



SAND DUNE FIXATION
IN W.A.

by D.H. Perry
1942

A
SUMMARY OF COASTAL SAND DRIFT RECLAMATION CARRIED
OUT BY THE DEPARTMENT IN RECENT YEARS

Introduction.

The loose sandy nature of the soil of our coastal belt renders it particularly susceptible to wind erosion. The indigenous vegetation is solely responsible for keeping the soil stable, and any serious damage to it by such factors as overgrazing, fire, trampling, etc., very quickly results in the formation of large drifting sand dunes which bury everything in their path.

Numerous areas of drifting sand exist around our south and south-western coastline, varying in size from a few acres to many square miles. It is thought that these dunes have always been a feature of this coastal belt but their formation has undoubtedly been accelerated since the country was occupied by the white man. Observation seems to indicate that many of these dunes tend to rehabilitate themselves with the passage of time. This particularly applies to those areas of shifting sand not having their origin at high water mark. If a strip of vegetation exists between the coast and the windward side of the dune, the more hardy species tend to advance out on to the sand. Progress is slow, but if the forward movement of the dune is arrested the chances are that the indigenous vegetation will gradually re-establish itself.

Some of the huge dunes facing the Southern Ocean, particularly the one lying between the mouths of the Warren and Donnelly rivers are engulfing Karri Forest up to 200' in height. It is interesting to note that the trees are killed for 5 chains or so ahead of the advancing dune by the sandblasting action of the sand. The foliage and thin bark of the twigs are removed by the abrasive action of the wind blown sand.

Many of these dunes are in very inaccessible country and are not at the present time causing any serious economic damage. There have been several exceptions, however, and these have been effectively dealt with by the Forests Department. Apart from the difficulties arising from inaccessibility of the site, no trouble has been experienced in fixing any dunes tackled.

Marram grass (*Ammophila arenaria*) thrives on the loose sands of our south-western littoral and in a few years arrests the drift and so transforms the site as to again render it fit for the establishment of indigenous species.

Exact information is not available regarding the minimum annual rainfall necessary for the successful establishment of Marram Grass but it is thought to be not less than 20-25 inches.

Method of Dune Fixation.

Satisfactory fixation of all dunes threatening points of economic importance has been effected by the systematic planting of Marram Grass (*Ammophila arenaria*). This grass possesses the ability to grow rapidly through the accumulating sand and may in the short period of a year be responsible for the formation of a hummock 6' to 8' in height. This rapid growth is arrested once the sand movement ceases and stable or fixed dunes are characterised by tussocks of dead or dying grass. Usually by this time, however, much of the indigenous flora has become sufficiently re-established to prevent any serious erosion by prevailing winds.

Drift sands that have been dealt with in this State fall naturally into two classes:-

1. Those commencing immediately from high water mark and spreading inland.
2. Areas of drifting sands separated from the coast by a belt of country on which the indigenous flora remains unharmed.

In dealing with dunes of the former type the main difficulty is associated with the establishment of the Marram Grass close to the high water mark. This position is usually so exposed that in many cases the grass is blown out before it can become rooted. Fortunately in Western Australia we have an indigenous plant, *Spinifex hirsutus* which will thrive just out of reach of high tide and this plant is admirably suited for raising a littoral dune to protect the first plantings of Marram Grass. Immediately behind the low dune thus formed the Marram is planted in rows parallel to the sea. The greater the

degree of exposure the closer the planting distance and rows from 3 ft. to 6 ft. apart, and the sets of Marram from 2 ft. to 3 ft. in the rows have been found satisfactory for most exposed sites. Where there is an excavating movement going on the Marram should be planted deeply, at least 75% of the cutting being buried.

It has not been found necessary in any of our work to date to erect palisades to build up a protective littoral dune and it is not proposed to discuss this phase of the work. Constant attention for several years will be necessary to establish Marram on the windward side of the littoral dune as it is often blown out before it can become rooted and must be replanted.

Dunes of the latter type are comparatively easy to fix as they are usually not so exposed. The dune may be planted up with Marram Grass, the rows being at right angles to the direction of the prevailing or most damaging winds. The espacement may vary from 12 ft. between the rows and 4 ft. between the sets of 60 ft. between the rows and 5 ft. between the sets, depending on various factors which will be discussed later.

The establishment of Marram Grass from seed may only be effected in protected areas or where artificial protection has been provided in the form of a thick covering of branches over the sand. As the cost of this method would be prohibitive in most localities planting is the most economical and satisfactory method of establishment.

Cuttings may best be obtained by opening up a trench 12 inches deep immediately in front of a clump of Marram Grass and severing the roots by a horizontal cut with a spade at the bottom of the trench. The grass cuttings are heaped in bundles/^{of} convenient size and topped to leave them approximately 24 inches long with three or four nodes in the bottom 12 inches. Each of these nodes is capable of producing roots which appear about 10 to 12 days after planting out. The cuttings when prepared are tied up in bundles and covered up or heeled in. They should not be exposed to the air longer than is absolutely necessary to trim them and tie them up.

The transport of the grass to the planting site is

a serious problem. Where it has been impossible to get a horse drawn vehicle on to the job as at the Warren River, two men distributed the grass on an improvised stretcher. Probably the most successful method of distributing the grass is to utilise a specially constructed cart, it need only be a platform, and shafts on an old car front axle springs and wheels. This type of vehicle has a very light draught as the pneumatic tyres do not sink in the sand if run in a semi deflated condition.

Pack horses should be useful in isolated localities.

Of the various planting methods available that of pit planting has been found most satisfactory. This is almost as cheap as notching or spearing in soft sand and ensures the sets of grass being planted deeply enough. Spearing may only be done where the surface is wet and firm as otherwise the sand runs in when the spade is removed. A simply V-shaped pit should be opened up with a spade, the set consisting of two cuttings inserted and the sides stamped in. The digger should place the excavated sand on the lip of the hole to facilitate planting and should not be permitted to open up more than a dozen holes ahead of the planter as the sand quickly dries and runs in. One digger to one planter has been found a very satisfactory unit.

The factors that influence espacement are many; the more important of these include money available, degree of exposure of the site to be planted, the amount of grass available and the time in which it is necessary to fix the area. Since the cost of the work is governed directly by the espacement it becomes necessary at the outset to evaluate properly all the factors concerned in order that the most economical planting distances may be utilised. When there are large areas of moving sand to be fixed and the degree of exposure or sand movement is not great, a maximum espacement of 60 ft. between the rows and 5 ft. within the rows may be allowed. Each row of grass will form a low hummock or ridge and in

time the Marram will regenerate itself from seed in the intervening hollows. It is absolutely essential that the grass be planted closely in all exposed positions and particularly where the sand is being excavated. Rows should be from 3 ft. to 6 ft. apart and the sets 2 ft. to 3 ft. in the rows according to the degree of exposure.

In Western Australia the transport question is a very difficult one as most of the areas of shifting sand are in very isolated and inaccessible country. Supplies of grass on such areas could best be made available by the establishment of small nurseries close to the planting site. These nurseries should be about 2 or 3 acres in extent, from which sufficient supplies of grass for the planting of approximately one square mile of dune might be obtained. The sets of Marram should be planted 3ft. x 3ft. in the nursery and left for 2 or 3 years to develop. Once established such a nursery may be worked over for cuttings each year as the grass quickly shoots again. The most suitable site for a nursery is a fairly sheltered position where sand is being built up or deposited and is to be found generally on the lee side of a gently sloping dune.

If the maximum benefits are to be derived from any planting programme, sheep and goats should be totally excluded and the grazing of horses and cattle strictly regulated.

WORK DONE.Swanbourne.

By 1924 a large drift of about 200 acres had developed on Education Endowment Lands between North Street and the Rifle Range. This dune was advancing in an Easterly direction at an alarming rate and threatened to overwhelm private homes to the eastward. The Education Endowment Trustees approached the Department in 1924 with a request that we plant this area up with marram grass, the Trustees to make the money available to do the work.

As unrestricted grazing was largely responsible in this instance for the destruction of the indigenous flora, and the consequent erosion by the wind of the sand, the area was first fenced. Owing to the limited funds available for the work, operations were spread over five years. In 1924 the sum of £30 was spent, in 1925 £100, in 1926 £136, in 1927 £47, and in 1928 £20. A total of £333. The major portion of this sum was expended on the actual planting of marram grass. The amount spent on fencing being in addition to this.

This area is now, 13 years after completion of the work, quite stable, and the indigenous flora is becoming established amongst the marram grass. See photos attached hereto.

Warren River.

Very large areas of drifting sand dunes have existed in the vicinity of the mouths of the Warren and Donnelly rivers for many years. The first record on our files of these drifts was submitted by Mr. Hugh Oldham in November, 1914. These dunes were threatening to obstruct the course of the Warren River and overwhelming some fair Jarrah and Karri forest. Mr. Lane-Poole tried very hard in 1916 to obtain funds to establish marram grass on these dunes, with the object of ultimately fixing them, and, after a hard and determined struggle, was successful in obtaining £130 from the Treasury. This money

was spent in lifting and transplanting from Capel a quantity of marram grass, and planting it out on what is now known as the Calcup dune immediately south of the Warren River. This grass was later spread over further areas of this dune by Colonel Vialls and Mr. Brockman, local settlers. A year later Forester McKay visited these dunes and reported that only about 10% of the marram planted out had survived. At the same time, he spread two bags of marram seed over the area previously planted. The grass resulting from these plantings and sowings was to provide the planting stock for the extensive work to be carried out on these dunes ~~for~~ 20 years later.

Despite repeated efforts by Mr. Lane-Poole to obtain further funds for this work, no more money was forthcoming until, in 1936, Forester Perry, at the instigation of the Conservator of Forests, inspected these dunes under the guidance of Mr. W. Brockman, Jr., and reported that very large areas of drift sands existed between the Warren and the Donnelly rivers, and also that a large drift was menacing the course of the Warren river from the south.

This latter area required instant attention, as it had reached the river, and the sand was flowing down a 500-ft. slope into the river (see photos. attached). There was no doubt that, in a few years, this dune would seriously affect the flow of the Warren river. The huge dunes to the north of the Warren (see photos. attached) were not doing any immediate serious damage. Their rate of advance was slow, but they were burying some fair swampland and also some fair Jarrah and Karri forest, and their fixation would have to be faced some time. The immensity of these dunes had to be seen to be appreciated, they stretch for miles to the north, and one appeared to be in the centre of a vast Sahara. The advancing wall of dune was well over 100 feet high and burying the forest in its path.

As a result of this inspection, it was decided to spend £250 in planting up the Calcup dunes south of the Warren. The major portion of the surface of this dune, about 600 to 700

acres, was planted in 1936, the espacement varying from 6' to 10' between the rows depending on the degree of exposure.

In 1937 a further £250 was spent on this work. A small portion of this sum was expended on patching up the Calcup Dune,,and the balance on establishing nursery plots on the Yeagerup Dune north of the river. Four plots of 25 acres and 30 plots of 3 acres were established over the surface of this huge drift to provide grass for its ultimate fixing. In 1940 a further £30 was spent on patching up breakaways in the earlier plantings. The Calcup Dune is now comparatively stable and the threat to the course of the Warren river entirely removed.

It will be necessary to inspect these dunes periodically to ensure that no major breakaways occur, but the Forests Department has this well in hand.

As opportunity occurs and the money is available, steps will be taken to plant up the huge Yeagerup, and two other smaller dunes, north of the Warren River.

Margaret River.

In 1938, a report was received from a settler in the Margaret River District, expressing concern at the progress several areas of shifting sand were making over his holding.

A report by Forester Weston, after an inspection of the locality, stressed the seriousness of the position. There were a number of small patches of shifting sand at intervals along the coast between Cowaramup Bay and Hamelin Bay, some of them threatening good agricultural and grazing country. All were of recent origin and were making fairly swift progress inland. It was thought by Forester Weston that rabbits were largely responsible for the trouble.

In 1938 the sum of £90 was spent on planting marram grass on the Ellensbrook, Gnoocardup and Boodjedup drifts. In 1939 £82 was spent in planting up the Cowaramup, Kilcarnup, Gnarabup, and Calgardup drifts and patching up breakaways in the earlier plantings on the Ellensbrook, Gnoocardup and Boodjebup areas. In 1940 the sum of £5.10.0 was expended on repairing small breakaways on the Ellensbrook and Gnoocardup drifts. In 1941 £40 was expended in replanting breakaways on the Gnoocardup, Boodjebup, Calgardup, Ellensbrook and Cowaramup Bay dunes.

These dunes will require watching, and possibly a small amount of repair work carried out from time to time, should the grass fail to hold the sand.



Swanbourne 1938.

Taken to illustrate the manner in which *Spinifex hirsutus* holds the sand just above high water mark.



Boranup 1941.

Planted with Marram Grass about 40 years ago. Marked absence of indigenous vegetation. Steps should be taken to re-establish this.



Ellensbrook, Margaret River. Old Bussell home.

Note. Marram grass planted in 1938 to hold the shifting dunes in this vicinity.



Ellensbrook - Margaret River. Marram planted in 1938.
Note indigenous vegetation already re-establishing
itself as a result of the shelter offered by the Marram.



Ellensbrook - Margaret River. As above.



Swanbourne. This was a shifting sand dune in 1926, when it
was planted up with Marram. Photo taken in 1938 shows
how Marram has fixed the sand and the indigenous veget-
ation may be seen establishing itself again.



Swanbourne. Another view of the above area, taken in 1938.



Swanbourne. Another view of the above area taken in 1938.



Warren River. Calcup Dune. 1936. Shows the point at which the dune had reached the river and commenced to fill its course. Planted with Marram in 1936.



Warren River. Calcup Dune. Planted with Marram in 1936.
Note Marram grass setts which have just been planted.



As above. Looking down the slope to the river. Note
figure on the river bank.



Warren River. Calcup Dune. 1936. A wandering sand dune
rolling over the main dune.



Warren River. Calcup Dune. 1936.
sand dune on the main dune.

Another wandering



Warren River 1936. The two cuttings in the central foreground caused by Warren River eroding the base of the hills. River can be seen in right hand corner. Big dune in the background is to the north of the river and is advancing rapidly in an easterly direction.



Yeagerup Dune. North of the Warren River. Tops of dead Jarrah trees about 60ft. high protruding from the sand. 1937.



Yeagerup Dune. North of the Warren River. 1937.



Looking north across the Warren River from the Calcup Dunes
to the Yeagerup Dunes.



View of section of the Yeagerup Dune to the North of the
Warren River. 1936.



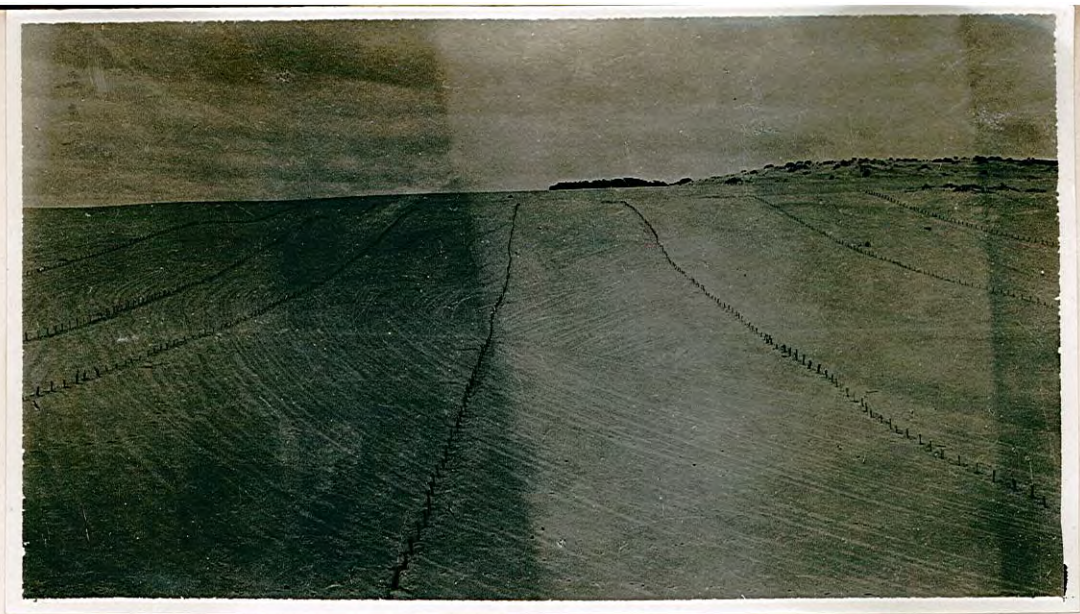
View of section of the Yeagerup Dune to the North of the
Warren River. 1936.



View of section of the Yeagerup Dune to the North of the
Warren River. 1936.



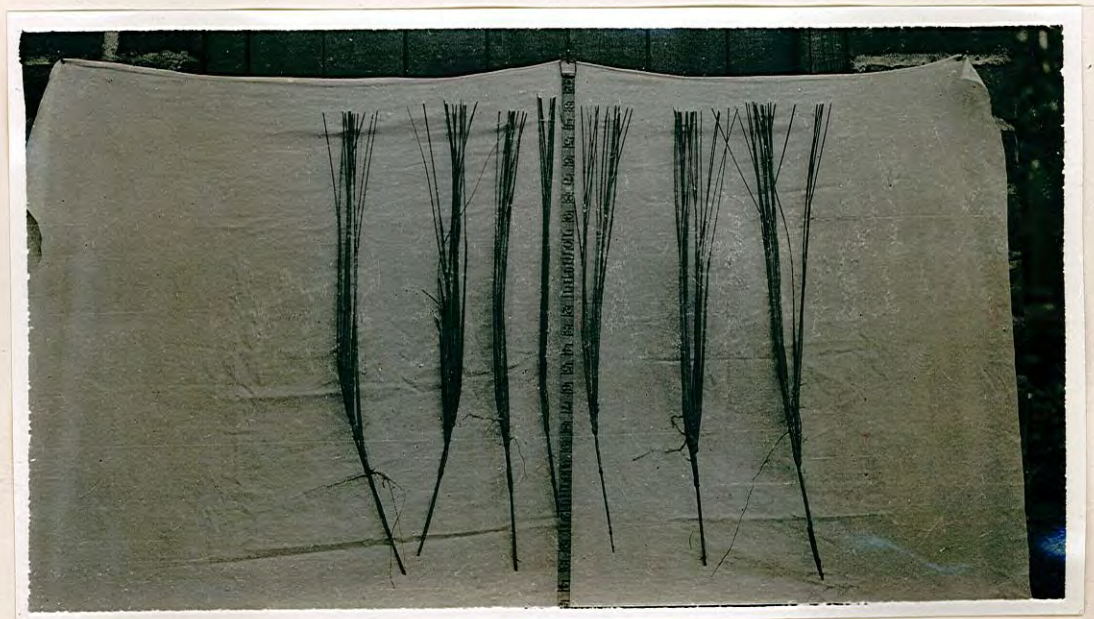
Yeagerup Dune. North of Warren River. Marram grass has just
been planted. Taken in 1937. The sand is covering
Jarrah forest about 50' high.



Warren River. Calcup Dune. Taken in 1936. Shows
Marram Grass planted in 1936. Rows 60 ft. apart and
setts about 5 ft. apart.



Warren River. Calcup Dune. Taken in 1936. Same
details as above.



Marram Grass setts prepared for planting.

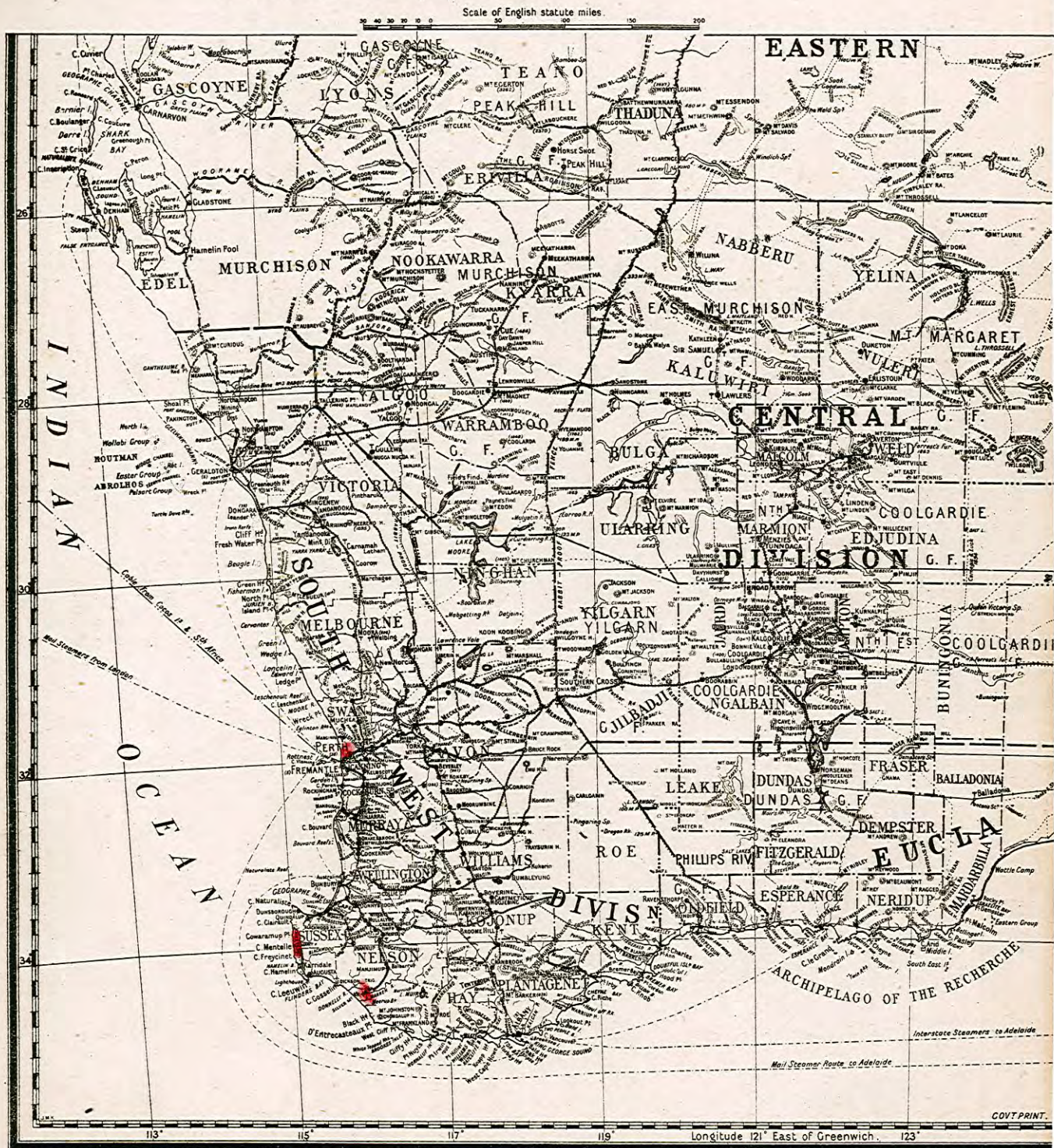


Warren River. Calcup Dune. Taken in 1936.
Shows regeneration of Marram Grass from seed on
a sheltered slope of the dune.



Warren River. Calcup Dune. Illustrates how the Marram
arrests the movement of the sand, by continuously
growing up through the sand as it piles up against
the grass.

MAP OF PORTION OF WESTERN AUSTRALIA Showing the habitat of



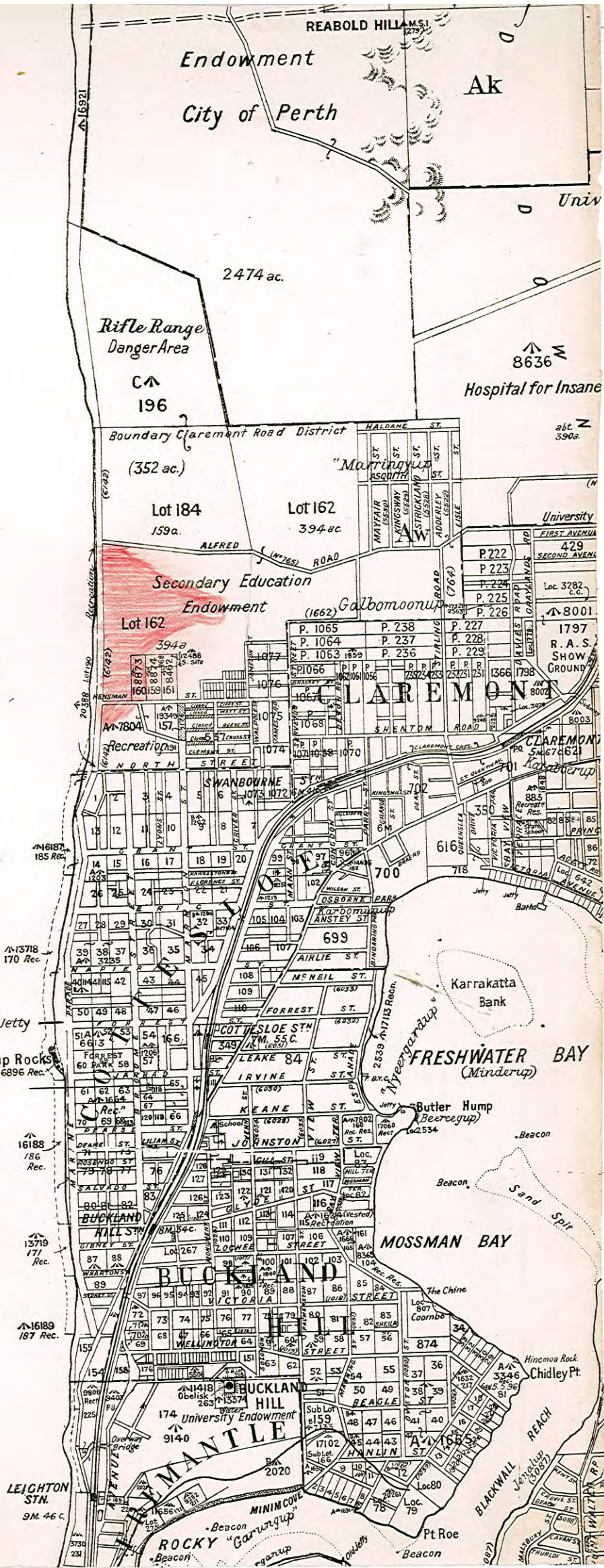
PLAN SHOWING LOCALITY OF DUNES THAT HAVE
BEEN TREATED.
AREAS ARE SHOWN THUS

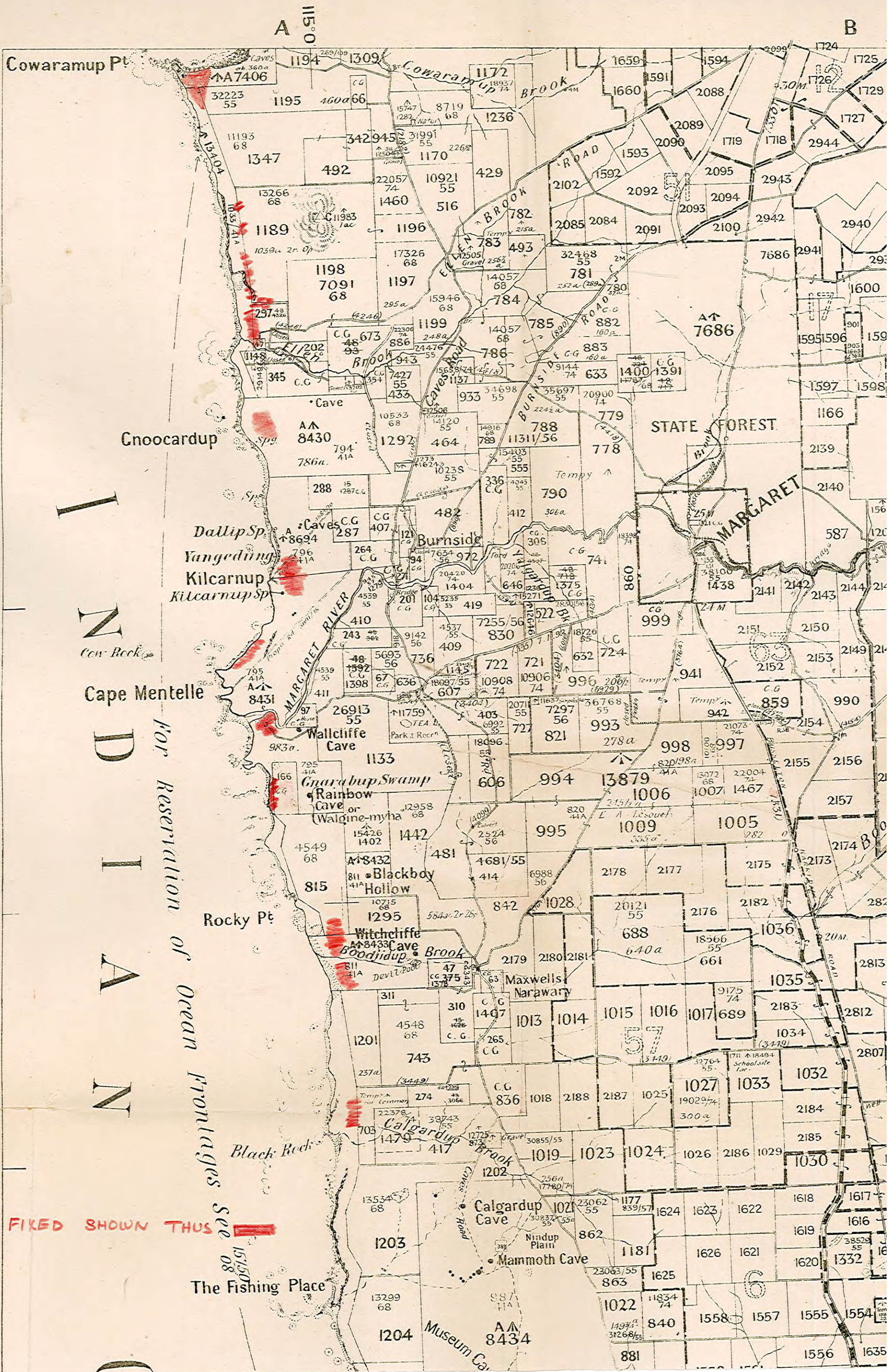
A N

 SAND DUNES FIXED

N

Scale $\frac{1}{2}$ mile to an inch





SAND DUNES FIXED SHOWN THUS 

