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DEPARTMENT OF CONSERVATION  
& LAND MANAGEMENT  
WESTERN AUSTRALIA

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VEGETATION SURVEY OF THE WONGAN HILLS

Prepared for : Department of Conservation  
and Land Management  
Western Australia

By : Anne Coates  
Consultant Botanist

November 1988

ARCHIVAL

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## 1.0 INTRODUCTION

### 1.1 Project Description

The Wongan Hills in the Shire of Wongan-Ballidu are well known as an area of high flora conservation value including a number of local endemics. Twenty-nine rare and/or geographically restricted plant species, 18 of which have been gazetted rare, occur within 20kms of the Wongan Hills townsite. Of these species seventeen (10 gazetted rare) are found in the "Wongan Hills" as defined by Kenneally (1982). The conservation value of the Hills is further emphasized by its listing in the "Register of the National Estate" and by the interest of the Environmental Protection Authority based on a report by the Conservation Through Reserves Committee.

Although the W.A. Naturalist's Club has produced a very useful booklet on the area entitled "The Natural History of the Wongan Hills", there has been no attempt to map the vegetation of the Hills. Such a map is now essential to:

- a) facilitate management of rare species;
- b) identify and delineate priorities for land purchase;
- c) improve the data base used to assess mining tenements.

Currently a number of mining tenements exist over the Wongan Hills.

The objectives of this project are to map the vegetation types of the Wongan Hills and adjoining land (see Figure 3), and to gather further information on rare species of flora.

### 1.2 Project Requirements

The consultant will :

- a) produce a vegetation map showing the major vegetation types for the areas designated (Figure 3).

- b) write one or more association descriptions, based on the classification system of B. Muir, which typify the vegetation categories mapped as in (a) above. The site of each description must be accurately recorded on the vegetation map, and each description will be accompanied by a photograph.
- c) accurately map locations of declared and other rare flora encountered during field work.
- d) identify vegetation types which are found on private land but are poorly represented on the nearby nature reserves; and
- e) collect and identify a representative sample of the flora encountered and lodge field specimens with CALM's Merredin Office and samples of less common specimens with the WA Herbarium.

### 1.3 History of the Wongan Hills

A detailed account of the history of the Wongan Hills, written by K.F. Kenneally, can be found in "The Natural History of the Wongan Hills". The hills, known by the Aborigines as "Wongan katta" were discovered and named by the Surveyor General J.S. Roe in November 1836.

James Drummond wrote to Hooker at the Royal Botanic Gardens Kew in June 1836 and described the sandplain country that lay to the north and east of the Toodyay Valley and extended for 200 miles. This description of "Guangan" would have included areas of residual sandplain occurring in the Wongan Hills District. Drummond also visited the hills with John Gilbert in 1842 to collect scientific specimens.

The flora and fauna of the Wongan Hills area has attracted a number of naturalists, botanists and ornithologists over the years. From some of the collections made new species were subsequently described for which the hills are the type locality, for example, *Acacia orbifolia*, *Acacia semicircularis*, *Astartea heteranthera*, *Caladenia*



*drummondii*, *Eremophila sargentii*, *Stylidium coroniforme* and *Phebalium brachycalyx* (Kenneally, 1977).

The red clay soils and their associated woodlands around the hills attracted first the pastoralists then the agriculturalists. The unusual geological formation of the hills attracted prospectors and first gold and later copper were discovered. As early as the 1920's concern was being expressed at the diminishing flora in and around the Wongan Hills (Kenneally, 1977) but even so, over the following years, large areas were cleared for agriculture. The lateritic breakaways of the hills however, were unsuitable for farming and have therefore remained predominantly uncleared to the present day.

In more recent times the hills have been subjected to increasing pressure to be used for mining and the central area of the hills including Mt Matilda and the Speakers Chair was made a temporary (Land Act) reserve for minerals. This area of 418ha was subsequently gazetted as "C" class reserve for flora and fauna conservation in August 1975. In May 1975 the complete hills area was pegged for unspecified minerals after aerial magnetometer surveys had shown rich deposits, thought to be copper, to the south of the hills. The W.A. Naturalists Club and the Wongan-Ballidu Districts Museum lodged objections to mining in the hills and by 1976 successfully opposed the mining claims (Kenneally, 1977).

The Wongan Hills were subject to recommendations of the Conservation Through Reserves Committee and the Environmental Protection Authority. The latter's recommendations, endorsed by the State Cabinet in 1976 were that :

1. the temporary reserve for minerals and reserve 25808 be declared Class A reserves for the purpose of Conservation of Flora and Fauna, vested in the W.A. Wildlife Authority;
2. the owners of private lands adjoining the reserve be commended on the conservation work they have done. If the present

conservation ceases, however, steps should be taken to retain the land in its present state;

3. the Department of Agriculture be requested to release portions of reserve 18762 (Experiment Farm) still in their natural state for addition to reserve A 25808.

Mt Matilda (33530) and Elphin Reserve (25808) were both made 'A' Class reserves in 1977 and Elphin Reserve was increased in size to 197.6ha. Reserve A 39145 (Rogers Reserve) was purchased by the government from the Rogers family in February 1985 for the purpose of Conservation of Flora and Fauna. All three reserves are vested in the National Parks and Nature Conservation Authority.

#### 1.4 Definition of "The Wongan Hills"

Wongan Hills township is situated in the Wongan-Ballidu Shire, approximately 143 km (air distance) north-east of Perth. The Wongan Hills are a range of flat-topped hills lying 12 kms to the north-west of the township. Kenneally (1982) has delineated the outcropping lateritised area associated with the hills on the basis of the contour line of best fit. With the aid of the Department of Defence maps completed in 1977 and the advice and assistance of the Department of Land Administration a 320m contour line was selected to delineate the hills from the surrounding sandplain. Kenneally reports that this is in accord with the original concept of the Wongan Hills held by Surveyor General J.S. Roe who discovered and named the hills.

On the south-eastern boundary of the area thus delineated an arbitrary line joining the 320m contour line was drawn to exclude sandplain which intrudes over the laterite (see Figure 1).



## 1.5 Physical Environment

### 1.5.1 Climate

The area has a typical wheatbelt climate with hot dry summers and mild wet winters. Rainfall recorded at the Wongan Hills post office between 1907 and 1986 gives a mean annual rainfall of 387mm. Most of the rain falls in winter from May to August with occasional thunderstorms in summer.

Mean maximum and minimum temperatures for each season taken from data recorded at the Wongan Hills post office are as follows :

	<u>max</u>	<u>min</u>
Autumn (March to May)	25.8°	12.9°
Winter (June to August)	17.6°	6.9°
Spring (September to November)	24.6°	10.2°
Summer (December to February)	33.4°	17.2°

(Bureau of Meteorology, 1988)

The mean annual 0900H recording of relative humidity is 59%, with the highest recordings in July (80%) and the lowest in January (40%).

Beard (1979) classes this regime with its 7 dry months as Dry Warm Mediterranean.

### 1.5.2 Geology and Soils

The Wongan Hills District is underlain by the archaean rocks of the Darling Plateau which are part of the Yilgarn Block, a stable nucleus composed mainly of granite and gneisses with some altered volcanics and sediments known as "greenstone belts" (Carter and Lipple, 1982).

The hills are formed of infolded beds of the altered volcanics and sediments which are more resistant to erosion than the country rock.

The rocks at one time were eroded into low, rounded hills and became thickly crusted with laterite. Subsequently the laterite has been breached to form mesas bounded by breakaways and scarp slopes (Beard, 1979).

In the report of the Conservation Through Reserves Committee to the Environmental Protection Authority (1974) the hills were described as including rock types of schists, chert, quartzite, jaspilite and concordant ultramafic rocks and basalts with laterization covering much of the original rock and granite evident on either side.

Carter and Lipple (1982) provide a more detailed account of the composition of the rocks of the Wongan Hills in the explanatory notes for the Moora sheet of the 1:250,000 Geological map series. Metamorphosed mafic igneous rocks are indicated to be a conspicuous feature of the Wongan Hills succession with a smaller development of metamorphosed felsic igneous rocks and meta sedimentary rocks such as BIF and chert.

Kenneally (1977) describes the lateritic profile of a well developed breakaway within the Wongan Hills with its associated caverns and scree. "The plateau is covered mainly by large angular lateritic gravel with shallow soil. Immediately below the breakaway rim large lateritic boulders are common, with the size of the fragments becoming progressively smaller down the slope. On the gully floors alluvial detritus predominates". Figure 2 is taken from "The Natural History of the Wongan Hills" and illustrates the variety of rock, laterite and soil types in relation to topography.

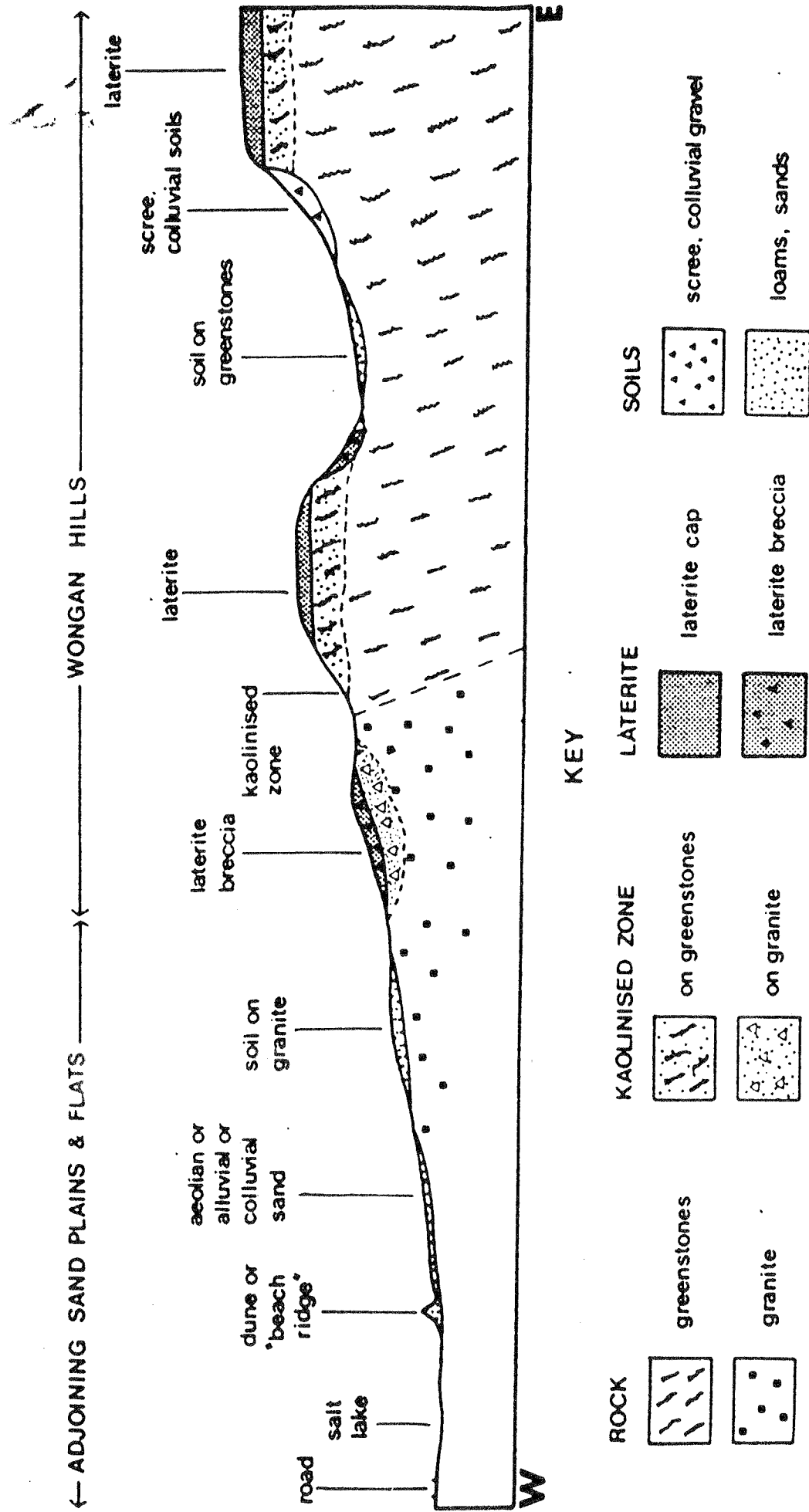


Fig. 2 — Diagrammatic E-W cross-section through Mt Rupert Estate illustrating the variety of rock, laterite and soil types found in the Wongan Hills. (Kenneally, 1977)

In the country surrounding the hills the granite and gneiss form a gently undulating landscape with few topographical features. Granite domes and tors are not common in the area and are confined to a few localities mainly around and to the east of the town of Wongan Hills (Beard 1979). Yellow sand containing laterite or large amounts of ironstone gravel predominate to form large areas of residual sand plain. These plains are occasionally interrupted by large salt lakes and salt flats with lunettes and claypans also occurring (Kenneally, 1977).

The soil types of this surrounding country occur in an intricate mosaic of small patches of yellow sand on higher ground which appear to be of aeoline origin, areas of deeper sand, shallow sand over ironstone gravel, duplex soil with sand over clay and areas of rich red soil of loam (red earths). The Atlas of Australian Soils (Northcote *et al.*, 1967).

#### 1.6 Physical Features of Areas Surveyed

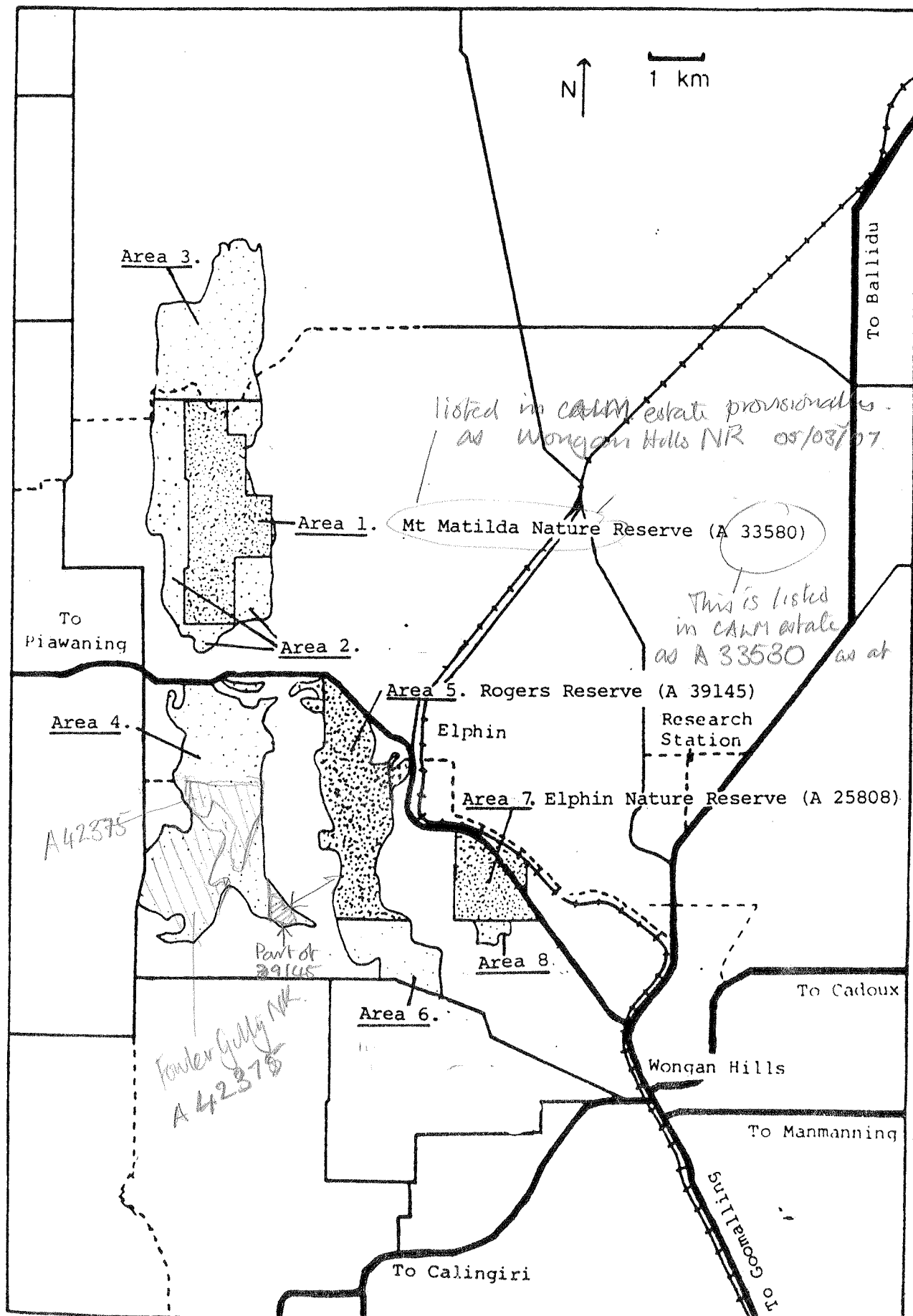
Wongan Hills is the centre of a large wheat and sheep farming district. Rye (1980) has reported that 6 nature reserve ranging in size from 20 to 1,235 ha can be found within a 20km radius of the Wongan Hills townsite. Since this internal Department of Conservation and Land Management report was compiled reserve A39145 (Rogers Reserve, 341 ha) has been gazetted for the conservation of flora and fauna bringing the number of nature reserve surrounding the town to seven.

Other areas of natural vegetation remaining in the district include a large water catchment reserve (↑16418, 984.7 ha), at least 500 ha of uncleared land on the Department of Agriculture's Experimental Farm (↑18672, 2,503.5 ha) and ca 1,300 ha of freehold land still remaining within the defined area of the Wongan Hills range.

Areas included in the present survey are outlined in Figure 3 and consist of all major areas of remnant vegetation in the Wongan Hills

**Figure 3 - Areas of native vegetation included in the present survey.**

The lightly stippled areas are the uncleared parts of the Wongan Hills range and the more heavily stippled areas are flora and fauna reserves.





as defined by Kenneally (1977) and Reserve A25808 situated to the east of the hills.

The size of the areas surveyed are as follows :

- |  |           |
|--|-----------|
| 1. Mt Matilda Nature Reserve (A 33580)   | 417.5 ha  |
| 2. Privately owned bushland adjacent to A 33580<br>on Melbourne locations 1012, 1598, 1645, 1732,<br>(part) 1770, 1789, 1833, 2096, 2270 | ca 320 ha |
| 3. Privately owned bushland north of A 33580 on<br>Mt Rupert Estate on locations 665, 2727, 2193,<br>1769, 1592, (part) 1770             | ca 340 ha |
| 4. Privately owned bushland south of the Wongan<br>hills-Piawaning road on locations 2221, 3457,<br>2214, 1768, 1596, 1597               | ca 490 ha |
| 5. Rogers Reserve (A 39145)  | 341 ha    |
| 6. Privately owned bushland adjacent to A 39145<br>on locations 3042, 1411, 1768, 2586   | ca 110 ha |
| 7. Elphin Reserve (A 25808)  | 197.6 ha  |
| 8. Privately owned bushland adjacent to A 25808<br>on location 1407.   | ca 25 ha  |

**1, 2. Mt Matilda Nature Reserve (A 33580) and adjacent uncleared land**

Mt Matilda (434m) is the highest point in the hills. The nature reserve also includes a high spot known as the Speakers Chair. The reserve and adjacent bushland to the south, east and west have terrain typical of the Wongan Hills which comprise a series of laterite-capped mesas generally trending north-south, dissected by numerous steep gullies in which exposures of greenstone and granite can be seen. Access to the reserve is through farmland to the south on a track leading from the Piawaning-Wongan Hills road to the south-east corner of the reserve. Another track which winds east-west through the hills in the Mt Rupert Estate cuts through the north-east corner. Tracks within the reserve are not suitable for

vehicle use. Farm tracks and firebreaks provide access to the edge of adjacent, privately owned bushland.

### 3. Mt Rupert Estate

This area includes privately owned bushland to the north of Mt Matilda Nature Reserve and also includes the homestead area on the Stewart's property. The highest hill on the property is Mt Rupert (419m). Hills rise abruptly in a series of ridges and gullies and the northern sections of bushland have been disturbed by grazing. Monks Well Gully is about 1.5km due east of the homestead and derives its name from the Mission well put down supposedly by the Benedictine Monks of New Norcia, when they held pastoral leases in the area. The gully is narrow near the Monk's Well but widens out into an area which is a popular local landmark and picnic site. A track running east-west through the hills passes the homestead and Monk's Well Gully. Farm tracks and firebreaks give access to the edge of the bushland in the northern sections.

### 4. Privately Owned Bushland South of the Wongan-Piawanning Road

A television translator tower is situated on the hills to the south of the Wongan Hills-Piawanning road on Melbourne location 3457 at an elevation of 412m. A gravel road provides vehicle access to the area which is known as Mt O'Brien (424m). To the south-west of the tower the lateritic breakaways form an area known as the "Amphitheatre" and to the south is Fowlers Gully (approximately 2kms south of the Wongan-Piawanning road). Fowlers Gully is flanked both north and south by well developed breakaways. Drummonds Gully just to the north of Fowlers Gully is a drainage area which slopes from the east and terminates in wheat paddocks to the west. Farm tracks and firebreaks provide access to the edge of the bushland areas.

5, 6. Rogers Reserve (†39145)

The terrain of the reserve is typical of that of the hills area with laterite-capped mesas dissected by numerous steep gullies. The Piawaning-Wongan Hills road runs along the northern boundary of the reserve. Farm tracks and firebreaks provide vehicle access to the edge of the bushland and narrow tracks provide foot access through areas of dense thicket.

The Wilding road (gravel) runs along the southern boundary of the area of privately owned bushland to the south of the reserve which was also included in the present survey.

7, 8. Elphin Reserve A 25808, and adjacent bushland

Part of the reserve includes outcropping lateritised areas reaching the 320m contour line selected by Kenneally (1982) to delineate the "Wongan Hills". The reserve however has been excluded from the defined hills area because of the intrusion of sandplain over laterite over a large section. The Piawaning-Wongan Hills road cuts through the reserve and runs along part of the eastern and northern boundaries. The pistol club is situated on 2.4ha (†29621) in the middle of the reserve and a race track is situated near the western boundary on privately owned land. To the north-east the reserve adjoins the railway reserve and bushland to the north and north-east of the line is included in the Department of Agriculture's Experimental Farm (†18672). To the east the adjoining bushland is part of the Water reserve (†16418). A track running along the railway line provides access to the north eastern section of Elphin Reserve and farm tracks and firebreaks provide access to the edge of bushland in the south-western section. Regeneration of the native vegetation is taking place along internal reserve tracks.

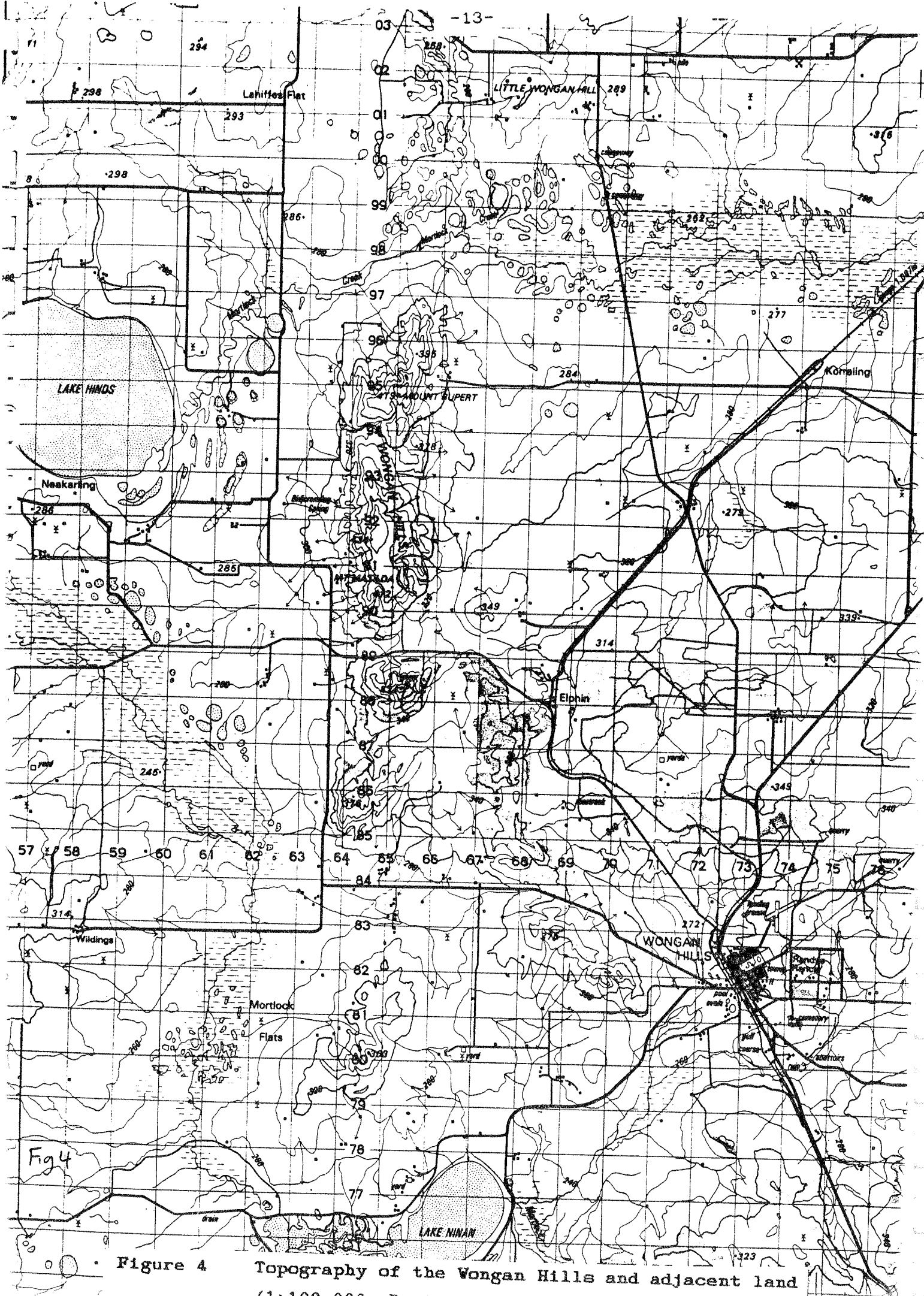


Figure 4

Topography of the Wongan Hills and adjacent land

(1:100 000)

## 2.0 METHOD

The ground survey of the vegetation and flora of the areas outlined in Figure 3 was carried out during periods in June and July, 1988.

General vegetation divisions were noted using colour aerial photography at a scale of 1:6,000. Areas of interest thus delineated were examined in the field and the vegetation and soils at selected sites described. Because of time limitations some areas were not covered in detail in the ground survey and mapping was carried out by extrapolation of known vegetation associations using the aerial photographs.

Vegetation association descriptions were based on the classification system devised by Muir (1977) which was specifically designed for describing wheatbelt vegetation (Table 1).

Voucher specimens of most plant species encountered were collected and identified using keys and by comparison with specimens at the Western Australian Herbarium. Experts involved in revising particular genera were consulted wherever possible to ensure accuracy with identification.

TABLE 1 MUIR SYSTEM OF VEGETATION CLASSIFICATION

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70 - 100% <sup>d</sup>	MID DENSE <sup>c</sup> 30 - 70%	SPARSE <sup>i</sup> 10 - 30%	VERY SPARSE 2 - 10% <sup>r</sup>
T Trees > 30 m M Trees 15 - 30 m LA Trees 5 - 15 m LB Trees < 5 m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low Woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
KT Mallee tree form KS Mallee shrub form	Dense Tree Mallee Dense shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
S Shrubs > 2 m SA Shrubs 1.5 - 2.0 m SB Shrubs 1.0 - 1.5 m SC Shrubs 0.5 - 1.0 m SD Shrubs 0.0 - 0.5 m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
P Mat plants H Hummock Grass GT Bunch grass > 0.5 m GL Bunch grass < 0.5 m J Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid Dense Hummock Grass Tall Grass Low Grass Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
VT Sedges > 0.5 m VL Sedges < 0.5 m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
X Ferns, Mosses, Liverwort	Dense Ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

### 3.0 VEGETATION SURVEY

#### 3.1 Previous Surveys

The Wongan Hills and surrounding countryside are situated in the Avon Botanical District. Beard (1979) has mapped the vegetation of the Moora grid square which includes the Wongan Hills District at a scale of 1:250,000. From this work it can be noted that the remaining natural vegetation in the area defined as the Wongan Hills is covered by *Allocasuarina campestris* and *Dryandra* Thicket (Map unit oodSc). The Mt Rupert and Mt Matilda area of the hills is surrounded by *Eucalypts loxophleba* Woodlands (Map unit e<sub>3</sub>Mi), Reserve #25808 just east of the hills is covered by Mallee and Casuarina Thicket (Map unit ecSc) with *Eucalyptus loxophleba* and *E. salmonophloia* Woodland covering the south-west corner (Map unit e<sub>3</sub>Mi).

The Mallee and *Allocasuarina* thicket is typical of the sandplain vegetation of the Guangan System. This system is the classical Guangan of James Drummond and is accordingly named with his original spelling. The country consists mainly of residual sandplain with occasional granite outcroppings. The valleys are saline with salt lakes and halophytes with small areas of peripheral woodland and aeolian sandplain. Beard points out that the residual sandplain is mapped as "Mallee and Casuarina thicket" but is a mosaic, too intricate to be mapped at 1:250,000 and determined by soil variation. Small patches of yellow sand occur in higher ground and carry a *Banksia-Xylomelum* association. The floristics of the thickets on the residual sandplain proper vary depending on soil type which includes some deep sand and areas of shallower sand over ironstone gravel where *Allocasuarina campestris* and mallee eucalypts dominate. The mallees become more exclusive and develop into mallee formations on a duplex soil with sand over clay. Woodlands of *E. loxophleba*, *E. salmonophloia* or *E. salubris* occur on patches of red loam, or there are thickets of *Melaleuca uncinata* and other *Melaleuca* species with scattered eucalypts. The soil types occur in the mosaic and not in the usual catenary sequence indicating that

they are probably linked with variations in the underlying rock (Beard, 1979).

The Hills support a vegetation system of their own which forms a small enclave within the Guangan System. Kenneally (1977) and Beard (1979) define seven plant communities which are arranged in catena. On the summit plateau there is *Allocasuarina-Dryandra* thicket with scattered emergent mallee in groups or as individuals. On the scarp slopes immediately below breakaways there is a "dwarf scrub" of *Melaleuca undulata* (now reidentified as *M. coronicarpa* ms) and on scree slopes a thicket of *Allocasuarina campestris* and *Calothamnus asper* occurs. Below this, heavy red soils carry woodlands of *E. longicornis* and *E. salubris* and lighter red soils have *E. loxophleba* and *E. salmonophloia*. Mallee with a considerable number of component species is found on red soils with a surface layer of ironstone gravel. Finally, and extraneous to the catena, there is the open vegetation of rock slabs. Kenneally (1977) and Beard (1979), both list component species for each of these communities. Kenneally gives details of sites at Mt Rupert Estate (see Figure 5), Monks Well Gully, Fowlers Gully and Drummonds Gully.

### 3.2 Current Survey

In the present survey the vegetation of the Wongan Hills and Elphin Nature Reserve (A25808) is analysed in more detail. The intricate mosaic of plant communities on the sandplain and the catena arrangement of the communities in the hills area is linked to topographical, pedological and /or geological features.

The vegetation was primarily divided into Tree communities (Low Forest, Low Woodland, Woodland), Mallee communities (Very Open Shrub Mallee to Shrub Mallee). Kwongan communities (heathland, shrublands), Sedgelands (Tall Sedges) and Lithic Complex. The vegetation was then further divided into species associations within these groupings. Table 2 lists the 19 vegetation associations



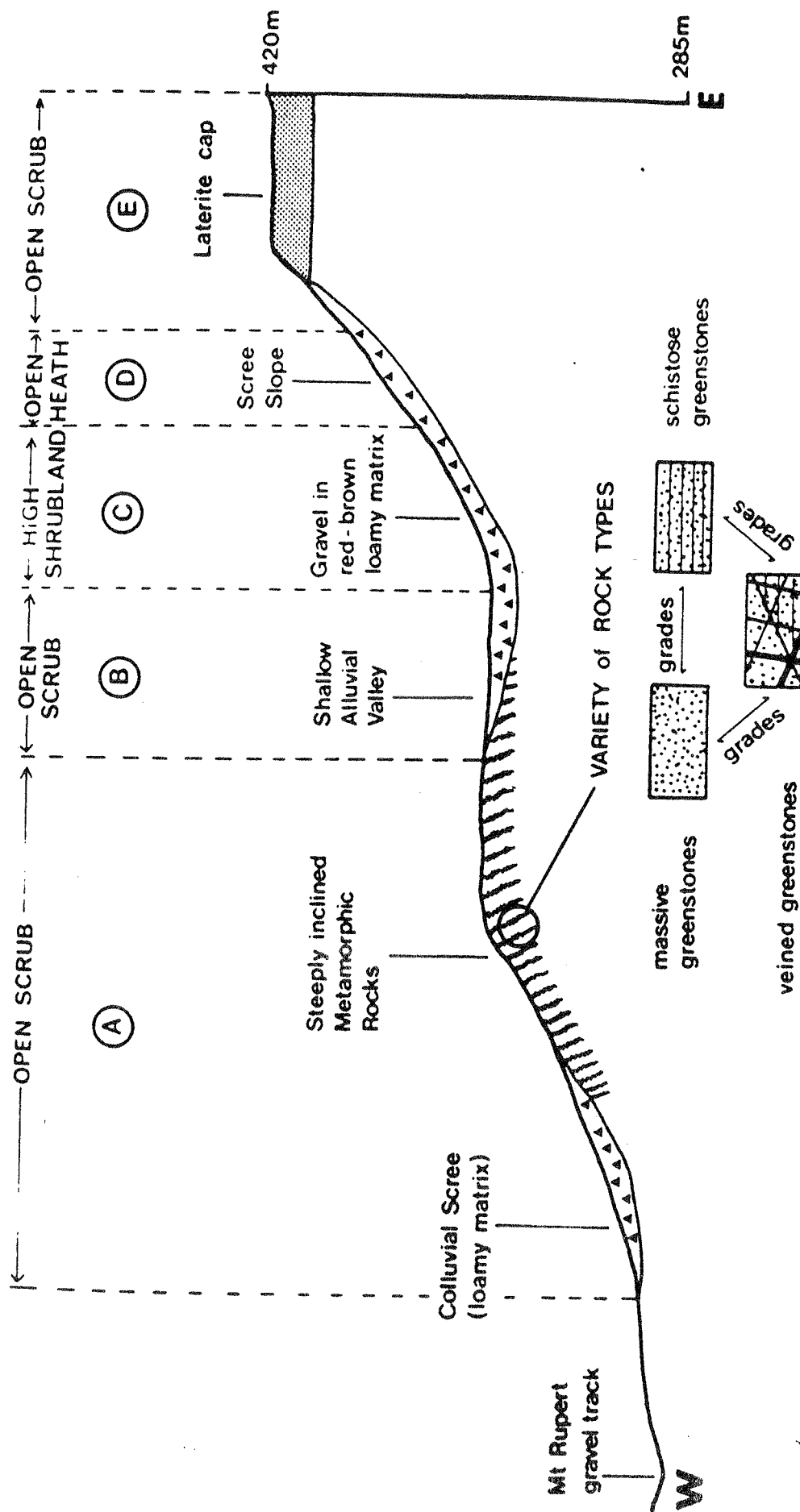


Fig. 5. — Diagrammatic E-W cross-section of the west-facing slope of Mt Rupert Estate illustrating the physiography, geology, soils and plant formations. (A) Open-scrub: *Casuarina campestris*, *Melaleuca radula* and *Spartochloa scirpoides*. (B) Open-scrub: *Acacia acuminata*, *A. orbiculata*, *Alyxia buxifolia*, *Eucalyptus loxophleba*, *Casuarina campestris* and *Stylobasium australe*. (C) High shrubland: *Melaleuca* sp. (D) Open-heath: *Eucalyptus salubris*, *Melaleuca adnata* and *M. undulata*. (E) Open-scrub: *Eucalyptus* spp. (From 'The Natural History of the Wangan Hills', W.A. Naturalist's Club, 1977).

described and mapped in this study, thirteen of which occur in the hills. Thirteen associations also occur on Elphin Nature Reserve covering an area of only 198ha. Vegetation maps of the areas surveyed are presented in Figures 6 to 10 and Muir descriptions for the vegetation found at each site are listed in Appendix 2.

### **Vegetation Maps**

It was not possible to draw accurate boundaries between the Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket (Mt) and Mallee over *Allocasuarina* Thicket (ma) associations as these vegetation types tend to merge.

Areas where Mallee is present only as scattered individuals or absent altogether in the association "Mallee over *Melaleuca coronicarpa* (ms) Heath (Mc)" are marked on the map using the symbol (s). This symbol is also used on the vegetation maps of Elphin Reserve (25808) to indicate areas of *Allocasuarina* Thicket where the Mallee is present only as scattered individuals or absent.

### **Vegetation of the Wongan Hills**

Covering extensive areas of the summit and slopes of the laterite crusted plateau of the Wongan Hills on shallow gravelly soils over ironstone is the Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket association. *Dryandra* species are prominent in some areas usually on the summits of mesas and upper slopes but sometimes also occurring on low slopes. Beard (1979) refers to this association as *Casuarina*-*Dryandra* Thicket. The distribution of mallee is discontinuous and patchy but a number of species including *Eucalyptus ebbanoensis*, *E. drummondii*, *E. eudesmioides* and *E. transcontinentalis* form an upper stratum in many areas. The changes in density of the mallee occur over such short distances that Mallee over Thicket formations and Thicket with scattered mallee as emergents are mapped as one association.

Merging with this association on the slopes of the lateritic plateau is Mallee over *Allocasuarina campestris* Thicket. The discontinuous Mallee stratum is also typical of this vegetation type but here *Allocasuarina campestris* shrubs form a dense understorey with other plant species present only as scattered individuals.

Where the laterite has been breached Mallee over *Melaleuca coronicarpa* (ms) Heath occurs immediately below the breakaway on shallow red soil overlying the residual laterite debris on the scarp slopes. The mallee stratum is again patchy and may be absent in some areas. Areas where the Mallee stratum is absent are indicated of the vegetation maps by (s). *Melaleuca coronicarpa* is a manuscript name which has not yet been published by Dr Barlow. This species has been previously identified as *M. undulata*.

Below the Mallee over *M. coronicarpa* formation on scree slopes with red-brown clay and a surface covering of ironstone and greenstone rubble *Allocasuarina campestris/Calothamnus aspera* Thicket occurs often with an understorey of *Melaleuca radula* and/or *Spartochloa scirpoidea*. The underlying rocks are not laterised and outcrops support a mat of *Borya nitida* herbs and *Verticordia* aff. *preissii* shrubs on shallow soils.

On the lower portion of the landscape below the laterite plateau and upper slopes the plant communities vary according to soil and topography. Woodlands of *Eucalyptus longicornis/E. salubris* occur mainly on heavy red soils in gullies but are also found in some areas on lower scree slopes below the Mallee over *M. coronicarpa* association. On these lower slopes *E. salubris* is dominant. Red loam soils support *E. salmonophloia* woodlands on more level terrain and *E. loxophleba* is found mainly along streamlines and gullies. *Acacia acuminata* Low Forest is also found on the alluvial detritus of the gully floor and on the steeply sloping sides. *Eucalyptus falcata* woodlands are rare and were only found covering a small area on the western side of the hills on gravelly soils over ironstone.

The catenary sequence is complicated by the occurrence of small areas of Mallee with no discernable understorey growing on clay soils with gravel on slopes below breakaways and also adjacent to *E. salmonophloia* and *E. longicornis*/*E. salubris* woodlands in low lying areas. Mallee over *Melaleuca* thicket also occurs on the slopes below the summits of the mesas on clay loam soils. This association frequently extends onto the lower more level terrain especially along streamlines. *Melaleuca uncinata* is the most common understorey species but other *Melaleucas*, for example *M. adnata*, may be prominent in places. *Trymalium ledifolium* is often present with *Callitris ?canescens* an occasional emergent on slopes.

Less frequent are areas of mallee including *Eucalyptus ebbanoensis* Mallee over Scrub which covers small areas on gently sloping or flat terrain and is commonly found adjacent to cleared farmland. The understorey is variable due to past clearing operations or grazing by stock. An Open Mallee association with *Eucalyptus drummondii* dominant is found on sandy loam with gravel east of Drummonds Gully and in Rogers Nature Reserve and adjacent bushland. The area east of Drummonds Gully has been allowed to regenerate after agricultural rolling and the understorey is rich in plant species.

Photograph 1 - Part of the areas known as the Amphitheatre south west of the T.V. Translator tower. The sequence of vegetation associations found in the hills is illustrated here with Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* thicket on the plateau on the horizon, *Melaleuca coronicarpa* (ms) with scattered Mallee directly below the breakaway, *Allocasuarina campestris*/*Calothamnus aspera* thicket on the lower slopes and *Eucalyptus salubris* (gimlet) in the foreground.



## Vegetation of Elphin Nature Reserve (A25808)

Although part of Elphin Nature Reserve reaches the 320m contour line this reserve is not included in the area defined as the Wongan Hills because of the intrusion of sandplain in some sections over the laterite which is the characteristic capping of the hills. The reserve is therefore situated in an area of transition where plant communities typical of the hills (7 vegetation associations) merge with communities characteristic of the surrounding countryside including the sand plains (6 associations).

Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket with *Dryandra* species prominent is found on the summits and slopes of small areas of residual lateritic plateau. The association also extends into the northern sections of the reserve on shallow soils over laterite. Mallee over *Allocasuarina campestris* thicket is also found on areas where the terrain is fairly flat and here the Mallee is present only as scattered emergents amongst the dense tamma thicket.

Mallee over *Melaleuca coronicarpa* Heath also extends into the areas in the northern sections of the reserve but is still characteristically found immediately below breakaways. Small areas of Mallee and Mallee over *Melaleuca* thicket occur on lower slopes. In the southern sections of the reserve and in adjacent bushland *Eucalyptus salmonophloia* and *E. loxophleba* woodlands occur on heavier soils (loams and clay loams) in low lying areas and sandy loam soils support woodlands of *E. wandoo*. Granite outcrops are surrounded by a thicket of *Allocasuarina campestris* with mats of *Borya sphaerocephala* or *B. nitida* herbs and *Calytrix depressa* and other shrubs on shallow soils. *Melaleuca* thicket occurs on low lying poorly drained areas on clay and clay loam soils.

The plant communities covering the sandplain areas form an intricate mosaic determined mainly by soil variation with *Ecodeoclea monostachya* Tall sedges on poorly drained sandy loam, *Eucalyptus*

*pyriformis* Very Open Mallee over heath which is rich in species on yellow sandy loam over gravel and Mixed Dense Heath in bleached sandy loam.

In the following pages vegetation descriptions of the structure and species composition of each vegetation association mapped in the present survey are detailed. The location of sites is as follows :

Numbers with the prefix Site E occur on Elphin Nature Reserve  
(A25808)

Numbers with the prefix Site R occur on Rogers Nature Reserve  
(A39145)

Numbers with the prefix Site T occur on privately owned bushland south of the Piawaning-Wongan Hills road

Numbers with the prefix Site M occur on Mt Matilda Nature Reserve  
(A33530)

Numbers with the prefix Site MR occur on privately owned bushland on Mt Rupert Estate and to the north of Mt Matilda Reserve.

p follows the letter prefix if the site occurs on privately owned bushland adjacent to the nature reserve indicated.

Table 2 - Vegetation Associations of the Wongan Hills and Elphin  
Nature Reserve (A25808)

Woodlands, Low Woodlands, Low Forests

- |    |  |      |
|----|--|------|
| 1. | <i>Eucalyptus wandoo</i> (wandoo, whitegum) Woodland                             | ~Ew  |
| 2. | <i>Eucalyptus loxophleba</i> (York gum) Woodland                                 | ~El  |
| 3. | <i>Eucalyptus salmonophloia</i> (salmon gum) Woodland                            | ~Es  |
| 4. | <i>Eucalyptus salubris</i> (gimlet) / <i>E. longicornis</i> (morrel<br>woodland) | ~Egm |
| 5. | <i>Eucalyptus falcata</i> (silver mallet) Woodland                               | ~Ef  |
| 6. | <i>Acacia acuminata</i> (jam) Low Forest   | ~Aa  |

Mallee

- |     |  |     |
|-----|--|-----|
| 7.  | Mallee   | ~M  |
| 8.  | Mallee over <i>Petrophile shuttleworthiana</i> / <i>Allocasuarina<br/>campestris</i> Thicket | ~Mt |
| 9.  | Mallee over <i>Allocasuarina campestris</i> Thicket  | ~Ma |
| 10. | Mallee over <i>Melaleuca</i> Thicket   | ~Mm |
| 11. | Mallee over <i>Melaleuca coroncarpa</i> (ms) Heath   | ~Mc |
| 12. | <i>Eucalyptus ebbacoensis</i> Mallee over Scrub  | ~Me |
| 13. | <i>Eucalyptus drummondii</i> Open Mallee over Heath  | ~Md |
| 14. | <i>Eucalyptus pyriformis</i> Very Open Mallee over Heath                                     | ~Mp |

Kwongan (Shrub/Heath communities)

- |     |  |     |
|-----|--|-----|
| 15. | <i>Melaleuca</i> Thicket   | ~Km |
| 16. | Mixed Dense Heath  | ~Kh |
| 17. | <i>Allocasuarina campestris</i> / <i>Calothamnus asper</i> Thicket | ~Ka |

Sedgelands and Lithic Complex

- |     |   |    |
|-----|---|----|
| 18. | <i>Ecdiocolea monostachya</i> Tall Sedges | ~S |
| 19. | Granite rock surface, Herbs               | ~G |

WOODLANDS, LOW WOODLANDS, LOW FORESTS

Ew *Eucalyptus wandoo* (Wandoo, whitegum) Woodland

Diagnosis Low Woodland A (Low Woodland A to Low Forest A) over variable understorey.

Sites E12, Ep16, E38

Description

Stratum 1 *Eucalyptus wandoo* trees, stratum 4-10m. Canopy cover generally 10-30% but patchy in places and occasionally increasing in density to 50% cover.

Stratum 2 Very variable in density and species composition. Often only scattered shrubs are present but shrubs to 1m form a sparse stratum reaching 30% canopy cover in places. Areas of *Allocasuarina campestris* shrubs 1-3m, 30-70% canopy cover are common. Species present include *Acacia acuaria*, *Acacia fragilis*, *A. microbotrya*, *Astroloma serratifolium*, *Calytrix gracilis*, *Dampiera oligophylla*, *Daviesia ?hakeoides*, *Dianella revoluta*, *Dodonaea viscosa* ssp. *angustissima*, *Gastrolobium obovatum*, *Grevilla ?intricata*, *Hakea lissocarpha*, *Laxmannia grandiflora*, *L. squarrosa*, *Leptospermum erubescens*, *Melaleuca radula*, *Mesomelaena preissii*, *Oxylobium parviflorum*, *Petrophile divaricata*, *Scholtzia drummondii*, *Watizia ?acuminata*, *Wurmbea tenella*.

Stratum 3 In some areas *Loxocarya ?cinerea*, 10cm, forms a mid-dense stratum (canopy cover 30-70%) or *Borya sphaerocephala* herbs, 5cm, form a sparse stratum (10-30% canopy cover).



Comments     *Eucalyptus wandoo* woodland occurs in sandy loams on Elphin reserve (A25808) on flat to gently sloping terrain. The understorey is very variable and changes in species composition and plant density are found over short distances. Some weed invasion was recorded at site Ep16 which is adjacent to cleared farmland.

Photograph 2     *Eucalyptus wandoo* (Wandoo, whitegum) Woodland at site Ep 38



E1 *Eucalyptus loxophleba* (York gum) Woodland

Diagnosis Low Woodland A/Low Forest A over variable understorey.

Sites Ep11, E15, T16, T23, T28, Mp33, M36, Mp40, MR6

Description

Stratum 1 *Eucalyptus loxophleba* trees, stratum 5-10m. the canopy cover is variable ranging from sparse to mid-dense, (0-70%). Sometimes scattered trees of *E. salmonophloia* are emergent to 15m. Other stratum 1 species include *E. obtusiflora*, *E. wandoo* and *E. ebbanoensis*.

Stratum 2 *Acacia acuminata* trees, 2-4m, are present in some areas and occasionally form a sparse to very sparse stratum, canopy cover 2-30%.

Stratum 3 Usually no distinct understorey is present but *Melaleuca* shrubs 1.5-2.5m form a stratum reaching 70% canopy cover in places and mixed shrubs to 1m, 30-70% canopy cover may form a lower stratum occasionally. Understorey species include : *Acacia acuarina*, *A. cliftoniana*, *A. erinacea*, *A. ligustrina*, *A. leptospermoides*, *A. pulchella*, *Allocasuarina campestris*, *Alyogyne huegelii*, *Alyxia buxifolia*, *Anthocercis genistoides*, *Astroloma serratifolium*, *Baeckea crispiflora*, *Calothamnus aspera*, *Cassia nemophila*, *Cheilanthes austrotenuifolia*, *Daviesia benthamii*, *Dianella revoluta*, *Dodonaea pinifolia*, *Drosera macrantha*, *Enchylaena ?lanata*, *Grevilla ?paniculata*, *G. stenophylla*, *Hakea preissii*, *Hibbertia exasperata*, *Hypocalymma angustifolium*, *Lysiopetalum rugosum*, *Melaleuca acuminata* ssp. *websteri*, *M. adnata*, *M. radula*, *M. uncinata*, *Ptilotus obovatus*, *Rhagodia acicularis*, *Santalum acuminatum*, *Templetonia sulcata*,

*Trymalium ledifolium*, *Waitzia pacuminata*, *Wurmbea tenella*.

**Comments** *Eucalyptus loxophleba* woodland occurs on red-brown loam and clay loam soils usually at the bottom of gullies or along stream lines. Scattered salmon gums are occasionally present and *Acacia acuminata* commonly occurs in association with York gum in the Mt Matilda and Mt Rupert areas.

**Photograph 3** *Eucalyptus loxophleba* (York gum) and *Acacia acuminata* (jam) at Monks Well Gully, Mt Rupert Estate (site MR6)



Es *Eucalyptus salmonophloia* (Salmon gum) Woodland

Diagnosis Woodland (from Low Forest A to Woodland) over variable understorey.

Sites E14, E37, Rp51, Rp52, M17, MR5

#### Description

Stratum 1 *Eucalyptus salmonophloia* trees, stratum 8-20m. Canopy cover usually 10-30% but increasing in density to 60% in some areas. Scattered trees of *E. salubris*, *E. loxophleba*, *E. longicornis* or *Acacia acuminata* are sometimes present.

#### Lower Stratum

Usually shrubs 0.5m-3m form a sparse or very sparse stratum (2-30% canopy cover) but a distinct understorey may be absent. At one site only, *Melaleuca* shrubs (2-3m) form a dense stratum, 70-90% canopy cover. Lower stratum species include *Acacia acuarria*, *A. erinacea*, *A. ligustrina*, *A. dura*, *A. orbifolia*, *Anthocercis genistoides*, *Daviesia benthamii*, *Dianella revoluta*, *Dodonaea larraeoides*, *D. bursariifolia*, *Eremophila decipiens*, *Grevillea huegelii*, *Goodenia spinescens*, *Melaleuca adnata*, *M. acuminata*, *M. coronicarpa*, *M. uncinata*, *Olearia muelleri*, *Santalum acuminatum*, *Templetonia sulcata*.

#### Comments

*Eucalyptus salmonophloia* woodlands occur on red brown loams and clay loams in low lying areas. Near Mt Matilda the woodlands are interspersed with mallee. Scattered trees of *Eucalyptus salubris* or *E. longicornis* are usually present and *E. loxophleba* and *Acacia acuminata* occur in the Mt Rupert area.

Photograph 4 *Eucalyptus salmonophloia* (Salmon gum) Woodland  
at site E37.



Egm *Eucalyptus salubris* (Gimlet)/*E. longicornis* (Morrel) Woodland

Diagnosis Low Woodland A/Low Forest A over variable understorey

Sites R16, R33, T6, T7, T12, T15, T24, T29, Mp5, M11, M21,  
M28, M35, MR3, MR9

#### Description

Stratum 1 *Eucalyptus salubris* and *E. longicornis* trees, stratum  
8-15m. Canopy cover generally 30-70% but becoming  
sparse (10-30% cover) in places. Other stratum 1  
species which occur as scattered trees or mallee  
include *E. salmonophloia*, *E. loxophleba*, *E. virella*  
(ms), *E. yilgarnensis*, *E. erythronema*, *E. myriadena*, *E.*  
*transcontinentalis*.

### Lower Stratum

The understorey is variable, patchy and in places undefined with scattered shrubs and herbs. In some areas *Melaleuca lanceolata* ssp. *thaerifolia* shrubs to 4m form a sparse to very sparse stratum. Other species of *Melaleuca* 1-3m, commonly form a stratum which may vary from sparse to mid-dense (2-70% canopy cover) at different localities. Lower stratum species include *Acacia erinacea*, *A. dura*, *A. ligustrina*, *Acacia orbifolia*, *Alyxia buxifolia*, *Anthocercis genistoides*, *Daviesia benthamii*, *Dodonaea larraeoides*, *D. bursariifolia*, *Eremophila decipiens*, *E. drummondii*, *E. oppositifolia*, *Enchylaena lanata*, *Grevillea huegelii*, *Melaleuca acuminata*, *M. undulata*, *M. adnata*, *M. coronicarpa* (ms), *Olearia muelleri*, *Rhagodia acicularis*, *Scaevola spinescens*, *Santalum acuminatum*, *Trymalium ledifolium*.

### Comments

Woodlands of *Eucalyptus salubris* and *E. longicornis* occur on heavy red soils (loams and clays) which have developed on metamorphic rocks. The woodlands are usually found on the lower scree slopes below the breakaways and lateritic plateau and on low lying areas. The association varies in composition from areas of *E. salubris* with only scattered *E. longicornis* usually on scree slopes sometimes below *Melaleuca coronicarpa* (ms) shrubs to areas of *E. longicornis* with an understorey of *Melaleuca lanceolata* ssp. *thaerifolia* shrubs in more low lying areas. Mallee are sometimes interspersed. *Eremophila ternifolia* (gazetted rare) is found in this association at site M21.

Photograph 5 *Eucalyptus salubris* (Gimlet) with scattered *E. longicornis* (Morrel) at site M28 on Mt Matilda nature reserve.



Photograph 6 *Eucalyptus longicornis* (Morrel) with an understorey of *Melaleuca lanceolata* shrubs on low lying areas at site T24. Only scattered trees of *E. salubris* are present.



Bf *Eucalyptus falcata* (Silver mallet) Woodland

Diagnosis Low Woodland A over variable understorey.

Sites Mp31

Description

Stratum 1 *Eucalyptus falcata* trees, stratum 10-12m. Canopy cover generally 10-30%.

Stratum 2 An understorey is sometimes absent but usually shrubs 2-3m form a mid-dense stratum of canopy cover 30-60%. Stratum 2 species include *Acacia acuaria*, *Allocasuarina campestris*, *A. acutivalvis*, *Calothamnus aspera*, *Dodonaea bursariifolia*, *Goodenia pinifolia*, *Petrophile shuttleworthiana*, *Santalum acuminatum*, *Trymalium ledifolium*.

Comments *Eucalyptus falcata* woodland was only found to the west of Mt Matilda nature reserve on privately owned land. The woodlands occur on residual laterite with gravelly soils over ironstone.

Photograph 7 *Eucalyptus falcata* (Silver mallet) Woodland at site Mp31.





Aa *Acacia acuminata* (jam) Low Forest

Diagnosis Low Forest A

Sites MR2

Description

Stratum 1 *Acacia acuminata* trees, 5-8m, forming a mid-dense stratum, canopy cover 30-50%.

Lower Stratum

Usually no distinct understorey is present. Scattered shrubs and annual species are present. These include *Grevillea ?paniculata*, *Ptilotus obovatus*, *Scaevola spinescens*, *Wurmbea tenella*, *Waitzia ?acuminata*.

Comments *Acacia acuminata* trees become dominant on the alluvial detritus of the gully floor and sloping sides at Monks Well Gully and on clay soils in other bushland areas of the Mt Rupert Estate. Annual weed species are prevalent.

Photograph 8 *Acacia acuminata* (jam) at site MR2.



MALLEE

M Mallee

Diagnosis Shrub Mallee/Tree Mallee

Sites E5, E10, E34, R26, R29, R36, R40, Rp43, Rp45, T17, T27, T37, Mp22, Mp29, Mp32, M38, MR11, MR12

Description

Stratum 1 Mallee, 3-10m, forming a mid-dense stratum of canopy cover 30-80%. Stratum 1 species include *Eucalyptus arachnaea* (ms), *E. eremophila*, *E. erythronema*, *E. ebbanoensis*, *E. flocktoniae*, *E. ?obtusiflora*, *E. pileata*, *E. subangusta* (ms), *E. transcontinentalis* and *E. virella* (ms). Scattered trees of *E. longicornis*, *E. salubris*, *E. salmonophloia* or *E. loxophleba* are often present.

Lower Stratum

Usually no distinct understorey is present. Occasionally *Melaleuca* shrubs to 1.5m form a sparse and patchy stratum 10-30% canopy cover or *Trymalium ledifolium* shrubs 0.5-1.5m, may form a stratum of varying density at different localities (2-50% canopy cover). Species present at different localities includes *Acacia jacksonioides*, *A. sp. nov. (ericsonii ms)*, *A. ligustrina*, *Astroloma epacridis*, *Baeckea crispiflora*, *Boronia ericifolia*, *Cassythia melantha*, *Cryptandra leucophracta*, *Cryptandra sp.*, *Dampiera coronata*, *Daviesia benthamii*, *Dianella revoluta*, *Dodonaea bursariifolia*, *Enchylaena lanata*, *Eremophila drummondii*, *E. oppositifolia*, *E. sargentii*, *Grevillea huegelii*, *G. petrophiloides*, *Goodenia pinifolia*, *Hakea sp.*, *Hibbertia exasperata*, *Hypocalymma angustifolium*, *Melaleuca adnata*, *M. coronicarpa*, *M. lateriflora*, *M.*

*uncinata*, *M. acuminata*, *Olearia muelleri*, *Phebalium tuberosum*, *Templetonia sulcata*.

**Comments**

Areas of mallee occur on the slopes of lateritic hills and sometimes below breakaways on red clay soils with gravel. On the lower slopes scattered shrubs of *Melaleuca* species and *Trymalium ledifolium* may increase in density and merge into Mallee over *Melaleuca* Thicket.

**Photograph 9** Mallee including *Eucalyptus erythronema* and *E. virella* at site E10.



Mt Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket.

**Diagnosis** Variable Shrub Mallee (Very Open Shrub Mallee to Shrub Mallee) over Thicket (Dense Thicket to Heath B)

**Sites** E3, E4, E21, E22, E29, E35, R3, R6, R10, R12, R13, R18, R22, R24, R28, R30, R35, R38, R41, Rp44, Rp48, Rp49, T1, T5, T14, T19, T20, T21, T25, T30, T38, Mp1, M7, M8, M9, Mp15, M20, M25, M26, Mp43, MR8, MR15.

**Description**

**Stratum 1** This stratum is discontinuous and very variable in density with Mallee, 2.5-8m, present in patches with canopy cover ranging from 2-70% or as scattered individuals. Stratum 1 species include *Eucalyptus drummondii*, *E. ebbacoensis*, *E. erythronema*, *E. eudesmioides*, *E. flocktoniae*, *E. obtusiflora*, *E. pluricaulis* (ms), *E. rigidula*, *E. subangusta* (ms), *E. transcontinentalis*, *E. virella* (ms) and *E. yilgarnensis*.

**Stratum 2** Shrubs, 0.5-3m, forming a continuous mid-dense to dense stratum, canopy cover 50-100%. *Petrophile shuttleworthiana* and *Allocasuarina campestris* are prominent with species of *Dryandra* including *D. comosa*, *D. pulchella*, *D. purdieana* (ms) and *D. aff. hewardiana* also prominent in some areas. Other stratum 2 species include *Acacia multispicata*, *A. pygmaea* (ms), *A. stenoptera*, *A. jacksonioides*, *A. shuttleworthii*, *A. botrydion*, *A. cliftoniana*, *A. acuaria*, *A. pulchella*, *A. leptospermoides*, *Allocasuarina acutivalvis*, *Alyxia buxifolia*, *Allocasuarina drummondiana*, *Astroloma epacridis*, *Astartea heteranthera*, *Baeckea crispiflora*, *Beyeria brevifolia*, *Beaufortia interstans*, *Billardiera ?coriacea*, *Boronia ericifolia*, *Bossiaea eriocarpa*,

Mixed  
Mallee to 12m  
diff from  
mixed mallee  
with another  
side of sp

*Calothamnus quadrifidus*, *Callitris canescens*, *C. roei*,  
*Cassytha melantha*, *Comesperma volubile*, *Cryptandra*  
*leucophracta*, *Conospermum ephedroides*, *Conostylis*  
*androstemma*, *Daviesia spiralis*, *Dampiera coronata*, *D.*  
*oligophylla*, *Dodonaea bursariifolia*, *Drosera macrantha*,  
*Gastrolobium spinosum*, *Grevillea armigera*, *G.*  
*?paniculata*, *G. petrophiloides*, *Goodenia pinifolia*,  
*Guichenotia macrantha*, *Hakea gilbertii*, *H.*  
*multilineata*, *H. scoparia*, *H. incrassata*, *Halgania* aff.  
*preissiana*, *Hypocalymma angustifolium*, *Hibbertia*  
*exasperata*, *H. huegelii*, *Hemigenia* aff. *saligna*,  
*Isopogon divergens*, *I. scabriusculus*, *Leucopogon*  
*conostephoides*, *Lepidosperma* aff. *tenuis*, *Melaleuca*  
*conothamnoides*, *M. cordata*, *M. aff. holosericea*, *M.*  
*pungens*, *M. radula*, *M. scabra*, *M. sclerophylla*, *M.*  
*uncinata*, *Micromyrtus racemosa*, *Microcorys*  
*eremophiloides*, *Phebalium brachycalyx*, *P. tuberculosum*,  
*Petrophile brevifolia*, *Psammomoya choretroides*,  
*Persoonia coriacea*, *Ricinocarpus muricatus*, *Santalum*  
*acuminata*, *Scholtzia drummondii*, *Stylidium*  
*nungarinense*, *Trymalium ledifolium*.

**Stratum 3** Occasionally upper stratum 2 is sparse or on the edge of cleared areas *Melaleuca cordata* or *M. conothamnoides* form a mid-dense stratum of shrubs to 0.5m but usually these *Melaleuca* are present as scattered individuals.

**Comments** Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* thicket is the most extensively occurring vegetation formation on the lateritic plateau of the hills. This association covers the slopes and summits of the mesas and breakaways with *Dryandra* species more prominent on the summits and upper slopes. The soils are orange-brown clay with gravel over ironstone. The distribution of mallee is discontinuous and patchy with changes in density occurring over such short distances

that it was not possible to map Mallee over Thicket and Thicket with scattered Mallee as separate associations. *Allocasuarina campestris* becomes the major component species in the thicket in places but the association is not mapped as Mallee over *Allocasuarina campestris* Thicket unless other species are present only as scattered individuals. In areas where fire has been absent for some years the shrubs reach a height of 3m.

Photograph 10 Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket on Rogers Reserve (A39145) with *Dryandra comosa* in the foreground.



Ma  
Mc Mallee over *Allocasuarina campestris* (tamma) Thicket

**Diagnosis** Variable Shrub Mallee (from Very Open Shrub Mallee to Shrub Mallee) over *Allocasuarina campestris* Thicket (from Heath A to Dense Thicket).

**Sites** Ep6, E9, E25, R4, R5, R7, R9, R20, R21, R27, T22, T36, T39, M18, M19, M34, M41, M44, MR7.

**Description**

**Stratum 1** This stratum is discontinuous and very variable in density with shrub mallee and some tree mallee 3-8m, present in patches with canopy cover ranging from 2-70%, or scattered as individuals or occasionally absent. Stratum 1 species include *Eucalyptus arachnaea* (ms), *E. drummondii*, *E. ebbanoensis*, *E. eudesmioides*, *E. flocktoniae*, *E. hypochlamydea* subsp. *edysiustes* (ms), *E. obtusiflora*, *E. subangusta* (ms), *E. transcontinentalis*.

**Stratum 2** *Allocasuarina campestris* shrubs, 1-4m, form a dense to mid-dense stratum with canopy cover 50-100%. Species present as scattered individuals at different localities include *Acacia cliftoniana*, *A. leptospermoides*, *A. orbifolia*, *A. stenoptera*, *A. pulchella*, *Allocasuarina acutivalvis*, *A. drummondiana*, *Astartea heterantha*, *Astroloma serratifolium*, *Astroloma epacridis*, *Baeckea crispiflora*, *Callitris roei*, *Cryptandra leucophracta*, *Conostylis androstemma*, *Drosera macrantha*, *Dryandra* aff. *hewardiana*, *D. pulchella*, *D. comosa*, *Gastrolobium spinosum*, *Goodenia pinifolia*, *Grevillea petrophiloides*, *Hakea gilberti*, *H. multilineata*, *Hakea scoparia*, *Hibbertia exasperata*, *Hypocalymma angustifolium*, *Hemigenia westringioides*, *Isopogon divergens*, *I. scabriusculus*, *Lepidosperma* aff. *tenuis*, *Melaleuca pungens*, *M. conothamnoides*, *M.*

*cordata*, *M. uncinata*, *M. aff. holosericea*, *Micromyrtus racemosa*, *Psammomoya choretroides*, *Petrophile brevifolia*, *P. shuttleworthiana*, *Persoonia coriacea*, *Phebalium tuberosum*, *Ricinocarpos muricatus*, *Santalum acuminatum*, *Trymalium ledifolium*, *Stylidium leptophyllum*.

**Comments** Mallee over *Allocasuarina campestris* Thicket is found in sandy loams and clay loams with gravel. Beard (1979) mapped the area of residual sandplain as "Mallee and Casuarina Thicket" and the above vegetation association occurs on sandplain on Elphin Nature Reserve (A25808). Mallee over *Allocasuarina campestris* Thicket is also found on the slopes of the laterite crusted hills extending into low lying areas in some situations. The formation merges with *Allocasuarina campestris*/*Petrophile shuttleworthiana* Thicket and it was not possible to draw a vegetation boundary between the two associations using the available aerial photography. In areas which have remained unburnt for many years the *Allocasuarina campestris* shrubs reach a height of 4m, a situation rarely seen in wheatbelt areas.

**Photograph 11** Mallee over *Allocasuarina campestris* Thicket near site T22. The area has remained unburnt for many years with "shrubs" reaching 4m.





**Mm Mallee over Melaleuca Thicket**

**Diagnosis** Shrub Mallee over *Melaleuca* Thicket (from Dense Thicket to Heath B)

**Sites** E1, E8, E36, R11, R14, R17, R25, R32, R34, R37, Rp42, Rp47, T9, T18, T31, T32, M2, Mp4, M13, Mp14, M16, Mp24, M42.

**Description**

**Stratum 1** Shrub Mallee and occasionally Tree Mallee, 3-7m, usually forming a mid-dense stratum, 30-70% canopy cover but sometimes becoming sparse (10-30% cover). Stratum 1 species include *Eucalyptus arachnaea* (ms), *E. erythronema*, *E. eudesmioides*, *E. flocktoniae*, *E. obtusiflora*, *E. transcontinentals*, *E. subangusta* (ms), *E. virella* (ms). Scattered trees of *E. loxophleba* are sometimes present in low lying areas.

**Stratum 2** *Melaleuca* shrubs, 1-3m, usually forming a dense to mid-dense stratum, canopy cover 30-100%. *Trymalium ledifolium* is prominent in some areas and scattered shrubs of *Callitris ?canescens* are occasionally emergent or form a sparse stratum (2-10%). Species of *Melaleuca* include *M. acuminata* ssp. *websteri*, *M. coroncarpa* (ms), *M. adnata*, *M. lanceolata* ssp. *thaerifolia*, *M. radula*, *M. scabra*, *M. uncinata*, *M. undulata* (Wongan biotype). Other stratum 2 species occurring as scattered individuals include *Acacia cliftoniana*, *A. leptospermoides*, *A. orbifolia*, *A. sulcata* var. *platyphylla*, *A. sp. nov. (ericsonii ms)*, *A. ligustrina*, *A. multispicata*, *A. dura*, *Allocasuarina acutivalvis*, *A. campestris*, *Baeckea crispiflora*, *Boronia ericifolia*, *Cassytha ?pomiformis*, *C. ?melantha*, *Callitris roei*, *Cryptandra leucophracta*, *Conostylis androstemma*, *Comesperma volubile*, *Daviesia benthamii*,

*Dampiera oligophylla*, *D. coronata*, *Dodonaea bursariifolia*, *D. pinifolia*, *D. larraeoides*, *Eremophila decipiens*, *Gastrolobium spinosum*, *Grevillea huegelii*, *G. petrophiloides*, *G. stenophylla*, *Hakea scoparia*, *Hibbertia exasperata*, *H. rostellata*, *Hypocalymma angustifolium*, *Melaleuca sclerophylla*, *M. conothamnoides*, *Microcorys obovata*, *Micromyrtus racemosa*, *Olearia muelleri*, *Petrophile shuttleworthiana*, *Phebalium tuberculosum*, *P. brachycalyx*, *Platysace effusa*, *Santalum acuminatum*, *Templetonia sulcata*, *Westringia cephalantha*.

**Stratum 3** *Melaleuca coronicarpa* (ms) shrubs to 0.5m, occasionally form a sparse to mid-dense stratum (10-70% canopy cover)

**Comments** Mallee over *Melaleuca* Thicket occurs on slopes below the plateau on red brown clay loam soils over gravel and extends to low lying areas on clay loam soils along some streamlines.

**Photograph 12** Mallee over *Melaleuca uncinata* and *Trymalium ledifolium* shrubs at site Mp4.



Mc Mallee over *Melaleuca coronicarpa* (ms) Heath

Diagnosis Variable Shrub Mallee (from Very Open Shrub Mallee to Shrub Mallee) over *Melaleuca coronicarpa* Heath (Dense Low Heath C to Dense Heath A)

Sites E24, R1, R15, R23, R31, (T2), M27, M37, M46, MR13

Description

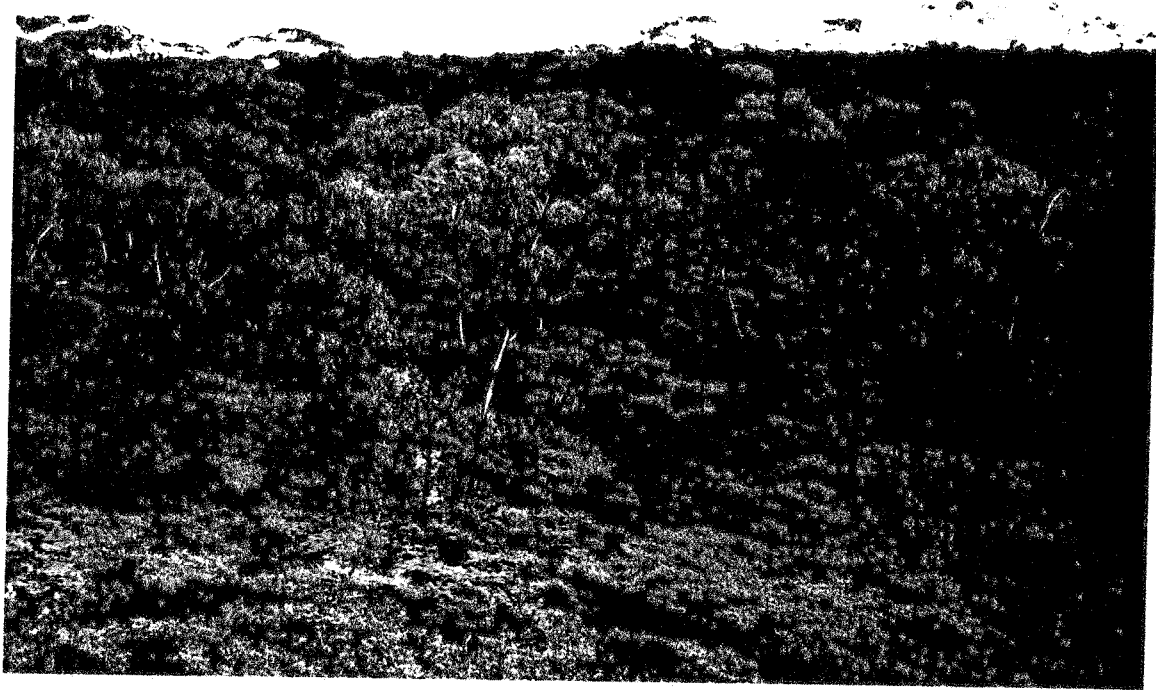
Stratum 1 Shrub Mallee and occasionally Tree Mallee, 3-8m, forming a discontinuous and variable stratum, canopy cover 2-70%. In some areas the mallee may only be present as scattered individuals or absent. Stratum 1 species include *Eucalyptus erythronema*, *E. obtusiflora*, *E. sheathiana*, *E. transcontinentalis*. Scattered trees of *E. salubris* and *E. longicornis* may also occur.

Stratum 2 Shrubs of *Melaleuca coronicarpa* (ms) 0.5-2m usually forming a mid-dense to dense stratum, canopy cover 50-90%. Other species occurring as scattered individuals include *Acacia dura*, *A. acuarina*, *Allocasuarina campestris*, *Baeckea crispiflora*, *Callitris Proei*, *Daviesia benthamii*, *Dodonaea bursariifolia*, *D. divaricata*, *Melaleuca adnata*, *M. lanceolata*, *Olearia muelleri*, *Phebalium brachycalyx*, *Pterostylis vittata*, *Trymalium ledifolium*.

Comments Mallee over *Melaleuca coronicarpa* (ms) Heath appears to favour the shallow red soil overlying the residual laterite debris and is usually found on scarp slopes immediately below breakaways. This *Melaleuca* species has been previously identified as *M. undulata* (Kenneally, 1977) but has now been recognised as a separate species by Dr. Barlow who is revising the genus *Melaleuca*. The new name has not been published as yet. Areas where Mallee is only present as

scattered individuals or is absent altogether are marked on the map using the symbol (s).

Photograph 13 Mallee including *Eucalyptus transcontinentalis* and *E. obtusiflora* over *Melaleuca coronicarpa* (ms) at site R23.



Me *Eucalyptus ebbanoensis* Mallee over Scrub

Diagnosis Open Shrub Mallee/Shrub Mallee over variable understorey.

Sites R39, T8, T10 (regen.), T13, Mp3, M45.

Description

Stratum 1 Shrub and tree mallee to 7m, forming a mid-dense to sparse stratum, canopy cover 20-70%. *E. ebbanoensis* is usually dominant. Other stratum 1 species include *E. obtusiflora*, *E. plenissima*, *E. subangusta* (ms).

Lower Stratum

Very variable in density and species composition and in some places no distinct understorey is present. In other areas shrubs 0.5-2.0m, form an understorey variable in density and from 2-70% canopy cover.

*Phebalium tuberculosum*, or *Baeckea crispiflora* may be prominent in some areas. Other lower stratum species include *Acacia botrydion*, *A. cliftoniana*, *A. latipes*, *A. stenoptera*, *A. pulchella*, *A. ulicina*, *A. leptospermoides*, *A. sp. nov. (ericsonii ms)*, *Allocasuarina campestris*, *Beyeria brevifolia*, *Boronia ericifolia*, *Bossiaea eriocarpa*, *Calytrix drummondii*, *Chamelaucium drummondii*, *Cryptandra leucophracta*, *Dodonaea bursariifolia*, *Dryandra purdieana* (ms), *D. aff. hewardiana*, *Drosera macrantha*, *Gastrolobium spinosum*, *Grevillea ?intricata*, *G. petrophiloides*, *G. stenophylla*, *Goodenia pinifolia*, *Hakea gilbertii*, *H. scoparia*, *Halganina aff. preissiana*, *Hemigenia aff. saligna*, *Hibbertia exasperata*, *Hypocalymma angustifolium*, *Isopogon divergens*, *Leucopogon conostephoides*, *Lysiosepalum nigrosum*, *Melaleuca undulata*, *M. cordata*, *M. scabra*, *M. conothamnoides*, *M. uncinata*, *Micromyrtus racemosa*, *Persoonia coriacea*,

*Phebalium ?brachycalyx*, *Petrophile shuttleworthiana*,  
*Santalum acuminatum*, *Verticordia chrysantha*.

**Comments**

*Eucalyptus ebbanoensis* mallee over scrub occurs on gentle slopes at the base of the "hills" on clay loam soils with gravel. The variable understorey is in part due to the grazing of stock on areas adjacent to cleared farmland. Some areas have also been cleared and are now regenerating.

**Photograph 14** *Eucalyptus ebbanoensis* over Scrub at site R39.



**Md *Eucalyptus drummondii* Open Mallee over Heath**

**Diagnosis** Very Open Shrub Mallee/Open Shrub Mallee over Heath  
(Low Scrub C to Heath B)

**Sites** R8, R19, R46, Rp50, T4, T26.

**Description**

**Stratum 1** Shrub mallee, stratum 2.5-6m. Variable in density, 2-30% canopy cover, usually with a patchy distribution. In some areas mallee are present only as scattered emergents. Stratum 1 species include *E. drummondii* (dominant) and frequently *E. ebbanoensis* and *E. eudesmioides*.

**Stratum 2** Shrubs 0.1-1.5m (rarely to 2m) usually form one discernible stratum. The density is patchy ranging from 2-70% canopy cover. *Baeckea crispiflora*, *Dryandra pulchella* or *Melaleuca conothamnoides* are prominent in some areas and *Daviesia spiralis*, *D. hakeoides* and *D. debilis* are commonly found. Other stratum 2 species include *Acacia acuaria*, *A. bidentata*, *A. stenoptera*, *A. pulchella*, *A. sp. nov. (ericsonii ms)*, *A. erioclada*, *A. multispicata*, *A. cliftoniana*, *A. semicircinalis*, *A. leptospermoides*, *Allocasuarina acutivalvis*, *A. campestris*, *Astroloma epacridis*, *Beaufortia interstans*, *Boronia ericifolia*, *Bossiaea eriocarpa*, *Calothamnus sanguineus*, *C. quadrifidus*, *Calytrix sapphirina*, *Calytrix ?gracilis*, *C. depressa*, *Chamelaucium drummondii*, *Corynotheca ?micrantha*, *Cryptandra glabriflora*, *C. leucophracta*, *Daviesia benthamii*, *Dampiera oligophylla*, *Dampiera coronata*, *Dryandra aff. hewardiana*, *D. comosa*, *D. purdieana (ms)*, *Drosera macrantha*, *Eriostemon rhomboideus*, *Glischrocaryon aureum*, *Gastrolobium spinescens*, *Grevillea armigera*, *G. biformis*, *G. petrophiloides*, *G. shuttleworthiana*, *G.*

*Pintricata*, *Goodenia pinifolia*, *Guichenotia macrantha*, *Halgania* aff. *solonacea*, *Hemigenia* aff. *saligna*, *Hakea multiligneata*, *H. scoparia*, *H. gilbertii*, *Hibbertia exasperata*, *H. huegelii*, *Hypocalymma angustifolium*, *Isopogon divergens*, *I. scabruisculus*, *Leschenaultia biloba*, *Leucopogon conostephoides*, *Lepidosperma* aff. *tenue*, *Lysinema ciliatum*, *Melaleuca platycalyx*, *M. cordata*, *M. aff. holosericea*, *M. conothamnoides*, *M. radula*, *Micromyrtus racemosa*, *Microcorys eremophiloides*, *Petrophile brevifolia*, *P. shuttleworthiana*, *Persoonia coriacea*, *Platysace effusa*, *Santalum acuminatum*, *Synaphaea* sp. nov., *Thomasia molle*, *Verticordia densiflora*, *V. chrysantha*.

**Comments**

*Eucalyptus drummondii* Open Mallee over Heath occurs mainly on low lying areas on sandy loam with gravel. At sites T4 and T26 the vegetation has been allowed to regenerate after the area was "rolled" for agricultural clearing.

**Photograph 15** *Eucalyptus drummondii* over mixed shrubs at site Rp50. *Melaleuca cordata* is prominent in the foreground.





Mp *Eucalyptus pyriformis* Very Open Mallee over Heath

Diagnosis Very Open Shrub Mallee over Heath (Low Heath C to Heath B)

Sites E19, E30, E31.

Description

Stratum 1 *Eucalyptus pyriformis* shrub mallee to 4m form a very sparse stratum, canopy cover 2-10%. The density is variable and patchy with mallee present only as scattered emergents in some areas and occurring frequently in clumps. Other stratum 1 species include *Eucalyptus eudesmioides*, *E. drummondii*, *E. ?obtusiflora*, *E. rigidula*.

Lower Stratum

Usually one stratum is discernible with mixed shrubs 0.5-1.5m, canopy cover 50-70%. Scattered herbaceous plant species are also present. Lower stratum species include *Acacia lasiocalyx*, *A. stenoptera*, *A. ?shuttleworthiana*, *A. drewiana*, *Allocasuarina campestris*, *A. drummondiana*, *Astartea heteranthera*, *Beaufortia interstans*, *Calothamnus quadrifidus*, *Chamelaucium drummondii*, *Comesperma scoparia*, *Conospermum stoechadis*, *Conostylis androstemma*, *Dampiera coronata*, *D. oligophylla*, *Daviesia ?hakeoides*, *D. nudiflora*, *D. aff. daphnoides*, *Drosera macrantha*, *Dryandra purdieana* (ms), *Ecdeiocollea monostachya*, *Grevillea armigera*, *G. biformis*, *Gastrolobium spinosum*, *Hakea gilbertii*, *H. trifurcata*, *H. lahmanniana*, *H. scoparia*, *Hibbertia exasperata*, *Isopogon scabriusculus*, *Jacksonia macrocalyx*, *Lysinema ciliatum*, *Melaleuca conothamnoides*, *M. cordata*, *Micromyrtus racemosa*, *Patersonia* sp. nov., *Petrophile ericifolia*, *P.*

*shuttleworthiana*, *Synaphaea* sp. nov., *Verticordia brownii*.

**Comments** This vegetation association is found on yellow sandy loam over gravel on Elphin reserve (A25808) where sandplain intrudes over laterite.

**Photograph 16** *Eucalyptus pyriformis*, *E. eudesmioides* and *E. rigidula* mallee over mixed shrubs at site E19.



km *Melaleuca* Thicket

**Diagnosis** Thicket (from Heath B to Dense Thicket)

**Sites** E2, E13, E17, E23, E33.

**Description**

**Stratum 1** *Melaleuca* shrubs forming a dense to mid-dense stratum (canopy cover 50-90%) ranging from 1-3m in different areas. *Melaleuca uncinata* is usually dominant. Other

*Melaleuca* species include *Meleleuca acuminata* ssp. *websteri*, *M. adnata*, *M. scabra*, *M. conothamnoides*, *M. cordata*, *M. sclerophylla*, *M. aff. holosericea*, *M. undulata* (Wongan biotype) and *M. ?pentagona*. Scattered shrubs of *Callitris canescens* and *Leptospermum erubescens* to 3m and scattered mallee including *E. flocktoniae* and *E. erythronema* also occur. Other plant species which occur as scattered shrubs or herbs include *Acacia* sp. nov. (*ericsonii* (ms)), *Allocasuarina campestris*, *Astartea heteranthera*, *Beyeria brevifolia*, *Calothamnus quadrifidus*, *Calytrix depressa*, *Conostylis androstemma*, *Cryptandra leucophracta*, *Cassytha ?pomiformis*, *Dampiera oligophylla*, *D. coronata*, *Drosera macrantha*, *D. macrophylla*, *Diplolaena microcephalus*, *Daviesia benthamii*, *Dryandra purdieana* (ms), *Ecdeiocollea monostachya*, *Grevillea armigera*, *Gastrolobium ?hookeri*, *Hakea erinacea*, *H. incrassata*, *H. scoparia*, *H. subsulcata*, *Hibbertia exasperata*, *Hypocalymma angustifolia*, *Isopogon scabriusculus*, *Lepidosperma aff. resinosum*, *L. aff. tenue*, *Leucopogon gracillimus*, *Lysinema ciliatum*, *Lasiopetalum molle*, *Loxocarya ?cinerea*, *Micromyrtus racemosa*, *Petrophile divaricata*, *P. ericifolia*, *P. brevifolia*, *P. shuttleworthiana*, *Platysace effusa*, *Phebalium tuberculosum*, *Psammomoya choretroides*, *Santalum acuminatum*, *Stylidium leptophyllum*.

**Stratum 2** Occasionally *Melaleuca* shrubs 0.1-1.0m form a mid-dense stratum. Stratum 2 species include *M. conothamnoides*, *M. cordata*, *M. coronicarpa* (ms) and *M. aff. holosericea*.

**Comments** *Melaleuca* Thicket occurs on Elphin reserve (A25808) on flat to gently sloping low lying areas. These areas

are often poorly drained and the soils are composed of clay and clay loams with some gravel on slopes.

Photograph 17 *Melaleuca uncinata* Thicket near site R2.



kh Mixed Dense Heath

Diagnosis Dense Heath B

Sites E27

#### Description

**Stratum 1** One stratum is discernible with shrubs to 1.5m, canopy cover 70-100%. Scattered shrubs of *Petrophile shuttleworthiana*, *Actinostrobus arenarius* and *Allocasuarina campestris* emergent to 2m. Scattered shrub mallee of *Eucalyptus pyriformis* also occur. Species present include *Acacia drewiana* ssp. *minor*, *A. phaeocalyx*, *Allocasuarina ?drummondiana*, *Beaufortia elegans*, *Caustis dioica*, *Calothamnus sanguineus*,

*Cryptandra glabriflora*, *Cryptandra* sp., *Dampiera oligophylla*, *Daviesia hakeoides*, *D. aff. daphnoides*, *D. nudiflora*, *Drosera ?macrophylla*, *Dryandra purdieana* (ms), *D. fraseri*, *Ecdeiocolea monostachya*, *Eremaea pauciflora*, *Grevillea armigera*, *Hakea platysperma*, *H. aff. falcata*, *H. trifurcata*, *Hibbertia exasperata*, *H. hypericoides*, *Isopogon dubius*, *I. scabriusculus*, *Lepidosperma aff. tenue*, *Leptospermum erubescens*, *Loxocarya ?cinerea*, *L. parthenica* (ms), *Lysinema ciliatum*, *Melaleuca cordata*, *Petrophile ericifolia*, *P. brevifolia*, *P. striata*, *Stylidium repens*, *Synaphaea* sp. nov., *Verticordia brownii*.

**Comments**      Mixed Dense Heath occurs on residual sand plain on Elphin Reserve (A25808). Light brown sandy loam bleached at the surface supports this association.

**Photograph 18**   Mixed Dense Heath at site E27 with scattered *Allocasuarina campestris*, *Actinostrobus arenarius* and *Eucalyptus pyriformis*.



ka *Allocasuarina campestris*/*Calothamnus asper* Thicket

Diagnosis Thicket (Heath A to Scrub to Dense Thicket) over variable understorey.

Sites R2, T3, T11, T33, T34, T35, T40, T41, Mp10, M12, Mp23, Mp30, Mp39, MR1, MR 4, MR10, MR14.

Description

Stratum 1 *Allocasuarina campestris* and *Calothamnus asper* shrubs. 1.5-4m, form a mid-dense to dense stratum, canopy cover 30-100%. The density is variable and occasionally only a sparse stratum is present (canopy cover 10-30%).

Stratum 2 *Melaleuca radula* shrubs, 1-2m often form a stratum variable in density (2-70% canopy cover). These shrubs may also be present only as scattered individuals.

Stratum 3 *Spartochloa scirpoidea* bunch grass, 0.5-1m, frequently forms a stratum which may vary in density from 2 to 70% canopy cover in different areas.

Other understorey plant species characteristic of this vegetation formation include *Astroloma serratifolium*, *Boronia coerulescens* ssp. *spinescens*, *Cryptandra* sp. (1634), *Cheilanthes austrotenuifolia*, *Grevillea paniculata*, *Halgania* af. *preissiana*, *Hibbertia potentilliflora*, *Stylidium bulbiferum*, *Verticordia* sp. nov. (aff. *preissii*), *Waitzia* sp.

Species of particular interest occurring in this association include *Eriostemon wonganensis*, *Eremophila sargentii*, *Acacia denticulosa* and *A. pharangites* (see Flora section). Other casual species include *Acacia dura*, *A. orbifolia*, *A. acuminata*, *A. leptospermoides*, *A. erinacea*, *Alyxia buxifolia*, *Anthocercis genistoides*,

*Baeckea crispiflora*, *Cassia nemophila*, *Caladenia deformis*, *Chorizema genistoides*, *Calytrix depressa*, *Cassytha ?pomiformis*, *Dianella revoluta*, *Diuris longifolia*, *Dodonaea pinifolia*, *Drosera macrantha*, *Eremophila decipiens*, *Eucalyptus erythronema*, *E. loxophleba*, *Grevillea petrophiloides*, *G. stenophylla*, *Hakea scoparia*, *Hypocalymma angustifolium*, *Lysiosepalum rugosum*, *Melaleuca acuminata* ssp. *websteri*, *M. adnata*, *M. uncinata*, *Pimelea avonensis*, *Santalum acuminatum*, *Stypandra glauca*, *Stackhousia monogyna*, *Trymalium ledifolium*, *Wurmbea tenella*.

#### Rock Slabs to Surface

Flat places on rock surface in shallow soil.

*Borya nitida* herbs to 5cm, 30-70% canopy cover (patchy) forming a mat covering.

Shallow soil layer on crevices or border areas.

*Verticordia* aff. *preissii* shrubs or *Calytrix depressa* shrubs to 0.5m, 10-70% canopy cover occasionally with scattered shrubs of *Acacia denticulosa* (site MR1) or *Hakea petiolaris* (site T41). *Dianella revoluta*, *Stypandra glauca*, *Cheilanthes austrotenuifolia*, *Lepidosperma* aff. *tenue* and moss and lichens are also present.

Border area on deeper soils.

*Allocasuarina* shrubs usually with *Calothamnus apsera* present reaching a height of 4m, 30-70% canopy cover.

#### Comments

*Allocasuarina campestris*/*Calothamnus asper* Thicket is very variable with changes in density in the 3 strata forming an intricate mosaic within the association itself. In the Mt Rupert area *Eucalyptus loxophleba* and sometimes *Acacia acuminata* are found in the gullies

or streamlines over areas too small to map separately. A number of weed species have invaded more open areas especially adjacent to cleared farmland. This association is found on scree slopes with red-brown clay and a surface covering of ironstone and greenstone rubble. In some areas rock slabs are exposed and are referred to by Beard (1979) as fine grained metamorphic rock. Kenneally (1977) indicates that the underlying rocks are not laterised. Rock exposures were scattered amongst the vegetation and it was not possible to map these areas separately. *Allocasuarina campestris* and *Calothamnus aspera* reach 6m in places indicating that fire has been absent from that area for many years.

Photograph 19 *Allocasuarina campestris* and *Calothamnus aspera* thicket with an understorey of *Melaleuca radula* and *Spartochloa scirpoidea* at site T40.





Photograph 20 Area of exposed rock at site T41. *Borya nitida* herbs form a mat covering on the rock in places with *Verticordia* aff. *preissii* shrubs on shallow soils and *Allocasuarina campestris* shrubs bordering the outcrop.



#### SEDGELANDS

Se *Ecdeiocolea monostachya* Tall Sedges

Diagnosis Tall sedges.

Sites E18, E20, E26, E28.

#### Description

Stratum 1 Generally only one stratum is discernible with *Ecdeiocolea monostachya* sedges 0.5-1m dominant forming a mid-dense stratum 30-70% canopy cover. Scattered shrubs of *Acacia latipes*, *Actinostrobus arenarius*, *Allocasuarina campestris*, *Grevillea armigera*, *Isopogon scabriusculus* and *Acacia lasiocalyx* emergent to 2m

occur at different sites. *Allocasuarina campestris* shrubs to 2m may form a very open stratum (canopy cover 2-10%) in some areas. Small areas of shrubs 0.5-1m, 30-70% canopy cover are sometimes found including *Verticordia brownii* or *Melaleuca cordata*. Other plant species occurring within the association as scattered individuals include *Allocasuarina ?drummondiana*, *Astartea heteranthera*, *Borya sphaerocephala*, *B. nitida*, *Boronia coerulescens*, *Cryptandra glabriflora*, *Cryptandra* sp., *Conostylis androstemma*, *C. wonganensis*, *Conospermum stoechadis*, *Comesperma scoparia*, *Dampiera oligophylla*, *Daviesia hakeoides*, *D. nudiflora*, *Drosera macrantha*, *Dryandra purdieana* (ms), *Eremaea pauciflora*, *Grevillea eryngioides*, *G. ?intricata*, *G. tridentifera*, *G. biformis*, *G. uncinulata*, *Glischrocaryon aureum*, *Hakea incrassata*, *H. aff. falcata*, *Hibbertia exasperata*, *Isopogon divergens*, *I. scabriusculus*, *Jacksonia macrocalyx*, *Lepidosperma aff. resinosum*, *Leucopogon conostephoides*, *L. hamulosus*, *L. gracillimus*, *Leptospermum erubescens*, *Melaleuca conothamnoides*, *Mirbelia spinosa*, *Micromyrtus racemosa*, *Mesomelaena stygia*, *Platysace effusa*, *Psammomoya choretroides*, *Patersonia* sp. nov., *Scholtzia drummondii*, *Stypandra glauca*, *Verticordia chrysantha*.

**Comments**

*Ecdeiocolea monostachya* Tall Sedges is found on poorly drained sandy loam on the residual sand plain areas of Elphin Reserve (A25808). *Conostylis wonganensis*, a gazetted rare species occurs in this association. The sedges are usually bordered by *Allocasuarina campestris* shrubs which may form clumps within the association. Site E20 is not typical of this association as many shrub species from neighbouring vegetation types have invaded the area.

Photograph 21 *Ecdiocollea monostachya* sedges at site E26 with *Alloesuarina campestris* shrubs in the background.



#### LITHIC COMPLEX

G Granite Rock Surface, Herbs

Sites E7, E32

Rock surface  
shallow soils

*Borya sphaerocephala* or *B. nitida* herbs to 10cm forming a mat on flat areas of the rock surface (30-80% canopy cover).

Shallow soil  
and crevices

*Calytix depressa* shrubs to 0.5m in some areas forming a canopy cover 30-70%. Also present are scattered shrubs, herbs, sedges and ferns including *Acacia lasiocalyx*, *Calothamnus quadrifidus*, *Cheilanthes*

*austrotenuifolia*, *Dianella revoluta*, *Dodonaea viscosa* ssp. *angustissima*, *Drosera macrantha*, *D. macrophylla*, *Ecdeiocolea monostachya*, *Grevillea ?intricata*, *Hakea petiolaris*, *Kunzea pulchella*, *Lepidospermum ?aff. leptostachyum*, *Leucopogon hamulosus*, *Santalum acuminatum*, *Stypandra glauca*, *Verticordia aff. preissii*, *Waitzia ?acuminata*.

Deeper soil-border of  
rock outcrop

*Allocasuarina campestris* shrubs 1-2m, 30-100% canopy cover.

**Comments**

Areas of outcropping granite have a characteristic flora including mosses and liverworts. *Borya* species form a mat on the rock surface with shrubs including *Hakea petiolaris* (site E7) and *Kunzea pulchella* (site E32) in crevices and soil pockets with other shrubs in run-off zones. *Allocasuarina campestris* surround the rock growing in deeper soils.

Photograph 22 Granite outcrop at site E7.



#### 4.0 FLORA SURVEY

The plant species list for the Wongan Hills published by the W.A. Naturalists' Club (1977) in "The Natural History of the Wongan Hills" has since been updated by K.F. Kenneally (unpublished). Species recorded by Kenneally but not encountered during the present survey can be identified in Appendix 1 by the initials KFK.

A total of 525 plant species are listed in Appendix 1. Of these species 224 were not recorded during the present survey. These plants were annuals and other herbaceous species and occasionally small shrubs which are inconspicuous or difficult to identify when not in flower. Members of the Asteraceae, Poaceae, Orchidaceae, Amaranthaceae, Portulacaceae, Caryophyllaceae, Brassicaceae, Droseraceae, Apiaceae and Goodeniaceae were mostly involved. *The species list for the Mt. Matilda Nature Reserve, Rogers Reserve and Elphinstone Nature Reserve will be incomplete as these areas have not been examined extensively by the Naturalists' Club.* The distribution of plant species in the areas surveyed are shown in the columns accompanying the species list with "p" indicating that the plant occurs on privately owned land and "n" indicating that the species is present on a nature reserve.

The "h" category includes species growing in red soils or laterite for which no exact locality is available. These species were collected in the hills area (Kenneally, Pers. comm.). The "k" category refers to plant species collected in kwongan or remnant vegetation but an exact locality is not available. These species, which number 54, have been added to the species list for interest but may or may not occur in the surveyed areas. Species from kwongan localities in the Wongan Hills district which do not occur within the area surveyed have been excluded from Appendix 1, for example those listed from Matlock Creek.

Manuscript names (ms) have been used to avoid confusion between undescribed species. Identifications with the generic name followed by "sp." or ? are uncertain because of lack of flowering material.

The nomenclature follows that of Green (1985) and unpublished supplements to this work unless otherwise stated.

#### 4.1 Flora of the Wongan Hills

A total of 411 plant species including four ferns, 3 gymnosperms and 403 angiosperms are listed in Appendix 1 as occurring in the area defined as the Wongan Hills. Twenty-eight of these species are exotic or introduced and were restricted mainly to the gullies on heavier soils of loam or clay. The families with the largest representatives of genera and species are listed below.

	Number Species	Number Genera	Number Exotics
Myrtaceae ( <i>Eucalyptus</i> , <i>Melaleuca</i> etc.)	58	14	
Asteraceae (daisies)	47	27	6
Mimosaceae (wattles)	35	1	
Proteaceae ( <i>Dryandra</i> , <i>Hakea</i> etc.)	27	8	
Papilionaceae (pea flowers)	15	9	
Goodeniaceae ( <i>Dampiera</i> , <i>Goodenia</i> etc.)	15	5	
Orchidaceae (orchids)	13	6	
Poaceae (grasses)	12	10	7

The family Myrtaceae is the richest in species. Kenneally (1977) reports that although most of these species are found on other nature reserves they are much more widely scattered and that the concentration of the Myrtaceae in the Wongan Hills is remarkable. The Asteraceae are next in number but most of these species are annuals appearing only in the spring and were not recorded during the present survey. The hills are one of the richest areas in the wheatbelt in species of *Acacia*. Four of the *Acacia* species are gazetted rare and a further 2 have a restricted geographical distribution. *Eremophila* species are also well represented in the hills with 5 species. Of the monocotyledons, members of the family Orchidaceae and Poaceae are most common.

Using the present data the overall floristic diversity of the hills (approximately 20km<sup>2</sup> in area) can be estimated at 20.5 species/km<sup>2</sup>. This is higher than the original estimate for the area calculated by Kenneally (1977) and is similar to Tutanning Nature Reserve which has a floristic diversity of 22 species/km<sup>2</sup> and has also been intensively studied.

#### 4.2 Flora of Elphin Nature Reserve (A25808)

A total of 194 plant species were recorded for Elphin Nature Reserve. Due to the time and seasonal constraints of the survey, Appendix 1 does not contain a complete list of the flora present. Further survey work, especially in the wildflower season would provide a more comprehensive record of the flora of the reserve especially annual and herbaceous species.

The families Myrtaceae, Proteaceae, Mimosaceae and Papilionaceae were the most strongly represented in the flora. Of the monocotyledons, members of the family Cyperaceae, Restionaceae and Anthericaceae are the most common. The number of species and genera recorded for the most prominent families is as follows :

	Number Species	Number Genera
Myrtaceae ( <i>Eucalyptus</i> , <i>Melaleuca</i> etc.)	56	15
Proteaceae ( <i>Dryandra</i> , <i>Petrophile</i> etc.)	36	7
Mimosaceae (wattles)	17	1
Papilionaceae (pea flowers)	14	7
Epacridaceae (heath plants)	6	3
Cyperaceae (sedges)	4	2
Restionaceae (rushes)	4	3
Anthericaceae (lilies)	4	2

Using the present data, the overall floristic diversity of the reserve can be estimated at 87 species/km<sup>2</sup> - a very rich flora.

This result reflects the large number of species found in the kwongan associations and also the presence of a number of plant species typical of the hills flora. Elphin Nature Reserve covers a remarkable number of habitat types in a relatively small area (197ha). Vegetation and flora surveys of the bushland on the Water Reserve (16418) and the Experimental Farm (18762) is now needed as the general area appears to be of particular value for flora and fauna conservation. The diversity figures are helpful when comparing areas for floristic richness but must be regarded with caution. As Muir (1977) points out, such estimates depend on the distribution of vegetation types within the reserve boundary and reserve size, both of which when viewed statistically are largely a matter of chance.

#### 4.3 Species of Interest

Rare and geographically restricted species occurring within 20km of the Wongan Hills townsite are listed in Table 3. This table is modified and updated from Rye (1980) and Kenneally (1982).

Species listed in Table 3 which were not found in the present survey and which have not been previously recorded for the survey areas include *Acacia vassalii*, *Calytrix stowardii*, *Eucalyptus caesia*, *?Hemigenia viscida*, *Gastrolobium glaucum*, *G. hamulosum*, *Verticordia staminosa* and *Wurmbea humilis*.

The species endemic to the Wongan Hills include *Acacia botrydion*, *A. pharangites*, *A. pygmaea* (ms), *Clematis* aff. *microphylla*, *Dryandra pulchella*, *Eremophila terniflolia*, *Eriostemon wonganensis* and *Rhagodia acicularis*. *Acacia semicircularis*, *Daviesia spiralis* and *Dryandra comosa* have been recorded from outside the defined hills area but are endemic to the district. Also endemic to the district but not occurring in the hills are *Stylidium coroniforme*, *Daviesia euphorbioides* and *Conostylis wonganensis*.



Table 3. Rare and Geographically Restricted Species occurring within 20km of Wongan Hills Townsite (modified from Rye, 1980 and Kenneally, 1982).

Species	Approx Range (km)	Endemic to Wongan Hills Range	Classification			
			VR	R	VGR	GR
<i>Acacia botrydion</i> Maslin	15	+	-	-	+	-
<i>A. denticulosa</i> F. Muell.	175	-	-	-	-	+
<i>A. dura</i> Benth.	30	-	-	-	+	-
<i>A. phaeocalyx</i> Maslin	130	-	-	-	-	+
<i>A. pharangites</i> Maslin	2	+	+	-	+	-
<i>A. sp. aff. obovata</i> (pygmaea ms)	2	+	+	-	+	-
<i>A. semicircinalis</i> Maiden and Blakely	15	-	-	+	+	-
<i>A. vassalii</i> Maslin	50	-	+	-	+	-
<i>Boronia ericifolia</i> Benth.	90	-	-	-	-	+
<i>Calytrix stowardii</i> S. Moore	T	?	+	-	+	-
<i>Clematis</i> sp. aff. <i>microphylla</i> DC (Kenneally 5361)	9	+	-	-	+	-
<i>Conostylis wonganensis</i> S.D. Hopper	40	-	-	+	+	-
<i>Daviesia euphorbioides</i> Benth.	1	-	+	-	+	-
<i>D. spiralis</i> Crisp	10	-	-	?	+	-
<i>Dryandra comosa</i> Meisn.	11	-	-	-	+	-
<i>D. pulchella</i> Meisn.	8	+	-	-	+	-
<i>Eremophila sargentii</i> (S. Moore) Chinnock	70	-	-	-	-	+
<i>E. ternifolia</i> Chinnock	T	+	+	-	+	-
<i>Eriostemon wonganensis</i> Paul G. Wilson	1.5	+	+	-	+	-
<i>Eucalyptus caesia</i> Benth.	300	-	-	+	-	-
<i>Gastrolobium galucum</i> C.A. Gardner	T	-	+	-	+	-
<i>G. hamulosum</i> Meisn.	110	-	-	+	-	+
<i>Hemigenia viscida</i> S. Moore	110	-	+	-	+	-
<i>Melaleuca acuminata</i> ssp. <i>websteri</i> (ms) Barlow	90	-	-	-	-	+
<i>Microcorys eremophiloides</i> Kenneally	10	-	-	+	+	-
<i>Rhagodia acicularis</i> Paul G. Wilson		+	-	+	+	-
<i>Stylidium coroniforme</i> R. Erikson and Willis		-	+	-	+	-
<i>Tetratheca retrorsa</i> J. Thompson	220	-	-	?	++	-
<i>Verticordia staminosa</i> C.A. Gardner, A. George	300	-	-	+	-	-
<i>Wurmbea humilis</i> Macfarlane	T	-	+	-	+	-

++ Species known only from two widely separated areas

T Species known only from type locality (or a single locality)

VR Very Rare - having less than a few hundred reproductively mature plants in natural populations

R Rare - less than a few thousand reproductively mature plants in natural populations

VGR Very Geographically Restricted - having a maximum geographical range of less than 50km

GR Geographically Restricted - maximum geographical range less than 150km

#### 4.3.1 Rare Plants

Twelve gazetted rare plant species were mapped during the survey (see figures 6 to 10). Nine of these species occur in the hills and include *Acacia denticulosa*, *A. pharangites*, *A. pygmaea* (ms), *A. semicircinalis*, *Daviesia spiralis*, *Eremophila ternifolia*, *Eriostemon wonganensis*, *Microcorys eremophiloides* and *Rhagodia acicularis*. *Conostylis wonganensis* was found on Elphin Reserve and *Stylidium coroniforme* and *Daviesia euphorbioides* occur in areas adjacent to the reserve. Due to time constraints it was not possible to estimate the number of plants per population but information previously collected on these species is included in the report.

*Acacia denticulosa* has recently been discovered on reserve ↑36939 near Mt Churchman increasing its geographical range to 175 kms. During the present survey four populations were encountered. Population 1 was on Mt Matilda Nature Reserve west of sites M36 and M37. Populations 2, 3 and 4 were on privately owned land on the Mt Rupert Estate at sites MR1, MR10 and MR14. All populations were found in red-brown clay with numerous small rocks of laterite and greenstone in *Allocasuarina campestris*/*Calothamnus aspera* Thicket. Department of Conservation and Land Management records indicate that a population of over 130 individual plants has been estimated for the east slope of Mt Rupert.

*Acacia pharangites* is endemic to the hills and previously known from only one population at site T11 just north of the Television Translator tower. During the present survey a second population was found at site T3 to the south-west of the tower but only 4 plants were seen. Survey tags mark an overgrown trail which leads to site T3 from the access track to the Television Translator tower. Both populations occur on privately owned land in *Allocasuarina campestris*/*Calothamnus aspera* Thicket on red-brown clay with greenstone and laterite scree. Population one has been estimated at 400 plants (Rye, 1980).

*Acacia pygmaea* (ms) is endemic to the hills and three populations were found on the boundary of Mt Matilda Nature Reserve and privately owned land at sites M20, Mp1 and near M2. Only a few plants were seen on the reserve at M20 and the plants near M2 were in disturbed areas along a track. The other two populations were found in Mallee over *Petrophile shuttleworthiana*/*Allocasuarina campestris* thicket growing in rock crevices on the laterite conglomerate. Rye (1980) has estimated plant numbers at 50-100 for the population at site M20.

*Acacia semicircinalis* is known from 6 populations in the Wongan Hills district. These are as follows :

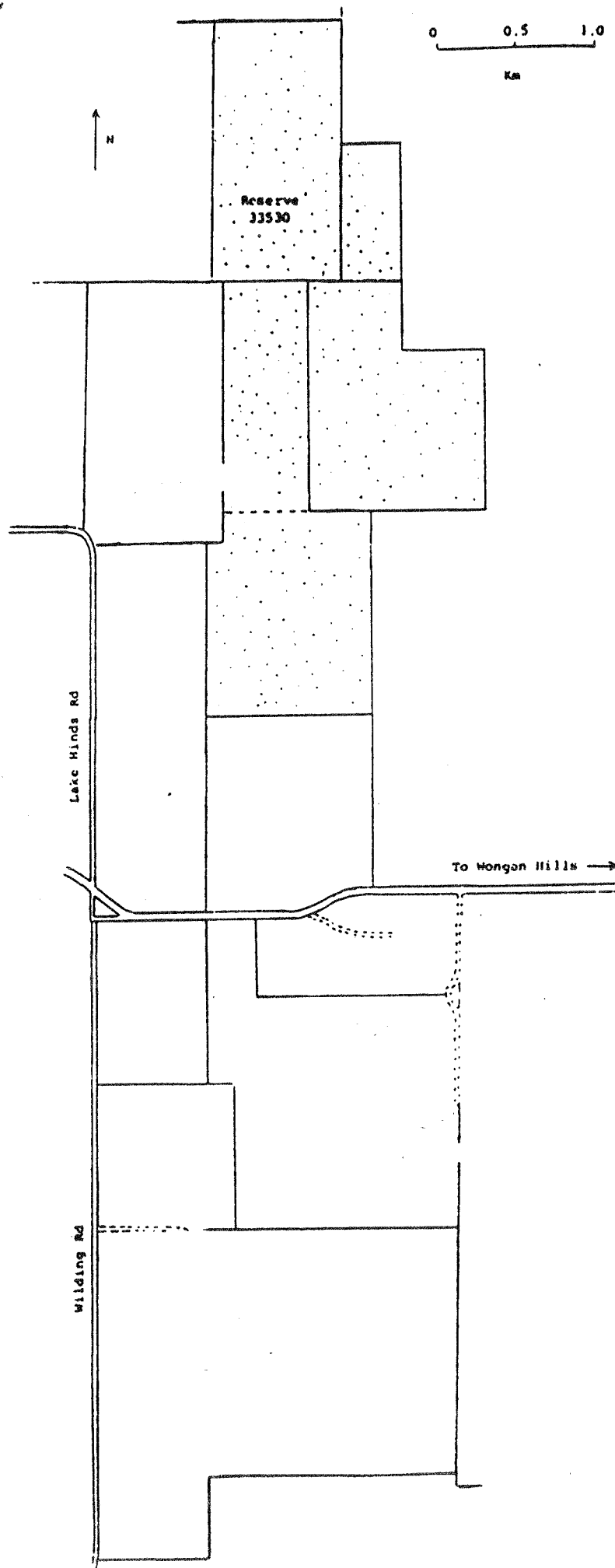
1. On the Wongan Hills-Piawanning road on the road verge 3-8 kms northwest of Wongan Hills townsite (over 80 plants).
2. 'A' class reserve ↑33530 (over 20 plants).
3. Fowlers Gully (privately owned bushland).
4. By the television translator tower (privately owned bushland).
5. Telecom access road (privately owned bushland).
6. Water Reserve ↑16418.

Populations 2 to 5 occur within the area surveyed and are mapped in Figure 11. New localities for this species were not recorded during the present survey as *Acacia semicircinalis* can be easily confused when not in flower with *Acacia botrydion*, a more common species. Kenneally (1977), has recorded *A. semicircinalis* at Drummonds Gully.

*Daviesia spiralis* was found on the road side verge adjacent to Elphin Nature Reserve and at site E4 but most recordings were from the hills. Plants were occasionally found in disturbed areas usually along tracks and this species appears to be a successful coloniser in certain situations. In undisturbed vegetation the species is relatively uncommon and is found on orange brown gravelly clay over laterite conglomerate on the lower or upper slopes of the hills. Plants were also recorded in *Eucalyptus drummondii* Open Mallee over Heath. Many of the plants seen were not healthy and

Figure 11. Location of Acacia semicircularis - Populations 2,3,4 & 5.

[Note: locations removed from this document copy]



some had died. Rye (1980) has estimated that 500 or more plants are present in the hills over a range of at least 10kms. Six major populations are listed below.

1. Wongan Hills-Piawanning road adjacent to Rogers Reserve (~ 100 plants)
2. Mt Matilda Nature Reserve (333530) site M9 (8 plants).
3. Telcom access track to the Television Translator tower between sites T1 and T4 (at least 5 plants).
4. West side of Rogers Reserve at sites R4 and R3 (14 plants).
5. Elphin Nature Reserve (25308) on the road verge near the entrance to the pistol club and at site E4.
6. Laterite gully adjacent to Fowlers Gully.

*Eremophila ternifolia* is endemic to the hills and only one population has been found on privately owned land near Mt Matilda Nature Reserve. In the present survey plants from this population were also noted on Mt Matilda Nature Reserve near site M21. Kenneally has estimated that about 70 plants occur in this area (Chinnock 1982). The plants grow in *Eucalyptus longicornis*/*E. salubris* woodland in red clay between breakaways.

*Eriostemon wonganensis* is endemic to the hills and has previously been found at only one location north of the Television Translator tower at site T11. In the present survey *Eriostemon wonganensis* was also found on the southern boundary of Mt Matilda Nature Reserve at site M12. The plants were growing on disturbed ground but are probably also present in adjacent thicket. Both populations were found on brown clay with greenstone and laterite scree in *Allocasuarina campstris*/*Calothamnus aspera* Thicket. There is a gully close to site M12 and *Eriostemon wonganensis* may occur on the lower parts of the gully and adjacent hills which is the case at site T11. Rye (1980) has estimated that 200-250 plants make up the population at site T11.

*Microcorys eremophiloides* has previously been recorded as endemic to the hills area but in the present survey one small population of this species (only 2 plants seen) was recorded on Elphin Reserve at site E35. In the hills this species was most frequently recorded along firebreaks or tracks where it has colonised cleared ground. Usually only one or two plants were seen but adjacent undisturbed areas were not extensively searched. In undisturbed vegetation the plants are very rare and found in *Petrophile shuttleworthiana*/*Allocasuarina campestris* Thicket often in rock crevices of the laterite conglomerate along the top edge of breakaways but also found in gravelly soil on the top of mesas or on their upper slopes. Five major populations are listed below. Rye (1980) has estimated the total number of plants in the hills at 200.

1. Mt Matilda Nature Reserve (A33530) at site M9 in disturbed areas. This is the largest population estimated at 85 plants (Rye, 1980).
2. Fowlers Gully at the top of a breakaway at site T30. 36 plants seen in the present survey.
3. Rogers Nature Reserve (39145) near site E32. Two plants, widely separated, reported by Rye (1980) at the edge of a breakaway.
4. By the Television Translator tower on the summit in an area which has been partly cleared and left to regenerate (14 plants, Rye, 1980).
5. On the telecom access road south of the Television Translator tower. (7 plants, Rye, 1980).

*Rhagodia acicularis* is endemic to the Wongan Hills and was previously known only from one locality. Four populations were found during the present survey in the northern section of the hills with only one population occurring on a nature reserve.

1. Monks Well Gully, site MR6. (150-200 plants, Rye 1980)
2. Mt Matilda Nature Reserve (A33530) at site M35. (8 plants counted).
3. West of site M45 on privately owned land (6 plants counted).

4. At site MR3 on privately owned land (8 plants counted).

Population 1 is found in *Eucalyptus loxopleba* woodland with *Acacia acuminata* on rich brown clay with lateritic scree at the base of a creek gully and the steep slopes of the breakaway on either side. The other three populations were all found in *Eucalyptus longicornis*/*E. salubris* woodland on clay loam soils in low lying areas or on slopes below the breakaways.

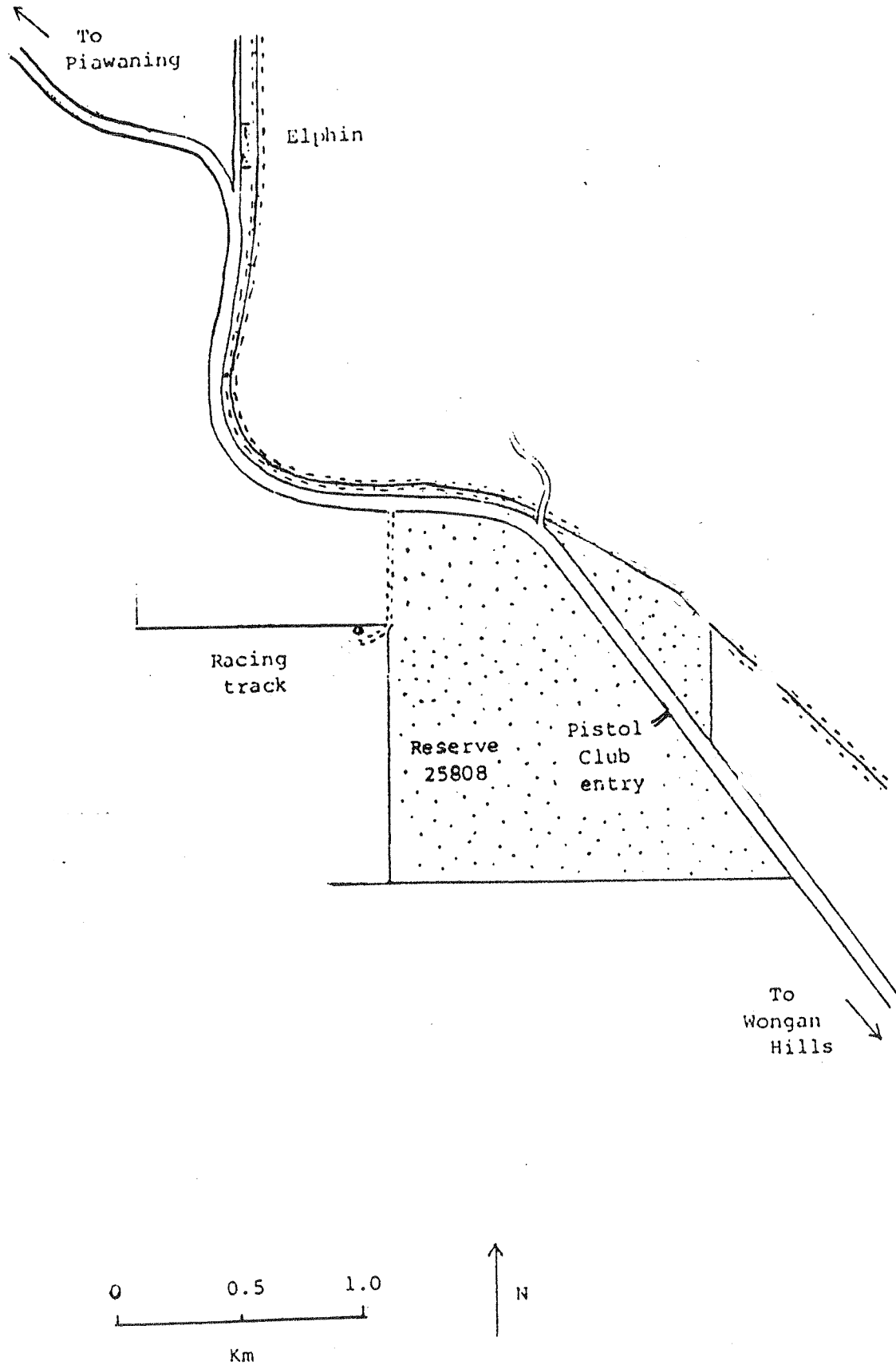
*Conostylis wonganensis* is known only from the Wongan Hills District and Manmanning. In the present survey this species was found on Elphin Nature Reserve (A25808) along the road side verge and at sites E18, E20 and E26. All populations were found in *Ecdeiocolea monostachya* Tall Sedges on sandy loam over clay or laterite. These populations probably extend into *Eucalyptus pyriformis* Very Open Mallee over Heath.

*Stylidium coroniforme* was not found in the areas included in the present survey. This species is inconspicuous when not in flower and further survey work in the wildflower season is recommended. Two populations of this plant species have been recorded for the Wongan Hills District. Population one is situated near the race track adjacent to Elphin Nature Reserve (Figure 12) and has recently been estimated at 52 plants (D. Coates, pers. comm.). A second population is present on the Water Reserve (↑16418). Population one occurs on sandy soils over the laterite conglomerate common to the hills with *Dryandra comosa*, *Eucalyptus pyriformis*, *Dampiera eriocephala* and *Acacia nigripilosa*.

*Daviesia euphorbioides* occurs in areas adjacent to Elphin Nature Reserve. The location of the three populations examined by Rye are shown in Figure 12. This species was found to be a coloniser on ground that had been cleared, growing with other species which thrive in disturbed areas.

Figure 12. Location of Stylidium coroniforme (population 1) and Daviesia euphorbioides (populations 1,2 & 3). (Rye 1980)

[Note: locations removed from this document copy]





#### 4.3.2 Geographically Restricted Plants

Nine of the species listed in Table 3 occur in the area surveyed and are geographically restricted plants. Three of these species are endemic to the hills but are relatively common. These include *Acacia botrydion*, *Clematis* sp. aff. *microphylla* and *Dryandra pulchella*. *Dryandra comosa* had also been recorded as a Wongan Hills endemic but this species occurs on Elphin Nature Reserve outside the hills area.

*Acacia dura* has been found growing in a number of habitats from Wongan Hills to Yerecoin. This is a CALM Priority 1 species "only known from one or a few localities on land under threat". In the present survey this species was found in *Melaleuca* associations and *Calothamnus aspera/Allocasuarina campestris* Thicket on clay and clay loam soils in the hills area.

*Acacia phaeocalyx* was recorded at site E27 on Elphin Nature Reserve growing on sandy soils over laterite. This species has a geographical distribution of approximately 130kms from Tammin to Wongan Hills occurring sporadically in the central wheatbelt region.

*Boronia ericifolia* has a geographical range of approximately 90kms from Moora to the Wongan Hills. This plant is a CALM Priority 2 species "known from one or a few localities on land not under immediate threat". *Boronia ericifolia* was relatively common throughout the hills growing on lateritic soils.

*Eremophila sargentii* has a geographical range of approximately 70km from Wongan Hills to Kalannie. This species was encountered only rarely during the present survey and recorded at sites MR11, Monks Well Gulls MR6 and site M39 on red loam soils with *Eucalyptus loxophleba*.

*Tetratheca retrorsa* has quite a wide range (220kms) but is only known from two areas, the Wongan Hills range and Tutanning Nature

Reserve where there are lateritic breakaways. In the present survey this species was found near Monks Well Gully on lateritic scree slopes.

*Melaleuca websteri* has now been recognised by Dr Barlow (unpublished) as a sub-species of *Melaleuca acuminata*. This sub-species has a geographical range of approximately 80kms from Wongan Hills to Cowcowing. Another subspecies of interest is *Daviesia debiliior ssp. senuans* which is a CALM Priority 3 species "known from several localities some of which are on lands not under immediate threat".

Other species of interest which are mentioned by Kenneally (1977) include disjunct species occurring in the wheatbelt areas of similar laterization as the Wongan Hills such as *Hibbertia potentilliflora* which is known otherwise only from the Moresby Range near Geraldton, *Thysanotus* sp. from Tutanning Nature Reserve and *Microcybe multiflora* var. *multiflora* which re-occurs to the south in the Ongerup area. Species at the western limit of their known range of distribution include *Cassia nemophila*, *C. pleurocarpa* and *Ptilotus obovatus*. At the northern limit of their range are *Billardiera coriacea*, *Conospermum ephedroides*, *Melaleuca pungens*, *Stylidium nungarinensis* (ms) and *Thelymitra canaliculata* and at its southern limit is *Ptilotus divaricatus*. *Pterosylis mutica* is at the most north-west limit of its range and is locally rare and *Caladenia gemmata* is normally found in more coastal areas.

## 5.0 MANAGEMENT CONSIDERATIONS

### 5.1 Vegetation Associations of Special Interest

Woodland associations (Ew, El, Es, Egm, Ef, Aa) cover only small areas of the hills and Elphin Nature Reserve. *Eucalyptus falcata* Woodland (west of Mt Matilda Nature Reserve) and *Acacia acuminata* Low Forest (Mt Rupert Estate) were especially rare. Although all these woodland associations are commonly found in the wheatbelt, vast areas have now been cleared because of the recognition by early settlers of the suitability of these woodland soils for farming. The exception is *Eucalyptus falcata* which is usually found on laterite. Areas of *E. falcata* Woodland and *Acacia acuminata* Low Forest were not found in the Nature Reserves surveyed.

Mallee associations covering only small areas in the hills include *Eucalyptus ebbacoensis* Mallee over Scrub (Me) and *Eucalyptus drummondii* Open Mallee over Heath (Md). Extensive areas of mallee surrounding the hills and the lower slopes have been cleared for farming. In some sections these two associations have been affected by past clearing operations or by the grazing of stock.

*Allocasuarina campestris*/*Calothamnus aspera* Thicket covers extensive areas in the hills but is poorly represented in the Mt Matilda and Rogers Nature Reserves. Gazetted rare flora recorded in this vegetation association include *Acacia pharangites*, *Eriostemon wonganensis* and *Acacia denticulosa*.

The extent in the Wongan Hills district of the Mallee and Kwongan associations found on the Elphin Nature Reserve is not known. A survey of bushland areas adjacent to the reserve including the Water Reserve (↑16478) and native vegetation on the Department of Agriculture's Experimental Farm (↑18672) is urgently needed.

## 5.2 The Purchase of Privately Owned Bushland for Nature Conservation

At present approximately 38% of the native vegetation covering the defined "Wongan Hills" area is protected for flora and fauna conservation. Because of the high conservation value of this area the purchase of the remaining areas of bushland by the Department of Conservation and Land Management is of great importance and should be given a high priority in the allocation of available funds.

Table 4 lists the vegetation associations and "species of interest" present in areas of privately owned bushland surveyed. The acquisition of Area 2a (Conways Property, SE of Mt Matilda Nature Reserve), Area 3 (bushland on Mt Rupert Estate) and Area 4 (bushland south of the Piawaning-Wongan Hills road) would appear to be of major concern because of the number of gazetted rare and geographically restricted plants occurring in these sections and the need for the protection of greater areas of *Allocasuarina campestris*/*Calothamnus apsera* Thicket for nature conservation.

Part of the bushland area on the Mt Rupert Estate north of Mt Matilda Nature Reserve is badly degraded due to the grazing of stock. The allocation of funds for fencing these areas should therefore be considered if the purchase of this area is not possible.

Photograph 23 Degraded areas of bushland on Mt Rupert Estate

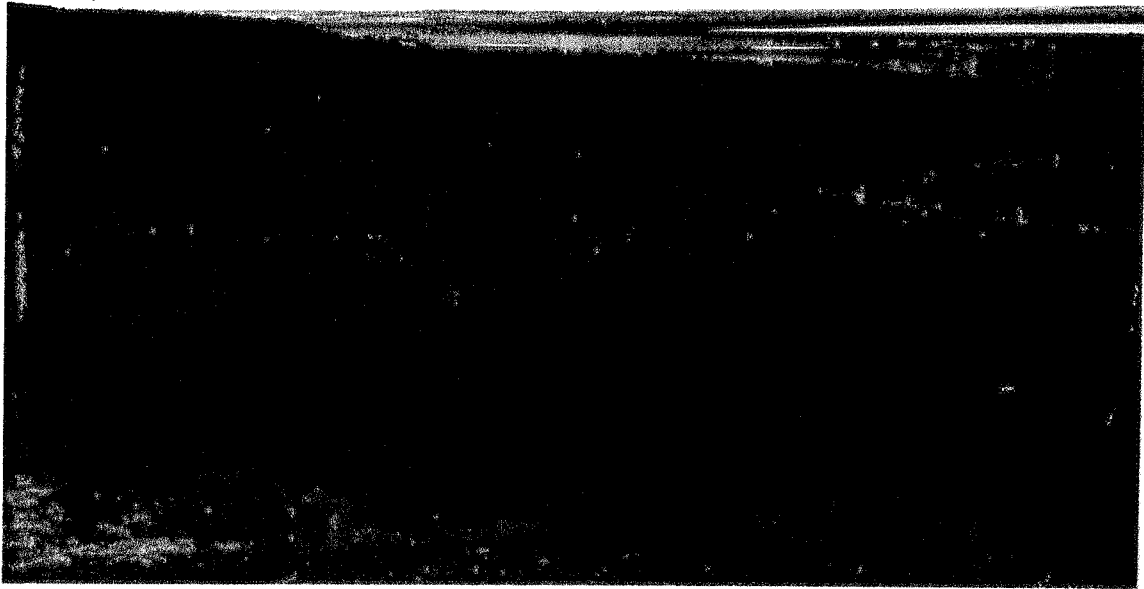


Table 4 - Vegetation associations and species of interest present on privately owned land in the areas surveyed.

Area	Vegetation Associations	Gazetted Rare Plants	Geographically Restricted Plants
2a SE of Mt Matilda Nature Reserve (Conways property)	Egm, M, Mt, Ma, Mm, Me, Ka	Acacia pygmaea (ms) Eremophila ternifolia Daviesia spiralis Microcorys eremophiloides	Acacia botrydion A. dura Dryandra pulchella Melaleuca acuminata ssp. websteri
2b W of Mt Matilda Nature Reserve	Egm, El, Es, Ef, M, Mt, Ma, Mc, Ka	Rhagodia acicularis	Acacia ?botrydion A. dura Eremophila sargentii Melaleuca acuminata ssp. websteri
2c S of Mt Matilda Nature Reserve	Egm, Ma, Mt, Mm, Mc		Dryandra comosa Dryandra pulchella
3 Mt Rupert Estate N of Mt Matilda Nature Reserve	Aa, Es, El, Egm, M, Ma Mt, Mc, Me, Ka	Acacia denticulosa Rhagodia acicularis Microcorys eremophiloides	Acacia botrydion A. dura Boronia ericifolia Eremophila sargentii Clematis aff. microphylla Tetratheca retrorsa
4 S of the Piawaning Wongan Hills Rd	El, Es, Egm, M, Mt, Ma Mm, Mc, Me, Md, Ka	Acacia pharangites A. semicircularis Daviesia spiralis Eriostemon wonganensis Microcorys eremophiloides	Acacia dura A. botrydion Boronia ericifolia Clematis aff. microphylla Daviesia debilior ssp. senuans Dryandra comosa Dryandra pulchella Melaleuca acuminata ssp. websteri
6 S of Rogers Nature Reserve	Es, M, Mt, Ma, Mm, Mc Md	Daviesia spiralis	Acacia ?botrydion Daviesia debilior ssp. senuans Dryandra comosa Dryandra pulchella
8 S of Elphin Nature Reserve	El, Es, Ew, Ma, Mm, G		

### 5.3 Development of the Wongan Hills for Tourism

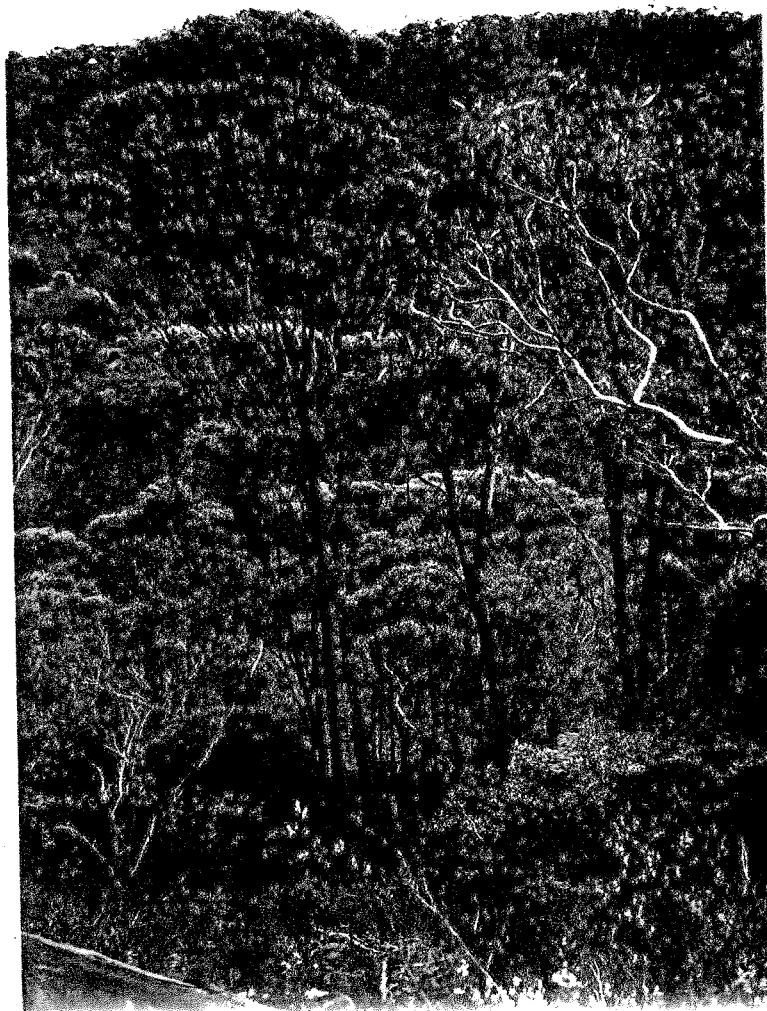
Suggestions have recently been put forward for the development of the Wongan Hills for tourism. The gravel road leading to the television translator tower has already been "improved" by the construction of a second track up the steep slope south of the tower, thereby forming a two-way system. It is not known if the presence of gazetted rare flora was taken into consideration at the time of construction. This area of the hills is signposted from the Wongan Hills townsite as the Mt O'Brien lookout. As this access road is already in place it would seem practical to restrict further development for tourism to this area rather than the Mt Matilda Nature Reserve as has been suggested. This would minimise disturbance to the hills, which are of great value for their unique flora and history. Only approximately 38% of the bushland covering the Wongan Hills is protected for flora and fauna conservation.

The "amphitheatre" formed by breakaways to the south-west of the television translator tower is one of the most attractive areas in the hills and is an ideal location for a walk trail which could start at the tower or nearby. The walk trail could promote nature conservation in the area and direct the activities of visitors. It would however be imperative for the Department of Conservation and Land Management to be involved in the development of the trail because of the presence of rare and endangered plant species in the area and to ensure that damage to the environment during the construction of the trail is kept to a minimum.

70  
Photograph 24 The "amphitheatre" taken from the top of a breakaway just south-west of the television translator tower.



Photograph 25 Gimlet (*E. salubris*) on the lower slopes below the breakaways in the area known as the amphitheatre.





## 6.0 ACKNOWLEDGEMENTS

Thanks are given to the following people :

Mr K.F. Kenneally for making available the updated species list for the Wongan Hills district.

Mr B. Maslin for the identification of *Acacia* species, Dr. M.I.H. Brooker for *Eucalyptus* species, Mr M. Trudgen for *Baeckea* species, Ms J. Wheeler for species of *Hibbertia* and Mr P. Wilson for species belonging to the families Chenopodiaceae and Rutaceae.

The Curator of the Western Australian Herbarium for permission to consult the collection.

Anna Napier for her word processing.

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## APPENDIX 1 - SPECIES LIST

### Areas Surveyed

- E = Elphin Nature Reserve (and adjacent privately owned bushland)  
R = Rogers Reserve (and adjacent privately owned bushland)  
T = Privately owned bushland south of the Wongan Hills-Piawanning Rd.  
M = Mt Matilda Nature Reserve (and adjacent privately owned bushland)  
MR = privately owned bushland north of Mt Matilda Nature Reserve on  
Mt Rupert Estate  
W = Wongan Hills district (exact localities unknown)

- p indicates the presence of the plant species on privately owned land  
n indicates the presence of the plant species on a nature reserve  
k refers to plant species recorded for the Wongan Hills district and occurring in kwongan vegetation but exact localities are not available  
h refers to plant species recorded for the area defined as the "Wongan Hills" but exact localities are not available  
\* introduced species

E R T M MR W

**PTERIDOPHYTA (ferns)**

**OPHIOGLOSSACEAE**

Ophioglossum lusitanicum KFK p

**ADIANTACEAE**

Cheilanthes lasiophylla KFK p

C. austrotenuifolia 1413 pn p pn p

**ASPLENIACEAE**

Pleurosorus rutifolius p p

**GYMNOSPERMAE**

**CUPRESSACEAE**

Actinostrobus arenarius 1509 n p

Callitris canescens 1426 n n

C. roei pn p pn

**MONOCOTYLEDONAE**

**POACEAE**

\*Aira cupaniana KFK p

Aristida contorta KFK h

\*Briza maxima KFK p n p

\*Bromus sp. KFK 9535 p

\*Ehrharta longiflora KFK h

\*Lamarckia aurea KFK h

Spartochloa scirpoidea 1631 p pn p

Stipa elegantissima KFK p p

S. hemipogon KFK h

S. variabilis KFK h

\*Trisetaria cristata KFK h

\*Vulpia bromoides KFK h

E R T M MR W

# CYPERACEAE

Lepidosperma sp. nov.

(aff. leptostachyum) KFK 855	n	n?	p		
L. sp. nov. (aff. resinosum) 1356	n				h
L. sp. nov. (aff. tenue) 1359	pn	p	p	n	
Mesomelaena ?stygia 1474a, 1474b	n				

# RESTIONACEAE

Caustis dioica 1516	n				
Eodeiocollea monostachya 1471	n	n			
Loxocarya cinerea 1393	pn				
L. sp. nov. (parthenica ms) 1394, 1519	n				

# CENTROLEPIDACEAE

Centrolepis pilosa KFK					p
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# PHORMIACEAE

Dianella revoluta	pn		p	pn	p
Stypandra glauca 1498, 1418	n		p	pn	p

# ANTHERICACEAE

Arthropodium capillipes KFK					p
Borya nitida 1414, 1500	n		p	p	p
B. sphaerocephala 1398b	pn				
Caesia micrantha KFK					p
Chamaescilla corymbosa KFK			p		p
Laxmannia grandiflora 1548	n				
L. squarrosa 1396	pn				
Thysanotus dichotomous KFK					h
T. patersonia KFK			p		p
T. tectantherus NHB 68/28		n			
Tricoryne humilis KFK					h

E R T M MR W

ASPHODELACEAE

Bulbine semibarbata KFK p

COLCHICACEAE

Wurmbea pygmaea KFK h

W. tenella 1428 pn p p

HAEMODORACEAE

Anigozanthos humilis ?n

Conostylis androstemma 1361, 1613 n n p pn

C. setigera KFK k

C. wonganensis 1497, 1473 pn

HYPOXIDACEAE

Hypoxis occidentalis KFK h

IRIDACEAE

Patersonia occidentalis KFK n k

ORCHIDACEAE

Caladenia deformis 1694 p p p

C. dilatata KFK p p

C. drummondii KFK p

C. denticulata KFK h

C. gemmata p

C. saccharata KFK h?

Diuris longifolia p p p

Eriochilus dilatatus KFK p

Pterostylis mutica KFK h?

P. nana h?

P. recurva KFK p p

P. sargentii h?

	E	R	T	M	MR	W
<i>P. scabra</i> var. <i>robusta</i> 1679			p	n	p	
<i>P. vittata</i> 1575		n	p			
<i>P. sp.</i> KFK 7504						h?
<i>Thelymitra canaliculata</i> KFK			p			
<i>Prasophyllum macrostachyum</i> KFK					p	
DICOTYLEDONAE						
CASUARINACEAE						
<i>Allocasuarina acutivalvis</i> 1541	n	pn	p	pn	p	
<i>A. campestris</i> 1637, 1654	pn	pn	p	pn	p	
<i>A. drummondiana</i> 1526	n	pn				
URTICACEAE						
<i>Parietaria debilis</i> KFK					p	
PROTEACEAE						
<i>Conospermum ephedroides</i> 1675			p	n		
<i>C. stoechadis</i> 1475	n					
<i>Dryandra comosa</i> 1580	n	pn	p	pn		
<i>D. fraseri</i> 1517	n					
<i>D. nivea</i> KFK						k
<i>D. pulchella</i> 1559		pn	p	pn		
<i>D. sp. nov.</i> (aff. <i>cirsoides</i> )						
( <i>purdieana</i> ms) 1370	n	pn	p			
<i>D. sp. nov.</i> (aff. <i>hewardiana</i> )						
1537, 1558	n	pn	p	pn	p	
<i>D. sp.</i> KFK 1842						k
<i>Grevillea armigera</i> 1463	n	p				
<i>G. biformis</i> 1481, 1502, 1476	n	pn				
<i>G. eriostachya</i> KFK						k
<i>G. eryngioides</i>	n					
<i>G. huegelii</i> 1577		n	p	pn	p	
<i>G. paniculata</i> 1624, 1408	pn	pn	p	pn	p	

	E	R	T	M	MR	W
<i>G. petrophiloides</i>	n	pn	p	pn	p	
<i>G. shuttleworthiana</i>	n					
<i>G. stenophylla</i> 1555		pn	p	n	p	
<i>G. tridentifera</i> 1524	n					
<i>G. uncinulata</i> 1522	n					
<i>G. sp. nov. (aff. intricata)</i> 1506, 1542	n	n	p	pn	p	
<i>Hakea erinacea</i> 1451	n					
<i>H. gilbertii</i>	n	pn	p	pn		
<i>H. incrassata</i> 1523	n	n	p	n	p	
<i>H. lehmanniana</i>	n					
<i>H. lissocarpha</i> 1447	n					
<i>H. multilineata</i> 1456	n	pn	p	pn	p	
<i>H. preissii</i>						p
<i>H. petiolaris</i> 1417	n		p			
<i>H. platysperma</i>	n					
<i>H. scoparia</i> 1366, 1422	pn	pn	p	pn	p	
<i>H. subsulcata</i> 1462	n					
<i>H. trifurcata</i>	n					
<i>H. sp. nov. (aff. falcata)</i> 1471 (large fruit cream form)	n					
<i>Hakea sp.</i> 1543, 1385	n					
<i>Isopogon divergens</i> 1365	n	pn	p	pn		
<i>I. dubius</i> 1520	n					
<i>I. scabruisculus</i> 1458	n	pn	p		p	
<i>Persoonia coriacea</i> 1563		pn	p	pn	p	
<i>P. striata</i> 1608, 1672, 1566		n	p	n		
<i>Petrophile brevifolia</i> 1376b, 1528	n	pn	p	n		
<i>P. ericifolia</i> 1466	n		p			
<i>P. shuttleworthiana</i> 1372	n	pn	p	pn	p	
<i>P. striata</i>	n?	n				
<i>P. divaricata</i> 1536, 1443	pn					
<i>Synaphaea sp. nov.</i> 1599, 1469	n	pn				



E R T M MR W

SANTALACEAE

Exocarpos sparteus	n					
Santalum acuminatum 1373, 1700	pn	pn	p	pn	p	
S. spicatum						k
Pittosporum phylliraeoides 1697					p	

OLACACEAE

Olax benthamiana KFK				p		
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POLYGONACEAE

Muelenbeckia adpressa						k
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CHENOPODIACEAE

Atriplex ?paludosa ssp. baudinii						
1663				p		
Enchylaena lanata KFK	n?p	n	p	pn	p	
Maireana carnosa KFK					p	
M. enchylaenoides KFK						h
M. georgei KFK			p			
M. marginata KFK					p	
Rhagodia acicularis				n	p	
R. drummondii 1702					p	
R. preissii	n				p	
Sclerolaena diacantha KFK			p			

AMARANTHACEAE

Ptilotus divaricatus KFK					p	
P. gaudichaudii KFK						h
P. holosericeus KFK						h
P. obovatus					p	
P. polystachyus KFK						k

P. spathulatus KFK

p

# GYROSTEMONACEAE

Gyrostemon ramulosus KFK

k

# AIZOACEAE

\*Micropterum papulosum KFK

p

# PORTULACACEAE

Calandrinia calyptrata KFK

p

C. corrigioloides KFK

h

C. eremaea KFK

h

# CARYOPHYLLACEAE

\*Cerastium glomeratum KFK

h

\*Petrorhagia velutina KFK

h

\*Silene gallica KFK

h

\*S. nocturna KFK

h

\*Spergularia pentandra KFK

p

\*S. saligna KFK

h?

# RANUNCULACEAE

Clematis sp. nov

(aff. microphylla) 1703, 1681

p

n

p

# LAURACEAE

Cassytha aurea var. hirta

hk

C. glabella KFK

k

C. ?melantha 1488b

n

pn

p

pn

p

C. ?pomiformis KFK 1461

n

n

n

p

# PAPAVERACEAE

\*Papaver hybridum KFK

h

5

	E	R	T	M	MR	W
A. assimilis KFK			p			
A. bidentata 1652			p			
A. blakelyi KFK						k
A. botrydion 1584		n	p	n	p	
A. cliftoniana 1688, 1627		pn	p	pn	p	
A. denticulosa 1692				n	p	
A. drewiana ssp. minor 1521	n					
A. dura 1552, 1488	n	n	p	pn	p	
A. erinacea 1430	pn	pn	p	pn	p	
A. eriocladya 1594		pn				
A. ?filifolia 1394	n					
A. fragilis 1449	pn		p			
A. hemiteles ?1695				p		
A. jacksonioides 1459	n					
A. lasiocalyx	n	pn	p	pn		
A. lasiocarpa 1405	pn					
A. latipes 1504, 1592	n	n				
A. leptospermoides 1570, 1375, 1425b	n	pn	p	pn	p	
A. ligustrina 1602, 1583	n	pn	p	pn	p	
A. lineolata Maslin			p			
A. mackeyana 1645			p			
A. microbotrya 1429	pn				p	
A. multispicata 1649, 1612, 1562	n	pn	p			
A. neurophylla KFK			p			
A. nigripilosa KFK						k?
A. orbifolia 1551		pn	p	pn	p	
A. pharangites 1607			p			
A. pulchella 1626			p	pn	p	
A. phaeocalyx 1514	n					
A. restiacea KFK			p			
A. saligna 1665			p			
A. saxatilis 1676				p		
A. semicircinalis			p	pn		

	E	R	T	M	MR	W
<i>A. sulcata</i> var. <i>platyphylla</i> 1589		n				
<i>A. shuttleworthii</i> 1483	n	p	p	n		
<i>A. stenoptera</i> 1381	n	pn	p	pn	p	
<i>A. ulicina</i> 1628			p	p		
<i>A. sp. nov.</i> ( <i>ms ericsonii</i> ) 1335	n	pn	p	pn		
<i>A. sp. nov.</i> ( <i>ms brumalis</i> ) 1398	n					
<i>A. sp. nov.</i> ( <i>pygmaea ms</i> ) 1669				p		
CAESALPINIACEAE						
<i>Cassia nemophila</i> 1664			p	p	p	
<i>C. pleurocarpa</i>					p	
PAPILIONACEAE						
<i>Bossiaea concinna</i>				n	p	
<i>B. eriocarpa</i> 1314	n	pn	p	n		
<i>Chorizema genistoides</i> 1686, 1635, 1684			p	n		
<i>Daviesia benthamii</i> 1427, 1657	pn	pn	p	pn	p	
<i>D. debilior</i> 1598 <i>sp senuans</i>		pn	p			
<i>D. euphorbioides</i>					k	
<i>D. hakeoides</i> 1437, 1496	pn	n				
<i>D. nudiflora</i> 1512	n					
<i>D. spiralis</i> 1540	n	pn	p	n		
<i>D. sp.</i> ( <i>aff. daphnoides</i> ) 1511	n					
<i>Gastrolobium bennettsianum</i> KFK						h?
<i>G. hookeri</i> 1453	n	n				
<i>G. obovatum</i> 1442	pn					
<i>G. spinosum</i>	n	pn	p	pn	p	
<i>Gompholobium aristatum</i> KFK			p		p	
<i>G. shuttleworthii</i> KFK			p			
<i>Jacksona macrocalyx</i> 1531, 1503	n					
<i>J. ulicina</i> KFK						k
<i>J. sp.</i> KFK 2352			p			
<i>Mirbelia dilatata</i> 1605	n			n	p	

	E	R	T	M	MR	W
<hr/>						
M. spinosa 1505	n					
Oxylobium parviflorum 1444	pn	p				
Templetonia sulcata 1546	n	pn	p	pn	p	
*Trifolium cherleri KFK		p				
GERANIACEAE						
*Erodium cicutarium					p	
E. cygnorum					p	
OXALIDACEAE						
Oxalis corniculata KFK					p	
ZYGOPHYLLACEAE						
Zygophyllum ovatum KFK					p	
Z. simile KFK						h
RUTACEAE						
Boronia coerulescens 1494	n					
B. coerulescens ssp. spinescens 1625			p	pn	p	
B. ericifolia 1576		n	p	n	p	
Diplolaena microcephalus 1535	n					
Eriostemon rhomboideus 1651, 1613			p	n	p	
E. wonganensis 1685, 1629			p	n		
Microcybe multiflora KFK				p		
Phebalium brachycalyx 1557		n	p	n		
P. filifolium 1647			p			
P. tuberosum 1485, 1564, 1391	n	pn	p	pn	p	
TREMANDRACEAE						
Tetratheca confertifolia KFK			n			
T. retrorsa 1701					p	

	E	R	T	M	MR	W
<hr/>						
POLYGALACEAE						
Comesperma integerrimum KFK						h
C. scoparium 1499	n					
C. volubile 1590		n	p	pn		
EUPHORBIACEAE						
Beyeria brevifolia 1556, 1388	n	pn	p	pn		
Ricinocarpos muricatus 1678				pn		
CELASTRACEAE						
Psammomoya choretroides 1449	n	n		n	p	
STACKHOUSIACEAE						
Stackhousia monogyna 1707					p	
SAPINDACEAE						
Dodonaea bursarifolia 1553, 1487	n	pn	p	pn	p	
D. divaricata 1574		n		p		
D. inaequifolia KFK						h
D. larraeoides 1640, 1619			p	pn	p	
D. pinifolia 1407	pn		p	pn	p	
D. viscosa ssp. angustissima 1415, 1445	pn					
RHAMNACEAE						
Cryptandra glabriflora 1467	n		p	n		
C. leucophracta 1360	n	pn	p	pn	p	
C. sp. 1634			p	p	p	
C. sp. 1452	n			p		
Trymalium ledifolium 1431, 1420	pn	pn	p	pn	p	
MALVACEAE						
Alyogyne hakeifolia KFK						k
A. huegelii					p	





	E	R	T	M	MR	W
Beaufortia interstans 1465	n	pn	p	n		
B. squarrosa KFK						k
Calothamnus aspera 1630, 1554		n	p	pn	p	
C. quadrifidus 1534	pn	pn		n		
C. sanguineus 1508	n	pn		n		
Calytrix depressa 1653, 1409	pn		p	p	p	
C. gracilis 1547	n	p?	p?	pn		
C. leschenaultii KFK						k
C. sapphirina 1600		p				
C. strigosa KFK						k
C. sp. KFK 2397						k
Chamelaucium ciliatum 1648			p			
C. brevifolium KFK						k
C. drummondii 1479, 1567	n	pn	p			
Darwinia purpurea KFK						h?
Eremaea pauciflora 1513	n					
Eucalyptus arachnaea (ms)						
1402, 1538, 1421, 1352	n	pn	p	n	p	
E. capillosa ssp. polyclada (ms) 1618		p				
E. drummondii 1374	n	pn	p	pn		
E. ebbacoensis 1561, 1591	n	pn	p	pn	p	
E. eremophila 1493, 1353	n					
E. erythronema 1603	n	pn	p	pn	p	
E. eudesmioides 1477	n	n	p	pn	p	
E. falcata				p		
E. flocktoniae 1367	n	n		n		
E. hypochlamydea (ms) 1614			p			
E. hypochlamydea ssp. edysiustes						
(ms) 1616, 1399, 1696	n		p	n	p	
E. longicornis		n	p	pn	p	
E. loxophleba 1411, 1615, 1436	pn	n	p	pn	p	
E. myriadena 1642			p			
E. obtusiflora 1683, 1621, 1573, 1583b		n	p	pn		

	E	R	T	M	MR	W
<i>E. pileata</i> 1387, 1544	n		p?			
<i>E. plenissima</i> KFK				p		
<i>E. pluricaulis</i> (ms) 1484	n	n	p			
<i>E. pyriformis</i> 1455	n					
<i>E. rigidula</i> 1527, 1395, 1478	n					
<i>E. salmonophloia</i>	pn	pn	p	pn	p	
<i>E. salubris</i>	n	pn	p	pn	p	
<i>E. sheathiana</i> 1550		n				
<i>E. spathulata</i>						k
<i>E. subangusta</i> (ms) 1660, 1486, 1571	n	pn	p	pn		
<i>E. transcontinentalis</i> 1404, 1549	n	pn	p	pn	p	
<i>E. virella</i> (ms) 1433, 1424, 1706	n	pn	p	pn	p	
<i>E. wandoo</i>	pn					
<i>E. yilgarnensis</i> 1641, 1617		p	p	pn	p	
<i>Hypocalymma angustifolium</i>	n	pn	p	pn	p	
<i>H. puniceum</i> 1378, 1667	n		p			
<i>Kunzea pulchella</i>	n					
<i>Leptospermum erubescens</i> 1446	pn					
<i>L. sp</i> 1454	n					
<i>L. sp.</i> KFK 7452						h
<i>Lhotzkyia violacea</i> KFK						k
<i>L. sp.</i> KFK 7511						k
<i>Melaleuca acuminata</i>	n	n	p	pn	p	
<i>Melaleuca acuminata</i> ssp. <i>websteri</i> 1354, 1403		n	p	pn		
<i>M. adnata</i> 1401	pn	pn	p	pn	p	
<i>M. conothamnoides</i> 1383	pn	pn	p	pn		
<i>M. cordata</i> 1525	n	pn	p	pn	p	
<i>M. coronicarpa</i> ssp. <i>coronicarpa</i> 1400 (prev. <i>M. undulata</i> )	n	pn	p	pn	p	
<i>M. lateriflora</i> 1435	n					
<i>M. lanceolata</i> ssp. <i>thaerifolia</i> (ms) (prev. aff. <i>pauperiflora</i> )		n	p	pn	p	
<i>M. platycalyx</i> 1530	n	p	p		p	

	E	R	T	M	MR	W
M. pentagona 1545	n					
M. pungens	n	pn	p	pn	p	
M. radula 1368a, 1410	pn	pn	p	pn	p	
M. scabra 1364	n	pn	p	n		
M. sclerophylla 1425	n	pn				
M. spicigera 1406	n					
M. uncinata	pn	pn	p	pn	p	
M. undulata "Wongan biotype" 1403	n	n		n		
M. sp. nov. (aff. holosericea) 1384	n	pn	p	n		
M. sp. (aff. subfalcata) 1489	n					
Micromyrtus racemosa 1382, 1572	n	pn	p	pn		
Scholtzia drummondii 1390	pn	n	p	n		
Thryptomene baeckeacea KFK						k
Verticordia chrysantha 1666	n	pn	p	pn		
V. brownii 1464	n					
V. densiflora 1480	n	n				
V. drummondii KFK						k
V. insignis KFK						k
V. muelleriana KFK						k
V. picta KFK						k
V. aff. muelleriana KFK						k
V. sp. nov. (aff. preissii) 1416, 1638	n		p	p	p	
HALORAGACEAE						
Glischrocaryon aureum	pn	n	p	n	p	
Gonocarpus cordiger KFK						h
G. nodulosus KFK						h
APIACEAE						
Daucus glochidiatus KFK			p			
Hydrocotyle callicarpa KFK					p	
Hydrocotyle diantha KFK						h
H. pilifera var. glabrata KFK					p	

	E	R	T	M	MR	W
H. rugulosa KFK						h
Platysace cirrosa KFK					p	
P. effusa 1491, 1501	n	n		n		
P. maxwellii KFK						k
Trachymene cyanopetala KFK			p		p	
T. ornata KFK			p		p	
EPACRIDACEAE						
Astroloma epacridis 1386	n	p	p	pn	p	
A. serratifolium 1492, 1438, 1532	pn	n	p	pn	p	
Leucopogon constephioides 1472	n	p	p	pn		
L. crassiflorus KFK						k
L. hamulosus 1482	n					
L. gracillimus 1450, 1363	n	pn				
Lysinema ciliatum	n	n				
PRIMULACEAE						
*Anagallis arvensis var. coerulea KFK			p		p	
LOGANIACEAE						
Logania flaviflora KFK						h
Mitrasacme paradoxa KFK					p	
GENTIANACEAE						
*Centaurium spicatum KFK			p			
APOCYNACEAE						
Alyxia buxifolia		n	p	pn	p	
CONVOLVULACEAE						
Wilsonia humilis KFK						h

E R T M MR W

# BORAGINACEAE

Halgania sp. nov (aff. preissiana)

1623, 1432

pn

p

H. sp. nov. (aff. solonacea) 1569, 1611

n

p

pn

p

# CHLOANTHACEAE

Cyanostegia angustifolia KFK

p

Lachnostachys ferruginea 1674

n

n

p

Mallophora rugosifolia KFK

k

Pityrodia bartlingii KFK

k

# LAMIACEAE

Hemigenia conferta KFK

p?

p

H. sp. nov. (aff. saligna) 1658, 1565

1610

pn

p

n

H. westringioides 1578

n

Microcorys eremophiloides 1539

n

n

p

pn.

p

M. ericifolia KFK

p

M. obovata 1581

n

p

Teucrium sessiliflorum KFK

p

Westringia cephalantha 1661

p

# SOLANACEAE

Anthocercis genistoides 1690

pn

p

Nicotiana rosulata KFK

h

N. rotundifolia KFK

p

Solanum oldfieldii KFK

p

# SCROPHULARIACEAE

\*Parentucellia latifolia KFK

p

\*Zaluzianskya divaricata KFK

h

\*Orobanche minor KFK

p

MYOPORACEAE

Eremophila decipiens 1568	pn	p	pn	p	
E. drummondii 1639, 1586, 1659	n	p	n		
E. lehmanniana KFK					k
E. oppositifolia 1691		p	n	p	
E. sargentii 1708, 1693			p	p	
E. ternifolia 1682			np		

RUBIACEAE

*Galium murale KFK					h
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CAMPANULACEAE

Wahlenbergia gracilentia KFK					h
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LOBELIACEAE

Isotoma hypocrateriformis KFK		p			
Lobelia rarifolia KFK					h
L. sp. KFK 7705					h

GOODENIACEAE

Dampiera coronata 1601, 71358	n	pn	p	pn	p	
D. eriocephala KFK						k
D. lindleyi KFK						h
D. oligophylla 1392, 1529, 1495	pn	p	p	pn		
D. spicigera KFK						k
D. teres KFK						k
D. wellsiana KFK			p			
Goodenia berardiana KFK			p		p	
G. glareicola KFK						k
G. hassallii KFK					p	
G. helmsii KFK						h
G. occidentalis KFK						h
G. pinifolia 1380	n	pn	p	pn	p	







	E	R	T	M	MR	W
*Cotula bipinnata					p	
Helichrysum leucopsidium						h
H. lindleyi			p		p	
H. tepperi						h
Helipterum demissum			p		p	
H. heteranthum			p			
H. hyalospermum			p		p	
H. laeve						h
H. manglesii			p			
H. polycephalum					p	
H. pygmaeum						h
H. strictum					p	
H. gracile			p			
Isoetopsis graminifolia					p	
Lagenifera huegelii						h
Millotia myosotidifolia					p	
M. tenuifolia			p		p	
Olearia homolepis			p			
Ol muelleri 1655		p	p	pn	p	
O. muricata						k
O. paucidentata					p	
O. elaeophila						k
Podolepis lessonii			p			
Podotheca angustifolia			p		p	
P. gnaphalioides			p			
Pogonolepis stricta						h
Quinetia urvillei						h
Schoenia cassiniana					p	
Senecia glossanthus			p		p	
S. lautus						h
*Urospermum picroides						h
*Ursinia anthemoides					p	
Vittadinia humerata			p			

E R T M MR W

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Waitzia acuminata	n?p	?p	pn		
W. aurea		p		p	
W. citrina				p	
W. paniculata		p			
W. suaveolens				p	
*Sonchus oleraceus				p	

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E R T M MR W

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Waitzia acuminata	n?p	?p	pn		
W. aurea		p		p	
W. citrina				p	
W. paniculata		p			
W. suaveolens				p	
*Sonchus oleraceus				p	

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## APPENDIX 2 - MUIR VEGETATION DESCRIPTIONS

E = Elphin Reserve and adjacent bushland  
 R = Rogers Reserve and adjacent bushland  
 T = privately owned bushland south of the Piawaning-Wongan Hills Rd.  
 M = Mt Matilda Nature Reserve and adjacent bushland  
 MR = bushland north of Mt Matilda Nature Reserve on Mt Rupert Estate  
 p = indicates that the site is situated on privately owned bushland

*Eucalyptus wandoo* Woodland (Ew)

E site 12 Low Woodland A/Low Forest A over Low Heath  
 D/*Allocasuarina campestris* Thicket/scattered shrubs  
 Ep site 16 Low Woodland A over *Allocasuarina campestris* Heath  
 A/*Loxocarya cinerea* Low sedges/*Borya sphaerocephala* Open  
 Herbs  
 E site 38 Low Woodland A over *Allocasuarina campestris*  
 Thicket/Dwarf Scrub C/*Loxocarya cinerea* Low Sedges

*Eucalyptus loxophleba* Woodland (El)

Ep site 11 Low Forest A (scattered *Eucalyptus salmonophloia*  
 emergent to 15m)  
 E site 15 Low Forest A (scattered *E. salubris* and  
*E. salmonophloia*)  
 T site 16 Low Woodland A  
 T site 23 Low Woodland A over *Melaleuca adnata*, *M. uncinata* Scrub  
 T site 28 Low Woodland A over *Melaleuca acuminata* Heath A/Low  
 Heath C  
 Mp site 33 Low Forest A  
 M site 36 Low Woodland A over *Melaleuca acuminata* Dense Heath A  
 Mp site 40 Low Forest A (scattered *Acacia acuminata*)  
 MR site 6 Low Forest A/Low Woodland A over *Acacia acuminata* Low  
 Woodland B (only scattered *A. acuminata* in some places)

*Eucalyptus salmonophloia* Woodland (Es)

- E site 14 Woodland over *Melaleuca adnata* Dense Thicket (scattered *E. salubris*)
- E site 37 Woodland over Low Scrub B
- Rp site 51 Low Forest A over Low Scrub A (scattered *E. salubris*)
- Rp site 52 Low Woodland A over Low Scrub A (scattered *E. salubris*)
- M site 17 Woodland (scattered *E. longicornis*)
- MR site 5 Low Woodland A over Open Low Scrub B (scattered *E. loxophleba* and *Acacia acuminata*)

*Eucalyptus salubris*/*E. longicornis* Woodland (Egm)

- R site 16 Low Forest A over *Melaleuca* Heath B (*E. salubris* prominent, *E. salmonophloia* scattered)
- R site 33 Low Forest A over *Melaleuca adnata* Heath A/*Melaleuca lanceolata* Thicket/scattered shrubs (*E. longicornis* prominent, *E. salubris* scattered)
- T site 6 Low Woodland A over *Melaleuca lanceolata* Scrub (*E. longicornis* prominent)
- T site 7 Low Woodland A over *Melaleuca lanceolata* Open Scrub (*E. longicornis* prominent, *E. salubris* scattered)
- T site 12 Low Forest A over *Melaleuca* Scrub/scattered shrubs (*E. longicornis* and *E. salubris* prominent)
- T site 15 Low Woodland A over Open Scrub (*E. salubris* prominent, *E. longicornis* scattered)
- T site 24 Low Woodland A over *Melaleuca lanceolata* Scrub (*E. longicornis* prominent, *E. salubris* scattered)
- T site 29 Low Forest A over *Melaleuca lanceolata* Scrub/*M. lanceolata* Thicket
- Mp site 5 Low Woodland A (*E. longicornis* prominent)
- M site 11 Low Forest A over *Melaleuca adnata* Thicket (*E. salubris* and *E. longicornis* prominent)
- M site 21 Low Forest A/Low Woodland A over *Melaleuca lanceolata* Thicket/scattered shrubs (*E. longicornis* and *E. salubris* prominent)



- M site 28 Low Forest A (*E. salubris*)  
 M site 35 Low Forest A over *Melaleuca lanceolata* Thicket (*E. salubris* and *E. longicornis* prominent)  
 MR site 3 Low Forest A over *Melaleuca* Open Low Scrub A/Scattered shrubs  
 MR site 9 Low Forest A (*E. salubris*)

*Eucalyptus falcata* Woodland (Ef)

- Mp site 31 Low Woodland A over Scrub

*Acacia acuminata* Woodland (Aa)

- MR site 2 Low Forest A

MALLEE (M)

- E site 5 Shrub Mallee  
 E site 10 Shrub Mallee  
 E site 34 Shrub Mallee  
 R site 26 Shrub Mallee  
 R site 29 Shrub Mallee scattered *E. salubris*  
 R site 36 Shrub Mallee/Tree Mallee  
 R site 40 Shrub Mallee  
 R site 43 Shrub Mallee over *Trymalium ledifolium* Open Dwarf Scrub C scattered *E. salmonophloia*  
 R site 45 Shrub Mallee over Dwarf Scrub C  
 T site 17 Shrub Mallee  
 T site 27 Shrub Mallee over Dwarf Scrub C/scattered shrubs  
 T site 37 Shrub Mallee  
 Mp site 22 Dense Shrub Mallee/Shrub Mallee  
 Mp site 29 Shrub Mallee (scattered *E. salubris*, *E. longicornis* and *E. salmonophloia*)  
 Mp site 32 Shrub Mallee  
 M site 38 Shrub Mallee over *Trymalium ledifolium* Heath B

MR site 11 Shrub Mallee

MR site 12 Shrub Mallee

Mallee over *Petrophile shuttleworthiana*/*Allocasuarina  
campestris* Thicket (Mt)

- E site 3 Open Shrub Mallee over Heath B
- E site 4 Dense Heath A (scattered Mallee)
- E site 21 Dense Heath B (scattered Mallee)
- E site 22 Open Shrub Mallee over Heath B
- E site 29 Very Open Shrub Mallee over Dense Heath B
- E site 35 Dense Heath A
- R site 3 Open Shrub Mallee over Low Scrub A
- R site 6 Very Open Shrub Mallee over Heath A
- R site 10 Open Shrub Mallee over Heath A
- R site 12 Open Shrub Mallee (Tree Mallee)/Very Open Shrub Mallee  
over Dense Thicket
- R site 13 Very Open Shrub Mallee over Dense Heath B/Heath B
- R site 18 Very Open Shrub Mallee over Dense Heath A
- R site 22 Thicket over *Melaleuca cordata* Dwarf Scrub D (scattered  
Mallee) *Allocasuarina campestris* prominent
- R site 24 Open Shrub Mallee over Heath A
- R site 28 Very Open Shrub Mallee over Dense Heath B
- R site 30 Dense Heath A/Heath A over *Melaleuca cordata* Low Heath D  
(scattered Mallee)
- R site 31 Open Shrub Mallee over Low Heath C
- R site 35 Heath A (scattered Mallee)
- R site 38 Dense Heath B (*Allocasuarina campestris* prominent)
- R site 41 Tree Mallee/Open Tree Mallee over Thicket
- Rp site 44 Open Tree Mallee over Thicket
- Rp site 48 Dense Thicket (scattered Mallee)
- Rp site 49 Heath A over Low Heath C (scattered Mallee)
- T site 1 Thicket (scattered Mallee, *Allocasuarina campestris*  
prominent)
- T site 5 Very Open Shrub Mallee over Dense Heath b
- T site 14 Thicket *Allocasuarina campestris* prominent)



- T site 19 Open Shrub Mallee over Heath B  
 T site 20 Very Open Shrub Mallee over Dense Heath A  
 T site 21 Very Open Shrub Mallee over Low Scrub A over Heath B  
 T site 25 Very Open Shrub Mallee over Thicket (*Allocasuarina campestris* prominent)  
 T site 30 Very Open Shrub Mallee/Shrub Mallee over Thicket  
 T site 38 Shrub Mallee/Open Shrub Mallee over Thicket  
 Mp site 1 Heath B (scattered Mallee)  
 M site 7 Very Open Shrub Mallee over Dense thicket  
 M site 8 Shrub Mallee over Thicket  
 M site 9 Scrub over Heath B (scattered Mallee)  
 Mp site 15 Dense Thicket (scattered Mallee)  
 M site 20 Very Open Mallee over Heath B (*Allocasuarina campestris* prominent)  
 M site 25 Open Shrub Mallee over Thicket/Dense Thicket  
 M site 26 Very Open Shrub Mallee over Heath A over *Melaleuca conothamnoides* Low Heath D  
 Mp site 43 Shrub Mallee over Thicket  
 MR site 8 Dense Heath A  
 MR site 15 Thicket (scattered Mallee)

**Mallee over *Allocasuarina campestris* Thicket**

(Ma)

- Ep site 6 Dense Heath A (scattered Mallee and trees)  
 E site 9 Heath A (scattered trees and Mallee)  
 E site 25 Dense Heath A/Heath A  
 R site 4 Open Shrub Mallee over Dense Thicket  
 R site 5 Very Open Shrub Mallee over Thicket/Dense Thicket  
 R site 7 Very Open Shrub Mallee/Open Shrub Mallee over Thicket  
 R site 9 Open Shrub Mallee over Dense Thicket/Thicket  
 R site 20 Very Open Shrub Mallee/Open shrub Mallee over Dense Thicket  
 R site 21 Open Shrub Mallee over Heath A  
 R site 27 Very Open Shrub Mallee over Thicket  
 T site 22 Thicket (scattered mallee)  
 T site 36 Dense Thicket/Thicket (scattered mallee)

T site 39 Open Shrub Mallee over Heath A  
 M site 18 Open Shrub Mallee over Dense Thicket  
 M site 19 Open Shrub Mallee/Shrub Mallee over Dense Thicket  
 M site 34 Very Open Shrub Mallee over Thicket  
 M site 41 Shrub Mallee over Dense Thicket  
 M site 44 Very Open Shrub Mallee over Heath A  
 MR site 7 Dense Thicket (Mallee scattered)

Mallee over *Melaleuca* Thicket (Mm)

E site 1 Open Tree Mallee over *Melaleuca uncinata* Thicket/Dense Thicket  
 E site 8 Open Shrub Mallee over *Melaleuca uncinata*, *M. acuminata*, *M. adnata*, *M. radula* Heath A (patchy)  
 E site 36 Shrub Mallee over *Melaleuca uncinata* Heath A  
 R site 11 Shrub Mallee over *Melaleuca uncinata* Heath A over *M. coroncarpa* Low Heath D  
 R site 14 Shrub Mallee over *Melaleuca uncinata* Heath A over *M. coroncarpa* Open Dwarf Scrub D  
 R site 17 Shrub Mallee over *Melaleuca acuminata*, *M. coroncarpa* Heath B  
 R site 25 Shrub Mallee over *Melaleuca uncinata*, *M. coroncarpa*, *M. adnata* Dense Heath A  
 R site 32 Very Open Shrub Mallee/Open Shrub Mallee over *Melaleuca uncinata* Dense Thicket  
 R site 34 Open Shrub Mallee/Open Tree Mallee over *Melaleuca uncinata*, *M. adnata* Dense Heath B  
 R site 37 Tree mallee over *Melaleuca uncinata* Heath A over *M. coroncarpa* Dwarf Scrub D (scattered *Callitris roei*)  
 Rp site 42 Open Shrub Mallee over *Melaleuca uncinata* Thicket  
 Rp site 47 Open Shrub Mallee over *Melaleuca uncinata* Heath A (*Callitris ?roei* Open Scrub in places)  
 T site 9 Shrub Mallee over mixed *Melaleuca* Dense Thicket  
 T site 18 Open Shrub Mallee over *Melaleuca uncinata* Heath A  
 T site 31 Open Shrub Mallee over mixed *Melaleuca* Dense Heath A  
 T site 32 Shrub Mallee over mixed *Melaleuca* Heath B

- M site 2 Open Shrub Mallee over *Melaleuca uncinata* Thicket over Low Heath D
- Mp site 4 Open Shrub Mallee/Shrub Mallee over *Melaleuca uncinata* Thicket over *Trymalium ledifolium* Low Scrub B
- M site 6 Dense Shrub Mallee/Shrub Mallee over *Melaleuca adnata* Low Scrub B
- M site 13 Shrub Mallee over *Melaleuca adnata*, *M. coroncarpa* (ms) Heath A
- Mp site 14 Shrub Mallee over mixed *Melaleuca* Thicket/*Melaleuca* Scrub
- M site 16 Shrub Mallee over *M. adnata*. *Trymalium ledifolium* Scrub
- Mp site 24 Shrub Mallee over *Melaleuca uncinata*. *Trymalium ledifolium* Heath B/*Melaleuca* Low Scrub A
- M site 42 Open Shrub Mallee over *Melaleuca coroncarpa* (ms), *M. uncinata*, *M. acuminata* Dense Heath A/Heath A (*Phebalium ?tuberculosum* Dwarf Scrub C in places)

**Mallee over *Melaleuca coroncarpa* (ms) Heath (Mc)**

- E site 24 Open Shrub Mallee over Dense Low Heath C
- ~~R~~ site 1 Shrub Mallee over Heath A
- R site 15 Shrub Mallee over Dense Heath B
- R site 23 Very Open Shrub Mallee/Very Open Tree Mallee over Low Heath C
- R site 31 Shrub Mallee over Heath B
- ~~T~~ ~~R~~ site 2 Heath B/Dense Heath B (scattered Mallee) → T 2 on map + p. 43 of report
- M site 27 Open Shrub Mallee over Dense Heath A
- M site 37 Open Shrub Mallee over Dense Heath A
- M site 46 Shrub Mallee over Heath A
- MR site 13 Open Shrub Mallee/Shrub Mallee over Dense Heath B

***Eucalyptus ebbanoensis* Mallee over Scrub (Me)**

- R site 39 Shrub Mallee/Tree Mallee over Open Low Scrub A over Dwarf Scrub C
- T site 8 Shrub Mallee (area previously grazed, scattered shrubs)

- T site 10 Open Shrub Mallee over Low Heath C (previously cleared)  
 T site 13 Shrub Mallee (previously grazed, scattered shrubs)  
 Mp site 3 Open Shrub Mallee over Low Heath C (*Baeckea crispiflora* prominent)  
 M site 45 Open Shrub Mallee/Open Tree Mallee over Heath B/Low Heath C

***Eucalyptus drummondii* Open Mallee over Heath (Md)**

- T site 4 Very Open Shrub Mallee/Open Shrub Mallee over Low Scrub B/Heath B  
 R site 8 Open Shrub Mallee over Dwarf Scrub C/Low Heath C/Low Scrub B  
 R site 19 Open Shrub Mallee over Heath B  
 R site 46 Low Heath C (scattered Mallee and shrubs to 1.5m)  
 Rp site 50 Very Open Shrub Mallee over Low Scrub B/Heath B  
 T site 26 Open Shrub Mallee over Low Scrub B/Heath B

***Eucalyptus pyriformis* Very Open Mallee over Mixed Heath (Mp)**

- E site 19 Very Open Shrub Mallee over Heath B  
 E site 30 Low Scrub B over Low Heath C (scattered Mallee)  
 E site 31 Very Open Shrub Mallee over Heath B

**KWONGAN**

***Melaleuca* Thicket (km)**

- E site 2 *Melaleuca uncinata* Dense Thicket (scattered Mallee)  
 E site 13 *Melaleuca* Dense Thicket (*M. adnata*, *M. acuminata*, *M. coronicarpa* (ms), *M. undulata*)  
 E siter 17 *Melaleuca uncinata* Heath B over *M. cordata*, *M. coronicarpa* (ms) Low Heath D (scattered *Callitris canescens* and Mallee)  
 E site 23 *Melaleuca uncinata* Heath A over *Melaleuca scabra* Heath B/*Melaleuca* Low Heath C (*M. conothamnoides*, *M. aff.*)

*holosericea*, *M. cordata*, *M. coronicarpa* (ms), scattered Mallee)

E site 33 *Melaleuca scabra* Heath B (scattered Mallee and shrubs of *Leptospermum erubescens*)

**Mixed Dense Heath (kh)**

E site 27 Dense Heath B (scattered *Petrophile shuttleworthiana*, *Actinostrobos arenarius*, *Allocasuarina campestris* and *Eucalyptus pyriformis*)

***Allocasuarina campestris*/Calothamnus asper Thicket (ka)**

- correct.*
- R site 2 Thicket (area of York Gum Low Woodland A)
  - T site 3 Dense Heath A (patchy)
  - T site 11 Scrub over *Melaleuca radula* Heath B over *Spartochloa scirpoidea* Tall Grass/Open Tall Grass
  - T site 33 Dense Thicket (scattered *E. loxophleba*)
  - T site 34 Thicket over *Melaleuca radula* Low Scrub A over *Spartochloa scirpoidea* Tall Grass (patchy)
  - T site 35 Scrub over *Melaleuca radula* Low Scrub A over Tall Grass
  - T site 40 Exposed rock Thicket/*Verticordia* aff. *preissii* Low Heath D/*Borya nitida* Herbs
  - T site 41 exposed rock Scrub/*Borya nitida* Open Herbs
  - Mp site 10 Heath A over *Spartochloa scirpoidea* Tall Grass
  - M site 12 Thicket over *Spartochloa scirpoidea* Tall Grass
  - Mp site 23 Scrub over *Melaleuca radula* Low Scrub B over *Spartochloa scirpoidea* Tall Grass (scattered *E. loxophleba*)
  - Mp site 30 Thicket over *Spartochloa scirpoidea* Open Tall Grass
  - Mp site 39 Scrub /Thicket over *Melaleuca radula* Low Scrub B over *Spartochloa scirpoidea* Tall Grass (small area of *E. loxophleba* Low Forest A)
  - MR site 1 exposed rock Dense Thicket/*Calytrix depressa* Low Heath D/*Borya nitida* Open Herbs
  - MR site 4 Dense Thicket
  - MR site 10 Thicket over *Melaleuca radula* Heath B

71  
MR site 14 Thicket over *Spartochloa scirpoidea* Tall Grass

#### SEDGELANDS

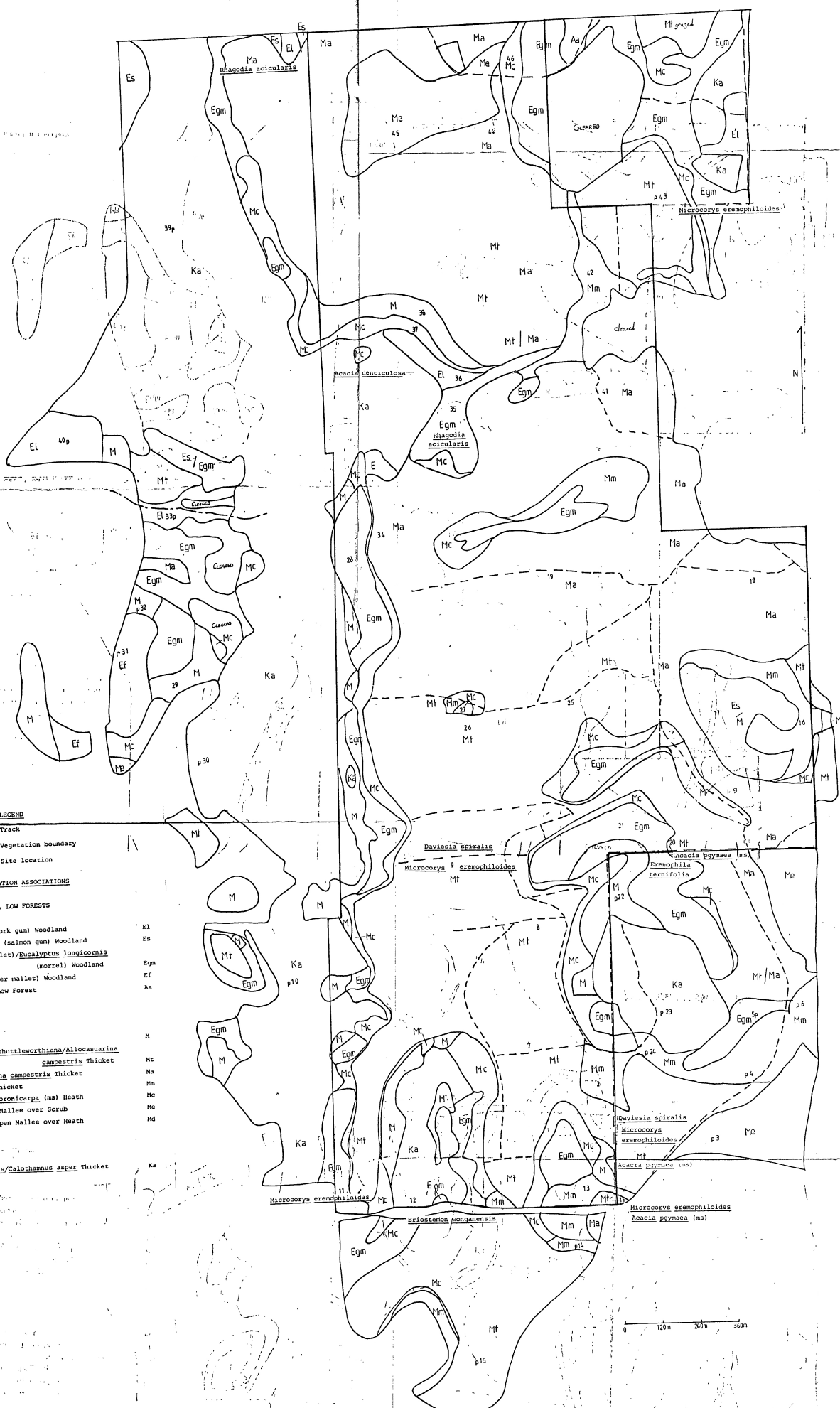
##### *Ecdeiocolea monostachya* Tall Sedges

- E site 18 *Ecdeiocolea monostachya* Tall Sedges scattered  
*Allocasuarina campestris*, *Grevillea armigera* and *Acacia lasiocalyx* (area of *Allocasuarina campestris* Low Scrub A and *Verticordia brownii* Low Heath C)
- E site 20 *Ecdeiocolea monostachya* Tall Sedges/Low Heath C  
scattered *Allocasuarina campestris* and *Isopogon scabrusculus*
- E site 26 *Ecdeiocolea monostachya* Tall Sedges scattered  
*Allocasuarina campestris*
- E site 28 *Ecdeiocolea monostachya* Tall Sedges scattered  
*Allocasuarina drummondiana* and *Actinostrobus arenarius*

#### LITHIC COMPLEX

##### Granite rock surface, herbs

- E site 7 *Borya sphaerocephala*, *B. nitida* Herbs (patchy)/*Calytrix depressa* Low Heath C (*Allocasuarina campestris* Dense Heath A at the edge of the outcrop)
- E site 32 *Borya nitida* Herbs (patchy) (*Allocasuarina campestris* Dense Heath B at the edge of the outcrop)



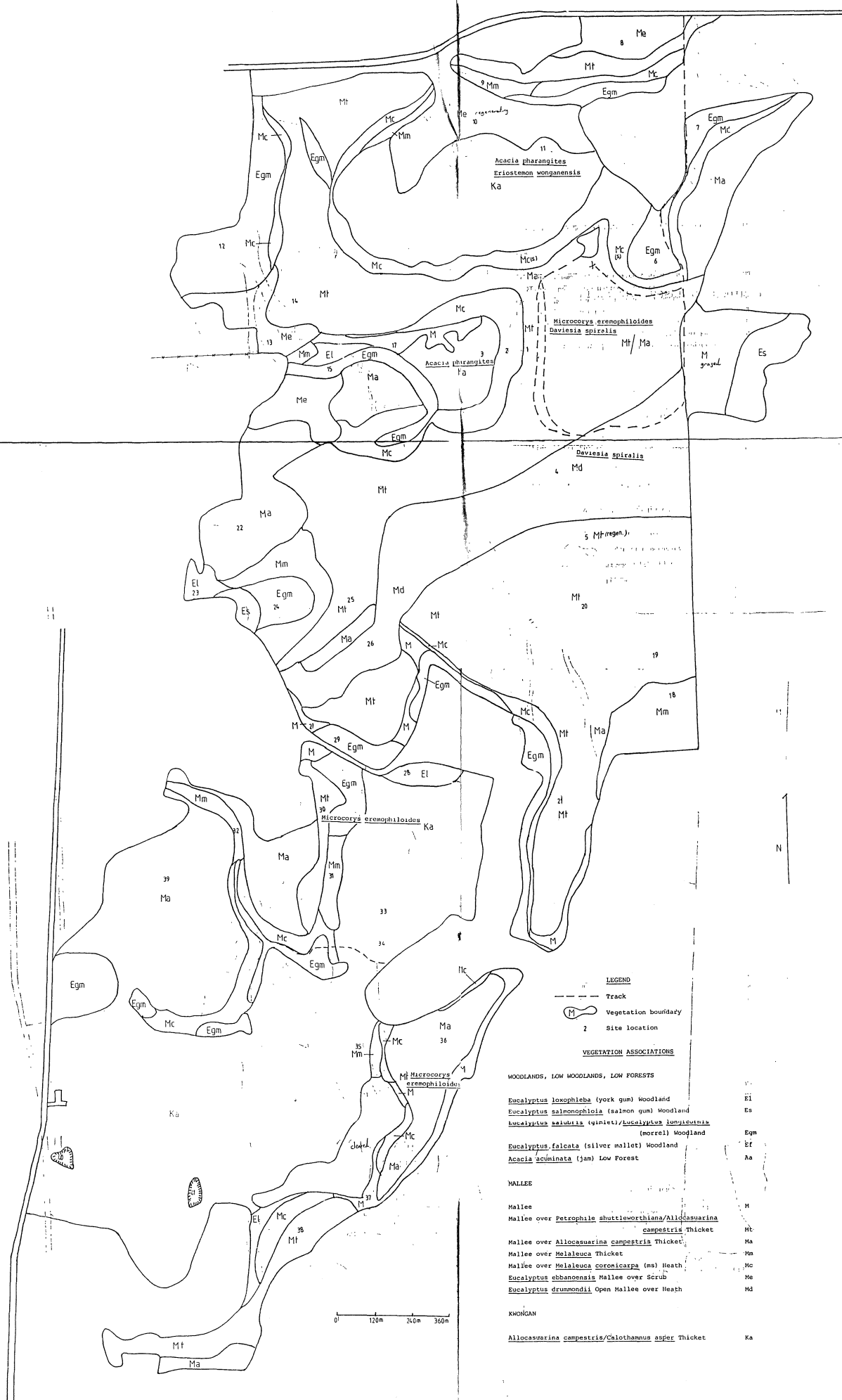
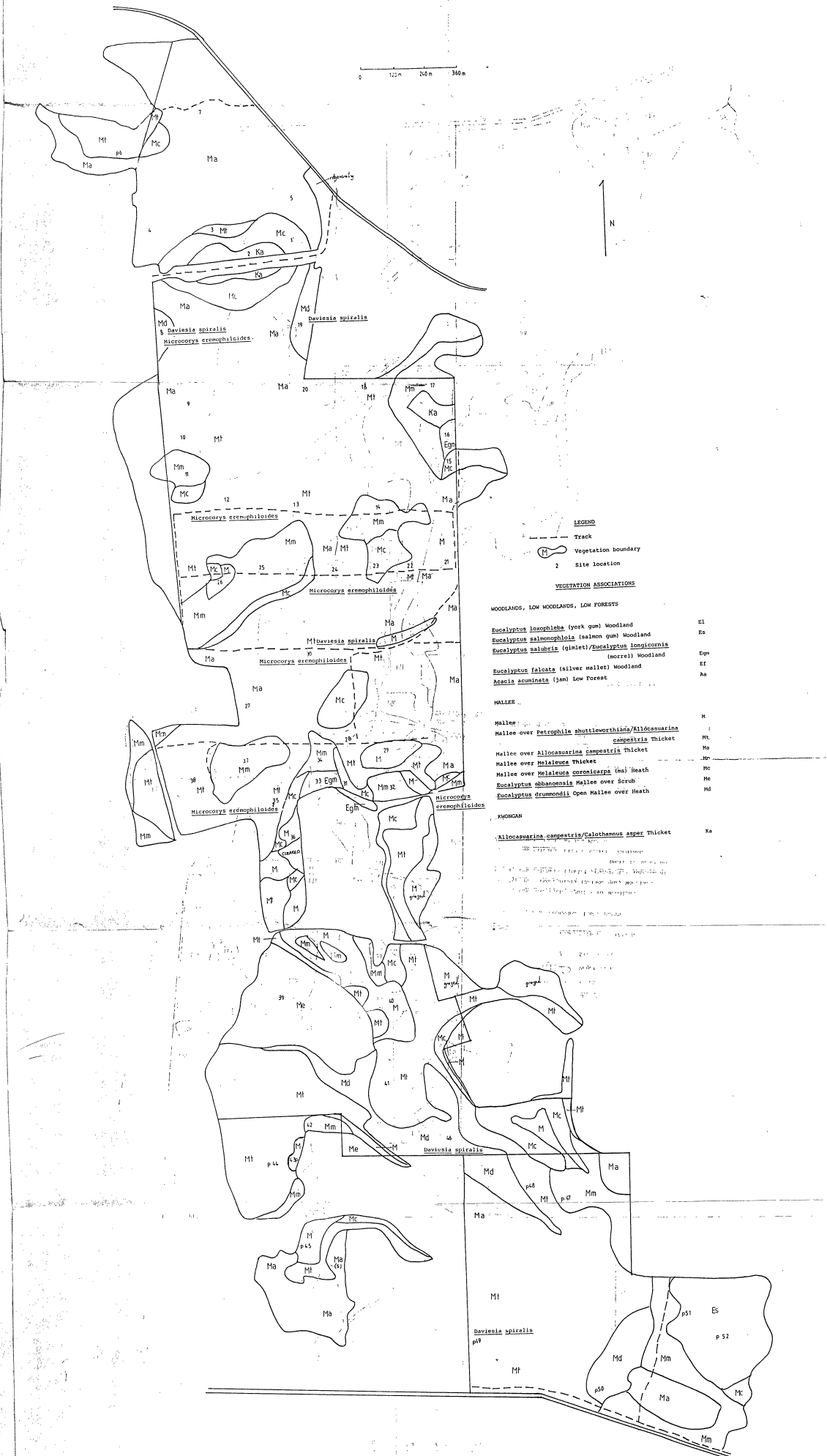
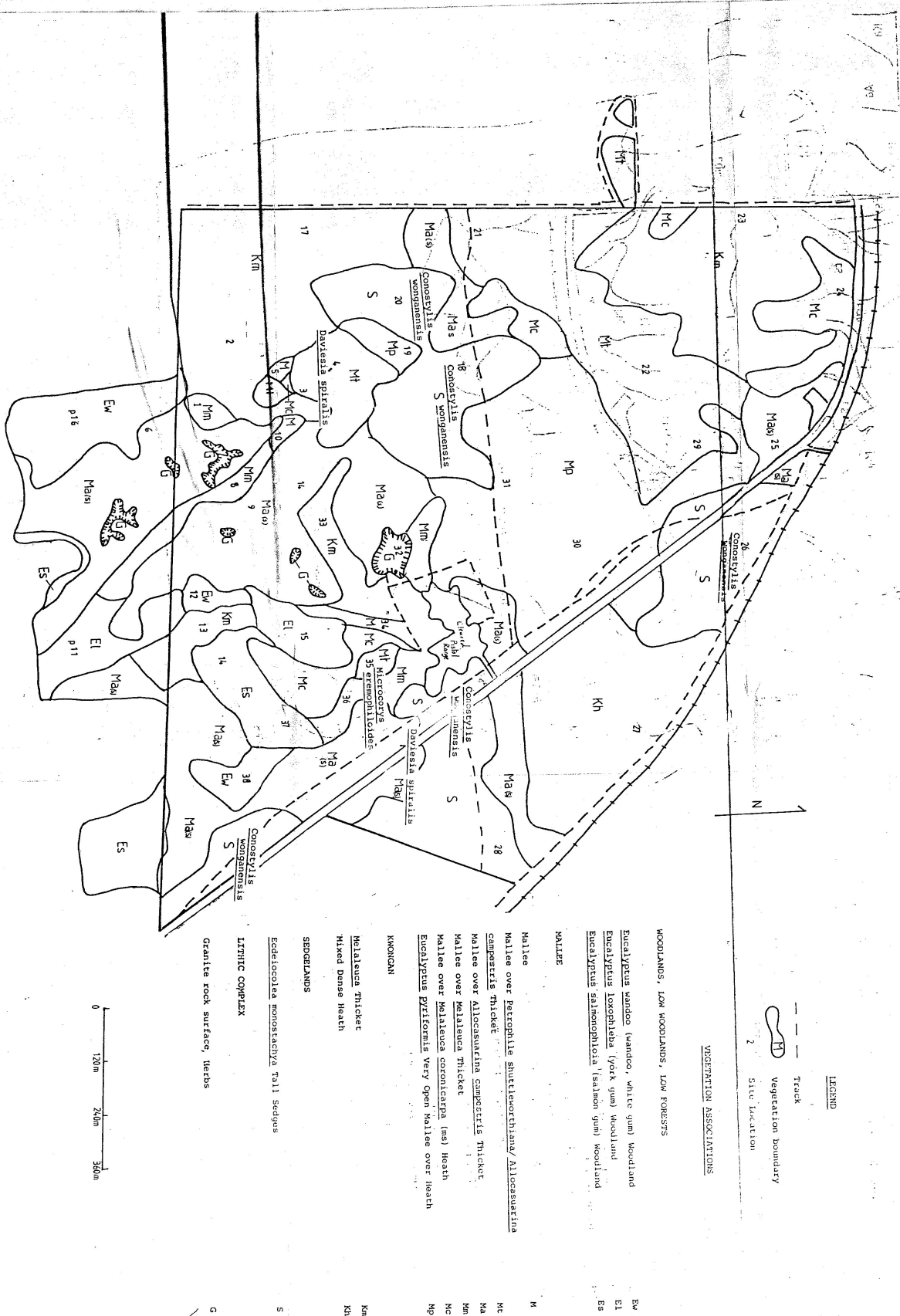




FIGURE 9. VEGETATION OF ROGERS RESERVE (A39145) AND ADJACENT BUSHLAND.



MAP D  
FIGURE 10. VEGETATION OF ELPHIN NATURE RESERVE (A25808)  
AND ADJACENT BUSHLAND.



MAP  
 OF MT MATILDA NATURE RESERVE ON MT RUPERT ESTATE.

