FIRE MANAGEMENT

MISSION AND OBJECTIVES – 1999-1997

CALM Annual Report 1998/1999. 1999
CALM Annual Report 1997/1998. 1998
CALM Annual Report 1996/1997. 1997

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/1993 – SIMILAR WORDING

FIRE OPERATIONS MANUAL – 1997

NOTE: FOR UPDATES ISSUED IN 1997 REFER TO THE ENTRIES UNDER THE FOLLOWING -
Fire Operations Manual : Volume 1. 1993
Fire Operations Manual : Volume 2 : Fire Protection Instructions. 1993
Fire Operations Manual : Volume 3 : Fire Protection Instructions. 1993

SILVICULTURAL GUIDELINE - 1997

Silvicultural guideline 3/97 Establishment Guidelines for Karri Forest Regeneration Following Harvesting

5. Regeneration Burning
"*Irrespective of the method by which regeneration is achieved, fire is the principle means by which a suitable site for seedling establishment is created.*

The objectives of burning are:

- *to create maximum receptive seed bed;*
- *induce seed fall from seed trees;*
- *remove logging debris;*
- *achieve maximum burn Intensity consistent with control and safety.*
- *temporarily remove competition from the understorey*." (p. 2)

MISSION AND OBJECTIVES – 1996

CALM Annual Report 1995/1996. 1996

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/1993 – SIMILAR WORDING

SILVICULTURAL GUIDELINE - 1997

Silvicultural Guideline 1/97 Fire as a Silvicultural Tool in the Jarrah Forest

"*This guideline seeks to link burning strategies with silvicultural objectives by defining:*

- *how burning can achieve silvicultural goals;*
- *the range of burning intensities to meet specific burning objectives;*

- *where fire exclusion should be adopted*." (p. 1)

3. Types of Burning
3.2 Post-Harvesting Burning
"*Burning following harvesting can be divided into three types depending on the primary objective.*

(a) ***Tops disposal burning*** *is carried out to reduce hazard by the removal of flash fuels and woody material up to 2.5 cm in diameter.* […]

If regeneration is already established, tops disposal burning must occur within 2 years of harvesting. Elsewhere the timing and intensity of these burns can be varied to meet diverse objectives such as the regeneration of understorey species, habitat manipulation etc.

Tops disposal burns are usually low intensity. To protect existing trees these burns must also take account of the soil dryness index (Table 1)." (p. 2)

*(b)****Release burning*** *is carried out to enhance the development of regeneration. It is particularly important where there has not been an advance burn. This burn is also of value in fuel reduction. The silvicultural objectives include:*

- *the removal of scrub competition*
- *the stimulate of dynamic growth of lignotubers*
- *removal of poorly-formed saplings*

Release burning must occur within 2 years of harvesting. Burn intensity will vary with the condition of the advanced growth. A low intensity is sufficient to stimulate ground coppice, but a fire of moderate intensity will be required where deformed saplings need to be burnt back to reshoot from ground level. […]" (p. 2)

"*(c) **Establishment burning** is carried out in the jarrah forest where the objective is:*

- *the removal of scrub competition*
- *the creation of suitable seedbed*
- *the stimulation of seedfall*

These objectives are pursued on all areas cut to shelterwood as a means of establishing regeneration. There is also significant fuel reduction benefit." (p. 2)

3.3 Rotational Fuel Reduction Burning
"*Such burns are primarily for the purpose of hazard reduction.* […]

Rotational burning is excluded from stands where regeneration has been released but still remains vulnerable to fire damage (Section 4.2)." (p. 3)

3.4 Strategic Fuel Reduced Buffers
"*Strategic fuel reduced buffers are located to restrict the spread of a major wildfire.*

"[…]*Where the silvicultural objective is thinning or shelterwood, harvesting in the strategic fuel reduced buffers can proceed without conflict.* […]" (p. 3)

"*- Prescribe for the most sensitive component of the silvicultural burn, eg, in a stand with mixed objectives, prescribe for thinning areas, in a stand of TEAS and gaps prescribe for the TEAS.*

- Prescribe for nominal 6 metre scorch height in Spring.

- *Prescribe for nominal 4 metre scorch height in Autumn.*" (p. 3)

4. Fire and Silvicultural Strategies
4.1 Thinning
Burning Objective
"*Hazard reduction: Rotational prescribed burning is compatible with the thinning objective provided that it is conducted within acceptable limits of fire intensity and SID. The acceptable fire intensity increases with the age and development of the stand* [...]" (p. 4)

4.3 Shelterwood – (Establishment of Advanced Growth)
Burning Objective
"*Pre-harvesting : Hazard reduction*
Advance burning prior to harvesting is particularly important to readily identify where advance growth is present/absent and so determine the location of shelterwood stands. […]" (p. 5)

5. Integrated Fire Management of Harvested Areas
Protection and Burning:
"*Following the tops disposal burn, fire is to be excluded from the regeneration until regrowth is 6 metres in height and 10 cm in diameter.* […] *Where this is required the first rotational burn must be completed within 5 years of the regeneration release burn. At this time there will be limited fuel in the gap and 5 leaf falls in the uncut patches of forest or retained strips.*[...]" (p. 6)

TIMBER HARVESTING … 1996 ED. – 1996

Timber Harvesting in Western Australia … 1996 Ed. 1996

PART ONE : CODE OF HARVESTING PRACTICE

Preface
NOTE: REFER TO ENTRY UNDER 1993 EDITION (SIMILAR WORDING)

Section 2. General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 7 : Environmental Protection : Fire – All Forest Areas
NOTE: REFER TO ENTRY UNDER 1987 EDITION, CODE OF HARDWOOD LOGGING PRACTICE (SIMILAR WORDING)

PART TWO : MANUAL OF HARVESTING SPECIFICATIONS

Section 1 : Planning and Monitoring
Specification 1.1 : Harvesting and Regeneration Plans
1. Responsibilities
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

2. Plan Types
2.3 Short Term Integrated Harvesting and Regeneration Plan

"*This is the tertiary level integrated harvesting plan which shows in detail proposed harvesting areas over a one or two year period. The short term plan takes into account the principles contained in 'Guidelines for Integrated Forest Harvest Planning and Design'.*" (p. 16)

NOTE: FOR LISTING OF PLANS REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

3. Plan Amendment
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

8.Records
"*SFBRU or District staff must maintain up-to-date field records of areas cut over and silviculturally treated. Forms for input into the computer system 'SILREC' will be collated every six months with assistance from Forest Management Branch.*" (p. 17)
Section 5 : Environmental Protection
Specification 5.6 : Protection From Fire
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

MISSION AND OBJECTIVES – 1995

CALM Annual Report 1994/95. 1995

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/93 – SIMILAR WORDING

MISSION AND OBJECTIVES – 1994

CALM Annual Report 1993/94. 1994

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/93 – SIMILAR WORDING

MANAGEMENT PLAN - 1994

Forest Management Plan 1994-2003. 1994

1. Forest Policy Statement
Management Objective
"*To protect and enhance identified forest values and to employ the best practices in managing forest ecosystems.*

To achieve this objective CALM will:
[…]
- *Plan and implement the prevention of, and response to, wildfires at a level commensurate with their potential to damage life, property and identified forest values.*

- *Use prescribed fire in a manner which is consistent with the need to sustain identified forest values.*

[…]" (p. 2)

2. The Strategies for the Sustainable Management of Native Forests
Protecting the Forest

Fire Protection
"*CALM's Fire Protection Strategy recognises five facts:*

(i) that forest fires starting from lightning or human activity are inevitable;" (p. 27)

"*(ii) that each year weather conditions occur under which fires can be so intense as to be impossible to control;*

(ii) that the intensity at which fires burn is directly related to the quantity of accumulated dry litter or available fuel on the forest floor;

(iv) that forest litter decomposes slowly and thus accumulates quickly, creating a fuel load in forests so high that fires occurring during extreme weather conditions are uncontrollable;

(v) that the strategic use of prescribed fire is the only way in which fuel can be maintained at levels that allow fires to be controlled and managed in the forest.

The principal fire management goal of CALM is to protect community and environmental values on, and adjacent to, land managed by the Department from damage or destruction from wildfire. The secondary goal is to use fire as a management tool to achieve land management objectives in accordance with designated land use priorities.

CALM has sought to achieve these goals through strategies dealing with fire management planning, fire protection, detection and suppression of fires, and research into fire behaviour and fire ecology.

The most important fire protection practice in forests is the use of prescribed fire to reduce fuels. This minimises the damage caused by severe wildfires, makes it easier and safer for fire fighters to control fires and permits the application of diverse fire regimes." (p. 28)

Fire Protection Strategies
"*1. All district fire management and prescribed burning programs in the forest areas will be based on a formal Wildfire Threat Analysis, which integrates the risks of fire starting, the factors which influence fire behaviour and suppression and the impact a fire might have on human or environmental values.*

2. Fire regimes will be developed that take into account the response of threatened or endangered species or communities to burning.

3. Supplementary fire-fighting resources (especially from personnel employed in the timber industry) will be trained and used for fire management programs in the forest.

4. Research results on biological research, and system analysis and computer techniques in fire management will be implemented in all forest districts." (p. 28)

3. Managed Forest Values
Managing Areas of Special Significance
Diverse Ecotype Zones
"*Prescribed burning in these zones will be carried out in accordance with the habitat requirements of the site, and as part of strategic fuel reduced buffers, as determined from wildfire threat analysis.*" (p. 42)

Nature Conservation
Ecological Processes
"*This Forest Management Plan will ensure that the ecological processes continue to be maintained by:*
[…]

- *maintaining a forest fire protection system which minimises the impact of wildfire on fire management programs;*" (p. 42)

- "*ensuring that the forest is subjected to a diverse fire regime;*

[…]" (p. 43)

STRATEGIC PLAN - 1994

Strategic Plan : Southern Forest Region. 1994

4.0 Vision

"*The Southern Forest Region is a place of EXTENSIVE VALUES where our PEOPLE ARE MOTIVATED, our UNIQUE ENVIRONMENT SUSTAINED, our RESOURCES are WELL MANAGED and our CUSTOMERS NEEDS are MET.*" (p. 2)

7.1 Objectives

"*Commencing immediately we plan to have achieved the following by the year 2000. (See 7.2 Action Plans for a description of how we intend achieving each of these objectives).*" (p. 4)

CALM Corporate Area

"*OBJECTIVE 3 – EFFECTIVE FIRE PROTECTION:*
We have wide community recognition of the threat of forest fire to life and property and CALM's process for reducing the threat. We have a process in place to resource and control the threat according to well defined standards." (p. 4)

Environment and Operational Area

"*OBJECTIVE 2 – FOREST MANAGEMENT STRATEGY:*
We have successfully implemented the 1994 Forest Management Plan and 1987 Regional Management Plan." (p. 5)

"*OBJECTIVE 4 – IMPLEMENTATION OF MANAGEMENT PLANS:*
We have effectively implemented the priority works defined in the:

- *Shannon D'Entrecausteaux Management Plan*
- *Walpole/Nornalup Management Plan*
- *Various Interim Management Guidelines*" (p.5)

MISSION AND OBJECTIVES – 1993

CALM Annual Report 1992/93. 1993

"*CALM's mission :*

We conserve and manage Western Australia's wildlife and the lands, waters and resources entrusted to the Department for the benefit of present and future generations*.*" (p. i)

"*In keeping with our mission, the Department of Conservation and Land Management has the following objectives.*

Conservation: *To conserve indigenous plants, animals and ecological processes in natural habitats throughout the State.*

Value and Use of Resources: *To optimise the value and economic return to the community of wildlife, lands, waters and resources entrusted to the Department without compromising conservation and other management objectives.*

Tourism and Recreation: *To identify and provide opportunities and services to the community which allows them to enjoy the wildlife, lands, waters and resources entrusted to the Department without compromising conservation and other management objectives.*

Knowledge: *To seek and provide an up-to-date and sound scientific and information basis for the Department's conservation and land management activities.*
[…]" (p. i)

OPERATIONS MANUAL – 1993

Fire Operations Manual. Volume 1. 1993

NOTE: INCLUDES UPDATES ISSUED 1997

Introduction
"*A Planner for the District Fire Protection Officers and Regional Fire Protection Officers has been developed. This is designed to be copied each year by the DFPO and used as a working prompt and check for the years work. It includes reference to Instructions on how to perform the various tasks, and facilitates the timely attainment of work deadlines.*" (p. Part I – page 1) Issued 14/1/97

Part II : Policy and Strategy
Policy
"*Western Australia's diverse natural environment contributes to the State's economic base and to the well-being of its citizens. The continued enjoyment of such benefits from the forests, national parks and nature reserves depends on sound management that includes due consideration of fire, both its negative and positive effects.*

The Department of CALM operates a fire management program to provide fire control and fire management services as required by land and resource managers to achieve certain objectives within their programs. In addition, fire management has the responsibility to protect persons and property from fire.

The Department's Fire Management Policy (Policy Statement No. 19) is directed towards two of the Department's primary objectives:

1. To protect the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

2. To conserve the indigenous plant and animal species and environmental processes in natural habitats throughout the State.

This policy is based upon the following premises, that:

- *Fire has occurred naturally from time to time in practically all lands managed by CALM. Fire has therefore played some part in determining present vegetation structures and composition.*

- *Under natural conditions, practically all ecosystems are made up of a mosaic of vegetation associations and structural stages according to their fire histories. The scale of the mosaic varies in different ecosystems.*

- *Fires from natural causes (eg, lightning) will inevitably occur. Fires resulting from human activities, either deliberate or accidental will also occur, but may be minimised by effective public education and awareness, and by legislation.*

- *In Western Australia, weather conditions occur every year under which fires can be so intense as to be impossible to contain with currently available technologies and resources. Such fires can threaten human lives and resources valued by the community, and their control involves considerable public expenditure and risks to fire-fighters.*" (p. Part II – page 1) Issued 14/1/97

- "*The speed and intensity at which a fire burns is related to the quantity of accumulated dry litter or other fine plant material. In some ecosystems, or in some high risk/high value situations, accumulated fuel loads can be reduced by prescribed burning. This reduces the likelihood of intense fires even under extreme conditions, and improves the capacity for fire-fighters to safely control a fire.*

- *Within most major fuel types there is a recognised weight of dry fuel above which fire-fighting forces are not likely to be able to contain wildfires burning under normal hot summer conditions.*

- *Much of CALM land, particularly in the south west, has a common boundary with well-developed private assets such as towns and farms, the protection of which reduces the flexibility for fire management.*

- *Information about the long term effects of different fire regimes, including fire exclusion on many ecosystems is limited, and any management policy must be under constant review and accompanied by research and monitoring programs.*

  The Department has a moral and legal obligation to comply with those provisions of the Bush Fires Act and CALM Act relating to fire prevention and control of wildfires on or near CALM lands." (p. Part II : Page 2) Issued 14/1/97

Fire Management Objectives
"*Two primary fire management objectives are recognised.*

(i) *To protect community and environmental values on lands managed by the Department from damage or destruction from wildfire.*

(ii) *To use fire as a management tool where appropriate to achieve land management objectives, in accordance with designated land use priorities.*

The fire management program is to be performed in a well planned, safe and cost-effective manner whilst ensuring that legislated objectives are met, Departmental responsibilities are fulfilled, and all land management objectives relative to fire are met to the extent possible." (p. Part II – page 2) Issued 14/1/97

Fire Suppression Policy
"*The Department will meet its legal obligations under the Bush Fires Act and CALM Act by responding to fires occurring on or near CALM land to a degree that is appropriate to the values at risk.*

The Department will assess its response to a fire in the light of potential damage to the following values in order of priority:

(i) *Threat to human life*
(ii) *Threat to community assets, property or special values (including environmental values)*
(i) *Cost of suppression in relation to values threatened.*" (p. Part II – page 2) Issued 14/1/97

Where values dictate the Department will:

(i) Provide a detection system which will give timely warning of the presence of a fire threatening community or environmental values

(ii) Provide a well-trained and equipped suppression organisation in conjunction with other local fire fighting organisations capable of containing several simultaneous unplanned fires under extreme weather conditions." (p. Part II – page 3) Issued 14/1/97

Use of Fire

"*The Department will:*

- *Use planned fire only where this use is in accordance with an approved management plan, or, where such a plan does not exist, to protect and maintain the designated priority land use.*

- *Prepare written prescriptions in advance, for approval by senior designated officers, before any planned fires are undertaken.*

- *For areas where primary land use is wildlife conservation, the Department will use fire in such a way as to promote a wide diversity of habitats within prevailing physical or financial constraints.*

- *In small conservation reserves and where information on the impact of fire is limited, fire will be used conservatively. In such areas the use of fire will be restricted to:*

  (i) Protection of neighbouring community assets.
  (ii) As far as is achievable and within safe limits, ensuring that different successional stages following fire are represented.

- *The Department will use prescribed fire or other methods to reduce fuels on appropriate areas of CALM lands, where it can be demonstrated that this is the most effective means of wildfire control, and where undesirable ecological effects do not result.*

- *The frequency of fuel reduction measures will be governed by the rate of build-up of fuels; the degree of risk to human lives; the value of the assets to be protected; the known sensitivity to fire, or dependence on fire, of the kinds of plants and animals present; and the resources available to carry out the work.*" (p. Part II – page 3) Issued 14/1/97

- "*Ensure effective liaison with neighbours, Bush Fire Brigades, Local Authorities, Bush Fires Board and other fire control organisations.*

- *Support the concept of Local Authority District Fire Plans and promote mutual aid inter-agency agreements for fire control on lands of mixed tenure with common fire problems.*

- *Provide for public education in relation to the prevention of fire, and the role and use of fire in ecosystem management, and hazard and risk reduction.*" (p. Part II – page 4) Issued 14/1/97

Research

"*The Department will undertake research into fire prevention and control, fire ecology and fire behaviour on CALM lands to improve the scientific basis for, and effectiveness of Fire Management Programs.*" (p. Part II – page 4) Issued 14/1/97

Strategies

Fire Suppression

"*The fire suppression objective is to be achieved through a coordinated approach that includes adequate capability, proper procedures, appropriate deployment and effective action to ensure that each fire affecting CALM estate receives a response.*

A response to a fire will vary from fast and thorough initial attack with aggressive suppression, through to backburning from a fire break or low fuel buffer, to an observation only strategy. The intent is to provide a response which results in the 'least cost plus net value change' and which has a reasonable probability of success.

The management objectives of the land affected is taken into account in deciding the most appropriate response. Other factors that are important to consider include the size and intensity of the fire; the safety of fire fighters; the impending weather conditions; the fuels ahead of the fire; and the likelihood of long-term damage from the fire; and suppression activities.

When it is evident that the original response action is not appropriate, a follow-up decision process becomes operative. The acceptable follow-up is based on:
(i) Clear understanding of land management objectives.
(ii) Analysis of acceptable alternatives.
(ii) Estimate of costs plus net value change." (p. Part II – page 4) Issued 14/1/97

"*Suppression of unplanned fires on or threatening Departmental land will be given priority over normal activities, except for those involved with safeguarding of human life.*

A detection system based on aircraft, lookout towers or ground patrol, will be used in designated areas where early warning of a fire occurrence is essential to enable rapid control measures. In other areas, the Department will rely on neighbours, staff presence, the public, or commercial aircraft for reports of fire outbreaks." (p. Part II – page 5) Issued 14/1/97

Use of Fire
"*Prescribed fires will be used to achieve a range of management objectives, including fuel reduction, habitat management, vegetation regeneration and the management of scenic values. Wildfire Threat Analysis will be used as a tool in determining the appropriate fire protection strategy to be adopted on CALM estate.*

According to management objectives, appropriate prescriptions will be developed, and staff will be trained in their application.

Monitoring of fire effects will be undertaken wherever effective systems have been developed and resources are available." (p. Part II – page 5) Issued 14/1/97

Liaison Arrangements
"*The Department will participate in the preparation and implementation of Local Authority District Fire Plans and inter-agency agreements.*

Departmental staff will attend Bush Fire Advisory Committees and Brigade meetings where appropriate, to foster and encourage good working relationships with other fire fighting organisations.

Where practical, Departmental staff will assist with fire control activities on adjacent lands on a mutual aid basis with local Bush fire Brigades, other fire control organisations and neighbouring land holders." (p. Part II – page 5) Issued 14/1/97

Public Awareness

"*Education of the public on the prevention of wildfire and on the use and role of prescribed fires will be promoted through the provision of literature, films and talks. Special attention will be directed towards school groups, CALM estate visitors and operators.*" (p. Part II – page 5) Issued 14/1/97

Research Priorities

"[…] *In order to maintain a high standard of performance an operations based research program must be provided for.* […]" (p. Part II – page 6) Issued 14/1/97

Part III : Instructions

1. Fire Protection Planning

1.1 Management Plans for Fire Protection

"*Fire protection plans for individual reserves, national parks or forest blocks are covered either by Management Plans, or by plans developed according to Administrative Instruction No. 39 Necessary Operations or Administrative Instruction No. 23 Interim Operations Guidelines. District level plans for fire protection are covered by District and Regional Fire Control Working Plans (FCWPs).*" (p. Chapt 1 – Page 1) Issued 14/1/97

1.2 Fire Suppression Plans

"*There are several needs that require advance planning of the fire organisation and its facilities. The most common needs are to:*

- *maintain readiness to attack a fire at any time and place within the protected unit;*
- *provide flexibility for the organisation to respond to wide fluctuations in the size and nature of fire fighting jobs from day to day;*
- *provide rapid and effective action in high value and fire vulnerable areas;*
- *establish quick and reliable contact with fire fighting and other organisations, for resources, supplies, welfare, communications, detection, back-up forces etc.*" (p. Chapt 1 – Page 1) Issued 14/1/97

Burning Plans

1.3 (i) Master Burn Plans

"*District Managers must draw up a Master Burn Plan (MBP) which will be reviewed annually. These plans will show areas which will be protected from fire and areas to be periodically burnt. The latter show the year and seasons of proposed burns over a number of rotations, and preferred rotation lengths. The location of fuel reduced buffers (see 7.2 Types of Burning) will also be shown. See also FP1 29 (Burn Nomenclature) for conventions on naming and dividing burns.*

Rotation length of areas to be burnt for protection of community and environmental values will depend on the average rate of fine fuel accumulation for each fuel type, unless defined management objectives dictate otherwise for a particular area[…]" (p. Chapt 1 – page 2) Issued 14/1/97

"*The review of the MBP will be in August to be completed by August 31. Details of the review process are in FPI 1. An essential part of the MBP review process is the Wildfire Threat Analysis (WTA) as described in the WTA Manual. This shall be reviewed and completed in each District by July 31 prior to the MBP review.*" (p. Chapt 1 – Page 2) Issued 14/1/97

1.3 (ii) Annual Burning Programs

"*The District Manager shall prepare a current burning plan each year setting out the proposed program derived from the Master Burn Plan. Each burn on the program must be evaluated according to the Rating System for Prescribed Burns (FP] 3) and given a District priority. The District Manager also must ensure that environmental conditions can be met by completing the Pre-Burn Checklist (form CLM 32) for each burn. This*

annual program must be reviewed and approved by the Regional Manager." (p. Chapt 1 – Page 2) Issued 14/1/97

1.3 (iii) Fire Exclusion Areas
"*Protection will be afforded to 'No Planned Burn Areas' as specified in Management Plans, or Interim Guidelines for Necessary Operations. Other areas to be protected include:*

- *Fire sensitive vegetation communities or special fauna habitats.*

- *Softwood and hardwood plantations vulnerable to fire damage.*" (p. Chapt 1 – Page 2) Issued 14/1/97

"**1.4 Performance Indicators**
- "*CALMfire Branch is required by Treasury to report on the effectiveness of fire protection and suppression activities carried out by CALM. These are described in FPI 32 Fire Protection Performance Indicators. Information shall be collected from Final Fire Reports (CLM 304), prescribed burning reports, and from program designed specifically for the purpose.*" (p. Chapt 1 – page 3) Issued 14/1/97

1.5 Fire Control Working Plans
"*All Districts are required to develop and maintain a fire emergency action plan called the Fire Control Working Plan (FCWP).*

The District FCWP consists of the following major sections.

(i) <u>Objectives</u> - describes the values to be protected; the protection objectives; the standards to be achieved; and the strategies to be adopted as determined through the use of Wildfire Threat Analysis.

(ii) <u>Planning Measures</u> - includes the following: Master Burning Plans, Data Maps, Detection and Communication Facilities, Liaison Arrangements, Training and Safety Measures, Officer Responsibilities in Fire Suppression.

(iii) <u>Action Measures</u> - includes Suppression Standing Orders in the event of fires including Duty and Standby Rosters;

Suppression Standing Orders must include instructions on the following aspects:

- *Fire suppression preparedness.*
- *Detention / standby arrangements.*
- *Action in the event of fire.*
- *Despatch action including Red Action procedures.*
- *Detection arrangements*
- *Responsibilities of Duty Officer and Fire Emergency Availability (FEA) Officer.*
- *Suppression organisation staffing arrangements.*
- *Deployment of fire resources.*
- *Communication schedules.*" (p. Chapt 1 – page 3) Issued 14/1/97

"*The Fire Control Working Plan must be revised annually and forwarded to Fire Protection Branch, Como with a copy to the Region by November 15 each year. A copy is also to be made available to neighbouring Districts.*" (p. Chapt 1 – page 4) Issued 14/01/97

1.6 Accreditation Lists
"*District Managers, Regional Managers and Fire Protection Branch are responsible for preparing and checking staff accreditation lists for approval by Fire Protection Branch. The lists are to be used to identify*

training needs, and determine requirements for assigning skilled staff to fire suppression roles. Needs analysis shall be completed by July 31, with training completed by November 15 each year.

This shall be done by the District Manager making an assessment of each person in the district. When completed the list will be checked by the Regional Fire Protection Officer to ensure consistency across districts. Cross Regional consistency is the responsibility of the Senior Fire Operations Officer." (p. Chapt 1 : page 4) Issued 14/1/97

1.7 Protection Zones

"*In planning for Fire Control it has been found necessary to divide Regions and Districts into several zones indicating the priority and degree of fire protection planning and implementation. These zones are based on the levels of values at risk, primary land management objectives, the activities undertaken in the area, accessibility and presence of suppression resources.*

The boundaries of these zones will be reviewed annually by the District Manager and where necessary, will be revised after discussion with the Regional Protection officer.

1.7 (i) 'P' Zone

'P' Zones will comprise very high value and high risk 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." (p. Chapt 1 – page 4) Issued 14/01/97

"*Fires the P zone will be attacked immediately upon detection. They will be given precedence for fire attack and will be defined for planning and fire suppression action. Response action for each of these areas will be detailed in District standing orders, and may be Red Action Orders (see 8.1 Red Action Despatch).*

1.7 (ii) 'A' Zone

This will comprise all land on which fires will be attacked as soon as they become known. Normally includes prime forest lands, important Parks and Nature Reserves and private properties in which it is important to mount a high priority suppression response.

1.7 (iii) 'B' Zone

This will include land on which protection is provided by prescribed burning and where suppression of uncontrolled fires is required but may need to be delayed when commitments on 'P' or 'W' Zones require the postponing of immediate attack.

1.7 (iv) 'C' Zone

Applies to remote CALM lands where adjoining values are relatively low and/or where the inaccessibility of the area precludes immediate or direct fire suppression operations. 'C' Zones only apply outside the three Forest Regions." (p. Chapt 1 – page 5) Issued 14/1/97

1.8 District Fire Control Checklist

"*Each year in the three forest regions a District Fire Control Checklist will be conducted in each district to ascertain the state of readiness of the district for the fire season. The checklist will be conducted by a representative of Fire Protection Branch or the Region, and will be completed prior to October 15. The format of the checklist is in FPI 14.*" (p. Chapt 1 – page 5) Issued 14/1/97

1.9 Fuel Age Plans

"*Each year by July 15 the District will have an up to date set of Fuel Age Plans. These shall show the year last burnt for all CALM land in the District..*" (p. Chapt 1 – page 5) Issued 14/1/97

1.10 Plantation Fire Management Plans

"*Fire management plans covering fuel reduced buffers, firebreaks, access, water points, etc. are to be prepared for each plantation managed by CALM. Specifications for plantations are given in Fire Protection Instruction 11. All new plantations must have a fire protection plan approved by the Regional Manager and Fire Protection Branch.*" (p. Chapt1 – page 6) Issued 14/1/97

1.13 Regional Fire Officers Responsibilities
"*Prior to the commencement of the burning season, the Regional Officer responsible for fire protection will ensure that adequate arrangements have been made by relevant Districts to cover the following concerns:*

1. *Daily burn coordination and communication;*
2. *Beacon vehicle availability, operation and training.*
3. *Firearms (Verey pistols, incendiary launcher) usage by authorised personnel;*
4. *Provisions for aircrew and aircraft;*
5. *Availability and preparation of flight plans;*
6. *Liaison with brigades and neighbours including any mutual aid agreements or Inter-agency Agreements or multi-agency Response Plans;*
7. *Notification procedures;*
8. *Recording procedures;*
9. *Smoke Management Guidelines;*
10. *Training of crews, fireline supervisors and Controllers and Incident Management Terms.*"(p. Chapt 1 – Page 7) Issued 14/1/97

1.14 Planning for Water Points
"*It is important that adequate water points are available in the field for fire control.*" (p. Chapt 1 – Page 7) Issued 14/01.97

1.15 Harvesting Operations
"*All logging activities and other operations involving mechanical equipment, in both native forest and plantations, must comply with the Environmental Protection section of Timber Harvesting in WA. This document describes the equipment contractors are required to have on site, particularly within pine plantations. It also details the responsibilities of contractors for the prevention and suppression of fires within their work areas.*

It is the responsibility of the Contract Manager and the District Manager to ensure that all staff and contract operators are instructed in and are familiar with the Environmental Protection sections of Timber Harvesting in WA." (p. Chapt 1 – Page 8) Issued 14/1/97

2. Fire Equipment
2.2 Fire Equipment Installation and Maintenance
"*Trucks within Midwest, Goldfields, Wheatbelt, South Coast, Swan, Central Forest and Southern Forest Region must be set up with fire units by October 15 each year.* […]" (p. Chapt 2 – page 1) Issued 12/2/97

2.7 Fire Ignition Equipment
"*CALMfire has made available a number of ground and aerial based ignition methods used a variety of equipment and consumables. Proper procedures for the use of each must be followed.*" (p. Chapt 2 – page 5) Issued 12/02/97

3. Aircraft Operations
3.1 Use of Aircraft by CALM

"*CALM uses aircraft in fire management in a number of ways including: aerial surveillance; aerial ignition; transport of fire crews; photography, and monitoring of prescribed burns.*" (p. Chapt. 3 – page 1) Issued 14/1/97

"*Aerial ignition provides a cost effective and safe means of igniting large areas in a short time.* […]" (p. Chapt. 3 – page 1) Issued 14/1/97

4. Legal Aspects

4.1 Legal Responsibilities

"*In both the preparation and implementation of plans Departmental staff must comply with the various Acts and legislation which impinge on operations. These include Acts administered by CALM, Acts under which CALM has specific responsibilities, and other Acts which affect CALM's land management responsibilities. These Acts are listed in the Regional Management Plan for each Region.*" (p. Chapt. 4 – page 1) Issued 14/1/97

4.2 CALM Act

"*The attention of all officers is drawn to the following fire provisions of the CALM Act and Regulations..*

- *Penalty for unlawfully lighting fires - Section 104 and 105.*
- *Setting fire to bush without notice to forest officers - Section 105.*
- *Forest officers calling for suppression assistance - Section 135.*" (p. Chapt 4 – page 1) Issued 14/1/97

4.3 Bush Fires Act

"*All CALM personnel involved in Fire Control must acquaint themselves with the Bush Fires Act (1954) and Regulations.* […]

The following sections of the Bush Fires Act are of particular significance.

Prohibited Burning Times and Restricted Burning Times	***Prohibited and Restricted Burning Times Declaration***
Service Notice to Burn	*Regulations Part IV*
Bush Fire Emergency Period	*Section 21*
Burning during restricted and prohibited burning times	*Section 18-26*
Occupier of land to extinguish bush fire occurring on his land	*Section 28*
Disposal of Cigarettes and Matches	*Section 30*
Wilful Lighting of Fires	*Section 32*
Local Authority to Require Fire Breaks	*Section 33*
Burning on Crown Lands	*Section 34*" (p. Chapt 4 – page 1)

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"***Prohibited Burning Times and Restricted Burning Times***	***Prohibited and Restricted Burning Times Declaration***
Duties of Bush Fires Control Officer	*Section 38 (4)*
Fire Weather Officer	*Section 38 (6)*
Special Powers of Bush Fire Control Officer	*Section 39 (1)*
Conditions when Forest Officers may	*Section 39 (2)*
exercise the authority of a Bush Fire	*Section 45*

Control Officer	
Bush Fire Brigades	*Section 41 - 44*
Bush Fire Control Officer or Forest Officer may postpone lighting of fires	*Section 46 (1)*
Requests for Coroner's Inquiry	*Section 49*
Duties of Persons Discovering an Offence	*Section 56*
Obstruction of Officers	*Section 57*
Recovery of Expenses	*Section 58 (3)*
Prosecution of Offences	*Section 59*
Protection of Officers	*Section 63*
Advisory Committees	*Section 67*
Regional Advisory Committees	*Section 68*" (p. Chapt 4 – page 2) Issued 14/1/97

4.4 Prohibited Burning Times

"*The Bush Fires Act provides for a period each year during which the lighting of fires, except for certain specific purposes, is prohibited*.[…]." (p. Chapt 4 – page 2) Issued 14/1/97

"*Provision is also made for this Department to obtain a suspension of the Prohibited Period to carry out protective burning and special purpose burning under specified conditions*." (p. Chapt 4 – page 2) Issued 14/1/97

4.5 Suspension of the Prohibited Burning Times

"*Applications for suspension of the prohibited season must be lodged with Fire Protection Branch, Como at least two weeks before the closing date of the Restricted Time. Except for special purpose burns (for example regeneration burns or fire behaviour studies), suspension will normally only be granted by the Bush Fires Board to enable burns (such as mixed karri forest burn)s already commenced to be completed.*

The District Manager is required to submit applications for suspension of the PBT through the Regional Manager 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.*
- *Local Authority Endorsement.*
- *Burn Prescription approved by District and Regional Managers.*
- *Description of weather conditions, fuel moistures and precautions to be followed at the time of the burn.*
- *A communication plan which ensures all relevant authorities and interested members of the public are advised of the proposed burn.*

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

Where suspensions are requested for several jobs (eg: karri regeneration burns) the application must show constraints imposed to avoid too many burns lit at once and over commitment of forces.

Before submitting any request, the District Manager will be required to contact Local Authorities in which the proposed burns are located and obtain the endorsement of the Chief Bush Fire Control Officer for the extension. A copy of the written endorsement must be included in the above application.

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

On the morning of each burn the District Manager must notify the Regional Manager of the intention to proceed with the burn. If the Regional Manager approves the burn Fire Protection Branch approval must then be obtained. If PPB approval is given the local authority must then be notified of the burn, either by the Region or the District as appropriate.

See also FPI 45 (Burning Conditions For Burns During Prohibited Burning Time) and Chapter 7, Prescribed Burning and Fuel Reduction." (p. Chapt 4 – page 3) Issued 14/1/97

4.10 Fire Investigation Report
"*In every case of a wildfire on CALM lands the District Manager will take immediate steps to ascertain the cause.* […]" (p. Chapt 4 – page 4) Issued 14/1/97

5. Liaison
5.1 Bush Fires Board Liaison Officers
"*It is vital that there be close liaison with the Local Bush Fires organisations, at District and Regional level.*" (p. Chapt 5 – page 1) Issued 14/1/97

5.10 Westrail Locomotives
"*It is the policy and practice of Westrail to fit all locomotives with spark arresters during the summer months. District officers must maintain close liaison with local Westrail officers in all relevant matters of fire prevention.*" (p. Chapt 5 – page 4) Issued 14/01/97

5.11 Western Power/Telstra
"*To minimise the risk of fires from powerlines, close liaison with the Western Power must be maintained in all relevant matters of fire prevention. Responsibility for the maintenance of vegetation underneath powerlines normally lies with the S.E.C., however in some situations this responsibility lies with CALM.*" (p. Chapt 5 – page 4) Issued 14/01/97

5.15 Fire Danger Signs
"*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.* […]" (p. Chapt 5 – page 6) Issued 14/01/97

6. Support Services
6.1 Weather Observations and Forecasts
"*A number of CALM offices are required to collect weather observations on a day to day basis. Observations will be entered on the Weather Observations form (CLM 788), then entered into the CALM network computer. Nominal reporting times are 0700, 0900, 1200 and 1500 hours. Additional observations are made at 1100, 1300 and 1700 hours.*

Weather forecasts for a number of specified points are produced for CALM by a contracted forecasting agency at the following times. 0745, 1000 and at 1600 for the following day. Parameters forecast are Maximum Temperature, Minimum RH, and Wind Speed and Direction for a number of periods during the day. Grassland Fire Danger, Upper Winds, Synoptic description, and a 4 day Outlook for the three forest Regions are also provided. Forecasts and amendments must be written into the Office Daily Log Book (CLM 815).

Spot forecasts are available for managers during fires for areas not covered by the forecasts, or for when conditions are obviously different to those forecast. A cost is incurred each time a spot forecast is given. The location for which the spot is required must be defined by the Grid reference on the Weather Forecast Area plan. Weather forecasts for areas outside the forest regions can be arranged through Fire Protection Branch.

Spot forecasts are to be requested through Fire Protection Branch during normal office hours. Outside these hours the District or Regional Duty Officer may authorise a request directly to the forecasting agency." (p. Chapt 6 – page 1) Issued 14/1/97

6.2 Fire Danger Calculations

"*The Fire Danger Index must be calculated for each major forest type in each District using the 0745 hours forecast and updated with the 1000 hours amendments. This will provide the basis for all fire control planning and should be displayed prominently at the District Centre and entered into the Office Daily Log Book (CLM 815).* […]

District Managers should ensure that all staff with fire control duties are trained and fully conversant with the use of the Fire Behaviour Tables and computer fire system: Forms CLM 646 and CLM 647 are used for Manual Daily Calculations. These staff must be able to manually calculate SIVIC, PIVIC, FDI and SDI (see FPI 55 Glossary of Terms). Instructions on how to perform calculations (including guidelines on non-forest fuels) are contained in FPIs 16 to 22, 41 and 51.

An area must be established in each forest District that is used to calculate the District SIVIC and FDI. Actual SMC measurements must be taken at a minimum frequency of once a week, and after each rain event. (See FPI 39 Direct Measurement of Surface Litter Moisture Content.)" (p. Chapt 6 – page 1) Issued 14/1/97

6.3 Fire Detection

"*Early detection and accurate location of fires is paramount to successful fire suppression. The detection system in the three Forest Regions is provided by a combination of spotter aircraft and lookout towers. Detection is provided to ensure coverage of high value and high fire activity areas. Adequate tower or aircraft coverage in these areas is to be maintained when the NJFD1 is greater than 20. In other areas the Department will continue to rely on traditional sources of fire reporting.*

In areas not adequately covered by spotter or tower detection, Districts are encouraged to provide land holders with alidades (fencepost fire sighters). […]

Liaison must be maintained with Shires, WAF13 and Police to ensure that fires reported to these agencies are communicated to CALM where appropriate." (p. Chapt 6 – page 2) Issued 14/1/97

6.5 Aerial Detection System

"*The Department employs managers, pilots and aircraft to cover surveillance circuits between Walpole and Wanneroo. Circuits are designed to ensure adequate coverage of high value areas and high fire activity areas; integration with other detection systems including fire towers and members of the public. Schedules are arranged by agreement between Districts according to current and predicted fire danger and seasonal conditions. Circuits and Schedules must be reviewed before the commencement of the fire season by Regional and District Fire Protection Officers in consultation Senior Pilots and the Aircraft Manager.*" (p. Chapt 6 – page 3) Issued 14/1/97

6.7 Fire Reports

"*<u>6.7(ii) 1600 Hours Fire Report</u>*

All fires still running at 1600 hours must be reported to the Regional Duty Officer, and to Fire Protection Branch on weekdays, by 1615 hours of the same day. Information required as per CLM 660.

<u>6.7(iii) ICS Type 2 & 3 and Red Action Initial Reports</u>

The District Manager or Duty Officer is responsible for immediate notification to the Regional Duty Officer of any Type 2 or 3 Incident or Red Action fire, a fire which may draw comment from the media, or a fire likely to cause claims for damages. […]" (p. Chapt 6 – page 5) Issued 14/1/97

"*<u>6.7(iv) Periodic Situation Reports</u>*

The following reports are required for fires where an ICS Type 2 or 3 structure has been established.

The Fire Controller is required to submit the completed Incident Situation Report (ICS 3.2) four times daily to the Regional Controller at 0200, 0800, 1400 and 2000 hours. […]" (p. Chapt 6 – page 6) Issued 14/1/97

"*6.7(vi) Final Fire Report Form CLM 304*

At the first opportunity after a fire, the District Manager shall complete the fire report CLM 304. The information from CLM 304 must be entered into Fire Support within 14 days of the completion of fire operations. A copy of the completed form must also be forwarded to CALMfire Como. […]" (p. Chapt 6 – page 6) Issued 14/1/97

"*6.7(vii) Annual Fire Report*
By May 31 the Annual Fire Report CLM 753 and the annual summary of wildfires CLM 434, with the Fire Plan (maps showing the location of all prescribed burns and wildfires, and showing unburnt pockets of 10 ha and greater), must be forwarded to Fire Protection Branch, Como, with a copy to the Region.

The Region will arrange with Forest Management Branch for the entry of burnt area into FMIS by June 30. Production of Year Last Burnt maps for Wildfire Threat Analysis will be completed and distributed to Districts by July 15. These plans shall be able to be used as fuel age plans by the District. (see Chapter 1.9 Fuel Age Plans.)" (p. Chapt 6 – page 8) Issued 14/1/97

7. Prescribed Burning and Fuel Reduction
7.1 Prescribed Burning on CALM Lands
"*Prescribed burning can be used to achieve a wide variety of land management objectives, for example:*

1. *Fuel reduction for wildfire control.*
2. *To achieve silvicultural objectives, eg. regeneration, clearing*
3. *To achieve ecological objectives eg., habitat management.*

For the study of fire effects and fire behaviour research." (p. Chapt 7 – page 1) Issued 14/1/97

7.2 Types of Burning
7.2 (i) High Risk Buffers
"*These are normally required in areas where the likelihood of ignition is high, and where the fire behaviour is likely to be rapid and intense.* […]

7.2 (5) High Value Buffers
These are located to keep fires out of such high value areas as town sites, schools, sawmills, isolated settlements, plantations, research areas, regeneration, recreation and ecologically valuable or sensitive areas. […]

7.2 Q5) Strategic Buffers
These are intended to restrict the spread of major fires. Buffers running generally east west (across the face of likely most severe fires) shall be a minimum of 3 km wide, and those running north south a minimum of 1 km wide.

The spacing of strategic buffers will depend on the values to be protected, existing immutable constraints, and the acceptable worst fire run in each case, but they will generally be 6 km apart.

Strategic buffers represent the minimum acceptable protection requirement. Their integrity must be maintained, and they should be supplemented with additional fuel reduction where possible.

7.2 (iv) Maintenance of Buffers

Fuel reduction within buffers must be programmed to ensure that fine flammable fuels are maintained below predetermined loadings. Buffers must be maintained until an alternative buffer can be substituted. […]" (Chapt 7 – page 1) Issued 14/1/97

"*Within designated buffers, fuel reduction is the priority activity. No other activity is permitted which will prevent fuel reduction being carried out during the period the buffer is so designated.*

Logging within buffers is not permissible except for the following operations.

- *Thinning which retain adequate stocking and does not create gaps.*[…]
- *Cutting to shelterwood of jarrah where a deficiency in lignotubers requires seedling establishment, overstorey cover to inhibit advance growth development and regular burning to develop lignotubers (see Silviculture Specification 2/91).*

Logging which creates regeneration is to be avoided. Even where it is planned to sacrifice resultant regeneration difficulties will arise. […]

Operations requiring dieback photography and interpretation must be programmed and carried out so that it does not adversely affect fuel reduction burning programs.

Plans will be prepared by Forest Districts and Regions in consultation with Specialist Branches. These will be submitted via the Region to the Manager Fire Protection Branch for approval. Any changes to designated buffers or operations likely to affect the integrity of buffers must be approved by the Manager Fire Protection Branch.

7.2 (v) Fire Management Areas
Prescribed burning of large areas outside of designated buffers may be programmed to meet various objectives such as: to minimise the impact of wildfires on forest values (eg, timber); to facilitate the control of wildfires; to facilitate achievement of a range of silvicultural objectives; to enhance wildlife; to study fire effects; to provide structural diversity of vegetation associations. The application of this system depends on the land-use objective, the burn objectives, the vegetation/fuel types, the rate of fuel build-up together with seasonal weather, manpower availability and other local circumstances.

7.2 (vi) Advance Burning
These are applied prior to logging operations, for the protection of the residual stand and the safety of the logging crews. In jarrah forest advance burning is also recommended as an aid to the identification of lignotubers during lignotuber surveys (see Silviculture Specifications 3190 and 1191). It is desirable to program normal rotational burns in such a way that the timing fulfils the requirements of fuel reduction and advance burning." (p. Chapt 7 – page 2) Issued 14/1/97

7.2 (vii) Regeneration Burns
"*Regeneration burns (often called Slash Burns) are conducted following logging of forests to meet several objectives: removal of logging debris; stimulation of seedfall in stands where seed trees have been retained; production of seed bed (ashbed) or suitable planting sites. Refer to Slash Burning Guidelines (17P1 37). These burns are often of high intensity and take place during the Prohibited Burning Time. (See also FPI 46 Slash Burning Prescription Preparation, and FP1 54 Standards for Coupe Preparation for Karri Regeneration Burning.)*

7.2 (viii) Tops Disposal Burns
"[…]. *The aim is to remove flash fuels and woody material up to 2.5 cm in diameter which have accumulated as a result of the logging operations. (See Silviculture Specification 1191.)*

7.2(ix) Release Burns
Release Burns Release burning is carried out to enhance the development of regeneration in jarrah harvested forest to the silvicultural objective of regeneration release (gap creation). It is particularly important where there has not been an advance burn. The objective includes the removal of scrub competition, the stimulation of dynamic growth of lignotubers and the removal of poorly formed saplings. (See Silviculture Specification 1/91.)" (p. Chapt 7 – page 3) Issued 14/1/97

7.3 Burn Proposal Deadlines
"*All burns (including aerial, hand and regeneration burns) must have prescriptions prepared by District Officers and approved by the District Manager. Aerial burns and sensitive hand burns shall then be submitted to the Regional Fire Protection Officer for approval. Any burns that are of a sensitive nature or affect neighbouring regions must be submitted to the Senior Fire Operations Officer in Fire Protection Branch for approval.*

7.4 Burn Prescriptions
"*A written prescription must be prepared for each individual burn and must be approved by the District and Regional managers. The prescription forms to be used include:*

CLM 873 for forests and woodlands;
CLM 657 for clearing or regeneration burns.
[…]

A burn prescription is made up of the following components:

- *Pre-burn and Environmental Checklist (CILM 32);*
- *Description of treated area, including 1:25,000 map based on API with a standard legend;*
- *Burn purpose and objectives;*
- *Fuel assessment records and calculations;*
- *Appropriate Fire Danger Index for each lighting;*
- *Lighting strategy;*
- *Burn preparation, including 7 Way Test and Necessary Operations approval;*
- *Resources required;*
- *Approval signatures;*
- *Post Burn assessment record.*" (p. Chapt 7 – page 4) Issued 14/1/97

7.4 (i) Burn Objectives and Standards
"*(Cross referenced with FP1 61)*
Each burn will have objective(s) set describing the desired outcome. For example these will describe values to be protected from wildfire, values to be promoted by burning, or activities to be facilitated by burning.

Standards shall be specified in the prescription including defining the appropriate fire intensity and level of acceptable damage in measurable terms.

Where the burn objective is for protection of values, the following standards will apply:

(a) *Hardwood forests:*
Burn coverage in the range of 60-80 percent of the area with up to 10 percent full scorch to dominant trees.

(b) *Low forest and Open Woodland:*
Burn coverage in the range of 50-70 percent with up to 30 percent scorch.

(c) Shrublands:
Burn to create a mosaic pattern giving 15-70 percent cover." (p. Chapt 7 – page 5) Issued 14/1/97

7.4 (ii) Pre-Burn Checklist
"*The Pre-burn Checklist (CLM 32) is comprised of 2 parts:*

Part 1 - Environmental Issues
This section must be completed as the first step of any proposed burn to ensure that any potential environmental problems are recognised and appropriate action taken.

Part 2 - People and Property
This section to be completed during the burn preparation stage and also during the burn implementation. Values to be identified at preparation stage and appropriate actions taken at each stage of the burn.

7.4 (iii) Environmental Considerations
The District Manager must ensure that all aspects of prescribed burning operations conform with the required environmental standards for each of the environmental components listed in the pre-burn checklist (CLM 32)." (p. Chapt 7 – page 5) Issued 14/1/97

Rare and Endangered Species:
"*Districts must check records and maps for known locations of any declared rare flora and priority listed species prior to any operations taking place. All reasonable action must be taken to protect and avoid the locations. Where operations cannot be modified to avoid these locations, they may only proceed if the species is not threatened by the operations. Ministerial approval to proceed must be obtained in the case of declared rare species. All applications 'to take' priority listed or Declared Rare or Endangered species are to be submitted through the Regional Ecologist, or nominated Regional officer.*

Guidelines on how to request Ministerial approval 'to take' rare flora and fauna and the appropriate form (Application for Approval to Take Declared Rare Flora in Management Operation) are available from Wildlife and Land Administration Branch." (p. Chapt 7 – page 6) Issued 14/1/97

7.4(iv) Fuel Assessment
"*Standard guidelines for forest fuel assessment procedures which are set out in FP] 23 Measurement of Forest Fuel Quantity. Fuel Assessment Record (CLM 871) and Fuel Assessment Summary (CLM 872) shall be used.*

7.4 (v) Fire Danger Index Calculation
"*The prescription must nominate the number of lightings, including edging, and the fire danger index for each ignition.*

The number of lightings in each burn will be decided from the range of vegetation types and fuel quantities in the area. […]

The following FDI ranges apply to forest areas where it is required to maintain scorch levels Within acceptable height limits:

- *Flats adjoining forest stands: FDI 12 - 18 m/hr*
- *Saplings over 6m in height: FDI 14 - 20 m/hr*
- *Poles: F131 20 - 26 m/hr*
- *Mature trees: FDI 28 - 40 m/hr*

See also Forest Fire Behaviour Tables for Western Australia Tables 6.14.1 and 6.14.2, and Silviculture Specification 1/91." (p. Chapt 7 – page 6) Issued 14/1/97

7.4(vi) Soil Dryness Index (SDI) Limits
"*Soil Dryness Index must be calculated at District Headquarters and used for planning operations such as prescribed burning.* […]" (p. Chapt 7 – page 7) Issued 14/1/97

7.4(vii) Post Burn Assessment
"*The District Manager is to arrange a reconnaissance of the burn to examine the results of the burn. The results of this inspection must be recorded in the Post-burn section of the Burn Prescription form CLM 873. Details will include areas of:*

- *Full scorch > 10 ha*
- *Unburnt pockets > 20 ha*
- *Likely escapes*

From such examinations follow-up action will be decided. The post burn assessment will include a review of the objectives set for the burn." (p. Chapt 7 – page 7) Issued 14/1/97

7.6 Burn Preparations
Firebreak Maintenance
"*In areas such as forests and woodlands where opportunity for fire escapes resulting from reigniting of logs, stumps et cetera all prescribed burn blocks must be completely enclosed by firebreaks and cleared to mineral soil at least 3m wide or by a safe edge as approved by the District Manager. Such firebreaks will usually be roads or firelines* […] *In the latter case, the burn must be completed at the earliest opportunity …* […]" (p. Chapt 7 – page 10) Issued 14/1/97

Edging
"*Early and effective edging provides the most efficient means by which prescribed burns can be implemented. It reduces the risk of escapes and minimises the number of personnel required on site on the day of a burn. FPI 40 (Edging) and FPI 53 (Scrub Rolling Prior to Prescribed Burning Operations) provides guidelines on procedures to be followed.*" (p. Chapt 7 – page 10) Issued 14/1/97

7.7 Burn Procedures
"*<u>Job Selection</u>*
Selection of daily jobs must be based on the 0745 hours fire weather forecast. […] *Spot forecasts are available on request. The forecast is used to determine the fire danger index (FDI) for the specific fuel types. The forecast FDI must be compared with the required FDI for each ignition in each burn job, before the decision to proceed is made.* […]" (p. Chapt 7 – page 10) Issued 14/1/97

1000 Hours Check
"*The 1000 hours weather forecast and subsequent FDI recalculation is to be checked by the Burn Controller before the final decision to proceed with the proposed burn(s). This forecast check must be supplemented by measurements of weather conditions and fuel moisture contents at the site of the burn.* […]" (p. Chapt 7 – page 10) Issued 14/1/97

Lighting Technique
"*The Burn Operations Officer must calculate the least amount of fire to be put into the area to meet the objectives and standards set in the prescription. For example where a forest fuel reduction burn is planned the general aim is to allow individual spot fires to burn through the day, and join up in the cool of the evening.*" (p. Chapt 7 – page 11) Issued 14/1/97

Modification of Lighting
"*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 and recorded. If weather changes require lighting to be stopped, consider taking action to secure all edges with firebreaks." (p. Chapt 7 – page 11) Issued 14/1/97

Ceasing Operations after Commencement
"*The decision to cease operations after commencement must be made by the Controller. If circumstances require that a burn operation be discontinued the area ignited must be secured to the standards set out in FPI 24 Mopup and Security Standards.*" (p. Chapt 7 – page 11) Issued 14/1/97

Mop-up and Burn Security
"*The perimeter of prescribed burns must be mopped up on completion of each lighting to the required standard as soon as is practicable. Specific standards are set to ensure burns conducted in any vegetation type have minimal possibility of fire escape, even during times of extreme fire danger. Every Officer and Crew Leader must become fully familiar with the mop-up standards and procedures. FP1 24 contains detailed instructions on these requirements.*" (p. Chapt 7 – page 11) Issued 14/1/97

Patrol
"*Patrol must be regarded as a very important duty. It is essential that patrols are carried out daily until the edge is safe.*" (p. Chapt 7 – page 11) Issued 14/1/97

Certification of Burns
"*All burns must be inspected by the burn Controller soon after the final ignition to determine whether or not burn coverage targets and other burn objectives have been met.* […]" (Chapt 7 – page 12) Issued 14/1/97

7.8 Aerial Burn Plans
"*The plans will be used to provide:*
[…]
(c) Spotter Plan annual updates." (p. Chapt 7 – page 12) Issued 14/1/97

Flight Plans
"*A flight plan must be prepared for all aerial burns. Copies of flight plans are to be distributed to aircrew, markers, suppression forces and controlling officers. The plan must always be retained for record purposes with the burn prescription.* […]" (p. Chapt 7 – page 13) Issued 14/1/97

7.10 Burn Records
Recording Burns
"*The District Manager is to ensure proper records of prescribed burning are maintained. Areas identified for burning on any day and lighting must be entered into the Office Daily Log Book (CLM 815).*

Burn Controllers must keep a log of events at the burn including all decisions made regarding the burns. Officers directly in charge of burning operations must mark on the plan in the District office each day the area considered to have been burnt in each lighting. The areas will not be finally recorded on the District burning plan until they have been inspected and certified." (p. Chapt 7 – page 14) Issued 14/1/97

7.14 Alternative Methods of Fuel Reduction
"*Apart from prescribed burning fuel reduction can be achieved by:*
- *Grazing*
- *Mechanical Modification*
- *Herbicides*" (p. Chapt 7 – page 15) Issued 14/1/97

Fire Suppression
8.1 Fire Organisation

"*CALM along with the Bush Fires Board and Bush Fire Brigades, and the Western Australian Fire Brigades Board have adopted the Incident Control System (ICS) of the Australian Inter-agency Incident Management System (A11MS) for the control of wildfire incidents.*

The ICS is a structure of delegation to ensure that all management, operational and informational functions are properly performed., ICS is directed into four functional areas: Control; Operations; Planning and Logistics. The Incident Management Team is comprised of the Incident Controller, Planning Officer, Operations Officer and Logistics Officer. The roles, responsibilities and interaction between these team members and their respective sections within the]CS are specified in the AlIMS booklet '1ncident Control System - the Operating System of AIIMS'.

All fireline staff and key support personnel are required to be familiar with the structure and operation of the]CS as it applies to wildfire emergencies." (Chapt 8 – page 1) Issued 14/1/97

8.2 Categories of Wildfires

"*Wildfires are to be classified into one of 3 incident types ranging from small fires (Type 1) through to medium fires including multi-agency fires (Type 2) to large or major fire emergencies (Type 3).*

Controllers are required to set up an Incident Control System structure according to the following criteria:

Type 1 Incident

1. *Resources are drawn from within the response zone (see below).*
2. *Suppression agencies only (CALM, 13FB, Brigades) are involved.*
3. *Requirement for Logistics and Planning functions are minimal.*
4. *Fire will be mopped up in the first shift.*
5. *No other fires occur in the response zone at the same time.*

Type 2 Incident

1. *Resources are called in from outside the response zone.*
2. *Other agencies may be involved.*
3. *Logistics and Planning positions are required.*
4. *Running fire is expected to be contained in the first shift,*
5. *Three or more fires occur within one response zone.*
6. *Rate of spread exceeds 140 m/hr in forest or 2500 m/hr in grassland.*
7. *More that 6 suppression units (see below) are involved at the incident.2*
8. *A Red Action response has been initiated.*" (page Chapt 8 – page 1) Issued 14/1/97

Type 3 Incidents

1. *Fire is likely to be a significant threat to life or property, or will not be contained in the first shift.*
2. *Resources are called in from outside the Regional response zone.*
3. *There is a significant input from non-CALM agencies.*
4. *Logistics and Planning functions are significant.*
5. *Shift changes are necessary during fire attack phase.*
6. *Several Type 2 Incidents occur in the one response zone or District.*
7. *High degree of media interest is likely.*" (p. Chapt 8 : page 2). Issued 14/1/97

8.9 Action to be taken for Fire On or Threatening CALM lands

"*The following sequence of action will be taken in the event of a fire on or threatening CALM lands:*

1. Plot the fire;
2. Check values at risk;
3. Check fuel ages and suitable access;

4.Determine current and potential fire behaviour and development, and complete Situation Analysis (ICS 1.1 to 1.4) for Type 2 and 3 incidents;
5.Check available resources and despatch forces according to Standing Orders for Fire Suppression in the Fire Control Working Plan or as appropriate (for instance using the Despatch Tables in the Red Book);
6. Adjust the despatch requirements accordingly to updated information of weather, fire, fuels and suppression progress;
7. Arrange advice as required to the Region and Fire Protection Branch;
8. Commence a fire diary recording the time, key decisions and despatch action taken." (p. Chapt 8 – page 4) Issued 14/1/97

8.10 Red Action Despatch
"*A Red Action is a pre-determined set of despatch orders which ensures appropriate despatch of resources from local and neighbouring districts to a fire threatening designated high value areas. (See also Chapter 1.7 Protection Zones.)*

District Managers are responsible for nominating and plotting the Red Action areas within these Districts, eg, pine plantations, karri regrowth and other areas of high value." (p. Chapt 8 – page 4) Issued 14/1/97

"*Red Action boundaries must be reviewed annually to take into account changes in values and hazards.*" (p. Chapt 8 – page 5) Issued 14/1/97

8.12 Fire Record to be Maintained
"*A complete record of events, instructions and reports must be maintained for all fires.* […]" (p. Chapt 8 – page 6) Issued 14/1/97

8.13 Incident Resources Management System
'*The Incident Resources Management System (IRMS) is a management tool designed to enable planners to keep an up to date display of resource location on a board, and more importantly allows the planning of the upcoming shift deployment and changeover arrangements. The system is managed as part of the Planning section of the ICS under the Resources Unit.*" (p. Chapt 8, page 6) Issued 14/1/97

Fire Operations Manual : Volume 2 : Fire Protection Instructions. 1993

NOTE: INCLUDES UPDATES ISSUED 1997

Fire Protection Instruction 1 : Master Burn Plan Review Process
Regional Planning
"*Output from Regional Planning is the Regional Master Burn Plan which is coordinated with other activities. The Master Burn Plan shows the location, year and season for each burn planned with the planning horizon (nominally 10 years). This allows for the orderly scheduling of all operations, particularly burning operations, but as a natural consequence of the planning process the planning for other operational activities is also advantaged. Individual interest groups such as Recreation or Resource Planning are then able to develop their own plans that incorporate and integrate the burns identified on the Master Burn Plan.*

A time line will be produced that show where and when operations are to take place, and to have a schedule of actions to be taken at certain points along the time-line for each area. This shall be consolidated for each activity into an action list for that activity on a year by year basis.

When an area becomes due for a burn then objective(s) shall be set. These shall be management objectives stating the desired outcome of the burn, rather than the specific measurements that shall be used to determine compliancy with the objective(s). Specific performance based measurements shall be the responsibility of Operational Planning.

This shall be reviewed annually so that as activities take place and the areas move along the time-line towards year of burn it can be seen whether or not necessary operations are completed, if conflicts have arisen, or if changes in circumstance require review of a burn's schedule.

It shall be the responsibility of the meeting to resolve conflict between priorities, for instance requirement for dieback photography and interpretation and protection burning, or areas designated for logging and burn buffers. It was evident from the Planning Steps developed that conflict resolution becomes very complex once a burn is closer than -5 years (year 0 is year of burn operation). Therefore Regional Planning needs to address beyond this time. The Planning Steps (see Appendix 1) indicated that a planning time-line of 10 years is appropriate." (Fire Protection Instruction 1 : p. 2) Issued 21/09/93

"*The Planning Steps are a series of activities that need to be addressed - considered and acted upon as necessary - to ensure the proper integration of burning with other activities. The Planning Steps are designated with a year of consideration relative to the year in which the burn is to take place rather than when action is required. For instance with dieback photography the area needs to be unburnt for 5 years before the photography can proceed. Therefore the Planning Step must be considered 5 years before action is required.*

Post-burn activities such as monitoring or regeneration counts shall also be addressed in the Regional Planning forum. This will be done on the same basis as pre-burn activities.

At this level of planning the timing and coordination of activities takes place. It is therefore essential that formal structures are established to ensure continuity between years of planning and coordination between Regions. For this reason a number of forms have been drafted, each designed to aid in the planning and implementation of burn related activities." (Fire Protection Instruction 1 : p. 3) Issued 21/09/93

Planning StepsTime-Line [see page 8]
"*The first of these is the Planning StepsTime-Line. On this form the year in which Planning Steps (or activities) should take place relative to the year of Burn are recorded. For instance if an area is to be logged then this must be determined at Year -8, as the area must be unburnt from -8 to -3 to allow photography to take place, then the area interpreted and demarcated prior to operations taking place. Therefore at Year -8 the Planning Step of determining the logging status of an area must be carried out. Put another way a Planning Step is scheduled to be addressed at the time when knowledge of the activity is critical, even though the activity itself may not take place for some years. Planning Steps have been included in Appendix 1.*" (Fire Protection Instruction 1 : p. 3) Issued 21/09/93

Master Burn Plan Summary of Burns [see page 9)]
The second form is the Master Burn Plan Summary of Burns or appropriate electronic format. It records the year in which all burns are to be conducted. It is completed once ail the concerns and conflicts have been resolved between the various interest groups. In practice each district should have a separate form(s) for their particular burns. […]" (Fire Protection Instruction 1 : p. 3) Issued 21/09/93

Operational Planning
"*Guiding principles for operational planning come from Regional Planning (provision of objective(s)), local management plans, and check-lists and guide-lines provided by specialist branches.*" (Fire Protection Instruction 1 : p. 4) Issued 21/09/93

"*Output from Operational Planning is an approved operational prescription, and implementation of the operation.*

At this level the prescription and implementation of activities is effected. The principal forms are the Burn Prescription (CLM 873) and the Pre-Burn Checklist (CLM 32). […]" (Fire Protection Instruction 1 : p. 4) 21/09/93

"*The provision of further guidelines and checklists to assist the operations staff in the implementation of burns is seen as an essential component of the overall planning process.* […]" (Fire Protection Instruction 1 : p. 4) 21/09/93

Appendix 1 Planning Steps

"*The following are Planning Steps that need to be considered and appropriately acted upon to properly implement the Prescribed Burning Planning Process.*" (Fire Protection Instruction 1 : p. 11) Issued 21/09/93

" *PLANNING STEP* *PL1*

Year Relative to Burn: *-8*

Issue: *Changing 7 Year Logging Plan. (Medium Term Logging Plan)*
Action: *Changes must not compromise 230mm photography requirements or integrity of burning buffers.*
Information: *Changes in year to be cut and impact on burning buffers.*
Custodian: *Forest Management Branch.*
Input By: *Forest Management Branch,*
Received By: *Forest Management Branch, Regional Operations Officer, District Planners, Regional and District Fire Protection Officers.*
Critical: *Yes, any later and 230mm photography and buffers cannot be maintained.*
Other Options: *No. See EP2.*"
(Fire Protection Instruction 1 : page 12) Issued 21/09/93

"*PLANNING STEP* *FP1*

Year Relative to Burn: *-3*

Issue: *Burn Programming*
Action: *Burns for which Operational Planning is about to commence to be reviewed by key players in the area concerned.*
Information: *Input factors affecting the decision to burn, eg. concerns, constraints, legal requirements, pre-requisites for other operations.*
Custodian: *District Fire Protection Officer.*
Input By: *District, Region, Specialist branches.*
Received By: *District and Regional Fire Protection Officers.*
Critical: *Yes, any changes after this point results in significant waste of resources.*
Other Options: *No.*" (Fire Protection Instruction 1 : page 15) Issued 21/09/93

"*PLANNING STEP* *FP3*

Year Relative to Burn: *-1*

Issue: *Identify yearly works program.*
Action: *Will be taken from Master Burn Plan with the following tools used to decide priorities: performance Indicators, Wildfire Threat Analysis, Strategic Plans and budgets.*
Information: *Constraints and considerations for each of the identified areas.*
Custodian: *District Manager.*
Input By: *District, Regional and Specialist staff.*
Received By: *District Fire Protection Officer.*
Critical: *Yes, allows prescriptions to be prepared.*
Other Options: *No.*" (Fire Protection Instruction 1 : p. 17) Issued 21/09/93

Fire Protection Instruction 23 : Measurement of Forest Fuel Quantity

"*It is essential to know the quantity of fuels present in the forest or reserves areas when prescribed burning is planned. Litter quantities can often be estimated in the office from records of past burning and forest canopy cover. However, complications may be caused by insect infestation of tree crowns, dieback disease, trade cutting and incomplete burning. Other fuel components, such as forest understorey or scrub vegetation and trash fuel made up of twigs and dead scrub, cannot be calculated from maps or records.*

An objective method for the assessment of fuel quantity, based on direct measurement of litter depth, trash height, and scrub density and height, is therefore needed.

The assessment techniques described here are designed to enable two men to cover an average size aerial burning block (about 3000 ha) in two days depending on the forest or vegetation types of the area.

These notes describe the sampling techniques for ground and scrub fuels, and provide examples of the field sheets and fuel quantity tables." (Fire Protection Instruction 23 : p. 1) Issued 09/15/93

2. Location of Sample Lines Within Burn Area

The fuel sampling techniques described below allow for reliable estimation of fuel quantity over large areas. Four factors which must be considered when planning the sampling intensity and assessment procedure, determine the number of location of sampling sites required:

- *the importance of the area in respect to the value of the timber and conservation assets.*
- *the presence of vulnerable regeneration and the proximity to private property.*
- *sampling intensity increases with diversity of the area sampled*
- *the ease of access.*

The location of sampling lines must be carefully planned as it is important to assess the full range of major forest or vegetation associations and fuel types in order to reduce costs and damage from the prescribed burning operations." (Fire Protection Instruction : p. 1) Issued 09/15/93

The following sets out the steps to follow in locating the sample lines.

[a] *From past burning plans previous burns are traced onto the 1:25,000 (where practical) map of the proposed area. Label with year and season of last burn.*

[b] *Outline the major forest or vegetation association types within the areas of same burning age.*

[c] *Isolate the canopy cover extremes of each major forest type, and randomly select sites for two sample lines within these extremes. Where substantial differences in fuel ages exist within a proposed burn area sufficient samples within each age must be made to ensure fuel quantities can be accurately assessed.*" (Fire Protection Instruction 23 : p. 2) Issued 09/15/93

3.Measurement Methods.

3.1Litter Depth and Weight

Litter weight and depth relationships have been determined for all major forest types (see Red Book 7.2.1 […]" (Fire Protection Instruction 23 : p. 2) Issued 09/15/93

"*Tests conducted in various litter types showed that a reliable depth estimate is obtained by taking ten*

depth measurements in a straight line at 10 metre intervals. This sampling intensity ensures that the mean is not greatly biased by local fuel irregularities such as those found in forest openings, on rock outcrops and at the base of trees." (Fire Protection Instruction 23 : p. 2) Issued 09/15/93

"*The litter fuel quantities (in tonnes per hectare) for karri dominant, jarrah dominant and mixed marri, karri and jarrah associations are listed within litter depth classes in Table 7.2.1 of the Red Book.*" (Fire Protection Instruction 23 : p. 2) Issued 09/15/93

3.2 Trash Height and Weight

"*An average trash height is estimated from the trash present within 3 metres radius of each of the 10 sites located for litter depthing. The trash height must be visually averaged over the entire 3 metre radius sub-plot.* […] *Dense trash is normally found in 10 years and older karri fuel and contains a high proportion of large, heavy sticks.* […] *Jarrah stands of less than 10 year old fuels are not likely to carry any significant trash.*" (Fire Protection Instruction 23 : p. 3) Issued 09/15/93

3.3 ScrubType and Weight

"*Figure 7.4.3 in the Red Book shows the scrub height density profiles of the six standard structural types in histogram form. Each type is broken down into sparse, medium and dense according to the density of the foliage throughout the scrub profile. With practice, the histogram can be readily used to classify scrub by appearance. However it is often necessary to identify the scrub structural type by field assessment by way of point sampling technique.*" (Fire Protection Instruction 23 : p. 3) Issued 09/15/93

"*To account for the effects of different scrub flammability on fire behaviour, a Scrub Flammability Factor is to be applied to the Scrub Fuel Weight. The Flammability Factor is determined by the foliage condition (ie; percentage dead or green) and the fineness and distribution of the foliage. See Table 7.4.2 of the Red Book. The Scrub Fuel Loading corrected for flammability is obtained by multiplying the available scrub fuel weight by the Scrub Flammability Factor. In most prescribed burning situations a factor of 1.0 is normally used.*" (Fire Protection Instruction 23 : p. 5) Issued 09/15/93

4. Calculation of Total Fuel Quantities

"*The values for the litter depth, trash heights and scrub types and heights measured on each sample line are totalled and averaged. The average value is used to derive the 'available' fuel quantities for the 3 fuel components. The three component weights are added together. The total weights for all the sample lines provide the range and distribution of fuel quantities present within the burn area.*

The fuel quantities are used to develop the burning prescription for hardwood (CLM 873)." (Fire Protection Instruction 23 : p. 5) Issued 09/15/93

Fire Protection Instruction 24 : Mopup and Security Standards

Standards For Mop-Up

"*Regardless of method of mopup the final standard will be the same. Final standard is emphasised because in some situations a holding mop up may be necessary when there is insufficient time, men or equipment available to complete mop up to final standard.*

In this situation only important or urgent work such as extinguishing logs or burning bark on trees is done initially, but will be completed when available resources allow." (Fire Protection Instruction 24 : p. 1) Issued 15/09/93

"*Final standards for hardwood forests are:-*

- *Clear a mineral earth break of at least 1 m wide (wider if scrub fuels necessitate it) with a 5 m vertical clearance free from overhanging scrub and flammable material.*

- *Logs across break to be removed or section removed by machine, axe or chainsaw. If removal is not possible, loose bark or pithy wood is to be removed.*

- *All low stumps or logs within 20 metres of the break must be extinguished with water, mineral soil (or both), removed to over 20 metres, or cut off with axel chainsaw.*

- *All burning trees within 100m of the break must be extinguished, felled or burnt around.*

- *Heaps of smouldering debris must be broken up, separated then extinguished or removed to over 20m from the break.*

- *Unburnt pockets within 100 m of the break should be burnt out if possible (under controlled conditions) or isolated by establishing a mineral earth break to the satisfaction of the Operations Officer.*" (Fire Protection Instruction 24 : p. 1) Issued 15/09/93

Technique

- "*Environmental matters (preventing possible dieback spread, excessive machine activity - soil erosion, damage to trees etc) must be considered and appropriate action taken.*" (Fire Protection Instruction 24 : p. 1) Issued 15/09/93

Minimum Security Standards for Hardwood Forests
Hardwood Forest (not including Tingle)

"*Distance From Perimeter Boundary*	*Standard of Unburnt Pockets Required for Certification*	*Comments*
0-100 metres	*NIL*	*This will include blackout to 20 metres and the mopup of all burning trees to a depth of 100 metres.*
100-200 metres	*0.5 ha maximum*	[…]
200-500 metres	*5 ha maximum*	*Unburnt pockets greater than 5 ha may be ignited by air to achieve this standard. It is not intended to isolate such areas with mineral earth breaks and mopup.*
500-1000 metres	*10 ha maximum*	*The size of pockets in this zone may be increased provided this requirement is clearly incorporated into the burn and is part of the burn objectives.*
1000 metres +	*In line with burn objectives*	*Large pockets are not considered a problem in this zone and may be necessary to enable a fuel mosaic to be created by prescribed burning operations.*" (Fire Protection Instruction : p. 3) Issued 15/09/93

Tingle or Mixed Tingle / Karri Types

"*Distance from Perimeter Boundary*	*Standard of Unburnt Pockets Required for Certification*	*Comments*
0-200 metres	*No unburnt pockets*	*Most mature large tingles have substantial numbers of dead limbs.* *The felling of these hazardous trees in generally not possible.*

		Alternative protection measures (cherry pickers) need to be considered and adopted. Occasional trees may be felled in advance with approval. No unburnt ground fuels may be left within 200 metres of the boundary because of substantial risk of bark ignition. Subsequent fires may spread from tree to tree via burning limbs.
200-500 metres	*Non contiguous scattered pockets <0.25 ha*	*As above*
500- 1000 metres		*As above*" (Fire Protection Instruction : p. 4) Issued 15/09/93

Fire Protection Instruction 25 : Patrol of Burns and Wildfires

"*Efficient patrolling is one of the most important tasks at any wildfire or burn. By identifying potential trouble spots (where hopovers may occur) or by locating and controlling a hopover during the early stage of its development can save considerable suppression effort, avoid damage and minimise costs.*" (Fire Protection Instruction : p. 1) Issued 13/1/97

Fire Protection Instruction 26 : Certification of Prescribed Burns

"*Prescribed burns have three major operational components.*

Commenced:
First ignition by any method (edging, aerial etc) has taken place. More ignitions are planned.

Completed:
Final planner or expected ignition has taken place. All boundaries are secure, with all hazardous trees which may pose a threat to motoring public checked, and unburnt pockets requiring no further action.

Certified:
A detailed ground and/or aerial inspection has been conducted by a recognised officer, assisted by a wages person, and/or senior pilot, either jointly or separately, to identify and assess:

- *areas burnt and unburnt*
- *potential weak points or problem areas adjacent to any boundary or value*
- *the outcome of the burn versus the initial objectives*
- *that the burn meets the appropriate prescribed burn security standards*

On the satisfactory completion of the above, the burn is to be signed as certified by the Inspecting officer who will usually be the District Fire Coordinator. In some cases, where potential problems are likely to occur, this officer may be assisted by the Regional CALMfire Coordinator." (Fire Protection Instruction *26 :* p. 1) Issued 14/1/97

Fire Protection Instruction 29 : Water Point Construction and Maintenance

Objective

"*To construct or provide access to sufficient water points to ensure adequate protection to adjacent CALM controlled lands during fire control operations. To achieve this objective, an analysis of the existing facilities must be made.* […]" (Fire Protection Instruction 28 : p. 1) Issued 15/09/93

Burn Nomenclature

"*To achieve uniformity in the designation of areas subject to prescribed burning a system of nomenclature has been developed.*" (Fire Protection Instruction 29 : p. 1) Issued 17/2/95

Fire Protection Instruction 37 : Slash Burn Guidelines

NOTE: SEE ALSO SLASH BURN PRESCRIPTION PREPARATION (FPI 46) AND STANDARDS FOR COUPE PREPARATION FOR KARRI REGENERATION BURNING (FPI 54)

1. Scope
'*These guidelines are applicable for the burning of slash following karri logging operations.*" (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

2. Objectives
"*To detail factors affecting, and methods that may be used, to safely and successfully undertake slash burns as above.*" (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

3.Factors Affecting Slash Burn Performance
3.1 Fuel Quality and Arrangement
"*The weight, distribution and arrangement of fine, flash fuels and heavy, wood fuels govern whether a fire will ignite, spread and be sustained. The amount of fine fuels determine the likelihood of igniting the heavier fuels and of spread from one heap to another. The arrangement and distribution of heavy fuels affect the amount of fuel consumed. Rough heaped or windrowed fuels burn hotter and more completely than scattered, broadcast fuels*." (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

3.2 Fuel Moisture Content (FMC)
Fine Fuels Moisture Content
"*The fine fuels must be dry enough to ensure ignition of the heavier fuels. The FMC of flash fuels varies within a heap, and unless the lower sheltered fuel is dry enough the burn will fail*." (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

Fine Fuel Moisture Differential
"*Drying on cut-over areas is more rapid than under adjacent forest. If a day can be selected when the fine slash is dry, but the surrounding forest is damp, then a satisfactory burn can be conducted with minimum risk of suppression problems.*

An adequate moisture differential occurs when the sheltered slash moisture content is below 18 per cent and the surrounding forest is 25 per cent or higher at the peak of the day.

Measurement of fuel MC in the forest must be made at least 30 m in from the boundary of the coupe to avoid edge drying effects." (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

Heavy Fuels Moisture Content
"*Success of ignition of large woody fuels varies with the period since logging, the drought factor as indicated by the Soil Dryness Index (SDI), the time of the year, and the species. Under the same conditions karri logs will ignite and burn before marri, jarrah and tingle logs, in that order. Logs with MC below 30 per cent will ignite satisfactorily if fine fuels are abundant and dry*." (Fire Protection Instruction 37 : p. 1) Issued 15/09/93

3.3 Weather Conditions
"*Temperature, relative humidity and wind strength affect the drying rate and final minimum values of the fine fuel MC.*

Wind is the most variable and least predictable factor. Surface winds are affected by the topography and by local heating and cooling. Wind is also influenced by local synoptic changes and by stability of the atmosphere.

Slash burns are generally conducted with south east winds because of their stability and duration. […]" (Fire Protection Instruction 37 : p. 3) Issued 15/09/93

3.4 Topographic Effects
"*Topography affects wind speed, turbulence and direction. Topography also influences the rate of drying of fuels through the influence of aspect and slope or the degree of exposure of fuels to sun and wind*." (Fire Protection Instruction 37 : p. 3) Issued 15/09/93

3.5 Burn Buffers
"*Most slash burns are conducted within prescribed SDI/FD1 limitations, often in the Prohibited Season with special suspension approval. It is especially important that burns are contained within the nominated boundaries. It is undesirable to undertake buffer burns under these conditions as they are outside the guidelines indicated in the Forest Fire Behaviour Tables. Significant scorch and damage to forest trees can occur if the buffer burn is conducted at the same time as the slash burn.*

"[…] *Pre burnt buffers offer the Fire Manager a greater degree of flexibility in the planning process, and the Operations Officer a greater choice of burn types to consider and implement on the day*.[…]" (Fire Protection Instruction 37 : p. 4) Issued 15/09/93

4. Burning Techniques
"*Behaviour of slash burns depends on the lighting pattern used.* […]" (Fire Protection Instruction 37 : p. 4) Issued 15/09/93

"*Lighting pattern can influence fire behaviour, for example through the deliberate creation of a convection column to draw fire from the burn perimeter.*

Three basic patterns of lighting are used for slash burn operations. These are:

1 . Strip lighting;
2. Convection lighting (centre firing or moving column);
*3.Simultaneous area ignition." (*Fire Protection Instruction 37 : p. 4) Issued 15/09/93

4.1 Strip Lighting
"*Firing in progressive strips is the most commonly practiced method in WA as it is the most versatile for the range of weather and topographic conditions. The procedure involves the consolidation of the most vulnerable edge (eg: downwind edge or upper edge) by back burning into the coupe, followed by the progressive stripping out of the remaining area.*

With this technique, light-up time is slow and therefore the burn is vulnerable to changes in weather condition, particularly wind. […]

As the downwind edge must be patrolled constantly, crews must work in smoke and heat. Likelihood of fire whirlwinds and hop-overs is high." (Fire Protection Instruction 37 : p. 5) Issued 15/09/93

4.2 Convection Ignition
"*Convection ignition aims to create a strong convection column near the middle of the burn area. When heavy fuels such as logging slash are burned, the convection column stabilises and acts as a chimney toward which ascending warm air is drawn. In this way flames and smoke are drawn back from the fire perimeter. Thus, the burn is easier to control, and working conditions are safer and more pleasant. The two forms of convection ignition are central ignition and moving column ignition.*" (Fire Protection Instruction 37 : p. 5) Issued 15/09/93

Central Ignition

"*Central ignition is employed on level areas (up to 10 degrees slope) and with light winds. This system will work under negative slopes (gullies). A cluster of fires is started in the centre of the prepared area and allowed to develop until an active convection column forms. More fires are lit 20 to 40 metres from the central fires as soon as indraught winds are established. Sequential radial lighting continues in concentric circles to the burn perimeter. A variant is to light from the centre in a spiral pattern.*

"*Once the convection column is established, follow-up lighting must proceed immediately. Delays will mean that the indraught influence of the central fire is lost.*" (Fire Protection Instruction 37 : p. 6) Issued 15/09/93

"*The central ignition system does not guarantee freedom from suppression problems. As soon as the convection column breaks up, normal precautions are needed on the downwind edge of the burn.*" (Fire Protection Instruction 37: p. 6) Issued 15/09/93

Moving Convection Column
"*The moving convection column is a combination of the strip and central ignition methods. In this method, lighters walk through the burn in arrowhead formation.* […]" (Fire Protection Instruction 37: p. 6) Issued 15/09/93

"*Moving column ignition is employed on areas that are considered too large or narrow for the central firing technique.* […]"(Fire Protection Instruction 37: p. 6) Issued 15/09/93

4.3 Area Ignition
"*Area ignition involves the use of simultaneous multispot ignitions to produce an intense fire through the full use of junction zones and convection column.*

This method is sometimes used when fuels are at a marginal moisture content level (eg: 19-20%). Electrical, or aerial ignition techniques can be used." (Fire Protection Instruction 37: p. 6) Issued 15/09/93

5. Slash Burn Organisation
"*High intensity slash burns require special organisation and discipline.*" (Fire Protection Instruction 37: p. 6) Issued 15/09/93

6.3 Inspection
"*After the briefing DC lighting and DC suppression will nominate their respective crews, and an inspection of boundaries and internal tracks will be made. An inspection is obligatory for all staff prior to ignition commencing.*" (Fire Protection Instruction 37 : p. 11) issued 15/09/93

7 Slash Burn Control
"*To produce the best seed bed, slash burns should be as intense as possible within limits set by safety and ease of control. Factors the Controller must consider are:*

***7.1Prescription**:*
The slash burn prescription (CLM 657) must be consulted before lighting commences. Check expected weather conditions on the day match those prescribed. […]"(Fire Protection Instruction 37 : p. 11) issued 15/09/93

7.2 Timing for the Day
"*This depends upon:*

- *Fine fuel moisture contents inside and outside the burn.*
- *Expected weather.*
- *Known and anticipated commitments elsewhere.*

- *Weather conditions as prescribed.*
- *Necessity to burn out buffers under mild conditions.*" (Fire Protection Instruction 37 : p. 11) issued 15/09/93

"*It may be necessary to terminate an incomplete burn. If so, all burning must cease on a mineral earth break and mop-up of exposed flanks completed before leaving that night, and early morning or overnight patrols arranged.*

The maximum burn size that can be completed within daylight hours by ground ignition methods is approximately 200 ha.

Therefore, always consider start time and expected time to light the job before burning commences. Start time will be influenced by:

- *Light up should only commence when the daily wind pattern has stabilised. Wind patterns established by mid afternoon generally persist for the remainder of the day.*

- *A burn must never be lit on the expectation of a desired wind change. Always delay start time until prescribed winds are experienced.*

- *The safest start time each day comes just after the daily hazard has peaked (ie; RH rising, temperature failing).*" (Fire Protection Instruction 37 : p. 11) issued 15/09/93

7.4 Cellular Lighting

"*On large slash burns the operation is lit systematically cell by cell. The sequence is determined by:*

- *The direction of the prevailing wind. The downwind cell is lit first, and then the downwind flanks are secured by burning adjacent cells. This pattern is repeated for the entire job, progressively working upwind.*

- *The requirement to draw fire and hence spotting potential away from a dangerous flank. By intelligent lighting of cells, pressure on dangerous flanks can be controlled.*" (Fire Protection Instruction 37 : p. 12) issued 15/09/93

7.5 Knowledge of Danger Points

"*(Identified where possible on burn plan and during briefing and inspection)*

Danger points are:

- *Slash which cannot be burnt, or special high value areas adjacent to the burn.*
- *A sharp bend in the boundary of the burn.*
- *Fire whirlwinds.*
- *Gully winds.*
- *Steep, upslope topography.*
- *Seed trees with dead limbs near perimeter.*" (Fire Protection Instruction 37 : p. 13) issued 15/09/93

7.7Suppression

- "*The nature of the suppression force depends on the size of the burn and expected fire intensity.* […]." (Fire Protection Instruction 37 : p. 13) issued 15/09/93

"*Points to note with regard to suppression are:*

- *Never light more than can be held with available suppression forces.*

- *If trouble is experienced beyond the capacity of suppression forces, immediately stop lighting.*
- *Suppression is more difficult in Autumn than in Summer due to the dryness of large fuel and the spotting potential of the fire.*
- *Suppression of escapes must take place immediately, while they are small.*
- *Suppression of escapes must be carried out with minimum damage to the forest adjoining the burn*." (Fire Protection Instruction 37 : p. 14) Issued 15/09/93

7.8Mopping Up

"*All burns must be made safe by mopping up the edges as soon as practical. Standard mop up rules require that burning material must be extinguished:*

for 20 metres from the edge on the ground, and
for 100 metres from the edge in the air." (Fire Protection Instruction 37 : p. 14) issued 15/09/93

Fire Protection Instruction 38 : Burn Costing Guide

"*Type 'A' Jarrah Aerial Burn*

1 . Area around 4,000 ha
2. Available fuel range does not exceed 10 t/ha
3. Jarrah type fuels.
4. Shape generally rectangular. Access roads require approx. 2 days machine work, with 4 days grading.
5. Perimeter/Area ratio is not greater than 6 metres/ha
6. Suitable for autumn or spring edging.
7. Requires average of 1.5 aerial ignitions.
8. Not more than 5 km of perimeter associated with private property.
9. Not effected by cutting proposals.
10. Within 30 km of HQ.

Type 'B' Southern Mixed Aerial Burn

1. Area around 3,000 ha.
2. Karri type fuels do not exceed 50% of area
3. Shape generally rectangular. Access roads require approx. 3 days machine work, with 4 days grading.
4. Scrub rolling required on not more than 15% of perimeter with 3 days for machine done between Jan - May.
5. Perimeter/Area radio is not greater than 8 metres/ha
6. Edging mainly spring and day of burn.
7. Requires average of 3 aerial ignitions.
8. Not more than 5 km of perimeter associated with private property.
9. Not effected by cutting proposals.
10. Within 30 km of HQ

Type 'C Karri Aerial Burn

1 . Area around 2500 ha.
2. Karri type fuels exceed 50% of area
3. Shape generally rectangular. Roading, scrub rolling and advance mopup require approx. 10 days with machine. Grader required for 4 days. Work carried out between Jan. - May.
4. Perimeter/Area radio is not greater than 10 metres/ha
5. Edging mainly day of burn.
6. Requires average of 3 aerial ignitions.
7. Not more than 5 km of perimeter associated with

private property.

8. Not effected by cutting proposals.

9. Within 30 km of HQ.

Type 'D' Jarrah Hand Burn

1 . Area around 400 ha

2. Even aged fuels.

3. Mainly one forest type.

4. Boundary roads require 1 day with machine, 1 day with grader.

5. Requires 1 lighting.

6. Not more than 2 km of perimeter associated with private property.

7. Within 30 km of HQ.

Type 'E' Southern Mixed Hand Burn

1 . Area around 200 ha

2. No heavy Karri type scrub.

3. Does not require walking lanes.

4. Requires not more than 2 days machine work on roading and scrub rolling. Approx. 2 days grading.

5. Requires one lighting.

6. Not more than 2 km of perimeter associated with private property.

7. Within 30 km of HQ.

Type 'F' Karri Hand Burn

1 . Area around 100 ha.

2. Mostly Karri type scrub.

3. Walking lanes required.

4. Requires 4 days machine work for roading and to scrub roll walking lanes. Approx. 1 day grading.

5. Requires one lighting.

6. Not more than 2 km of perimeter associated with private property.

7. Within 30 km of HQ.

Type 'G' Regrowth Jarrah Burn (10 y.o.plus)

1 . Area around 200 he.

2. Even age fuels.

3 One forest type.

4.. One day machine preparation and one day grading.

5. Requires one lighting.

6. Not associated with private property.

7 .Lit on low/failing hazard.

8. Within 30 km of HQ.

Type 'H' Regrowth Karri Burn (18 y.o. plus)

1 . Area around 100 ha.

2. Even age fuels.

3. Predominantly Karri type.

4. Roading 2 days machine preparation and 2 days grading.

5. Aerial ignition

6. Requires one lighting

7. Not associated with private property.
8. Late summer, high SDI, falling hazard burns.
9. Normally adjacent to established regrowth and or native forest.
10. Within 30 km of HQ"(F.P.I. p. 1) Issued 21/09/93

Fire Protection Instruction : 39 : Direct Measurement of Surface Litter Moisture Content

1. Scope

"*This prescription covers the sampling procedure and technique required for the measurement of fuel surface moisture content using the 'Speedy' or 'Marconi' type moisture meters.*" (Fire Protection Instruction 39 : p. 1) Issued 16/09/93

2. Objective

"*To obtain a representative value for surface moisture content for use in headfire rate of spread prediction.*" (Fire Protection Instruction 39 : p. 1) Issued 16/09/93

3. Sampling

"*Location must be representative of the area for which the HFROS information is desired. Consider:*
(a) Canopy cover – the less canopy the drier it is.
(b) Roads, tracks and forest openings – edge effect results in drier fuel.
(c) Aspects – drier on north than south.
(d) Ridge or gully – water in gully."
(Fire Protection Instruction 39 : p. 1) Issued 16/09/93

Fire Protection Instruction 40 : Edging

"*To strengthen roads and firelines acting as boundaries of a burn and avoid time consuming mop-up and patrol, edging is carried out 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 is reasonably safe whilst the Soil Dryness Index (SDI) is below 250.

Edging with unstable conditions ahead of lows and fronts associated with strong and gusty north westerly winds must be avoided." (Fire Protection Instruction 40 : p. 1) Issued 09/16/93

2.2 Value of Edging

"*Quality edging will greatly assist in determining the success of your prescribed burning programme by:*
(a) Reducing the need for costly and time consuming mop-up and patrol procedures.
(b) Reducing the risk of escape from subsequent flare ups in unburnt pockets as the season warms up.
(e) Ensuring gangs are available for 'today's burn' and not mopping up and patrolling previous burns with untidy edges.
[…]"(Fire Protection Instruction 40 : p. 1) Issued 09/16/93

3.0 Pre-Planning General

"*To make full use of the limited number of edging days available in any one year early pre-planning is of utmost importance.* […] *The month of March is an ideal time.*" (Fire Protection Instruction 40 : p. 1) Issued 09/16/93

3.0 Pre-Planning General

"*Set priorities for Autumn edging on those perimeters that are difficult to burn in Spring, for example:*
(a) Wandoo types.
(b) Southerly aspects.
(c) Adjacent to private property.

(d) Pine plantations.
(e) Wet gully systems.
(f) Quarantine areas.

Where roading permits, aim at complete Autumn hand burns as an edge buffer particularly when adjacent to private property, and pine plantations." (Fire Protection Instruction 40 : p. 1) Issued 09/16/93

3.1 Pre-Planning Karri Scrub Types
"*Scrub rolling is the only way to ensure a clean early edge in karri fuels. The need for scrub rolling will depend on the risk associated with each edge. In general the following will apply:*
(a) Southern and eastern boundaries – scrub roll to a depth of 40 metres where adjoining fuels are greater than 3 years old.
(b) Northern and western boundaries – scrub roll to a depth of 40 metres adjoining high value areas of where potential edge problems exist.
(c) Where heavy scrub types are encountered back up to the scrub rolling with parallel walking lanes at 15-20 metre intervals.
(d) Increase the depth of scrub rolling to 80 metres in the bottom of steep gully systems adjoining heavy fuel or high values.
(e) Separate scrub rolling from adjoining fuels with a mineral earth break.
Where possible plan scrub rolling for later Summer and Autumn." (Fire Protection Instruction 40 : p. 3) Issued 09/16/93

4. Selection of Conditions
4.1 Jarrah Types
"*(a) Aim for quality edging with a minimum depth of 40 metres.*
(b) Minimise risk of re-ignition by limiting SDI to less than 250.
[…]
(e) Do not select north or north west winds unless for a southern boundary adjacent to light fuels." (Fire Protection Instruction 40 : p. 4) Issued 09/16/93

4.2 Karri Types
"*(a) Aim for a quality edge of at least 40 metres. Increase edge depth in heavy fuel types, gully systems and high value areas.*
[…]
(e) Do not select north or north west winds unless for a southern boundary adjacent to light fuels." (Fire Protection Instruction 40 : p. 4) Issued 09/16/93

5. Prescription
"*All edge burning will be done to an approved prescription.*

Each prescription will show desired depth of edging, FDI, SDI, wind direction and wind strength limits.

Where edging is done for a burn the next season, Pre-burn Checklist CLM 32 must be completed." (Fire Protection Instruction 40 : p. 4) Issued 09/16/93

6. Edging Time
"*Suitable edging weather occurs during Spring or late Autumn and occasionally during Winter.* […]." (Fire Protection Instruction 40 : p. 5) Issued 09/16/93

8.Method of Lighting
8.2 The Drip Torch

"*This method is by far the surest way of achieving quality control in edging. Although it may cost slightly more, the result will be more than justified at the time of the main burn.* […] *The hand lighting method has many distinct advantages.*

(a) *Strip width and spot distance can be varied to suit fuel type and quantity.*
(b) *Required depth of edge can be achieved by strip adjustment.*
(c) *Wind direction does not determine which boundary you can light. Just place your strips to suit the wind. In fact you can even use N-NW winds provided you are on the southern boundary adjacent to light fuel.*
(d) *As the rear pair leap-frog with the vehicle to the front position they can observe fire behaviour and success of burn. This process is continually repeated.*

[…]

(f) *They will detect wind changes more readily.*
(g) *No problem negotiating wet and boggy areas.*
(h) *Readily detect damp area likely to result in undesirable patch edging.*
(i) *Movement of vehicles in quarantine areas can be overcome.*" (Fire Protection Instruction 40 : p.7) Issued 09/16/93

8.3 The Incendiary Launcher

"*This in itself is not a direct edging tool but can be very useful in situations where access is difficult.*

(a) *Deeper edging where very thick scrub is present.*
(b) *Creek systems and flats where access on foot is unsafe.*
(c) *Lighting spots high up on slopes where back burn downhill is required.*
(d) *Lighting down steep and difficult slopes where the fire is needed to run uphill to the break.*" (Fire Protection Instruction 40 : p.8) Issued 09/16/93

8.General Lighting Principles

"*(c)* *Do not light karri types until jarrah edges are completed.*
(d) *Keep spot spacing open to start with. It is easy to fill in later but impossible to take fire out if too much was put in too early.*
(e) *Beware of days that indicate a strong north west change, ie; trough movement with approaching cold front.*
(f) *Do not light the bottom of steep slopes. Go up and burn downhill.*" (Fire Protection Instruction 40 : p.8) Issued 09/16/93

11. Summary

"*Remember, edging is your important job.*
(a) *Do not miss out on any edging weather.*

[…]

(d) *Do not allow edging with N-NW winds or indicators of such (except in very special circumstances).*

[…]

(f) *Do not use a flame thrower on northern boundaries.*
(g) *Watch that 'SOIL DRYNESS INDEX'.*

[…]"(Fire Protection Instruction 40 : p.7) Issued 09/16/93

Fire Operations Manual : Volume 3 : Forest Protection Instructions. 1993

NOTE: INCLUDES UPDATES ISSUED IN 1997

Fire Protection Instruction 41 : :Limitations on Application of Forest Fire Behaviour Table Calculations

"*The tables in the Forest Fire Behaviour booklet can only ever be a guide to likely fire behaviour.* […]" (Fire Protection Instructions 41 : p. 1) Issued 17/09/93

2. What are the Tables Based On?
"*2.1 Moisture content tables are based on the correlation of sampled moisture contents with measured weather variables, ie; rainfall, temperature, RH%.*

Two types of sampling are involved - destructive, where litter samples are collected in tins and moisture content calculated by weighing before and after drying in an oven, and non destructive, where a litter profile is placed in a basket which is weighed at various times throughout the day to record the moisture gain and loss.

Both sampling methods have their problems, but are complementary when attempting to build up a picture of the rise and fall of MC% throughout a day.

The natural variation in litter depth, cover type makes pre-use sampling very difficult.

HFROS tables are based on many hundreds of spot fires measured through 1/2 to 1 hour. Data collected has a preponderance towards the cooler end of fire behaviour range, as the majority of prescribed burns are conducted under these conditions.

At these fires, fuel quantity, fuel moisture, weather variables and HFROS were recorded and later correlated to produce the tables." (Fire Protection Instructions 41 : p. 1) Issued 17/09/93

3.How Accurate are the Tables?
"*To assess this we must consider the following:*

The inherent accuracy of the tables. The factors affecting fire behaviour are very complex and all interrelated.

The only way some of these variables have been taken into account is through their interaction with variables that were measured.

Apart from the variables not directly measured, the following also lead to variation:

Sampling error, biological variation, spatial variation

In general, tables cannot account for any more than 60-70% of the observed variation in HFROS. Consequently, no matter how carefully one measures the variables to input the table there will be unaccounted for errors.

Weather variation, or the difference between forecast and actual is a constant problem. The defined limits of an accurate forecast are:

MT	*+ 20C*
MRH	*+7-15%*
Wind speed	*+ 10 km/hr*
Wind direction	*+450*

because it is not feasible to forecast any more accurately with the current state of the art. Therefore, even within an accurate forecast, there is variability. For example, a forecast could still be defined as accurate, yet give the following calculation results:

Yesterday's Min. SMC 12%, Overnight RH Count 30

	Under	*Forecast*	*Over*
MT	*28C*	*30C*	*32C*
MRH	*42%*	*35%*	*28%*
Wind speed	*5 km/hr*	*15 km/hr*	*25 km/hr*
HFROS	*22 m/hr*	*27 m/hr*	*35 m/hr*

a range of 22-35 m/hr. This situation gets worse as SMC% drops and HFROS rises. Fortunately, errors are not always cumulative.

All forecasts are for point sources, hence the calculations using them are also for point sources. Any attempt to use those calculations other than for the point they were calculated for introduces a further error, due to weather variability." (Fire Protection Instructions 41 : p.2) Issued 09/16/93

Fire Protection Instruction 45 : Burning Condition for Burns During Prohibited Burning Time

"*NOTE: No burns can proceed when the Grassland Fire Danger is rated Very High or Extreme for the area in question.*

Approval to burn outside the above limits will normally be granted only in special cases such as fire research study burns.

Approval of all burn proposals during the Prohibited Burning Times must be obtained from the Local Authority and the Bush Fire Board. All applications must also be vetted by the Manager of CALMfire Branch." (Fire Protection Instruction 45 : p. 1) Issued 15/11/97

Fire Protection Instruction : 53 : Scrubrolling Prior to Prescribed Burning Operations

1. Scope

"*Applies within the Southern Forest Region or wherever dense understorey scrub dictates that scrub rolling is necessary.*" (Fire Protection Instruction 53 : p. 1) Issued 09/16/93

2. Description

"*Scrup rolling is the use of machinery to roll standing green understorey material to a pre-determined depth around the perimeter of prescribed burns. This operation is particularly applicable where the proposed burn is adjacent to areas of high value, heavy accumulations of unburnt fuels, or complex boundaries with a high risk of fire escape from the burn.*" (Fire Protection Instruction 53 : p. 1) Issued 09/16/93

3. Objectives

- "*To facilitate efficient fuel reduction alongside roadsides.*
- *To ensure complete combustion of fuels within this scrub rolled edge.*
- *To minimise future fire escapes.*
- *To reduce mop up requirements.*
- *To minimise burnt scrub falling onto roads.*
- *To improve road user safety.*" (Fire Protection Instruction 53 : p. 1) Issued 09/16/93

5.2 Prescribed Burning

"[…] *Lighting the scrub rolled edge before the standing scrub and litter will burn and result in difficult and expensive edging later.*" (Fire Protection Instruction 53 : p. 1) Issued 09/16/93

7. Method of Operation

"*The aim of the operation is to lay the fuel onto the ground to allow it to cure sufficiently to ensure satisfactory combustion. Soil is not to be bared, especially if scrubrolling is to remain unburnt over winter.*

Scrub rolling is to be completed to an average depth of 20 metres from the adjacent road.[…]" (Fire Protection Instruction 53 : p. 3) (Fire Protection Instruction 53 : p. 3) Issued 09/16/93

"*Damage to standing trees is to be avoided. Scarring by removal of bark will eventually lead to hollow butting. Groups of saplings and mature understorey trees (peppermint, karri oak etc) are not to be pushed or scrub rolled except where visibility is affected.* […]" (Fire Protection Instruction 53 : p. 3) Issued 09/16/93

Fire Protection Instruction : 54 : Standards for Coupe Preparation for Karri Regeneration Burning

5.2 Cell Formation

"*Formation of these cells will provide;*

[…]

- *more flexibility of the lighting pattern to the fire boss.*
- *greater access during future regeneration operations.*
- *breakup the coupe for future prescribed burning/suppression activities.*
- *Access for the future logging operations and other management needs.*" (Fire Protection Instruction 54 : p. 4) Issued 21/09/93

5.6 Buffer Burns

- "*Buffer burns are generally done when control problems are anticipated during the slash burn. It is preferable if the buffer can be burnt in jarrah or mixed jarrah types with comparatively low fuel levels.*" (Fire Protection Instruction 54 : p. 6) Issued 22/09/93

5.7 Flexibility

"*In some cases it may be desirable to push in logging debris, plus prepare for a buffer burn along a particular flank. This will allow a greater amount of flexibility in the 'when and how' the burn is to be conducted and reduce the risk of escapes and costs at the same time. Again it is preferable to burn the buffer out well in advance if possible.*" (Fire Protection Instruction 54 : p. 6) Issued 22/09/93

Fire Protection Instruction 61 : Objectives and Standards : Aerial Prescribed Burning : Southern Forest Region

Objectives and Standards
Aerial Prescribed Burning : Southern Forest Region

"*OBJECTIVES:* […] *and the desired outcome objectives will vary according to the reason for the burn, eg. fauna and habitat development, silviculture, hazard reduction etc.*

STANDARDS: […]*. Standards must be measurable, realistic and achievable.*

[…]

Hazard Reduction Burning
Objectives:

Scorch:

- "*No extensive/significant visible scorch on viewsheds from nominated sites, eg: Gloucester Tree*
- *No adverse visual impacts evident after one year from date of burn.*
- *To restrict scorch along South West Highway (or any other road) to 4 metres.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Protection:

- *To protect adjacent life and/or property (eg: Diamond Mill or Diamond Tower and recreation site from wildfire).*
- *To provide a reduced fuel zone to protect adjacent karri regeneration from wildfire.*
- *To provide protection to established jarrah and karri regeneration within or adjacent to the burn*

- *To provide a fuel reduced buffer between adjoining jarrah or karri regeneration cells as per the Regional Management Plan.*
- *To fulfil the approved fire related objectives as specified in the appropriate Management Plan.*
- *To provide a low fuel zone in which to assist with containing incoming wildfires.*
- *To provide a low fuel area onto which future burns adjacent may be burnt*
- *To burn out flats vegetation only, leaving forested areas unburnt for age diversity purposes.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Management Plan:

- "*To fulfil the approved fire related objectives as specified in the appropriate management plan.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Standards:

General:

- "*The completed burn will meet all the mop up and security standards for the appropriate vegetation type as per FPI 24.*

[…]" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Jarrah:

- "*Reduce jarrah ground fuels to <2 tonnes per hectare over 60/80% of the total burn area.*
- *Maximum scorch height of 6 metres to less than 10% of the forested area.*
- *Roadside scorch along a public or nominated recreational or tourist road is not exceed 4 metres in height.*
- *Severe crown scorch in dominant and/or co-dominant trees not to exceed 10% of forested area within the burn boundary.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Karri/Tingle:

- "*Reduce ground fuels in karri or tingle forest types to <8 tonnes per hectare over 60-80% of the total burn area.*
- *Severe crown scorch in dominant and/or co-dominant trees not to exceed 10% of forested area within the burn boundary.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Flats:

- "*To reduce available ground fuels within flats areas to <2 tonnes per hectare, or 50% of prior available fuel levels.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Silvicultural
Standards:
Karri:
Regrowth Burning – Thinned Stands:
[…]"*To provide improved protection to adjacent forests or values from wildfire*." (*Fire Protection Instruction* 61 : p. 4) Issued 14/1/97

Pre-Burn Checklist (CLM 32) 1993
"*This checklist is designed to assist staff in recognising potential environmental considerations within areas proposed for prescribed burning operations.*" (Pre-Burn Checklist (CLM 32) : p. 1) Issued 22/09/93

Part 1 : Environmental Issues
"*The environmental section of the checklist must be completed as the first stage for all burn prescriptions. It allows for the recognition of potential environmental considerations and a subsequent course of action to be nominated.*" (Pre-Burn Checklist (CLM 32) : p. 1) Issued 22/09/93

Part 2 : People and Property
"*The people and property section of the checklist is to be completed prior to the preparation of the prescriptions (CLM 873). It allows for the identification of any object or operation likely to be affected by the burn and action to be taken to ensure necessary protection of such.*" (Pre-Burn Checklist (CLM 32) : p. 1) Issued 22/09/93

Pre-Burn Checklist (CLM 32) 1996
Instructions
"*It is important that the planning of prescribed burns be sufficiently detailed to prevent injury to property. Any object or operation within the burn area must be identified before the prescription is prepared and action taken to ensure its protection.* […]" (Pre-Burn Checklist (CLM 32) : p. 3) Issued 1996

Pre-Burn Checklist (CLM 32) 1991
"*The purpose of this checklist is to assist District staff in recognizing potential environmental problems in areas subject to proposed burning.* […]"(Pre-Burn Checklist (CLM 32) : p. 1) Issued 1991

Final Fire Report – CLM 304
"*The Final Fire Report is to be forwarded to Fire Protection Branch, Como by the District Manager within two pay periods of the completion of fire fighting activities.* […]" (Final Fire Report (CLM 304) : p. 1)

"*3. **Effect of Fuel Reduction Burns**.* […] *The Fuel Age Where Fire Stopped is the age of fuels where the headfire was held. The Fuel Age – Area Last Burnt is to record the age of the fuel that the fire passed through prior to entering the fuel in which the fire was stopped. This is required to distinguish between the initial, intermediate and final fuels, and to give an indication of the expected changes in fire behaviour in the different fuel ages.*" (Final Fire Report (CLM 304) : p. 1) Issued 5/10/93

Burn Prescription – CLM 873
Prescription
Scorch
"*The forest type, condition and lower canopy height will indicate the level of scorch which is acceptable. Scorch height varies with fire intensity which itself depends on the amount of fuel available and the rate of spread of the fire.* […] *CAUTION: Autumn scorch is approximately 1.8 times greater than scorch height in Spring, (800 SID). No scorch height is applicable for flats.*" (Burn Prescription – CLM 873 : p. 3) Issued 22/09/93

Actual Rate of Spread
"*Enter Table 6.14.1 (Jarrah) or 6.14.2 (Southern Forest) with available fuels and acceptable scorch height to determine the actual rate of spread.* […] *For flats, approximate rates of spread can be ascertained by multiplying the prescribed jarrah FDI by 5 (eg: NJ FDI 24m/h x 5 – 120m/hr for flats).*" (Burn Prescription – CLM 873 : p. 3) Issued 22/09/93

Equivalent Rate of Spread Index
"*From Actual Rate of Spread range, determine the Equivalent Rate of Spread Index for each "Standard" forest fuel type (8.0 t/ha NJ, 15-19 t/ha Sthn Forest types) by horizontal reference to the standard column. Again limit this to 4 m/hr.*" (Burn Prescription – CLM 873 : p. 4) Issued 22/09/93

Equivalent Fire Danger Index]
"*Is the same as ROSI only when 'Standard' wind ratios for the applicable forest type are used (ie; 5:1 for NJ - 1.0 correction factor). Wind ratios of less than 5.1 indicate extra wind penetration into a more open stand with a subsequent increase in fire spread. The adjusted equivalent FDl then equates to the ROSI to ensure correct ROS, and therefore scorch heights desired are obtained.*" (Burn Prescription – CLM 873 : p. 4) Issued 22/09/93

Maximum Wind
'*Strength under which burning is permitted must be clearly stated. This must be in the appropriate wind range for the correction factor used.*" (Burn Prescription – CLM 873 : p. 4) Issued 22/09/93

Edging Prescription
"*This section to be completed for all boundaries and must take into account SDI limits, objectives, and adjoining fuels.*[…]. *See Edging Guidelines.*" (Burn Prescription – CLM 873 : p. 4) Issued 22/09/93

Core Lightings
"*This section allows for different strategies and regimes for each lighting to be identified.*

Ignition - indicate lighting number and fuel type to be burnt (eg: 1 st flats). Each burn in the sequence, separate clearly.

FD1 Range - show desired FD1 for each lighting. […]

Strategy - indicate wind direction, desired flight line direction, lighting patterns etc for each lighting.

Resources - indicate resources required for each lighting. Do not be influenced by resource numbers in your District only." (Burn Prescription – CLM 873 : p. 4) Issued 22/09/93

Preparatory Tasks
"*Pre-Burn Checklist (CLM 32) Part 2 'People and Property' must be completed during this stage.*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Edge Preparation
"*After inspection of the burn perimeter indicate on the plan the edges that require special treatment (eg: scrub rolling of karri scrub types, wet gullies, ti-tree swamp edges).*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Fire Behaviour
"*Ensure this section is completed by Operations Officer as each lighting is carried out.*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Certification
"*To formalise the completion of any burn and to ensure that the approved objectives, and the security standards have been achieved, a final inspection (by air and/or ground) must be undertaken and the burn certified complete. This must be done by an experienced District or Regional Officer after the inspection.*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Post Burn Inspection
"*This section must be completed by Operations Officer in time to allow further action to be taken where necessary. Action must be signed off when completed.*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Burn Evaluation
"*This section allows for the end result to be assessed against original objectives.*" (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

Retention of Records
"*The prescription, evaluation and flight plans must be retained at least until the area is next burnt. These documents must be checked in the preparation of subsequent prescriptions to identify any potential problems, unburnt areas etc. This information assists improved planning and performance and aims to avoid repeating errors through ignorance of what happened before*." (Burn Prescription – CLM 873 : p. 5) Issued 22/09/93

WILDFIRE MANUAL – 1993

Wildfire Threat Analysis Manual For Lands Managed … 1993

"*All Districts / Regions are required to maintain a current Wildfire Threat Analysis (WTA) for lands managed by the Department of Conservation and Land Management (CALM).*

WTA underpins all fire protection undertaken by CALM. It is used to identify the threat posed by wildfires, to determine the optimum course of action, to explain fire protection alternatives and the decisions made.

A current WTA is a prerequisite for:

> *Preparation of the fire management section of all management plans.*
>
> *Annual reporting. CALM's fire protection performance indicators are defined in terms of WTA parameters.*
>
> *Completion of the Rating System for Prescribed Burning.*

This manual replaces the 'Wildfire Threat Analysis for SW Forest Areas of Western Australia', revised 9 October 1990.

Since the introduction of the Wildfire Threat Analysis (WTA) system in the forest Regions its application has broadened. Allocation of resources including aircraft for fuel reduction burning is based on a priority rating system which requires a current WTA. Annual and long-term measures of performance are now required by parliament. For fire protection, these are based on the WTA, and it is therefore necessary that a WTA be maintained for all areas.

The WTA principles apply universally. This manual broadens the scope of the guidelines originally issued for the South West areas, and incorporates corrections and amendments suggested by users of the earlier guidelines. […]" (p. 1)

Overview of Wildfire Threat Analysis System
"*The Wildfire Threat Analysis (WTA) is a structured approach that formalises the processes undertaken by experienced fire managers in considering the threat from and responses to wildfires. The WTA aims to:*

* *provide a framework to analyse the best available information on all factors contributing to the wildfire threat, and allow evaluation of alternative responses;*

* *provide a standard and repeatable process for decision making;*

* *permit objective comparisons between different areas with different problems;*

* *support the clear and explicit explanation of the rationale behind fire management decisions; and*

* *provide a rational basis for discussion and conflict resolution in the preparation of management plans.*

The factors that contribute to the wildfire threat are considered to fall into four categories:

* *The community and commercial **VALUES** that are to be protected.*

* *The **RISK OF IGNITION**. ie the probability that a fire will start.*

* *The **SUPPRESSION RESPONSE** possible, which is affected by a range of factors such as the location of forces in relation to the fire, terrain, and access.*

* *The likely **FIRE BEHAVIOUR**, which influences both the extent and severity of damage and the success of any suppression action, and is dependant on fuels, topography and weather conditions.*

The wildfire threat is represented by the combination of four map overlays that summarise the values in each of the categories. In turn, each of these four maps can be supported by maps of the factors that contribute to a category value (Fig. 1).

A single index value for wildfire threat is deliberately not used. The most effective response to counter the threat cannot be determined from an index, as it provides no information about its component parts. Also, while some of the relativities that make up the wildfire threat can be stated with confidence, there is not enough information for an objective and accurate rating to be made in all cases. Managers must not blindly follow a number, but must base their decisions on knowledge of the factors which contribute to the wildfire threat, and be aware of the reliability and uncertainties of the data used to identify this.

Managers must often make decisions on the basis of limited information, but it is important that all the information that is available is considered. The WTA provides a framework to do so. […]" (p. 2)

"*Many of the factors contributing to the wildfire threat are temporally as well as spatially dynamic, hence the WTA maps must be regularly reviewed to keep them current.*" (p. 2)

Guidelines for the Preparation of a Wildfire Threat Analysis
General Information
"*The WTA comprises:*
the Wildfire Threat maps
a separate Wildfire Threat book or file.

The information is displayed on the maps. Record the source of the information, explanatory notes, and non spatial information in the accompanying book." (p. 4)

"*Use the best available information for the preparation of the WTA maps. Contributions from people with knowledge or expertise in a range of related areas is to be encouraged. Areas where information is lacking or poor will become apparent.* […]" (p. 4)

Map Production
"*Wildfire Threat Analysis are required to be prepared wherever fire management activities are proposed to be undertaken on CALM land. The approach is consistent, but the scale at which are prepared depends on the scale of the planning undertaken. In the forest areas the standard scale for mapping is 1:50,000. Elsewhere the scale may be smaller, commensurate with the areas being considered, and the detail of the information available. In all larger scales may be used for specific areas if more detailed analysis is required. Use the scale appropriate to your task.*" (p. 4)

"*WTA maps can be produced using CALM's grid-based GIS 'FMIS' and ESRI's Arc-Plot where digitised data and the appropriate models are available. Access to the programs developed for this will be progressively provided to Regions as the data is captured. Regions with such access can produce updated prints for Districts.*" (p. 5)

The Use of Percentile Weather Conditions

"*Fires (and our planned response to them) are greatly influenced by weather conditions, which vary widely in time and from place to place. An analysis can be undertaken for any chosen conditions. To provide a consistent basis for planning and comparison between areas the 95 percentile conditions for the restricted and prohibited periods (the lire season) are chosen. ie fire weather conditions will be more severe on 5% of days. In areas of high values and a high probability of fires starting which cannot be reduced, this level of risk may be unacceptable, and a higher percentile selected at which to conduct an additional analysis. (An analysis at the 95 percentile will still be required to permit comparison with other areas.)*

To determine the 95% conditions, the records for all available years at a particular location are ranked according to the calculated Fire Danger Index, and the weather conditions for the 95% record are identified.[…] *Local records or Bureau of Meteorology records will need to be used elsewhere.*" (p. 5)

Hatching System for Major Theme Maps

"*Hatching is used on the Values, Risks, Suppression Response, and Fire Behaviour overlays to show the value in each category, the density of hatching representing the severity at that point. Each overlay is hatched at a different angle (450 to the previous one), so when overlaid the combined hatching shows the patterns of the wildfire threat, and the extent of the contribution by each factor.*

The hatch angle and spacing used for GIS maps is stated in the following notes. The spacing has been modified from the earlier guidelines, and has been chosen to provide an acceptable visual display of the severity. For manually produced maps the same angles are to be used, but the spacing may be increased to reduce the work involved. For most manual preparation it is recommended the spacings be increased to approximately three times that used in the GIS maps." (p. 5)

Supporting Data Maps

"*Where maps are manually prepared, the Values' and 'Ignition Risk' are usually mapped directly, but the 'Suppression Response' and 'Fire Behaviour' maps are derived from supporting data maps (see Fig 1). In the GIS mapping there may be additional layers or intermediate themes where updating of mapped information involves modelling (eg see Fig 3). In all cases where the final value is not mapped directly, there is scope for errors to be introduced. Grouping into classes at the supporting data map level and then using the mid-class values in subsequent calculations will lose accuracy and can introduce cumulative errors.*

Some grouping or averaging is inevitable as we define a boundary (create a polygon) on a nonuniform area. This occurs for example when large areas are assigned the same fuel quantity despite variations in previous burn and subsequent fuel accumulation. Don't compound these inherent errors by hatching in a standard class with a mid-point value that may be quite different from your 'average' value, but show the actual values to be used in any calculations.

In all cases, collect the best available data. Do not amalgamate information into larger areas or classes at the data map level if it can be avoided. […]. *For manual preparation of the Vv7A maps, some grouping at the data map level may be necessary to reduce the number of individual calculations required to a manageable level, but keep this to a minimum.*

Notwithstanding that when collating data actual (unclassified) values are to be recorded, a classification and hatching system is outlined for supporting data maps. It is sometimes useful to be able to demonstrate the relative importance of the components of the final theme overlay. eg is the predicted severe fire behaviour due to fuel, or slope, or both? Often, however, the combination of the data maps becomes complicated with too much information to be useful. When maps are overlaid, new polygons are formed, as illustrated." (p. 6)

"*Where the initial data maps are detailed, with many polygons each with a discrete value, there are too many polygons in the combined map to be meaningful, This is especially the case where values are calculated/modelled within the GIS (eg slope calculations, wind ratio modelling, travel time modelling).In the extreme case, each pixel (FMIS grid cell) may have a different value, and polygon. A map showing thousands*

of polygons many with only sightly different values would be too complex to be readily interpretable. The hatching system and classes outlined amalgamate many of these polygons, which is useful where a visual display is to be generated." (p. 6)

"*Prints of the classified values for the supporting maps are produced as a matter of course where any modelling has been carried out in the GIS to facilitate quick checking for gross errors and inconsistencies. These prints can also be used to demonstrate the contribution of each component. The hatching system also allows for the supporting maps to be overlaid in a similar manner to the four major theme maps which summarise the wildfire threat, but such overlays are more expensive and only produced as required.*" (p. 7)

Preparing Map 1 : Values At Risk

"[…] *Both market (tangible) and non-market (intangible) values are grouped into broad classes. The members of a class are those perceived to be approximately equal.*

The classification of values outlines in Table 1 was initially developed for CALM lands in the forest areas of south western Australia. It is not an exhaustive list of all possible values either in the forest either in the forest areas or elsewhere, but provides a guide to permit local values to be classified in a consistent manner.

Where special circumstances exist and a value is allocated to other than its obvious group or the allocation is open to interpretation, the ***reasons for the assignment must be recorded*** *in the WTA Book.*" (p. 9)

"*A zone of influence or buffer – the area in which it is considered a running wildfire would pose a significant risk- is shown around each value. The size and shape of this zone varies to reflect directional variation in the perceived threat from wildfire due to predominant wind direction. The influence zone is extended furthest in the direction of prevailing winds associated with severe fire weather.* […]" (p. 9)

"*Experience has demonstrated that for fires burning in WA forests under adverse weather conditions, at least 3km of low fuel/moderate fire behaviour area is required to catch spot fires and provide the opportunity for suppression before the fire burns through the area. Whilst spotting is less of a problem with fires in other fuel types (woodlands, grasslands and shrublands) fires spread faster and therefore further during the time taken for suppression, and so the potential threat from fires in a similar influence zone is considered.*

The standard (default) influence zone extends:
3km NW to E of the value; and
1km in other directions.

These zones may be varied, but the reasons must be recorded in the WTA Book.

Influence zones are shown hatched on an overlay, the density corresponding to the category of the value generating the zone. Where zones overlap, only the highest value zone is shown." (p. 9)

REFER TO DOCUMENT FOR - ***Table 1 : Guide to Classification and Mapping Values for Wildfire Threat Analysis Based on Forest Areas of South Western Australia***

Preparing Map 2 : Risk of Ignition

"*Ignition risk is the probability that a fire will start, not that it will necessarily spread or cause damage (factors that are addressed separately in the Fire Behaviour and Values themes).*

Fires are caused either by lightning or human activity. Fire history alone is not an entirely satisfactory measure of ignition risk as not all fires are reported (particularly in less populated areas) and because circumstances may change with time. Activities which caused fires in the past may now occur less frequently or not at all. eg where the land clearing phase is replaced by the management of developed farmland, there is a marked reduction in the risk of escapes from such burns.

Historical data can identify lightning prone areas, and provides information on correlations between activities and fires. […]" (p. 12)

"*As the influence of activities leading to an ignition risk extends over an area, risk zones are mapped. These are shown hatched on an overlay according to the peak frequency of occurrence of ignition sources during the fire period (Table 2). The greater the risk, the closer the line spacing.*" (p. 12)

"***Table 2 : Ignition Risk Classes***

	Line Spacing	***Hatch Dir***
HIGH: (potential ignitions on >4 days/month)	***2.25mm***	***90 degrees (Horizontal)***
Examples:		
Regular path of summer storms and lightning strikes recorded. Areas within spotting distance (up to 3km) of active land clearing involving burning, or other planned burning (eg regeneration burning, stubble burning) High visitor use areas involving camping, barbecues, or marron fires. Recent history of ignitions from other sources. (Eg, deliberate lightings) and activity pattern believed unchanged.		
MODERATE: (1-4 sources/month)	***4.9 mm***	***90 degrees***
Examples		
History indicates little/no past ignition, moderate visitor use, reasonable access for visitors.		
LOW: (<1 source/month)	***8.0 mm***	***90 degrees***
No recorded history of fires. Little/no human activity at or near site, poor access for visitors.		
Summer storms rare. No recorded lightning strikes." (p. 12)		

Preparing Map 3 : Suppression Response

"*Suppression response reflects the time taken to detect a fire, for firefighters to reach the fire, and for effective fireline to be constructed around the fire. Detection Time, Travel Time, and Fireline Construction Rate maps can be prepared as separate overlays that, when combined, shown the variation in times which are grouped into the suppression response classes.*" (p. 13)

"'*Suppression Response' is expressed in five classes (Table 3). It is assumed that any fire can be suppressed provided adequate resources are available on site at any time of ignition.* […]" (p. 13)

Supporting Data for Suppression Response

"*To prepare the 'Suppression Response' map, data is required for detection and travel times and fireline construction rates.* […]" (p. 14)

Map 3.1 Detection Time
"[…] *Surveillance schedules and the concern and vigilance of neighbours usually increase with increasing fire danger. To provide a basis for comparison, the 95 percentile weather conditions (see previous note) are chosen.*" (p. 14)

Map 3.3 Fireline Construction
"*The time required to complete fireline construction depends on the fire itself as well as on the method of construction, the vegetation, and terrain. To compare only the factors that are inherent in the site itself, fireline construction is expressed as a rate (Table 6), thus making it independent of fire size.*

As a construction rate is expressed as elapsed time, it can be readily added to the detection and travel times to classify areas for suppression response. Constructed rate is the time taken to construct a standard length of fireline by the method and machinery/equipment appropriate to and commonly available in the area. This time is a measure of the physical difficulties of fireline construction at that site, not the time required to suppress a fire (which will also depend on the fire behaviour, the forces available, and the fire size)." (p. 16)

Preparing Map 4 : Headfire Behaviour
"*Headfire behaviour determines the suppression action crews can take in fighting a fire. It is a function of fuels, weather and topography.* […]" (p. 17)

"*The Headfire Behaviour is mapped in classes that have practical application (Table 7).*[…]" (p. 17)

Calculating Headfire Rate of Spread and Intensity
"*The fuel type will determine the fire behaviour model used to calculate the HFROS.* […]" (p. 17)

"*HFROS can be calculated from tables and meters, but this is more rapidly done using the "FIRE' program (Muller 1990). This program and User Manual were distributed to all Forest Districts in 1990. This program has been updated to include McCaw's preliminary findings from his shrubland fire research, and is appended to this manual.* […]" (p. 17)

"*Whether using tables or the FIRE program, the work of preparing or updating the fire behaviour map can be minimised by using a systematic approach. The combined map overlays can result in many polygons (areas) with different combinations of fuel type, fuel quantity, wind ratio and slope. All combinations can be rapidly calculated by the FIRE program, creating a large output. Rather than try to identify individual polygons to which to relate the figures, it is recommended that the limiting values for each class first be identified. Classification then becomes rapid.*" (p. 17-18)

Supporting Data for Fire Behaviour Map
"*The spatial data to be collated depends on the requirements of the fire spread models being applied. As previously noted, the actual value of the data is recorded and used in calculations, with grouping into classes deferred until required to provide visual displays. The source and reliability of the data is to be recorded in the WTA book. In the GIS the reliability of all data is tracked and recorded on each map.*" (p. 19)

Map 4.1 : Fuel Type
"*Fuel type determines the fire behaviour model which will be applied. Standard vegetation (eg Beard, Smith) or API (aerial photo-interpretation) maps are used to identify the vegetation types to which fuel models are assigned. Table 8 is a guide to the application of the fuel models.*" (p. 19)

NOTE: REFER TO DOCUMENT FOR - ***Table 8 : Fuel Models Assigned to Vegetation Classes***

Map 4.2 : Fuel Quantity
"*Fuel quantity is required to calculate the headfire rate of spread (HFROS) for forest fire models, and its intensity (I) for all fires. In many cases the fuel quantity will be derived from fuel age maps. Fuel accumulation rates used to determine the fuel quantities are to be verified by comparison with fuel sampling carried out for prescribed burning in the area.* […] *Details of how fuel quantities were determined must be recorded in the WTA book.*" (p. 20)

Map 4.3 : Wind Ratio
"*Standard wind forecasting and recording is for a 10m tower in the open. For all practical purposes this is considered to be about the same as the tower wind recorded 15m above a forest canopy (provided this is beyond the 'edge effect'), and the guide in the Forest Fire Behaviour Tables for WA (FFBT) can be applied.*

The FFBT is based on empirical date derived from wind speed measured at 1-2m above ground. Wind ratio is an estimate of the reduction in ground wind speed compared with tower wind speed due to friction, which varies with the vegetation type.

The equations used to calculate HFROS in both the 'FIRE' program and the GIS for both grass and forest fuels have been written for ground winds, therefore wind ratios must be mapped. In the GIS wind ratio is modelled from old API data, cutting history, and subsequent stand growth modelling. It is printed for checking in the classes shown in table 9." (p. 21)

Map 4.4 : Slope
"*Slope is recorded in the GIS in one degree classes. For display or manually prepared maps it is portrayed in five degree classes as in table 9.*" (p. 22)

Appendix 1 Summary of Information Required for GIS Wildfire Threat Analysis

	"*Display Requirements*	*Data/Analysis Requirements*
Map 1 MAJOR VALUES	** Values to be identified as to type (eg. recreation camp) by symbol.*	** Location of defined values. The 'Classification of Values' attached) is indicative, not exhaustive. Additional values may be defined For particular areas.*
.	** All values belonging within group identified by colour*	
	** Buffer zones generated around values shown by hatch (45 degrees from vertical).*	
Map 2 RISK OF IGNITION	** Risk classes shown as horizontal hatch.*	** Statistical (non GIS) information on fire causes*
		** Ignition history - a GIS data base to be established and maintained annually to record location and cause.*
		** Geographic location of activities.*
Map 3 SUPPRESSION RESPONSE	** Suppression base (work centre).*	*(* Derived from maps 3.1, 3.2, 3.3.)*

	** Time zones (hatch 135 degrees from vertical - NW-SE).*	
3.1 Wildfire Detection	** Hatch (45 degrees) in nominated time zones.*	** 'Contours' of seen areas and levels below seen area* *(eg. areas 20m below line of sight, 40m below etc.) based on detection system (towers, spotter aircraft, land-holders).*
3.2 Travel Time	** Hatch (135degrees) in nominated*	** Road classification for all time zones roads and tracks (incl. non-maintained).* ** Terrain classification: Slope, vegetation, soil type, streams, swamps.* ** Network analysis of road and track system.* ** Buffer generation (dependant on terrain class) from points at short time intervals along road/track network. (ie. total time to a buffer boundary requires optimising the travel time along road system plus off-road travel.)*
3.3 Fireline Production	** Hatch (horizontal) in nominate time zones*	** Terrain classification (data as required in 3.2)*
Map 4 HEADFIRE	** Hatch (vertical) in suppression difficulty classes.* ** Weather inputs.*	** Derived from 4.1 and 4.2*
4.1 Headfire Rates of Spread	** Hatch (vertical) in* ** Weather inputs*	** Calculated from data in 4.3.1-4.3.5 by equations supplied (see Appendix 2) These may be replaced if future approved fire spread models are derived.*
4.2 Headfire Intensity	** Hatch (vertical) in defined classes.* ** Weather inputs.*	** Calculated from data in 4.3.1 – 4.3.5 by equations supplied.* *These may be replaced if future approved fire spread models are derived.*
4.3.1 Fuel Type	** Hatch (horizontal) type classes as defined.*	** Vegetation map.*

4.3.2 Fuel Quantity	** Hatch (vertical) in nominated classes.*	** Vegetation type.* ** Year last burnt.* ** Crown cover (density).* ** Co-dominant vegetation height (tree, shrubland or grass)* *OR* ** Direct input of fuel quantities where known.*
4.3.3 Wind Ratios	** Hatch (135 degrees) in defined ratio classes.*	** Crown cover (density).* ** Vegetation height.* ** Exposure (ridge, slope, gully).*
4.3.4 Slope	** Hatch (45 degrees) defined slope classes.*	** Slopes.*
4.3.5 Weather	** Not normally a separate map display but conditions identified in 4.1 and 4.2.*	** Long term weather and SMC records. (non GIS)*

** Footnote:* *Some of these may in turn be derived from other data, eg crown cover may be derived from API (aerial photo interpretation) type mapping, subsequent logging history and growth models.*" (p. 1-3)

Appendix 2
Rating System for Prescribed Burning (Revised July 1993)

			Index Value
"***1. <u>Fire Protection Values</u>.***			
Factor 1.1:	***Values at or Near Sites***.		
	(Site is defined as the area proposed for prescribed burning.)		
	A.	*Within Wildfire Threat Analysis (WTA) values zone category 1.*	*80*
	B.	*Within WTA values zone category 2*	*50*
	C.	*Within WTA values zone category 3, or within 3km of WTA values zone 1*	*30*
	D.	*Within WTA values zone category 4, or within 3 km of WTA zone category 2*	*20*
	E.	*Within WTA values zone category 5, or Within 3km of WTA zone category 3*	*15*
Factor 1.2:	***Risk of Ignition. (As per WTA maps)***		
	A.	*High Risk areas within burn*	*30*
	B.	*Moderate Risk areas within burn*	*15*
	C.	*Low Risk areas within burn*	*5*
Factor 1.3:	***Suppression Response. (As per WTA maps)***		
	A.	*Within Poor response zone*	*40*
	B.	*Within Slow response zone*	*30*
	C.	*Within Moderate response zone*	*20*
	D.	*Within Rapid response zone*	*10*

	E.	*Within Immediate response zone*	*0*
Factor 1.4:	***Fuels/Fire Behaviour. (Refer WTA maps)***		
	A.	*Category 1 – indirect attack unlikely to succeed*	*80*
	B.	*Category 2 – direct attack not possible*	*60*
	C.	*Category 3 – machine attack possible*	*30*
	D.	*Category 4 – hand attack feasible*	*10*
Factor 1.5	***Strategic Value of Burn.*** *To stop the run of major fires, strategic fuel reduction in forest Fuels should be planned to be 3 km wide. Small burns (hand-burns) would thus not normally rate under this factor.* *When considering potential fire run, include all uncleared land Irrespective of tenure.*		
	A.	*Burn forms part of a strategic buffer or will break up a major fire run of > 15 km (including private property) in fuels older than half rotation length.*	*60*
	B.	*Burn will break up a fire run of 10-15 km in fuels older than half rotation age.*	*30*
	C.	*Burn will break up a fire run of <10 km in fuels older than half rotation age.*	*10*
	D.	*No strategic value*	*0*
2. Other Management Values			
Factor 2.1:	***Dieback Impact on Site of Potential Fire Suppression activities****.*		
	A.	*High*	*20*
	B.	*Moderate*	*10*
	C.	*Low*	*0*
Factor 2.2:	***Compliance with Other Departmental Objectives.*** *Burn is required to meet objectives other than fire protection (eg advance burn, habitat management), or the timing of a fire protection burn affects another operation. (eg dieback photography program).*		
	A.	*Burn is a <u>critical</u> prerequisite for another operation*	*40*
	B.	*Burn is an <u>important</u> prerequisite for other objectives.*	*20*
	C.	*Burn is a <u>desirable</u> prerequisite for other objectives.*	*10*
	D.	*Burn has <u>minor</u> significance for other operations.*	*0*" (p. 5-6)

<u>'Fire' Program : Ver 1.3 : User Manual. 1993</u>

"*This program has been written to facilitate the rapid calculation of headfire rate of spread (ROS) and headfire intensity for different fuel, slope and weather conditions, as required for preparation of the Wildfire Threat Analysis (WTA).*

In preparing a WTA, the weather conditions for the analysis are pre-defined (usually the 95 percentile level). The projected fire behaviour then determines what, if any, suppression action may be successful.

Often, large areas are defined wherein successful headfire suppression is not possible under the prevailing (95 percentile) weather conditions. It can be useful to know the limiting weather conditions under which headfires can be expected to be successfully suppressed in a particular area (fuel/slope combination). Because of the laborious nature of the calculations, this has not been feasible where the WTA is prepared manually. This program permits a range of weather conditions to be readily input, and Rate of Spread and intensity rapidly calculated, permitting the 'limiting weather conditions' to be easily determined.

Similarly, 'what-if' scenarios can be played by varying fuel/slope parameters as well as weather parameters.

Whilst written primarily to support the Wildfire Threat Analysis, the program is sufficiently flexible to provide useful support for fire intelligence officers." (p.2)

TIMBER HARVESTING … 1993 ED. – 1993

Timber Harvesting in Western Australia … 1993 Ed. 1993

PART 1 : CODE OF LOGGING PRACTICE

Preface

"*This new publication 'Timber Harvesting in WA' contains revised editions of the 'Code of Logging Practice' (the Code) and the 'Manual of Logging Specifications' (the Manual).*

The Code and the Manual form parts of a hierarchy of rules relevant to timber harvesting operations controlled by the Department of Conservation and Land Management.

- *Conservation and Land Management Act (1984)*
- *Forest Management Regulations 1993 (gazetted 9 February 1993).*
- *Code of Logging Practice.*
- *Manual of Logging Specifications.*
- *Bush Fires Act*
- *Individual Contracts to Supply negotiated between a logging contractor and CALM.*
- *Forest Produce Licence.*" (p. i)

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)

Section 7 : Environmental Protection
Fire – All Forest Areas
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

PART 2 : MANUAL OF LOGGING SPECIFICATIONS

Section 1 : Planning and Monitoring
Specification 1.1 Harvesting and Monitoring and Regeneration Plans
Part A : Hardwood
"*Complete details are contained in the Department's 'Provisional Manual of Hardwood Logging Planning'. The following is a summary.*" (p. 20)

1. Responsibilities
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

2. Plan Types
2.3 Short Term Integrated Harvesting and Regeneration Plans
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

3. Plan Amendment
NOTE: REFER TO ENTRY UNDER 1992 EDITION (SIMILAR WORDING)

8. Monitoring and Records
NOTE: REFER TO ENTRY UNDER 1992 EDITION (SIMILAR WORDING)

Section 5 : Environmental Protection
Specification 5.7 : Protection From Fire
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

MANAGEMENT PLAN - 1992

<u>Walpole-Nornalup National Park Management Plan 1992-2002. 1992</u>

Flora and Vegetation
Objective
"*Protect and maintain existing plant communities, emphasising priority and key species.*" (p. 22)

Actions
"*4. Protect populations of species that are vulnerable to particular fire regimes by appropriate fire management strategies (see Section 10.0 Fire).*" (p. 22)

Management for Conservation – Protection
Fire
Objectives
[…]
- "*Encourage and maintain the composition and diversity of plant and animal communities.*
- *Provide for the survival of populations of threatened or restricted plant and animal species by the maintenance of required habitat.*

[…]
- *Reduce the incidence of unplanned fires.*
- *Restrict fires, where possible, to a single cell.*" (p. 33)

Strategies

"*In order to achieve the overall objectives of protecting life, property and environmental values and to manage natural ecosystems, a system of three separate fire regimes will be implemented:*

> ***No Planned Burn Regime***
> *Parts of most major vegetation types will not be burnt by prescribed fire within the life of the plan and will be reviewed at the end of the period of the plan. These areas are usually located away from likely ignition sources, such as major roads and recreation areas. Maximum protection needs to be ensured for these areas, including maintenance of good perimeter access and regular burning of parts of adjacent areas.*
>
> ***Vegetation Management Regime (VMR)***
> *VMR aims to contribute to ecological diversity (that is, a variety of fuel ages) within the vegetation communities. Most of these regimes will entail rotation burns of about 10-20 years.* […] *Each VMR area will be reviewed annually in light of additional scientific knowledge to determine whether or not it should be burnt for ecological or protection purposes.*
>
> ***Fuel Reduction Regimes (FRR)***
> *FRR will be applied to designated areas whenever ground fuel loads exceed critical levels at which fire containment by direct attack, under hot summer conditions, becomes very difficult and unsafe for firefighters. The rotation period between burns will vary from approximately six to eight years, depending on the rate of fuel accumulation.*

The prescribed burning of wide buffers aims to restrict the spread of wildfires. Areas of low fuel will also be located adjacent to areas with a high risk of fire ignition (for example, recreation areas) and where high values are at risk (for example, townships). They will consist of perimeter buffers and strategically location blocks throughout the Park.

Map 4 outlines the overall fire management strategy for the Park. The plan achieves the greatest diversity of regimes possible within the constraints of the protection of life and property, and CALM resources. While most of the coastal areas are proposed No Planned Burn Regime, recent burns will ensure a diversity of fuel age for the life of this plan.

A long unburnt area of tingle forest in the Hilltop areas will be maintained on a No Planned Burn Regime.[…]" (p. 34)

"*Where possible, adjacent blocks will be prescribed burnt in alternate years. Tingle forest most readily burns in summer and autumn when moisture levels are low enough to support a fire. This coincides with the dormant period of relictual invertebrates. Fuel reduction burning in the Nuyts Wilderness Area for protection of people, property and environmental values will be achieved by wind-driven buffers (see Section 20.4).* […]" (p. 35)

"[…] *Most 'special conservation' zones are under the No Planned Burn Regime that will ensure most vegetation communities will have a late serial stage in the Park, with the exception of the Conspicuous and Nut Road areas that are proposed Vegetation Management Regime. This area contains few species with a long juvenile period (thereby requiring longer periods without burning) that are not found elsewhere in 'special conservation' zones, and the VMR will help protect the Peaceful Bay townsite.* […]" (p. 35)

Actions

Fire Prevention

"*1. Confine prescribed burning by established tracks or firebreaks, and ensure burning complies with written prescriptions approved by CALM's Walpole District Manager or Southern Forest Regional Manager. Prescribed burn frequency will depend on the rate of fuel accumulation, but is not likely to be less than six years. Where possible it is planned to conduct at least 40 percent of burns in autumn*

or spring. Where possible, successive burns in each block will be programmed in different seasons. All burn prescriptions will take into account the need for dieback disease control.

[…]

3. *Where known or suspected gazetted threatened flora or fauna occur within proposed burn areas, the burn will be modified, relocated or deferred. Where it is a requirement of the species, or where, in exceptional circumstances, it is considered by CALM that the burn should proceed, Ministerial permission to 'take' flora will be obtained.*

[…]

5. *Revise strategies and actions as more fire information becomes available, when conditions change, or whenever major wildfires occur.*" (p. 35)

"*7.* *Define roads required for fire control and essential management activities. Those roads considered unsuitable for public use will remain closed to the public. Management vehicles using these roads will be subject to dieback disease hygiene requirements.*

[…]" (p. 36)

Fire Management

"*11.* *Implement prescribed burns, in accordance with the annual burning plan. Implement a range of fire regimes, including variation in season, intensity and size, particularly between different blocks according to the fire management plan (Map 4).*

[…]

13. *If a fire exclusion area is burnt by wildfire it will be exchanged, wherever possible, with an area of similar size and ecological type after careful review of the ecological and protection requirements.*" (p. 36)

Fire Suppression

"*14.* *Contain all fires in or threatening the Park.* […]

15. *Minimise construction of any new firebreaks. In the case of a wildfire, limit construction to those necessary for the protection of priority values, rehabilitate any subsequent unnecessary firebreaks. Construct new firebreaks according to strict dieback disease hygiene principles. Avoid vegetation community types 1, 3, 5, 6 and 10 for firebreak construction where possible (see Section 7.0 Flora, Table 4 for vegetation community types).*" (p. 36)

TIMBER HARVESTING … 1992 ED. – 1992

<u>Timber Harvesting in Western Australia … 1992 Ed. 1992</u>

PART 1 : CODE OF LOGGING PRACTICE

Preface

" *'Timber Harvesting in WA' contains, under one cover, revised editions of the 'Code of Logging Practice' and the 'Manual of Logging Specifications'.*

The Code and the Manual are parts of a hierarchy of rules relevant to timber harvesting (logging) operations controlled by the Department of CALM:

* *CALM Act (1984) and other relevant Acts.*

* *Regulations under the CALM Act and other relevant Acts. (Note: Forest Resource Management Regulations under the CALM Act are currently being prepared. Until they are endorsed by Parliament, regulations under the Forest Act (1918) apply.)*

* *Manual of Logging Specifications, and other CALM guidelines relevant to timber harvesting.*
* *Log Supply Contracts between CALM and logging contractors, and Forest Produce Harvesting or Collection Licences*." (p. i)

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)

Section 7 : Environmental Protection
Fire – All Forest Areas
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PART 2 : MANUAL OF LOGGING SPECIFICATIONS

Section 1 : Planning and Monitoring
Specification 1.1 : Harvesting and Regeneration Plans
Part A : Hardwood
"*Complete details are contained in the Department's 'Manual of Hardwood Harvesting Regeneration Planning'. The following is a summary.*" (p. 23)

1.1 Responsibilities
NOTE: REFER TO ENTRIES UNDER 1990 EDITION (SIMILAR WORDING)

2. Plan Types
2.3 Short Term Integrated Harvesting and Regeneration Plan
NOTE: REFER TO ENTRIES UNDER 1990 EDITION

3.Plan Amendment
NOTE: REFER TO ENTRIES UNDER 1990 EDITION (SIMILAR WORDING)
EXCEPT FOR –
8. Monitoring and Records
"*District staff must maintain up-to-date field records of areas cut over and silviculturally treated. For each coupe, a Coupe Silvicultural Report (CLM 160) must be completed as quickly as possible following the completion of harvesting. (Refer Attachment 1.1.2)*

A Post Operation Checklist (CLM 813) must be completely between 12 and 24 months following the completion of harvesting. (Refer Attachment 1.1.3)" (p. 27)

Section 5 : Environmental Protection
Specification 5.7 : Protection from Fire
NOTE: REFER TO ENTRIES UNDER 1990 EDITION (SIMILAR WORDING)

LEGISLATION - 1991

<u>Conservation and Land Management Amendment Act No. 20 of 1991</u>

"*AN ACT to amend the Conservation and Land Management Act 1984, and to consequently amend certain other Acts.*

[Assented to 25 June 1991.]" (p. 1)

Section 33 Amended

"*21. Section 33 of the principal Act is amended –*

(a) in subsection (1) –

[…]

(dc) to promote the conservation of water, as to both quantity and quality, on land referred to in paragraph (a);

(ii) in paragraph (e) by deleting subparagraphs (i) and (ii) and substituting the following subparagraphs -

' (i) the management of land to which this Act applies;" (p. 12)

"*(ii) the conservation and protection of flora and fauna; and*
(iii) the taxonomy of flora and introduced plants,';
and
(iii) in paragraph (f) by inserting after 'other person' the following -
' , whether in the State or elsewhere';

(b) in subsection (3), by deleting paragraph (b) and substituting the following paragraph –

(i) in the case of nature reserves and marine nature reserves, in such a manner that only necessary operations, within the meaning in section 33A (1) are undertaken;

(ii) in the case of national parks, conservation parks and marine parks, in such a manner that only compatible operations, within the meaning in section 33A(2), are undertaken; or

(iii) in any other case, in accordance with the provisions of section 56 applicable to the land.'.
and

(c) by deleting subsection (4)." (p. 13)

Section 33A Inserted

"*22. After section 33 of the principal Act the following section is inserted-*

Definition of 'necessary operations' etc.

' 33A. (1) In section 33 (3) (b) 'necessary operations' means those that are necessary for the preservation or protection of persons, property, land, flora or fauna, or for the preparation of a management plan." (p. 13)

Section 55 Amended

"*27. Section 55 of the principal Act is amended by inserting after subsection (1) the following subsection (1) the following subsection-*

' (1a) A management plan for an indigenous State forest or timber reserve shall specify the purpose, or combination of purposes, for which it is reserved being one or more of the following purposes-

(a) conservation;
(b) recreation;
(c) timber production on a sustained yield basis;
(d) water catchment protection; or
(e) other purpose being a purpose prescribed by the regulations.'." (p. 17)

Section 56 Amended
"*28. Section 56 of the principal Act is amended-*

(a) in subsection (1)-

(i) by repealing paragraph (a) and substituting the following paragraph-

' (a) in the case of indigenous State forests or timber reserves, to achieve the purpose, or combination of purposes, provided for in the proposed management plan under section 55 (1a);';

(ii) in paragraph (c) by inserting after 'national parks' the following-

' and conservation parks';

and

(iii) in paragraph (d) by inserting after 'and fauna' the following-

' , and to preserve any feature of archaeological historic or scientific interest';

and

(b) *by repealing subsection (2).*" (p. 17)

Division 2 of Part V Repealed and a Division Substituted
"*32. Part V of the principal Act is amended by repealing Division 2 and substituting the following Division-*

' Division 2 – Classification of Land

Land may be classified

62.[…]
(2) A classification of land or waters as a temporary control area under subsection (1)(d) shall only be made for the purposes of public safety or the protection of flora or fauna, or both flora and fauna, and a notice of classification –

(a) shall not have effect for a period exceeding 90 days;
but
(b) may be made more than once for the same purpose and for the same area." (p. 19)

"*(3) A classification, or amendment of classification, of any land or waters shall not be made under this section –*

(a) unless it is in conformity with the provision of section 56 which is relevant to, or any management plan for, that land or those waters; and

(b) in the case of land to which section 16 applies, unless the owner, and any person occupying the land with the consent of the owner, has given approval in writing to the classification or the amended classification.

(4) In this section 'controlling body' means the Commission or the Authority.'. " (p. 20)

Unlawfully Lighting Fires
"*104. (1) A person shall not without lawful authority –*

(a) light or kindle, or assist another person in lighting or kindling, any fire within the boundaries or within 20 metres of any boundary of land to which this Part applies; or
(b) leave, without taking due precaution against its spreading or causing injury, a fire lighted or kindled as mentioned in paragraph (a),
if in either case any forest produce is burnt or injured, or is in danger of being burnt or injured.

Penalty: $10 000 and imprisonment for one year.

[…]" (p. 25)

Setting Fire to Bush or Grass Without Notice to Forest Officer
"*105. (1) A person shall not set fire in the open air to any tree, wood, bush or grass on any land that is contiguous to a State forest or timber reserve, without giving notice of his intention to a forest officer, so as to allow a forest officer to be present at the firing.*

Penalty: $4 000 and imprisonment for 6 months.

[…]" (p. 25-26)

POLICY STATEMENT- 1991

Policy Statement No. 9 : Conservation of Endangered Flora in the Wild. 1991

Strategies
"*5.8 Ensure that any burning program (for fire protection purposes) will not cause irreparable damage to species of threatened flora known to be susceptible to fire.*" (p. 4)

POLICY STATEMENT- 1991

Policy Statement No. 18 : Recreation. 1991

Protection of Recreation Site Values
Policy
"*1.10.4 Recreation sites and facilities will be protected from wildfires by the development of fuel reduced zones, prescribed burning or mechanical means.*" (p. 22)

STRATEGIC PLAN – 1991

CALM Annual Report 1 July 1990 to 30 June 1991. 1991

NOTE: THE STRATEGIC PLAN 1989-1993 IS REPRINTED WITH AN ADDITIONAL CLAUSE (SHOWN IN BOLD UNDER THE FOLLOWING SECTION) –

"*To achieve the primary objectives the Department will:*" (p. 11)

"***Prepare and implement management plans for lands and waters entrusted to the Department.***

This will involve:

- *Establishing priorities for management plan preparation according to set criteria.*
- *Preparing and implementing management plans according to agreed priorities.*
- ***Developing and implementing 'Interim Guidelines for Operations', according to an approved procedure and format, where there is a need for protection of people, property, land, flora and where there is no approved management plan***." (p. 14)

SILVICULTURE SPECIFICATION – 1991

Silviculture Specification 1/91 : Fire as a Silvicultural Tool in the Jarrah Forest

1.0 Introduction
"*Fire is the most important management tool available for extensive application in the forest. It is most prominent in hazard reduction burning, but it also has significant silvicultural use – particularly for the regeneration process (e.g. for creating ashbeds and stimulating seedfall).*

Since the 1960's rotational fuel reduction has been a pre-eminent concern in the management of many jarrah stands, but burning practices and priorities are adjusted to accommodate a variety of specific fire management objectives, including ecological, silvicultural and hazard reduction needs. This specification seeks to link burning strategies with silvicultural objectives by defining:

(1) how burning can achieve silvicultural goals;
(2) *the range of burning intensities to meet specific burning objectives*
[…]" (p. 2)

2.0 Fire Characteristics
"*Fire intensity is useful as a measure of the behaviour of a fire and its potential impact on vegetation. The principle variables that determine fire intensity in the jarrah forest are the rate of spread of the fire and the amount of fuel consumed in the flaming zone.* […]

[…]*The Soil Dryness Index (SDI) provides a good indication of the moisture content of woody material that has been on the ground for more than 2 years.*" (p. 2)

3.0 Types of Burning
"*The following types of burning are referred to in the text and their value for both silviculture and fire protection are discussed.*

3.1 Pre-harvest Burning
A burn which is carried out immediately prior to a timber harvesting operation is termed an advance burn.
[…]

Burn intensity will vary and is not usually an important silvicultural factor except where it may cause the abortion of buds from a shelterwood stand or may damage the bole or crown of trees to be retained. A low intensity burn (<350 kW/m) is generally preferred.

[…]
3.2 Post-harvesting Burning
"*Burning following harvesting can be divided into three types depending on the primary objective.*

(a) Tops disposal burning is carried out to reduce hazard by the removal of flash fuels and woody material up to 2.5 cm in diameter. […]

If regeneration is already established, tops disposal burning must occur within 2 years of harvesting.
[…]

Tops disposal burns are usually low intensity, the appropriate intensity is given on Table 1. To protect existing trees these burns must also take account of soil dryness index (Table 1).

[…]
(b) Release burning is carried out to enhance the development of regeneration. It is particularly important where there has not been an advance burn. This burn is also of value in fuel reduction. The silvicultural objectives include:
- *the removal of scrub competition*
- *the stimulation of dynamic growth of lignotubers*
- *removal of poorly-formed saplings*

Release burning must occur within 2 years of harvesting. Burn intensity will vary with the condition of the advanced growth. A low intensity is sufficient to stimulate ground coppice, but a fire of moderate intensity will be required where deformed saplings need to be burn back to reshoot from ground level. Appropriate intensities are given on Table 1. As hot burns in dry soil conditions will sometimes kill lignotubers these burns must conform with the constraints of the soil dryness index (SDI – Table 1).

(c) Regeneration burning is carried out in the jarrah forest where the objective is
- *the removal of scrub competition*
- *the creation of suitable seedbed*
- *the stimulation of seedfall*" (p. 3)

"*These objectives are pursued on all areas cut to shelterwood as a means of establishing regeneration. There is also significant fuel reduction benefit.*

[…] *Delaying this burn is acceptable where a seed crop will mature in the following year.*

Regeneration burning in shelterwoods needs to be of moderate intensity (Table 1) in order to achieve maximum seedbed preparation. Crown scorch is therefore acceptable." (p. 4)

3.3 Rotational Fuel Reduction Burning
"*Such burns are primarily for the purpose of hazard reduction.* […]

Rotational burning is excluded from stands where regeneration has been released but still remains vulnerable to fire damage (Section 4.2).

Regular rotational burning is of advantage in shelterwood stands to enhance the development of seedlings into ground coppice." (p. 4)

3.4 Strategic Fuel Reduced Buffers
"*Strategic fuel reduced buffers are located to restrict the spread of a major wildfire.*

Harvesting where a regeneration objective would be applied must be excluded from these buffers because of the consequent conflict between the fire exclusion and hazard reduction objectives. Where the silvicultural objective is thinning or shelterwood harvesting in the strategic fuel reduced buffers can be proceed. Inspection by staff from Fire and Silviculture Branches is required before coupes in buffers are included on the logging plan, or before regeneration areas are included in the buffers." (p. 4)

4.0 Fire and Silvicultural Strategies

4.1 Thinning

"* *Silvicultural Objective : In stands where there is adequate stocking of crop trees (trees capable of growing rapidly into higher quality products), the objective is to increase the growth of those trees by thinning. In some cases thinning is carried out for aesthetic reasons or to increase streamflow.*

* *Burning Objective : Hazard reduction : Rotational prescribed burning is compatible with the thinning objective provided that it is conducted within acceptable limits of fire intensity and SDI. The acceptable fire intensity increases with the age and development of the stand; guidelines are as follows:*

Table 2 : Acceptable Fire Intensity at Stages of Stand Development

STRUCTURE	*DIAMETER (CM)*	*FDI (m/hr)*	*MAXIMUM SPRING FIRE INTENSITY**
Saplings	*<15*	*12-17*	*120 kW/m*
Poles	*15-45*	*20-25*	*250 kW/m*
Mature trees	*>45*	*30-35*	*350 kW/m*

** Autumn fire intensities will need to be significantly less to remain at the same scorch height.*" (p. 4)

4.2 Regeneration

"* *Silvicultural Objective : In stands comprising mature and overmature trees where there are few crop trees but an adequate stocking of advance growth (ground coppice and saplings) the objective is to remove the overstorey to allow the development of vigorous regrowth. Stands suited to regeneration release are not cut if they lie within a strategic burning buffer.*

** Burning Objective*

Pre-harvesting : Hazard Reduction

Before the overstorey is removed rotational prescribed burning can proceed normally, but once cutting has released the regeneration it will rapidly develop into saplings and require complete protection from fire.

Post-harvesting : Regeneration Release/Hazard Reduction

After harvesting release or tops burning must be completed within 2 years. The intensity of such burning will vary according to stand conditions (Table1)

Following Regeneration : Fire Exclusion

Stands requiring protection from fire are:

(a) Those coupes containing areas which have been cutover for regeneration and contain adequate advance growth (Specification 7/89), and

(b) All previously cutover coupes less than 10 years old. Where it can be shown that the canopy cover of the residual overstorey is more than 20 per cent and gaps of less than 50 metres in diameter have been created burning may proceed. […]

[…]

These stands will require complete protection from fire until:

- *tall enough (usually 6 metres) so that the growing tip will not be damaged, and*
- *the bark is thick enough to insulate the cambium from the heat (once the diameter is 10cm) in a fire of low intensity. (Burrows, 1987)*

Figure 1 outlines an idealised fire management regime for stands requiring regeneration." (p. 5)

4.3 Shelterwood – (Establishment of Advanced Growth)

"* *Silvicultural Objective : These stands are similar in structure to those described in 4.2 except they lack a sufficient stocking of advanced growth to adequately regenerate the site. The initial aim of management is to establish seedlings and 'grow' them into suitable ground coppice and saplings. This is achieved by a partial removal of the canopy, removal of competing understorey rootstock species, burning to create ashbed and spreading seed where poor natural seed stocks exist.*" (p. 5)

"* *Burning Objective*
Pre-harvesting : Hazard reduction
Advance burning prior to harvesting in particularly important to readily identify where advance growth is present/absent and so determine the location of shelterwood stands. […]

Post-harvesting : Establish Regeneration
After harvesting, burning is essential as a means of creating ashbed, reducing competition, stimulating seedfall and reduction of fuel quantities. If possible this burn should be timed to coincide with an adequate seed crop, however burning soon after harvesting is the best opportunity for seedling establishment due to the disturbance by harvesting machinery. […]

Subsequent low intensity prescribed burning is compatible with a shelterwood objective as it will enhance the development of lignotubers. […]

Figure 2 outlines an idealised fire management regime for shelterwood stands." (p. 6)

4.4 Single Tree Selection Cutting

"*In some stands effective regeneration cannot be achieved due to the inability to market a significant proportion of overstorey trees. The number, size and potential value of such trees makes regeneration (as defined in section 4.2) difficult to achieve commercially and expensive to attain non-commercially. Currently vigorous trees are retained and small gaps are created by removing several trees.* […]

In general regeneration is not effectively released by harvesting in selectively cut stands and hence no special protection measures are warranted – except where specifically nominated following a post-harvesting inspection and recorded on HOCS." (p. 6)

4.6 Crop Tree Protection

"*The burning of logging tops has the potential to damage the retained components of the forest (crop trees, habitat trees, habitat logs). Their protection by the removal of woody material (>3 cm diameter) to a distance of at least 1 metre reduces the risk of damage in subsequent burning. This task must be completed by logging contractors.*" (p. 6)

5. Integrated Fire Management of Harvested Areas

"*Most areas recently cutover will contain a mosaic of the stand types described in section 4.* […]

As a general rule once an area has been cutover and burnt then the entire area must be protected from fire until the regeneration is old enough to withstand fire unless the areas of regeneration can be isolated.

This section discusses the management of stands with mixed objectives." (p. 6)

5.1 Regeneration Release and Uncut Patches or Strips

"*Fire management regime can proceed as described in figure 1.*

PRIOR TO HARVESTING Rotational prescribed burning. Advance burn to assist identification of advanced growth where it is suspected to be poor.

AFTER HARVESTING If the stand was not advance burnt, release burning is required. It is optional where there are only scattered tops and the area has been advanced burnt. Burning to be completed within 2 years of the commencement of harvesting.

FIRE EXCLUSION Following the tops disposal burn fire is to be excluded from the regeneration until regrowth is 6 metres in height and 10 cm in diameter. […]

ROTATIONAL PRESCRIBED BURNING When the regrowth is able to be burnt it should initially be of low intensity, usually obtainable within an FDI of 12-17m/hr. As regrowth size and diameter increase, so can the intensity of fire. See Table 3." (p. 7)

5.2 Regeneration and Thinning
"*PRIOR TO HARVESTING Rotational prescribed burning: advance burn to assist identification of advanced growth where it is suspected to be poor*

AFTER HARVESTING Following crop tree protection, tops disposal burning for hazard reduction is essential where there has not been advance burning or where required for hazard reduction. It must be completed within 2 years of the commencement of harvesting. Tops burning is optional where there are only scattered tops and the area was advance burnt. Burn intensity must be geared to ensure the retained stands are not damaged by the burn.

FIRE EXCLUSION As in 5.1 – except that discrete areas of thinning may be burnt where, for example, there is fuel separation or different fuel levels.

ROTATIONAL PRESCRIBED BURNING As for 5.1" (p. 7)

5.3 Regeneration and Shelterwood
"*PRIOR TO HARVESTING Rotational prescribed burning and advance burning is essential where there exists the possibility of poor advance growth stocking.*

AFTER HARVESTING A regeneration burn is required in the shelterwood. The timing of the burn will be critical if there is an existing seed crop.

*Tops in the gap **must** be burnt.*

PROTECTION AND BURNING This stand requires both on going protection (in the gaps where regeneration has been released) and regular burning (in the shelterwood areas). This conflict can most easily be avoided by not harvesting both types in one area. However where it does occur, the first shelterwood burn must be completed within 5 years of tops burning. At this time there will be limited fuel in the gap and 5 leaf falls in the shelterwood. This burn should be undertaken at low intensity (<250 kW/m) and low SDI to minimise the risk of significant fire run in patches of regeneration; hence it is vital that flash fuels have been effectively removed from the gap in the tops burn.
[…]
Bradshaw (1986) discusses other burning and protection options in greater detail.

ROTATIONAL PRESCRIBED BURNING As for 5.1" (p. 7)

6.0 Prescribed Burning and Herbicide Treatment
"*Burning can occur immediately before or at least 9 months following herbicide treatment. If burning before treatment the fire intensity must be low to ensure minimal crown scorch – otherwise notching will*

need to be delayed until crown flush." (p. 8)

7.0 Records
"*The following silvicultural records are required to ensure achievement of objectives:*
(1) HOCS
Location of silvicultural stand types (print 10)
Follow-up treatment required and completed (CLM 160)
Monitoring of regeneration development in shelterwoods

(2) MASTER BURN PLAN
Record location and date of regeneration and their predicted period of protection. Location of shelter woods, and when next due for burning." (p. 8)

MANAGEMENT PLAN – 1990

Waroona Reservoir and Catchment Area Management Plan 1990-2000. 1990

8.5.1 Fire
Objective
"*To use fire as a management tool to achieve land management objectives in accordance with land use priorities.*" (p. 42)

Rationale
"*CALM has a responsibility to protect community and environmental values from damage or destruction by wildfire on land it manages.*" (p. 42)

Prescription
- "*Apply fire management principles consistent with CALM's regional management plan for the northern forest region (CALM, 1987 a), bearing in mind the recreational value of the catchment.*" (p. 42)

MANAGEMENT PLAN – 1990

Lane Poole Reserve Management Plan 1990-2000. 1990

B8 Resources and Land Use
Protection
"*Protection of the ecosystem is fundamental if its values are to be maintained. Major values currently recognized in the northern jarrah forest are water, timber, recreation, scientific study, educational resources, flora, fauna, geological resources, landscape, and other forest products such as honey and wildflowers.*

Appropriate management of the forest ecosystem will help conserve these important values. Management must minimise damage from wildfires, dieback disease and other pathogens, feral animals, weeds and uncontrolled recreation. Only by controlling these damaging agents will it be possible to manage the Reserve in a way that ensures conservation of its values." (p. 33)

B8.1 Fire Protection
"*Between 1923 and 1954, a policy of fire exclusion was practised by the Forests Department over much of the jarrah forest. The progressive build up of forest fuels, however, made wildfire suppression virtually impossible even under mild conditions, despite the advances in fire fighting, manpower and quality of equipment.*

By 1953 it was realized that community and forest protection from wildfires could no longer be guaranteed under the existing policy. A new policy was developed, aimed at systematically reducing accumulated forest fuels by the regular and controlled use of mild fires. The Royal Commission Enquiry into the causes and impacts of the 1960/61 Dwellingup fires re-affirmed and gave new impetus to this fuel reduction policy.

The Forest Department's objective to bring almost the entire northern jarrah forest under a regime of rotational fuel reduction has now been achieved. This was accomplished by the use of aerial ignition methods, and by improved knowledge of forest fire behaviour (Peet 1965, Sneeuwjagt and Peet 1985). Average fuel ages now range from 5 to 7 years (probably about 8-14 t/ha), although several areas remain unburnt." (p. 33)

"*Advances in fire suppression capacity have also realised a marked reduction in the severity of wildfires. Methods include aerial detection systems, efficient fire fighting equipment, the use of chemical retardants, fuel reduction burns, and improved radio communications."* (p. 33-34)

B8.1.2 Fire History
"*The history of fire management in the northern jarrah forest also applies to the Lane Poole Reserve.* […]" (p. 34)

"*Current strategies in the Reserve are aimed at the protection of community and forest values, consistent with the priority land uses of conservation and recreation. Some of the values protected are:*

- *Life and property.* […]
- *Water catchments.* […]
- *Flora and Fauna.* […]
- *Timber values.* […]" (p. 35)

B8.1.3 Fire/Conservation Rationale
"[…] *For almost every positive ecological response from a fire regime a negative response can be demonstrated, often in a completely different part of the biota. The only rational approach to conservation management is to aim at maximising ecological diversity by applying a variety of management strategies.*" (p. 35)

B8.1.3 Fire/Conservation Rationale
"[…] *For almost every positive ecological response from a fire regime a negative response can be demonstrated, often in a completely different part of the biota. The only rational approach to conservation management is to aim at maximising ecological diversity by applying a variety of management strategies.*" (p. 35)

B8.1.4 Fire Protection Conflicts
"*Today, forest fuels are at a manageable level and the traditional hazard reduction approach can be modified in the Reserve to simultaneously take into account the achievement of ecological management objectives and the protection of life and property. This is particularly applicable to the Southern Conservation Zone.*" (p. 40)

B8.1.6 Summary
"*The aim in the Reserve is to design a fire program which ensures adequate protection of use, life and property while still catering for conservation objectives. The effects of different fire regimes on forest conservation values are not fully understood. Any burning regime or frequent fires may be detrimental to some species. The experience of implementing the draft fire plan has served to refine its practicality and indicate a revision that is a balance between the different objectives.*" (p. 42)

C5 Vegetation and Flora
Prescriptions
"*1. Wherever possible activities are to be located where they do not affect any scarce landform, vegetation type or plant species. Protection of these areas will be given high priority in the development of dieback disease and fire protection plans.* […]

2. The fire management program for the Reserve aims to maximise the diversity of vegetation." (p. 81)

C6 Fauna
Prescriptions
"*1. Fire regimes, including considerable variations in fire frequency, intensity and season will be formulated in order to maximise the diversity of vegetation.*

2 Stag headed and dead trees together with virgin forest areas will be preserved as long as they do not constitute a fire risk or a visitor safety risk." (p. 83)

C7 Protection
C7.1 Fire
"*The 10 objectives are:*

To protect vulnerable species and ecosystems, buildings, facilities and assets in the Reserve and properties and plantations from severe damage by uncontrolled fire.

To encourage and maintain diversity, natural abundance and composition of vegetation associations and wildlife habitats, within major vegetation and landscape types.

To minimise the risk of wildfires burning large portions of the Reserve by confining them to single fire management blocks surrounded by strategic buffers and firebreaks.

To ensure the survival of populations of rare and restricted flora and fauna species, by the maintenance and protection of their particular niche in the Reserves ecosystem.

To protect vulnerable soils, and landforms from the risk of wind and water erosion as a result of wildfires, inappropriate fire regimes, or machinery activity.

To protect landscape values from severe damage by uncontrolled fires or from inappropriate burning regimes or suppression techniques.

To minimise the introduction or further spread of dieback disease and weeds by fire management operations.

To reduce the risk and frequency of unplanned fires starting near to or within the Reserve as a result of human activity.

To provide the opportunity to obtain information about natural processes through the use and non-use of fire." (p. 85)

C7.1.1 Proposed Overall Strategies
"*In order to achieve the overall objectives of protecting life, property and environmental values and to manage natural ecosystems, a system of three separate fire regimes will be implemented (see Map 17):*

1. Fuel Reduction Burns (FRB)
Under this fire regime, FRB will be applied to strategic places in the Reserve whenever ground fuel-loads exceed critical levels at which fire containment, by direct attack, under hot summer conditions, becomes very

difficult and unsafe for firefighters. The rotation period between burns will vary from approximately 5 to 10 years, depending on the rate of fuel accumulation of the vegetation.

The burns will be arranged in wide buffers to restrict the movement of wildfires through extensive areas. Low fuel areas will also be strategically located adjacent to high risk areas (eg. strategically located heavy fuel areas, recreation facilities) and high value areas (eg. private property, pine plantations); these will consist of perimeter buffers and strategically located blocks throughout the Park." (p. 85)

"*2. No Planned Burn Areas*

Parts of major vegetation types will not be burnt within the life of the plan. These areas are located away from likely ignition sources such as major roads and the recreation areas. Maximum protection needs to be ensured for these areas, including maintenance of good perimeter access and regular burning of adjacent areas.

3. Intermediate Frequency Burns (IFB)

Burns in these areas aim to achieve ecological diversity within each of the major land units. Most of these regimes will entail longer rotation burns of about 10-20 years.

[…] *Each IFB will be reviewed annually to determine whether or not it should be burnt for ecological or protection purposes.*" (p. 87)

Prescriptions – Overall
"*The following prescriptions will be implemented as funds permit. If sufficient funds are not available, fire protection and management will be undertaken according to the objectives for fire protection. Alterations to the fire plan will be discussed with the Northern Jarrah Forest Region Advisory Committee.*" (p. 87)

Fire Prevention
"*1. In nominated areas maintain fuel levels of less than 8 tonnes per hectare, over at least 70 percent of each designated burn area, with the necessary maintenance of accompanying firebreaks.*

2.Confine burns inside established tracks or firebreaks. Burns must comply with written prescriptions approved by CALM's District Manager. Burn frequency will depend on the rate of fuel accumulation, but is not likely to be less than 5 years. Where possible, successive burns in each block will be programmed in different seasons.

3.Where there are known gazetted rare flora or fauna within proposed burn areas, the burn will either be modified, relocated or deferred. Where it is a requirement of the species, or it is essential for protection purposes, for burning to occur, Ministerial permission to 'take' rare flora or fauna species must be obtained.

4.Revise strategies and prescriptions as more fire information becomes available and whenever major wildfires occur.

5. Define roads required for fire control and essential management activities. Those roads considered unsuitable for public use will be closed to the public and management vehicles will be subject to hygiene requirements when using closed roads." (p. 88)

Monitoring
"*13. Implement prescribed burns which have a range of fire regimes, including variation in season, intensity and size, particularly between different blocks.*" (p. 89)

Fire Suppression
"*17. All fires in or threatening the Reserve will be contained to the smallest possible area either by direct attack or by backburning from established firebreaks, roads and fuel reduced areas, taking into account the likely threats to life and property and the impact of the suppression activities on the environment.*

[…]
19. Implement suppression of a wildfire in the following order of priority: (i) human life; (ii) community assets, property or special values (including environmental values) (iii) cost of suppression in relation to values threatened." (p. 89)

Fire Preparedness
"*22. Update the District Fire Control Working Plans (FCWP) covering the reserve and surrounding areas annually prior to the start of the fire season. These F.C.W.Ps must include procedural arrangements for actions in the case of wildfires in or near the Reserve.*" (p. 89)

C7.2 Dieback
"*The objective is to limit the spread of dieback and other diseases within the Reserve.*" (p. 90)

Background
"[…]. *Prescribed burning or wildfires represent significant disturbance, masking disease symptoms for a further 3 years. The use of fire to meet recreation and conservation management objectives will require balancing against the need to obtain information on disease distribution for planning operations and activities.*" (p. 90)

C13.2 Timber Utilization
Background
"*Timber cutting in the Recreation Zone will involve the temporary unavailability of some areas for recreational use. This is due to the reduction in conservation and recreation values, the need to protect regeneration areas from wildfires and the increased risk of environmental degradation (ie. dieback spread, soil erosion and stream turbidity) following logging and regeneration.*" (p. 119)

"*Fire must be excluded from regeneration areas. Jarrah regeneration must be protected for up to 15 years.* […]" (p. 119)

MANUAL OF LOGGING … 3RD ED. – 1990

<u>Manual of Logging Specifications … 3rd Ed. 1990</u>

Section 1 : Planning
1. Responsibilities
"*In all cases, planners must produce fully integrated plans and consult with Regional staff, District staff, Specialist Branch staff and where relevant Timber Industry Representatives during plan preparation.*" (p. 1)

Section 2 : Plan Types
2.3 Short Term Integrated Logging Plan
"*This is the tertiary level integrated logging plan which shows in detail proposed logging areas over a 2 year period.*

One plan per supply area is produced and issued during the first week of September in the Northern and CFR and the first week of January in the SFR.

Primary users of the plan are District staff, Regional staff, Timber Production Branch and Contractors." (p. 2)

"*The plans shall show:*

1) 1:250,000 overview plan showing the approximate location of all proposed logging areas for each year of the plan.
2) 1:50,000 block plan showing proposed logging boundaries and major access - also show CALM grid.
3) 1:25,000 plans showing:

<u>Plan A</u> - Operations plan
- boundary of proposed logging.
[…]
- CALM mapping grid.
[…]" (p. 2)
-"*special care zones (eg., areas close to domestic dams - 9 refer Section 4.1 of this Manual).*
[…]
- ***strategic burning buffers***.
[…]" (p. 3)

3.Plan Amendment
"*Logging plans can only be amended by the logging plan officer. Amendments must be approved in writing by the Regional Manager.*" (p. 3)

4. Monitoring and Records
"*Logging cannot commence until an approved logging plan has been issued and CLM 109 has been signed by the Regional Manager (ref Part 6 of this specification).*

District staff must maintain up-to-date field records of areas cut over and silviculturally treated. This information must be ready when inventory officers visit Districts within one month of the close of the logging season (refer to revamped HOCS issued from SOHQ on 14/8/90 and CLM 160 - Coupe silviculture report - Jarrah refer Attachment 1.1.2)." (p. 3)

Section 5 : Environmental Protection
Specification 5.2 Protection of Soil (Including Rehabilitation Measures)
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

Specification 5.7 : Protection from Fire
"*1. The logging contractor has certain fire control requirements specified in the relevant Contract to Supply. They are also outlined in the Code of Logging Practice.*

2.The District, through its nominated FOIC, must ensure that the fire control provisions of the contract and the Code are strictly adhered to. This includes training of the contractors' personnel.
[…]

	Chainsaws	*Logging Equipment*	*Load on Cleared Break*

HILLS PLANTATIONS	*0-60m/hr No Restrictions* *60m+ Cease Ops*	*0-60m/hr No Restrictions* *60m+ Cease Ops*	*0-140m/hr No restrictions* *140m+ Cease Ops*
COASTAL PLANTATIONS	*0-140m/hr No Restrictions*	*0-140m/hr No Restrictions*	*0-140m/hr No Restrictions*
(a) Prescribed Burnt	*140m+ Cease Ops*	*140m+ Cease Ops*	*140m+ Cease Ops*
(b)Unburnt	*0-60m/hr No Restrictions* *60m+ Cease Ops*	*0-60m/hr No Restrictions* *60m+ Cease Ops*	*0-140m/hr No Restrictions* *140m+ Cease Ops*

(p. 101)

CODE OF LOGGING … - 1990

Code of Logging Practice. 1990

Introduction

"*The 'Code of Logging Practice' is a concise set of rules governing the conductof timber harvesting (logging)operations on state forest and other Crown lands managed by the Department of Conservation and Land Management, and on private property where CALM is in control of the logging operation.*

The Code, which applies to both hardwood and softwood logging operations, is part of a hierarchy of rules relevant to logging operations controlled by CALM :

- *CALM Act (1984) and other relevant Acts*
- *Regulations under the CALM Act and other relevant Acts*
  (Note : Forest Resource Management Regulations under the CALM Act are currently being prepared. Until they are endorsed by Parliament regulations under the Forests Act (1918) apply)
- *Code of Logging Practice*
- *Manuals of Logging Specifications and other guidelines relevant to logging*
- *Log Supply Contracts between CALM and Logging Contractors, and Forest Produce harvesting or collection licences.*" (p. [i])

Section 2 : General

NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)

Section 7 : Environmental Protection
Fire – All Forest Areas
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

STRATEGIC PLAN (SOUTHERN REGION) – 1989

Strategic Plan : Southern Forest Region. 1989

3. Regional Strategic Goals
"*The goals listed below are broad statements largely drawn from goals set by the amalgamating agencies before CALM. These goals are not specific, quantifiable or measurable but provide the basis for formulating KEY RESULT OBJECTIVES which is the next stage of the Strategic Planning process.*" (p. 7)

Fire
"*To provide fire management programmes which protect the lives of CALM staff, neighbours and visitors, and which protect public and private assets from wild fires.*

To maintain diversity of plant and animal communities, scenic beauty and amenity by prescribed use of fire.

To minimize environmental disturbance such as erosion, disease spread or impairment of water quality by appropriate fire regimes
[…]" (p.9)

5. Most Important One Year Goals
"*5.4 To improve performance in fire management.*

- *During 1988/89 all SFR prescribed burns will meet the written objectives, with no escapes and a 10% reduction in unit costs.*

[…] (p. 14)

Key Result Objectives
Hardwood Tending
"*Objectives*
1. Karri. Ensure tending operations particularly thinning of 12 to 20 y.o. regrowth are directed to areas where stand growth and strategic importance are maximised.
[…]
Measure of Performance
'Priority'
1. All young karri regrowth thinning to be in primary buffers to enable fuel reduction burning.
[…]" (p. 47)

Fire Management
"*Objective*
1. To provide fire management programmes which protect the lives of all users and neighbours of CALM lands, and protect public and private assets from wild fire damage.

To utilise prescribed use (or non use) of fire as a management tool to encourage diversity of plant and animal communities, scenic beauty and amenity.

To minimise environmental disturbance which may result from fire management operations.
[…]

Measure of Performance
'Priority'
1. Review burning buffer system by September, to ensure it is still meeting the necessary objectives.
[…]
3. Complete all F.C.W.P. in Region by October.
[…]
5. All burning to be done to an approved prescription.
[...]
7. Develop with D/M's, R/L Logging a Regional strategic roading policy and commence implementation by Oct. Target 100km annually.

8. Prepare Interim Management Programmes for Parks, Reserves and high value Forest areas ie list all in order of priority and aim to complete 3 annually.
[…]" (p. 50)

"*16. Utilise Brigade resources to increase prescribed burning achievements (aim for a minimum of 10 burns totalling at least 600 ha per annum).*

17. Maintain programme annually in accord with Master Burning Plans …

18. By June in liaison with Forest Resources Branch programme for thinning young even aged karri regrowth where necessary to allow the consolidation of burning buffers." (p. 51)

STRATEGIC PLAN – 1989-1993

Strategic Plan For the Period 1989-1993. 1988

General Principles/Philosophy
"*The Department is committed to the principle that it is managing public land and natural resources, and conserving indigenous wildlife on behalf of the public of Western Australia. Consequently, particular importance is placed on informing the public of the Department's activities and wherever possible involving the public.*

The regional system of management as adopted by the Department ensures that its officers develop a detailed knowledge of the area of their operations, are available to interact with local communities and resolve problems associated with local conservation and land management operations. […]" (p. 10)

5. Mission
"*Western Australia has a beautiful and diverse natural environment which provides material, aesthetic and spiritual benefits. The natural environment is an essential component of the quality of life for West Australians. The statement of mission for the Department of Conservation and Land Management is therefore:-*

> *TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.*" (p. 11)

6. Primary Objectives
"*Five primary objectives have been established:-*

- *MANAGEMENT*
  To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community." (p. 12)

8. Major Outcomes Or Key Result Objectives Planned For the Period 1989-93
"*Twenty one major outcomes are identified for this strategic plan. All are concerned with getting the Department in a position to most effectively carry out its charter. The aim is to expand, renew or create as the case may be, systems and procedures so that CALM can be efficiently managed with the resources available.*

The desired major outcomes are:" (p. 20)

> *"**8.7 A comprehensive range of Counter-Disaster Plans covering wildlife, fire, flood, oil spills, aircraft crashes etc will have been prepared.***
>
> *Management of land and wildlife brings with it responsibility for the protection of life, private property and conservation values.*" (p. 21)
>
> "*Planning for emergencies which may occur within the areas of CALM's responsibilities is essential for the provision of an efficient response. Plans will be developed in sympathy with the responsibilities and activities of the Bushfire Board, the State Emergency Service and other organisations which would be involved.*" (p. 21)

10. The Organisation
10.3 Planning
"*Detailed planning of conservation and land management activities is a key function in the Department.*

Under the Conservation and Land Management Act, there is a responsibility to prepare management plans for all land and water vested in either the Lands and Forest Commission or the National Parks and Nature Conservation Authority. Such plans must be available to the public for comment for a period of at least two months. They apply for a maximum period of ten years.

Two levels of this planning are undertaken. These are regional and area management plans.

Regional management plans are to be prepared for each CALM administrative region. They will cover all categories of land and water entrusted to the Department. Each plan will described the management objectives to be achieved over the life of the plan and the strategies for implementation which are to be adopted.

Area management plans will apply to specific areas such as a national park, marine park, nature reserve, marine nature reserve. State forest, or other reserve. These are more detailed than regional management plans. Area management plans will be prepared only where there are requirements that cannot be adequately considered by a regional management plan. Each area management plan will also describe management objectives and strategies for implementation." (p. 31)

"*Other major plans prepared by the Department are issue plans that are either a follow up to an approved management plan, or consist of interim guidelines for necessary operations where there is not yet an approved management plan. Issue plans cover all relevant topics, such as site plans, fire plans, dieback plans, recreation plans, resource allocation plans and wildlife management programs. Issue plans are generally prepared by district or regional staff in conjunction with research and other specialist branches within the Department.* […]" (p. 32)

In addition, the Department prepares operational guidelines, manuals and prescriptions. These draw on the results of research and experience and are used to implement the works and activity programmes derived from the planning process." (p. 32)

10.4 Regionalisation
"*The Department is extensively regionalised in a way which provides the benefits of small autonomous organisations in close proximity to their area of operations while providing access to services that are best provided by a larger integrated organisation. Regions are responsible for the management of all departmental lands and waters and for conservation of flora and fauna within their boundaries. According to the intensity of activity regions are subdivided into districts.*" (p. 32)

"*The general responsibilities allocated to regions are to:*

- "[…]
- *preserve or restore the natural environment on departmental land and water;*
- *provide information and advice on land management and conservation to people in the region; promote conservation and good land and marine area management;*" (p. 33)

10.5 Specialist and Support Services
"*Functions of the Branches within each of these Division are as follows:*
[…]
- *Fire Protection Branch – prepares fire protection and suppression plans, provides detection and aerial prescribed burning services, and conducts fire training courses.*" (p. 33)

MANUAL OF HARDWOOD LOGGING … 2ND ED. – 1989

Manual of Hardwood Logging … 2nd Ed. 1989

1. Responsibilities
"*The preparation and distribution of logging plans is the responsibility of the Regional Inventory Branch Offices. These plans are prepared for each Supply Area and include:*
i) a one or two year logging plan (short-term)
ii) a four or five year logging plan (medium term)
and
iii) a long term (eg. 15 years) logging plan (long term).

These plans are produced after consultation with District staff, Regional staff and specialist branch staff, and timber industry representatives where necessary. The plans must be integrated with all other operational plans including plans for roading, silviculture, mining, fire control and visual resource management." (p. 1)

6. Monitoring and Records
"*Logging must not commence until plans are issued. If during a year additional areas of forest are to be cut, additional or amended plans must be issued by the relevant Inventory Office. Districts supervising logging must keep accurate records of areas cutover and quantities of log products removed and forward such information to the relevant Inventory office as required.* […]" (p. 2)

Section 5 : Environmental Protection
Specification 5.2 Protection of Soil (Including Rehabilitation Measures)
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

MINING ON C.A.L.M. – 1989

Mining on C.A.L.M. Lands Guidelines. 1989

Schedule 'B' Department of Conservation and Land Management : The Mining Act 1978 : Conditions for Prospecting and Exploration Licences on State Forest and Timber Reserves (South West)

Compliance With Acts

"*5. The licencee complying with and ensuring that all persons under its control operating in the licence area are aware of and comply with the provisions of:*

(i) the Conservation and Land Management Act, 1984 and the Regulations thereunder;

(ii) the Bush Fires Act, 1954-77 and the Regulations thereunder;

(iii) the Wildlife Conservation Act, 1950, as amended and the Regulations thereunder, and

(iv) the Country Areas Water Supply Act, 1947 and the Regulations thereunder." (p. 2)

ADMIN. INSTRUCTION – 1988

Administrative Instruction No. 39 : Fire break Construction. 1988

"*Admin Instruction 39 currently requires the approval of the Divisional Manager Operations for necessary operations involving new fire break construction.*

For the purposes of this instruction the activity – Fire Break Construction can be considered in two parts.

1. Perimeter Fire Break construction.
2. Internal Fire Break construction.

The Level of approval for Part 1, perimeter fire break construction, is hereby devolved to the Regional Manager.

The level for approval for Part 2, internal fire break construction, remains with the Divisional Manager Operations." (p. 1)

Levels For Approval For Necessary Operations In National Parks, Nature Reserves and Conservation Parks : November 1988

Activities		**Person To Approve**
"*Search and Rescue*		*DM*
Fire Protection:		
firebreak maintenance		*DM*
firebreak construction	*– perimeter*	*RM*
	- internal	*Div M*
burning buffers		*RM*

area prescribed burning	*Div M*
fire suppression	*DM*
Disease Protection:	
existing programmes	*DM*
new programmes	*RM*
Control of Noxious weeds:	
existing programmes	*DM*
new programmes	*RM*
Control of Feral Animals:	
existing programmes	*DM*
new programmes	*RM*
Protection of Known Rare Species, Cultural:	
archaeological and historic sites	*DM*
new occurrences/sites	*RM*
Recreation:" (p. 2)	
"*existing facilities*	*DM*
new facilities	*Gen M*
Access:	
maintenance	*RM*
closure	*RM*
new construction	*Gen M*
Control of Soil Erosion/Rehabilitation:	*RM*
Mining and Exploration:	*Hon Minister*
SEC, Telecom, WAWA, etc:	
maintenance	*RM*
new work	*Gen M*

DM	*District Manager*
RM	*Regional Manager*
Div M	*Divisional Manager Operations*
Gen M	*General Manager*
Hon Minister	*Hon Minister for CALM*" (p. 3)

CORPORATE MISSION AND OBJECTIVES - 1988

CALM Annual Report 1st July 1987 to 30th June 1988. 1988

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT FOR 1986/87 AND 1985/86. ENTRY IS SIMILAR EXCEPTING THAT THE MISSION STATEMENT HAS CHANGED (THE SCOPE HAS BECOME THE STATEMENT OF MISSION)

"*TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS*." (p. 6)

STRATEGIC PLAN – N.D. - 1988?

Central Forest Region Strategic Plan. N.D. 1988?

Industry Control – Timber (Function)
Hardwood
Objective
"*1. Use hardwood logging as a silvicultural tool to improve the forest.*" (p. 52)
Strategy
"*i) Carry out all hardwood logging operations in accordance with the Code of Hardwood Logging practice and the Manual of Specifications for the control of Hardwood Logging Operations.*

[…]
iii) Ensure retained crop trees are protected." (p. 52)
Measure of Performance
"*1. Silvicultural benefits are achieved.*

2. Forest growth rates are improved.

3.Forest is regenerated." (p. 52)

Hardwood Silviculture Establishment & Tending (Function)
Strategy
"*iv) Adjust prescribed burning plans to ensure that regenerated areas are protected.*" (p. 61)
Measure of Performance
"[…]
5. Regenerated areas are protected from fire.
[…]" (p. 61)

Fire Management
Objective
"*1. To protect community and environmental values on lands managed by the Department.*" (p. 85)
Strategy
"*i) Respond to fires occurring on or near CALM land to a degree that is appropriate to the values at risk.*

Assess the response to a fire in the light of potential damage to the following values in order of priority:-
[…]
- Community assets, property and environmental values.
[…]" (p. 85)
Measure of Performance
"*1. There is minimal damage to community and environmental values.*
2. Wildfires are kept to a small size." (p. 85)
Strategy
"*ix) Consistent with the requirement to protect life, property and ecological values, introduce diversity into prescribed burning fire regimes.*

x) Avoid or minimise damage to rare and endangered species in fire-fighting operations.
[…]" (p. 87)

Objective
"*2. To use fire as a management tool to achieve land management objectives, in accordance with designated land use priorities.*" (p. 87)

Strategy
"*i) Use planned fire only where this use is in accordance with an approved management plan, or, where such a plan does not exist, to protect and maintain the designated priority land use.*

ii) Prepare written prescriptions in advance, for approval by senior designated officers, before any planned fires are undertaken." (p. 87)

Measure of Performance
"*1. There is successful achievement of land use objectives by use of fire.*

2. There are no escapes from prescribed burns.
[…]
4.Burns are carried out to prescription." (p. 87)

Strategy
"*iii. Use fire conservatively in areas where information about the impacts of fire is limited, and in areas where the primary land use is conservation of flora and fauna*.

In such areas, the use of fire will be restricted to:-

- *protection of neighbouring community assets, and*

- *providing a diversity of fuel and vegetation ages, but ensuring as much as possible of each major vegetation association is maintained in the mature condition.*

iv) Give priority to the protection of high value areas (… rare flora sites) and high risk areas (logging slash).

v) Plan fire protection requirements in advance of mining.
[…]" (p. 88)

Harvey
Fire Management
"*1. Prepare 1988/89 prescribed burning programme. Programme to be based on the principle of protection of life, property and environmental values. All proposed burns will be assessed for priority according to Protection Branch criteria*.
[…]
3. Prepare detailed prescription for all planned burns and carry out the burn under the conditions specified in the prescription." (p. 90)

GUIDELINES - 1988

<u>Guidelines for Slash Burning in the Karri Forest. 1988</u>

2. Objectives
"*The objectives of slash burning are:*
[…]
- *To reduce fire hazard in the early years of regeneration …*" (p. 5)

3. Factors Affecting Slash Burn Performance

"*Factors which influence slash burn intensity are:*
Fuel Quantity and Arrangement
The weight, distribution and arrange of fine, flash fuels and heavy, woody fuels govern whether a fire will ignite, spread and be sustained. The amount of fine fuels determine the likelihood of igniting the heavier fuels and of spread from one heap to another. The arrangement and distribution of heavy fuels affect the amount of fuel consumed. Rough–heaped or windrowed fuels burn hotter and more completely than scattered, broadcast fuels." (p. 5)

3.2 Fuel Moisture Content (F.M.C.)
"*3.2.1 Fine Fuels Moisture Content*
The fine fuels must be dry enough to ensure ignition of the heavier fuels. The F.M.C. of flash fuels varies within a heap, and unless the lower sheltered fuel is dry enough the burn will fail. […] *Providing the heavy log and branch material is dry, a satisfactory burn will be achieved if fine sheltered fuels do not exceed 18 per cent moisture content.*" (p. 6)

"*3.2.2 <u>Fine Fuel Moisture Differential</u>*
Drying on cut-over areas is more rapid than under adjacent forest. If a day can be selected when the fine slash is dry, but the surrounding forest is damp, then a satisfactory burn can be conducted with minimum risk of suppression problems." (p. 6)

"*Measurement of fuel M.C. in the forest must be made at least 30m in from the boundary of the coupe to avoid edge drying effects.*" (p. 6)

3.3 Weather Conditions
"*Temperature, relative humidity and wind strength affect the drying rate and final minimum values of the fine fuel M.C.*

Wind is the most variable and least predictable factor. Surface winds are affected by the topography and by local heating and cooling. Wind is also influenced by local synoptic changes and by the stability of the atmosphere. Controller and Fire Boss need a sound understanding of local wind behaviour supported by wind monitoring by local towers or spotter aircraft, during slash burns." (p. 7)

3.4 Topographic Effects
"*Topography affects wind speed, turbulence and direction.*

Topography also influences the rate of drying of fuels through the influence of aspect and slope or the degree of exposure of fuels to sun and wind." (p. 7)

Slash Burn Preparation
4.3 Stag and Cull Falling
"[…] *Consider the falling of dead stags to a depth of 50 m outside the burn edge when these are classified as dangerous edges and the risk of burn escape is high.* […]" (p. 8)

4.4 Perimeter Tacks
"*Every slash burn must have a trafficable fire line around its perimeter.* […] *Slash must not occur outside perimeter tracks unless it is planned to burn the area out as a buffer.*[…]" (p. 8)

4.5 Water Points
"*The provision of water points at each slash burn is essential. The number of water points required will depend on the size of the burn, the proximity of a reliable water source, and season. As a guide, at least 1 water point will be required for every 40 ha of burn.*" (p. 9)

4.6 Advance Mop-Up
" *'Advance mop-up' is the pushing of logs and other heavy debris away from the perimeter into the burn before burning commences. This saves the need for massive mop-up after burns are lit.*

Advance mop-up must be carried out on the entire perimeter, except where the edge adjoins buffer areas or recent burns. The depth of pushing in is generally 20 metres …" (p. 9)

4.7 Internal Tracks
"*Internal access is vital, particularly at large slash burns, to enable:*
- *A break-up into cells so that systematic firing can take place, consistent with prevailing wind conditions.* […]
- *Access into the area by lighting crews for convection firing methods*

[…]
- *The formation of sub-boundaries, if the burn must be halted prematurely.*

[…]" (p. 10)

4.8 Installation of Buffer Strips
"[…] *As most slash burns are lit on SW-SE winds, the northern edge is the most important. Where an edge is considered particularly dangerous, it is advisable to install an additional track 100 to 200 meters in depth, parallel to the first. Fire escapes into adjacent bush, downward, have elevated fire behaviour to a depth of about 50 metres, due to open winds off the coupe and the radiant heat generated by the slash burn. Beyond this distance predicted forest fire behaviour becomes established.*" (p. 11)

"*Burn prescriptions must be drawn up and adhered to in order to meet fuel reduction objectives with minimum fire damage.*" (p. 11)

4.10 General Comments
"*Consider:*
[…]
- *Always prepare burns from the north of the coupe southwards. This enables a cut-off to be made if the entire coupe cannot be burnt, or is not ready.*
- *It is advisable to install all perimeter tracks and then complete remaining preparation cell by cell, north to south.*" (p. 11)

4.12 Aerial Photographs
"[…] *These are of value with regard to track and buffer locations, and planning of lighting techniques.*" (p. 12)

4.14 Burn Prescription
"*A prescription (See Appendix, page 25) must be prepared for every slash burn. It will be compiled by the Regeneration Officer and fully discussed with the District Manager prior to the burn. A Pre-Burn Checklist (CLM 32) form must also be drawn up for each burn.*

All items on the prescription must be completed." (p. 13)

5. Burning Techniques
"*Behaviour of slash burns depends on the lighting pattern used. Lighting pattern may vary according to:*
- *Aim of burn*
- *Wind strength and direction*
- *Size and shape of coupe*
- *Terrain*
- *Fuel arrangement, distribution and flammability*

- *Presence and fuel condition of surrounding and intruding forest fuels, and other factors.*

Lighting pattern can influence fire behaviour, for example through the deliberate creation of a convection column to draw fire from the burn perimeter.

Three basic patterns of lighting are used for slash burn operations. These are:
Strip lighting
Convection lighting (centre firing or moving column)
Simultaneous area ignition" (p. 13)

5.1 Strip Lighting
"*Firing in progressive strips is the most commonly practiced method in W.A. It is the most versatile for the range of weather and topographic conditions. The procedure involves the consolidation of the most vulnerable edge (e.g. downwind edge or upper edge) by back burning into the coupe, followed by the progressive stripping out of the remaining area.*" (p. 13)

5.2 Convection Ignition
"*Convection ignition aims to create a strong convection column near the middle of the burn area. When heavy fuels such as logging slash are burned, the convection column stabilizes and acts as a chimney toward which ascending warm air is drawn. In this way flames and smoke are drawn back from the fire perimeter. Thus, the burn is easier to control, and working conditions are safer and more pleasant. The two forms of convection ignition are central ignition and moving column ignition.*" (p. 14)

5.2.1 Central Ignition
"*The central ignition system does not guarantee freedom from suppression problems. As soon as the convection column breaks up, normal precautions are needed on the downwind edge of the burn.*" (p. 16)

6. Slash Burn Organisation
"*High intensity slash burns require special organisation and discipline*." (p. 16)

7. Slash Burn Control
7.2 Timing for the day
"*This depends on:*
- *Fine fuel moisture contents inside and outside the burn.*
- *Expected weather.*
- *Known and anticipated commitments elsewhere.*
- *Weather conditions as prescribed.*" (p. 20)

7.3 Timing on the day
"*The maximum burn size that can be completed within daylight hours by ground ignition methods is about 200 ha.*" (p. 21)

"*A burn must never be lit on the expectation of a desired wind change. Always delay start time until prescribed winds are experienced.*" (p. 21)

7.4 Cellular Lighting
"*On large slash burns the operation is lit systematically cell by cell. The sequence is determined by:*
- *The direction of the prevailing wind. The downwind cell is lit first, and then the downwind flanks are secured by burning adjacent cells. This pattern is repeated for the entire job, progressively working upwind.*
- *The requirement to draw fire and hence spotting potential away from a dangerous flank. By intelligent lighting of cells, pressure on dangerous flanks can be controlled.*" (p. 21)

7.5 Knowledge of Danger Points

"*Danger points are:*

- *Slash which cannot be burnt, or special high value areas adjacent to the burn.*
- *A sharp bend in the boundary of the burn.*
- *Fire whirlwinds.*
- *Gully winds.*
- *Steep, upslope topography.*
- *Seed trees with dead limbs near perimeter.*" (p. 22)

7.7 Suppression

"*The nature of the suppression force depends on the size of the burn and expected fire intensity.* […]" (p. 22)

"*Points to note with regard to suppression are:*

- *Never light up more than can be held with available suppression forces.*
- *If trouble is experienced beyond the capacity of suppression forces, the first course of action is to stop lighting.*
- *Suppression is more difficult in autumn than in summer dry to the dryness of large fuel and the spotting potential of the fire.*
- *Suppression of escapes must take place immediately, when they are small.*
- *Suppression of escapes must be done with minimum damage to the forest adjoining the burn.*" (p. 22-23)

9. Recording

"*The final responsibility of the Controller of each burn is to ensure full and correct records are made in the divisional office concerning each slash burn – viz*

- *The date of the burn*
- *Weather conditions*
- *Exact area burnt*
- *Completion of the post-burn appraisal*

These data are transferred to HOCS records at the end of each month or burning season." (p. 24)

CODE OF LOGGING PRACTICE – 1988

<u>Code of Logging Practice. 1988</u>

Section 2 : General

NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)

***EXCEPT* FOR AN ADDITIONAL PARAGRAPH UNDER 2.2 –**

"*The 'Forest Regulations' made under the Forests Act will continue to apply to all operations by virtue of Section 149 of the Conservation and Land Management Act 1984 until such time as new regulations are made under that Act.*" (p. 5)

Section 3 : Felling, Trimming and Crosscutting

NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)

Section 7 : Environmental Protection

Fire – All Forest Areas
NOTE: REFER TO ENTRY UNDER 1987 EDITION, *CODE OF HARDWOOD LOGGING PRACTICE* (SIMILAR WORDING)
***EXCEPT* FOR DIFFERENT DISTANCE IN 7.18 – "…*6 metres* …"** (p. 24)

GUIDELINES – 1988?

Interim Guidelines for Necessary Operations : Big Brook Nature Reserve. 1988?

2.3 Fire Protection Objectives
"*2.3.1 Protect life and property of neighbours from wildfires originating on reserve.*

2.3.2 Protect flora and fauna communities from damage by frequent wildfires.

2.3.3 Restrict the spread of wildfire so that the whole reserve is not burnt in the one fire." (p. 3)

3. Fire Protection and Ecological Monitoring
3.2 Fire Management Policy and Strategies
"*The fire management and protection strategies will conform with the Department Fire Management Policy and procedures.*

The strategies to be adopted are:

- *Ecological burn and non-burn treatments.*
- *Maintenance of low-fuel buffers.*
- *Fire Suppression.*
- *Liaison with neighbours.*" (p. 4)

3.3 Ecological Burn/Non-Burn Treatment
"*Due to the small size of this nature reserve, it is not practical to develop a wide spectrum of burn regimes. It is considered that it is important to maintain as much as possible of the area in a long-unburnt state, taking into consideration the risks of fires to the adjoining lands and the Reserve itself.*

It is proposed to subdivide the Reserve into three blocks.

> *Cell 1 is to be burnt on 6 year rotation in Spring 87/88. (in the first cycle)*
> *Cell 2 (largest block) is to be left unburnt*
> *Cell 3 is to be burnt on 8-10 year rotation in Autumn. (in the first cycle).*" (p. 4)

3.4 Fire Protection Actions
3.4.1 Maintenance of Low-Fuel Buffers
"*The Reserve is already divided by access tracks with 3 distinct cells:*

Cell 1. – Graphite Road to power line.
Cell 2. – Powerline to centre track.
Cell 3. – Centre track to Southern Boundary." (p. 4)

"*Cells 1 and 3 are of strategic importance to fire control. Cell 1 is adjacent to Graphite Roads is a likely source of fires from this road.*

Cell 3 being immediately to the north of the rural subdivision represents an important buffer to these properties.

[…]
Actions required are:

Prescribe burn Cell 3 in 1987/88 and Cell 1 in Spring 1989 to reduce fuel loads in the jarrah to less than 8.5 tonnes/ha.

Maintain suitable fire control access to buffer cell boundaries and to Cell 2 boundaries.

Co-operate with owners of bush block South-eastern boundary to implement a fuel reduction burn in this area east of Cell 3.

Burns to be programmed in different seasons within a fire intensity range of 100 to 500 kw per metre to give a minimal scorch to the tree canopy." (p. 5)

3.4.2 Fire Suppression
"*In accordance with the Department's fire policy, priority for fire suppression or fire in or near the Reserve will be:*

1. *Human life*
2. *Community assets, property and environmental values*

Actions required are:

Wildfires threatening the Reserve will be contained to the smallest possible area by direct attack, taking into consideration the fire behaviour, and the likely threats of life and property and the impacts of the suppression activity on the environmental management objectives of the Reserve." (p. 5)

"*Procedures and arrangements for actions in case of wildfires are to be listed in the Manjimup District Fire Control Working Plan each year.*" (p. 6)

9.2 Management Objective
"*To provide a suitable perimeter track and nominated internal tracks to enable fire protection objectives to be carried out.*

Require visitors to the Reserve to enter on foot from the perimeter roads." (p. 9)

9.3 Proposed Construction
"*Upgrade existing perimeter boundary to 4.0m width and provide adequate turn around points for fire units. Upgrade internal tracks nominated for fire control purposes to 4.0m width.*" (p. 9)

CONSERVATION POLICY - 1987

Strategies for Conservation and Recreation on CALM Lands in Western Australia. 1987

The Objectives and Principles in the State Conservation Strategy (SCS)
"*The SCS for W.A. sets out five key objectives for conservation. These are:*

> *to maintain essential ecological processes and life-support systems;*
> [...]

to maintain and enhance environmental qualities;
[...]" (p. 4)

"*CALM is committed to the objectives and principles listed in the SCS and uses them as the basis for all conservation planning and operations.*" (p. 4)

The Legislative Base
"*CALM operates under two legislative acts: the CALM Act and the Wildlife Conservation Act.*

These Acts place a number of statutory requirements on the way in which CALM manages land and wildlife. The major requirements are:

(1) Management must be in accord with a published management plan and all management plans must be made available for public review and comment in the draft phase.

(2) All lands are vested in two controlling bodies (not the Department). The controlling bodies (National Parks and Nature Conservation Authority and Lands and Forest Commission) are comprised mainly of members of the public representative of conservation and land management interests.

(3) The Department must perform the following functions:

manage land vested in the NPNCA and LFC;
provide the NPNCA and LFC with assistance;
[...]
be responsible for the conservation of flora and fauna throughout the State;
[...]" (p. 4)

(4) Indigenous State forests must be managed on a sustained yield basis to ensure long-term social and economic benefits from forest resources." (p. 4)

The Corporate Plan : the CALM Mission and Key Objectives
General Principles and Philosophy
"*CALM is committed to the principle that it manages public land and natural resources and conserves native wildlife on behalf of the public of W.A. Emphasis is placed, then, on informing the public of the Department's activities and, wherever possible, involving the public in planning and management.*" (p. 5)

Statement of Mission
"*In recognising that Western Australia has a beautiful and diverse natural environment which provides material, aesthetic and spiritual benefits and that the natural environment is an essential component of the quality of life for Western Australians, a statement of mission adopted for the Department of CALM is:*

TO PROVIDE FOR THE USE OF THE NATURAL ENVIRONMENT WITHOUT DETRACTING FROM POSSIBLE FUTURE USE." (p. 5)

Charter
"*The scope of the Department's responsibilities is represented by its charter which is:*

TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE PUBLIC LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.

Primary Objectives
Five primary objectives have been established:

Management

To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

Conservation

To conserve the indigenous plant and animal species and environmental processes in natural habitats throughout the State.

Production

To provide and regulate the supply of renewable resources on a sustained yield basis for the satisfaction of long-term social and economic needs, and in a manner that minimises impact on other values.

[…]" (p. 5)

"*Subsequent sections of the Department's corporate plan elaborate on these objectives, particularly those relating to conservation. The strategies used to meet these objectives are:*

ESTABLISH AND MAINTAIN A SYSTEM OF SECURE RESERVES WHICH PROTECT VIABLE REPRESENTATIVE SAMPLES OF ALL THE STATE'S NATURAL ECOSYSTEMS AND SPECIES, BOTH TERRESTRIAL AND AQUATIC, AS WELL AS AREAS SUITABLE FOR RECREATION AND THE PRODUCTION OF RENEWABLE NATURAL RESOURCES.

This will involve:

The development and maintenance, in conjunction with other government instrumentalities and the public, of a comprehensive data base on the occurrence and conservation status of the State's ecosystems and species.
[...]
Categorising lands and waters entrusted to the Department into priority land use zones and applying the principle of multiple use to provide for the needs of nature conservation, recreation and production.

Protecting ecosystems, landscape and the cultural heritage on the lands and waters entrusted to the Department from damage by fire, disease, grazing, feral animals and people.

Developing prescriptions for control of disturbance and for rehabilitation of damaged forests, parks and reserves.

Opposing the incompatible use of lands and waters entrusted to the Department and opposing the release of such lands and waters for other purposes." (p. 6)

"*ENSURE THAT CONSERVATION AND LAND MANAGEMENT IS CARRIED OUT ACCORDING TO SOUND, WELL-RESEARCHED SCIENTIFIC PRINCIPLES.*" (p. 6)

"*PREPARE AND IMPLEMENT MANAGEMENT PLANS FOR LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT*

This will involve:

The establishment of priorities for management plan preparation according to set criteria.

Restricting procedures to necessary operations to maintain public safety and the status quo of area management where no management plan exists." (p. 7)

"*PREPARE AND IMPLEMENT WILDLIFE MANAGEMENT PROGRAMS FOR WILDLIFE THROUGHOUT THE STATE.*

This will involve:

Providing special protection for declared rare (endangered) flora by regulating land use of their habitat.

Managing rare animal populations to ensure their survival." (p. 7)

"*MANAGE EXPLOITATION OF RENEWABLE NATURAL RESOURCES ACCORDING TO THE FOLLOWING PRINCIPLES:*

resources are managed to ensure their long-term conservation;
[...]
the resource is managed to minimise waste." (p. 7)

POLICY STATEMENT - 1986

Administrative Instruction No. 23 : Interim Guidelines For Operations. 1986

Introduction
"*For substantial areas of land under the control of the Department of Conservation and Land Management it will be many years before approved Management Plans will be developed. In the meantime the CALM Act provides in Section 33 (3) (b) that certain operations can be carried out when there is no management plan.*" (p. 1)

"*For indigenous State forest the operations are defined as those actions that ensure the multiple use and sustained yield of that resource for the satisfaction of long term social and economic needs.*

In accordance with the Departmental Planning Policy (Policy 1, January 1986) the necessary operations must be carried out in a planned manner through the development and implementation of INTERIM GUIDELINES FOR OPERATIONS.

The Interim Guidelines will consist of:

(1) a brief description and brief guidelines for major potential activities;

(2) a map showing the locality and area of proposed management activities;

(3) an indication of who must give approval before particular operations can be carried out.

This paper shows how the Interim Guidelines are intended to work." (p. 1)

Aim
"*The aims of the Interim Guidelines are:*

(i) *to provide an adequate safeguard against natural and operational calamities on lands administered by CALM in the absence of an approved Management Plan;*

(ii) *to ensure that critical 'necessary operations' are identified and properly prescribed;*

(iii) *to ensure that the impacts of necessary operations are fully considered and effectively incorporated within existing management and control systems;*

(iv) *to provide a simple, efficient and attainable means of gaining approval for necessary operations.*" (p. 2)

Identification
"*The first step is to identify all the necessary operations within each of the areas concerned. Use can be made of a checklist showing all the possible necessary activities – see Appendix 1. Only those operations that are essential for safeguarding the area in question should be considered. These must be consistent with the objectives for the area concerned as described in the CALM Act.*" (p. 2)

"*The development of suitable strategies and prescriptions* ***will*** *necessitate consultation and collaboration between CALM Operations, Planning and Specialist groups.* […]" (p. 3)

Duration of Interim Guidelines
"*Most Interim Guidelines should have an approval duration of at least 3 years with a maximum of 5 years.* […] *However, the works programme that emanates from these Interim Guidelines must be reviewed and updated annually.*" (p. 4)

Approval
"*A system of approval for the Interim Guidelines and the methods of implementing these is to be adopted which recognises and utilises the established hierarchy of authority and control, i.e. District Manager to Regional Manager to Divisional Manager (or Branch Manager) to Directorate (Director National Parks or Director Nature Reserves or both, or entire Policy Directorate depending on the range of necessary activities). It is expected that once the pattern of the development of these Interim Guidelines have been universally accepted, that the final approval will be delegated to Divisional or Regional Managers.*" (p. 4)

POLICY STATEMENT– 1987

Policy Statement No. 19 : Fire Management Policy. 1987

Introduction
This policy is based upon the following premises:

1.1 *Fire has occurred naturally from time to time in practically all lands managed by CALM. Fire has therefore played some part in determining present vegetation structures and composition.*

1.2 *Under natural conditions, practically all ecosystems are made up of a mosaic of vegetation associations and structural stages according to their fire histories. The scale of the mosaic varies in different ecosystems.*

1.3 *Fires from natural causes (eg. lightning) will inevitably occur. Fires resulting from human activities, either deliberate or accidental will also occur, but may be minimised by effective public education and awareness, and by legislation.*

1.4 In Western Australia, weather conditions occur every year under which fires can be so intense as to be impossible to contain with currently available technologies and resources. Such fires can threaten human lives, and resources valued by the community, and their control involves considerable public expenditure and risks to fire-fighters.

1.5 The speed and intensity at which fire burns is related to the quantity of accumulated dry litter or other fine plant material. In some ecosystems, or in some high risk/high value situations, accumulated fuel loads can be reduced by prescribed burning. This reduces the likelihood of intense fires even under extreme conditions, and improves the capacity for fire-fighters to safely control a fire.

Within each major fuel type there is a recognised weight of dry fuel above which fire-fighting forces are not likely to be able to contain wildfires burning under normal hot summer conditions.

1.6 Much of departmental land, particularly in the south west, has a common boundary with well developed private assets such as towns and farms, the protection of which reduces the flexibility for fire management." (p. 1)

"*1.7 Information about the long term effects of different fire regimes, including fire exclusion on many ecosystems is limited, and any management policy must be under constant review and accompanied by research and monitoring programmes.*" (p. 1)

"*1.8 The Department has a moral and legal obligation to comply with those provisions of the Bush Fires Act, and CALM Act relating to fire prevention and control of wildfires on or near CALM lands.*" (p. 2)

2. Objectives

"*The fire management goal of the Department of Conservation and Land Management is:*

2.1 To protect community and environmental values on lands managed by the Department from damage or destruction from wildfire.

2.2 To use fire as a management tool to achieve land management objectives, in accordance with designated land use priorities." (p. 2)

3. Policy

3.1 Fire Suppression

"*1. The Department will meet its legal obligations under the Bush Fires Act and Conservation and Land Management Act by responding to fires occurring on or near CALM land to a degree that is appropriate to the values at risk.*

2. The Department will assess its response to a fire in the light of potential damage to the following values in order of priority.

(i) Human life;
(ii) Community assets, property or special values (including environmental values);
(iii) Cost of suppression in relation to values threatened.

3. Where values dictate the Department will:

(i) provide a detection system which will give timely warning of the presence of a fire threatening community or environmental values;" (p. 2)

"*(ii) provide a well trained and equipped suppression organisation capable of containing several simultaneous unplanned fires under extreme weather conditions in conjunction with other fire fighting organisations.*" (p. 3)

3.2 Use of Fire
"*The Department will:*

1. Use planned fire only where this use is in accordance with an approved management plan, or, where such a plan does not exist, to protect and maintain the designated priority land use.

2. Prepare written prescriptions in advance, for approval by senior designated officers, before any planned fires are undertaken.

3. For areas where primary land use is wildlife conservation, use fire in such a way as to promote the greatest possible diversity and variety of habitats within prevailing physical or financial constraints.

In small conservation reserves and where information on the impact of fire is limited, fire will be used conservatively. In such areas the use of fire will be restricted to:

(i) protection of neighbouring community assets; and

(ii) as far as is achievable and within safe limits, ensuring that different seral stages following fire are represented.

4. Use prescribed fire or other methods to reduce fuels on appropriate areas of CALM lands, where it can be demonstrated that this is the most effective means of wildfire control, and where undesirable ecological effects do not result.

The frequency of fuel reduction measures will be governed by the rate of build-up of fuels; the degree of risk to human lives, the value of the assets to be protected; the known sensitivity to fire, or dependence on fire, of the kinds of plants and animals present; and the resources available to carry out the work." (p. 3)

3.3 Liaison
"*The Department will:*

1. Ensure effective liaison with neighbours, Bush Fires Brigades, Shires, Bush Fires Board and other fire control organisations.

2. Support the concept of Shire District Fire Plans and promote mutual aid interagency agreements for fire control on lands of mixed tenure with common fire problems." (p. 4)

3.4 Public Awareness
"*The Department will provide for public education in relation to the prevention of fire, and the role and use of fire in ecosystem management, and hazard and risk reduction.*" (p. 4)

3.5 Research
"*The Department will undertake research into fire prevention and control, fire ecology and fire behaviour on CALM lands to improve the scientific basis for, and effectiveness of Fire Management Programmes.*" (p. 4)

4. Strategies
4.1 Fire Suppression

"*Suppression of unplanned fires on or threatening departmental land will be given priority over normal activities, except for those involved with safeguarding human life.*

A detection system based on aircraft, lookout towers or ground patrol, will be used in designated areas where early warning of a fire occurrence is essential to enable rapid control measures.

In other areas, the Department will rely on neighbours, staff presence, the public, or commercial aircraft for reports of fire outbreaks.

When a fire is detected an appreciation will be made to estimate its likely spread and potential to cause damage to life, property or environmental value.

Unplanned fires will be contained to the smallest possible area by the most appropriate means available taking into consideration the values at risk and the impact of the suppression activity on the environment." (p. 4)

4.2Use of Fire
"*Prescribed fires will be used to achieve a range of management objectives, including fuel reduction, habitat management, forest regeneration and the management of scenic values.*

According to management objectives, appropriate prescriptions will be developed, and staff will be trained in their application.

Monitoring of the effects of fires will be undertaken wherever effective systems have been developed and resources are available." (p. 5)

4.3 Liaison
"*The Department will participate in the preparation and implementation of Shire District Fire Plans and interagency agreements.*

Departmental staff will attend Bush Fire Advisory Committees and Brigade meetings where appropriate, to foster and encourage good working relationships with other fire fighting organisations.

Where practical, departmental staff will assist with fire control activities on a neighbour to neighbour basis with local Bush Fire Brigades and other fire control organisations." (p. 5)

4.4 Public Awareness
"*Education of the public on the prevention of wildfire and on the use and role of planned fires will be promoted through the provision of literature, films and talks. Special attention will be directed towards school groups.*" (p. 5)

POLICY STATEMENT- 1987

Policy Statement No. 9 : Conservation of Endangered Flora in the Wild. 1987

Strategies
"*4.6 Ensure that any burning program (for fire protection purposes) will not cause irreparable damage to species of endangered flora known to be susceptible to fire.*" (p. 4)

POLICY STATEMENT - 1987

Policy Statement No. 18 : Recreation. 1987

1.10 Protection of Recreation Site Values
"*1.10.5 Recreation sites and facilities will be protected from wildfires by the development of fuel reduced zones, prescribed burning or mechanical means.*" (p. 22)

CORPORATE MISSION AND OBJECTIVES - 1987

CALM Annual Report 1st July 1986 to 30th June 1987. 1987

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT FOR 1985/1986. ENTRY IS SIMILAR

MANAGEMENT PLANS - 1987

Timber Production in Western Australia : a Strategy to Take W.A.'s South-West Forests Into the 21st Century. 1987

Prescribed Burning
"*The prevention and control of forest fires is a critical part of forest management and a fundamental aspect of this strategy.*

[…] *Recognising that fires cannot be absolutely prevented, the system seeks to minimise the damage which fires cause and maximise the ease of their control. The key strategy adopted is prescribed burning: fires are deliberately lit in selected areas of forest under mild weather conditions. These 'prescribed' fires burn slowly, cleaning up the accumulated debris of leaves and twigs on the forest floor. In areas that have been recently prescribed burnt, wildfires burn less intensely, and can more easily be controlled and extinguished.*

Where prescribed burning is carried out for fuel reduction, areas are reburnt at intervals of several years so that fuel levels do not become too great. The normal interval between prescribed burns is about 5-7 years in the jarrah forest and 7-10 years in the karri forest." (p. 31)

Logging
"[…]*Independent logging operators will be contracted by CALM to harvest all logs from Crown land. In addition, it is proposed that these contractors be trained in fire control and forest hygiene to contribute to the control of fire and disease in the forest.* […]" (p. 32)

Northern forest region regional management plan 1987-1997
Central Forest Region Regional Management Plan 19 87-1997
Southern Forest Region Regional Management Plan 1987-1997

Part 3. Land Use Classification and Management
Protection
"[…] *The Departmental policy on fire … requires that:*

all possible steps will be taken to prevent bushfires;
an effective organisation will be maintained to detect and suppress fires;
where appropriate, fire suppression will be made easier and safer by the practice of cyclic prescribed burning;
a continuing research program into fire ecology and fire control will be given high priority." (p. 34)

Northern Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines … during the period of this plan CALM staff in the region will:*

(i) *continue to maintain an efficient fire detection system and fire fighting force;*

(ii) *wherever appropriate, reduce fuels by prescribed burning;*

(iii) *develop a regional framework for the integration of fire management between priority land use and operations;*

(iv) *consistent with the requirement to protect life, property and ecological values, introduce diversity into prescribed burning fire regimes;*

(v) *implement inter-agency agreements with shires for fire-management in remote areas;*

(vi) *train CALM staff in firefighting techniques to minimise damage to rare and endangered species and ecosystems;*

(vii) *develop interim protection plans for national parks and nature reserves;*

(viii) *establish and maintain firebreaks on all CALM lands;*

(ix) *priority will be given to protection of high value production areas such as pine plantation, regeneration or rehabilitation areas and to high risk areas such as private property;*

(ix) *plan fire protection requirements in advance of mining, logging or plantation establishment to ensure fire protection buffers are established within the area or adjacent land;*

[...]

(xiv) *fire buffers may be established in conservation land when a biological surveys have been done and results indicate consequences will be acceptable as decided by the Executive Director;*

[…]" (p. 35)

Central Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines ... during the period of this plan CALM staff in the region will:*

(i) *continue to maintain an efficient fire detection system and fire fighting force;*

(ii) *where appropriate, reduce fuels by prescribed burning;*

(iii) *develop interim protection plans for CALM national parks and nature reserves;*

(iv) *consistent with the requirement to protect life, property and ecological values, introduce diversity into prescribed burning fire regimes;*

(v) *avoid or minimise damage to rare and endangered species in fire-fighting operations;*

(vi) *give priority to the protection of high value areas (pine plantations, private property, rare flora sites) and high risk areas (logging slash);*

(vii) *plan fire protection requirements in advance of mining;*

(ix) *maximise the amount of protection burning and grazing in pine forests;*

(x) *develop neighbour and public interest in the fire protection needs of CALM lands.*" (p. 36)

Southern Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines ... during the period of this plan CALM staff in the region will:*

(i) *continue to maintain an efficient fire detection system and fire fighting force;*

(ii) *wherever appropriate, reduce fuels by prescribed burning;*

(iii) *consistent with the requirement to protect life, property and ecological values, introduce diversity into prescribed burning fire regimes. Use fire to develop or favour habitat for specific flora and fauna species;*

(iv) *implement inter-agency agreements with brigades for fire management in remote areas;*

(v) *develop fire protection plans for all land managed by CALM;*

(vi) *develop more neighbour and public knowledge about community fire protection needs.*" (p. 35)

MANAGEMENT PLAN – 1987

Shannon Park and D'Entrecasteaux National Park Management Plan 1987-1999. 1987

1.0 Management Objectives For National Parks
"*The following management objectives for national parks are derived from the Conservation and Land Management Act (1984) and departmental polices for management. The objectives are to:*

1. Protect and conserve native plants and animals and their habitats.
2. Protect and conserve physical, cultural and scenic resources.
[…]
4. Regulate use to be consistent with the maintenance and protection of natural resource values and to minimise conflict between uses.
[…]" (p. 47)

2.0 Management Objectives For the Shannon Park and D'Entrecasteaux National Park
"*Management objectives specific to the two Parks were derived from: the above general objectives; the dual purpose of 'national park and water'; and the information provided in B. Description of the Parks. The following background information is most relevant to the determination of specific objectives –*
[…]" (p. 48)

"*The specific management objectives for the Parks are to:*

1. *Protect the biological and physical environment and the cultural and scientific features of the Parks.*

[…]" (p. 48)

6.0 Protection
6.1 Fire
Objectives
"*The Parks are to be managed primarily to conserve their natural ecosystems and landscapes, whilst ensuring the Park visitors have the opportunity to enjoy the Parks without detrimentally affecting them. In setting the specific fire management objectives to achieve the management objectives for the Parks, the protection of life and property within and near the Parks must be of high importance.*

Consistent with this principle, the following objectives will apply in order of priority:

[…]
2. *To protect community and environmental values in or near the Parks including settlements, private property, recreation facilities, forest regeneration and public utilities.*

3. *To minimize the risk of large wildfires burning out large portions of the Parks by confining them to a single block.*

4. *To maintain the scenic beauty and visual amenity of outstanding landscapes.*

5. *To maintain the natural processes and diversity of structure and composition of plant communities.*

6. *To maintain the natural abundance, diversity and ecological integrity of fauna communities.*

7. *To ensure the survival of sustainable populations of rare, endangered or restricted flora and fauna species by the protection and maintenance of their required habitat.*" (p. 75)

"*8. To minimize the introduction and spread of disease through the application of appropriate hygiene measures, road restrictions and suitable fire regimes.*

9. To protect vulnerable soils from the risk of erosion.

10. To maintain the quality of water resources.

[…]" (p. 76)

Background
"*Australian ecosystems have evolved in the presence of fire (Singh et al. 1981). Such adaptations are widespread in the plant communities found in the Parks.*

The array of adaptations enable most of the Western Australian flora to regenerate successfully after fires of almost any intensity and frequency (Gill et al. 1981). […]

There is a wide range of opinion about what constitutes a natural or the most appropriate fire regime for these Parks. However, it is generally agreed that fire is a key management tool in the achievement of both conservation and protection objectives for the Parks.

Fire management prescriptions for the Parks must therefore provide a practical basis for improving the understanding of the relationship between the Parks' plant and animal communities and fire, as well as protection human values from fire." (p. 76)

"*Following a fire there is a progressive change in the structure and composition of the plant and animal community (a process known as succession). Each stage of recovery favours the survival and reproduction of different groups of plant and animals. Research throughout Australia has shown that it is not possible to achieve optimum conditions for all species of plants and animals in one area at any one point of time. It is only through the wise application of a wide range of fire regimes that such an optimum condition can be approached.*" (p. 76-77)

"*In the absence of detailed information on the successional processes and the fire requirements of the Park ecosystems, it is proposed to aim for a wide range of successional stages within the major plant and animal communities of the Parks.*

Apart from the ecological considerations there are may safety aspects which must be considered in fire management. Uncontrolled fire poses a danger to human and conservation values in and surrounding the Parks each summer. The risks are greatest in summer during periods of hot, dry conditions, particularly where large quantities of litter have accumulated and where the probability of ignition is high. Fires burning under these conditions are unsafe to fight by direct attack, and there is a risk of severe damage to and even death of mature karri trees.

Fire hazards can be reduced by careful design and forward planning. Areas of high public values which can be damaged by fire must be identified and strategies developed to ensure their protection." (p. 77)

Fire Management Regimes
"*Three fire management regimes are used in this plan. These are:*

1. Short-rotation Protection Burns
Under this regime, fuel reduction burns will be applied whenever ground fuel-loads exceed critical levels at which fire containment, by direct attack, under hot summer conditions, becomes very difficult and unsafe for firefighters. The rotation period between burns will vary from approximately six to eight years depending on the rate of fuel accumulation of the vegetation." (p. 77)

"*The burns will be arranged in wide buffers to restrict the movement of wildfires through large areas of the Parks. These low fuel areas will also be strategically located adjacent to high risk zones (eg. settlements, heavy fuel areas, recreation facilities) and high value zones (eg. karri regrowth, private property).*" (p. 77-78)

"*These short-rotation burns are categorized as either park or forest protection burns depending on their location.*" (p. 78)

2. No Planned Burn (NPB)
"*Parts of each of the major land units (Map 7) will be protected from wildfires and will not to be deliberately burnt within the foreseeable future. These areas are located remote from likely ignition sources such as major roads, recreation areas and settlements. Many of these NPB areas include the least disturbed sites within the Parks.*

Maximum protection needs to be ensured for the NPB areas, including maintenance of good perimeter access and regular burning of adjacent areas." (p. 78)

3. Flexible Management Areas (FMA)
"*Burns in these areas aim to achieve ecological diversity within each of the major land units. Most of these regimes will entail long rotation burns of about 15 years. It is proposed to burn, on an experimental basis,*

some fire-dependent ecosystem, such as the coastal peppermint/yate association near Lake Maringup, on a rotation of four to five years.

It may be necessary to burn some of the FMA areas for protection reasons if it considered that they constitute a major fire hazard to other values. Each FMA will be reviewed annually to determine if it should be burnt or not, for ecological or protection purposes." (p. 78)

Fire Master Plan
"*To achieve the objectives outlines and using the three regimes given above, a master plan for fire management, essentially geographic in nature, was designed. A framework was developed which details fire management spatially, using defined land units (B. Description of the Parks 6.0 Land Use Capability) and temporarily through the concept of succession. The master plan (Map 14) aims to achieve maximum diversity by using a wide range of successional stages (burn ages) within each of the major land units; subject to the over-riding constraints of the natural resources and the protection of cultural and natural values.*" (p. 79)

Prescriptions
"*If funds are not available to implement the following prescriptions fire protection will be undertaken according to the objectives which introduce this section.*" (p. 79)

Prescribed Burning
"*1. The fire master plan indicated in Map 14 will be implemented. This plan provides for a combination of areas to be periodically burnt to provide buffers (short-rotation protection burns), areas from which fire will be excluded for ecological reasons (no planned burn), and areas to be burnt under a range of fire regimes (flexible management areas).*

2. Park protection burns, including settlement protection areas, will be implemented on a rotational basis when fuels reach 15-19 tonnes/ha in karri and 7-9 tonnes/ha in jarrah and other vegetation types. Burns will aim to achieve an effective cover of 60-80%.

[…]
4. Wherever possible areas will be burned in a variety of seasons.

5. Aerial ignition will be used to implement most burns. […]" (p. 79)

"*6. In those coastal areas shown as extremely susceptible to erosion (Map 6) aerial ignition will not be used.*

7. Stands of regenerating karri within areas to be prescribe burnt will not be isolated and protected, as by the time most stands are burnt they will be mature enough to withstand prescribed burning.

8. No planned burn areas will be protected from fire subject to access constraints. […]" (p. 80)

Wildfire Suppression
"*9. The existing chain of command for the control and use of fire in the Parks will be used. This draws on expertise in ecological and wildlife management, recreation and landscape management, fire behaviour, weather and fire control capability.*

10. Wildfires that enter or start in the Parks will be contained to the smallest possible area, either by direct attack or by backburning from existing tracks and prescribed burnt boundaries, taking into consideration the likely threats to life and property and Park values, and the impact of the fire and the suppression activities on the environmental and ecological values of the Parks." (p. 80)

7.3 Access for Management : Prescriptions
"[…]

2. Only roads designated for public access and those considered essential for management purposes, such as the strategic control of fire, disease and exotic species, will be maintained in a trafficable condition.

3. Tracks required for prescribed burning will only be maintained prior to the burn and to a standard sufficient to allow safe access.

4. All tracks surrounding no planned burn areas (Map 14) will be maintained to a standard sufficient to allow rapid access for fire-fighting.
[…]" (p. 94)

MANUAL – 1987

Fire Resource Recording System. Rev. 1987

NOT INCLUDED, REFER TO DOCUMENT - SHELF NUMBER: COMO 630.432.38(941) WES

MANUAL OF HARDWOOD LOGGING - 1987

Manual of Hardwood Logging … 1987

Section 5 : Environmental Protection
Specification 5.2 Protection of Soil (Including Rehabilitation Measures)
"*3.6 Any burning of debris, seeding or planting considered necessary will be carried out by the relevant CALM District during the winter following rehabilitation.*" (p. 83)

GUIDELINES - 1987

Northern forest region regional management plan 1987-1997
Central Forest Region Regional Management Plan 19 87-1997
Southern Forest Region Regional Management Plan 1987-1997
Strategies for Conservation and Recreation on CALM Lands in Western Australia

Appendix 2, Environmental Management Guidelines

Fire : Objectives
"*To protect community and environmental values on lands managed by the Department from damage or destruction by wildfire.*

To use fire as a management tool to achieve land management objectives, in accordance with designated land use priorities.

Specifically the aim is:" (p. 81)

Fire suppression
"*The Department will:*

Respond to fires occurring on or near CALM land to a degree that is appropriate to the values at risk.

Assess its response to a fire in the light of potential damage to the following values in order of priority:

(i) Human life;
(ii) Community assets, property and environmental values;
(iii) Cost of suppression in relation to values threatened.

Where values dictate:

(i) provide a detection system which will give timely warning of the presence of a fire threatening community or environmental values;

(ii) provide a well-trained and equipped suppression organisation capable of containing several simultaneous unplanned fires under extreme weather conditions in conjunction with other fire-fighting organisations." (p. 82)

Use of Fire
"*The Department will:*

Use planned fire only where this use is in accordance with an approved management plan, or, where such a plan does not exist, to protect and maintain the designated priority land use.

Prepare written prescriptions in advance, for approval by senior designated officers, before any planned fires are undertaken.

Use fire conservatively in areas where information about the impacts of fire is limited, and in areas where the primary land use is conservation of flora and fauna.

In such areas, the use of fire will be restricted to:

(i) protection of neighbouring community assets; and

(ii) providing a diversity of fuel and vegetation ages, but ensuring as much as possible of each major vegetation association is maintained in the mature condition.

Use prescribed fire or other methods to reduce fuels on CALM lands, where it can be demonstrated that this is the most effective means of wildfire control, and where undesirable ecological effects do not result.

The frequency of fuel reduction measures will be governed by the rate of build-up of fuels, the value of the assets to be protected, and the resources available to carry out the work." (p. 82)

OPERATIONS MANUAL - 1987

Southern Forest Region Operations Manual. 1987

Measurement of Forest Fuel Quantity
Location of Sample Lines within Burn Area
"*The fuel sampling techniques described below allow for reliable estimation of fuel quantity on large areas. Three factors which must be considered when planning the sampling intensity and assessment procedure, determine the number of location of sampling sites required. The first consideration is the importance of the area in respect to the value of the timber and conservation assets, the presence of vulnerable regeneration and*

the proximity to private property. The second is that sampling intensity increases with diversity of the area sampled, whilst the third consideration is the ease of access.

The location of sampling lines must be carefully planned as it is important to assess the full range of major forest or vegetation associations and fuel types in order to reduce costs and damage from the prescribed burning operations.

The following sets out the steps to follow in locating the sample lines.

(a) From past burning plans trace the areas of same age burns onto the 1:25000 (where practical) map of the proposed area. Label with year and season of last burn.
(b) Outline the major forest or vegetation association types within the areas of same burning age.
(c) Isolate the canopy cover extremes of each forest type, and randomly select sites for two sample lines within these extremes." (p. 5)

Hardwood Burning Prescription Preparation
"*The following notes have been issue to obtain uniformity in the preparation of the Hardwood Prescription and Burning Report. These notes accompany the handout describing the assessment of forest fuel quantity.*" (p. 14)

Location
"*1. The hardwood burning prescription form must be completed as follows: (See Appendix 1)*

Prior Inspection
"*2. The PLAN of the area must be included in the Burning Prescription.*" (p. 14)

3.Description of Area
"*From the Fuel Assessment Sheet extract the following and record on prescription form.*
3.1 Litter age: Show age by number of leaf falls. Show average tonnes/ha for separate fuel ages and separate forest types within the burn. Indicate full range of litter weights encountered. Similarly indicate range of trash fuel quantity measured.
Scrub: Indicate the scrub structural types, major scrub species, and range of available scrub weight encountered.
3.2 Slope: Indicate whether topography is flat, undulating or steep, and relate this to heavy and light fuels. Where relevant show main aspect.
3.3 Forest or Vegetation Type: Show species, size, and condition.
3.4 Logging Type: Show distribution of tops, plus the year of each separate logging operation. Define the silvicultural treatment required for logging areas." (p. 15)

4. Suggested Conditions for Burning
"*In setting the conditions necessary to achieve a successful burn result, it is important to keep in mind the factors that dictate the number, the timing, the fire danger ratings, and the strip spacing of each of the lightings required.*

These factors include:
- *the season of burn*
- *the forest or vegetation type, condition and vegetation/tree size,*
- *the total <u>available</u> fuel quantities*
- *the acceptable scorch limits,*
- *the range of fire danger index required to burn the full range of fuels.*" (p. 15)

4.1 Season
"*Allocation of the burn season depends on the moisture content of the fuels, the crown height of the potential crop trees and other local requirements. In general, Autumn burns are cleaner and so of high protection value*

than Spring burns. Certain forest areas, e.g., flats and eastern wandoo types, will not burn in early spring. However, Autumn burns are associated with high scorch heights due to the dryness of outer bark, heavy ground fuels and duff litter. Also the Autumn burning season can be cut short by winter rains and at best is an unpredictable burning season. On the other hand, Spring is a more reliable season, and burning at this time leads to less scorch damage." (p. 16)

4.2 Total Available Fuel Quantity
"*Fire behaviour studies indicate that scorch heights vary with fire intensity which in turn is related to the amount of available fuel and the fire rate of spread.*

These relationships have been tabulated for both karri (including karri-marri) and jarrah forest associations.

To calculate the <u>available</u> fuel quantity, refer to appropriate trash and scrub fuel tables (Forest Fire Behaviour Tables) and obtain the available fuel weight for these components. Obtain the available <u>litter</u> weight by multiplying the total litter weight by the Available Fuel Factor (AFF). (For Jarrah litter one can assume AFF to be 1.0; for Karri litter AFF = 0.5)

Add the trash, scrub and litter <u>available</u> values to derive the total available weight." (p. 16)

4.3 Acceptable Scorch Height Limits
"*The forest type, condition and height of canopy will indicate the level of scorch which is considered acceptable. Stands susceptible to scorch, such as young saplings, require a lower scorch standard than pole stands, which in turn can stand less fire than mature forests.*" (p. 16)

Table 1 : Maximum Scorch Acceptable for Various Tree Sizes

Stand Type	*Max. Scorch Height (metres)*	
	Spring	*Autumn*
J Coppice	*3m*	*3m*
J, M or K Saplings	*4*	*4*
J, M or K Poles (10-18m tall)	*5*	*5*
J, M or K Poles (20+ m tall)	*6*	*7*
" Mature	*7 to 9*	*7 to 12*

Note: These scorch limits may need to be modified if stands contain logging tops or massive fuel accumulations." (p. 17)

7. Pre-Burning Work Required
"*Record on the prescription form details of the following jobs that must be completed before lighting takes place.*" (p. 19)

7.1 Edging
"*After inspection of the burn perimeter indicate on plan the edges that require special treatment, e.g., scrub rolling of karri scrub types, wet gullies, ti-tree swamp edges. Give full details on the edging operations required and fuel moisture content, Fire Danger Index and Soil Dryness Index limits under which successful edging will result.*" (p. 20)

8. Notifications
"*Every object, operation, or establishment within the burn areas which may suffer damage must be identified and action taken to ensure protection. Locate the position of any of these items on the plan. (Refer to Fire Control Manual, para 119). Attach copy of complete P.A.F.S.O.U. form.*" (p. 20)

11. Post-Burn Record
"*O.I.C.'s of the burn must complete information on fire behaviour observed from the ground and air for each lighting. This includes the range of fire Rate of Spread and any unusual fire behaviour. The post burn inspection includes a plan showing areas burnt, unburnt, scorched, and areas of escape.*" (p. 20)

Hardwood Burn Preparation
Scope
"*These guidelines cover the operations conducted before a hardwood prescribed burn is lit (generally stag removal and scrub rolling on edges), together with the related issue of stag removal during a burn. The guidelines refer to all tenures of land controlled by CALM.*" (p. 30)

2. Objectives
"*a) To minimise the amount of stag falling necessary, commensurate with the satisfactory completion of the burn with minimum risk of escape.*
b) to minimise the environmental effects of pre burn scrub rolling, and ensure the objective of a fully burnt out edge with no re-ignition is achieved.
[…]" (p. 30)

Guidelines for Edging
Scope
"*These guidelines cover edging for prescribed burning in Southern Forest fuel types.*" (p. 36)

Objective
"*To ensure edging is done:-*
a) To accepted Departmental standards.
b) To adequate environmental standards.
[…]" (p. 36)

Value of Edging
"*Quality edging will greatly assist in determining the success of your prescribed burning programme by:-*

a)Reducing the need for costly and time consuming mop-up and patrol procedures.

b)Reducing the risk of escape from subsequent flare ups in unburnt pockets as the season warms up.
[…]" (p. 36)

Prescription
"*7.1 All edge burning will be done to an approved prescription.*

7.2 Each prescription will show desired depth of edging, F.D.I., S.D.I., wind direction and wind strength limits.

7.3 Where autumn edging is done for a burn the next season P.A.F.S.O.U. and environmental checklist must also be completed." (p. 38)

Edging Time
"*Suitable edging weather occurs during spring or late autumn and occasionally during winter for southern flats. As there are likely to be only a few hours of good edging conditions on any one day, sensible planning of gang and staff disposition is essential to obtain the best results.*" (p. 38)

Jarrah Regeneration Burning
Scope

"*This prescription provides guidelines for the burning of jarrah, marri forest stands following trade operations.*" (p. 56)

Objective
[…]
2.3Provide protection for the growing stock through fuel reduction." (p. 56)

3. Planning
"*3.1 The cutting prescription dictated by the stand structure will largely determine the type of fire appropriate for the regeneration burn.*
[…]

4. Burn Prescription
"*4.1 All burns conducted must be to a prescription which clearly states the objectives and F.D.I.'s to be used.*
1.2 The attached table gives guidelines for the different cutting systems." (p. 56)

Policy for Scrubrolling Prior to Prescribed Burning Operations
Description
"*Scrub rolling is the use of machinery to roll standing green understorey material to a pre-determined depth around the perimeter of prescribed burns. This operation is particularly applicable where the proposed burn is adjacent to areas of high value, heavy accumulations of unburnt fuels, or complex boundaries with a high risk of fire escapes from the burn.*" (p. 64)

3. Objectives
"*3.1 To ensure complete combustion of fuels within this scrub rolled edge.*
3.2 To use this operation to minimise the chance of future fire escapes.
3.3 To reduce mop up requirements.
3.4 To minimise burnt scrub from falling onto roads.
[…]" (p. 64)

4. Location
"*Scrub rolling will only be done on a needs basis.*
4.1 Scrub types associated with Karri Forest types.
4.2 Some Jarrah Forest with Karri types scrub.
4.3 Other dense scrub types." (p. 64)

7. Method of Operation
"[…]
7.3 The aim of the operation is to lay the fuel onto the soil to allow it to cure sufficiently to ensure satisfactory combustion. Soil is not bared, especially if scrub is to remain unburnt over winter.

7.4 Scrub rolling is to be done to an average depth of 20 metres from the adjacent road. […]" (p. 66)

"*7.4.4 Damage to standing trees is to be avoided. Scaring by removal of bark will eventually lead to hollow butting. Groups of saplings and mature understorey trees (peppermint, karri oak etc) are not to be pushed or rolled except where visibility is affected.* […]
[…]
7.4.6 Paper bark and other swamps will not be scrub rolled.
[…]
7.6 Because of the sensitive nature of this operation it is essential that adequate supervision be given to this type of work." (p. 67)

Mopping Up
Scope
"*The standards and instructions contained in this prescription applicable within the Southern Forest Region.*" (p. 80)

2.Objectives
"*To define the STANDARDS and METHODS required to successfully MOP-UP boundaries of prescribed burns or wildfires to ensure subsequent fire escape is eliminated or severely reduced.*" (p. 80)

5. Standards
"*Regardless of method of mop up the final standard will be the same. Final standards is emphasised because in some situations holding mop up may be necessary when there is insufficient time, men or equipment is available to complete mop up to final standards.*

In this situation only important or urgent work such as extinguishing logs or burning bark on trees is done, but will be completed when available resources allow.

Final standards (for hardwood forests) are:-
5.1Rake Trials
At least 1 metre wide (depending on location and adjacent fuel type) and clear to mineral soil." (p. 80)

"*5.2 Dozer Breaks*
4metre wide, and trafficable to four wheel drive trucks. Turn around to be installed every 150m or as required.

5.3All burning material on or near the ground (logs, stumps, hollowbutts) for at least 20 metres from the break to be entirely extinguished.

5.4All burning trees or stags within 100 metres of the break to be extinguished (of felled if necessary).

5.5 All unburnt pockets within 100 metres of the edge to be burnt, or isolated to satisfaction of fire boss.

5.6 *Any burning logs that may roll across the break to be stabilised.*" (p. 81)

Technique
"*6.1 Environmental matters (preventing possible dieback spread, excessive machine activity – soil erosion, damage to trees etc) must be considered.*
[…]
6.3 Burning material may be extinguished by any of 3 methods:-
- *Water/ and retardent*
- *Completely covering with soil*
- *Removal to and placing within the fire more than 20m from the break.*

Any of these methods is satisfactory depending on circumstances.

6.4 Adequate patrol along the break until mop is completed will be necessary to avoid hopovers and escapes.

6.5 Where machinery and pumper units are being used together, the ideal situation is for the machine (dozer, rubber tyred loader) to precede the crew and push/lift large burning material away from the break and into the fire.

If sufficiently equipped and it is safe to do so the machine may push (preferably away from the break) any burning trees, stags or spars. Experienced machine operators, overseers or staff will know which trees <u>have</u> to be pushed, and which ones may be left to burn out (especially hollow limbs), rather than push the tree. This is especially true to larger karri, marri and other trees, even if the burning limb cannot be reached with a canvas hose." (p. 81)

"[…] *When constructing firelines, machine operators must be instructed to push logs and debris to the outside must be instructed to push logs and debris to the outside of the break where possible, so as to reduce mop up. Obviously caution must be exercised to avoid moving any burning material to the 'wrong' (non fire) side of the break. Heaps of soil covered combustible material must not be left on the break edge, but should be spread out to allow fuel to burn and again reduce mop up.*" (p. 83)

Fire Detection Using Spotter Aircraft
Scope
"*This prescription covers the use of spotter aircraft in aerial surveillance operations over the Southern Forest Region.*" (p. 87)

Objective
"*To detect, assess and report accurately, the position of any fires in or adjacent to CALM lands, early enough to allow suppression action to be taken if required before a major fire develops, and to provide reconnaissance information for any major fires.*" (p. 87)

Water Point Construction and Maintenance
Scope
"*This prescription covers all water points for fire suppression, and presuppression purposes in the Southern Forest Region.*" (p. 97)

Objectives
"*2.1 To construct or provide access to sufficient water points as to ensure adequate protection to adjacent CALM controlled (S.F. N.P. N.R.) lands during fire control ops.*

To achieve this objective analysis of the existing facilities must be made. Value of estate projected varies widely but may be broadly defined as <u>High Value</u>: (generally in 'P' or 'A' Zone)

a) Valuable or potentially valuable resource that has attracted significant capital expenditure or work output in the past eg. Pine plantations, regenerated hardwood stands, commercially thinned stands etc …
b) Scientific (rare plant spp, no burn areas, research sites etc).
c) Other values, recreation, conservation etc.

<u>Lower Value: ('B' Zone</u>
Other estate with the Region – JB, JC stands, flats.

Establishment and maintenance of water points for the above areas will be required relative to their value rating." (p. 97)

Top Disposal in Karri Regrowth Stands
Scope
"*This prescription covers the removal of logging debris from around the base of retained stems following thinning in karri regrowth stands.*" (p. 119)

Objective
"*To prevent future cambial damage during prescribed burning by removing woody material from the base of crop trees.*" (p. 119)

Technique
"*a) Programme gangs to carry out the work as soon as possible after thinnings is complete. Maximum 2 years after thinning.*
[…]
d) Debris and logs to be cleared for at least 1 metre from the base of stems marked for retention.
[…]" (p. 119)

Top Disposal in Jarrah Regrowth Stands
Scope
"*Tops disposal shall be applied to areas of forest where protection of retained or crop trees is required following logging operations.*" (p. 121)

Objective
"*To protect retained trees from fire damage during tops burning and subsequent fuel reduction burns.*" (p. 121)

Prescription
"*3.1 <u>Selection of Trees to be Tops Disposed</u>*
a) Each area to be tops disposed will be treated on the merits of that stand.
b) The marking of potential crop trees shall be carried out by the OIC of the coupe prior to the logging operation i.e. retention marking.
[…]" (p. 121)

3.2 Tops Disposal
"*a) Using axes or chainsaws remove all debris >75mm in diameter from base of retained trees to a distance of at least 1 metre.*
b) Elevated branches immediately around the tree to be lopped flat." (p. 121)

Standards for Coupe Preparation for Karri Regeneration
Scope
"*This preparation covers standards required for various items during preparation burns. Location and quality of all operations during preparation for the burn are to be detailed in the 'Slash Burn Preparation Prescription'.*" (p. 123)

Objectives
"*a) To ensure that standards defined herein are applied uniformly between Districts.*
b) So satisfactory future access is assured.
c)And that the potential for future productivity is maximised." (p. 123)

3. Preplanning
"*Obviously if sufficient fore thought and planning takes place before logging commences many benefits will be assured.*
1.1 Coupe Shape – symmetrical preferred.
Coupe Location – to avoid untrafficable boundaries if possible.
Forest Types – Cutting to adjacent forest types will avoid cutting poorly shaped pockets in future. Many allow buffer burning of jarrah types adjacent to reduce preparation expenditure.
Existing Road Use – To avoid additional expenditure and duplication.
[…]" (p. 123)

4.Standards
4.2 Roading

"*b) External Roads – These are primarily for fire control and access purposes only. As such they will generally be built to summer access standards only, but will be drained and piped to avoid deterioration and provide winter access if possible.* […]" (p. 124)

4.3 Scrub Rolling

"*This is the operation to flatten standing green scrub, unmarketable small trees, poles etc. sp they will burn more readily and create a more suitable sites for future regeneration. A D7 or D6 size machine with tree arm is required.*

However, depending on the time of year especially, not all scrub needs to be rolled. Small areas of material (20 metres square) may be left standing, where surrounded by dense dry logging slash." (p. 123)

4.5 Advance Mop-Up (Pushing In)

"*This is the pushing of logs and large debris away from any boundary (into the burn) before burning commences. This allows better control when burning and adjacent to no – burn areas (stream reserves etc.) and avoids costly and extensive mopping up after the burn.*

The location of any pushing in will be marked on the prescription plan, and will need to be done where no buffer burn is proposed or recent burn exists.

The depth of pushing will be 20 metres …[…]" (p. 125)

4.8 Other Preparatory Work

"[…]

High value/risk areas adjacent eg: karri regrowth stands, pines, private property etc which must not be burnt under any circumstances will require special preparation and protection consideration." (p. 127)

CODE OF HARDWOOD – 1987

Code of Hardwood Logging Practice. 1987

"*Where specifications for the performance of the rules and instructions in this Code are required they are to be found in the Manual of Specifications covering the forest area in which logging operations are taking place*." (p. i)

Section 2 : General

"*2.1 The Instructions contained in this Code shall be observed by all persons participating in any hardwood forest logging operation on land managed by the Department of Conservation and Land Management.* […]

2.2 An Operator shall observe all Acts of the State of Western Australia, and in particular, the Bush Fires Act 1954, the Conservation and Land Management Act 1984, the Inspection of Machinery Act 1921, the Machinery Safety Act 1974, the Road Traffic Act 1975, the Timber Industry Regulation Act 1926, the Workers Compensation Act 1912, the Wildlife Conservation Act 1950-79, the Agriculture and Related Resources Protection Act 1976-83, the Country Areas Water Supply Act 1947-76, and the Water Authority Act 1986, including all amendments to those Acts for the time being in force and any Act passed in substitution or in lieu thereof and all Regulations for the time being in force thereunder as well as this Code of Logging Practice." (p. 4)

"*2.12 An Operator must ensure that all major roads as nominated by a Forest Officer are left open at the cessation of work each day, or if required, during the day, to allow access for fire control and administrative purposes. All other roads and tracks in a coupe or sub-coupe may be blocked in the course of logging operations but access must be restored to the satisfaction of the Forest Officer in Charge upon completion of logging.*" (p. 6)

Section 3 : Felling, Trimming and Crosscutting

"*3.21 All tops, slash and other debris from the operators operations shall be cleared from roads, firebreaks, creeks, landings and logging tracks as directed by a Forest Officer.*" (p. 11)

Section 7 : Environmental Protection

Fire

"*7.10 Particular attention must be paid to the sections of the Conservation and Land Management Act and the Bush Fires Act and to Regulations made under those Acts for the purpose of controlling fires.*

7.11 No fires are to be lit in a hardwood forest area without the express permission of a Forest Officer.

[…]

7.13 Operator or any person employed by him shall take all necessary precaution to prevent the occurrence or spread of fire in the hardwood forest area and shall be liable to the Executive Director for suppression costs and damage caused within the said areas or on any State forest, timber reserve or Crown land by any fire on, or extending from, the said area unless the Operator can prove to the satisfaction of the Executive Director that such fire or fires without any act or omission on the part of the Operator originated outside the said area and/or arose through some cause beyond his control.

7.14 An Operator and all his employees shall co-operate with officers of the Department in preventing and suppressing bush fires and shall when called upon by a Forest Officer act under his instructions in fire fighting or preventing outbreaks of fire.

7.15 An Operator shall not use, or operate, or permit the use or operation of, any chainsaw or other internal combustion engine in any forest area unless the engine is fitted with an exhaust system of a type and design approved by the Executive Director. The exhaust system will be inspected regularly by the Operator to ensure that the efficiency is maintained. Spark arrestors of a YUBA or equivalent type will be fitted to all petrol and diesel engines other than turbo charged diesels.

7.16 Every machine involved in extraction or loading must carry a suitable fire extinguisher (Bush Fires Reg 37).

7.17 An Operator shall keep all logging machines free of accumulated combustible material, particularly the spaces between the engine and engine guards.

7.18 *An Operator may establish in any hardwood forest area not more than one dump of fuel per logging unit on a site and 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 3 metres.*" (p. 23)

CORPORATE MISSION AND OBJECTIVES - 1986

CALM Annual Report 1st July 1985 to 30th June 1986. 1986

Corporate Objectives

"*Under a corporate plan formulated in 1985/86 the statement of mission for the Department of Conservation and Land Management is:*

TO PROVIDE FOR THE USE OF THE NATURAL ENVIRONMENT WITHOUT DETRACTING FROM POSSIBLE FUTURE USE.

The scope of the Department's responsibilities is represented by its charter which is:

TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE PUBLIC LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.

Primary objectives are:
Management

To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

[….]" (p. 8)
"*To achieve the primary objectives the Department will:*

Provide an effective administrative framework for the conservation of wildlife throughout the State and the management of lands, waters and natural resources entrusted to the Department.

This will involve:

- *The maintenance of a Policy Directorate to establish, review and refine Departmental aims, policies and priorities; to monitor the implementation of management plans; and to see that goals are achieved.*
- *The maintenance of an operations wing to implement policies and management plans and to set up efficient financial, administrative and management systems.*" (p. 9)

"*Establish and maintain a system of secure reserves which protect viable representative samples of all the State's natural ecosystems and species, both terrestrial and aquatic, as well as areas suitable for recreation and the production of renewable natural resources*.

This will involve:
[…]

- "*Protecting ecosystems, landscape and the cultural heritage on lands and waters entrusted to the Department from damage by fire, disease, grazing, feral animals and people.*

- *Developing prescriptions for control of disturbance and for rehabilitation of damaged forests, parks and reserves.*" (p. 10-11)

"*Prepare and implement management plans for lands and waters entrusted to the Department.*

This will involve:

- *The establishment of priorities for management plan preparation according to set criteria.*

- *Restricting procedures to necessary operations to maintain public safety and the status quo of area management where no management plan exists.*" (p. 13)

STRATEGIC PLAN - 1986

Strategic Plan : Southern Forest Region. [1986]

3. Regional Objectives
3.3 Protection
Fire
"*To provide fire management programmes which protect the lives of CALM staff, neighbours and visitors, and which protect public and private assets from wild fires.*

To maintain diversity of plant and animal communities, scenic beauty and amenity by prescribed use of fire.

To minimize environmental disturbance such as erosion, disease spread or impairment of water quality by appropriate fire regimes." (p. 6?)

Key Area : Hardwood Tending
Objective
"***1. Karri**. Ensure tending operations particularly thinning of 12 to 20 y.o. regrowth are directed to areas where stand growth and strategic importance are maximised.*" (p. 16?)
Measure of Performance
"*1. All young karri regrowth thinning to be in primary buffers to enable fuel reduction burning.*" (p. 16?)

Key Area : Fire Management
Objective
"*1. To provide fire management programmes which protect the lives of all users and neighbours of CALM lands, and protect public and private assets from wild fire damage.*

To use prescribed use (or non use) fire as a management tool to encourage diversity of plant and animal communities, scenic beauty and amenity.

To minimise environmental disturbance which may result from fire management operations.
[…]" (p. 18?)
Measure of Performance
"*1. Review burning buffer system by September, 1986 to ensure it is still meeting the necessary objectives.*
[...]
3. Complete all F.C.W.P. in Region by October, 1986.

4. All burning to be done to an approved prescription.
[...]
7. Implement the strategic roading policy as previously approved." (p. 17?)
"*8. Prepare Interim Management Programmes for all Parks, Reserves and high value Forest areas according to strict priority.*

9. Plan and implement an improved fire management recording system.
[...]
13. More carefully assign priorities to all burns in the Region before the season commences.

14. *Review the basis and techniques for coupe preparation and stag falling to determine if they are still totally appropriate.*

15. *Complete planned burning programme for 1986/97 to prescription.*

16. *Utilise Brigade resources to increase prescribed burning achievements (aim for a minimum of 10 burns totalling at least 600 ha per annum).*

17. *Develop a revised pre burn scrub rolling prescription to account for existing needs plus environmental and landscape needs.*

18. *Maintain programme annually in accord with Master Burning Plans, and implement a strict cost control system to gain accurate costing data for burning operations.*

19. *Define a programme for thinning young even aged karri regrowth where necessary to allow the consolidation of burning buffers.'* (p. 17?)

Key Area : Wood Production
Objective
"*1. To ensure effective planning of all logging operations to maximise benefits and minimize overall costs (including subsequent operations).*" (p. 55?)
Measure of Performance
" [...]
4. Logging/burning sequence to be planned to:
(a) minimize number of burning operations
(b) avoid slash adjoining planned burn." (p. 55?)

Key Area : Protection - Fire
Objective
"*1. Carry out all prescribed burning in accordance with Departmental policies and procedures.*" (p. 59?)
Measure of Performance
"*1. Prepare prescriptions for all burns and carry out the burns under the conditions nominated.*

2. In 1986/87 fire season achieve 10 A/C burns and 16 hand burns.

3. Encourage co-operative burning on CALM lands and achieve 4 such burns annually." (p. 59?)

"*4. In 1987/88 fire season achieve 10/A/C burns and 15 hand burns.*

5. Prepare fire protection plans for all CALM plantations by 15th November, 1986." (p. 60?)

Key Area : Protection - Fire
Objective
"*2. Prevent the loss of forest values resulting from uncontrolled fires*" (p. 60?)
Measure of Performance
"*1. Prescribe burn as per Protection (Fire) objective (1)*

2. Prepare a FCWP by November, 1987.

3. Apply FCWP to its defined standards." (p. 60?)

Key Area : Protection - Fire
Objective

"*1. Carry out all prescribed burning and fire suppression activities in accordance with Departmental policy and procedures.*" (p. 68?)
Measure of Performance
"*1. Prepare a FCWP, to Protection Branch standards by November, 1986.*

2. Prepare detailed prescriptions for all burns to be undertaken.

3. Carry out all burns under the conditions specified in the prescription.

4. Complete burns with less than 10% scorch.

5. Undertake all burns without significant escapes.

6. Report, and investigate all significant escapes from CALM burns.

7. Precede all suppression operations with a Fire Appreciatic." (p. 68?)

Key Area : Protection - Fire
Objective
"*2. Encourage and refine new burning techniques in karri regrowth stands*" (p. 68?)
Measure of Performance
"*2. Carry out 2 operational regrowth burns annually.*" (p. 68?)

Objective
"*6. Continue Strategic Roading Programme.*" (p. 69?)
Measure of Performance
"*2. Produce a strategic access plan for hardwood areas, both for established regrowth areas and DRA areas, by January 1987.*" (p. 69?)

Key Area : Hardwood Establishment
Objective
"*1. To regenerate all areas of logged old growth karri forest.*" (p. 74?)
Measure of Performance
"*1. Carry out all regen. burns without significant escapes.*
2. Conduct regen. burns surrounded by established regrowth only when a moisture differential exists.
3. Establish, and burn, buffers where ever possible to reduce the amount of push in required.
3. All regen. burn boundary tracks are to be piped to reduce erosion and to ensure that they can be maintained once regeneration is completed.
[…]" (p. 74?)

Key Area : Hardwood Establishment
Objective
"*3. To regenerate all cut over jarrah forest*" (p. 75?)
Measure of Performance
"*2. Carry out advance burns at least 12 months prior to logging and mild tops burns in spring following logging.*
[…]" (p. 75?)

Key Result Objectives - Walpole District
Key Area : Protection
"*1. To most efficiently utilize limited District Resources to achieve the highest priority works in a pre-planned District Fire Control Strategy.*
- a) identify the greatest areas of hazard." (p. 84?)

Measure of Performance
"*1. Achievement of an annually identified programme of works.*
[...]
3. The priority areas of concern (ie. life, property, forest values etc.,) are adequately protected from fire." (p. 84?)

Key Result Objectives - Walpole District
Objective
"*3. Ensure fire protection activities are conducted to prescribed standards. Emphasis on the quality of boundary track construction, edging, burning and mopup.*
- Environmental consideration high priority in prescriptions." (p. 85?)
Measure of Performance
"*1. Prescriptions to be monitored for successful achievement.*
2. All burning to be done to an approved prescription." (p. 85?)

Key Result Objectives - Walpole District
Objective
"*5. Preplan fire suppression action in all CALM areas to be formalized - especially, no planned burn areas and coastal heaths.*" (p. 85?)
Measure of Performance
"*1. Prepare fire suppression models for high value/high risk areas in the District.*" (p. 85?)

5. Five Important Tasks to Achieve in Next Five Years
5.1 Southern Forest Region
5.2.1 Forest Protection
"*Achieve the burning programme as per approved burning plans (including interim plans for Nature Reserves) to provide the required level of strategic and specific protection.* […]" (p. 92?)

MANUALS – 1986

Fire Fighting Personnel : Training Manual. [1986]
NOT INCLUDED, REFER TO DOCUMENT – SHELF NUMBER: COMO 630.432(94) FIR
and
Fire Fighting Personnel Training Manual : Fire Behaviour, Level 2. 1986
NOT INCLUDED, REFER TO DOCUMENT – SHELF NUMBER: WOODVALE A 630.432(941) FIR

Fire Suppression Organisation. 1986

Preamble
"*Together with other initiatives the following major updates have been included:-*
(a) An improved definition of fires on CALM lands, the development of a Fire Suppression Organisation which caters for each, and a specification of minimum requirements for Control Point layout and organisation.
[…]" (p. 2)

Fire Organisation : An Explanation
The Need for a Standard Fire Organisation
"*Fire fighting is by nature an emergency operation. It calls for fast, aggressive and efficient action. To achieve such action, good organisation of fire fighting forces is essential. Without good organisation, disasterous consequences brought about by uncertainty, slowness, conflicts in authority, and lack of teamwork are likely.*

Case histories of past wildfires expose the need for a planned fire organisation that ensures that all the functions required to combat and control a wildfire are catered for by trained personnel.

1.1 FIRE CLASSIFICATION
Under CALM, fires are classified into three broad groups:-

a) <u>District fire:</u>
- *R.O.S. < 2.5km/hr in grass & < 140m/hr in forest, 1 or 2 gang units# despatched*
- *initial attack will succeed.*
- *values at risk forest/park/reserve - low to moderate; life and property - low.*
- *short duration fire (i.e., running fire likely to be contained in <2 hours).*

b) <u>Large Fire</u>:
- *R.O.S. > 2.5km/hr in grass or > 140m/hr in forest,*
  3 or more gang units despatched or a Red Action.
- *initial attack not likely to be successful i.e. task will require greater input for longer periods.*
- *values at risk include life, property and forest/park/reserves.*
- *may involve some support from other bodies eg. Bushfires Board.*
- *running fire likely to be stopped in first shift.*
- *may involve two or more smaller fires.*

c) <u>Campaign Fire</u>:
- *CALM resources exceeded, requiring large input from outside sources.*
- *values at risk:- large numbers of people; large amounts of property; high value CALM assets.*
- *involves several other Government organisations and large numbers of resources.*
- *running fire not stopped on first shift, potential for long duration suppression operation.*
- *high degree of media interest.*
- *most likely to occur in the high priority zones (A, B or P zone) of the Forest Regions.*" (p. 4)

SILVICULTURAL GUIDELINES - 1986

<u>Silvicultural Guidelines for Virgin Southern Jarrah Forest. 1986</u>

6. Integration of Logging, Regeneration and Fire Protection
"*A silvicultural system requires the integration of logging, regeneration and fire protection. It is pointless to acquire regeneration which will later be damaged by logging or fire.*

The silvicultural treatment required for the two types – those that contain advanced regeneration and those that do not – are quite different, particularly with respect to fire management.

On one hand, types where logging is designed to release advanced regeneration require a top disposal burn to remove logging debris, but the burn is not constrained by the need to protect an overstorey. This is followed by a fire exclusion period of approximately 10 years.

On the other hand, types where regeneration has to be established require a top disposal burn which will not damage retained trees, followed by regular prescribed burning every five years for about 20 years.

These different types, however, occur as a mosaic within the one stand, occupying areas of a few hundred square metres to several hectares. […] *The conflicting needs of the various components of the stand must be taken into account.*

There are several alternative strategies, each with advantages and disadvantages, aimed at satisfying these conflicting needs." (p. 18)

(a) Strategy 1

"*This provides for gap creation to release existing regeneration (ground coppice) and uniform selection cutting to establish regeneration at the time of the initial cut. Protection regrowth is given priority by not burning the stand for 10 years after the initial cut.*

[…]

(i) *Advance burn the coupe two years before the proposed cutting. This will improve visibility of the lignotuber development and allow sufficient time for the lignotuber to re-shoot after the burn.*

(ii) *Demarcate stands that contain very dense ti-tree and a low stocking of trees. These usually occur on deep sands of peat,, and frequently contain blackbutt of poor form. These stands should not be logged.*

(iii) *Demarcate areas with an adequate stocking of regeneration of ground coppice or larger (see Section 5 (a): Stands with Adequate Advance Growth of Saplings and Ground Coppice) and create gaps by logging. Carry out a uniform selection cut in the remainder (Section 5 (b) Stands with Inadequate Advance Growth).*

(iv) *Carry out cull treatments in the created gaps, disturb the soil in the uniform selection cut patches, and burn tops in a seed year.*" (p. 19)

" *(v)* *Exclude fire from the stand till regeneration in the gaps is large enough to withstand a prescribed burn (5-6 m in height, or about 10 years).*

(vi) *Following the fire exclusion period burn about every 5 years till regeneration in the uniform selection cut areas has developed to the ground coppice stage (about year 20).*

(vii) *Then cut, burn tops, and cull the uniform selection cut area in the same way as for previous gap cutting (Section 5 (a) : Stands with Adequate Advance growth of Saplings and Ground Coppice). It is important to cut this area before the regeneration begins to develop into large saplings and small poles. If left beyond this time the regeneration which will be damaged by logging will be more difficult to burn back to ground level. This may result in excessive coppice development and malformed stems in the future regrowth stand.*

Following cutting, exclude fire from the area till the new saplings are old enough to withstand a mild fire (about 10 years) before resuming normal prescribed burning." (p. 20)

"(v) *Exclude fire from the stand till regeneration in the gaps is large enough to withstand a prescribed burn (5-6 m in height, or about 10 years).*

(vi) *Following the fire exclusion period burn about every 5 years till regeneration in the uniform selection cut areas has developed to the ground coppice stage (about year 20).*

(vii) *Then cut, burn tops, and cull the uniform selection gap cutting (Section 5(a): Stands with Adequate Advance growth of Saplings and Ground Coppice). It is important to cut this area before the regeneration begins to develop into large saplings and small poles. If left beyond this time the regeneration which will be damaged by logging will be more difficult to turn back to ground level. This may result in excessive coppice development and malformed stems in the future regrowth stand.*

(viii) *Following cutting, exclude fire from the area till the new saplings are old enough to withstand a mild fire (about 10 years) before resuming normal prescribed burning.*" (p. 20)

(b) Strategy 2

"*This provides for initial gap creation to release existing regeneration (ground coppice) and a delay of uniform selection cutting required to establish regeneration till the first protection period is complete (Fig. 4).*

(i) *Advance burn, demarcate and cut to create gaps as described for Strategy 1. Do not remove any trees from areas containing inadequate or undeveloped lignotubers.*

(ii) *After logging, burn the whole area with the primary objective of burning the tops in the gaps. Poison or coppice culls in the gaps.*

(iii) *Exclude fire from the stand till the regeneration in the gaps is old enough to withstand a fire (5-6 m in height or about 10 years).*

(iv) *Following the first prescribed burn, cut the remaining areas on the basis of a uniform selection. Disturb the soil and burn tops in a seed year (see Section 5 (b)).*

(v) *Burn regularly till lignotubers have developed into ground coppice but have not yet become large saplings or small poles.*

(vi) *At this stage cut, burn tops and cull the uniform selection cut area in the same way as for previous gap cutting described in Section 5 (a): Stands with Adequate Advance Growth of Saplings and Ground Coppice.*" (p. 22)

"*(vii)* *Exclude fire from the stand till new regrowth can withstand a fire (a further 10 years).*

Then resume normal protective burning." (p. 24)

(c) Strategy 3

"*This provides for gap creation to release existing regeneration (ground coppice), and a uniform selection cut in other areas to establish regeneration. The initial fire exclusion period for the released regeneration is foregone in favour of frequent burning to stimulate the development of new regeneration in the selectively cut areas (Fig. 5).*

(i) *The first stages of the operation (advance burning, group and selective cutting, and tops burning) are the same as for Strategy 1 (I-iv).*

(ii) *Following the top disposal burn, the area is burnt after 5 years. Regular burning stimulates the development of lignotubers in the selectively cut areas. This involves the risk of damage to regeneration in the gaps. However, if the gaps are free of overstorey and the scrub is not dense, leaf litter accumulation in the gaps will be very low. In such circumstances it may be possible to burn the whole area at year 5, without excessive damage to the regrowth in the gaps. This strategy then becomes feasible.*

(iii) *Subsequent final cutting of the selective areas and the follow up protection period of 10 years is the same as for previous strategies.*" (p. 24)

(a) Strategy 4

"*This is a special case where some cutting may be required to provide a resource, but regeneration is not immediately desirable because of the need for continued protective burning in these areas. This could apply in burning buffers or in coupes where the proportion of the areas with adequate ground coppice is very low. In the latter case a large area could be under fire exclusion to protect a very small area of regrowth (Fig. 6).*

(i) *Advance burn as for previous alternatives.*

(ii) *Demarcate areas with inadequate or undeveloped lignotubers and carry out a uniform selection cut as described in Section 5 (b). Disturb the soil and burn in a seed year.*

(iii) *Do not cut areas containing adequate ground coppice. In these patches it is necessary to maintain a full overstorey canopy to prevent this regrowth developing into saplings and poles.*

(iv) *Conduct regular prescribed burning to promote the development of lignotubers to the stage of dynamic ground coppice.*

[…]" (p. 26)

"*(vi)* […] *Following the tops disposal burn the area is again protected for 10 years, before resuming normal fuel reduction burning.*" (p. 28)

(e) Some Applications of Alternative Strategies

"The choice of an appropriate strategy largely depends on management requirements. Table 2 lists relevant data for a number of parameters against each alternative. Each has its own characteristics.

Strategy 4, for example, delays the fire exclusion period for 20 years, but provides a low yield at year 0 and delays regeneration release for 20 years. […]

Strategy 3, on the other hand, delays the fire exclusion period for the same time (20 years), but it does so at the expense of proper protection of developing regrowth. For that reason it is not a preferred alternative unless it can be shown that lignotuber development is seriously impaired by a no-burn period in the first 10 years.

On the basis of this analysis of the advantages and disadvantages of the systems, Strategy 2 is the best choice from a silvicultural point of view. It may, however, produce some management problems by reducing the immediately available resource and in the process exacerbate protection problems. Management requirements are therefore important factors to consider.

Silvicultural requirements will have a marked effect on the timing of the availability of wood yield from particular stands and on strategic fire protection. Effective planning will depend on extensive surveys of lignotuber development well ahead of proposed logging. " (p. 29)

"*It is also clear that variable silvicultural requirements involve a commitment to thorough scheduling and conduct of operations. This is made more difficult because of the long-term nature of the commitment.* […]" (p. 30)

POLICY - 1985

Forests Department Annual Report 1 July 1984 to 21 March 1985. 1985

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

MANAGEMENT PLAN – 1985

Northern Forest Region : Working Arrangements and Management Program. 1985

5. Land Management
State Forest and Timber Reserves

"*Within State forests, Timber Reserves and other Crown lands vested in the Conservator of Forests, to conserve the full range of forest values. This involves:*

[…]

- *Forest Protection: To maintain and add to the area of permanently reserved forests; to protect these forests from fire, insects and other harmful agencies, and to maintain and improve the health and vigour of the forest area.*" (p. 23)

5.1 Regional Objectives
Conservation : Strategies

"[…]

- *Develop prescriptions for fire control which aim to maintain conservation values.*" (p. 26)

Fire Protection
"*The Northern Jarrah Forest is highly flammable by world standards and the most severe fire the State has experienced in recent times occurred in this Region (Dwellingup fires 1961). It is pertinent that fire precautions are adequate to preserve life and property as well as conservation and other forest values.*" (p. 27)

Objectives
- "*Department G.W.P. Provides effective suppression force and detection system, ensure fuel reduction so that suppression is feasible, assist authorities and landowners with fire control, provide public education and warning on fire, research fire effects and fire management.*
- *Region. Ensure fire protection measures for all C.A.L.M. lands reflects Sect. 33 of C.A.L.M. Act i.e. to protect or preserve persons, property, land, flora and fauna.*
- *Provide for greater diversity in fire regimes in N.P., N.R. and Conservation Reserves in S.F.*
- *Develop techniques for more effective fire control e.g. use of helicopter for prescribed burning and use of foam for suppression.*
- *Develop standards for fire control.*

[…]" (p. 27)

Strategies
- "*Prepare burning plans for all C.A.L.M. lands with greater emphasis on diversity of fire regime in conservation areas (N.P., N.R. & C.R.)*

[…]" (p. 27)

- "*Implement fire management plans for rehabilitated bauxite pits and other high risk areas (Murray Valley). Obtain Alcoa and other assistance with funding.*

[…]
- *Reinforce excellent L.F.O. performance by Districts in 84/85 by pre season refresher training. Ensure staff understanding and implementation of fire control section of Foresters Manual and other specifications.*

- *Adjusts spotter circuits and tower coverage to provide improved detection system for all C.A.L.M. Lands.*

[…]" (p. 28)

Bauxite Mining
Objectives
[…]
- *Region.* […] *Ensure high standard of rehabilitation consistent with long term forest management requirements e.g. fire control.* […] *Implement effective fire control practice over areas already rehabilitated …*" (p. 34)

LARGE FIRE ORGANISATION – 1985

Large Fire Organization : Staff Duties and Responsibilities. - 1985 ed.

NOT INCLUDED. REFER TO DOCUMENT – SHELF NUMBER: COMO 35.083(941) WES

LEGISLATION

Conservation and Land Management. No. 126 of 1984

"*AN ACT to make better provision for the use, protection and management of certain public lands and waters and the flora and fauna thereof, to establish authorities to be responsible therefor, and for incidental or connected purposes*

[Assented to 8 January 1985]" (p. 1881)

Part IV. - Department of Conservation and Land Management
Division 1. - Establishment of Department
"*33.(1) The functions of the Department are, subject to the direction and control of the Minister-*

(a) to manage land-

(i) to which this Act applies; or

(ii) which becomes subject to the management of the Department under subsection (2),

and the associated forest produce, fauna and flora;

(b) to provide the Commission, the Authority and the Council with such assistance as they may reasonably require to perform their functions;" (p. 1905)

"*(d) to be responsible for the conservation and protection of flora and fauna throughout the State, and in particular to be the instrument by which the administration of the Wildlife Conservation Act 1950 is carried out by the Executive Director pursuant to section 7 of that Act;*

(e) to carry out or cause to be carried out such study or research of or into-

(i) the management of land to which this Act applies; and

(ii) the conservation and protection of flora and fauna, as the Minister may approve;
[…]" (p. 1906)

"*33(3) The management of land referred to in subsection (1) (a) (i) and the associated forest produce, flora and fauna shall be carried out-*

(a) where there is a management plan for the land, in accordance with that plan; or" (p. 1906)

"*(b) where there is for the time being no such plan-*

(i) in the case of national parks and nature reserves, in such a manner that only necessary operations are undertaken; or
(ii) in any other case, in accordance with the provisions of section 56 applicable to the land.

(4) In subsection (3) (b), 'necessary operations' means those that are necessary for the preservation or protection of persons, property, land, flora or fauna, or for the preparation of a management plan.

(5) Nothing in subsection (1) shall be read as limiting the functions of the Commission and the Authority under sections 19 and 22 respectively.

34. Subject to this Act and the Public Service Act 1978, the Executive Director has power to do all things that are necessary or convenient to be done for, or in connection with, the performance of the functions of the Department." (p. 1907)

Part V. – Management of Land
Division 1. – Management Plans
"*54. (1) A controlling body shall be responsible-*

(a) for the preparation of proposed management plans; and

(b) the review of expiring plans and preparation of further management plans,

for all land which is vested in it whether solely or jointly with an associated body.

(2) This Part applies to the preparation of a plan under subsection (1) (b) in the same way as it applies to the preparation of an initial management plan." (p. 1914)

"*(3) Proposed management plans for any land shall be prepared-*

(a) by the controlling body for that land through the agency of the Department; and

(b) within such period after the commencement of this Act as is reasonably practicable having regard to the resources of the Department available for the purposes." (p. 1915)

"*55. (1) A management plan for any land shall contain –*

(a) a statement of the policies or guidelines proposed to be followed; and

(b) a summary of the operations proposed to be undertaken,

in respect of that land during a specified period which shall not exceed 10 years.

(2) A management plan shall state the date on which it will expire, unless it is sooner revoked, but notwithstanding anything in this section or in the plan, a plan which would otherwise expire shall, unless it is revoked, remain in force until a new plan is approved." (p. 1915)

"*56. (1) A controlling body shall, in the preparation of proposed management plans for any land, have the objective of achieving or promoting the purpose for which the land is vested in it, and in particular management plans shall be designed –*

(a) in the case of indigenous State forest or timber reserves, to ensure the multiple use and sustained yield of that resource for the satisfaction of long-term social and economic needs;" (p. 1916)

"*(2) In subsection (1) (a) 'multiple use' means as many different uses as are possible and compatible among themselves.*" (p. 1916)

"*62(1) Subject to this section, the Minister may, on the recommendation of the Authority and, where applicable, any associated body, by notice published in the Gazette, classify the whole or any part of land or waters to which this section applies as-*

(a) a prohibited area;
(b) a restricted area;
(c) a limited access area;
(d) an unlimited access area;
(e) a recreational area for specified activities;
(f) in the case of a national park, a wilderness area; or
(g) such other class of area as the Minister, on the recommendation of the Authority, thinks necessary to give effect to the objects of this Act,

and may in like manner amend or cancel any such classification.

62(2) A classification, or amendment of classification, of any land or waters shall not be made under this section-

(a) unless it is in conformity with the provision of section 56 which is relevant to, or any management plan for, that land or those waters; and

(b) in the case of land to which section 16 applies, unless the owner, and any person occupying the land with the consent of the owner, has given approval in writing to the classification or the amended classification.

(3) This section applies to any national park, nature reserve, marine nature reserve or marine park." (p. 1919)

Part IX. – Offences and Enforcement
Division 2. – Forest Offences
"*104. (1) No person shall-*

(a) light, kindle, or assist to light or kindle, or aid or abet another person in lighting or kindling, any fire within the boundaries or within 20 metres of any boundary of a State forest or timber reserve; or

(b) leave, without taking due precaution against its spreading or causing injury, a fire lighted or kindled by him as mentioned in paragraph (a), or in the lighting or kindling of which he has aided or abetted,

if in either case any forest produce is burnt or injured, or is in danger of being burnt or injured.

Penalty: $1 000 and imprisonment for one year.
[…]
105. No person shall set fire in the open air to any tree, wood, bush or grass on any land contiguous to a State forest or timber reserve, without giving notice of his intention to a forest officer so as to allow such officer to be present at the firing.

Penalty: $500 and imprisonment for 6 months." (p. 1938)

POLICY - 1984

Forests Department Annual Report 1984. 1984

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

RECREATION PLAN – [1984]

Forest Recreation Framework Plan. [1984]

Definitions
"*Management Priority Areas – the forest has been divided into areas in which the dominant and secondary uses are specified and their priority ranking nominated. Each unit is known as a management priority area (M.P.A.) and is described according to its dominant (or priority) use. Areas in which recreation is the management priority are known as Recreation M.P.A.s.*" (p. ii)

Summary
"*The aim of this plan is to provide a framework for planning, development and management of forest recreation in the Northern Region.*

The plan covers the nature of forest recreation, analyses the availability of recreational opportunities in the region and discusses a range of management options. The various environmental, management, legislative and economic constraints which apply are considered.

The policy adopted is to provide for recreational activities which:

(i) are forest-dependent;
(ii) are environmentally acceptable;
(iii) do not endanger other forest users, and
(iv) are not disruptive to the majority of other forest users.

The region is subdivided into a series of 'management units' for which appropriate recreation strategies are developed.

The plan then specifies a series of regional strategies which will apply to all management units. These cover site design and maintenance, provision for the disabled, visitor information, dieback hygiene, mining, urban development, use of firearms, camping, off-road vehicles and other matters.

The plan concludes with proposals for implementation and control and specifies the structure of the follow-up plans to be developed by local staff in divisions." (p. iii)

7. Forest Recreation Development and Management Constraints
"*The capacity of the Forests Department to implement a recreation policy is constrained by a number of factors. Such factors may be environmental, management, legislative or economic.*

In the Northern Region of State forest, where land use pressures are intense, a number of factors currently determine how the forest is used and managed for outdoor recreation. These existing constraints can be summarised as follows:" (p. 31)

"*With respect to management constraints, the ability to provide for recreation is influenced by land tenure and land use. The land considered in this plan is managed under the multiple use concept and includes all land under the control of the Conservator of Forests. In simple terms, this means that recreation provision must be integrated with the provision of other forest values (e.g. timber and water production) and their protection requirements (from disease and fire in particular).*" (p. 31)

9.3 Planning and Management Strategies Applicable To All Management Units
"*In addition to the management unit strategies just outlined, there are a number of other recreation planning and management aspects for which Regional policy directives are required.*
These are …

1. Design and Development of New and Existing Sites
All recreation development within the Region, whether it be the construction of new areas and facilities or the redevelopment of existing sites, must be in accord with the requirements of Fire and Dieback Control policy. Plans must be approved by the Regional Superintendent and the Recreation Officer. Specialist staff will be available to assist Divisions with these sites." (p. 47-48)

"*2. Site Maintenance*
Strategy
[…]
- *site maintenance programmes will include the periodic inspection and maintenance of:*

[…]
fire protection requirements …
[…]" (p. 48)

FORESTERS' MANUAL – 1984

Foresters' Manual : Part 2 : Field Administration. 1984 [included in *Foresters' Manual.* 1979]

Alienating Land Must Not Interfere with Land Management Procedures
"*2.031* […] *Alienation must not adversely affect fire protection or any other land use.*" (p. 11)

LARGE FIRE ORGANISATION – 1984

Large Fire Organization : Staff Duties and Responsibilities. - 1984 ed.
NOT INCLUDED. REFER TO DOCUMENT - SHELF NUMBER: COMO 35.083(941) WES

POLICY - 1983

Forests Department Annual Report 1983. 1983

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

GUIDELINES – 1983

Guidelines for Slash Burning in the Karri forest. 1983

Introduction
"*Slash burning for karri regeneration requires specialised lighting and logistics. These guidelines outline the principles involved and the methods to be used.*" (p. 5)

2. Objectives
"*The objectives of slash burning are:*
[…]
- *To reduce accumulation of logging debris;*

[…].” (p. 5)

3. Factors Affecting Slash Burn Performance
“*Factors which influence slash burn intensity are:*
3.1 Fuel Quantity and Arrangement
The weight, distribution and arrangement of fine, flash fuels and heavy, woody fuels govern whether a fire will ignite, spread and be sustained. The amount of fine fuels determine the likelihood of igniting the heavier fuels and of spread from one heap to another. The arrangement and distribution of heavy fuels affect the amount of fuel consumed. Rough-heaped or windrowed fuels burn hotter and more completely than scattered, broadcast fuels.” (p. 5)

3.2 Fuel Moisture Content (F.M.C.)
“*3.2.1 Fine Fuels Moisture Content*
The fine fuels must be dry enough to ensure ignition of the heavier fuels. The F.M.C. of flash fuels varies within a heap, and unless the lower sheltered fuel is dry enough the burn will fail. The sheltered fine fuels M.C. at which ignition will or will not occur, are: […]

Providing the heavy log and branch material is dry, a satisfactory burn will be achieved if fine sheltered fuels do not exceed 18 per cent moisture content.” (p. 6)

3.2.2 Fine Fuel Moisture Differential
“*Drying on cut-over areas is more rapid than under adjacent forest. If a day can be selected when the fine slash is dry, but the surrounding forest is damp, then a satisfactory burn can be conducted with minimum risk of suppression problems.*

An adequate moisture differential occurs when the sheltered slash moisture content is below 18 per cent and the surrounding forest is 25 per cent or higher at the peak of the day.

Measurement of fuel M.C. in the forest must be made at least 30 m in from the boundary of the coupe to avoid edge drying effects.” (p. 6)

3.2.3 Heavy Fuels Moisture Content
“*Success of ignition of large woody fuels varies with the period since logging, the drought factor as indicated by the Soil Dryness Index (S.D.I.), the time of the year, and the species. Under the same conditions karri logs will ignite and burn before marri, jarrah and tingle logs, in that order. Logs with M.C. below 30 per cent will ignite satisfactorily if fine fuels are abundant and dry.*” (p. 6)

Refer to table 3.2.4 in actual document – Burn Rating and Fuel Moisture Content

3.3 Weather Conditions
“*Temperature, relative humidity and wind strength affect the drying rate and final minimum values of the fine fuel M.C.*

Wind is the most variable and least predictable factor. Surface winds are affected by the topography and by local heating and cooling. Wind is also influenced by local synoptic changes and by the stability of the atmosphere. Controller and Fire Boss need a sound understanding of local wind behaviour supported by wind monitoring by local towers or spotter aircraft, during slash burns.” (p. 7)

3.4 Topographic Effects
“*Topography affects wind speed, turbulence and direction.*

Topography also influences the rate of drying of fuels through the influence of aspect and slope or the degree of exposure of fuels to sun and wind.” (p. 7)

4.4 Perimeter Tracks
"*Every slash burn must have a trafficable fire line around its perimeter.* […] *Slash must not occur outside perimeter tracks unless it is planned to burn the area out as a buffer.* […]" (p. 8)

4.5 Water Points
"*The provision of water points at each slash burn is essential. The number of water points required will depend on the size of the burn, the proximity of a reliable water source, and season. As a guide, at least 1 water point will be required for every 40 ha of burn.*" (p. 9)

4.6 Advance Mop-Up
" *'Advance mop-up' is the pushing of logs and other heavy debris away from the perimeter into the burn before burning commences. This saves the need for massive mop-up after burns are lit.*

Advance mop-up must be carried out on the entire perimeter, except where the edge adjoins buffer areas or recent burns. […]" (p. 9)

4.7 Internal Tracks
"*Internal tracks is vital, particularly at large slash burns, to enable:*
- *A break-up into cells so that systematic firing can take place, consistent with prevailing wind conditions.* […]
- *Access into the area by lighting crews for convection firing methods.*
- *Internal inspection.*
- *The formation of sub-boundaries, if the burn must be halted prematurely.*
- *Future access for planting, fertilizing or regeneration assessment.*

[…]" (p. 10)

4.8 Installation of Buffer Strips
"[…]
The proper use of buffer strips can create many advantages as they eliminate the need for advance mop-up, allow men to work on the perimeter away from smoke and heat, and reduce the risk of subsequent escapes.

Buffer strips, even if pre-burnt and mopped up, must never be considered 100% safe on the day of the burn, particularly at intense fires. Constant patrolling must always be carried out.

Burn prescriptions must be drawn up and adhered to in order to meet fuel reduction objectives with minimum fire damage.

In all track construction or maintenance, strict adherence to dieback hygiene and erosion control rules must be observed." (p. 11)

4.10 General Comments
"*Consider:*
[…]
- *Always prepare burns from the north of the coupe southwards. This enables a cut-off to be made if the entire coupe cannot be burnt, or is not ready.*" (p. 11)

4.14 Burn Prescriptions
"*A prescription (see Appendix 1) must be prepared for every slash burn. It will be compiled by the Divisional Regeneration Officer and fully discussed with the D.F.O. prior to the burn. A PAFSOU must also be drawn up for each burn.*

All items on the prescription must be completed." (p. 13)

5. Burning Techniques
[…]
"*Three basic pattern of lighting are used for slash burn operations. These are:*
Strip lighting
Convection lighting (centre firing or moving column)
Simultaneous area ignition" (p. 13)

7. Slash Burn Control
"[…]
Factors the Controller must consider are:
7.1 Prescription
The slash burn prescription (see Appendix 1) must be consulted before lighting commences. Check whether expected weather conditions on the day match those prescribed. […]

7.2 Timing for the day
This depends on:
- *Fine fuel moisture contents inside and outside the burn*
- *Expected weather.*
- *Known and anticipated commitments elsewhere.*
- *Weather conditions as prescribed.*

7.3 Timing on the day
[…]
The maximum burn size that can be completed within day-light hours by ground ignition methods is about 200 ha.

Therefore, always consider start time and expected time to light the job before burning commences. Start time may be influenced by:
[…]
- *A burn must never be lit on the expectation of a desired wind change. Always delay start time until prescribed winds are experienced.*
- *The safest start time each day comes just after the daily hazard has peaked (i.e. R.H. rising, temperature falling).*

7.4 Cellular Lighting
On large slash burns the operation is lit systematically cell by cell. The sequence is determined by:
- *The direction of the prevailing wind. The downwind cell is lit first, and then the downwind flanks are secured by burning adjacent cells. This pattern is repeated for the entire job, progressively working upwind.*
- *The requirement to draw fire and hence spotting potential away from a dangerous flank. By intelligent lighting of cells, pressure on dangerous flanks can be controlled.*" (p. 21)

7.5 Knowledge of Danger Points
"*Danger points are:*
- *Slash which cannot be burnt, or special high value areas adjacent to the burn.*
- *A sharp bend in the boundary of the burn.*
- *Fire whirlwinds.*
- *Gully winds.*
- *Steep, upslope topography.*
- *Seed trees with dead limbs near perimeter.*

7.6 Lighting
Lighting must always proceed as planned. Changes can only be initiated at Controller / Fire Boss level.
[…]

7.7 Suppression
The nature of the suppression force depends on the size of the burn and expected fire intensity. […]

Points to note with regard to suppression are:
- *Never light up more than can be held with available suppression forces.*
- *If trouble is experienced beyond the capacity of suppression forces, the first course of action is to stop lighting.*
- *Suppression is more difficult in autumn than in summer due to the dryness of large fuel and the spotting potential of the fire.*" (p. 22)

- "*Suppression of escapes must take place immediately, when they are small.*
- *Suppression of escapes must be done with minimum damage to the forest adjoining the burn.*" (p. 23)

7.8 Mopping Up
"*All burns must be made safe mopping up the edges as soon as this can be done. Standard rules require that burning material must be extinguished-*
- *For 20 metres from the edge on the ground, and*
- *For 100 metres from the edge on the air.*

[…]" (p. 23)

HANDBOOK – 1983

<u>Bauxite Mining : Northern Jarrah Forest : Mining Operations Handbook 1. Ed. 2. 1983</u>

NOTE: REFER TO ENTRY UNDER EDITION 1981 AS IT CONTAINS SIMILAR DETAILS EXCEPT FOR AMENDMENTS TO THE FOLLOWING PRESCRIPTONS-

'Rehab 83' : Prescription for Rehabilitation of Bauxite Mines in the Western Jarrah Forest
Objective
"*An objective is a broad statement of what it is expected to achieve within known constraints.*

The overall objective for rehabilitation of bauxite mines in the western jarrah forest is:-

'To regenerate a stable forest ecosystem, planned to enhance or maintain water, timber, recreation, conservation and/or other nominated forest values'.

Specific goals (not listed in order of importance since priorities may vary with designated land use) are:-

[…]
2.4 <u>Protection</u>: […] *and to ensure that unacceptable fire hazards do not accumulate.*" (p. 2)

4.1 Broadscale Regional Planning

"*The mining company is required to produce each year an updated 5-year Mining and Management Plan for approval by Government. In the preparation of these plans, the following aspects of rehabilitation are to be considered:-*

- *The sequence of mining and rehabilitation.*
- *Access for mining and future management.*
- *Location of mine facilities.*
- *Dieback Hygiene*
- *Landscape considerations*
- *Water management systems and water course protection.*
- *Land use priorities.*
- *Buffer zones for fire protection.*

This prescription deals with Mining Operations only within Water Production M.P.A.s and Recreation M.P.A.s.
At this stage no mining is proposed for other M.P.A.s." (p. 4)

4.4 Special Fire Protection Provision
"*When rehabilitation is scheduled within the boundaries of the Jarrahdale or Dwellingup Townsite Protection Plans, refer to these plans for details of tree and shrub species permitted and access required.*" (p. 6-7)

Forest Management After Bauxite Mine Rehabilitation in the Western Jarrah : ***Prescription 82***
Responsibilities
"*This new prescription deals with the subsequent management of these areas, comprising the regenerated stands on pits, roads, crusher sites and other sites disturbed by mining*." (p. 7.1)

3. Objective
"*The objective of management after rehabilitation in the forests of the mining envelopes is: To sustain a site-adapted forest capable of resisting fire, disease and parasites, able to regenerate naturally and produce valued products.*

In other words, the aim is to manage a healthy and productive forest ecosystem in accordance with designated management priorities." (p. 7.1)

GENERAL WORKING PLAN - 1982

Working Plan No. 87 1982 Part I, General Working Plan for State Forests in Western Australia. 1982.

Protecting the Forest
Fire Protection
Management Objective
"*To provide a fire control system capable of protecting recognized forest values from serious damage. This 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*." (p. 55-56)

Policy
"*(1) Provide a well-trained and equipped fire suppression force capable of suppressing several simultaneous wildfires under severe weather conditions.*

(2) Provide a detection system that will ensure rapid and effective attack of all wildfires in State forests and assist local authorities with detection of fires on neighbouring land.

(3) Employ fuel reduction techniques to enable wildfires to be contained under normal weather conditions.

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

(5) Liaise with other fire protection organizations to provide public education, warning and control in relation to fire risks.

(6) Continue investigations into the effects of fire on flora and fauna and on relationships with major land uses.

(7) Continue research programme into the technological and managerial aspects of fire protection, particularly in respect of changing patterns of land use." (p. 56)

Strategy

"*(1) Ensure effective liaison with neighbours, bush fire brigades, shires and other organizations with fire protection responsibilities, particularly at local level.*

(*2) Provide a detection system for:*
(a) rapid and accurate determination of fire location;
(b) early investigation of fire behaviour;
(c) information on values threatened;
(d) information on factors affecting fire behaviour;
(e) monitoring fire development.

(3) Carry out prescribed burning of indigenous forest in appropriate seasons at intensities and frequencies that facilitate achievement of the major land use objectives.

(4) Carry out fuel reduction programmes in pine plantations on predetermined buffer strips using either low intensity prescribed fire, grazing, or mechanical means." (p. 56)

(4) Carry out training, preparedness checks, planning and equipment maintenance at appropriate times to ensure efficient suppression of wildfire.
[...] (p. 57)

NORTHERN REGION OBJECTIVES - 1982

Northern Region : Objectives and Goals 1982/83. 1982

1.1 Departmental Objective : Conservation

"*Our overall aim is to achieve the Departmental objective, which is*
'the conservation, though planned use and management, of forest land and resources for the greatest long term social and economic benefit'." (p. 1)

1.2 Regional Objective

"*The role of the Regional Group is to determine management strategies for each activity in the region, so as to provide co-ordinated direction for the achievement of Departmental objectives by divisions.*

Where necessary, management strategies will be presented in the form of Regional Plans. These will take account of: -

- *Departmental objectives, policies and strategies*
- *Land use objectives*
- *Site capability and potential*
- *Protection requirements*

[…]" (p. 1)

1.3 Resources

"*The forest resources of the northern region are water, timber, flora and fauna, minerals, recreational and scientific/educational values and the physical environment of soil and air.*

Factors which threaten the long-term conservation of these resources are fire, disease, alienation of land, and uses which permanently destroy the productive capacity of the forest.

The specific land, resource and protection objectives are:" (p. 1)

1.6 <u>Protection</u>

1.6.1 <u>Fire</u>

"*<u>Objective</u>: to protect forest and associated community values from serious damage by fire.*" (p. 5)

"*<u>1982/3 Goals</u>*

(i) Complete the Regional Protection Plan.

(ii) Prepare townsite protection plans for Dwellingup, Jarrahdale, Mundaring Weir, Dryandra and Gnangara.

(iii) Develop Fire Interagency agreements with Worsley, M.W.A. and P.W.D.

(iv) Organize a Fire Gang competition with emphasis on manual suppression and mop-up.

<u>Responsibility</u> :: R/L Hardwood forests. S.F.C.F. and Divisions.

<u>Priority</u> : 2." (p. 6)

"*1.7.3 <u>Protectability</u>*

<u>Objective</u>: to ensure that management plans account for the present and future protection of the forest and the community from destruction by fire or disease." (p. 9)

LARGE FIRE ORGANISATION – 1982

<u>Large Fire Organization : Staff Duties and Responsibilities. - 1982 ed.</u>

NOT INCLUDED, REFER TO DOCUMENT AT WOODVALE A 35.083(941) WES

OPERATIONS MANUAL – 1982

<u>Aircraft Operations Manual. 1982</u>

NOT INCLUDED, REFER TO DOCUMENT AT WOODVALE A 629.135.2(941) WES

FORESTERS' MANUALS – 1981

Fire Control : Foresters' Manual. 1981[included in *Foresters' Manual.* 1979]

9 – Fire Protection
"*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 wildfires." (p. 1)

History
"*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.

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." (p. 1)
Updated 10/81

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 wildfire 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." (p. 2)

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*
Burning of Crown Lands	*Section 34*
Conservator's Authority to Require Firebreaks	*Section 34 (2)*
Appointment of Bush Fire Control Officers	*Section 38*
Duties of Bush Fire Control Officer	*Section 38 (4)*
Fire Weather Officer	*Section 38 (6)*
Special Powers of Bush Fire Control Officer	*Section 39 (1) Section 59 and Regulations*
Conditions when Forest Officer	*Section 39 (2)*

exercises authority of B.F.C. Officer	*Section 45*
Bush Fire Brigades	*Section 41 - 44*
Power to Stop Fires Being Lit	
Bush Fire Control Officers'	*Section 46 (1)*
Forest Officers'	*Section 46 (1)*
Requests for Coroner's inquiry	*Section 49*
Duties of Persons Discovering an Offence	*Section 56*
Obstruction of Officers	*Section 57*
Recovery of Expenses	*Section 58 (3)*
Protection of Officers	*Section 63*
Advisory Committees	*Section 67*
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." (p. 2-3)
Updated 10/81

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
Suspension of prohibited burning period" (p. 3-4)

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.* […]" (p. 4)

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

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 application must show constraints imposed to avoid too many burns lit at once and over-commitment of forces." (p. 3)
Updated 10/81

"*Once Departmental requirements have been satisfied, the O.I.C. Protection Branch will arrange for the suspension through the Bush Fires Board.*" (p. 4)
Updated 10/81

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.*[…]" (p. 5)
Updated 10/81

Liaison with 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.*" (p. 8b)
Updated 6/85

Fire Danger Signs
"*9.014 … 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 …*" (p. 8b)
Updated 6/85

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.* […]" (p. 12)
Updated 10/81

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.*

… Extreme caution must be exercised when fighting fires in the immediate proximity of powerlines." (p. 12)
Updated 10/81

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

A study of fire causes is of value as an indicator of possible points of attack in the campaign against future outbreaks." (p. 14)
Updated 10/81

"*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 : 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 : 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.

'Priority' Zone : This will comprise areas on which exotic or indigenous species have been established, areas cleared or partcleared awaiting planting, areas under regeneration, paired catchments or other nominated ares. [...]" (p. 15)

"*'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.

Fire Organisation
"*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.*" (p. 15)
Updated 10/81

"*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.*" (p. 16)
Updated 10/81

Fire Control Checklist
"*The work of fire control falls into three main categories:*

Fire Prevention

Fire Pre-suppression

Fire Suppression

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 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." (p. 16)
Updated 10/81

Fire Weather Forecasting
"*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.*" (p. 16)
Updated 10/81

"*The 0745 forecast must be obtained by all Divisions each morning.* [...]" (p. 17)
Updated 10/81

"*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.*" (p. 17)
Updated 10/81

Weather Observations
"*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.*" (p. 17)
Updated 10/81

F.D.I.
"*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 ...*" (p. 17)
Updated 10/81

"*The local fire danger must be calculated for each fire at the time it is reported.*" (p. 17)
Updated 10/81

S.D.I.
"*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	*Jarrah edging*
	Nth Jarrah, prescribed burning
160-550	*Sth Jarrah, Karri 3 & 6 prescribed burning*
200-600	*Karri 4 & 5 prescribed burning*
300-700	*Karri 1 & 2 prescribed burning*
500+	*Karri regeneration burns*" (p. 17-18

Updated 10/81

Fire Behaviour
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." (p. 18)

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. jarrah 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." (p. 18)
Updated 10/81

"*The tail fire is normally controlled last, but must on no account be entirely neglected.*" (p. 19)
Updated 10/81

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.*" (p. 19)

Updated 10/81

Detection System
"*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.*" (p. 20)
Updated 10/81

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.*" (p. 22)

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." (p. 22)
Updated 10/81

"*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." (p. 23)
Updated 10/81

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." (p. 23)
Updated 10/81

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. […]" (p. 23)

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:" (p. 23)

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." (p. 23)
Updated 10/81

Annual Burning Plan and Notification
"*The area O.I.C. shall draw up a current burning plan each year setting out the proposed programme.* […]" (p. 24)

All hardwood burning (hand and aerial) proposals are to be shown on a 1:50,000 plan with job numbers and areas. […]" (p. 24)

"*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" (p. 24)
Updated 10/81

Prescriptions
"*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" (p. 25)
Updated 10/81

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 be recorded on the inspection form so that protection is not overlooked, see PAFSOU and Environmental Check List forms." (p. 25)
Updated 10/81

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).*" (p. 25)
Updated 10/81

Hardwood Prescriptions
"*9.047 Prescriptions for hardwood burning will be based on 1:25, 000 scale API plans.*" (p. 26)
Updated 10/81

NOTE: REFER TO DOCUMENT FOR LISTING OF GUIDELINES

Environmental Controls
"*9.048 The area O.I.C. is to ensure prescribed burning conforms with required environmental standards …*" (p. 27)
Updated 10/81

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."* (p. 27)

Updated 10/81

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 ...* [...]" (p. 28)

"*9.051 The area so enclosed must be completely burnt out before the following day, except where multiple lightings have been prescribed.* [...]" (p. 28)

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.*" (p. 28)

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.*

[...] *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.*" (p. 28)

Control of Scorch
"[...] *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.* [...]" (p. 28)
Updated 10/81

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.* [...]" (p. 29)

"*Selection of daily jobs must be based on the 0745 hours fire weather forecast.* [...] *Operational spot forecasts are available on request.*" (p. 29)

"*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.*[...]" (p. 29)

"*The 'forecast' local fire danger index must match that prescribed before a job is programmed for lighting.*" (p. 29)

Lighting technique
"*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.*" (p. 29)

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.*" (p. 29)

"*9.060 A heavy-duty outfit must be taken to every burn except where otherwise directed by the area O.I.C.*" (p. 29)

Mopping Up
"*9.061 The perimeter of prescribed burns must be mopped up to the standard set out Fire Suppression section (9.105).* [...]" (p. 29)

Patrol of Burn Edges
"*9.062 Patrol must be regarded as a very important duty. [...] It is essential that subsequent patrols are carried out daily until the edge is completely safe*. [...]" (p. 29)
Updated 10/81

Air Transport Group Regulations
"*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.*" (p. 31)

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.*" (p. 31)

> **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.* [...]
> **Karri**
> *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)*" (p. 31)

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.* [...]

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*. [...]

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." (p. 31) Updated 10/81

Method of Burning
"*9.071 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. 32)

Lines of Fire
"*The lines will be lines of spot fires, or lines of continuous fire, depending on conditions and the method of burning used.*" (p. 32)

Lighting
"*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. 32) Updated 10/81

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.*" (p. 33)

"*Strips are started on the down-wind edge of the burn and move progressively up-wind. Hatching illustrates area burnt.*" (p. 33)

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.*" (p. 33)
Updated 10/81

Fire Behaviour
"*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.*" (p. 34)

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.*" (p. 34)

Updated 10/81

Aerial Burning
"*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:
… (e) Check the weather forecast;
(f) Check fire danger regularly and assess fire; […]")p. 34)
Updated 10/81

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.*" (p. 35)
Updated 10/81

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.*" (p. 35)
Updated 10/81

Fire Attack
"*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." (p. 43)
Updated 10/81

"*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.*" (p. 44)

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.

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.

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.

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" (p. 44)
Updated 10/81

"*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." (p. 45)
Updated 10/81

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:*
dvise 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." (p. 46)

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.

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 plantantion 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.

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." (p. 46)
Updated 10/81

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.*" (p. 47)

"*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.*" (p. 47)
Updated 10/81

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.*" (p. 47)

"*Back-firing is always risky since, if the main fire is too hot to handle directly, the backfire 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. [...] *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.

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
"*9.104 The method of fire fighting, particularly in areas managed to prevent the spread of dieback to be carried 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." (p. 48)

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." (p. 48) Updated 10/81

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.

" [...] *Trees that cannot be extinguished by pumpers are to be felled.* [...]"

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)*" (p. 49)

"*Patrolling of Stopped Fires and should follow the instructions laid down under prescribed burning.*" (p. 49)

Staff Headquarters Organisations - Large Fire

"*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." (p. 49)

Updated 10/81

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." (p. 55)
Updated 10/81

Fire Retardants
"*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 o f the fuel. See Prescription Section." (p. 57)
Updated 10/81

Water Supplies
"*9.131 It is important that adequate static water points are available for fire 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. Include 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." (p. 63)
Updated 10/81

Foresters' Manual : Part 13 : Recreation and Landscape Management. 1981[included in Foresters' Manual. 1979]

Recreation Policy
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.* […] *… areas equipped with barbecue fireplaces must conform with Bush Fires Act regulations for land cleared of flammable material.*" (p. 6)

Foresters' Manual : Part 12 : Mining in Forest Areas. 1981 [included in *Foresters' Manual*. 1979]

Appendix II Application For Coal Mining Leases
3. Exploration Conditions*:*
"*3.8The provisions of the Bush Fires Act, 1959 and the Regulations thereunder*." (p. 20?)

HANDBOOK – 1981

Bauxite Mining Northern Jarrah Forest Mining Operations Handbook 1. Edition 1. 1981

'Rehab 80' : Prescription for Rehabilitation of Bauxite Mines in Western Jarrah Forest
3. Rehabilitation Objective
"*The overall objective for rehabilitation of bauxite mines in the western jarrah forest is :-*

'To regenerate a stable forest ecosystem, capable of maintaining or enhancing water, timber, recreation, conservation and/or other nominated forest values'.

Specific goals (not listed in order of importance since priorities may vary with designated land use) are :-
[…]
3.2 Protection : … to control fire hazard.
[…]" (p. 38)

5. Planning Approval
"*5.1 Overall rehabilitation planning must precede, not follow, the mining operation. Accordingly, the following aspects must be taken into account in the preparation and approval of the 5 year Mining and Management Plans for each mine site :-*
[…]
- *buffer zones for screening and fire protection*

[…]" (p. 39)

LARGE FIRE ORGANISATION – 1981

Large Fire Organization : Staff Duties and Responsibilities. 1981
NOTE: NOT INCLUDED, REFER TO DOCUMENT – SHELF NUMBER: COMO 35.083(941) WES

MANAGEMENT PLAN – N.D. - 1980?

Land Management Plan for State Forest in the Mount William Area. N.D. 1980?

2.2 Fire Control
"*Physical closure of roads around the envelope of mining operations will restrict wildfire attack operations. Whilst such measures (locked gates, earth barriers, etc.) are essential for public safety and company security, they are likely to have serious consequences when wildfire occurs in severe weather conditions. The Company will be required to make adequate provision for continuity of access for this purpose and provide fire suppression support as in their other operations.*" (p. 6)

3.1 Prescribed Burning
3.1.1 Objectives of Management
"*To carry out hazard reduction burning over the area without detriment to allocated land uses.*" (p. 12)

3.1.2 Prescription
"*The general prescription outlined below will apply over the entire area (Water Production, Recreation and Conservation MPAs). In the case of the Samson Conservation MPA the prescription will apply until a specific working plan is drawn up for the management of the reserve.*

3.1.2.1 Carry out detailed burning prescriptions on all areas programmed on the master burning plan according to the requirements of the Foresters Manual." (p. 12)

"*3.1.2.2 List all areas for spring burning except where from time to time autumn burning is required for specific purposes (e.g. trials for acacia germination, removal of ground debris adjoining tourist routes etc.).*

3.1.2.3 Upgrade roads surrounding the burn only where absolutely necessary and then under dry soil conditions.

3.1.2.5 Ignite burns when the fire intensity is between 20-30 metres/hour rate of forward spread, to ensure maximum scorch height does not exceed 6 metres and 70% coverage of the area is achieved.
[…]" (p. 13)

3.1.3 Effect of Influence Zones on the General Burning Prescriptions
"*3.1.3.1 <u>Reservoirs</u> The general prescription will be amended as follows:*

(a) Select wind directions that will avoid ash contamination of the reservoirs." (p. 13)

"*(b) Ignite perimeter adjacent to reservoirs under same conditions as in 3.1.2.4.*

(b) The entire perimeter of a reservoir will not be burnt in the one year." (p. 14)

MANAGEMENT PLAN - 1980

<u>Land Use Management Plan : Northern Jarrah Forest : Management Priority Areas. 1980</u>

"*Because the northern jarrah forest is located within 150 kilometres of the Perth metropolitan area, there are strong demands for the various products and values of the forest. In some areas there is conflict between alternative forms of land use (Forest Focus, 1973). Inappropriate land uses may have far-reaching and damaging effects.*

Timber production, bauxite mining, water yield, recreation, conservation of flora and fauna, water purity (bacterial, viral, physical or chemical quality), forest disease and fire control are key factors in land use decisions within this region." (p. 2)

Prescribed Burning
Sample Prescription for Banksiadale Block
1.Objectives of Management
"*To carry out hazard reduction burning over the block without detriment to the allocated land uses.*" (p. 33)

2.Factors for Consideration
"2.1 Primary land uses - water production, catchment protection.

2.2 Compatible land uses - timber production, conservation of flora and fauna, minor forest products, catchment protection, bauxite mining scientific study.

2.3 A considerable proportion of the block is protectable from dieback and has been quarantined.

2.4 Other factors - logging is not proposed within the next 10 years and it is not anticipated that the area will be subject to bauxite mining application within the next 10 years. The South Dandalup Dam adjoins the southern boundary of the block." (p. 33)

Prescription
"3.1 From the master burning plan ascertain the year Banksiadale Block is due to be burnt for hazard reduction.

3.2 Using forest type maps, carry out field assessment of fuel quantity and crop tree height. Stratify samples according to the proportion of major forest types represented. These factors provide the basis for adopting fire behaviour parameters which are compatible with land use objectives." (p. 33)

"*3.3 Check that fuel quantities have reached an average of 6 tonnes per hectare. If fuel quantities are generally lower, consider deferment of burn, taking into account hazard reduction plans for the protection of surrounding public and forest values.*

3.4 Complete the detailed burning prescription form F.D. 655 (see Appendix 6).

3.5 Complete a check list detailing persons and property to be protected from damage during the burn on F.D. 659 (see Appendix 7).

3.6 Submit both F.D. 659 and 655 to the Conservator for approval to carry out prescribed burning as planned.

3.7 Upgrade roads surrounding the burn under dry soil conditions. Grading or surface scraping is prohibited in quarantined areas.

3.8 Ignite the perimeter adjoining the South Dandalup Dam in spring, with the Byram Drought Index less than 100 and under a Fire Danger Index of 12-16 metres/hour. A minimum edge depth of 80 metres, in which the unburnt duff layer remains to act as a filter strip for runoff into the dam, is required.

3.9 Ignite the perimeter fuels along the remaining boundary of the area under a Fire Danger Index of 12-16 metres/hour and ensure a minimum burnt edge of 80 metres. This edging is to be undertaken in spring where the Byram Drought Index is less than 100 and prior to ignition of the internal area, or in the autumn preceding the spring burn." (p. 34)

"*3.10 Locate and isolate areas of dieback infected forest with a surrounding break constructed with hand tools. Ignite this break under Fire Danger Index of 12-16 metres/hour and ensure a minimum burnt 80 metres. The dieback infected area is to subsequent to burning the remainder of the block.*

3.11 Ignite the main area using aerial ignition according to the following provisions:

a) wind direction - use southerly bearing to avoid ash contamination to the dam waters;
b) a spring burn is necessary for variable moisture condition;
c) fire intensity - burn between 16-20 metres/hour to ensure maximum scorch height 6 metres and 70% coverage of the area.

3.12 Ignite isolated dieback infected sites under conditions which will produce high ground temperatures (dry soil and slow moving fire) in provide ashbeds for natural regeneration and promote an acacia understorey.

3.13 Carry out a post-burning inspection to determine area burnt and whether fire intensities from the prescribed limits. Review assessment prescribing techniques accordingly." (p. 27-35)

FORESTERS' MANUAL – 1980

Foresters' Manual : Fire Protection. Rev. 1980

9 – Fire Protection

"*1.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 project is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

2. 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.

3.The eucalypt forests of Western Australia have evolved in a fire environment. Both flora and fauna have adapted to hot, dry summers, 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 wildfires.

History
4.At 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, the forest has been progressively roaded and, until the early 1950s, the aim was to give complete protection. 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 organisation was not yet established.

6.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 southwest 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." (p. 1)
issued 12/78.

Policy
"*7. Present fire control policy results from six decades of experience and research and may be summarised as follows:*
7.1Continue 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." (p. 1-2)

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

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

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

7.5 Reduce fuels on buffer strips systematically throughout pine plantations to limit major spread of wildfire

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

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

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

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

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

9.'A' Zone: This will comprise all country on which fires will be attacked immediately they become known. Included will be regenerated or planted forest as well as the greater part of the prime forest." (p. 2) issued 12/78.

"*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.*

10. '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 in Zone 'A' or 'P' require the postponing of immediate attack. Certain areas of private property adjacent to State forest will be included.

11. 'Priority' Zone: This will comprise areas on which exotic or indigenous species have been established, areas cleared or part cleared awaiting planting, 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 immediately 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 Appendix XIII).

12. 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.

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

14. 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 officer in charge and the Regional Leader (Operations). Officers of the Protection Section and Fire Research officer are available to help with the planning of pre-suppression measures and maintenance of standards in all fire control operations.

Within all such organisations, stress is placed on the clear definition of duties and responsibilities. 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 actual rank of the officer." (p. 3) Issued 12/78.

"*16. The work of fire control falls into three main categories:*
16.1 Fire Prevention
16.2 Fire Pre-suppression
16.3 Fire Suppression

Fire Control Working Plan
17. All Divisions must prepare Fire Control Working Plans. These Working Plans will give regular checks, locally, 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.

The Fire Control Working Plan will consist of two parts under the broad headings set out below. The detail required in these parts is given in Appendix 1.

Part A - Inventory
17.1 Manpower and Equipment
(Forests Department and outside sources.)
17.2 Water Supplies
17.3 Detection and Communications
17.4 Access
17.5 Location of Research Plots
17.6 Sawmilling Permit or Licence Areas
17.7 Dieback Quarantine Areas

Part B - Planning
17.8 Prescribed Burning
17.9 Suppression - Standing Orders and Organisation" (p. 4)

Divisional Fire officers
"*18. 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.*" (p. 4)

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 in Appendix II as a guide*." (p. 4) Issued 12/78.

Fire Prevention
"*19. Fire prevention, a most important branch of fire control, can be divided into the following:*
19.1 Risk Reduction –
(a) General provisions
(b) Education
(c) Law Enforcement.
19.2 Hazard reduction.

20. A study of fire causes is of value to indicate possible points of attack in the campaign against future outbreaks." (p. 5)

Risk Reductions
General Provisions
"*21. A study of fire causes will give some indication of the risks to be reduced or eliminated. Risk reduction can be by education, law enforcement or mechanical adjustment.*" (p. 6)

"*24. Whenever mechanical equipment is used in plantations the following procedure must be followed during summer months:*

24.1 Chainsaws must be fitted with an efficient spark arrester which will be inspected periodically.
24.2 Chainsaws must not be used for at least 60 minutes prior to the operator leaving the area.
24.3 Pack sprays must be kept in the immediate work area, full of water, tested frequently and ready for instant use.
24.4 The area worked over each day must be closely inspected by the operator before leaving.
24.5 Vehicles must be in reasonable condition and particular attention given to exhaust systems and brakes.
24.6 For large logging operations the 'Code of Softwood Logging Practice' specifies additional conditions.

25. All new employees must be instructed in precautions outlined in paragraphs 22 to 24." (p. 6) Issued 12/78.

Education
Fire Danger Signs
"*27. … 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 …*" (p. 7)

Law Enforcement
"*29. 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.* […]" (p. 7)

"*The following sections of the Bush Fires Act are of particular significance to forest officers: Prohibited Burning Times; Prohibited and Restricted Burning Times Declaration; Restricted Burning Times; Burning Times Declaration; Serving Notice to Burn; Regulations Part IV*" (p. 7)
Revised 10/79

"*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*
Burning of Crown Lands	*Section 34*
Conservator's Authority to Require Firebreaks	*Section 34(2)*
Appointment of Bush Fire Control Officers	*Section 38*
Duties of Bush Fire Control Officer	*Section 38(4)*
Fire Weather Officer	*Section 38(6)*
Special Powers of Bush Fire Control Officer	*Section 39(1); Section 59 and Regulations*
Conditions when Forest Officer	
Exercises Authority of B.F.C. Officer	*Section 39(2), Section 45*
Bush Fire Brigades	*Sections 41-44*
Power to Stop Fires Being Lit	
of Bush Fire Control Officers	*Sections 46(1)*
of Forest Officers	*Sections 46(1)*
Requests for Coroner's Inquiry	*Section 49*
Duties of Persons Discovering an Offence	*Section 56*
Obstruction of Officers	*Section 57*
Recovery of Expenses	*Section 58(3)*
Protection of Officers	*Section 63*
Advisory Committees	*Section 67*

Regulations Part IV Part VII Part VIII" (p. 8_

Bush Fires Board Liaison Officers
"*30.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 on the role of liaison officers and give full co-operation." (p. 8)
Issued 12/78

Forests Act
"*31.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" (p. 9)

Prohibited Burning Period
"*32.The Bush Fires Act provides that there shall be a prohibited 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.*

33.Provision is also made for this Department to obtain a suspension of the prohibited period to enable us to carry out protective burning." (p. 9)

Suspension of Prohibited Burning Period
34.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." (p. 9)

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

34.1 Reason the suspension is required.
34.2 Period the suspension is required (dates).
34.3 Area of each job to be burnt.
34.4 Prohibited burning zone for each job." (p. 9)

"*Maps showing each job area with fuel within the burn and for a 4 km width outside the burn boundary.*
34.5 Values at risk in the event of an escape must be shown on these plans, e.g. farm crops, plantations, buildings, etc.
34.6 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.

34.7 Where suspension is requested for several jobs, (e.g. karri regeneration burns) the application must show constraints that will be imposed to avoid too many burns lit at once and overcommitment of forces.

34.8 Once Departmental requirements have been satisfied the O.I.C. Protection Branch will arrange for the suspension through the Bush Fires Board." (p. 9-10)

Fire Investigation
"*35.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.* [...]" (p. 10)
Issued 12/78.

Legal Procedure
"*48. 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.*" (p. 14)
Issued 12/78

Westrail Locomotives
"*50. It is the policy and practice of the Railways Commission to fit all Westrail locomotives with spark arresters during the summer months.* […]" (p. 15)

Powerlines
"*52. To minimise the risk of fires from powerlines, close liaison with the S.E.C. must be maintained in all matters of fire prevention.*
52.1 Where a fire has started from or threatens a powerline, the S.E.C. must be notified immediately.
52.2 Extreme caution must be exercised when fighting fires in the immediate proximity of powerlines." (p. 15)
Issued 12/78

Hazard Reduction
Prescribed Burning
"*All areas of hardwood forest which do not require complete protection will be burned systematically by fires of prescribed intensity.*

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

54.1Buffer 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.

54.2 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.

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

54.4 Advance burning - prior to logging operations.

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

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

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

55.1 Pine and hardwood plantations

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

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

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

55.5 Areas required for research and investigation." (p. 16)

Issued 12/78

Planning for Prescribed Burning
Master Plans

"*56. Area O.I.C.'s must draw up prescribed burning master plans. These plans, will show:*

56.1 Hardwood areas which will be burnt as buffer areas. See paragraphs 54.1 and 54.2.

56.2 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. [...]

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

(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 percent with minimal crown scorch to crop or potential crop trees.

Karri Forest:
Burning cover in the range 60 to 80 percent. Up to 10 percent scorch in small clumps or individual crop trees.

Flats:
Burning under mild conditions only to give a mosaic pattern with 40 to 60 percent cover.

Poor Quality Forest:
Burning cover in the range 40 to 60 percent carried out under mild conditions." (p. 17)

Issued 12/78.

"*(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.

57.The master plans must be checked annually and adjusted, if necessary, in the light of previous burning. [...]

Annual Burning Plan
"*58.The Area O.I.C. shall draw up a current burning plan each year setting out the proposed programme.* [...]

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: […]
(b) Protection Branch with records.
(c) Drafting Branch with necessary information for the preparation of flight plans.

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

Hardwood - 15th May (Note paragraph 59)
Plantation - 15th March.

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

60.A prescription is to be prepared for all burns whether hand, aerial, karri regeneration or clearing burns." (p. 18)
Revised 10/79

"*Job specifications have been prepared describing the methods of fuel sampling and proper recording for the prescription form, i.e.:*

F.D. 655 for hardwood
F.D. 574 for burning under pine canopy
F.D. 657 for clearing or regeneration burns" (p. 19)

Burning Prescription
"*62.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 F.D.I. range of up to 40 m/hr.*" (p. 19)
Issued 12/78

Hardwood Prescription
"*63.Prescriptions for hardwood burning will be based on 1:25,000 scale A.P.I. plans.*

Preparation of hardwood prescriptions should follow guidelines set out below:

> *63.1Use the A.P.l. plan for separating each job into similar forest types based on species, height, and density.*
> *63.2 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 prescription and works programme.*
> *63.3 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.*" (p. 19)

Issued 12/78

"*71. The area O.I.C. is to ensure proper records of prescribed burning are maintained.*
71.1 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." (p. 22)
Issued 12/78

"*71.2 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 hrs each Monday morning or 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

71.3 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." (p. 22-23)
Issued 9/79

Burn Objectives
"*73. Proposals will be submitted for approval by 15 March to O.I.C. Protection Branch after vetting by Protection Forester and Regional Leader. Prescriptions will list objectives.*

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

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

73.3 Burn only where total fuel exceeds 12 tonnes/ha, i.e. 25-30 mm of needlebed." (p. 23)
Issued 9/79

O.I.C. Responsible
"*75. O.I.C.'S will be responsible for the daily decision to burn, having taken into account past and present weather.*" (p. 24) Issued 9/79

Moisture Readings
"*76. Surface moisture readings must be taken using Speedie Moisture meter before and during each burn.*" (p. 24) Issued 9/79

Test Fires
"*Test fires must be lit and weather conditions confirmed according to the prescribed F.D.I. Limits on flame height R.O.S. and resulting damage are unchanged.*" (p. 26) Issued 12/78

"*77.Test fires must be lit in each burning unit before overall lighting starts*. [...]*Their performance will indicate whether fire intensity will be acceptable under the prevailing conditions. Head fire flame height above 0.7 to 1.0 metre is unacceptable except for occasional flare-ups.*" (p. 24) Issued 9/79

Spacing of Spots
"*78. Test fire performance will not illustrate the effect of multiple ignition points.* […]" (p. 25)
Issued 9/79

Compartment Edges
"*79. Compartment edges within 20 metres of breaks must be treated as separate fuel types and burned under minimum conditions where necessary, according to the prescribing officer.*" (p. 25) Issued 9/79

Soil Dryness Index
"*80. The Soil Dryness Index 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 S.D.I. greater than 250.*" (p. 25)
Issued 9/79

Recording
"*81. 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 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 Section, Como." (p. 25)
Issued 12/78 as number 83 and Issued 9/79

Advance Burning
"*87. 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.*" (p. 27)

"*87.1 In jarrah forests where rotational prescribed burning is applied, the fuel quantity is not likely to exceed 7 tonnes per hectare at the time of cutting, and advance burning is only warranted when heavier fuels, exist.* [...]

87.2 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 effect 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." (p. 28)
Issued 12/78

Top Disposal
"*88. Burning of tops is carried out to reduce fine fuel hazard and to dispose of as much limb wood as possible.*[…]

88.1Burning 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." [...] p. 28
Issued 12/78

Method of Burning
"*89. 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).*

The lines will be lines of spot fires, or lines of continuous fire, depending on conditions and the method of burning used.

89.1 Lighting may be done by aircraft or men on the ground. In each case the selection of strip width and spotting distance must be determined from the Forest Fire Danger Tables on the day of the burn." (p. 29)
Issued 12/78

"*89.4 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.* […] *When crew members are 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." (p. 29-30) Issued 12/78

Burning Techniques
"*90. Burning with strips across the wind.*

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 some (allowed for) distance with the wind until it runs into the burn of the previous line." (p. 30)
Issued 12/78

"*Strips are started on the down-wind edge of the burn and move progressively up-wind.* […]" (p. 30)
Issued 12/78

"*91. Burning with strip straight into the wind – this is a secondary method, only to be used in small areas in 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.*" (p. 30) Issued 12/78

General Provisions
"*92.An area prescribed for burning must be completely enclosed by firebreaks 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 this latter case the burn must be completed at the earliest opportunity and should take precedence over any new job.*[...]

93. The area so enclosed must be completely burnt out before the following day except where multiple lightings have been prescribed. [...]" (p. 31) Revised 10/79

Leeward Edge Safe
"*94. In 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 is to be avoided through proper use of early edge burning.*" (p. 31)
Revised 10/79

Conditions for Edge Burning
"*95. To strengthen roads and firelines acting as boundaries of a burn and so 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 tip and continue running. Re-ignition is unlikely and edging reasonably safe whilst drought index is under:*
(a) 100 in Northern Jarrah Type
(b) 140 in Southern Jarrah Type" (p. 31-32)
NOTE: DATE OF ISSUE IS UNCLEAR – "*Revised 10/79*" or "*Issued 12/78*"

"[...] *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.*" (p. 32) Issued 12/78

Control of Scorch
"*96.*[...] *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 so to the rate of fire spread.* [...]" (p. 32) Issued 12/78

"*97. The area O.I.C. must select the day on which weather and fuel conditions will give a rate of spread and so a flame height, which will keep scorch within the desired limits and yet will satisfactorily reduce the hazard over a high proportion of the area. To guide this selection all prescriptions must be summarised in an Index Table.* [...]" (p. 32) Issued 12/78

> "*97.1 Selection of daily jobs must be based on the 0745 hrs fire weather forecast.* [...] *Operational spot forecasts are available on request.*
>
> *The daily check of actual conditions at 1015 hrs 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.* […]" (p. 32)
>
> *The 'forecast' local fire danger index must match that prescribed before a job is programmed for lighting*." Issued 12/78

Lighting technique to be employed
"*98. The officer or overseer directly 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.*

Flight Plans
"*99. 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*." (p. 33)

"*99.1 Copies of flight plans are to be distributed to aircrew, markers, suppression forces and controlling officers*. [...]" Issued 12/78

Fire Behaviour and Weather
"*100. 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*." (p. 33) Issued 12/78

"*101.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.*" (p. 34) Issued 12/78
>
> "*(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.*

102.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.

> *102.1 The Controller will usually be the area O.I.C. and his duties are as follows:*
>
> *Maintain liaison with officers responsible for aircraft movements and daily jobs*
>
> *Provide warning notices to the public on each day of an aerial burn*

Ensure flight plans are prepared and that aircrew and markers are fully briefed

Direct use of suppression forces through the Fire Boss

Check the weather forecast

Check fire danger regularly and assess fire behaviour by obtaining reports from aircraft navigator and ground crew

Direct the aircrew

Determine starting and stopping of lighting.

102.2The aircrew will consist of a pilot, navigator and bombardier. The navigator directs movement of ground markers and reports on fire behaviour to the Controller." (p. 34) Issued 12/78

Post Burn Inspection
"*103 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.*" (p. 34)
Issued 12/78

Prescription to Ensure Protection From Damage
"*106. 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 form).*" (p. 35) Issued 12/78 Revised 10/79

Bush Operations
"*106.1 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 form 'hop-overs'." (p. 36)
Issued 12/78

Tower Coverage
"*1009. Sufficient towers or weather stations to give adequate coverage and weather data must be manned while prescribed burning is being carried out …*" (p. 37) Issued 12/78

Heavy Duty
"*110. A heavy-duty outfit must be taken to every burn except where otherwise directed by the area O.I.C.*" (p. 37) Issued 12/78

Patrol of Burn Edges
"*111. Patrol must be regarded as a very important duty.* […] *It is essential that subsequent patrols are carried out daily until the edge is completely safe.* […]" (p. 37) Issued 12/78

Records
"*112. Area O.I.C's must see that the day-to-day work of prescribed burning is properly reported and recorded.*" (p. 37) Issued 12/78

Fire Pre-Suppression
"*122. Fire Control Working Plans are required at three levels:*

Divisional, Regional and Departmental.

Inventories and plans contained in Part 'A' of the Fire Control Working Plan cover the sub-sections listed above. […]" (p. 39) Issued 12/78

Manpower And Training
Bush Fire Brigades
"*126. It is important that there be close liaison with the Bush Fires organisations …* […] *Good personal relations with Fire Control officers and Brigades is essential.*" (p. 40) Issued 12/78

Detection
"*136. 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 F.D.I. is greater than 20.*" (p. 45) Issued 12/78

Communications
"*151. Effective means of communication are vital, not merely in fire control but in the successful administration of the Department.*

152. There are five 'legs' to the communication system for fire control:
(1) Aircraft or lookout to Headquarters.
(2) Headquarters to fire gang.
(3) Fire back to Headquarters.
(4) Point to point around the fire.
(5) *Fire to aircraft for reconnaissance information.*" (p. 48) Issued 12/78

Fire Weather
"*157. Weather forecasts are broadcast over the Department's radio network daily at 0745 hours, 1015 hours and 1615 hours during the season. In early spring at 1615 forecast will be issued on weekdays before conditions are suitable for general control burning.* […] *These forecasts give brief information on expected cloud, wind strength and direction, maximum temperature and minimum relative humidity.*

157.1 Where necessary, forecasts will be provided for five locations representing regions as follows:

West Coastal Plains (North)	-	*Perth*
West Coastal Plains (South)	-	*Bunbury*
West Costal Plateau (Northern Jarrah)	-	*Dwellingup*
South Coastal (Inland) (Southern Jarrah)	-	*Bridgetown*
South Coastal (karri)	-	*Pemberton*

157.2. In addition to the regional forecasts issued at 0745, 1015 and 1615 hours, local operational forecasts will be available for major control burns or running fires. […]" (p. 49-50) Issued 12/78

"*158. To assist in the preparation and checking of forecasts, wind direction and strength will be required at 0900 and 1500 hours from stations nominated at the commencement of the fire season, and additional weather readings as specified by O.I.C., Protection Branch.*" (p. 50)

"*160. The Fire Danger Index should be calculated for each major forest type in a Division from the morning forecast. 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." (p. 50) Issued 12/78

Soil Dryness Index
"*161. Soil Dryness Index should be recorded at all Divisional Headquarters and used for planning operations such as prescribed burning. The limits to be observed are:*

For edge burning only:

North jarrah	-	*D.I. up to 100*
South jarrah	-	*D.I. up to 140*
Karri	-	*D.I. not less than 120*
Broadscale jarrah	-	*D.I. up to 180*
Broadscale burning karri	-	*D.I. up to 350*
Radiata pine burning late autumn and winter	-	*D.I. less than 200*
Pinaster burning	-	*D.I. 0*" (p. 50-51)

Issued 12/78

Forecasts
"*162. The 0745 hours forecast must be obtained by all Divisions each morning and passed on to Districts under their charge.* […]" (p. 51
Issued 12/78

"*163. Area and District O.I.C.'s must use these forecasts in deciding daily operations and dispositions of gangs.*

Part B of the Fire Control Working Plan sets out disposition of gangs and equipment against the Fire Danger Scale for normal working days and weekend and holiday 'Standby' periods.

164. If full and effective use is to be made of all time suitable for prescribed burning and if fires are to be suppressed efficiently at minimum cost, officers must be able to interpret the effect of weather on fire behaviour." (p. 51)
Issued 12/78

Water Supplies
"*165. It is important that adequate static water points are available for fire control.*" (p. 51)
Issued 12/78

Fire Retardant
"*166. 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, alters the combustion reactions of the fuel. See Appendix XIV." (p. 52)
Issued 12/78

Fire Suppression
"*167. Refer to definitions of the three types of forest fires in Appendix IX.*

Crown fires
Ground fires

Surface fires" (p. 52) Issued 12/78

Fire Behaviour
"*168. 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, distribution, type.
Forest – Density, height, species, understorey, scrub.
Topography – Slope and aspect" (p. 51-52) Issued 12/78

Forest Fire Danger Tables
"*169.The Forest Fire Danger Tables are provided as a basis for prediction of fire behaviour. Predictions from Table C assume level topography, 60 percent crown cover and standard fuel quantities for each forest type, e.g. jarrah 7 to 9 tonnes per hectare. They also assume lateritic soil type and 10-20 percent low scrub. Variations from these standard conditions must be given due allowance when predicting local fire behaviour*

170.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.

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

172.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.

173.The tail fire is normally controlled last, but must on no account be entirely neglected." (p. 53)
Issued 12/78

Fire Attack
"*174.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.*

175.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 o f controlling it is increased tremendously.

176.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." (p. 53)
Issued 12/78

"*177. 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." (p. 54)

Sequence of Action

"*178.The following sequence of action will be taken in the event of a fire endangering State forest:*

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

178.2 Locate the smoke on a grid reference and record.

178.3The 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.

178.4 Record the time and despatch action taken.

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

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

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

179.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." (p. 54)
Issued 12/78

"*180.If first to arrive at the fire the overseer will:*

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

Reports arrival.
Unloads equipment and arranges for its protection (see paragraphs 192 to 199 inclusive).
Proceeds to forward section of the fire and commences suppression under control of No. 1 pack-spray man.

180.2 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.

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

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

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

180.6 Report when the fire is safe and gang leaving.

180.7Advise despatcher what further patrol action is necessary." (p. 55)
Issued 12/78

"*181. If other than first to arrive at the fire, the overseer will:*

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

181.2 In the absence of a control point, arrange advice to Headquarters of arrival at the fire.

181.3 Proceed with suppression.

181.4 For Large Fire Organisations the overseer is responsible for filling in and handling the gang unit card (F.D. 661) to the Control Point Officer." (p. 55)
Issued 12/78

Action by Area O.I.C.
182. The area O.I.C. will:

182.1 Inspect the fire during or as soon as possible after suppression.
182.2 Check efficiency of gang's work.
182.3 Enquire into cause (see Appendix V).
182.4 Complete Fire Report Form F.D. 304 and forward copies to the Divisional officer." (p. 56)

Red Action
"*184. A Red Action is used to describe certain fires occurring in high risk plantation areas that trigger an automatic response by suppression forces. (See Appendix XIII).*" (p. 56)

Appendix XIII
Red Action Definition
"*The term Red Action applies to a set of instructions on the prearranged strength of forces and plant from neighbouring Divisions which will be automatically despatched when a Red Action is called.*

2.RED ACTION AREA
2.1The 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 forest values or forces available, such as increases in plantation areas or changes in fire hazards.

2.2The Red Action areas will be shown on office co-ordination boards.

2.3A 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.

3. DESPATCH
3.1 If a smoke is reported in the Red Action area, a Red Action must automatically be called by the most senior person present at the time in the Divisional office.

3.2 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.
3.3 Automatic assistance from neighbouring Divisions will be forthcoming. […]" (p. 123)

Methods of Fire Suppression
185. 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 around, 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." (p. 56)
Issued 12/78

Direct Attack
"*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.*" (p. 56)
Issued 12/78

Counter attack
"*186.In counter-firing 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. [...]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." (p. 57)

Back-Firing
"*187. General rules for back-firing:*
187.1 Assess the back-firing possibilities and proposed base line carefully before spending much time clearing the break.

187.2 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.

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

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

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

187.6 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." (p. 57) Issued 12/78

"*187.7 Patrol continuously.*
187.8 Keep as close to the main fire as is commensurate with safety.
187.9 Back-fire against the head fire and attack the flanks and tail directly." (p. 58)

Fire Appreciation
"*188.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 F.D. 613. 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 fire line constructed by the available fire fighting forces compared with rate of perimeter spread for the fire." (p. 58) Issued 12/78

Mopping Up and Patrol
"*189.Mopping up is the term used for the work done in rendering a fire safe after it has been brought under control.*

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

> *190.1A strip at least one metre wide must be cleared to mineral earth around every fire, strictly following its edge.*
>
> *190.2 Within 20 metres 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.*
>
> *190.3 Within 100 metres of unburnt fuel around the edge all burning spars 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.*" (p. 58) Issued 12/78
>
> "*190.4 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.*" (p. 59) Issued 12/78
>
> "*190.6 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.* […]" (p. 59)

"*191. Patrolling of all stopped fires is essential …*" (p. 59) Issued 12/78

Staff and Headquarters Organisation – Large Fires
"*200. 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." (p. 60) Revised 10/79

Fire Reports
"*220. At the first opportunity after a fire the area O.I.C. shall fill in the fire report from F.D. 304 while details are fresh in mind. A copy of the completed form must be forwarded to Protection Branch, Como within 14 days.*" (p. 65) Issued 12/78

Annual Fire Report
"*226. 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.*" (p. 67) Issued 12/78

NOTE: REFER TO DOCUMENT FOR COPIES OF THE FOLLOWING:
APPENDIX I : FIRE CONTROL WORKING PLAN
APPENDIX II: DIVISIONS FIRE CONTROL CHECK LIST
APPENDIX III: POWERS OF VARIOUS OFFICERS UNDER THE BUSH FIRES ACT
APPENDIX IV: LIST OF FIRE CONTROL FORMS
APPENDIX V: POINTS IN INVESTIGATING OUTBREAK OF FIRE
APPENDIX VI: STANDARDISED EQUIPMENT ON FIRE TRUCKS
APPENDIX VII: TOWERS AND TOWERMEN
APPENDIX VIII:ANNUAL FIRE REPORT
APPENDIX IX: GLOSSARY OF FIRE CONTROL TERMS IN COMMON USAGE IN WESTERN AUSTRALIA
APPENDIX X: FIRE CONTROL – ROADSIDE SIGNS
APPENDIX XI: PROTECTION OF PERSONS AND PROPERTY FROM DAMAGE DURING PRESCRIBED BURNING
APPENDIX XII: SEARCH AND RESCUE (S.A.R.) WATCH ACTION TO BE TAKEN IN AN AIRCRAFT EMERGENCY
APPENDIX XIII:RED ACTION DEFINITION
APPENDIX XIV: CHEMICAL FIRE RETARDANTS

PLANNING POLICY - 1977

A Perspective For Multiple Use Planning in the Northern Jarrah Forest. 1977

Foreword
"*The objective has been to accommodate as many compatible uses as possible within each land management category subject to the requirement of catchment protection which has special significance in the Region.* (p. 1)

"*The perspective is drawn primarily from the viewpoint of multiple use management in the northern jarrah region. Nonetheless, it establishes principles that can be applied to State Forests as a whole. It also establishes a framework for more broadly based regional land use plans.*" (p. 2)

Introduction
"*The Forests Department is required to provide a multiplicity of benefits from the northern jarrah forest according to the inherent capabilities of the environment, the existing statutory constraints and the recognised public demand. This objective is attainable because sufficient data are now available for a comprehensive and environmentally responsible regional plan.*" (p. 4)

"*This document sets the overall perspective for the development and subsequent implementation of detailed proposals. In doing this the region has been divided into six management zones based on geomorphology and*

climate. However, for detailed local planning it is envisaged that site vegetation zoning will be more appropriate and precise.

The management strategies proposed supplement the Forests Department policy on multiple land use." (p. 4)

3. Current Management and Resource Use
Fire Protection
"*A Policy of fire exclusion was practised by the Forests Department between 1919 and 1954 when the policy of fuel reduction by prescribed burning commenced. However, it was not until the devastating fires of 1961 that the application of this policy widened to cover all State Forest, on a frequent rotation. Most areas are now burnt under prescribed conditions each 3 to 7 years, depending on the inherent fire risk.*

Techniques have been developed and perfected to allow aerial ignition of large areas at a time (up to 5 000 ha). Manual prescribed burning is still carried out, but is usually limited to small high risk areas, (up to 400 ha).

A number of alterations to fire protection policy have resulted from decades of fire research and practice, which give greater emphasis to conservational, environmental and aesthetic values. These include:" (p. 22)

"*b)* *burning roadsides over long distances simultaneously is to be avoided for aesthetic reasons.*
[…]
d) *attempts are not made to burn a high proportion of any one area. Prescriptions are set at limits which will ensure unburnt pockets comprising about 20-40% of the area. This policy was adopted in the light of research into the ecology of many forest animals; particularly the swamp dwellers.*" (p. 23)

GENERAL WORKING PLAN - 1977

General Working Plan No. 86 of 1977. Part I. 1977

4.2 The Concept of Multiple Use of Land Management
"*c)The selection of a priority or dominant use for an area with the practice of secondary uses which in some circumstances may not significantly interfere with the primary aim, but in others may impose a restriction on output from each competing use. This necessitates a social ranking of use priorities which can usually be done satisfactorily with limited data and experienced value judgement. The Forests Department has adopted this approach for the future management of State Forests and timber reserves.*

Multiple use has temporal as well as spatial over-tones. In the long term the structure of use priorities may alter with socio-economic, technological and successional changes. Such changes could be brought about by a number of influences such as dieback spread, mining, increased water supply requirements or altered demand for wood." (p. 31)

Resource Management Objectives
"*Fire Protection: To provide a fire control system capable of protecting recognised forest values from serious damage. This system is to be compatible with the dominant land use in any area, with the cost or protection not exceeding the value of the loss prevented.*" (p. 4)

5. Resource Management
5.1. Water
5.1.6 Management Strategy
"*4.* *On salt-sensitive areas, fire suppression strategy must give priority to minimising the risk of dieback spread.*

5. Provide for prescribed burning to be continued on catchments. Burning on each major catchment will be spread over several years to regulate runoff, and to minimise the potential danger from turbidity, ash pollution, and salinity, during the hazard reduction programme or in the event of wildfire." (p. 49)

5.2 Wood Production

5.2.5.4 Wood residues

"[…] *The removal of cull trees and debris by these industries is also beneficial with respect to silviculture and fire protection*." (p. 69)

5.3 Other Forest Produce

"[…]*The Department's prescribed burning programme will be discussed each year with the Government Apiculturist.*" (p. 80)

5.9.3.3 Fire protection capability

"*<u>Current resources:</u> Since prescribed burning has been implemented on a rotational basis over most State forests, Departmental fire protection resources have proved adequate to meet the majority of fire situations.* [...] *Current resources are listed below:*

[...]

(c) <u>Fire control plans</u>: Detailed plans for each administrative area specify fire control procedures and resources. [...]" (p. 120)

5.9.3.4 Objective of management

"*The objective is to provide a fire control system capable of protecting recognised forest values from serious damage. This 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*." (p. 121)

5.9.3.5 Background to policy formation

"*Throughout the hardwood forest prescribed burning during spring or autumn is applied on a rotational basis, except where management requirements for regeneration or research favour fire exclusion. In plantations where management is more intense and trees more sensitive to fire damage, prescribed burning in winter is generally used on buffer strips designed to restrict movement of wildfires.*" (p. 122)

5.9.3.6 Fire protection policy

"*1. 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.*

[...]

3. Provide a detection system which will ensure rapid effective attack of all wildfires on State forests.

4. Reduce fuels systematically in the indigenous forest to the level at which wildfire can readily be contained under normal weather conditions.

[...]

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

[…]" (p. 122)

5.9.3.7 Management Strategy

"*3. Carry out prescribed burning of indigenous forest in appropriate seasons at intensities and frequencies which facilitate achievement of the major land use objectives.*

[...]" (p. 123)

POLICY - 1976

Forests Department 1976 'Focus on Forest Policy', *Forest Focus*, No. 17 pp. 1-15.

"[…] *Prescribed burning must cater for protection of flora, fauna and ecological needs while continuing the protection of community life and assets.*

Recognising this complexity and diversity of interests, the department will continue existing traditional protective roles. The forest estate will be kept intact and increased wherever possible. Fire protection will continue using the most advanced techniques of fire prevention, detection, suppression and prescribed burning, and these techniques will be amended as knowledge is expanded in both technical and environmental fields." (p. 13)

Forest Policy
"*The Forests Department will manage the state-owned forests and timber reserves in Western Australia according to a policy that will ensure provision for the optimum social and material needs of the people. At the same time the policy will provide for the environmental well-being of the forests themselves.*

The policy involves the following objectives:" (p. 15)
[...]
Forest Protection

To maintain and add to the areas of permanently reserved forests; to protect these forests from fire, insects and other harmful agencies; to maintain and improve the health and vigour of the forest area." (p. 15)

FOREST POLICY – N.D. - 1975?

Forest Policy : Western Australia. N.D. [1975?]

Introduction
"*It has therefore become necessary to restate forest policies to take into account the major changes that have taken place since rigid control of the timber industries was first introduced in 1918.*

The objectives of forest management at that time were to protect the forest estate through control of the industry and to protect the forest itself from fire and other destructive agencies.

In more recent times there has been a greater emphasis placed on multiple-use of the forest but with a strong tendency still to produce timber for industry. However, multiple-use demands have imposed limits on the timber resources of the native forests. Emphasis has therefore been given to pine planting to provide a source of timber to supplement and in some instances replace those native forests that will be required for purposes other than timber production.

This statement will outline the current situation regarding those permanently dedicated State Forests and Timber Reserves which come within the stewardship of the Forests Department and formally establish management objectives according to the requirements that now exist. It will take into account a multiple-use concept of those forests managed by the Forests Department." (p. 2)

2.4 Forest Protection
"*As well as safeguarding the integrity of the forest estate, the principal avenues of the protection which must be afforded the dedicated State Forests are those of cutting control, fire protection and control of forest pests and diseases. Authority to undertake these protective functions is provided in the Forests Act.*

Although fire has always been an integral part of the environment in South Western Australia, human activities increased the likelihood of severe, uncontrolled fires capable of inflicting serious damage to the forest complex. Therefore one of the earliest tasks undertaken by the Forests Department was the development of an effective fire control organisation which implemented the findings of its research through fire weather forecasting, a detection and communication network, development of an extensive road system and training of efficient crews for fire suppression and prescribed burning. This protection has not been restricted to commercially productive forests but has been extended to adjacent areas serving as water catchments and national parks." (p. 7)

3. Future Management Objectives

3.1 Policy

"*The future policy will emphasise the multiple-use management of State Forests and Timber Reserves. It will continue to provide for the renewable resources of publicly-owned forests to be utilised in the combination that will best meet the needs of the West Australian people. The aim will be to make the most judicious use of the land for some or all of the resources or related service over areas sufficiently large to provide latitude for periodic adjustments in use to conform with changing public needs and the development of the forest itself.*" (p. 12)

3.1.1 Multiple-Use Priorities

"*Multiple-use management implies the realisation of the best combination of forest benefits according to the particular attributes of each area considered. Compatible benefits may be derived simultaneously from the same area, but separate areas must be used where there is conflict in management for non-compatible benefits.*

In order to overcome the problems imposed by limited forest area, it is proposed to establish a system of management priorities so that the greatest possible number of compatible uses can be practised throughout most of the forest, whilst carefully selected representative areas of native forest will be managed specifically to retain them in an undisturbed condition for scientific reference purposes." (p. 12)

"*The major forest values currently recognised for multiple-use management are:*

> *Timber Production*
> *Water Supplies*
> *Amenity and Recreation*
> *Flora and Fauna*
> *Special Scientific Values*" (p. 13)

3.1.2 Multiple-Use Requirements

"*Future requirements to meet the need for multiple-use forest management posed by increasing public demand are:*

> *Classification and designation of State Forest into areas to be managed according to a scale of multiple-use priorities, together with increased security for these management objectives.*
>
> *Increased research into recreational use and intensified environmental monitoring and inter-departmental co-ordination and liaison with respect to land use planning in the forest areas of the South West including engagement of professional staff with appropriate qualifications where necessary.*" (p. 13)

3.2.2 Forest Protection

"*It is intended to continue the existing traditional protective roles of the Forests Department. The forest estate will be kept intact and added to wherever this is possible; fire hazard reduction through prescribed burning will continue and techniques will be amended to match proven environmental requirements;* […]

To a large extent protection of the State Forests has become complex and more difficult to achieve. Because of greater demands by the public for forest use, fire protection through hazard reduction must leave certain unburned [sic] *areas for tourist purposes. At the same time, burning must be carried out to give maximum flora and fauna expression on favoured recreation areas.*[…] *Limited access because of forest hygiene and quarantine restrictions placed on forest dieback areas will also demand modification of fire suppression measures in some instances.*" (p. 15)

CODE OF LOGGING … - 197-?

'Code of Regrowth Logging Practice' for all Logging Operations … 197-?

Section 2 : General

"*2.1 The Instructions contained in this Code shall be observed by all persons carrying out any regrowth logging operation.* […]"(p. 3)

"*2.3 A contractor shall observe all Acts of the State of Western Australia, and in particular, the Bush Fires Act, 1954, the Forests Act, 1918-1976 … including all amendments to those Acts for the time being in force and any Act passed in substitution or in lieu thereof and all Regulations for the time being in force thereunder as well as this Code of Regrowth Logging Practice.*" (p. 3)

"*2.5 A contractor shall exercise strict supervision and control over the operations of all workers employed by him with a view to:*

2.5.1 Preventing any breach of the Forests Act and Regulations and this Code of Practice." (p. 3)

"*2.9 A contractor must ensure that all roads and tracks are left open at the cessation of work each day, or if required, during the day, to allow access for fire control and administrative purposes.*" (p. 4)

Section 3 : Felling, Trimming, Crosscutting, Etc.

"*3.13* […] *All tops, slash and other debris shall be cleared from roads, firebreaks, creeks, landings and logging tracks as directed by a Forest Officer.*" (p. 7)

Section 6 : Fire Protection

"*6.1 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 fires.*

6.2 No fires are to be lit in a Regrowth area without the express permission of a Forest Officer.

6.3 A contractor or any person employed by him shall take all necessary precautions to prevent the occurrence or spread of fire in the Regrowth 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 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 his control.

6.4 A contractor and all his employees 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 his instructions in firefighting or preventing outbreaks of fire.

6.5 A contractor shall not use, or operate, or permit the use or operation of, any chainsaw or other internal combustion engine in any Regrowth area 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.

6.6 To obtain approval a chainsaw system will:

6.6.1 Include a muffler large enough to allow gas expansion and cooling before final emission.

6.6.2 Be of such metal and design as to allow rapid heat dissipation before final emission of gases.

6.6.3 Be of such solid construction as to reduce noise, and be without vibrating parts where these add to noise levels.

6.6.4 Be dismantable for inspection and cleaning" (p. 14)

"*6.6.5 Be located in a position so that the emissive material is not directed on to the forest floor while in the felling position, nor towards the operator and that heated surfaces do not contact forest floor in cutting position.*

6.6.6 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. […]

6.6.7 Not allow ignition of any natural forest fuel held adjacent to the exhaust orifice within 30 seconds when the saw is operating under load.

6.7 A contractor shall not use or operate or permit the use or operation of any internal combustion engine in a Regrowth area 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 smoke, 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.

6.8 A contractor may establish in any Regrowth area section not more than 1 dump of fuel on a site and 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.

[…]

6.10 A contractor or his employee shall not start or permit to be started any chainsaw immediately after fuelling until such chainsaw has been wiped to remove any spillage and has been moved clear of the place at which the fuelling was carried out." (p. 15)

FORESTERS' MANUAL – 1973

Foresters' Manual : Fire Control. 1973

Introduction

"1. *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.*

2. 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.

3.The eucalypt forests of Western Australia have evolved in a fire environment. Both flora and fauna have adapted to hot, dry summers, 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." (p. 3)

History

"*4. At the passing of the Forests Act, 1918, the northern half of the State Forests had been ravaged by unrestricted cutting and uncontrolled fires.*

5. Since 1919 the forest has been progressively roaded and, until the early 1950s, the aim was to give complete protection. 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 organisation was not yet established.

6. 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." (p. 3)

Policy

"*'1. Present fire control policy results from five decades of experience and research and may be summarised as follows:*

7.1 Prescribed burning and intelligent planning is used to reduce the danger of severe uncontrolled fires.

7.2 Use our well-developed fire-fighting organisation to quell outbreaks in the dangerous summer months, but fight fires with discretion and consider cost of operation.

7.3 Train officers and men to think in terms of cost and collateral values on every operation involving fire protection.

7.4 Train and trust the junior officer to use fire as a controlled weapon to accomplish silvicultural ends and to guard against calamities.

8.In the implementation of this policy it has been found necessary to divide the forest into three zones indicating the degree of fire protection.

9. 'A' Zone. This will comprise all country on which fires will be attacked immediately 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.

10. '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 in Zone 'A' or 'P' require the postponing of immediate attack. Certain areas of private property adjacent to State Forest will be included." (p. 3)

" *'Plantation' Zone is in 'A' Zone and fires will be attacked immediately they become known. They will be given precedence within 'A' Zone 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.*

"*12. The boundaries of these zones will be reconsidered annually by the D.F.O. and, where necessary, will be revised after discussion with the Fire Control Superintendent.*" (p. 4)

"*13. All fire reports dealing with damage to the forest will refer to the area in terms of these zones.*" (p. 4)

"*14. The Forests Department's organisation covers a large area and must train, organise and prepare for periods of extreme effort. The detailed organisation of fire control within divisions is the responsibility of the D.F.O. or other officer in charge. Officers of the Fire Control Section, Fire Research Officer and administrative Inspectors are available to help with the planning of presuppression measures and maintenance of standards in all fire control operations. Within all such organisations, stress is placed on the clear definition of duties and responsibilities. These definitions and responsibilities are laid down in this section of the manual and all officers must clearly understand that such duties are associated with the position rather than the actual rank of the officer.*" (p. 4)

"*16. The work of fire control falls into three main branches:*
16.1 Fire Prevention.
16.2 Fire Pre-suppression.
16.3 Fire Suppression." (p. 4)

"*17. All Divisions must prepare Fire Control Working Plans. These Working Plans will give regular cheeks, locally, 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.*

The Fire Control Working Plan will consist of two parts under the broad headings set out below. […]

Part A-Inventory
17.1 Manpower and Equipment (Forests Department and outside sources).
17.2 Water Supplies.
17.3 Detection and Communications.
17.4 Access.
17.5 Location of Research Plots.

Part B-Planning
17.6 Prescribed Burning.
17.7 Suppression - Standing Orders and Organisation." (p. 4)

NOTE: REFER TO DOCUMENT FOR "*DEFINITIONS*"

Fire Prevention

"*34.Fire prevention, a most important branch of fire control, can be divided into the following:*
34.1 Risk reduction-
(a) General provisions.
(b) Education.
(c) Law enforcement.
34.2 Hazard reduction." (p. 6)

Risk Reduction

"*39. Whenever mechanical equipment is used in plantations, the following procedure must be followed during summer months:*
39.1 Chainsaws must be fitted with an efficient spark arrester which will be inspected periodically.
39.2 Chainsaws must not be used for at least 60 minutes prior to the operator leaving the area.
39.3 Pack sprays must be within 50 metres of felling and loading operations, full of water, tested frequently and ready for instant use.
39.4 The area worked over each day must be closely inspected by

the faller before leaving.

39.5 Vehicles must be in reasonable condition given to exhaust systems and brakes.

40. All new employees must be instructed in precautions outlined in paragraphs 37 to 39." (p. 6)

Law Enforcement

"*45. Every forest officer must acquaint himself with the Bush Fires Act and Regulation and make sure that his copy of the Act is kept up to date by entering any amendments that are gazetted.* […]" (p. 7)

Forests Act

"*46. 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 – Reg. 140.
Responsibilities of licensees and permit holders – Schedules." (p. 8)

Prohibited Burning

"*47. The Bush Fires Act provides that there shall be a prohibited 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 D.F.O.s should acquaint all officers with the dates of local zone restrictions.*

48. Provision is also made for this Department to obtain a suspension of the prohibited period to enable us to carry out protective burning." (p. 8)

W.A.G.R. Locomotives

"*65. It is the policy and practice of the Railways Commission to fit all W.A.G.R. locomotives with spark arresters during the summer months. Forest officers have no authority to stop or inspect any W.A.G.R. locomotives suspected of being faulty.*" (p. 10)

Hazard Reduction

Prescribed Burning

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

71. There are six types of prescribed burning for fuel reduction that are standard practice:

71.1Burning of buffer areas 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.

71.2 Burning of buffer strips or firebreaks around areas of high value-that is, to keep fires out of places such as saw mills, schools, townsites, isolated settlements, plantations, research areas, regeneration, etc. (The burning of the above two types will be carried out as frequently as possible, but not less frequently than every third year.)

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

71.4 Advance burning: prior to logging operations.

71.5Top disposal burning, for regeneration and hazard reduction, following logging operations.

71.6 Subdivision of extensive plantation areas with prescription burn buffers to minimise loss in the event of wildfires." (p. 10)

"*72. Except for those areas where specific approval for burning has been obtained from Head Office, complete protection will be afforded to:*

"*72.1 Plantations.*
72.2 Karri tops or scrub-rolled areas being held for regeneration burning and severely fire-damaged areas programmed for cutting within five years.
72.3 Regenerated karri areas where crop saplings are less than 15 metres tall.
72.4 Regenerated jarrah areas where crop saplings are less than 6 metres tall.
72.5 Areas required for research and investigation." (p. 11)

Planning for Prescribed Burning

"*73. Officers in charge of Divisions must draw up prescribed burning master plans will show:*

73.1 Hardwood areas which will be burnt on a three-year (or less) rotation - i.e., areas covered by burning types defined in 71.1 and 71.2 above.

73.2 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 seven to ten tonnes/ha, this should generally be used as the criterion to decide rotation length.
The map attached to Management W.P. 85 shows the broad categories for management and, unless otherwise specifically stated in individual working plans, the standards for fire intensity and percentage area burnt are to conform with the limits set below:

Standard for Prescribed Burning

(a) I.M.U.'s, potential I.M.U.'s and other areas of good forest.

Jarrah Forest:

Burning cover in the range 60 to 80 per cent without scorch to crop or potential crop trees.

Karri Forest:

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

Flats:

Burning cover in pockets ranging between 40 to 60 per cent. under spring conditions only.

(b) Poor Quality Forest.

Burning cover in the range 40 to 60 per cent. Burning to be restricted to conditions of drought index less than 100 to minimise possibility of reignition and scorch.
Planning must aim to achieve annual programmes of continuous strips rather than a patchwork of scattered areas, and wherever possible be designed for aircraft ignition." (p. 11)

"*74. The master plans must be checked annually and adjusted, if necessary, in the light of previous burning.* […]" (p. 11)

Annual Burning Plan

"*75.The Divisional Forest Officer shall draw up current burning plans each year setting out his proposed programme. This will be submitted, after vetting by the Fire Control Forester and Inspector, to the Fire Control Superintendent for approval or amendment by the following dates:*

Hardwood - 15th June.
Plantations - 15th March." (p. 12)

Hardwood prescription

"*The master plan and plans showing results of previous burning will be used to frame the annual programme for both pines and hardwood. Proposals for aerial prescribed burns, listing number of burns, approximate area, locations and number of lightings, are to be forwarded to the Fire Control Superintendent by the 30th April.*" (p. 12)

"*76. The Forester-in-Charge is responsible for burning in his own district.*

A local officer must inspect each area to be burnt to assess the fuel condition and vulnerability and decide the weather conditions under which it should be burnt. A member of the field staff must issue instructions for each piece of burning. This should not be left to an overseer or leading hand." (p. 12)

"*77. The description, prescription and fire behaviour data for each burn is to be recorded. Hardwood burning is to be planned for spring unless management objectives or special conditions of fuel flammability demand otherwise. Such exceptions are to be discussed with fire control staff. Plantation burning times are laid down in paragraphs 84 to 93.*

78. Prescriptions for hardwood burning are to be completed by the 15th July to ensure adequate time for checking, and full advantage is taken of suitable early weather, for edging, flat burning, etc. In plantations, they are to be completed by 15th March. Prescriptions are to be checked by the Forester-in Charge before burning commences.

79. Prescriptions for hardwood burning will be based on 1:25000 scale A.P.l. plans and on 1:12500 plans for plantations. For aerial ignition, map copies suitably marked for flight plans will be prepared on request to Drafting Branch, Head Office.

80. Compile each hardwood prescription as follows:

80.1 *Use the A.P.l. plan for separating each job into similar forest types based on species, height, and density.*

80.2 *Examine cutting records to determine sapling age, likely height of regeneration and changes to canopy density since aerial photography. In karri forest, proposed cutting will be noted.*

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

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

80.5 *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.*

81. Prescribe suitable burning conditions for each forest and fuel type in terms of maximum fire danger, within the nearest half unit; wind direction; burning technique and lighting pattern; requirements for edge burning and number of ignitions required. Comment on adjacent fuels and items requiring prior attention, namely:

areas to be given protection (pine plots, etc.);
advice to property owners;
road grading or improvement;
persons and property in the area (see App. G.).

82. Descriptions and prescriptions for plantation burning are to be prepared on form F.D. 574. All details of stand condition, fuel, slope, aspect or position which may affect fire behaviour must be described and an appropriate fire danger prescribed for burning. […]" (p. 12)

Post-Burn Inspection
"*83. Overseers or officers directly in charge of the burning operations must mark on the plan the area considered to have been burnt. This will not be finally washed in on the Divisional burning plan until it has been inspected and the area and quality of the burn verified.*

Areas not burned to schedule will be marked on the plan and arrangements made for these portions to be burned later." (p. 13)

Fire Danger
"*86. The factors to be used to derive fire danger are:*
86.1 Past weather: […]
86.2 Present weather […]" (p. 14)

Test Fires
"*87. Test fires must be lit in each burning unit before overall lighting starts.* […] *Their performance will indicate whether fire intensity will be acceptable under the prevailing conditions. Head fire flame height above 0.7 to 1.0 meter is unacceptable except for occasional flare-ups.*" (p. 14)

Spacing of Spot Fires
"*89. Test fire performance will not illustrate the effect of multiple ignition points.* […]" (p. 14)

Compartment Edges
"*90. Compartment edges within 20 metres of breaks must be treated as separate fuel types and burned under minimum conditions where necessary, according to the prescribing officer.*" (p. 14)

Use of Fusees
"*91. The lighting crew will be limited to four and fusee matches used when the ignition pattern exceeds a 10-metre grid.*" (p. 14)

D.F.O.
"*92. Divisional Forest Officers will be responsible for the daily decision to burn, having taken into account past and present weather.* […]

Approval of the Fire Control Superintendent must be obtained each year:
(a) before burning commences in any plantation unit;
(b) for any burning after 15th September under pine canopy." (p. 14)

Recording
"*93. The following information will be recorded for each burn:*
Date, time of commencement and duration.

Areas burned and detailed costing.
Weather and fuel conditions
Fire behaviour notes and results obtained." (p. 14)

Advance Burning
"*97. 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.*

> *97.1In jarrah forests where rotational prescribed burning is applied, the fuel quantity is not likely to exceed 7 tonnes per hectare at necessary 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.*
>
> *97.2 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 effect 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.*
> *97.3 Plantation (Refer paragraph 84.2 above)*" (p. 16)

Top Disposal
"*98. 'Serious damage can be done to the remaining tree crop by uncontrollable fires following in the wake of 'felling' operations. Not only are saplings, poles and piles destroyed in this way, but where the butts of mature trees are surrounded by a litter of tops the resultant scorching reduces the value of the standing crop by the production of dry sides, hollow butts, or death and by allowing the ingress of termites and wood-destroying fungi.*

Judicious expenditure on top disposal operations generally will be repaid many times over in the saving of valuable timber." (p. 16)

"*99. Unless otherwise directed by the D.F.O., workmen will follow the fallers and clear away limbs and other debris for a distance of about 1 metre from around valuable trees and saplings.*

100. 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.

> *100.1 Jarrah tops burning 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.* […]
>
> *100.2 Karri tops burning is tied completely to silvicultural requirements. Seed must be present in retained trees and conditions chosen to achieve a clean seed bed.*" (p. 16)

Method of Burning
"*101. 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.)*

The lines will be lines of spot fires or lines of continuous fire, depending on conditions and the method of burning used." (p. 16)

"*101.1 Lighting may be done by aircraft or men on the ground. In each case the selection of strip width and spotting distance must be determined from the Prescribed Burning Guide on the day of the burn.*" (p. 16)

Burning Techniques
"*102. Burning with strips across the wind - 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 some (allowed for) distance with the wind until it runs into the burn of the previous line.*" (p. 17)

"*Strips are started on the downwind edge of the burn and move progressively up wind. Hatching illustrates area burnt.*

103. Burning with strip straight into the wind - this is a secondary method, only to be used on small areas in 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." (p. 17)

General Provisions
"*105. An area prescribed for burning in one day must be completely enclosed by lines within which the burn can be contained. Such lines will usually be roads, firelines or water reservoirs, but may be fuel moisture barriers in mixed forest types. In this latter case the burn must be completed at the earliest opportunity and should take precedence over any new job.*

106. 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.

107. In 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 is to be avoided.

108. To strengthen roads and firelines acting as boundaries of a burn and so 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 drought index is under 100." (p. 18)

Control of Scorch
"*109. 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 so to the rate of fire spread." (p. 19)

Index Table
"*110. The officer in charge must select the day on which weather and fuel index table conditions will give a rate of spread, and so a flame height, which will keep scorch within the desired limits and yet will 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 it.*

110.1 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. The daily check of actual conditions at 1000 hours is to be 1000 hour check the criterion for implementing aerial prescribed burns. This check is to be based on temperature and relative humidity at the site of the burn and wind strength and direction from adjacent towers. Any queries on the forecast should be referred to Fire Control, Como.

The 'forecast' local fire danger, adjusted for fuel quantity, must match with that prescribed before a job is programmed for lighting." (p. 19)

Lighting Technique
111. The officer or overseer directly in charge at the burn must then Lighting technique calculate the least amount of fire he is able to put into the area to ensure that to be employed it will burn out in the available time on the day.

112. Strip width and spotting distance must be calculated from the prescribed burning guide on the morning of the burn and for aerial ignition a flight plan will be prepared." (p. 19)

Fire Behaviour
"*113. 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.*" (p. 19)

Briefing
"*114. The overseer (or officer) directly in charge of the 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.*
(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.*" (p. 19)

"*115. At each aircraft burn there will be a Controller and he will direct aerial burn the aircrew, markers and suppression crews. A Fire Boss will assist the Controller.*

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

Maintain liaison with officers responsible for aircraft movements and daily jobs.

Provide warning notices to the public on each day of an aerial burn.

Ensure flight plans are prepared and that aircrew and markers are fully briefed.

Direct use of suppression forces through the Fire Boss.

Check the weather forecast.

Check fire danger regularly and assess fire behaviour by obtaining reports from aircraft navigator and ground crew.

Direct the aircrew.

Determine starting and stopping of lighting.

115.2 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." (p. 20)

"*116. Forest officers and inspectors are 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.*" (p. 20)

Prescription to Ensure Protection from Damage
"*119. 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.*

119.1 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 'hopovers'." (p. 20)

Burning in March
"*120. No burning shall be carried out in March without the authority of a D.F.O. or above.*" (p. 21)

Restrictions
"*121. No fires shall be lit on days above average summer hazard or local fire danger of 40.0 without the authority of a D.F.O. or above.*" (p. 21)

Tower Coverage
"*122. Sufficient towers to give adequate coverage and weather data must be manned while prescribed burning is being carried out, except that during the months of May to September inclusive the manning of towers may be dispensed with at the discretion of the officer in charge of the Divisions.*" (p. 21)

Heavy Duty
"*123. A heavy-duty outfit must be taken to every burn except where otherwise directed by the officer in charge of the Divisions.*" (p. 21)

Daily Burning
"*124. Patrol must be regarded as a very important duty. The officer Patrol of burn edges responsible for the burn should also be responsible for the final patrol of the edge.*

The frequency of patrol and length of time for which it is continued should be decided after assessing the risk of breakaway, i.e., by considering adjacent fuel, conditions of the fire edge, width of break and weather conditions." (p. 21)

"*133. 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.*" (p. 22)

Fire Pre-Suppression
Manpower
"*136. The Forester-in-Charge shall see that his gangs get regular training in handling equipment, fire suppression methods and organisation of fire-fighting gangs.* […]" (p. 23)

Auxiliary Manpower
"*139. It is important that there be close liaison with the Bush Fires Organisation ...* […]" (p. 23)

"*140 … All sources of auxiliary manpower and equipment must be listed in the Working Plans.*" (p. 24)

Equipment
"*141. The Forester-in-Charge will list and order the equipment he considers necessary for his district and will be responsible for seeing that it is obtained and efficiently maintained.*

This equipment will be sufficient for his gangs together with replacements and additional equipment for the auxiliary gangs he is likely to pick up under normal conditions." (p. 24)

Detection
"*149. Early detection and accurate location of fires is of paramount importance in fire control. A fire is located by plotting the bearings on it from two or more towers. Adequate tower or aircraft coverage is to be maintained on all days when the local fire danger exceeds 20.0.*" (p. 26)

Detection by Aircraft
"*155. Light aircraft are available on hire for fire spotting and location.* […] *Aircraft spotting can be of considerable value in the early morning following lightening storms and on days when smoke haze cuts down visibility from lookout towers.* […]" (p. 26)

Communications
"*156. Effective means of communication are vital, not merely in fire control but in the successful administration of the Department.*" (p. 26)

Fire Weather
"*163. Weather forecasts are broadcast over the departmental radio network Weather forecasts daily at 0745 hours, 1000 hours and 1615 hours during the fire season. In early spring a 1615 forecast will be issued on week days before conditions are suitable for general control burning. An 0745 hours forecast will only be issued automatically on Mondays. Otherwise it will be by request from Divisions.*
A confirmation or correction of the 0745 hours forecast will be issued at 1000. These forecasts give brief information on expected cloud, wind strength and direction, maximum temperature, minimum relative humidity and fire hazard.

163.1 Where necessary, forecasts will be provided for five locations representing regions as follows:
West Coastal Plains (North)-Perth.
West Coastal Plains (South) -Bunbury.
West Coastal Plateau (Northern Jarrah)-Dwellingup.
South Coastal (Inland) (Southern Jarrah)-Bridgetown.
South Coastal (Karri)-Pemberton.

The approximate boundaries of these regions may be obtained from the Fire Control Section.

163.2 In addition to the regional forecasts issued at 0745, 1000 and 1615 hours, local operational forecasts will be available for major control burns or running fires. They will be provided at any time on request from divisions. The location for which they are requested must be defined by grid reference.

163.3 The 0745 hours forecasts will be issued through Como. The 1000 hours, 1615 hours and operational forecasts will be issued through Como on week days and Dwellingup on weekends." (p. 27)

Weather readings

"*164.To assist in the preparation and checking of forecasts, wind direction required by and strength will be required at 0930 and 1430 hours from the following towers:*

West Coastal Plains-Gnangara and Hampton.
West Coastal Plateau-Dale, Wells and Mungalup.
South Coastal (Karri) -Collins, Gloucester and Frankland.
South Coastal (Inland)-Munro, Alco, and Kepal.

Manjimup will collate readings from the South Coastal regions. Dwellingup will collate readings from the West Coastal regions. From Monday to Friday these two stations will transmit the readings to Como. At weekends Dwellingup will telephone all readings to the Bureau of Meteorology.

Fire Hazard
165. Fire hazard is expressed on two scales: an empirical scale from 0-10 and a general scale using descriptive names." (p. 27)

"*The measurement of the moisture content of wood cylinders is used as an aid to forecasting fire hazard. The relationship between the two hazard scales and the wood cylinders' moisture content is set out below:* […]" (p. 28)

F.D.I.

"*166.1 The Fire Danger Index should be calculated, for each major forest type in a Division, from the morning forecast. 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." (p. 28)

Forecasts
"*167. The 0745 hours forecast must be obtained by all Divisions each morning and passed on to Districts under their charge. (Should Divisions not be able to receive the forecast by radio, they must obtain it by P.M.G. or Departmental telephone).*

168. Officers in Charge of Divisions and Districts must use these forecasts in deciding daily operations and disposition of gangs.

Part B of the Fire Control Working Plan sets out disposition of gangs and equipment against the Fire Danger Scale for normal working days and weekend and holiday 'standby' periods.

169. If full and effective use is to be made of all time suitable for prescribed burning and if fires are to be suppressed efficiently at minimum cost, officers must be able to interpret the effect of weather on fire behaviour." (p. 28)

Water Supplies
"*170. It is important that adequate static water points are available for fire control.*[…]" (p. 28)

Fire Suppression
Fire Behaviour
"*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, distribution, type.
Forest –
Density, height, species, understorey, scrub.
Topography: slope and aspect.

173. 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., jarrah 7 to 9 tonnes per hectare. They also assume lateritic soil type and 10-20 per cent low scrub. Variations from 1 these standard conditions must be given due allowance when predicting local fire behaviour.

174. 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.

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

176. The flank fires, on either side of the head fire, 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 or topography and this dangerous flank must be controlled simultaneously with the head fire or very soon after it.

177. The tail fire is burning slowly and quietly against the wind, is doing least damage and should be controlled last, but must on no account be entirely neglected." (p. 29)

Fire Attack
"*178. 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.*

179. 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.

180. 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 with which he is sent to deal. Officers can do much to foster this idea in the minds of their gangs." (p. 29)

Action Related to Fire Danger
"*181. 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." (p. 30)

"*182. The following sequence of actions will be taken in the event of a fire endangering State Forest:*

182.1 Request towerman to check bearings and distances or check aircraft report.
182.2 Locate the smoke on a grid reference and record.

182.3 The most senior officer present will take charge and despatch forces laid down in the operation orders or despatcher tables.

182.4 Record the time and despatch action taken. If aircraft is available, request a report on fire behaviour, fuels and access.

182.5 Recalculate the local fire danger for the area of the fire and amend forces despatched if necessary.

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

182.7 Advise the officer in charge as soon as possible.

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

184. If first to arrive at the fire the overseer will:

184.1 On arrival make a quick reconnaissance of the fire while the gang-reports arrival, unloads equipment and arranges for its protection (see paragraphs 196-203 inclusive), proceeds to forward section of the fire and commences suppression under control of No. 1 packspray man.

184.2 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.

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

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

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

184.6 Report when the fire is safe and gang leaving.

184.7 Advise despatcher what further patrol action is necessary.

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

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

185.2 In the absence of a control point, arrange advice to Headquarters of arrival at the fire.

185.3 Proceed with suppression.

186. The Officer-in-Charge will:

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

186.2 Check efficiency of gang's work.

186.3 Enquire into cause (see Appendix C)." (p. 30)

Direct Attack

"*188. Basically there are only two methods of fire suppression: direct attack and counter or back firing.*

189. 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." (p. 31)

"*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.*" (p. 31)

Counter-Firing

"*190. In counter-firing 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.*" (p. 31)

"*One of the main dangers in back-firing is the tremendous up-draft 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 the 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." (p. 31)

Precautions for Back-Firing

"*91. General rules for back-firing:*

- *191.1 Assess the back-firing possibilities and proposed base line carefully before spending much time clearing the break.*
- *191.2 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.*
- *191.3 Never light a longer line than can be held; special care is necessary if choppy winds are likely.*
- *191.4 Always burn clear to the line and well in towards the main fire.*
- *191.5 If burning on a slope, start at the top and burn down.*
- *191.6 If the main fire is coming up a slope, back-fire from the lee of the ridge top, that is, just over the top from the direction of the main fire.*
- *191.7 Patrol continuously.*
- *191.8 Keep as close to the main fire as is commensurate with safety.*
- *191.9 Back-fire against the head fire and attack the flanks and tail directly.*" (p. 31)

Mopping Up

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

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

- *193.1 A strip at least one metre wide must be cleared around every*
- *193.2 Within 20 metres 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.

193.3 Within 100 metres of unburnt fuel around the edge all burning spars must be extinguished, felled or burnt around to provide 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." (p. 32)

Staff and Headquarters Organization – Large Fires

"*204. Once three gangs are committed on one or more fires in a division or the rate of spread prediction for any fire exceeds 140 metres per hour, the Large Fire Organization will be implemented.* […]" (p. 33)

Control Centre Facilities

"[…]

220.2 A fuel age plan showing at least the previous four years burning. This must also be prominently displayed. […]" (p. 34)

Fire Reports

"*224. All fires in protected forest that are likely to attain an area of 40 hectares and all fires in plantations must be reported immediately by radio or telephone to the Fire Control Office at Como during week days and to the Fire Control Superintendent at other times.*" (p. 35)

Annual Fire Report

"*227. 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 Fire Control Superintendent.*" (p. 36)

REFER TO DOCUMENT FOR COPIES OF :
APPENDIX A: FIRE CONTROL WORKING PLAN;
APPENDIX B : LARGE FIRE STAFF ORGANISATION – STATEMENT OF DUTIES;
APPENDIX C : POINTS IN INVESTIGATING OUTBREAK OF FIRE;
APPENDIX D : STANDARDISED EQUIPMENT ON FIRE TRUCKS;
APPENDIX E : TOWERS AND TOWERMEN;
APPENDIX F: ANNUAL FIRE REPORT
APPENDIX G : PROTECTION OF PERSONS AND PROPERTY FROM DAMAGE DURING PRESCRIBED BURNING
APPENDIX H : LIST OF FIRE CONTROL FORMS

FORESTERS' MANUAL - 1972

Foresters' Manual : Reforestation and Silvicultural Operations : Jarrah and Karri. 1972

"*The designation of intensive management units also serves to demonstrate the boundaries of 'Zone X' (-zone where any reported wildfire is immediately attacked-) for fire control purposes.*" (p. 3)

Protection of cutting area

"*103. For good karri seedling regeneration a clean regeneration burn, with widespread ashbed and complete removal of green scrub and understorey is essential. Maximum dry fuel quantity of all sizes at the time of the burn is therefore desirable. This not only ensures widespread ashbed, but extends the limit of fire danger ratings which can be used into a lower, safer range.* […]" (p. 25)

Seed Collection
"*128. Owing to the natural periodicity of karri seeding, it is often necessary to withhold karri tops for periods of up to six years before adequate supplies of mature seed are available for a successful regeneration burn. For this reason, regeneration burning may be carried out during the prohibited period, under special suspension, so as to cover all areas ready for burning within the relatively short period available.*" (p. 29)

"*132. It is axiomatic that the hottest burn produces the best regeneration. More fuel is consumed and ashbed, most favourable to seedling development, is more widespread and continuous. The object of the regeneration burn is to bare the mineral soil and create widespread ashbed and promote seedfall (para.123). The only restraint on fire intensity are the requirements for control. Seed tree damage is unimportant. A large quantity of dry fuel available for burning means that lower fire dangers can be utilised to achieve the desired seed bed.*" (p. 30)

WORKING PLAN – 1971

General Hardwood Working Plan No. 85. 1971

7.2 Forest Conservation and Multiple Use Management
"*In all operations proper attention will be paid to:*

1. *Preservation of selected forest reserves on areas where no major trade operation has taken place.*

2. *Continued attention to conservation of flora and fauna of the forest by proper management techniques including fire control and forest hygiene.*" (p. 36)

OPERATIONS MANUAL – [197-?]

Aerial Forestry Fire Prevention Surveillance : Operations Mannual [i.e. Manual]. [197-?]

NOT INCLUDED, REFER TO DOCUMENT – COMO 630.432.23(94) AER

TRAINING MANUAL – [1967]

Forest Fire Control Training Manual. [1967]
NOT INCLUDED, REFER TO DOCUMENT – SHELF NUMBER: COMO 630.432 FOR

FORESTERS' MANUAL - 1964

Foresters' Manual : Fire Control. - Rev. 1964

The Importance of Fire Control
"*1. The problem of fire control is intimately bound up 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.*

2.Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations.

3. The eucalypt forests of Western Australia lend themselves to hazard reduction by the intelligent use of fire in the Spring, Autumn and Winter by Prescribed Burning." (p. 7)

Policy

"*4. At the passing of the Forests Act, 1918, the Northern half of the State Forests had been ravaged by unrestricted cutting and uncontrolled fires.*

5. Since 1919 the Northern half of the forest has been roaded and until recently given complete protection at a very high cost.

During this period, the extension of group settlement and other farming ventures resulted in heavy damage due to indiscriminate firing of much of the Southern forest area where the forestry organisation was not yet established.

6. 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 "stay" a fire under the severe weather conditions that occur periodically in Western Australia. Other States have learned this lesson with equal force.

7. The result of nearly four decades of fire control experience and research is a policy introduced in 1954 which may be briefly summarised as follows-

(a) Put all available funds into the roading of valuable forest areas to cheek annual losses by uncontrolled fires.
(b) Use prescribed burning and intelligent planning to the fullest extent possible to reduce the danger of severe uncontrolled fires.
(c) Use our well developed fire-fighting organisation to quell outbreaks in the dangerous summer months, but fight fires with discretion and with an eye to the cost of operation.
(d) Train officers and men to think in terms of costs and collateral values on every operation involving fire protection.
(e) Train and trust the junior officer to use fire as a controlled weapon to accomplish silvicultural ends and to guard against calamities.

Demarcation of Zones

8. In the implementation of this policy it has been found necessary to divide the forest into three zones indicating the degree of zones indicating the degree of fire protection aimed at and for the annual Fire Report.

*9. '**A' Zone**-This will comprise all country on which fires will be attacked immediately they become known.*

This will include regenerated or planted forest as well as the greater part of the prime forest over which fire control measures are gradually being extended.

Within this zone there will be a proportion of sub-marginal forest and even unforested country as well as private property.

*10**. 'B' Zone**-Will include forest on which it is possible 'B' zone to afford limited protection only by broadcast burning in suitable weather.*" (p. 7)

"*Suppression of uncontrolled fires in this zone will only be delayed when commitments in Zone 'A' require the post- poning of an immediate attack. This zone will also include certain areas of private property adjacent to State Forest boundaries.*" (p. 8)

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

14. The Forests Department's organisation covers a, large area loosely controlled and must train, organise and prepare, in periods of little danger, for periods of extreme effort." (p. 8)

The Fire Organisation
"*The details and organisation of Fire Control within Divisions is the responsibility of the D.F.O. or other officer in fire.*

To assist D.F.O.'s in this task the Fire Control Superintendent has a Fire Operations Officer, Fire Research Officer and Fire Control Foresters. These officers help with the planning of pre-suppression measures, inspection of fire control operations generally, training gangs and fighting large fires.

In all such organisation stress is placed on the clear definition of duties and responsibilities. Those definitions and responsibilities are laid down in this section of the Manual and all officers must clearly understand that such duties are the responsibility of the position rather than the actual rank of the officer.

Branches of Fire Control
"*16. The work of fire control falls into three main branches:-*
(1) Fire Prevention
(2) Fire Pre-suppression.
(3) Fire Suppression.
These branches are dealt with under each heading in the following pages." (p. 8)

Fire Control Working Plans
"*17. All Divisions must prepare Fire Control Working Plans. These W.P.'s will give regular checks, locally, of the general organisation within 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.*

The Fire Control Working Plan will consist of two parts under the broad headings set out below. The detail required in these parts is given in Appendix 'A'.

Part A. - Inventory
(1)Manpower and Equipment (Forests Department and outside sources).
(2)Water Supplies.
(3)Detection and Communications.
(4)Access.
(5)Previous Prevention Burning." (p. 8)

"*Part B-Planning.*
(1) Prevention-Controlled Burning.
(2) Pre-suppression-Fire Control training.
(3) Suppression-Standing Orders and suppression organisation." (p. 9)

Fire Prevention
"*33. Fire prevention, a most important branch of fire control, can be divided into the following sections and subheadings which are dealt with in turn:-*
(1) Risk Reduction
(a) Education
(b) Law Enforcement.
(2) *Hazard Reduction.*" (p. 10)

Law Enforcement
"*44. Every forest officer must make himself acquainted 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.*

45. Besides the provision of the Bush Fires Act, the attention of all forest officers is drawn to the following fire provisions of the Forests Act:

Section 46-Penalty for unlawfully lighting fires (minimum 1/20th of maximum).
Section 47-Forest Officers calling for assistance to extinguish fires.
Section 48-Setting fire, to bush without notice to forest officers." (p. 11)

Fire Protected Areas
"*46. The Bush Fires Act makes provision for the declaration of Fire Protected Areas in which the lighting of fires (during the 'restricted burning times') is prohibited except by written permit to burn issued by the Minister for Lands or an officer acting with his authority.*

There are only two such areas so far gazetted, one within a twelve mile radius of Collie Railway Station, and the other an irregular area in the Mundaring Weir district.

47. Forest officers have the sole authority to issue permits to burn in these areas.

48. The correct procedure for the issue of permits to burn in fire protected areas is fully set out in the regulations under the Bush Fires Act and must be followed." (p. 12)

"*50. No permit to burn shall be issued during the prohibited period except during a period when the Department has obtained a suspension of the prohibited period, and then only if the forest officer is satisfied that conditions are safe.*

Prohibited Period
51. The Bush Fires Act provides that there shall be a prohibited 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.

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

53. Before the beginning of the prohibited period the Forester-in-Charge should apply to Head Office for any suspension required, setting out the reason for his request, the minimum period required, the Road District concerned and the particular areas on which the burning operations are to be carried out.

All such applications for the suspension of the prohibited period must be countersigned by a S.D.F.O. and forwarded to the Fire Control Superintendent.

54. In every case of fire the local officer must take immediate steps to ascertain the cause with a view to possible law enforcement. The procedure to be followed is set out in Appendix 'C.'" (p. 12)

"*65. Forest Officers must be most punctilious in the observance of all provisions of the Act.*" (p. 13)

W.A.G.R. Locos
"*66. It is the policy and practice of the Railways Commission to fit all W.A.G.R locomotives with spark arresters during the summer months. Forest officers have no authority to stop or inspect any W.A.G.R. locomotives suspected of being faulty.*" (p. 13)

"*67. The Railways Commissioners have promised full cooperation in fire prevention and details of the organisation set up will be found in Appendix 'D'.*

Forest officers must maintain close liaison with local W.A.G.R. officers in all matters of fire prevention." (p. 13)

"*69. These telephoned reports must be confirmed in writing as soon as practicable and a copy forwarded to the Fire Control Superintendent in Perth.*" (p. 13)

"*71. Every effort must be made to have the local Permanent Way Gang patrol behind a train with a defective engine to deal with any fires which may occur.*" (p. 13)

Hazard Reduction
Controlled Burning
Periodic burning
"*73. All areas which do not require complete protection will be burned systematically by light controlled fires.*" (p. 14)

Types of Controlled Burning
"*74. There are five types of controlled burning, for fuel reduction, that are standard practice.*
(a) Burning of buffer areas 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.
(b) Burning of buffer strips or firebreaks around areas of high value-that is to keep fires out of places such as saw mills, schools, townsites, isolated settlements, plantations, research areas, regeneration, etc. (The burning of the above two, types will be carried out as frequently as possible, but not less frequently than every third year.)
(c) Prescribed burning of large areas on a rotational system. The length of the rotation will depend on seasonal weather, manpower available and other local circumstances.
(d) Advanced burning: prior to, logging operations.
(e) Top disposal burning, for regeneration and hazard reduction, following logging operations.

Areas Afforded Complete Protection
"*75.Complete fire protection will be afforded to:*
(a) Plantations.
(b) Regeneration areas nominated in paragraphs 56, 60-62, 64, 75-80, Pamphlet No. 6 (revised) of the Manual.
(c) Where possible, areas listed for trade operations in ord,er that they will carry a fire immediately before trade cutting commences.
(d) Karri tops awaiting a seed year.
(e) Areas required for research and investigation." (p. 14)

Planning For Controlled Burning
Controlled Burning Master Plans
"*76. Officers in charge of Divisions must draw up controlled burning master plans. These plans will show:-*
(a) Areas which will be burnt on a three-year (or less) rotation - i.e., areas covered by burning types (a) and (b) above.
(b) Areas for prescribed burning on a rotational basis. There may be one, two or more lengths of rotation in this burning in one Division. The fundamental which must not be overlooked here, however, is that the yearly or cyclic burning plans must aim at areas linked into continuous strips of not less than 40 chains width rather than a patchwork of scattered areas.
(c) Advanced and top disposal burning will be incorporated in this plan.
The master plans must be checked annually and adjusted if necessary, in the light of results of previous burning." (p. 15)

Current Year's Burning Programme

"*77.Immediately after the completion of the annual fire report and before the 15th August in each year, the D.F.0. shall draw up a current burning plan setting out his burning programme for the next Spring, Autumn and Winter. Subject to approval or amendment by the Fire Control Superintendent or his staff this plan shall form the basis of his controlled burning operations. (See paragraphs 111, 114 of Pamphlet No. 6 (revised) of the Manual.*

(*The master plan, mentioned in paragraph 76, and the plans showing the results of previous controlled burning will be used as guides in framing this annual programme.)*" (p. 15)

"*78. The Forester -in-Charge is responsible for burning in his own district.*

A local officer must inspect each area to be burnt to assess the fuel condition and vulnerability and decide the weather conditions under which it should be burnt. A member of the field staff must issue instructions for each piece of burning." (p. 15)

"*80. Overseers or officers directly in charge of the burning operations must mark on plan the area considered to have been burnt. This will not be finally washed in on the Divisional burning plan until it has been inspected and the area and quality of the burn verified.*

Areas not burned to schedule will be marked on the plan and arrangements made for these portions to be burned later." (p. 15)

Advance Burning

"(*See also paragraphs 16-18, Pamphlet No. 6 (revised) of the Manual.)*

89. The importance of burning country in advance of falling operations, as a means of modifying and controlling subsequent fires cannot be over-emphasised.

Exceptional cases will arise where burning is impossible, and in such cases the Forester-in-Charge should send prior information to the Divisional Office and the Fire Control Superintendent." (p. 16)

Time of Advanced Burning

"*90. Preferably an area to be cut over should be burned in the early Spring prior to the fallers commencing operations, but in any case should not be burnt months in advance*." (p. 16)

"*91. A fire twelve or eighteen months prior to the commencement of felling operations will leave the forest floor in such a state that it will not burn again immediately in front of the fallers, but will yet run a fire when the crowns and bark litter the ground. This adds to the difficulty of disposing of this litter without damage to the remaining crop*." (p. 16)

Top Disposal

"*92. Serious damage can be done to the remaining tree crop by uncontrolled fires following in the wake of 'felling' operations. Not only are saplings, poles and piles destroyed in this way, but where the butts of mature trees are surrounded by a litter of tops the resulting scorching reduces the value of the standing crop by the production of dry sides, hollow butts or death and by allowing the ingress of termites and wood destroying fungi.*

Judicious expenditure on top disposal operations generally will be repaid many times over in the saving of valuable timber." (p. 16)

"*93. Unless otherwise directed by the D.F.O., workmen will follow the fallers and clear away limbs and other debris for a distance of about three feet from around valuable trees and saplings. Elsewhere tops will be lopped flat.*" (p. 16)

"*94. Top burning is carried out during mild weather or at night to reduce damage to the remaining trees.* […]" (p. 16)

"*The length of time between trade cutting and top disposal will be determined by the silvicultural requirements of the stand*." (p. 16)

Methods Of Burning
Stripping
"*95. All recognised methods of burning large areas involve 'stripping.' (This refers to the lighting of roughly parallel lines of fire over varying distances and at set spacings between the lines.)*

96. The lines will be lines of spot fires or lines of continuous fire, depending on conditions and the method of burning used.

97. Stripping may be done in "close formation" where three or more men run parallel lines of fire or spots and each maintains full time visual contact with his neighbours. Density of scrub and topography will govern the distance at which one man is visible from the next. This distance will seldom be more than five chains and often will be less.

98. Alternatively, "open formation" may be adopted. Here the strip lines will be on a wide spacing of between approximately 8 to 15 chains. Visual contact, between such widely spaced lines, cannot be maintained and so, to avoid men working entirely alone, each of these trips will be run by a pair of lighters working in contact." (p. 17)

Maintaining Direction.
"*99. With all types of stripping it is essential that lighters maintain directions and position in the formation.*

100. In close formation direction will be maintained by placing the most capable and experienced man or a 'marker' on one end of the formation. This man keeps correct direction by compass, direction finder or natural skill as a bushman. The others maintain formation by keeping contact with him.

In open formation stripping all pairs must be equipped with direction finders or compasses." (p. 17)

Burning Methods.
"*101. There are two fundamental methods of stripping out large areas such as have to, be burnt in fulfilling the prescribed burning programme. They are described below.*

102. ***Burning with Strips Across the Wind****-In this method the direction of the strip lines (continuous or spots) will be approximately at right angles to the wind direction. 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 some (allowed for) distance with the wind until it runs into the burn of the previous strip line.*

Strips roughly at right angles to wind direction – each successive strip run to windward to previous one." (p. 17)

"*Areas burnt by spots shown hatched. New spots running into Previously burned area.*" (p. 18)

"*103.* ***Burning with Strips Straight into the Wind****-In this method the direction of the strip lines (continuous lines of fire) must be STRAIGHT into the wind. The lighters must move strictly in 'line abreast' formation. This method allows that all fires burn only as side fires. Nowhere in this method should head fires run with the wind. The lighters must return to the same base line to start each new strip unless there is a change in wind direction*." (p. 18)

"*Areas burnt by strips shown hatched*." (p. 18)

"*Strips directly into the wind-must not waver off this direction-Lighters must return to same base line for each new strip*." (p. 18)

"*104. Other Methods-Other approved methods are variations or combination of the two outlined above*." (p. 18)

General Provisions
"*105. An area prescribed for burning in one day must be completely enclosed by lines within which the burn can be contained. Such lines will usually be roads, firelines or water reservoirs*." (p. 18)

"*106. The area so enclosed must be completely burnt out before the following day*. […]" (p. 18)

"*107. In 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 is to be avoided." (p. 18)

Early Edging Burns
"*108. To strengthen roads and firelines acting as boundaries of a burn and so avoid time-consuming mop-up and patrol, early edging is allowed. This lighting of edges must be carried out in winter or very early spring when subsequent weather will not allow the edge burn to flare up and continue to run. The area within the edging burns must be burnt out later in the same season*. […]" (p. 18)

Crown Scorch
"*109. 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 so to the rate of fire spread." (p. 19)

"*110. The officer in charge must select the day on which weather and fuel conditions will give a rate of spread and so a flame height, which will keep scorch within the desired limits and yet will satisfactorily consume the ground fuel over the whole area.*

He must be able to do this either by experience or by reference to tables based on measured fire behaviour.

111. The officer, or overseer directly 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 still all be burnt out in the burning time available on the day.

112. He must space the strips and the spotting distance along those strips so that they will join, but only just join, by the time conditions alone will quell the fire.

113. He must continually observe the rate of spread and flame height, during the burn, to see that the fire behaviour is according to the prescription. He must alter strip spacing and spotting distance to suit changes of conditions. Wind direction and speed, the most difficult weather factors to forecast, must be checked with lookout towers.

114. Paragraph 78 sets out the necessity for officers to issue instructions or prescriptions for each burn.

115. The overseer (or officer) directly in charge of the 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.*
(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.*

116. Officers must ensure that all members of the Department under their control have read and understood Bulletin 71, 'Safety in Controlled Burning'.

117. No controlled burning shall be carried out in March without the authority of a D.F.O. or above.

118. No fires shall be lit on days of high summer hazard without the authority of a D.F.O. or above.

119. Sufficient towers to give adequate coverage must be manned while controlled burning is being carried out, except that during the months May to September inclusive the manning of towers may be dispensed with at the discretion of the officer in charge of the Division.

120. A heavy duty outfit must be taken to every controlled burn except where otherwise directed by the officer in charge of the Division.

121. Patrol must be regarded as a very important duty." (p. 19)

"*122. Officers in charge of Divisions must see that the day to day work of controlled burning is properly reported and recorded.*

123. There is no objection to our assisting adjoining landholders in burning breaks either on their property or on adjoining State Forest or Crown Land. In many cases this assistance is most desirable and it may be necessary for the Forester -in -Charge to roster settlers burning to ensure that there is not an excessive number of fires burning simultaneously.

124. The settler's responsibilities must be clearly understood and impressed upon him. When the burning is being done on private property the owner must be in attendance and should do the actual lighting, or should at least commence it. He must understand also that future patrol is entirely his responsibility.

125. 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 is to be remembered that a Forest Officer has no legal protection when burning on other than Forest Land.

126. When a break is being burned in State Forest or Crown Lands adjoining private property at the request of the owner of the property he must be notified of the time of the burn, irrespective of the time of year, and burning will not be done unless he agrees to attend the burn and assist with the fire, at least to, the extent of patrolling his property, and accepting responsibility for future patrol on his land." (p. 20)

"*129. 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*." (p. 20)

Fire Pre- Suppression
Manpower
Training
"*132. The Forester-in-Charge shall see that his gangs get regular training in handling equipment, fire suppression methods and organisation of fire fighting gangs*." (p. 21)

"*134. The Forester-in-Charge, assisted by the Fire Control forester, must see that his gangs get ample opportunity for training*. […]" (p. 21)

Auxiliary Manpower
"*135. The Department has not sufficient men at this juncture completely to protect the forest.*

However, there is a large manpower pool living in and around the forest, some of whom are forest workers and every effort must be made to have these men trained and available to assist in fire control measures as untrained men are an embarrassment at a fire." (p. 21)

"[…] *All sources of auxiliary manpower and equipment must be listed in the Working Plans*." (p. 21)

Equipment
"*138. The Forester-in-Charge will list and order the equipment he considers necessary for his district and will be responsible for seeing that it is obtained and kept up to strength.*

This equipment will comprise sufficient to equip his gangs with the necessary replacements and additional equipment for the auxiliary gangs he is likely to pick up under normal conditions.

Reserves of fire equipment will be held at centres determined by the Divisional Forest Officer." (p. 22)

Pre-season check
"***142.*** *Before the commencement of the spring burning seasonequipment must be checked over again to make sure it is all there and in good order, particular attention being given to pack sprays to ensure that the leather pump buckets, and rubber hose have not perished and that the tank is not leaking.Any replacement required should be requisitioned for early*." (p. 22)

Detection
"*143. Early detection and accurate location of fires is of paramount importance in fire control.*

[…]*Towers shall be manned continuously from the first day of average summer after the 1st October until the end of the fire season*." (p. 22)

"*148. The towerman is The Watchman of the forest and as such must be willing to render continuous service fromdawn till after dark if required in an emergency*." (p. 23)

Aircraft for Fire Spotting
"*150. Light aircraft are available on hire for fire spotting and location*." (p. 23)

"*Aircraft spotting can be of considerable value in the early morning following lightning storms, and on days when smoke haze cuts down visibility from lookout towers*." (p. 23)

Communication
"*151. Effective means of communication are vital, not merely in fire control, but in the successful administration of the Department*." (p. 23)

"*158. It is the forester's duty to see that his lines of communication are functioning efficiently.*
Every failure of a telephone line circuit must be investigated as soon as possible and the fault rectified.

Before the spring burning season commences the forester must arrange a thorough maintenance of all his telephone lines." (p. 23)

Fire Weather

"*159. Weather forecasts are broadcast over the Departmental radio network daily, at 0745 hours and 1615 hours, during the fire season.*

These forecasts give brief information on expected cloud, wind direction and strength, maximum temperature, minimum relative humidity and fire hazard.

Where necessary separate forecasts for the Jarrah Forest Region and the Karri Forest Region are given." (p. 24)

Fire hazard scales

"*160. Fire hazard is defined in paragraph 26 and in the Department it is expressed on two scales -an empirical scale from 0-10 and a general scale using descriptive names.*

The measurement of the moisture content of wood cylinders is used as an aid to forecasting Fire Hazard. The relationship between the two hazard scales and the wood cylinders moisture content is set out below:-" (p. 24)

"*161. The 0745 hours forecast must be obtained by all Divisions each morning and passed on to Districts under their charge. (Should Divisions not be able to receive the forecastby radio they must obtain it by P.M.G. or Departmental telephone.)*

162. Officers in charge of Divisions and Districts must use these forecasts in deciding the daily disposition of fire gangs.

Part 'B' of the Fire Control Working Plan sets out dispositions of gangs and equipment against the recognised hazard scale for normal working days and weekend and holiday 'stand-by' periods.

163. It has already been pointed out that a sound knowledge of the weather and the state of the fuel is essential in any prescribed burning operations. Officers must be able to interpret the effect of weather on the rate and intensity of burning if they are to make full use of all time suitable for controlled burning operations.

For similar reasons, where uncontrolled fires are being fought, a special forecast can be obtained from Dwellingup." (p. 24)

Water Supplies

"*164. It is important that adequate static water points are available for fire control.*" (p. 24)

"*170. As soon as possible after the beginning of the spring burning season all wells and water holes should be put into good condition for the fire season.*

The information required for this work will be obtained automatically where spring burning is being carried out, but a special patrol must be sent out to inspect all water points particularly in country that has not been burned within the previous three years." (p. 25)

Fire Suppression

"*171. For the three types of forest fires-*
(a) ground fires,
(b) surface fires,
(c) crown fires,
see paragraphs 21, 22 and 23." (p. 25)

Fire Behaviour

"*172. The intensity of a fire depends on weather conditions and fuel density, though rate of spread will be influenced also by topography and wind strength.*

In a dead calm, on a level surface, with an even fuel layer, a fire spreads slowly in an ever widening circle at an even rate in all directions.

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

(a) the head fire,
(b) the flank or side fire,
(c) the tail fire.

Head Fires
173. The head fire is the most forward Portion of the fire, usually narrow, travelling fastest and very hot. It is causing the greatest damage and if possible must be controlled first.

Flank Fires
174. The flank fires, on either side of the head fire are spreading 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 or topography and this dangerous flank must be controlled simultaneously with the head fire or very soon after it." (p. 25)

Tail Fires
"*175. The tail fire is burning slowly and quietly against the wind, is doing least damage and should be controlled last, but must on no account be entirely neglected*.' (p. 26)

Fire Attack
"*176. 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.*

"*177. 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*." (p. 26)

"*178. 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 with which he is sent to deal.*

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, tend to fall back on fire lines or tracks and wait for better conditions, by which time the fire has increased in size and needs many more men and equipment to bring it under control." (p. 26)

Fire Action
"*179. 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 hazard of the day." (p. 26)

Sequence of First Attack

"*180. The following sequence of action by Despatcher and gangs will apply. Some slight modifications may be needed to cover peculiar local situations.*" (p. 26)

Despatcher Action

"*181. After locating the position of a fire requiring attention the Despatcher will-*

(1) Advise the nearest available fire gang (gang A) by the most rapid means of communication.
(2) Record in the log book, the time of their departure.
(3) Arrange for a listening watch.
(4) Despatch one wagon pumper.
(5) If in leaf litter over five years old, or on a day of severe summer or higher - load bulldozer and scraper.
(6) Alert gang B or C if gang B already despatched.

All subsequent gangs arriving at the fire will operate under overseer of gang A until relieved by senior officer.

(7) Advise Officer -in-Charge concerned as soon as possible." (p. 26)

Overseer Action

182. The gang overseer will-

(1) Advise Despatcher of time of departure.
(2) Proceed directly by the quickest route to the nearest location to the head of the fire.
(3) On arrival make a quick reconnaissance of the fire while the gang will-
(a) Set up radio and report arrival.
(b) Unload equipment and arrange for its protection. (Paragraphs 190-196.)
(c) Proceed to forward section of the fire and commence suppression under control of No. 1 pack-spray man." (p. 26)

"*(4) After reconnaissance arrange report to Despatcher –*

(a) Position of fire.
(b)Possible cause.
(c)Details of size.
(d) Type of fuel.
(e) Estimated time to control.
(f) Whether further assistance required" (p. 27)

"(*5)Assume control of gang and proceed with suppression by the application of such routine as the situation demands.*
(6) Report to Despatcher at half-hourly intervals if possible, but without fail if fire is proving difficult to control.
(7) Report fire under control and estimated time of mopping up.
(8) Report when fire safe and gang leaving.
(9) Advise Despatcher what further patrol action necessary." (p. 27)

District Action

"*183. The Officer-in-Charge will-*

(1) Inspect fire during or as soon as possible after suppression.
(2) Cheek efficiency of gang's work.
(3) Enquire into cause. (See Appendix 'C.')
(4) Complete Fire Report (Form F.D.304, see Appendix 'F') in duplicate and forward original to Despatcher or Divisional officer." (p. 27)

Fundamental Methods

"*184. Basically there are only two methods of fire suppression, direct attack and counter or back firing.*" (p. 27)

Direct Attack
"*185. 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 to the burnt ground, or by raking a narrow strip clear of fuel a few feet ahead of
the fire and letting the main fire burn up to the raked strip." (p. 27)

"*If the area of unburned fuel is more than a few feet 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.*" (p. 27)

Counter-firing
"*186. In counter-firing 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.*" (p. 27)

"*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 up-draft 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." (p. 27)

"*The greatest care must be taken in setting back-fires. As little face as possible should be lit at a time. Never backfire from anything but a good break line which is long enough to ensure that the 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." (p. 28)

General Rules
"*(1)Assess back-firing possibilities carefully before spending much time clearing the break.*

(2)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.

(3)Never light a longer line than can be held, special care is necessary if choppy winds are likely.

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

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

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

(7)Patrol continuously.

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

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

(10) Select the base line with great care." (p. 28)

Mopping Up And Patrol
"*187. Mopping up is the term used for the work done in rendering a fire safe after it has been brought under control.*

When a running fire is brought under control it is only stopped and not by any means safe. It is obviously futile to spend considerable energy on stopping a bush fire only to have it escape and need as much or more work to bring it under control a second time.

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

A strip at least 2 ft. wide must be cleared around every fire, strictly following its edge.

All low stumps or logs within a chain of the edge 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 round the butts of trees close to the edge must be cleared away." (p. 28)

"*If water is used to extinguish burning logs or trees care must be taken to ensure that they are really out.*

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 in to the face so that water can be applied to burning trees and stumps.

If mopping up is done during the heat of the day the pumpers should go round fairly rapidly damping down the more dangerous areas and then return to consolidate the position." (p. 28)

"*189. Patrolling of all stopped fires is essential and should follow the instructions laid down under controlled burning.*" (p. 28)

Staff And Headquarters Organisation : Larger Fires
"*197. Should this initial attack (as outlines in paragraphs 181-183) fail to control the fire, more gangs and equipment will be called in at the discretion of the Officer-in-Charge.)*" (p. 29)

Fuel Age Plan
"*214. A fuel age plan showing at least the previous four years' burning. This must be prominently displayed.*" (p. 31)

Fire Diary
"*218. A fire diary to be kept up to date by the Recorder. This fire diary will consist of a large book or pad from which the pages can be torn for filing.*

Pages will be headed with the fire serial number, date and all relevant information, such as location, cause and weather conditions. […]" (p. 31)

"*Later, the diary provides a basis on which to conduct a fire study from which much vital information may be obtained.*" (p. 31)

Fire Reports
"*220. At the first opportunity the Officer-in-Charge of a gang shall fill in the preliminary fire report on Form F.D.304 and hand it in to the district office.*" (p. 32)

"*221. All fires in protected forest that are likely to attain an area of 100 acres and all fires in plantations must be reported immediately by telephone or radio to the Fire Control Office who will advise Head Office.*" (p. 32)

Annual Fire Report
"*225. 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 Fire Control Superintendent.*" (p. 32)

NOTE: REFER TO DOCUMENT FOR COPIES OF-
APPENDIX 'A', FIRE CONTROL WORKING PLAN;
APPENDIX 'B', LARGE STAFF ORGANISATION;
APPENDIX 'C', POINTS IN INVESTIGATING OUTBREAK OF FIRE;
APPENDIX 'D', W.A.G.R. ORGANISATION;
APPENDIX 'E', TOWERS AND TOWERMAN;
APPENDIX 'F', REPORTS AND FORMS

FORESTERS' MANUAL – 1960

Foresters' Manual : Field Administration. 1960

Recommendations
"*85. F.D. 89 calls for recommendations from the inspecting officer under four headings-*
(1) for immediate alienation;
(2) alienation subject to marketable timber being reserved for the Crown;
(3) reserved until marketable timber removed;
(4) for permanent dedication as State forest.

An officer making a recommendation under these headings must remember that present-day timber values are not the only guide and that considerable thought needs to be given to the area under consideration, as decisions made today may have far-reaching affects in the future.

Some of the many factors which need consideration are-
(1) the necessity for preserving lines of access for hauling and fire control;
(2) the question of fire lines and the State Forest boundaries; […]
(4) the affect of alienation upon fire hazards in the locality; […]

The remarks column of the report provides space in which to set out reasons for the recommendation made." (p. 24)

WORKING PLAN – 1960

General Working Plan 1960 For The Regulation Of The Cut In The Jarrah, Karri and Wandoo …1960

Part I (b) – History of Previous Working Plans
"*In the earlier Working Plans of 1928 and 1945 there was less knowledge of the forest statistics on which to base a Working Plan, and this planning in a different economic era, undoubtedly led to an over conservative policy which resulted in some 2 million acres of virgin forest being left to the ravages of fire, with the mistaken idea that it could remain as a static reserve for the future without forest management.*

The appalling losses in this zone were, by the application of modern assessment based upon the study of air photographs, brought to light only after 1953. The need for development, protection and utilisation of this forest was so pressing, that considerations of the theoretical productive capacity of the whole State Forest had to be relegated to the background.

The salvage cutting of at least 100, 000 per annum in this zone was deemed advisable in the 1956 plan but was not accomplished due to various economic factors. Action was taken, however, during the years 1956-1960 to open up the country by extensive roads and to institute some measure of fire control." (p. 9)

Part 2 (d) : Miscellaneous Prescriptions
Part 2 (d) (I) : Sylviculture and Protection
"*Fire protection is the responsibility of Divisional and District Officers assisted by the Fire Control Superintendent and his Staff. The permissible cut for future cutting cycles is intimately connected with the success or failure of fire protection and its extension into new areas. It is based upon controlled burning in Autumn, Winter and Spring months, and early suppression of fires in Summer. Its extension into areas at present unprotected is proceeding rapidly.*" (p. 25)

GENERAL WORKING PLAN –1956

General Working Plan 1956, Jarrah, Karri & Wandoo (Original) and Planning Section Data : Working Plan no. 79 (1956-1960)

Part 1 : Summary of Facts and Discussions
Part 1(b) : History of Previous Working Plans
"*In the earlier Working Plans of 1928 and 1945 there was less knowledge of the forest statistics on which to base a Working Plan, and this planning in a different economic area, undoubtedly led to an over conservative policy which resulted in some 2 million acres of virgin forest being left to the ravages of fire, with the mistaken idea that it could remain as a static reserve for the future without even a Forest Ranger living within the forest.*

The appalling losses in this zone have only been brought to light over the past 2 years by the application of modern assessment, based upon the study of air photographs, and the need for development, protection and utilisation of this forest is so strong that mere considerations of the theoretical productive capacity of the whole State Forest must be relegated to the background." (p. 9)

Part II : Prescriptions for Future Management
Part 2 (a) : Objects of Management and Period of the Plan
"*The main object of the Working Plan remains as it always has been, to stabilise the Timber Industry; to ensure continuity of operations, regular employment for the men engaged, and long life for the timber trade and the communities and industries dependent upon it; and at the same time, to bring the cutting of the forests to a sustained yield basis.*" (p. 19)

"*While the main object of management of the State Forests is to ensure that such areas are brought on to the basis of sustained yield, this desideratum cannot be accurately obtained until more precise data is available on the forest inventory and the rate of growth of species, and until the whole of the potential State Forest area is dedicated, under fire protection and in thrifty protection and in thrifty condition sylviculturally.*" (p. 19)

"*The determination of a permissible cut has also to be considered in the light of severe losses from fire in virgin forests over the past 3 decades, which losses are still occurring and which have become more apparent as these areas become more fully known. Such areas can be held as reserves for the future, only in theory, unless they are placed under protection, and the introduction of sawmilling becomes necessary as a means to the end of having them 'roaded' and protected.*" (p. 19)

Part 2 (b) : Determination and Regulation of the Cut and Issue of Cutting Rights
"[…] *The necessity to cut and protect large virgin areas which are losing volume by uncontrolled fire has to be taken into account, together with the fact that over the past three decades the gross permissible cut on permits issued has never been realised due to losses of mills by fire, to labour shortages and to periods of trade recession.*" (p. 20)

Part 2 (d) : Miscellaneous Prescriptions
Part 2 (d) (i) : Sylviculture and Protection
"*Fire protection is the responsibility of Divisional and District Officers assisted by the Fire Control Superintendent and his Staff. The permissible cut for future cutting cycles is intimately connected with the success or failure of fire protection and its extension into new areas. It is based upon controlled burning in Autumn, Winter and Spring months, and early suppression of fires in Summer, and its extension into areas at present unprotected is proceeding rapidly.*" (p. 25)

FORESTERS' MANUAL – 1956

The Foresters' Manual. Part III Fire Control (South-West – 1956). 1956

The Importance Of Fire Control
"*745. The problem of fire control is intimately bound up 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.*

746. Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations.

747. The eucalypt forests of Western Australia lend themselves to hazard reduction by the intelligent use of fire in the Spring, Autumn and Winter by Prescribed Burning." (p. 5)

Policy
"*748. At the passing of the Forests Act, 1918, the Northern half of the State Forests had been ravaged by unrestricted cutting and uncontrolled fires.*

749. Since 1919 the Northern half of the forest has been roaded and until recently given complete protection at a very high cost.

During this period, the extension of group settlement and other farming ventures resulted in heavy damage due to indiscriminate firing of much of the Southern forest area where the forestry organisation was not yet established.

750. 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 'stay' a fire under the severe weather conditions that occur periodically in Western Australia. Other States have learned this lesson with equal force.

751. The result of nearly four decades of fire control experience and research is a policy introduced in 1954 which may be briefly summarised as follows:-

(a) Put all available funds into the roading of valuable forest areas to check annual losses by uncontrolled fires.
(b) Use prescribed burning and intelligent planning to the fullest extent possible to reduce the danger of severe uncontrolled fires.
(c) Use our well developed fire-fighting organisation to quell outbreaks in the dangerous summer months, but fight fires with discretion and with an eye to the cost of the operation.
(d) Train officers and men to think in terms of costs and collateral values on every operation involving fire protection.
(e) Train and trust the junior officer to use fire as a controlled weapon to accomplish sylvicultural ends and to guard against calamities." (p. 5)

Demarcation of Zones
"*752. In the implementation of this policy it has been found necessary to divide the forest into three zones indicating the degree of fire protection aimed at and for the annual Fire Report.*

753. ***'A' Zone****. – This will comprise all country on which fires will be attacked immediately they become known.*

This will include regenerated or planted forest as well as the greater part of the prime forest over which fire control measures are gradually being extended.

Within this zone there will be a proportion of sub-marginal forest and even unforested country as well as private property." (p. 5)

"*754.* ***'B' Zone****. – Will include forest on which it is possible to afford limited protection only by broadcast burning in suitable weather.*

Fires in this zone will be suppressed only when threatening 'A' Zone, or when creating heavy smoke haze which may interfere with fire control measures on adjoining forest areas.

This zone will also include certain areas of private property adjacent to State Forest boundaries." (p. 6)

The Fire Organisation
"*757. The Forests Department's organisation covers a large area loosely controlled and must train, organise and prepare in periods of little danger for periods of extreme effort. This involves emergency measures and the use of untrained men and incomplete equipment. In all such organisations, stress is placed upon the clear definition of duties and responsibilities. Those definitions and responsibilities are laid down in this section of the Manual, and all officers must clearly understand that such duties are the responsibility of the position rather than the actual rank of the officer.*" (p. 6)

Branches of Fire Control
"*759. The work of fire control falls into three main branches:-*
(1) Fire Prevention
(2) Fire Pre-suppression
(3) Fire Suppression." (p. 6)

Fire Prevention
"*776. Fire prevention, a most important branch of fire control, can be divided into the following sections and sub-headings which are dealt with in turn:-*
(1) Risk Reduction
  (a) Education
  (b) Law Enforcement.
(2) *Hazard Reduction.*" (p. 8)

Law Enforcement
"*788. Besides the provision of the Bush Fires Act, the attention of all forest officers is drawn to the following fire provisions of the Forests Act.*
Section 46. – Penalty for unlawful lighting of fires (minimum 1/20 th of maximum).
Section 47. – Forest officers calling for assistance to extinguish fires.
Section 48. – Setting fires to bush without notice to forest officers." (p. 9)

Fire Protected Areas
789. The Bush Fires Act makes provision for the declaration of Fire Protected Areas in which the lighting of fires (during the 'restricted burning times') is prohibited except by written permit to burn issued by the Minister for Lands or an officer acting with his authority." (p. 9)

"*790. Forest officers have the sole authority to issue permits to burn in these areas.*" (p. 9)

Permits to Burn
"*791. The correct procedure for the issue of permits to burn in fire protected areas is fully set out in the Regulations under the Bush Fires Act and must be followed.*" (p. 9)

No Permits During Prohibited Period
"*793. No permit to burn shall be issue during the prohibited period except during a period when the Department has obtained a suspension of the prohibited period, and then only if the forest officer is satisfied that conditions are safe.*

Prohibited Period
"*794. The Bush Fires Act provides that there shall be a prohibited 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.*

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

796. […]
Suspensions applied for at this time if endorsed as above will be granted up to 31st December for all districts except Nannup and Pemberton where suspension up to 6th January may be applied for, although it must be appreciated that this is a serious matter.

Any further suspension required must be the subject of a special application about the end of December; they will not be considered before this date.

No suspension beyond 15th January will be considered.

797. In every case of fire the local officer must take immediate steps to ascertain the cause with a view to possible law enforcement. The procedure to be followed is set out in paragraph 968." (p. 10)

Bush Locomotives
"*813.Under Regulation 135 all bush locomotives must be provided with efficient spark arresters and ash pans from 1st December to 30th April each year or any other period the Conservator may indicate in writing to the sawmill management.*" (p. 11)

"*816. Regulation 136 authorises the holding up of locomotives for inspection at any point and confers on forest officers the power to stop them from running if the fire prevention apparatus is considered unsatisfactory.* […]" (p. 12)

"*817. After inspecting a mill locomotive the mill manager must be advised immediately of any defect in the apparatus and this advice must be confirmed in writing to the district office.*

818. If any locomotive is found to be consistently causing trouble, the mill management must be made responsible for detecting the defect in the apparatus and remedying such defect before putting the locomotive into commission again." (p. 12)

"*821. Regulations under the Forests Act provide that a forest officer may stop the running of bush locomotives when 'dangerous fire weather' (see Para. 763) is forecast or develops during the months of January, February and March. This practice must be adopted regularly throughout the summer. When this action is taken the Conservator must be advised of the fact together with details of weather conditions prevailing at the time.*" (p. 12)

W.A.G.R. Locos
"*830. Every effort must be made to have the local Permanent Way Gang patrol behind a train with a defective engine to deal with any fires which may occur.*" (p. 13)

Controlled Burning
Types
"*832. There are six types of controlled burning for fuel reduction that are standard practice.*

833. (1) Cleaning up firebreaks around areas of high risk, that is areas where fires frequently start or occur more or less regularly, e.g. external boundaries, railway lines, main roads and certain areas of private property.
(2) Burning out buffer areas or dangerous flanks and pockets of dangerous hazard. The burning of these two types is carried out as frequently as possible, but not less frequently than every third year.
[…]
(4) Prescribed burning according to the prescribed burning plan. […]
(5) Advanced burning. […]
(6) Top disposal. […]" (p. 13)

Frequency
"*834. Usually it is impossible to get a clean burn in the forest more frequently than once in three years and burning plans are drawn up accordingly.*" (p. 13)

"*836. The local officer must inspect each area to be burnt to assess its inflammability and decide the weather conditions under which it should be burnt. A member of the Field Staff must issue instructions for each piece of burning. This should not be left to an overseer or leading hand. A district officer … must inspect all burns after they are completed.*" (p. 13)

Periodic Burning
"*838. All areas which do not require complete protection will be burned systematically by light controlled fires.'* (p. 14)

Areas Afforded Complete Protection
"*839. Complete fire protection will be afforded to:-*
(a) Plantations.
(b) Regeneration areas nominated in Section 640A of the Manual.
(c) Where possible areas listed for trade operations in order that they will carry a fire immediately before trade cutting commences so that subsequent top disposal fires will not run.
(d) Karri tops awaiting a seed year.
(e) Areas required for research and investigation." (p. 14)

Unburnt Patches
"*840. Each year the Forester carrying out spring controlled burning will mark on a plan those areas, such as wet gullies that were not burned to schedule and arrange for their burning at a date later in spring.*" (p. 14)

"841. It is of paramount importance to make certain that those areas are burned before the main danger period as they constitute a weak link in the protection system and can lead to the escape of a fire that otherwise was confined." (p. 14)

Firelines
"*842. The practice of constructing non trafficable firelines through the forest has been discontinued, and replaced by the forming of tracks which permit access by firefighting vehicles as well as serving as firelines.*" (p. 14)

Buffer strips, etc.
"*843. The worst fires with which the forester has to contend are those that originate outside the forest and sweep in on a wide face.*

All external boundaries and boundaries of private property within the forest must receive special attention." (p. 14)

Northern and Western boundaries
"*845. The Northern and Western boundaries are usually the more dangerous and where those boundaries adjoin large areas of vacant Crown Lands special attention must be given to the controlled burning of wide buffer strips.*" (p. 14)

Advance Burning
"*853. The importance of burning country in advance of falling operations, as a means of modifying and controlling subsequent fires cannot be over-emphasised.*

Exceptional cases will arise where burning is impossible, and in such cases the Forester-in-Charge should send prior information to the Divisional Office and the Fire Control Superintendent." (p. 15)

"*855. A fire twelve or eighteen months prior to the commencement of felling operations will leave the forest floor in such a state that it will not burn again immediately in front of the fallers, but will yet run a fire when the crowns and bark litter the ground. This adds to the difficulty of disposing of this litter without damage to the remaining crop.*" (p. 15)

Top Disposal
"*856. Serious damage can be done to the remaining tree crop by uncontrolled fires following in the wake of 'falling' operations. Not only are saplings, poles and piles destroyed in this way, but where the butts of mature trees are surrounded by a litter of tops the resulting scorching reduces the value of the standing crop by the production of dry sides, hollow butts, or death and by allowing the ingress of termites and wood destroying fungi.*" (p. 15)

Clearing Debris
"*857. Unless otherwise directed by the D.F.O., workmen will follow the fallers and clear away limbs and other debris for a distance of about three feet from around valuable trees and saplings. Elsewhere tops will be lopped flat.*

The amount of work to be done around any tree will depend on its value. […]" (p. 16)

Top Burning
"*858. Top burning is carried out during mild weather or at night to reduce damage to the remaining trees.* […]

The length of time between trade cutting and top disposal will be determined by the silvicultural requirements of the stand." (p. 16)

Controlled Burning – General Provisions
"*859. Controlled burning will be carried out in spring, autumn and winter.*" (p.16)

"*860. No controlled burning shall be carried out in March without the authority of the Fire Control Superintendent or a Regional Superintendent.*" (p. 16)

"*861. No fires should be lit on days of high summer hazard or higher except in the Karri where burning is permitted in high summer weather, though it must be appreciated that this is a serious risk.*" (p. 16)

"*863. A heavy duty outfit must be taken to every controlled burn except where otherwise directed by the Divisional Forest Officer.*" (p. 16)

"*864. The butts of all trees within a chain of the edge of the area to be burned must be raked around when burning in proximity to a fuel bed over three years old.*" (p. 16)

Patrols
"*865. All fires must be carefully patrolled, special attention being given to fires in dead trunks and tops of standing trees.*

Patrol of a fire or Controlled Burn after a cool change or rain is absolutely necessary. […]" (p. 16)

"*Patrolling must be regarded as a very important duty involving the following:-*
(a) Patrol on the morning of the day following a fire.
(b) Patrol of areas of high risk some days after the burn if the hazard rises to High Summer, or worse, including a few days after rain.

The use of Heavy Duty pumpers to hose burning debris will reduce the amount of patrolling required." (p. 17)

Fortnightly Burning Reports
"*867. It is essential that close attention be paid to the condition of the forest, both before and after the burn, and to weather conditions prevailing at the time to provide more information to assist in perfecting prescribed burning technique.*

To this end the fortnightly controlled burning report (F.D. 421) will be filled in daily and forwarded at the end of the fortnight to the Divisional office where it will be available to visiting officers." (p. 17)

Detection
"*889. Early detection and accurate location of fires is of paramount importance in fire control.*" (p. 20)

"*893. The forester must make sure that he has an efficient towerman …*" (p. 20)

Communication
"*896. Effective means of communication are vital, not merely in fire control, but in the successful administration of the Department.*

897. There are four 'legs' to the communication system for fire control:-

(1) Lookout to Headquarters.
(2) Headquarters to fire gangs
(3) Fire back to Headquarters.
(4) Point to point round the fire." (p. 21)

Forest Fire Weather
"*905. Close co-operation is maintained with the Meteorological Bureau to whom weather telegrams are despatched at 9 a.m. and 3 p.m. each day during the fire season from Dwellingup, Pemberton and Dryandra. The 3 p.m. telegram also includes the maximum Fire Hazard for that day.*

Using the current fire hazard as a basis and applying their knowledge of possible future weather conditions, the Bureau pass a forecast by telephone to Dwellingup at 4 p.m. each day. This is in the form of a brief weather forecast and the estimated Fire Hazard for the following day for both the Jarrah and Karri forest areas." (p. 22)

"*906. At 7.30 a.m. next morning weather reports are received by Dwellingup and these together with Dwellingup readings are used to check the forecast made on the previous afternoon. The latest forecast of weather and Fire Hazard is then transmitted from Dwellingup at 7.45 a.m. with a view to having this information available before the gangs leave headquarters for work.*" (p. 22)

"*907. This forecast is normally picked up by the Divisional fixed stations and it is the responsibility of the Divisional office to see that the information is passed on promptly to all Districts.*" (p. 22)

"*909. A sound knowledge of the weather and the state of the fuel is essential in any prescribed burning operations. Forest officers must be able to interpret the effect of weather on the rate and intensity of burning if they are to make full use of days suitable for controlled burning operations.*" (p. 23)

Water Supplies
"*910. With the increase in the use of mobile water tankers and power pumpers, the provision of adequate static water points becomes increasingly important.*" (p. 23)

"*915.* […] *The information required for this work will be obtained automatically where spring burning is being carried out, but a special patrol must be sent out to inspect all water points particularly in country that has not been burned within the previous three years.*" (p. 24)

Fire Suppression
"*917. For the three types of forest fires –*
(a) ground fires,
(b) surface fires,
(c) crown fires,
see paragraphs 764-766." (p. 24)

Fire Behaviour
"*918. The intensity of a fire depends on weather conditions and fuel density, though rate of spread will be influenced also by topography and wind strength.*

[…] *With a wind blowing, or up a slope, a fire rapidly assumes a long oval shape and has three distinct parts-*
(a) the head fire.
(b) the flank or side fire.
(c) the tail fire." (p. 24)

Head Fires

919. The head fire is the most forward portion of the fire, usually narrow, travelling faster and very hot. It is causing the greatest damage and if possible must be controlled first." (p. 24)

Flank Fires
"*920. The flank fires, on either side of the head fire are spreading 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 or topography and this dangerous flank must be controlled simultaneously with the head fire or very soon after it.*" (p. 24)

Tall Fires
"*921. The tail fire is burning slowly and quietly against the wind, is doing least damage and should be controlled last, but must on no account be entirely neglected.*" (p. 24)

Fire Attack
"*922. 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.*" (p. 24)

Speed of Attack
"*923. The two essentials for all fires are early attack and aggressiveness. The earlier the fire is attacked the sooner is brought under control. Once a fire is allowed to develop a long perimeter, the task of controlling it is increased tremendously.*" (p. 24)

Offensive
"*924. 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 with which he is sent to deal.* […]" (p. 25)

Fire Action
"*925. 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.*" (p. 25)

District Action
"*928. The District Officer will-*
(1) Inspect fire during or as soon as possible after suppression.
(2) Check efficiency of gang's work.
(3) Enquire into cause.[…]
(4) Complete Fire Report (form F.D. 304, see also paragraph 941) in duplicate and forward original to Despatcher or Divisional officer." (p. 25)

Direct Attack
"*929. Basically there are only two methods of fire suppression, direct attack and counter or back firing.*

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 to the burnt ground, or by raking a narrow strip clear or fuel a few feet ahead of the fire and letting the main fuel burn up to the raked strip." (p. 26)

Counter Firing
"*930. In counter-firing 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.*" (p. 26)

931: General Rules
"*1. Assess back firing possibilities carefully before spending much time clearing the break.*
3. Rake around dangerous trees well back from the edge. It is often advisable to burn the heaps of

Debris separately before the back fire reaches them.[…]
4. *Always burn clear to the line and well in towards the main fire.*
5. *If burning on a slope, start at the top and burn down,*
6. *If the main fire is coming up a slope, back fire from the lee of the ridge top, that is, just over the top from the direction of the main fire.*
7. *Patrol continuously.*
8. *Keep as close to the main fire as is commensurate with safety.*
9. *Back fire against the head fire and attack the flanks and tail directly.*
10. *Select the base line with great care.*" (p. 26)

Mopping Up
"*932.* […] *Mopping up means completely extinguishing every piece of burning material that might permit the fire to escape.*" (p. 27)

Fire Reports
Large Fires
"*942. All fires in protected forest that are likely to attain an area of 100 acres and all fires in plantations must be reported immediately by telephone or radio to the Fire Control Office who will advise Head Office.*" (p. 28)

Daily Fire Report
"*944. All centres will submit a daily report on the fire position for the previous day.*

These reports will be given over the air each morning to Collier (VL6DE) at 0815 hrs. except on Saturdays and Sundays. Details required are set out in Appendix 'F', paragraphs 1006-1009." (p. 28)

Annual Fire Report
"*945. 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 Fire Control Superintendent.*" (p. 28)

Staff Organisation
"*946. The role of the forester in fire control is organisation. Successful fire control cannot be based on a strenuous personal effort alone.*" (p. 28)

Forester on Call
"*947. The Forester is expected to be on call for fire duty continuously during the fire season.*" (p. 28)

The Forest Assistant
"*950. During the fire season, the Forest Assistant is vital to the fire organisation.*

He is frequently the first officer to be advised of the fire and must then assume the role of Despatcher. As such he must be fully conversant with paragraphs 926 and 927 so that the suppression force swings into action with the minimum delay." (p. 29)

"*952. He will receive direct, or arrange to have received the 0745 fire weather forecast and see that it is re-transmitted to all towers and outstations in the area. He will be responsible for keeping the office daily log posted regularly during the day.*" (p. 29)

Fire Diary
"*959. When a large fire, or a large number of fires necessitates many complicated gang movements and staff rotation, a clear picture of the situation must be available to a controlling officer.* […]" (p. 30)

Appendix 'A' : Points in Investigating Outbreak of Fire
"*963. Speed in reaching the source of the fire is important …*" (p. 31)

"*968. A full report must be submitted to the Fire Control Office immediately after the investigation is completed.* […]" (p. 31)

Appendix 'C' : W.A.G.R. Organisation
"*Locomotives are checked in and checked out by a Locomotive Foreman or Driver-in-Charge who has to certify to the condition of:-*

Smoke Box,
Brick Arch,
Ash Pan" (p. 34)

"*Fines are imposed on engine crews when a fire is started by a defective locomotive, provided it is proved that the locomotive when received was in correct order.*" (p. 34)

Appendix 'F' : Reports and Forms
"*1002. Form F.D. 434 will form the basis of the Annual Fire Report and should be kept as a running day to day record of fire occurrence.*" (p. 39)

Annual Fire Report
"*1003. A separate Annual Fire Report is required for the natural forest and for the plantation zone where a plantation has been established in a District that also fire protects the natural forest.*

1004. The Annual Fire Report for areas of natural forest will be in the following form and this schedule must not be departed from without Head Office approval." (p. 39)

NOTE: REFER TO DOCUMENT FOR COPY OF THE REPORT FORM AND INFORMATION REQUIRED WHICH INCLUDES -

8. Fire Plan

"*A paper litho to be forwarded with the fire report showing …*

1. *Zone Boundaries – Blue*
2. *Controlled Burning-*
   Spring – Yellow
   Autumn – Brown
   Clearing burn – Yellow with Red Hatch
3. *Uncontrolled fires – Red and numbered*
4. *Private Property during Prohibited period – Green crosshatched Red.*
5. *Private Property fires during open season – Green.*" (p. 45)

Daily Fire Report
"*1006. The Daily Fire Report as required in paragraph 944 will set out:-*
(1) Number of uncontrolled fires over 20 acres on the previous day.
(2) Total acreage of controlled burning carried out under the headings:-
   (a) Advanced burn
   (b) Prescribed burning
   (c) Top disposal.
(3) Details of any major fires still running." (p. 45)

LEGISLATION – 1954

Bush Fires Act 1954

Fires In or Near Forest Land or Crown Lands
"*45. (a) Where a bush fire is burning in or near forest land, or in or near Crown lands, if a forest officer is present, the powers and authorities conferred by this Act upon a bush fire control officer appointed under this Act, or upon a captain or other officer of a bush fire brigade, are exercisable by him*." (p. 65)

Bush Fires Regulations 1954

Part IV. – Burning During Restricted Times and Prohibited Times
Restricted Burning Times
"*15B (1) Subject to the Act a person who has obtained a permit to burn the bush under section 18 of the Act (in this regulation called 'the permit holder') shall comply with the conditions set out in this regulation in relation to the burning of the bush.*
(2) The permit holder shall give notice of his intention to burn the bush upon land, or upon a part of land, to-
[…]
(c) a forest officer if the bush is situated within three kilometres of forest land;
[…]" (p. 5)

Charcoal Burning
"*23 (1) Every person proposing to light a fire or fires for the conversion of any bush into charcoal at any time during the restricted burning times or prohibited burning times in every yearly period as provided for in paragraph (b) of subsection (1) of section 25 of this Act shall, at least seven days before lighting the fire, give notice in writing of the intention to the local authority in whose district the land on which the fire is to be lit is situate, and, in the event of the land on which the fire is to be lit being within three kilometres of a State forest, to the local forest officer.*

(2) The notice shall specify the land on which the burning is to take place and the period during which the fire is to be kept burning.

(3) The local authority, through its bush fire control officer or the local forestry officer as the case may be, may, within the period specified in subregulation (1) of this regulation, direct that such further measures or precautions be taken, as in the opinion of the bush fire control officer or forestry officer, are considered necessary to prevent the fire from spreading or escaping, and when the bush fire control officer or forest officer has given the directions, the fire shall not be lit until the directions have been complied with." (p. 8)

FORESTERS' MANUAL - 1953

The Foresters' Manual. Part II, Reforestation and Sylvicultural Operations (Jarrah and Karri). 1953

Advance Burn

"*624. Controlled burning, which must be carried out before trade cutting commences is dealt with under Fire Control. The object of this operation is to reduce the severity of fire hazard both during felling operations and during the subsequent top disposal*." (p. 1?]

FORESTERS' MANUAL - 1950

The Foresters' Manual. Part I. General District Work (South-West). Sections 5. 6. 7. Administration and Land Inspection. 1950

Recommendations
"*468. F.D. 89 calls for recommendations from the inspecting officer under four headings-*
(1) for immediate alienation;
(2) alienation subject to marketable timber being reserved to the Crown;
(3) reserved until marketable timber removed;
(4) for permanent dedication as State forest.

An officer making a recommendation under these headings must remember that present day timber values are not the only guide and that considerable thought needs to be given to the area under consideration, as decisions made today may have far-reaching affects in the future.

Some of the many factors which need consideration are-
(1) the necessity for preserving lines of access for hauling and fire control;
(2) the question of fire lines and the State Forest boundaries;
[…]
(4) the effect of an alienation upon fire hazards in the locality;
[…]." (p. 15)

LEGISLATION - 1948

Bush Fires Act. No. 79 of 1948, s.7 (a)
"*11. (1) Subject to subsections (3) and (4) of this section no person shall at any time between the first day of October and the next ensuing thirty-first day of May in any yearly period set fire to the bush on any land, whether such land is within a fire-protected area or not, unless the following conditions are complied with, namely-*
(a) he has delivered or caused to be delivered personally at least two days' notice in writing of his intention to burn such bush to each of the following persons, that is to say-
[…]
(iii) *where the land upon which the bush proposed to be burnt is situated within two miles of a State forest and the burning operations are intended to take place on a day between the fifteenth day of December and the next fifteenth day of April in any yearly period, to a forest officer employed in connection with such State forest;*" (p. 12)

LEGISLATION – 1937-1942

The Bush Fires Act, 1937-1942 : Regulations

Permit to Burn Within a Fire Protected Area
"*4. (1) Any owner or occupier of land within a fire protected area desiring to obtain permission of subsection (2) of section 8 of the Act to set fire to the bush upon such land shall lodge an application, signed by him, in*

the Form 1 in the Appendix to these regulations with the nearest authorised officer within the fire protected area or if there be no such officer within the fire protected area, with the Minister, for a permit to burn as hereinafter prescribed. (2) An application under the preceding paragraph of this regulation may be accepted in the form of a letter provided that the full information contained in the Form 1 aforesaid is supplied in such letter. (3) For the purpose of this regulation the term 'authorised officer' shall mean an officer acting with the authority of the Minister. (4) Every forest officer appointed under the Forests Act, 1918, shall be deemed to be an 'authorised officer' within the meaning of this regulation." (p. 3)

"*9. The holder of a permit to burn shall take such precautions as may be required by any authorised officer for the purpose of preventing the spread of fire from the land in respect of which the permit is granted on to any State forest, timber reserve or other Crown land or upon any adjoining holding.*" (p. 4)

Charcoal Burning

"*14. (1) Every person proposing to light a fire or fires for the conversion of any bush into charcoal at any time during the period commencing on the first day of October and ending on the thirty-first day of May next ensuing in every yearly period as provided for in paragraph (b) of subsection (1) of section 16 of the Act shall, at least seven days before lighting such fire, give notice in writing of such intention to the local authority in whose district the land on which the fire is to be lighted is situate, and, in the event of the land on which the fire is to be lighted being within two miles of a State forest, to the local forest officer. Such notice shall specify the land on which the burning is to take place and the period during which the fire is to be kept burning. (2) The local authority, through its fire control officer or the local forestry officer as the case may be, may, within the period specified in paragraph 1 of this regulation, direct that such further measures of precautions be taken as, in the opinion of the bush fire control officer or forestry officer, are considered necessary to prevent the fire from spreading or escaping, and when the bush fire control officer or forest officer has given such directions, the said fire shall not be lighted until such directions have been complied with.*" (p. 2)

Permit To Burn Plants (Other Than Flax) During Prohibited Times

"*20. The person proposing to burn plants or the refuse thereof as aforesaid shall – (a) two days at least before doing so, deliver or cause to be delivered notice in writing of his intention so to do personally to each owner or occupier of all lands adjoining the land upon which the plants or refuse thereof will be burnt, and also to the secretary or a bush fire control officer of the local authority in whose district or adjacent thereto the said last-mentioned land is situated, and, if the area to be burnt is situated within two miles of a State forest, to a forest officer employed in connection with such State forest; …*" (p. 3)

Permit To Burn Flax or Flax Stubble During A Prohibited Time

"*21.* […] *9. If the permit to burn applied for is granted the holder thereof shall, before commencing to burn under the authority of such permit- (i) deliver or cause to be delivered personally to each owner or occupier of all lands adjoining the area to be burnt, and, where the authorised officer who granted the permit is not an officer of the local authority within whose district the area to be burnt is situated, to such local authority or to the bush fire control officer of such local authority at least four days' notice in writing of his intention to burn such area; and (ii) if the area to be burnt is situated within two miles of a State forest, deliver or cause to be delivered personally to a forest officer employed in connection with such State forest at least four days' notice in writing of his intention to burn such area.* […] *11. No fire is to be lit if the fire hazard is as defined by the Forests Department to be above 'average summer.'*" (p. 6)

LEGISLATION – 1937

Bush Fires. No. 55 of 1937. 1938

"*31. When any bush fire is burning in or near any State forest within the meaning of the Forests Act, 1918, or in or near any Crown lands, the powers and authorities conferred by this Act upon a bush fire control officer appointed under this Act, or upon a captain or other officer of a bush fire brigade registered under this Act, shall be exercisable by any forest officer appointed under the Forests Act, 1918, who may be present at such fire, and if any such forest officer is present at any such fire he shall have and take supreme control and charge of all the operations, and every bush fire control officer, and the officers and members of every bush fire brigade also present at the fire, shall in all respects be subject to and act under his orders and directions.*" (p. 27)

FORESTERS' MANUAL - 1927

The Foresters' Manual. Parts II, III, IV, and V . 1927

Part III : Fire Control
Introductory
"*The problem of fire control is intimately bound up with the question of reforestation and afforestation, and the ultimate success of the Department's efforts in these directions is entirely dependent on a strong measure of public sympathy and co-operation in tackling the fire problem.*

Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations. The extent to which controlled burning is desirable and necessary is completely set out in the following pages […]" (p. 24)

"*The work of fire control falls into two main branches:-*
(1) Fire Prevention
(2) Fire Suppression
Preventative measures are the primary aim." (p. 24)

Preventative Measures
"*(a) Legislation.*
'Bush Fires Act, 1902' (with amendments).
391.
The attention of all forest officers is called in particular to Clauses 5, 6, 7, 7a, 10 and 12 set down hereunder.

Clause 7a is of particular importance to this Department as it enables fire protected areas to be gazetted where extensive fire control measures have been inaugurated, and renders it necessary for any persons desirous of burning on private property to obtain permission from the local Forest Officer. It is not proposed to declare such fire protected areas in any district except where look-out towers are established, and extensive fire control measures are in operation, e.g., Collie, Mundaring." (p. 24)

"*7. No person shall burn any part of the bush at any time during the months of October to April, both inclusive, unless-*
(a) he has delivered or caused to be delivered personally to each owner or occupier of all adjoining lands four days' previous notice in writing of such intention; nor unless
(b) he keeps at least three men in attendance until all grass, stubble, or scrub has been burnt, to prevent such fire extending beyond the limit of his own land or land occupied by him." (p. 25)

"*392. In order to give effect to the provisions of 'The Bush Fires Act, 1902' (Amendment Act, 1925), the following Regulations for the control of fire protected areas have been gazetted:-*
1. These Regulations may be cited as 'The Bush Fires Regulations, 1926.'

2. *No person shall set fire to the bush at any time on land within any portion of the State that has been declared to be a fire protected area, without first obtaining a 'Permit to Burn' from the Minister for Lands or a person acting with his authority.*
3. *For the purpose of these Regulations any officer of the Forests Department shall be deemed to be an officer acting with the authority of the Minister for Lands. Such officers are herinafter referred to as 'authorised officers.'"* (p. 26-27)

"*5. A 'Permit to Burn' shall be issued by an authorised officer, provided he is satisfied that proper precautions will be taken by the applicant to confine the fire within the boundaries of his own land or land occupied by him, and that there is no undue risk of the fire getting out of control. Such permit shall contain such conditions relating to the precautionary measures to be taken by the permit holder as may be considered necessary at the time by such authorised officer.*" (p. 27)

398. Controlled Burning

"*All areas which do not require complete fire protection will be burned systematically by light, controlled fires. Complete fire protection will be afforded to-*

(a) Areas treated and regenerated except that, where the crowns of the trees have reached a sufficient height to be beyond damage by a light surface fire, instructions may be given by the Conservator for controlled early burning under such stands.
(b) Areas partially treated and awaiting final treatment pending seed years.
(c) Areas to be worked over for trade purposes within three years within three years need protection in order that they will carry a fire immediately before trade cutting commences. This fire is of importance as a means of modifying and controlling the final burn in order to protect groups of young poles." (p. 30)

"*399. The remainder of the forest will not be afforded complete fire protection, and will be burnt under control in regular cycles. In view of the fact that the bush will carry a fire only every three years, approximately one-third of the area will be dealt with each year, so that the whole area will be covered in a three-year cycle.*

Within the boundaries of a Working Circle, this controlled burning will be carried out by compartments.

Special measures are necessary where large areas of country, not subdivided into compartments, adjoin a Working Circle. In the Jarrah belt the eastern boundary is the most critical from the fire control aspect, because the fiercest fires always come from that direction. In dealing with such country on the eastern boundary it is necessary to arrange systematic controlled burning in one-mile strips, running approximately north and south. It is necessary to have three such strips for burning in successive years." (p. 30)

"*400. The officer in charge will make an inspection to determine –*

(a) The nature of the country to be burnt.
(b) Its inflammability.
(c) Natural aids towards fire control, such as tracks and formations." (p. 31)

"*401. A rough plan of the area to be burnt must be made, if only approximately. In most cases the area can be sketched in relation to compartment boundaries, features, or areas already treated and marked on the plan.*" (p. 31)

"*402.* […] *In the plan of burning, special attention must be paid to areas forming particularly dangerous hazards such as:-*

1. *Areas on which trade cutting operations are to take place.*
2. *External boundaries.*
3. *Blackboys flats.*
4. *Other areas in the forest where work will take place, such as stone-quarrying operations.*

A copy of this plan will be submitted to Head Office as part of the annual fire proposals scheme.[…]" (p. 31)

The Burning
"*403. A responsible officer must be in attendance while burning operations are being carried out* […]." (p. 31)

"*404.* […] *Particulars concerning any cases of fire escaping must be reported to Head Office without delay.*" (p. 31)

"*When a fire is lit by a departmental employee, under instructions from the Forest Officer in charge of operations, the latter is to be held directly responsible for the fire being kept under control. It is the duty of every of forest officer, therefore, to see that there is no possibility of any such fire getting out of control.*" (p. 31-32)

Time of Burning
"*405. The Bush Fires Act of 1902 lays down that there shall be a closed season each year, during which the lighting of fires will be absolutely prohibited. This period will vary in different districts and is fixed each year by the local governing Road Board.*

Care must be taken by the officer-in-charge to see that burning operations in his district are not carried out in contravention of the Act, and that any adjoining landholders are notified as required under the Act." (p. 32)

"*406. Controlled burning will be carried out in early spring or late autumn.*

At no time should any burning be undertaken which may possibly get out of control. The more inflammable the country, the earlier (or later) will it burnt." (p. 32)

"*407. Country carrying dense young regrowth needs burning as lightly as possible, and when this regrowth occurs in patches, the desired result may be obtained by burning such patches in the cooler part of the day.*" (p. 32)

"*408. In districts gazetted 'fire protected areas' under Section 7A of the 'Bush Fires Act, 1902,' there is no prohibited period, but during the months of December to February no departmental burning may be carried out unless a permit is written out and issued to the officer responsible by the Forester in Charge.*" (p. 32)

"*409. In districts not gazetted 'fire protected areas,' the Conservator, on receipt of the forester's application to burn during the prohibited period, may, if he considers the reasons advanced in the application sufficiently strong, arrange for the approval of the Executive Council under Section 5 of the 'Bush Fires Act, 1902.' Such permission, however, will only be granted subject to the burning being carried out during the most favourable weather periods for control, and under the strictest precautions.*" (p. 32)

Summary
"*410. 1. Local regulations and restrictions concerning close season must always be observed.*
2. *A fire must never be allowed to escape beyond control. All officers must realise that, quite apart from the actual damages for which the Department may become liable on this account, the consequences of letting a fire get out of control are serious.*" (p. 32)

Top Disposal
"*415. Enormous damage has been done in the past by bush fires following in the wake of 'falling' operations when the bush has been littered with 'tops. Not only are saplings, poles and piles destroyed in this way, but where, as is often the case, the butts of mature trees are surrounded by a litter of tops, the resulting scorching, where not actually fatal, renders the trees of much less value, or in some cases even useless, from the timber point of view.*" (p. 34)

"*416. The following procedure will be adopted in carrying out top disposal operations in typical Jarrah country. Sequence of operations:-*

1. *Advance burning.*
2. *Clearing Debris.*
3. *Top Burning.*" (p. 35)

"*417. The importance of burning country in advance of falling operations, as a means of modifying and controlling subsequent fires, cannot be over-emphasised.*

The Forester, or assistant forester, in charge of Top Disposal Operations will be held guilty of neglect if such work is being carried out on country not previously burnt.

Exceptional cases will arise where burning is impossible, and in such cases, the Forester should send prior information to Head Office, and not wait for the irregularities to be discovered by an inspecting officer." (p. 35)

"*418. For the purpose of preparing this programme of work, the Forester shall obtain in July of each year a plan showing approximately the log lines to be constructed or location of cutting for the ensuing twelve months from mill managers concerned. In this connection, the attention of Foresters is drawn to Regulation 29, by virtue of which the Department is empowered to confine operations on a permit area to certain defined sections. Accordingly it is the duty of the local officer to see that operations are strictly confined to the sections agreed upon, and that no departure from this is allowed except by express permission in writing from the Conservator.*" (p. 35)

"*419.*[…] *It will often be found necessary to burn several months in advance on account of the fire close season, weather conditions, etc.*" (p. 35)

"*A fire twelve or eighteen months prior to felling operations will leave the country in such a state that it will not burn again immediately in front of the fallers, but will yet run a fire when the crowns and bark lumber the ground, thus adding to the difficulty of disposing of this litter under favourable circumstances.*

To avoid this, great care must be taken that advance fires do not escape and burn more than is necessary for the year's coupe. […]" (p. 36)

"*Burning will, in all cases, be carried out strictly in accordance with instructions set down for 'Controlled Burning.'*" (p. 36)

"*420. Workmen will follow the fallers and clear away the debris for a distance of about three feet from around valuable trees and saplings.*" (p. 36)

"*421. The tops can safely be burnt at any time of the year, provided the advance burning has been satisfactorily carried out.*

[…] *The burning of tops must be suspended during the prohibited period for the district.*" (p. 36)

"*When, owing to fires having occurred during the previous twelve to eighteen months, an advance burn has not been obtained, the burning of the tops must only be carried out early in the following spring when there is no possibility of the bush running a fire. This means that the Department is taking a risk of the area being swept in the interval by an uncontrolled fire, but it is better in such cases to accept that risk and clear the debris only, rather than undertake top burning under dangerous weather conditions when the Department carries the entire onus of letting a fire get out of control.*" (p. 37)

Spark Nullifers on Mill Locomotives
"*Mill locomotives must always be regarded as a very great source of bush fires.*[…]" (p. 37)

Hardwood Working Circles
"*In hardwood working circles the firebreaks are not cultivated strips, but belts of green timber burnt periodically by controlled fires, and the compartment is 500 acres in extent. No regeneration cleaning or ringbarking is carried out within five chains of compartment boundary, or within ten chains of private property locations, where these form external boundaries. Compartments are, therefore, separated by belts of green timber ten chains in width. Controlled burning is carried out over one-half of the width of each firebreak belt on alternate years.*

Such belts must be retained in addition to country which cannot be burnt early (e.g., wet flats)." (p. 37)

Tracks
"*In fire control, tracks serve as a means of access, as an aid to the control of burning on areas not treated or undergoing treatment, and also (in many cases) as compartment boundaries.*

As an aid to the control of burning, however, tracks can be effectively used only when the burning is carried out frequently. If this is done, an early or late burn can readily be confined to a compartment, or to a portion of a compartment where such is surrounded by well-defined tracks." (p. 38)

"*428. Where the tracks formed by bush haulage are not sufficient, or where these have become overgrown through disuse, a horse-drawn scraper is used to form new tracks and to link up existing ones. This implement will be extensively used where the formation of new tracks is necessary, as on private property boundaries, in country which has not been cut over for trade purposes … and on the boundaries of 10-chain strips of green timber separating compartments.* […]" (p. 38)

Fire Detection and Suppression
"*The successful combating of fires is mainly dependent on:-*
1. *Efficient organisation for their immediate detection (e.g., look-out towers).*
2. *An effective system of communication between headquarters, look-out towers and field gangs.*
3. *Efficient fire fighting personnel and equipment.*
4. *Means of rapid transport to the site of the fire.*" (p. 38)

"*446. No time must be lost in travelling to the fire. The important thing is to stop a fire before it gains headway.* […]" (p. 42)

"*447.* […] *When an accidental outbreak of fire occurs on country subject to controlled burning, it will prove more effective and economical to allow the fire to burn out if the spread is not threatening any treated country. A very complete knowledge of surrounding country and hazards in the vicinity is necessary to justify permitting a fire to burn out in this way without any control.*[…]

On the areas subject to complete protection, the suppression of outbreaks is the principal responsibility of all employees during the summer months, and the following notes will prove a valuable guide in attacking the problem in an intelligent manner.

No two bush fires can be fought in exactly the same manner.

Two methods of actual attack are, however, employed. These are 'direct beating' and 'back firing.'" (p. 42)

Back Firing
"*449. On protected country, and particularly on treated areas where the bush has been closed for, say, three to four years, it will be necessary to back fire from the five chain belts or other burnt country.*" (p. 43)

"*450. The back fire must not be set in a long line at once, but gradually, in sections, so that each section can be made safe before another section is lit.*" (p. 43)

"*In all cases, however, a strip averaging about a foot wide, either raked or swept, must be left all round the fire.*" (p. 43)

Factors Influencing Mode of Attack

"*The method of attacking a fire in the jarrah bush will vary with-*

(a) Month of the year. – Fires in November or December, depending on the season, might be beaten out, whereas fires in February and March generally need to be dealt with by 'raking and counter-firing.'

(b) Period since last burnt. – A fire occurring on an area burnt 18 months or two years before might easily be beaten out, whereas a fire on an area not burnt for, say, four years, would most easily be dealt with by 'raking and counter-firing.'' (p. 43)

"*(c) Type of country. – Fires starting in scrub with Blackboys, or bracken country, are usually too hot for 'direct beating,' whereas, under identical weather conditions, a fire on more open country could be beaten out. Fires burning uphill are much fiercer than those on the level.*

(d) Wind. – If strong gales are blowing, it is wisest to back-fire." (p. 44)

Extinguishing the fire

"*452. Nothing is so troublesome as a fire which breaks out again. All fire fighters must remember that their job is to put fires out, not merely to stop them, and should aim to make it a record that no fire they have dealt with has ever broken out again.*" (p. 44)

"*A fire which has been merely 'beaten out' is not extinguished. It is only 'stopped.'*

If a fire is stopped by 'direct beating,' care must be taken to sweep a narrow strip along the edge of the burnt country.

On the edge of a burnt area the following require special attention and must be burnt around:-

- *(a) Burning trees.*
- *(b) Burning stumps.*
- *(c) Burning logs.*
- *(d) Burning debris, such as sleeper chips, bark.*
- *(e) Burning blackboys.*
- *(f) Any heap of thick litter.*

Fire, or smouldering embers, in such places unnoticed in the haste of the attack on the live fire, can be made safe only by patrol.

It is always necessary to go back over the line to make sure the fire has not broken, or will not break out anywhere." (p. 44)

Organisation

"*454. The controlling officer's part in fire control is organisation.*

Successful fire control cannot be based on a strenuous personal effort only. Careful attention must be paid to the instructions concerning methods and systems." (p. 44)

"*455. On or before the 1st November each year the Forester must draw up a scheme of fire-control for the district under his charge, and forward a copy to Head Office.*

456. The report must be accompanied by a map showing:-

Areas burnt by uncontrolled fires in previous season;

Areas burnt by controlled fires during the previous twelve months;

Areas on which controlled burning is to be carried out during the ensuing fire season (a) before the season beings, (b) after the close season ends." (p. 45)

Major Working Circle (and Groups of Minor Working Circles under A.D.F.O.)
Fire Control Reports
"*The report must be accompanied by a map showing:-*

Areas burnt by uncontrolled fires in previous season;
Areas burnt by controlled fires during the previous twelve months;
Areas on which controlled burning is to be carried out during the ensuing fire season (a) before the season begins, (b) after the close season ends." (p. 106)

WORKING PLAN – 1926

Working Plan No. 1 : Mundaring Working Circle. 1926

Part I : Summary of Facts
6. Past Management
"*Prior to July, 1920, the only forest management practised on the area comprised in this Working Circle was policing and revenue collecting.*

In September, 1921, a Preliminary Working Plan drawn up by Mr S.L. Kessell was approved by the Governor in Executive Council.

In the summer of 1921-1922, fire-control measures were instituted, and the fire towers on Mounts Gungin and Dale were constructed." (p. 12)

C. Fire Control
"*Fire Control measures were instituted over 120, 000 acres in December, 1921. The experience gained on this Working Circle will prove of great value in all future fire control work undertaken in this type of forest, both in this State and in other parts of Australia.*" (p. 13)

Part II : Future Management
12. Fire Control
A. Basis of Proposals
"*The whole of the Working Circle shall be considered as under Fire Control Measures.*

These measures will vary according to the conditions of the forest. Complete protection will be afforded to:-

(a) Areas treated and regenerated, except that, where the crowns of the young crops have reached a sufficient height to be beyond damage by a light surface fire, instructions may be given by the Conservator for controlled early burning under such stands.

(b) Areas treated and awaiting final treatment pending seed years.

[…]
The remainder of the forest will be burned systematically by light controlled fires. In view of the fact that the bush will carry a fire usually only every three years, approximately one-third of the country not afforded complete protection will be burnt each year." (p. 25)

B. Fire Control Measures
"*Supervision of fire control measures will be direct charge of the Forester in charge of the Mundaring Working Circle.*" (p. 26)

(a) Fire Protection
"*In November of each year a 'controlled burning map', showing the work carried out, must be submitted to the Conservator for approval, together with remarks on the work necessary for completion.*
[…]
Firebreaks and fire belts for early burning will be maintained as follows:-

(i) Working Section 'A'
No regeneration cleaning or ringbarking will be carried out within five chains of compartment boundaries or within ten chains of private property locations forming compartment boundaries.
[…]
(ii) Working Section 'B'
Provisionally every 300 years of plantation will be surrounded with a three-chain break and divided into two more or less equal parts with a one chain break. Subdivisional breaks half a chain wide will surround each Compartment, which will be approximately 25 acres in area.

The method to be adopted for the formation and maintenance of these breaks will be in accordance with the instructions in the latest circular referring to this work.

(iii) Working Section 'C'
Provisionally every 100 acres will be surrounded with a one-chain ploughed break.

(b) Fire Suppression.
Observation and location of fires will be secured from the fire towers situated on Mounts Gungin and Dale.
[…]" (p. 26)

FORESTERS' MANUAL – 1926

The Foresters' Manual. Part 1. General District Work (South-West). 1926

Permanent Reservation
"*326. Permanent Reservation. – Prime timber country carrying Jarrah and Karri in reasonably pure formation.* […]

Other factors as set out in the standard form of land inspection report, F.D. 89, need, however, to be taken into consideration in making recommendations, but the principal determining factor remains the question as to whether Jarrah or Karri occurs in reasonably pure formation. Among other considerations which may justify a recommendation that an area be included in a State Forest are –
… (4) The protection of the forest from dangerous fire hazards." (p. 83-84)

LEGISLATION - 1925

Bush Fires. No. 27 of 1925. An Act To Further Amend The Bush Fires Act, 1902

"*7. (1.) Section two of the Bush Fires Amendment Act, 1904, is hereby amended by inserting after the words 'railway reserve' the words 'or any land under the control of the Conservator of Forests.*" (p. 53)

LEGISLATION - 1919

Forests Act. No. 8 of 1919

"*AN ACT to provide for the better Management and Protection of Forests.*

[Assented to 3rd January 1919.]" (p. 117)

Part I. – Preliminary
"*1. This Act may be cited as the Forests Act, 1918.*" (p. 117)

Part VII. – Offences, and General Provisions
"*46. (1.)If any person-*
(a) lights, kindles, or assists to light or kindle, or aids or abets another person in lighting or kindling, any fire within the boundaries or within twenty yards of any boundary of a State forest or timber reserve; or
(b) leaves, without taking due precaution against its spreading or causing injury, a fire lighted or kindled by him as aforesaid, or in the lighting or kindling of which he has aided or abetted;
and in either case any forest produce is burnt or injured, such person shall be guilty of a forest offence, and liable, on conviction, to imprisonment for not exceeding one year, or to a penalty not exceeding one hundred pounds." (p. 136)

"*48. Any person who sets fire in the open air to any tree, wood, bush or grass on any land contiguous to a State forest or timber reserve, without giving notice of his intention to a forest officer so as to allow such officer to be present at the firing, commits a forest offence.*" (p. 137)