



**FITZGERALD RIVER NATIONAL PARK
HAMERSLEY DRIVE UPGRADE**



VEGETATION & FLORA SURVEY



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HAMERSLEY DRIVE UPGRADE**

VEGETATION & FLORA

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A report prepared for
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In undertaking this work, the authors have made every effort to ensure the accuracy of the information. Any conclusions drawn or recommendations made in the report are done in good faith and the consultants take no responsibility for how this information is used subsequently by others.

Cover photos: [top left] *Eucalyptus burdettiana* (Burdett's Gum), [top centre] *Morelia imbricata* (Carpet Python), [top right] *Lechenaultia superba* (Barren Leschenaultia), [centre] East Mt Barren and wave-cut bench from east, [bottom left] *Eucalyptus coronata* (Crowned Mallee) bud and flowers, [bottom centre] *Adenanthos ellipticus* (Oval-leaf Adenanthos), [bottom right] *Stylidium galioides* (Yellow Mountain Triggerplant), (©E.J.Hickman 2009).

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Executive Summary

Main Roads Western Australia is undertaking upgrade works on Hamersley Drive in the Fitzgerald River National Park (Shire of Ravensthorpe) on behalf of the Department of Environment and Conservation. The works will involve widening and sealing of the existing road for tourism purposes, and will remain on its current horizontal alignment. It is likely that the works will require the clearing of up to 10 m of native vegetation on either side of the existing gravel road from the current centreline.

Vegetation and flora surveys are being carried out in a staged process. This report includes results from the first 10 km, ie Culham Inlet to Hamersley Inlet Road.

Vegetation

The survey area lies in the Barren Ranges system of Beard (1976). Most of the vegetation comprises five units of 'Barren Ranges thicket' – one characterized by *Adenanthos venosus* on shallow soils over outcropping quartzite at the base of East Mt Barren and wave-cut bench, three predominantly on lateritic soils, *Dryandra quercifolia*, *Eucalyptus preissiana* and *Eucalyptus falcata*, and *Melaleuca papillosa* on valley slopes where schist is exposed.

Deeper, sandy soils have typical coastal plain vegetation that includes *Eucalyptus pleurocarpa*. Four units were recognized that were characterized by *Banksia repens*, *Banksia speciosa*, *Calothamnus quadrifidus* or *Melaleuca pulchella*.

Five coastal scrub units lie inland of the beaches, dominated by *Acacia rostellifera*, *Eucalyptus angulosa*, *Melaleuca lanceolata*, *M. nesophila* or *M. pentagona*. Adjacent to Culham Inlet a wetland community of *M. cuticularis* grows. Inland drainage lines support *Eucalyptus occidentalis* dominated plant associations.

The vegetation is in excellent condition with no weeds or *Phytophthora cinnamomi* dieback disease evident. A fire in 2006 burnt parts of the survey area east of the West Beach spur road.

Declared Rare and Priority flora

Field surveys were carried out in spring 2009 and identified five Declared Rare flora (DRF) - *Adenanthos ellipticus*, *Eucalyptus burdettiana*, *Eucalyptus coronata*, *Kunzea similis* subsp. *similis* and *Stylidium galioides* - growing on the wave-cut bench on the south side of East Mt Barren, in the proposed area of disturbance. A sixth DRF species, *Verticordia pityrhops*, was not found but previous surveys suggest that some plants grow within 10 m of the current road verge.

Most Priority species occur between Mylies Creek and Culham Inlet, including four Priority Two species - *Calothamnus macrocarpus*, *Gonocarpus hispidus*, *Hibbertia papillata*, *Leptospermum confertum*. Five Priority Four species, *Acacia argutifolia*, *Anthocercis fasciculata*, *Dampiera deltoidea*, *Jacksonia compressa* and *Pimelea physodes* are present in this section. Two other P4s, *Lechenaultia superba* and *Hakea hookeriana* have been collected near the road in the past, but were not found in the proposed impact area during this survey.

West of Mylies Creek, the Priority Four species *Acacia moirii* subsp. *dasycarpa* and *Jacksonia compressa* are frequent and widespread. *Melaleuca papillosa* is abundant on schist on slopes of drainage lines. *Leucopogon compactus* was found west of the West Beach turnoff.

Threatened Ecological Communities

No listed Threatened or Priority Ecological Communities were found during the field survey, although a community of ecological significance is located on the wave-cut bench that extends

south of East Mt Barren. These micro-wetlands are sedge-dominated communities that are fed by freshwater from further upslope. They occur within the *Banksia speciosa* vegetation unit and were too subtle to map individually.

Recommendations

The wave-cut bench on the seaward side of East Mt Barren is the one of the most botanically significant areas in the Fitzgerald River National Park and the south coast. The following is recommended:

- keep road verges and spur drains to the absolute minimum width/size allowed by road design;
- survey DRF *Verticordia pityrhops* when flowering (February - June);
- consult an expert in freshwater habitats to assess the ecological value of the micro-wetlands;
- ensure that sub-surface drainage to and from the micro-wetlands is not impeded by the road base;
- have an on-site inspection of the wave-cut bench with biologists and surveyor/ road engineer present;
- design a high quality walk trail along the wave-cut bench, linking the carparks at the east and west ends of East Mt Barren;
- weed invasion and plant disease have the greatest potential to impact the high biological and conservation value of the FRNP. Road materials (including water) must come from weed- and disease-free areas, so that they are not imported by either the material itself or the machinery carting it.

1. Introduction

Purpose

Main Roads Western Australia (Main Roads) is undertaking upgrade works on Hamersley Drive in the Fitzgerald River National Park (FRNP) on behalf of the Department of Environment and Conservation (DEC). The works will involve widening and sealing of the existing road for tourism purposes, and will remain on its current horizontal alignment. It is likely that the works will require the clearing of up to 10 m of native vegetation on either side of the existing track from the current centreline.

Main Roads require biological surveys for the above project. The purpose of the surveys is to provide an appropriate examination and description of the receiving environment to ensure that all aspects of biological/ecological significance are identified and recorded. The results of the biological survey will assist in the preparation of an Environmental Impact Assessment and an Environmental Management Plan or other referral documents.

Background

The proposal to upgrade roads in the Fitzgerald River National Park was first announced on the 30 January 2009 by the Honorable Colin Barnett Premier; Minister for State Development with the intent to offset the economic effect of the closure of the Ravensthorpe nickel mine. The State Government committed to a long term measure of support to increase economic viability of the towns of Ravensthorpe and Hopetoun in the Shire of Ravensthorpe.

The road upgrade is intended to inject funds into the communities of Hopetoun and Ravensthorpe by providing opportunities for local sub-contractors to be employed through the construction process. Economic benefits will also flow to service providers in the local towns through the delivery of this project.

Study Area

Figure 1 details the location of the biological survey. The survey is restricted to an area 25 m either side of the existing road alignment, including all spur roads and car parks. Eventually, the survey area is to include borrow and gravel pits, basecourse and sub-base pits, spoil sites, proposed works camp and compound areas, stockpile sites and any other areas to be disturbed.

Stage 1

This interim report includes 10 km of Hamersley Drive, ie from Culham Inlet to the Hamersley Inlet Road intersection. Stage 2 will include Hamersley Inlet Road to Hamersley Inlet.

The spur roads and carparks will be surveyed during 2010.

Concurrent biological studies

Separate reports have been prepared by:

1. Ellen Hickman surveyed the vegetation and flora at the proposed gravel pits on Location 6382 Steeredale Road, Hopetoun;
2. Andrew Chapman has assessed the implications for fauna;
3. Malcom Grant surveyed for dieback *Phytophthora* and other plant pathogens.

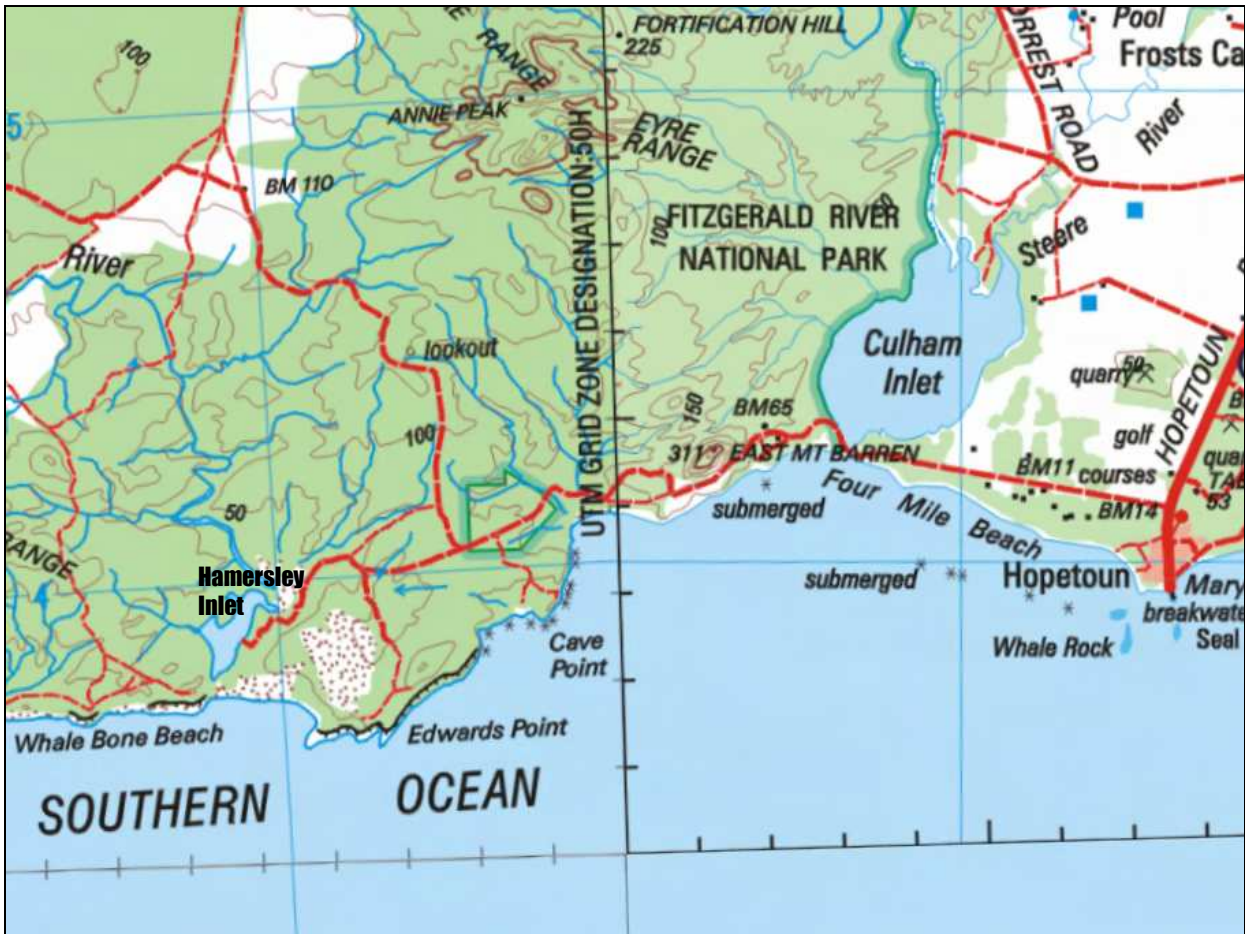


Figure 1: Survey area in Fitzgerald River National Park – Hamersley Inlet to Culham Inlet

2. Methods

Desktop

A search was made of the Department of Environment and Conservation's (DEC) Threatened Flora Database (DEFL), WA Herbarium database (WAHerb) and the Declared Rare and Priority Flora Species List. The search co-ordinates requested were NW corner: 33°45'S 119°45'E SE corner: 33°57' 120°14'E. A search was undertaken of the DEC Threatened Ecological Communities database.

The Commonwealth's Threatened Flora database was searched to determine the category under the Environmental Protection and Biodiversity Conservation (EPBC) Act for listed Threatened flora.

The flora database information was imported into OziExplorer® software to determine those species likely to occur in the impact area. Orthophotos of the Whoogerup (2003- pre-burn) and Ravensthorpe (2007 – post-burn) map sheets were provided by DEC to use as base imagery.

Scientific licences and a Regulation 4 Authority permit were obtained from DEC to take flora within the Fitzgerald River National Park. Permission to use digital information was obtained from DEC's Species and Community Branch, Kensington.

Previous reports and publications relevant to the region were reviewed.

Eucalypts on East Mt Barren

DEC Albany's threatened flora files for *Eucalyptus coronata* and *Eucalyptus burdettiana* were reviewed, specific locations of all known population on and around East Mt Barren were identified and plant numbers were summarised to get an overview of each species.

Orthophotos from the Ravensthorpe sheet (2003 – pre-burn and 2007 – post-burn) were provided by DEC for use in the field.

Field survey

Hamersley Drive

The survey was carried out according to the Environmental Protection Authority's Draft Guidance No.51 (EPA 2003). Each side of the road was traversed on foot by Gillian Craig, between the verge and up to 25 m into the undisturbed vegetation. Along each traverse, boundaries of vegetation units (based on changes in species composition) and threatened flora were marked as waypoints on the GPS using the GDA94 datum.

Relevés were recorded and a digital photo taken of representative vegetation units. Common species were recorded, ie more than five plants were observed in the general vicinity, in a plotless 10 m x 10 m quadrat for shrubs (< 2 m tall), sedges and herbs, and 20 m x 20 m for tall shrubs (> 2 m tall) and eucalypts. Vegetation structure, based on a modified Muir classification (Appendix 2), was recorded.

Surveys were carried out on 22nd, 25th and 29th September, 1st, 12th, 16th and 23rd October 2009. The weather was cool to warm (16°C – 21°C max) and sunny or intermittently overcast with a slight to moderate winds.

Plant specimens were verified using the author's private herbarium (previously verified in the Perth Herbarium), Albany and Ravensthorpe Regional Herbaria, and the Perth Herbarium; nomenclature follows that of WAHERB, except for *Dryandra*. Voucher specimens will be lodged in the Perth and Ravensthorpe herbaria.

Waypoints were downloaded from the GPS to OziExplorer®, then divided into individual files for each species of declared rare or priority flora. Vegetation units were mapped using combination of field data and interpretation of orthophotos.

Eucalypts on East Mt Barren

Foot traverses of all the populations identified from the Threatened Flora file review of *Eucalyptus coronata* and *E.burdettiana* on and around East Mt Barren were carried out on 29th and 30th September, 1st, 2nd, 21st, 22nd, 23rd and 24th October 2009 by Ellen Hickman. The weather was cool to warm (15°C – 28°C max) and sunny or overcast with slight to moderate winds.

Most plants were marked as waypoints on a Garmin GPS 60 using the GDA94 datum. A proportion of each species was also tagged using sheep tags. The tags were of two shades of green to distinguish the two species and scribed with the species initials and a number in sequence (ie EC001, EC002 to EC500 for *E.coronata*, and EB001, EB002 to EB500 for *E.burdettiana*). When the tags ran out the plants were simply marked with a waypoint.

Plants of each species identified as growing within 25 m on either side of the Hamersley Drive road were waypointed and flagged with blue flagging tape, but not tagged.

Areas of vegetation known to have plants of either species that were not burnt in the 2006 fire proved to be too thick to traverse by foot so estimations of plant numbers were made by interpreting aerial photography.

Waypoints and tracks were downloaded from the GPS using DNR Garmin software. The waypoints were exported as text files to be imported into Excel to allow for sorting the data into individual files for each species. These were then imported into Arcview to provide shape files of each species location on and around East Mt Barren. The tracks were saved as shape files for direct import into Arcview.

Digitising

Digital files including waypoints of each species of threatened flora encountered during the survey and line work of the vegetation map (1:10 000 scale) were sent to Meredith Spencer (DEC Albany) for digitising. Final maps were provided as shapefiles for compatibility with ArcMap.

3. Desktop Assessment

Physical Environment

Climate

A Mediterranean climate of warm to hot summers and cool, wet winters is generally experienced. The nearest weather station is Hopetoun North, for which the last 13 years of data is available (Table 1). Mean maximum temperature recorded at Hopetoun in the hottest month (February) is 26°C. Mean minimum temperature in the coldest months (July-August) is 8°C. The highest recorded temperature of 46°C was recorded in January 1997, while the lowest of -0.3°C was in July 2000. Frosts have been recorded by farmers in the catchment during winter and spring, but are usually rare on the coast.

The rainfall is typical of a Mediterranean climate with a pronounced winter maximum and a long dry summer. The mean annual rainfall on the coast is about 500 mm, but has been highly variable over the past 10 years with the maximum of 610 mm in 2001, followed by a very dry year in 2002 when only 274 mm fell. Sporadic heavy rainfall events can occur in summer as a result of cyclonic events in the north of the State - the highest monthly rainfall of 185 mm was recorded in January 2000.

Annual evaporation is generally 1500 mm.

Morning wind speeds are typically 17-22 km/h and increase in the afternoon to average 20-29 km/h.

Climate Change is predicted to impact the south coast of Western Australia. Changes in temperature and rainfall patterns may lead to changes in the physical condition of the region and to the growing season, incidence of frost and flood events etc.

Table 1: Climate data for Hopetoun North (BOM 2009)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Temperature															
Maximum temperature															
Mean maximum temperature (°C)	25.2	25.8	25	23.3	21.6	19.2	18.2	18.9	20.5	21.4	23.1	24.4	22.2	14	1996 2009
Minimum temperature															
Mean minimum temperature (°C)	15.2	15.7	14.3	12.6	10.5	8.5	7.7	7.9	8.7	10	12.2	13.9	11.4	14	1996 2009
Rainfall															
Mean rainfall (mm)	48.6	18.1	29.3	44.5	36.8	49.5	66.3	54.1	49.1	39.5	37.4	24	496.4	13	1996 2009
Highest rainfall (mm)	185	72.4	69.4	138	78.4	106	126	127	109	70.4	97.2	54.6	609.8	13	1996 2009
Date	2000	1997	2006	2007	1999	2005	2001	2001	1996	2008	2008	2008	2001		
Lowest rainfall (mm)	0	0.2	0	0	8.2	14.4	30	19.6	5.2	14.4	1.4	3.2	274	13	1996 2009
Date	1998	2008	2008	2008	2002	2002	1996	1996	2000	2006	2007	2006	2002		
Mean number of days of rain	6.5	5.4	7.8	11.5	12.5	13.8	15	14.8	13.9	10.9	8.1	6.7	126.9	13	1996 2009

Geology and Soils

The Barren Ranges group of hard massive Proterozoic quartzites rise into a small abrupt mountain at East Mt Barren (about 275 m) with a pediment 90 m above sea level that fronts onto the sea, creating one of the most striking coastlines of the south coast. Soils on the mountain and pediment are rocky and skeletal. The 90 m platform at the base of East Mt Barren is a wave-cut bench formed during the Tertiary when sea levels were about 100 m higher than today. The ranges at that time would have been isolated islands at the time of deposition of the Plantagenet sediments that form the coastal plains.

The coastal plain that formed during the Tertiary to the west of East Mt Barren rises gently inland from the coast to about 150 m altitude. These Plantagenet Group of sediments consist of thin-bedded mudstones and siltstones which are overlain by Quaternary drift sands on the seaward margin of the plain. The surface has developed a clearly differentiated profile with a superficial layer of bleached sand overlying a band of ironstone nodules over a mottled loam.

Numerous intermittent streams flow directly to the sea, flooding after heavy rain and usually dry up in summer, except Mylies Creek which maintains pools of water either side of Hamersley Drive. Water runoff is generally brackish, becoming more saline as volumes decrease.

A major fault east of East Mt Barren provides the boundary of the Esperance plain developed by Tertiary Plantagenet sediments. Again Quaternary sands have overlain the pediments on the lower, eastern slopes of the mount.

Previous biological surveys

Vegetation and flora surveys have been carried out by:

- Beard (1976, 1979) mapped the vegetation at 1:250 000 scale;
- Aplin and Newbey (1990 a & b) described the vegetation and flora of the FRNP;
- Chapman and Newbey (1995) established a series of monitoring quadrats for flora and trap lines for fauna across the FRNP (Appendix 6);
- Lamont and Witkowski (1995 and 1999) have measured the response to fire of *Banksia* species growing near Hopetoun;
- in 2007, DEC Albany established monitoring plots north of Hamersley Drive, to determine vegetation response to the October 2006 fire. The fire followed from a prescribed burn between Eyre Range and East Mt Barren to achieve some 'break up' of the 1989 wildfire.

Assessment of the state of biological knowledge and its relevance to the FRNP can be found in:

- Hopper and Gioia (2004) discuss the evolution and conservation of the south-west's flora in the context of the area being an International biodiversity hotspot. The FRNP is recognized as an area of particularly high diversity within the south-west;
- Deegan (2005 and 2006) prepared a bibliography and review of the state of knowledge of the Fitzgerald Biosphere;
- a list of the 1,665 plant taxa known from the Park is given in Newbey and Hickman (2008) .

Fitzgerald Biosphere Reserve

The national park is the core area of the Fitzgerald Biosphere which is a part-tenured management concept recognised by UNESCO's Man and the Biosphere program. The Fitzgerald Biosphere Reserve is recognised as being a 'hotspot' within one of Earth's 34 global biodiversity 'hotspots'. The FRNP has approximately 1,660 plant taxa, containing over one-quarter (29%) of the south-west's flora.

The protection of biodiversity is increasingly seen as a global concern. This change in perspective has been associated with an increasing number of international instruments addressing biodiversity conservation issues. Some of these instruments, such as those relating to Biosphere Reserves, have been given some recognition in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. Moreover, the Environmental Protection Authority has recognised the importance of maintaining ecosystem/ecological processes for ecologically sustainable management (EPA 1999).

The government of Western Australia occasionally discusses the *Biodiversity Conservation Act* in Parliament. This Act proposes to enhance legislation for the protection, restoration and sustainable use of our native plants, animals and other native organisms. The government recognises that “all of our natural biodiversity is important and it is our responsibility to ensure that our biodiversity is conserved” (Government of WA 2002).

Vegetation Classification

The survey area lies in the South West Botanical Province and the Esperance Biogeographic Region (after Cresswell and Thackway 1995) and is in the Barren Ranges System described by Beard (1973, 1976). This system includes four types of pediments:

- the small mountains of the Barren Ranges group supporting Barren Ranges thicket – the most consistent species being *Eucalyptus preissiana* and *Dryandra quercifolia*;
- small adjacent portions of coastal plain on sandy lateritic soil supports *Eucalyptus pleurocarpa* mallee-heath;
- river trenches with mallee, including *Eucalyptus redunca*, *E. uncinata* and *E. conglobata*;
- areas of coastal drift sand with coastal scrub – *Eucalyptus angulosa* and *Melaleuca pentagona* being typical.

Threatened Ecological Communities

The search of DEC’s Threatened Ecological Communities database found no known occurrences of threatened ecological communities in the study area (M. Hunter, pers.comm.). However, there are occurrences of the following ecological communities within approximately 5 km of the survey area:

- The ‘Vulnerable’ threatened ecological community – ‘Thumb Peak - Mid-Mount Barren - Woolburnup Hill (Central Barren Ranges) *Eucalyptus acies* mallee heath’ ;
- The ‘Priority 1’ ecological community – ‘Very open mallee over *Melaleuca* sp. Kundip (GF Craig 6020) dense heath’.

Declared Rare and Priority Flora

The WAHERB and DEFL searches found 40 species in the vicinity of the survey area, including eight Declared Rare flora. After overlaying their locations on an orthophoto, this number was reduced to twenty species being recorded near Hamersley Drive (Appendix 1.2). Six Declared Rare flora were located on or near East Mt Barren (Table 2).

Table 2: Declared Rare flora near Hamersley Drive

Species Name	DEC Conservation Code	EPBC Act
<i>Adenanthos ellipticus</i>	R	Vulnerable
<i>Eucalyptus burdettiana</i>	R	Endangered
<i>Eucalyptus coronata</i>	R	Vulnerable
<i>Kunzea similis</i> subsp. <i>similis</i>	R	-
<i>Stylidium galioides</i>	R	Vulnerable
<i>Verticordia pityrhops</i>	R	Endangered

4. Field Investigation

Vegetation

The survey area lies in the Barren Ranges system of Beard (1976). Most of the vegetation comprises five units of 'Barren Ranges thicket' – one characterized by *Adenanthos venosus* on shallow soils over outcropping quartzite at the base of East Mt Barren and wave-cut bench, three predominantly on lateritic soils, *Dryandra quercifolia*, *Eucalyptus preissiana* and *Eucalyptus falcata*; and *Melaleuca papillosa* on valley slopes where schist is exposed (Table 3).

Deeper, sandy soils have typical coastal plain vegetation characterized by *Eucalyptus pleurocarpa*. Four units were recognized that were characterized by *Banksia repens*, *Banksia speciosa*, *Calothamnus quadrifidus* or *Melaleuca pulchella*.

Five coastal scrub communities lie inland of the beaches, dominated by *Acacia rostellifera*, *Eucalyptus angulosa*, *Melaleuca lanceolata*, *M. nesophila* or *M. pentagona*. Adjacent to Culham Inlet a wetland community of *M. cuticularis* grows. Inland drainage lines support *Eucalyptus occidentalis* dominated plant associations.

Seven A4 maps at 1:10 000 scale will cover the whole project area. Stage 1 of the project covers Maps 2, 3A, 4 and 5 (Appendix 3).

Table 3: Vegetation units in the Fitzgerald River National Park

Map Code	Vegetation structure	Typical species
1. Quartzite & schist:		
Adven	Heath	<i>Adenanthos venosus</i> , <i>Taxandria conspicua</i> ssp. <i>abrupta</i> , <i>Regelia velutina</i>
Dque	Open mallee-thicket/heath	<i>Dryandra quercifolia</i> , <i>Eucalyptus pleurocarpa</i> , <i>Banksia lemnioides</i>
Efal	Mallee scrub	<i>Eucalyptus falcata</i> , <i>Templetonia retusa</i>
Epre	Mallee shrub	<i>Eucalyptus preissiana</i> , <i>Dryandra quercifolia</i>
Mpap	Shrub heath	<i>Melaleuca papillosa</i>
2. Coastal plain		
Brep	Open mallee-heath	<i>Eucalyptus pleurocarpa</i> , <i>Banksia repens</i> , <i>Adenanthos cuneatus</i> ,
Bspe	Scrub thicket - sedge	<i>Banksia speciosa</i> , <i>Anarthria laevis</i>
Eple/Cqua	Open mallee-heath	<i>Eucalyptus pleurocarpa</i> , <i>Calothamnus quadrifidus</i> , <i>Anarthria laevis</i>
Mpul	Heath	<i>Melaleuca pulchella</i>
3. Coastal dunes:		
Aros	Thicket	<i>Acacia rostellifera</i>
Eang	Open mallee-heath	<i>Eucalyptus angulosa</i>
Mlan	Scrub thicket	<i>Melaleuca lanceolata</i> , <i>Scaevola crassifolia</i> , <i>Acacia rostellifera</i>
Mnes	Shrub heath	<i>Melaleuca nesophila</i>
Mpen	Shrub heath	<i>Melaleuca pentagona</i>
4. Creeklines & wetlands:		
Eocc	Woodland	<i>Eucalyptus occidentalis</i> , <i>Rhagodia baccata</i>
Mcut	Shrubland	<i>Melaleuca cuticularis</i>

These vegetation units will be described in greater detail when all surveys for the project area have been completed in 2010.

Declared Rare and Priority Flora

Five species of Declared Rare flora were found adjacent to Hamersley Drive, principally on the wave-cut bench south of East Mt Barren or on the western flanks of the mountain. A sixth DRF *Verticordia pityrhops* was expected to be found, however no plants were seen (see notes below). A summary of each species is given below and full details of GPS locations and population numbers given in Appendix 4.

Declared Rare flora (Figure 2)

***Adenanthos ellipticus* Oval-leaf Adenanthos (Vulnerable)**

Endemic to the Fitzgerald River National Park, this species grows on the summit and south-west slopes of East Mt Barren, extending onto the wave-cut bench south of the mountain. It is a relatively slow growing plant that is killed by fire, but regenerates readily from seed. Field observations (Robinson and Coates 1995) suggest a high susceptibility to *Phytophthora* dieback.



This population was surveyed by DEC Albany in 2008 and estimated to be 30,000+ mature plants and approximately 10,000 seedlings in the burnt area (2006 prescribed burn). In addition, *Adenanthos ellipticus* is known to occur on Thumb Peak and West Mt Barren. Less than 1% of the East Mt Barren population will be impacted by the Hamersley Drive upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	350	0.9	0.7
¹ East Mt Barren	40,000+		
² Thumb Peak	10,000+		
² West Mt Barren	1,000+		

¹ DEC Albany 2008

² Robinson & Coates 1995

***Eucalyptus burdettiana* Burdett Gum (Endangered)**

Burdett gum is a multi-stemmed mallee, up to 4m high. It has smooth bark and glossy green leaves 9 cm long and 1.7 cm wide. It has stalkless clusters of 7 to 11 flowers on a flattened flower stalk. The floral tubes are not fused and they have very long, horn-shaped bud caps that are slightly warty. This species only grows on and around East Mt Barren.

Prior to this survey *E. burdettiana* was recognised to occur in 2 populations, with population 1 divided into 5 sub-populations (1A, 1B, 1C, 1D & 1E). The total number of plants was believed to be 239, however these numbers fluctuated across visitation from the 1980's to 2000's particularly in populations 1A and 1B. This survey estimates the population to consist of 3500 – 4000 plants, with 1571 plants actually waypointed. 42 plants were identified within the 25 m road buffer. Therefore the plants deemed to be under threat from the proposed road works constitutes 1.2% of the entire population on East Mt Barren.



Population 1E was visited but no plants located and after review of notes on this population it is believed to be equivalent to population 1C. *E. burdettiana* plants were found on all slopes of East Mt Barren with the exception of the extreme eastern slopes, populations 1A, 1B, 1C and 1D all merge and as such the subdivision of these populations is irrelevant. Specific comments on each population are presented in Appendix 4.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	42	1.2	1.2
East Mt Barren	3580		

***Eucalyptus coronata* Crowned Mallee (Vulnerable)**

The Crowned Mallee is a small multi-stemmed, smooth-barked mallee up to 2.5 m high, with bluish-green leaves 12 cm long and 3 cm wide. Strongly ribbed buds occur in threes on a broad flattened stalk. The large fruits have a broad disc and domed, protruding valves that look like a crown.



Prior to this survey *E. coronata* was recognised to occur in 4 populations, from East Mt Barren, Eyre Range, Whoogarup Range and Mid Mt Barren. The total plant numbers was estimated at 215, with 150 of these plants known from East Mt Barren, within 2 sub-populations 1A on the eastern slopes consisting of 100 plants and 1B the summit consisting of 50 plants. This survey amended the population number on East Mt Barren to approximately 2000 plants, with 461 plants actually waypointed. Nine plants identified within the 25 m road buffer. Therefore the plants deemed to be under threat from the proposed road works constitutes 0.5% of the entire population on East Mt Barren.

Since populations 1A and 1B merge on the southern slopes of East Mt Barren the division into sub-populations is irrelevant. Specific comments on each population are presented in Appendix 4. *E. burdettiana* and *E. coronata* population overlap near the summit and on the south-eastern slopes of East Mt Barren.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	9	0.45%	<0.45%
East Mt Barren	2,000		
Annie Peak	unknown		
Whoogerup Range	unknown		
Mid Mt Barren	unknown		

***Kunzea similis* subsp. *similis* (EPBC - not listed)**

Endemic to East Mt Barren, the only known population is on the wave-cut bench, south-west of the mountain. The closely related subsp. *mediterranea* is only known from Bandalup Hill. A survey by Craig (2000) found the population extends for approximately 300 m x 450 m (= 13.5 ha) and was restricted to



areas of shallow sand over outcropping quartzite. At that time the population was estimated to be approximately 1,000 plants which were unevenly distributed. This population was surveyed again by DEC Albany in 2009 and estimated to be 3,600 plants in 10 ha. No seedling recruitment was found where the 2006 prescribed burn had escaped into the population.

The densest areas of plants grow in shallow depressions on the bench and in the gullies which drop-off the bench towards the ocean. Here, *Kunzea similis* grows to 1.2 m tall, in an *Adenanthos venosus* vegetation unit.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	2.8	2.8
¹ East Mt Barren	3,600		

¹ DEC Albany 2009

***Stylidium galioides* – Yellow Mountain Triggerplant (Vulnerable)**

Endemic to the Eyre Range, a plant with trailing stems that apparently roots at the nodes, which makes it difficult to count the number of plants in a population/area. It is common on East Mt Barren and during the eucalypt survey Ellen Hickman observed *S. galioides* along the walk trail to the summit, all over summit, on the south-eastern face above Hamersley Drive, on the north-eastern face up into the gully directly below the summit and in the gully on west side of East Mt Barren.



Along Hamersley Drive, *S. galioides* occurs from the western slopes of East Mt Barren to the eastern carpark on the wave-cut bench, preferring shallow soil amongst outcropping quartzite. Although the table below indicates a significant percentage of plants would be impacted, the widespread occurrence of *S. galioides* on East Mt Barren suggests that in reality only a very small percentage of plants will be affected by the road upgrade.

		% EMB population	% all populations
Hamersley Drive upgrade	500+	<16%	unknown
¹ East Mt Barren	3,000+		
² Fortification Hill	scattered		
² Annie Peak	common		

¹ E.Hickman pers.comm.

² Robinson & Coates 1995

***Verticordia pityrhops* (Endangered)**

Endemic to East Mt Barren, the only known population is on the wave-cut bench, south-west of the mountain, in the same area as *Kunzea similis*. *Verticordia pityrhops* was surveyed by DEC Albany in 2009 and the population estimated to be approximately 2,000 plants in 10 ha. *Verticordia pityrhops* is killed by fire and no seedling recruitment was found where the 2006 prescribed burn escaped into the population. It is very slow to regenerate from seed (Robinson and Coates 1995).

This species was not found during the current survey, probably because it was vegetative in spring and difficult to discern amongst the relatively mid-dense to dense vegetation in its known area of occurrence. *V. pityrhops* usually flowers between February and June, and a survey adjacent to Hamersley Drive during this period is recommended.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil seen	few(?)	
¹ East Mt Barren	+/- 2000		

¹ DEC Albany 2009

Priority Two flora (Figure 3)

Calothamnus macrocarpus

Endemic to the East Mt Barren and immediate environs. A robust shrub that grows in sandy soils between Mylies Creek and Culham Inlet, often in association with the very similar *Calothamnus validus*. A large population (100+) occurs on the east bank of Mylies Creek in coastal scrub. A scattered population (estimated 1,000) occurs on the wave-cut bench south and south-east of East Mt Barren growing in shallow soil over rocky quartzite and extends downslope to the park entrance – the north-south extent of this population is unknown.



C. macrocarpus readily resprouts from rootstock following disturbance - some of the largest plants occur on the road verge where plant competition is reduced and there is increased water runoff. A significant number of plants will be affected by the road upgrade.

		% EMB population	% all populations
Hamersley Drive upgrade:			
A. Mylies Beach	233	unknown	unknown
B. Wave-cut bench - inlet	157	est. 15%	unknown
¹ East Mt Barren	200+		
² Wave-cut bench	est. 1,000		

¹ Robinson & Coates 1995

² S.Barrett DEC Albany 2008

Gonocarpus hispidus



Endemic to the Eyre Range, an unobtrusive, weak shrub that is known only from the summit and slopes of East Mt Barren and immediate surrounding hills (Robinson and Coates 1995), growing amongst outcropping quartzite. The species shows massive germination when stimulated by fire and on the lower, east slope of East Mt Barren a large population (1,000+) plants occurs upslope of Hamersley Drive in an area burnt in October 2006. This sub-population starts 15 m from the verge, extending north and north-east, and is not likely to be impacted by the road upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	50	0.05	0.05
¹ East Mt Barren	100,000+		

¹ Robinson & Coates 1995

Hibbertia papillata

Endemic to the Eyre Range, being recorded from East Mt Barren and the Eyre Range only (Wheeler 2004) - the size and extent of the population has not been surveyed. It is apparently frequent on mid- and upper-elevations of the mountain (Horn & Butcher, 1999 voucher collection). *H. papillata* is a common component of the *Adenanthos venosus* vegetation unit on the wave-cut bench and extends for nearly 4 km along Hamersley Drive, around the base of East Mt Barren.

A significant number of plants will be affected by the road upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 500+	unknown	unknown
East Mt Barren	not surveyed		

Leptospermum confertum

Endemic to the Fitzgerald River National Park, known mainly from the summit of East Mt Barren and Thumb Peak. The population on East Mt Barren has not been fully surveyed, although Sarah Barrett (DEC Albany 2005) counted approximately 100 plants adjacent to the walk trail to the summit. A dense thicket of ten plants occurs on the north side of Hamersley Drive, within 10 m of the verge and is likely to be impacted by the road. They are in the same vicinity as *Eucalyptus burdettiana* and *E. coronata*.

		% EMB population	% all populations
Hamersley Drive upgrade	10	?10%	unknown
¹ East Mt Barren	+/-100		
² Thumb Peak	500+		

¹ S.Barret, DEC Albany 2005

² Robinson & Coates 1995

Priority Four flora (Figure 4)

Acacia argutifolia East Barrens Wattle

This species is known from a number of ranges in the Fitzgerald River National Park, including Whoogerup Range, Thumb Peak and Sepulchralis Hill. It extends northward from East Mt Barren through the Eyre Range, occurring at No Tree Hill and eastwards at Kundip (Robinson and Coates 1995). Along Hamersley Drive it is a frequent component of the *Adenanthos venosus* vegetation unit on wave-cut bench.

Although 100+ plants will be affected by the road upgrade, the impact on this species will be relatively low.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 100	est. <5%	est. <3%
¹ East Mt Barren	2,000+		
¹ FRNP	830+		
¹ Kundip	3+		

¹ Robinson & Coates 1995

Acacia moirii subsp. *dasycarpa*



This species is widespread on sandplain from Hamersley Inlet to Munglinup. It is most common on yellow sands after disturbance such as fire. It was frequent in nearly all vegetation units of the study area.

It is recommended that this species be deleted from the Priority flora list.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 1,000+	est. <1%	est. <0.5%
¹ Hamersley Drive	occasional		
¹ Hamersley Inlet	common		
¹ Mt Desmond	100+		
¹ Jerdacuttup	10+		

¹ Robinson & Coates 1995

Anthocercis fasciculata

Endemic to the FRNP, found on quartzite peaks and hills from West Mt Barren to East Mt Barren growing in shallow rocky soils. A disturbance opportunist that appears in great numbers after fire and is relatively short-lived (about 5 years). A patch was found immediately east of Mylies Creek then small groups of plants from near the eastern carpark on the wave-cut bench downslope to the Ranger's residence – all areas which had been burnt in October 2006. In addition, Ellen Hickman observed many patches of *A. fasciculata* on East Mt Barren during the eucalypt survey.



About 100 plants may be affected by the road upgrade, although many of these are adjacent to the existing section of bitumen road that extends uphill from the Park entrance, so presumably won't be impacted.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	est. <2%	est. <1%
¹ East Mt Barren	1,000+		
¹ West Mt Barren	500+		

¹ Robinson & Coates 1995

Dampiera deltoidea

A widespread species that is known from Bandalup Hill and from a number of populations in the FRNP, including the Whoogerup Range. It prefers shallow soils over rock (lateritic caprock and quartzite). During this survey, two sub-populations were found on quartz outcrops east of East Mt Barren. These outcrops are near the existing bitumen road, extend beyond the 25 m survey zone and are not likely to be impacted by the upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	80	unknown	<0.7%
¹ FRNP	6,000		
¹ Bandalup Hill	6,000		

¹ Cockerton and Craig 2000

Hakea hookeriana

A robust shrub that grows to about 2 m high which grows on shallow sand over outcropping quartzite adjacent to the coast. It is endemic to the FRNP and is known from the platform west of West Beach, Thumb Peak and Two Bump Hill. It has previously been collected near Hamersley Drive on the east of East Mt Barren (WAHERB), close to the unburnt/ burnt 2006 boundary. *H. hookeriana* was not found in this survey – the known plant/s were probably burnt in 2006 thus only seedlings would be present. Seedlings would be difficult to identify from the similar *Hakea pandanicarpa* subsp. *crassifolia* which may also grow in the area.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil seen	unknown	unknown
East Mt Barren	?		
¹ Thumb Peak	100+		
¹ Two Bump Hill	50+		

¹ Robinson & Coates 1995

Jacksonia compressa

A species that is widespread in the FRNP, and known from West Mt Barren, Mid Mt Barren, Woolbernup Hill and East Mt Barren. It was frequent and widespread in the survey area, particularly on disturbed road verges. Hundreds of plants will be impacted by the road upgrade, but *J. compressa* appears to readily re-establish following disturbance, although areas burnt in 2006 may not have developed an adequate seed bank for regeneration.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	1,400	est. <5%	est. 2%
East Mt Barren	est. 10,000+		

Lechenaultia superba



A species that is usually found within a few years of fire. It has previously been collected near Hamersley Drive, west of East Mt Barren. In this survey it was not found along Hamersley Drive, although Ellen Hickman observed thousands of flowering plants on East Mt Barren, usually in association with *Eucalyptus burdettiana*.

This species is a disturbance opportunist and is not likely to be impacted by the road upgrade.

Leucopogon compactus

A low shrub, found growing in the *Eucalyptus falcata* vegetation unit. Not common in survey area, but is known to frequent coastal scrub heaths in the FRNP. A few plants were found on the south side of Hamersley Drive, west of the West Beach turnoff. It is not expected to be significantly impacted by the road upgrade.

Melaleuca papillosa



A species endemic to the FRNP which forms shrub thickets on schist on valley slopes. It covers large areas west of Mylies Creek, and huge patches of flowering plants could be seen extending for hundreds of metres north of Hamersley Drive plus on slopes behind West Beach.

Seedlings were regenerating in areas that had been burnt in 2006 and an earlier fire (?1989) – apparently a very slow growing species.

It is recommended that this species be deleted from the Priority Flora list.

	No. Plants	% FRNP population
Hamersley Drive upgrade	2,000+	est. <<2%
FRNP	est.100,000+	

Pimelea physodes



A widespread, attractive low shrub that is found throughout the FRNP, mostly on sandplain. It is also known from the Ravensthorpe Range. Localised patches occur along Hamersley Drive in coastal plain communities. The road upgrade will take a small number of plants.

	No. Plants	% all population
Hamersley Drive upgrade	50	est. <0.2%
FRNP	common	
Ravensthorpe Range	occasional	

Threatened Ecological Communities

No listed Threatened or Priority Ecological Communities were found during the field survey, although a community of ecological significance is located on the wave-cut bench that extends south of East Mt Barren.

Significant Ecological Community

The perched micro-wetlands on the wave-cut bench are considered to be a rare community on the south coast (A. Chapman 2009; S.Comer, pers.comm.). These sedge-dominated communities occur within the *Banksia speciosa* vegetation unit and have permanently wet soil fed by freshwater from further upslope - they were too subtle to map individually. A number of small, freshwater pools were present. According to Chapman (2009) they are significant because “they maintain small patches of mesic environment in an otherwise very fire prone and possibly drying environment”.

Currently, Hamersley Drive cuts through these micro-wetlands, but the porosity of the road base does not appear to be impeding water flow. It is imperative that any upgrade does not prevent natural water flow downslope of the road, nor cause unnatural ponding of water on the upside.

Vegetation Condition Assessment

The vegetation was generally in excellent health with no weeds observed.

Plants are regenerating in an area between Mylies Beach Road and the western slopes of East Mt Barren, following an escaped prescribed burn in October 2006. Resuckering species are up to 1 m tall, with many having flowers and/or fruits, while obligate seeder species are still establishing. Sandier soils have some relatively bare patches, although overall the original pre-burn suite of plants appears to be establishing successfully. Notes were taken during the survey of the method of regeneration of plants, ie resuckering from rootstock or obligate seeders.

In 1989, much of the survey area was burnt during a wildfire started by lightning strikes. Now, twenty years later, most of the plant communities have re-established with the majority of plants being sexually mature (producing fruits and seeds).

Several aerially-dispersed, canker-causing fungi including species of *Botryosphaeria*, *Diplodina* and *Zythiostroma*, have been isolated from *Banksia* in the Hopetoun region. Aerial canker *Botryosphaeria ribis*, which kills from the top down, was observed in a few areas, eg in old gravel pits south of Hamersley Inlet Road. In addition, the native dieback *Phytophthora megasperma* is known to occur on East Mt Barren. Plant pathogens appear to be causing decline of a patch of *Banksia speciosa* on the wave-cut bench, north side of Hamersley Drive. A full report on plant diseases and pathogens is being prepared by Malcom Grant.

5. Requirement for Referral or Other Clearances

DEC has ranked plant taxa considered to be threatened under a series of conservation codes, depending on their apparent degree of threat (see Appendix 1). Taxa listed as Declared Rare Flora require permission from the Minister responsible for the Wildlife Conservation Act 1950, if any portion of the plant is to be, or likely to be, disturbed.

The Hamersley Drive upgrade will require permits to take *Adenanthos ellipticus*, *Eucalyptus burdettiana*, *Eucalyptus coronata*, *Kunzea similis* subsp. *similis*, *Stylidium galioides* and possibly *Verticordia pityrhops*.

Schedule 5 of the *Environmental Protection Act 1986* has 10 principles of clearing. The wave-cut bench at the base of East Mt Barren, is one of the most botanically important sites in the FRNP and along the south coast. It is highly diverse with a large number of short-range endemics, including six species of Declared Rare flora two of which (*K. similis* and *V. pityrhops*) grow nowhere else. Also, a number of micro-wetlands supporting sedge communities important to fauna occur here (see A. Chapman report).

According to Schedule 5, native vegetation should not be cleared if —

1. it comprises a high level of biological diversity;
2. it includes, or is necessary for the continued existence of, rare flora;
3. it is growing in, or in association with, an environment associated with a watercourse or wetland;
4. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

According to the above criteria, none of the vegetation on the wave-cut bench should have any further disturbance.

The upgrade of Hamersley Drive should be considered a controlled action under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act* and will need to be referred to the Commonwealth's Minister of Environment for approval.

6. Conclusions and Recommendations

Stage 1 of the biological survey included 10 km of Hamersley Drive, from Culham Inlet to the Hamersley Drive turnoff. The section of road from about 2 km west of the carpark at the western end of East Mt Barren, to the eastern carpark on the wave-cut bench, is the most critical for road design and engineering. A high number of short-range endemic species grow here, including six Declared Rare flora which will be impacted by the upgrade. Five of the DRF were adequately surveyed, however it is recommended that *Verticordia pityrhops* be surveyed when flowering (February - June) to determine the number of plants potentially impacted by the road upgrade.

Additionally, on the wave-cut bench there are some ecologically significant micro-wetlands that will require care to ensure that drainage is not impeded by the road (also see A. Chapman's report). It is recommended that an expert in freshwater wetlands be consulted to assess the ecological value of these communities.

Further consultation will be required between DEC and Main Roads to determine the preferred biological trade-offs in the road upgrade, particularly on the wave-cut bench. Most of the DRF occur at each end of the bench where outcropping quartzite may limit road construction – it is imperative that the intervening section of sandy soils characterized by the *Banksia speciosa* vegetation unit (which includes many of the micro-wetlands), is not compromised in the upgrade.

As well as the wave-cut bench being one of the most important botanical sites in the FRNP, it is also one of the most scenic. Despite the "No Stopping/Parking" signs along this section of road, tourists regularly stop to admire the plants and views. Although a 'pull-off' area is desirable to appease the tourists, there is no obvious location to put one. An alternative suggestion is to have a high quality, walk trail along the wave-cut bench, linking the carparks at the east and west ends of East Mt Barren.

An on-site inspection with biologists and surveyor/ road engineer is recommended. For example, near the populations of DRF *Eucalyptus burdettiana*, *E. coronata* and Priority 2 *Leptospermum confertum* a few large boulders on each side of the road provide ideal habitat for King skinks *Egernia kingii*. In deciding the road alignment, this fauna habitat will need to be considered as well as the threatened flora. Also, the micro-wetlands are difficult to flag on the ground and would be easier to show to the surveyor/ road engineer.

Both weed invasion and plant disease have the greatest potential to impact the high biological and conservation value of the FRNP. Road materials (including water) must come from weed- and disease-free areas, so that they are not imported by either the material itself or the machinery carting it.

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Charmaine Hickman accompanied Ellen in her scrambles over East Mt Barren in search of eucalypts. Rosemary Jasper confirmed identification of plant specimens at the Perth herbarium.

References and Further Reading

- Aplin, T.E.H. and Newbey, K.R. (1990) The Flora of the Fitzgerald River National Park, Western Australia. *Kingia* 1(2) pp 155-193. Western Australian Herbarium Publication.
- Aplin, T.E.H. and Newbey, K.R. (1990) The Vegetation of the Fitzgerald River National Park, Western Australia. *Kingia* 1(2) pp 141-153. Western Australian Herbarium Publication.
- Aplin, T.E.H. and Newbey, K.R. (1990) Additional notes on the flora of the Fitzgerald River National Park, Western Australia. -1. Additional and unnamed taxa, and taxa with a high conservation value. *Kingia* 1(2) pp 141-153. Western Australian Herbarium Publication.
- Atkins KJ 2008 Declared Rare and Priority Flora list for Western Australia. Department of Environment and Conservation. August 2008.
- Beard, J.S. (1976) The Vegetation of the Newdegate & Bremer Bay Areas, Western Australia. Vegmap Publications, Perth.
- Beard JS 1979 The vegetation of the Ravensthorpe area, Western Australia. Map and explanatory memoir 1:250 000 series. Vegmap Publications, Perth.
- Bradby K 1989 A Park in Perspective: a report on the past, present and future of the Fitzgerald River National Park. Fitzgerald River Park Association.
- CALM 1991 Fitzgerald River National Park Management Plan 1991-2001. Department of Conservation and Land Management, Perth.
- CALM 1922 South Coast Region. Regional Management Plan 1992-2002. Management Plan No.24. Department of Conservation and Land Management, Perth.
- CALM 1994 A plan for the protection of South Coast vegetation from dieback. No.3, 1994-1998. Department of Conservation and Land Management, Albany.
- Chapman A 2009 Faunal considerations for proposed upgrade of Hamersley Drive – East Mt Barren to Hamersley Inlet in Fitzgerald River National Park, Western Australia. Unpublished report for Main Roads Western Australia, Albany.
- Chapman A and KR Newbey 1995 A biological survey of the Fitzgerald area, Western Australia. CALMScience [Supplement 3]. Department of Conservation and Land Management, Perth.
- Cockerton G and GF Craig 2000 Flora and vegetation surveying for Ravensthorpe Nickel Project – September-October 2000. Unpublished report for Sinclair Knight Merz and Ravensthorpe Nickel Operations, Perth.
- Craig GF 1995 Native plants of the Ravensthorpe Region. Ravensthorpe Wildflower Show Inc.
- Craig GF 2000 *Kunzea similis*: regional survey and trial sites. Unpublished report for Landcare Services Pty Ltd, on behalf of Sinclair Knight Merz and Ravensthorpe Nickel Operations.
- Craig G F and D J Coates 2001 Declared Rare Flora and Other Plants in Need of Special Protection in the Esperance District. Wildlife Management Program No.21. Department of Conservation and Land Management, Como.
- Deegan P 2005 Fitzgerald Biosphere bibliography. Fitzgerald Biosphere Group, Jerramungup.

- Deegan P 2006 Fitzgerald Biosphere review: the state of knowledge of the Fitzgerald Biosphere. Fitzgerald Biosphere Group, Jerramungup.
- EPA 1999 Environmental protection of native vegetation in Western Australia. Preliminary Position Statement No.2. Environmental Protection Authority, Perth.
- EPA 2004 Guidance for the assessment of environmental factors (in accordance with the Environmental Protection Act 1986). Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. No. 51. Environmental Protection Authority, June 2004.
- George EA 2002 *Verticordia*: the turner of hearts. University of WA Press, Perth.
- Government of WA 2002 A Biodiversity Conservation Act for Western Australia. Consultation Paper. December 2002.
- Hussey BMJ, GJ Keighery, RD Cousens, J Dodd and SG Lloyd 1997 *Western Weeds: a guide to the weeds of Western Australia*. The Plant Protection Society of Western Australia Inc.
- Lamont BB and ETF Witkowski 1995 A test for lottery recruitment among four *Banksia* species based on their demography and biological attributes. *Oecologia* 101, 299-308.
- Lamont BB, PK Groom, MB Richards and ETF Witkowski 1999 Recovery of *Banksia* and *Hakea* communities after fire in mediterranean Australia – the role of species identity and functional attributes. *Diversity and Distributions* 5, 15-26.
- Newbey K and EJ Hickman 2008 Checklist of plants; Fitzgerald River National Park. Second Edition. Friends of the Fitzgerald River National Park.
- Paczkowska G and AR Chapman 2000 *The Western Australian Flora: a descriptive catalogue*. Wildflower Society of WA, WA Herbarium, CALM, and the Botanic Gardens and Parks Authority.
- Robinson CJ and DJ Coates 1995 Declared rare and poorly known flora in the Albany district. Western Australian Wildlife Management Program No.20. ANCA, Canberra and CALM, Como.
- Sanders A 1996 Conservation value of Fitzgerald Biosphere Reserve buffer/transition zone, phases 1-1V. Unpublished report to Environment Australia, Canberra.
- Shepherd DP, GR Beeston and AJM Hopkins 2002 Native vegetation in Western Australia: Extent, Type and Status. Resource Management Technical Report 249. Department of Agriculture, WA.
- Wheeler J 2004 Miscellaneous new *Hibbertia* species (Dilleniaceae) from the south coast and adjacent interior of Western Australia. *Nuytsia* 15(2): 303-5.
- Wills RT and GJ Keighery 1994 Ecological impact of plant disease on plant communities. *Journal of the Royal Society of Western Australia*, 77, 127-131.
- Witkowski ETF, BB Lamont and SJ Connell 1991 Seed bank dynamics of three co-occurring banksias in south coastal Western Australia: the role of plant age, cockatoos, senescence and interfire establishment. *Australian Journal of Botany* 39: 385-397.
- Witt WK 1997 Geology of the Ravensthorpe and Cocanarup 1: 100 000 sheets. Geological survey of WA, Dept Minerals and Energy.
- Witt WK 1998 Geology and mineral resources of the Ravensthorpe and Cocanarup 1: 100 000 sheets. Report 54. Geological survey of WA, Dept Minerals and Energy.

Appendix 1: Department of Environment and Conservation's declared rare and priority flora list

Rare flora legislation and guidelines for gazettal

The State Conservation Strategy, Wildlife Conservation Act, 1950, and Conservation and Land Management Act 1984 provide the guidelines and legislative basis for the conservation of the State's indigenous plant and animal species. Under the Wildlife Conservation Act, the Department of Environment and Conservation (DEC) is responsible for the protection of flora and fauna of all lands and waters throughout the State. Section 23F of the Act gives the Minister responsibility for the Act statutory responsibility for the protection of those classes of flora declared to be rare.

The Wildlife Conservation Act (1950-1985) protects all classes of indigenous flora throughout the State. Protected flora includes:

- Spermatophyta - flowering plants, conifers and cycads
- Pteridophyta - ferns and fern allies
- Bryophyta - mosses and liverworts
- Thallophyta - algae, fungi and lichens

Section 23F of the Act provides special protection to those taxa (species, subspecies, varieties) considered by the Minister to be:

- * in danger of extinction - the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other factors continue to operate;
 - * rare - less than a few thousand adult plants of the taxon existing in the wild;
 - * in need of Special Protection - the taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or occurs largely on sites likely to experience changes in land use which could threaten its survival in the wild;
- or
- * presumed Extinct - 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.

This is achieved by declaring them to be 'rare' by notice published in the Government Gazette. DEC's Policy Statement No.9 discusses the legislation relating to Declared Rare Flora and outlines the criteria for gazettal.

Under the provisions of Section 23F, the 'taking' of Declared Rare Flora is prohibited by any person on any category of land throughout the State without the written consent of the Minister. A breach of the Act is liable to a penalty of up to \$10 000. The legislation refers only to wild growing populations and applies equally to Government officers and private citizens on Crown and private land.

To 'take' in relation to any flora includes 'to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause a permit the same to be done by any means'. This includes not only direct destruction or injury by human hand or machine but also such activities as allowing grazing by stock, introducing pathogens, altering water-tables so as to inundate or deprive the flora of adequate soil moisture, allowing air pollutants to harm foliage, and burning.

The schedule published in the Government Gazette is revised annually to accommodate additions and deletions to the Declared Rare Flora. To qualify for gazettal, plants must satisfy certain requirements as defined in Policy Statement No.9, namely:

- * the taxon (species, subspecies, variety) must be well-defined, readily identifiable and represented by a voucher specimen in the State or National Herbarium. It need not be formally described under conventions in the International Code of Botanical Nomenclature, but such a

description is preferred and should be undertaken as soon as possible after listing on the schedule;

- * the taxon must have been thoroughly searched for in most likely habitats in the wild by competent botanists during the past five years;
- * the searches have established that the plant in the wild is either rare, endangered or deemed to be threatened and in need of special protection.

Plants may be deleted from the Rare Flora schedule where:

- * recent botanical survey has shown that the taxon is no longer rare, endangered or in need of special protection;
- * the taxon is shown to be a hybrid;
- * the taxon is no longer in danger of extinction because it has been adequately protected by reservation of land on which it occurs or because population numbers have increased beyond the danger point.

DEC's Priority Species List

DEC maintains a priority species list to determine for survey of plants of uncertain conservation status. The list comprises some 1000+ taxa that are poorly known and in need of high priority survey or are adequately surveyed but in need of monitoring. The poorly known taxa are possibly at risk but do not meet the survey requirements for gazettal as Declared Rare Flora (DRF), as outlined in Policy Statement No.9. Only those plants considered to be threatened on the basis of thorough survey or presumed extinct can be included on the DRF schedule.

The priority flora list is divided into the following categories according to the degree of threat.

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.

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.

Priority Three - Poorly known Taxa

Taxa which are known from several 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 need of further survey.

Priority Four - Rare Taxa

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

Declared Rare and Priority Flora recorded in Fitzgerald River National Park survey area

The following list includes all species that have been recorded by the Department of Environment and Conservation between Hamersley Inlet and Culham Inlet (column 1). Species recorded in the near vicinity of Hamersley Drive are ticked in column 3, and those found during the current spring survey, within 25 m of the road verge ticked in column 4.

DEC Codes: R – Declared Rare Flora (X – presumed extinct)

P1 – Priority One

P2 – Priority Two

P3 – Priority Three

P4 – Priority Four

Environmental Protection and Biodiversity Conservation Act:

Codes EN – endangered

VU - vulnerable

Species Name	DEC Conserv Code	EPBC Act	Hamersley Drive DEFL & WAHERB	Spring survey 2009
<i>Adenanthos dobagii</i>	R	EN		
<i>Adenanthos ellipticus</i>	R	VU	✓	✓
<i>Cooperookia georgei</i>	R	EN		
<i>Eucalyptus burdettiana</i>	R	EN	✓	✓
<i>Eucalyptus coronata</i>	R	VU	✓	✓
<i>Kunzea similis</i> subsp. <i>similis</i>	R	-	✓	✓
<i>Stylidium galioides</i>	R	VU	✓	✓
<i>Verticordia pityrhops</i>	R	EN	✓	
<i>Astartea</i> sp. Fitzgerald (K.R. Newbey 10844)	P2			
<i>Calothamnus macrocarpus</i>	P2		✓	✓
<i>Eremophila chamaephila</i>	P2			
<i>Eucalyptus sinuosa</i>	P2			
<i>Gonocarpus hispidus</i>	P2		✓	✓
<i>Hibbertia papillata</i>	P2		✓	✓
<i>Leptospermum confertum</i>	P2		✓	✓
<i>Pimelea longiflora</i> subsp. <i>eyrei</i>	P2			
<i>Pultenaea brachyphylla</i>	P2			
<i>Stenanthemum cristatum</i>	P2			
<i>Thysanotus brachiatus</i>	P2			
<i>Calycopeplus marginatus</i>	P3			
<i>Eucalyptus arborella</i>	P3			
<i>Gastrolobium stenophyllum</i>	P3			
<i>Lasiopetalum monticola</i>	P3			
<i>Lissanthe pleurandroides</i>	P3			
<i>Thomasia pygmaea</i>	P3			
<i>Acacia argutifolia</i>	P4		✓	✓
<i>Acacia moirii</i> subsp. <i>dasycarpa</i>	P4		✓	✓
<i>Adenanthos labillardierei</i>	P4			
<i>Anthocercis fasciculata</i>	P4		✓	✓
<i>Corybas limpidus</i>	P4			
<i>Dampiera deltoidea</i>	P4		✓	✓

Species Name	DEC Conserv Code	EPBC Act	Hamersley Drive DEFL & WAHERB	Spring survey 2009
<i>Eucalyptus praetermissa</i>	P4			
<i>Eucalyptus x erythrandra</i>	P4			
<i>Hakea hookeriana</i>	P4		✓	
<i>Jacksonia compressa</i>	P4		✓	✓
<i>Lechenaultia superba</i>	P4		✓	
<i>Leucopogon compactus</i>	P4		✓	✓
<i>Melaleuca papillosa</i>	P4		✓	✓
<i>Pimelea physodes</i>	P4		✓	✓
<i>Pleurophascum occidentale</i>	P4			
Total species	40		20	17

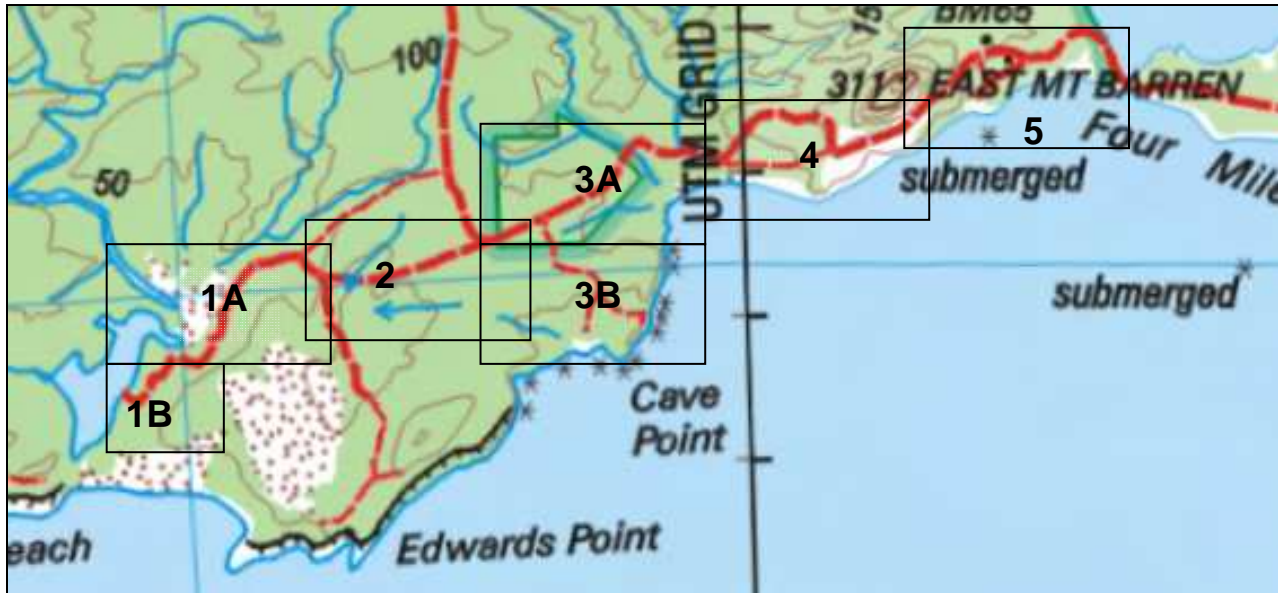
Appendix 2: Muir's (1977) Vegetation Classification

The classification was modified in this project by combining the 'Shrubs 1-1.5 m' and 'Shrubs 1.5 – 2 m' into a single layer, ie Shrubs 1-2 m.

LIFE FORM/ HEIGHT CLASS		CANOPY COVER			
		DENSE 70-100%	MID-DENSE 30-70%	SPARSE 10-30%	VERY SPARSE 2-10%
T	Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M	Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA	Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB	Trees <5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT	Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS	Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S	Shrubs >2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA	Shrubs 1.5-2m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB	Shrubs 1-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC	Shrubs 0.5-1m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD	Shrubs <0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P	Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H	Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT	Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL	Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J	Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT	Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL	Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X	Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
	Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

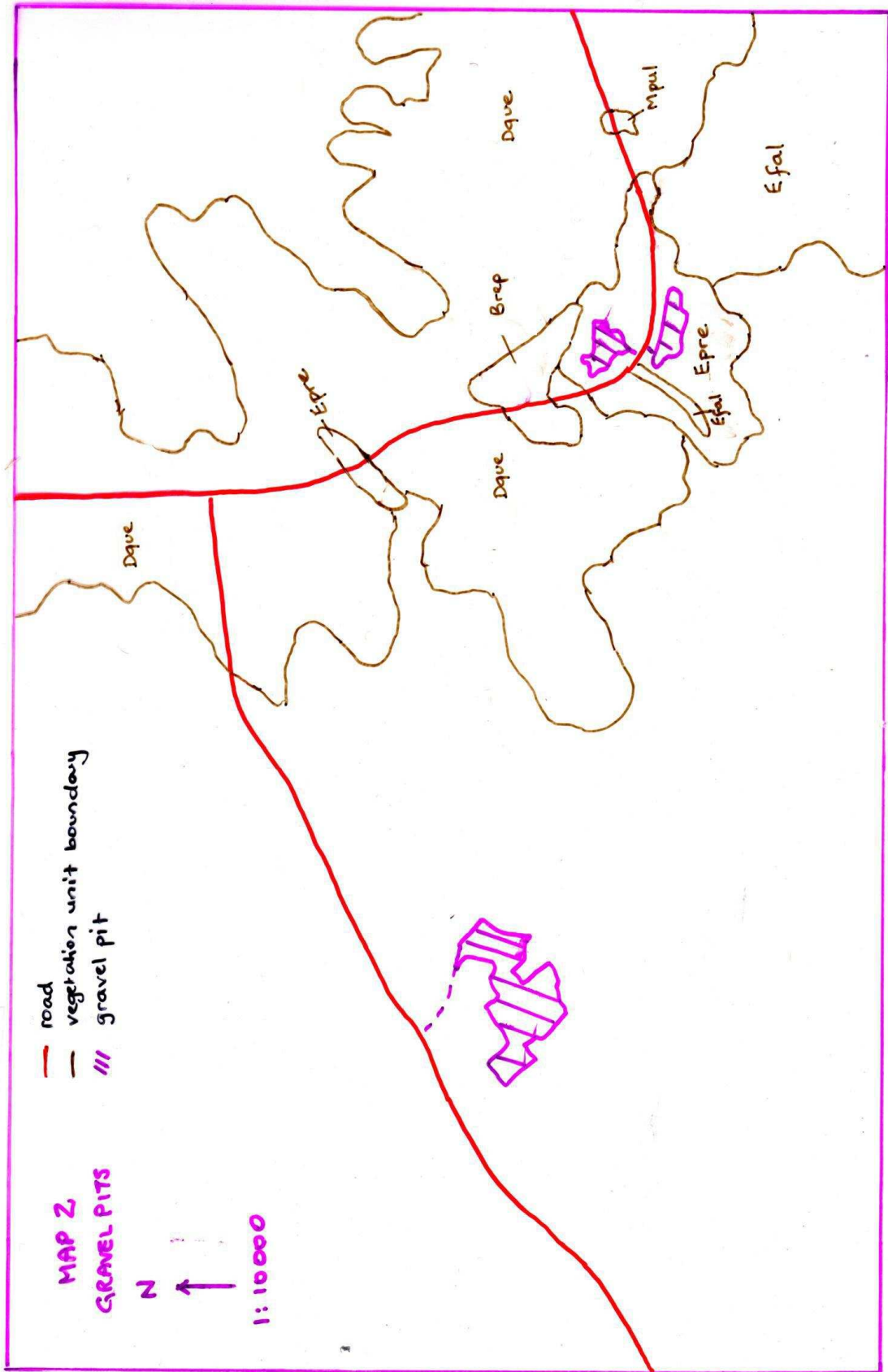
Appendix 3: Vegetation maps

Appendix 3.1: Coverage of vegetation maps

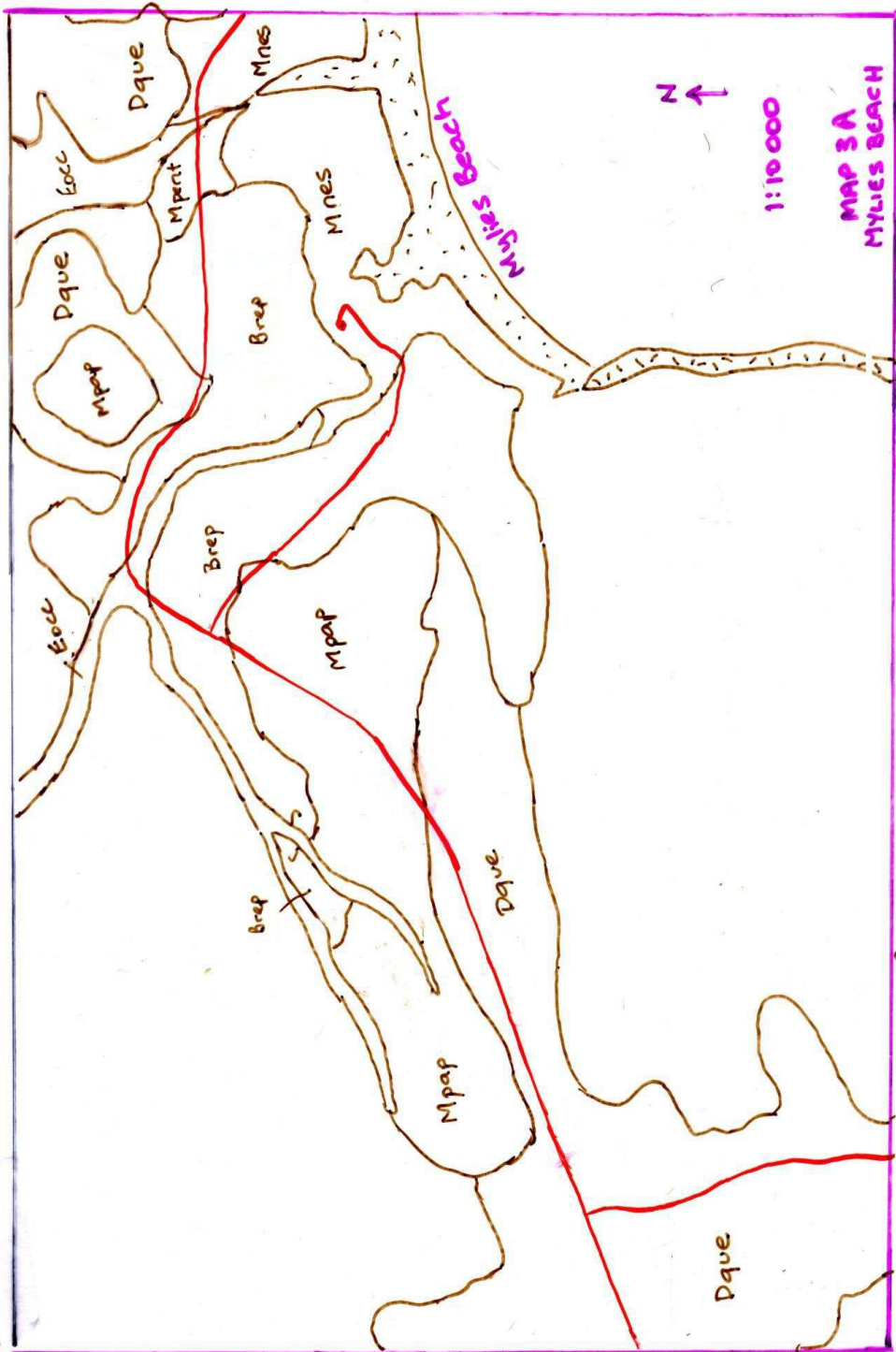


Appendix 3.2: Vegetation units adjacent to the Hamersley Drive upgrade

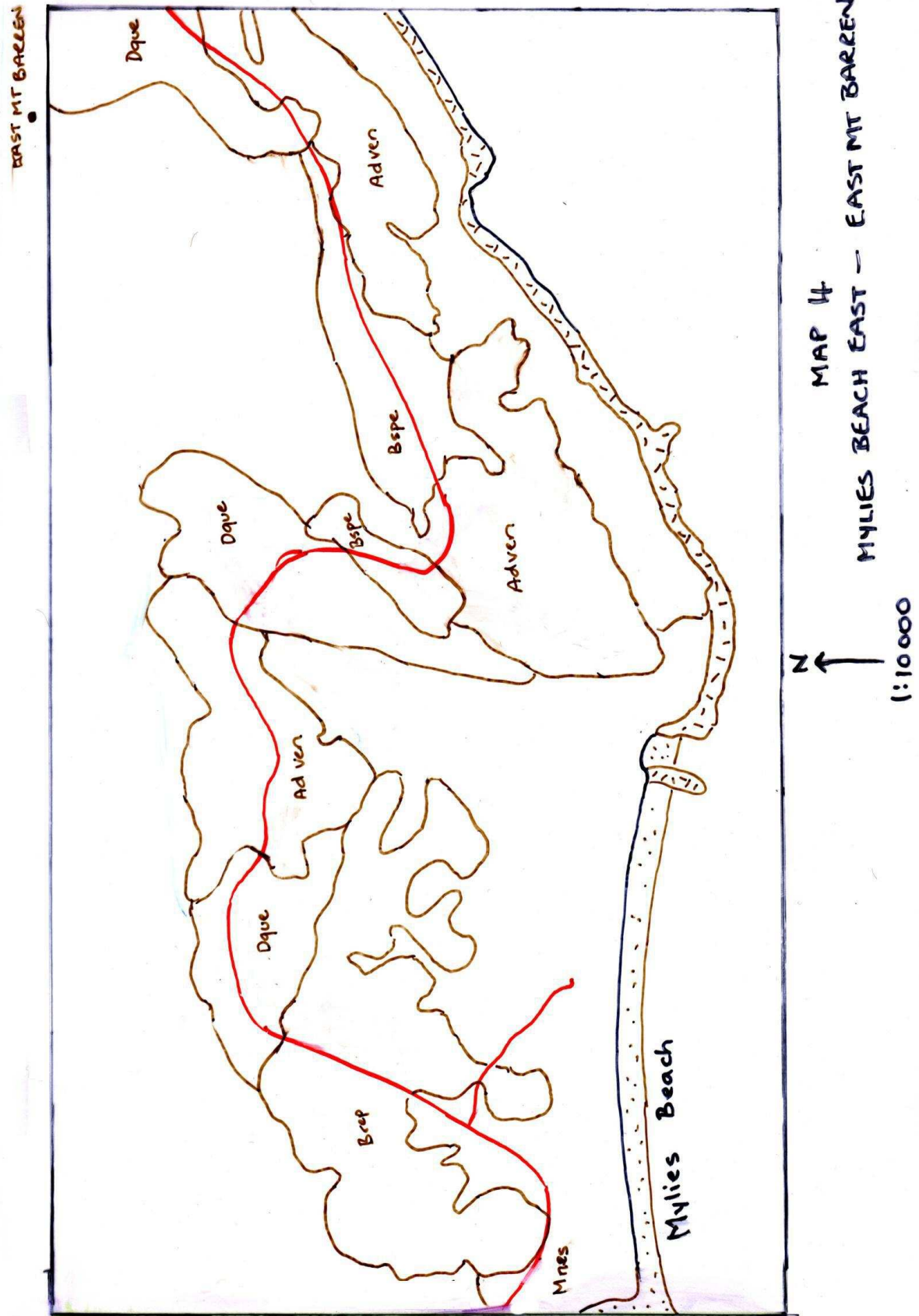
Map Code	Vegetation structure	Typical species
Quartzite & schist:		
Adven	Heath	<i>Adenanthos venosus</i> , <i>Taxandria conspicua</i> ssp. <i>abrupta</i> , <i>Regelia velutina</i>
Dque	Open mallee-thicket/heath	<i>Dryandra quercifolia</i> , <i>Eucalyptus pleurocarpa</i> , <i>Banksia lemmaniana</i>
Efal	Mallee scrub	<i>Eucalyptus falcata</i> , <i>Templetonia retusa</i>
Epre	Mallee shrub	<i>Eucalyptus preissiana</i> , <i>Dryandra quercifolia</i>
Mpap	Shrub heath	<i>Melaleuca papillosa</i>
Coastal plain:		
Brep	Open mallee-heath	<i>Banksia repens</i> , <i>Adenanthos cuneatus</i> , <i>Eucalyptus pleurocarpa</i>
Bspe	Scrub thicket - sedge	<i>Banksia speciosa</i> , <i>Anarthria laevis</i>
Eple/Cqua	Open mallee-heath	<i>Eucalyptus pleurocarpa</i> , <i>Calothamnus quadrifidus</i> , <i>Anarthria laevis</i>
Mpul	Heath	<i>Melaleuca pulchella</i>
Coastal dunes:		
Aros	Thicket	<i>Acacia rostellifera</i>
Eang	Open mallee-heath	<i>Eucalyptus angulosa</i>
Mlan	Scrub thicket	<i>Melaleuca lanceolata</i> , <i>Scaevola crassifolia</i> , <i>Acacia rostellifera</i>
Mnes	Shrub heath	<i>Melaleuca nesophila</i>
Mpen	Shrub heath	<i>Melaleuca pentagona</i>
Creeklines & wetlands:		
Eocc	Woodland	<i>Eucalyptus occidentalis</i> , <i>Rhagodia baccata</i>
Mcut	Shrubland	<i>Melaleuca cuticularis</i>



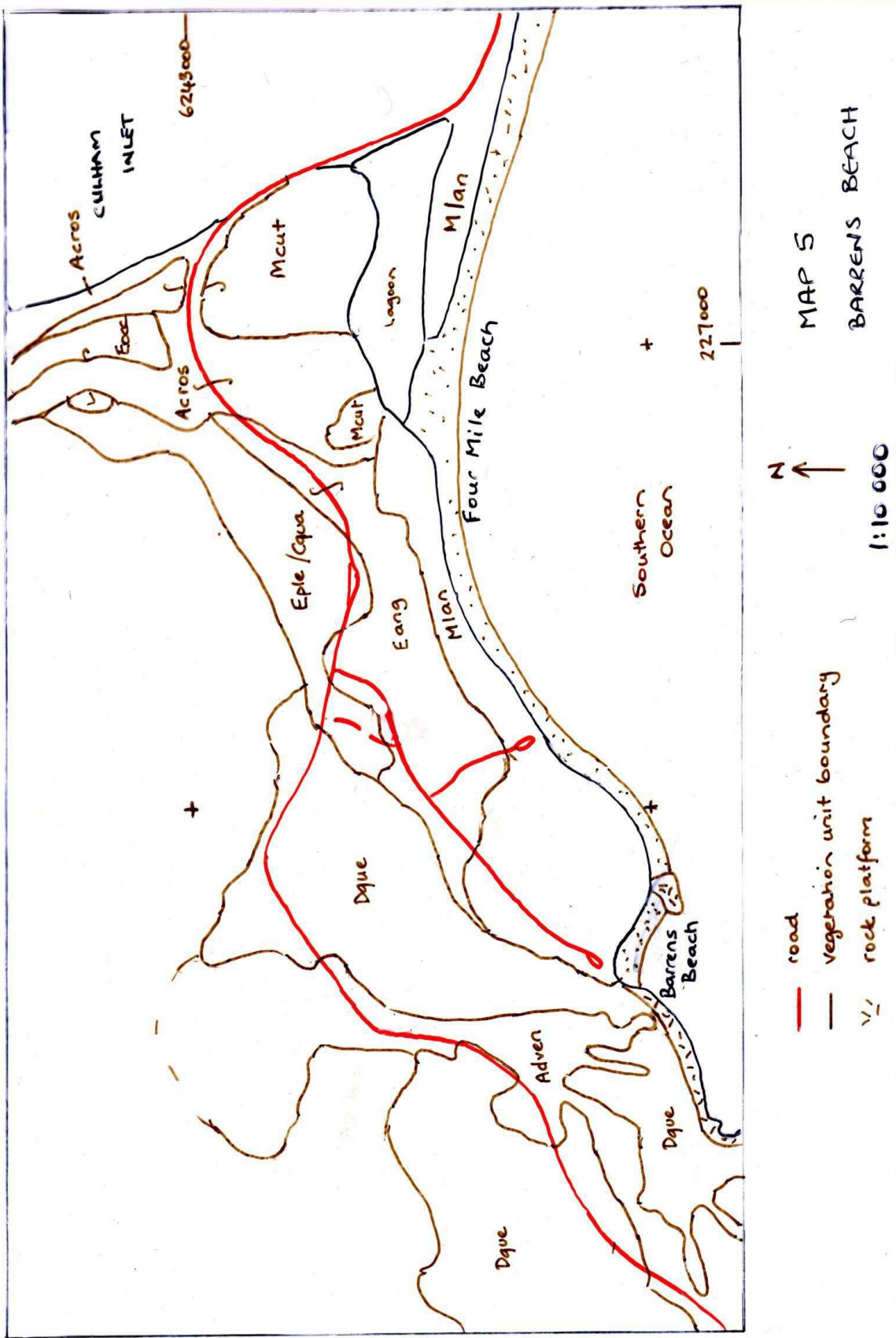
Map 2: Gravel Pits – Hamersley Drive/ Hamersley Inlet Road intersection



Map 3A: Mylies Beach Road



Map 4: Mylies Beach East – East Mt Barren



Map 5: Barrens Beach – Culham Inlet

Appendix 4: Declared Rare and Priority flora

[insert Appendix 4.doc]

Appendix 1: Declared Rare and Priority flora

Adenanthos ellipticus (DRF)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Alt	Plant Count	Size	Notes	DigiPic
Hamersley Drive upgrade:								
59	-33.9267	120.01115	1-Oct-09	100.6	2			dscn6420-23
60	-33.92672	120.01123	1-Oct-09	98.5	20	<10m		
67	-33.92645	120.01106	1-Oct-09	98.8	1			
10	-33.93104	120.0128	12-Oct-09	90.5	30	patch	1.5 m	
14	-33.93115	120.01327	12-Oct-09	95.4	7			
15	-33.93113	120.01347	12-Oct-09	93.9	80			
16	-33.93108	120.01361	12-Oct-09	92.7	20	+		dscn6439
18	-33.93095	120.01411	12-Oct-09	90.2	20	+		dscn6442-5
26	-33.93072	120.01393	12-Oct-09	92.7	7			
27	-33.93079	120.01358	12-Oct-09	92	100	+ big patch	to wpt 30	
28	-33.93077	120.0133	12-Oct-09	95.7	30			
30	-33.93066	120.01283	12-Oct-09	97.5	10			
52	-33.92694	120.02457	16-Oct-09	101.2	4			
53	-33.92697	120.02443	16-Oct-09	101.2	3			
57	-33.92764	120.02373	16-Oct-09	96.3	4			
58	-33.92767	120.02369	16-Oct-09	91.1	1			
100	-33.9273	120.02446	16-Oct-09	88.4	11			
					350			

East Mt Barren (WAHERB & DEFL):

17Ae	-33.93194	120.01361	28/02/2008
18Ae	-33.91833	120.01333	26 11 1931
19Ae	-33.91833	120.01333	02 11 1929
20Ae	-33.91833	120.01333	21 04 1962
21Ae	-33.91833	120.01333	26 11 1931
22Ae	-33.91833	120.01333	07 05 1993
23Ae	-33.91833	120.01333	25 10 1964
24Ae	-33.91833	120.01333	02 11 1929
25Ae	-33.91833	120.01333	31 01 1960
26Ae	-33.91833	120.01333	14 04 1974
27Ae	-33.91833	120.01333	25 10 1964
28Ae	-33.91666	120.03333	09 11 1983
29Ae	-33.91833	120.01333	29 12 1984
30Ae	-33.91666	120.03333	12 01 1979
31Ae	-33.92986	120.01456	26 04 2004
32Ae	-33.92486	120.02678	10 04 1994
33Ae	-33.92986	120.01539	30 11 1993
34Ae	-33.91833	120.01333	07 09 1993
35Ae	-33.91666	120.03333	19 11 1985
36Ae	-33.91833	120.01333	25 05 1983
37Ae	-33.91666	120	08 09 1992
38Ae	-33.91666	120.03333	09 09 1971
39Ae	-33.91666	120.03333	09 09 1971
40Ae	-33.92861	120.0125	29 09 1999

***Adenanthos ellipticus* – cont.**

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	350	0.9	0.7
¹ East Mt Barren	40,000+		
² Thumb Peak	10,000+		
² West Mt Barren	1,000+		

¹ DEC Albany 2008

² Robinson & Coates 1995



***Kunzea similis* subsp. *similis* (DRF)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	Size	DigiPic
Hamersley Drive upgrade								
11	-33.93104	120.01294	12-Oct-09	92	1			
14	-33.93115	120.01327	12-Oct-09	95.4	70	to wpt 15		dscn6433-8
15	-33.93113	120.01347	12-Oct-09	93.9				
16	-33.93108	120.01361	12-Oct-09	92.7	1			
19	-33.93083	120.01456	12-Oct-09	90.8	5			
21	-33.93043	120.01611	12-Oct-09	82.9	3			
23	-33.92956	120.01743	12-Oct-09	88.4	1			
25	-33.93064	120.01411	12-Oct-09	90.5	5			
26	-33.93072	120.01393	12-Oct-09	92.7	4			
28	-33.93077	120.0133	12-Oct-09	95.7	5			
84	-33.93057	120.0184	16-Oct-09	73.8	5			
					100			
East Mt Barren (WAHERB & DEFL):								
201Ks	-33.93153	120.01347	11/05/2005					
201Ks	33.932259	120.01262	07 09 1986					
203Ks	-33.93347	120.01206	04 01 2001				10 ha	

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	2.8	2.8
1 East Mt Barren	3,600		

1 DEC Albany 2009



***Eucalyptus burdettiana* (DRF)**

Surveyed by Ellen Hickman- October 2009

Waypoint	Latitude	Longitude	y_proj	x_proj	Date	Altitude	Plant Count
Hamersley Drive upgrade:							
23	-33.9287249	120.0205123	6241747	224574	30-Sep-09	92	1
24	-33.9285661	120.0206604	6241765	224587	30-Sep-09	92	1
25	-33.9285392	120.0206471	6241768	224586	30-Sep-09	93	1
26	-33.9285297	120.0206463	6241769	224586	30-Sep-09	96	1
27	-33.9285016	120.0209229	6241773	224611	30-Sep-09	95	1
28	-33.9284123	120.0209826	6241783	224617	30-Sep-09	94	1
2	-33.9241108	120.0294694	6242283	225387	30-Sep-09	86	1
3	-33.9247515	120.0275988	6242207	225217	30-Sep-09	97	1
4	-33.9245827	120.0273505	6242225	225193	30-Sep-09	90	1
5	-33.924585	120.0273392	6242225	225192	30-Sep-09	91	1
6	-33.9247328	120.0272272	6242208	225182	30-Sep-09	91	1
7	-33.9247898	120.0271298	6242202	225173	30-Sep-09	101	1
8	-33.9247976	120.027071	6242201	225168	30-Sep-09	103	1
9	-33.9251008	120.0266809	6242166	225133	30-Sep-09	98	1
10	-33.9251094	120.0267091	6242165	225135	30-Sep-09	99	1
13	-33.9254482	120.0260613	6242126	225077	30-Sep-09	94	1
14	-33.925424	120.0260233	6242128	225073	30-Sep-09	98	1
15	-33.9257424	120.0256209	6242092	225037	30-Sep-09	97	1
18	-33.9289674	120.0202768	6241720	224553	30-Sep-09	96	1
19	-33.9288234	120.0203926	6241736	224563	30-Sep-09	90	1
20	-33.9287992	120.020383	6241739	224562	30-Sep-09	93	1
21	-33.9288111	120.0203379	6241737	224558	30-Sep-09	92	1
30	-33.9290463	120.0201499	6241711	224542	30-Sep-09	90	1
31	-33.9290353	120.0202277	6241712	224549	30-Sep-09	90	1
33	-33.9291188	120.0210128	6241705	224622	30-Sep-09	91	1
35	-33.9259481	120.0258895	6242070	225062	30-Sep-09	99	1
36	-33.9254957	120.0261001	6242121	225080	30-Sep-09	95	1
37	-33.9255242	120.026105	6242118	225081	30-Sep-09	96	1
39	-33.9254707	120.0262328	6242124	225093	30-Sep-09	100	1
40	-33.9254684	120.0263565	6242124	225104	30-Sep-09	100	1
41	-33.9254716	120.0266466	6242125	225131	30-Sep-09	97	1
42	-33.9255715	120.0266922	6242114	225135	30-Sep-09	96	1
43	-33.9255661	120.0266395	6242114	225130	30-Sep-09	95	1
44	-33.9253376	120.0267516	6242140	225140	30-Sep-09	96	1
45	-33.9253099	120.0267647	6242143	225141	30-Sep-09	96	1
46	-33.9253151	120.0267883	6242143	225143	30-Sep-09	93	1
47	-33.9252779	120.0268573	6242147	225150	30-Sep-09	91	1
48	-33.9249459	120.027257	6242185	225186	30-Sep-09	90	1
49	-33.9248718	120.0274608	6242194	225204	30-Sep-09	88	1
50	-33.9248717	120.0274753	6242194	225206	30-Sep-09	88	1
51	-33.9248518	120.0276342	6242196	225220	30-Sep-09	85	1
52	-33.9247981	120.0276199	6242202	225219	30-Sep-09	79	1

42

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	42	1.2	1.2
East Mt Barren	3580		

***Eucalyptus coronata* (DRF)**

Surveyed by Ellen Hickman- October 2009

Waypoint	Latitude	Longitude	y_proj	x_proj	Date	Altitude	Plant Count
Hamersley Drive upgrade:							
*	-33.925439	120.02603	6242127	225073	30-Sep-09	96	1
*	-33.925437	120.02603	6242127	225073	30-Sep-09	96	1
*	-33.926044	120.02534	6242058	225012	30-Sep-09	100	1
*	-33.927679	120.02368	6241872	224863	30-Sep-09	94	1
*	-33.928714	120.02045	6241749	224568	30-Sep-09	97	1
*	-33.928932	120.02004	6241723	224531	30-Sep-09	93	1
*	-33.92898	120.02077	6241720	224599	30-Sep-09	92	1
*	-33.92602	120.02585	6242062	225058	30-Sep-09	97	1
*	-33.925522	120.02616	6242118	225086	30-Sep-09	97	1
							9

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	9	0.45%	0.45%
East Mt Barren	2,000		
Annie Peak	unknown		
Whoogerup Range	unknown		
Mid Mt Barren	unknown		

***Eucalyptus burdettiana* – cont.**

Surveyed by Ellen Hickman- October 2009

Pop No.	Location	No. of plants prior 2009	No. of plants 2009 survey	Comments
1A	W lower slopes of East Mt Barren above valley 3-400m N of Hammersley Drive extending N along E side of valley	200 (1/9/88 NMQ) ?(22/9/92 CJR) 50 (20/5/02 NMQ) 52 (15/1/02 JAC) ? (4/10/06 SAB)	267 + 10	This population was assessed 1/10/09. 267 plants tagged. Plants regenerating from fire, old burnt fruits only no new buds/flowers/fruits. Ran out of tags. More plants to the NE and SW of tagged population estimated additional 10 plants. (6/10/09)
1B	Both sides of Hammersley Drive on E side of East Mt Barren	? (22/10/83 RLS) 20 (7/5/93 NMQ) 150 (30/6/98 DNI) 150 (28/4/00 SAB) 50 (3/4/02 SAB) ? (16/1/07 SAB)	92 + 200	This population was visited on 30/9/09 & 2/10/09. 50 plants tagged, another 42 plants marked with blue flagging tape along roadside within 25m proposed disturbance area. These plants are assumed to be potentially under threat during road works. This population is a mixture of <i>E.burdettiana</i> & <i>E.coronata</i> . Lots more plants seen and yet to be tagged. Vegetation very thick, last burnt 1989. (6/10/09) This population was not revisited during this survey as it was concluded that to visit and mark every plant was not effective. Estimates of additional plants made using aerial photography is 200
1C	On ridge running NE, N of Hammersley Drive where it turns cnr from running N-S to E-W	1 (22/4/95 NMQ) ? (4/10/06 SAB)	42 188 + 300 316 + 1500	This population was initially visited on 1/10/09. 42 plants tagged, ran out of light. Population extends further up ridge from tagged plants (6/10/09). This population was revisited 21/10/09 and found to extend upslope and into gully/plateau below sheer cliff of the summit. Nearer the top this species begins to mix with <i>E.coronata</i> . The vegetation was last burnt in 1989 and was too thick to do a thorough survey so plants counted is 188 but estimated number of plants is 300 (30/10/09). This population also extended from where the plants were recorded on the 1/10/09 to the west along the NW face of East Mt Barren and extends from just below summit downslope almost to bottom. The extent and no. of plants was assessed on 24/10/09, 316 plants were marked but a lot more were seen (too many to count individually). The estimated number of plants is 1200

1D	Near summit of East Mt Barren	? (18/10/64 CAG) ? (4/10/66 PAW) 1 (15/3/00 MAT) ? (4/10/06 SAB)	0	No plants found near summit. Large population seen below SE cliff face but not easily accessible from summit, probable access from extension of W valley before summit beyond <i>E.coronata</i> Pop No. 1 or from E ridgeline of East Mt Barren. These plants are assumed to be <i>E.burdettiana</i> but may be <i>E.coronata</i> , or a mixture of both species (6/10/09). <i>E.burdettiana</i> were found to extend upslope as noted in comments of population 1C. As the old path to the summit originally traversed the east face of the mountain prior to 1989 fire, this population was probably initially recorded as one of the plants from population 1C. (30/10/09)
1E	2.5km N of Hammersley Drive 500m off Culham Inlet	35 (2/9/90 SDH) ? (4/10/06 SAB)	0	Not surveyed yet. (6/10/09) This population site was visited on 22/10/09, however no plants were located. The terrain was not quite right. On reading the notes on file pertaining to this population it is now assumed that this is actually population 1C and that there was a miss communication with the distances. From File Note: "Steve Hopper advised that he saw the population of <i>E.burdettiana</i> on the NE running ridge, mentioned by Nathan McQuoid (f125), on 2/9/90. It was 500m W of Culham Inlet and 2.5km N of Hammersley Dr. There were 30 mature plants and a few seedlings. Regenerating from coppice after fire, 1m tall. Quartzite. <i>E.burdettiana</i> was also seen scattered between this location and East Mt Barren. This was the most NE location of <i>E.burdettiana</i> that Steve saw. Brenda Moran 18/5/95". It is probably 2.5km up Hammersley Drive from Culham Inlet and 500m N of Hammersley Drive making it population 1C. (30/10/09)
2	Creekline ca. 1.5km NW of East Mt Barren	100 (28/6/08 SAB)	666	Not surveyed yet (6/10/09). This population was visited 23/10/09, There were two sub-populations – 2A consists of 620 plants approximately (plants were not individually counted) in a gully 750m N of Hammersley Drive. The plants extend for 800-900m along the gully and up the SE facing slope or N side of gully. 2B consists of 46 plants on the end of a ridge S of 2A on the S & SE facing slope of this ridge. (30/10/09)
TOTAL			1571 + 2010	

***Eucalyptus coronata* – cont.**

Surveyed by Ellen Hickman- October 2009

Pop No.	Location	No. of plants prior 2009	No. of plants 2009 survey	Comments
1A	Both sides of Hamersley Drive at base of East Mt Barren on E side	2 (22/10/83 RLS) 1 (31/10/86 RLS) ? (5/6/91 LA) 50 (9/8/92 NMQ) 150 (9/9/92 CJR) 30 (7/5/93 NMQ) 20 (20/5/95 NMQ) 50 (21/1/96 DN) 150 (22/4/00 SAB) 2 (1A only 3/4/02 SAB) 50 (1B only 11/5/05 SAB) ? (1A only 27/2/08 SAB) 50 (1B only 27/2/08 SAB)	132 64 + 300	<p>This population was visited 30/9/09 & 2/10/09. 123 tagged, remaining 9 marked with blue flagging tape along roadside within 25m proposed disturbance area. These plants are assumed to be potentially under threat during road works. This population is a mixture of <i>E.burdettiana</i> & <i>E.coronata</i>. Lots more plants seen and yet to be tagged. Vegetation very thick, last burnt in 1989. (6/10/09 EJH)</p> <p>Because the vegetation was too thick to traverse when entering from the south side of the mountain, upslope into unburnt vegetation decided to try and access it from the N side across the burnt vegetation which is not as thick. 64 plants were marked until the vegetation was again too thick to traverse. The population is again a mixture of <i>E.coronata</i> & <i>E.burdettiana</i>. The population of <i>E.coronata</i> is estimated to have an additional 300 plants. (30/10/09 EJH)</p>
1B	Summit of East Mt Barren		222 43 + 1200	<p>This population was visited 29/9/09. 222 were tagged. Population extends both N & S. Most plants tagged so far were burnt in recent fire and regenerating, old burnt fruits, no new buds/flowers/fruit. Some plants tagged in unburnt area to S. Vegetation very thick. (6/10/09 EJH)</p> <p>I had intended to assess the rest of this population to the S, to tag the plants and to see if the population continues around to the E to join up with 1A. However because other areas of unburnt vegetation were found to be too thick to traverse it was decided to abandon this plan and to assess the population to the N. On the 24/10/09 43 plants were marked, 18 were the N extension of 1B and the remaining 25 were mixed in with <i>E.burdettiana</i> population 1C. There were more seen, not marked but number are estimated at 1200. (30/10/09 EJH)</p>
2	Eyre Range in a gully running E of Annie Peak	? (16/9/86 ES) 50 (26/9/88 AN)		Not survey yet (6/10/09 EJH)
3	Whoogarup Range	? (23/9/23 CAG) 15 (26/9/96 FO)		Not survey yet (6/10/09 EJH)
4	Mid Mt Barren	? (23/9/23 CAG) 0 (28/11/02 SAB)		Not survey yet (6/10/09 EJH)
TOTAL			461 + 1500	

Stylidium galioides (DRF)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	Size	DigiPic
Hamersley Drive upgrade:								
33	-33.92735	120.00877	1-Oct-09	88.7	12	?burnt 2006		dscn6414
34	-33.92741	120.00874	1-Oct-09	89	60			
35	-33.92741	120.00861	1-Oct-09	88.7	7			
36	-33.92742	120.00854	1-Oct-09	87.5	4			
37	-33.92746	120.0085	1-Oct-09	86.3	7			
38	-33.9274	120.00879	1-Oct-09	87.5	16	BLUE TAPE (S limit)		
40	-33.92744	120.00855	1-Oct-09	87.5	4	BLUE TAPE (W limit)		
53	-33.92712	120.0095	1-Oct-09	88.1	11	BLUE TAPE + BLUE TAPE (W limit)		dscn6415- 8
55	-33.92678	120.0102	1-Oct-09	92.7	24			
56	-33.9267	120.01029	1-Oct-09	92.7	2			
58	-33.92665	120.01048	1-Oct-09	96	50	BLUE TAPE (E limit)		
67	-33.92645	120.01106	1-Oct-09	98.8	5			
69	-33.92651	120.01032	1-Oct-09	93.3	20	BLUE TAPE (E limit)		
70	-33.92664	120.00997	1-Oct-09	90.5	50	BLUE TAPE (W limit)		
4	-33.9297	120.01238	12-Oct-09	90.8	17			
5	-33.9298	120.01244	12-Oct-09	89	30	+ seedlings; burnt 2006		
39	-33.92458	120.02813	16-Oct-09	94.5	10			dscn6456- 7
48	-33.92603	120.02538	16-Oct-09	102.4	5	+		
49	-33.92617	120.02524	16-Oct-09	99.1	20	+		
60	-33.92807	120.02291	16-Oct-09	93.3	15			
71	-33.92884	120.02014	16-Oct-09	95.1	1			
75	-33.92894	120.01934	16-Oct-09	93.3	10			
76	-33.92901	120.01899	16-Oct-09	91.7	50	+		
78	-33.92919	120.01858	16-Oct-09	88.7	10	+		
80	-33.92937	120.01811	16-Oct-09	82.9	50	+		
85	-33.92982	120.01844	16-Oct-09	79.6	5			
86	-33.92942	120.01874	16-Oct-09	84.1	5			
95	-33.92834	120.02282	16-Oct-09	89.9	1			
111	-33.92439	120.02912	16-Oct-09	84.4	1			
					502			
East Mt Barren (WAHERB & DEFL):								
271Sg	-33.92361	120.02033	22/04/2000					
290Sg	-33.91833	120.01333	12 1971					
283Sg	-33.91833	120.01333	04 10 1966					
288Sg	-33.91833	120.01333	04 11 1967					
285Sg	-33.91833	120.01333	11 10 1974					
293Sg	-33.92666	120.01694	15 01 2002					
280Sg	-33.91833	120.01333	16 10 1961					
294Sg	-33.92013	120.03289	16 11 2003					
275Sg	-33.91833	120.01333	18 10 1964					
279Sg	-33.91666	120.01667	20 10 1987					
272Sg	-33.91833	120.01333	20 11 1989					
273Sg	-33.91833	120.01333	22 10 1961					
289Sg	-33.91833	120.01333	24 09 1967					
282Sg	-33.91833	120.01333	25 10 1964					
277Sg	-33.91666	120.01667	25 10 1982					
278Sg	-33.91833	120.01333	26 11 1931					
292Sg	-33.92736	120.02095	27 09 1997					
291Sg	-33.91833	120.01333	28 10 1963					
274Sg	-33.91833	120.01333	31 10 1962					

***Stylidium galioides* – cont.**

		% EMB population	% all populations
Hamersley Drive upgrade	500+	<16%	unknown
1 East Mt Barren	3,000+		
2 Fortification Hill	scattered		
2 Annie Peak	common		

1 E.Hickman pers.comm.
2 Robinson & Coates 1995



***Verticordia pityrhops* (DRF)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	PlantCount
East Mt Barren (WAHERB & DEFL):					
302Vp	-33.92931	120.01484	6/05/1999		
303Vp	-33.92931	120.01484	6/05/1999		
304Vp	-33.93083	120.01278	3/04/2002		
305Vp	-33.91833	120.01333	23 01 1969		
306Vp	-33.93333	120.03333	04 10 1966		
307Vp	-33.91833	120.01333	31 01 1960		
308Vp	-33.91833	120.01333	24 01 1969		
309Vp	-33.91833	120.01333	31 01 1960		
310Vp	-33.91666	120.01667	25 10 1982		
311Vp	-33.93194	120.0125	07 09 1986		
312Vp	-33.91833	120.01333	25 05 1968		
313Vp	-33.91833	120.01333	24 10 1984		
314Vp	-33.93125	120.01706	24 05 1999		
315Vp	-33.91666	120.03333	17 03 1972		
316Vp	-33.91833	120.01333	05 1970		
317Vp	-33.91833	120.01333	08 04 1988		

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil seen	few(?)	
1 East Mt Barren	+/- 2000		

1 DEC Albany 2009



Calothamnus macrocarpus (Priority 2)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	Size	DigiPic
Hamersley Drive upgrade:								
A. Mylies Creek								
11	-33.93149	119.99441	29-Sep-09	6.7	3			
12	-33.93154	119.99447	29-Sep-09	5.8	1			
13	-33.93163	119.99449	29-Sep-09	6.7	1			
14	-33.93167	119.99446	29-Sep-09	7.3	4			
20	-33.93164	119.99494	29-Sep-09	8.8	1	2 m tall		
21	-33.93175	119.99485	29-Sep-09	6.7	5			dscn6362-4
22	-33.93189	119.99491	29-Sep-09	7.6	100	+ (S of upgrade area)		
23	-33.93189	119.9953	29-Sep-09	8.5	20			
24	-33.93195	119.9954	29-Sep-09	8.8	20			
25	-33.9317	119.99543	29-Sep-09	11.9	12			
27	-33.93211	119.99585	29-Sep-09	13.7	12			
28	-33.93216	119.99598	29-Sep-09	14.9	9			
29	-33.93222	119.99607	29-Sep-09	14	12			
30	-33.93233	119.99588	29-Sep-09	10.4	10			
33	-33.93255	119.99731	29-Sep-09	21.3	1			
34	-33.93248	119.99787	29-Sep-09	15.8	5			
35	-33.93237	119.99812	29-Sep-09	13.4	5			
37	-33.93221	119.99826	29-Sep-09	19.8	6			
38	-33.93212	119.99837	29-Sep-09	17.1	30	+		
39	-33.93194	119.9985	29-Sep-09	21.9	5	E limit		
47	-33.93193	119.99828	29-Sep-09	20.4	1			
49	-33.93214	119.99754	29-Sep-09	22.9	1			
50	-33.93221	119.99743	29-Sep-09	22.9	4			
51	-33.93226	119.99716	29-Sep-09	22.3	40	dense patch		
52	-33.93232	119.99709	29-Sep-09	21	1	old road		
53	-33.9322	119.99665	29-Sep-09	18.6	20	scattered		
55	-33.93206	119.99611	29-Sep-09	17.7	4	scattered		
					233			
B. Wave-cut bench - Culham Inlet								
11	-33.93104	120.01294	12-Oct-09	92	5			
13	-33.93125	120.0131	12-Oct-09	94.8	3			
17	-33.93103	120.01367	12-Oct-09	92.7	2			
29	-33.9308	120.01316	12-Oct-09	97.2	4			
36	-33.92423	120.02927	16-Oct-09	86.9	5			
41	-33.92496	120.02694	16-Oct-09	87.2	2			
43	-33.9254	120.02614	16-Oct-09	96.6	1			
44	-33.92563	120.02581	16-Oct-09	99.4	5			
45	-33.92568	120.0257	16-Oct-09	100	5			
46	-33.92584	120.02555	16-Oct-09	100	1			
47	-33.92599	120.02542	16-Oct-09	98.8	3			
50	-33.92643	120.02499	16-Oct-09	99.7	3			
52	-33.92694	120.02457	16-Oct-09	101.2	3			
57	-33.92764	120.02373	16-Oct-09	96.3	2			
58	-33.92767	120.02369	16-Oct-09	91.1	1			
59	-33.92803	120.0232	16-Oct-09	86.9	10	+		
61	-33.92821	120.02257	16-Oct-09	89.3	5			
65	-33.92863	120.02131	16-Oct-09	93	4			
68	-33.9288	120.02075	16-Oct-09	94.5	2			
69	-33.92884	120.02049	16-Oct-09	97.8	3			
70	-33.92886	120.0203	16-Oct-09	96.3	2			
72	-33.92889	120.01995	16-Oct-09	93	3			
88	-33.92911	120.02006	16-Oct-09	90.8	5			
91	-33.92898	120.02074	16-Oct-09	93	2			
97	-33.9281	120.0233	16-Oct-09	87.5	5			

98	-33.92768	120.02399	16-Oct-09	93.3	2
99	-33.9274	120.02434	16-Oct-09	96.6	3
104	-33.9254	120.02636	16-Oct-09	94.5	2
106	-33.9252	120.02674	16-Oct-09	96.3	3
107	-33.92507	120.02699	16-Oct-09	95.1	10 +
110	-33.92449	120.0289	16-Oct-09	88.4	3
114	-33.92342	120.03073	16-Oct-09	83.8	3
9	-33.92079	120.04127	23-Oct-09	7.9	1
11	-33.92075	120.04054	23-Oct-09	4.6	10
23	-33.9208	120.03899	23-Oct-09	11.6	2
26	-33.92095	120.03989	23-Oct-09	9.8	2
29	-33.92097	120.04031	23-Oct-09	9.1	3
31	-33.92102	120.04055	23-Oct-09	7.9	1
34	-33.91957	120.0341	23-Oct-09	52.4	1
48	-33.92033	120.03732	23-Oct-09	25.3	1
62	-33.91923	120.03458	23-Oct-09	57.9	12
76	-33.92121	120.03117	23-Oct-09	88.7	2
80	-33.92048	120.03223	23-Oct-09	82.9	10

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East Mt Barren (WAHERB & DEFL):

64Cm	-33.931759	120.01222	27/02/2008
65Cm	-33.93167	119.99556	28/09/2004
66Cm	-33.93167	119.99556	28/09/2004
67Cm	-33.91833	120.01333	25 08 1964
68Cm	-33.91805	120.04667	22 09 1970
69Cm	-33.91833	120.01333	25 08 1964
70Cm	-33.91833	120.01333	11 10 1967
71Cm	-33.91833	120.01333	04 10 1966
72Cm	-33.93333	120	09 11 1983
73Cm	-33.91833	120.01333	29 08 1962
74Cm	-33.91833	120.01333	10 01 1969
75Cm	-33.91833	120.01333	31 10 1962
76Cm	-33.91833	120.01333	
77Cm	-33.91833	120.01333	11 10 1967
78Cm	-33.925	120.025	16 09 2000
79Cm	-33.92138	120.04139	08 09 1992
80Cm	-33.91666	120.03333	19 11 1985
81Cm	-33.92319	120.03067	04 01 2001
82Cm	-33.91833	120.01333	21 04 1962
83Cm	-33.93166	119.99556	28 09 2004
84Cm	-33.92138	120.04139	08 09 1992

Calothamnus macrocarpus – cont.

		% EMB population	% all populations
Hamersley Drive upgrade:			
A. Mylies Beach	233	unknown	unknown
B. Wave-cut bench - inlet	157	16%	unknown
1 East Mt Barren	200+		
2 Wave-cut bench	est. 1,000		
1 Robinson & Coates 1995			
2 S.Barrett DEC Albany 2008			



Gonocarpus hispidus (Priority 2)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
71	-33.92016	120.03231	23-Oct-09	81.1	50	+ abundant	GFC 8660	dscn6557-9
East Mt Barren (WAHERB & DEFL):								
165Gh	-33.9255	120.01989	9/09/1992					
166Gh	-33.91833	120.01333	14 09 1974					
167Gh	-33.92611	120.00722	09 09 1992					

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	50	0.05	0.05
1 East Mt Barren	100,000+		

1 Robinson & Coates 1995



Hibbertia papillata (Priority 2)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
14	-33.92694	120.00157	1-Oct-09	58.5	30		GFC8614	dscn6403-6
33	-33.92735	120.00877	1-Oct-09	88.7	+			
42	-33.92703	120.00759	1-Oct-09	90.8	+			
53	-33.92712	120.0095	1-Oct-09	88.1	+			
59	-33.9267	120.01115	1-Oct-09	100.6	+			
9	-33.93071	120.01239	12-Oct-09	88.7	+			
25	-33.93064	120.01411	12-Oct-09	90.5	+			
33	-33.92338	120.03006	16-Oct-09	86.3	+			
35	-33.92415	120.0293	16-Oct-09	87.8	+			
67	-33.92877	120.02099	16-Oct-09	92.4	+		GFC8638	
83	-33.9301	120.01842	16-Oct-09	77.7	+			
109	-33.92452	120.02873	16-Oct-09	89.6	+			dscn6509
117	-33.92188	120.03108	16-Oct-09	83.8	+			
79	-33.92074	120.0317	23-Oct-09	85	2			
85	-33.93106	120.01345	23-Oct-09	92	100	+	GFC8661	
					est. 500			
					+			

East Mt Barren (WAHERB & DEFL):

170Hp	-33.92706	120.01633	8/09/2001
171Hp	-33.93333	120.03333	04 10 1966
172Hp	-33.92861	120.0125	29 09 1999
173Hp	-33.91666	120.01667	01 10 1970
174Hp	-33.91666	120.01667	01 10 1970
175Hp	-33.91666	120.01667	04 10 1966
176Hp	-33.927189	120.01617	08 09 2001
177Hp	-33.931864	120.01269	03 09 1986
178Hp	-33.91833	120.01333	23 09 1986
179Hp	-33.93333	120.05	07 10 1971
180Hp	-33.91833	120.01333	22 09 1986

Eyre Range:

2-Nov-65

AS George 7262

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 500+	unknown	unknown
East Mt Barren	not surveyed		



Leptospermum confertum (Priority 2)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	Size	DigiPic
Hamersley Drive upgrade:								
47	-33.92599	120.02542	16-Oct-09	98.8	ca. 10	dense thicket	10m x 10m	dscn6467-71
East Mt Barren (WAHERB & DEFL):								
2Lepc	-33.91833	120.01333	12 1931					
3Lepc	-33.91833	120.01333	13 12 1964					
4Lepc	-33.91833	120.01333	12 1926					
5Lepc	-33.91833	120.01333	03 1966					
6Lepc	-33.91833	120.01333	31 01 1960					
7Lepc	-33.93333	120.03333	04 10 1966					
8Lepc	-33.91833	120.01333	18 10 1964					
11Lepc	-33.91833	120.01333	12 1966					
13Lepc	-33.92472	120.01889	09 08 2003					
14Lepc	-33.92291	120.02234	04 01 2001					

		% EMB population	% all populations
Hamersley Drive upgrade	10	?10%	unknown
1 East Mt Barren	+/-100		
2 Thumb Peak	500+		

- 1 S.Barret, DEC Albany, 2005
- 2 Robinson & Coates 1995

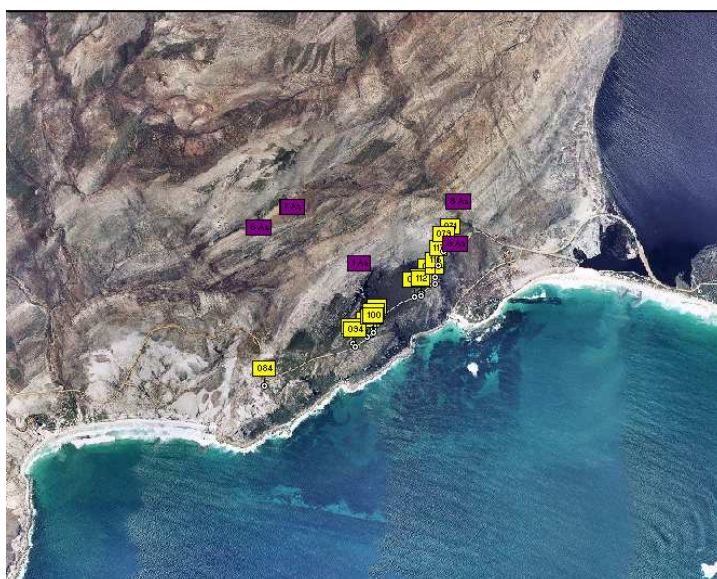


Acacia argutifolia (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo
Hamersley Drive upgrade:							
32	-33.92337	120.03024	16-Oct-09	91.1	20	+	
35	-33.92415	120.0293	16-Oct-09	87.8	10		
38	-33.92443	120.02866	16-Oct-09	90.8	+	occasional	
51	-33.92659	120.02482	16-Oct-09	102.4	13	+	
53	-33.92697	120.02443	16-Oct-09	101.2	5	+ frequent	
57	-33.92764	120.02373	16-Oct-09	96.3	+	frequent	
62	-33.92821	120.02234	16-Oct-09	89.9	+	few	
94	-33.92847	120.02256	16-Oct-09	87.2	3		GFC8641
99	-33.9274	120.02434	16-Oct-09	96.6	20	+	
100	-33.9273	120.02446	16-Oct-09	95.4	+		
112	-33.92434	120.02927	16-Oct-09	84.1	+		
114	-33.92342	120.03073	16-Oct-09	83.8	+		
116	-33.92285	120.03073	16-Oct-09	81.7	+		
117	-33.92188	120.03108	16-Oct-09	83.8	+		
71	-33.92016	120.03231	23-Oct-09	81.1	2		
79	-33.92074	120.0317	23-Oct-09	85	2		
84	-33.93148	120.01341	23-Oct-09	93	1		
					84+		
East Mt Barren (WAHERB & DEFL):							
1Aa	-33.92153	120.02317	25/10/1982				
2Aa	-33.91666	120.01667	25 10 1982				
3Aa	-33.91666	120.01667	02 12 1980				
4Aa	-33.91666	120.01667	01 10 1970				
5Aa	-33.91666	120.01667	13 12 1964				
6Aa	-33.91833	120.01333	28 10 1968				
7Aa	-33.91666	120.01667	11 1931				
8Aa	-33.91666	120.03333	18 11 1985				
9Aa	-33.92013	120.03289	16 11 2003				

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 100	est. <5%	est. <3%
1 East Mt Barren	2,000+		
1 FRNP	830+		
1 Kundip	3+		
1 Robinson & Coates 1995			



***Acacia moirii* subsp. *dasycarpa* (Priority 4)**

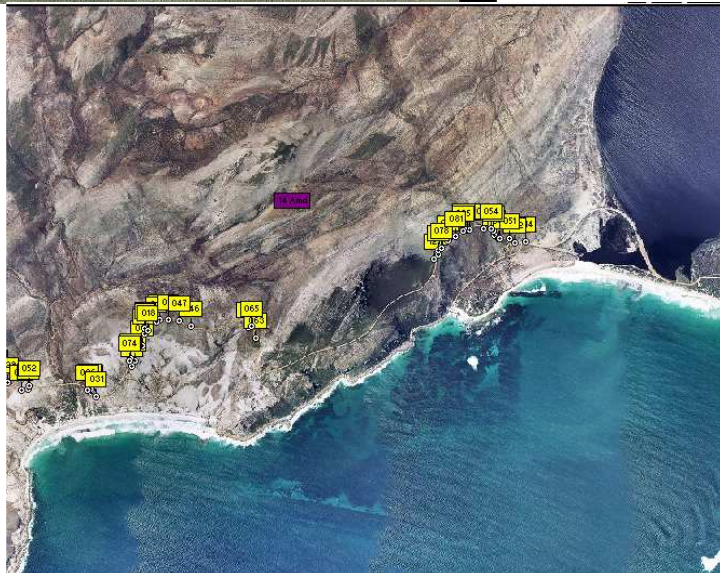
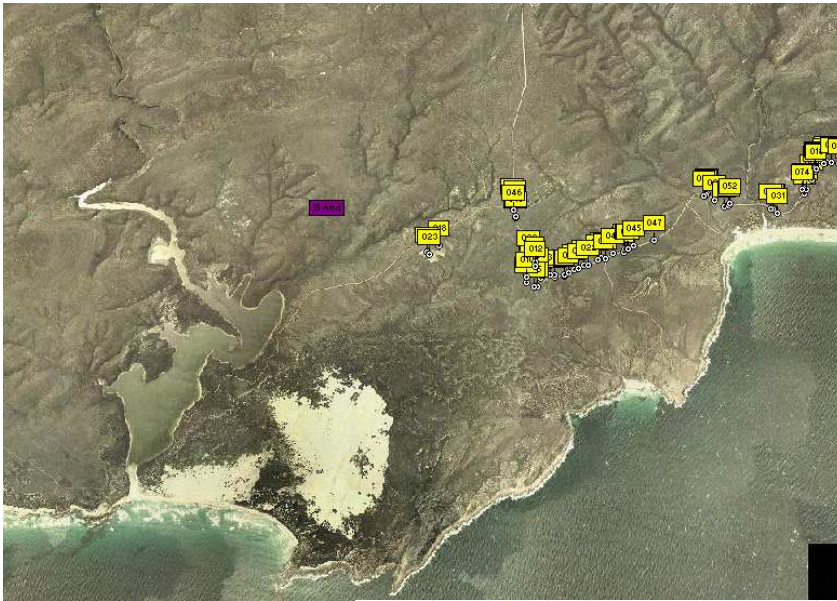
Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	DigiPic
Hamersley Drive upgrade:							
2	-33.93217	119.95932	22-Sep-09	69.2	2		
7	-33.93244	119.9597	22-Sep-09	66.4	+		
8	-33.93378	119.95989	22-Sep-09	61.3	+		
16	-33.93873	119.96198	22-Sep-09	55.5	+		
17	-33.93935	119.96217	22-Sep-09	58.2	+		
18	-33.94018	119.96287	22-Sep-09	57.6	+		
20	-33.94028	119.96308	22-Sep-09	57.6	+		
23	-33.94074	119.96361	22-Sep-09	56.7	23		
27	-33.94063	119.96561	22-Sep-09	57.6	+		
28	-33.9404	119.96557	22-Sep-09	57.9	2		
30	-33.94042	119.96499	22-Sep-09	57.9	2		
33	-33.94042	119.96411	22-Sep-09	59.7	+		
34	-33.94019	119.9632	22-Sep-09	58.5	+		
37	-33.93908	119.9622	22-Sep-09	57	6		
38	-33.93823	119.96191	22-Sep-09	55.8	4		
45	-33.93373	119.95985	22-Sep-09	66.1	2		
46	-33.93296	119.95963	22-Sep-09	67.7	5		
1	-33.93823	119.97194	23-Sep-09	68.6	20	+	
2	-33.93848	119.97149	23-Sep-09	67.1	+		
6	-33.93913	119.96968	23-Sep-09	61.3	5		
9	-33.93961	119.96828	23-Sep-09	59.7	30	+	
14	-33.94045	119.96689	23-Sep-09	59.1	+		
15	-33.94032	119.96688	23-Sep-09	56.4	+		
16	-33.94004	119.9676	23-Sep-09	60.4	+		
21	-33.9395	119.96894	23-Sep-09	61.9	+		
22	-33.93905	119.97017	23-Sep-09	62.5	+		
23	-33.93828	119.97257	23-Sep-09	73.8	100	freq in Oct2006 burn area	
28	-33.93747	119.97513	23-Sep-09	65.8	+		
36	-33.93715	119.97536	23-Sep-09	61.9	+		
40	-33.93764	119.97364	23-Sep-09	68	+		
43	-33.93705	119.97565	23-Sep-09	64	+		
44	-33.93709	119.97579	23-Sep-09	61.6	+		
45	-33.93665	119.97654	23-Sep-09	59.7	+		
47	-33.93593	119.97932	23-Sep-09	52.4	+		
2	-33.93042	119.9866	25-Sep-09	19.2	+		
5	-33.9305	119.98648	25-Sep-09	15.8	+		
27	-33.93059	119.98619	25-Sep-09	10.4	+		
29	-33.93115	119.98768	25-Sep-09	16.5	+		
32	-33.93181	119.98904	25-Sep-09	20.4	+		
35	-33.93171	119.98965	25-Sep-09	21	+		
52	-33.93139	119.98979	25-Sep-09	24.1	+		
2	-33.93192	119.99605	29-Sep-09	16.8	+		
3	-33.93187	119.99592	29-Sep-09	16.5	+		
26	-33.93196	119.99558	29-Sep-09	9.1	+		
31	-33.93246	119.99641	29-Sep-09	22.6	+		
59	-33.93003	120.00015	29-Sep-09	27.7	+		
62	-33.92958	120.00043	29-Sep-09	31.1	+		
64	-33.92836	120.00121	29-Sep-09	43.3	+		
69	-33.92737	120.00155	29-Sep-09	53.9	+		
73	-33.92944	119.99999	29-Sep-09	33.5	+		
74	-33.92957	119.99999	29-Sep-09	32.9	+		
1	-33.9263	120.00306	1-Oct-09	68.6	+		
2	-33.92625	120.00304	1-Oct-09	69.2	+		
10	-33.92643	120.00271	1-Oct-09	66.8	+		

13	-33.92682	120.00166	1-Oct-09	60.4	+
15	-33.92698	120.00156	1-Oct-09	58.2	+
18	-33.9271	120.00181	1-Oct-09	56.1	+
21	-33.92632	120.0039	1-Oct-09	70.4	+
46	-33.92692	120.00617	1-Oct-09	82.9	+
47	-33.92636	120.00497	1-Oct-09	79.9	+
62	-33.92711	120.01187	1-Oct-09	100.6	+
63	-33.92802	120.01257	1-Oct-09	96	+
65	-33.92706	120.01218	1-Oct-09	103.3	+
119	-33.92153	120.0311	16-Oct-09	86.3	+
121	-33.92186	120.03068	16-Oct-09	89.3	+
3	-33.94175	119.96317	19-Oct-09	57	+
5	-33.94182	119.96272	19-Oct-09	59.1	+
9	-33.94128	119.96172	19-Oct-09	57.9	+
10	-33.94073	119.9616	19-Oct-09	54.9	+
11	-33.93886	119.96279	19-Oct-09	59.4	+
12	-33.93944	119.96274	19-Oct-09	57.3	+
18	-33.93732	119.94923	19-Oct-09	59.4	+
20	-33.93818	119.94756	19-Oct-09	61.3	+
23	-33.93842	119.94788	19-Oct-09	54.6	+
14	-33.92069	120.03994	23-Oct-09	10.4	+
22	-33.92073	120.03887	23-Oct-09	13.1	+
34	-33.91957	120.0341	23-Oct-09	52.4	+
35	-33.91951	120.03434	23-Oct-09	63.4	+
42	-33.91952	120.03574	23-Oct-09	42.1	+
46	-33.92008	120.03679	23-Oct-09	30.8	+
47	-33.92031	120.03718	23-Oct-09	27.1	+
48	-33.92033	120.03732	23-Oct-09	25.3	+
51	-33.92035	120.03824	23-Oct-09	18.9	+
53	-33.91966	120.03669	23-Oct-09	33.8	+
54	-33.91954	120.03648	23-Oct-09	37.8	+
64	-33.91942	120.0338	23-Oct-09	68	+
65	-33.91961	120.03368	23-Oct-09	65.5	+
73	-33.92038	120.0321	23-Oct-09	79.6	+
76	-33.92121	120.03117	23-Oct-09	88.7	+
78	-33.92097	120.03143	23-Oct-09	87.5	+
81	-33.92008	120.03293	23-Oct-09	75	+
					est. 1,000+
East Mt Barren (WAHERB & DEFL):					
10Amd	-33.91666	120.01667	28 10 1963		
11Amd	-33.91666	120.01667	04 10 1966		
12Amd	-33.93333	120.06472	17 11 1993		
13Amd	-33.91666	120.01667	18 11 1985		
14Amd	-33.91666	120.01667	13 04 1974		
15Amd	-33.93333	119.93333	12 09 1983		

Acacia moirii* subsp. *dasycarpa

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 1,000+	est. <1%	est. <0.5%
1 Hamersley Drive	occasional		
1 Hamersley Inlet	common		
1 Mt Desmond	100+		
1 Jerdacuttup	10+		
1 Robinson & Coates 1995			



Anthocercis fasciculata (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
6	-33.93141	119.99496	29-Sep-09	12.6	20		GFC8600	dscn6355-60
7	-33.93142	119.9951	29-Sep-09	11.3	20			
16	-33.93166	119.99464	29-Sep-09	6.1	2			
18	-33.93154	119.99472	29-Sep-09	8.8	+	W limit		
19	-33.93156	119.99484	29-Sep-09	9.8	+	E limit		
45	-33.92697	120.00646	1-Oct-09	84.7	1			
13	-33.92067	120.0401	23-Oct-09	10.1	1			
15	-33.92061	120.03979	23-Oct-09	7.3	13			
16	-33.92048	120.03958	23-Oct-09	11.9	5			
17	-33.92051	120.0393	23-Oct-09	14.3	7			
19	-33.92034	120.03876	23-Oct-09	17.4	3			
25	-33.9209	120.03957	23-Oct-09	11.9	2			
32	-33.92107	120.0407	23-Oct-09	7.6	1			
33	-33.92117	120.04071	23-Oct-09	7.6	12			
38	-33.91926	120.03498	23-Oct-09	47.9	5			
39	-33.91925	120.03508	23-Oct-09	48.8	4			
40	-33.91948	120.03553	23-Oct-09	46.6	200	+ large patch extends upslope		
55	-33.91939	120.0361	23-Oct-09	37.5	2			
59	-33.91891	120.03484	23-Oct-09	52.4	10			
65	-33.91961	120.03368	23-Oct-09	65.5	70			
66	-33.91979	120.03329	23-Oct-09	68.3	+			
67	-33.91998	120.03293	23-Oct-09	71.6	20			
81	-33.92008	120.03293	23-Oct-09	75	2			
					200			
East Mt Barren (WAHERB & DEFL):								
43Af	-33.91666	120.03333	05 08 1974					
44Af	-33.91833	120.01333	22 10 1961					
45Af	-33.91833	120.01333	25 10 1964					
46Af	-33.93305	119.98333	05 05 1991					
47Af	-33.91666	120.01667	13 04 1974					
48Af	-33.91833	120.01333	28 10 1963					
49Af	-33.91833	120.01333	26 11 1931					
50Af	-33.91833	120.01333	26 11 1931					
51Af	-33.91833	120.01333	26 11 1931					
52Af	-33.91833	120.01333	28 10 1963					
53Af	-33.925	120.05	14 09 1974					
54Af	-33.91666	120.01667	08 09 1992					

Anthocercis fasciculata

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	est. <2%	est. <1%
1 East Mt Barren	1,000+		
1 West Mt Barren	500+		
1 Robinson & Coates 1995			



***Dampiera deltoidea* (Priority 4)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	DigiPic
Hamersley Drive upgrade:							
37	-33.91939	120.0348	23-Oct-09	56.7	25	+	dscn6547-9
41	-33.91945	120.03558	23-Oct-09	40.5	1		
54	-33.91954	120.03648	23-Oct-09	37.8	1		
71	-33.92016	120.03231	23-Oct-09	81.1	50	+	
East Mt Barren (WAHERB & DEFL):							
91Dd	-33.91986	120.03484	1/10/1998				
92Dd	-33.93333	120.03333	04 10 1966				

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	80	unknown	<0.7%
1 FRNP	6,000		
1 Bandalup Hill	6,000		
1 Cockerton and Craig 2000			

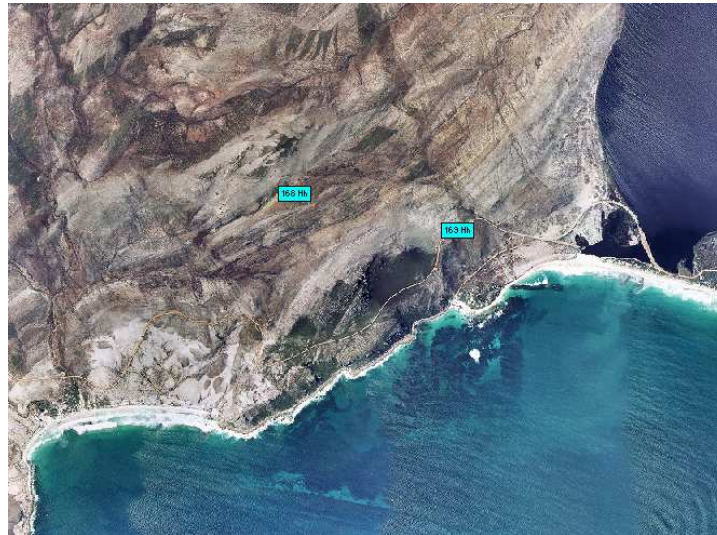


***Hakea hookeriana* (Priority 4)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude
East Mt Barren (WAHERB & DEFL):				
168Hh	-33.91666	120.01667	31 01 1960	
169Hh	-33.92013	120.03289	16 11 2003	

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil found	-	-
East Mt Barren	?		
1 Thumb Peak	100+		
1 Two Bump Hill	50+		
1 Robinson & Coates 1995			



Jacksonia compressa (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
9	-33.93489	119.96026	22-Sep-09	57.6	11			
10	-33.93519	119.9605	22-Sep-09	58.2	10			
12	-33.93541	119.96062	22-Sep-09	61	10			dscn6238-41
13	-33.93558	119.96038	22-Sep-09	62.2	30			
42	-33.93557	119.96094	22-Sep-09	61.9	45	50+ on E-W ridge		
43	-33.93516	119.96055	22-Sep-09	62.2	+			
44	-33.93504	119.96047	22-Sep-09	61.3	5			
42	-33.93653	119.97734	23-Sep-09	55.8	13			
43	-33.93705	119.97565	23-Sep-09	64	50	W limit		
44	-33.93709	119.97579	23-Sep-09	61.6	20	abundant on N verge		
45	-33.93665	119.97654	23-Sep-09	59.7	30			
46	-33.93672	119.97706	23-Sep-09	57.6	1			
47	-33.93593	119.97932	23-Sep-09	52.4	200			
48	-33.93576	119.97964	23-Sep-09	50	5	E limit		
52	-33.93576	119.97949	23-Sep-09	50	500			
53	-33.93655	119.97724	23-Sep-09	57.6	20			
1	-33.9026	119.9476	25-Sep-09	171	+			
10	-33.92643	120.00271	1-Oct-09	66.8	2			
11	-33.92658	120.00213	1-Oct-09	63.4	20	+		
12	-33.92668	120.00186	1-Oct-09	61.3	50			
13	-33.92682	120.00166	1-Oct-09	60.4	10	+		
15	-33.92698	120.00156	1-Oct-09	58.2	+			
18	-33.9271	120.00181	1-Oct-09	56.1	8			
19	-33.92667	120.00221	1-Oct-09	62.2	6			
20	-33.92649	120.00297	1-Oct-09	69.2	4			
22	-33.92637	120.00482	1-Oct-09	75	1			
23	-33.92688	120.00558	1-Oct-09	78.3	50			
26	-33.92724	120.00646	1-Oct-09	84.1	10			
28	-33.92715	120.00718	1-Oct-09	89.9	5			
29	-33.92715	120.0072	1-Oct-09	86	5			
30	-33.92739	120.00781	1-Oct-09	87.2	10	+		
37	-33.92746	120.0085	1-Oct-09	86.3	+			
39	-33.92745	120.00866	1-Oct-09	86.3	+			
41	-33.9272	120.00838	1-Oct-09	89.3	20	+		
43	-33.927	120.00736	1-Oct-09	89.3	+			
46	-33.92692	120.00617	1-Oct-09	82.9	+	common		
47	-33.92636	120.00497	1-Oct-09	79.9	+			
50	-33.92694	120.00878	1-Oct-09	88.4	+	frequent		
54	-33.92681	120.01008	1-Oct-09	89.9	+			
56	-33.9267	120.01029	1-Oct-09	92.7	+			
59	-33.9267	120.01115	1-Oct-09	100.6	+			
61	-33.92681	120.01149	1-Oct-09	100.3	50			
67	-33.92645	120.01106	1-Oct-09	98.8	+	E limit		
68	-33.92644	120.01069	1-Oct-09	95.4	10	+		
14	-33.93115	120.01327	12-Oct-09	95.4	3			
27	-33.93079	120.01358	12-Oct-09	92	3			
32	-33.92337	120.03024	16-Oct-09	91.1	50	+		
35	-33.92415	120.0293	16-Oct-09	87.8	+			
36	-33.92423	120.02927	16-Oct-09	86.9	+	frequent		
42	-33.92526	120.02648	16-Oct-09	94.2	+	frequent		
45	-33.92568	120.0257	16-Oct-09	100	+			
50	-33.92643	120.02499	16-Oct-09	99.7	+			
52	-33.92694	120.02457	16-Oct-09	101.2	+			
58	-33.92767	120.02369	16-Oct-09	91.1	+	occasional		
61	-33.92821	120.02257	16-Oct-09	89.3	+			
62	-33.92821	120.02234	16-Oct-09	89.9	+			

70	-33.92886	120.0203	16-Oct-09	96.3	+	frequent
72	-33.92889	120.01995	16-Oct-09	93	+	
96	-33.92821	120.02323	16-Oct-09	89.9	+	
97	-33.9281	120.0233	16-Oct-09	87.5	+	frequent
98	-33.92768	120.02399	16-Oct-09	93.3	+	
99	-33.9274	120.02434	16-Oct-09	96.6	+	
100	-33.9273	120.02446	16-Oct-09	95.4	+	
101	-33.9268	120.0248	16-Oct-09	96.3	+	
107	-33.92507	120.02699	16-Oct-09	95.1	10	+
110	-33.92449	120.0289	16-Oct-09	88.4	+	
112	-33.92434	120.02927	16-Oct-09	84.1	+	
114	-33.92342	120.03073	16-Oct-09	83.8	+	
117	-33.92188	120.03108	16-Oct-09	83.8	+	
119	-33.92153	120.0311	16-Oct-09	86.3	+	
120	-33.92123	120.03093	16-Oct-09	87.8	+	
122	-33.92216	120.03075	16-Oct-09	87.2	+	
18	-33.93732	119.94923	19-Oct-09	59.4	+	
34	-33.91957	120.0341	23-Oct-09	52.4	20	+
44	-33.91959	120.03598	23-Oct-09	38.4	5	+
45	-33.91994	120.03668	23-Oct-09	32.9	5	+
49	-33.92045	120.03804	23-Oct-09	19.2	8	
58	-33.91904	120.03484	23-Oct-09	53.3	5	
64	-33.91942	120.0338	23-Oct-09	68	+	
65	-33.91961	120.03368	23-Oct-09	65.5	+	
66	-33.91979	120.03329	23-Oct-09	68.3	+	
67	-33.91998	120.03293	23-Oct-09	71.6	+	
69	-33.92015	120.03262	23-Oct-09	76.2	+	
72	-33.92024	120.03219	23-Oct-09	85.3	+	
73	-33.92038	120.0321	23-Oct-09	79.6	+	
74	-33.92103	120.03108	23-Oct-09	87.5	+	
76	-33.92121	120.03117	23-Oct-09	88.7	+	
78	-33.92097	120.03143	23-Oct-09	87.5	+	
79	-33.92074	120.0317	23-Oct-09	85	+	
80	-33.92048	120.03223	23-Oct-09	82.9	+	
81	-33.92008	120.03293	23-Oct-09	75	+	
82	-33.91966	120.03378	23-Oct-09	66.8	+	

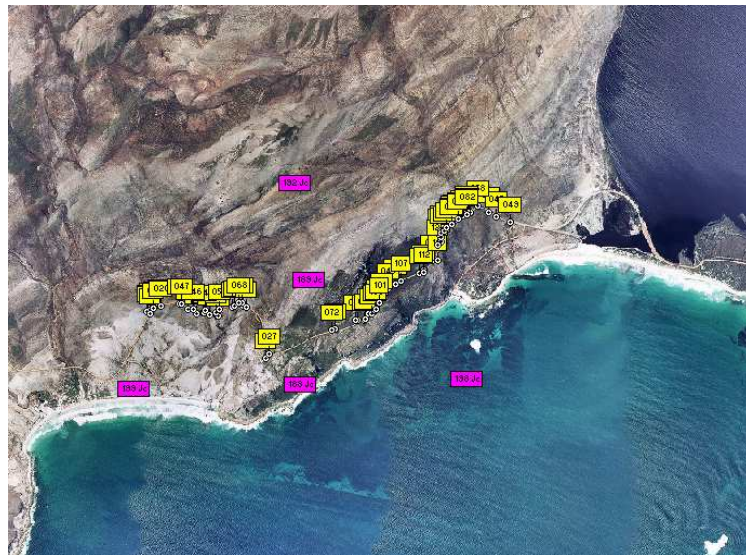
1370

East Mt Barren (WAHERB & DEFL):

181Jc	-33.91666	120.01667	22 10 1985
182Jc	-33.91666	120.01667	10 01 1969
183Jc	-33.91666	120.01667	17 09 1965
184Jc	-33.91666	120.01667	01 10 1970
185Jc	-33.91666	120.01667	21 04 1962
186Jc	-33.91666	120.01667	31 01 1960
187Jc	-33.91666	120.01667	13 12 1964
188Jc	-33.93333	120.01667	02 01 1983
189Jc	-33.92472	120.01778	15 01 2002
190Jc	-33.91666	120.01667	14 07 1971
191Jc	-33.93333	120.03333	07 02 1986
192Jc	-33.91666	120.01667	25 05 1983
193Jc	-33.91055	119.9575	26 12 2006
194Jc	-33.93333	120.03333	28 11 1992
196Jc	-33.93333	120.03333	28 11 1991
197Jc	-33.93333	119.96667	29 11 1992
199Jc	-33.93333	120	28 11 1992
200Jc	-33.93833	119.97806	19 09 2005

Jacksonia compressa

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	1,400 est.	est. <5%	est. 2%
East Mt Barren	10,000+		



Leucopogon compactus (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
29	-33.9404	119.96534	22-Sep-09	57.9	+		GFC8559-2	
East Mt Barren (WAHERB & DEFL):								
239Le	-33.93208	119.9515	14/07/1992					
242Le	-33.89875	119.93484	14/07/1982					
225Le	-33.91666	120.01667	03 09 1986					
226Le	-33.93333	119.95	14 07 1982					
227Le	-33.91833	120.01333	23 10 1985					
228Le	-33.91666	120.01667	03 09 1986					
229Le	-33.90833	119.93472	11 09 1986					
230Le	-33.89472	119.945	21 08 1991					
231Le	-33.9	119.93333	14 07 1982					



Melaleuca papillosa (Priority 4)

Surveyed by Gillian Craig – October 2009

c	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
35	-33.93974	119.96333	22-Sep-09	57.6	10	gravel pit regen	GFC8562	dscn6256-63
8	-33.93951	119.96844	23-Sep-09	59.7	1			
29	-33.93803	119.97523	23-Sep-09	58.2	200+	burnt 1989; nil in 2006 burn		
33	-33.93706	119.97556	23-Sep-09	63.4	2			
34	-33.93698	119.97555	23-Sep-09	62.2	2			
35	-33.93688	119.97534	23-Sep-09	61.9	1,000	+ N&S side		
37	-33.93727	119.97462	23-Sep-09	63.4	+	W limit at verge		
38	-33.93728	119.97416	23-Sep-09	64.9	+			
39	-33.93738	119.97384	23-Sep-09	65.8	+	SW limit - lge pop extends to N		
49	-33.93545	119.98023	23-Sep-09	44.5	20	unburnt		
					1,000	+ seedlings burnt 2006; extends S		
51	-33.93482	119.98101	23-Sep-09	38.1	+	extends N & E; burn mosaic		
54	-33.93221	119.98331	23-Sep-09	22.6	+	E limit on verge		
14	-33.93054	119.98457	25-Sep-09	9.1	1			
18	-33.93115	119.98309	25-Sep-09	12.2	6	patch; creekline (extends upslope to NW)		
19	-33.93136	119.9842	25-Sep-09	13.1	+			
55	-33.93093	119.98816	25-Sep-09	22.9	+	seedlings 30 cm tall		
56	-33.93084	119.98806	25-Sep-09	18	+			dscn6356 (N)
					2042			
East Mt Barren (WAHERB & DEFL):								
255Mp	-33.91666	120.03333	19 11 1985					
256Mp	-33.95	119.91667	30 09 1972					

	No. Plants	% FRNP population
Hamersley Drive upgrade	2,000+	est. <2%
FRNP	100,000+	



Pimealea physodes (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
54	-33.93219	119.99658	29-Sep-09	19.5	1	old track		
57	-33.93047	119.99976	29-Sep-09	23.8	1			
58	-33.9304	119.99983	29-Sep-09	23.2	12			dscn6375-83
61	-33.92988	120.00023	29-Sep-09	31.7	1			
72	-33.92893	120.0004	29-Sep-09	36.3	3			
74	-33.92957	119.9999	29-Sep-09	32.9	3			
75	-33.92966	119.99982	29-Sep-09	32.9	6			
32	-33.92337	120.03024	16-Oct-09	91.1	1			
115	-33.9231	120.03055	16-Oct-09	71.6	2			
121	-33.92186	120.03068	16-Oct-09	89.3	+			
72	-33.92024	120.03219	23-Oct-09	85.3	3			
75	-33.92092	120.03103	23-Oct-09	88.4	5			
77	-33.9211	120.03132	23-Oct-09	87.8	+			
78	-33.92097	120.03143	23-Oct-09	87.5	+			
79	-33.92074	120.0317	23-Oct-09	85	+			
					ca. 50			

East Mt Barren (WAHERB & DEFL):

260Pp	-33.91833	120.01333	29 08 1962
261Pp	-33.91833	120.01333	22 10 1961
262Pp	-33.91833	120.01333	17 09 1965
263Pp	-33.93333	119.93333	12 09 1983
264Pp	-33.86858	119.89684	29 05 2000
265Pp	-33.92861	120.0125	29 09 1999

	No. Plants	% all population
Hamersley Drive upgrade	50	est. <0.2%
FRNP	common	
Ravensthorpe Range	occasional	



Appendix 5: Plant species list

Preliminary list of plant species found during survey for Hamersley Drive upgrade. Collection numbers of specimens to be vouchered in the WA Herbarium are indicated.

TAXON NAME	COLLECTION NO.
Aizoaceae	
<i>Carpobrotus virescens</i>	
Anthericaceae	
<i>Corynotheca micrantha</i>	
<i>Johnsonia acaulis</i>	
<i>Thysanotus</i> sp.	
Apiaceae	
<i>Platysace compressa</i>	
<i>Xanthosia huegelii</i>	
Boraginaceae	
<i>Halgania cyanea</i>	GFC8579-1
Caesalpiniaceae	
<i>Labichea lanceolata</i> subsp. <i>brevifolia</i>	
Casuarinaceae	
<i>Allocasuarina corniculata</i>	
<i>Allocasuarina humilis</i>	
Chenopodiaceae	
<i>Atriplex cinerea</i>	
<i>Rhagodia baccata</i>	
<i>Sarcocornia quinqueflora</i>	
<i>Suaeda australis</i>	
Cyperaceae	
<i>Caustis dioica</i>	
<i>Gahnia ancistrophylla</i>	
<i>Gahnia lanigera</i>	
<i>Gahnia trifida</i>	
<i>Lepidosperma</i> sp. <i>Ravensthorpe</i> (G.F. Craig 5188)	GFC8583-1
<i>Lepidosperma</i> sp. <i>U1 big heads</i> (A.S. George 11294)	
<i>Mesomelaena stygia</i>	
<i>Schoenus brevisetis</i>	GFC8554-2
<i>Schoenus grandiflorus</i>	
<i>Schoenus pleiostemoneus</i>	
<i>Schoenus sublaxus</i>	GFC8564
Dasygongonaceae	
<i>Lomandra mucronata</i>	
Dilleniaceae	
<i>Hibbertia gracilipes</i>	
<i>Hibbertia hamulosa</i>	
<i>Hibbertia mucronata</i>	GFC8590
<i>Hibbertia papillata</i>	GFC8614
<i>Hibbertia racemosa</i>	
<i>Hibbertia rupicola</i>	
Droseraceae	
<i>Drosera paleacea</i> subsp. <i>trichocaulis</i>	GFC8560
Epacridaceae	
<i>Acrotriche cordata</i>	
<i>Andersonia parvifolia</i>	

<i>Astroloma tectum</i>	GFC8550
<i>Leucopogon carinatus</i>	GFC8551
<i>Leucopogon compactus</i>	GFC8559-2
<i>Leucopogon conostephioides</i>	GFC8596
<i>Leucopogon flavescens</i> var. <i>brevifolius</i>	
<i>Leucopogon revolutus</i>	
<i>Lysinema ciliatum</i>	
<i>Oligarrhena micrantha</i>	
<i>Sphenotoma dracophylloides</i>	
<i>Sphenotoma gracilis</i>	
<i>Styphelia melaleucooides</i>	GFC8548
Euphorbiaceae	
<i>Phyllanthus calycinus</i>	
<i>Stachystemon polyandrus</i>	GFC8557
Goodeniaceae	
<i>Dampiera angulata</i>	
<i>Dampiera deltoidea</i>	
<i>Dampiera juncea</i>	GFC8549
<i>Dampiera loranthifolia</i>	
<i>Goodenia coerulea</i>	
<i>Goodenia scapigera</i>	
<i>Lechenaultia formosa</i>	
<i>Lechenaultia heteromera</i>	
<i>Scaevola aemula</i>	GFC8589
<i>Scaevola thesioides</i> subsp. <i>filifolia</i>	GFC8584
<i>Velleia trinervis</i>	
Gyrostemonaceae	
<i>Gyrostemon subnudus</i>	GFC8581
Haemodoraceae	
<i>Conostylis vaginata</i>	
Haloragaceae	
<i>Glischrocaryon aureum</i>	
<i>Gonocarpus hispidus</i>	
Iridaceae	
<i>Patersonia lanata</i>	
<i>Patersonia occidentalis</i>	
Lamiaceae	
<i>Pityrodia</i> sp. <i>Dalwallinu</i> (M. Hislop 1860)	
Loganiaceae	
<i>Logania buxifolia</i>	
<i>Logania serpyllifolia</i>	
Loranthaceae	
<i>Nuytsia floribunda</i>	
Malvaceae	
<i>Alyogyne wrayae</i> ms	GFC8583-2
Menyanthaceae	
<i>Villarsia parnassiifolia</i>	
Mimosaceae	
<i>Acacia argutifolia</i>	GFC8630
<i>Acacia cedroides</i>	
<i>Acacia cochlearis</i>	
<i>Acacia cyclops</i>	
<i>Acacia delphina</i>	
<i>Acacia gonocarpa</i>	
<i>Acacia moirii</i> subsp. <i>dasycarpa</i>	
<i>Acacia myrtifolia</i>	GFC8585
<i>Acacia rostelifera</i>	

*Acacia subcaerulea***Myoporaceae***Myoporum tetrandrum***Myrtaceae***Agonis baxteri**Baeckea ovalifolia**Beaufortia anisandra**Beaufortia micrantha**Beaufortia schaueri**Calothamnus gracilis**Calothamnus macrocarpus**Calothamnus pinifolius**Calothamnus quadrifidus**Calothamnus validus*

GFC8598

*Calytrix leschenaultii**Conothamnus aureus**Darwinia vestita**Eucalyptus angulosa**Eucalyptus burdettiana**Eucalyptus coronata**Eucalyptus falcata**Eucalyptus leptocalyx**Eucalyptus occidentalis**Eucalyptus pleurocarpa**Eucalyptus preissiana**Eucalyptus uncinata**Hypocalymma strictum**Leptospermum maxwellii**Leptospermum* sp. Bandalup Hill (G. Cockerton 11001)*Leptospermum spinescens**Melaleuca citrina**Melaleuca cuticularis**Melaleuca nesophila**Melaleuca papillosa*

GFC8562

Melaleuca pentagona

GFC8592

*Melaleuca pulchella**Melaleuca rigidifolia**Melaleuca striata**Melaleuca suberosa**Melaleuca subtrigona**Regelia velutina**Taxandria conspicua* subsp. *abrupta**Taxandria spathulata**Verticordia tumida* subsp. *therogana***Olacaceae***Olax benthamiana***Papilionaceae***Chorizema glycinifolium*

GFC8546

*Chorizema trigonum**Chorizema uncinatum*

GFC8582

*Daviesia emarginata**Daviesia incrassata* subsp. *reversifolia**Daviesia striata**Dillwynia pungens**Eutaxia neurocalyx* ms

GFC8554-1

*Gompholobium knightianum**Gompholobium polymorphum*

GFC8576

<i>Gompholobium tomentosum</i>	GFC8586
<i>Jacksonia furcellata</i>	
<i>Jacksonia viscosa</i>	
<i>Kennedia coccinea</i>	
<i>Kennedia nigricans</i>	
<i>Sphaerolobium daviesioides</i>	GFC8570
<i>Sphaerolobium racemosum</i>	GFC8559-1
<i>Templetonia neglecta</i>	
<i>Templetonia retusa</i>	
Poaceae	
<i>Amphipogon amphipogonoides</i>	
<i>Neurachne alopecuroidea</i>	
Polygalaceae	
<i>Comesperma flavum</i>	
Polygonaceae	
<i>Muehlenbeckia adpressa</i>	
Proteaceae	
<i>Adenanthos cuneatus</i>	
<i>Adenanthos ellipticus</i>	
<i>Adenanthos labillardierei</i>	
<i>Adenanthos oreophilus</i>	
<i>Adenanthos venosus</i>	
<i>Banksia baueri</i>	
<i>Banksia coccinea</i>	
<i>Banksia lemanniana</i>	
<i>Banksia media</i>	
<i>Banksia oreophila</i>	
<i>Banksia repens</i>	
<i>Banksia violacea</i>	
<i>Conospermum distichum</i>	
<i>Conospermum teretifolium</i>	
<i>Dryandra cirsioides</i>	
<i>Dryandra falcata</i>	
<i>Dryandra nivea</i>	
<i>Dryandra obtusa</i>	
<i>Dryandra plumosa</i>	
<i>Dryandra quercifolia</i>	
<i>Grevillea coccinea</i>	
<i>Grevillea nudiflora</i>	
<i>Grevillea tripartita</i> subsp. <i>macrostylis</i>	
<i>Hakea ferruginea</i>	GFC8547
<i>Hakea nitida</i>	
<i>Hakea pandanica</i> subsp. <i>crassifolia</i>	
<i>Hakea prostrata</i>	
<i>Hakea trifurcata</i>	
<i>Hakea victoria</i>	GFC8599
<i>Isopogon formosus</i>	
<i>Isopogon polycephalus</i>	
<i>Isopogon</i> sp. <i>Fitzgerald River</i> (D.B. Foreman 813)	
<i>Isopogon teretifolius</i>	
<i>Isopogon trilobus</i>	
<i>Petrophile linearis</i>	
<i>Petrophile seminuda</i>	
<i>Petrophile squamata</i> subsp. <i>northern</i> (J. Monks 40)	GFC8561
<i>Stirlingia anethifolia</i>	
<i>Stirlingia latifolia</i>	
<i>Synaphea favosa</i>	

<i>Synaphea spinulosa</i>	GFC8580
Ranunculaceae	
<i>Clematis pubescens</i>	
Restionaceae	
<i>Anarthria laevis</i>	
<i>Anarthria prolifera</i>	GFC8563
<i>Anarthria scabra</i>	
<i>Desmocladius flexuosus</i>	GFC8566
<i>Hypolaena exsulca</i>	
<i>Lyginia barbata</i>	
Rhamnaceae	
<i>Cryptandra myriantha</i>	GFC8587
<i>Pomaderris myrtilloides</i>	
<i>Stenanthemum intricatum</i>	
<i>Stenanthemum tridentatum</i>	
Rutaceae	
<i>Boronia albiflora</i>	
<i>Boronia crassifolia</i>	
<i>Boronia spathulata</i>	GFC8553-2
Santalaceae	
<i>Exocarpos sparteus</i>	
<i>Leptomeria axillaris</i>	
Solanaceae	
<i>Anthocercis fasciculata</i>	GFC8600
<i>Anthocercis littorea</i>	
Stackhousiaceae	
<i>Stackhousia monogyna</i>	
Sterculiaceae	
<i>Guichenotia ledifolia</i>	
<i>Lasiopetalum quinquenervium</i>	GFC8605
Stylidiaceae	
<i>Stylidium albomontis</i>	GFC8597
<i>Stylidium breviscapum</i>	GFC8588
<i>Stylidium galioides</i>	
<i>Stylidium schoenoides</i>	
Thymelaeaceae	
<i>Pimelea drummondii</i>	GFC8591
<i>Pimelea lehmanniana</i>	GFC8555
<i>Pimelea physodes</i>	
Xanthorrhoeaceae	
<i>Xanthorrhoea platyphylla</i>	

Appendix 6: Location of monitoring quadrats

GPS locations of Chapman and Newbey (1995) quadrats in the vicinity of the Hamersley Drive upgrade and Moir Track

SITE NO.	ZONE	EASTING	NORTHING	(GDA94 datum)	
40 A	50H	775941	6241362	burnt Dec 89, Sept 06	Mylies Beach
43A (2)	50H	225919	6242252	burnt Dec 89, Sept 06	Four Mile Beach
44A	50H	774850	6240122	burnt Dec 89	West Beach Rd
47A	50H	771449	6240365	burnt Dec 89	Hamersley Inlet Rd
46B	50H	773590	6241635	?burnt Dec 89	Hamersley Drive
62B	50H	769688	6250585	burnt Dec 89	Moir Track- east side
63B	50H	769804	6251120	burnt Dec 89	Moir Track - east side