TRIAL TINGLE BURN

PREPARED FOR RED TINGLE CONSULTATIVE COMMITTEE

MAY 1998

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PREFACE

Following prescribed burns carried out by CALM in forest containing Red Tingle (E.jacksonnii) within the Walpole Nornalup National Park during the summer of 1996, Members of the Walpole Nornalup National Parks Association approached the National Parks and Nature Conservation Authority (NPNCA) raising concerns in relation to the impacts of the burns upon the Red Tingle.

The concerns listed related to the degree of loss through collapse attributed to impacts of fire, the amount of canopy scorch, the relatively large percentage of the area burnt and the ability of juvenile Tingle trees and seedlings to survive after prescribed fire.

In June 1996 the members of the NPNCA visited Walpole and inspected the burns conducted the previous summer. The Association was briefed by both CALM and WNNPA members during the field visit.

Following this inspection the NPNCA resolved at the June meeting of the Authority (131st meeting) to form a committee to determine the best practices for prescribed burning in the Red Tingle areas for the management of the Conservation Estate and other issues including protection of community assets and Park values. The Committee comprised of Mr Tom Day (Chairman NPNCA) Mr Graeme Rundle (NPNCA member) Mr Geoff Fernie (President Walpole Nornalup National Parks Association) and Mr Greg Mair (CALM- Walpole) and was to be known as the Red Tingle Consultative Committee.

The Committee met on 12/9/96 and resolved to conduct a trial burn in Red Tingle forest under defined parameters, particularly moisture contents, and to monitor the results. The results of this trial burn are set out and include recommendations made by the Red Tingle Consultative Committee.

ACKNOWLEDGMENT

The Red Tingle Consultative Committee wishes to thank the staff from the Walpole District of the Department of Conservation and Land Management for their co-operation, the thoroughness of their report and the spirit in which they assisted in the conducting of the trial burn.

The contribution by the members of the Walpole Nornalup National Parks Association into the trial methodology and provision of feedback is also acknowledged.

Research into invertebrate populations in the Tingle forest area by Paul Van Heurck and on post fire recruitment of Tingle and Karri seedlings by Lachlan McCaw has proved most valuable for the Committee.

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1.0 RECOMMENDATIONS

Following the trial burn conducted in Red Tingle forest at Walpole in Summer 1997 the Red Tingle Consultative Committee makes the following recommendations-:

1. Based upon the results of the 1997 trial burn, future Tingle burns should be conducted within moisture content parameters of Soil Dryness Index in the range of 500 - 900 and Profile Moisture Content of 50%-70%. These moisture contents are considered to be desirable where prescribed burn objectives in Red Tingle forest include the retention of patches of unburnt area and retention of a percentage of the humic profile, after burning

2. Findings from current research and monitoring into the effects of fire upon the Tingle environment, especially in relation to tree loss, invertebrates and seedling survival shall be considered when reviewing the WNNP Management Plan.

3. Within the regimes described in the WNNP Management Plan 1992-2002, continue to monitor the impact of prescribed fire, in selected areas of Red Tingle occurrence. Monitoring should include the following areas.

    i) the number of large tree collapses in a prescribed fire event, taking into consideration moisture contents at the time of burning and time since last burnt.
    ii) the ability to retain, in an unburnt state, riparian zones and seeps, with due regard to the security of the burn.
    iii) the impact of fire upon invertebrate populations and the relationship between their richness and abundance in a variety of fuel ages with particular reference to restricted relic species.
    iv) the germination and subsequent survival of eucalypt species in the Red Tingle forest following prescribed burning. This should be linked to research on the seed cycle, seeding characteristics and the fate of Red Tingle seed following capsule release.

4. In the review of the Walpole Nornalup National Park Management Plan (1992-2002) consider the development of fire regime options for the Red Tingle Forest which may result in changes to the dispersal and proportion of areas to each of the 3 categories of fire regimes including fuel reduction rotation (6-8 years), vegetation management (10-20 years), and no planned burns.

The committee acknowledges that research work is in progress in the Tingle forest, on invertebrate populations and seedling development following post fire germination. Progress reports have been given to the Committee. Notes

on the post fire recruitment of Red Tingle and Karri seedlings following prescribed burning are attached to these recommendations. Of particular interest to the development of future fire management options is the observations to date of a low probability of seedling survival in a fully stocked stand with an intact canopy. Additional research into the relationship between fire intensity, canopy effect and the survival of Red Tingle seedlings would be useful for future planning.

The committee recognized the extent of tree falls in the 1997 trial burn and recommends that this area be monitored in future burns to determine comparative tree loss. When linked to the monitoring programmes described above, this may assist in identifying whether previous damaging wildfires were significant in contributing to the loss during the 1997 trial.

There are other areas involving the relationship between Red Tingle and prescribed fire, such as nutrient cycling and bark loss and replenishment, which were not part of this particular trial burn but worthy of future investigation.

2.0 TINGLE CONSULTATIVE COMMITTEE - TRIAL TINGLE BURN

(i) OBJECTIVES

(a) To test whether it is possible to achieve a mosiac of burnt and unburnt patches within Red Tingle Forest by use of appropriate fuel moisture, soil moisture and weather conditions.

(b) To monitor tree falls of veteran Red Tingle as a result of fire.

A fuel reduction burn in Red Tingle forest will be conducted which will test a set of fuel and soil moisture conditions and their relationship, to burn 'patchiness' and tree falls of Red Tingle.

(ii) **PROPOSED AREA -** The area proposed for the trial burn is located 16 km east of Walpole townsite and adjoins the South Coast Highway. The cell proposed to be burnt contains flats Jarrah/Marri and Karri/Tingle forests.

The area is known as WNHB 17 and is presently programmed for fuel reduction burning in the 1996/97 season. The ability to burn flats and jarrah, ie. the earlier drying vegetation types, to the north and south-east of the burn and the presence of two year old forest to the south, provide a reasonable degree of security from escape, for the burn.

The proposed trial area is within the fuel reduction and vegetation management regimes of the Walpole Nornalup National Park (WNNP) Management Plan (Attachment 1).

a) **AREA OF TRIAL -** The trial area is bounded by South Coast Highway in the south, 28 Mile Road on the west and Private Property on the north and east, is an area of approximately 250 ha. (Attachment 2). The Red Tingle occurrence within this area is = 65 ha. And is mostly visible on the aerial photograph. (Attachment 3)

b) **YEAR LAST BURNT -** Records held in the Walpole District indicate that the trial burn area contains a variety of fuel ages ranging from 1995/96 to 1971/72.
Attachment 4 indicates the fuel ages within the trial area.

(iii) MONITORING

Monitoring of a number of elements prior to, during, immediately after, and at the cessation of the fire season is critical to ensure that maximum information

is obtained from the trial. Factors which should be assessed or monitored are:-

a) **PRE BURN**

- Map Red Tingle occurrence.
- Confirm fuel age records.
- Fuel loads in Tingle - broad scale fuel measuring has been done however a finer scale should be considered for the trial.
- Surface moisture content (SMC).
- Profile moisture content (PMC).
- Soil Dryness Index (SDI).
- Rainfall (relates to SMC, PMC, SDI).
- Locate selected Tingle hollow butts to track outcome following burn.
- Locate Tingle with intact stems - record condition to ascertain whether fire initiates Dry Siding.
- Locate selected Tingle with small fissure.

b) **DURING BURN**

- At time of burn record SMC, PMC, SDI.
- Weather conditions.
- Lighting technique employed.
- Record difficulties associated with ignition and suppression.
- Resources required.
- Fire behaviour - rates of spread, flame heights, intensity, tendency for fire's to 'climb' Tingle trees.

c) **POST BURN**

- Survey and plot unburnt pockets within the Karri, Tingle types, and record cause e.g. wet gully, lighting pattern, fuel arrangement.
- Assess tree fails as a result of the burn - ie. number and species, age class and condition.
- Assess scorch by vegetation type.
- Observations of disturbance, other than failing, to the Red Tingle - eg. large limb loss through fire.
- Assess impact of fire on selected hollow butts.
- Assess impact of fire on selected intact trees.
- Unburnt Tingle profile - depth.
- P.M.C. of remaining profile.

d) **PERIOD BETWEEN COMPLETION OF BURN AND END OF FIRE SEASON**

- Record re-ignition and re-burn of the area following the main ignition.

- Record fire crews attendance at trial area for purposes of security or suppression.
- Maintain SDI.

e) **AT END OF FIRE SEASON**
(In order to capture any change to unburnt mosaic and tree fails as assessed immediately following the burn)

- Survey and plot unburnt pockets within the Karri, Tingle types.
- Assess tree fails as a result of the burn.
- Assess scorch by vegetation type.

f) **AFTER WINTER 1997**

- Assess tree falls in addition to those recorded at (e).

This is not considered to be a complete list of monitoring required and the Tingle Consultative Committee may suggest other areas of study. Note that Red Tingle seedling emergence trials and invertebrate plots have been established within the Red Tingle Forest and that this trial is primarily aimed at the issues of unburnt mosaic and tree loss of veteran Tingle.

It is envisaged that the majority of monitoring can be done with Walpole District staff, however some assistance may be required from Science and Information, Manjimup and the WNNP Association.

ATTACHMENT 5 is a table prepared by CALM comparing prescribed burn conditions and the most likely outcomes. This information was used as a guide by the Red Tingle Consultative Committee in formulating conditions for the trial burn.

3.0 PRESCRIBED BURN WN HB 17

WALPOLE NORNALUP NATIONAL PARK.

BACKGROUND

Walpole Nornalup Hand Burn 17 (WNHB 17) is a prescribed burn proposed during the 1996/97 fire season within the 'Giants Block' section of the Walpole Nornalup National Park (WNNP) in order to protect the adjoining private property, Bow River and the National Park from the effects of wildfires. The burn, when completed, will provide valuable protection from fire to the substantial area of vegetation management to its west within Giants Block. Walpole Nornalup National Park Management Plan 1992 - 2002 requires that fire regimes of fuel reduction and vegetation management occur within the area of WN HB 17.

This burn was originally planned for the 1995/96 fire season however suitable conditions did not eventuate during the season and only edging of jarrah and scrub flats was conducted in late Autumn 1996.

Following review by the NPNCA on the outcomes of two burns containing Red Tingle (E. jacksonii) conducted during Autumn 1996 it was agreed that a trial Tingle burn, in which particular conditions would be monitored, would be conducted. WNHB 17 was selected from the areas available as being the most suitable for conducting the burn trial. The burn area is approximately 250 ha of which some 65 ha is considered to contain Red Tingle.

ISSUES.

1. WNHB 17 contains fuel loadings of approximately 33.0 tph to 52.0 tph in the Tingle and Karri/Tingle vegetation types.

2. Any fire will have an impact upon the structure of a mature Red Tingle stand due to the relatively high proportion of hollow - butted trees. This, combined with the tendency for high fuel build up around the base of trees will result in some trees being burnt out and falling over.

3. The presence of relictual Gondwanan invertebrates within the Tingle forest.

4. Red Tingle poses particular difficulties for prescribed burning due to the high fuel loadings, propensity for fire to 'climb' up the tree bole towards the crown (due to the fibrous nature of the bark) and the relatively narrow 'window of opportunity' of suitable conditions under which to conduct Tingle burning. It is not unusual for the 'window' to occur in the prohibited fire season.

5. WNHB 17 will become 'live' quite early in the burning season due to the other, earlier drying, vegetation types within it's boundaries. Subsequently re-ignition can occur after the initial lighting.

THE BURN STRATEGY

1. OBJECTIVES

- To carry out fuel reduction as designated in the WNNP Management Plan 1992-2002 in accordance with the fire management objectives.
- To protect the National Park and community values, especially the adjoining farmland and Bow Bridge community, from the effects of wildfire.
- Reduce 70% - 80% of the Jarrah forest fuel types to <2.0 tph.
- Reduce 80% - 90% of the Karri/Tingle fuels to approximately 15 tph - 18 tpha.
- Achieve scorch heights of less than 9.0m over 90% of the Karri/Tingle type and to less than 6.0m in the Jarrah type.
- To maintain viewsheds, particularly from the South Coast Highway and Bow Bridge, such that visual impact is not evident within one year of the burn.
- To conduct the burn in accordance with the objectives and requirements as described in the Tingle Burn Trial brief.
- To complete the burn with no significant escapes of fire outside of the intended boundaries.
- To ensure the prescribed burn is conducted with no injury to personnel.

2. PREPARATION (Prior to the Burn)

- Prepare burn boundaries to a standard suitable for conducting the prescribed burn.
- Public information in the form of 'Park Notes' will be prepared and available from the Valley of Giants Tree Top Walk and the Walpole District office. Warning signs will be displayed prior to the day of the burn.
- Using suitable machine, lay down scrub around Red Tingle trees 0-30m metres from the edge of 28 mile Road. Bare earth to be avoided and maximum retention of Tingle saplings, commensurate with operations of the selected machine, to occur.
- Lay down scrub on old alignment running (approx) from Thompson Road. North-east to location 1653. This will provide access for ground crews to light from and for gathering of data necessary for the Tingle Burn Trial

- Individual Tingle trees 0-100 metres from road edges will be inspected and a decision to provide access to aid in suppression will be made.
- 'Stag' trees 0-100 metres from road edges will be inspected and a risk assessment of them conducted. Trees which pose a threat to the security of the burn and for which no other option is available may need to felled.
- Complete all pre-burn measuring as required for the Tingle Trial ie fuel assessment, SMC, PMC samples, tree identification within categories described in the trial.

3. PREPARATION (Day of Burn)

- Public notification as standard.
- Notification of Tourist Bureau, Valley of the Giants Tree Top Walk office, Science and Information Manjimup, President WNNP Association (as member of Tingle Consultative Committee).
- An assessment of the fuel/weather conditions to be made to determine the requirement for a travel tower to assist in edge control of trees which may light up with burning limbs in the crown.
- Obtain record of day of ignition PMC, SMC, SDI and weather conditions.

LIGHTING TECHNIQUE

- WNHB 17 contains a range of vegetation types from scrub flats, Jarrah/Marri to Karri/Tingle. Associated with this range is a variation in the rate of drying of the respective fuels and their subsequent availability for ignition.
- Burn out the Jarrah/Marri and scrub fuel types meeting the objectives of the prescription and under such condition that a moisture differential exists in the Tingle/Karri and this type will not sustain ignition.
- Following burning of the scrub and Jarrah/Marri types, the Tingle /Karri types in WNHB 17 can be burnt on wind directions ranging from SW to SE with a lighting strategy varying accordingly.
- If burnt on a South Westerly wind-:
  - Deepen the Eastern boundary by lighting at the Karri/Jarrah type boundary
  - Progressively work east and west creating a back burn in the Tingle-Karri forest along the line of the previously burnt Jarrah.
  - Depending upon fire behaviour use the scrubrolled access track to light from the east at appropriate spacing according to the conditions.
  - Progressively light the Tingle/Karri sections of the South Coast Highway and 28 mile Road at a rate commensurate with fire behaviour and edge control.

- If burnt on a South Easterly wind:-
  - Commence lighting in the north western section of the burn at the junction of 28 mile Road and the Karri type. This should be at the formed (unnamed) track running through WN HB 17.
  - Establish a backburn by working to the south along 28 Mile Road and to the east along the line of the previously burnt Jarrah.
  - Depending upon fire behaviour use the scrubrolled access track to light from the west at appropriate spacing according to the conditions.
  - Progressively light the Tingle/Karri sections of the South Coast Highway.

It is anticipated that all lighting will be by hand from ground crews.

The location and rate of lighting will be under the direction of the Operations officer. No other lighting other than that authorised by the Operations Officer is permitted

As per standard practice, no felling of burning trees will occur unless authorized by the Operations Officer.

POST BURN MONITORING

- Post burn monitoring as described in the Tingle Trial Burn brief will be conducted.

  This includes -: plot of unburnt pockets
  - scorch by vegetation type
  - depth of profile remaining
  - survey of tree falls as a result of fire
  - impact of burn on selected Tingle trees.

Supporting monitoring of invertebrates in the Tingle and post fire Red Tingle seedling emergence is occurring in other areas.

4.0 POST BURN REPORT WNHB 17

TRIAL TINGLE BURN

INTRODUCTION

The following report summarises field and actual observations that were made prior to and during the prescribed burn WNHB 17 in Walpole-Nomalup National Park in January 1997.

The information is presented in the same format as the monitoring requirements that were determined by the Tingle Consultative Committee.

1. PRE BURN MONITORING

1.1 Map Red Tingle Occurrence

ATTACHMENT 6 details Red Tingle Occurrence throughout proposed burn area.

This map was prepared from information provided by Forest Management Branch using the Forest Management Information System (FMIS)

1.2 Confirm Fuel Age Records

The original information provided in the "Tingle Trial Burn" notes did not indicate all of the area that was Prescribed burnt in 1988/89. Walpole District records confirm that all of WNHB 17 was burnt over in 1988/89.

1.3 Fuel Loadings in Tingle

Fuel assessments were taken in preparation of the Burn Prescriptions. Additional fuel assessments were taken in 5 areas in the Tingle at the same location as the PMC sample points.

These fuel loadings are summarised in **ATTACHMENT 7** as total fuel loading and available fuel loading. Each of the 5 sample lines consisted of 10 points to provide the overall loading.

1.4 Surface Moisture Content

Surface Moisture Content is calculated daily at 0800 using forecast conditions (Temp & RH) as provided by the Bureau of Meteorology. Adjustments are made to the predicted Min SMC from actual readings that are then taken approx once per week.

1.5 Profile Moisture Content

5 PMC monitoring sites were established within the proposed area on 4th December 1996. These were monitored on a weekly basis until the burn was completed. These are summarised on **ATTACHMENT 8.**

1.6 Soil Dryness Index

The SDI is calculated daily at the Walpole Office. The Soil Dryness Index at the time of ignition was 731. SDI for the period October to April 1996/97 is shown on **ATTACHMENT 10.**

1.7 Rainfall

Rainfall observations are taken at 0900 Daily at Walpole. Rainfall observations for the month leading up to the burn are summarised on **ATTACHMENT 10.**

1.8 Locate Selected Tingles For Monitoring
1.9 &1.10

A total of 15 red Tingles were selected for monitoring pre and post burn.

These fell into 3 categories

1. Hollow butts.
2. Intact trees.
3. Trees with small fissures that may have potential to develop.

The trees that were selected fell into one or more of the above categories.

Information was compiled for each tree on diameter, description of bole/tree condition, measurement of hollow or opening prior to the burn and also several months following the burn. Directional photographs of each tree were also taken prior to and at the completion of the burn.

ATTACHMENT 12 summarises description of each tree and **ATTACHMENT 11** summarises the number of trees in each category.

Comparative photographs have been prepared showing each tree side by side (pre and post
burn) for future reference.

In summary, tree 4 was the only tree that sustained significant damage with the top of the tree burning off. All of the intact trees received no

significant damage at all. Trees No. 1, 12 and 13 received some damage to sections that had previously been affected by fire.

2.0 DURING BURN

2,1 **At Time of Burn Record** SMC, PMC, **SDI**

SMC actual	16% (ave)	<	Jarrah SMC (ave) -16% Karri/Tingle (range) -17.5%-24.5%
PMC actual	51.16% (ave)		
SDI	731		

2.2 **Weather Conditions**

Local weather forecasts are provided to CALM Walpole 3 times daily including a 4 day outlook at 1600. These forecasts are generated by the Bureau of Meteorology from observations taken at CALM Walpole at 0700, 0900, 1100, 1200, 1300, 1500, 1700 daily. These forecasts provide the best method of predicting weather conditions at the burn and predicting fire behaviour, rates of spread etc

Weather conditions (temp and RH plus local winds) were also monitored at WNHB 17 throughout the burn on day 1 only.

Weather forecasts and local observations through out the duration of the burn are summarised on **ATTACHMENT 13**

2.3 **Lighting Technique.**

All of the lighting conducted at WNHB 17 was carried out by ground crews using 'Fire Bug torches'. No aerial ignition was used.

Lighting commenced at the junction of 28 Mile Road and the gravel pit access road on 9th January 1997. Lighting progressed both East on the gravel pit access road and South on 28 Mile road with the aim to establish a backburn into the South East wind.

Lighting on 9th January 1997 proceeded south on 28 Mile road to South Coast Highway and east on the Gravel Pit Access road to Ebbett road (eastern Boundary). Lighting then proceeded south cast on Ebbett Road to tie the northern boundary edging into the older edging in the SE corner of the burn that was completed in Spring 1996.
No further lighting was conducted on 9th January 1997. On 10th January the spotter plane was used to assess the southerly progress of the backburn south of the Gravel Pit access road, and confirm it had gone out overnight.

The decision was then made to use crews to light on the north side of the scrub rolled access track that runs from 28 Mile Road north east to Ebbett road.

Small spot fires were started at approximately 100m intervals along the entire length of this track on the north side.
Once this was complete, the south side of the track was lit in a continuous line to re-establish the backburn south towards the highway. This had to be done twice as difficulties were experienced, the majority of this backburn reached the South Coast Highway late on 10th January 1997 or by 11 th January 1997. Some lighting of pockets on South Coast Highway was conducted on 11th January 1997 to secure this edge.

ATTACHMENT 14 details progression of backburn over time.

2.4 Difficulties with Ignition and Suppression.

As explained in 2.3, the backburn established from the Gravel Pit Access Road failed to maintain over the evening of 9th January 1997. This necessitated the lighting on the north side of the walking lane.

Fire behaviour from this edging, which ran with the wind was considerably stronger with flame heights up to 4 - 5 metres and Rate of Spread up to 100m/hr.

Difficulties with ignition and maintaining a backburn were also experienced south of the walking lane, however on the second attempt, a mild backburn was established south of this track.

All Red Tingles within 50m of 28 Mile road were scrub rolled around prior to the burn. This provided access for crews whilst edging around these trees, pre mop-up (wetting down) and fire suppression.

Several limbs ignited in trees adjacent to 28 Mile Road within the burn, however these posed no difficulty for Fire Suppression. No other difficulties with suppression were encountered.

2.5 Resources Required

Due to the relatively young fuels surrounding the burn, only limited resources were required.

Resources used are as follows:

9th January 1997	2 crews, 1 Operations Officer, 1 Sector Commander
10th January 1997	2 crews, 1 Operations Officer, 1 Sector Commander
11th January 1997	1 Operations Officer, 1 crew

2.6 Fire Behaviour

Over the majority of the burn, fire behaviour was very mild and often struggled to maintain a backburn.

Flame heights in the range of 0.2 to 2.5m were experienced with Rates of Spread
of 10 - 30 metres per hour.
Fire behaviour from edging north of the walk track can be described as moderate to strong with flame heights up to 4 - 5 metres (ave of 2 - 3m) and Rate of Spread up to 100m/hr.

3.0 POST BURN

3.1 Unburnt Pockets

Unburnt pockets were plotted by the spotter after the burn. These have been ground truthed by crews and plotted accurately. Known unburnt pockets as at end of March 1997 are shown on **ATTACHMENT 15.**

The majority of unburnt pockets appear to have been caused by either the mild backburn stopping once encountering logs and obstructions or stopping at heavy fuel pockets that were possibly damper from heavy shading. Seven notable unburnt pockets were plotted which made up an area of 4 ha.

3.2 Tree Falls

The total area of the burn was stripped out at Approx 30m intervals in March 1997 to assess tree falls post fire by species. The species, approximate height and diameter and status of the tree (eg severely fire damaged) were recorded in the survey. The results of this survey have been summarised in table form and also plotted on a map as **ATTACHMENT 16.**

3.3 Assessment Of Scorch By Vegetation

An overall plot of crown scorch was completed from the spotter plane in March 1997. A total area of 12 ha received crown scorch which equated to 18% of the Tingle Area.

A plan of the areas that received crown scorch is shown on **ATTACHMENT 15.**

3.4 Disturbance Other Than Falling Trees

Some loss of limbs was heard by crews during the burn, however these could not be ground truthed until the burn was declared safe.

The ground survey to assess tree falls also recorded losses to parts of trees eg partial crown loss etc. These are summarized **ATTACHMENT 16 AND 16(a).**

3.5 **Impact Of Fire On Selected Hollow Butts.**

A total of 15 trees were established as monitoring sites to assess impact of Burn.

Categories assessed were - Hollow Butts
- Intact
- Fissured with potential for development

Some of the trees assessed met more than one of the above criteria. 3 of the trees assessed were severely hollow butted from fire prior to the Burn.

Of these, one lost approx 50% of its height (burnt off) during the burn, one received some damage in extended fissure and partial removal of previously damaged spar and the third one received no apparent damage at all.

All trees in the assessment were thoroughly assessed pre and post burn with directional photographs taken of each tree.

This information is summarized as **ATTACHMENT 11. and12.**

3.6. **Impact Of Fire On Selected Intact Trees**

As for point 5.4, this assessment included several intact trees, that is trees that appeared to have no damage from previous fires.

Of these trees, none received visible damage as a result of this prescribed burn.

This information is summarized as **ATTACHMENT 12.**

3.7. **Unburnt Tingle Profile Depth**

To date this work has not been completed.

3.8. **PMC of Remaining Profile**

Unfortunately this work was unable to be completed after the Burn.

4.0 PERIOD BETWEEN COMPLETION OF BURN AND END OF FIRE SEASON.

4.1 Pre Ignition and Pre Burn

The area of the Prescribed Burn was constantly monitored by the Spotter and Frankland Tower after completion of the burn.
No significant re ignition and re burn was recorded after completion of the burn.

4.2 Fire Crew Required for Suppression or Security Post Burn

1 crew was required at the Burn on 13/01/97 for mop up and patrol.

Apart from this attendance, no other crews were required for security of the Burn.

This was mainly due to the low fuel loadings surrounding the burn.

4.3 Maintain SDI

SDI is calculated daily at the Walpole Office and a register is maintained.

A graph of SDI and Rainfall from October until April has been compiled and is displayed as **ATTACHMENT 10**

5.0 AT END OF FIRE SEASON

5.1 A Survey of Unburnt Pockets Will Be Conducted At The End Of Fire Season

No change is expected from the immediate post Burn. No active fire has been recorded from the Burn since February.

5.2. Assess Tree Falls

The tree fall assessment conducted at end of March was also designed to cover the end of fire season survey, as well as no active fire has been reported for some time.

No further survey will be conducted unless specifically requested.

5.3 Scorch By Vegetation

The last plot of scorch was conducted by the spotter in late March.

A final plot will be conducted at the end of the Fire Season, however no change is expected from the March plot.

6.0 ASSESS TREE FALLS AFTER WINTER 1997

After winter 1997, a further assessment will be conducted to monitor further tree falls due to strong winds etc. this information will be provided to the Tingle Consultative Committee.

7.0. SUMMARY

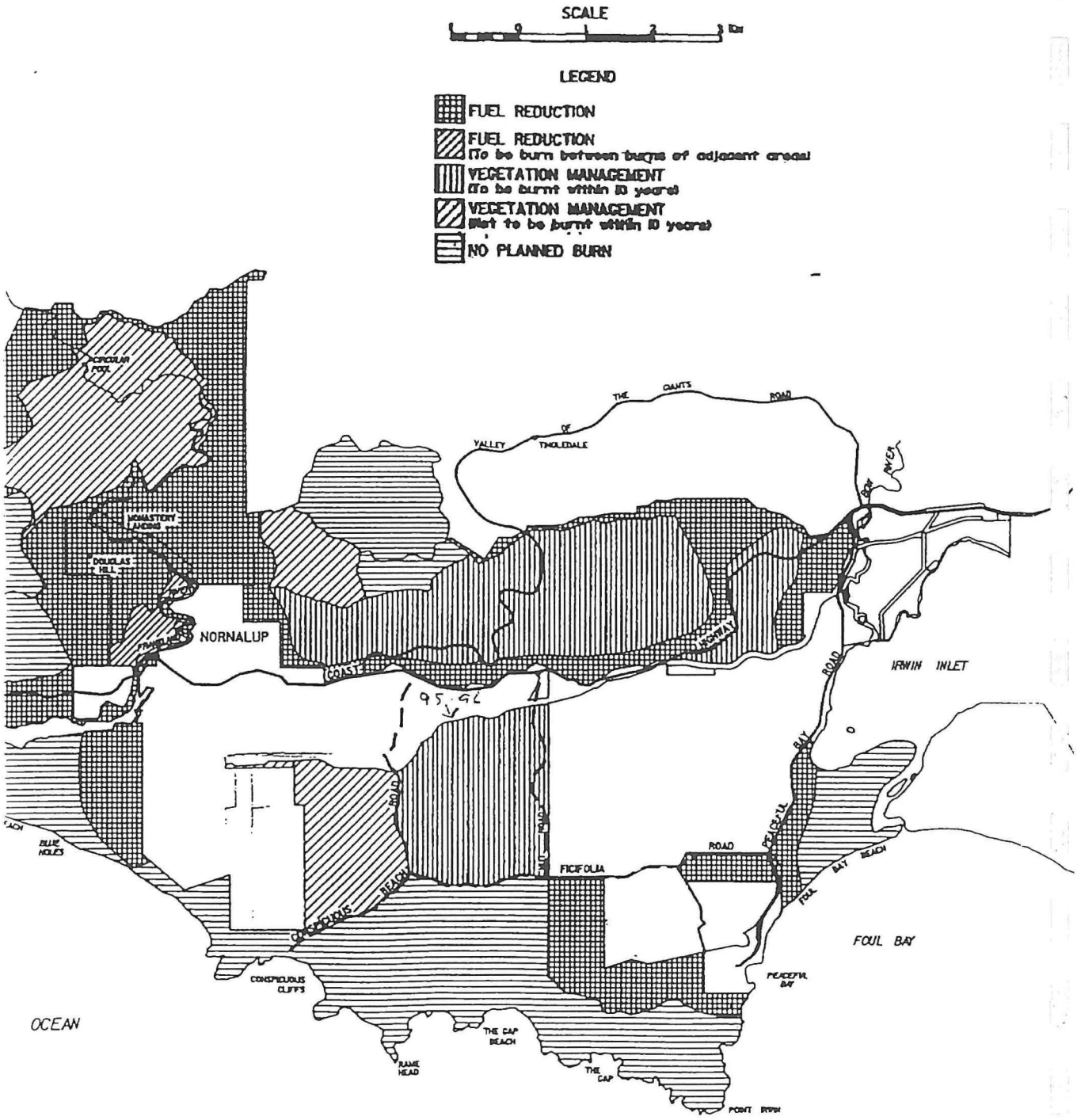
WNHB 17 can be classed as a successful Burn with most burn objectives being met. The number of tree falls is of concern and should possibly be investigated further.

It is interesting to note that most of these were in fact trees that had previously been severely damaged and weakened by intense wildfire as indicated by 1960 API maps. SEE **ATTACHMENT 17.** No noticeable damage was sustained during the mild prescribed burn to intact trees in the formal assessment, that could lead to future dry side or hollow butting.

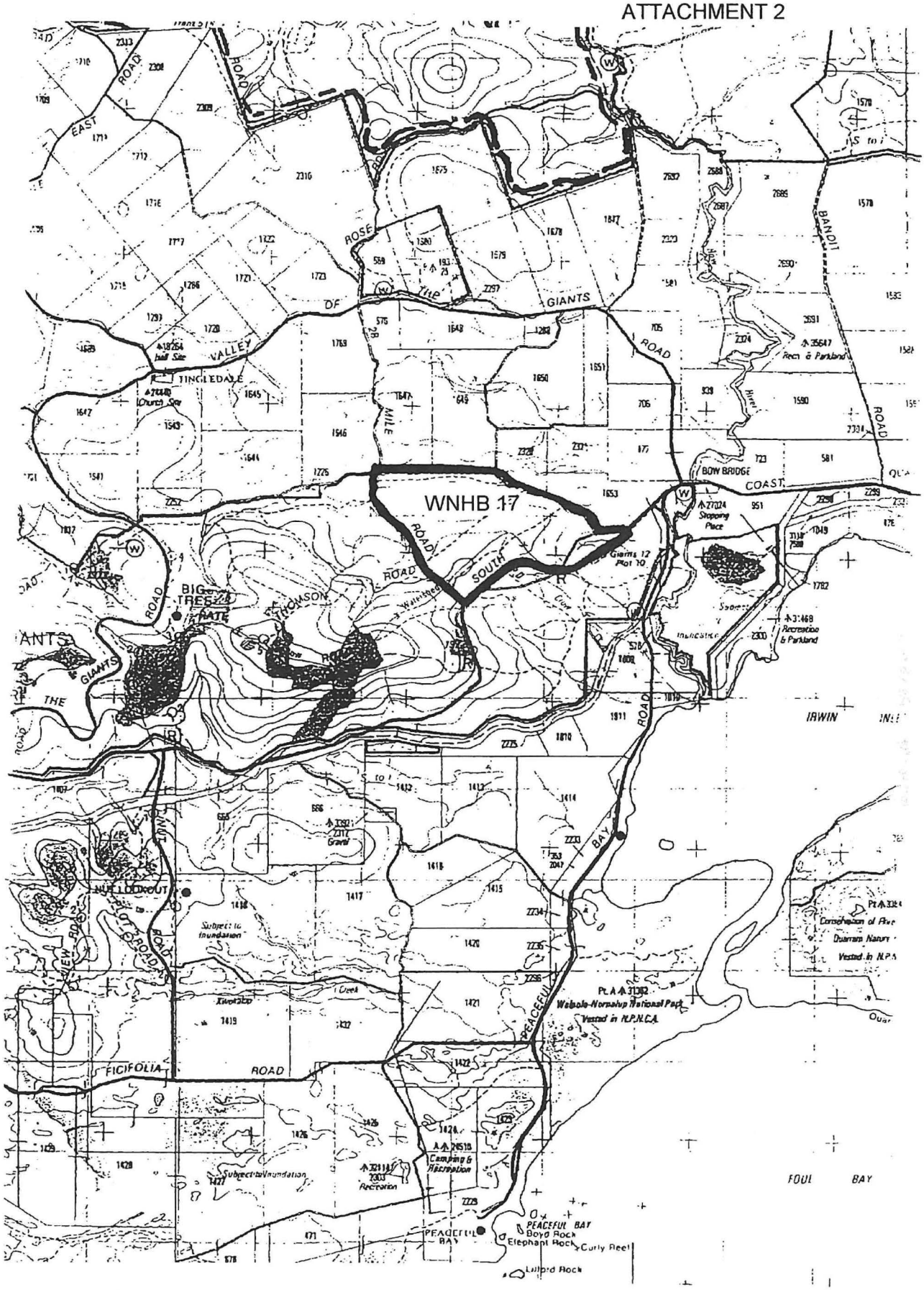
ATTACHMENT 1

FIRE MANAGEMENT

FIRE REGIMES



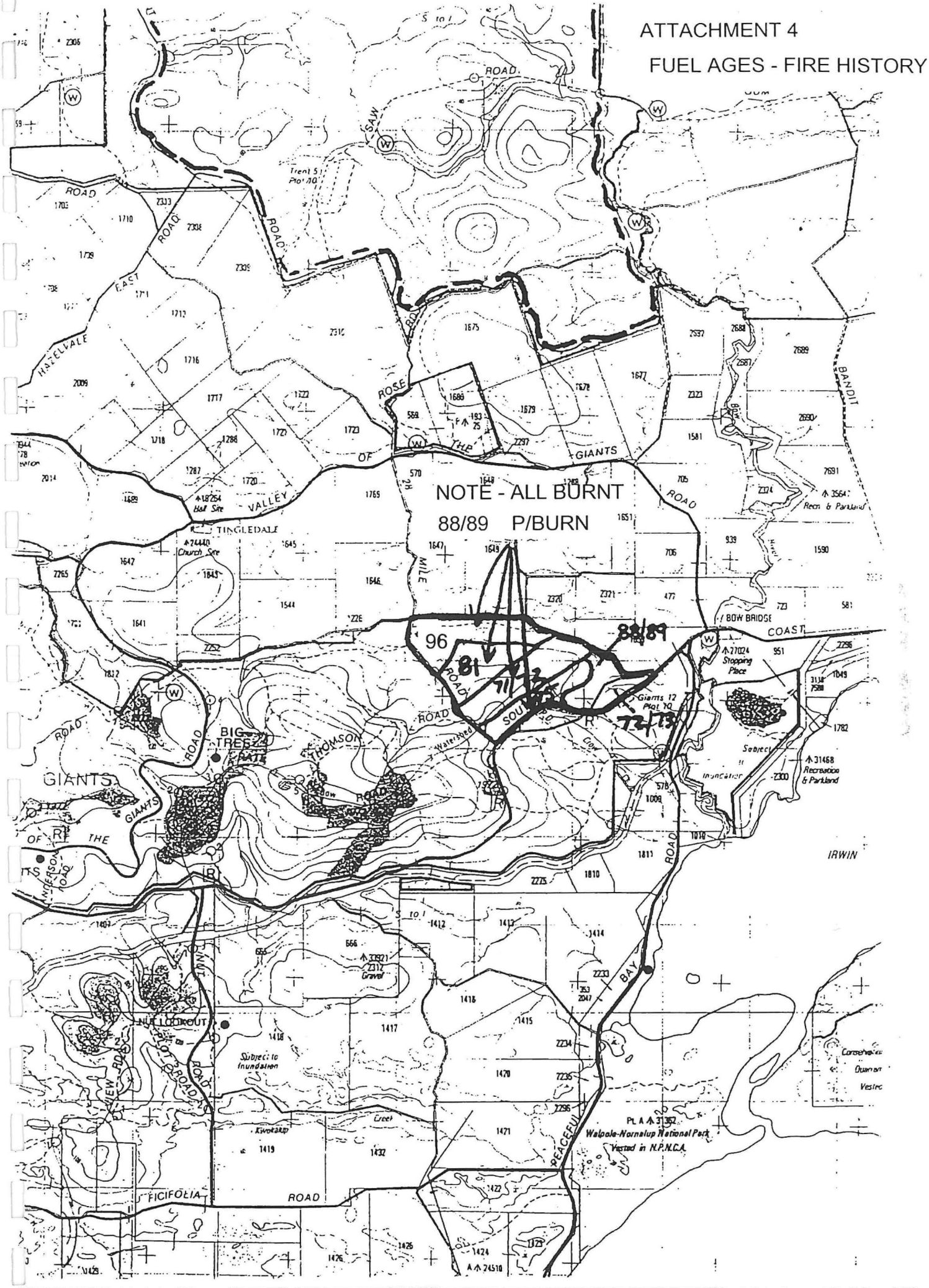
ATTACHMENT 2



WNHB17 TRIAL TINGLE BURN

ATTACHMENT 4

FUEL AGES - FIRE HISTORY



RED TINGLE BURNS (CARRYING HEAVY FUELS); CONDITIONS AND MOST LIKELY OUTCOMES

BURN OBJECTIVES : AS PER FIRE MANAGEMENT PLAN IN THE WALPOLE-NORNALUP NATIONAL PARK MANAGEMENT PLAN (1992-2002)

NO. 1 TO MAINTAIN DIVERSITY IN VEGETATION STRUCTURE AND HABITAT TYPES
NO. 2 PREVENT WILDFIRES/BURNS FROM CONSUMING MOST OR ALL OF A SINGLE VEGETATION ASSOCIATION.
ALSO: RESTRICT WILDFIRES TO SINGLE CELL (AS PER MAP)
NO. 3 MAXIMISE AGE VARIATIONS BETWEEN BURN/MANAGEMENT BLOCKS
NO. 4 PROTECT LANDSCAPES FROM SEVERE DAMAGE BY WILDFIRES AND PRESCRIBED BURNS

OUTCOMES APPLY TO SMALL (100 HA) TO MODERATE SIZED (600 HA) BLOCKS OF RED TINGLE/KARRI CARRYING DEEP, HEAVY FUEL LOADS

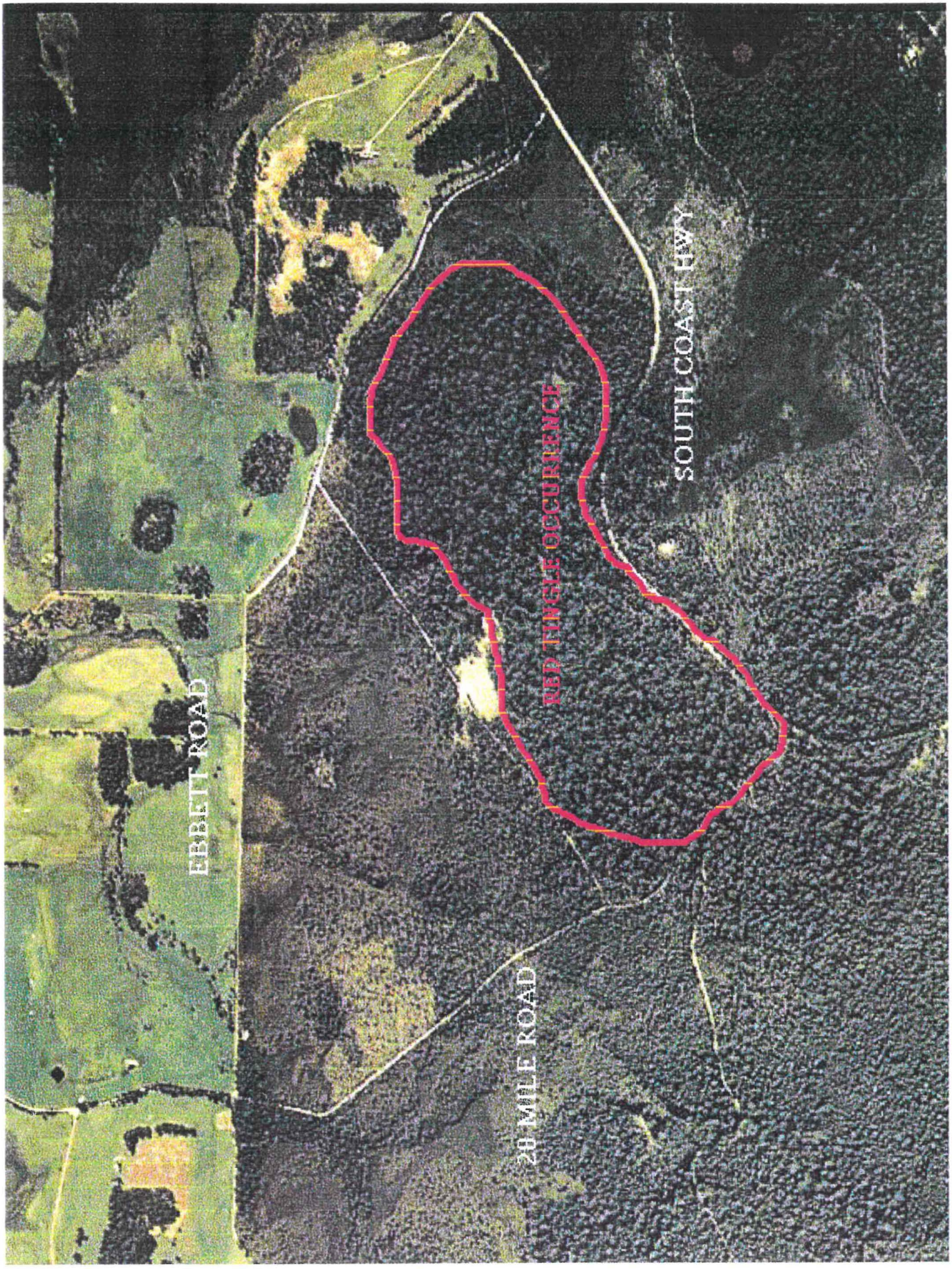
Option	Time of Year	Soil Dryness Index Range	Fuel Moisture Range %	[illegible]	Ave Flame Ht Range	Re-ignition of Patches	Escapes [illegible] Trees	Likely Burn Cover %	Prob. of Success	Likely Scorch %	Potential Tree Loss No./100 ha	Burn Objectives [illegible]
1	December (Spring)	500 - 900	SMC 10-16 * PMC 50+	0.5-1.5	0.5-1.5 m	High	Low	70-85 initially. May re-ignite later	Mod.	10-15% ↓ 20-25%	1-3 trees per 100 ha ↓ 5-8/100 ha	1,2,3,4 May lose (4) later
2	December	500-900	SMC 10-16 PMC 25-50* (*rare in December)	1.0-2.0	1.0-2.0 m	Mod.	Low	80-95%	High	15-20%	3-5 trees per 100 ha	1,2,3, partly 4
3	January & February	900 - 1400	SMC 10-16 PMC 50+	1.0-2.0	1.0-2.0 m	Low	Mod.	85-95%	High	15-25%	5-8 trees per 100 ha	1,2,3, partly 4
4	January & February	900 - 1400	SMC 10-16 PMC 25-50	1.5-2.5	1.5-2.5 m	Low	Mod.	90-98%	Mod.	20-30%	6-10 trees per 100 ha	1,2,3, partly 4
5	March/April (Autumn)	1400 +	SMC 10-16 PMC 50-80* (*rare in Autumn)	1.0-2.5	1.0-2.5 m	Low	Mod.	85-95%.	High	20-25%	5-8 trees per 100 ha	1,2,3, partly 4
6	March/April	1400 +	SMC 10-16 PMC 25-50	1.5-3.0	1.5-3.0 m	Low	Mod.	90-98%	Mod.	25-33%	6-10 trees per 100 ha	1,2,3, partly 4

As SMC is relatively constant (10-16%)
PMC is the most important fuel variable affecting burn results
All burn options conducted under very mild weather conditions (ie: Temp 15-25°C, RH >40%, Lights winds)

ATTACHMENT 5.

WNHB17

RED TINGLE OCCURRENCE



WNHB 17 FUEL ASSESSMENT RECORD 29/8/95

Sample Line	Forest Type	Total Fuel (t/ha)	Available Fuel (t/ha)
1.	Jarrah, Marri	**21.0**	**17.4**
2.	Jarrah, Marri	**14.0**	**11.8**
3.	Tingle, Karri	30.0	21.6
4.	Tingle, Karri	**21.0**	15.4

WNHB 17 FUEL ASSESSMENT RECORD for P.M.C. SAMPLE POINT LOCATIONS 4/12/96

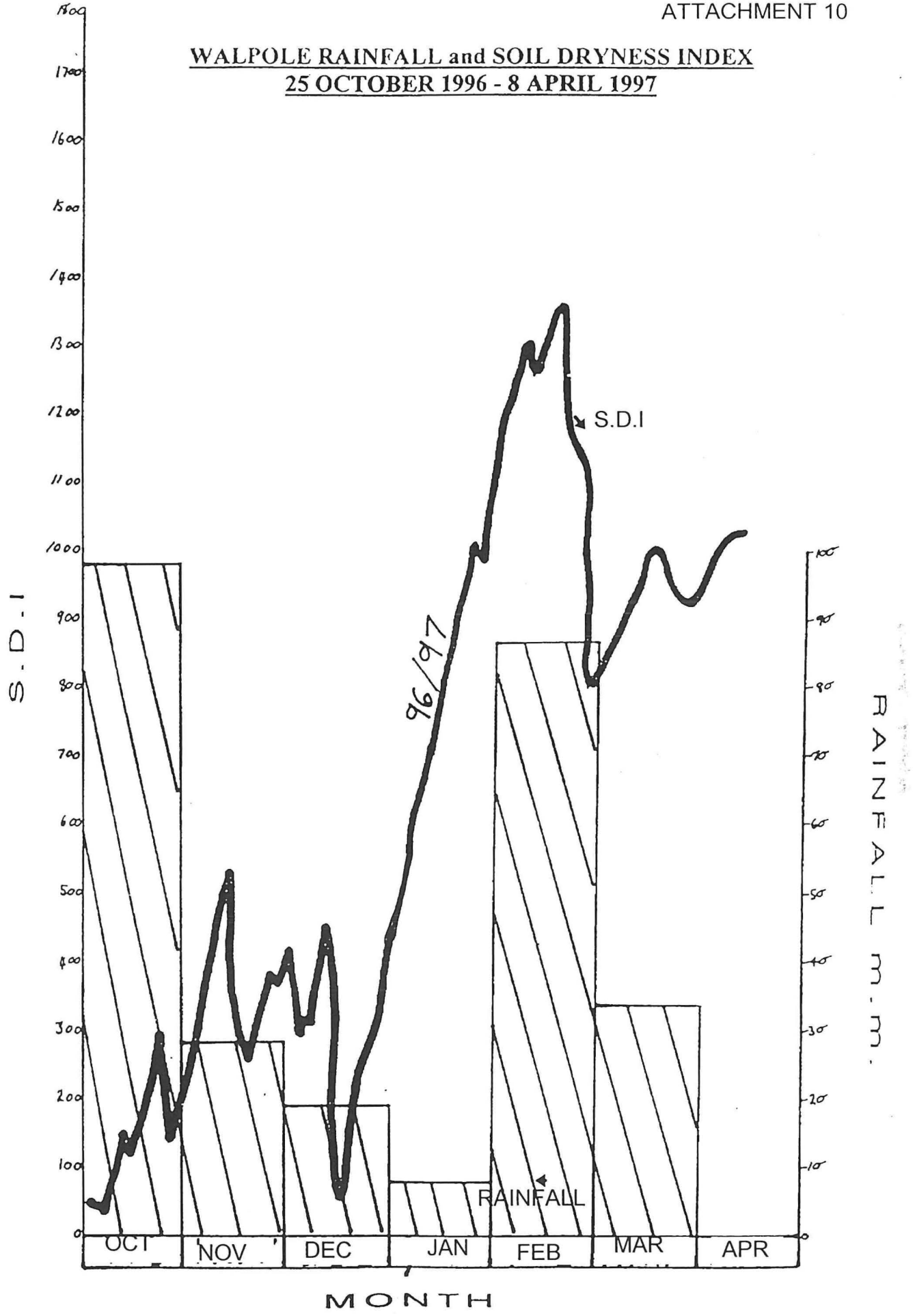
Sample Line	Forest Type	Total Fuel (t/ha)	Available Fuel (t/ha)
1.	Tingle, Karri	**52.0**	**25.6**
2.	Tingle, Karri	46.0	22.6
3.	Tingle, Karri, Marri	33.0	**14.7**
4.	Tingle, Karri	38.5	17.7
5.	Tingle, Karri	36.5	16.7

WNHB17 - 28 MILE ROAD PMC'S ACTUAL				
DATE	SAMPLE POINT	PMC	TOTAL FUEL	ACTUAL FUEL
	1	169%	52.0 +/ha	25.6 +/ha
"	2	149%	46.0 "	22.6 "
"	3	134%	33.0 "	14.7 "
"	4	121%	38.5 "	17.7 "
"	5	62%	36.5 "	16.7 "
	Average	***147%***		
11/12/96	1	119%		
"	2	139%		
"	3	55%		
"	4	84%		
"	5	59%		
	Average	***90.80%***		
18/12/96	1	130.97%		
"	2	115.49%		
"	3	105.86%		
"	4	121.61%		
"	5	66.13%		
	Average	***108%***		
24/12/96	1	123.50%		
"	2	106.88%		
"	3	88.23%		
"	4	81.12%		
"	5	108.06%		
	Average	***101.52%***		
2/1/97	1	85.80%		
"	2	40.26%		
"	3	20.07%		
"	4	42.61%		
"	5	19.65%		
	Average	***41.66%***		
8/1/97	1	62.76%		
"	2	66.72%		
"	3	35.63%		
"	4	59.76%		
"	5	30.96%		
	Average	***51.16%***		

WNHB17

P.M.C. SAMPLE LOCATIONS AND FUEL SAMPLE LOCATIONS

WALPOLE RAINFALL and SOIL DRYNESS INDEX
25 OCTOBER 1996 - 8 APRIL 1997



ATTACHMENT 11.

SAMPLING

TREE CATEGORIES

HOLLOW BUTT TREE NO.	FISSURED/DRY SIDE TREE NO.	INTACT TREE NO.
1	2	3
4	4	
6	5	
9	6	7
	9	8
	10	14
	11	
	12	
	13	
	15	
TOTAL 4	10	4

WNHB 17.28 MILE ROAD
FIRE DAMAGE
RED TINGLE MONITORING TRIAL

Tree No.	Diameter Pre Burn	Diameter Post Burn	Description of Bole Condition Pre Burn	Description of Bole Condition Post Burn	Measurement Hollow Butt Opening Pre Burn	Measurement Hollow Butt Opening Post Burn
1	2739	2739	Hollow Butt. Significant. Only external wood holding tree. Cracks and fissures in back of tree. Sever fire damage to crown, epicormic limb growth	Spar at front of hollow burnt away (see photo's). Large fissure at rear has become larger	1355	1405
2	600	600	Sub dominant dry side on S.E. face to approx 3m high. Bark enclosing over damage on sides. Dry side possible caused by fallen crown adjacent to tree	No damage from fire	470	470
3	1565	1565	Sound dominant tree - no significant bole damage. 2 burnt off limbs at approx 8m and 12m. No hollow or fissures. Full healthy crown	No damage sustained. Unburnt pocket to within 1m of N.W. side of tree.	No hollow	
4	3000	3000	Significant hollow butt which has burnt out bole to approx 20m, fissures along back of tree through to hollow. Epicormic have developed to become main crown.	Majority of original trunk has burnt off and is lying beside tree. 1 dominant epicormic leader remaining on trunk. New epicormic shoots developing on back of hollow	1350	1970
5	1850	1850	Sound tree with 1 burn fissure at base east side. Scar/damage at base of west side from fallen branch (has no charcoal on these). Epicormics on bole possibly last burn. Sparse fire damaged crown - moderate fuel around base.	No damage or effects - mild fire has caused superficial bark removal only around base to 0.5m high.	(1)5W-scar from fallen branch 190mm across bark 290mm actual width of removed bark. (2) 5E 400mm	

ATTACHMENT 12.

Tree No.	Diameter Pre Burn	Diameter Post Burn	Description of Bole Condition Pre Burn	Description of Bole Condition Post Burn	Measurement Hollow Butt Opening Pre Burn	Measurement Hollow Butt Opening Post Burn
6	1106	1106	Hollow forming on west side where log is against tree. Fissure forming at base of east side. Severely fire damaged crown. Epicormics from base to crown	Fissure SE same. Mild fire has removed leaf litter around base and between log on west side and butt. 6W - Dry side same. scorch on epicormics to 5m	(1) 6W - Dry side/hollow forming where log is lying against tree 690mm (2) 6E - Fissure 200mm across 500mm high	Same
7	887	887	Co dominant no bole damage large branch broken off SE crown. Healthy crown no epicormics. Large logs adjacent to west side	Nil effect, leaf removal only around base of tree. Some humus remains around base.	No hollows	Nil
8	2010	2010	Bole intact no butt damage. Significant fuel accumulation around Butt 1 indent on SE side with significant fuel load. Possible fissure under fuel layer-not visible. Healthy crown.	Mild fire around base - leaf litter removal only superficial bark removal 0.3m to 0.5m. Some humus remaining at base. No fissure occurred under heavy fuel layer on SE side.	No hollow	Nil
9	2120	2120	Large hollow North side only shell remaining. Fissure on West side through to hollow. Numerous burls on bole. Full crown	Mild fire around base has removed leaf litter only. Superficial bark removal to 0.5m. Some humus remains around base. Leaf litter inside hollow has not burnt. Hollow and fissure have not changed.	Main hollow 950mm between nails. Fissure West side 280mm between bark	Same
10	1240	1240	Bole- Damage and dry side on South and West sides. Crown fire damaged. Some epicormics on North side	Mild fire around base only. Superficial bark removal to 0.2m around base. Unburnt pocket within 1m of West side.	(1) East dry side 290mmx1870mm high. (2) Fissure South side base 120mm wide - dry to left side of fissure. (3) South West side 520mm acrossx2400mm high.	No change

ATTACHMENT 12.

Tree No.	Diameter Pre Burn	Diameter Post Burn	Description of Bole Condition Pre Burn	Description of Bole Condition Post Burn	Measurement Hollow Butt Opening Pre Burn	Measurement Hollow Butt Opening Post Burn
11	1045	1045	Dominant sound bole, small fissure on West side. Full crown	Fire has been quite warm through this area. Fire has run up bark to crown break. Majority of humus has been removed around base. No damage sustained.	170mm between nails	Same
12	705	705	Sub dominant dry side and hollow. Heavy fuel load between 12 and 13 where hollow is formed	Fire has removed all leaf litter between 12 and 13 dry side has lost 'leg' on North side some crown scorch.	790 dry side to 2400 high (in west) Hollow West side 240mm across 950mm high	No change in width of scarring. Possibly deeper charring
13	1180	1180	Dominant, hollow on East side adjacent to Tree 12. Bole damage free apart from hollow.	Majority of leaf litter removed around base. Some crown scorch. Superficial bark removal base.	Hollow East side 260mm across 70mm high	Same
14	590	590	Intact co dominant pile, full crown nor fire damage	No bole damage. Majority of leaf litter and humus removed around base. Full crown scorch. Superficial bark removal around base only.	No hollows	Nil
15	2140	2140	Large dominant tree, small hollow NW side. Bole undamaged apart from hollow. Full crown	Majority of leaf litter removed around base. Superficial bark removed only around base. Some scorch in lower crown branches.	1150 across by 900mm high	No change

ATTACHMENT 12.

WHNB 17 FIELD /OFFICE- OBSERVATIONS RECORD 09/01/97

SDI = 731 (HQ)
SMC = FORECAST - J - 15%
- SJ - 17%
- K - 25%
ACTUAL - SJ - 16.5%
- K - 24%
PMC = 51% (ACTUAL)

WIND STRENGTH AND DIRECTION WALPOLE (HQ)

TIME	WINDS
0700	SE 13
0900	SSE 22
1100	S 20
1200	S 17
1300	S 25
1500	S 16
1700	S 15

TEMP READINGS WALPOLE (HQ)

TIME	Dry	WET	RH
0700	17.5	14	66
1000	22.5	19.5	74
1200	25.5	20.9	64
1500	25.0	19.5	72

ON LOCATION (WNHB 17)

TIME	Dry	WET	RH	LOCATION
1215	26	22	69	JARRAH @ nw EDGE
1305	22.5	20.5	82	KARRI
1400	24	21	75	TINGLE 28 MILE RD
1500	24.5	21	72	TINGLE 28 MILE RD
1600	24.5	21	72	TINGLE 28 MILE RD
1700	23	20	75	TINGLE 28 MILE RD

WHNB 17 FIELD /OFFICE- OBSERVATIONS RECORD 10/01/97

SDI = 763 (HQ)
SMC = FORECAST - J - 13%
- SJ - 15%
- K - 23%
ACTUAL - SJ - 12%
- K - 23%

WIND STRENGTH AND DIRECTION WALPOLE (HQ)

TIME	WINDS
0700	SE 4
0900	SE 01
1100	SSE 25
1200	S 25
1300	SE 20
1500	SSE 17
1700	SSE 14

TEMP READINGS WALPOLE (HQ)

TIME	Dry	WET	RH
0700	20.5	18.5	81
1000	23.5	20.0	71
1200	27.2	22.0	61
1500	27.0	22.0	62

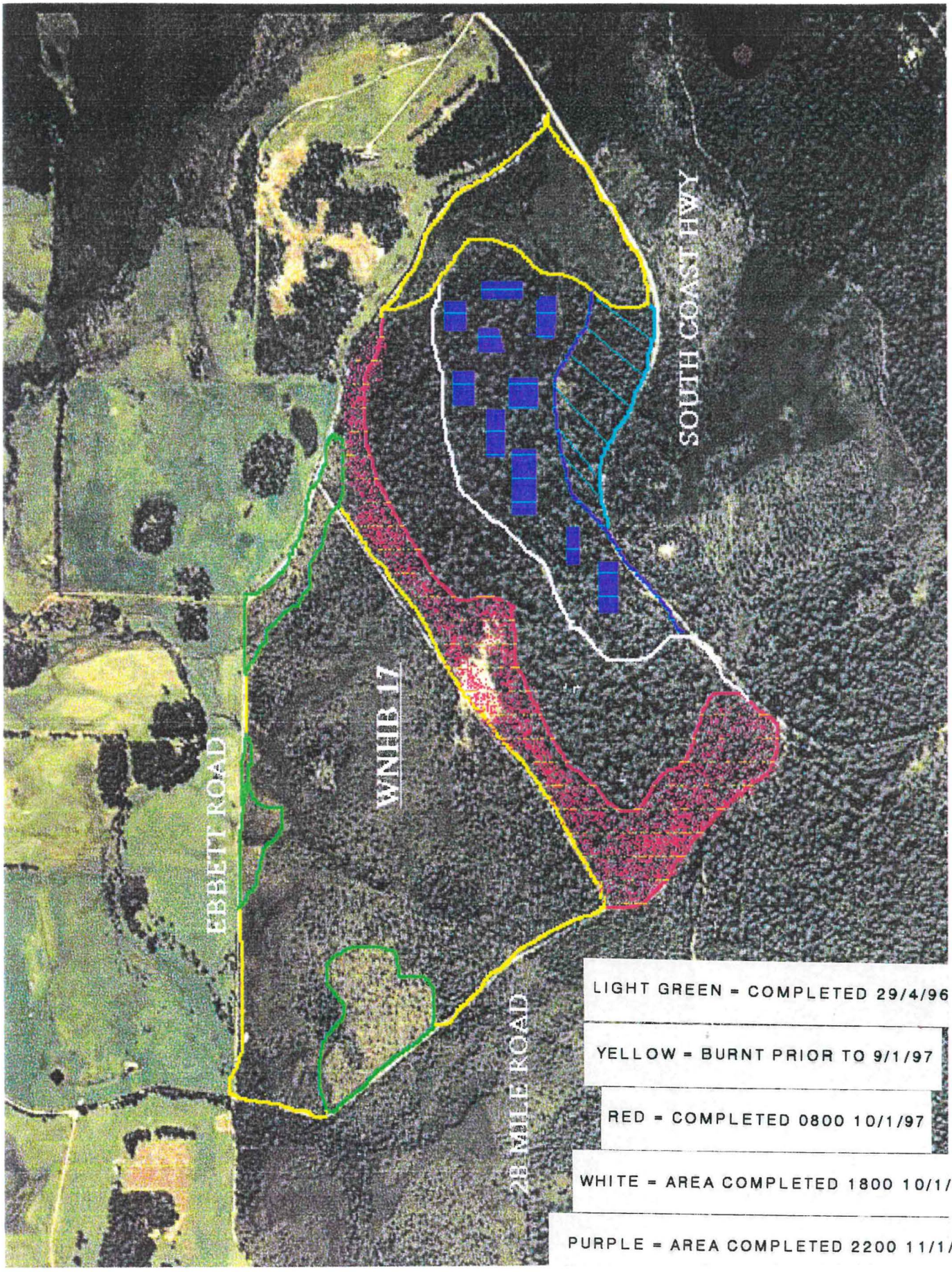
ON LOCATION (WNHB 17)

TIME	Dry	WET	RH	LOCATION
1050	26	22	69	TINGLE 28 MILE RD
1215	27	22.5	67	TINGLE 28 MILE RD
1340	26	21.5	66	TINGLE 28 MILE RD
1440	26	22	69	SOUTH WEST HIGHWAY
1530	26	21.5	66	TINGLE 28 MILE RD
1630	24	21	75	TINGLE 28 MILE RD
1700	24	21	75	TINGLE 28 MILE RD

ATTACHMENT 14

WNHB 17

BURN PROGRESS

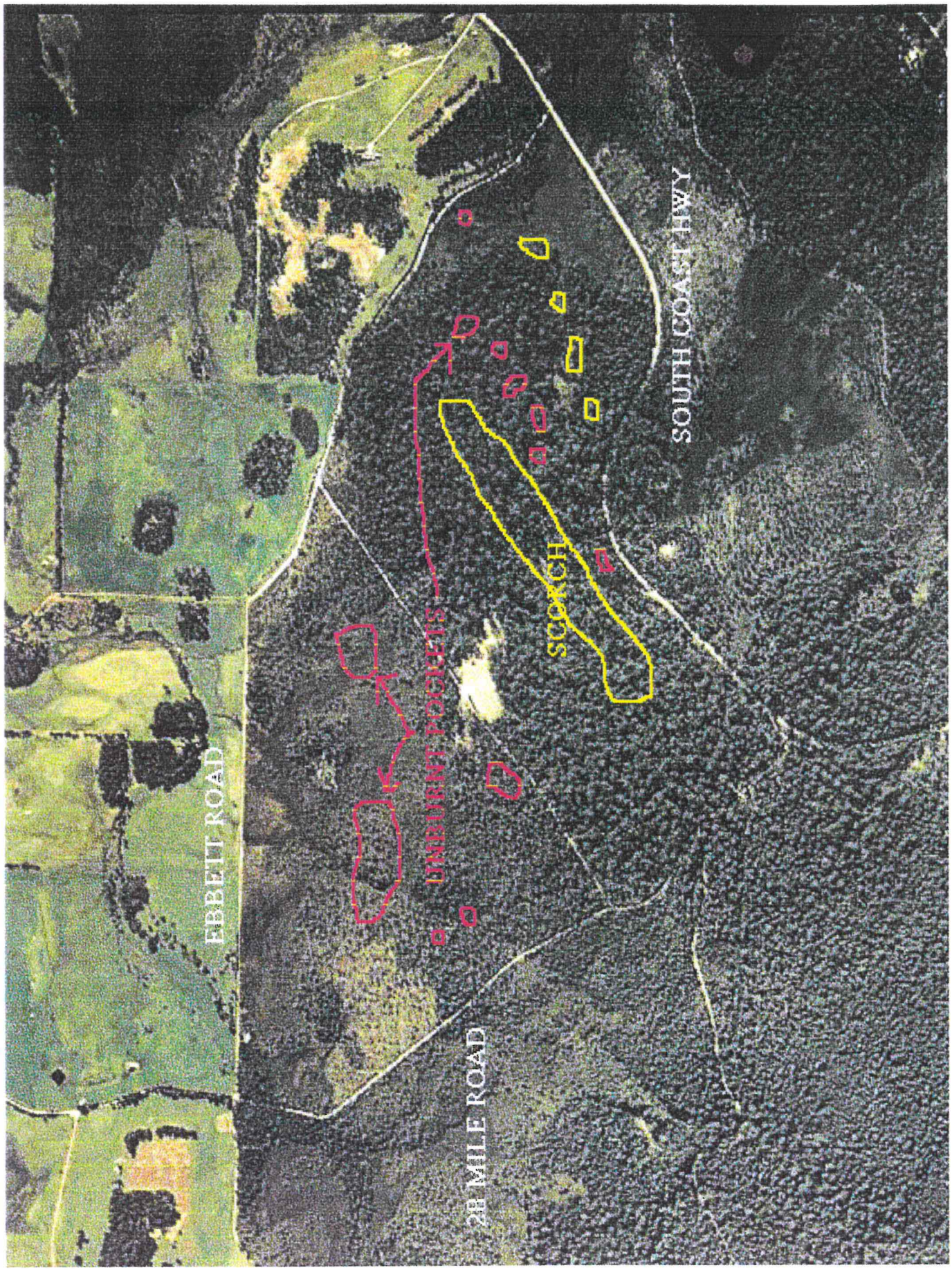


WNHB17

ATTACHMENT 15

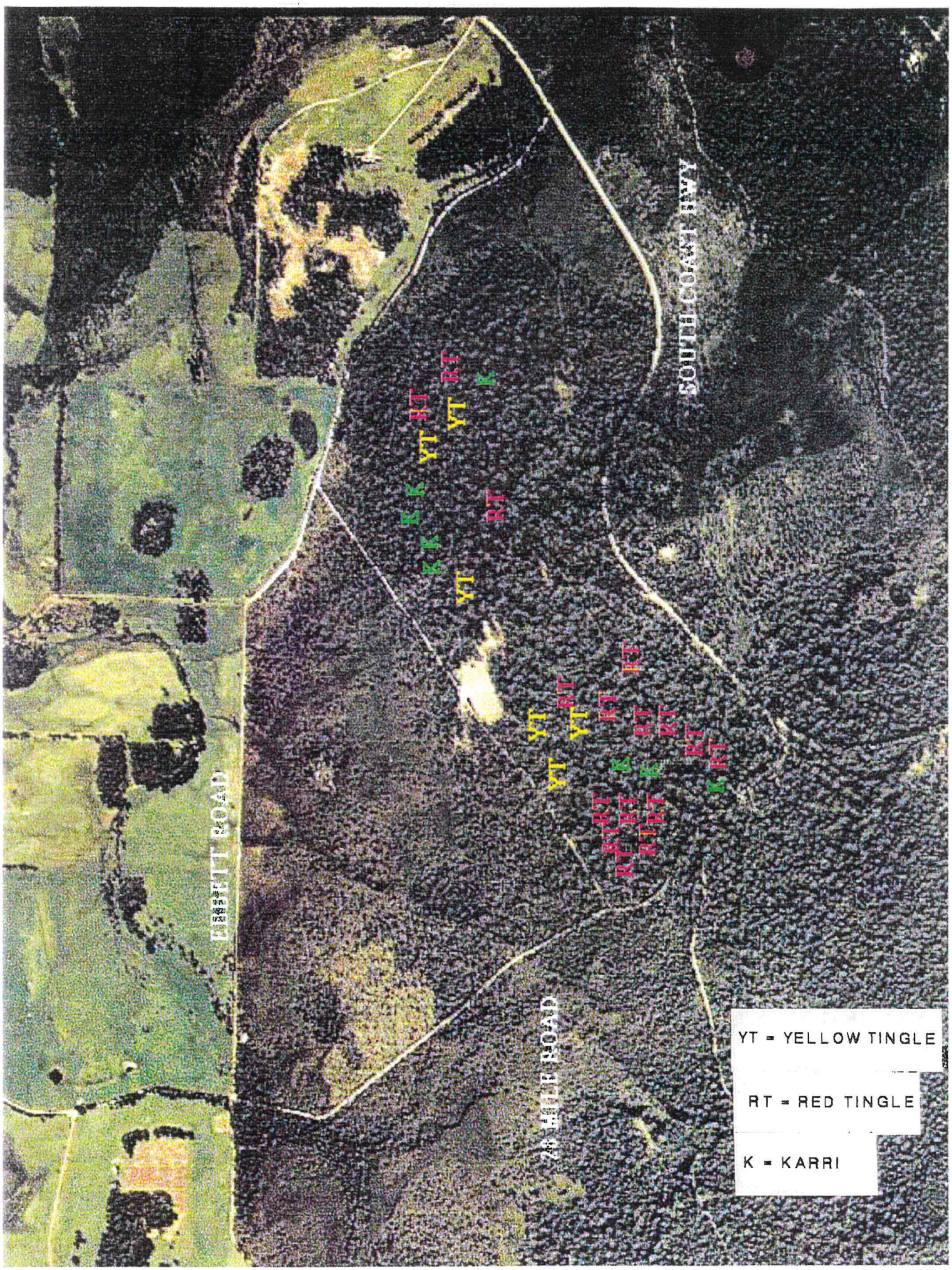
PLOT OF SCORCH

AND UNBURNT POCKETS



WNHB17

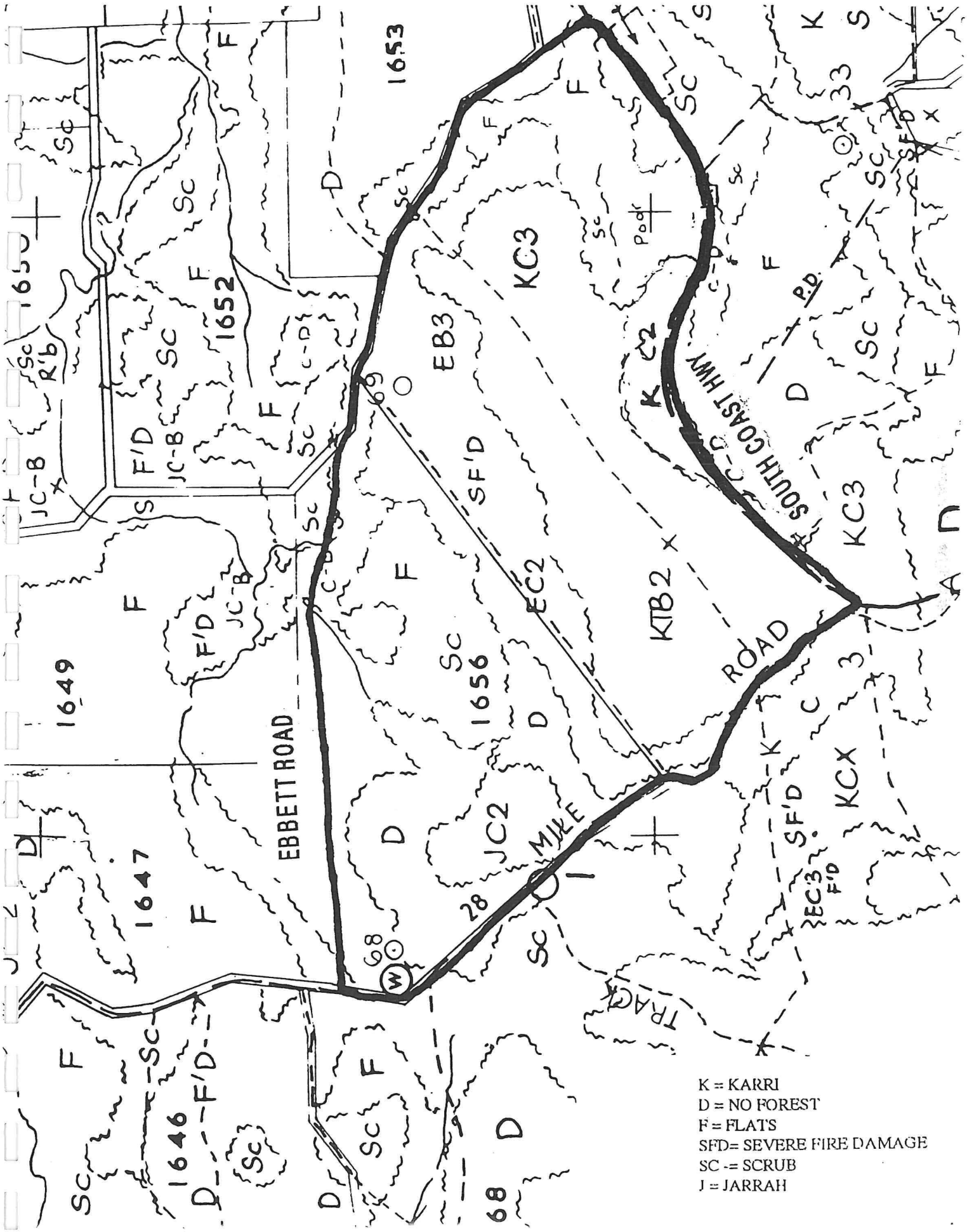
POST BURN TREE FALL



WNHB 17
VEGETATION TYPES

(Source A.P.I. 1960)

ATTACHMENT 17.



Post-fire recruitment of Red Tingle and Karri following prescribed burning

Notes prepared for Red Tingle Advisory Committee field visit to Walpole
April 1998

Lachlan McCaw,
Senior Research Scientist
CALMScience Division
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Introduction

There is ample evidence of successful regeneration of Red Tingle and Karri following high intensity wilfires such as occurred in the Walpole district in 1937 and 1951, and following timber harvesting operations in Giants block during the early 1970's. However, the extent of regeneration following less severe forms of disturbance such as prescribed fuel reduction burning has not previously been investigated.

Seedling recruitment of Red Tingle and Karri was studied in two areas of mature forest in the Walpole Nornalup National Park that were burnt in autumn 1996. This study investigated the extent of seedling regeneration following low to moderate intensity fires in Tingle/Karri forest, and the survival and growth of seedlings over the subsequent two years.

Methods

During August 1996, transects to monitor seedling emergence were established in burnt stands of Red Tingle and Karri located near Shedley Drive (WN 2), west of Walpole and near Anderson Road (HB 15) in Giants block. Two transects were established at each location, one beneath a fully stocked overstorey canopy and the other in an opening up to 50 metres across. Each transect consisted of ten quadrats of 1 m^2 area spaced at 10 m intervals. The number of seedlings of Red Tingle and Karri was recorded within each quadrat at approximately monthly intervals between August 1996 and March 1997, and then again during June 1997 and March 1998. Monitoring spanned a period of two years following fire.

Individual seedlings were marked with coloured sticks to allow detailed assessment of emergence and mortality during the course of the study. Seed bed conditions within individual quadrats were assessed according to the nature of the seedbed (mineral soil/burnt ground/fallen log) and the degree of fuel consumption. Basal area and height of overstorey and intermediate trees were also determined in a 0.1 ha plot defined by a distance 5 m either side of the transect centre line.

Care was taken to examine the distinctive features of cotyledons and juvenile leaves on each species to ensure that seedlings were correctly identified. Seed of known source was germinated and grown at the CALM Research Centre in Manjimup to confirm observations of seedling characteristics made in the field.

Results

Seedling emergence began in April and continued until October when seedling densities for Red Tingle reached a maximum. Seedlings of both species germinated on a variety of seedbeds including burnt ground, the surface of old fallen logs, and on exposed mineral soil that had been disturbed but not burnt.

Initial seedling densities varied considerably, with some quadrats containing up to 32 Red Tingle seedlings per m^2 and up to 17 Karri seedlings per m^2. Other quadrats did not contain any germinants of either species. As of October 1996, 55 per cent of quadrats contained at least one Red Tingle or Karri seedling, and 43 per cent of quadrats contained at least one Red Tingle seedling. Stocking was poorest on Transect 2 at Shedley Drive where only one quadrat contained a live seedling in October 1996. This transect was located beneath a dense stand of Red Tingle with a heavy intermediate canopy of Sheoak (*Allocasuarina decussata*). Measured basal areas were 205 $m^2\ ha^{-1}$ for Tingle and 22 $m^2\ ha^{-1}$ for Sheoak. By comparison, the other three transects had total basal areas of between 52 and 95 $m^2\ ha^{-1}$.

The number of Red Tingle seedlings declined progressively from November 1996 onwards (Figures 1 and 2). By March 1998, two years after burning, only one Red Tingle survived at Shedley Road and one at Anderson Road. Karri seedlings also declined in numbers at Anderson Road, but not to any appreciable extent at Shedley Drive.

Surviving Karri seedlings exhibited best growth on the edges of ashbeds created where logs and fallen branches had burnt away. The two fastest growing seedlings were 1.3 m and 2.3 m tall in March 1998, and appeared likely to continue growing vigorously for some time to come. The remainder of the Karri seedlings were less than 0.4 m tall and appeared unlikely to remain competitive with the increasingly dense understorey shrub layer.

The two surviving Red Tingle seedlings were both about 0.3 m tall and were not particularly vigorous.

Healthy Red Tingle seedlings were observed at the Shedley Road site on areas other than the sample quadrats during the March 1998 inspection. These were mostly on ashbed sites beneath relatively open parts of the forest canopy.

Discussion

The main points to emerge from this simple study of seedling emergence are as follows:

(a) There appears to be a store of Red Tingle and Karri seed available in the crowns of mature trees. This is supported by the observations of regeneration events following the fires in 1937 and 1951, the post-logging burns of the early 1970's and the observed seedling emergence following the two prescribed burns in autumn 1996. The magnitude of the seed crop is likely to vary cyclically from year to year, but seed appears to be present in most years.

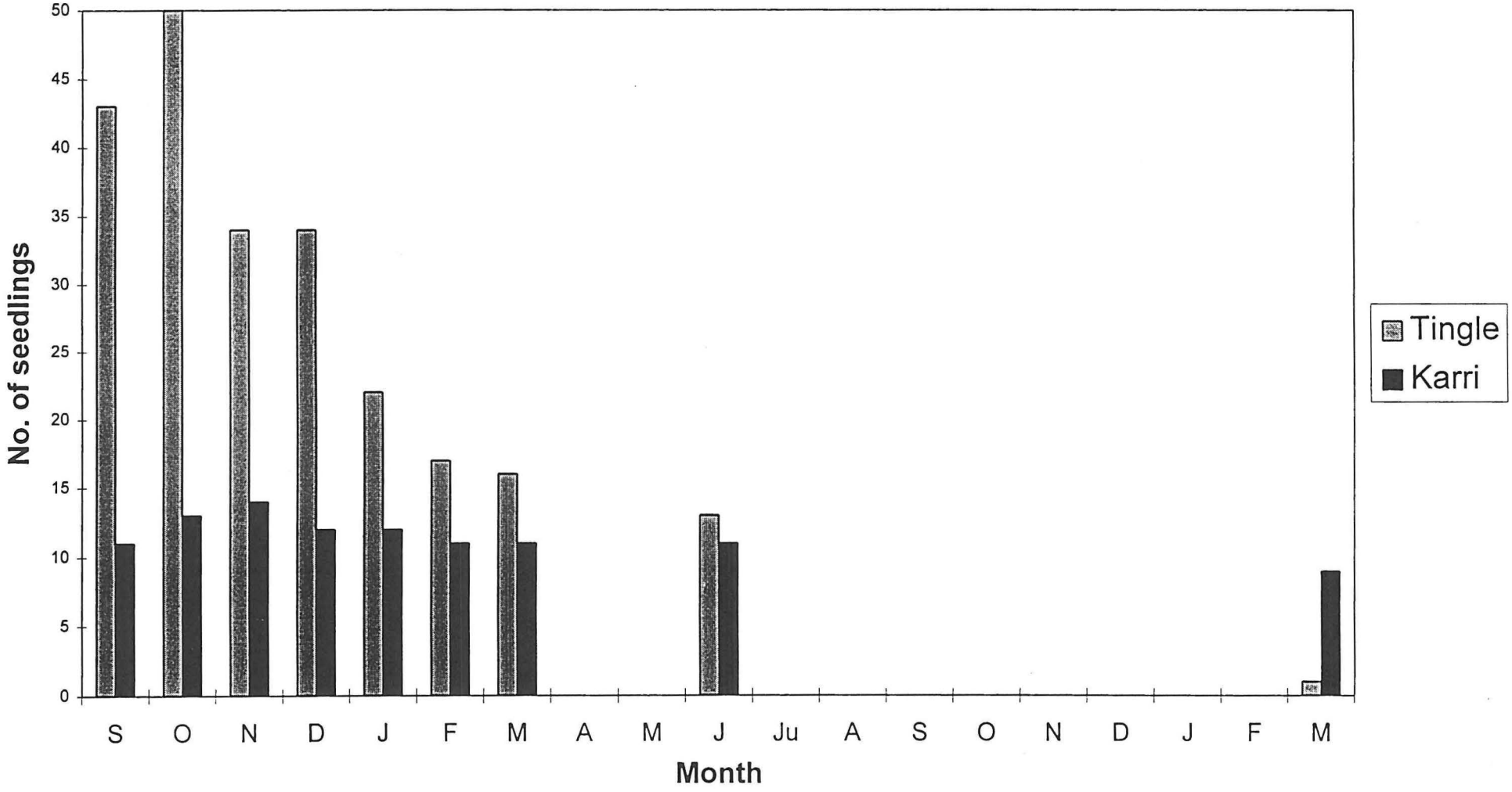
(b) Seedlings can germinate and establish on a range of seedbed types including disturbed but unburnt mineral soil, burnt litter, ashbeds and the top of fallen logs. Ashbed sites are likely to favour rapid initial growth.

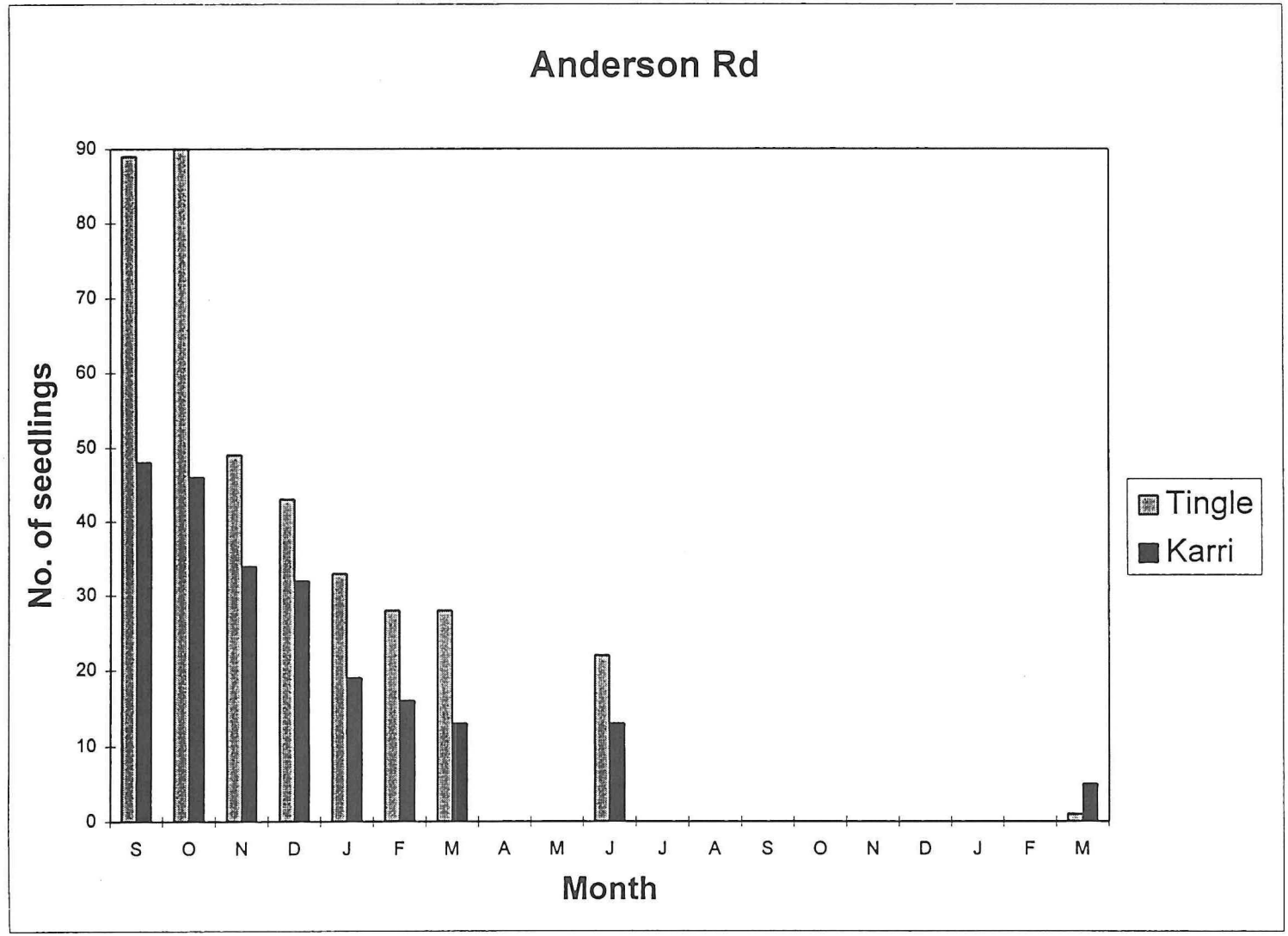
(c) There is some evidence that the presence of a heavy canopy of overstorey and intermediate trees may inhibit seedling emergence during the winter following burning. This observation is consistent with evidence from studies in tall eucalypt forests elsewhere, and is probably attributable to low light intensities and losses due to disease.

(d) Karri seedlings appeared to experience a lower percentage mortality than Red Tingle over the two years following fire. Possible reasons for this have yet to be established. This observation should be regarded as preliminary until survival assessment is replicated over another period where seasonal conditions may be different.

(e) The scarcity of established regeneration in the 1987 wildfire area and in Karri/Tingle stands subject to prescribed burning is more likely to reflect the low probability of survival of seedlings in a fully stocked stand with an intact canopy, rather than an absence of seedfall or failed seedling emergence.

Shedley Drive




Anderson Rd
No. of seedlings
90
80
70
60
50
40
30
20
10
0
S O N D J F M A M J J A S O N D J F M
Month
Tingle
Karri