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1926.

WESTERN AUSTRALIA.

WORKING PLAN NO. 1.

MUNDARING WORKING
CIRCLE

Prepared by

T. N. STOATE, B.Sc., Working Plans Officer,

Under the direction of

S. L. KESSELL, B.Sc., Dip. For., Conservator of Forests.

Issued by the authority of

HON. P. COLLIER, M.L.A., Minister for Forests.

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FOREWORD.

The decision to print this Working Plan for general distribution will enable copies to be sent to the many interested inquirers who have sought information concerning the lines on which forest management is developing in Western Australia, but it is hoped that its educational value within the State will more than justify the decision. The Mundaring Working Circle is within easy motoring distance of Perth, and it is hoped that as the areas brought under treatment increase and develop this forest may form a valuable object lesson. Unless the visitor has opportunity to study provisions of the Working Plan providing for a continuity of operations and management, he fails to grasp the essential difference between the tended forest and the forest where the rate of exploitation is governed by orders held from year to year by a particular sawmiller.

The structure of the Plan has not been sacrificed in any way, and the only special provision made on account of the decision to print in this form has been the preparation of a small scale reference map which is included in lieu of the large number of bulky maps which of necessity are associated with a Plan of this nature. This reference map does not show compartments which are shown on the large scale maps of each Block. The scale used is 20 chains to one inch, except in the case of pine planting areas, in which cases the scale is 10 chains to one inch. The squares shown on the reference plan conform with the general system adopted extending over all forest areas under the control of the Department. All field "bench marks" which are cut on trees at the intersection of tracks, compartment boundaries, etc., refer to these squares.

Owing to the abnormal state of a great deal of the forest within the Working Circle, it has not been possible to apply the principle of sustained yield according to any recognised system. The guiding consideration in many instances has been sustained work for staff and overseers, and with such sustained work is inevitably associated sustained yield. The Jarrah forest extending from Mundaring District in the North to Manjimup District in the South is geographically one forest. Owing to the fact that heavy exploitation by sawmilling and hewing has proceeded for seventy years, while forest management on the simplest lines has only been introduced within the past five years, the problem of sustained yield is one of great difficulty. Any attempt at sustained yield must envisage the whole 2,000,000 acres of Jarrah forest as one unit. The problem is at present being investigated on these lines.

The forest between Mundaring on the North and Karragullen on the South was the first area of Jarrah to be brought under the provisions of a Working Plan, and with this object a preliminary Working Plan took effect from September 26th, 1921. Since this date 24 other Working Plans have been prepared and put into operation. The form and provisions set out in the attached Plan are the result of experience gained in the intervening period.

July 7th, 1926.

S. L. KESSELL,
Conservator of Forests.

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WORKING PLAN NO. 1.

MUNDARING WORKING CIRCLE.

Introduction.

This Working Plan, dated the 1st June, 1926, supersedes the Preliminary Working Plan for the Jarrah Working Circle, Mundaring District, approved by Governor in Executive Council on 26th September, 1921.

Subject to the approval of the Governor in Council, in accordance with Section 31, Forest Act, 1918, this Working Plan shall remain in force until the next periodic revision, which, circumstances permitting, shall be completed on the 31st May, 1931.

PART I.—SUMMARY OF FACTS.

1. NAME, LOCATION, AND SIZE.

The Mundaring Working Circle is situated in the Canning, Swan, and Avon Land Districts and the Mundaring Forest District, and is shown on Lands Lithographs Nos. 1/80 and 341/80. Total area 124,500 acres.

The Working Circle lies to the immediate South of the Mundaring Railway and the Perth-York Road, and is at Mundaring Siding, distant by rail 21 miles from the city of Perth and 33 miles from Fremantle, seaport of shipment for export timber.

The railway lines and roads traversing the area are shown on the accompanying plan No. 1.

2. EXISTING RIGHTS AND PRIVILEGES.

(a.) *Continuing.*

The Northern half of the Working Circles comprises State Forest No. 7, 77,400 acres (as shown on map No. 2), gazetted 28th November, 1924.

Water Supply catchment areas, as shown on Map No. 2, embrace the whole area of the Working Circle. These Catchment Areas are subject to the by-laws and regulations of the Water Supply Department concerned, but these Departments have agreed to the control of forest produce on these areas being placed in the hands of the Forests Department (see Files 112/20 and 924/24).

The following smaller Reserves are included in the Working Circle:—

No.	—	Area.	Compt.	Date of Gazettal.
18946, Loc. 3157 ...	Timber Reserve	7 acres ...	S30	17/7/25/1725.
18695	Forests Department road, resumed but not gazetted a Reserve	3 ,, ...	...	22/7/21.
16622	Water Reserve	2½ ,, ...	C18	23/2/17/324.
5343	Camping	105 ,, ...	Z4 and 10	25/3/18/751.
5342	Camping in connection with reservoir works	353 ,, ...	Z9, K2, R1, R2	13/5/98/1255.

The following Reserves are included within the boundaries of, but excluded from the area of the Working Circle:—

No.	—	Area.	Compt.	Date of Gazettal.
18464	School site, Location 3133	4 acres ...	Z10	7/12/23/2635.
10448	School site	5 ,, ...	Z9	28/9/6.
6637	Church site, Location 441	1 ,, ...	C18	7/4/99/1015.
6853	Post Office site	½ ,, ...	C22	15/6/00/2060.
17447	Church site (Adventists)	½ ,, ...	C34	16/4/20/694.
14633	School site	5 ,, ...	C33	21/11/13/4634.

Where any improvements still exist on locations resumed on the Catchment Areas no action in regard to such locations may be taken by the Forester without first referring the matter to the Conservator.

The Mundaring, Mahogany Creek, Glen Forrest, Beamulla, Pickering Brook, Kalamunda, Sawyers' Valley, and Karragullen townsites, shown coloured red on Map No. 2, are excluded from the area of the Working Circle.

Rifle Range, Reserve No. 15952, Loc. 2811, of 249 acres, Compts. Z2 and 3, is leased to the Commonwealth Government under Annual Permit.

(b.) *Terminable.*

The following Sawmill Permits are in force over portions of the Working Circle:—

No.	Holder.	Area.	Date of Expiration.	Royalty.
603	A. Wedgewood	685 acres ...	30/9/26	1.44pence C.F.
615	Weston, Smailes & Liebow	2,900 „ ...	31/12/26	1.96 „
617	Millars' T.T. Co.	4,600 „ ...	31/12/26	1.32 „
363	A. Waters	137 „ ...	30-6-26	1.2 „

The following Firewood Permits (other than local) are in force:—

Permit 203—A. Young; 16,055 acres; Indefinite; 9 pence cord.

Local Hewing Permits and Firewood Permits are issued from month to month.

3. PHYSIOGRAPHY.

The Mundaring Working Circle is situated in the Darling Range, which forms the escarpment of the plateau or plains of the interior of the State.

The average elevation above sea-level is about 900 feet. Mundaring Weir is 500 feet above sea-level; the elevation of Mt. Dale, the highest point, being 1,840 feet.

The topography is undulating to hilly, broken, in some cases, with steep falls to the main streams which flow to the West.

The rocks are mainly granite with schists and gneiss. A thin layer of laterite, mainly ferruginous, which passes gradually into the underlying rocks without any sharp line of demarcation, occurs as a capping over the greater portion of the area. The slopes are, for the most part, covered with a lateritic detritus (commonly referred to as ironstone gravel), though granite outcrops are common on the steep falls to the creeks and to the Helena and Victoria Reservoirs. Alluvial wash in certain of the gullies provides small areas of soil varying from red to sandy loam.

The climate is characterised by winter rains and hot dry summers. Only moderately cold weather is experienced. Light frosts occur in May to September. In the summer months the temperature rarely rises above 100deg. F. The average annual rainfall at Mundaring Weir is 42 inches. The maximum precipitation recorded was 60.39 inches (1917) and the minimum 22.11 inches (1914). The following table shows the monthly averages at that station:—

From 1st January, 1898, to 31st December, 1925.

Month.	Average rainfall for 28 years.	To date
January ... ..	.51	
February ... ..	.59	1.00
March ... ..	.74	1.84
April	1.53	3.37
May	5.70	9.07
June	7.96	17.03
July	8.20	25.23
August	7.12	32.35
September	5.15	37.50
October	3.40	40.90
November ... ..	.98	41.88
December ... ..	.72	42.60

The rainfall, however, decreases to the east of the Working Circle. Rainfall figures at the Goldfields Water Supply Recording Stations Nos. 1 and 4 (see Map No. 1), are as follows:—

No. 1 RAINFALL GAUGE—MALMALLING. (LOCATION 3444).

From 1st January, 1915, to 31st December, 1925.

Month.	Average rainfall for 11 years.	
		To date
January ... ..	.32	
February ... ..	.44	.76
March ... ..	.86	1.62
April ... ..	.78	2.40
May	2.10	4.50
June	6.85	11.35
July	6.41	17.76
August	5.66	23.42
September	2.77	26.19
October	2.80	28.99
November	1.50	30.49
December ... ..	.50	30.99

Maximum rainfall 43.36 (1917). Minimum rainfall
22.73 (1925).

No. 4 RAINFALL GAUGE—DARKIN RIVER.

From 1st January, 1915, to 31st December, 1925.

Month.	Average rainfall for eleven years.	
		To date
January ... ..	.11	
February ... ..	.86	.97
March	1.02	1.99
April ... ..	.71	2.70
May	3.47	6.17
June	6.79	12.96
July	6.53	19.49
August	7.42	26.91
September	5.42	32.33
October	3.14	35.47
November	1.28	36.75
December ... ..	.77	37.52

The Helena and Victoria Reservoirs are included in the Working Circle, and the surface areas of each are respectively 672 acres and 42 acres.

The permanent streams are "A" creek and Bickley Brook.

The Working Circle is fairly well watered by a number of wells and soaks.

4. GENERAL DESCRIPTION OF FOREST GROWTH.

The Mundaring Working Circle is situated near the northernmost limits of the Jarrah Belt, but for the most part is typical Jarrah country.

The volume of timber per acre is not so great, nor do the trees attain such large dimensions as in the region of optimum development, but the timber is very sound.

Jarrah (*Eucalyptus marginata*) and Marri (*Eucalyptus calophylla*) occur in mixture, the best Jarrah forest occurring on the laterite capped hilltops. Amongst a sparse understory of small trees the following species occur:—

<i>Banksia grandis.</i>	<i>Casuarina Fraseriana.</i>
<i>Xylomelum occidentale.</i>	<i>Dryandra floribunda.</i>
<i>Nuytsia floribunda</i>	<i>Persoonia elliptica.</i>
<i>Persoonia longifolia.</i>	

The most distinctive plants of the ground cover are the Blackboys (*Xanthorrhoea* spp.), Grasstree (*Kingia australis*) and Zamia (*Macrozamia Fraserii*). Forty or more species of woody shrubs occur, but no Graminae or good edible plants for stock are found.

The proportion of Marri trees increases towards the bottoms of the gullies, in which, and in alluvial pockets, Marri is found with Blackbutt (*Eucalyptus patens*). Flooded Gum (*Eucalyptus rudis*) occurs along many of the creeks. Bullich (*Eucalyptus megacarpa*) is met with rarely. A sparse stand of Wandoo of inferior quality, with some Jarrah and Marri, is found on the steep falls to the creeks in pockets of soil among the granite boulders. Large areas of this type of country form the upper reaches of the Helena and Darkin Rivers on the eastern boundary of the Working Circle.

The subject area, owing to its ready accessibility to the city of Perth, has been heavily cut over for all classes of timber during the past 40 years. 17,220 acres surrounding the Helena Reservoir were ringbarked in 1903 with the object of increasing the run-off of water from the Helena Reservoir Catchment Area (see Map No. 3). An extremely good natural regeneration followed the ringbarking. Repeated fires, however, have caused the malformation of almost the entire crop, which now consists of stunted saplings about 25 feet in height.

A timber classification of the area was carried out in December, 1917, by the Forests Department. The field book numbers are 1, 2, 34-40, 50-56, 121-127, 154-157. A print of the classification plan is attached as an appendix (see Map No. 3).

Map No. 4 shows areas suitable for sawmilling, and also areas on which utilisation must be effected by hewing, either on account of inaccessibility, or of the low volume of timber remaining.

A more detailed description, by Blocks, of the forest growth is attached as Appendix No. 3.

5. FIELD SURVEY.

The survey of the creeks, old tramway formations, and tracks, as delineated on Map No. 1, was completed in January, 1925.

The instruments used for the work were the plane-table, the Verschoye transit prismatic compass, and, finally, the military sighting vane, when this was adopted as the standard instrument for forest surveys. The method employed was traversing with back sighting, distances being measured with a five-chain band.

The collection of the field data required for the revision of the plan was carried out by Mr. W. Lockhart.

6. PAST MANAGEMENT.

Prior to July, 1920, the only forest management practised on the area comprised in this Working Circle was policing and revenue collecting.

In September, 1921, a Preliminary Working Plan drawn up by Mr. S. L. Kessell was approved by the Governor in Executive Council.

In the summer of 1921-1922, fire-control measures were instituted, and the fire towers on Mounts Gungin and Dale were constructed.

In June, 1922, the first plantation (*P. insignis*), now Compartments G2 and 3, was established.

In December, 1923, a commencement was made with regeneration cleaning under the Group Selection System, and at the same time control of trade cutting by Tree-marking under the Group Selection System was instituted.

Details of past operations (by blocks and compartments) are shown in Appendix No. 2.

A summary of the operations is as follows:—

A. Jarrah Forest Regeneration Cleaning—Group Selection System.

Year.	Compartments.	Acreage.
1923-24	B. 9	610
	S. 4	134
	S. 2	79
	S. 1	92
1924-25	B. 8	244
	B. 13	270
	S. 1	253
	S. 2	281
	C. 12	271
1925-26	C. 15	165
	B. 15	127
Total to 31st May, 1926		2,526 acres

B. Exotics. Planting.

Season—Year.	Compartments.	Species.	Area in acres.	Total in acres.
1922	G. 3	P. insignis	39	53
	G. 2	P. insignis	14	
1923	D. 8 and 9	P. insignis	30	57
	D. 6, 8, and 14	P. pinaster	24	
	H. 5	P. palustris	3	
1924	G. 12 and 19	P. insignis	51	64
	G. 2	P. pinaster	13	
1925	G. 4, 6, 19 and 20	P. insignis	67	69
	G. 2, 4	P. muricata	2	
Total to the 31st May, 1926			...	243 acres

C. Fire Control.

In December, 1921, two lookout stations, including towers 30 feet high and observers' huts, were erected on Mounts Gungin and Dale. These towers were equipped with theodolites for taking cross bearings, and heliographs for communicating with men in the forest. Twenty-five miles of telephone line connected the lookout stations with Forest Headquarters at Mundaring Weir.

Fire Control measures were instituted over 120,000 acres in December, 1921. The experience gained on this Working Circle will prove of great value in all future fire control work undertaken in this type of forest, both in this State and in other parts of Australia.

The results of past Fire Control are as follows:—

Year.	Area controlled in Acres.	Area burned in Acres.	Per cent.	No. of Fires.	Cost per Acre.
1921-22	120,000	1,653	1.4	89	.2
1922-23	120,000	8,184	6.82	75	1.75
1923-24	120,000	29,506	24.58	94	1.8
1924-25	120,000	1,400	1.17	74	1.96
1925-26	112,000	643	.574	19	1.75

D. Permanent Establishment.

In 1920-21 eighteen miles of road were constructed around the Helena Reservoir.

In 1922-23 50 chains of feeder road to connect with the above road were constructed.

In 1923-24 a forester's house, assistant forester's house, staff cottage and stables were erected at Forest Headquarters at Mundaring Weir.

In 1924-25 overseers' cottages were erected at Barton's and Illawarra Forest Stations.

In 1925-26 an office was erected at Forest Headquarters and a house was purchased at Canning Forest Station. The main telephone line connecting the Fire Towers and Headquarters was extended by ten (10) miles of line to connect with the Illawarra and Canning Forest Stations. Connection with the Sawyers' Block Overseer's private house at Mundaring was established through the Western Australian Government Railways telephone line. Seven (7) miles of telephone line were constructed to connect the proposed Greystones and Helena Forest Stations with Forest Headquarters.

7. STATISTICS OF GROWTH AND YIELD.

Pending more accurate determination of the rate of growth of Jarrah in the locality, no yield tables are available.

Note.—A load is equivalent to 50 cubic feet.

PART II.—FUTURE MANAGEMENT.

8. OBJECTS OF MANAGEMENT.

(1.) To manage the forest so as to maintain a well regulated supply of pure water in the creeks and springs on the reservoir catchment areas.

(2.) To produce Jarrah timber for local requirements and trade purposes generally, including the maintenance of a supply of firewood for Nos. 1 and 2 Pumping Stations of the Goldfields Water Supply Scheme.

(3.) To utilise, as far as possible, all country unsuitable for the production of a marketable crop of Jarrah for the growth of exotic conifers to supply in part the softwood requirements of the State.

9. DIVISION AND ALLOTMENT OF AREAS.

(a.) *Subdivision into Compartments and Blocks.*

With the more intensive work now being carried out on the subject area, it has been found necessary to alter the original subdivision.

The Working Circle has now been subdivided into 236 Compartments. The Jarrah forest has been subdivided chiefly according to roads, tracks, tramway formations and creeks, into Compartments of approximately 500 acres each.

The non-Jarrah country to be afforested with conifers has been subdivided into compartments of approximately 25 acres each, and in this survey due regard has been given to the necessity of fire-breaks, which separate compartments, being ploughable.

For the purposes of general orientation, and local supervision, the Compartments have been grouped into the following Blocks:—

Name.	Area in Acres.	No. of Compartments.	Reference Letter.
Sawyers	18,343	36	S
Zamia	4,781	10	Z
Kalamunda	6,276	12	K
Reservoir	8,508	16	R
Greystones	3,180 (1,160 acres sub-divided)	33	G
Helena	8,595 (861 acres sub-divided)	25	H
Darkin	9,100 (372 acres sub-divided)	14	D
Bartons	11,052	19	B
Canning	14,211	28	C
Illawarra	13,926	23	I
Thompsons	13,555	20	T
Occidental	12,896 not sub-divided	...	O

Compartments are numbered separately for each Block.

The subdivision is shown on the Block Plans (*see* maps Nos. 5 to 14). In the Occidental Block, which has not yet been subdivided into Compartments, the subdivision, based primarily on the tramway system to be established for the Barton's Mill, will be made as the work proceeds.

In the Greystones, Helena, and Darokin Blocks, subdivision sufficient for the planting during the period of the Plan has been carried out. Additional subdivisions must be completed before June 30th, 1930.

In deciding on the boundaries of Blocks in the Jarrah forest still to be worked over for sawmilling, due consideration has been given to the location of sawmilling areas so that any one sawmilling area shall not form part of two Blocks.

The sawmilling areas have been decided by the natural limits of hauling for small mills (capacity ten loads in the round per day), working under existing conditions.

The Barton's Mill (capacity 30 loads in the round per day) is, by means of tramlines, enabled to operate beyond the natural limit for a small mill on the same site.

(b.) *Formation of Working Sections.*

The Working Circle has been divided into three Working Sections according to the different silvicultural systems employed in each.

Working Section A.—

Jarrah Forrest. Group Selection System. Includes the following Blocks:—

Zamia. Canning. Illawarra. Kalamunda. Occidental. Bartons. Thompsons. and portions of Sawyers Block.

Working Section B.—

Non-jarrah country to be afforested with conifers. Clear felling to be followed by planting.

Includes the greater portions of following Blocks:—
Greystones. Helena. Darkin.

Working Section C.—

The area of 17,220 acres ringbarked in 1903 and now carrying dense regrowth, malformed and ruined by repeated fires. Clear felling followed by regeneration from coppice. Includes the Reservoir Block and the greater portion of Sawyers Block.

Trade operations such as pile and pole cutting, firewood cutting, and the gathering of such forest produce as stone, gravel, soil, banksia nuts, blackboys, etc., depend on intermittent orders and are not of great economic importance at the present time. These are dealt with under the heading Minor Forest Produce (Section II., page 23), instead of under the separate Working Sections.

10. PROPOSALS FOR THE RESPECTIVE WORKING SECTIONS.

10A. WORKING SECTION "A."

(Jarrah Forest—Group Selection System.)

1. Silvicultural System—(Selection by Groups.)

Regeneration operations. The general practice will be as follows:—

The formation of openings or blanks in the forest by the marking for removal for trade purposes of such trees as possess utilisation value, and by the destruction by felling and ringbarking of adjoining worthless Jarrah and useless species such as Marri, etc. Where an underwood or lower cover composed of such species as Banksia, Wattles, large shrubs and Blackboys exists in the openings so formed, this growth must be removed. These blank areas will subsequently be burned by as severe a fire as possible. The details of these operations will conform with the procedure laid down in the latest Departmental circular of instructions referring to this work.

Improvement Work.

The removal of worthless Jarrah and trees of useless species, dominating useful groups of young Jarrah, is called for. This treatment will not be carried out in any Compartment for a period of four years following Regeneration Cleaning in that Compartment, when instructions for this work may be given by the Divisional Forest Officer in writing or from Head Office. A four-year period is set down in order to allow sufficient time for the ringbarked trees in the blanks to lose their leaves and bark, and so become a less dangerous fire hazard before any further ringbarking takes place. At least once in this four years period, an early light burn may be carried out in the groups where practicable and economical, to aid in the protection of the adjoining regrowth from fire.

Thinning.—It is not expected that any thinning will be required during the period of the plan. If any thinning should be required, directions governing such operations will be given by the Conservator.

2. *Methods and Order of Operations.*

Department operations will consist of Advance Burning, Tree Marking, and Regeneration Cleaning.

All forest produce permit holders must comply with the by-laws of the Water Supply Department concerned and take all action necessary in order to prevent the pollution of water supply when working on any catchment area.

The various operations in the bush will be carried out in the order, and in accordance with the instructions, given below.

(a.) *Advance Burning.*

The country to be worked over during the ensuing year may be burnt by a light controlled fire in either late or early summer. Details will conform with the latest circular of instructions referring to this work.

(b.) *Tree-marking.*

All trade cutting operations will be controlled by "Tree-marking," which, carried out in advance by fallers or cutters, will be by the system, Selection by Groups.

The trees will be marked by a brand in an axe cut at the foot of the tree.

The brand will be F.D. over a number in a circle; the number denoting the officer using the brand.

Tree-marking will be performed only by a Forest Overseer or other officer authorised by the Conservator of Forests.

The tree-marking will be carried out by coupes, to which the fallers or cutters will be restricted as the Forester shall direct. The size of a coupe shall not be greater than is sufficient to provide one month's cutting.

(c.) *Sawmilling Operations.*

Falling and hauling will follow the tree-marking.

Sawmilling operations will be governed by Sawmill Permits under the Forests Act and by the following special conditions:—

- (1.) Only trees marked with an F.D. brand by an Officer of the Department may be felled and converted.
- (2.) All trees so marked must be felled and converted, provided that due consideration is given by the Department to hauling facilities, and that all mill logs are reasonably sound.
- (3.) The mill manager must exercise strict control over his men with regard to avoiding damage to regrowth and useful unmarked timber in falling and hauling operations, and in the use of fire.

(d.) *Hewing.*

Timber will be disposed of under permit, renewable locally from month to month.

Permits will be granted only to registered hewers who are approved by the Forester in Charge, local residents receiving preference.

Local hewing permits will be issued on the prescribed form and in accordance with the conditions expressed thereon.

No permit will be issued to more than two cutters.

The total royalty under any one permit shall not exceed £10.

The area granted under permit shall not exceed that area necessary to provide one month's cutting for the permit holders.

(e) *Silvicultural Work* will be carried out by departmental employees in accordance with the instructions given in Section 10a 1.

(3.) *Determination of Cut.*

With the exception of small areas of virgin bush in the extreme South-Eastern portion, the Munding Working Circle has been heavily cut over during the past 40 years for all classes of forest produce.

In determining the cut now permissible account can be taken only of the area now carrying milling timber. The following statement shows the areas of the different classes of country:—

	acres.
(i.) Ringbarked	18,000
(ii.) Non-jarrah	30,000
(iii.) Cut-out or suitable for hewing only (jarrah) ..	35,000
(iv.) Carrying milling timber (jarrah)	41,000

The country on which milling timber occurs now carries an open stand of mature and over-mature trees so deficient in the younger age classes that poles, piles, and immature trees are rarely met with.

Before the present ruined stand can be replaced by a new crop, utilisation of the remaining mature timber must be effected, and for this purpose sawmilling and hewing, conducted according to silvicultural rules, under control by tree-marking, is necessary.

The principle of sustained yield according to any recognised system is not possible for the following reasons:—

- (i.) Practically nothing but mature timber remains, the forest being very deficient in the younger age classes.
- (ii.) The volume of this mature timber is very low, averaging about four (4) loads in the round per acre. (This loadage should not be accepted as an indication of the yield per acre which may be expected in the second crop when the forest should be more or less normal.
- (iii.) The smallest capacity mill that can operate under existing conditions, particularly in regard to the large size of the logs, is about ten (10) loads in the round per day. Such a mill has a hauling limit of $1\frac{1}{2}$ miles, and from one mill site about 4,000 acres of average country is the maximum area that can be cut-over. This area is only sufficient to keep the mill operating for five and one-half years.

Exceptions occur in the case of mills worked by owners, such as an orchardist and his sons operating part time to cut fruit cases from small logs, and with an average cut as low as 30 loads in the round per month. But the successful operation of such a mill is dependent upon local markets, and can only be worked by men who are not solely dependent on the industry for their livelihood.

- (iv.) The Barton's Mill has a large capacity, cutting about thirty (30) loads in the round per day. Pending the revision of the working plan, certain tramline extensions into relatively inaccessible country have been allowed. The stock-taking associated with the revision of the plan has shown that the maximum life which this mill can be allowed is about four years, having regard to the necessity for continuity of work on the Working Circle.

With the exception of the small mill operating in the Sawyers Block, only one mill will be allowed to operate on the Working Circle when the Barton's Mill closes down in four years' time. This mill shall not have a capacity greater than ten loads in the round daily. For such a mill it is estimated that the 25,000 acres of country which will then be available for sawmilling will provide a life of thirty-five years.

Hewing, following the sawmilling, is necessary in order to effect thorough utilisation of the mature timber in the present crop, particularly in regard to "dry-siders" and "short-butts," and on the small areas on the steep falls to certain creeks which are inaccessible to the mills.

It is desirable that hewing should be spread over as long a period as possible for the following reasons:—

- (i.) To provide long-term employment for old cutters who are local residents and who have been following the calling for many years.
- (ii.) To provide employment in the forest as long as possible for a number of men who can be called upon for seasonal forest work, such as fire-fighting, pine planting, etc.
- (iii.) To keep some population, other than departmental employees, and therefore schools, stores, etc., as long as possible in the parts of the district where the present population depends entirely on the timber industry.

On the other hand, the rate of hewing cannot be reduced below a certain minimum for the following reasons:—

- (i.) Hewing must be conducted over the area to be treated for regeneration annually.
- (ii.) The necessity for providing cutting for sufficient hewers to provide continuous employment for a team in carting. This necessity would be obviated if all cutters would cart their own sleepers, but apart from the fact that few cutters have sufficient means to purchase the necessary outfit, and that the old cutters have so long relied upon a teamster, as sub-contractor, to arrange all matters of business, it is obviously not economical for a cutter to keep a horse and dray for intermittent work.

The rate of regeneration cleaning has been fixed as that necessary to provide continuous employment for one man (Overseer or Foreman) and employment during the fire season for one additional man.

4. *Prescriptions.*

(a.) *Sawyers Block.*

(i.) Sawmilling operations are being carried out for a mill with a monthly average capacity of thirty loads in the round, twelve in the square, established on private property, Loc. 2030, adjoining Compartment S3. One hundred to two hundred acres are cut over annually. This mill is dependent on intermittent orders for local scantling and fruit cases, with consequent fluctuations of prices. It is doubtful whether operations can be continued for more than a few months, when the bush within profit-

able hauling distance (under present conditions), will have been cut out. Subject to satisfactory markets, it is estimated that a further area of 1,850 acres (see Map No. 4), Compartments S.13 and portions of 4, 5, 6, 12, and 14, can be cut over for the mill under the present method of operating by the permit holder, although the hauling is longer and uphill. This area should provide a life of 10 to 12 years.

Compartments will be worked as far as possible in the order S4, 5, 12, 13, 14, and 6.

Not more than one mill may operate at the same time during the period of the plan, and this one mill shall not have a greater monthly average capacity than twelve loads in the square (30 in the round).

(ii.) Hewing. As no country will be treated for regeneration under the Group Selection System during the period of the plan, no hewing will be permitted. This regulation will apply to Wandoo as well as Jarrah.

(iii.) Regeneration Cleaning. No bush will be treated for regeneration during the period of the plan.

(b.) *Zamia Block.*

The timber on this block will be held in reserve during the period of the plan, and no regeneration cleaning will be carried out.

(c.) *Kalamunda Block.*

(i.) Sawmilling operations are being conducted for a mill with a daily average capacity of ten (10) loads in the round, established on private property, Loc. 20A, and North of Compartment K6. Only Compartment K6 and portion of K5, totalling 685 acres, are held under permit. It is expected that this area will be cut out about June, 1927.

Areas in this block suitable for sawmilling (see Map No. 4) are as follows:--

Compartments K3, 4, 5, 9, 10, totalling 2,300 acres. Mill site on private property Loc. 169. Probable life for a ten-load mill (in the round) is two years.

Compartments K7, 8, 11, 12, totalling about 2,100 acres. Mill site on the Southern portion of Loc. 392. Probable life for a ten-load mill (in the round) is four to five years.

The above milling areas are to be regarded as reserves, and during this period of the plan no sawmilling should be allowed on this block other than in the exercise of the rights already held under Sawmill Permit No. 603, which rights should be cancelled if opportunity offers.

(ii.) Hewing. As no country will be treated for regeneration during this period of the plan, no hewing will be permitted.

(iii.) Regeneration Cleaning. No bush will be treated for regeneration during this period of the plan.

(d.) *Barton's Block.*

This block has been heavily cut over in the past for sawmilling, and may now be considered to be cut out in respect to milling timber.

(i.) Hewing will be conducted at the average rate of approximately 500 acres annually, which area it is estimated is sufficient to keep two hewers constantly employed.

Compartments will be worked over as far as possible in the order B4, 15, 7, 3, 2, 11, 12, 17, 16.

(ii.) Regeneration Cleaning will be carried out at the rate of 500 acres annually.

Compartments will be worked over as far as possible in the order B4, 15, 7, 3, 2, 11, 12, 17, 16.

(e.) *Canning Block.*

(i.) Sawmilling operations are being carried out for a mill called Weston's Mill with a daily average capacity of ten (10) loads in the round, established on the Pickering Brook Townsite immediately North of Compartment C. 10.

Log supplies are being drawn from S.M. Permit 615 of 2,900 acres, embracing Compartments C. 4, 9, 10, and 11, and portions of 5 and 17, which should provide a life of three years.

Owing to the fact that Compartments 4 and 9 and portions of 5 can be cut over only in the summer months, no definite order of working Compartments can be laid down, but the Forester in Charge will arrange operations so that not more than two Compartments are partially cut over at any one time.

Other areas in this Block suitable for sawmilling (*see* Map No. 4) are as follows:—

Compartments C. 8, 18, 19, 20, 22, 23, and portions of 7 and 21, totalling approximately 3,400 acres. Mill Site in Canning Mills. Probable life for a mill with a capacity of ten loads in the round daily is three years.

Compartments C. 24, 25, 26, and portions of 17, totalling approximately 1,600 acres. Mill site in Canning Mills. Probable life for a mill with a capacity of ten loads in the round daily is eighteen months.

No sawmill permits over this block will be issued until Permit 615 at present held is cancelled.

Not more than one mill, which must not have a greater average capacity daily than ten loads in the round, will be permitted to operate.

Should other permits be issued during the period of the plan, the order in which the Compartments are to be worked will be given by a senior professional officer to the Forester in charge in writing.

(ii.) Hewing.—Should the bush be worked to the best advantage by the Sawmill Permit holders, little timber suitable for hewing should remain except on small areas on the steep falls to the creeks from which mill logs cannot be hauled.

On the Compartments recently cut over for sawmilling, and to be treated for regeneration during the period of the plan, practically no hewing timber remains.

Should it be possible to utilise any of the remaining timber, hewing may be conducted in advance of the regeneration cleaning, the location and extent of the latter (as given in paragraph iii.) governing the location and extent of the hewing.

(iii.) Regeneration cleaning will be carried out at the average rate of 500 acres annually.

Compartments will be worked as far as possible in the order C15, portion of 14, 13, 16, 11, 10, portion of 17, 4, and 9.

(f.) *Thompson's and Occidental Blocks.*

(i.) Sawmilling operations are being conducted for a mill called the Barton's Mill with a daily average capacity of 12 loads in the square (or 30 loads in the round), established in the southern corner of Compartment B. 8 in the Barton's Block.

Log supplies are being drawn from S.M. Permit 617 of 4,600 acres embracing Compartments T. 4, 5, 10, 11, 15, and 16, and portion of the Occidental Block (*see* Map No. 4), which should provide a life of twelve months, and will be cut out about the 30th of June, 1927.

The capacity of this mill shall not be increased, and no other permits will be issued over these Blocks while the Barton's Mill is operating.

Additional country, about 6,500 acres in extent, to the west and south of the present permit area, and as shown on Map No. 4, is proposed for the future requirements of this mill. Having regard to the present consumption of the mill (30 loads in the round per day), this area should provide an additional life of three years. When this additional country is cut out the Thompson's Block will be cut out in respect to sawmilling timber, and no further log supplies will be made available for the Barton's Mill on its present site.

Further milling operations on the Occidental Block must be conducted only by small mills of insufficient capacity to carry a tramline, and therefore dependent upon road motor transport for carting the sawn output of timber to the nearest railway station.

(ii.) Hewing, following the falling, will be conducted at the average rate of approximately 500 acres annually, which area, it is estimated, is sufficient to keep two hewers continuously employed.

Two sleeper-cutters are at present working at the head of the Barton's bush line in the Occidental Block. Within the next nine months, however, milling operations will be transferred to the Thompson's Block and the present head of the line pulled up. Hewing will then of necessity be confined to the Thompson's Block, and compartments should be worked through as far as possible in the following order:—T. 9, 4, 5, 16, 17, 10, 11, 12, 13, 3.

If, when the Barton's bush line is moved from its present position in the Thompson's Block, it should prove impossible to arrange carting for only two hewers, additional hewers up to the number of six may be granted permits, provided the area cut over in five years does not exceed 2,500 acres.

In addition a considerable area of country (about 3,000 acres), comprising Compartments T. 1, 6, 7, 8, 18, and 19, on the Western fall to the Darkin River, carries scattered Jarrah in poor forest, and will probably in the future be utilised for afforestation with conifers. The timber is inaccessible for milling and can only be utilised by hewing.

This country is, however, accessible for hewing only while the Barton's bush line is in its present position, and must therefore be cut out in the eighteen months during which this line will continue in operation. On a basis of one-quarter of a load of sleepers per acre, it is estimated that five hewers will cut this area out in eighteen months.

(iii.) Regeneration cleaning will be carried out during the period of the plan in the Thompson's Block only and at the rate of 500 acres annually.

Compartments will be worked over as far as possible in the order T. 9, 4, 5, 16, 10, 11, 12, 3.

(g.) *Illawarra Block.*

The timber on this block will be held in reserve during the period of this plan and no regeneration cleaning will be carried out.

Areas in this block, probably suitable for sawmilling (see Map No. 4), are as follows:—

Compartments 4, 5, 9, 10, 11, totalling approximately 3,300 acres. Mill site on or about Location 381. Probable life for a mill with daily capacity of ten loads in the round is three years. In addition, Compartments 1, 2, 3, and 12 may possibly be included.

Compartments 14, 18, 19, and portions of 13. Totalling approximately 2,000 acres. Mill site in north-west corner of Compartment 19. Probable life for a mill with a daily average capacity of ten loads in the round is two and one-half years.

Compartments 20, 21, 22, 23, and portion of 13, totalling approximately 2,500 acres. Mill site at junction of creeks on southern boundary of Compartment 22. Probable life for a mill with a daily average capacity of ten loads in the round is six years.

10b. WORKING SECTION "B."

(Non-jarrah country to be afforested with conifers in the Greystones, Helena and Darkin Blocks.)

(1.) *Silvicultural System.*

This Working Section comprises the inferior Eucalypt country, occurring chiefly along the main streams in the Working Circle, which, being considered suitable for the growth of certain exotic conifers, will be converted into coniferous forest by clearing and planting.

The various timber and soil types to be dealt with are shown on Maps Nos. 15, 16, and 17.

(2.) *Species.*

Pinus insignis has been chosen as the species likely, in view of present knowledge, to give satisfactory results on the better class soils available for pine planting. In making the first subdivision, the aim has been to include only the better class soils, and in consequence *Pinus insignis* will form the bulk of the planting stock. (For further description see Appendix 3.)

Even on the soils chosen however, the results must be watched carefully and the plan revised in this respect at any time it is found necessary.

In view of the fact that *Pinus insignis* must be restricted to the better soils, experiments will be conducted to determine species less exacting as to soil requirements, and likely to make satisfactory growth on all or most of the types of country available.

Experimental plantations of *Pinus laricio* and *Pinus ponderosa*, and smaller plots of *P. canariensis*, *P. Torreyana*, *P. Coulteri*, *P. taeda*, *P. caribaea*, *P. Lambertiana*, *P. densiflora*, *Libocedrus decurrens*, and other species will be established as seed supplies are obtained and planting stock becomes available.

The timber type, Wandoo, Marri, and Jarrah (poor soil) as occurring in Compartments G 2, 6, and 7; H 7, 9, 10, 12, and 13, will be planted with *Pinus pinaster*, unless further experience shows that this type is more suitable for another species.

The typical Jarrah country has been eliminated as far as possible in the subdivision, but the small areas necessarily included will be dealt with experimentally. The country on the steep falls to the creeks, carrying Wandoo and Marri of poor type in pockets of soil among the granite rock outcrops, has also been eliminated as far as possible in the subdivision, and will be dealt with experimentally. In addition to the large areas which occur externally, this type is found in Compartments 8, 21, 23 at Greystones. This country would support only a sparse stand consisting chiefly of groups of rather widely spaced trees among the granite rock outcrops, but its economic suitability can be considered in conjunction with the results obtained from experiments at the next revision of the plan.

The Wandoo country on the fringe of the alluvial soils along the Helena Valley is more or less typical of the large areas of Wandoo country to the east of the Working Circle. The results of experiments conducted on these Wandoo types will therefore be of value in deciding the species to be used in planting the large areas of Wandoo country available outside the Working Circle.

3. *Methods and Order of Operations.*

(a.) *Nursery Operations.*

Temporary nurseries with a capacity sufficient to supply the required planting stock have been established at the Weir Wall, Forest Headquarters, Barton's Forest Station, and Compartment G3 at Greystones.

The planting stock required will continue to be raised in these nurseries until either a central nursery, or nurseries on the site of the actual plantations in the Helena and Darkin Blocks, can be established. The existing nurseries, with the exception of Greystones, will then be abandoned.

Details of nursery operations will conform with instructions given in the latest circular referring to this work.

(b.) *Clearing.*

Clear felling to be followed by burning. Details of clearing will conform with the instructions given in the latest circular referring to this work.

In order to utilise any scattered useful timber on country to be planted, hewing and firewood cutting will be conducted (under local permit), as directed from time to time, in advance of the clearing.

(c.) *Planting.*

Pit planting will be the method employed.

The spacing distance has been provisionally fixed at 8ft. x 8ft. for *Pinus insignis*, and 7ft. x 7ft. for *Pinus pinaster*.

Details of planting operations will conform with the instructions given in the latest circular referring to this class of work.

4. *Determination of Planting Rate.*

There is not sufficient data available on which to determine the rotation of any species grown under local conditions, but the rate of establishment has been fixed at the minimum area sufficient to keep one man continuously employed, which is 25 to 50 acres annually.

In the case of the Helena Block where a larger area of the better soil types is available, the rate has been increased to 100 acres annually.

5. *Prescriptions.*

(a.) *Greystones Block.*

Planting will be carried out at the average rate of 25 acres (approximately one compartment) annually.

Compartment 1 has been reserved for experimental plots of *Pinus insignis*, *Pinus pinaster*, *Pinus Coulteri*, *Pinus laricio*, *Pinus taeda*, *Pinus torreyana*, and *Pinus ponderosa*, as shown on Map No. 12, and will be planted as planting stock becomes available. Compartments will be planted as far as possible in the order G4, 6, 20, 18, 13, 10, 26, 11, 27, 31, 32, 33.

(b.) *Helena Block.*

Planting will be carried out at the average rate of 100 acres (approximately four compartments) annually.

Compartments will be planted as far as possible in the order: 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 8, 14, 15, 16, 17, 18, 19, 20, 21.

(c.) *Darkin Block.*

Planting will be carried out at the average rate of 50 acres (approximately two compartments) annually.

Compartments will be planted as far as possible in the order: 14, 6, 7, 1, 2, 3, 4, 5, 10, 11, 12, 13.

10c. WORKING SECTION "C."

(Ringbarked country in the Sawyers and Reservoir Blocks.)

(1.) *Silvicultural System.*

The silvicultural system will be clear felling followed by coppice regeneration.

Details of operations will conform with the instructions given in the latest circular referring to this work.

(2.) *Methods and Order of Operations.*

This work is largely experimental, and modification may be introduced under written instructions from the Conservator of Forests.

It is anticipated that the Goldfields Water Supply Department may be induced to use, as a proportion of the firewood for the pumping stations, some of the small size round wood which will be converted in the course of the clear-felling.

If such arrangements can be made, the converted wood will be disposed of under the Permit held for the supply of firewood to the pumping stations. For detail of the firewood supply see Section II. (2).

The specifications for the wood will be five feet eight inches to six feet in length by six inches at the small end for round wood, and timber over nine (9) inches at the small end will be split to from three inches to nine inches; unless it is found that wood of smaller dimensions can be disposed of.

The clear felling of the malformed coppice and the conversion of the felled timber into firewood will be carried out by Departmental employees.

Should odd ringbarked trees suitable for conversion into firewood be met with, the Forester in Charge will arrange with Permit-holder for the cutting and working of such trees.

In the clear-felling, tracks ten (10) feet wide will be left every 30 to 40 feet, according to the height of the trees, by felling the trees off such tracks. The converted wood will be stacked on end for drying on these tracks, which will be used for access in carting.

It will probably be necessary to establish dumps at intervals on the main roads or tracks where the converted wood can be stacked for six to twelve months for drying before being disposed of to the pumping stations.

(3.) *Determination of Cut.*

It is recognised that most of the malformed regrowth on this ringbarked country will never be suitable for any purpose other than firewood.

In view of the fact that the supply of firewood to the Goldfields Water Supply Pumping Stations is one of the objects of management, the rate at which this ringbarked country can be treated for regeneration, with the object of establishing a better type of crop, will depend on the rate of the disposal of the existing crop as firewood.

In the Prescriptions, the rate laid down is 100 acres per annum for each Block supplying the respective pumping stations. This rate must be regarded as provisional only, but will, in all probability, be maintained as long as supplies of dry firewood from dead waste timber are available within economic hauling distance of the pumping stations.

If, during the period of the plan, the economic position should cause the Goldfields Water Supply Department to ask for larger annual supplies of firewood from the malformed regrowth, an increased cut, up to 500 acres annually in each Block, may be allowed by the Conservator of Forests.

(4.) *Prescriptions.*

(a.) *Sawyers' Block.*—The regeneration cleaning will be carried out at the average rate of 100 acres annually. The ringbarked or eastern portion (about 400 acres) of Compartment S. 15 and 100 acres of Compartment S. 16 will be worked through during this period of the Plan.

(b.) *Reservoir Block.*—The regeneration cleaning will be carried out at average rate of 100 acres annually. Compartment R. 1 will be worked through during this period of the Plan.

11. MINOR FOREST PRODUCE.

(1.) *Pile and Pole Cutting.*

Timber will be disposed of under permit renewable locally from month to month.

Local pile and pole permits will be issued on the prescribed form and in accordance with the conditions expressed thereon.

The total royalty on any one permit shall not exceed £10.

The area granted under permit shall not exceed that area necessary to provide one month's cutting for the permit holders.

The pile and pole trade is a secondary business, and can receive attention only after the other provisions of the plan are complied with.

When inquiries for piles and poles are received a sale may be arranged if the orders can be fulfilled from the coupes at that time being operated over for mill logs or hewn sleepers, or being treated for regeneration.

Under these conditions the trees which may be marked for piles and poles will be those trees which would otherwise be ringbarked, together with a small percentage of damaged and suppressed trees in groups.

(2.) *Firewood.*

Firewood is supplied from the Mundaring Working Circle for the requirements of:—

- (a) The Goldfields Water Supply Pumping Stations Nos. 1 and 2.
- (b) The City of Perth and local residents.

- (a) The Goldfields Water Supply Pumping Stations Nos. 1 and 2.

Firewood permits have been issued and will continue to be issued to the person securing from the Goldfields and Country Water Supply Department the contract for the supply of firewood for the pumping stations.

The present Permit No. 203 of 16,000 acres is held by A. Young, the royalty payable being nine (9) pence per cord.

The sum of sevenpence per cord, in addition to the usual royalty of twopence per cord in the district, is charged to cover the use of the Departmental road, no road license being charged by the local Roads Board for drays used under the permit. The present contract price is twenty-six (26) shillings per cord. The contractor pays the cutters ten (10) to twelve (12) shillings per cord, and does the carting with his own horse teams.

The area granted under permit will be sufficient to supply that volume of firewood contracted for by the contractor, but the operations of the contractor shall be restricted to coupes as the Forester shall direct.

The average monthly requirements for the pumping stations are as follows:—

No. 1 Pump, 265 cords (397 tons).

No. 2 Pump, 215 cords (322 tons).

The firewood is obtained from dead waste wood, jarrah and marri, chiefly from the ringbarked trees on the area of 12,380 acres around the Helena Reservoir ringbarked in 1902. The pumping stations at present demand first quality wood which must be in six-foot lengths, dry and solid. Proposals regarding the cutting of green timber were made in 1925 to both the permit holder and the Goldfields Water Supply Department, but these were rejected, the reasons given being the unsuitability of green timber as firewood and the loss incurred in stacking green timber for drying. Supplies are obtained from separate sources in the vicinity of each pump, separate cutters being engaged.

At present the wood is carted with two-horse wood drays, about a cord and a quarter being carted each trip. The approximate areas cut over for each pump since the pumping stations opened in 1902 are as follows:—

No. 1 Pump, 3,750 acres.

No. 2 Pump, 3,650 acres.

The areas cut over do not surround the pumping stations, but in the case of No. 1 Pump lies to the Southward, and for No. 2 Pump to the Eastward. The greatest distance over which timber is at present hauled to the Pumping Stations is about three miles.

The areas cut over are not cut out, and the volume of wood yet to be obtained from these areas depends primarily on two factors:—

- (i.) The price paid for wood by the Pumping Stations.
- (ii.) The high quality of wood at present demanded.

With the use of motor lorries instead of horse drays first quality wood from areas not at present cut over could no doubt be supplied to the pumping stations at the present price.

The use of motor lorries would render the supply of wood available ample for the period of the plan. Although the gravel road made by this Department is excellent for summer carting it will not carry heavy winter carting. This may render it necessary for the contractor to use drays to dump the wood along the road in the winter months and cart to the pumping stations only during the summer.

The time must come, however, when the quality of the wood demanded must be reduced or the price raised, when the cut over areas will be again worked over for further supplies.

For these reasons no definite order of working has been set out, but the Forester in Charge will endeavour to secure thorough utilisation under prevailing conditions on areas being cut over.

In connection with the treatment for coppice regeneration of the areas of malformed regrowth in the ringbarked country in the Sawyers' and Reservoir Blocks (see Section 10c), it is anticipated that the pumping stations will be induced to take a portion of small sized round wood. A clause should be inserted in the new permit agreement to provide for the permit holder taking over as part of his con-

tracted supply for the pumping stations a small quantity of firewood (about 300 cords annually) cut in the course of silvicultural work. This wood should be supplied to the contractor at a price of eleven (11) shillings per cord.

(b) The City of Perth and Local Residents.

Firewood comprises dead waste timber, green Banksia, green Sheoak, and green Jarrah where the latter is marked by an officer of the Department.

Firewood will be disposed of under permit renewable locally from month to month.

Local firewood permits will be issued on the prescribed form and in accordance with the conditions expressed thereon.

The total royalty under any one permit shall not exceed £10.

The present royalty payable under Local Permit is about one penny per cord, being one shilling for a four-wheel truck (up to 7 tons), and two shillings for an eight-wheel truck (up to 16 tons).

The area granted under any permit shall not exceed that area sufficient to provide the permit holder with one month's cutting.

The firewood trade with Perth consists of the supply of Bakers' Wood, Firewood Yard Wood, Brick Kiln Wood, and Engine Wood, the qualities being in the order given. The trade is an intermittent one, depending on orders received, almost from day to day, by the cutters for the different classes of wood. An average of sixty cutters are engaged in supplying the Perth trade with an average total of 300 seven-ton trucks, or 2,000 tons of wood, monthly. The average number of cutters engaged under permit in this industry should not exceed sixty, and permits should be issued only to local residents at present engaged in the industry. Owing to the fact that—

- (i) firewood is cut for intermittent orders for the various qualities of wood stated,
- (ii) many of the men engaged in the industry are old men who are content to work for a part wage in order to remain in close proximity to their houses,

any given area may be worked over time and again without being cut out, depending on the orders being fulfilled and the men engaged.

For this reason no order of working Compartments is given, but the Forester in Charge will confine the operations to as small an area at any one time as possible. No firewood cutting will be permitted on Compartments closed for regeneration.

(3) *Other Forest Produce.*

Such as granite, ironstone, gravel, soil, Banksia nuts, Blackboys, etc. The supply of such produce depends on intermittent orders received by local settlers who do not depend entirely on these industries for sustenance. For this reason no definite order of working has been set out. The Forester in charge will, however, concentrate operations as far as possible, and restrict the gathering of such produce as granite, ironstone, soil, gravel, etc., to defined areas which may from time to time be set aside for the purpose. This produce will, in general, be disposed of under permit renewable locally from month to month. The total royalty under any such permit shall not exceed £10. The area granted any permit shall not exceed that area sufficient to provide one month's work for the permit holder.

It will, however, be a matter for decision from time to time, whether the gathering of such produce as Blackboy can best be controlled under long-term permit subject to auction or tender, or under permit issued locally from month to month.

12. FIRE CONTROL.

A. BASIS OF PROPOSALS.

The whole of the Working Circle shall be considered as under Fire Control Measures.

These measures will vary according to the conditions of the forest. Complete protection will be afforded to:—

- (a) Areas treated and regenerated, except that, where the crowns of the young crops have reached a sufficient height to be beyond damage by a light surface fire, instructions may be given by the Conservator for controlled early burning under such stands.
- (b) Areas treated and awaiting final treatment pending seed years.
- (c) Areas which will be worked over for trade purposes in the near future, and which therefore will be burnt twelve months or two years in advance.

The remainder of the forest will be burned systematically by light controlled fires. In view of the fact that the bush will carry a fire usually only every three years, approximately one-third of the country not afforded complete protection will be burnt each year.

B. FIRE CONTROL MEASURES.

Supervision of fire control measures will be the direct charge of the Forester in charge of the Mundaring Working Circle.

(a) *Fire Prevention.*

In November of each year a "controlled burning map," showing the work carried out, must be submitted to the Conservator for approval, together with remarks on the work necessary for completion.

The Forester in Charge will apply to the Conservator of Forests, from time to time as conditions warrant, for lectures in departmental operations (to be delivered by a special officer) to local residents and settlers in the various centres.

The erection of posters and signs, calling public attention to the fact that fire control is being exercised over the forest in the locality, must be completed by the 1st November in each year.

Firebreaks and fire belts for early burning will be maintained as follows:—

(i) *Working Section "A."*

No regeneration cleaning or ringbarking will be carried out within five chains of compartment boundaries or within ten chains of private property locations forming compartment boundaries.

This provision is made in order that Compartments will be separated by belts ten chains in width, half of the width of which may be burnt in alternate years. Such belts must be exclusive of non-jarrah country. Before a Compartment is treated for regeneration the blackboys on the five chain belt surrounding that Compartment will be cut to facilitate control of burning.

(ii.) *Working Section "B."*

Provisionally every 300 acres of plantation will be surrounded with a three-chain break and divided into two more or less equal parts with a one chain break. Subdivisional breaks half a chain wide will surround each Compartment, which will be approximately 25 acres in area.

The method to be adopted for the formation and maintenance of these breaks will be in accordance with the instructions in the latest circular referring to this work.

(iii.) *Working Section "C."*

Provisionally every 100 acres will be surrounded with a one-chain ploughed break.

(b.) *Fire Suppression.*

Observation and location of fires will be secured from the fire towers situated on Mounts Gungin and Dale.

Departmental employees engaged on the various operations in the Working Circle will form the nuclei of fire-fighting gangs, carrying out fire control in the ordinary course of their work.

Communication with men in the bush will be maintained by telephone, heliograph and other means, such as wireless, which may be developed.

Details of fire control will conform with the instructions laid down in the latest circulars referring to this work.

Forest stations, telephone lines and heliograph stations are shown on Map No. 1.

13. GRAZING.

Grazing by domestic animals on the Water Supply Catchment areas which cover the whole of this Working Circle is prohibited by the by-laws and regulations of the Water Supply Departments concerned.

In spite of this, considerable damage by trampling has been caused to plantations by brumbies, both wild and owned by local residents. Owing to action taken by the Department either through impounding or destruction, according to the circumstances of the case, no further damage is being caused, but constant vigilance is necessary to prevent a recurrence of the trouble or grazing by any other animals.

Some damage to plantations has been caused by native fauna (*e.g.*, Brush, eating the tops of, and Quokka and Tamar, ringbarking young pines). At the first signs of damage from these causes steps must be taken to deal with the pests.

Rabbits are met with very occasionally, but no damage by them has been noted.

14. ADMINISTRATION.

The Mundaring Working Circle will constitute a Major Working Circle.

Forest Headquarters are situated at Mundaring Weir.

The Forester in Charge of the Mundaring District will be responsible for carrying out the provisions of the Working Plan.

Two Assistant Foresters, one of whom is resident at Forest Headquarters and the other at Canning Forest Station, are attached to assist the Forester in control of the operations on the Working Circle, and district work generally.

The basis of organisation is the division of the Working Circle into Blocks, one or more of each being the charge of a resident Forest Overseer or Foreman; but for the purposes of general fire control and administration the Working Circle must be treated as one unit.

Subject to minor alterations which may be made with the approval of the Conservator, the control of Blocks will be maintained as follows:—

Sawyers' and Zamia Blocks by an Overseer resident in Mundaring.

Kalamunda and Reservoir Blocks by a Foreman resident at Kalamunda Forest Station.

Greystones Block by a Foreman resident at Greystones Forest Station.

Helena Block by an Overseer resident at Helena Forest Station.

Darkin Block by a Foreman resident at Darkin Forest Station.

Barton's Block by an Overseer resident at Barton's Forest Station.

Canning Block by a Foreman resident at Weston's Forest Station in the Canning Block.

Illawarra, Thompson's and Occidental Blocks by an Overseer resident at the Illawarra Forest Station.

Procedure in regard to correspondence and returns concerning financial matters will conform with instructions laid down in Working Circle Circular No. 9. Monthly and annual reports will be submitted in accordance with the form set out in Working Circle Circular No. 2.

15. SUPPLEMENTARY PROVISIONS.

(a.) *Permanent Plant.*

The establishment of the following houses is proposed:—

(i.) Overseer's House—Greystones Forest Station.

(ii.) Overseer's House—Weston's Forest Station in the Canning Block.

(iii.) Overseer's House—Darkin Forest Station.

(iv.) Overseer's House—Kalamunda Forest Station.

(v.) Workman's House—Helena Block.

The erection of these houses will depend on the funds available and the requirements of the trained staff.

(b.) *Working Plan Control.*

The Annual Report, drawn up on standard lines, will constitute the Working Plan Control.

(c.) *Revision of the Plan.*

The work in connection with the revision of the plan should be put in hand not later than April 1st, 1931.

APPENDICES.

Appendix 1.

MAPS.

1. Working Plan Map, showing subdivision into Blocks, and reference squares for fire-control.
2. Water Supply Catchment Areas, State Forests and Townsites.
3. Timber Classification (also showing ringbarked country).
4. Sawmill Permits, areas existing and areas proposed for milling and hewing.
5. Sawyers Block with subdivision into compartments.
6. Zamia and Kalamunda Blocks with subdivision into compartments.
7. Reservoir Block with subdivision into compartments.
8. Bartons Block with subdivision into compartments.
9. Canning Block with subdivision into compartments.
10. Illawarra Block with subdivision into compartments.
11. Occidental Block.
12. Greystones Block with subdivision into compartments for pine planting.
13. Helena Block with subdivision into compartments for pine planting.
14. Darkin Block with subdivision into compartments for pine planting.
15. Greystones Block—Timber and soil types.
16. Helena Block—Timber and soil types.
17. Darkin Block—Timber and soil types.
18. Thompsons Block with subdivision into compartments.

Appendix 2.

DETAILS OF PAST OPERATIONS BY BLOCKS AND COMPARTMENTS.

WORKING SECTION A.

Year.	Block	Compt.	Acreage.	Remarks.
1923-24	Barton's	B 9	610	Subsequent burn prior to seed fall in December, 1923.
"	Sawyers'	S 1	92	do. do. do.
"	"	S 2	79	do. do. do.
"	"	S 4	134	do. do. do.
1924-25	Barton's	B 9	...	Final ringbarking carried out.
"	"	B 8	244	No subsequent burn owing to regeneration from seed fall, December, 1923, being already in the ground. Preliminary and final ringbarking combined
"	Sawyers	B 13	270	do. do. do.
"	"	S 1	253	Tops only burnt as regeneration from seed fall in December, 1923, was already in the ground. Preliminary and final ringbarking combined.
"	"	S 2	281	No subsequent burn owing to regeneration from seed fall, December, 1923, being already in the ground. Preliminary and final ringbarking combined.
"	"	S 4	...	Final ringbarking carried out.
"	Canning	C 12	271	No subsequent burn owing to regeneration from seed fall, December, 1924. Preliminary and final ringbarking combined.
1925-26	Barton's	B 15	127	Part only finally ringbarked.
"	Canning	C 12	...	Tops only burnt as regeneration from seed fall, December, 1924, already in ground.
"	"	C 15	165	

WORKING SECTION B.

Year.	Block.	Compartment.	Acreage.	Species.	Spacing.	Remarks.
1922	Greystones	G 3	39	P. insignis	8' x 8'	} Refilled, 1923.
		G 2	13.8	P. insignis	8' x 8'	
1923	Darkin	D 6	5.8	P. pinaster	7' x 7'	} Refilled, 1924.
		D 8	13.3	P. pinaster	7' x 7'	
		D 8	2.7	P. insignis	8' x 8'	
		D 9	27.3	P. insignis	8' x 8'	
		D 14	4.5	P. pinaster	7' x 7'	
1924	Helena	H 5	2.7	P. palustris	8' x 8'	} Refilled, 1925.
	Greystones	G 2	13.3	P. pinaster	6' x 6'	
		G 21	42.2	P. insignis	8' x 8'	
1925	Greystones	G 19	8.6	P. insignis	8' x 8'	} Refilled, 1925.
		G 2	.8	P. muricata	8' x 8'	
		G 2	4.1	P. insignis	8' x 8'	
		G 4	26.2	P. insignis	8' x 8'	
		G 4	.8	P. muricata	8' x 8'	
		G 6	7.6	P. insignis	8' x 8'	
		G 19	14.6	P. insignis	8' x 8'	
		G 20	14.7	P. insignis	8' x 8'	

Appendix 3.

DESCRIPTION OF FOREST GROWTH, BY BLOCKS.

1. ZAMIA BLOCK.

The greater portion of this Block has carried an open stand of Jarrah which, though small in volume per acre and of comparatively low height growth, was very sound in quality.

On the steep falls to the Helena River where granite outcrops are prominent (in Compartments 5, 8, 9), the Jarrah is replaced by a sparse stand of mixed Marri and Wandoo of inferior quality. (See Map No. 6.)

Compartments 1 to 7 have been operated over in the past for mill logs by three different mills, two of which were situated on the Block. Compartments 1, 2, 3, 5, 6, 7 have been thoroughly cut out (in respect to mill logs) under control by tree-marking.

The stand has been culled for hewn sleepers from time to time.

Thorough utilisation of the mature timber in Compartments 4 and 7 and portion of 1 and 6 has been completed by hewing under control by tree-marking. The remainder of the Jarrah forest consists of an open stand of mature and worthless trees with little or no regrowth or immature timber; and the average volume of this mature timber is about one-third of a load of hewn sleepers per acre.

2. KALAMUNDA BLOCK.

With the exception of the scattered Wandoo and Marri of poor type which occur among the granite boulders on the steep slope to the Helena River (see Map No. 6), the forest consists of an open stand of Jarrah with some Marri in mixture.

This Block has been cut over for mill logs by four different mills, and sleeper hewers have operated at various times.

Portions of Compartments 5 and 6 have been thoroughly cut out (in respect to mill logs) under control by tree-marking.

Two logging sections suitable for the operations of a mill with a capacity of ten loads in the round daily, have been defined. (See Map No. 4.)

(i.) Compartments K 3, 4, 5, 9 and 10, totalling 2,300 acres and carrying an average volume of about three loads in the round per acre.

(ii.) Compartments K 7, 8, 11 and 12, totalling 2,100 acres and carrying an average volume of about seven loads in the round per acre.

3. SAWYERS' BLOCK.

On the steep falls to the Helena and Four Mile Brooks and to the Helena Reservoir, scattered Wandoo and Marri of inferior quality occur on the patches of soil among the granite boulders. (See Block Map No. 5.)

The remainder of the area has carried a comparatively poor open stand of Jarrah with Marri in mixture.

In the past, four (4) mills operated on the area and the whole Block has been worked over from time to time for hewn sleepers and firewood.

In 1903, 9,240 acres (as shown on Map No. 3), were ringbarked by the Water Supply Department. With the exception of small pockets along the gullies, this is Jarrah country. Owing to repeated fires the resultant regrowth now in the small pole and sapling stages is badly malformed and useless except as firewood.

An area of 1,850 acres (as shown on Map No. 4), embracing Compartments S 13, those portions not ringbarked in Compartments 5, 6, 12 and 14, and that portion not cut out in Compartment 4, still carries a low volume of milling timber (about one load in the round per acre).

The remainder of the Block, i.e., those portions of Compartments 18, 19, 24, 25, 26, 32, 33, 35, not ringbarked, and the whole of Compartments 31, 34 and 36, carries a low volume of mature timber (about one load of hewn sleepers per acre) with useless over-mature trees, and little or no regrowth or immature timber.

4. RESERVOIR BLOCK.

Up to 1903 the greater portion of this block carried a fair stand of Jarrah, estimated at about fifteen loads in the round per acre.

On the slope to the Helena Reservoir pure stands of Marri occurred on the patches of loamy soil, while scattered Wandoo and Marri of poor type were to be found among the granite outcrops. (See Map No. 7.)

In 1903 the whole area, with the exception of a small strip along the southern boundaries of Compartments 11, 12, 13 and 14, was ringbarked by the Water Supply Department, and now carries a dense crop of small poles which have been malformed by repeated fires.

5. BARTON'S BLOCK.

In its virgin state the Jarrah occurred in a moderately dense stand, yielding logs of short length but of remarkably sound quality.

On the Pickering Brook flats the Jarrah is replaced by a sparse stand of Marri and Blackbutt in mixture, with heavy blackboy undergrowth.

The forest has been heavily cut over for mill logs by two mills, whilst sleeper cutters have operated at various times.

The Block can now be considered as cut-out in respect to mill logs.

On Compartments 4, 8, 9, 13 and portion of 16, utilisation of the mature timber has been completed by hewing under control by tree-marking.

The stand of Jarrah now covering the remainder of the Block consists chiefly of mature and worthless trees with scattered groups of immature growth. It is estimated that the volume of the mature timber averages one load of hewn sleepers per acre.

6. CANNING BLOCK.

A generally open stand of Jarrah occupies the larger part of the area. The proportion of Marri increases in the gullies. In the pockets of soil among the granite boulders on the steep slopes to the Victoria Reservoir, Wandoo and Marri of poor type are found.

In the past the Block was operated over by two mills and numerous sleeper hewers.

The mature timber in Compartments 12, 13, 15 and portions of 11, 14 and 16 was thoroughly cut-out by milling and hewing under tree-marking conditions.

To complete the utilisation on the area two logging sections suitable for the operations of a mill with a capacity of ten loads in the round daily, have been defined. (See Map No. 4.)

- (i.) Compartments 8, 18, 19, 20, 22, 23 and portions of 7 and 21, totalling 3,400 acres and carrying an average volume of three loads in the round per acre.
- (ii.) Compartments 24, 25, 26 and 17, totalling 1,600 acres and carrying an average volume of three loads in the round per acre.

These are in addition to Sawmill Permit 615 at present in existence.

7. ILLAWARRA BLOCK.

The Illawarra Block is typical Jarrah country, and the height growth of the trees is greater than in any other part of the Working Circle.

This area has been drawn upon for log supplies by two different mills, and at intervals has been cut over by beam squarers and by sleeper cutters, but logging operations consisted of merely culling the very best trees.

The following areas are probably suitable for the operations of a mill with a daily average capacity of ten loads in the round. (See Map No. 4):—

- (i.) Compartments 5, 4, 11, 10, 9, totalling 3,300 acres and carrying an average volume of three loads in the round per acre.
- (ii.) Compartments 14, 18, 19 and portion of 13, totalling 2,500 acres and carrying an average volume of four loads in the round per acre.
- (iii.) Compartments 20, 21, 22, 23 and portion of 13, totalling 2,500 acres and carrying an average volume of seven loads in the round per acre.

8. THOMPSON'S BLOCK.

On the laterite-capped ridge forming the boundary of the Helena Reservoir catchment area, and on the gravelly slopes to the Little Darkin River, an open stand of Jarrah of only fair height growth but good quality is found.

On the eastern boundary, on the fall to the Darkin River, the Jarrah forest is replaced by a mixed stand of Marri and Wandoo, with some good Jarrah trees. The area of this type is about 3,000 acres and the volume of the Jarrah averages about one-third of a load of hewn sleepers per acre.

The Jarrah forest has been cut over for mill logs for two mills, one of which, the Barton's Mill, is still operating on the Block on Permit 617. (See Map No. 4.)

The remaining area suitable for sawmilling, some 3,000 acres in extent, averages three loads in the round per acre and can be drawn upon for the Barton's Mill. (See Map No. 4.)

9. OCCIDENTAL BLOCK.

Virgin bush occupies the southern portion of the Block. (See Map No. 4.)

On the laterite-capped ridges and spurs occurs a fair stand of Jarrah, the volume of which, though as high as thirty loads in the round per acre in patches, averages about ten loads in the round per acre.

On the gravelly slopes to the creeks the stand becomes poorer in quality, finally merging into the mixed Marri and Blackbutt type which occupies the gullies.

A conspicuous feature is the so-called barren flats which support only occasional Marri, Wandoo, Blackbutt, and Paper-bark.

The north-eastern portion, about 1,100 acres in extent, has been thoroughly cut-out by sawmills under control by tree-marking. The remainder of the country adjoining the northern boundary has been lightly cut-over, for mill logs by two mills, and for hewn sleepers.

The southern portion of the Block, about 6,400 acres (see Map No. 4), includes on the eastern boundary an area of virgin bush, and carries over the whole area a volume of about six loads of timber in the round per acre; this portion will be reserved from cutting during the period of the plan.

The remainder of the Block, about 3,500 acres, carrying an average of about six loads in the round per acre, will be made available for the Barton's Mill. (See Map No. 4.)

10. GREYSTONES, HELENA AND DARKIN BLOCKS.

The feature of these Blocks is the occurrence along the creeks and lower slopes of the ridges of relatively large areas of the non-Jarrah and poor Jarrah country suitable for afforestation with conifers.

With the exception of the small patches of typical Jarrah forest on the ironstone ridges, the remaining area of these blocks is broken granite country on the steep slopes to the creeks. Apart from the occasional granite outcrops of considerable area which are devoid of vegetation, this broken granite country carries Wandoo, Marri and Jarrah in the pockets of soil among the granite boulders.

The areas of country suitable for pine planting, which have so far been located by reconnaissance surveys, are as follows:—

Greystones	..	..	..	..	..	1,200 acres.
Helena	..	..	..	..	..	3,000 "
Darkin	..	..	..	..	..	1,600 "

Included in these blocks are the old clearings resumed by the Goldfields Water Supply Department at the time of the reservation of the Helena Reservoir Catchment Area. On these clearings, all the existing pine plantations of the Working Circle have been established.

For the reason that the timber types have a definite association with soil conditions, the following have been distinguished in the country subdivided for pine planting:—

(a) Considered suitable for *Pinus insignis*:

- (i) Marri, with some Jarrah. (Good loam.)
- (ii) Marri, Jarrah and Blackbutt.
- (iii) Flooded Gum, Blackbutt, with some Jarrah and Marri.
- (iv) Blackbutt, with some Marri and Jarrah.
- (v) Wandoo with some Jarrah and Marri. (Red loam.)

(b) Considered doubtful for *Pinus insignis*, but worth testing for other pines:

- (vi) Wandoo, Marri and Jarrah. (Poor soil with quartz felspar or rubble.)
- (vii) Jarrah and Marri. (Loose gravelly soil.)
- (viii) Pure Wandoo. (Red gravel.)

(c) Excluded, as far as possible, in the subdivision:

- (ix) Typical Jarrah country on ironstone outcrops.
- (x) Broken granite country, carrying Wandoo, Marri and Jarrah in the pockets of soil among the granite rock outcrops.

Very few of the above types show a sharp line of division from an adjoining type, and in consequence intermediate types occur.

The location of the types on the area subdivided is shown on Maps Nos. 15, 16 and 17.

Appendix 4.

SUMMARY OF OPERATIONS TO BE CARRIED OUT.

1. SAWMILLING:

Block.	Name of Mill.	Capacity in loads in the round per day.	Present annual cutting rate in acres.
Sawyers'	Waters'	30 (per month)	100 to 200
Kalamunda	Wedgewood	10 ..	450
Canning	Weston's	10 ..	900
Thompson's and Occidental	Barton's	30 ..	3,000

2. HEWING:

Block.	No of Hewers.	Area to be cut over per annum.	Number of loads hewn annually.
Barton's	2	500	200
Thompson's and Occidental	2	500	200
Thompson's and Occidental (additional for eighteen months)	5	2,000	500

3. SILVICULTURAL OPERATIONS:

Regeneration Cleaning—Group Selection System.

Block.	Area in acres to be treated annually.
Barton's	500
Canning	500
Thompson's	500

Regeneration Cleaning—Clear-felling System.

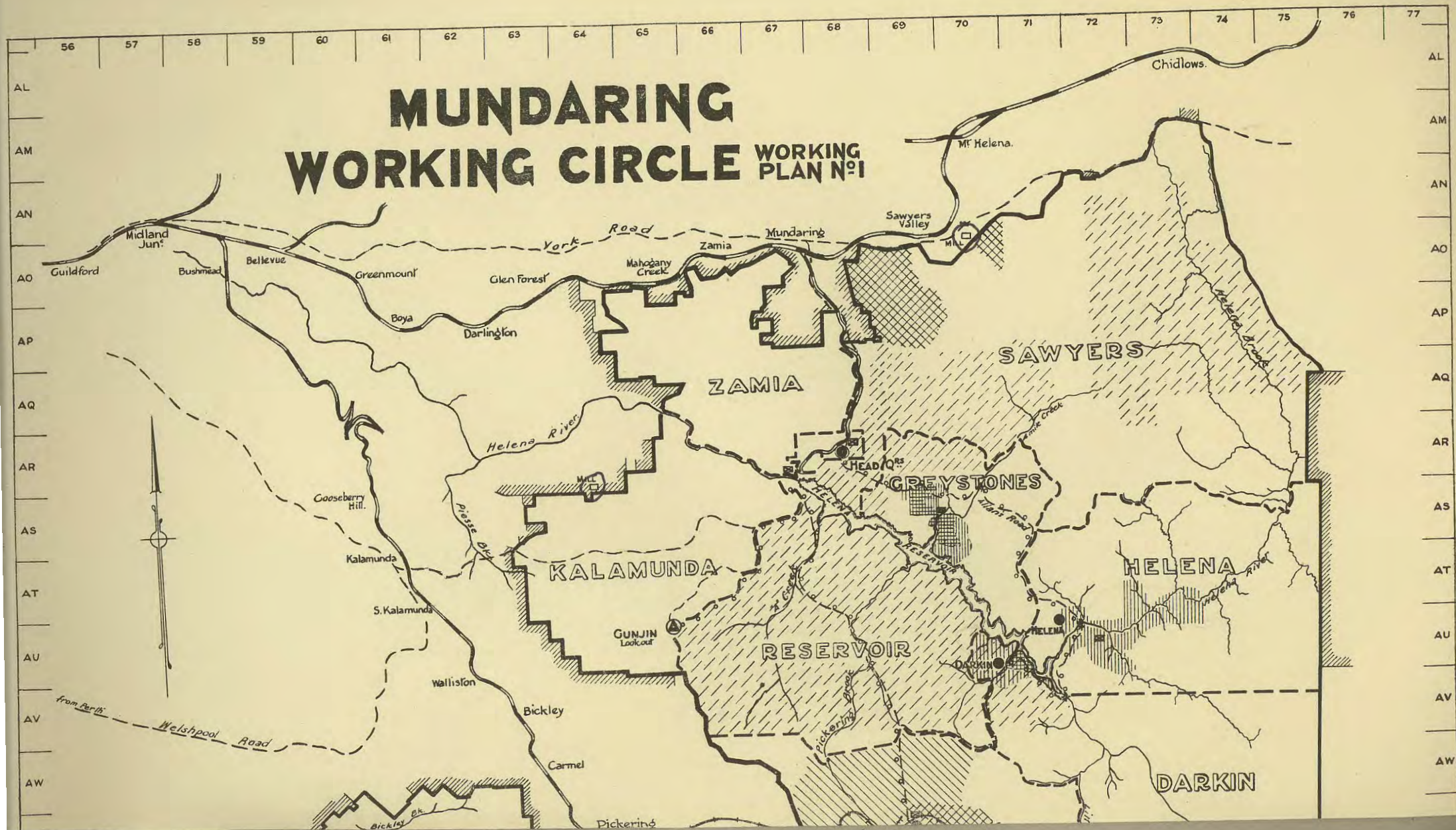
Block.	Area in acres to be planted annually.
Sawyers' Reservoir	100
Reservoir	100

Pine Planting.

Block.	Area in acres to be planted annually.
Greystones	25
Heiena	100
Darkin	50

MUNDARING WORKING CIRCLE

WORKING PLAN N^o 1





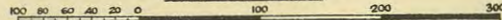
REFERENCE

- RINGBARKED
- JARRAH REGENERATION (COMPLETED)
- " " (TO BE DONE IN PERIOD OF PLAN)
- PINE PLANTATIONS
- " " (TO BE ESTABLISHED IN PERIOD OF PLAN)
- DEPT. STATIONS
- NURSERIES
- MILLS
- FIRE LOOKOUTS
- TELEPHONES
- RAILWAYS
- TRAMWAYS & FORMATIONS
- ROADS & GOOD TRACKS
- RIVERS & CREEKS



S. L. KESSELL,
CONSERVATOR OF FORESTS.

—SCALE OF CHAINS—



56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74

F.D. PLAN N° 400