauses (a) and (b), a truck shall not carry liquid fuel whilst also conveying workmen.

(a) A truck carrying a fire-fighting unit may carry petrol in the normal supply truck of the pumper engine.

(b) For chain saw or fire pumper operation, a truck carrying men may carry a maximum of two leakproof metal cans of petrol, each not above 23 L capacity.

Marking of containers Containers used and their identification must be as follows:

Petrol: Jerry-can containers or permanently mounted tank painted silver with the word "PETROL" in red, above a central red band.

Repeater Avgas: 18 L drum painted green with the words "REPEATER AVGAS" in yellow, on two sides.

Chainsaw fuel: Jerry-can container painted red with a central green band, and the words "CHAINSAW FUEL" in white, above the band.

Kerosene: Jerry-can container or permanently mounted tank painted silver with a central yellow band and the word "KEROSENE" in yellow, above the band.

Distillate: Jerry-can container painted orange with central white band and the word "DISTILLATE" in black, above the band.

Oil: 18 L drum painted yellow with a central black band and the word "OIL" in black, above the band.

Water containers are to be identified with the word "WATER" in large white letters on a black background, and jerry-cans must not be used for drinking water. If the water is unsuitable for drinking, the container must be labelled accordingly.

No unlabelled containers are to be carried.

Ethyl glycol and permanganate Ethyl glycol and permanganate crystals must not be carried on the same vehicle.

All containers must be securely fastened during transit.

Area O.I.C.s must ensure that all staff, overseers and truck drivers are thoroughly aware of and understand these instructions.

Maintenance
of canvas
hose

9.129 An annual programme of maintenance for canvas hose will be undertaken as follows:

All 38 mm canvas hose, whether unservicable (U/S), on list or otherwise, will be sent to Collie Fire Store. (Arrangements will be made for Divisions with a mill or plantation fire risk to hold emergency hose during change-over period).

Collie Fire Store will test and classify hose into four categories and paint couplings accordingly:

Tested at 1725 kPa - yellow
Tested at 1035 kPa - white
Tested at 690 kPa - blue
Training hose only - black

Classifying and coding of Divisional pumps will be carried out by Technical Officer (T.O.) or Plant and Regional Protection Officer. Units will carry colour codes on 38 mm outlets according to pressure, e.g. 1035 kPa - white.

At the beginning of the next fire season, hose will be issued to Divisions according to requirements. These requirements will be decided by the Protection Officer and area O.I.C. and will be assessed on numbers and classification of fire units, plantation and hardwood etc. This initial assessment will need to be carried out in the early winter.

This system will eliminate -

- (a) The need for Divisions to requisition hose replacement;
- (b) The need for Divisions to have U/S hose written off;
- (c) The need for Divisions to carry out the testing;
- (d) The suitable storage problem in most centres.

Collie Fire Store will then be able to arrange:

- (e) Write-off of all U/S hose in bulk;
- (f) A continued supply of replacement hose based on first-hand annual inspection of all hose held by the Department.

Divisional Protection Officers will be required to carry out the following at the end of each fire season:

- (a) Prepare a list of all pump units held in the Division that will require canvas hose for the following fire season;
- (b) Collect all hoses and prepare for dispatch to Collie. Hose to be clean and correctly rolled. Any U/S hose should be marked accordingly. Couplings are not to

be removed;

- (c) Upon request, the hose is to be delivered to the Collie Fire Store by D.P.O. in person, wherever possible.

In addition to the annual hose maintenance programme, the area O.I.C. is responsible for ensuring hose is properly maintained in the Division, i.e.:

Cleaned and dried after use:

Stored in a clean and dry condition;

Checked regularly for mildew or other deterioration;

Hose is not painted.

Protection of
equipment
at fires

- 9.130 All equipment taken to the vicinity of a fire is in danger of being burnt, and whenever any such equipment is left unattended, every precaution must be taken to see that it is adequately protected.

Particular attention must be given to cleanliness of bulldozers working near a fire face to minimise chances of the machine catching alight. The chassis must be cleaned of trash and fuel or oil spillages at frequent intervals. Particular attention must be given to removal of trash accumulation around the sump plate. The chassis can be cleaned adequately with a high pressure water jet from a heavy duty pumper.

Inflammable materials such as cleaning rags, cotton waste or clothing must not be carried on the bulldozer while it works on the fire face. The bulldozer must be fitted with a chemical fire extinguisher (suitable for oil or diesoleum fires) at all times. In addition, between 1 October and 13 April, the bulldozer must be equipped with a packspray of water, to conform with the Bush Fires Act, and to suppress fires which the machine may start in the forest.

Overseer's
responsibility

The overseer's first duty on arrival at a fire is to detail a man to prepare a cleared area which will accommodate spare equipment, with a minimum of one metre clearance around the apparatus.

In the case of motor vehicles, greater care must be taken than for hand equipment, in view of their greater value and the more inflammable nature of the unit.

Vehicle
precautions

The safest place to park a vehicle is on cold burnt ground or bare mineral soil, such as gravel pits, away from overhanging trees. If the ashes are still hot, a strip must be raked down to mineral soil for each wheel, and all smoking embers raked from under and around the truck. Care must be taken to see that the truck is sufficiently removed from burning trees to

preclude the possibility of sparks or burning debris dropping on the vehicle. All inflammable articles, such as clothing, etc., should be placed in the cab of the vehicle, the windows of which must be wound up to prevent the entry of sparks or burning embers.

If the vehicle must be left on unburnt ground it should be placed on an area clear of scrub and trees. All litter must be raked from under it and for a space of two metres all round it, and any trees that might possibly drop debris on the truck must also be raked to ensure that they do not become alight from any fire. Raked litter must be well scattered and not left in heaps.

When a vehicle is left on the road, all litter must be raked away from the sides of the vehicle. Do not leave a vehicle on a road unless there is ample clearance to permit the passage of other vehicles.

A vehicle should always be left facing an escape route so that it is possible to drive straight away without the need for time-wasting manoeuvring. Ignition keys should be left in the vehicle.

WATER SUPPLIES

Distance between water points

9.131 It is important that adequate static water points are available for fire control.

In hardwood areas the objective should be to provide major points on an 8 km grid pattern.

In plantations they should be sufficiently close to allow a 20 minute turn-around of tankers.

Capacity

Each water point should be capable of yielding a minimum of 50,000 L at any time during the summer.

Location

They should be placed as close to major access roads as possible. Access to water supply must be positive, and sufficient area should be cleared and surfaced to allow the turn-around of pumpers and parking of control point traffic.

Head Office advised of new points

As each new water point is established, its exact location should be indicated on office plans and Head Office advised so that master plans may be kept up to date for future inclusion in Departmental lithos.

Signposting water points

The roads into water points should be well signposted. It is not sufficient to place one notice on the turnoff from a main track.

Local
records

Notes of capacity, supply and permanence of water points should be kept in the local office, with a view to incorporating this information on Departmental lithos at some future date and to improving the supply where necessary.

Water
points to
be inspected

At the end of each summer all water points should be inspected and maintained where necessary.

Where water points are located in forest affected by dieback, the O.I.C. must ensure tanker drivers are instructed in the use of fungicide additives for disease control.

PRESCRIPTIONS

FIRE CONTROL WORKING PLAN

The area O.I.C. is to prepare a Fire Control Working Plan for the division that is to be updated annually. The updated plan is to be checked by the Regional Leader and a copy forwarded to O.I.C. Protection Branch, Como by 15th November.

The Fire Control Working Plan is in three parts as shown in the attached table of contents.

Part A. Sets out the Fire Control objectives for the division and the strategies by which these will be achieved.

Part B. Includes all information necessary for planning and implementing the working plan. It is important this section be set out clearly and concisely and contain full information that can be readily assessed by visiting officers during L.F.O.

Part C. Provides an inventory of manpower and equipment for the division and includes auxiliary resources available in the district. The section also includes working sheets and checklists to aid staff in procedural requirements for despatch of suppression forces and other fire control activities.

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 - 5.6.2 Fire Gang Roster
 - 5.6.3 Other Specialist Section Rosters
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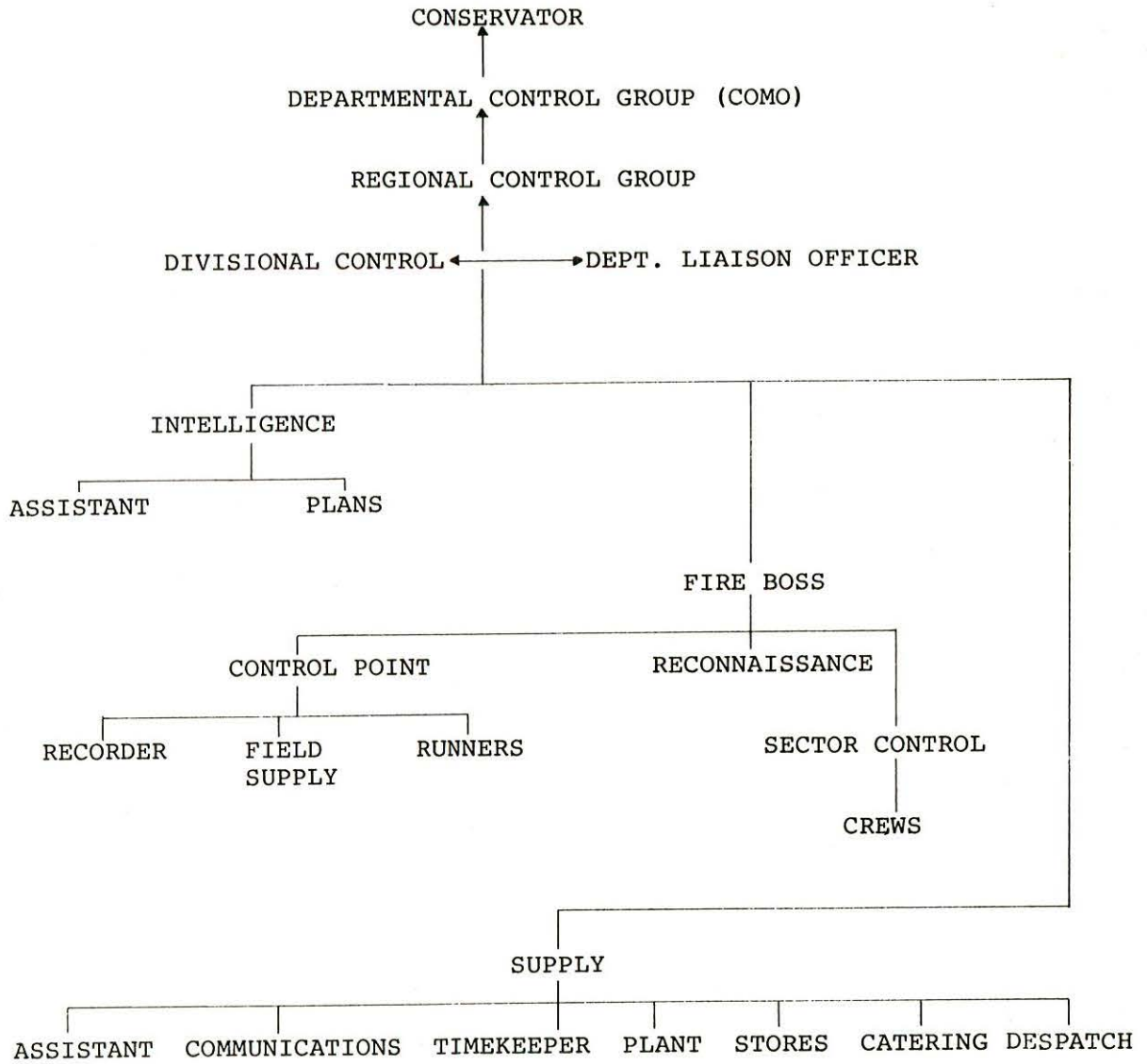
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- 7. WORKING SHEETS AND CHECKLISTS

EXPLANATORY NOTES

(5.7) Large Fire Organization. The Fire Control Working Plan is to show officers nominated for positions on L.F.O., organization chart from Divisional Controller downwards.

FUNCTIONS AND LINE OF RESPONSIBILITY



NOTE: MORE THAN ONE FUNCTION MAY BE FILLED BY ONE PERSON.

FIRE CONTROL WORKING PLAN (CONT'D)

6. INVENTORY OF MANPOWER AND EQUIPMENT SHOWN ON TABLE BELOW.

1. Fire Fighting Manpower and Equipment

1.1 Forests Department

1.1.1 Officers:

Name, rank, normal duties and headquarters station.

1.1.2 Summary of gangs and equipment:

Established gang units-

Unit No	Over seer	Normal Number of Men	Make and Type of gang Transport	Radio Call Sign	HD (4 x 4 or 4 x 2) and Pumper Unit No

Total number of men and equipment in the Division:

Officers.

Overseers.

Employees.

Utilities.

Light 4 x 4s.

Gang trucks (equipped for fire gang) (4 x 2 or 4 x 4).

Gang trucks (not equipped for fire gang).

Heavy trucks - carrying heavy duty outfits (4 x 2 or 4 x 4).

Heavy trucks - other.

Bulldozers - light.

Bulldozers - heavy.

Low loaders (capacity).

Shovel loaders.

FIRE CONTROL WORKING PLAN:
INVENTORY OF MANPOWER AND EQUIPMENT (CONT'D)

1.1.3 Detailed Manpower Lists.

Name
USUAL STATION
Light truck driver
Heavy truck driver
Low loader driver
HD pump operator
Light dozer driver
Heavy dozer driver
Chain saw operator
Handyman
Carpenter
Mechanic

1.1.4 Detailed list - Vehicles and Chain Saws

Reg. No.	Usual Station or Driver	Make	Capacity	4x2, 4x4 or 6x6 etc.	Pump - if any	Remarks
1.	Cars and utilities.					
2.	Light 4 x 4s.					
3.	Medium transport (equipped and used for fire gangs).					
4.	Medium transport (other than used for fire gangs).					
5.	Heavy transport (normally carrying H.D.).					
6.	Heavy transport (other - not normally carrying H.D.).					
7.	Bulldozer - light.					
8.	Bulldozer - heavy.					
9.	Shovel loaders or similar.					
10.	Chain saws.					
11.	Relay pumping trailers.					
12.	L.F.O. trailers.					

FIRE CONTROL WORKING PLAN:

INVENTORY OF MANPOWER AND EQUIPMENT (CONT'D)

1.2 Outside Sources

- 1.2.1 (i) Established Gangs. (Defined crews with training or experience and with a nominated officer or foreman).

Immediately available. (Those such as sawmill and shire council gangs immediately available for fire fighting in forest areas).

Personnel
and Vehicles
and Equipment

- (ii) With other commitments. (Such as bush fire brigades of farming areas bordering forests).

Personnel
and Vehicles
and Equipment

- 1.2.2 Supplementary Fire Fighting Personnel. (Other sources of manpower and equipment which may be called upon. List names, telephone numbers or other means of contact).

Bulldozing contractors and machines.
Hauling and carting contractors and low loaders.
Tractors and Trucks.
Fallers and power saws.
Unorganised manpower (not already mentioned - P.W.D., M.R.D., sawmills, etc.) - vehicle and equipment.
Oil company depots - fuel supply and water tankers.

- 1.2.3 Auxiliary Services. (List names and telephone numbers).

Local Authority - Secretary, Chief F.C.O.,
Road Traffic Authority.
Police - names.
Telecom - services and names.
Medical - doctors, ambulance, hospital, Red Cross.
Food Supply - caterers, butcher, baker, grocer.
Accommodation - hotels, motels, guest houses etc.

2. Water Supplies

- 2.1 Town, village and mill supplies.

- 2.2 Static water in the forest (show on plan).

- 2.3 Ferry tankers (Forests Department, oil companies, M.R.D., and bulk milk companies).

ANNUAL FIRE REPORT

DIVISION _____

SEASON 19__ / __

1. PREVENTION

1.1 Prescribed burning costed to hardwood (excluding recoupable work):

Season	Number of Days Burning Took Place	Area in Hectares				Total All Types
		Broadcast Burns		Slash Burning		
		Aerial	Hand	Top Disp	Regen.	
Spring						
Autumn						
Total						

1.2 Prescribed burning costed to softwood:

Winter burning under pine canopy ha

Clearing burns for new plantation establishment ha

" " after clear felling ha

Other prescribed burning costed to softwood but not under pines, e.g. indigenous species buffers, swamps etc. within plantation perimeter or zone ha

TOTAL ha

1.3 Prescribed burning costed to recoupable items:

Aerial burns ha

Hand burns hardwood ha

Other recoupable burning, specify _____ ha

ANNUAL FIRE REPORT (CONT'D)

2. SUPPRESSION

2.1 Fire Plan. Forward standard Divisional plans showing:

Prescribed burning hardwood spring - yellow wash

" " " autumn - brown "

" " pines - blue "

Wildfires attended by F.D. - red wash and serial number

Outside Forest Estate - burning off- green wash

" " " - wildfires - green wash with red hatch.

At lower R.H. corner of each plan sheet show:

FIRE PLAN - DIVISION - SEASON

2.2 Summary of Fires Attended - attach form F.D. 434.

This form provides a summary as well as a final check on data given in the individual reports earlier in the season. Where any of this data had to be subsequently corrected you should attach a written explanation.

2.3 Fire Damage to Pines - show in the table below, areas of F.D. pines burnt by wildfires.

		Destroyed (ha)			Retained (ha)			
		Total loss or salvage felled (no. of yrs)			Light to moderate damage only (no. of yrs)			Total Area Burnt
		1-5	6-15	16+	1-5	6-15	16+	
Area ha								
Salvaged m3	Chip logs							
	Saw logs							

ANNUAL FIRE REPORT (CONT'D)

3. THE FIRE SEASON AND DIVISIONAL ORGANISATION

- 3.1 Staff fire duties commenced on _____ and ended
on _____
- 3.2 Surveillance by spotter A/C commenced _____ ended _____
- 3.3 Tower surveillance. First date _____ Last date _____
- 3.4 Brief summary of seasonal characteristics and relative
severity of the season _____

- 3.5 Average number of wages employees in Division _____
- 3.6 Number of wages employees given fire training _____
- 3.7 Co-operation with adjoining landholders. Brief notes on
co-operative prevention or suppression and on training or
publicity given _____

- 3.8 Notable saves of property _____

- 3.9 Recommendations for next season _____

- 3.10 Remarks _____

Officer in Charge _____ Date _____

POWERS OF VARIOUS OFFICERS UNDER THE BUSH FIRES ACT

Section	Powers and Duties Under the Bush Fires Act	Bush Fires Control Officer	Forest Officer	Brigade Officer or Members	Police
Section 14	At any time may enter land or building to: Examine a fire believed to have been lit or maintained illegally or to be not under control	x			x
	Examine firebreaks or fire hazards.	x			
	Investigate cause and origin of fire.	x			x
	Inspect fire precaution measures or brigade equipment.	x			
	Do anything necessary to give effect to Act.	x			
Section B & 56	Demand to see Permit	x	x	x	x
Section 39 & 44	When fire is burning may exercise any of the Powers of the Chief Officer of Fire Brigades as may be necessary for the prevention of spread or extinguishing of a bush fire.	x		x*	
	Enter any building or land.	x		x*	
	Cut, pull down, or remove a fence.	x		x*	
	Cause firebreaks to be ploughed or cleared to control a fire.	x		x*	

POWERS OF VARIOUS OFFICERS UNDER THE BUSH FIRES ACT (CONT'D)

Section	Powers and Duties Under the Bush Fires Act	Bush Fires Control Officer	Forest Officer	Brigade Officer or Members	Police
Section 39 & 44 (cont'd)	Take or use water other than from a school or domestic supply in a tank.	x		x*	
	Give directions to Bush Fires Brigades.	x		x*	
	Employ a person or use voluntary services.	x		x*	
	Enter a building to extinguish a fire except in a townsite in a Fire District or a townsite where there is a W.A.F.B.B. or W.A.F.B.B. volunteer brigade.	x		x*	
39 (2) (a)	Where a fire is burning in or on Forest Land or Crown Land and a Forest Officer is present the above powers and authorities are exercisable by a Forest Officer.		x		
	(2) (b) In the case of 2(a) above a Forest Officer, if present, takes precedence over a B.F.C.O.		x		
45 (a)	Duty to take charge of controlling and extinguishing a bush fire.	x		x*	
	Where a fire is burning in or near Forest Land, or in or near Crown Land, the powers of a B.F.C.O are exercisable by a Forest Officer if present.		x		
	45 (b) The Forest Officer shall take supreme control and charge of operations over B.F.C.O.s and Brigades present.		x		
56	May demand a person's name, address and permit to light a fire. Request name and address if an offence is suspected. A person refusing to give these details may be arrested.	x	x		x

POWERS OF VARIOUS OFFICERS UNDER THE BUSH FIRES ACT (CONT'D)

Section	Powers and Duties under the Bush Fires Act	Bush Fires Control Officer	Forest Officer	Brigade Officer or Members	Police
59	May investigate an offence and issue an infringement notice or prosecute under the Act.	x	x		x

NOTE: Asterisk * denotes that "A Forest Officer" takes control if present when a fire is within three km of State forest boundaries or in or near Crown Land.

LIST OF FIRE CONTROL FORMS

1. Fire Weather

- F.D. 646 Daily Moisture Content Northern Jarrah.
- F.D. 647 Daily Moisture Content Karri & Southern Jarrah.

2. Prescribed Burning

- F.D. 576 Fuel Assessment Sheet No. 1.
Scrub Point Sampling Assessment Sheet.
- F.D. 243 Adjoining Landowners.
- F.D. 622 Beekeepers.
- F.D. 659 P.A.F.S.O.U. (see Appendix XII).
- F.D. 562 Low Flying During Aerial Burning.
- F.D. 713 Environmental Protection During Prescribed Burns.
- F.D. 655 Hardwood.
- F.D. 574 Under Pine Canopy.
- F.D. 657 Karri Regeneration and Clearing Burns.

3. Fire Suppression

- F.D. 573 Notice of Illegal Burning to Shires.
- F.D. 661 Gang Unit Card.
- F.D. 613 Controllers' Fire Suppression Guide.
- F.D. 304 Fire Report (for wildfires attended by F.D.)
- F.D. 434 Summary of Fires Attended During the Fire Season.
- F.D. 693 L.F.O. Situation Report.
- F.D. 660 Initial Fire Report Form.

4. Aircraft Operation

- Spotter Daily Work Sheets.
- F.D. 624 Aircraft Smoke Reporting Log.
- F.D. 714 Duty and Flight Time Record.

POINTS IN INVESTIGATING OUTBREAK OF FIRE

Speed, consistent with safety, in reaching the source of the fire is important; it may be possible to intercept the persons lighting the fire, either on the spot or going away from it. Spotter pilots should be instructed to report the presence of persons and/or vehicles near the scene of fires which may have been deliberately lit.

Further, an officer should arrive early to pick up any tracks that may be in the vicinity before they are obliterated by fire fighters, and to ascertain as nearly as possible the exact point of origin of the fire.

Any tracks found should be protected as far as possible by covering with bushes or bark or by placing a small log over them.

The following are a few of the possible clues that should be looked for:

1. Remains of a campfire.
2. Cartridge cases.
3. The spot where someone stopped to light a cigarette. This might be indicated by the tracks of two vehicles pulling up together, footprints by the side of the vehicle tracks, or by spent matches.
4. Cattle tracks overmarked by horse or dog tracks indicating travelling stock.
5. Pieces of smouldering bag or other lighting material.
6. Ash from old blackboy cores or rotten branches in a cleared patch indicating a delayed action fuse.

Careful note must be made of any tracks in the vicinity, their direction, size, whether boots or shoes, or in the case of horse tracks, whether shod or unshod and any peculiarities such as hobnails and patched shoes. The width and tread marks of tyres, the width between wheels and whether dual or single rear wheels, should be looked for.

It is usual and advisable to call in the services of the local police constable to accompany the forest officer. The psychological effect of police attendance and questioning of suspected persons and possible informants is quite considerable.

Every person in the locality who is likely to have useful information should be interviewed.

A full report must be submitted to the Protection Office immediately after the investigation is completed. The following details should be included:

1. Full name and address of the person lighting or suspected of having lit the fire.
2. Signed statements from this person, if possible.
3. The section of the Act infringed.
4. Exact location of the start of the fire, within an attached plan.
5. Tenure of land where fire started, e.g., State forest or private property.

POINTS IN INVESTIGATING OUTBREAK OF FIRE (CONT'D)

6. Time fire started as nearly as possible.
7. Method of lighting.
8. Reason, e.g. carelessness, match, cigarette butt or, if deliberate, incendiarism, the suggested motive.
9. Names and address of witnesses, with signed statements.

A detailed report must be compiled for any fire likely to involve the Department in legal action to recover costs (refer Circular Letter H.O. 140/73 on 23/10/73).

STANDARDIZED EQUIPMENT ON FIRE TRUCKS

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The movement of men and equipment between karri, jarrah and plantation areas for fire suppression, has made it necessary to specify the type and minimum quantity of equipment which shall be available on pumpers and personnel carriers.

Equipment on all such trucks should be as listed below and checked regularly by overseers and officers. The relevant list should be carried in each truck.

TYPE AND MINIMUM QUANTITY OF EQUIPMENT FOR H.D. TRUCKS

1 tank - 2 700 litres to 3 000 litres

1 pump unit

50 metres of 19mm Nylex high pressure hose on live reel

8 m x 63 mm armoured suction hose strainer and foot valve

10 x 30 m (300 m) of 38 mm canvas hose (150 m only where vehicle is certain to be confined to hardwood areas)

2 x 38 mm short canvas hoses (numbers as required locally)

1 set hose keys

3 x 38 mm directors with tips

2 "Y" couplings, 38 mm

2 hose clamps

1 shut-off nozzle

2 packsprays

2 axes

1 shovel

A container of drinking water (CLEARLY MARKED)

2 drip torches with quantity of kerosene

1 spotlight

1 torch (hoseman)

1 first-aid kit

4 rake hoes

1 crowbar

1 Divisional plan (1:50 000 or 1:63 360 scale)

Quantity of fire retardant

Emergency rations (one meal for each man)

1 set (3) vehicle roadside warning signs (A.S.S. E38-1962)

1 plastic folder with gang/unit cards (Large Fire Organization)

STANDARDIZED EQUIPMENT ON FIRE TRUCKS (CONT'D)

Quantity of hose washers

OPTIONAL EQUIPMENT

Detergent and measuring cup

Kangaroo jack and handle

Plantation plans (where applicable)

18 m x 12 mm nylex hose

1 x 38 mm director with tips (extra)

Hose winder and board

1 hand electric torch

Tow rope

Snig chain

1 chain saw - hammer and wedges

TYPE AND MINIMUM QUANTITY OF EQUIPMENT FOR STANDARD GANG TRUCKS

1 water tank - 800-900 l.

1 light pumper unit

50 m of nylex type high pressure hose on live reel

8 m of 38 mm armoured suction hose, strainer and foot valve

8 m of 38 mm canvas hose, director and tips

1 shut-off nozzle fitted to hose on live reel

1 set of hose keys

3 packsprays

1 container drinking water (CLEARLY MARKED)

1 container kerosene (CLEARLY MARKED) plus pump

6 drip torches

6 kerosene carrying containers

2 shovels

2 axes

4 rake hoes

1 crowbar

1 snig chain

1 chain saw, plus filing equipment, oils and fuel (fuel cans to be CLEARLY MARKED)

Hammer and wedges

4 waterbags

STANDARDIZED EQUIPMENT ON FIRE TRUCKS (CONT'D)

1 spotlight
1 radio, plus list of call signs
1 first-aid kit
1 divisional plan (1:500 000 or 1:63 360 scale)
1 axe stone
1 pair pliers, footprints or similar
Quantity of retardant
2 prescribed burning/wildfire signs
1 set (3) vehicle roadside warning signs, A.S.S. E38 - 1962
Emergency rations (one meal for each man)
1 plastic folder with gang unit cards (Large Fire Organisation)
Burning prescription and report forms
P.A.F.T.A.C. report forms
Quantity of torch wick, fusees, hose washers etc.

TOWERS AND TOWERMEN

The towerman must possess the following qualifications:

1. Must have good eyesight.
2. Must have good speech and hearing.
3. Must be capable of reading a map and learning the country visible from the tower.
4. Must become proficient in using the instruments and in furnishing reliable information.
5. Must be able to endure the necessary isolation and fend for himself, and must be sober.

Instructions for Use of Forest Service Eye Test for Fire Lookouts:

The lookout eye test is designed to measure the relative ability of towermen to see small smokes. The eye test card may be obtained from Protection Branch, COMO for testing of towermen's eyesight. The eye test is given as follows:

Select a suitable place out-of doors. Either a sunny or cloudy day will do. A dark foreground, such as green grass or earth is necessary. Avoid bright foregrounds, such as dusty or gravelled roads.

Insert the round peg in the block on the back of the board to form a handle, hold eye test board in full light of open sky but shaded from direct rays of sun. Avoid getting under eaves of buildings or under tree crowns.

Hold eye test board upright so that one pair of diagonal black bars is vertical, the other horizontal (the small spot will be up, down to right, or to left), with white side of eye test board facing towards the person being tested.

Have man being tested back away from eye test board until small black spot almost disappears (usually 12 to 14 metres).

Whirl eye test board several times so the small black spot may assume a new position, up, down, right or left. Have observer signal or state new position of the small spot. If correct, have him step back half a metre or more. Repeat procedure until the observer indicates position of small black spot incorrectly. Have him guess when he is no longer certain. He may rest his eyes if he wishes.

Record the observer's rating as the distance in metres from eye test board to the last point from which he can indicate position of the small black spot correctly. The distance at which this small spot can be seen is definitely related to the distance at which small smoke columns can easily be detected. The following tabulation indicates quality of eyesight in relation to eye test rating in metres.

Maximum distance at which <u>small</u> black spot can be seen (metres)	<u>Quality of eyesight</u>
>19	Exceptional
18-19	Good
15-18	Average
13-15	Fair
<13	Poor

TOWERS AND TOWERMEN (CONT'D)

The towermen will be required to:

1. Make early and late observations which the area O.I.C. shall require.
2. At first observation ensure that the orientation of the plan and finder is correct. This may be done by checking the bearing of one or two known points.
3. At 8 a.m. obtain the early morning fire weather forecast and pass it on to neighbouring towers or Divisions.
4. Report the wind direction, strength and visibility in each of the four quarters of the compass to District Headquarters. This information must be supplied as conditions change, hourly or more frequently as required.
5. Remain on continuous watch during such hours of the day as the Duty Officer shall determine, with stipulated times off for meals or short breaks as advised.
6. Maintain a careful watch for smoke at all times.
7. All smokes will be identified by number, Division and date. Immediately on locating a smoke, the lookout man should take a bearing and estimate the position of the fire. He should communicate this bearing and approximate location, together with a description of volume and character of the smoke, to central towerman or Divisional Headquarters, as previously instructed by the area O.I.C.
8. When the position of a fire has been definitely determined, the towerman will be supplied with the location and the serial number of the fire to be entered in the log book and in the margin of the plan at a point which is a continuation of the bearing. This serial number will be used in all further reports concerning such fire.
9. All messages to and from the tower must be entered in the tower log book against the time of the transmission.

In transmitting information from the tower the following codes will be used:

Visibility-

1. Clear vision up to 24 km.
2. Clear vision up to 16 km.
3. Clear vision up to 11 km.
4. Clear vision up to 8 km.
5. Clear vision less than 8 km.

Wind strength will be recorded in kilometres per hour if the tower is equipped with an anemometer or wind speed indicator. Otherwise, Beaufort Scale descriptions will be applied. The minimum period over which reliable wind speed estimates can be made with an anemometer is 12 minutes. Read the meter, wait 12 minutes, read it again. Subtract the first from the second reading and convert to kilometres per hour with the table provided.

TOWERS AND TOWERMEN (CONT'D)

Description of smokes:

A - Direct view

B - Not direct view

<u>Volume</u>	<u>Character</u>	<u>Colour</u>
Fine 1	Columnar 1	Blue 1
Medium 2	Spiral 2	White 2
Heavy 3	Billowy 3	Brown 3
Dense 4	Blankety 4	Black 4
	Drift 5	Copper 5

The towermen should receive some instructions on the use and care of instruments along the following lines:

Direction Finder. Care should be taken in removing and replacing the steel arm of the direction finder to see that the sighting vane and arm are not damaged. Any damage should be reported immediately.

Plan Board. The plan board should be protected as much as possible from any damage by rubbing and scraping and should be covered in the event of rain.

On vacating the tower each evening, the cover should be placed on the plan.

Binoculars. The binoculars now being issued to towers, besides being a precise optical instrument are also a very costly item of equipment and must receive every care in use.

The binoculars should be worn with a short strap and should not be left lying on the table or box to be picked up when required.

When not in use they should be kept out of the sun, either by keeping them in the cupboard or, if they are hung in their case, the lid of the case must be kept closed to protect the lenses.

Prolonged exposure to direct sunlight causes crystallisation of the cement used in the assembly of the large objective lens, causing a blurring of the image and necessitating complete dismantling and cleaning of the lens at considerable expense of rectification. Under no circumstances should binoculars be left on unattended towers.

Sunglasses. Sunglasses assist in the detection of fires in hazy conditions and to relieve unnecessary eyestrain resulting from continuous observation under conditions of heavy haze, sun glare and high winds. They should be kept clean and placed in the case when not in use. The best type of sunglasses are of the "polaroid" type.

Panorams. Panorams should be kept as clean as possible. Covers should be placed over the boards each evening and sometimes during the day to give protection from sun, wind and rain.

The towerman should be encouraged to make additions to the panorams as points are identified from time to time.

TOWERS AND TOWERMEN (CONT'D)

Care of Fire Towers and Lookout Trees:

At the end of the fire season the town plan, sighting vane, log book, panorams, anemometer, binoculars and sunglasses should be removed from the tower and the last two locked up.

At the same time the tower or tree hut should be inspected and a full report with suggested renovations or repairs (if any) should be submitted to the Divisional Office. The tower should be inspected with a view to determining -

- (1) The need for iron bands round uprights to control splitting.
- (2) The need for treating exposed ends of timber with hot creosote, petrolatum or some similar compound.
- (3) The need for painting or otherwise treating any exposed wood or ironwork.
- (4) The need for renovations or improvements to the lower cabin and hut.

Trees should be inspected for the following:

- (5) Dying back of the limbs or trunk.
- (6) Patches of rot in dead areas.
- (7) Rot or borer attack in tree pegs.

With the exception of towers which have been erected on a concrete base, each tower should be regularly examined to check condition of piles where they enter the ground.

At each inspection, the ground around the piles should be opened to a depth of 0.5 m and any weathered or decayed wood should be scraped off and exposed section should be painted thoroughly with hot creosote. If there are any indications of termites or decay, deeper holes should be opened and affected wood cleaned away. The creosote, before application, should be heated to simmering point, but not allowed to boil violently. The piles should be allowed to dry before treatment.

The tightening of bolts used in the construction of fire towers should only be necessary at the beginning of each fire season for the first two or three years, after which further tightening should not be necessary.

Excessive tightening of bolts is to be avoided.

In the course of this work, any patches of decay noted in the structural timber should be cleaned and a dressing of hot creosote applied to the affected areas.

It is estimated that for the treatment of the supporting piles in each tower 36 litres of creosote may be required. Any excess creosote left after painting the legs and other affected parts can be used for puddling the earth round the legs, particularly in the vicinity of any patches showing rot or termite attack. Supplies of creosote as required should be requisitioned.

TOWERS AND TOWERMEN (CONT'D)

In addition to the above periodic inspections, all towers and trees should be inspected before each fire season and officers-in-charge of districts where towers or trees are located should submit a report to the O.I.C. Protection Branch, Como, not later than 30 September in each year, setting out the general condition of the lookout and the towerman's hut.

At the beginning of the fire season steps must be taken to clear all undergrowth for a radius of 100 m around each tower or tree, so that there is no possibility of its carrying fire on the hottest day.

During the fire season at least two packsprays or 18L drums filled with water must be kept on the tower in case of emergency.

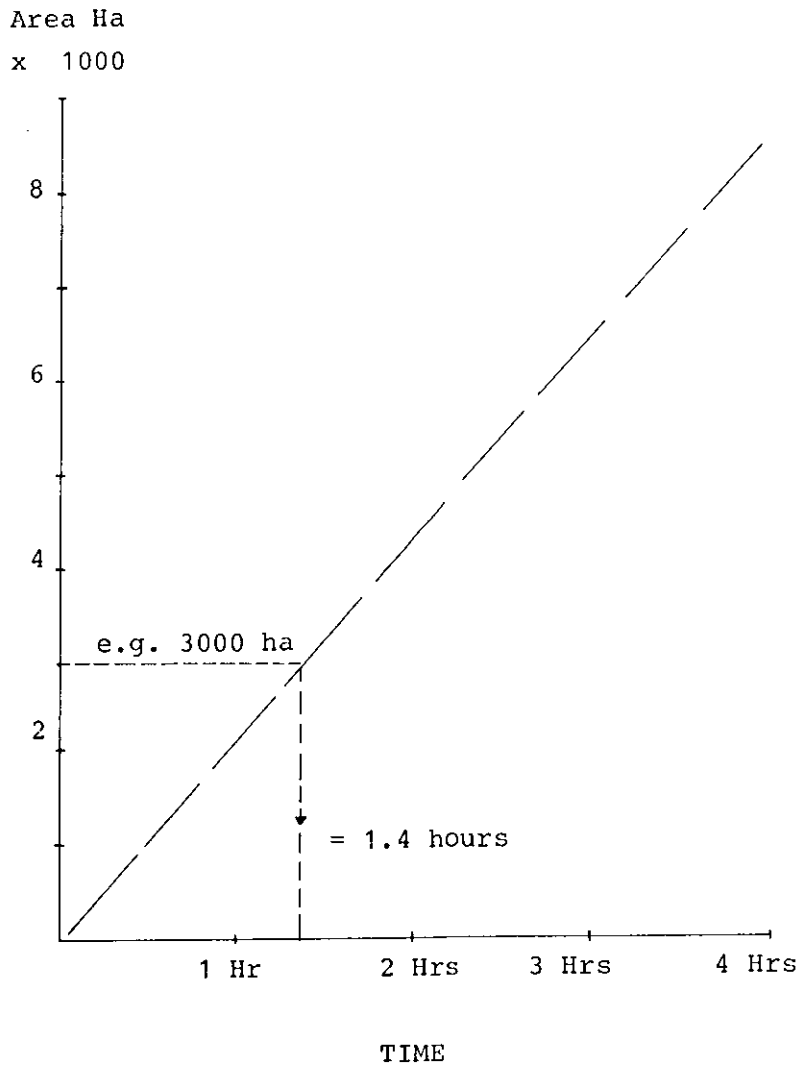
GUIDELINES TO DIVISIONS - AIRCRAFT PERFORMANCE

1. The following have been drawn up to assist Divisions in estimating the time that the B.N. 2 Islander aircraft can be expected to take to complete a job. These are intended as a guide only.
2. Other factors which should be taken into account, and will affect what time the aircraft can be expected over a job are:

Warm-up and taxiing		5 minutes
Flying to the job	3.5km or 2nm/ minute	
Reconnaissance circuit of the job		10-20 minutes
Dummy flight line to establish drift		5-10 minutes

3. Graph for calculating the amount of aircraft burning time required in relation to the job size:

ACTUAL TIME SPENT OVER JOB



GUIDELINES TO DIVISIONS - AIRCRAFT PERFORMANCE (CONT'D)

4. Constraints on Job Size:

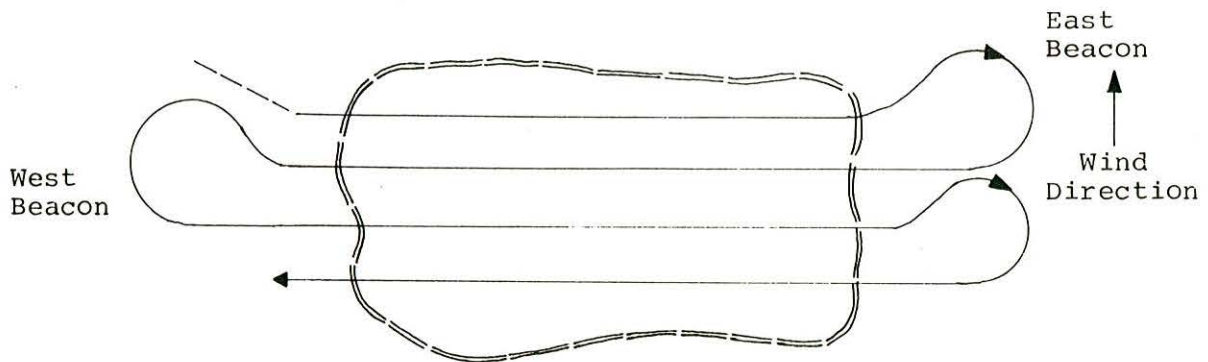
As the aircraft can carry only 4000 capsules, this reasonably limits burn size to an area which will not use more than 4000 capsules with a given lighting pattern. The table below shows the maximum job size for varying lighting patterns based on the 4000 capsule capacity.

<u>Strip Width by Spot Distance</u>			<u>Maximum Job Size</u>
150	x	75 metres	4 500 hectares
200	x	100 "	8 000 "
250	x	125 "	12 500 "
300	x	150 "	18 000 "
350	x	175 "	24 500 "
400	X	200 "	32 000 "

5. Flight Patterns:

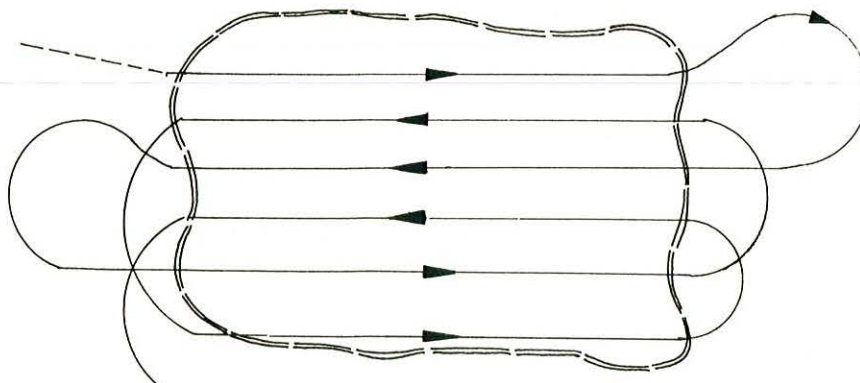
Parallel Method

Consists of marking every line with beacons and very pistol flares.



Corridor Method

Consists of marking only every second line with the beacon, i.e. the beacon has to move 400 metres if flight lines are 200 metres apart. The initial three or four lines are slow as the aircraft waits for the smoke to show up; when this occurs the aircraft flies back between the previous flight lines.



LIST OF FIRE CONTROL SIGNS

FIRE CONTROL - ROADSIDE SIGNS

F.D. 1 (Vacant)

F.D. 2 CAUTION - SLOW DOWN
 BURNING OFF
 "WATCH FOR"
 FALLEN TIMBER
 MEN, VEHICLES
 OBSTRUCTIONS

F.D. 3
 BUSH FIRE
 DRIVE SLOWLY
 HEADLIGHTS ON

F.D. 4
 AERIAL
 BURNING IMMINENT
 IF STAYING IN AREA
 CHECK AT OFFICE
 PHONE..

F.D. 5 (Old)	FORESTS DEPT 4x4 ONLY	FORESTS DEPT NO ENTRY
	FORESTS DEPT 4 x 4 ONLY	FORESTS DEPT NO ENTRY
	FORESTS DEPT WATER →	FORESTS DEPT CONTROL POINT
	FORESTS DEPT WATER →	FORESTS DEPT →
	FORESTS DEPT →	FORESTS DEPT →
	FORESTS DEPT →	FORESTS DEPT →
	FORESTS DEPT →	FORESTS DEPT PARK HERE
	FORESTS DEPT →	

LIST OF FIRE CONTROL SIGNS (CONT'D)

F.D. 5
(new)

4x4 ONLY
4x4 ONLY

HOSE LAY
ACCESS

WATER



HOSE LAY
ACCESS

WATER



NO ENTRY
NO ENTRY

HOSE LAY
ACCESS

F.D. 6

ROAD CLOSED

BURNING OFF

IN PROGRESS

F.D. 7

RETARDANT STICKERS

Amgard

MOP-UP

Retardant

2700-3000L	(600-660 Gal)	- 3½	PAILS	70 kg.
800- 900L	(180-200 Gal)	- 1	PAIL	20 kg.
400- 500L	(90-110 Gal)	- ½	PAIL	10 kg.

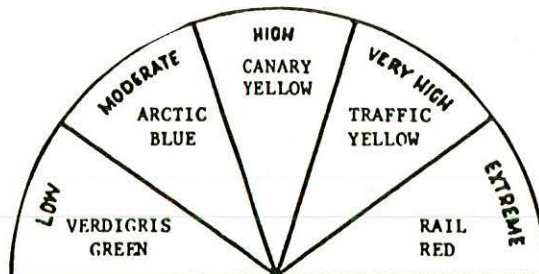
KNOCK-DOWN

2700-3000L	(600-660 Gal)	- 13	PAILS	260 kg.
800- 900L	(180-200 Gal)	- 4	PAILS	80 kg.
400- 500L	(90-110 Gal)	- 2	PAILS	40 kg.

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FIRE DANGER INDICATOR SIGNS

FIRE DANGER TODAY



CHEMICAL FIRE RETARDANTS

Proprietary brands of chemical fire retardants such as Phoschek, Firetrol, Metagard, Amgard etc., use either di ammonium phosphate (D.A.P.), ammonium sulphate or ammonium polyphosphate as the basic active ingredient.

This basic ingredient, when applied to cellulous fuels, alters the combustion reactions of the fuel.

Pyrolysis and combustion occurs at lower temperatures than normal. This low energy pathway of combustion occurs around 270°C and in so doing creates water, char, and a great deal of residue.

Normal combustion, or the high energy pathway occurs around 340°C, creating flammable volatiles which are consumed, leaving very little residue.

Combustion is made up of two phases, the "flaming phase" which would mainly be the flame front of a running fire, and the "glowing phase", which would be the burning of logs and large pieces of debris after the running fire has passed through.

To retard combustion during the "flaming phase", solutions of 15% to 30% w/w of D.A.P. would need to be applied to the fuels ahead of the flame front or onto the burning fuel, whereas to retard or extinguish burning material such as logs, trees, etc., i.e. "glowing phase", solutions of less than 5% w/w S.A.P. will usually be sufficient.

It should be noted that D.A.P. does not totally decompose until exposed to temperatures of approximately 700°C, whereas ammonium sulphate is dissipated at about 450°C. (Figures are not available for ammonium polyphosphate).

Retardant chemicals are generally used to produce retardation of the combustion process, including reduction in the rate of spread and fire intensity. Thus, retardants are used to buy time and reduce the effort necessary to suppress wildfires and speed the process of making edges secure.

For a retardant to be effective, it must coat most of the fuel which is contributing to fire propagation. This may or may not include all the fuel and will vary depending on the fuel type, for example, in an area where ground fuel is sparse and suspended fuels abundant, it is desirable to have the retardant remain as a coating on suspended fuels.

Use of a thickened retardant increases the amount of chemical retained on suspended fuels. Likewise, in an area of deep fuel beds - peat, sawdust, etc., - for the retardant to be effective it must penetrate and coat these compacted fuels. The most effective retardant for this type of fuel would be one of low viscosity, perhaps even containing a wetting agent.

In the case of aerial drops, the ability of a retardant material to hold together during the fall depends on the cohesiveness or flow properties of the retardant and the conditions affecting the drop, i.e., drop height, aircraft speed and wind. On coming in contact with the forest and scrub canopy, the retardant must then have the ability to adhere to suspended fuels in sufficient quantity to be effective, while the balance of the retardant is able to penetrate to coat the surface litter.

Corrosion

Uninhibited fire retardants are quite corrosive to almost all alloys and to many metals. Only retardant formulations containing effective

FIRE RETARDANTS (CONT'D)

corrosion inhibiting additive must be used in tanks, pumps and plumbing equipment.

AMGARD D./S.B.

W.A. Developed Fire Retardant

This is the proprietary name covering the blending of 88% D.A.P. and 12% sodium benzoate, a basic active ingredient plus a corrosion inhibitor.

The D.A.P. used is type "R", a refined, highly soluble material which readily conforms to our specific requirements, while sodium benzoate is a recommended corrosion inhibitor which is not so readily soluble.

This blended, basic fire retardant is supplied to this Department in poly-lined, 23 litre steel pails, complete with crimp over lids and carrying handles.

This basic mixture, when mixed with water at the rate of 2.4 kg/100 L is suitable for mopping-up purposes.

For knockdown purposes this rate should be increased to 9.5 kg/100 L. To make it fully effective, thickeners should be added to assist the retardant to adhere to the fuel and so prevent draining off into the soils. If the fuel bed is compacted or of a peaty nature, then thickeners should be left out and if necessary, a detergent or surfactant added to increase penetration of the fuel bed.

It is intended to stock a second pack of Amgard containing a blend of thickener, mainly for use in knockdown situations. The second pack will be suitably marked so that it is easily identified.

The adding of a colouring agent to the mixture will assist in applying and locating the laid swathe of retardant.

Mixing

Because of its high solubility, very little trouble should be experienced in mixing Amgard D.S/B with water. Water in the tank should receive adequate agitation during the mixing process.

It is recommended that the pumper be operating with a short hose recycling the solution through the pump back to the tank under pressure, whilst the chemicals are being added.

Where thickening agents, in the form of dry powders are being mixed, it is important that they are added slowly to the solution, which should be receiving maximum agitation, otherwise problems will be encountered with pre-wetting (a condition where lumps will occur - the surface of the lumps will be wetted, but the centre core remains dry. In this condition it is extremely difficult to get the material into solution).

Blending the thickening powder with other ingredients will greatly assist the mixing process, particularly if used through a feeding hopper. It should be noted that the addition of retardant to the pumper will increase the quantity in the tank, so approximately 230 litres should be allowed for this increase.

FIRE RETARDANTS (CONT'D)

Application

Knockdown Mixtures

The generally accepted application rate in knockdown of running fires is 1 litre per square metre, but may have to be increased up to twice this figure or more where heavy fuels are encountered.

If a direct attack method is used on a fire, retardant should be applied to coat the unburnt fuel directly in front of the flames, with about 20% of the retardant being applied to the flaming areas.

Where an indirect attack is used, a swather of retardant should be laid ahead of the fire front. A retardant break of 150 m by 20 m (3000 sq. metres) can be covered at the application rate of 1 litre/square metre by heavy duty tanker. The retardant properties still remain after the water has evaporated.

Nozzlemen should receive training in simulating the application of retardant, to become proficient in covering the area at the prescribed application rates.

Mop-Up

Concentrations of Amgard as low as 2.5 kg/100 L of water are usually quite sufficient to douse burning logs, trees and stumps, providing care is taken that the retardant is applied to cover all smouldering areas. Re-ignition is likely to occur when all areas are not adequately doused.

Fire in hollow trees or on the underside of burning logs should be doused by inserting a low volume variable spray nozzle into such areas, and by using a pumper pressure of around 700 kilopascals (100 p.s.i.) to create a fog or mist atmosphere ensuring coverage to the underside of the burning timber. Extension attachments to nozzles can aid this operation.

Housekeeping and Maintenance

Fire retardants are naturally corrosive to a range of metals and although corrosion inhibitors are added, some corrosion can be expected to occur. It is essential that good housekeeping is maintained to keep corrosion to a minimum. Therefore, every pumper using fire retardant will need to have the pump, plumbing and hoses flushed through each day after use. For this purpose, a quantity of at least 250 L of clean water will need to be flushed through the pump, and valves should be activated during this operation to avoid subsequent seizing.

Mixed retardant should not be stored in pumper tanks, but when a quantity of retardant is left over after a day's operation and intended to be used the following day. The pump and plumbing can be flushed through by closing the valve to the tank and the required amount of water draughted through the suction line and pumped via the necessary components.

Where the mixed retardant is spilt on truck trays and elsewhere, the possibility of slipping is increased, particularly where thickening agents are used in the formulations. Effective footing and frequent washing down is essential for safety reasons. D.F.O.s and fire officers are urged to keep a close watch on these practices.

FIRE RETARDANTS (CONT'D)

Storage of Mixed Retardants

Divisions which have overhead Phoschek storage tanks installed, will be required to go over to mixed Amgard retardant when their present stocks of Phoschek are exhausted.

Amgard can be stored successfully in the liquid state for twelve months or more, provided no thickening agents are added. Recycling of the mixture from time to time is still required as the corrosion inhibitor is inclined to settle out.

Tests are under way to prove that a spoilage agent will preserve a mixed retardant with thickening agents for long periods.

A number of fibreglass tanks are being purchased to provide storage facilities for mixed retardants at Divisions, which will provide access to retardants for fast attack calls.

Safety and Health

Toxicity has not been considered a problem with ammonium phosphate, since this material has been commonly used as an agricultural fertiliser for many years.

Ammonium vapour, because of its irritating fumes, has a built-in safety feature, in that people will normally withdraw from the vapour zone when the discomfort level is reached. The inhalation of ammonia fumes does not have a cumulative effect and a person is able to breathe 25 p.p.m. (threshold limit value) continuously without harm.

When ammonium sulphate is applied to a heat source such as burning logs, heavy ammonia fumes are emitted. A nozzleman should position himself on the upwind side of material being doused so as to stand in a zone of clear air.

The use of an extended nozzle attachment would assist in placing the operator away from the emitted gases.

Where a susceptible hoseman finds continued discomfort from ammonia fumes, the use of a face mask and goggles should be tried. Should the trouble persist, a change of operators should be contemplated.

The corrosion inhibitor, sodium benzoate, is not regarded as a health hazard, as a large quantity would need to be swallowed to cause any harm. This material is used in the manufacture of soft drink as a preservative.

Tables for mixing retardant quantities:

FIRE RETARDANT - MOP-UP MIXTURES

TYPE R, AMGARD D./S.B. (Contains D.A.P. blended with sodium benzoate corrosion inhibitor).

MOP-UP MIXTURE R 12

2 730 litres (600 gallons)	=	5	pails Amgard "Type R"
820 litres (180 gallons)	=	1½	pails Amgard "Type R"

MOP-UP MIXTURE R 16

2 730 litres (600 gallons)	=	3¼	pails Amgard "Type R"
820 litres (180 gallons)	=	1	pail Amgard "Type R"

FIRE RETARDANTS (CONT'D)

FIRE RETARDANT - KNOCKDOWN MIXTURE

TYPE R4 AMGARD DS/SB (Contains D.A.P. blended with sodium benzoate corrosion inhibitor and Manutex R.S. 92 alginate thickener)

R4 KNOCKDOWN MIXTURE

2 730 litres (600 gallons) = 13 pails Amgard "Type R4"
820 litres (180 gallons) = 4 pails Amgard "Type R4"

FIRE RETARDANT - TRAINING MIXES

A coloured, thickened water for training purposes may be made up using the following mixtures:

Viscous Water Mix No. 1 (Ground Tanker Use)

1.14 kg/455 litres (100 gals) Courlose) Viscosity
.7 litres/455 litres (100 gals) Lo-drift) approximately
.25 kg/455 litres (100 gals) Red Marker Dye) 20-25 M.F.S.

Courlose is recommended for this mixture but may be substituted with-

- (a) Celofas 1.3 kg/455 litres
- (b) Manutex 1.8 kg/455 litres

Viscous Water Mix No. 2 (Aircraft Drop)

2.13 kg/45 litres (100 gals) Courlose)
.7 litres/45 litres (100 gals) Lo-drift) 55 M.F.S.
.25 kg/455 litres (100 gals) Red Marker Dye)

Courlose is recommended for this mixture but may be substituted with-

- (a) Celofas 3 kg/455 litres
- (b) Manutex 3.8 kg/455 litres

NOTE:

With all mixtures (both retardant and training) allowance should be made in the tank for additives, e.g., 2730 litres (600 gals) of mixed retardant - start with 2500 litres (550 gals) water.

Viscosity may vary considerably depending on the pH of the water used. Some adjustment of thickener quantities may be required.

SCALE 'A' CONTROL POINT EQUIPMENT

CONTROL POINT EQUIPMENT

- 1 tent 3 x 3m.
- 6 folding chairs) can include folding combination
- 4 folding tables) table and seats.
- 1 camp stretcher with mattress and pillow
- 1 ambulance stretcher
- 1 large first aid kit
- 10 directional "Control Point" signs
- 2 'Bushfire' warning signs F.D. 3
- 1 shovel
- 1 rake hoe
- 1 axe
- 1 hammer approx. 2 kg.
- 1 packspray
- 1 syphon hose 1.5 m x 12 mm

STATIONERY AND OFFICE EQUIPMENT ETC.

- 1 disposition board
 - 1 large blackboard, chalk and duster
 - 1 map clipboard
- QTY: writing pads, pencils, biros, Chinagraph pencils, clear plastic, erasers, adhesive tape, drawing pins, scale rulers, protractor, message forms, gang unit cards, sector boss report forms, Paftacc, dieback hygiene check lists, bulldog clips, paperweights, matches, V.H.F. callsigns, insect spray, hardwood and plantation plans, L.F.O. book, Fusee matches.

LIGHTING EQUIPMENT

- 1 gas light (300 candlepower) + 10 spare mantles
- 2 gas bottles 1.13 kg. size
- 1 wooden box with lid to store above equipment
- 1 Honda 12 volt generator + can petrol and pourer
- 4 12 volt fluorescent awning lights
- 1 30 m extension lead for lights
- 1 wooden box containing sundry light fittings, short leads etc.

COMMUNICATIONS EQUIPMENT

- 1 portable pack for V.H.F. radio
- Instruction sheet for portable repeater station (available Communications Branch).

COOKING, EATING AND WASHING EQUIPMENT

- 1 2 burner gas stove with stand
- 2 2 kg. gas bottles
- 1 portable gas barbecue
- 1 4 kg. gas bottle

RATIONS - food, tea, coffee etc.

EATING - cutlery, tin openers, polystyrene cups with lids

WASHING

- 2 large plastic bowls
- 6 rolls paper towels
- 6 teatowels
- 6 toilet rolls
- 6 cakes toilet soap
- 1 bottle liquid detergent

SCALE 'A' CONTROL POINT EQUIPMENT (CONT'D)

OTHER EQUIPMENT

- 1 PVC drinking water container with tap
- 2 large insulated drink containers
- 2 large insulchests (40-60 l)

SCALE 'B' CONTROL POINT EQUIPMENT

- 2 folding chairs) can include folding combination
- 2 folding tables) table/seats
- QTY. directional "Control Point" signs
- 1 disposition board
- 1 large blackboard
- 1 map clipboard
- 1 box stationery:
writing pads, pencils, biros, Chinagraph pencils, clear plastic
rolls, erasers, adhesive rolls tape, drawing pins, scale rulers,
protractor, message forms, gang unit cards, sector boss report
forms, 'Paftacc', dieback hygiene check lists, bulldog clips,
paperweights, chalk and duster, matches, V.H.F. callsign sheet,
insect spray, hardwood and plantation plans, L.F.O. book,
Fusees.
- 1 gas barbecue
- 1 gas bottle 4 kg. size
- 1 2 burner gas stove
- 2 gas bottles 2 kg. size
- 1 gas light (300 candlepower)
- 2 gas bottles 1.13 kg. size
- 10 spare mantles
wooden box with lid to store lamp, bottles, mantles etc.
- 1 portable pack for V.H.F. radio
- 1 first aid box (large)

RATIONS - food, tea, coffee, sugar etc.

EATING - cutlery, tin openers, disposable cups

- 1 large kettle
- 1 large pot
- 1 P.V.C. drinking water container with tap
- 1 large insulated drink container
- 1 large insulchest (40-60 l)

LIST OF OTHER JOB PRESCRIPTIONS.

1. Division Fire Control Check List.
2. Operating instruction for aerial control burning incendiary machine.
3. Fire detection with spotter aircraft.
4. Air operations manual.
5. Fire Control Training: Teaching Plan Pro formas.
6. Care and maintenance of Marconi Moisture Meter.
Speedy " "
Thermohygrograph.
7. Care and maintenance of canvas hose.
8. Preparation of hardwood burning prescriptions.
" " pine fuel " "
" " "
9. Guideline for edge burning.
10. Measurement of forest fuel quantity.
11. Guide to slash burning in Karri Forest.

PART 12

FORESTERS' MANUAL

MINING IN FOREST AREAS

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

PART 12 - MINING IN FOREST AREAS

- History of mining activity in Western Australia
- 12.001 Mining activity has long been associated with economic growth in Western Australia: the discovery of gold at Coolgardie and Kalgoorlie initiated the first major immigration to this State. Although the first mining in high forest was for tin at Greenbushes, commencing in 1888, the woodlands of the Coolgardie-Kalgoorlie area also played a vital role for many years in the production of timber for underground mining purposes, dwellings and fuel.
- Mining in the main forest zone
- 12.002 In the main forest zone, tin and coal mining have been more or less continuous, but other mining was initially sporadic or limited to the extraction of engineering materials such as gravel, sand and rock. However, in the middle 1950s mineral sand production began in the Capel-Ludlow area. For a number of years these operations took place adjacent to State forest, and the Department entered into written agreements with several of the mining companies.
- Coal mining
- 12.003 Coal mining began at Collie in 1898. Mining was underground with very little above-ground disturbance until open-cut mining began in 1943. However, there has always been a big demand for mining timbers, often to exact

specifications, with a consequent deleterious effect on regrowth forests in the area.

Bauxite mining

12.004

Currently the biggest mining operation in the forest is for aluminium ore (bauxite). Clearing for mining operations began at Jarrahdale in 1963 after nearly ten years of exploratory work and expanded rapidly from the predicted 14 ha a year to a level approaching 270 ha a year in 1976.

Other mined resources

12.005

A number of other mining operations impinge either directly or indirectly on forest areas:

<u>Resource</u>	<u>Regions concerned</u>
Cladium peat	Wanneroo, Manjimup
Diatomaceous earth	Wanneroo
Limestone	Wanneroo, Busselton
Brick clay	Mundaring, Kelmscott
Vanadium	Mundaring

Although the area covered by these operations is relatively small, it cannot be overlooked.

Minerals exploration of the 1960s

12.006

The mineral exploration activity of the late 1960s had a dramatic effect on State forest and Timber Reserves. In 1970 there were 76 000 ha of mineral claims and 640 000 ha of mineral leases on State forest. At December 1975 there were still some 230 mineral claims on State forest, covering an area of approximately 52 000

ha. These claims are pegged for a wide variety of materials including diatomaceous earth, clay, peat, lead, silver, nickel, chromium, vanadium, quartz, feldspar, etc. Many of the claims have still to be heard in the Warden's Court (see paragraph 12.030).

LEGISLATION

Mining Act and Mines
Regulation Act

12.007 The current Mining Act was reviewed by a Committee of Enquiry in 1970, and in 1978 a bill to amend the Act was introduced and debated in Parliament. Pending acceptance of the amendments by Parliament, the two Acts currently relevant to mining are:

Mining Act, 1904 and Regulations
Mines Regulation Act, 1964 and
Regulations.

These Acts are administered by the Mines Department. All small mining tenements are controlled by the provisions of these two Acts.

Mineral agreement
acts

12.008 In recent years, and particularly for large mining proposals, it has become normal practice to enact specific legislation for each venture. As a result various agreement acts now exist for the operations, active or proposed, in State forest and Timber Reserves:

Alumina Refinery Agreement Act
No. 3 of 1961
Alumina Refinery Agreement Act
No. 48 of 1963
Alumina Refinery Agreement Act
No. 76 of 1966
Alumina Refinery Agreement Act
No. 61 of 1967
Alumina Refinery Agreement Act
No. 47 of 1972
Alumina Refinery Agreement Act
No. 34 of 1974
Alumina Refinery (Pinjarra)
Agreement Act No. 75 of 1969
Alumina Refinery (Pinjarra)
Agreement Act No. 48 of 1972
Alumina Refinery (Pinjarra)
Agreement Act No. 67 of 1973
Alumina Refinery (Pinjarra)
Agreement Act No. 116 of 1976.

Specific agreement
acts are advantageous

12.009

These special agreements are of advantage in that they can incorporate provisions specific to a particular venture. It is likely that the use of special legislation will continue. It is, however, difficult for the individual to keep himself informed about the increasing volume of legislation. Field staff should be familiar with those sections of the relevant agreement acts dealing with forest activity and with those sections of the Mining Act dealing

Staff must have
knowledge of relevant
acts and agreements

with applications for mineral tenements.

POLICY

12.010 The main policy directions were first put into printed form in the Department's General Working Plan No. 86 of 1977. They are as follows.

Major policy directions regarding mining

Advise Government of the effects of mining lease approval on forest values.

Continue research into techniques aimed at minimising environmental damage and land-use conflict.

Liaise directly with mining companies to ensure that they are aware of the effects of mining on the environment and other land uses and of rehabilitation techniques.

Liaise with other authorities responsible for administering mining agreements and with other organisations authorised to study mining effects and rehabilitation techniques.

Rehabilitate areas affected by mining to suit the anticipated land use, in accordance with conditions imposed by State Government under the various mining agreements.

Investigate rehabilitation techniques.

Strategy for implementing policy directions

12.011 The strategy adopted to implement this policy requires minimisation of the area cleared for mining,

realistic compensation payments, rehabilitation in accordance with land management objectives and the direction of open-cut operations into areas where the least land-use conflict will occur and where salinity problems are unlikely.

MINERAL FIELDS

Definition of mineral fields

12.012 As an aid to reference and location of mining tenements, the State has been divided into a number of mineral fields. These are defined by the Mining Act as "any lands proclaimed or deemed to have been proclaimed a mineral field under the provisions of this Act".

12.013 Most of the main forest zone lies within the South-west Mineral Field but note that within this are special areas designated as the Collie River Mineral Field and the Greenbushes Mineral Field.

Warden

12.014 Each mineral field has an appointed officer known as a Warden, who presides over the Warden's Court.

MINING TENEMENTS - PROCEDURE

Definition of mining tenements

12.015 A mining tenement is defined in the Mining Act as:
"Any land applied for, held, occupied, used, or enjoyed under a lease or application therefor, or as a claim, or any area, water race, drain, dam, or

reservoir; any stack or accumulation of earth containing gold or any other mineral; or any easement taken up, held, occupied, used, or enjoyed under or by virtue of miner's right".

Types of mining tenement

12.016 There are many types of mining tenement. Those most commonly occurring on State forest and Timber Reserves are as follows.

Mineral claim - a portion of land pegged by a miner

Mineral lease - a lease granted under the Act

Coal mining lease

Prospecting area (usually for coal)

Mineral reserve

Quarrying area

Size of mining tenements varies according to purpose

12.017 The size of the tenement varies with its purpose.

The following general rules apply:

Gold mining: 10 to 20 ha

Mining lease: 20 to 40 ha

Coal mining: 130 ha

Sluicing, dredging: 2000 ha

Prospecting area (coal): 1200 ha

The Mining Act provides that "the length of the area, as far as practicable, shall not exceed twice the width thereof".

Ministerial temporary reserves

12.018 Section 276 of the Mining Act provides for the Minister to "temporarily reserve any Crown land from occupation, and the Minister may at any time cancel such reservation:

Provided that if such reservation is not confirmed by the Governor within twelve months, the land shall cease to be reserved".

Ministerial Temporary
Reserve No. 5487^H

12.019 On 2 July 1971, Crown land within State forest and Timber Reserves in the South-west, Collie River and Greenbushes Mineral Fields was temporarily reserved. The creation of the Ministerial Temporary Reserve 5487^H prevented holders of a miner's rights from being granted a mining tenement on the reserve. The reservation did not apply to Alcoa's mineral lease nor subsequently to the Worsley Alumina Pty. Ltd. lease, Collie coal fields, parts of the Greenbushes tin mining field and approved mining claims for sand mining at Capel.

Prospecting without
satisfactory reason

12.020 An officer who encounters persons or groups pegging or prospecting in State forest or Timber Reserves outside the Temporary Reserve should notify Head Office immediately, giving full details.

Method of pegging
a mineral claim

12.021 Mineral tenements are usually pegged by the holder of a Miner's Right. The length of a tenement is approximately twice its width and it is rectangular in shape. The Mining Act provides that the tenement shall be "marked off by fixing firmly in the ground at each corner or angle thereof a substantial post or cairn of stones projecting not less than three feet above the

surface and set in the angle of two trenches, not less than four feet in length and six inches deep and cut in the direction of the boundary lines". A copy of the application for a claim should be fixed, in a waterproof wrapping, to one of the corner posts or cairns, the "datum post".

Application to be lodged within ten days of pegging

12.022 Within ten days an application (Form No. 9, Application for Lease) must be lodged with the Warden or Mining Registrar, together with deposits for rent and the prescribed survey fee.

Notice of application to be published

12.023 The applicant must also publish notice of his application at least once in a local newspaper within fourteen days after lodging the Application for Lease.

Objection to mineral claims

12.024 Up to thirty days after an application for a lease has been lodged, any person may lodge an objection (see Appendix I, Form of Objection, which should be submitted in duplicate).

Warden's Court procedure

12.025 Upon receipt of any objection, the Mining Registrar fixes a day for hearing the objection and advises both the applicant and the objector. At the hearing the Warden takes evidence tendered on oath, and either gives his recommendation directly or forwards it to the Mines Department,

Standard objection
procedures modified
for Forests Department

12.026 The standard procedures for objection, defined by the Mining Act, have been modified in the following respects as a result of representations by the Conservator to the Under Secretary for Mines:

The Mines Department sends written advice and plans of each new application for a mineral tenement on forest land to the Forests Department.

The thirty-day limit for lodging objections is not enforced.

The Forests Department does not pay the prescribed fee for each objection.

Processing of claim
is often a long
procedure

12.027 The entire process, from the time a mineral claim is pegged until its cancellation or approval, can be quite prolonged, often up to five or six years.

Example of typical
mineral claim
procedure

12.028 For any mineral claim there may be variations in procedure. The following is, however, a typical example.

<u>Time lapse</u>	<u>Action</u>	<u>Person concerned</u>
	Mineral Claim	Miner
	MC 1000 ^H	
	lodged	
+ 4 weeks	Advice of MC	Under
	1000 ^H to	Secretary
	Forests	for Mines
	Department	

<u>Time lapse</u>	<u>Action</u>	<u>Person concerned</u>
+ 4 weeks	Objection to MC 1000 ^H lodged	Conservator
+ 6 months	Advice of date for hearing of objections	Registrar, Mineral Field
+ 1 week	Crown Law requested to represent	Conservator
+ 6 weeks	Warden's Court hearing and recommendation	Warden
+ 6 weeks	Advice of decision	Minister for Mines

Report on claims required from Divisional staff

12.029

Divisional and Regional staff may be contacted at two stages in this process:

- 1) at the time of first notification, in order to assess the value of lodging objections;
- 2) at notification of the date fixed for the Warden's hearing, where the Conservator's witness may need background information, description of land-use conflicts, dieback risk, photographs etc., to be able to represent the Conservator in the courtroom. At the latter stage in particular, there is usually some urgency about

returning the information requested. Preparing a detailed case for every claim at the first stage is not warranted because some claims lapse and do not come before the Warden's Court. (See Appendix II, Inspection: Particulars of Mining Claims and Leases.)

Warden's Court

12.030

The Warden's Court is a court of record. The south-west Warden's Court is on the top floor of Mineral House, Adelaide Terrace, Perth. The Warden is usually a magistrate with legal training. He may exercise the powers of the Supreme Court or of a judge thereof. All parties are usually represented by Counsel. Witnesses take the oath in a witness box, as for any other courtroom procedure, and are examined and cross-examined. Procedure is often less formal than in other courts. An important difference is that there are no rules of precedent. This means that for a second hearing of the same claim, all evidence must be presented again. Therefore, an argument that might have carried a ruling in favour of the Forests Department one day might not be as effective at the next sitting of the court.

Rules of precedent
do not apply in
Warden's Court

Warden's Court
recommendation

12.031 The Warden may conclude the hearing with his recommendation, but more commonly his judgement is reserved and the Conservator is advised by mail of the recommendation.

It is important to note that in most instances, the Warden does not make an immutable decision but rather a recommendation, which is forwarded to the Under Secretary for Mines and thence to the Minister for Mines. The Minister is not bound to agree with the Warden's recommendation.

Conditions for mining
can usually be
nominated by Forests
Department

12.032 When Forests Department objections have been unsuccessful the Department is still usually in a position to nominate conditions under which the prospecting or mining can proceed. In the case of open-cut mining in particular, the Department has been able to have very stringent conditions accepted by both Warden and claimant. (Appendix III shows a typical set of conditions. However, these are varied to meet specified needs.)

BAUXITE MINING

History of bauxite
mining in Western
Australia

12.033 In 1958 a temporary lease was made available to a prospecting group, Western Aluminium NL, to carry out a broadscale test drilling programme for bauxite, one of the world's

most common mineral ores and the source of alumina and aluminium. Alcoa of Australia began mining bauxite near Jarrahdale in 1963 and opened a second operation at Del Park, near Dwellingup, in 1972.

Mining agreement acts vary in details

12.034 As mentioned earlier (paragraph 12.008), there are a number of mining agreement acts between the Government and Alcoa. The agreements are generally similar, but their details vary, particularly with respect to the procedure for mine clearing, rates of compensation for forest destroyed and the assignment of responsibility for rehabilitation.

Mining agreement acts administered by Department of Industrial Development and various committees

12.035 The mining agreement acts are officially administered by the Department of Industrial Development. There are also several groups or committees concerned with both the practical and environmental aspects of open-cut bauxite mining operations:

- Bauxite Policy Committee
- Mining Management Programme Committee
- Purity of Water Committee
- Research Coordination Committee
- Mining Operations Control Group (MOG).

Erosion Control and Rehabilitation Working Group

12.036 The Mining Operations Group is an inter-disciplinary group representing Government interests, including the Public Works Department, the Metropolitan Water

Board and the Department of Agriculture (Soil Conservation Service). It is chaired by the Forests Department's Superintendent (Northern Region). All applications for access to forest areas for mining activity are submitted to the Conservator at least six months in advance (up to 2 years in advance for roadworks), and are referred to this committee before approval is given for the removal of timber and subsequent operations.

Group monitors forest values at risk and rehabilitation operations

The committee assesses the likely impact of mining activities on forest and some social values, including risk of erosion, stream turbidity, and conservation of flora and fauna. The Committee then reports to the Conservator on whether they consider there are grounds for objection, deferral, or modification to the areas applied for, and for any conditions to be met to meet mining and rehabilitation standards. The group works in close liaison with research and operational bodies associated with the mining sphere.

Interdepartmental working committee resolves problems

12.037

Any abnormal situations are referred for comment and resolution to an interdepartmental working committee consisting of the Chief Engineer (M.W.B.), the Commissioner for Soil Conservation and the Deputy Conservator of Forests.

- Written approval required for mining 12.038 Head Office provides written approval for access to State Forest for mining activities, specifies the conditions, and forwards an invoice for compensation.
- Dieback hygiene in mining operations 12.039 Apart from the mining operations, the movement of mining equipment and the activity of the almost continuous test drilling programme in areas well in advance of current mining are likely to spread Phytophthora cinnamoni (the pathogen causing dieback disease). Special washing down procedures have been developed, and are especially important for the highly mobile test-drilling units.

BAUXITE MINE REHABILITATION

- Preliminary proposals for rehabilitation 12.040 After Alcoa has advised of areas ready for rehabilitation, preliminary proposals are prepared by the Divisional O.I.C. and Regional Leader (Operations), and are submitted to the Superintendent (Northern Region), who is also required to consider proposals from the Department's Research Branch, and other involved organisations including the CSIRO.
- Annual inspection of sites to be rehabilitated 12.041 The Mining operations Group, accompanied by Alcoa environmental personnel, the local O.I.C. and the Regional Leader (Operations), inspects areas in November each year.

Details to be included
in proposals

12.042 Proposals for rehabilitation include recommendations for soil erosion control, water disposal, contouring, species of trees, ground cover, and planting patterns and technique to be used. They are submitted to Head Office for approval.

Pit is prepared
in summer

12.043 Pit preparation may include battering of pit faces, levelling, the return of top-soil, and deep ripping at close spacing on the contour (all carried out in summer). The site is planted or seeded and fertilised in May to July by the Forests Department at Jarrahdale and by Alcoa at Dwellingup.

Subsequent tending
prescribed by
Forests Department

12.044 Subsequent tending operations are prescribed by the Forests Department. Consideration is given to recommendations put forward by the mining company, the Metropolitan Water Board, the Public Works Department and research personnel.

APPENDIX I

Form No. 25

M.D. 97

THE MINING ACT, 1904

FORM OF OBJECTION

No.....

Reg. 159 To the Warden of the Goldfield (or Mineral Field).

* I or We *.....the undersigned, hereby give you notice that.....

** As the case may be object **
.....

*** Here set out the reason for the following reasons, viz.:-***

And*.....require you to withhold **.....

pending the hearing by you of my (our) said objections.

Dated this.....day of

Full name(s) of Objector(s).....

.....

**** For Service of Notice. Address****.....
.....

.....Signature.

Received the above objection at.....o'clock,....m, on the.....

day of19....., with fee of

This objection will be heard in the Warden's Court on the

.....day of19....., at the

hour of o'clock,.....m.

.....(Warden (or Mining Registrar).

.....(Goldfield (or Mineral Field).

APPENDIX II

APPLICATION FOR COAL MINING LEASES

1. Upon the expiration of its two-year term (from the date of registration), the lease will be cancelled without compensation. However, this will not occur if the holder demonstrates, within the two-year period and to the satisfaction of the Minister for Mines, the existence of an economic deposit of minerals on the mining area. (Under these conditions, "mining area" means the area comprised in Coal Mining Lease Numbers (see attached sheet)).
2. Mining will be restricted to exploration operations until:
 - 2.1 The holder has demonstrated, to the satisfaction of the Minister for Mines, the occurrence of an economic deposit of minerals on the "mining area".
 - 2.2 An environmental review and management programme of the development and rehabilitation of the "mining area" has been submitted to and approved jointly by the Minister for Mines and the Minister for Forests.
 - 2.3 The holder has satisfied the Minister for Works that mining will not adversely affect the water quality and quantity of any reservoir, stream, river or watershed, and approval to proceed has been given by that Minister.
 - 2.4 The holder has agreed that no mining operations or associated activities be undertaken in areas designated as Conservation Management Priority Areas.
3. Exploration Conditions:
 - 3.1 All proposals for forest clearing for mining exploration on the "mining area" must be submitted in writing by the holder to the Conservator of Forests at least six months in advance of the intended commencement date. Clearing must not commence until the Conservator's approval in writing has been given.

The holder must obtain a license for any clearing on any declared catchment (Part II, Country Areas Water Supply Act 1947/80 as amended).
 - 3.2 The holder must pay compensation to the Conservator of Forests for areas cleared.

Compensation for areas cleared must be payable at the rate of \$967.00 per hectare. This rate will be reviewed annually, bearing in mind the rate payable for areas cleared for bauxite mining.

- 3.3 The holder must rehabilitate the cleared areas at his own expense, in consultation with and to the satisfaction of the Conservator of Forests.
- 3.4 Access to and from, and the movement of vehicles and personnel within the "mining area" is restricted to those roads and tracks agreed to by the Divisional Forest Officer.

Vehicle access and the use of potential carriers of the disease known as *Phytophthora cinnamomi* in the "mining area" are subject to Forest Disease Regulations, and may only be granted under permits issued by the Forests Department.

Permits for vehicle access and the use of potential carriers of *Phytophthora cinnamomi* in a Forest Disease Risk Area, for exploration purposes, will only be considered after the area involved has been effectively quarantined, photographed and mapped to show precisely the extent and location of *Phytophthora cinnamomi*.

- 3.5 The holder must wash down and clean all equipment, rigs, vehicles, tools and other equipment, in accordance with the standard required by the Divisional Forest Officer. This must be carried out prior to and on each occasion any such equipment, rig, vehicle, tool or other equipment is brought onto or taken from the "mining area", unless otherwise advised by the Divisional Forest Officer or his nominee.
- 3.6 The holder must comply with the instructions of the Conservator of Forests, or his nominee, concerning the disease known as *Phytophthora cinnamomi*, the prevention and spread of that disease and general forest hygiene.
- 3.7 The provision of the Forest Act, 1918 and the Regulations thereunder.
- 3.8 The provisions of the Bush Fires Act, 1959 and the Regulations thereunder.
- 3.9 The right of the Conservator of Forests, his servants, agents or nominees to enter upon the "mining area" and inspect any work being carried out on the "mining area".

- 3.10 The holder must inform the Divisional Forest Officer each week of the operation's location on the "mining area" (unless otherwise advised by the Divisional Forest Officer or his nominee).
- 3.11 The holder must keep the "mining area" free from litter and rubbish, and leave the area in a clean and tidy condition to the satisfaction of the Conservator of Forests.
- 3.12 Upon the completion of each exploration operation, the site must be left in a clean and tidy condition to the satisfaction of the Conservator of Forests.
- 3.13 The holder must take all reasonable precautions not to unnecessarily destroy or damage any tree or woody shrub on the "mining area".
- 3.14 The holder must refrain from allowing any firearms to be taken onto or used on the "mining area".
- 3.15 The holder must refrain from establishing any camp, base works or area, fuelling depot or similar establishment on the "mining area" unless the site is agreed to by the Divisional Forest Officer.

PART 13

FORESTERS'
MANUAL

RECREATION AND LANDSCAPE
MANAGEMENT

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

PART 13 - RECREATION AND LANDSCAPE MANAGEMENT

RECREATION

Definition of recreation 13.001 Recreation is defined in many ways for many different purposes. The following is a useful general definition: "An act or experience selected by the individual during his leisure time to meet personal want or desire".

Forest recreation, then, consists of recreation acts or experiences carried out in a forest environment.

RECREATION POLICY

Recreation in planning for multiple use 13.002 The Department recognises that recreational activity constitutes a legitimate use of forest lands and should therefore be considered in planning for multiple use. The 1976 Working Plan provides for Management Priority Areas for Recreation, and gives guidelines for the definition of further recreation areas.

Recreational facilities provided for by General Working Plan 13.003 A framework plan for recreation will be prepared for incorporation in the General Working Plan. New facilities will be provided in accordance with this framework plan.

Inventory of recreational facilities 13.004 A special inventory will be made to assess the demand for recreational facilities. It will include forest visitor surveys, the compilation of facility lists and the recording of historic buildings and sites, and will recognise legal restraints with respect to fire, health, and local government.

Control of recreation facilities

13.005

Service facilities, including campsites and caravan parks, are not encouraged on forest land unless there are no alternatives on adjacent land. However, camping associated with hiking and bushwalking is permitted provided that it is restricted to small groups for a maximum of three nights at any one site, away from developed picnic facilities and outside domestic water supply catchment areas.

Camping

Lease of forest land for recreation

Where forest land is to be leased for specific recreational activities, leases will be offered to competent authorities in preference to individual user groups. Any developments must be planned in accordance with the multiple-use policy for management of the forest estate, and in consideration of all other relevant legislation.

Motorised recreation

13.006

Unlicensed motor vehicles of all types are prohibited on forest land and forest roads. Licensed vehicles may use designated forest roads and tracks. Off-road use of licensed vehicles is prohibited, except in areas where such activity may be specifically designated.

- Other active recreation 13.007 Riding or driving of horses in State forest must conform with water supply and quarantine requirements. Hunting and shooting are prohibited in State forest, except on approved rifle ranges or within approved fauna management programmes.
- Historic sites 13.008 The value of historic sites is to be determined by reference to the relevant authority, such as the Heritage Commission, the National Trust and the State Museum. The Department does not propose to manage historic sites unless no other competent group is available. All items of historic interest should be referred to Extension Branch for recording and evaluation.

LIAISON WITH OTHER AUTHORITIES

- Overlap of Forests Act and other legislation 13.009 Multiple-use management has now been adopted as a general forest policy. However, it has already applied for a long time in forestry because of the existence of other legislation that may overrule the Forests Act. This overlap with other legislation varies in extent, and its impact on recreation in forests likewise varies widely. The principal legislation that may need to be considered with respect to recreation activity in State forests and timber reserves is given in Part 1 (paragraph 1.030) of the Foresters' Manual.

Water supply

13.010 Most of the potable and irrigation water in the settled country districts and metropolitan area is harvested from forested catchments, ranging from the underground aquifers of the coastal plain north of Perth - the Gnangara Mound - to the irrigation reservoirs such as Wellington Weir. With few exceptions, the dams are either wholly or partly used for domestic purposes, and the production of clean, pure water is therefore of utmost importance.

Recreation activity and the development of recreation facilities must give due consideration to potential effect on water yield, and in most cases will be referred for approval to the appropriate water supply authority, such as the Country Water Supply section of the Public Works Department or the Metropolitan Water Board.

Public health

13.011 Legislation covering public health is administered by the Department of Public Health, by local authorities, and in proclaimed water catchments by the water supply authority. Specific legislation exists for camping areas and for problems of dust and noise pollution, while rubbish removal and sanitary services are provided for by the Local Government Act.

Quite apart from the legal requirements, it is obviously good management policy to ensure that all developments carried out by or for the Forests Department meet these standards.

Mineral agreements

13.012

Part 12 of the Foresters' Manual outlines the role of mineral agreements with respect to large mining operations, placing particular emphasis on bauxite mining. The land on which open-cut mining is carried out remains part of State forest throughout the mining operation, but is often not open to officers of the Forests Department or to the general public, mainly for reasons of safety and security. Entry restrictions may be short-term or long-term, and must be accepted as a constraint in planning for recreation.

Chipwood

13.013

The woodchip licence area in the southern forests is the subject of special legislation. All Departmental staff should be familiar with this legislation. The private status of roads used by the woodchip companies is very important, since private vehicles and pedestrians cannot travel along them and may cross them only at designated places. This constraint influences the planning of access to picnic and tourist sites, the location of walk tracks, the design of self-guiding motor tours, etc.

Similarly, right of entry to the woodchip factory at Diamond cannot be assumed without consultation with the chipwood company.

Public utilities

13.014

There are several Acts governing the activity of the public utility organizations in providing main roads, electricity, telecommunications and water and natural gas pipelines. Existing or proposed utility services must be given due consideration in all stages of recreation planning, and regional representatives of the relevant organisations should be consulted.

Bush Fires Act

13.015

The planning, prevention and suppression aspects of fire control are described in Part 9 of the Foresters' Manual. The provisions of the Bush Fires Act must also be considered with respect to camping sites, picnic areas and other recreation facilities. There should be uniformity of policy for the establishment of picnic areas within and adjacent to plantations, and areas equipped with barbecue fireplaces must conform with Bush Fires Act regulations for land cleared of flammable material.

Department of Youth,
Sport and Recreation

13.016

The Department of Youth, Sport and Recreation controls a number of cabin and camping holiday sites that are available to the general public,

four of these comprising leases of the former forest settlements at Pimelea, Wellington, Myalup and Lewana. District officers should familiarise themselves with the lease document, maintain liaison with the manager or caretaker, and be aware of occupancy constraints that may apply in summer months. Of less obvious but equally important impact is the Duke of Edinburgh Award Scheme, which is also administered by the Department of Youth, Sport and Recreation through representatives in the Education Department. Many of the Silver and Gold Medal exercises take the form of compass trips of two days or more in forest country, and there are up to 200 candidates each year.

Road Traffic Act

13.017

The legal status of roads and tracks on land under the control of the Conservator cannot be precisely defined. As a general rule, any forest road or track that is used by conventional licensed vehicles is a public road and subject to the jurisdiction of the Road Traffic Authority. This means that such roads cannot be closed without reference to that Authority, nor can they be used by unregistered vehicles or unlicensed riders and drivers.

RECREATION - CAPITAL DEVELOPMENT

Flexibility of development is desirable

13.018 The Department's adoption of multiple-use planning and management provides the opportunity to plan the development of recreational facilities. However, since planning and management policies are under constant review, facilities should be developed in a flexible manner and should be movable if possible.

Location of facilities

13.019 Many facilities become necessary because of an existing natural feature, historic site or panoramic view that is being used by the recreating public. Care must be exercised in development that caters for this demand, particularly with respect to the following points:

- Separation of people and vehicles;
- Siting buildings, barbecues, etc., to blend with the surroundings;
- Allowance for growth in user levels;
- Fire protection;
- Servicing of bins and toilets;
- Physical separation of feature and facility;
- Simple, neat and attractive signposting.

The staff of Extension Branch are available to help in the design of site facilities.

Toilets

13.020 The heavy use of some picnic sites often necessitates the provision of toilets, and although the Department

has authority on most areas of State forest, it is nevertheless advisable to seek the approval of local health authorities. In any case, in catchment areas the Department is obliged to consult with the water supply authorities about the type of building and the toilet systems to be used. The situation changes frequently and officers are advised to check with Extension Branch before proceeding with toilet installation. There are four kinds of toilet that may be appropriate in certain situations:

Septic tank - full water system

Dry septic - limited water

Chemical toilet - using formalin

Bore-hole toilet - Victorian system

Other furniture

13.021

There are many designs and materials that can be used for tables, seats, rubbish bins and barbecues. From time to time standard design details will be provided to Regions for trial.

Sign-posting notices

13.022

During the last ten years, fairly uniform colour and style have evolved for the information boards and sign-posts produced for forest recreation areas. All Regions have access to a routing machine and the combination of routed letters painted in white on a brown painted or stained hardwood base is now

widely used. There is no intention to suppress initiative, but for the present all officers are requested to use this colour scheme and to apply the following guidelines to signs.

Finger posts: use no more than 3 or 4 words; lettering should be a minimum of 70 mm high; spelling must be accurate.

Information boards: keep wording to a minimum; stress a positive message whenever possible; use only metric measurements; if there are more than 10 words, provide a place for cars to stop on the road verge; if there are more than 30 words, it is better to use flat galvanised iron and a professional signwriter.

Plots and arboreta: both scientific and common names should be used, and they must be spelled accurately. Forests Department Bulletins and pamphlets can be used as sources for the names of nursery stock, but should there be any doubt about the spelling, reference should be made to Research or Extension Branch personnel, since botanical nomenclature is in a constant state of flux.

e.g. Sheoak was Casuarina fraseriana

in 1976 but was Casuarina fraserana in 1977. Leschenaultia is now Lechenaultia.

VISITOR SURVEYS AND PATROLS

Surveys of forest use

13.023 Interviews or observation of forest users can help in planning to meet recreation needs. To this end, various types of visitor survey are conducted from time to time and Divisions will be consulted and involved with some of these studies. Divisions wishing to carry out their own surveys should consult Extension Branch.

Patrols

13.024 In areas of heavy public use, periodic patrols by an officer are of value from the viewpoint of both the Department and the public. The officer chosen for patrols should be carefully selected, should dress neatly and should be trained to make use of pamphlets and brochures that may be of interest to recreation groups. The primary purpose of patrols is that of public relations, but the officer can also play a role in ensuring that standards relating to vehicle activity, cooking fires and quarantine are observed.

LANDSCAPE

Landscape in planning

13.025 Without doubt, one of the most critical components of satisfactory forest recreation experience is

an attractive forest landscape. Appreciation of landscape must eventually be an integral part of the planning and execution of all forest operations. Nowhere is this appreciation more important than in the development of recreation facilities.

- | | | |
|---------------------------------------|--------|--|
| Definition of landscape | 13.026 | Landscape may be defined as "the total aesthetic effect of features of a particular environment"; as such it forms an integral part of the impression made by the forest on the visitor. It is therefore important that all the Department's activities involving planting, removing or altering vegetation receive landscape consideration. |
| Landscape management | 13.027 | There are many ways to assess the landscape and it is important to appreciate that the public viewpoint will often be different from that of the forester. Guidelines for landscape management will be circulated to Divisions from time to time, but some preliminary guidelines are provided here. |
| Alternatives for landscape management | 13.028 | There are six basic landscape management alternatives* that encompass all possible management action and their effects: |

* Source: "Forest Landscape Management" Volume 1, United States Department of Agriculture Forest Service (Northern Region), n.d.

landscape preservation

landscape enhancement

landscape retention

landscape deterioration

landscape destruction

landscape rehabilitation

Their application to logging, roading and building construction will further define them. Owing to the many variables that exist, sites can be placed in specific categories only after close analysis.

Preservation

Landscape Preservation:

"Conscious management of the visual resource to keep its constituent parts intact and untrammelled by man". This type of management usually applied to areas that are of particular appeal to the public.

Enhancement

Landscape Enhancement:

"Management of the visual resource in which additional visual interest is provided through alterations by design and through adding harmonious structures". This type of management aims to increase visual variety where little such variety now exists.

Retention

Landscape Retention:

"Management of the visual resource by which man's activities and works are kept subordinate to the visual strength and character of the landscapes they occur in." Landscape alterations to provide facilities

are to be subtly integrated so that they attract little attention to themselves. Retention of existing landscape values is favoured over large-scale developments that would alter the visual composite to any great extent.

Deterioration

Landscape Deterioration:

"Management of the visual resource in which man's activities and works demean the visual qualities of existing landscapes by virtue of their unharmonious and consequently detractive visual natures."

Landscape alterations that are inappropriate in terms of scale, colour or form create the unharmonious visual contrasts with the greater landscape continuum that typify this kind of management.

Landscape deterioration is usually a long-term process affected by numerous major and minor physical effects, few of which relate positively to each other.

Destruction

Landscape Destruction:

"Management of the visual resource in which the activities and works of man abruptly alter existing landscapes in both reversible and irreversible fashions with little regard for landscape values or future land uses." Landscape alterations that destroy the

component parts of landforms (and consequently landforms themselves), without provision for remedial measures, typify this kind of management. Both landscape deterioration and landscape destruction lead toward negative physical effects. The distinction between the two rests largely on the degree and the rate of physical change. Alterations resulting in landscape deterioration proceed slowly and fragmentarily; alterations resulting in landscape destruction proceed rapidly and totally.

Rehabilitation

Landscape Rehabilitation:

"Management of the visual resource aimed at reversing or minimizing the detrimental visual effects caused by landscape deterioration and landscape destruction." Landscape alterations that minimise negative contrasts in the greater landscape continuum are typical of this kind of management. Landscape rehabilitation should not be confused with landscape restoration, for while a semblance of the order that preceded landscape deterioration or destruction can be recreated, the original state of the landscape can never be truly restored.

- Degradation of landscape 13.029 The landscape resulting after a period of timber harvesting or other routine operational treatment may be equal to, better or worse than the original forest. In the short term, the visual impacts are usually adverse. Such things as excess soil disturbance, massive erosion, poor regeneration, careless burning of slash, bulldozed tracks and snig tracks all cause degradation of the landscape.
- Trade operations 13.030 The prescription used for treemarking and hence cutting of either pine or hardwood varies from time to time, but is generally adapted to the market demand. While this constraint may persist, there is room for flexibility within most prescriptions. Since the impact of landscape is closely related to public access, treemarking prescriptions should try to consider this particularly in areas that are visited or seen by the public.
- Construction works 13.031 Many of the Department's activities, such as the construction of roads, bridges and dams and the preparation of areas for reforestation or afforestation involve the use of heavy machinery such as bulldozers, graders and so on. There are many examples

of poor landscape treatment, for example windrows or avenues of stumps left after road construction; isolated trees and stumps left in borrow pits; plantation clearing that pushes all unwanted debris into wetlands or streams; ugly scars from bad design of firebreaks in rolling landscape.

It is appreciated that it is not always possible to avoid these effects. However, operations can usually be planned with attention to landscape without much additional cost. Repairs to this kind of aesthetic damage are always costly and rarely satisfactory.

PART 16

FORESTERS'
MANUAL

PINE PLANTATIONS

Prepared under the direction of
B.J. Beggs Conservator of Forests

FORESTS DEPARTMENT
PERTH
WESTERN AUSTRALIA

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PART 16 - PINE PLANTATIONS

INTRODUCTION

- Aim 16.001 The Forests Department aims to provide an adequate supply of timber for local consumption in Western Australia. Since production from the native hardwood forests will be inadequate to provide for the requirements of future populations, the Forests Department has undertaken a pine planting programme of 3000 ha per annum.
- Two suitable commercial species for W.A. 16.002 Two species of pine are suitable for commercial plantations in the south-west of Western Australia. These are *Pinus radiata* and *Pinus pinaster*. *Pinus radiata* has a high nutrition requirement, needing either a naturally fertile soil or repeated applications of fertiliser. *Pinus pinaster*, on the other hand, grows well on less fertile soils and is planted extensively on the coastal sand plain near Perth. A tree breeding programme over the last two decades has produced a pedigreed strain of *P. pinaster* much improved in form and vigour over the original Portuguese stock.
- Plantation establishment and maintenance 16.003 Plantation establishment and tending and maintenance of the increasing area of plantations involve specialised techniques. These are described in the following sections.

LAND FOR PINE PLANTING

- Site selection 16.004 Both *P. radiata* and *P. pinaster* have particular site requirements. Study of the existing plantations and pilot plots has shown a clear correlation between site and pine growth, and techniques have been developed for delineating land suitable for pine growth by assessing the soils and native vegetation. All areas proposed for planting are subject to a careful soil and vegetation survey.
- Climate 16.005 The climate of Western Australia is not generally suitable for pine plantations and the scope for establishment is limited to the area in the south-west of the State with a rainfall of at least 750 mm per annum.
- Proximity to markets 16.006 The economics of pine plantations are heavily affected by haulage costs and distance from market. This applies particularly to the low-value, small-sized material such as case logs and particle board logs. Plantations should therefore be located in reasonable proximity to the future markets, which will probably be Perth and Bunbury.

- P. radiata* 16.007 Most *P. radiata* plantations have been established on naturally fertile, loamy soils of basic origin. In recent years suitable land has been obtained by repurchasing farmland, notably in the Blackwood Valley. Replanting of uneconomic farmland is a most desirable method of afforestation. However, opportunities to repurchase large areas of suitable farmland are becoming increasingly restricted, with fewer properties being offered for sale at very high prices.
- Donnybrook Sunkland 16.008 A considerable area of sandy soils carrying poor-quality, diseased jarrah forest inside State forest in the Donnybrook Sunkland has been shown to be suitable for pine plantations, provided appropriate fertiliser regimes are applied. The Department will continue to seek additional land but at present it appears that most future plantations will be established by conversion of this low-quality native forest in the Sunkland.
- P. pinaster* 16.009 *Pinus pinaster* is grown mainly on the sands of the coastal plain near Perth. It requires a good depth of soil with reasonable moisture relationships and the application of fertiliser. The presence of organic matter or iron (yellow sands) is important for the retention of nutrients.
- Plantation selection 16.010 Guidelines for selecting planting boundaries, provided as detailed instructions for each specific locality, take into account local limitations as to soil, topography, fire hazards and aesthetics. The Sunklands Development Plan is an example.
- Land acquisition 16.011 The Forests Department has no authority to resume land for pine planting and land is therefore purchased by private treaty. Before any negotiations commence, the property must have been advertised for sale.
- Land valuations 16.012 From the Department's point of view, the value of properties depends on:
- a) suitability of soils and topography,
 - b) location in relation to the market, and
 - c) the amount of clearing that has been carried out on suitable soils (clearing on unsuitable soils cannot be regarded as an asset to the Department).
- Valuations must be based on the value to the Department and not the cost value of the improvements. For example, orchards and buildings may in many cases have no value to a plantation scheme, while fences and water supplies may be of great value.

Purchasing
private land

16.013 When private property is offered for sale, the Area Officer-in-Charge (O.I.C.) should

- a) obtain a written offer from the owner indicating the price and giving permission for the Forests Department to carry out assessments and soil surveys on the property,
- b) forward the original copy of the offer for sale to Head Office with a brief report, and
- c) on instructions from Head Office, carry out a reconnaissance of the area, submit a sketch plan with notes as to timber, clearing and other improvements, and note whether the improvements would be of value to a plantation.

Soil
survey

A decision will then be made by Head Office as to whether a detailed soil survey is warranted. If so, Head Office will arrange for a soil survey to be carried out. Guidelines for soil description are outlined in Appendix 1.

Land
exchange

16.014 An alternative method of obtaining suitable farm land for pine planting is by exchange for an area of State forest. Generally, land exchanges are made on the basis of equal areas, with a cash adjustment to cover improvements such as clearing and fencing. This method is attractive since it allows the Forests Department's limited finance to be spent directly on plantation establishment and maintenance.

A disadvantage of land exchange is that it is a lengthy process, often taking over a year to finalise. All parties to land exchange deals should be made aware of this.

To facilitate land exchange, suitable areas of State forest that may be made available for exchange should be defined. Such areas would normally be low-quality forest adjacent to existing farm land in situations such that the transfer would be advantageous to both farmers and the Department.

PLANTATION DESIGN

Plantation
layout

16.015 Plantation establishment involves considerable expenditure, and decisions made in the initial stages have long-term effects. It is therefore important that the layout of the plantation be carefully planned in advance.

Management plan

16.016 After the soil survey has been approved by the Chief of Divisions-- Operations, the Area O.I.C., in consultation with the staff of the Protection and Procurement Branches, will prepare a detailed management plan. This will present the initial plans for the plantation with respect to roading and protection requirements.

The plan should be prepared at least five years ahead of the proposed planting date, and development of the area must not commence until it has been approved by the Chief of Division - Operations.

Plan scale

16.017 The management plan is normally drawn at a scale of 1:12 500. A smaller scale (1:25 000) may be used for larger projects. Drafting Branch will provide a base plan as a transparency on request. The plan should extend sufficiently beyond the limits of the plantation to show requirements for fire control in the surrounding country. Some survey work may be necessary in new areas, but generally air photos will provide sufficient information.

Fire hazards and access

16.018 The management plan must be designed to meet the fire hazards and access problems anticipated for the particular area. Precise detail may not be practical and is not expected at this stage. However, the plan must show:

- a) area to be planted, by species;
- b) position of all roads with a view to both extraction of timber and access;
- c) position and width of all firebreaks and fuel-reduced buffers; and
- d) proposals for fuel reduction.

Legend

16.019 Management plan legend:

Planting boundary (external) ///////////////

Species boundary (internal)

First class roads _____

Second class roads - - - - -

Third class roads -----

Firebreaks (not trafficable to conventional vehicles) -x-x-x-x-x-x

Width of clearing (shown in figures thus) _____ 10 m

Water point - developed (W)

Water point - proposed (W)

Loading ramp - developed (R)

Loading ramp - proposed



Turning points

-----T-----

Landscape in plantations

16.020 All proposals for plantation development must take into account the protection of rare species and areas of particular scenic interest. Plantations are to be designed with a view to their effect on the landscape, and provision is to be made for planting other species where aesthetic improvement is desirable. These points must be considered at the time of preparation of the management plan, and all special features and areas requiring special treatment are to be shown on the plan. This special treatment is to be approved by the Chief of Division - Operations, bearing in mind all cost factors.

Straight-line boundaries to be avoided

Straight-line boundaries across contours will be avoided where they are in general view. Soil boundaries will be rationalised to give a curvilinear effect. Unavoidable straight-line boundaries may be broken by planting clumps of ornamental trees or commercial eucalypts.

Uncleared enclaves for fauna

16.021 Areas having steep slopes and shallow, rocky or marginal soils should be aggregated as uncleared enclaves providing refuges for fauna.

Plantation roading

16.022 Road building is expensive and can easily become excessive. Plantation road systems should be designed primarily to provide access for operations and fire control. Long-term requirements for logging should be made in consultation with Procurement Branch Staff.

Specifications to be approved.

16.023 Close attention to standards at both the planning and construction stages is required. All road specifications should be approved by the Regional Leader before work commences. The maximum grade should be 1 in 10.

Boundary road

16.024 A trafficable boundary road is required. This need not necessarily follow the planting boundary if easier alignments are available on more level ground within 60 m of the boundary. The boundary road along the top edge of the plantation should cut across narrow intrusions of unplantable land rather than follow their edges.

Gravelling

Gravelling will be limited in the early years to the minimum required for gang-truck access. Later it will be carried out as required for logging purposes. Annual drainage maintenance will be required in the early years.

Management plan 16.016 After the soil survey has been approved by the Chief of Division - Operations, the Area O.I.C., in consultation with the staff of the Protection and Procurement Branches, will prepare a detailed management plan. This will present the initial plans for the plantation with respect to roading and protection requirements.

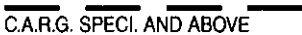
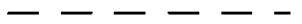
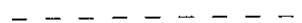
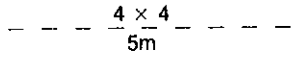
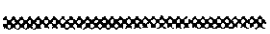







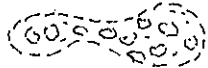
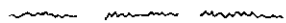







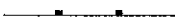

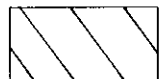
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However, the plan must show:

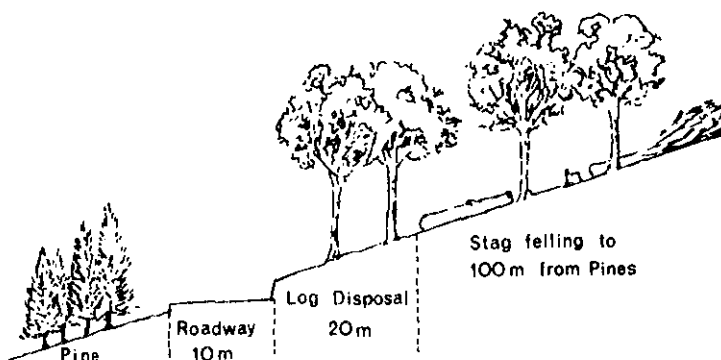
- a) area to be planted, by species;
- b) position of all roads with a view to both extraction of timber and access;
- c) position and width of all firebreaks and fuel-reduced buffers; and
- d) proposals for fuel reduction.

MAJOR ACCESS ROAD		C.A.R.G. SPECI. AND ABOVE
TRAFFICABLE ROADS (INCL COMPT BDYS)		
TRACKS		
(4 x 4) FIRE BREAK (width.)		
PLANTATION BOUNDARY		
SUB SPECIES BOUNDARY		
HOSE LAY TRACK		
WATER POINT – PROPOSED		
WATER POINT – DEVELOPED		
STRATEGIC F.R.B.'s PINE		(BROWN)
HIGH RISK F.R.B.'s		(RED)
HARWOOD FOREST REGULARLY BURNT (year of burn shown in circle)		(ORANGE)
UNPLANTABLE		
PARKLAND CLEAR & STAG FALL		
LOADING RAMP – PROPOSED		
LOADING RAMP – DEVELOPED		
TURNING POINTS – PROPOSED		
TURNING POINTS – DEVELOPED		
REFERENCE TREE	COMPASS  ¹ THEODOLITE  ²	
TRANSMISSION LINE		
FENCE		
FLATS, SWAMP		
M.P.A.'s		(GREEN BORDER)

N.B. ALL INTERNAL POCKETS OF NATIVE FORESTS
& CREEK RESERVES ARE BORDERED BY A (4 x 4) TRACK

Landscape in plantations	16.020	All proposals for plantation development must take into account the protection of rare species and areas of particular scenic interest. Plantations are to be designed with a view to their effect on the landscape, and provision is to be made for planting other species where aesthetic improvement is desirable. These points must be considered at the time of preparation of the management plan, and all special features and areas requiring special treatment are to be shown on the plan. This special treatment is to be approved by the Chief of Division - Operations, bearing in mind all cost factors.
Straight-line boundaries to be avoided		Straight-line boundaries across contours will be avoided where they are in general view. Soil boundaries will be rationalised to give a curvilinear effect. Unavoidable straight-line boundaries may be broken by planting clumps of ornamental trees or commercial eucalypts.
Uncleared enclaves for fauna	16.021	Areas having steep slopes and shallow, rocky or marginal soils should be aggregated as uncleared enclaves providing refuges for fauna.
Plantation roading	16.022	Road building is expensive and can easily become excessive. Plantation road systems should be designed primarily to provide access for operations and fire control. Long-term requirements for logging should be made in consultation with Procurement Branch Staff.
Specifications to be approved	16.023	Close attention to standards at both the planning and construction stages is required. All road specifications should be approved by the Regional Leader before work commences. The maximum grade should be 1 in 10.
Boundary road	16.024	A trafficable boundary road is required. This need not necessarily follow the planting boundary if easier alignments are available on more level ground within 60m of the boundary. The boundary road along the top edge of the plantation should cut across narrow intrusions of unplantable land rather than follow their edges.
Gravelling		Gravelling will be limited in the early years to the minimum required for gang-truck access. Later it will be carried out as required for logging purposes. Annual drainage maintenance will be required in the early years.

- Compartments 16.025 The plantation will be divided by trafficable roads into compartments varying in size from 100 ha in the Hills to 400 ha in the Sunkland.
- Fire control master plan 16.026 The area O.I.C., in consultation with fire control staff, will prepare a fire control master plan for each plantation, setting out all provisions for protection.
- External breaks 16.027 External breaks adjoining private property are to be 20 m wide, and must be maintained free of flammable material. External breaks adjoining State forest will be roadways 10 m wide outside the planting boundary. Road edges will be maintained free of grass where possible.
- Unfavourable slopes are to be avoided by selecting an alternative boundary. All land inside the boundary break will be regarded as plantation, whether planted or not.
- Prescribed burning 16.028 The fire control master plan must provide for regular prescribed burning in hardwood forest adjacent to the plantation. As funds permit, the following special treatments should be carried out around the perimeter



- Stag felling and parkland clearing outside boundaries 16.029 Stag felling of dead-topped trees will be carried out to a distance of 100 m from the boundary of the pines. All such merchantable trees are to be removed as a trade operation. Parkland clearing (the disposal of dead logs on the ground) will be carried out outside the cleared break for a distance of 20 m to facilitate future prescribed burning. It should be done with contract machines at the time of initial clearing.

Fuel reduction
for fire
control

16.030 Fire control in large plantations is based on the maintenance of fuel-reduced zones in areas of high risk, such as alongside public roads, and of wide buffers breaking up the main plantation areas. Small, isolated plantations are maintained in a safe condition by rotational prescribed burning.

The size and location of fuel-reduced areas is determined by factors such as topography, plantation age and exposure to public use, and by the proposed method of fuel reduction. The buffers are to be at least 200 m wide. The fire control master plan will show both the location of fuel-reduced areas and the prescription and specifications for fuel reduction.

Burnt buffers
on high ground

Buffers maintained by burning are usually located on high ground such as ridges and spurs, where burning is easier and safer. On lower ground, fuel reduction by grazing is usually favoured. Special silvicultural techniques have been developed to allow grazing throughout the rotation. It is essential that fuel be reduced to the prescribed level before the beginning of the fire season, and grazing must be controlled to ensure that this is achieved.

Grazing on
low areas

Water supply
location

16.031 Water supplies for fire fighting in plantations should be developed on the basis of a 20-minute turn-around, i.e. from any point within the plantation a heavy-duty unit should be able to travel to the water supply, be filled and return within 20 minutes. There should be a minimum supply of 100 000 l at each water point.

20-minute
turn-around

Natural and
artificial
supplies

Natural water supplies such as dams and soaks should be developed where possible. The construction of concrete tanks will be considered only where natural supplies are insufficient to satisfy the 20-minute turn-around specification.

Coastal and
Sunkland
plantations

16.032 The previous paragraphs deal with plantation design in general. Special provisions for Coastal and Sunkland plantations are set out in the following paragraphs.

Coastal plantations

Design

16.033 Topography is usually easy on the coastal plain and plantation layout is therefore greatly simplified. However, forward planning is required just as for all other plantations and the layout must be designed to meet the

anticipated fire hazard and access problems.

Fire control measures

16.034 Fire control requirements are met by the provision of reliable access throughout the plantation and by the maintenance of fuel-reduced buffers. Fuel reduction is usually achieved by prescribed burning.

Access within compartments

16.035 Access within compartments is provided by wide spacing between rows and by cross-tracks 3.5 m wide at 200 m intervals.

Sunkland plantations

20% of area for plantations

16.036 Pine plantations will be developed as a series of discrete "cells" on approximately 20% of the total Sunkland area.

Design

16.037 Roadmaking on the gentle topography of the Sunkland is fairly easy and plantation design is therefore dictated largely by soil types and by specifications for protection and conservation.

Detailed guidelines for plantation design are given in the Sunklands Development Plan.

Plantation mapping

16.038 Field survey work for plantation mapping should be kept to a minimum. Base plans from Head Office are used to record sub-division, clearing, roading and planting in the early stages. These plans are approximate only. Accurate, detailed plans are prepared from air photos after planting is completed.

Plantation nomenclature

16.039 Discrete areas of pine plantation are designated by a plantation name. Each plantation is subdivided into numbered compartments. Some older plantations comprise sections identified by letters, but this type of sub-division was discontinued in 1978.

Current plantations

16.040 The following is a list of Forests Department plantations current in 1979.

<u>Division</u>	<u>Plantation Name</u>
Wanneroo	Collier Gnangara Moore Pinjar Yanchep

<u>Division</u>	<u>Plantation Name</u>
Mundaring	Barton Beraking Carinyah Clifford Dale Gorrie Greystones Helena Wellbucket
Jarrahdale	Bell Cooke Frollet Gleneagle Karnet Peel
Dwellingup	Hamel Murray Turner
Harvey	Brunswick Harvey Weir McLarty Myalup Tallanalla Tumlo
Collie	Bussell Mungalup Stockton Wellington
Kirup	Balingup Claymore Ferndale Grimwade Kelly Savage Creek Southampton Thomson Brook
Nannup	Brockman Dalgarup Ellis Folly Lewana Milward Nelson Shelley
Busselton	Baudin Jarrahwood Ludlow Margaret St. Paul Vasse Wilcock
Pemberton	Dombakup Pimelea
Manjimup	Strachan
Kalgoorlie	Esperance

SITE PREPARATION

- Management plan to be approved 16.041 Clearing of native timber must not begin until the management plan is approved. The Area O.I.C must then prepare a programme for the utilisation of native timber and for clearing and planting.
- Initial clearing 16.042 Initial clearing by chaining is preferred in the Sunkland. For heavy clearing, pushing down and windrowing may be required.
- Clearing by contract 16.043 Clearing should be done by contract and as far as possible for a specified rate per hectare. To be certain the contractor understands what is involved, the Department will supply detailed specifications and indicate wherever possible a sample area showing the standard of work required. Maps, aerial photographs, and soil and topographic data should be provided if available.
- Debris must not block streams 16.044 Any windrowing should be carried out across the contours on gentle slopes (up to a grade of 1 in 8). To prevent soil from moving into rivers and reservoirs, two windrows should be made along the contours on the lowest slopes. Logs and other debris must not be pushed into creek beds to impede stream flow.
- Difficult areas left uncleared 16.045 It is intended to clear completely within the plantation boundary, but particularly difficult areas, where machinery cannot operate, will be left uncleared and unplanted.
- Thorough burn important Considerable savings can be made by ensuring that a thorough burn is carried out and by accepting that some log debris will remain.
- Specifications for each area 16.046 Detailed specifications for site preparation may be updated from time to time. Examples are given in the Sunklands Development Plan.
- Erosion control 16.047 To control erosion where necessary, grade drains should be established at a spacing of approximately 12 m vertical height, at a grade of 1 in 44 directed away from the drainage line. This is expensive work and is generally required only on steep country surrounding reservoirs.
- Regrowth of native species 16.048 When hardwood forest areas are converted to plantation, the native eucalypt species tend to persist in the form of coppice and root suckers, and the scrub species as regrowth and germinants. Their presence causes:
a) severe competition affecting pine survival and growth;

		b) reduced access, making subsequent tending difficult, dangerous and costly or in extreme cases, impossible; and
		c) a serious fire hazard.
Grass	16.049	In areas that were previously cleared, competition for moisture from dense grass can drastically affect the survival and growth of young pines.
Ploughing	16.050	Ploughing provides a favourable planting bed, encourages early growth and eliminates most of the weeds likely to compete with the pines in the early years.
		All coastal plain and Sunkland areas are ploughed. Ploughing is carried out in the hills areas, except in areas immediately adjacent to reservoirs, areas too steep or rocky to plough, and pastured areas.
Ploughing depths		On sandy soils, a ploughing depth of at least 230 mm is required to satisfactorily eradicate scrub and to provide a good rooting medium for the young pines. In heavier soils containing rock fragments or boulders, this depth is sometimes difficult to attain. In this case a minimum depth of 150 mm is specified. The 230 mm minimum must nevertheless be attempted within the limits imposed by correct use of machinery.
		Good ploughing requires experienced operators. Unless the correct equipment is used, and unless it is properly set up and in good working order, damage to the equipment and an unsatisfactory ploughing job will result.
Clover	16.051	Clover pasture is established prior to, or at the time of planting, in the Sunkland.
Inter-row cultivation	16.052	After planting, cultivation between rows is carried out as necessary where the terrain permits. As with ploughing, careful attention is required in setting up the equipment.
Herbicides	16.053	Herbicides control weeds when ploughing or cultivation are impracticable and may also be used as an adjunct to these methods.

They must be used with caution. Major hazards in their use are:

- a) damage to vegetation outside the target area;
- b) damage to pines;
- c) possible hazard to water supplies in catchment areas; and
- d) injury to operators through accidental inhalation or skin contact.

Their use must be carefully prescribed and planned with regard to these hazards and must be carried out under adequate supervision.

Precautions in catchment areas	16.054	The application of herbicides in catchment areas should be kept to a minimum and extreme care should be taken to avoid contamination of the water surface. Special precautions must be taken in the use of 2,4,5T in particular. Where herbicides are essential, untreated buffers 10 m wide should be left on either side of running streams. Aircraft are not used at all on catchments, and misting machines are not to operate within 50 m of the edge of reservoirs or feeder streams. Areas within 50 m of the water surface are to be treated by hand, using the stem injection or basal spray methods.
Control of native vegetation	16.055	A number of techniques are used to control the regeneration of native vegetation.
Foliar spraying	16.056	Foliar spraying: This method (fully described in Forests Department Bulletin 83) has been used extensively for controlling weeds prior to planting. A low-volume spray of 2,4,5T in water was generally used. It has now been largely superseded by ploughing on the easy terrain of the Sunkland and the coastal plain, but is still used for particular problems such as blackberry control.
Notching	16.057	Stem injection (notching): Where eucalypt coppice and regeneration have survived initial attempts at weed control and are competing with the pines, notching with "Tordon" is the standard method of control. Details of this treatment are given in Appendix 2.
Basal spraying	16.058	Basal spraying: This is an effective method of controlling eucalypt coppice and large scrub. There is, however, a risk of vapour drift, which can damage pines and surrounding vegetation. See Appendix 2 for details.

Safety
precautions

16.059 Safety precautions must be observed when using herbicides so that skin contact and inhalation are avoided. The tractor operator must be suitably protected by means of an effective canopy, long-sleeved shirt and long trousers, mask, goggles and barrier cream. Soap and water must be available for use before eating or smoking. These precautions must be strictly enforced.

The utmost precautions must also be taken to ensure against drift of herbicides on to private property since grapevines, fruit trees and vegetable crops are susceptible.

Mounding for
improved
drainage

16.060 In wet areas, mounding is carried out along the planting line prior to planting, using a special mounding plough. This treatment provides better drainage and aeration of the soil, and is essential where free water is likely to lie on the surface in winter. Where mounding is done it is important that the planting lines run up and down the slope.

Drains

16.061 Most areas that require mounding also require additional drainage work. It is essential that all surface water be able to drain from the site. Generally, a system of shallow drains is adequate, but their locations must be carefully selected to ensure that they function effectively. In flat situations where the drainage lines are not obvious, a Dumpy Level or similar equipment should be used to determine the location and direction of the drains.

In sandy country, drains can be established quite cheaply using graders after ploughing and mounding are completed.

Rabbit
control
essential

16.062 In most areas, damage by rabbits can be a major cause of loss of young pines. All rabbits must be eradicated from the site prior to planting. This often requires continuous effort over several months. The advice and assistance of the Vermin Control Officer of the Agriculture Protection Board should be sought in this work.

PLANTING

One-year-old
seedlings
planted

16.063 Plantations are generally established with one-year-old seedlings. Planting machines are used on easy terrain, but hand planting continues to play an important part, especially in hilly areas.

Many factors influence the survival and development of the transplanted seedlings, and so it must be ensured that they are properly planted.

Planting season: June and July	16.064	The planting season is generally limited to June and July. The start of the planting season depends on the amount of early winter rain, because the soil must be thoroughly wet before planting can commence. Experience has shown that in general, planting should not commence before the beginning of June. Permission to commence before June must be obtained from the Chief of Division - Operations. On no account may planting continue beyond the end of July, and the operation must be suspended if prolonged dry spells occur during the planting season.
Planting suspended in dry weather		
Direction of planting lines	16.065	In the Hills plantations, planting lines are run across the contour (i.e. up and down slopes). The rows must be kept reasonably straight to facilitate the use of machinery at later stages, and sighting waddies are used for alignment. On level country where the seedlings are planted by machine, the direction of the rows is determined largely by the shape of the planting area. Long runs are preferred in reducing the time lost in turning.
Planting spacing	16.066	Planting spacing determines the initial stocking density. Sufficient trees are planted to give adequate choice of crop trees and to provide some centres of branch development. Current spacings for the two species are: <i>P. radiata</i> 3m x 2.5 m (1330 spha) <i>P. pinaster</i> 3m x 3.25m (1000 spha)
Supervision necessary		Careful supervision is essential to ensure that trees are properly planted and that correct spacing is achieved.
Delay in planting to be avoided	16.067	Unnecessary delay between lifting and planting should be avoided. The placing of dumps must be arranged each day by the officer in charge so that plant carriers (for either planters or planting machines) can be refilled conveniently. Dumps must not be placed in running water.
Care of plants	16.068	The plants must be kept moist and shaded, and vehicles used for transporting them must be provided with canopies. Root exposure must be kept to a minimum at all stages while transported from the nursery to planting. If plants arrive from the nursery in an unsatisfactory condition, this should be brought to the attention of the officer in charge of the nursery immediately.

Careful planting essential	16.069	Planting is a most important and exacting operation. Its quality must not be sacrificed for the sake of speed.
Pre-planting brief	16.070	At the beginning of the season, before planting starts, all personnel must be fully briefed as to what is expected. The method of planting must be demonstrated and practised.
Supervision necessary	16.071	Constant supervision is essential throughout planting, regardless of the particular method used, to ensure that the required standards are met. There should be regular checks on spacing.
Daily report required	16.072	The supervising officer must prepare a daily report including figures for tree numbers on measured sample areas.
Hand planting	16.073	The method used is called notch planting and is carried out using a special planting spear. <ul style="list-style-type: none"> a) The spear is driven into the ground so as to open a notch approximately 300 mm deep. b) The seedling is inserted into the notch, taking care that the roots are disposed downwards and not bent. The seedling must be set 50 to 75 mm below the nursery level. c) The notch is closed by a heavy stamp of the heel. Care must be taken to eliminate air pockets around the roots and in heavy soils this necessitates double spearing: the spear is placed into the soil a second time, alongside the plant, and moved so that it packs the soil tightly around the roots. d) The plant must be vertical when planted.
Variation in spacing	16.074	Variation in spacing along the line is permitted to avoid planting in unsuitable situations, such as against stumps or large plants, or in patches of dry soil.
Payment on area basis	16.075	Hand planting is usually carried out by piece work, payment being based on the area planted rather than on the number of trees. This obviates the need to count the pines when they are being bundled in the nursery.
Three-man planting gang	16.076	Various working arrangements have been developed for different situations. One satisfactory arrangement is to plant in gangs of three men; one man carries the plants and hands them to the two planters. This has been found to give a planting rate of 2500 trees per gang per day, but output obviously depends to a large extent on the terrain.

Plant carriers	16.077	Various types of plant carriers have been devised locally. The two most successful are the wheat sack and the kerosene tin. The main objective is to ensure that the plants are carried in such a way that they are not exposed.
Machine planting	16.078	Where the terrain permits, planting is carried out by means of tractor-drawn planting machines. Two types of planting machine are employed: <ul style="list-style-type: none"> a) Gnanagara-type universal mounted planting machines, which are suitable for the easy terrain of the sand plain and which are usually drawn in pairs; and b) three-point linkage planting machines, which can be used on moderate slopes in hilly country.
Fertiliser dispenser	16.079	Planting machines are generally equipped with a fertiliser dispenser to apply a measured quantity of fertiliser to each newly planted tree.
Weedicide spray	16.080	In pasture country, the tractor is fitted with spray equipment to apply weedicide along the planting line.
Care in machine planting	16.081	As with most mechanised operations, machine planting can greatly improve planting efficiency, but careful attention is essential to ensure that the machines are properly set up and that the operators are well trained.
Faults to be reported immediately	16.082	Since machines greatly increase the rate of planting, it is very important that any faults in planting be detected and corrected swiftly.
Sample counts	16.083	In March (or after the first autumn rains) a sample count must be made. Sample rows are to be pegged and all trees along the rows are to be counted. Dead trees are to be recorded by noting their respective numbers along the row. This gives an indication of whether the deaths are scattered or whether there are patches of dead trees.
Sample count report		A pine count report is to be forwarded to the Regional Office, giving the percentage of deaths by compartments, together with notes on the causes of these deaths.
Refilling	16.084	Experience has shown that refilling (i.e. the replacement of scattered failed trees one year after the general planting) is not warranted. The new plants are invariably inferior to the established ones and rarely develop into usable trees. Replanting is only to be undertaken where there is less than 75% survival in an area, and only when control of scrub and grass can be assured.

NUTRITION

- Fertilisers can increase productivity
- 16.085 Fertilisers extend the range of soils that can be used for pine plantations and increase the productivity of many plantations.
- Major deficiencies
- 16.086 Superphosphate has been used for many years on plantations on the coastal plain. More recently, fertiliser regimes using superphosphate and nitrogen have been developed to grow *P. radiata* on the poor soils of the Donnybrook Sunkland. Minor elements including zinc, manganese and copper have been found necessary on certain sites.
- Clover
- 16.087 A clover sward in association with pines not only provides nitrogen but also improves soil fertility by increasing organic matter content and biological activity so that added nutrients may be retained in the system.
- Specific regimes for specific areas
- 16.088 Nutritional requirements vary for different situations. Fertiliser regimes are prescribed in specific instructions such as the Sunklands Development Plan. These instructions are reviewed and updated regularly.
- Fertilisers applied when planting
- 16.089 Fertilisers are applied at the time of planting in the Sunkland and Coastal Plain plantations and in plantations on marginal quality Hills soils. In machine planting the fertiliser is usually applied from a hopper on the planting machine, but in hand planting it is applied by hand after planting.
- Supervising officers must ensure that the fertiliser is accurately applied within 300 mm of each tree. In the case of nitrogenous fertilisers, the fertiliser must not come into contact with the tree.
- Subsequent applications
- 16.090 Further applications of fertiliser are required on certain sites to maintain the growth of the pines. In general, the greatest benefit is obtained if refertilising is carried out in association with thinning.
- These fertilisings are usually carried out by aircraft. Supervising officers must ensure that the correct quantity of fertiliser is applied and that the coverage is reasonably even.
- Specific regime for each area
- The frequency and rate of applications will depend on various factors, including soil, and will be prescribed individually for each area. Research into the use of fertilisers for maintaining and improving production is continuing.

Proposals to be approved

Proposals for fertiliser applications other than routine must be approved by the Chief of Division - Operations.

Minor elements as foliar spray

16.091 Minor elements such as zinc and manganese are necessary in certain areas and are usually applied as a foliar spray three to six months after planting and at specified intervals throughout the rotation.

NURSERIES

Large centralised nurseries

16.092 Pine stock for the plantation programme is raised to one year old as open-rooted seedlings in two large centralised nurseries which allow the economies of large-scale operations and reduce production costs. Specialised equipment is available in a large nursery and, most important, skilled specialists can develop the techniques necessary for this vital stage of the afforestation programme.

Nannup and Gnangara

The Nannup nursery raises *P. radiata* (some 3 million plants annually), and the Gnangara nursery raises *P. pinaster* (approximately 500 000 plants per annum).

Tree improvement programme

16.092 A programme to improve the form and vigour of future plantations by selective breeding has resulted in the establishment of seed orchards which will in the future provide all pine seed.

Seed orchards

16.093 Since 1972, seed orchards have produced all the Department's *P. pinaster* seed requirements, and a *P. radiata* seed orchard at Manjimup is producing an increasing proportion of the seed requirements for this species.

Seed orchard production areas

16.094 The balance of required seed is collected locally from specially developed seed production areas. These are stands that have been heavily thinned to leave only the best trees for seed production.

Collection of cones

16.095 Only mature cones from selected trees are acceptable. Seed is mature and cones are collected between August and November each year, before high temperatures open the cones and release the seed. *P. pinaster* cones are picked in May to avoid depredation by black cockatoos, and are stored through winter and spring.

Details of origin required

16.096 Full details of the origin of all seed collections must be recorded and forwarded to the Seed Store.

- Seed extraction and treatment 16.097 All pine collections are sent to the Seed Store at Como, where the seed is extracted, cleaned and stored in cool-storage facilities.
- Prior to despatch to nurseries the seed is stratified (a treatment designed to improve germination rates), dusted with fungicide and tested for germination percentage.
- Seed serial number 16.098 Each seed lot is allocated a serial number as a reference to its source. A label identifying the serial number and the germination result will accompany the seed on delivery. Care must be taken that a record of the serial numbers sown at each nursery is maintained, and that all delivery notes show the correct serial number for each batch of trees despatched for field planting. This will ensure that the seed source of all plantations can be identified.
- Nursery layout facilitates mechanisation 16.099 Because operations in the nursery are mechanised as far as possible, the nursery layout must be designed to provide long runs for economical use of machinery. The beds are therefore long and of a width that can be straddled by the tractor wheels.
- Soil inoculated with mycorrhiza 16.100 New nursery soils must be inoculated with mycorrhizal fungi, which are essential for pine growth. This is done by applying soil and litter from under a healthy, mature pine stand as a top dressing to the new soil.
- Preparation of beds 16.101 Techniques for the preparation of nursery beds for sowing vary with different soil types but in all cases, soil compaction should be avoided and there should be a level surface of fine tilth. This is achieved by removing all roots and stones from the site and then ploughing, cultivating and raking.
- Suitable weather conditions are essential in the final stages of preparation: the soil must be moist but the final preparation and seeding must be carried out in continuous fine weather.
- Soil sterilisation 16.102 Sterilisation of the soil can be beneficial where there are fungal problems, but it is an expensive operation and will only be undertaken where the need is demonstrated. Soil sterilisation on a large scale must be approved by the Chief of Division - Operations.
- Sowing 16.103 Seed is sown in August and September. Fine weather is essential and the operation must therefore be well organised so that it can be completed quickly when conditions are favourable.

6-row beds	A tractor-mounted machine consisting of six "Stanhay" seeders, each 230 mm apart, is used to sow a 6-row bed.
	These machines allow precise control of the sowing rate and depth of sowing, and they must be carefully adjusted before sowing proceeds. The seed flow must be carefully watched during sowing to ensure that there are no blockages and that the covering mechanism functions properly.
Sowing rate	The sowing rate should be such as to ensure a plant production rate of 25 to 30 plants per metre along the row of 150 to 180 plants per square metre of bed. This fairly open spacing is desirable for sturdy, uniform stock.
Sowing depth	Sowing too deep commonly leads to failure in nurseries. The seed should be covered by no more than 6 mm of soil.
Fertilisers	16.104 Fertiliser requirements vary according to the soil type and separate fertiliser regimes are therefore prescribed for each nursery.
Crop rotation	16.105 Continuous cropping on a nursery soil leads to a reduction in soil fertility and often to a deterioration of the soil structure. Crops are therefore rotated. Oats and various legumes are grown in alternation with the pine crop, and ploughed in while green to build up the organic matter.
Care of young plants	16.106 Young seedlings are delicate and can easily be damaged. The most critical period is during the first few weeks after germination, when weeds, disease and even bad weather can cause serious losses. An almost constant watch must be kept on the young plants at this stage.
Regular watering essential	16.107 A good supply of fresh water and an efficient irrigation system are essential for a nursery. The size of the plants and the form of the root system can be controlled by watering and fertiliser regimes: adequate summer watering promotes the development of a fibrous root system close to the surface, which is desirable, whilst inadequate watering leads to the development of a deep tap root. Watering should not be regarded as an emergency treatment to be used only in times of drought. On the contrary, it should be carried out regularly to maintain healthy growth.

Chemical weed control	16.108	<p>Control of weeds in nurseries is now achieved mainly by the use of chemical herbicides. Problems and their control measures vary according to soil conditions, species and climate. When new control techniques are proved to be more effective, they are introduced. The essence of control is to deal with the problem before or as soon as it becomes apparent.</p> <p>Herbicides used in nurseries fall into two main groups: pre-emergent and post-emergent herbicides. Appendix 3 lists the herbicides at present being used.</p>
Pre-emergent herbicides		<p>Pre-emergent herbicides form a film on the surface of the soil that inhibits the germination of the weeds. It is important that a fine tilth be prepared before treatment, since large clods impede the effectiveness of the herbicide barrier. The barrier is broken by disturbance after treatment, so subsequent working on the beds must be avoided for as long as possible.</p>
Post-emergent herbicides		<p>Post-emergent herbicides are used to kill weeds that have already germinated.</p> <p>Precautions must be taken to avoid skin contact and inhalation of vapours when handling herbicides.</p>
Hand weeding	16.109	<p>Hand weeding may be necessary at times, despite the use of herbicides. The longer this is delayed the more difficult it is to deal with the problem.</p>
Damping-off	16.110	<p>The major fungal problem in nurseries is damping-off. This disease is caused by a number of soil fungi such as <i>Pythium</i>, <i>Rhizoctonia</i> and <i>Phytophthora</i>, which are common inhabitants of garden soils. Under warm, moist conditions they attack the germinating seed or young seedling. Pre-emergence damping-off kills the seedling before it germinates, whilst post-emergent damping-off usually occurs within the first few weeks after germination. The symptoms are the collapse of the stem at ground level, followed by wilt and death of the seedling.</p>
Seed dusting		<p>The seed is dusted with a fungicide prior to delivery as a precautionary measure. Since this does not provide complete protection, a very careful watch must be maintained during the first few weeks after germination for any signs of damping-off. Affected areas should be treated promptly with a fungicidal drench. When the presence of the fungus is suspected, the</p>

fungicidal drench may be applied prior to germination.

Insects

16.111 Cutworms and black beetles can cause considerable damage. Insect control is usually achieved by spraying with dieldrin.

As with herbicides, safety precautions must be observed when handling fungicides and insecticides.

Birds

16.112 Some species of parrot occasionally steal newly sown seed. A watch should be kept for this and appropriate action taken. Crows have become a problem at the Nannup nursery, and the introduction of a gas gun has proved fairly successful in their control.

Nursery stocktake

16.113 A nursery stocktake is carried out at the end of summer. Procedures are set out in specific instructions.

Lifting seedlings

16.114 Machines have been developed for undercutting and loosening the soil around the roots to facilitate lifting, which is done by hand.

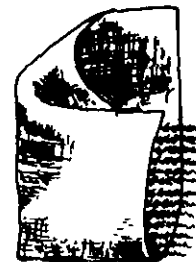
Every precaution must be taken to prevent the roots from drying out through exposure to wind and sun. The plants must be packed as quickly as possible after lifting into bags.

Bagging seedlings

16.115 The bags are made from wheat sacks cut down one side. They must be thoroughly soaked prior to use and kept wet throughout the operation. The following illustration indicates the general technique for filling and fastening.



Bag stood upright



Side pushed tightly inside



Side pulled tightly around and fastened with bale hook



Completed bundle

The number of plants per bag varies according to plant size, but generally a bag holds about 500 plants.

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| Sample counts for distribution | 16.116 | Plants are not counted for distribution unless this is specifically required: in fact, this practice should be avoided as far as possible. Sample counts to determine an average number of plants per bag normally suffice. |
| Culling before distribution | 16.117 | Any culling or sorting should be done in the nursery at the lifting stage and not at the planting site. |
| Transport of plants | 16.118 | Plants are often transported long distances from the central nursery. It is most important that the vehicles used be equipped with canvas covers to prevent exposure and drying out. |
| Coordination essential in distribution | 16.119 | A large nursery is very busy during the planting season, and since there is a limit to the number of plants that can be lifted each day, coordination is essential so that the programme proceeds smoothly. A programme setting out a timetable of deliveries to the various planting centres must be prepared in advance by the officer in charge of each nursery and circulated to all concerned. |
| Annual nursery report | 16.120 | <p>At the end of the planting season, a report is required on the operation of the nursery for the past year.</p> <p>This report, which is set out on a standard form, provides an account of the number of plants raised and details of their distribution.</p> |

PRUNING AND THINNING

- | | | |
|---------------------------------------|--------|---|
| Sawlogs main objective | 16.121 | Plantation silviculture in Western Australia aims at maximising sawlog production on a short rotation through heavy, early thinning and high pruning of crop trees where necessary. Production thinnings are heavy and infrequent. Because of excessive branch development, the practice of early culling has been discontinued except on drought prone sites and high-risk fuel-reduced buffers. |
| Pruning and thinning depend on market | 16.122 | Regimes for pruning and thinning vary depending on the species, the terrain and on the markets available for thinnings. In the past, insufficient markets for small logs have led to delays in thinning in most plantations. |

Thinnings to be scheduled 16.123 Delayed thinning and subsequent overstocking causes instability and susceptibility to wind throw as well as reduced growth rates and, in extreme cases, death from drought. On the other hand, thinning too early gives a reduced thinning yield. It is therefore of utmost importance that thinnings be carried out on schedule.

PINUS RADIATA

Classification of P. radiata plantations 16.124 Pinus radiata plantations are divided into three broad classes for tending purposes: Hills (red soil areas), Sunklands and Coastal sands. Hills plantations are further sub-divided into five sub-classes based on the quality of the site viz.

1. Hills (1) - High quality sites
 (2) - Average quality sites
 (3) - Low quality sites
 (4) - Steep (over 14° slopes)
 (5) - Drought prone sites

2. Sunklands

3. Coastal sands.

Methods for defining these management classes are being developed and Regional Staff should be consulted for advice. The classes are to be defined on plantation plans and the boundaries shown on P.O.C.S. sheets.

Terrain 16.125 In most plantations the terrain is generally gentle with slopes less than 14° and suitable for thinning by tree harvester or forwarders. These areas are managed for optimum sawlog production with two commercial thinnings and high pruning of crop trees where necessary. Slopes greater than 14° can usually be successfully thinned by a cable logging system but because of the higher logging costs only one commercial thinning is carried out. Low quality and drought prone sites also receive only one thinning.

Pruning and thinning of Hills Plantations 16.126 Pruning and thinning treatments for Hills Plantations depend on the site quality and terrain and on previous culling treatment. Special treatments are applied to fuel-reduced fire-control buffers.

High quality sites These sites produce rapid growth and usually large branches. Somewhat higher stockings and additional pruning are carried out on the high quality sites. See Schedule 1.

Average quality sites	No high pruning is envisaged for average quality sites under revised schedules. However, where stands have already been culled to 750 spha or less, some high pruning of crop trees may be required. See Schedule 2.	
Low quality sites	No pruning at all is proposed for low quality sites in future. They will receive one commercial thinning. Such sites comprise a small proportion of the plantations. See Schedule 3.	
Steep sites	Slopes greater than 14° are thinned by cable logging. They will be low pruned and will receive one commercial thinning. High pruning will not normally be applied. See Schedule 4.	
Drought prone sites	Drought prone sites must be recognised early. Generally, sites on shallow soils with northerly aspects are drought prone. Stands on these sites will be culled to 750 spha and low pruned. Requirements for further pruning will be monitored. See Schedule 5.	
Fuel reduced buffers	16.127	Fuel-reduced buffers (F.R.B.s) are established in some plantations to assist in fire control. They receive special treatment to maintain fuel at a low level. There are two types of F.R.B.s and both types need to be defined on P.O.C.S. sheets and plantation plans.
High Risk F.R.B.s		High risk F.R.B.s are established in areas of high risk and are designed to protect against fires starting in or burning into plantations. They are limited areas, usually up to 100 m wide and are maintained in a minimum fuel condition throughout the rotation by means of early heavy culling, high pruning and grazing. Their pruning requires special attention and they must receive priority in scheduling for both pruning and thinning. See Schedule 6.
Strategic F.R.B.s		Strategic F.R.B.s are broad buffers, 500 - 1000 m wide, designed to separate plantations into discrete areas of up to 500 ha. They are maintained in a fuel-reduced condition as far as possible through grazing. Grazing will be possible early in the rotation before canopy closure and for the balance of the rotation after first thinning.

Grazing		Grazing under an agroforestry system is the favoured means of reducing fuel quantities in buffers to the required level. Techniques are being developed for the maintenance of pasture under trees and for the management of grazing to meet fuel-reduction objectives.
		Other means of ground fuel reduction are also available, e.g. herbicides, burning, mechanical mulching, and removal of tops.
P. radiata in Sunkland	16.128	Silvicultural prescriptions for P. radiata in the Sunkland are still in the developing stage. It is possible there will eventually be special regimes for this area. Stability problems may necessitate special treatments. In the interim, the regimes set out in Schedule 1 and 2 will be followed.
P. radiata in Coastal Sands		The regime as set out in Schedule 2 (Average site) should be applied to P. radiata on the coastal sands.
Pruning and thinning Schedules for P. radiata	16.129	The schedules presented below must be used as a guide to the treatment of P. radiata in various situations. Some departures from schedule may be necessary with pruning, and continuous monitoring of all stands is required to ensure that limb size and knotty core are contained within the specifications set out in paragraph 16.131.
Effect of past culling treatment on schedules		Young stands (planted since 1966) may be standing at one of three densities. e.g., 1140 spha (no culling), 750 spha (syl. 70) and 500 spha (FRB). These lower densities, compared to the 1330 spha prescribed for new plantings, may result in excessive branch development. To offset this, variations to the schedule such as delaying the time of first commercial thinning and extra high pruning may be needed. As a general rule, first thinning should be delayed until the lower branches up to ten metres have been suppressed.
Intermediate stands		Intermediate stands (postwar stands planted prior to 1966) which have not been culled or thinned, cannot be thinned to the standard prescriptions because of the risk of wind damage. Generally these stands are thinned first to 400 spha and later to 250 spha. This may be varied, depending on procurement requirements and on the height and condition of the stand.

SCHEDULE 1

P. radiata - High Quality Sites

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3m x 2.5 m spacing).
3 - 5	5	Low prune all well formed trees to 2 m, cull malformed stems and whips.
5 - 7	9 - 10	High prune to 5 m (350 spha).
6 - 8	14 - 15	High prune to 7.5 m (200 spha).
*9 - 11	18 - 20	First thinning from 1330 to 350 spha.
18 - 20	-	Second thinning from 350 to 200 spha.
30	-	Clear fell.

* First thinning may need to be deferred in open stands on high quality sites to prevent excessive branch development following thinning. Thinning should be delayed until the branches ten metres up the stem have been suppressed by competition.

SCHEDULE 2

P. radiata - Average quality sites

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m spacing).
5	5	Low prune to 2.5 m all well formed trees, cull malformed stems and whips.
11 - 14	18 - 20	First thinning from 1330 to 250 spha.
18 - 20	-	Second thinning from 250 to 125 spha.
30+	-	Clear fell.

No high pruning is listed for this regime. However, limb development needs to be monitored and if excessive branching occurs, proposals should be submitted for some high pruning. Where stands have already been culled to 750 spha and low pruned to 2 m, high pruning of 125 spha stands to 5 m is to be carried out.

SCHEDULE 3

P. radiata - Low Quality Sites

- No tending Regime

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m spacing).
14 - 18	18 - 20	Thin from 1330 to 250 spha.
30 - 40	-	Clear fell.

Consideration will be given to low pruning the 250 crop trees for fire control purposes.

SCHEDULE 4

P. radiata - Steep (over 14° slopes)

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m spacing).
5	5	Low prune to 2.5 m, all well formed trees, cull malformed stems and whips.
11 - 14	18 - 20	First thinning from 1330 spha to 250 spha.
30	-	Clear fell.

When stands have previously been culled to 750 spha, high pruning to 5 m of 250 spha stands will normally need to be carried out. First thinning should be delayed until branches ten metres up the stem have become suppressed.

SCHEDULE 5

P. radiata - Drought prone sites

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1100/ha (3 m x 3 m).
5	5	Cull to 750 spha. and low prune 750 to 2.5 m.
11 - 14	18 - 20	First thinning to 200 spha.
30	-	Clear fell.

Requirements for high pruning will need to be monitored.

SCHEDULE 6

P. radiata - High Risk F.R.B.

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m).
3 - 5	5	Low prune to 2 m and cull to 500 spha.
4 - 6	8 - 9	High prune to 3.5 m (250 spha).
5 - 7	9 - 10	High prune to 5 m (250 spha).
6 - 9	14 - 15	High prune to 7.5 m (100 spha).
9 - 11	18 - 20	*High prune to 10.0 m (100 spha).
15 - 18	-	First thinning from 500 to 250 spha.
30 - 40	-	Clear fell.

* If branch development makes this necessary.

Where only 200 spha have been pruned to 3.5 m or above, the stand should be reduced to the 200 high pruned trees at the first thinning.

High risk F.R.B.'s will be grazed throughout the rotation.

SCHEDULE 7

P. radiata - Strategic F.R.B.

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m).
3 - 5	5	Low prune all well formed trees to 2 m, cull malformed stems and whips.
5 - 7	8 - 10	High prune to 5 m (250 spha).
6 - 9	14 - 15	High prune to 7.5 m (100 spha).
9 - 14	18 - 20	First thinning from 1330 to 250 spha.
15 - 18	-	Second thinning to 100 spha.
30 - 40	-	Clear fell.

Strategic F.R.B. will be grazed in the early years until canopy closure and for the balance of the rotation after first thinning.

Detailed prescriptions for fuel reduction or FRBs are to be prepared in local fire control working plans.

PART 16 - PINE PLANTATIONS

SCHEDULE 6P. radiata - High Risk F.R.B.

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m).
3 - 5	5	Low prune to 2 m and cull to 500 spha.
4 - 6	8 - 9	High prune to 3.5 m (250 spha).
5 - 7	9 - 10	High prune to 5 m (250 spha).
6 - 9	14 - 15	High prune to 7.5 m (100 spha).
9 - 11	18 - 20	*High prune to 10.0 m (100 spha).
9 - 11	18 - 20	First thinning from 500 to 250 spha.
15 - 18	-	Second thinning from 250 to 100 spha.
30 - 40	-	Clear fell.

* If branch development makes this necessary.

Where only 200 spha have been pruned to 3.5 m or above, the stand should be reduced to the 200 high pruned trees at the first thinning.

High risk F.R.B.'s will be grazed throughout the rotation.

SCHEDULE 7P. radiata - Strategic F.R.B.

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3 m x 2.5 m).
3 - 5	5	Low prune all well formed trees to 2 m, cull malformed stems and whips.
5 - 7	8 - 10	High prune to 5 m (250 spha).
6 - 9	14 - 15	High prune to 7.5 m (100 spha).
9 - 14	18 - 20	First thinning from 1330 to 250 spha.
15 - 18	-	Second thinning to 100 spha.
30 - 40	-	Clear fell.

Strategic F.R.B. will be grazed in the early years until canopy closure and for the balance of the rotation after first thinning.

Detailed prescriptions for fuel reduction or FRBs are to be prepared in local fire control working plans.

PINUS PINASTER

- P. pinaster north of Perth 16.130 Pinus pinaster plantations in the Wanneroo Division north of Perth are located on the intake area of the Gnangara Mound, an important ground water resource which provides a significant portion of Perth's water supplies. This influences silvicultural practice in these plantations, since densely stocked stands prevent adequate re-charge of the ground water. The plantations are managed on a low stocking regime in which the basal area should not exceed 15 sq.m. per ha for any extended periods.
- The pruning and thinning regime for P. pinaster in this area is designed to retain sufficient trees in the early years, thus preventing excessive branch development. It is then planned to maintain an open stocking which allows rapid tree growth and re-charge of the ground water. High pruning of trees retained after first thinning is required. See Schedule 8.
- P. pinaster at Havey Coast P. pinaster plantations on the Harvey Coast provide a valuable source of particle board and fencing material as well as future sawlogs. Restrictions on stocking levels for water re-charge do not apply. These plantations are managed on a somewhat heavier stocking regime than at Wanneroo. See Schedule 9.
- P. pinaster in the Sunkland P. pinaster in the Sunkland will be managed on the same regime as P. pinaster at Harvey Coast. See Schedule 9.
- Special treatment, such as a lighter first thinning may be required on some Sunkland sites where stability is a problem.
- Other P. pinaster The relatively small plantings of P. pinaster in other Hills plantations will be treated according to Schedule 9.
- Effect of past culling treatments As with P. radiata, young P. pinaster stands may be standing at various densities. e.g. 750 spha (syl. 70), 650, 500, or 300 spha. These stands will require special attention in the way of early or more frequent high pruning, to ensure that limb size and knotty cores are contained within the specifications set out in paragraph 16.131. These developing stands should be thinned to bring them into line with current schedules.

SCHEDULE 8

Regime for pedigree P. pinaster - Wanneroo Plantations

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1000 spha. (3m x 2.5 m).
5 - 6	5	Low prune to 2m all well formed trees and cull malformed trees and whips.
8 - 11	10 - 11	High prune to 5m (250 spha).
10 - 14	13 - 14	High prune to 7.5m (100 spha).
11 - 15	-	First thinning to 250 spha.
18 - 25	-	Second thinning to 100 spha.
24 - 32	-	Third thinning to 50 spha.
30 - 40	-	Clear fell.

Older, non pedigreed stands of P. pinaster should be brought into line with this regime as the opportunity occurs.

SCHEDULE 9

P. pinaster - Harvey Coast, Sunkland and Other

<u>Age (years)</u>	<u>Height (m)</u>	<u>Treatment</u>
0	-	Plant 1330 spha (3m x 2.5 m)
5 - 6	5	Low prune all well formed trees to 2m, cull malformed trees and whips.
8 - 11	10 - 11	High prune to 5m (250 spha).
11 - 15	-	First thinning to 250 spha.
20 - 25	-	Second thinning to 100 spha.
30 - 40	-	Clear fell.

This regime also applies to stands already culled to 750 spha.

PRUNING

- 16.131 With the exception of poor quality sites, all plantations receive some pruning. Apart from enhancing timber quality, pruning improves working conditions, access, visibility and safety in the plantation. It is also important in fire control.

Pruning for timber quality

Pruning in pine plantations is carried out primarily to avoid the development of large knots which seriously degrade the quality of sawn timber. Levels of stocking adopted to promote rapid growth unfortunately allow the development of the lower branches to grow to an unacceptable size, particularly on high quality plantation sites.

Aims of Pruning

Pruning treatments aim at limiting knot size in the utilisable portion of the tree to 35 mm diameter by removing the lower limbs before they reach this size. Pruning also aims at limiting the size of the knotty core to 150 mm diameter.

Schedules as a Guide

Pruning schedules are intended as a guide to the age and height of pruning. The growth of individual stands must be monitored to ensure pruning is carried out before the branch size and knotty core exceed the specified limits.

Variable height pruning

Rigid pruning prescriptions requiring all trees to be pruned to the same height at the same time inevitably result in the most vigorous trees being pruned too late. More flexible prescriptions are being developed to provide for a variable height of pruning whereby each tree is pruned as high as possible in a number of lifts, until sufficient trees are adequately pruned. This approach may involve pruning annually on some sites.

Low pruning to 2.5m

Stands which are to be low pruned only (eg. Schedules 2, 4 and 5) are to be low pruned to 2.5m to ensure that every tree has the potential to produce a stud length of sawn timber free of large knots.

Selection of trees for high pruning

Final crop trees are selected for their straightness, vigour and fine branching. Edge trees, wolf trees, or trees likely to produce excessively large branches should not be selected. Because this selection is vital to the quality of the future crop it must be carried out by trained personnel and carefully supervised.

Outrows not to be high pruned

In most plantations, every fifth row is marked as an outrow to be removed during the first thinning. Trees in the outrows are therefore avoided in the selection of crop trees for high pruning.

Pruning tools

Long-handled shears are used for low pruning. Large branches particularly, may have to be removed using chainsaws (see below), but pruning should be done before branch size becomes excessive.

Chain saws

To be approved for pruning or culling, a chain saw must have a chain brake, approved spark arrestor, anti-vibration handle and approved chain. The O.I.C. must inspect and approve all chain saws before they are used. Fire control requirements may at certain times necessitate a restriction on the use of chain saws in plantations.

High pruning tools

Pole saws, special hydraulic shears or saws powered by a tractor, are used for high pruning. Topography limits the extent to which this mechanised pruning can be carried out.

THINNING

Thinning encourages crop tree development

16.132 Thinning to encourage the rapid development of crop trees is necessary for the economic production of sawlogs.

The economics of thinning are affected firstly by production costs, which vary with such factors as the distance from markets, terrain, etc. and secondly by the value of the product, which generally increases with log size.

Thinning can provide a useful intermediate yield and help defray some of the expenses of plantation establishment and maintenance. However, the major monetary return comes from the sale of the final crop trees.

There are various priorities to be observed when planning the thinning operation. For example, in *P. radiata* stands, the first thinning must be carried out before the stand reaches a height of 20m, to ensure wind stability. Priority must be given to stands that will best respond to thinning (those where the remaining trees are likely to develop into high-value material), to fuel-reduced buffers and to stands that have been culled and high pruned.

Before thinning commences, a thinning prescription must be prepared. Any deviation from standards laid down in this Manual must be approved by the Chief of Division-Operations.

Tree Marking

Tree marking for thinning is to be done by trained personnel. A continuous check must be maintained by counting sample plots. Marking is to be adjusted accordingly if necessary, and the results of counts are to be submitted to the O.I.C.

Intermediate stands

Intermediate stands (stands of a thinnable age that have not been culled and are hence still at their planting spacing) cannot be thinned to the standard prescriptions because of the risk of wind damage. Generally these stands are thinned first to 400 spha and later to 250 spha. This may be varied, depending on the procurement requirements and on the height and condition of the stand.

Crop tree damage to be avoided

Felling and logging must be carried out in such a way as to avoid damage to the remaining crop trees. This requires strict supervision. Common causes of damage are careless felling that breaks other trees, and negligent use of machinery, resulting in the de-barking of the butts of crop trees. Because the remaining trees are of far more potential value than the thinnings, damage to these crop trees must be avoided.

Logging operations (see Section 17)

The planning and control of logging operations are covered in Section 17 of the Foresters' Manual.

Rotation age

The rotation age is generally 30 years for *P. radiata* and 30 to 40 years for *P. pinaster*, but this varies according to site quality. The timing of clear felling is also influenced by the demand for sawlogs.

PLANNING AND CONTROL OF PLANTATION ESTABLISHMENT AND TENDING

Plantation Operations Control System

16.133

Plantation records are maintained and plantation operations are controlled by means of the Plantation Operations Control System (POCS).

P. Year is unit of management

16.134

The system is based on the Planting Year (P. Year) as the unit of management. A P. year is the area planted during a particular year in each plantation.

P. Year print	16.135	The P. Year Print is a map depicting the P. Year on a foolscap-sized sheet, at a suitable scale (usually 1:12 500). The prints are copied from plantation plans, and are identified by plantation and year of planting. Planted areas are shown by section and by species.
Operations Sheets		<p>P. Year Prints are produced in quantity and are used as Operations Sheets, which</p> <ol style="list-style-type: none"> 1) support estimates by showing the location of proposed works; 2) provide a record of the proposed works; 3) are used as job description sheets, and for field recording of the works progress; 4) support financial reports by showing the work done; and 5) provide a permanent detailed record of all work completed. <p>A separate sheet should be used for each operation. There is no prescribed legend; notations should be used freely to record any information that may be useful. Photocopying facilities eliminate the need to hand copy the information shown on the sheets.</p>
Current Operations File		The Estimates Works Programme is supported by a set of Operations Sheets covering all the operations proposed for the year. These sheets form the Current Operations File for that year.
Works Programme Control List	16.136	All proposed plantation works for the year are listed for each division in a Works Programme Control List which shows the P. Year specification and the area proposed for all operations, classified by individual jobs. Each job is allocated a job number. Progress of work or area completed is shown at the end of the year.
Record File of completed operations	16.137	<p>The Record File contains the Operations Sheets for all completed operations. The sheets are filed by P. Years so that for each there is a set of consecutive Operations Sheets showing details of all work carried out on that area of plantation to date.</p> <p>Partly completed Operations Sheets for operations such as thinning should be stored in the Record File if work ceases before completion.</p> <p>They should be replaced in the Current Operations File when work recommences.</p>

P. Year Index provides summary of progress of work

16.138 The P. Year Index consists of a set of visible-edge cards, one for each P. Year. Each card contains the following information.

- 1) The plantation name and planting year.
- 2) A summary of areas by section and by species.
- 3) A description of all operations carried out to date. Entries are in chronological order, one entry for each operation, showing date commenced and completed, type of treatment and area treated.
- 4) Planned operations, particularly the next operation due, and their dates. Details are shown at the right-hand side of the card.

The visible edge (along the bottom of the card) is divided into a series of cells, each of which represents a particular piece of information, e.g. the P. Year area by species, or each expected operation. As operations are completed the cell is marked with the year of completion.

This set of cards thus gives the complete history of the whole plantation or any particular area, both in detail and in summary. A P. Year Print can be attached to each card to provide a fuller description of the area.

Index cards updated annually

The cards must be checked and updated annually at the end of the financial year. All entries are made in pencil so that they can be amended easily. All entries are brief; full details are provided in the Record File.

Pre-planting operations

16.139 Operations carried out prior to planting must be recorded on plans in the form of Operations Sheets, using prints of the Management Plan. Provisional cards should be included in the Index ahead of the current year to carry a summary of these pre-planting works.

Duplicate cards maintained at regional office

16.140 A duplicate set of Index Cards is maintained in each regional office and is updated annually.

Plantation plans and area statements

16.141 Planting records must be forwarded to Head Office, through the Regional Inventory and Planning Office, within two weeks of the completion of planting (normally by the end of July). To meet this requirement, areas will need to be mapped as the program progresses.

A report of areas planted is required in statement form (FD722) and should be supported by a 1:12500 plantation plan showing as accurately as possible all planting details, including species, spacing and planting stock serial numbers.

When replanting takes place following clear felling, it is shown as second rotation planting.

Planting is to be classified by previous land use.

Records of clear felling

16.142 Thinning and clearfelling is to be recorded in full (FD 724). The form, supported by P. Year prints, is to be forwarded to the Regional Inventory and Planning Office within two weeks of the close of the half-year period. From these records, Inventory and Planning Offices will prepare a statement of areas clearfelled (FD 723). The statement and supporting P. Year prints will be forwarded to head office at the end of each financial year.

Planting updated

16.143 Mapping Branch prepares a summary of new planting, second rotation planting and clear felling for the year, and plantation plans are updated using this information.

New P. Year Prints are prepared as required for new planting and for P. Years affected by clear felling. They are also used for re-drafting plantation plans following aerial photography.

Plantation Area Statement on computer

16.144 Detailed records of plantation areas by division, plantation, compartment, P. Year and species are stored in computer memory as the Plantation Area Statement. This is updated each year by Inventory and Planning to include areas newly planted or clear felled as advised by Mapping Branch. Print-outs of the Plantation Area Statement are produced as required.

PROTECTION OF PLANTATIONS

Surveillance necessary to avoid damage by pests and disease

16.145 Pines are susceptible to many diseases and damaging insect pests. However, plantations in Western Australia are free of serious disease, no doubt due to the area's isolation and to strict plant quarantine regulations. Careful

tending to maintain the trees in a vigorous condition is also a safeguard against disease.

Early detection of disorders is most important and constant surveillance of the plantations is therefore necessary.

- Sirex wasp 16.146 The sirex wasp (*Sirex noctilio*) has caused serious damage to pine plantations in New Zealand, Tasmania and Victoria. It has not been recorded in Western Australian plantations so far, but it remains a potential threat. Publications are available describing this insect. All staff should be familiar with its appearance and habits, and should maintain a constant watch for it.
- Bark beetle 16.147 The bark beetle (*Ips grandicollis*) is present in most Western Australian plantations. It is normally found only in dead trees or logs, but it is also known to attack living trees that are weak because of drought or other causes. The best protection against this insect is to maintain the trees in a vigorous, healthy condition.
- Insects to be sent to Como 16.148 Any insect found damaging pine trees should be caught and forwarded to the Research Branch, Como, for identification.
- Rabbits 16.149 Rabbits can be a major cause of loss in newly established plantations, and they should therefore be completely eradicated. There are various ways in which this can be done. The advice and co-operation of Agriculture Protection Board officers should be sought.
- Grazing animals 16.150 Grazing animals can damage young trees and this must be borne in mind in agro-forestry management systems.
- Needle-cast fungi 16.151 *Dothistroma pini* causes needle blight, a fungal disease of pine needles. It has caused widespread damage to *P. radiata* and other pines in New Zealand and Africa, but has not become established in Australia. Other less virulent needle-cast fungi such as *Lophodermium* and *Naemacyclus* occur in some Western Australian plantations but do not appear to cause serious damage. Any abnormal discolouration of needles should be reported to Research Branch.
- Drought damage 16.152 Even in the high-rainfall areas of the south-west of Western Australia there are prolonged summer droughts. In many plantations these have resulted in heavy mortalities in overstocked stands. Avoidance of drought-prone sites and thinning according to schedule help reduce the risk of loss through drought.

- Wind damage 16.153 A severe cyclone in 1978 caused heavy losses, showing that wind can be a serious threat to pine plantations. Recently thinned stands are most susceptible, particularly if the thinning has been delayed. Early heavy thinning promotes the development of resistant stands.
- Fire protection essential 16.154 Pine plantations in Western Australia are very susceptible to fire. The risk of fire is present each summer, and all plantations must therefore be protected by efficient fire detection and suppression mechanisms. Adequate access and water supplies are essential.
- Fuel reduction 16.155 Fuel-reduced zones in areas of high risk and fuel-reduced buffers are the basis of fire control in many plantations. Fuel reduction is achieved by burning in winter under strictly controlled conditions or by grazing. It is most important that fuel quantities are not allowed to exceed prescribed levels in these areas.
- Fire control described in Section 9 16.156 Fire control measures are described in Section 9 of the Foresters' Manual.

PRIVATE PLANTATIONS

- Forests Act amendments (1976) 16.157 Privately owned pine plantations are a potentially valuable supplement to State-owned plantations in meeting anticipated demands. For this reason Section 7 of the Forests Act was amended in 1976 to allow the Department to provide advice to private owners.
- Advice to be given 16.158 Advice will be given on the following aspects.
- 1) Potential suitability of sites for planting.
 - 2) Roading and access for protection purposes, in conjunction with Departmental roading proposals (where applicable).
 - 3) Silviculture techniques.
- Managerial advice not given Direct managerial advice such as would be given by a consultant will not be provided. Instead, the private grower will be given technical information so that he can determine his own management objectives and decide on the best way to fulfil them.
- Comment given on silvicultural potential The Department will comment on the probable results of particular courses of action, particularly with regard to the difficulties of economically disposing of small logs and the

problems of drought in pine plantations. The grower will be free to make his own decisions in the light of these opinions.

- Officers have no right of access 16.159 Forests Department officers have no right of access to private plantations except in circumstances as stipulated in the Bush Fires Act, when fires on private land are threatening State forest.
- Fire control policy 16.160 The Department's normal fire suppression policy will apply to private plantations adjoining State-owned plantations. However, the protection of State-owned plantations will at all times be the priority of the Department's fire control organisation.
- Fire detection 16.161 Similarly, fire detection services will continue to follow Departmental priorities, but any information obtained concerning privately-owned plantations will be offered through the Bush Fires organisations attached to local authorities or such caretakers as are nominated by the private owners.
- Appraisal of site suitability 16.162 Appraisals of prospective planting areas may be carried out on request for individual growers or landowners, providing the area lies within the region considered generally satisfactory for pine plantations (i.e. in the south-west region where rainfall exceeds 760 mm per annum). Head Office will arrange for officers to carry out inspections.
- Detailed soil surveys not undertaken 16.163 Detailed soil surveys will not be undertaken. After inspection a statement as to general suitability will be prepared using the broad classification of suitable, doubtful and unsuitable sites. Where it is not feasible to prepare such an appraisal from a half-day inspection, owing to the size or complexity of the area, a recommendation will be made as to whether a more detailed examination by a private forestry consultant is warranted.
- Detailed soil survey plans of areas previously surveyed will not be made available, but they will be used to prepare a general statement of suitability.
- Department not responsible to private growers 16.164 The Forests Department's appraisal of the suitability of an area for pine planting is based on pine growth on apparently similar sites elsewhere. This experience is not exhaustive and, in any case, different fertilizer treatments and different silvicultural methods will produce different results.

The general statement of apparent suitability is subject to these reservations and the Department will not be responsible for the performance of pine plantations established in accordance with the statement.

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| Requests for site appraisals | 16.165 | Requests for site appraisals should be made in writing to the Officer in Charge, Forests Department, 121 Todd Avenue, Como, W.A., 6152. They should be accompanied by evidence of ownership of the property concerned or by written authorisation from the owner for entry and inspection. The report will be supplied only to the owner with copies only to persons nominated in writing by the owner. |
| Maps available for purchase | 16.166 | Forests Department planimetric 1: 25 000 scale plans showing, on the basis of information provided, established plantations on private property are available to divisions and for purchase. Departmental 80 scale plans or their metric equivalent define locations known to contain private plantations. |
| Aerial photos available from Lands Department | 16.167 | The Forests Department does not sell aerial photographs. These are available through the Central Map Agency, Lands and Surveys Department, Cathedral Avenue, Perth. |
| Provision of seed | 16.168 | Depending on stocks available, the Department will endeavour to supply high-quality <i>P. radiata</i> or <i>P. pinaster</i> seed to private growers who wish to establish their own nurseries. |
| Provision of nursery stock | 16.169 | The Department is prepared to raise limited quantities of seedlings of these two species against advance orders. As nursery space may be limiting, the Department reserves the right to decline any orders. |
| Large orders to be placed 1 year ahead | | The Chief of Division - Operations should be advised of all substantial orders for trees received at Divisions. Large orders for over 5000 plants must be placed before 31 August for supply during the following winter. Seedlings will not be supplied before 1 June or after 31 July in any year. There will be a maximum limit of 50 000 seedlings per individual or company. |
| Method of payment | | The normal arrangement for payment will be by cash for orders up to 5000 plants. For larger orders an advance payment of 50% of the total price will be required when the order is placed, and the remaining 50% is to be paid before delivery. |

Price		Price will be in accordance with the current nursery price list. Orders received after sowing will be accepted only on the understanding that they will be met from surplus stock, and that supply therefore cannot be guaranteed.
No charge for services	16.170	Charges for services will not be levied. Maps or other materials will be available at normal Departmental rates.
Requests from private growers to be sent to Como	16.171	Requests from private growers and investors for advice and inspections should be addressed in writing to the Officer in Charge, Forests Department, 121 Todd Avenue, Como, W.A. 6152. Any written requests received by divisions should be also forwarded to that address.
Managerial advice not to be given	16.172	The area O.I.C. should refrain from giving managerial advice, as distinct from information. He may inform enquirers of methods and techniques in use in his own division and the reasons for their selection. Information Sheet 17 should be supplied to any enquirers.
Information on field costs	16.173	Verbal information may also be given on the field costs of local silvicultural operations, except for contracts, which are confidential agreements between the Conservator and the contractors. It should be pointed out that overheads apply to wages costs (to cover such items as leave, payroll tax, workers' compensation etc.) and variable administration charges apply to all costs. Divisional officers must appreciate that they are not in a position to comment on the overall costs and profitability of conversion operations.
Summary of enquiry to be sent to Bunbury and Como	16.174	A brief summary of the enquiry and information given should be forwarded in writing to both Bunbury and Como regional offices.
No comments to be made on other private growers	16.175	No personal opinions are to be given concerning the silvicultural and business practices of other private owners, planters or managers.
Divisions to report on high-risk areas	16.176	A plantation can be considered to be a high fire risk area within five years of planting or until the first pruning, whichever is earlier. Area O.I.C.s should record such areas of high risk and forward plans of these areas through their regional office to Protection Branch at the same time as the risk hazard plans for Departmental plantations required annually by Protection Branch.

Proposals for
protection
concerning
private plantations

16.177 With these plans, divisions should include proposals for pre-suppression techniques to be used in State forests to minimise escape of fire from or into private plantations.

Divisions to
report areas
privately
planted

16.178 Area O.I.C.s should advise the Head Office each year of any known private planting in the division, detailing where possible the location number, owner of location, map reference, estimate of area planted, species planted, and estimate of stems per hectare.

This information should be supplied at the same time as the details of Departmental planting, before the end of August each year.

APPENDIX 1A

A GUIDE TO SOIL DESCRIPTION IN FORESTS DEPARTMENT SURVEYS

Colour

Compare slightly moist soil with the range from the Munsell Soil Colour Chart (Munsell Colour Company, Baltimore, 1954).

Abbreviations are as follows:

Principal colour (capital letter): Y, R, B, etc.

Modifying colour (lower case letter): y, r, b, etc.

Colour density (lower case letter): l, d, str.

Thus: dark yellowish brown dyB
light reddish yellow lrY
strong brown strB

Texture

Soil texture and abbreviation

Characteristics of moist sample

Sand (S)

Gritty and coarse. Does not cohere.

Loamy sand (LS)

A cast may cohere, but breaks up easily on handling. Stains the fingers.

Sandy loam (SL)

A cast will cohere, but is friable. Small grains can be felt.

Silt loam (SiL)

Powdery when dry. Readily forms coherent cast. Non-plastic when moist; collapses and will not ribbon

Loam (L)

As for sandy loam, but sand grains cannot be felt. Will roll into a cigar shape which is very fragile. Slight ability to ribbon.

Sandy clay loam (SCL)

As for clay loam, but sand grains can be felt. Rolls readily into cigar shape but will stand only slight bending. Will form ribbons which break every inch or so.

Clay loam (CL)

Cast is plastic and will roll into a pencil shape. Stands slight bending without breaking. Has smooth feel. Ribbons fairly well.

Sandy clay (SC)

As for clay, but sand grains can be felt. Usually sticky.

Clay (C)

Tough and plastic. Can be rolled into long pencil shape and bent into ring without breaking. Ribbons easily without breaking. Sometimes smooth, often sticky.

Appendix 1 cont...

Stone content

The term 'gravel', when used in Forests Department soil surveys, is strictly reserved for the 'ironstone' pebbles common in Western Australian soils. 'Rubble' is used to describe small fragments of other rocks. Other forms of stone occurrence are floaters, massive sheets and outcrops. They are abbreviated as follows: g, ru, fltrs, M, o/c.

Genetic types of stone: 'ironstone' = Lat
lateritised rubble = Lttd ru
granitic = G
quartzitic = Q
basic = B

Amounts of stone : trace (< 5%) = tr
light (5 to 20%) = l
moderate (20 to 60%) = m
heavy (> 60%) = h

Size of stone: fine (< 6 mm diam.) = f
medium (6 to 20 mm) = m
coarse (> 20 mm) = c

Other likely stone sizes are: fm (fine and medium)
mx (mixed sizes over complete range)

Sequence of description of horizon sample

Colour, texture, stone quantity, stone size, stone type (if applicable) stone form.

Example: A horizon of yellowish brown loam containing coarse sand and 50% of granite rubble and some quartzite rubble averaging about 30 mm in diameter would be described as:
yBcSLmxxG(&Q)ru

A horizon of dark yellowish red sandy clay loam containing 10% of fragments of dolerite 5 mm in diameter which had been turned a dark reddish brown colour externally, would be described as:

dyRSCLlfBru(lttd)

Sequence of description of profile

Usually one or two descriptions for the A₂ horizon and one description for the B₁ horizon, if encountered, are required. The A₁ horizon, which is usually thin in Western Australian forest soils, is not described unless unusually thick; however, a note of thickness (cm) should always be made.

Appendix 1 cont...

Within the A₂ horizon, there will commonly be a change in colour or texture or both. (Hence the need for more than one description.) This change will usually occur as a gradation. This is abbreviated as ↓. Make the first warranted A₂ description. (The depth of examination and description required will be specified at the start of the survey.) Indicate the depth of these if this is not shown by a boundary depth indication.

Between the A₂ horizon and the B₁ horizon there is usually a more or less distinct boundary. Abbreviate this and indicate the depth, for example _____ 45.

The same symbol can also be used to indicate the upper surface of a horizon with stone content.

Example: A₁ - 2.5
 dyBLS
 ↓
 yB↓LS.lfg 35
 ↓
 lyB.SL.lfg
 _____ 50
 lyB.SCL.mfmg
 _____ 65
 lgBSC

85+ - indicates examination to depth below first description of clay.

Appendix 1A

Colour

Compare slightly moist soil with the range from the Munsell Soil Colour Chart (Munsell Colour Company, Baltimore, 1954).

Abbreviations are as follows:

Principal colour (capital letter): Y,R,B, etc.

Modifying colour (lower case letter): y,r,b, etc.

Colour density (lower case letter): l,d,str.

Thus: dark yellowish brown = dyb; light reddish yellow = lrY; strong brown = strB. If mottles occur in a horizon only the most extreme colour of these is recorded, and it can be qualified as weak (wk) or strong (str). The mottle colour is recorded after the principal colour and is separated by a hyphen, e.g. yB-strBY.

Texture

(after Northcote*)

Soil texture is a measure of the behaviour of a small handful of soil when moistened and kneaded into a ball and then pressed out between thumb and forefinger.

The method is to take a sample of soil sufficient to fit comfortably into the palm of the hand. The soil is moistened with water, a little at a time, and kneaded until the ball of soil, so formed, just fails to stick to the fingers. More soil or water may be added to attain this condition which is known as the sticky point, and approximates field moisture capacity for that soil. Kneading and moistening are continued until there is no apparent change in the soil ball, usually a working time of 1 to 2 minutes. The soil ball, or bolus, is now ready for shearing manipulation, but the behaviour of the soil during bolus formation is also indicative of its texture. The behaviour of the bolus and of the ribbon produced by shearing (pressing out) between thumb and forefinger characterises the texture. Grades of texture commonly recognised and defined by the behaviour of the moist bolus are set out below.

Soil Texture Grades - Adapted from Northcote*

Coherence	Bolus Characteristics	Ribbon Length	Other Remarks	Grade	Texture Group
Nil to Slight	Sandy to touch	Cannot be moulded	Single sand grains adhere to fingers	Sand (S)	1
Slight	Sandy to touch	About 6mm	Fingers discoloured with dark organic stain	Loamy Sand (LS)	1
Slight	Sticky when wet; sandy touch	6 to 13mm	Many sand grains stick to fingers; fingers discoloured with clay stain	Clayey Sand (CS)	1
Slight	Sandy to touch	13 to 25mm	Dominant sand grains are of medium size (0.2mm) but readily visible	Sandy Loam (SL)	2
Medium	Fine sand felt and heard	13 to 25mm	Fine sand grains seen under a hand lens	Fine Sandy Loam (fSL)	2
Medium	Sandy to touch	20 to 25mm	Dominant sand grains are of medium size (0.2mm) but readily visible	Light Sandy Clay Loam (lsCL)	2
Medium	Spongy and smooth to touch; no obvious sandiness or silkiness	About 25mm	Greasy to touch if large quantity of organic matter present	Loam (L)	3
Medium	Very smooth or silky to touch	About 25mm		Silt Loam (SiL)	3
Strong	Sandy to touch	25 to 38mm	Medium size grains visible in a finer matrix	Sandy Clay Loam (sCL)	3
Strong	Plastic and smooth to touch	38 to 50mm		Clay Loam (CL)	4
Strong	Smooth, plastic and silky to touch	38 to 50mm		Silty Clay Loam (SiCL)	4
Strong	Fine sand can be felt and heard	38 to 50mm		Fine Sandy Clay Loam (fsCL)	4
Strong	Plastic to touch; fine to medium sand seen, felt or heard in a clayey matrix	50 to 75mm		Sandy Clay (SC)	5
Strong	Plastic, smooth and silky to touch	50 to 75mm		Silty Clay (SiC)	5
Strong	Plastic and smooth to touch	50 to 75mm	Slight resistance to shearing between thumb and forefinger	Light Clay (LC)	5
Strong	Plastic and smooth to touch	About 75mm	Slightly greater resistance to shearing than light clay	Light Medium Clay (lMC)	5
Strong	Plastic and smooth to touch; handles like plasticine	Greater than 75mm	Moulded into rods without fracture; moderate shearing resistance	Medium Clay (MC)	6
Strong	Smooth and plastic to touch; handles like plasticine	Greater than 75mm	Moulded into rods without fracture; firm shearing resistance	Heavy Clay (HC)	6

*Northcote, Keith H., A Factual Key for the Recognition of Australian Soils. Rellim Technical Publishers 1979.

Texture Groups:

- 1. The Sands
- 2. The sandy loams
- 3. The loams
- 4. The clay loams
- 5. The light clays
- 6. The medium-heavy clays

Note: It should be clearly understood that for the purpose of determining the Duplex characteristic (see later), a texture span equivalent to one texture group does not have to correspond to the limits of any of the six recognised groups, it can extend from the mid-range of one group to the mid-range of the next adjacent group.

PART 16

Appendix 1A cont...

Stone content

The term 'gravel', when used in Forests Department soil surveys, is strictly reserved for the 'ironstone' pebbles common in Western Australian soils. Small fragments of other rocks are described as 'rubble'. Other terms used to describe stone occurrences in soils are 'floater', 'massive sheet' and 'outcrop'.

The quantity of small stones in a sample can be conveniently estimated after their removal from the sample, which is a step usually necessary to allow field texture determination to be carried out. Quantity should be estimated as a volume percentage of the total sample, in steps of 5 per cent. In an abbreviated description of a soil profile the percentage figure(s) without a % sign should be recorded, but for a rough estimate, e.g. of gravel in surface soil, broad categories defined below can be adopted.

Stone size categories are defined below, and broad geological types of stone are listed. Abbreviations to be used, where applicable, are placed in brackets after the word which each represents.

Amounts of stone in sample: e.g.	<u>Quantity recorded</u>	<u>Range</u>	<u>Category</u>
	5	0 - 5%	trace (tr.)
	15	5%-20%	light (l.)
	45	20%-60%	moderate (m.)
	70	60%+	heavy (h.)
	(for very coarse material) 1-5 pieces occasional (occ.)		
Size of stone in sample:	fine (f)	0-6 mm diameter	
	medium (m)	6-20 mm diameter	
	coarse (c)	20-50 mm diameter	
	very coarse (vc)	50 mm+ diameter	
	N.B. Combination of stone sizes is permissible in the interests of better description e.g.		
	fine and medium (fm)		
	mixed (mx)		
Type of stone:	ironstone (Lat)		
	lateritized rubble (Ltzd ru)		
	granitic (G)		
	quartzitic (Q)		
	basic (B)		

PART 16

Appendix 1A cont...

Description sequence for horizon sample

Colour, texture, stone quantity, stone size, stone type (if applicable) and stone form.

Examples of abbreviated sample descriptions

1. A horizon of yellowish brown sandy loam containing coarse sand and 50 per cent granite (and some quartzite) rubble between about 5 and 40 mm in diameter, could be described as:

yBoSL50mxG(&Q)ru

2. A horizon of dark yellowish red sandy clay loam consisting of 10 per cent dolerite fragments (5 mm in diameter) which had turned a dark reddish brown colour externally, could be described as:

dyRSCL10fBru(Ltzd)

Description sequence for soil profile

The A¹ soil horizon, which is usually thin in Western Australian forest soils, is not described unless it is unusually thick. However, a note of its thickness (cm) should be recorded. Usually one or two descriptions for the A² horizon and one description for the B¹ horizon, if encountered, are required. The total depth of examination and description will be specified at the start of a survey.

The first A² horizon description should be made for a depth below the soil surface of about 15 cm and further descriptions made which will describe the profile in the most concise way. Within the A² horizon there will commonly be a change in soil colour, or texture or both. This change will usually be a gradual one (defined as change spanning a depth interval greater than 10 cm) in which case the symbol ↓ is used between the two descriptions at the start and finish of the gradation.

Revised 6/85

The total depth in centimetres to a second or subsequent description should be recorded as a figure, without the 'cm' notation, opposite the description. However, this figure can be eliminated if a horizon boundary symbol and its associated depth figure are recorded immediately after the description.

A horizon boundary is recorded where a change in colour, texture, stone content or stone grade occurs over a depth interval of less than 10cm. The boundary is symbolized by a horizontal line with the depth to the centre of the boundary zone recorded alongside.

Forest soils in W.A. are more often than not of the Duplex profile form, i.e., there is a texture change between the A₂ and the B₁ horizons of at least 1.5 texture groups, occurring over a depth interval of less than 10cm. It is usually necessary, therefore, to record a boundary between those horizons.

Example of abbreviated soil profile description

A ¹ - 2.5	
dyBLS	(at standard depth, therefore depth not shown)
yBLS5fg	35
lyBSL15fg	(note change in colour, texture and gravel content)
	50
<hr/>	
lyBSCL40fmg	
	65
<hr/>	
lgBSC	(note that the last described horizon is continuing at the maximum depth examined)
85+	

Revised 6/85

APPENDIX 1B

CLASSIFICATION OF SOILS - HILLS PLANTATIONS

A - Excellent

Exceptionally deep dark red to dark brown loam to sandy loam, with depths ranging from 90 to 180 cm. Derived from eroded mid-slope igneous rock formation; generally located in pockets along the lower slopes of dissections.

B - Good

Dark red to brown loam to sandy loam with a minimum root-penetrable depth of 90 cm. Generally located along the lower slopes of weathered igneous rock dissections, away from the laterite cap.

C - Satisfactory

Light red to light brown loam to sandy loam with scattered broken rock and colluvial over-spills from the laterite cap with a minimum root-penetrable depth of 90 cm. Derived from dissected igneous rock just below the laterite cap; generally located on mid and upper slopes.

D - Marginal

Yellow to grey sands with a minimum root-penetrable depth of 90 cm, but of light texture and lacking natural fertility. Generally derived from acid igneous rock forming leached sands, or from laterite caps with a low percentage of gravel forming podsolised sand. Suitable for *P. radiata* with the addition of trace elements and N.P.K. fertiliser.

E - Sub-marginal

Sandy gravels, and very stony to rubbly soils, all with low soil percentages and high gravel and broken rock percentages, reducing the moisture- and fertilizer-holding capacity. Usually 20 to 50 cm deep. Generally part of the laterite cap or stony ridges just below the laterite cap.

F - Unsuitable

All surface sheet rock, broken rock out-crops and skeletal soils 0 to 20 cm deep over rock. Also slopes steeper than 14° covered by native forest.

The following suffixes are used after the grade initial (e.g. Bb) to demonstrate the soil origin:

- a acid soils
- b basic soils
- d dioritic soils
- l lateritic soils
- m metamorphic soils
- o alluvial soils

APPENDIX 1C

CLASSIFICATION OF SOILS - DONNYBROOK SUNKLAND

Generalised soil type descriptions to be used for Forests Department mapping purposes are given below. The type numbers are no indication of site quality.

Type 1 - Laterite

Any soil containing more than 20% by volume of hard lateritic gravel within 20 cm of the surface. This category includes boulder laterites.

Type 2 - Shallow sands

Loamy sands between 20 and 50 cm deep above soil containing considerably more than 20% gravel by volume or massive laterite. The colour of the sand may be yellowish brown or greyish.

Type 3 - Yellowish brown sands deeper than 50 cm

The texture is loamy sand or sand above a depth of 50 cm but may be heavier at greater depth. There may be up to 20% by volume of gravel, usually fine or medium, in the upper 50 cm. The underlying material is usually heavy gravel or massive laterite, rarely clay. There is occasionally a thin layer, continuous or fragmentary, of accumulated organic matter (A₃ horizon).

Type 4 - Greyish brown sands deeper than 50 cm

The texture may be loamy sand or sand, and the colour may range from light grey to dark grey or dark greyish brown. There is commonly an A₃ horizon with an upper limit between 60 cm and 100 cm below the surface. In most cases this forms a continuous layer of 'coffee rock', but sometimes it is fragmentary or only a dark brown colour horizon. Its average thickness is about 15 cm. Depth is often limited by an iron-cemented pan; otherwise it is limited by heavy gravel or massive laterite.

Type 5 - Loamy soils

The texture in the upper A₂ horizon is usually at least sandy loam but some profiles with loamy sand at this level are admitted because the texture becomes sandy loam or heavier within 60 cm of the surface. The colour is most commonly light yellowish brown or yellowish brown, but in some cases is light greyish brown.

In these soils the gravel content is generally less than 10%, above a limiting horizon containing approximately 50% gravel. A soil containing gravel may be classified as Type 5 provided that the proportion of gravel within 20 cm of the surface is less than 20% by volume. In most cases, however, there is no gravel and the limiting horizon is clay. The depth may vary greatly.

Type 6 - Very heavy soils

At the surface the texture is sandy loam or heavier (often sandy clay) and grades down to sandy clay at depths less than 60 cm. The colour is light greyish brown with mottling or light yellowish brown with less frequent mottling.

Appendix 1C cont...

At least 50% by volume of gravel is present in admixture with the sandy clay of both colour phases, but is found more commonly in the yellowish soils.

Type 7 - 'Alluvial' soils

These soils are usually associated with watercourses. Colours are brownish yellow, strong brown or yellowish red.

The texture in the upper A₂ horizon is usually silty loam, silty clay loam or sandy loam. It may become heavier with increasing depth. Up to 20% by volume of gravel may be present in some profiles; it is usually fine gravel.

Depth is usually 75 to 120 cm with laterite as the limiting horizon. Where clay texture is considered the limiting horizon, depth may be as little as 35 cm.

Potential for pine plantation

All these soils have very low natural fertility. Type 1 is known to be unsuitable for pine plantations and type 6 is likely to be so because of poor aeration and penetrability. Type 2 appears likely to support only a slow growth rate at an uneconomic cost. Type 7 soils may support a rapid growth rate, but trees grown on them would be liable to instability in winter; in any case most of the occurrences of this soil type in the Sunkland are within mandatory stream reserves. Soil types 3, 4 and 5 are regarded as the plantable land; however, wet areas of type 4 must be left unplanted, at least initially.

APPENDIX 2

METHODS OF HERBICIDE APPLICATION (1979)

Stem injection (notching)

For the control of coppice and regeneration that has survived initial attempts at weed control, notching with "Tordon 105 Treekiller" is the standard method. The treatment is applied when eucalypt regrowth competes with the pines.

Notches are cut with a chisel-head axe at 50 to 75 mm intervals around the stem at waist height; one notch is sufficient for small stems up to 25 mm diameter. The injection is carried out using a back pack sheep-drench outfit to apply 2 cm³ per notch of a 50:50 mixture of "Tordon" and water. Best results are obtained during late spring and early summer.

Basal spraying

This is an effective method of controlling eucalypt coppice and larger scrub but there is a risk of vapour drift, which can cause damage to pines and surrounding vegetation.

"Tordon 255 Mixture Oil Soluble Brushkiller" in 2% mixture with dieseline and 0.25% of the surfactant "Plus 50" is applied as a basal spray to thoroughly drench the base of the stem to a height of 30 cm. The entire circumference must be saturated. Where the terrain permits, basal spraying is best done with hoses from a tractor-mounted tank.

Best results are obtained from basal spraying during the spring and early summer. The chemical volatilises at approximately 24°C and so the operation must be restricted to cool weather (below 24°C).

APPENDIX 3

HERBICIDES FOR WEED CONTROL IN PINE NURSERIES (MARCH 1979)

1. Pre-emergent herbicides

Chlorthal ("Dacthal")

Chlorthal is very efficient in sandy soils but not in heavier soils. It is most effective against couch and crab grass, and is harmless to pine seedlings. It is applied immediately after sowing at the rate of 14 kg in 1124 l water per hectare.

Propazine ("Gesamil 50")

In the heavier soils at Nannup nursery propazine has given good results as a pre-emergent herbicide. It is used in nurseries in place of simazine ("Gesatop 80"), which has a toxic effect on plants.

Propazine is applied immediately after sowing at the rate of 1 kg active ingredient in 450 l water per hectare. It is highly effective against broad-leaved species but not against barnyard grass (*Echinochloa crusgalli*).

2. Post-emergent herbicides

Caragard

The effectiveness of this chemical as a post-emergent herbicide for the control of barnyard grass is at present being tested in research trials.

Mineral Oil

Mineral oil is an effective, selective herbicide to be used against crab grass and some other soft weeds. It is usually prepared as a 60:40 mixture of power kerosene and lighting kerosene. The aromatic content is the critical factor: the higher the aromatic content, the more severe the effect. For safe use with pines it must be between 25 and 28%. Pure power kerosene is normally 38 to 40% aromatic, while lighting kerosene is much lower at about 7%. Because these percentages vary from time to time it is preferable to order a blended mixture of the required aromatic content.

Mineral oil is applied as a spray in fine, still weather at the rate of 785 l per hectare. Equipment must be calibrated carefully to ensure that application rates are not exceeded: excessive amounts of mineral oil will damage the pines.

Mineral oil applied at this rate is effective only against very young weeds. Crab grass should be sprayed while still in the cotyledonary stage.

Paraquat-Diquat

The mixture of these two chemicals gives a powerful non-residual contact weedicide. It should be used each year to kill pre-germinated barnyard grass in the fallow section of the nursery during November to December, before the green crop is sown.

Forests Department
50 Hayman Road
Como W A 6152

FORESTS DEPARTMENT

Please find enclosed a new addition to the Forester's
Manual, Part 17 - SOFTWOOD UTILIZATION.

P J McNamara
Acting Conservator of Forests

Distribution List B.

11 June 1984

Part 17

Foresters'
Manual

Softwood
Utilization

prepared under the direction of
P J. McNamara, A/Conservator of Forests

Forests Department
Perth
Western Australia

Softwood Utilization

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SOFTWOOD LOGGING

- Introduction 17.001 Softwood logging is the linking of the plantation establishment programme with log marketing commitments.
- All softwood logging operations are conducted on a commercial basis, using logging contractors employed by the Forests Department under specific contracts. Softwood logging contractors perform all the necessary logging work and deliver the various log products to customers for further processing.
- Code of Softwood Logging Practice 17.002 All persons carrying out softwood logging operations will follow the instructions laid down in the Code of Softwood Logging Practice. This code is the basis for the control of logging operations and forms part of each logging contract.
- Pine Logging Computer System 17.003 All softwood logging operations are conducted through the Forests Department Pine Logging Computer System. The system is an integrated data processing and recording system for financial and resource information which covers the total recording and calculation requirements of the pine logging operations of the Department. The system is described in detail in the Pine Logging System User Manual.
- Supervision 17.004 Each officer supervising a pine logging operation must:
- (1) have a clear understanding of the policy goals and management strategy of each operation they control. The divisional pine logging plan sets out these details.

- (2) have an intimate knowledge of the logging prescription relating to each operation, as laid down in the relevant FD 709 contained in the Divisional Pine Logging Plan.
- (3) apply the Departmental general principles of management and institute necessary controls to achieve the goals set for the operation.
- (4) take personal responsibility to ensure that the maximum utilization is obtained for each class of log product, according to the specifications. The officer must also maximize the recovery of the highest value log product, in particular sawlogs.
- (5) as the Conservator's representative, bring to the notice of the contractor any failure, on the part of the contractor or the contractor's employees, to comply with operating standards laid down in the contract; in particular, those standards contained in the Code of Softwood Logging Practice.

Planning of Operations

17.005 A Logging Plan for each division is drawn up each year, after discussion between Divisional and Regional staff, Inventory and Planning, Protection Branch and the OIC of Pine Logging from Harvesting and Marketing Branch.

Inventory and Planning issue the plan to the Division. The plan contains a series of approved Pine Logging Prescription Forms (FD 709) for current or proposed operations and defines reserve areas. The plan shows the method of logging, time of year, operating schedules, approved customers, estimated volumes to be obtained, and other relevant information.

Part 17 Softwood Utilization

Roading

Construction of Logging Roads	17.006	The Forests Department is responsible for the construction of pine logging roads, at its expense.
Calculation of Stumpage	17.007	In calculating stumpage charges, an allowance is made for the cost of road construction, as part of the cost of growing principle. In effect, the buyer of each pine log product then pays a proportionate share of the overall cost of road construction.
Annual planning	17.008	<p>Each division will prepare an annually updated 5 year programme of proposed road construction, together with estimate costs, after consultation with the Regional D/F Pine Logging. The plan will generally be based on the expectation that logging roads will be required for the first thinning of plantations when they reach 12 years of age.</p> <p>An important result of the shortwood harvesting system which uses Forwarders for extraction on moderate terrain is the negligible requirement for landings.</p>
Contractor Liaison (planning)	17.009	It is most desirable for the contractor or the contractor's representative to be involved in discussions and on site inspections of the annual work proposed. While it is not essential for the contractor to agree with all aspects of proposals, the contractor's concurrence with the plans should greatly facilitate the logging operation later.

Part 17 Softwood Utilization

Roading Priorities

17.010

The regional officer responsible will amalgamate the divisional submissions, and set priorities for work to be done, up to the level of finance available each year.

Each Region will submit its proposals to State Headquarters for consideration in the annual estimates and works programme.

Approved works will be carried out generally by employing contractors. OIC's of Divisions must ensure that contracts are called in plenty of time and that specifications for the jobs comply with standard instructions for road contracts.

Completion dates

17.011

Wherever possible, roadworks should be completed one winter prior to proposed logging activities. If it is necessary for roads to be used for winter operations immediately after completion, logging operations must then be planned so the road is "run in" by log trucks. Any weak spots exposed, prior to the onset of winter rains, will then need to be strengthened.

A pine logging road is not considered to be completed to the required standard, until it has proved satisfactory for one winter's logging operations. Each Division will maintain a plan showing logging roads which meet this criteria.

Part 17 Softwood Utilization

- | | | |
|------------------------------------|--------|---|
| Contractor liaison
(Completion) | 17.012 | Each Division will advise the major logging contractor annually of roads considered to be all weather logging roads and for which the contractor is responsible for maintenance. |
| Handover | 17.013 | Prior to commencement of each logging operation, roads to be used for logging should be graded by the Department (if necessary), and any repair work required carried out. |
| Safety sign posting | 17.014 | Before logging operations commence, adequate signs must be erected. These signs should indicate the Operations No., Type of Operation and the topography. Any one way routes, safety signs, and road closures etc., must be decided and adequately signposted in advance. |
| Tree Marking | 17.015 | <ol style="list-style-type: none">(1) Approved operation prescriptions show the type of thinning required and the number of stems to be retained.(2) Sample counts are needed to determine the current stocking and the number of trees marked for either removal or retention.(3) Plots must also be used during the operations, as a check on the standard.(4) If in any doubt, contact should be made with the pine silviculturalist. |

Part 17 Softwood Utilization

- (6) Tree marking should be in advance of logging requirements, sufficient to allow for unforeseen conditions or the need to fill a particular order.
- (7) It is the responsibility of the OIC Pine Logging, from Harvesting and Marketing Branch, to give sufficient notice to Divisions of impending operations in each area.

Maintenance of Logging
Roads : Contractor's
responsibilities

- 17.016 (1) The logging contractor is generally responsible (includes costs) for the maintenance of plantation roads used for pine logging during the contract.
- (2) At the completion of the logging operation, the roads must then be returned to the same condition by the contractor, at the contractor's expense.
 - (3) This maintenance will generally consist of the removal of logging debris from the road and drains and its stacking in heaps where directed; grading the road; repair of culverts damaged during logging and limited patch gravelling where required.
 - (4) It is not intended that the contractor be responsible for major reconstruction type work, particularly if the road was not initially handed over in 'all weather' condition.

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- (5) It must be realized that when logging is being carried out in a number of Divisions concurrently, the contractor may not always be able to maintain all the roads in the ideal condition for each Division. Nevertheless, if maintenance is unduly delayed, pressure must be exerted by the Division concerned. If all else fails, the work may be carried out by the Department and charged to the contractor. This is an extreme step, and the concurrence of the regional officer must be obtained prior to such work being carried out.

Forest access
during logging

17.017

Notwithstanding paragraph above, pine logging roads must not remain impassable for any extended period. The logs must be removed immediately, and debris or road damage of a major nature should be removed or repaired so the road is trafficable. This is of particular significance during the fire season.

Fire season
access

17.018

Major through roads must be kept open at all times during the fire season. Logging along these access roads during winter will help to achieve this. It is the responsibility of the supervising officer to inform the fire duty officer of any roads which are impassable and to ensure alternative through access exists and is known.

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Drainage of run off water

17.019 (1) As many hill plantations are adjacent to dams and reservoirs, or follow major watercourses, timing and the extent of road maintenance are most important. Free water tends to accumulate on and near roads and may increase after logging. One aim of planning logging operations in general, and road maintenance in particular, is to slow the movement of water and dissipate it through the plantation, in order to reduce turbidity (see section 17.025 on turbidity)

(2) Logging debris is an ideal filter, and the aim should be to divert water into the plantation by spoon drains across roads, etc. Debris can be left in drains for a period immediately after logging, but culverts must be clear and exit into logging debris where possible.

Firebreak Maintenance

17.020

As part of the road maintenance described in para 17.016(3) the contractor will, as a matter of course, heap up a considerable amount of logging debris on adjacent firebreaks. Close liaison and discussion with the contractor will ensure this is done in a manner which assists future protection requirements.

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Operation clean-up

17.021

Supervisory field officers must ensure that the contractor removes discarded equipment, drums, oil filters and paper and leaves the general area clean and tidy when the operation is completed. Landing areas require special attention.

The discharge of used engine oil onto the ground in the plantation is not permitted.

Environmental safeguards: Care of hill sites. 17.022

In the ongoing situation, because of the relative areas planted on hills and in coastal plantations, it will be necessary to operate in some hill plantations in winter. Good planning of the timing and the siting of operations will minimize soil and environmental damage to plantations and fire-breaks.

Wet weather : control of operations. 17.023 (1)

When operations are carried out in periods of very wet weather, most damage is generally caused in relatively short periods. With the general acceptance of a level of log stockpiling at mills, it is now possible to suspend operations for these short periods.

- (2) The OIC should exercise his discretion in stopping, either all or part of, the operation until weather conditions improve. Until more quantifiable data is available, consideration should be given to stopping operations while there is free water running in the table drains of the road being operated on.

Repair of road damage

17.024

Any deep wheel ruts, or other damage which may occur, must be repaired during the ensuing summer period, as part of the overall firebreak maintenance programme. Particular attention needs to be paid to loading points.

Water Reservoirs :
Special Requirements.

17.025

- (1) Plantations adjacent to reservoirs require special treatment to prevent turbidity, and care should be taken at all stages of logging.
- (2) Visible turbidity results from soil disturbance and surface erosion on either roads or outcrops. Excessive soil disturbance can occur when the soil is saturated or when powdering of the soil occurs during summer.
- (3) A favourable time for logging can be late spring, when the ground is moist but not saturated. This prevents powdering of soil and subsequent turbid runoff.
- (4) The opportunity for surface erosion to occur is greatest immediately after the disturbance and decreases with time. Any control measures prescribed to minimize erosion must be well planned and implemented as soon as possible, following the disturbance.

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- (5) Winter logging adjacent to reservoirs should be minimized or excluded where possible.
- (6) Undisturbed filter strips adjacent to the reservoir or major creeks are required to filter water runoff. Depending on topography, the filter strips may have to be a full compartment wide or just a strip between the lowest road and the reservoir.
- (7) Logging should cease within 40m of reservoirs at the first sign of excessive soil disturbance or erosion likely to cause turbidity.
- (8) Mechanical harvesters or processors leave a greater amount of debris on the outrows, reducing the potential disturbance by the Forwarder.
- (9) Cross drains may be required on outrows adjacent to a haul road.
- (10) Winter haul roads which cross major creeks close to reservoirs must be :
 - (a) stabilized by water binding, or other suitable means, for 40m on either side of the creek.
 - (b) crowned and sufficiently drained, using adequate side drains and culverts with silt traps leading into vegetation filters.
- (11) Roads adjacent to reservoirs should not be used for hauling if they are likely to become heavily powdered during summer operations.

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- Logging Operations: 17.026 (1) Inspection of logging operations should
Departmental Inspections be carried out on a daily basis.
- (2) Try to arrange inspections accompanied by the contractor's representative. When this is not possible, arrange for a suitable time to suit both parties, at least at weekly intervals.
- (3) All instructions to contractors should be done through the nominated contractor's representative.
- (4) Do not give instructions to individual logging crew members, unless there is a flagrant breach of safety rules or other recognized procedure.
- (5) If instructions have to be issued directly to an operator or faller, the same information must be passed to the nominated representative as soon as possible.
- Check List for 17.027 (1) Be correctly attired and equipped for
Inspections the job, (i.e. hard hat, safety boots, tape, timber crayon etc.).
- (2) Be fully aware of the products required and the specifications of each product.
- (3) Check the condition of the logging roads being used. Bring to the contractor's attention any likely problems.
- (4) Check that the contractor's operators are correctly dressed.
- (5) Check stump height and log lengths (measure a sample).

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- (6) Check that trees are being utilized fully and cut into correct log products. All trees should be looked at for diameter class first, then cut to ensure the best possible utilization by log product required (highest value has highest priority). i.e. Working from peeler logs down to particleboard logs.
- (7) Check to see if any logs are being left too long in the bush. Watch for Blue Stain developing.
- (8) Check that bin measured materials are being loaded properly - no crossed logs - gaps etc.
- (9) Check to see that the remaining stems are not being damaged.
- (10) Check for any hang-ups.
- (11) Check for signs of excessive soil damage, or erosion.
- (12) Check that the requirements listed under the Code of Softwood Logging Practice relating to Fire Control are being carried out. (e.g. fire attack pumper units and pack sprays available and working).
- (13) Check that there are sufficient Warning Signs to ensure a safe working environment.

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Aid for Bush Control 17.028 Code of Softwood Logging Practice:

A sound knowledge of the Code of Softwood Logging Practice is essential to maintain a good standard of operation. Most problems can be resolved by using the Code as a guide. If disputes cannot be resolved, the Regional D/F Pine Logging is the first contact.

Tree Damage Assessment Forms

- 17.029 (1) Tree Damage Assessment should be done on a fortnightly basis, to monitor damage to remaining trees and as a comparison between different types of logging and different seasons.
- (2) One assessment should be done for each type of logging, each period (machine, hand fallers, steep etc.).
- (3) The assessment should be done by the Divisional OIC Logging, accompanied by his understudy.
- (4) Results should be forwarded to the Regional D/F Pine Logging.

Skyline Logging 17.030 This type of operation requires rather different forward planning to conventional methods of extraction, even though a 5th Row Outrow arrangement still applies.

- Skyline extraction** 17.031 (1) The ideal situation is to extract approximately half the trees in each direction (i.e.) up hill and down hill. The ideal extraction distance for this type of machine is between 150-250 metres. An inspection of the area to be logged and the measurement of distances through the longest axis must be part of the planning.
- (2) The contractor's representative, or the Skyline operator should take part in the inspection. The aim should be to complete the area without constructing internal tracks.

- Internal Roading** 17.032 (1) If the construction of internal roads becomes necessary, these should be planned well in advance. Internal roads will be constructed for summer operations only, and will be at the minimum standard to allow access for the Skyline unit and Forwarder.
- (2) Internal roads or tracks should nearly follow the contour to maintain as flat a footing as possible. It may be necessary to construct short shunts and pull the material on a fan layout.

(As these machines have been working in the Nannup Division for some years, it is recommended the advice of Nannup Officers be requested in the overall planning and preparation, until experience is gained.)

**FIRE CONTROL RESPONSIBILITIES
OF THE LOGGING CONTRACTOR**

- | | | |
|---|--------|--|
| Introduction | 17.033 | The logging contractor has certain fire control requirements specified in the contract. They are outlined in the Code of Softwood Logging Practice. |
| Responsible Officers | 17.034 | <ul style="list-style-type: none">(1) Each Division, through its OIC and nominated Supervising Officer, must ensure that the fire control provisions of the contract are strictly adhered to.
(2) Regional personnel must check that fire control requirements are in order when inspecting each logging operation. Particular attention must be paid to the sections of the Forests Act and the Bush Fires Act, and to Regulations made under those Acts for the purposes of controlling fire. |
| Regulations from the Forests Act and Bush Fires Act | 17.035 | <ul style="list-style-type: none">(1) No fires are to be lit in a plantation without the express permission of a Forest Officer.
(2) A contractor shall take all necessary precautions to prevent the occurrence or spread of fire in the plantation area, and shall be liable to the Conservator for damage caused within the said area, or on any State Forest Timber Reserve or Crown land, by any fire |

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on, or extending from, the said area, unless the contractor can prove to the satisfaction of the Conservator that such fire or fires, without any act or omission on the part of the contractor, originated outside the said area and/or arose through some cause beyond the contractor's control.

- (3) A contractor shall co-operate with officers of the Forests Department in preventing and suppressing bush fires and shall, when called upon by a Forest Officer, act under the Officer's instructions in fire fighting or preventing outbreaks of fire.

Smoking

17.036

Smoking is prohibited in all plantations except where the ground has been cleared of all vegetation or inflammable material. Butts and spent matches must be deposited on bare mineral soil and buried.

Operation of Chainsaws

17.037

- (1) A contractor shall not use or operate, or permit the use or operation, of any chainsaw or other internal combustion engine in any pine plantation unless the engine is fitted with an exhaust system of a type and design approved by the Conservator. The exhaust system will be inspected regularly to ensure that the efficiency is maintained.

(2) To obtain approval, a chainsaw exhaust system will:

- a) Include a muffler large enough to allow gas expansion and cooling before final emission. Be of such metal and design as to allow rapid heat dissipation before final emission of gases. Be of such solid construction as to reduce noise and be without vibrating parts where these add to noise levels.

- b) Be able to be dismantled for inspection and cleaning. Be located in a position so that the emissive material is not directed onto the forest floor while in the felling position nor towards the operator. The heated surfaces must not contact the forest floor in any cutting position.

- c) Include baffles or screens in such a manner that continued expansion and cooling of exhaust material is progressive during passage from engine port to final exit. These should be simple and are regarded as secondary in importance to the size and cooling capacity of the exhaust system.

- d) Not allow ignition within 30 seconds of any pine needles held adjacent to the exhaust orifice when the saw is operating under load.

Adjacent fire equipment

17.038

All chainsaw operators working in plantations must have, in their immediate work area, a pack spray of a type, size and colour approved by a Forest Officer. The pack spray must always be full of water and be in a good working order.

Operation of internal combustion engines

17.039

A contractor shall not use or operate, or permit the use or operation of, any internal combustion engine in a plantation if:

- a) The exhaust system of the engine is not clean, sound and free from gas leaks;
- b) there is emitted from the engine any carbon particles, sparks or oily substance;
- c) the engine is subject to any fault or mechanical defect which in the opinion of a Forest Officer would cause, or be likely to cause, an outbreak of fire.

Fuel Dumps

17.040

- (1) A contractor may establish in any plantation section not more than one fuel dump on a site, and it must be of a size approved by a Forest Officer. The ground around such dump shall, at all times, be clear of all vegetation or inflammable debris for a distance of not less than 6 metres.

- (2) Smoking is not permitted within 6 metres of the closest point of a fuel dump.

Refueling

17.041

The fuelling of chainsaws, vehicles or other powered equipment and the mixing of fuel shall not be carried out in plantations, except on firebreaks, tracks or roads where the ground is clear of all vegetation or inflammable material for a distance of not less than 1.5 metres around the fuelling position.

Restarting

17.042

A contractor shall not start, or permit to be started, any chainsaw immediately after fuelling, until the chainsaw has been wiped to remove any spillage and has been moved clear of the place at which the fuelling was carried out.

Daily Operational Shutdown

17.043

(1) Where chainsaws and harvesting machines are being used in the plantation a contractor shall ensure:

- a) that no chainsaw or harvesting machine is used for at least 60 minutes prior to the operator leaving the work area, and that immediately before leaving the plantation the operator inspects the area covered by the last 2 hours of chainsawing or harvesting machine activity; or

- b) that a patrol or inspection of each area fallen or worked over by machines in the last 2 hours of each working day is made, not less than 1 hour and not more than 2 hours after the chainsawing or harvesting activity has ceased. This inspection must be made by some responsible person nominated by the contractor and approved by a Forest Officer;

- c) when harvesting activity ceases, all harvesting machinery must be parked on a site cleared to mineral earth and approved by a Forest Officer.

Fire damage and control of operations 17.044

A Forest Officer may prohibit any, or all types of, logging operations in the plantation at such times, and for such periods, as is necessary when, in the officer's opinion, such action is warranted by the Forests Department Fire Danger ratings. The following restrictions apply:

	Chain Saws	Logging Equipment	Load on Cleared Break
HILLS PLANTATIONS	0-60 m/hr No restrictions	0-60 m/hr No restrictions	0-140 m/hr No restrictions
	60 m+ Cease ops.	60 m+ Cease ops.	140 m+ Cease ops.
COASTAL PLANTATIONS	0-140 m/hr No restrictions	0-140 m/hr No restrictions	"
	140 m+ Cease ops.	140 m+ Cease ops.	
a) Prescribed burnt	0-60 m/hr No restrictions	0-60 m/hr No restrictions	"
b) Unburnt	60 m+ Cease ops.	60 m+ Cease ops.	

Figures relate to Jarrah F.D.I.

Fire suppression training of 17.045
contract staff

- (1) A contractor will, at the contractor's own expense, ensure that each member of each of the plantation crews employed on the contracted works is available to the Forest Officer in Charge for one day's training in fire suppression in each fire season. This one day's training will normally take place in October of each year, but if this is not possible, or if new men are to be trained, the training will be arranged at a time agreed to by the contractor and the Forest Officer in Charge. In addition, the contractor will, at the contractor's own expense, ensure that each member of each of the plantation crews employed on the contracted works, is available for a training period in fire suppression of not more than 2 hours per month, for each of the months of November, December, February, March and April of each year.
- (2) The equipment for use during the training sessions will be that listed under paragraph 17.046(3), and will be provided by the contractor for such training at the contractor's expense.
- (3) Training staff and sites will be provided by the Forests Department at no cost to a contractor and within reasonable proximity to a contractor's work sites.

- (4) Contractor's personnel engaged solely in carting operations will be exempt from paragraphs 17.045(1) and 17.046(3).
- (5) A Forest Officer may exempt a contractor from the requirements of paragraphs 17.035(1); 17.036; and 17.043; 1 (a) (b) & (c) when, in the opinion of the Forest Officer, weather conditions allow. This could normally be expected in winter.

Fire suppression procedures 17.046

1. If a fire starts within a contractor's work site, the contractor's plantation crew will immediately endeavour to suppress it with their own equipment, under the leadership of the contractor's senior representative on the site. As soon as a Forests Department officer or gang arrives at the fire, the contractor's crew will work under the direction of the senior Forests Department officer at the site. The whole of the contractor's manpower will continue to operate under Forests Department control until relieved, or until the fire is declared safe by the senior Forests Department officer. This operation will be at the contractor's expense.
2. If a fire starts outside a contractor's work site, but inside the plantation, the provisions of para 17.046(1) will apply, save that where, in the opinion of the Forest Officer in Charge, the fire is not caused by, or does not arise from, any negligent act or omission

or any want of co-operation on the part of the contractor or any of his employees, the costs incurred by the contractor in fighting the fire (as certified for payment by the senior Forests Department officer directing the operation), will be borne by the Forests Department. In the event of a dispute, costs will be finally determined by the Conservator.

3. A contractor and a contractor's manpower will not normally be called on to fight fires outside the plantation, but if this is necessary the provisions of the Forests Act and the Bush Fires Act, will apply.

**Fire suppression: contractor's 17.047
equipment**

1. A contractor will, at all times, at the contractor's own expense, provide on site and maintain in good working order (to the satisfaction of the Forest Officer in Charge) firefighting hand tools and equipment complying with current Forests Department specifications on the following basis:

For every five workers, or part thereof, employed in the plantation -

- 1 chainsaw
- 2 knapsack sprays with water
- 2 squared off, round mouth shovels
- 1 rake hoe

(Knapsack sprays and chainsaws provided as a part of the normal equipment for fallers, under the Code, will be included as equipment for this purpose).

2. One fire suppression unit for each group of ten workers employed on the contract at any one plantation worksite, with a minimum of one unit on each plantation worksite.

This fire suppression unit will be of a standard acceptable to the Forest Officer in Charge, but will not deviate in any essential from the standard 450 litre patrol unit being used by the Forests Department.

The patrol unit will be the "slip on" type mounted on its own prime mover.

Liability for loss	17.048	The Conservator of Forests will accept no liability for the loss or damage by fire of any equipment or property owned or operated by a contractor or any of the contractor's employees, however the fire started.
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Volume determination	17.049	The determination of log volume will be by the approved Forests Department method of measurement applying for each log product.
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Log products	17.050	<ol style="list-style-type: none"> 1. <u>Pine Particle Board Logs</u>: true volume under bark, calculated by bin measure using the appropriate Forests Department conversion factor. 2. <u>Pine Case Logs</u>: true volume under bark, calculated by bin measure using the appropriate Forests Department conversion factor.
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3. Pine Mill Logs: measured either by - true volume under bark measured by small end diameter class, calculated on individual logs using the appropriate Forests Department Log Volume Table; or true volume under bark, calculated by bin measure using the appropriate Forests Department conversion factor.
4. Pine Peeler Logs: true volume under bark measured by small end diameter class, calculated on individual logs using the appropriate Forests Department Log Volume Table.
5. Pine Rounds for Treatment: true volume under bark, calculated by bin measure using the appropriate Forests Department conversion factor.

Pine Log volume measurement	17.051	There are two approved Forests Department methods of <u>Pine Log volume measurement</u> . Bin measurement and individual log volume measurement.
Bin measurement	17.052	<ol style="list-style-type: none"> 1. Removes the need for measuring each log. 2. Requires truck bin with logs of one length per bin. 3. Requires measuring the height and width of the bin in addition to the log length. The height is variable, which results in a "free" bin, and is measured by a measuring stick (see para 17.053/1).

4. The width of each bin is fixed at 2.2m by the stauncheons on all trucks.
5. A bin conversion factor is applied to the gross bin volume, and allows a deduction for the volume taken up by air and bark. The result is the net wood volume under bark.

Procedure for measuring
bin volume

17.053

1. An official measuring stick supplied to each mill by the Forests Department is used to measure height in 10cm intervals.
2. Each bin is measured in the centre and at each end, to the nearest 10cm, and the average of these measurements recorded on the F.D. 544. See para 17.062 for "Instructions for the completion of Pine Log Delivery Notes F.D. 544". Note that an F.D. 544 must be prepared for every delivery of logs.
3. For identification, the bins are listed from the front to the rear of the truck when recorded on the F.D. 544.
4. Before recording, agreement must be reached on the measurement by the mill representative and the truck driver.
5. The Pine Log Delivery Note must be signed by both parties.
6. The bin volume is calculated from an official table prepared by the Forests Department for each particular product and species. The sum of the individual bin heights is applied to the tables.

Loading precautions

17.054

1. The loading of the bins by the contractor must be such as to satisfy the Forest Officer in Charge that the Bin Conversion Factor, as determined for that particular operation, is applicable to that load. Logs are to be stacked uniformly with no crossed logs.
2. The driver will be responsible for ensuring the top of each bin is trimmed level enough to ensure the correct application of the Bin Conversion Factor.
3. If the Forest Officer in Charge is of the opinion that the loading of any bin is such as to cast doubt on the application of the authorized Bin Conversion Factor, the contractor will unload the bin and reload it to the satisfaction of the Forest Officer in Charge.
4. All measurements must be taken while the load binder chains are still secured.

Calculation of the conversion factor 17.055

1. The conversion factor is the wood volume under bark expressed as a fraction of the gross bin volume and requires:

- measurement of gross bin volume
= length x width x height of bin

- measurement of wood volume under bark in the bin

e.g. Gross bin volume = 10m^3
Wood volume underbark = 6m^3
Conversion factor = 0.6

Wood volume under bark is calculated from each log using Smalian's formula.

Volume of each log =

$$\frac{(\text{Buttend Basal Area}) + (\text{Crown end Basal Area}) \times \text{length}}{2}$$

2. The crown and butt diameter of each log for each bin must be recorded on the Bin Volume Measurement Sheet (See Appendix).
3. These sheets are used by Inventory and Planning Section in State Headquarters to calculate the wood volume under bark.
4. At least nine bins must be measured and a statistical test applied to check the variation in the factor used.

Individual log volume measurement

17.056

Individual Log Measurement requires measurement of the diameter at the crown end (small end) for every log.

The General Log Volume Table (with 5cm log classes), is used and is applicable to all plantations. There is one table for radiata and one for pinaster.

Procedure for Measuring Individual Log Volume

17.057

1. A Pine Log Delivery Note (F.D. 544) will be prepared in accordance with "Instructions for the completion of Pine Log Delivery Notes F.D. 544: Section 17.062" for each and every delivery of pine logs supplied from F.D. plantations.

2. On arrival at the mill, the total number of logs will be checked against that shown on the F.D. 544 by the mill representative and the truck driver. If there is a discrepancy at this stage it should be adjusted on the F.D. 544, with an explanation.
3. Either on the truck or in the course of unloading or on the mill landing, the logs making up the total on the F.D. 544 will be individually measured by the mill representative, as laid down in "Pine Mill Log Measurement Softwood Log Volume Table - 5cm log class", and identified as to which F.D. 544 they are recorded on.
4. The individual measurements resulting from above will be tallied onto the F.D. 544, as the measurement proceeds.
5. The sum of the individual log measurement recordings must be the same as the total log tally previously identified on the F.D. 544.

Distribution of F.D. 544

17.058

1. When the above has been completed, to the satisfaction of both the truck driver and the mill representative, both parties should sign the appropriate place on the F.D. 544.

2. Only at this stage will the copies of the F.D. 544 be separated and distributed by the truck driver, in accordance with the listed distribution.

Double Check

17.059

To enable subsequent checking by F.D. officers, the mill management will ensure that each delivery will be identified in such a way that it can be related to the appropriate F.D. 544. In particular, any stockpiling of logs will be on a delivery basis.

Calculation of Log Volume using the General Log Volume Table - 5cm Log Class

17.060

1. Length Measurement

The length of logs should be measured from sawcut to sawcut when a log has been cut obliquely and minimum length between sawcuts should be recorded. The measurement should be recorded in metres and tenths of metres, rounded down to the nearest tenth of a metre.

2. Preferred Lengths

If logs are being supplied to a preferred length e.g. 2.1, 4.2 etc., all length measurements should be rounded down to the nearest preferred length.

Examples

ACTUAL LENGTH	ENTRY IN THE RECORDS	
	To Nearest Tenth Metre	To Preferred Length
3.80m	3.8m	3.6m
4.11m	4.1m	3.9m
4.75m	4.7m	4.5m
4.99m	4.9m	4.8m

3. Diameter Measurement

The diameter of logs should be measured under bark at the crown end of the log. When the cross-section at the crown end is not circular, the average of measurements along the greatest axis and the axis at right angles to the greatest axis should be recorded. The measurement should be recorded in centimetres rounded down to the nearest multiple of 5.0cm, i.e. in a log diameter class of 5.0cm.

ACTUAL DIAMETER	ENTRY IN THE RECORDS 5cm log class
44.0cm	40.0cm
46.5cm	45.0cm
33.1cm	30.0cm
49.9cm	45.0cm

4. Cubic Contents

The table gives volumes in cubic metres under bark. It is referenced directly by the diameter class and length class, entered in the records. Different volume tables are required for the different diameter class intervals used in measurement. Therefore only the table for 5cm log diameter classes should be used.

Volume Table Computation

17.061

The volume table incorporates two rounding rules stated below:

1. Length Rounding Rule

The recorded length places the log in a 300mm (i.e. 0.3m) log length class. The nominal or effective length used to calculate volume is the low end of the class.

Examples

Actual Length	Recorded Length	Length Class	Effective Length
3.80m	3.8m	3.6m - 3.89m	3.6m
4.11m	4.1m	3.9m - 4.19m	3.9m
4.75m	4.7m	4.5m - 4.79m	4.5m
3.99m	3.9m	3.9m - 4.19m	3.9m

2. Diameter Rounding Rule

The recorded diameter places the log in a 5cm diameter class. The effective diameter used to calculate volume is the midpoint of the class.

5cm Log Diameter Class

Actual Diameter	Recorded Diameter	Diameter Class	Effective Diameter
45.0cm	45.0cm	450-499mm	475mm
49.9cm	45.0cm	450-499mm	475mm
50.1cm	50.0cm	500-549mm	525mm

Instructions for the field use 17.062 of Pine Log Delivery Notes F.D. 544. (System User Manual) (Extract from Computer Pine Logging)

The issue of a Pine Log Delivery Note F.D. 544 (D/Note) is the recognized method of recording the sale of any pine log produce from the W.A. Forests Department's plantations. The D/Note is the only record created for the sale of pine log produce and, as such, records on one piece of paper all the necessary information to serve

a number of purposes at the same time. This ensures that only one set of records exists and that problems of reconciliation do not occur. The D/Note, in its present form, has been specially adapted to serve as the base document for the computer input of all pine logging field data.

The following processes arise 17.063
from the F.D. 544

1. The customer receives an account.
2. All contractors and pieceworkers are paid.
3. Logging operational data becomes available.
4. Plantation records of production are maintained.
5. Product data for the operation is compiled.
6. Product data on sales is compiled.
7. Financial data for operations and products is compiled.
8. Statistical records are maintained.
9. Security of log movement ex F.D. Plantations is policed.

How to use the F.D. 544 17.064
correctly

1. At least one F.D. 544 is required for any delivery of round pine from State plantations to any one customer.

2. Only one log type can be entered on any F.D. 544. For example, if mill logs and peelers are to be loaded on a truck, two F.D. 544s will be required. If peelers 1 and peelers 2 are to be loaded on a truck, two F.D. 544s will be required.
3. If more than one species is loaded on a truck an F.D. 544 is required for each species, even if the delivery is for one customer.
4. Normally, it will be one F.D. 544 per delivery i.e. the load is made up of one log type and is being delivered to one customer.
5. As all data is maintained on a separate operation basis, wood from 2 operations cannot be recorded on the same D/Note.
6. If more than one work code is involved in any one job, e.g. falling, followed by extract and load, then the work codes listed must be compatible in the computer, otherwise a separate D/Note is required for different work codes.

The Completion of the F.D. 544 17.065

1. An F.D. 544 can be made out by either the loader, the carter, a F.D. officer or any person nominated to do so by the OIC of the operation.
2. The four (4) copies of the F.D. 544 are to be treated as one in the initial stages (see 17.066 below).

3. (a) The product type has to be identified.
 - (b) The species identified.
 - (c) The D/Note dated.
 - (d) The terrain identified.
 - (e) The customer's name and delivery address completed and the type of delivery identified. Completion of this information must be made so that no ambiguity or mistakes result in faulty processing of the invoices.
 - (f) The plantation must be identified.
 - (g) The operation type identified.
 - (h) The operation number inserted.
 - (i) The "Team" requirement identified, if required (see (4) below).
4. The felling, extracting, loading and carting operations must be identified in sufficient detail to allow accurate completion of financial data. If work effort and therefore payment are to be split, the proportion of the load must be identified at this stage.

For example, Smith and Brown are a partnership, so nominate a 50/50 split. Smith, Brown and Jones work as a team. If a truck of their wood is to be split three (3) ways, describe it as:

Smith	33%
Brown	33%
Jones	33%

The computer has been programmed to accept 99% as = 100% and each will be paid for exactly 1/3 of the volume.

N.B. Whilst the D/Note itself and the D/Note Data Entry programme are apparently listed to accept a maximum of 3 fallers and 3 road extractor/loaders in the 6 listed entry spaces, provision has been made to modify the Data Entry programme to allow for a maximum of 4 fallers. To do this the D/Note is appropriately marked at the "Team" item on the D/Note and input accordingly. To avoid confusion fields 1, 2, 3, 4 as required should have in succession the appropriate fallers' names entered in them and field 6 should then be reserved for the extractor/loader name.

Whatever split up is listed the percentages listed must total 99% or 100% or the computer will not accept the data.

5. In the body of the form the log volume information is entered as follows:
 - (a) For product types sold by individual logs measurement: as individual logs in the appropriate diameter classes as listed. The extra lines can be used for different lengths of the same diameter class, as required.

If log diameter classes in excess of 55-60cm are to be entered they should be listed by crossing out the standing S.E.D. class on the D/Note and listing the appropriate S.E.D. class.

Where product types sold by individual log measurement are to be measured later, at say a mill landing, a total number tally of logs is all that should be entered on the F.D. 544 at this stage. Where logs are measured individually and the volume calculated for each log, the log volume is listed to 3 decimal places of a cubic metre.

- (b) For products sold by bin measure: in the appropriate box for bin measurement.

Where a fixed bin system is operating, the S.E.D. class and the log length are listed with the appropriate "Conversion Factor (C.F.)". The "Conversion Factor" will be given correct to 2 decimal places (e.g. .62 NOT .6204). The bin measurements will be entered on the D/Note at the place of measurement, and the "Bin Volume" calculated subsequently.

Part 17 Softwood Utilization

Bin volumes listed on D/Notes will be given correct to the first decimal place, e.g. 20.6m³ not 20.602m³.

6. The "comments" space can be used for any message relating to any area of the D/Note, as required.
7. Signatures on the F.D. 544 must be provided in all three places.
 - (a) At the time of delivery of the logs a representative of the buyer (mill representative) and seller (generally the truck driver employed by the contractor) must both sign the D/Note. If a Forest Officer is present and checks the data on the D/Note, the Forest Officer should also initial the "Checking Officer" space on the D/Note.
 - (b) Checking Officer - the Forest Officer who "codes" (prepares the document for computer input) the D/Note should sign in the appropriate space at the time of coding. This officer should check all data to ensure that it is correct and represents the timber delivered.

The disposition of the F.D. 544

17.066

1. The four copies of the D/Note should remain together as long as possible.

2. When the book is held by the loader driver, it should not be split until after he has signed the D/Note. When the book is split, the top three copies should be given to the carter and these should be kept together until the mill representative has signed. If alteration is required at the mill for any reason, it must be made while the top three copies are together. The quadruplicate is regarded as a check copy only and is not necessarily a correct record of each delivery.
3. When the book is held by the carter it should not be split until after the mill representative has signed the D/Note. If alteration is required at the mill for any reason, it must be made while the four copies are together.
4. Only after the mill representative has signed, confirming receipt of the logs, should the F.D. 544 copies be split up completely.
5. The original should be returned to the OIC of the operation. The duplicate should be given to the mill representative. The triplicate should be retained by the carter. The quadruplicate should be retained by the issuing centre.
6. The D/Note original only is to be used for payment and charging purposes, and for computer input.

- The checking of F.D. 544 17.067 1. Checking of a D/Note falls into two parts:

Field checking, and Office checking, prior to computer input.

(a) Field Checking

This includes all checking done by a Forest Officer, up to and including log measurement on the mill landing.

Officers are responsible for checking that all details shown on the D/Note are correct, as well as ensuring that the loaded volume is correctly described and is to the correct specification.

Field checking of D/Notes should be maintained at the 5% level at least. D/Notes thus checked must be indicated by the Checking Officer initialling in the space provided.

(b) Office Checking prior to Computer Input

See Computer Manual for procedure to be followed.

- Sundry Instructions for use of F.D. 544s 17.068 1. Cash Sales will be entered on an F.D. 544. To avoid sending out invoices, the customer's name should be entered with 'CASH SALE' immediately following the name. The receipt of the cash should be confirmed on the D/Note original by entering the receipt number in the appropriate place.

2. Cancelled D/Notes should have

CANCELED

DATE AND INITIALS

endorsed on them. In addition, the plantation in which the D/Note was used or was intended to be used should be entered. Cancelled D/Notes will be input as prescribed in the appropriate Section.

3. The "Pine Log Delivery Note" F.D. 544 is regarded as an "accountable" document for financial and audit purposes, and a record of issue of D/Note numbers is maintained at SHQ.

APPENDIX 17.069

FORESTS DEPARTMENT W.A.

SCHEDULE "A"

LOG SPECIFICATION: PINE PARTICLEBOARD LOGS

EFFECTIVE: January 13, 1983

DESTINATION: For supply to Wesfi Pty Ltd Dardanup Plant. Ex Central Region Plantations.

PREPARATION:

Logs shall be freshly cut and have all branches flush trimmed. Logs shall be removed from the plantation within five days of cutting.

DIMENSIONS:

Diameter small end under bark: 10cm to 15cm with acceptance up to 30cm. If the 10cm diameter limit is reached beyond a length 2.7m, the length of the piece may be extended to 5.4m except that the minimum diameter shall not fall below 7.5cm. Large end diameter under bark shall not exceed 35cm.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt Changes in diameter
Sharp kinks
Massive knot whorls

The following log defects are permitted to the limits shown:

Cone holes as they occur.
Bent or curved logs, if they will pass through the barkers at Dardanup without interfering with production.
The moisture content of logs at the time of delivery shall not be less than 75%.
Burnt bark, provided the timber has not been affected.

APPENDIX 17.070

FORESTS DEPARTMENT W.A.

SCHEDULE A1

LOG SPECIFICATION: PINE PARTICLE BOARD LOGS

EFFECTIVE: January 13, 1983

DESTINATION: For supply to Wesfi Pty Ltd Kewdale Plant.
Ex Northern Region Plantations.

PREPARATION:

Logs shall be freshly cut and have all branches flush trimmed. Logs shall be removed from the plantation within five days of cutting.

DIMENSIONS:

Diameter : Small end under bark 7.5cm to 15cm with acceptance up to 30cm. Large end diameter under bark shall not exceed 30cm.

Length : 2.7m with tolerance from nominal to +50mm.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt changes in diameter
Sharp kinks
Massive knot whorls

The following log defects are permitted to the limits shown:

Cone holes as they occur.
Bent or curved logs, if they will pass through the barkers at Kewdale without interfering with production.
The moisture content of logs at the time of delivery shall not be less than 75%.
Burnt bark, provided the timber has not been affected.

APPENDIX 17.071

FORESTS DEPARTMENT W.A.

SCHEDULE "B"

LOG SPECIFICATION: PINE CASE LOGS

EFFECTIVE: January 13, 1983

DESTINATION: For supply to Forests Department and Private Sawmills.
Ex Central Region Plantations.

PREPARATION:

Logs shall be freshly cut, flush trimmed and square docked. Butts will be supplied as cut, with sloven and withdrawn slivers, but generally free from falling splits and shakes. The sloven will not be tallied in the length.

DIMENSIONS:

Diameter : Small end under bark - 15cm to 20cm.

Length : 2.1m, 2.4m and 2.7m. Tolerance from nominal to +50mm.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt changes in diameter
Massive knot whorls

The following log defects are permitted to the limits shown:

Dead knots less than 5cm in diameter on greatest axis.
Live knots less than 6cm in diameter on greatest axis.
Not more than 2 whorls of cone holes in any 1m of length.
Sweep shall not exceed 15mm over the total length measured,
from log surface to the chord created by a straight edge
or tight cord.
Burnt bark, provided the timber has not been affected.

APPENDIX 17.072

FORESTS DEPARTMENT W.A.

SCHEDULE B1

LOG SPECIFICATION: PINE CASE LOGS

EFFECTIVE: January 13, 1983

DESTINATION: For supply to private sawmills. Ex Northern Region Plantations.

PREPARATION:

Logs shall be freshly cut, flush trimmed and square docked. Butts will be supplied as cut, with sloven and withdrawn slivers, but generally free from falling splits and shakes. The sloven will not be tallied in the length.

DIMENSIONS:

Diameter : Small end under bark - 13cm to 20cm.

Length : 2.1m, 2.4m and 2.7m. Tolerance from nominal to +50mm.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt changes in diameter
Massive knot whorls

The following log defects are permitted to the limits shown:

Dead knots less than 5cm in diameter on greatest axis.
Live knots less than 6cm in diameter on greatest axis.
Not more than 2 whorls of cone holes in any 1m of length.
Sweep shall not exceed 15mm over the total length measured, from log surface to the chord created by a straight edge or tight cord.
Burnt bark, provided the timber has not been affected.

APPENDIX 17.073

FORESTS DEPARTMENT W.A.

SCHEDULE "C"

LOG SPECIFICATION: PINE MILL LOGS

EFFECTIVE: January 13, 1983

DESTINATION: For supply for Forests Department and Private Sawmills.

PREPARATION:

Logs shall be freshly cut, trimmed and square docked. Butts will be supplied as cut, with sloven and withdrawn slivers but generally free from falling splits and shakes. The sloven will not be tallied in the length.

DIMENSIONS:

Diameter : Small end under bark not less than 20cm.

Length : A minimum of 2.1m with increments of 0.3m to 4.8m plus overcut for board docking. Tolerance will be from +20mm to +50mm. 5.4m + 6.0m may be supplied by arrangement.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt changes in diameter
Massive knot whorls

The following log defects are permitted to the limits shown:

Dead knots, up to 3 knots per whorl, biggest knot not to exceed 4cm in diameter on greatest axis.
Individual dead knots not to exceed 6cm in diameter on greatest axis.
In logs 3.0m and over in length not more than 2 whorls of cone holes in any 3m length.
In logs less than 3.0m in length, not more than 1 whorl of cone holes in any 3m length.
Sweep shall not exceed 30mm in any 2.1m length, measured from log surface to the chord created by a straight edge or tight cord.
Burnt bark, provided that the timber has not been affected.

APPENDIX 17.074

FORESTS DEPARTMENT W.A.

SCHEDULE "D"

LOG SPECIFICATION: PINE PEELER LOGS

EFFECTIVE January 13, 1983

DESTINATION: For supply to WESFI Pty Ltd, Victoria Park.

PREPARATION:

Diameter : Small end under bark not less than 35cm.

Length : Variable up to 2.56m and nominated by buyer. Tolerance will be nominal to +50mm.

DEFECTS:

The following log defects are not permitted:

Blue Stain
Abrupt changes in diameter
Massive knot whorls
Individual dead knots exceeding 6cm in diameter

The following log defects are permitted to the limits shown:

Dead or decayed knots, or knot holes up to 3 per whorl
biggest not to exceed 4cm in diameter on greatest axis.
Not more than 1 whorl of cone holes in any length.
Sweep shall not exceed 20mm in any peeler length, measured
from log surface to the chord created by a straight edge
or tight cord.
Pith shall not be off centre at the small end by more than
20%, or at the butt end by more than 25% of the smallest
axis diameter.
Burnt bark, provided the timber has not been affected.

End Coating : Logs shall be end coated promptly after preparation.

Identification : Logs shall be end marked on one end with water based paint to identify the source of production. Colours will be allocated by the Forests Department from time to time.

2ND CLASS PEELERS:

Logs prepared in good faith to the peeler specification but not to standard, will be supplied as 2nd class peelers at a reduced stumpage.

APPENDIX 17.075

FORESTS DEPARTMENT W.A.

SCHEDULE "E"

LOG SPECIFICATION: PINE ROUNDS FOR PRESSURE TREATMENT

EFFECTIVE: January 13, 1983

DESTINATION: For supply to pressure treatment plants from Forests Department Plantations.

DESCRIPTION:

Logs shall be freshly cut, square sawn at both ends with all branches flush trimmed, and not display marked variations in diameter over the length.

DIMENSIONS:

Diameter : Small end under bark 7-20cm. Supply will be in any range of diameters of 4cm or greater.

Length : From 1.8m upward in 0.3m increments to a maximum of 4.8m. Tolerance will be nominal to +50mm for 1.8m and -50mm to +50mm for all other lengths.

DEFECTS:

The following log defects are not permitted:

Fractures
Dry Sides
Overgrowths
Unsound Knots
Termite Damage
Clusters of Cone Holes
Insect damage other than limited superficial bark borer
Fungal decay (except blue stain)
Axe or saw cuts other than superficial, and bearing in mind end use.

The following log defects are permitted to the limits shown:

Blue Stain - limited so as not to interfere with the treatment process.

Limbs and Spurs - shall protrude not more than 5mm above the bark.

Sound Knots - except when in a whorl or located such as to impair seriously the strength of the pieces.

Cone holes.

Distance Apart of Whorls	S.E. Diameters	
	12cm or less	More than 12 cm
Less than 1m	1 hole per whorl	1 hole per whole
1m or more	2 holes per whorl	3 holes per whorl +1 for every 4 cm of additional diameter.

Sweep - The maximum allowable sweep in length, measured from log surface to a chord created by a straight edge or cord at the points of greatest deviation will be -

S.E.D. cm	Sweep per metre of length
Less than 12cm	8 mm
12 cm or more	10 mm

Burnt bark, provided the timber has not been affected.

VARIATION FROM SPECIFICATION

A tolerance up to 5% variation from the above specifications in any one parcel is to be accepted.

6-15% departure from specification - faulty material will be replaced.

Over 15% departure from specification - whole parcel will be replaced.

SAWMILLING

- INTRODUCTION 17.076 The Forests Department operates a timber processing complex at Harvey, comprising research sawmill, tunnel and high temperature drying kilns, a square dressing machine and a mechanical proof grader.
- The facilities are used primarily for research, development and training activities.
- Research Sawmill 17.077 The Forests Department is conducting active programmes of milling, seasoning and grading, in hardwood and softwood utilization.
- Traditional methods of timber handling have not been successful with young trees of either hardwoods or softwoods. To establish markets for the large volumes of these materials available, it is essential that techniques for processing them be developed.
- Controlled seasoning is a vital process for adding value to sawn timber.
- Kiln Seasoning 17.078 For initial drying of hardwoods, progressive tunnel kiln facilities provide low temperature controlled humidity conditions.
- For the full schedule of softwood drying and the final stage of hardwood drying, a high temperature kiln provides temperatures up to 130°C.
- A steaming chamber provides the facilities of presteaming and reconditioning.
- Planer 17.079 A major use of pine is as a structural timber. Strict adherence to the S.A.A. grades and RPAA grading rules is therefore required. Planer gauging to finished size is an integral part of these rules.

PART 17 Softwood Utilization

Proof Grader	17.080	<p>As an alternative to visual stress grading, proof grading is a mechanical grading technique, designed for relatively small throughput. The principle is to apply an actual load in excess of the design load - pieces which show excessive deflection or break during testing, are rejected.</p> <p>Proof grading in pine is carried out to RPR1 Industry Standards 103-1982 Specification for Machine Proof Graded Radiata Pine, and 104-1982 Code of Practice for the Machine Proof Grading of Radiata Pine.</p> <p>(Proof grading in hardwood is in the experimental stage).</p>
Liaison with Industry	17.081	<p>In all this work, close co-operation will be sought with RPAA, CSIRO (DBR), other relevant research organizations, the timber industry and wood manufacturing and using industries.</p>
OPERATION OF THE MILL		
Conservator to Direct	17.082	<p>The Harvey Mill will operate as directed by the Conservator.</p>
Programme to be prepared annually	17.083	<p>The programme will be costed in the Divisional Estimates, and, on approval by the Chief of Division, will be the basis of operation for the succeeding financial year.</p>
Programme and estimate may be amended	17.084	<p>The area OIC will ensure that amendments to the programme of operations and estimates are prepared, as necessary, and, after approval, incorporated into the work's programme.</p>

PART 17 Softwood Utilization

Marketing arrangements	17.085	The area OIC will be informed by SHQ from time to time of the arrangements made for the marketing of the mill produce.
Mill may operate on production	17.086	After the research functions are fulfilled, the mill may operate on a semi-production basis to supply private industry with material which is not available from the normal sources of supply.
Financial Management	17.087	When operating on a semi-production basis, the activity of the mill must at least cover all direct costs associated with the operation.
HARDWOOD MILLING		
Log supplies	17.088	The area OIC will arrange with the Regional Leader, Central Region for the delivery of adequate supplies of hardwood logs to the research programme.
Use of FD325 for Hardwood log deliveries	17.089	<ol style="list-style-type: none">1. All hardwood log deliveries are to be listed on the Delivery Note (FD325) written out when the trip leaves the bush landing, listing<ol style="list-style-type: none">a) type of produceb) number of piecesc) origind) destination <p>Copies of the D/Note FD325 are to be distributed to</p> <ol style="list-style-type: none">a) SHQ via Harveyb) the Harvey Divisionc) remain in the book as a check. <p>No debits are to be raised from these D/Notes.</p>

PART 17 Softwood Utilization

2. Hardwood logs are to be recorded on a daily basis in a Mill Landing Book to the standard GP Mill log procedure except that crown diameter will be used in lieu of mid length diameter. The Mill Landing Book procedure will be maintained on a monthly basis. (FD182).
3. Hardwood logs will be identified at the mill by attaching numbered aluminium tags by brass staples to the small end.
4. Logs will be recorded in diameter classes of 1 cm (e.g. 16.0 - 16.9, 17.0 - 17.9).
5. Log lengths will be recorded to the nearest 0.3m rounded down. (e.g. 1.2, 1.5, 1.8, etc.)
6. Hardwood log volumes will be calculated by individual log measurement of length and small end diameter. An approved Jarrah Regrowth Volume table will be applied.

PINE MILLING

Log Supplies 17.090

The area OIC will arrange with the OIC Pine Logging Central Region for the delivery of adequate supplies of pine logs for milling as programmed.

Use FD544 for pine log deliveries 17.091

Deliveries of the specified pine logs will be recorded on the Pine Log Delivery Note (FD544), and the Mill OIC will arrange for the loads to be received, checked, measured as required and entered on the FD544, in accordance with the current procedure.

PART 17 Softwood Utilization

Measurement of Pine Mill Logs	17.092	Pine mill log volumes will be calculated by individual log measurement of length and small end diameter in 5cm classes. The species : General Approved Softwood Log Volume Tables for Pinaster and Radiata will be applied to the log measurements to ascertain the volume of each log.
Measurement of Pine Case Logs	17.093	Pine Case Log Volumes will be calculated on a system of free bin measurement, (i.e.) the volume of a bin will be ascertained by multiplying the height, width and length of a bin load of logs. The conversion factor relevant to the plantation from whence the logs came is then applied to obtain the volume of logs in the bin.
MILL MANAGEMENT		
Specifications Issued by SHQ	17.094	Specifications for milling will be issued by SHQ from time to time.
Mill Supervision	17.095	The area OIC is responsible for the day to day financing, staffing, running and maintenance of the mill. The D/F Utilization is responsible for the standard of sawmilling and mill maintenance (see Mill Maintenance paras).
Standards of Milling	17.096	All timber shall be truly sawn and free from decay, shakes and splits. All timber will be square docked at each end.
Orders on FD324	17.097	All orders will be issued by SHQ on FD324 Sales Order. Research milling will be carried out in conjunction with commercial cutting.

PART 17 Softwood Utilization

Authority to Cut	17.098	An FD324, duly signed by an authorized officer, is the authority to cut the specified timber, according to any instructions listed on the Sales Order. In no circumstances should cutting take place in the absence of a Sales Order.
Payment of Wages	17.099	Milling in the pine sawmill is carried out on daywork or piecework. Piecework is favoured when the mill is cutting on a semi-production basis, while daywork may be used for experimental and research milling.
Daywork Rates	17.100	When mill workers are on daywork, the respective margins in the Sawmills (Forestry) Agreement currently in force, or such other rates as approved by the Conservator, must be paid.
Piecework Rates	17.101	When mill workers are on piecework, the rates are based on the Sawmills (Forestry) Agreement the A.W.U. (Government) Forestry Award and the general piecework conditions of the Forests Department. It is mandatory for piecework rates to be set at a level such that a worker of average ability has the opportunity to earn at least 10% above the daywork award rate.
Adjustment of Rates	17.102	Piecework rates will require adjustment from time to time. In particular, when variations occur in Award rates, or in production due to changes in equipment, work methods, etc. Amended piecework determinations must be prepared under the direction of the area OIC and forwarded via the regional office to State Headquarters for approval.

PART 17 Softwood Utilization

Previous Production Rates to be Supplied	17.103	<p>The proposals must be fully documented with a complete description of the work method, production rates, and other relevant details set out on a Piecework Determination (FD615).</p> <p>When approved by the Chief of Division the form is the authority to pay the piecework rates specified.</p>
Cutting Records	17.104	<p>It is necessary to maintain a complete record of all operations carried out at the mill. This will be done monthly (two pay periods), on the forms FD412-1 and 412-2.</p> <p>To aid in the compilation of the FD412's, it is necessary to correctly account for the volume of logs on FD544's, maintain daily cutting records and keep accurate sawn timber recovery figures.</p>
FD182A to be completed	17.105	<p>For statistical purposes a "Summary of Pine Sawmilling Operations (FD182A) must be completed on a four weekly basis, and forwarded to State Headquarters.</p>
HANDLING OF SAWN TIMBER		
Stacking and Segregation	17.106	<p>The Officer in Charge of the mill must ensure that suitable arrangements are made for the correct stacking and segregation of mill production. All sawn timber must be strip stacked promptly, in an approved jig after cutting. Top boards must be stacked heart down. Before removal from the strip stacking jig, all bundles must be strapped;</p> <ol style="list-style-type: none">1. as close to each end as possible, and2. at the middle, if the bundle length exceeds three metres.

PART 17 Softwood Utilization

Strip Stacking to be on piecework	17.107	In order to control the costs of strip stacking, the semi-production jobs should be on piecework or contract, except in an emergency.
Standard Size Bundles	17.108	<p>Sawn timber will be stripped in standard sized bundles and will consist of :</p> <ol style="list-style-type: none">1. material of the same section and length.2. the correct number of boards in width and height.3. strip sticks spaced at approximately 400 millimetre centres.
Dimensions of Bundles	17.109	<p>The standard bundle dimension for timber to be kiln dried is 1.5 metres wide by .9 metres high. Standard sized strips of 1.5 metres long by 42 x 19 millimetres thick are used. The 19 mm will be gauged.</p> <p>The bundle dimension for seasoned timber will be .7 metres wide by .4 metres high. No strip sticks are used with seasoned timber.</p>
Cutting of Strip Sticks	17.110	Strip sticks for use in timber seasoning will be produced on the multi-saw to dimensions as required. A return (FD605) will be maintained for the multi-saw, whenever it is working.
Strip Stacking Jigs	17.111	All timber for structural use and broads is to be stripped in jigs, ensuring correct spacing of strips (407mm). Sufficient jigs of approved design to allow prompt strip stacking of all production must be available.

PART 17 Softwood Utilization

Strapping Machines	17.112	The Department at present hires strapping machines. Servicing of this equipment is the responsibility of the lessor. Payment for the hire charges will be authorized by the OIC Harvey Mill.
Date Marking of Bundles	17.113	On completion of strip-stacking, the bundle will be clearly marked on the edge with the date of stripping.
Precautions against Insect Attack	17.114	The OIC Mill must inspect all stocks at regular intervals for insect attack or decay. Infestations noticed must be reported immediately to the D/F Utilization.

ISSUED 6/84