MIDWEST CORPORATION LIMITED (MIDWEST)

VEGETATION AND FLORA ASSESSMENT, KOOLANOOKA

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1. INTRODUCTION

1.1 Project Scope

Midwest Corporation Limited (Midwest) is proposing to develop an Iron Ore Project to mine and process shipping grade iron ore for export overseas. ATA Environmental was commissioned by Midwest Corporation Limited (Midwest) to undertake a vegetation and flora assessment of the project area and prepare an associated report to support the Notice of Intent for the proposed development.

The report identifies, classifies and maps vegetation types and locations of identified significant flora within the mine lease that may potentially be impacted upon by the proposed associated infrastructure activities and mine related to the mining operations and provides preliminary measures to minimise potential environmental impacts.

1.2 Study Area Location and Land Use

The mine lease and study area is located in the Shire of Morawa approximately 160km south east of Geraldton and 21km east of Morawa (Figure 1). The total area of the study area (ie the three mining leases M70/1014, M70/1013 and M70/1012) is approximately 6400ha (Figure 2).

2. STUDY AREA DESCRIPTION

2.1 Physical Environment

2.1.1 Climate

Koolanooka is located in the northeastern portion of the Mid West Region of Western Australia. The climate of the study area is considered semi arid with mild, wet winters and hot, dry summers.

The average annual rainfall is 335mm (measured at Morawa), with the average monthly rainfall ranging from 9mm in December to 57mm in June. There are 2 wet periods during the year, during summer from January to March and in winter from May-August. The most significant winter rains are generally associated with frontal systems from the southwest, which weaken considerably by the time they reach the Morawa district. Summer rains are associated with isolated thunderstorms with falls of up to 30-40mm, tropical lows with falls of up to 100mm occurring in 5-10 intervals and rare cyclonic disturbances (100mm plus) with a return period of several decades.

Rainfall in this semi-arid region either infiltrates into the substrate, runs off in creeks or evaporates. High temperatures and high evaporation rates associated with summer conditions ensure a much drier climate during the summer months. The average monthly maximum temperatures range from 18.1^0C in July to 36.7^0C in January.

2.1.2 Geology

The Koolanooka iron ore deposit occurs towards the northern end of the Koolanooka Hills, a 13km long zone comprised of Archaean synformal supracrustal rocks enclosed within a gneissic domain which in turn has been intruded by granitoids. Of particular significance at Koolanooka is a sedimentary sequence of tuffs and siltstones, sandstones and minor conglomerates, which are overlain by, and inter-bedded with, various banded iron formations and pelitic shales. These rocks, which form the western limb of the synform, have been intruded in places by quartz feldspar porphyries, andesite, dolerite and gabbro.

The Banded Iron Formation (BIF) at Koolanooka is more than 200m thick and dips steeply to the west. In the primary zone, the main minerals are magnetite, various amphiboles, quartz, minor chlorite, garnets and sulphides. The iron occurs largely in the magnetite and the amphiboles. Towards the surface, the banded iron formations are variously weathered and oxidised. The surface materials comprise scree, a geothite hardcap and haematite conglomerates, which overlie the main weathered zone in which the magnetite has been largely altered to haematite, goethite and limonite. In the underlying transition zone, the main minerals are haematite, magnetite, chert, chlorite, some amphiboles and goethite. The previous mining activities were focussed on the weathered and surface zones, where the iron content is higher than in the primary banded iron formation. The soils associated with the Koolanooka Hills are generally rocky with gradational red gravelly loams

The soils of the area surrounding the Koolanooka Hills are a mixture of deep yellow acidic sands, gradational sands on yellow ferruginous gravels, gradational red sandy

loams, gritty sands on granites and with some minor areas of yellow and over ironstone gravel (Western Australian Department of Agriculture, 1996).

2.1.3 Landforms

The Koolanooka area has been surveyed and classified according to different land systems by the Department of Agriculture on the basis of the underlying geology, landforms, soils and vegetation characteristics. Three land systems are associated with the majority of the Koolanooka study area. These are the:

- Koolanooka Land System
- Noolagabbi Land System; and
- Pindar Land System

The Koolanooka Land System comprises the Koolanooka Hills, a range of rolling to very steep low hills with gently inclined foot slopes, which have been extensively cleared for agriculture (Western Australian Department of Agriculture, 1996). The Koolanooka Hills are characterised by the "sand over gravel and shallow soils on granite or gneiss (Wilcox *et al.,* 1996).

The Noolagabbi Land System is associated with the level and gently inclined flats and lower slopes surrounding the Koolanooka Land System and is often associated with a saline drainage network. The Noolagabbi Land System is characterised by red sands, loams and clays over a red/brown hard pan.

The Pindar Land System is associated with the gently undulating sandplain with long gentle slopes to the southeast of the Koolanooka Hills. This system has been even more extensively cleared for agriculture than the Koolanooka Land System, primarily for cropping and grazing.

2.2 Biological Environment

2.2.1 Vegetation

The Koolanooka study area is located within the Avon-Wheatbelt Bioregion of Australia (Thackaway and Cresswell, 1995), in relatively close proximity to the intersection of the South-Western and Eremaean Botanical Provinces of Western Australia. The study area is also situated within the Perenjori Botanical District (Beard, 1976). The study area is also associated with one of several vegetation systems associated with the Perenjori Botanical District, the Koolanooka System (Beard, 1976). This vegetation system is naturally restricted to the two known existing occurrences at Koolanooka Hills and the nearby Perenjori Hills (south east of Koolanooka Hills) (CALM, 2003).

The vegetation associated with the Koolanooka System is described as consisting of an Open Woodland of *Allocasuarina huegeliana, Eucalyptus ebbanoensis* subsp. *ebbanoensis, Acacia* sp. scrub with *Dodonaea inaequifolia* interspersed with thickets of *Allocasuarina campestris, Acacia acuminata, Grevillea stenostachya, Melaleuca cordata, Melaleuca nematophylla* and *Melaleuca radula*. York Gum (*Eucalyptus*

loxophleba) Woodland interspersed with *Melaleuca* sp. scrub is prominent on the footslopes, while mixed Acacia spp. (A. *tetragonophylla, A. quadrimarginea and A. ramulosa*) scrub is supported on granite outcrops of the Koolanooka Hills (Beard, 1976).

3. VEGETATION AND FLORA SURVEY

3.1 Methodology

Prior to the survey, aerial photographs at a scale of 1:5,000 and colour orthophoto at a scale of 1:10,000 were examined to identify the patterns of vegetation change in the study area. These aids were also used in the field to map the different vegetation associations.

The flora and vegetation survey was conducted using the Draft *EPA Guidance No. 51: Guidance for the Assessment of Environmental Factors: Terrestrial flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2003) as a guide.

A desktop search for the presence of rare flora was undertaken prior to the field survey. This investigation encompassed a review of the following databases:

1. Department of Conservation and Land Management (CALM) *'Threatened (Declared Rare) Flora'* database.

2. *'Western Australian Herbarium Specimen'* database for priority species opportunistically collected in the area of interest.

3. DCLM's *'Declared Rare and Priority Flora List'* which contain species that area declared rare (Conservation code R or X for those presumed to be extinct) poorly known (Conservation codes 1, 2 or 3) or require monitoring (Conservation Code 4).

Prior to undertaking the field survey, previous flora and vegetation studies from the region were reviewed and recent aerial photography of the study area was examined to identify differences in vegetation types and structural units for the area. In addition, voucher specimens of plants species listed from the Department of Conservation and Land Management's (CALM) Declared Rare and Priority Flora database search as occurring in the general region of the study area were viewed at the Western Australian Herbarium to familiarise and assist with field identification.

TABLE 1
SIGNIFICANT FLORA PREVIOUSLY RECORDED IN THE VICINITY OF THE KOOLANOOKA HILLS PROJECT AREA

Species	Conservation Code	Distribution
Acacia acanthoclada subsp. *glaucescens*	P3	Mt Gibson Stn, Koolanooka Hills, Three Springs, Paynes Find
Acacia formidabilis	P3	Perenjori, Wanarra, Paynes Find,
Acacia isoneura subsp. isoneura	P3	Perenjori, Three Springs, Wubin, Bentine
Angianthus miropodoides	P3	Meckering
Baeckea sp. Perenjori (Green	P2	Perenjori, Bowgada

Species	Conservation Code	Distribution
1516)		
Epitriche demissus	P2	Three Springs, Morawa
Eremophila rostrata	R	Perenjori, Cue
Fitzwillia axilliflora	P2	Lake Magenta, Lake Bryde, Moora
Gnephosis setifera	P1	Bunjil, Morawa
Grevillea asparagoides	P3	Perenjori, Bindi Bindi, Morawa, Wongan Hills
Gunniopsis rubra	P3	Perenjori, Paynes Find, Ballidu
Halosarcia bulbosa	R	Morawa-Koolanooka Hills
Lechenaultia galactities	P3	Perenjori, Koorda, Latham, Dandaragan
Leptospermum exsertum	P1	Perenjori, Mullewa, Tardun
Levenhookia octomaculata	P3	Bolgart, Canna
Persoonia pentasticha	P2	Perenjori, Yuna, Mullewa, Mingenew
Podotheca uniseta	P3	Koolanooka, Morawa, Lake O'Grady
Urodon capitatus	P3	Perenjori, Ballidu, Koorda, Miling
Verticordia venusta	P3	Perenjori to Moonijin, Wongan Hills, Buntine

In addition, the Western Australian herbarium's specimen database was accessed to obtain a list of plant collections from the Koolanooka area to aid in plant identification.

The survey was undertaken by a combination of vehicle access with traverses on foot up to the ridges. The amount of time on site was considered adequate given the low diversity of species in the area at the time of the survey. There were few dead annuals on the ground to suggest that the timing of the survey limited the number of ephemeral species being recorded.

Aerial photography was used to identify and delineate major vegetation types, which were intensively sampled for all floristic plant species by way of traversing parallel, non-permanent transect to 50m in length, depending on structure, area and floristic complexity, through at least one of each of the provisionally identified vegetation types (Figure 2). All plants species were recorded at 1m intervals along each transect. Within each sampling location, the structure and floristic composition of the vegetation was described and, where appropriate, a brief description of the soil and landform characteristics of that particular unit was provided. For areas where vegetation had been cleared or the understorey had been completely removed, the transect line survey method was not adopted.

The locations of plants positively identified in the field as CALM listed Declared Rare or Priority Flora were recorded using a Global Positioning System (GPS) (Magellan Meridian Gold) (MGA 94 Zone 50).

4. SURVEY RESULTS

4.1 Vegetation Types

The vegetation types recorded from the study area have been described using the vegetation structural classes adapted from Muir (1977). Both the structure and species composition of many of the vegetation types recorded from the survey area were extremely variable and the descriptions provided in this report refers to the dominant vegetation layer and the most dominant species associated with a particular vegetation type.

A total of 31 different vegetation types were identified during the October 2003 vegetation and flora survey of the Koolanooka site (Figure 3). These were:

1. **Closed Tall Scrub dominated by *Acacia assimilis* subsp. *assimilis, Allocasuarina campestris* and *Melaleuca filifolia* over Herbland of mixed species and bare ground.**

This vegetation type occurs over a significant area of the slopes on the western side of the Koolanooka Hills range. This vegetation type was variable in height and dependent on the depth of soil, which was skeletal on the upper slopes, but was generally to 3m. Scattered *Eucalyptus oldfieldii* subsp. *oldfieldii* trees to 5m occurred at the base of the hills. The *Allocasuarina campestris* component of this vegetation type was most prominent near to the crest of the hills, becoming less dominant near the base.

2. **Closed Heath to Tall Open Scrub dominated by *Acacia acuminata, Acacia aneura, Grevillea intregrifolia* and *Melaleuca cordata* over Herbland of *Cephalipterum drummondii, Xanthosia bungei, Podolepis lessonii***

This vegetation type was recorded from an area to the immediate north of Koolanooka Spring Road at the base of the western side Koolanooka Hill range. The vegetation ranges in height between 2m and 3m, with occassional scattered *Eucalyptus leptopoda* (to 4m) occurring along the northern edge of the area. Associated, less commonly occurring species recorded from the middle stratum of this vegetation type include *Dodonaea pinifolia, Grevillea paradoxa, Aluta appressa, Aluta aspersa* subsp. *hesperia* and *Pimelea rosea*.

3. **Open Woodland to Very Open Shrub Tree Mallee of *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over a Tall Open Shrubland to Tall Open Scrub of *Acacia acuminata, Acacia exocarpoides, Acacia tetragonophylla, Hakea preissii* and *Melaleuca filifolia* with scattered *Allocasuarina huegeliana* over a Herbland dominated by *Ptilotus obovatus* var. *obovatus.***

Occurring over the crest and east-facing slopes of the Koolanooka Hills, *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee (to 5m in height) is the most prominent component over the plateau and upper slopes of the hill, becoming less common at its base, where *Eucalyptus loxophleba* subsp. *loxophleba* and *Eucalyptus oldfieldii* subsp. *oldfieldii* become the more prominent components. The Tall Shrubland to Tall Open Scrub stratum of this vegetation type is dominated by *Acacia tetragonophylla* to 3m in

height. Apart from lower slopes of the hill, the soil is relatively skeletal supporting few lower stratum species. While *Eucalyptus ebbanoensis* subsp. *ebbanoensis* was consistently the dominant overstorey component of this vegetation type, the structure was quite variable ranging from Very Open Shrub Tree Mallee over the crest of the hills to a more Open Woodland, often in association with *Eucalyptus loxophleba* subsp. *loxophleba* over the lower slopes. Similarly, the floristic composition of this vegetation type was more diverse on the lower slopes where the soil tended to be deeper than on the shallow, skeletal soils that occurred over the crest of the hills.

This vegetation type appears to be closely aligned with CALM's description of the Threatened Ecological Community (TEC) (*Plant Assemblages of the Koolanooka System*) that was assessed by the Department of Conservation and Land Management in 1999 as Vulnerable.

4. Open Heath of *Aluta appressa, Aluta aspersa* subsp. *hesperia,* Acacia *acuminata* and *Acacia assimilis* subsp. *assimilis* over an Open Herbland of *Borya sphaerocephala. Waitzia acuminata* subsp. *acuminata, Brunonia australis* and *Glischrocaryon aureum* with large areas of bare open ground

This vegetation type to 2m in height and relatively small in area, was recorded to the east of the Koolanooka Hills, adjacent to cleared farmland. In addition to the dominant species recorded from this vegetation type, other associated species included *Acacia resinomarginea, Acacia exocarpoides, Calothamnus gilesii, Grevillea paradoxa, Grevillea dielsiana, Melaleuca cordata* and *Dodonaea inaequifolia.*

5. Closed Tall Scrub of *Acacia acuminata* and *Acacia assimilis* subsp. *assimilis* over large areas of bare ground

Occurring to the east and southeast of the Koolanooka Hills and to the north of Koolanooka Spring Rd, this is a relatively homogeneous *Acacia* sp. dominated vegetation type to 3m in height. Less commonly occurring species recorded from this vegetation type included *Acacia stowardii, Acacia tetragonophylla, Acacia aneura, Dodonaea inaequifolia, Eremophila clarkei* and *Aluta appressa.*

6. Tall Shrubland dominated by *Acacia acuminata* and *Allocasuarina campestris*

This was the dominant vegetation type over the northern portion of the Koolanooka Hills as well as over a smaller, gently sloping area to the east. Although *Acacia acuminata* and *Allocasuarina campestris* were the dominant overstorey species in the vegetation types, the lower stratum was comprised of a diverse mixture of heath and herbaceous species including *Melaleuca filifolia, Grevillea paradoxa, Acacia exocarpoides, Acacia assimilis subsp. assimilis, Eremophila latrobei* subsp. *latrobei, Keraudrenia hermanniifolia, Sida atrovirens, Ptilotus obovatus* var. *obovatus, Cephalipterum drummondii, Waitzia acuminata* subsp. *acuminata, Brunonia australis* and *Lobelia winfridae.* Scattered mallee, including *Eucalyptus loxophleba* subsp. *loxophleba, Eucalyptus ebbanoensis* subsp. *ebbanoensis and Eucalyptus leptopoda* as well as *Allocasuarina huegeliana* were recorded from this vegetation type.

7. Very Open Tree Mallee to Low Open Woodland of *Eucalyptus oldfieldii* subsp. *oldfieldii* and *Allocasuarina huegeliana* on buckshot iron.

This open vegetation type on buckshot iron occurred over a previously cleared, degraded area to the immediate west of Koolanooka Hills. Associated species include *Acacia exocarpoides, Acacia assimilis* subsp. *assimilis, Acacia ramulosa* var. *ramulosa, Hakea francisiana, Cephalipterum drummondii* and *Ptilotus obovatus* subsp. *obovatus*.

8. Tall Open Scrub of *Grevillea intregrifolia, Grevillea paradoxa, Acacia assimilis* subsp. *assimilis* and *Eremophila clarkei* with scattered *Eucalyptus leptopoda* over a stony surface.

This vegetation type was recorded from THE base of the west-facing slopes of the Koolanooka Hills. While *Grevillea intregrifolia, Grevillea paradoxa, Acacia assimilis* subsp. *assimilis* to 3m in height were the dominant components of this vegetation type, other less commonly occurring shrub species included *Acacia aneura, Acacia erinaceae* and *Hibbertia exasperata.* The herb layer was dominated by *Cephalipterum drummondii, Thysanotus patersonii, Ptilotus obovatus* subsp. *obovatus* and *Prasophyllum sargentii.*

9. Tree Mallee of *Eucalyptus leptopoda* over *Acacia erinaceae* dominated Low Shrubland over Herbland of *Ptilotus obovatus* var. *obovatus* and annual daisies and/or bare ground

This vegetation type was recorded from the flat plains area to the immediate north of Koolanooka Spring Rd, almost due north of the Dingle Well Station and to the immediate west of the main north-south access track on the Koolanooka exploration lease. The *Eucalyptus eriopoda* tree mallee to 4m in height is the dominant upper stratum component of this vegetation type. Other than *Acacia erinacea,* shrub species recorded from this vegetation type included *Senna chatelainiana, Daviesia hakeoides* subsp. *subnuda* and *Acacia aneura.*

10. Tall Shrubland of *Allocasuarina campestris* on stony, bare ground

This vegetation type (to 3m in height) is represented by two highly degraded, unfenced remnants surrounded by cleared farmland adjacent to the Dingle Well homestead, south of Koolanooka Spring Rd. Apart from a carpet of *Cephalipterum drummondii*. The herb layer of this vegetation type has been completely removed through over-grazing. Scattered shrub species associated with this vegetation type included *Acacia assimilis* subsp. *assimilis, Acacia exocarpoides, Melaleuca filifolia, Melaleuca uncinata* and *Aluta maisonneuvei.*

11. Closed Tree Mallee to Tree Mallee of *Eucalyptus leptopoda* and *Allocasuarina campestris* over an Open Shrubland of *Acacia assimilis* subsp. *assimilis, Acacia erinaceae, Grevillea intregrifolia, Santalum acuminatum* and *Eremophila clarkei*

This vegetation type, to 4m in height, was recorded from the flats on western side of the Koolanooka Hills that lies to the south of Koolanooka Spring Rd and to the east of

the Dingle Well homestead. The overstorey of *Eucalyptus leptopoda* became less prominent as the slopes of the hill became steeper. Other shrub species recorded from this vegetation included *Olearia pimeleoides, Acacia exocarpoides, Hakea francisiana, Melaleuca cordata* and *Hakea preissii.* Herb species recorded included *Cephalipterum drummondii, Thysanotus patersonii, Glischrocaryon aureum, Podolepis lessonii* and *Waitzia acuminata* subsp. *acuminata.*

12. Open to Very Open Tree Mallee of *Eucalyptus kochii* subsp. *plenissiama* over Tall Open *Scrub Acacia tetragonophylla, Acacia acuminata, Melaleuca filifolia* and *Senna artemisioides* subsp. *helmsii* with scattered *Allocasuarina huegeliana*

This vegetation type was recorded from the crest of the Banded Iron Formation (BIF) hills occurring to the south of Koolanooka Spring Rd. The *Eucalyptus kochii* subsp. *plenissiama* tree mallee component was to 3m in height, while the Tall Open Scrub was to 2m in height. Other less commonly occurring shrub species recorded from this vegetation type included *Acacia aneura, Acacia campestris* and *Grevillea paradoxa.*

13. Open Woodland of *Allocasuarina huegeliana* over Tall Open Scrub dominated by *Acacia acuminata, Melaleuca filifolia* and *Melaleuca uncinata* over a Herbland dominated by *Borya sphaerocephala*

This vegetation type (to 10m in height) predominantly occurs between the BIF ranges and over the north and east-facing lower slopes and rises that extend from immediately south of Koolanooka Spring Rd to the southern boundary of the study area. Less commonly recorded shrub species from this vegetation type include *Acacia tetragonophylla, Acacia erinaceae* and *Dodonaea inaequifolia*. Herb species other than *Borya sphaerocephala* included *Lobelia winfridae, Ptilotus obovatus* var. *obovatus, Goodenia pinnatifida* and *Brunonia australis*.

14. Closed Heath dominated by *Aluta maisonneuvei, Aluta appressa* and *Acacia assimilis* subsp. *assimilis*

This vegetation type was recorded from a small area that includes and immediately surrounds the Morawa Rifle Range (Reserve 46614), which is located to the immediate south of Koolanooka Spring Rd. Other shrub species associated with this vegetation type includes *Calothamnus gilesii, Grevillea paradoxa, Philotheca brucei* and *Melaleuca cordata.* The Priority 3 listed taxon, *Frankenia glomerata,* was recorded from this vegetation type.

15. Tall to Tall Open Shrubland dominated by *Acacia acuminata* and *Acacia aneura* with scattered *Eucalyptus loxophleba* subsp. *loxophleba*

This vegetation unit, to 3m in height, occurs over the plain to the immediate east and southeast of the Morawa Rifle Range (Reserve 46614) where it is associated with scattered *Eucalyptus loxophleba* subsp. *loxophleba,* as a narrow strip of vegetation to the southwest of the Koolanooka Hills and as a more degraded and open vegetation to the immediate northwest and west of the old Koolanooka Mine pit. The southern example of this vegetation type is associated with a high level of litter as a result of bark shed and leaf and limb fall. This vegetation type is also associated with a larger

unfenced remnant on a granite outcrop to the northeast of the old Koolanooka Mine Pit. Less common species associated with this vegetation type included *Grevillea paradoxa, Dodonaea inaequifolia, Eremophila clarkei, Acacia tetragonophylla, Hakea preissii* and *Cratystylis spinescens*. Apart from scattered *Ptilotus obovatus* var. *obovatus* and *Cephalipterum drummondii* there were few herbaceous species recorded from this vegetation type.

16. Tall Shrubland of *Acacia tetragonophylla, Acacia acuminata, Acacia exocarpoides* and *Hakea preissii* on bare ground

This vegetation type to 3m in height is associated with a relatively small area of remnant vegetation with a degraded understorey and a paucity of native herb or grass species as a result of over-grazing. Other species less commonly recorded from this vegetation type included *Rhagodia baccata, Acacia ramulosa* var. *ramulosa, Melaleuca uncinata,* and *Dodonaea inaequifolia*.

17. Tall Shrubland to Tall Open Scrub of *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Acacia assimilis* subsp. *assimilis*

This vegetation type, to 3m in height, was recorded immediately to the south of Koolanooka Springs Rd adjacent to eastern boundary of the study area. The understorey was degraded as a result of overgrazing with relatively few native herb species recorded. Associated shrub species included *Grevillea paradoxa, Hakea preissii, Acacia tetragonophylla, Santalum acuminatum* and *Calothamnus gilesii*, with an occasional scattered *Allocasuarina huegeliana* tree.

18. Tall Shrubland *Hakea preissii* on bare ground

This vegetation association was recorded from an area to the immediate west of Koolanooka Springs (Reserve 19005) and the immediate north of Koolanooka Spring Rd. The vegetation, which was to 2.5m in height, was relatively homogeneous in terms of species composition, with occassional scattered *Acacia acuminata* and *Acacia tetragonophylla*.

19. Tall Open Shrubland dominated by *Acacia acuminata*

This *Acacia acuminata* dominated vegetation type to 4m in height occurred over a relatively flat area to the north of Koolanooka Spring Rd. Other species recorded from the lower stratum included *Acacia tetragonophylla, Allocasuarina campestris, Dodonea inaequifolia, Cratystylis spinescens, Melaleuca fulgens* subsp. *steedmanni, Grevillea dielsiana, Hakea preissii.* Scattered herb species includes *Prostanthera magnifica* and *Borya sphaerocephala*.

20. Shrubland dominated by *Acacia exocarpoides* on granite outcrop

This relatively homogeneous vegetation type to 2m in height occurred over several small granite outcrops to the north of Koolanooka Spring Rd. Several species were recorded from the herb layer including *Dianella revoluta, Lobelia winfridae, Podolepis lessonii, Ptilotus obovatus* var. *obovatus, Rhodanthe charsleyae, Waitzia acuminata* subsp. *acuminata* and *Cephalipterum drummondii.*

21. Tall Open Shrubland of *Acacia ramulosa* var. *ramulosa* on stony, bare ground

This vegetation type, which was to 3m in height, was associated with the northern portion of a relatively large, unfenced remnant to the northeast of Koolanooka Springs (Reserve 19005). Less common species recorded from this vegetation type included *Hakea preissii, Acacia tetragonophylla* and *Cratystylis spinescens.*

22. Tall Shrubland of Mixed *Acacia* spp. with scattered *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground

This vegetation type was recorded from a large, unfenced remnant abutting the northern boundary of the study area. The dominant species included *Acacia acuminata*, *Acacia ramulosa* var. *ramulosa*, *Acacia tetragonophylla* and *Acacia exocarpoides* to 4m in height with scattered *Eucalyptus loxophleba* subsp. *loxophleba* tree to 5m. Less common species recorded from this vegetation type included *Dodonaea adenophora* and *Hakea recurva,* while herb species included *Solanum lasiophyllum, Lobelia winfridae, Schoenia cassiniana* and *Helichrysum craspedioides*.

23. Open Shrubland of *Acacia acuminata, Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla.*

This vegetation type was recorded from several, degraded unfenced remnants surrounded by cleared farmland to the immediate north of the existing Koolanooka Mine pit. Apart from scattered *Ptilotus exaltatus* var. *exaltatus* and *Ptilotus obovatus* subsp. *obovatus,* very few native understorey species were associated with this vegetation type.

24. Tall Shrubland of *Acacia acuminata, Allocasuarina campestris* and *Melaleuca leiocarpa*

This vegetation type is associated with a narrow strip of vegetation that adjoins cleared pasture to the east of the existing Koolanooka Mine pit. The surface of the ground of this vegetation type was mostly bare and stony with areas of *Borya sphaerocephala* the most prominent component of the herb layer.

25. Shrubland to Closed Tall Scrub of *Acacia assimilis* subsp. *assimilis, Acacia ramulosa* var. *ramulosa, Grevillea intregrifolia*

This vegetation type was widespread over the plain to the west of the Koolanooka Hills ranges which surrounds the old Koolanooka Mine administration area and is one of largest vegetation types represented in the study area. Other, less common shrub species associated with this vegetation type included *Melaleuca cordata, Hakea preissii* and *Senna artemisioides* subsp. *artemisioides*.

26. Open Tree Mallee of *Eucalyptus eudesmioides*

This vegetation was associated with a small area (<0.1ha) adjacent to a windmill to the southwest of the Koolanooka Hills, approximately 1km to the northeast of the junction of Fallon and Koolanooka Spring Rd.

27. Tall Shrubland to Open Shrubland dominated by *Acacia assimilis* subsp. *assimilis, Acacia burkitii, Acacia resinosa, Grevillea intregrifolia* and *Hakea preissii*

This is a variable vegetation type, which ranges from a very open, predominantly cleared vegetation adjacent to the old Koolanooka mine administration area to a more closed tall shrubland dominated by *Acacia assimilis* subsp. *assimilis, Acacia burkitii, Acacia resinosa, Grevillea intregrifolia* and *Hakea preissii* near the corner of Koolanooka Spring and Fallon Roads.

28. Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground

This vegetation is associated with two degraded remnants either side of Morawa Rd East, approximately 1km west of Fallon Rd, abutting the western boundary of the study area. Although currently fenced, these remnants have been previously grazed and are consequently in degraded condition. The vegetation associated with both remnants was associated with a high level of litter as a result of bark shed and limb fall. Scattered understorey shrub species included *Acacia ramulosa* var. *ramulosa*, *Acacia tetragonophylla* and *Melaleuca uncinata*. Herb species recorded from this vegetation type included *Ptilotus exaltatus* var. *exaltatus, Ptilotus obovatus* subsp. *obovatus, Sclerolaena densiflora, S. drummondii, Maireana georgei* and *Maireana carnosa*.

29. Tall Shrubland of *Acacia aneura, Acacia tetragonophylla* and *Grevillea intregrifolia*

This vegetation type to 3m in height, occurs as a large unfenced remnant in the northeastern corner of the study area. A minor drainage line that flows in a northerly direction, intersects the southwestern corner of the remnant, which is a CALM managed reserve. The most common species were *Acacia aneura, Acacia tetragonophylla* and *Grevillea intregrifolia* while less common shrub species included *Hakea preissii, Acacia assimilis* subsp. *assimilis* and *Acacia exocarpoides.* Herb and grass species recorded from this vegetation type includes *Maireana drummondii, Sclerolaena densiflora, Ptilotus obovatus* var. *obovatus, Austrostipa elegantissima, Avena barbata, Solanum lasiophyllum* and *Cephalipterum drummondii*.

30. Tall Shrubland to Tall Open Scrub of *Acacia aneura, Acacia assimilis* subsp. *assimilis, Grevillea intregrifolia, Grevillea paradoxa* and *Allocasuarina campestris* with scattered *Eucalyptus loxophleba* subsp. *loxophleba* and *Eucalyptus leptopoda.*

This is a mostly intact vegetation type recorded from a remnant to the immediate north of the existing Koolanooka Mine pit. Dominated by *Acacia aneura, Acacia assimilis* subsp. *assimilis, Grevillea intregrifolia, Grevillea paradoxa* and *Allocasuarina campestris* to 4m in height this vegetation type occurs over a gently sloping plain. Other shrub species recorded from this vegetation type included *Grevillea obliquistigma* subsp. *obliquistigma, Grevillea paniculata, Acacia acuminata, Hakea preissii, Olearia pimeleoides* and *Senna artemisioides* subsp. *filifolia*. Other species recorded from the herb layer included *Cephalipterum*

drummondii, Sida fibulifera, Sclerolaena uniflora, Dianella revoluta, Brachyscome ciliocarpa, Rhodanthe laevis, Thysanotus patersonii, Calandrinia eremaea and *Stypandra glauca.*

31. Tall Shrubland of *Acacia aneura and Melaleuca acuminata* subsp. *websteri* with scattered *Eucalyptus oldfieldii* subsp. *oldfieldii*

This vegetation type, up to 3m in height, is represented by two small, unfenced remnants to the immediate west of Koolanooka Spring Rd. These remnants are highly disturbed and virtually devoid of ground cover as a result of over-grazing and have a high level of litter as a result of bark shed and limb fall.

4.2 Threatened Ecological Communities

Ecological Communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat (Blyth and English, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, ie Presumed Totally Destroyed, Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Some TECs are protected under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*. Although TEC's are not protected under the *Wildlife Conservation Act 1950* or any other Western Australian legislation, some TECs trigger the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999.* In addition, the EPA's position on TECs as described in its Guidance Statement Number 10 (EPA, 2003), states that proposals that result in the direct loss of threatened ecological communities are likely to be formally assessed.

Plant assemblages of the Koolanooka System were assessed by the WA Threatened Ecological Communities Scientific Committee in October 1999 as Vulnerable. The Koolanooka System TEC is described by the Department of Conservation and Land Management as *Allocasuarina campestris* scrub over red loam on hill slopes; shrubs and emergent mallees on shallow red loam over massive ironstone on steep rocky slopes; *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* sp. scrub on granite.

The description of the Koolanooka System TEC provided by CALM and based on the description of Beard's Koolanooka Vegetation System (Beard, 1976) broadly corresponds with the description of several vegetation types mapped for the Koolanooka study area during this assessment (Figure 4). These are:

1 Closed Tall Scrub dominated by *Acacia assimilis* subsp. *assimilis, Allocasuarina campestris* and *Melaleuca filifolia* over Herbland of mixed species and bare ground.

3. Open Woodland to Very Open Shrub Tree Mallee of *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over a Tall Open Shrubland to Tall Open Scrub of *Acacia*

acuminata, Acacia exocarpoides, Acacia tetragonophylla, Hakea preissii and *Melaleuca filifolia* with scattered *Allocasuarina huegeliana* over a herbland dominated by *Ptilotus obovatus* var. *obovatus.*

6 Open Woodland to Shrub Mallee of *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over a Tall Open Shrubland to Tall Open Scrub of *Acacia acuminata, Acacia exocarpoides, Acacia tetragonophylla, Hakea preissii* and *Melaleuca filifolia* with scattered *Allocasuarina huegeliana* over a herbland dominated by *Ptilotus obovatus* var. *obovatus.*

7 Very Open Tree Mallee to Low Open Woodland of *Eucalyptus oldfieldii* subsp. *oldfieldii* and *Allocasuarina huegeliana* on buckshot iron.

10 Tall Shrubland of *Allocasuarina campestris* on stony, bare ground

11 Closed Trees Mallee to Tree Mallee of *Eucalyptus leptopoda and Allocasuarina campestris* over an Open Shrubland of *Acacia assimilis* subsp. *assimilis, Acacia erinacea, Grevillea intregrifolia, Santalum acuminatum* and *Eremophila clarkei*

12 Open to Very Open Tree Mallee of *Eucalyptus kochii* subsp. *plenissiama* over Tall Open Scrub *Acacia tetragonophylla, Acacia acuminata, Melaleuca filifolia* and *Senna artemisioides* subsp. *helmsii* with scattered *Allocasuarina huegeliana*

13 Open Woodland of *Allocasuarina huegeliana* over Tall Open Scrub dominated by *Acacia acuminata, Melaleuca filifolia* and *Melaleuca uncinata* over a Herbland dominated by *Borya sphaerocephala*

20. Shrubland dominated by *Acacia exocarpoides* on granite outcrop

24. Tall Shrubland of *Acacia acuminata, Allocasuarina campestris* and *Melaleuca leiocarpa*

4.3 Flora

A total of 220 taxa belonging to 117 genera and 43 families were recorded from the Koolanooka Hills study area during the flora and vegetation survey undertaken by ATA Environmental during October 2003 (Appendix 1). This included 207 native and 13 introduced or non-endemic species. The dominant families were Asteraceae (Daisy family – 26 taxa), Mimosaceae (*Acacia* family – 21 taxa), Myrtaceae (*Eucalyptus* family – 21 taxa) and Poaceae (Grass family – 19 taxa). These four dominant families represented approximately 39% of the total number of taxa recorded from the study area.

4.4 Significant Flora

ATA Environmental undertook a search of CALM's Rare Flora Database prior to undertaken the field assessment. A total of 19 Declared Rare and Priority species were listed as having been previously recorded in the vicinity of the study area (Table 1).

Populations of two of the taxa listed as having been previously recorded from the vicinity of the study area (i.e. *Acacia acanthoclada* subsp. *glaucescens* (P3), and *Persoonia pentasticha* (P3)) as well populations of *Frankenia glomerata* (P3) and *Baeckea* sp. Three Springs (P2), which were not listed on CALM database search as occurring in the area, were recorded during the survey of the study area.

The majority (i.e ~20 plants) of the Priority 3 listed taxa *Acacia acanthoclada* subsp. *glaucescens* were recorded from an area to the west of Koolanooka Hills and north of Koolanooka Spring Rd in association with Tall Open Scrub of *Grevillea intregrifolia, Grevillea paradoxa, Acacia assimilis* subsp. *assimilis* and *Eremophila clarkei* with scattered *Eucalyptus leptopoda* over a stony surface and Tree Mallee of *Eucalyptus leptopoda* over *Acacia erinacea* dominated Low Shrubland over Herbland of *Ptilotus obovatus* var. *obovatus* and annual daisies and/or bare ground. A smaller number of plants (~10) were recorded from the small area of Tall Shrubland *Acacia tetragonophylla, Acacia acuminata, Acacia exocarpoides* and *Hakea preissii* on bare ground to the immediate north of Koolanooka Spring Rd, approximately 1km west of Koolanooka Springs (Reserve 19006). As this taxa could not be positively identified in the field, the precise location and population size of the taxa could only be estimated (Figure 3). An estimated 40 plants in total were recorded from four populations associated with two vegetation types.

A single individual plant of the Priority 2 listed *Persoonia pentasticha* was recorded from the study area, over an open portion of the Closed Tall Scrub dominated by *Acacia assimilis* subsp. *assimilis, Allocasuarina campestris* and *Melaleuca filifolia* on Band Iron Formation on the western slope of the Koolanooka Hills range (Figure 3).

A single plant of the Priority 3 listed *Frankenia glomerata* was recorded from an area Tall to Tall Open Shrubland dominated by *Acacia acuminata* and *Acacia aneura* adjacent to the Morawa Rifle Range (Reserve 46614) (Figure 3).

A population of approximately seven plants of the Priority 2 listed *Baeckea* sp. Three Springs was recorded from the small area of Tall Shrubland *Acacia tetragonophylla, Acacia acuminata, Acacia exocarpoides* and *Hakea preissii* on bare ground to the immediate north of Koolanooka Spring Rd, approximately 1km west of Koolanooka Springs (Reserve 19006) (Figure 3).

No Declared Rare Flora (DRF) were recorded from the study area during the October 2003 survey. The DRF taxon *Halosarcia bulbosa,* which has been previously recorded from the vicinity of the study area, is associated with saline sandy clays or red/brown loams. These types of soils are not found within the survey area and as a consequence it can be stated with a high level of certainty that this species does not occur within the study area. Another DRF taxon previously recorded from the vicinity of the study area, *Eremophila rostrata,* an erect shrub, 1.2–3 m high with red to pink flowers, on sandy loam, stony saline clay, granite and quartzite hills, is quite distinguishable and would have been identified from the study area had it occurred there.

4.5 Weeds

Very few weeds or introduced species were recorded during the survey of the study area. The majority of these species were recorded from unfenced remnants on farmland that exhibited signs of having been extensively grazed by sheep. It is likely that so few weed species were recorded from the vegetation associated with the Koolanooka Hills because stock were unlikely to have ever grazed on the hills, preferring the pasture on the surrounding flats.

A total of 13 weed species were recorded from the study (see Appendix 1). Paterson's Curse (*Echium plantagineum*), which was most prevalent on the edges of access tracks surrounding the old Koolanooka Mine pit, is considered by the Department of Agriculture to be a Declared Weed. No other Declared Weeds were recorded from the study area.

5. DISCUSSION AND CONCLUSIONS

A total of 31 vegetation types were recorded from the Koolanooka study area. The most prominent and extensive vegetation type was the vegetation associated with significant proportion of the plateau and eastern slopes of the banded ironstone hills (Koolanooka Hills) (i.e Vegetation Type No. 3 - Open Woodland to Very Open Shrub Tree Mallee of *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over a Tall Open Shrubland to Tall Open Scrub of *Acacia acuminata, Acacia exocarpoides, Acacia tetragonophylla, Hakea preissii* and *Melaleuca filifolia* with scattered *Allocasuarina huegeliana* over a herbland dominated by *Ptilotus obovatus* var. *obovatus*).

As many as ten of the vegetation types described in this report are similar to or share major components with the Threatened Ecological Community (TEC) *Plant Assemblages of the Koolanooka System* was described and assessed by the Department of Conservation and Land Management in 1999 as Vulnerable. The *Plant Assemblages of the Koolanooka System* TEC is not listed as a Threatened Ecological Community under the *Environmental Protection and Biodiversity Conservation Act* 1999. The TEC is also known from the adjacent "Perenjori Hills", which are a range of long, narrow hills approximately 8km to the SE of Koolanooka Hills. It is understood that CALM considers that all vegetation associated with the Koolanooka System (including the Koolanooka Hills and the surrounding plains vegetation, of which a significant proportion of has been previously cleared) to be analogous with the TEC.

Four Priority Listed taxa representing seven populations were recorded from the study area during the October 2003 survey. This included approximately 40 plants from 4 populations of the Priority 3 listed *Acacia acanthoclada* subsp. *glaucescens* plants. Only one of the Priority listed taxa recorded from the study area, a single plant of the Priority 2 listed *Persoonia pentasticha,* was recorded on the Banded Iron Formation on Koolanooka Hills and is likely to the adversely affected by future mining operations in the area. This species is known from several populations in the vicinity of the Koolanooka study area, including near Perenjori, Mullewa and a recent record from the adjacent Mt Gibson Mining exploration lease to the immediate south of the study area.

REFERENCES

Beard, J.S. (1976) *The Vegetation of the Perenjori Area of Western Australia.* Map and Explanatory Memoir Series, Vegmap Publications.

Department of Conservation and Land Management (2003). Description of the Threatened Ecological Community (*Plant Assemblages of the Koolanooka System*0. Email

English, V. and Blythe, J. (1997). *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province.* ANCA National Reserves System Cooperative Program.

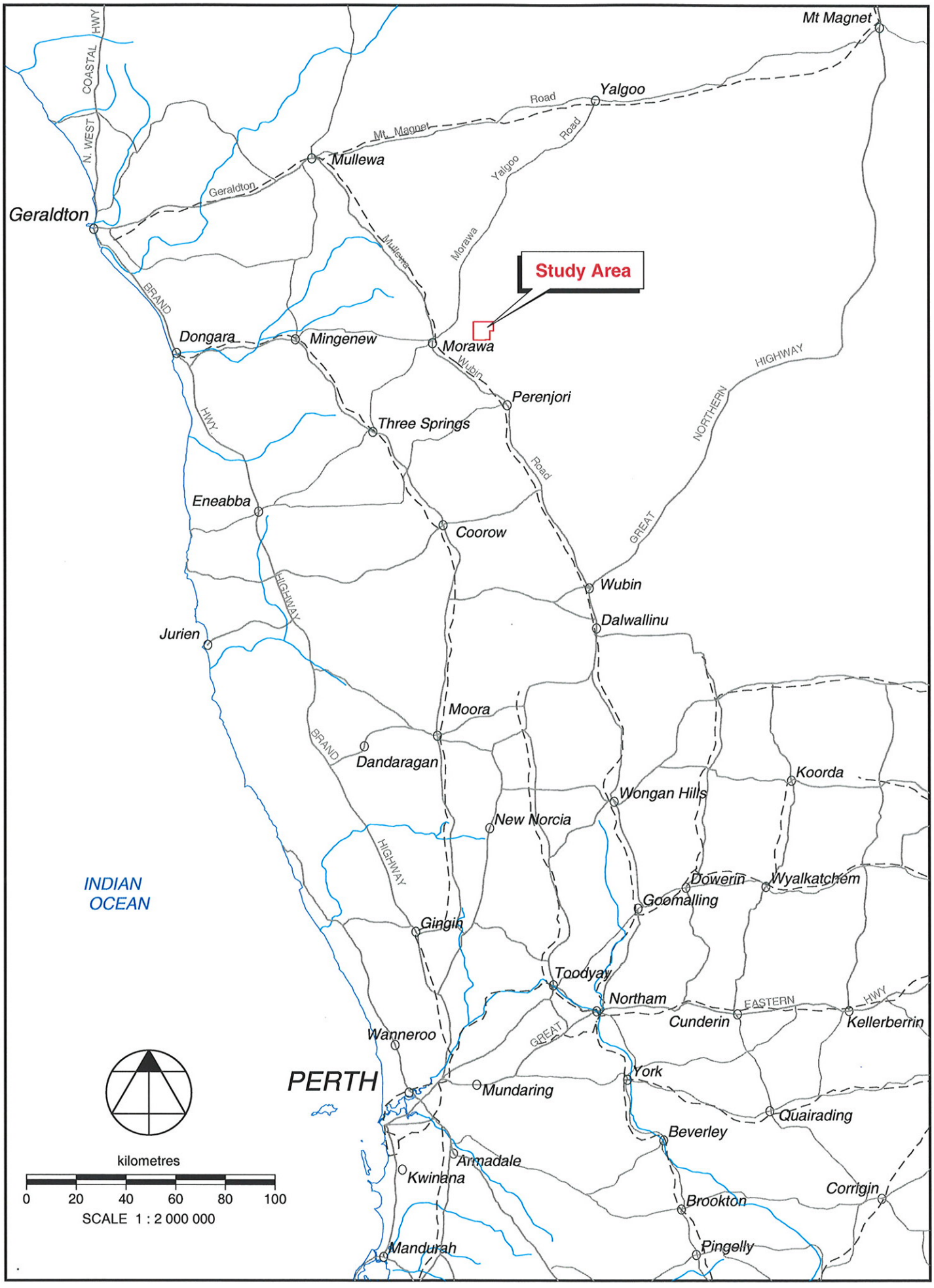
Environmental Protection Authority (2003). *Guidance for the Assessment of Environmental Factors: Terrestrial flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* EPA, No. 51 Draft February, 2003.

Rogers L.G. (1996) *Geraldton Region Land Resources Survey*. Land Resources Series No 13. Agriculture Western Australia

Thackway, R and Cresswell, I.D. (1995). *An Interim Biogeographic Regionalisation for Australia: Biogregions of Western Australia*. Australia Nature Conservation Agency, Canberra.

Wilcox, D.G., Lefroy, E.C., Stoneman, T.C., Schoknecht, N.R., and Griffin, E.A. (1996) *Trees and Shrubs for the Midlands and Northern Wheatbelt.* Agriculture Western Australia.

FIGURES



PRINTED: Fri 26 Mar 04 CHECKED BY: SG 25-3-04 DRAWN BY: GLM 25-3-04 DATUM: AMG MIS-2003-001/KOOL/VEAS/24_23f1.dgn

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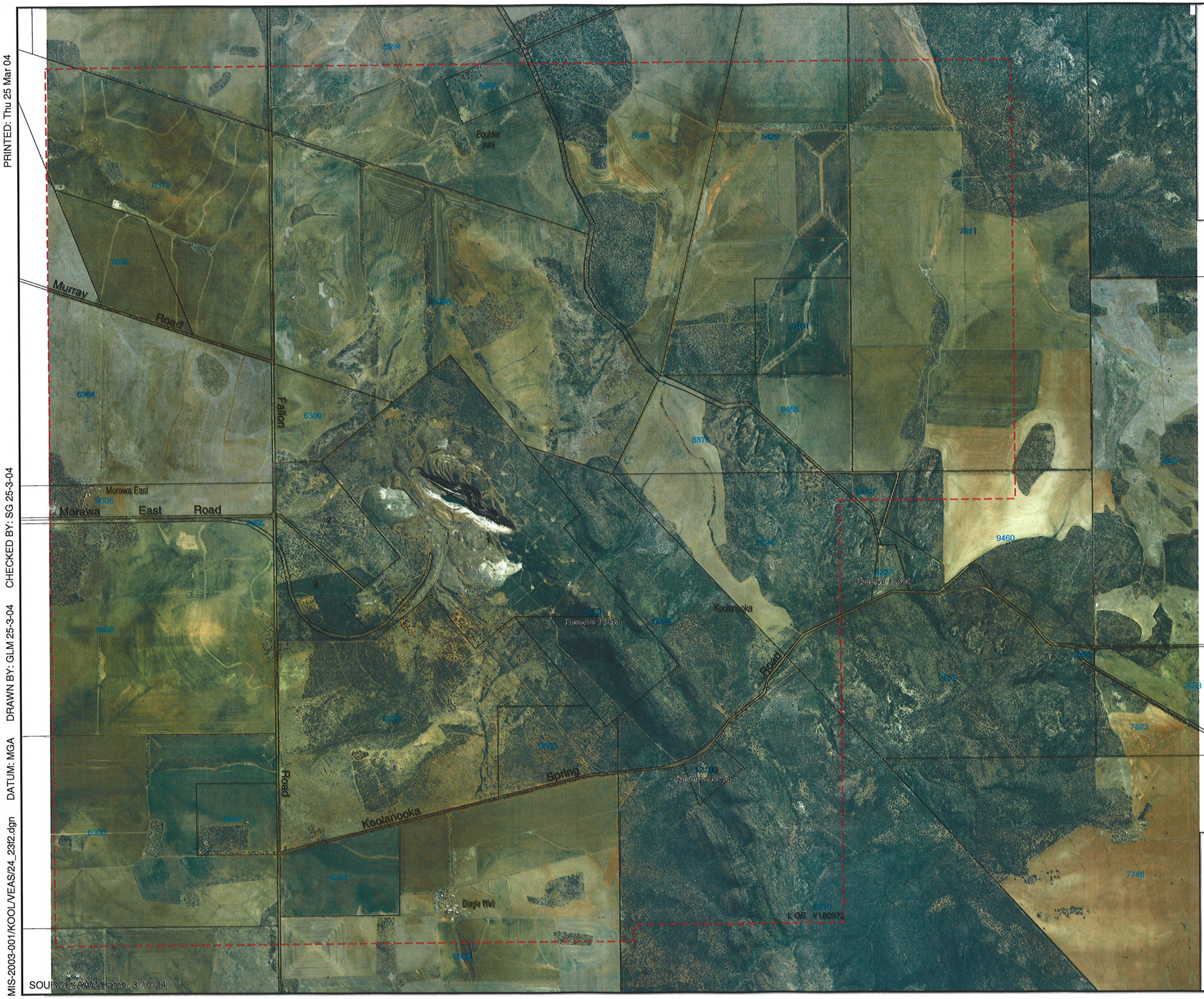
VEGETATION AND FLORA ASSESSMENT, KOOLANOOKA

REGIONAL LOCATION

FIGURE 1



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VEGETATION AND FLORA ASSESSMENT, KOOLANOOKA

AERIAL PHOTOGRAPH

FIGURE 2

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Boulder (ruin)

Murray Road

Fallon Road

Morawa East Road

Koolanooka Road

Spring

Reserve 46614

Dingle Well

Aa Pp Bsp Fg

CADASTRA SOURCE: AAM Hatch 3-10-03

LEGEND

Boundary of Study Area

Cadastral Boundary

Vegetation Type Boundary

VEGETATION TYPES

1 Closed Tall Scrub dominated by *Acacia assimilis* subsp. *assimilis*, *Allocasuarina campestris* and *Melaleuca filifolia* over Herbland of mixed species and bare ground.

2 Closed Heath to Tall Open Scrub dominated by *Acacia acuminata, Acacia aneura, Grevillea intregrifolia* and *Melaleuca cordata* over Herbland of *Cephalipterum drummondii, Xanthosia bungei, Podolepis lessonii*

3 Open Woodland to Shrub Mallee of *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over a Tall Open Shrubland to Tall Open Scrub of *Acacia acuminata, Acacia exocarpoides, Acacia tetragonophylla, Hakea preissii* and *Melaleuca filifolia* with scattered *Allocasuarina huegeliana* over a herbland dominated by *Ptilotus obovatus* var. *obovatus*.

4 Open Heath of *Aluta appressa, Aluta aspersa* subsp. *hesperia, Acacia acuminata, Acacia assimilis* subsp. *assimilis* over an Open Herbland of *Borya sphaerocephala. Waitzia acuminata* subsp. *acuminata, Brunonia australis* and *Glischrocaryon aureum* with large areas of bare open ground

5 Closed Tall Scrub of *Acacia acuminata* and *Acacia assimilis* subsp. *assimilis* over large areas of bare ground

6 Tall Shrubland dominated by *Acacia acuminata* and *Allocasuarina campestris*

7 Very Open Tree Mallee to Low Open Woodland of *Eucalyptus oldfieldii* subsp. *oldfieldii* and *Allocasuarina huegeliana* on buckshot iron.

8 Tall Open Scrub of *Grevillea intregrifolia, Grevillea paradoxa, Acacia assimilis* subsp. *assimilis* and *Eremophila clarkei* with scattered *Eucalyptus leptopoda* over a stony surface.

9 Tree Mallee of *Eucalyptus leptopoda* over *Acacia erinaceae* dominated Low Shrubland over Herbland of *Ptilotus obovatus* var. *obovatus* and annual daisies and/or bare ground

10 Tall Shrubland of *Allocasuarina campestris* on stony, bare ground

11 Closed Tree Mallee to Tree Mallee of *Eucalyptus leptopoda* and *Allocasuarina campestris* over an Open Shrubland of *Acacia assimilis* subsp. *assimilis, Acacia erinaceae, Grevillea intregrifolia, Santalum acuminatum* and *Eremophila clarkei*

12 Open to Very Open Tree Mallee of *Eucalyptus kochii* subsp. *plenissiama* over Tall Open Scrub *Acacia tetragonophylla, Acacia acuminata, Melaleuca filifolia* and *Senna artemisimoides* subsp. *helmsii* with scattered *Allocasuarina huegeliana*

13 Open Woodland of *Allocasuarina huegeliana* over Tall Open Scrub dominated by *Acacia acuminata, Melaleuca filifolia* and *Melaleuca uncinata* over a Herbland dominated by *Borya sphaerocephala*

14 Closed Heath dominated by *Aluta maisonneuvei, Aluta appressa* and *Acacia assimilis* subsp. *assimilis*

15 Tall to Tall Open Shrubland dominated by *Acacia acuminata* and *Acacia aneura* with scattered *Eucalyptus loxophleba* subsp. *loxophleba*

16 Tall Shrubland of *Acacia tetragonophylla, Acacia acuminata, Acacia exocarpoides* and *Hakea preissii* on bare ground

17 Tall Shrubland to Tall Open Scrub of *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Acacia assimilis* subsp. *assimilis*

18 Tall Shrubland of *Hakea preissii* on bare ground

19 Tall Open Shrubland dominated by *Acacia acuminata*

20 Shrubland dominated by *Acacia exocarpoides* on granite outcrop

21 Tall Open Shrubland of *Acacia ramulosa* var. *ramulosa* on stony, bare ground

22 Tall Shrubland of Mixed *Acacia* sp. with scattered *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground

23 Open Shrubland of *Acacia acuminata, Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla*

24 Tall Shrubland of *Acacia acuminata, Allocasuarina campestris* and *Melaleuca leiocarpa*

25 Shrubland to Closed Tall Scrub of *Acacia assimilis* subsp. *assimilis, Acacia ramulosa* var. *ramulosa, Grevillea intregrifolia*

26 Open Tree Mallee of *Eucalyptus eudesmioides*

27 Tall Shrubland to Open Shrubland dominated by *Acacia assimilis* subsp. *assimilis, Acacia burkitii, Acacia resinosa, Grevillea intregrifolia* and *Hakea preissii*

28 Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground

29 Tall Shrubland of *Acacia aneura, Acacia tetragonophylla* and *Grevillea intregrifolia*

30 Tall Shrubland to Tall Open Scrub of *Acacia aneura, Acacia assimilis* subsp. *assimilis, Grevillea intregrifolia, Grevillea paradoxa* and *Allocasuarina campestris* with scattered *Eucalyptus loxophleba* subsp. *loxophleba* and *Eucalyptus leptopoda*

31 Tall Shrubland of *Acacia aneura* and *Melaleuca acuminata* subsp. *webster*i with scattered *Eucalyptus oldfieldi*i subsp. *oldfieldii*

C Cleared / Predominently Cleared

PRIORITY LISTED FLORA

Location of Population

Aa *Acacia acanthoclada* subsp. *glaucescens* (P3)

Bsp *Baeckea* sp. Three Springs (P2)

Fg *Frankenia glomerata* (P3)

Pp *Persoonia pentasticha* (P2)

metres

0 200 400 600 800 1000

SCALE 1 : 30 000

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VEGETATION AND FLORA ASSESSMENT, KOOLANOOKA

VEGETATION TYPES AND PRIORITY LISTED FLORA

FIGURE 3

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DATUM: MGA

MIS-2003-001/KOOL/VEAS/24_23f4.dgn

metres

0 200 400 600 800 1000

SCALE 1 : 30 000

LEGEND

- Study Area Boundary
- Cadastral Boundary
- Vegetation Type Boundary
- Vegetation Types Corresponding with CALM's Description of the Threatened Ecological Community (Plant Assemblies of the Koolanooka System)

NOTE: For Vegetation Types Legend see Figure 3.

Boulder (ruin)

Murray Road

Fallon Road

Morawa East Road

Koolanooka Spring Road

Dingle Well

Reserve 46614

0980 Reserve 19005

CADASTRA SOURCE: AAM Hatch 3-10-03

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VEGETATION AND FLORA ASSESSMENT, KOOLANOOKA

VEGETATION TYPES CORRESPONDING WITH CALM's DESCRIPTION OF THE TEC

FIGURE 4

PLATES

1. **Closed Tall Scrub** dominated by ***Acacia assimilis* subsp. *assimilis*, *Allocasuarina campestris*** **and *Melaleuca filifolia* over Herbland of mixed species and bare ground**

2. **Closed Heath** dominated by *Acacia acuminata, Acacia aneura, Grevillea intregrifolia* and *Melaleuca cordata*

3. **Open Woodland to Woodland *Eucalyptus ebbanoensis* subsp. *ebbanoensis* over *Acacia acuminata, Acacia exocarpoides, Acacia tetragonophylla, Allocasuarina huegeliana, Hakea preissii* and *Melaleuca filifolia* Tall Open Shrubland to Tall Open Scrub over a herbland dominated by *Ptilotus obovatus* var. *obovatus.***

4. **Open Heath *Aluta appressa, Aluta aspersa* subsp. *hesperia*, Acacia *acuminata, Acacia assimilis* subsp. *assimilis* over an Open Herbland of *Borya sphaerocephala. Waitzia acuminata* subsp. *acuminata, Brunonia australis* and *Glischrocaryon aureum* with large areas of bare open ground**

5. **Closed Tall Scrub of *Acacia acuminata* and *Acacia assimilis* subsp. *assimilis* over large areas of bare ground**

6. **Tall Shrubland of *Acacia acuminata* and *Allocasuarina campestris***

7. **Very Open Tree Mallee to Low Open Woodland *Eucalyptus oldfieldii* subsp. *oldfieldii* and *Allocasuarina huegeliana* on buckshot iron.**

8. Tall Open Scrub of *Grevillea intregrifolia, Grevillea paradoxa, Acacia assimilis* subsp. *assimilis* and *Eremophila clarkei* with scattered *Eucalyptus leptopoda*

9. Tree Mallee of *Eucalyptus leptopoda* over *Acacia erinaceae* dominated Low Shrubland over Herbland of *Ptilotus obovatus* subsp. *obovatus* and annual daisies and/or bare ground

10. **Tall Shrubland of *Allocasuarina campestris***

11. Closed Trees Mallee to Tree Mallee of *Eucalyptus leptopoda and Allocasuarina campestris* over an Open Shrubland of *Acacia assimilis* subsp. *assimilis, Acacia erinaceae, Grevillea intregrifolia, Santalum acuminatum* and *Eremophila clarkei*

12. **Open Tree Mallee of *Eucalyptus kochii* subsp. *plenissiama* over Tall Open Scrub of *Acacia tetragonophylla, Acacia acuminata, Melaleuca filifolia* and *Senna artemisimoides* subsp. *helmsii* with scattered *Allocasuarina huegeliana***

13. **Open Woodland *Allocasuarina huegeliana* over Tall Open Scrub dominated by *Acacia acuminata, Melaleuca filifolia* and *Melaleuca uncinata* over a Herbland dominated by *Borya sphaerocephala***

14. **Closed Heath dominated by Closed Heath dominated by** *Aluta maisonneuvei, Aluta appressa* and *Acacia assimilis* subsp. *assimilis*

15. **Tall to Tall Open Shrubland dominated by*Acacia acuminata* and *Acacia aneura***

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16. **Tall Shrubland *Acacia tetragonophylla, Acacia acuminata, Acacia exocarpoides* and *Hakea preissii* on bare ground**

17. **Tall Shrubland to Tall Open Scrub of *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Acacia assimilis* subsp. *assimilis***

18. **Tall Shrubland *Hakea preissii* on bare ground**

19. **Tall Open Shrubland dominated by *Acacia acuminata***

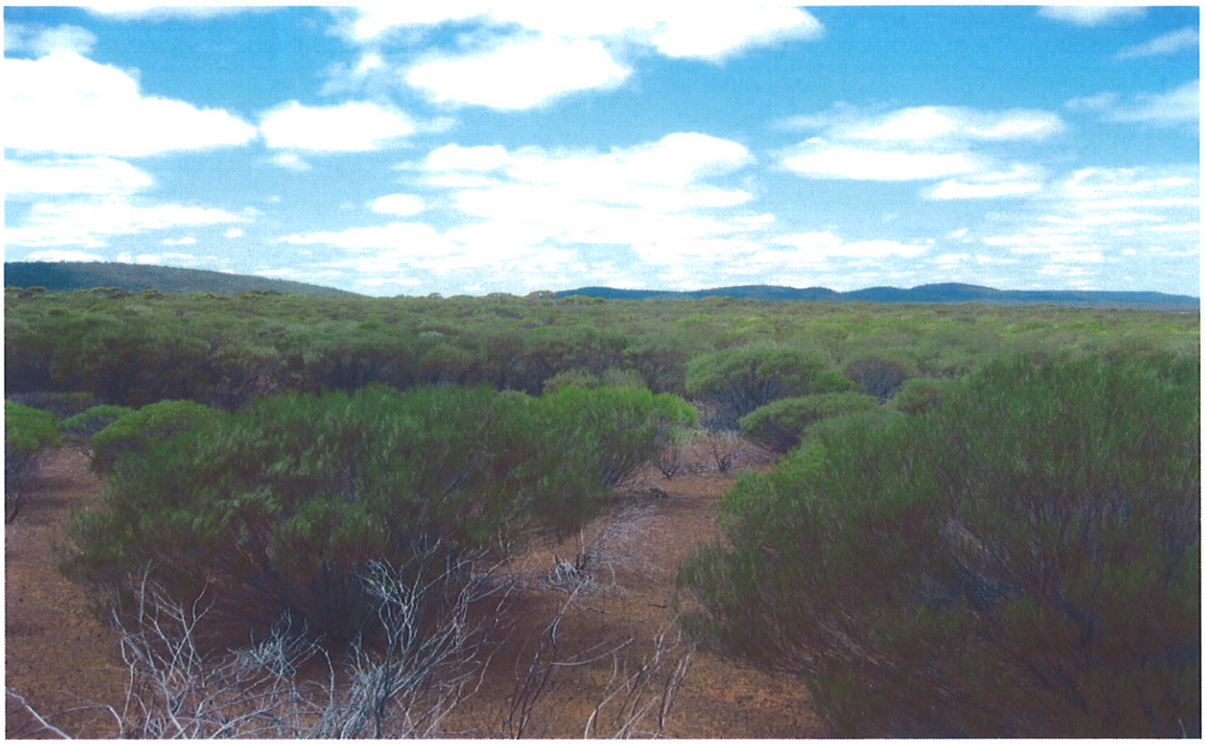
20. **Shrubland of *Acacia exocarpoides* on granite outcrop**

21. **Tall Open Shrubland *Acacia ramulosa* var. *ramulosa* on stony, bare ground**

22. **Tall Shrubland of Mixed *Acacia* sp. with scattered *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground**

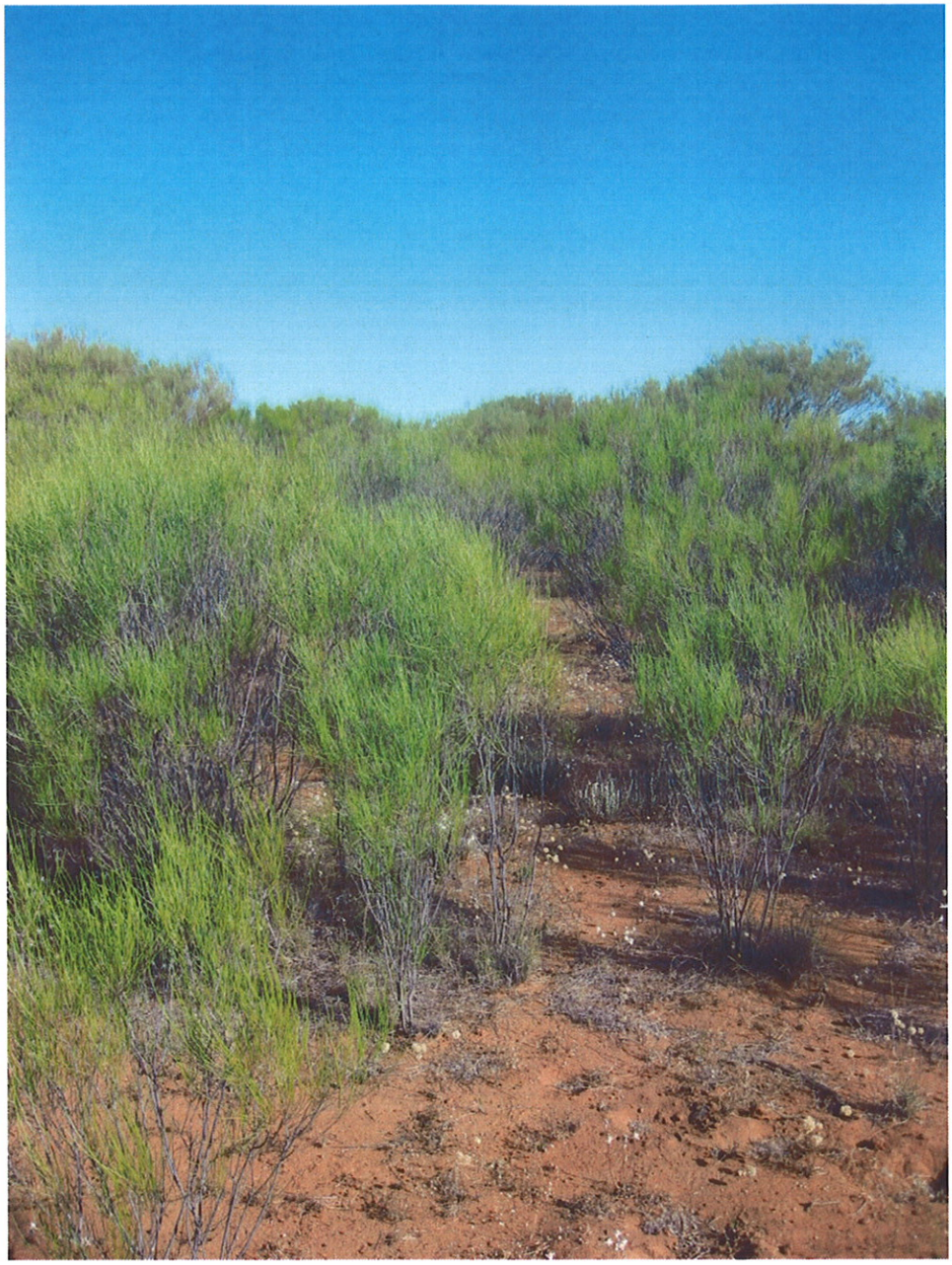
23. **Open Shrubland of *Acacia acuminata, Acacia ramulosa* var. *ramulosa* and *Acacia tetragonophylla***

24.* Shrubland of *Acacia acuminata, Allocasuarina campestris* and *Melaleuca leiocarpa



25 Shrubland to Closed Tall Scrub of *Acacia assimilis* subsp. *assimilis, Acacia ramulosa* var. *ramulosa, Grevillea intregrifolia*

26 **Open Tree Mallee *Eucalyptus eudesmioides***



27 Tall Shrubland to Tall Open dominated by *Acacia assimilis* subsp. *assimilis, Acacia burkitii, Acacia resinosa, Grevillea intregrifolia* and *Hakea preissii*

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28 **Low Open Woodland *Eucalyptus loxophleba* subsp. *loxophleba* on bare ground**

29 **Tall Shrubland *Acacia aneura, Acacia tetragonophylla* and *Grevillea intregrifolia***

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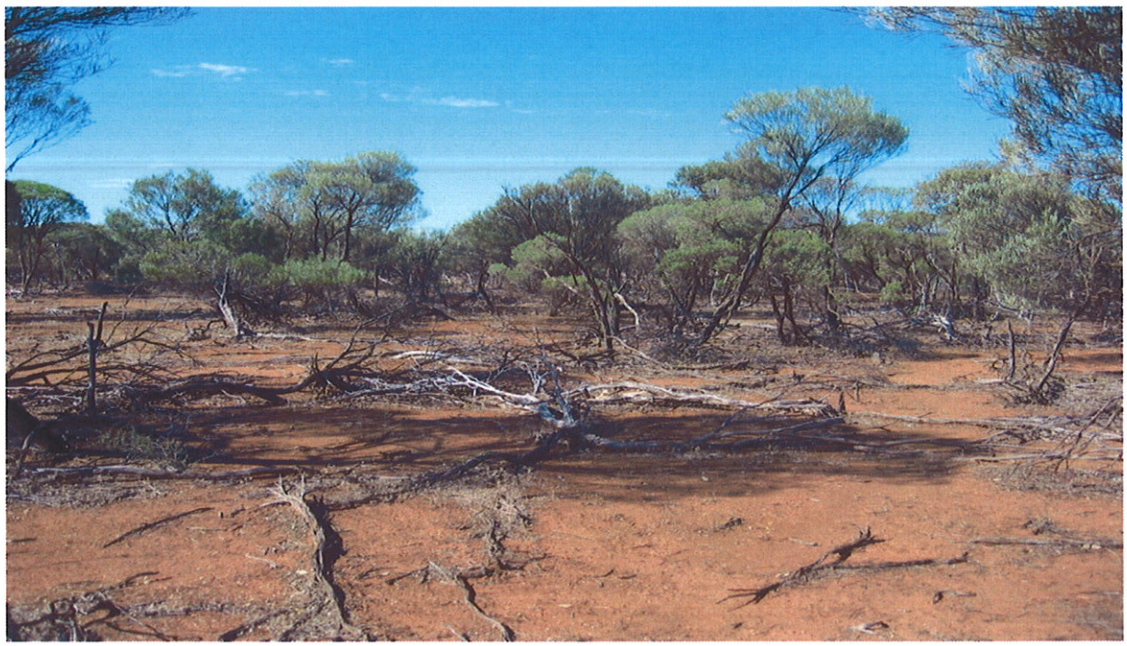
30 **Tall Shrubland to Tall Open Scrub of *Acacia aneura, Acacia assimilis* subsp. *assimilis, Grevillea intregrifolia, Grevillea paradoxa* and *Allocasuarina campestris* with scattered *Eucalyptus loxophleba* subsp. *loxophleba* and *Eucalyptus leptopoda.***



31 **Tall Shrubland *Acacia aneura and Melaleuca acuminata* subsp. *websteri* with scattered *Eucalyptus oldfieldii* subsp. *oldfieldii***

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32. Priority 3 listed *Persoonia pentasticha*

APENDICES

APPENDIX 1

FLORA SPECIES LIST
KOOLANOOKA HILLS

APPENDIX 1
FLORA SPECIES LIST
KOOLANOOKA HILLS

FAMILY	SPECIES
ADIANTACEAE	*Chielanthes sieberi*
AIZOACEAE	*Disphyma crassifolium*
	Gunniopsis septifraga
AMARANTHACEAE	*Ptilotus exaltatus* var. *exaltatus*
	Ptilotus obovatus var. *obovatus*
ANTHERICACEAE	*Arthropodium dyeri*
	Borya sphaerocephala
	Caesia occidentalis
	Dichopogon capillipes
	Thysanotus patersonii
APIACEAE	*Daucus glochidiatus*
	Trachymene cyanopetala
	Trachymene ornata
	Trachymene pilosa
	Xanthosia bungei
APOCYNACEAE	*Alyxia buxifolia*
ASTERACAEAE	*Angianthus tomentosus*
	Bellida graminea
	Brachyscome cheilocarpa
	Brachyscome ciliocarpa
	Cephalpiterum drummondii
	Chthonocephalus pseudevax
	Cratystylis subspinescens
	Glischrocaryon aureum
	Gnephosis tenuissima
	Helichrysum craspedioides
	**Hypochaeris glabra*
	Lawrencella davenportii
	Lawrencella rosea
	Millotia sp.
	Millotia perpusilla
	Minuria cunninghamii
	Myriocephalus occidentalis
	Olearia humilis
	Olearia muelleri
	Olearia pimeleoides
	Podolepis lessonii

FAMILY	SPECIES
	Rhodanthe charsleyae
	Rhodanthe chlorocephala
	Rhodanthe laevis
	Schoenia cassiniana
	**Sonchus olearus*
	Waitzia acuminata subsp. *acuminata*
BORAGINACEAE	**Echium plantagineum*
CAESALPINIACEAE	*Senna artemisioides* subsp. *artemisioides*
	Senna artemisioides subsp *filifolia*
	Senna artemisioides subsp. *helmsii*
	Senna artemisioides subsp. x *coriacea*
	Senna chatelainiana
	Senna glutinosa
CASUARINACAE	*Allocasuarina acutivalvis* subsp. *prinsepiana*
	Allocasuarina campestris
	Allocasuarina dielsiana
	Allocasuarina huegeliana
CHENOPODIACEAE	*Atriplex codonocarpa*
	Atriplex paludosa
	**Chenopodium murale*
	Enchylaena tomentosa var. *tomentosa*
	Maireana brevifiolia
	Maireana carnosa
	Maireana drummondii
	Maireana georgei
	Maireana tomentosa subsp. *tomentosa*
	Rhagodia baccata
	Rhagodia drummondii
	Rhagodia eremaea
	Rhagodia spinescens
	Salsola kali
	Sclerolaena densiflora
	Sclerolaena drummondii
	Sclerolaena eurotioides
	Sclerolaena uniflora
CYPERACEAE	*Gahnia drummondii*
	Isotropis cuneifolia
DASYPOGONACEAE	*Lomandra effusa*
DILLENIACEAE	*Hibbertia arcuata*
	Hibbertia subvaginata

FAMILY	SPECIES
	Hibbertia exasperata
DIOSCOREACEAE	*Dioscorea hastifolia*
DROSERACEAE	*Drosera* sp.
EPACRIDACEAE	*Astroloma serratifolium*
EUPHORBIACEAE	*Calycopeplus pauciflora*
	Ricinocarpus veltinus
	Euphorbia drummondii
FRANKENIACEAE	***Frankenia glomerata* (P3)**
GERANIACEAE	**Erodium botrys*
GOODENIACEAE	*Brunonia australis*
	Dampiera stenostachya
	Goodenia occidentalis
	Goodenia pinnatifida
	Scaevola spinescens
	Velleia rosea
GYROSTEMONACEAE	*Codonocarpus cotinifolius*
LAMIACEAE	*Hemigenia divaricata*
	Prostanthera magnifica
	Prostanthera patens
LAURACEAE	*Cassytha sp.*
LOBELIACEAE	*Lobelia winfridae*
LORANTHACEAE	*Amyema preissii*
MALVACEAE	*Sida fibulifera*
	Sida calyxhymenia
	Sida atrovirens
MIMOSACEAE	*Acacia acuaria*
	***Acacia acanthoclada. subsp. glaucescens* (P3)**
	Acacia acuminata
	Acacia aestivalis
	Acacia andrewsii
	Acacia aneura
	Acacia anthochaera
	Acacia assimilis subsp. *assimilis*

FAMILY	SPECIES
	Acacia burkitii
	Acacia colletoides
	Acacia ericksoniae
	Acacia erinacea
	Acacia exocarpoides
	Acacia hemiteles
	Acacia kochii
	Acacia ramulosa var. *ramulosa*
	Acacia resinosa
	Acacia resinomarginea
	Acacia scleroclada
	Acacia stowardii
	Acacia tetragonophylla
MYOPORACEAE	*Eremophila clarkei*
	Eremophila decipiens
	Eremophila forrestii
	Eremophila latrobei subsp. *latrobei*
	Eremophila longifolia
	Eremophila oldfieldii
	Eremophila oppositifolia subsp. *angustifolia*
	Eremophila pantonii
	Eremophila serrulata
	Eremophila viscida
MYRTACEAE	*Aluta appressa*
	Aluta aspersa subsp. *hesperia*
	Aluta maisonneuvei
	***Baeckea* sp.Three Springs (P2)
	Calothamnus gilesii
	Eucalyptus ebbanoensis subsp. *ebbanoensis*
	Eucalyptus eudesmioides
	Eucalyptus leptopoda
	Eucalyptus loxophleba subsp. *loxophleba*
	Eucalyptus kochii subsp. *plenissiama*
	Eucalyptus oldfieldii subsp. *oldfieldii*
	Melaleuca acuminata subsp. *websteri*
	Melaleuca cordata
	Melaleuca dichroma
	Melaleuca filifolia
	Melaleuca fulgens subsp. *steedmanni*
	Melaleuca leiocarpa
	Melaleuca nematophylla
	Melaleuca radula
	Melaleuca uncinata
	Thryptomene mucronulata
	Thryptomene racemulosa

FAMILY	SPECIES
ORCHIDACEAE	*Cyanicula gemmata*
	Diuris laxiflora
	Prasophyllum sargentii
PAPILIONACEAE	*Daviesia divaricata*
	Daviesia hakeoides subsp. *subnuda*
	Gastrolobium spinosum
	Mirbelia ramulosa
	Swainsona gracilis
PHORMIACEAE	*Dianella revoluta*
	Stypandra glauca
PITTOSPORACEAE	*Pittosporum angustifolium*
POACEAE	*Aristida contorta*
	Austrodanthonia caespitosa
	Austrostipa elegantissima
	Austrostipa scabra
	Austrostipa variabilis
	** Avena barbata*
	** Bromus diandrus*
	**Bromus hordeaceus*
	Eragrostis eriopoda
	** Ehrharta calycina*
	** Eragrostis curvula*
	Eriachne ovata
	Neurachne alopecuroidea
	Paractaenum novae-hollandiae
	** Pennisetum setaceum*
	** Pentaschistis airoides*
	Themeda triandra
	Thyridolepis multiculmis
	Tripogon loliiformis
POLYGONACEAE	*Comesperma volubile*
	Muehlenbeckia adpressa
	**Rumex vesicarius*
PORTULACACEAE	*Calandrinia eremaea*
	Calandrinia polyandra
	Calandrinia primuliflora
PROTEACEAE	*Grevillea dielsana*
	Grevillea intregrifolia
	Grevillea levis

FAMILY	SPECIES
	Grevillea obliquistigma subsp. *obliquistigma*
	Grevillea paniculata
	Grevillea paradoxa
	Grevillea stenostachya
	Grevillea teretifolia
	Hakea francisiana
	Hakea preissii
	Hakea recurva
	***Persoonia pentasticha* (P3)**
RUTACEAE	*Philotheca brucei*
SANTALACEAE	*Santalum acuminatum*
	Santalum spicatum
SAPINDACEAE	*Dodonaea adenophora*
	Dodonaea inaequifolia
	Dodonaea lobulata
	Dodonaea pinifolia
	Dodonaea rigida
SOLANACEAE	*Anthocercis genistoides*
	Anthotroche pannosa
	Solanum lasiophyllum
STERCULIACEAE	*Keraudrenia hermanniifolia*
THYMELEACEAE	*Pimelea leucantha*
	Pimelea micocephala
	Pimelea rosea
	Pimelea spiculigera
Total	207 Native Species 13 Introduced Species
* = Introduced species	
** = Priority Listed Species	
Subsp. = subspecies	
var. = variety	
sp. Three Springs = Identification name applied to this taxon	

APPENDIX 2

RESULTS OF DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT FLORA DATABASE SEARCH

Koolanooka

Your Ref:
Our Ref: 2001F001173VO11
Enquires: Melanie Harding
Phone: (08) 9334 0431
Fax: (08) 9334 0278
Email: melanieh@calm.wa.gov.au

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

ATA Environmental
Dilhorn House
2 Bulwer Street
PERTH WA 6000

Attention: Brian Donnelly

Dear Brian

REQUEST FOR RARE FLORA INFORMATION

I refer to your request of 19 September 2003 for information on rare flora in the Weld Range, Blue Hills and Koolanooka areas. The search co-ordinates used were as follows:

Weld Range	26^0 58' 12" - 27^0 03'00" S and 117^0 27' 00" - 117^0 34' 12" E.
Blue Hills	29^0 07' 12" - 29^0 10' 48" S and 116^0 44' 24" - 116^0 49' 12" E
Koolanooka	29^0 10' 48" - 29^0 15' 36" S and 116^0 00' 36" - 116^0 06' 00" E

A search was undertaken for this area of (**1**) the Department's *Threatened (Declared Rare) Flora* database (for results, if any, see "Summary of Threatened Flora Data" – coordinates are GDA94), (**2**) the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, if any, see "WAHERB Specimen Database General Enquiry"- coordinates are AGD84) and (**3**), the Department's *Declared Rare and Priority Flora List* [this list, which may also be used a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, if any, see "Declared Rare and Priority Flora List"].

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point which refers to the requirement to undertake field investigations for the accurate determination of rare flora occurrence at a site. *The information supplied should be regarded as an indication only of the rare flora that may be present and may be used as a target list in any surveys undertaken.*

An invoice for $300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of rare flora encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss rare flora management, please contact my Principal Botanist, Dr Ken Atkins, on (08) 9334 0425.

Yours faithfully

for Keiran McNamara
ACTING EXECUTIVE DIRECTOR

24 September, 2003

Attached

ATTACHMENT

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

RARE FLORA INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Executive Director, Department of Conservation and Land Management, Attention: Administrative Officer Flora, Wildlife Branch.

2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Executive Director, Department of Conservation and Land Management.

3. Specific locality information for Declared Rare Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for DRF may not be used in public reports without the written permission of the Executive Director, Department of Conservation and Land Management. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Department is to be contacted for guidance on the presentation of rare flora information.

4. Note that the Department of Conservation and Land Management respects the privacy of private landowners who may have rare flora on their property. Rare flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Conservation and Land Management.

5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Conservation and Land Management accepts no responsibility for this.

6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

7. It should be noted that the supplied data do not necessarily represent a comprehensive listing of the rare flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.

8. Acknowledgment of the Department of Conservation and Land Management as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Conservation and Land Management, Attention: Principal Botanist, Wildlife Branch.

THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

DECLARED RARE AND PRIORITY FLORA LIST

for Western Australia

CONSERVATION CODES

R: Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

ABBREVIATIONS USED IN THREATENED FLORA DATABASE PRINTOUTS

VESTING

AGR	Chief Exec Dept of Agriculture
ALT	Aboriginal Land Trust
BAP	Baptist Union of WA Inc
BSA	Boy Scouts Association
CC	Conservation Comission –NPNCA
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
DOL	Dept of Land Administration
DPU	Ministry for Planning
EXD	Exec Direc CALM
FRE	Freehold
HOW	Homeswest
ILD	Industrial Lands Develop. Auth
JOI	Joint Vesting-NPNCA & Shire
LAC	LandCorp
LFC	Lands and Forests Commission
MAG	Minister for Agriculture
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
NPN	NPNCA
OTH	Other
PRI	Private
RAI	Westrail
SEC	Western Power
SHI	Shire
SPC	State Planning Commission
TEL	Telstra
TGR	Timber Govt Requirement
TOW	TOWN
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
AER	Aerodrome
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CPK	Car Park
COM	Common
CON	Conservation Park
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes UWA
ENE	Enjoyment of Natural Environ.
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GRE	Green Belt
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAC	Public access
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUT	Public Utility
QUA	Quarry
RAD	Radio Station
RAC	Racecourse
REC	Recreation
REH	Rehabilitation
RNP	Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHI	Shire Requirements
SHO	Showgrounds
SNN	Sanitary
STO	Stopping place
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
TVT	Television transmitting
UNK	Unknown
UTI	Utilities
VCL	Vacant Crown Land
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WCO	Water & Conservation of F & F
WOO	Firewood

Kadlancoka

Taxon Name	Cons.	Pop ID	Latitude	Longitude	Purpose	Vest
Fitzwillia axilliflora	2	1	29^14'47.5"	116^02'05.2"		UNK
Gnephosis setifera	1	1	29^15'28.0"	116^01'04.4"	VCL	DOL

A total of 2 records were printed.

Koolanooka.

WAHERB SPECIMEN DATABASE GENERAL ENQUIRY – Koolanooka

Acacia acanthoclada
F.Muell. subsp. glaucescens Maslin (Mimosaceae)
CONSERVATION STATUS:P3
Coll.: S. Patrick SP 2260 Date: 20 06 1995 (PERTH 04210964)
LOCALITY Munckton Road ca 3.2 km W of Fallon Road WA
LAT 29 Deg 11 Min 0.000 Sec S LONG 116 Deg 6 Min 0.000 Sec E
Abundance: estimated 20 mature with flower buds over 2 x 20 m area.

Angianthus micropodioides
(Benth.)Benth. (Asteraceae)
CONSERVATION STATUS:P3
Coll.: P.S. Short, K. Watanabe, K. Kosuge & T PSS 4509 Date: 29 10 1995 (PERTH 05015596)
LOCALITY 5 km from Morawa on road to Perenjori, Avon Botanical District, WA
LAT 29 Deg 15 Min 2.000 Sec S LONG 116 Deg 0 Min 40.000 Sec E
On samphire ridge in saline depression.

Epitriche demissus
(A.Gray)P.S.Short (Asteraceae)
CONSERVATION STATUS:P2
Coll.: R. Melville & J. Calaby RM 4279 Date: 22 07 1953 (PERTH 04549139)
LOCALITY 3 miles SE of Morawa on Goomalling - Mullewa road WA
LAT 29 Deg 14 Min 26.000 Sec S LONG 116 Deg 2 Min 36.000 Sec E
Herb - flowers dark red. Near salt lake on sandy clay.
Previous det.: ? Myriocephalus sp.

Epitriche demissus
(A.Gray)P.S.Short (Asteraceae)
CONSERVATION STATUS:P2
Coll.: P.S. Short 1642 Date: (PERTH 500208)
LOCALITY C. 5 km S of Morawa along the main road to Perenjori WA
LAT 29 Deg 15 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E
Annual herb, forming variably dense mats on ground. light brown sand & very sandy loam saline depression
shrubs Halosarcia Atriplex

Fitzwillia axilliflora
(Ewart & Jean White)P.S.Short (Asteraceae)
CONSERVATION STATUS:P2
Coll.: P.S. Short, M. Amerena & B.A. Fuhrer PSS 2959 Date: 16 09 1986 (PERTH 1056816)
LOCALITY 5 km S of Morawa along road to Perenjori WA
LAT 29 Deg 15 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E
Florets pale white. Saline flats. Growing on sandy ridge. With samphire.
Previous det.: Angianthus axilliflorus

Gnephosis setifera
P.S.Short (Asteraceae)
CONSERVATION STATUS:P1
Coll.: L. Polomka & S. Patrick SP 3264 Date: 24 09 1999 (PERTH 05510228)
LOCALITY 5.3 km S of Morawa on road to Perenjori, adjacent to salt lake on E side of road, on slightly raised ridges ca 5-10 m from edge of road, WA
LAT 29 Deg 15 Min 33.000 Sec S LONG 116 Deg 0 Min 59.000 Sec E
Prostrate herb up to ca 6 cm diameter; yellow flower heads, ca 1 cm diameter lying on soil surface.
E aspect, saline flat at edge of salt lake. Moist saline brown sand/clay.
Scattered plants of Gunniopsis sp. and samphires, Hyalochlamys globifera.
Condition of population: moderate.

Gnephosis setifera
P.S.Short (Asteraceae)
CONSERVATION STATUS:P1
Coll.: P.S. Short, M. Amerena & B.A. Fuhrer PSS 2956 Date: 16 09 1986 (PERTH 1056867)
LOCALITY 5 km S of Morawa along road to Perenjori WA
LAT 29 Deg 15 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E
Saline flats. Growing on sandy ridge. With samphire.

Gnephosis setifera
P.S.Short (Asteraceae)
CONSERVATION STATUS:P1
Coll.: P.S. Short, M. Amerena & B.A. Fuhrer PSS 2956 Date: 16 09 1986 (PERTH 1422499)
LOCALITY 5 km S of Morawa along road to Perenjori, WA
LAT 29 Deg 15 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E
Saline flats. Growing on sandy ridge. With samphire.

Gnephosis setifera
P.S.Short (Asteraceae)
CONSERVATION STATUS:P1
Coll.: P.S. Short 4371 Date: 08 09 1995 (PERTH 06109632)
LOCALITY 5 km S of Morawa, Avon Botanical District WA
LAT 29 Deg 14 Min 59.000 Sec S LONG 116 Deg 0 Min 37.000 Sec E
Prostrate herb; florets yellow. Occurring on sand ridges in samphire flats. With samphires.

Halosarcia bulbosa
Paul G.Wilson (Chenopodiaceae)
CONSERVATION STATUS:R
Coll.: P.G. Wilson 11702 Date: 29 04 1979 (PERTH 1006509)
LOCALITY 10 km E of Morawa. WA
LAT 29 Deg 13 Min 0.000 Sec S LONG 116 Deg 6 Min 0.000 Sec E
Shrub 1 m high, 2 m diameter, sprawling, pruinose. Articles large, barrel-shaped. Red sandy clay.

Halosarcia bulbosa
Paul G.Wilson (Chenopodiaceae)
CONSERVATION STATUS:R
Coll.: P.G. Wilson 11702 Date: 29 04 1979 (PERTH 1006495)
LOCALITY 10 km E of Morawa. WA
LAT 29 Deg 13 Min 0.000 Sec S LONG 116 Deg 6 Min 0.000 Sec E
Shrub 1 m high, 2 m diameter, sprawling, pruinose. Articles large, barrel-shaped. Red sandy clay.

Podotheca uniseta
P.S.Short (Asteraceae)
CONSERVATION STATUS:P3
Coll.: P.S. Short, M. Amerena & B.A. Fuhrer PSS 2690 Date: 16 09 1986 (PERTH 880175)
LOCALITY 5 km S of Morawa along road to Perenjori, WA
LAT 29 Deg 15 Min 0.000 Sec S LONG 116 Deg 2 Min 0.000 Sec E
Major axes mainly ascending, sometimes decumbent or erect. Sandy ridge on saline flats.
Samphire.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
DECLARED RARE AND PRIORITY FLORA LIST
16 April 2003

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Acacia formidabilis	3	MW,WB, GLD	Wanarra, Perenjori, Paynes Find, Southern Cross, Warralackin, Bungalbin Hill	
Acacia isoneura subsp. isoneura	3	MW,WB	Mingenew, Three Springs, Caron, Buntine, Perenjori, Wubin	
Baeckea sp. Perenjori (Green 1516)	2	MW	Perenjori, Bowgada	Aug
Eremophila rostrata ms	R	MW	Cue, Perenjori	-
Grevillea asparagoides	3	MW,WB	Bindi Bindi, Perenjori, Wubin, Wongan Hills, Morawa, Latham	Jul-Sep
Gunniopsis rubra	3	WB,MW, GLD	Perenjori, Paynes Find, Ballidu, Bullfinch, Laverton	Sep-Oct
Lechenaultia galactities ms	3	WB,MW	Kokardine, Nth Beacon, Latham, Perenjori, Dandaragan, Koorda	Jun,Sep, Oct
Leptospermum exsertum	1	MW	Tardun, Mullewa, Perenjori	Sep
Levenhookia octomaculata	3	MW,SC, CF	Kalbarri, Northampton, Boigart, Canna, Lesueur, Ravensthorpe, Wicherina, Dinninup, Perenjori	Nov
Persoonia pentasticha	2	MW	Camel Soak, Mingenew, Mullewa, Perenjori, Yuna, Oudabunna Station	Aug
Urodon capitatus	3	MW,WB	Wyalkatchem, Ballidu, Mollerin, Wubin, Miling, Koorda, Watheroo, Perenjori	Sep-Dec
Verticordia venusta	3	WB,MW	Perenjori to Moonijin, Wongan Hills, Buntine	Nov