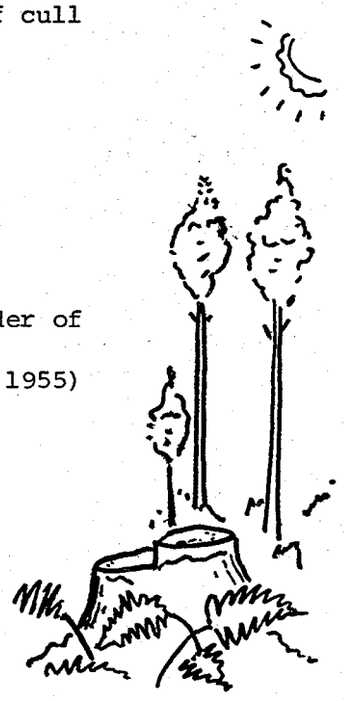
A/116

SOUTHERN JARRAH SILVICULTURE

WITH A NEW TOOL - CHIPPING

1870 - 1920	Heavy exploitive cut, virtual clear-felling in high quality sites.
1920 - 1940	Selective cutting varying from light selection to virtually clear-felling. Intensive stand development with depression labour.
1940 - 1970	Lighter selective cut, no cull removal.
1970 - 1979	Virtual clear-fell of marketable saw-logs, no cull removal.
1979	Varying treatments approaching clear felling with removal of sawlogs and chip, and varying degrees of cull removal.
1980+	??????????????



"The probable physical rotation is of the order of 800 - 1000 years."

(Jacobs, M.R. 1955)

Southern Region
22 December 1980

CONTENTS

INTRODUCTION AND PREAMBLE

With the advent of large scale and intensive jarrah logging operations within the chipwood license area, particularly in Manjimup, a potential 3121 hectares could be available for regeneration treatment during 1980/81. A summary of the coupes and areas concerned are provided in Table 1.

Trade cutting prescriptions in Southern JM forests now allows for the retention of vigorous, well formed and protectable jarrah and marri regrowth either in groups of any size, or as individual stems. Regeneration practises are subsequently aimed at maximizing stand productivity of the residual mosaic of cut and uncut forest areas, within the coupe.

Because of the heavy nature of selective cutting, specific regeneration procedures are required, which differ significantly from those practised in Northern jarrah forests.

1. LOGGING OBJECTIVES

Logging needs to satisfy the following objectives:

1.1 Environmental - preservation of soil and water values.

1.2 Silvicultural - maximise jarrah sawlog production consistent with maintaining the forest in a fully stocked, healthy and vigorous condition.

1.3 Hydrological - apply forest cutting regimes which maintain the existing hydrological balance.

1.4 Disease - apply forest cutting procedures which minimize the spread of P. cinnamomi and the impact of jarrah leaf miner.

1.5 Aesthetics - apply forest cutting procedures which minimize the visual impact of broadscale cutting within the landscape.

1.6 Socio-political - apply forest cutting procedures which optimize multiple forest landuse, consistent with social and political needs.

Forest harvesting in Southern JM stands has essentially changed from a system of control by removal to control by retention. A further addition has been the facility to integrate marri chipwood removals thus resulting in an intensity of trade cutting greatly exceeding that occurring in jarrah forests outside the Chipwood License Area.

This Marri utilization has resulted in a number of operational problems which are outlined as follows:-

2. OPERATIONAL CONSTRAINTS

2.1 Advance Burn - it is seen as desirable to advance burn all JM coupes to reduce fuels particularly in retained groups, and to improve access for treemarking staff and industry fallers. Advance burning has created an additional operational requirement for fire in the forest, which must now compete with rotational hazard reduction burning and jarrah regeneration burns, during the same period.

2.2 Dieback - identification, mapping and field demarcation will be required before advance burning takes place. Areas previously logged without adequate hygiene precautions often have infections associated with snig tracks and landings. Because of the intensive nature of trade cutting and the financial investment in jarrah regeneration works, accurate P. cinnamomi disease status must be determined. Systematic grid sampling from the ground is unlikely to identify all infections due to the fragmented occurrence of the disease, and the application of 70mm API procedures must now be considered. The use of 70mm API capacity over non-quarantined areas will conflict with other forest use priorities within Quarantined State Forest such as fuel reduction, and this matter requires urgent resolution.

2.3 Stem Retention - the application of a consistent standard for group, and particularly individual stem retention has proved difficult to implement. Selection criteria based on crown and bole characteristics, general form, vigor and protectability factors have been established, but variations in the field are still evident between and within coupes depending on the treemarkers interpretation. In addition, upper and lower size class retention values should be established to assist in the selection and/or removal process.

2.4 Industry Logging - the retention of individual stems has impeded intra-coupe movements by industry snigging machines and in some coupes has reduced log production at landings by up to 30%, e.g. Quillben 2.

2.5 Damage to Growing Stock - the elimination of all felling and snigging damage to retained individuals and groups has not always been possible.

2.6 Cull Removal - ideally, the removal of all culls should be an operational objective, but this is not possible where falling will damage retained growing stock.

2.7 Tops Disposal - at this stage, adequate tops disposal around retained stems and group edges has not been consistently carried out by the industry. It is reasonable to expect a commitment by the industry because:-

2.7.1 Retained growing stock, free of butt damage represents future sawlog and chipwood resources.

2.7.2 All subsequent jarrah production coupes will be advance burnt, thus reducing the scrub rolling component in procurement operations.

3. REGENERATION

The majority of Southern JM coupes now available for trade cutting have had a previous cutting history where selective logging for jarrah has established a predominance of sapling and pole sized marri regrowth, in groups. Jarrah is often additional to this size class, but is generally physiologically older and of poor form and vigor.

Forests with the above species and structural composition are of reduced productivity, favour the formation of a marri dominated regrowth forest, and therefore cannot meet the Departmental objective to maximize future jarrah sawlog volumes. The facility to remove marri and hopefully jarrah chipwood residues has generated the potential to convert these low productive stands into jarrah dominated forests through planned silvicultural manipulation.

The following general considerations are relevant to effective regeneration procedures in intensively cut-over Southern JM stands:-

To what extent does jarrah require overhead, side and/or root competition for active regrowth?

What effect will intensive trade cutting and regeneration preparation procedures have on lignotuber status, and other environmental factors such as P. cinnamomi spread, soil erosion and stream turbidity?

What is the regional hydrological significance of intensive trade cutting in intermediate and low rainfall forested zones?

What effect will tree and group retention have on the final stand species and structural composition, particularly where marri is the predominant tree species retained?

How is it possible to protect retained growing stock from initial slash removal fires and subsequent hazard reduction burns?

TABLE 1

SUMMARY JARRAH REGENERATION TREATMENT 1980/81

COUPE	AREA(HA)
GORDON 1	400
GORDON 2	110
GORDON 4	140
GRAPHITE 1	100
GRAPHITE 2	200
IFFLEY 3	136
LEWIN 5	470
WHEATLEY 6	510 (Part Burnt Sp. 80)
CARDAC 4	330 (Part Burnt Sp. 80)
QUILLBEN 1	310
YETICUP 7	200
YETICUP 10	215
TOTAL	3121 hectares

ITINERARY

1. MANJIMUP - Initial briefing and statement of objectives.

STOP 1. Morgans - Even aged jarrah/marri pole stand resulting from clearing for farming approx. 25 years of age.

STOP 2. Dingup - Stay in vehicles -
Even aged blackbutt and jarrah stand resulting from clear-felling early this century.

STOP 3. Quillben - Clear felling of marketable trees for sawlogs and woodchips commenced 1978/79. Not yet burnt. Varying degrees of retention during scrub rolling, including coppicing of culls, retention of some future crop trees. Note comparatively low amounts of debris on the ground, and no scrub rolling done in gully situations.

STOP 4. Lewin 5 - Cut for sawlog and chip 1979, culls remain not burnt yet.

Additional removal of marri and jarrah to 2.1m length, 150mm top diam. on trial basis.

STOP 5. Graphite 1 - Cut for sawlog and chip with subsequent logging of jarrah chipwood.

STOP 6. Iffley 3 - Selectively cut for sawlog 1951 - 1970 with resultant regrowth. Current trade cut leaves retained groups and individuals.

STOP 7. Coronation Rd. Trial - Experimental research coupe 40 hect. felled for sawlogs only 1968/69. Burnt 1969/70. Four treatments;

1. Burn log debris plant to exotics.
2. Complete scrub roll.
3. Leave jarrah seed trees.
4. Leave marri seed trees. Fairly detailed records kept (see Research note).

STOP 8. Gordon 4 - Stay in vehicles -
Virgin forest. Clear felled for sawlogs and chip. Scrub rolled.

STOP 9. Gordon 3 - Varying treatments in progress.

1. Group selection, 30% and 40% of the canopy left intact by selecting sub-dominant jarrah trees. Marri is also being taken if it does not create a 'hole'.
2. Tree marking for retention before cutting.
3. Clear felled and scrub rolled.

Along the Way - Note the results of different intensities of selection cutting in the past. An uneven aged forest has developed varying widely with respect to density and distribution of young regrowth and poles. These forests create difficulties with respect to the second cut.

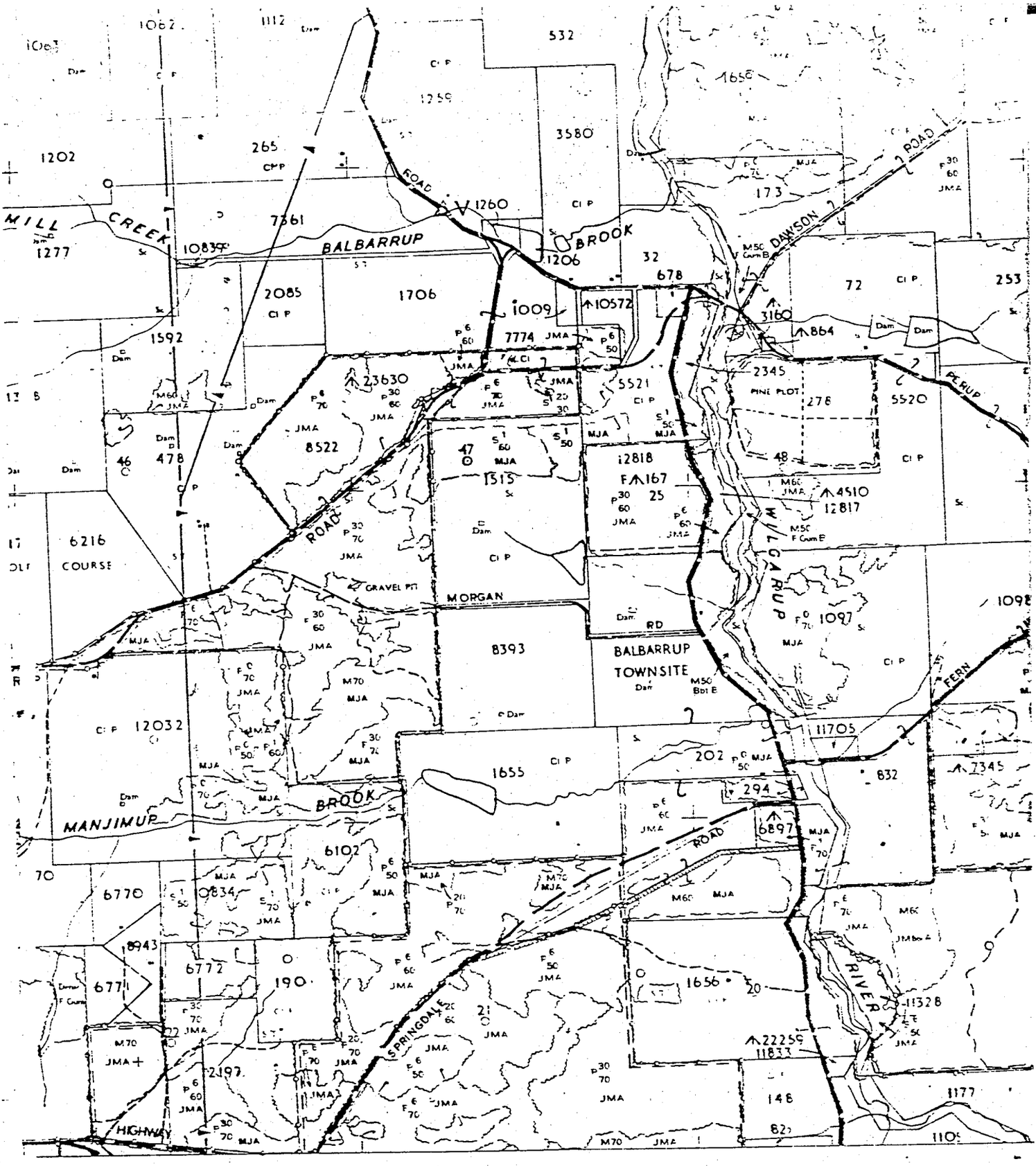
TOUR DETAILS

STOP 1. MORGANS

Even aged Marri-Jarrah pole stand resulting from clearing for farming approximately 25 years ago. Marri has now overtopped the Jarrah, indicating that on similar sites a thinning to favour Jarrah should take place about age 15. The farm is good. The grazing regime is not known but it is recognised that cattle prefer Jarrah to Marri for browsing. This could account for at least part of the Marri dominance.

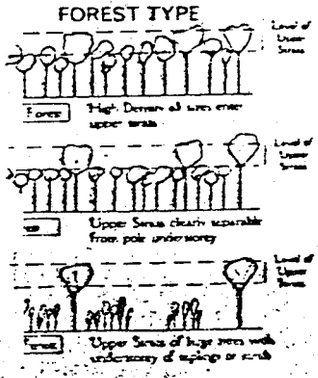
STOP 2. DINGUP

Remain in vehicles and view Blackbutt in gully on left-hand side.



FOREST ASSESSMENT

FOREST TYPE



UPPER STRATA

Percentage Crown Cover

JARRAH		KARRI	
0	1 - 5	1 - 4	5 - 9
6 - 19	20 - 29	10 - 14	15 - 19
30 - 39	40 +	20 - 24	25 - 29
		30 - 34	35 - 39
			40 +

20=% Upper Strata

80=% Total Density

M type —total density only

A.P.I. TYPE MAP

FORESTS DEPA

METRIC

STOP 10 Wheatley 6 - Clear fell for sawlogs and chip 1978/79. Previously group selection forest. Varying retention of individual trees and groups. Other treatments include windrowing and heaping of debris. Experimental spring regeneration burns.

Note high quantity of log debris on the ground.

STOP 11 Yornup - 1920's regrowth with tops disposal and cull ring barking.

STOP 3. QUILLBEN 1 (305ha)

3.1 Description of the Area

3.1.1 Before current logging, the area was selectively cut for jarrah sawlogs, between 1941 and 1950. Recent trade cutting was aimed at the removal of all jarrah sawlog and marri chipwood, with average volume productions of 44 and 74 cu.m/ha, respectively.
Residual growing stock comprised non-merchantable jarrah and marri stems, including the potential jarrah chipwood component.

A streamline in the southwest corner of the coupe was reserved from cutting and declared a "Special Care Zone", due to steep slopes and possible environmental degradation, (stream feeds farmers dam).

3.1.2 Regeneration preparation comprised a number of treatments, which are summarized on Plan 1. Generally, the coupe was subjected to a minimal scrub rolling and tree pushing treatment, which was directed at culls and stags, greater than 450mm D.B.H.

3.2 Production Objectives have been achieved consistent with existing markets. However, a considerable proportion of jarrah chipwood remains not utilized, predominantly in standing form.

Cutting has maintained silvicultural, soil conservation, and multiple landuse objectives and has minimized the spread of P. cinnamomi. However hydrological, jarrah leaf miner and aesthetic considerations were not predominant factors during the procurement phase.

3.3 Regeneration Operations were aimed at the production of a fully stocked and protected jarrah dominant regrowth forest.

Regeneration preparation in Quillben 1 has compared a range of treatments from total push down to the pushing of culls and stags only exceeding 450mm D.B.H. - see Plan 1. In addition a small manual cull felling trial was installed to evaluate the contribution to the new crop of regrowth coppice from small diameter stumps. The eastern streamline received no preparatory treatment for hydrological reasons, due to the advanced nature of regrowth present.

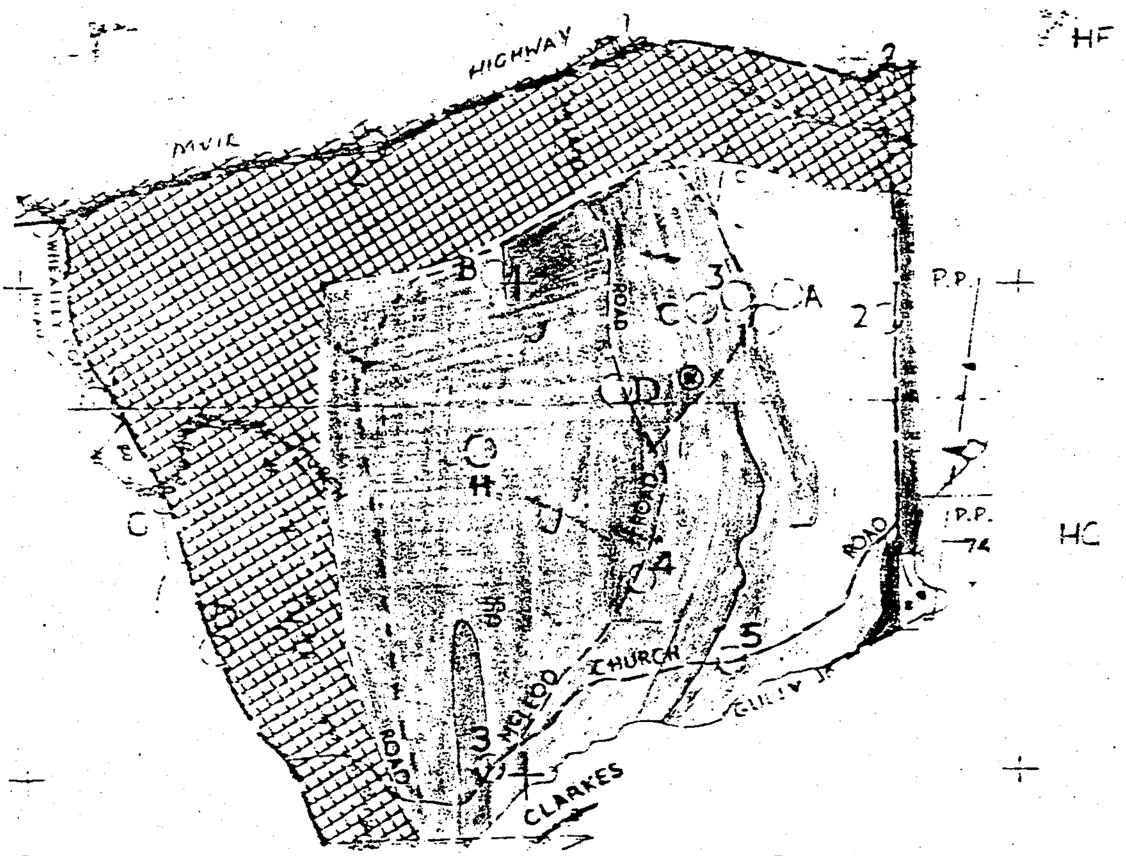
QUILLBEN BLOCK - coupe 1

SYMBOLS USED

J - jarrah
K - karri
S - summer logging
W - winter logging
C/F - clear fallen
STS - seed trees standing
REGEN - regeneration
G/S - group selection cut
M - marri
-x—x- boundary between S & W
-•—•- boundary between S.M.P.'s
N.F - non forest
C - cleared
K.S.T - karri seed trees
stream reserve
amenity reserve
D/B - dieback
P.P - private property
P - pine plot

78 79

PLAN I



MANUAL CULL FELLED. RETAINED 25 S.P.HA.

PUSH CULL STEMS > 450mm D.B.L. & STAGS ≥ 450mm D.B.L.

NO SCRUB ROLLING OR TREE PUSHING.

TOTAL SCRUB ROLL & TREE PUSH.

RETAIN CROP TREES.

40 METRES PUSHED IN EDGE.

N

MANJIMUP SHIRE

REF. HG 79

STOP 4. LEWIN 5 (Jarrah/Marri chipwood logging trial)

4.1 Description of the Area

Previous Cutting

Cutover by Bunnings Deanmill winter, 1979, for Jarrah sawlog and Marri chipwood to 3.4m and 230mm crown.

Soils

Laterite and yellow clay loam.
The area was not well drained and water lay on the surface in places during the trial.

4.2 Trial Objectives

1. To obtain volume data for Marri and Jarrah chipwood within a number of log size classes down to 2.1m length and 150mm crown diameter.

2. To study two logging systems:

2.1 Forwarder extraction and loading

2.2 Grapple skidder extraction and wheel loader loading.

3. To obtain more information on debarking of jarrah logs for preparation of a log specification.

4. To determine the effect of utilization of this material on regeneration burn intensity and related silvicultural effects; such as the survival and development of lignotuberous advance growth.

5. To determine the effect of utilization of this material on potential butt damage to future crop trees.

4.3 Trial Method

Two fallers cut logs on day wages

PLOT 1 2.73 ha

FORWARDER KOCKUM (PINE HAULIERS)

PLOT 2 2.19 ha

GRAPPLE SKIDDER J.D. 540 (GANDYS)

LOADER CAT 966 (W.A.C.A.P.)

The trial was conducted in the first week of September in mainly fine conditions.

4.4 Trial Results

VOLUMES (See Detailed Charts also)

PLOT 1	MARRI	12.9 T	10.5 m^3/ha
FORWARDER	JARRAH	83.4 T	68.4 m^3/ha
	TOTAL		78.9 m^3/ha
PLOT 2	MARRI	11.4 T	9.3 m^3/ha
SKIDDER	JARRAH	72.6 T	59.5 m^3/ha
	TOTAL		68.8 m^3/ha

COSTS

PLOT 1	Felling and Cutting	$ 1.98/T
FORWARDER	Extraction and Loading	$ 6.65/T
	TOTAL	$ 8.63/T
PLOT 2	Felling and Cutting	$ 1.15/T
SKIDDER	Extraction	$ 5.26/T
	Loading	$ 3.70/T
		$ 10.11/T

PRODUCTION RATES (EXTRACTION)

PLOT 1 (FORWARDER)	14.2 TONNES PER HOUR
PLOT 2 (SKIDDER)	6.4 TONNES PER HOUR

DETAILED VOLUME INFORMATION

PLOT 1 (2.73ha) FORWARDER

TRIP NO. & DOCKET NO.	JARRAH>3.4 WITH CROWN DIA. 230mm	JARRAH>3.4 WITH CROWN DIA. 150mm	JARRAH>2.1 WITH CROWN DIA. 230mm	MARRI>3.4 WITH CROWN DIA. 230mm	MARRI>3.4 WITH CROWN DIA. 150mm	MARRI>2.1 WITH CROWN DIA. 230mm	MARRI>2.1 WITH CROWN DIA. 150mm
TOTAL	136.6	69.9	21.2	3.5	29.0	2.6	
TONNES PER HECTARE ÷ 2.73	50.0	25.6	7.8	1.3	10.6	1.0	
M³ PER HA	41	21	6.4	1.0	8.7	0.8	

PLOT 2 (2.19ha) SKIDDER

TRIP NO. & DOCKET NO.	JARRAH>3.4 WITH CROWN DIA. 230mm	JARRAH>3.4 WITH CROWN DIA. 150mm	JARRAH>2.1 WITH CROWN DIA. 230mm	MARRI>3.4 WITH CROWN DIA. 230mm	MARRI>3.4 WITH CROWN DIA. 150mm	MARRI>2.1 WITH CROWN DIA. 230mm	MARRI>2.1 WITH CROWN DIA. 150mm
TOTAL	81.4	23.0	26.3	4.6	14.4	2.2	
TONNES PER HECTARE ÷ 2.19	37.2	10.5	12.0	2.1	6.6	1.0	
M³ PER HA	30.5	8.6	9.8	1.7	5.4	0.8	

AVERAGE OF BOTH PLOTS	218.0	92.9	47.5	8.1	43.4	4.8	
TONNES PER HECTARE	44.0	19.0	9.6	1.6	8.8	1.0	
M³ PER HA	36	15.5	7.8	1.3	7.2	0.8	

STOP 5. GRAPHITE 1 (Jarrah Chipwood Logging)

5.1 Description of the Area

Initially cut April/May, 1980 for Marri Chipwood only.

Yield 73m^3/ha

Partially cutover (50ha) August/September, 1980, for Jarrah Sawlog and Jarrah Chipwood (3.4m and 230mm crown)

Yield 59.6 m^3/ha sawlog
17 m^3/ha chipwood

A significant volume of Jarrah Chipwood in this coupe was not up to specification, due to charcoal contamination from past fires.

5.2 Production Objectives

When the chipwood market was buoyant and W.A.C.A.P. had secured a market for Jarrah chips they requested 12,000 tonnes of Jarrah logs for chipping at Diamond. This resource was provided from:

1. salvage on current landings.
2. scrounging reject logs on completed dumps in Wheatley 6 and Lewin 5, and
3. an integrated operation in Iffley 3. When Iffley 3 was suspended because of dieback hygiene Graphite 1 was substituted as the integrated coupe. Despite the loss of the Jarrah market Graphite 1 will be logged to completion for Jarrah chipwood as a demonstration area.

STOP 6. IFFLEY 3 (410ha)

6.1 Description of the Area

Selectively cut for jarrah sawlogs immediately south of Dickson Tower Road between 1951 and 1960. The remaining forest within the coupe was selectively cut for jarrah sawlogs between 1961 and 1970.

The resultant forest is now uneven-aged comprising the residual mature stand, together with groups of marri, jarrah regrowth in the sapling size class. In addition, the stand includes a small number of pole sized jarrah stems, possibly resulting from a very light selective cut 20 - 30 years ago.

6.2 Production Objectives

Current trade cutting has aimed at group and individual stem retention, followed by clear-falling for jarrah sawlogs and chipwood of all remaining stems. Retention criteria are based on form, vigor, and protectability considerations, but is open to subjective judgement resulting in a degree of variability.

Groups may be of any size, and no falling is permitted within the retained area. Individually retained stems must remain free of falling damage, but may be removed under tree marker direction if their retention will inhibit other falling operations.

In general, all trade cutting objectives have been achieved.

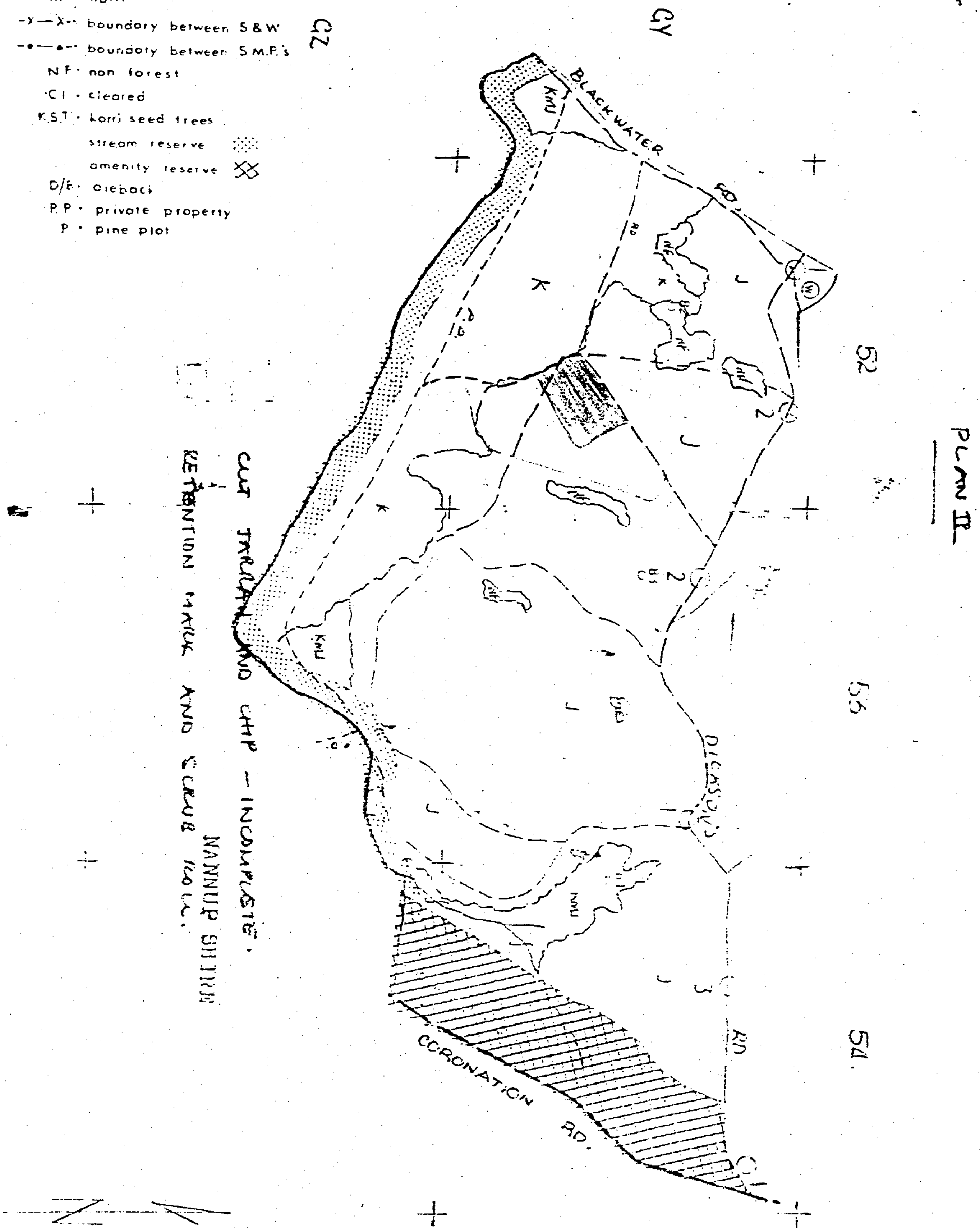
6.3 Regeneration Operations

Regeneration preparation was carried out during June, 1980. It's aim was to scrub roll and tree push all non-retained stems, followed by tops disposal adjacent to retained groups and individuals. Additional stems worthy of retention remained accidentally after logging, and these were included during the preparatory phases.
Production rates of 0.75 hours/ha at a cost of $23.25 per ha were achieved.

IFFLEY BLOCK - coupe 3

SYMBOLS USED

S · summer logging
W · winter logging
C/F · clear fallen
S.T.S · seed trees standing
REGEN · regeneration
G/S · group selection cut
M · marri
-x—x- · boundary between S & W
-•—•- · boundary between S.M.P.'s
N.F · non forest
C.I · cleared
K.S.T · karri seed trees
stream reserve
amenity reserve
D/B · dieback
P.P · private property
P · pine plot



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SURVEY / INVENTORY DATES: Oct/Nov. [illegible]

STOP 7. CORONATION ROAD JARRAH/MARRI AND CLEAR FELLING TRIAL

7.1 Description of the Area

Five - treatment unreplicated design with plots of 5ha each.

Treatments: Virgin (untreated control)
Clear felled, retain jarrah seed trees
Clear felled, retain marri seed trees
Clear felled, retain seed trees of both sp.
Clear felled, plant exotics

The area was logged in 1969/70, jarrah sawlogs removed, marri felled and left at stump. Regen. burn mid - Dec. 1970.

7.2 Regeneration

In all cases regeneration from the existing source of lignotubers and saplings was sufficient to satisfy the minimum level of stocking required.

The numbers of seedlings which germinated and developed reflected the seed tree retention in terms of numbers and species. However, seedlings do not contribute substantially to the composition of the present stand. The retention of seed trees therefore does not alter the species composition of the next crop.

Coppice comprises a large proportion of the regrowth. It does not appear to significantly influence the stocking levels of the other forms of regeneration but there is some indication of a reduction in the mean height of seedlings, advance growth and saplings in close proximity to coppice stems.

There is no indication of marri dominance, in terms of numbers of stems of regeneration, on any of the plots. The relative proportions of jarrah and marri regeneration in the pre-logged stand varied considerably but by and large both species occurred in roughly equal proportions.

STOP 8. GORDON 4 (135 ha)

8.1 Description of the Area

Virgin jarrah, marri stand which was clear felled for jarrah sawlogs and chipwood between 1979 and 1980. Average values removed were 75 cu.m/ha for jarrah sawlogs, and 154 cu.m/ha for chipwood. A 10 hectare karri intrusion on the western boundary yielded 43 cu.m/ha in sawlogs.

The residual stand, after cutting comprised stags, overmature,defective culls, with a small component of non-merchantable growing stock, within smaller size classes.

8.2 Regeneration

Regeneration preparation commenced in 1980, and was aimed at the retention of growing stock which was considered to have a future sawlog potential, and all other stems were tree-pushed. Because of the virgin nature of the stand, and the fact that retention marking was not carried out before trade cutting, only a small component of growing stock with a genuine sawlog potential remains.

Trade cutting at Grodon 4 has satisfied silvicultural, hydrological, environmental, multiple landuse and disease risk objectives. Although it has guaranteed the production of a fully stocked regrowth stand, species composition is in doubt. Aesthetic objectives have not been fully considered.

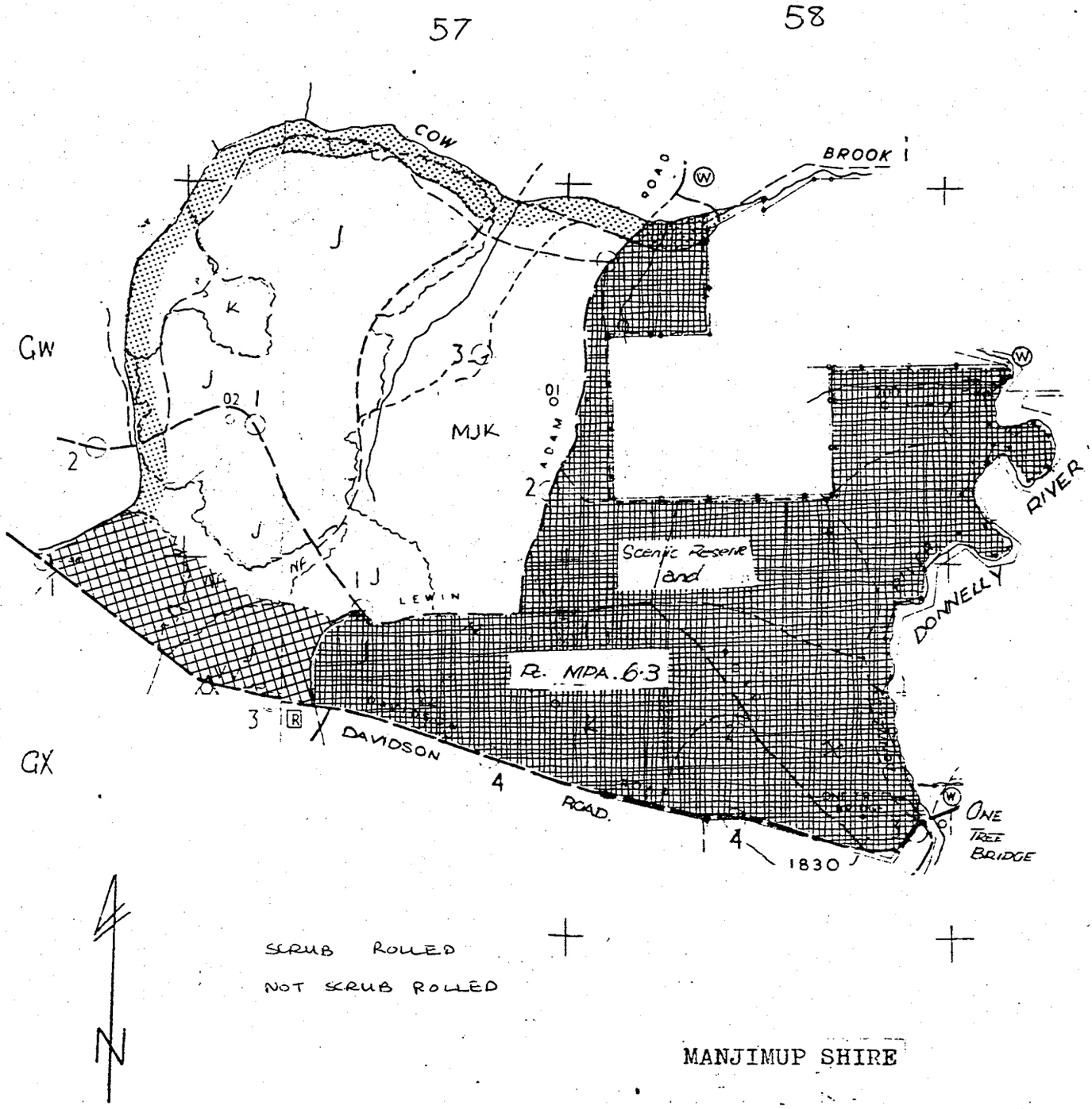
Regeneration treatment has optimized stem retention remaining after logging. Note that selection criteria are rather variable with some stems having a doubtful sawlog potential.

Production rates of 0.5 hours/ha at a cost of $15.50, were achieved.

GORDON BLOCK - coupe 4

SYMBOLS USED:

J - jarrah
K - karri
S - summer logging
W - winter logging
C/F - clear fallen
STS - seed trees standing
REGEN - regeneration
G/S - group selection cu
-X—X- boundary between S & W
-•—•- boundary between S.M.P.'s
N.F. - non forest
Cl - cleared
K.S.T. - karri seed trees
stream reserve
amenity reserve
D/B - dieback
P.P. - private property
P - pine plot



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~~PHOTO~~/INVENTORY DATE: April/May 1977.

STOP 9. GORDON 3 (Alternative Jarrah Prescription Trials)
Implemented November/December, 1980

9.1 Virgin Stand

9.1.1 Non-Regeneration Cut

TREATMENT 1

Prescription:

Single tree selection for removal.

Aim to retain 40% + canopy cover which implies less than one third canopy removal. Priority for removal is decadent or damaged sawlog followed by chipwood understorey.

Results:

Volume removed $18m^3$/ha sawlog
$34m^3$/ha chipwood

Residual Basal Area $30m^2$/ha

(Basal Area before cutting $44m^2$/ha)

Comments:

1. The aim of this treatment was to create so few gaps that regeneration released would be insignificant when the following regeneration cut was effected.

2. This area took 4 officer hours to treemark and approximately the same time to fall by the Industry.

3. Treemarking to a canopy retention is very difficult. A relationship between B.A., and Canopy Cover may exist, but variation in crown development requires selection according to crown.

4. Although the regeneration task would be reduced, the staff time to control the operation would be more than doubled.

TREATMENT 2

Prescription:

Single tree selection for removal.

Aim to retain 30% canopy cover.

Priority for removal is sawlog followed by chipwood.

Results:

Volume removed $36.5m^3$ sawlog
$43m^3$ chipwood

Residual Basal Area $26m^2$/ha

(Basal Area before cutting $44m^2$/ha)

Comments:

1. Gaps created are obviously greater in number and size than Treatment 1.

9.2 Cut-Over Stand

9.2.1 Group Selection Regeneration Cut

TREATMENT 3

Prescription:

Select groups to be cut on the basis of a predominance of currently saleable trees. (Priority to Jarrah sawlog).

Remove trees leaning into the group or out of the group by treemarking.

Minimum group size 1ha. Maximum group size 10ha.

Total group area to equal 50%.

Results:

Two groups selected for removal, and surrounding groups for retention.

Group size approx. 3ha

Culling task quite minor. Approx. 4 culls per ha which could be treated by chainsaw.

Comments:

1. Results show that the aim of removal of mostly saleable bolewood can be achieved. A significant volume of potentially saleable limbwood still remains on the forest floor however. This fuel may present silvicultural disadvantages similar to the current prescription.

2. This treatment was extremely difficult and time consuming to mark in the field. Junior officers would find this prescription quite perplexing to apply. It took 7 officer hours to mark two groups of total 6ha for removal, including toemarking on the boundaries.

3. Selection of groups crossed dieback boundaries which made snigging difficult.

4. This treatment has demonstrated that a two stage clear-felling system could work without causing damage to regeneration created, however, the cost to control the operation and the initial logging costs are higher.

5. Moreover, the task and costs of regeneration burning and subsequent protection are massively greater.

STOP 10. WHEATLEY 6 (MJ stand 510ha)

10.1 Description of the Area

Cutting History

Selection cut during 1930's at varying intensities for Jarrah sawlogs resulting in uneven-aged forest varying widely in density and distribution of young regrowth and poles. Second cut in 1979/80 for removal of all merchantable sawlogs and chip.

Average yield of $40m^3$/ha Jarrah sawlogs, and $80m^3$/ha of chip. Second cut a virtual clearfall with exception of a few groups of young poles considered to be protectable against fire. Criteria for group retention was stringent and only matched by 8 small groups.

10.2 Production Objectives

A series of experimental and operational trials have been installed to determine the effects of various post logging treatments on vegetation, regeneration, fauna and fuels.

The treatments include:

10.2.1 Operational trials on efficiency and costs of varying intensity of scrub rolling for cull removal. The treatments include:

10.2.1.1 Removal of all unmerchantable stems other than retained groups. ($29 to $35/ha)

10.2.1.2 Tops disposal of selected stems with future crop tree potential and scrub rolling the remainder. ($24 to $29/ha)

10.2.1.3 Retaining the best 30 stems per ha and scrub rolling the remainder.

10.2.1.4 Rough heaping and stacking of all material ($62.ha)

10.2.1.5 Windrowing and stacking ($68.ha)

The currently favoured option of treepushing of large culls only (as done in Quillben 1) has not been implemented here as yet.

During the trial, operational costs were monitored. These figures are shown in brackets beside each treatment described above.

The attached plan shows the location of treatments

10.3 Regeneration (Burn Treatment Stand)

A series of burn treatments have been planned and partly implemented as part of a larger operational trial to determine the effects of varying burn conditions, curing period and season of burn, on the removal of logging debris.

Burn treatment includes 3 spring burns lit on 14 and 30 October, and 8 November, 1980. These were carried out during increasing dryer and warmer conditions. Another 2 autumn burns are planned also.

Fuel removal by fire, plus fire damage to retained crop trees is being monitored. Results show that the preburn mean fuel quantity has been reduced from 371 tonnes/ha to 256 tonnes/ha (or 31 percent reduction) in the cool burn. Early figures on the hottest spring burn indicate a 37 percent removal.

The effects of logging, scrub rolling and burn treatment on the survival, development and species composition of the lignotuberous growth is being monitored by the Silvicultural Research Section.

10.4 Other

A small pilot study to monitor the change in bird populations and behaviour is being installed by the Fauna Research Section.

WHEATLEY BLOCK - coupe 6

SYMBOLS USED

J · jarrah
K · karri
S · summer logging
W · winter logging
C/F · clear fallen
S.T.S. · seed trees standing
REGEN · regeneration
G/S · group selection cut
M · marri
-x—x-- boundary between S & W
-•—•-- boundary between S.M.P.'s
N F · non forest
C l · cleared
K.S.T. · karri seed trees
stream reserve
amenity reserve
D/B · dieback
P.P. · private property
P · pine plot

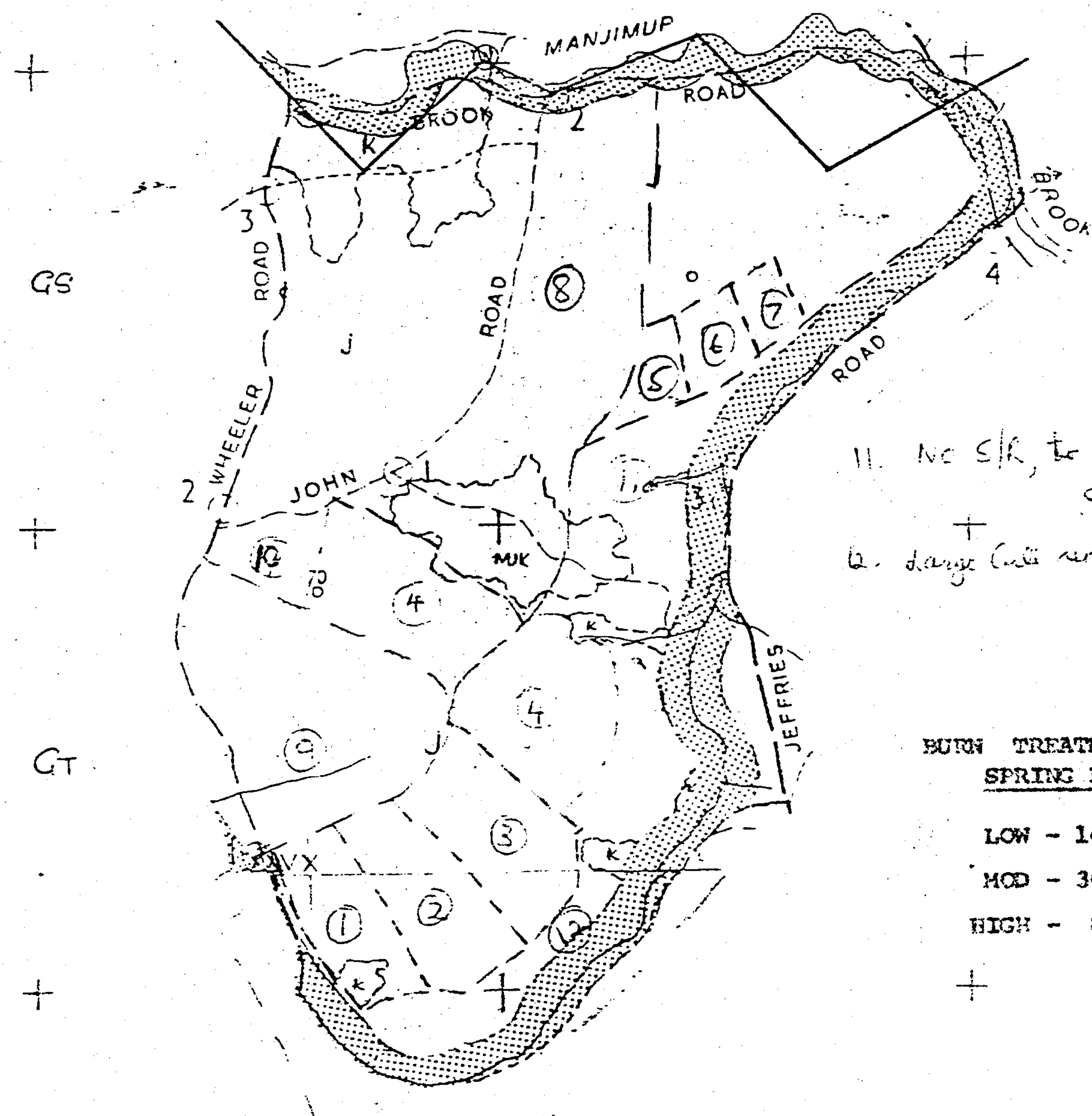
TREATMENT

1. Merch. stems retained only
2. Best 30 s.p ha. retained only.
3. Complete scrub Roll.
4. Groups retained only
5. Rough Heap c̄ Bull blade
6. Windrow c̄ Bull Blade
7. Windrow c̄ Rake Blade
8. Protectable, potential crop tree retained only.
9. Dieback area. No S/R treatment
10. Complete S/R – left unburnt.

NANNUP SHIRE

59

60



11. No S/R, to be burnt for fauna study
12. Large logs removed only.

BURN TREATMENTS
SPRING BURNS

LOW - 14.10.80
MOD - 30.10.80
HIGH - 8.11.80

MANJIMUP SHIRE

N

GRID REF: GT 60.

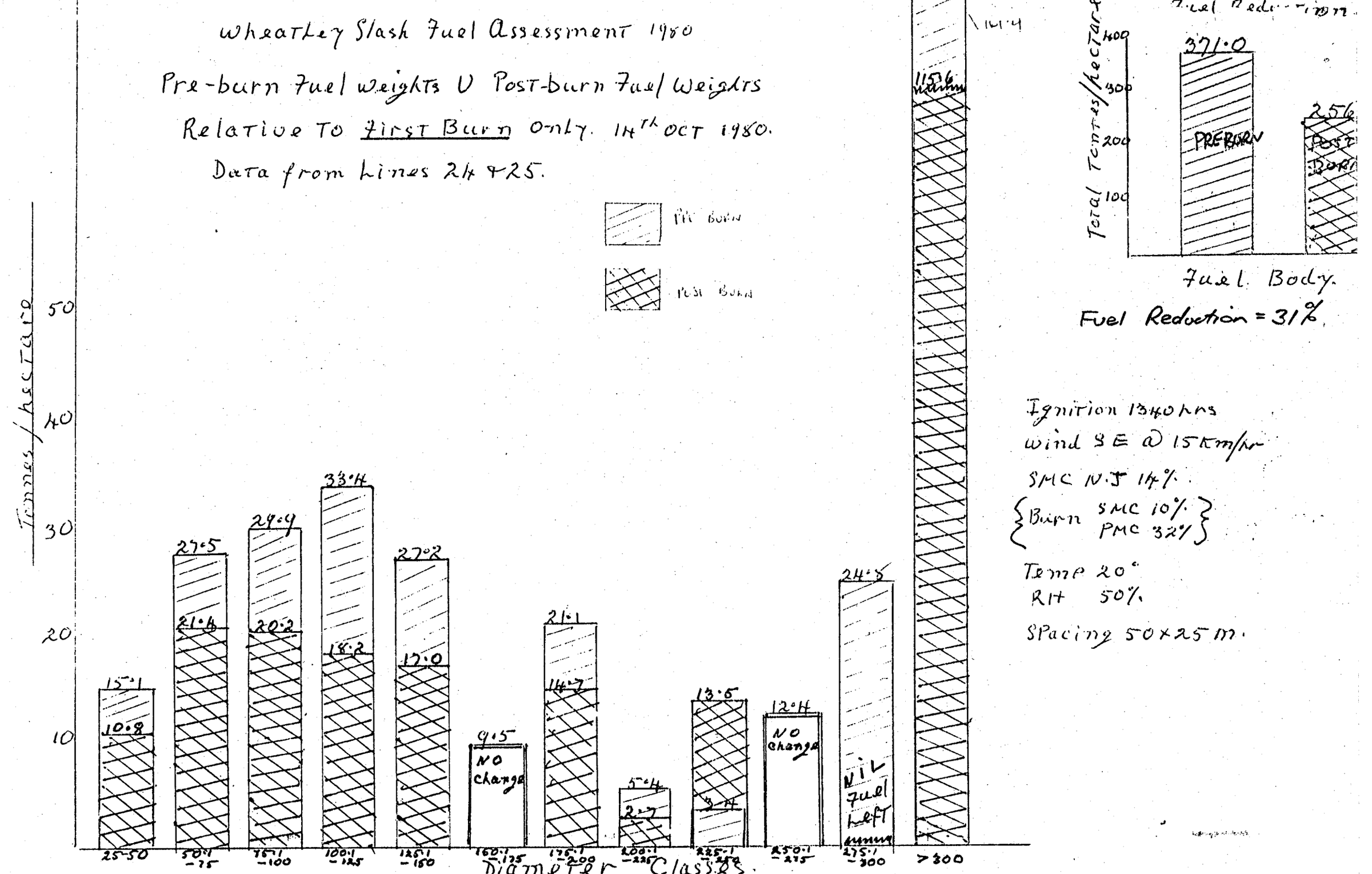
1:25000

Wheatley Slash Fuel Assessment 1980

Pre-burn Fuel Weights V Post-burn Fuel Weights

Relative To First Burn only. 14th OCT 1980.

Data from Lines 24 & 25.



Fuel Reduction = 31%

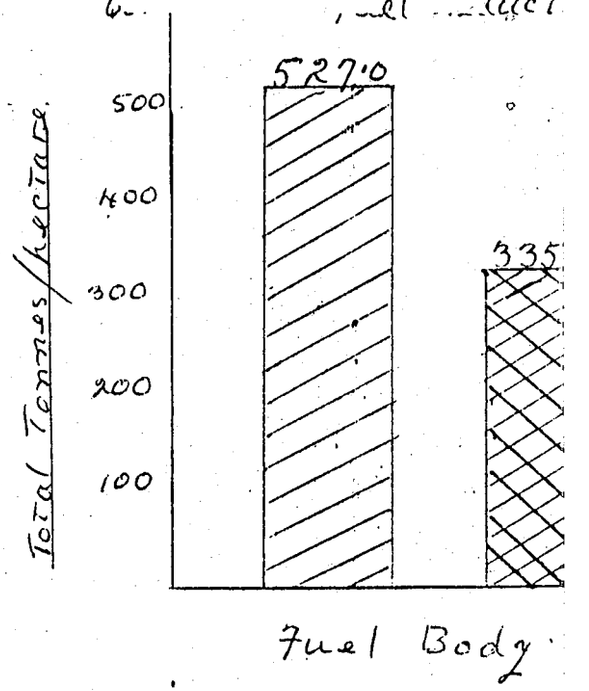
Ignition 1340 hrs
wind SE @ 15 km/hr
SMC N.F 14%.
{Burn SMC 10%. PMC 32%}
Temp 20°
RH 50%.
Spacing 50 × 25 m.

Whitney Slash Fuel Assessment 1980

Pre-burn Fuel Weights & Post-burn Fuel Weights

Relative to Third Burn Only 8-11-80.

Data from Lines 1, 2, 3, 4, 5, 6, 7, 9.



Fuel Reduction = 36%

STOP 11. YORNUP POLE STAND

11.1 Site Description

Heavy selection cutting during the 1920's plus follow-up treatment by heaping and burning, and ring barking of culls has resulted in a massed J/M A pole stand. The species distribution is 2:1 in favour of jarrah. However, marri stems are predominantly larger and taller than jarrah and appear to suppress the jarrah poles. It appears that thinning to favour jarrah development may be too late at this stage, as these may be too physiologically old to respond to crown release.

It is of interest to note the high degree of butt damage evident as a result of past burning of ground logs. This highlights the need to reduce the amount of larger ground debris prior to regeneration.

SUMMARY

1. EVALUATION OF REGENERATION TREATMENTS

1.1 Intensive Tree Pushing $23.75 ha; 1.0 ha/hour

eg. Crop tree Retention (WH6, IF3, GO4, QL1)

Total Clear Fall (WH6, QL1)

Advantages

- removes all physiological overmature culls including small stems from previous selective logging, which may have a suppressive effect on subsequent tree growth.
- establishes an even-aged forest condition, therefore enhancing future forest management options, particularly production and protection operations.
- can programme hot slash removal fires, therefore maximising ground fuel consumption.
- reducing commitment for tops disposal, and the protection of retained crop trees and groups.

Disadvantages

- increment loss from potentially merchantable stems.
- volume loss from currently non-saleable stems. eg jarrah chipwood
- increased risk of P. cinnamomi spread due to intensive regeneration treatment.
- reduced influence or local and possibly regional hydrological values, particularly in low rainfall areas.
- full utilization of lignotuber pool, where populations, distribution and species composition are not fully known.
- unknown long term effect on species composition, and stand dynamics.
- unknown effect on other environmental values such as fauna, soil and water quality, conservation.
- increased slash component on forest floor, therefore creating a future fire hazard, and the potential to cause butt damage on sawlog stems.
- increased slash component could impede intra-coupe movements for logging and other forest management activities.
- relatively low regeneration preparation production rates, and high unit costs.

1.2 Minimal Tree Pushing $8.56 /ha; 3.62 ha/hour

eg. cull and stag pushing only (QL1)

streamline retention (QL1)

Advantages and Disadvantages are the reverse of 4.1

1.3 Manual Cull Felling $35.40/ha; 0.16 ha/hour

Advantages

- produces regrowth from established root systems, creating a competitive advantage over marri.
- improved control of stand species composition because procedure is selective for jarrah.
- has little effect on the development of lignotuber regrowth.

Disadvantages

- labour intensive and therefore costly with production rates probably below annual coupe turn-over.

2. RESEARCH RESUME

Earlier this month the Region was visited by a team from the Australian National University. Appended (Appendix 2) is a part of the resume prepared for this tour that is relevant to the Jarrah forest.

Log push $75/ha -

WHEATLEY BLOCK - coupe 6

SMP 1543.

SYMBOLS USED:

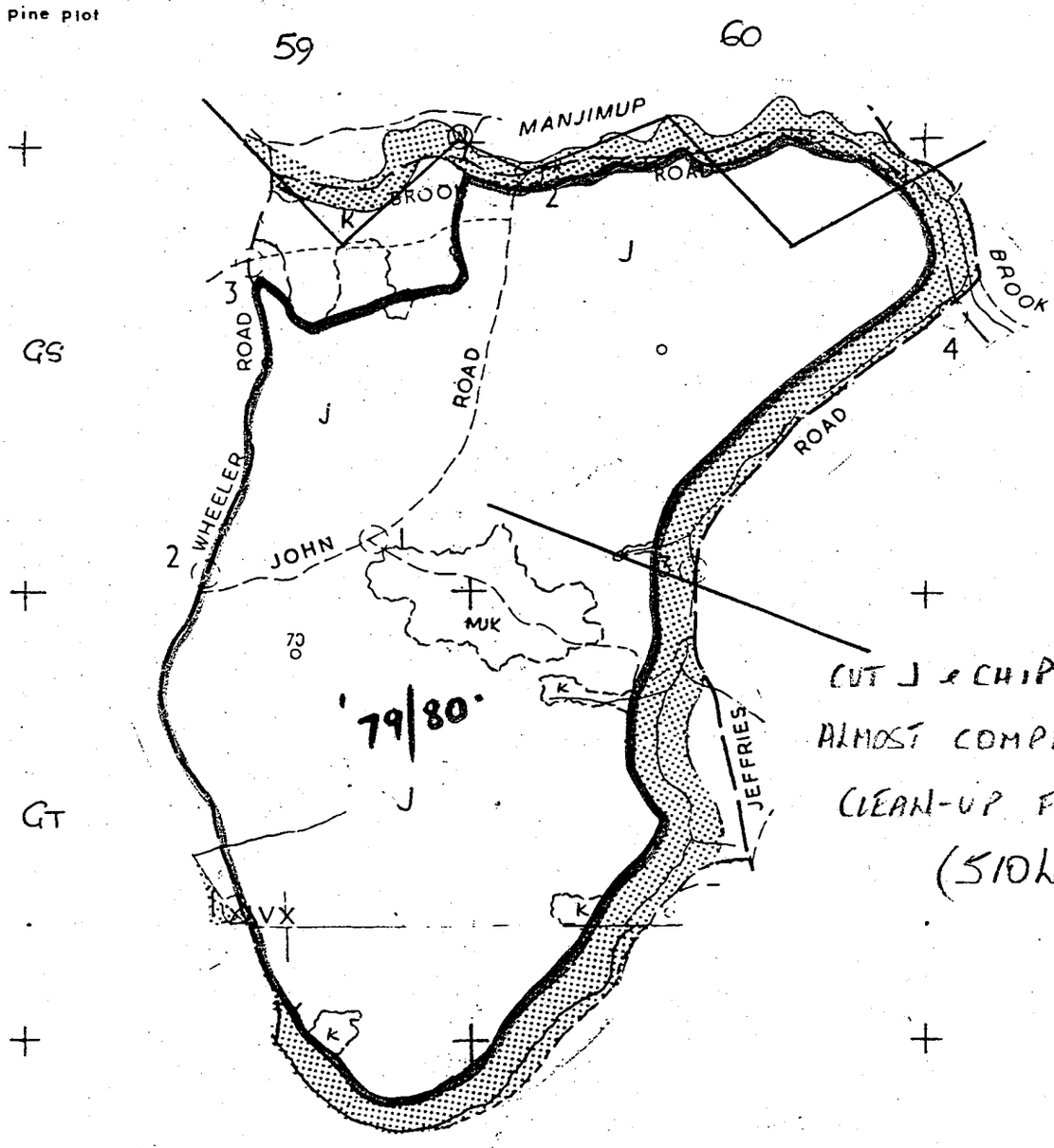
- J • jarrah
- K • karri
- S • summer logging
- W • winter logging
- C/F • clear fallen
- S.T.S. • seed trees standing
- REGEN • regeneration
- G/S • group selection cut
- M • marri
- -X—X- boundary between S & W
- -•—•- boundary between S.M.P.'s
- N F • non forest
- C I • cleared
- K.S.T. • karri seed trees
- stream reserve
- amenity reserve
- D/B • dieback
- P.P. • private property
- P • pine plot

CUTTING STARTED - APRIL '79 - INCOMPLETE - CLEAN UP '81

ACTUAL REMOVALS AS AT - 30 NOV 1980

J s/logs = 19,565m³
K s/logs = 272m³
CHIP = 40,141m³
} 59978m³ TOTAL.

NANNUP SHIRE

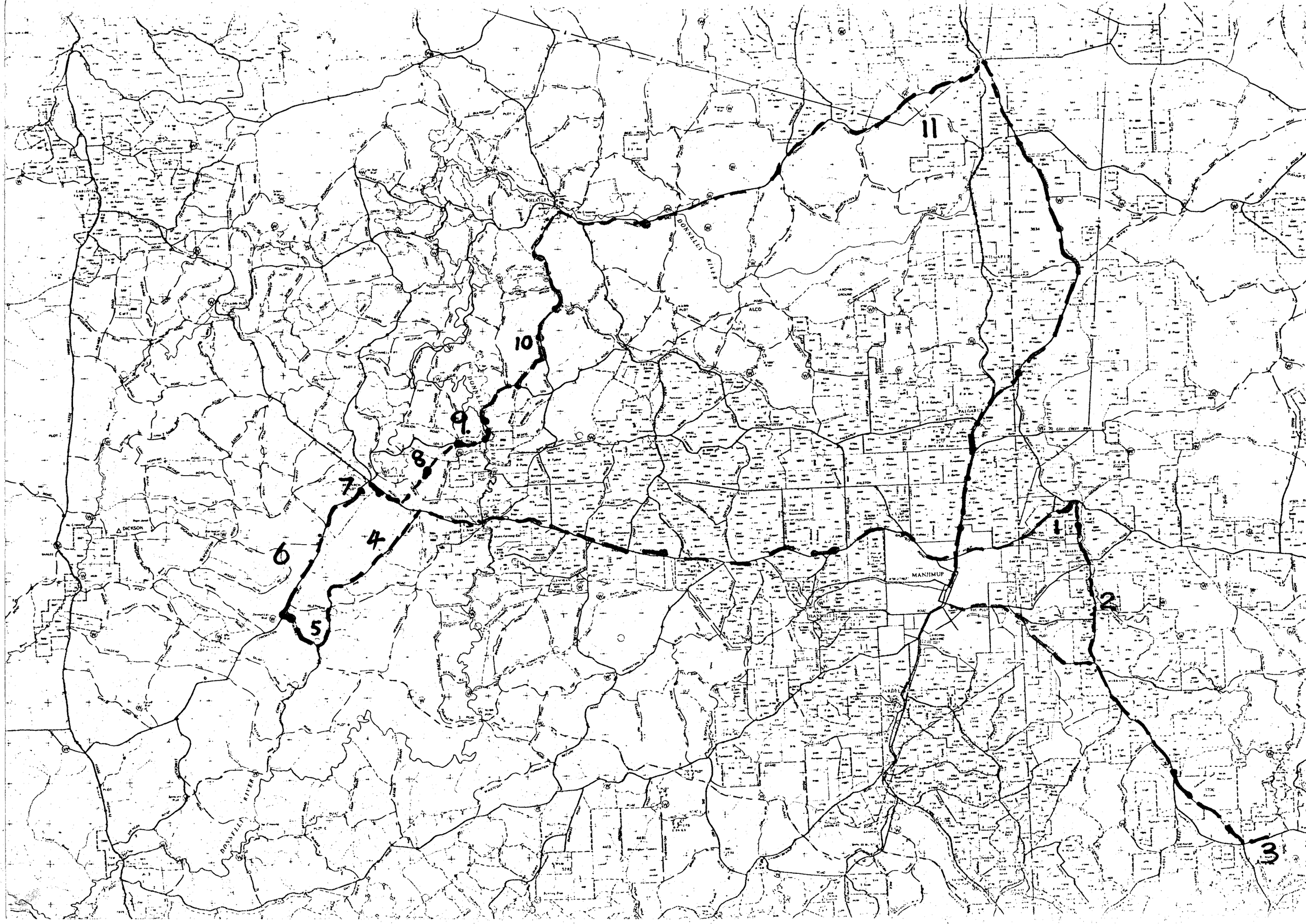


CUT J & CHIP 79-80 ✓
ALMOST COMPLETED.
CLEAN-UP FOR '81
(510ha.)

MANJIMUP SHIRE

GRID REF: GT 60.

1:25000 0 metres 500 1000 metres


11
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DONNELLY RIVER
ALCO
MANJIMUP
DICKSON

App. 2

A RESUME PREPARED FOR THE VISITING A.N.U. TEAM LISTING SOME OF THE RESEARCH RELEVANT TO CLEAR FELLING WHICH HAS BEEN CARRIED OUT BY THE FORESTS DEPARTMENT OF WESTERN AUSTRALIA

It is understood that the team is concerned with environmental aspects of clear felling. Our environmental research however, is not neatly packaged into water tight compartments of this nature and is closely aligned to the whole 'business of forestry'. Thus the environmental aspects of clear felling need to be examined in the context of the whole forestry operation. For example, different burning regimes which may be the result of, or necessary because of, different silvicultural treatments which in turn may have arisen in response to changing market opertunities, may have different effects on flora and fauna successions or the hydrology in a catchment and so on.

For this reason this resume includes aspects of clear felling research other than those which might be interpreted as being environmental in the strict sense of the work.

Over the years much research has been carried out by many individuals, some of this has been written up and published, some is available in the from of reports, other data remains uncollated on Departmental files. Obviously it is not possible to prepare a complete list of projects and this resume should therefore not be regarded as being necessarily complete. Other research, for example in the field of fire ecology may also have relevance to clear felling but is not listed here.

With regard to seeing or discussing research in this field, a major difficulty is the wide scope of research activities and dispersal of individual experiments both in time and space. In view of this, two field trips have been organized, one through the karri, the other through the jarrah, to illustrate aspects of clear felling and including also alternative group selection systems which have been and are in use.

It is hoped that all the major aspects of clear felling research in both karri and jarrah forest types can be discussed at relevant sites during these two trips.

Jarrah *(E. marginata)* Silvicultural Research

SEEDFALL

Quantity and periodicity measured over a few years. Maximum yields came from pile stands. Old veterans relatively poor producers of seed.

FATE OF NATURAL SEEDLINGS BENEATH CANOPY

Fate of some hundreds of seedlings followed for 5 years. Heavy annual mortality; particularly heavy following a prescribed fuel reduction burn at age 4. Suggests that pool of advance growth may take a long time to develop due to high mortality rates.

PLANTED JARRAH

Into cleared, ploughed lateritic gravel sites. Bushy advance growth stage largely by-passed - 50% of plantings had a dynamic shoot in 2nd year, 95% by fifth year. Form tended to be poor, even at very close spacings (approx. 1 m x 0.6 m).

CROWN DAMAGE

1. Saplings - damage to apical shoot by fire, frost or clipping caused undue forking (> 50 percent compared 20 percent of control). However, scorch that did not reach apical shoot caused no forking.

2. 40 year old ploes. Crown scorch increased growth rate for at least 4 years. Result due in part to destruction

of flower buds and hence reduced seed production. - Research Paper No. 37 (1978).

FERTILIZER TRIALS

Trials with veterans by A.B. Hatch failed to respond to N x P.

Trials with 40 year old poles by Kimber showed a major response to N with a slight improvement with the addition of P (compare pot trials with relatively high rates of fertilizer when a massive N x P interaction showed up). Evidence of a N x K interaction in the field, but not always reproducible.

SILVICULTURAL SYSTEMS

1. Poor form of regeneration in very large gaps reputedly due to frost damage. A trial of heavy cutting leaving about 10% crown cover of small veterans resulted in regeneration of good form (unfortunately no control for comparison) (Amphian Block).

   Note - frequency of frosts is high in northern jarrah forest and low in southern jarrah forest (Dwellingup 35 frosts/annum, Manjimup 3).

2. There is some evidence, which needs further substantiation, that poles (40 - 50 years old) grow faster in even-aged stands than in all-aged stands. (Evidence from comparing even-aged stands from Inglehope (local experiment Dwellingup No. 13) with all-aged stand in Amphian (local

experiment Dwellingup No. 53)). The observed difference is of the order of 10% but the data have yet to be subjected to statistical analysis. From previous experience of trials of this nature the difference will not be due to chance.

3. Large trial initiated in 1969 to study effect of logging a jarrah/marri stand using four silvicultural variations. Clear felling, retention of jarrah seed trees, retention of marri seed trees, retention of seed trees of both species. It appears that the retention of a seed source will not influence the species composition of the dynamic regeneration. It will however, influence the composition of seedlings. It appears that the dynamic regeneration is composed of, lignotuberous advance growth which was suppressed before the logging, and coppice growth.

Various papers, bulletins and reports exist on jarrah silviculture. If the group is interested, a list could be made up and forwarded later.

CURRENT AND FUTURE JARRAH RESEARCH

Trials have been or are in the process of being initiated to look at -

1. The effect of the regeneration fire on jarrah and marri lignotuberous stock. Will look at survival in relation to season and intensity of burn.

2. Effect of residual stems on regrowth. Plots will be set up to monitor the growth rate and form of regeneration in relation to its distance from residual stem and also the density of residual stems.

3. Espacement trial. To determine the effect that initial plant spacing has on early development of jarrah seedlings on an open site. Of particular interest will be the effect that spacing has on form and the age at which competition stagnates or reduces stand growth. One of the spacings will be duplicated using fertilizer.

4. Colonization of problem sites. (Where advanced growth is either lacking or of small size). Plots will be established to monitor succession of the site after the slash disposal burn.

5. Thinning trials. These will be initiated to study effect of thinning at various ages ranging from age 1 - 2, 10 - 15 and 40 - 50. Selective thinning trials will also increase the jarrah to marri ratio where it is currently very low.

In addition to above trials a major survey of southern jarrah forests is planned to increase our understanding of factors effecting stand structure and composition. Plots from a wide range of jarrah/marri forests will be analysed. Parameters which will be recorded include advance growth, basal area, dominant height, soil type, plant species present and their abundance, fire history, cutting history, rainfall and some measure of site productivity. Principal component analysis will be used to look for correlations between various parameters and the stand composition. Of particular importance is the abundance or lack of lignotuberous advance growth.

FIRE RESEARCH ACTIVITY IN RELATION TO CLEAR FELLING

1. Site Preparation Burning

1.1 Karri *(E. diversicolor)*

Past research and operational trials have resulted in a high degree of skill in preparing, implimenting and controlling karri site preparation burns (1, 2, 3, 4, 5, 6). Further research will be directed at increasing the area burnt for a given limited number of burning days.

1.2 Jarrah *(E. marginata)*

Current research and operational trials are examining 1) acceptable standards of slash disposal burns and 2) the effect of slash disposal burn intensity and season of burn on future stand structure and stocking.

2. Protection of Regeneration from Fire

Research objectives are to define the fire intensity and the tree size limits for successful hazard reduction burns in even-aged karri and jarrah regrowth (7).

QUILLBEN BLOCK - coupe 1

F.P.(S) L - 1632

SYMBOLS USED:

- J - jarrah
- K - karri
- S - summer logging
- W - winter logging
- C/F - clear fallen
- ST.S - seed trees standing
- REGEN - regeneration
- G/S - group selection cut
- M - marri
- x—X-- boundary between S&W
- •—•-- boundary between S.M.P.'s
- N.F. - non forest
- Cl - cleared
- K.S.T. - karri seed trees
- stream reserve
- amenity reserve
- D/B - dieback
- P.P. - private property
- P - pine plot

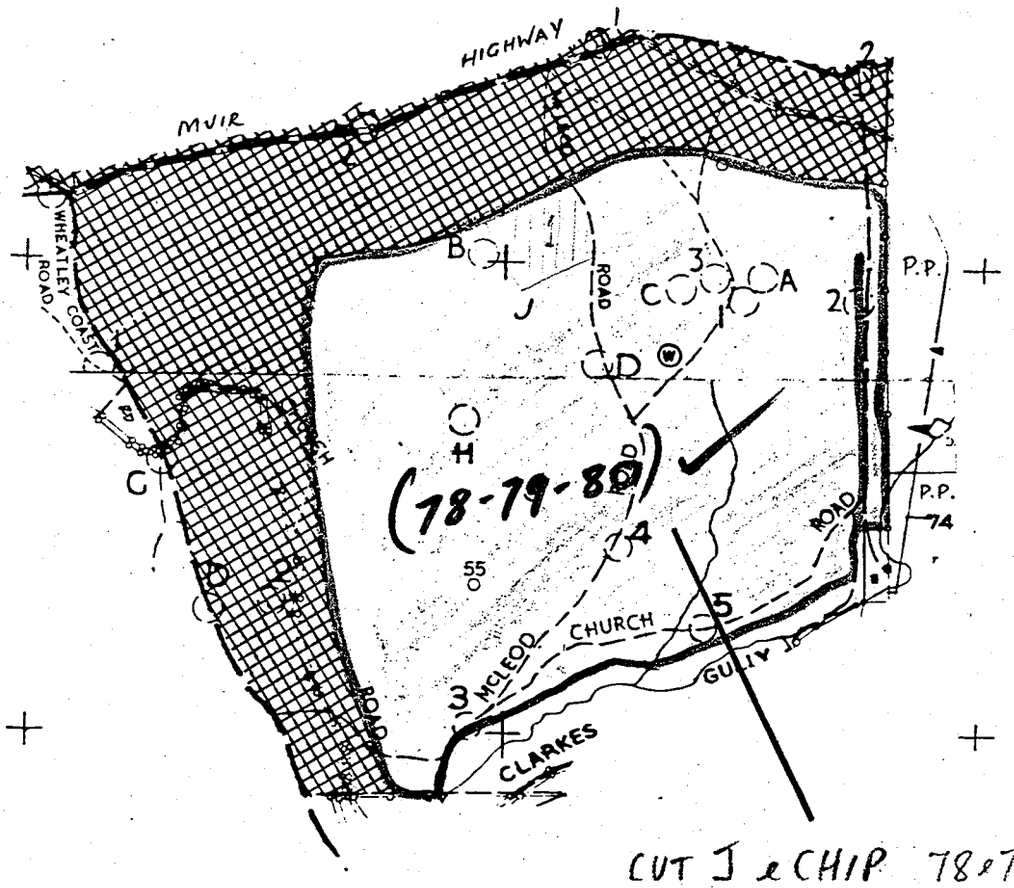
CUTTING STARTED - MAY '78 - COMPLETED. - STOCKPILE.

ACTUAL REMOVALS AS AT 30 NOV 1980

J's/LOGS = 13,457 m³
CHIP = 22,550 m³
} 36,007 m³ (44 m³/ha) (≈ 74 + m³/ha)

NOTE: CHIPWOOD STILL COMMING IN FROM STOCKPILE.

78 79



CUT J & CHIP 78 & 79 & 80 ✓

COMPLETED.

(305 la)

MANJIMUP SHIRE

GRID REF: HG 79

1:25000 0 metres 500 1000 metres

INVENTORY DATE: Jan. 1975.

LEWIN BLOCK - coupe 5

SMP : 1543

SYMBOLS USED:

J · jarrah
K · karri
S · summer logging
W · winter logging
C/F · clear fallen
S.T.S. · seed trees standing
REGEN · regeneration
G/S · group selection cut

-X—X- boundary between S&W
-•—•- boundary between S.M.P.'s
N.F. · non forest
Cl · cleared
K.S.T. · karri seed trees
stream reserve
amenity reserve
D/B · dieback
P.P. · private property
P · pine plot

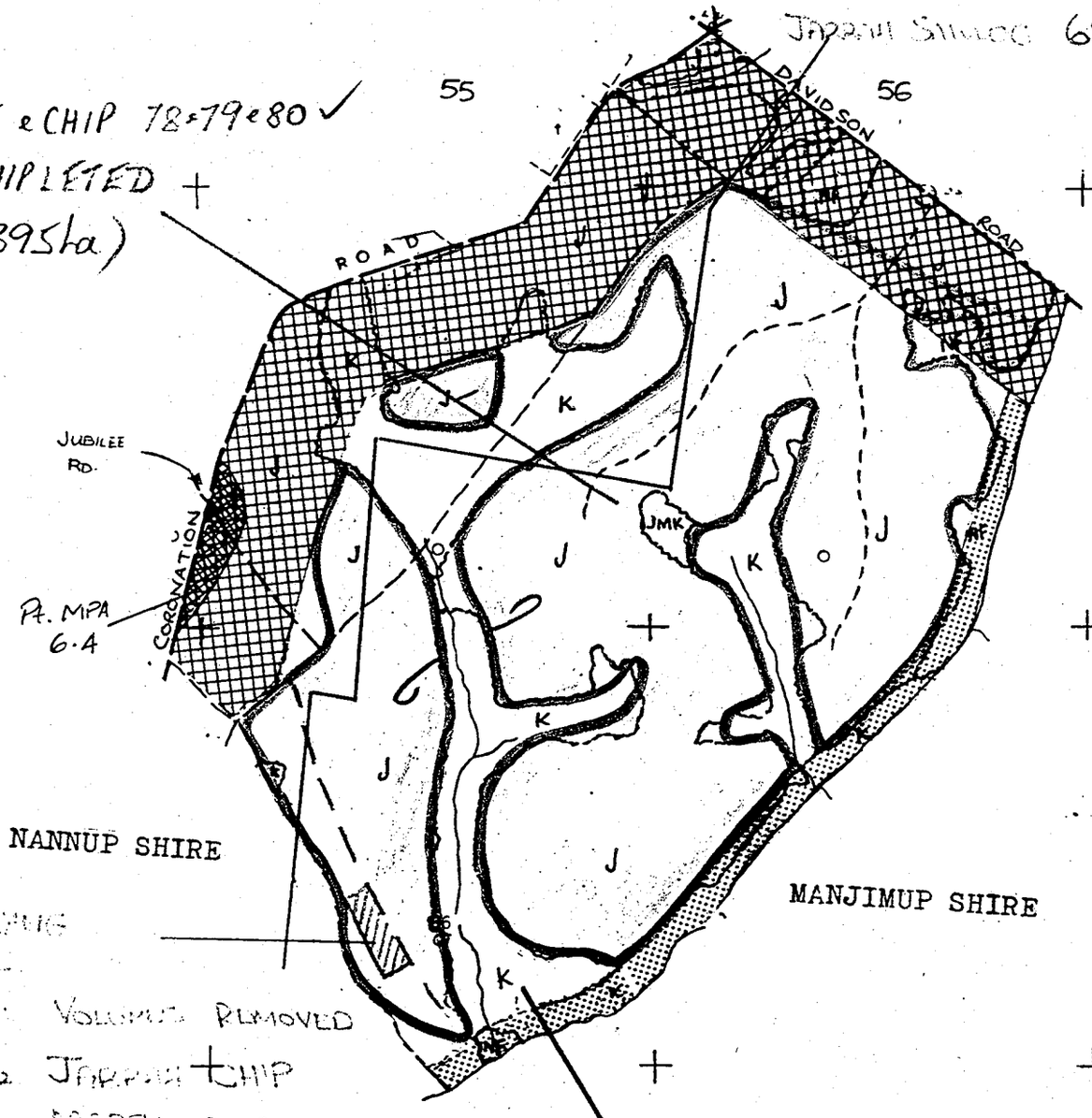
CUTTING STARTED - FEB '78 & COMPLETED NOV '80.

ACTUAL REMOVALS AS AT 30 NOV 1980.

J sl logs = 27,270 m³
K sl logs = 570 m³
CHIP = 28,746 m³
} 66,586 m³ TOTAL.

VOLUMES REMOVED
MARRI CHIP 72 m3/ha
JARRAH SL LOGS 69 m3/ha

CUT J & CHIP 78-79 & 80 ✓
COMPLETED (395 ha)



VOLUMES REMOVED
39 m³/ha JARRAH + CHIP
9 m3/ha MARRI CHIP

N

GRID REF: G4:55
1:25000
~~PHOTO~~/INVENTORY DATE: NOVEMBER 1973.

GRAPHITE BLOCK - coupe 1

SMP - 1543 -

SYMBOLS USED:

J - jarrah
K - karri
S - summer logging
W - winter logging
C/F - clear fallen
STS - seed trees standing
GEN - regeneration
G/S - group selection cut
M - marri
—X— boundary between S & W
—•— boundary between S.M.P.'s
N F - non forest
C I - cleared
K.S.T. - karri seed trees
stream reserve
amenity reserve
D/B - dieback
P.P. - private property
P - pine plot

CUTTING STARTED MARCH '80

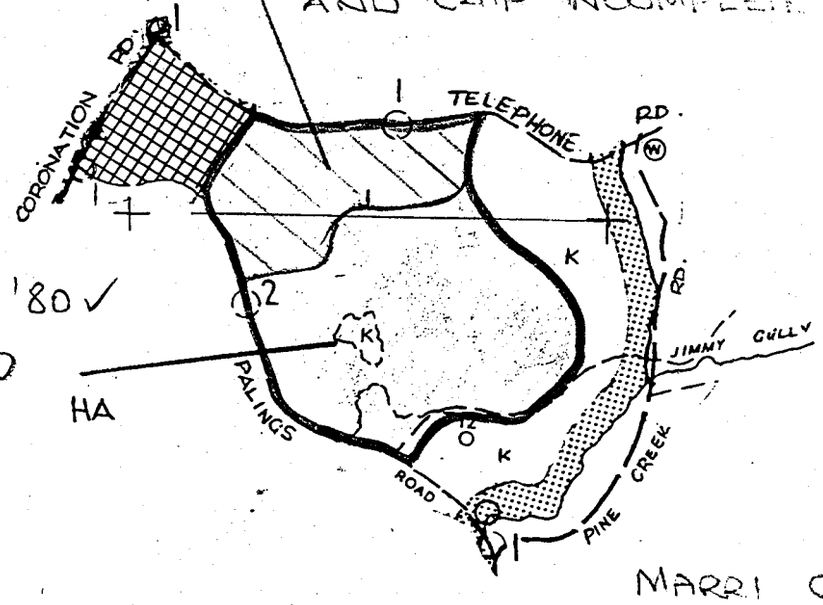
ACTUAL REMOVALS AS AT - 30 NOV 1980

J S/LOGS = 3158 m³
CHIP = 8206 m³
K S/LOGS = 440 m³
} 11,804 m³ TOTAL.

54

MARRI CHIP
GZ ONLY

J SAWLOG
AND CHIP INCOMPLETE (52 ha)



C.T J & CHIP '80 ✓
COMPLETED
(68 ha)
HA

VOLUMES REMOVED

MARRI CHIP 52 m³/ha
JARRAH CHIP 17 m³/ha
JARRAH SAWLOG 50 m³/ha (Est.)

NANNUP SHIRE

N

GRID REF: HA 50
1:25000
0 metres 500 1000 metres
PHOTO/INVENTORY DATE:

IFFLEY BLOCK - coupe 3

SMP : 1543.

CUTTING STARTED NOV '75.

SYMBOLS USED:

- J - jarrah
- K - karri
- S - summer logging
- W - winter logging
- C/F - clear fallen
- ST.S. - seed trees standing
- REGEN - regeneration
- G/S - group selection cut
- M - marri
- X—X - boundary between S & W
- —•—•— boundary between S.M.P.'s
- N F - non forest
- C l - cleared
- K.S.T. - karri seed trees
- stream reserve
- amenity reserve
- D/B - dieback
- P.P. - private property
- P - pine plot

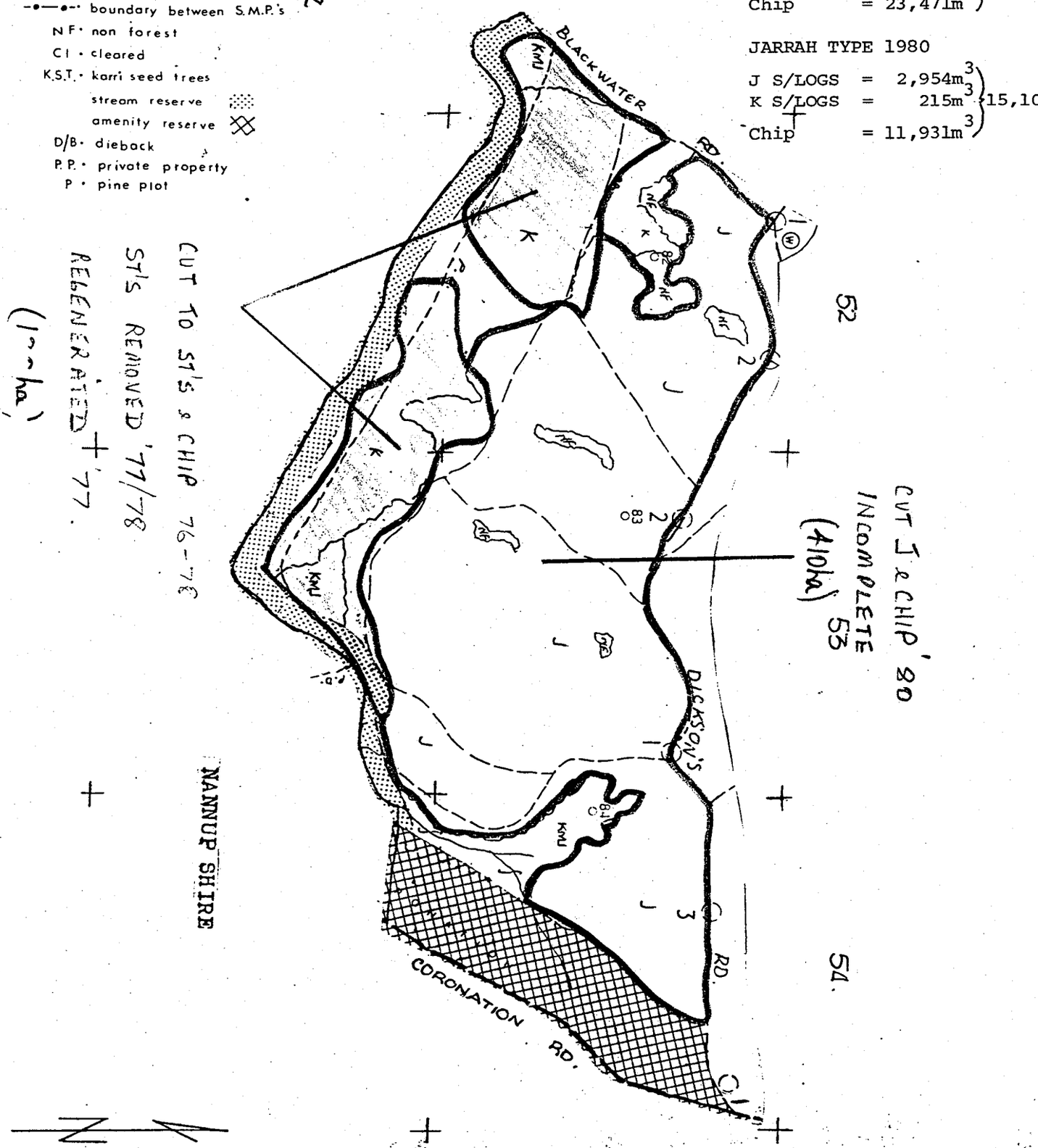
ACTUAL REMOVALS AS AT 30 NOVEMBER, 1980

KARRI TYPE 77/78

K S/LOGS	= 13,275m³	40,204m³
J S/LOGS	= 3,458m³	
Chip	= 23,471m³	

JARRAH TYPE 1980

J S/LOGS	= 2,954m³	15,100m³
K S/LOGS	= 215m³	
Chip	= 11,931m³	



GRID REF: CY 53

1:25000 0 metres 500 1000 metres

PHOTO/INVENTORY DATE: Oct/Nov. 1980.

GORDON BLOCK - coupe 4

SMP : 1543.

SYMBOLS USED:

J • jarrah
K • karri
S • summer logging
W • winter logging
C/F • clear fallen
ST.S • seed trees standing
REGEN • regeneration
G/S • group selection cut
-X—X- boundary between S & W
-•—•- boundary between S.M.P.'s
N.F • non forest
Cl • cleared
K.S.T. • karri seed trees
stream reserve
amenity reserve
D/B • dieback
P.P. • private property
P • pine plot

CUTTING STARTED JAN '79 · FINISHED SEPT '80.

ACTUAL REMOVALS :-

J S/LOGS = 10,180 m³ ÷ 135ha = 75 m³/ha.

K S/LOGS = 434 m³ ÷ 10ha = 43·4 m³/ha.

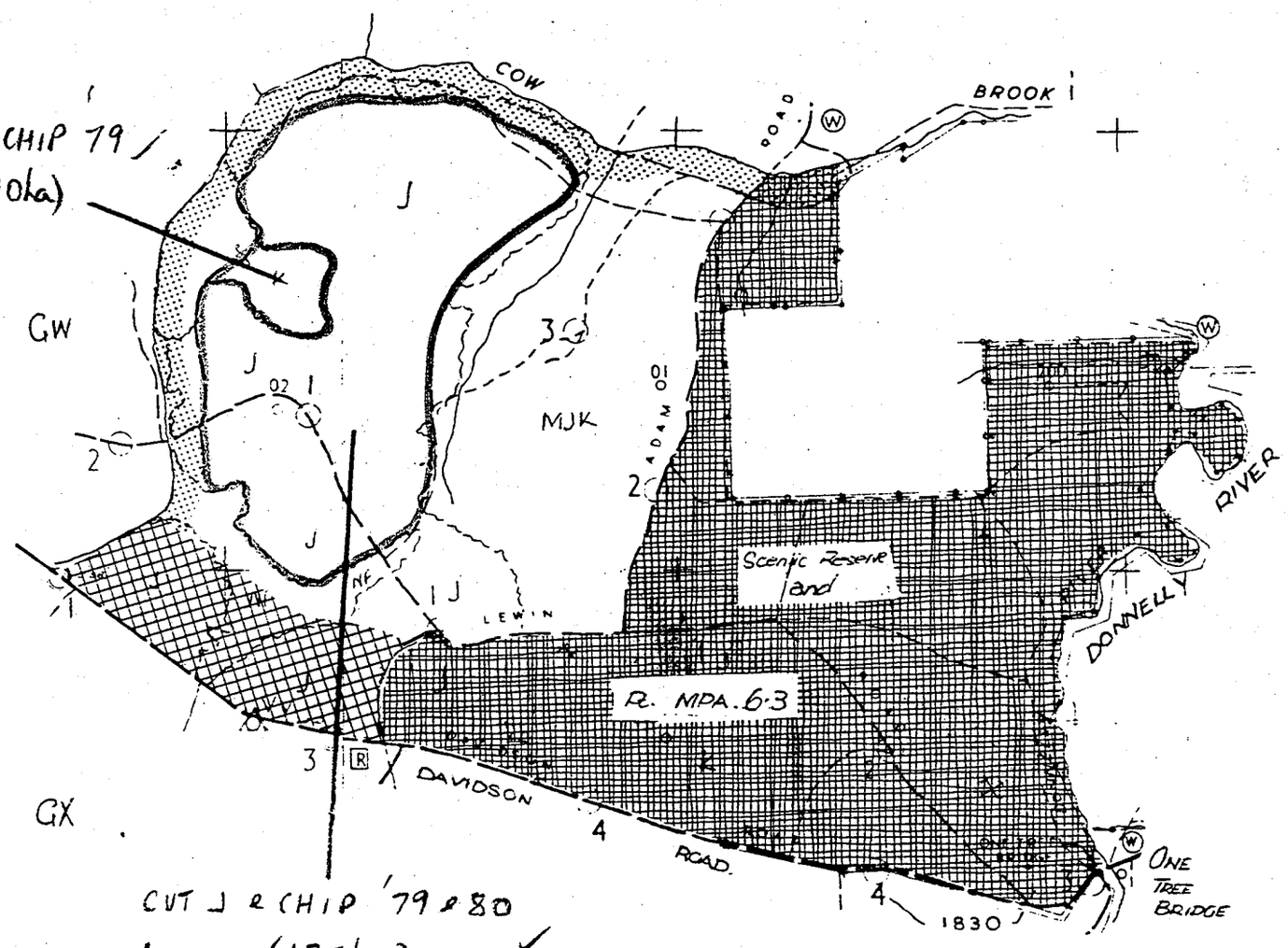
CHIP = 22388 m³ ÷ 145ha = 154 m³/ha.

TOTAL VOLUME REMOVED = 33002 m³ ÷ 145ha = 228 m³/ha

57 58

C/F K & CHIP 79 .. (10ha)

CUT J & CHIP '79 & 80 (135ha)



MANJIMUP SHIRE

GRID REF: GW 58

1:25000

PHOTO/INVENTORY DATE: April/May 1977.

GORDON BLOCK – coupe 3

SMP: 1543.

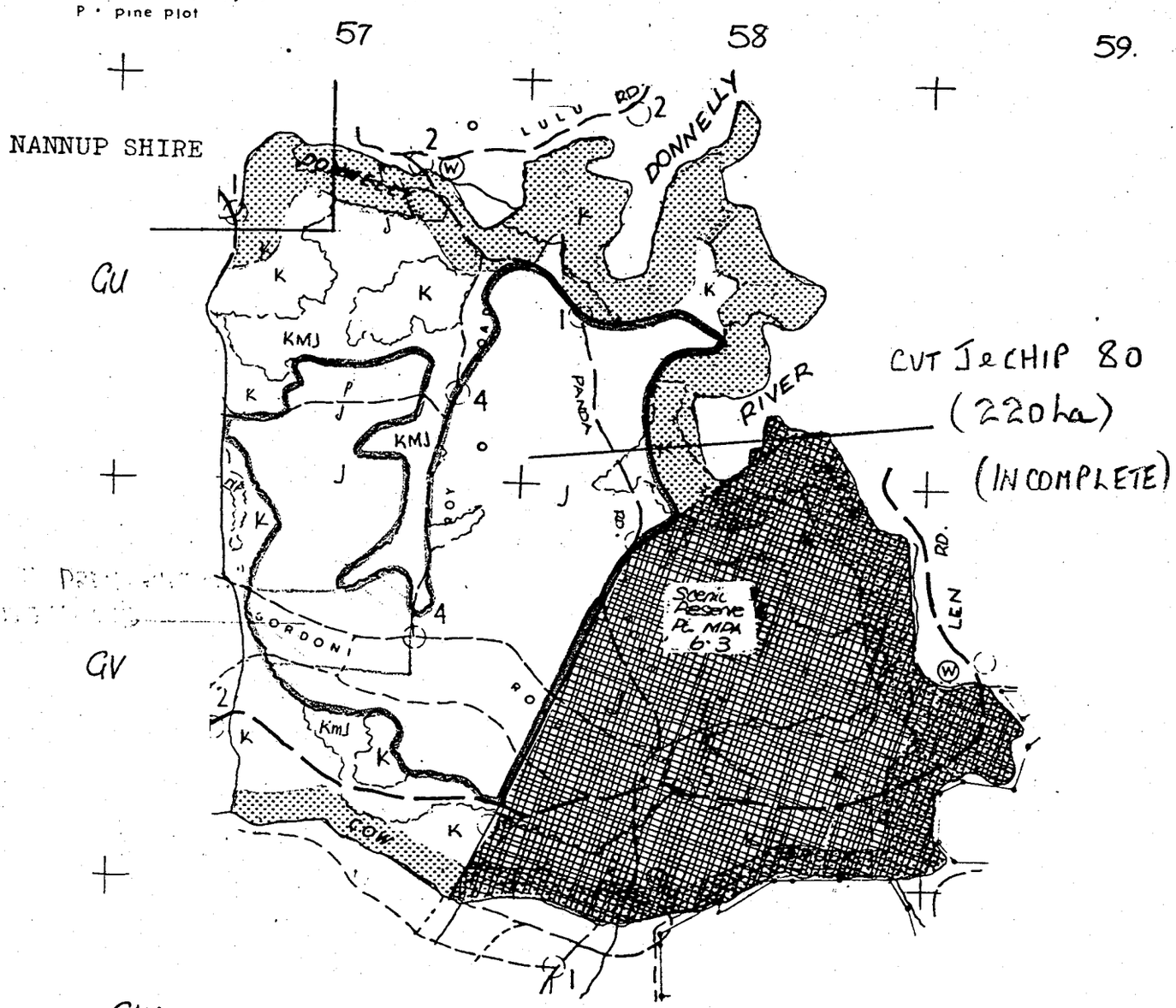
SYMBOLS USED:

J · jarrah
K · karri
S · summer logging
W · winter logging
C/F · clear fallen
STS · seed trees standing
REGEN · regeneration
G/S · group selection cut
-X—X- boundary between S & W
-•—•- boundary between S.M.P.'s
N.F · non forest
Cl · cleared
K.S.T. · karri seed trees
stream reserve
amenity reserve
D/B · dieback
P.P. · private property
P · pine plot

CUTTING STARTED – MAY '80 – STILL IN PROGRESS

ACTUAL REMOVALS AS AT – 30 NOV 1980

J s/LOGS = 3911 m³
CHIP = 5085 m³
K s/LOGS = 410 m³
} TOTAL = 9406 m³.



CUT J & CHIP 80 (220 ha) (INCOMPLETE)

GRID REF: GU 58

1:25000

~~PHOTO~~/INVENTORY DATE: April 1974.