Appendix A

Vegetation and Flora Report

FLORA AND VEGETATION SURVEY

FOR A PROPOSED COLLGAR

WIND FARM

NORTH OF MERREDIN

Prepared for:

Bayley Environmental Services

on behalf of

Collgar Wind Farm

Prepared by:

Mattiske Consulting Pty Ltd

July 2008

MATTISKE CONSULTING PTY LTD

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1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned by Bayley Environmental Services on behalf of Collgar wind Farm in July 2008, to undertake a botanical assessment of the proposed development area north of Merredin. As the proposed development occurs primarily within largely cleared agricultural areas, the survey effort concentrated on remnant areas that may be disturbed by vehicle movement and installation of the wind farm facilities.

A total of 77 taxa (including subspecies and varieties) from 42 genera and 21 families were recorded within the survey area during the July 2008 survey.

No plant taxa located in the survey area are gazetted as Declared Rare Flora pursuant to subsection (2) of section 23F of the Wildlife Conservation Act (1950).

No plant taxa listed as Threatened pursuant to Schedule 1 of the Environmental Protection Biodiversity Conservation Act (1999) were located in the survey area.

Two Priority flora species were recorded in the survey area and these should be avoided in any construction activities. If the remnant areas of native vegetation are avoided the latter should readily be addressed. The two species were *Banksia shanklandiorum* (Priority 4) and *Synaphea* ?*constricta* (Priority 3). The latter species could not be confirmed as the specimen was lacking flowering material and the State Herbarium was not open part of this week.

Banksia shanklandiorum was recorded at GDA94 - 640932mE: 6504210mN on the edges of a roadside and *Synaphea* ?*constricta* was recorded at GDA 94 - 639293mE: 6504444mN and 640690mE: 6503450mN on the edges of roadsides and tracks.

Another species of interest, *Melaleuca* sp. was recorded in remnant areas of native vegetation near GDA94 - 639292mE: 6512381mN and 636300mE: 6507100mN. The latter results reflect the significance of the road verges and remnant vegetation in the survey area.

A total of 4 plant communities were defined within the survey area. All communities were slightly degraded as a result of the degree of fragmentation within the survey area. The majority of the sites occurred in narrow strips along road verges or in localized remnant areas within the agricultural farming properties. In addition, a plantation (PL) site was assessed. None of the plant communities described are considered Threatened Ecological Communities pursuant to Schedule 2 of the Environmental Protection Biodiversity Conservation Act (1999). Whilst the latter is the case, in the highly modified Wheatbelt all areas of remnant native vegetation are significant from a conservation perspective. The latter is particularly evident from the Biodiversity Audit of Western Australia by May and McKenzie 2003 and from the specific section within this document on the Avon Wheatbelt IBRA regions (Beecham 2002a, 2002b).

To minimize impacts on the environment clearing of native vegetation should be minimised and at all times vehicle hygiene measures should be maintained to minimize the spread of weeds and introduced species. If the areas of native vegetation are avoided then the populations of Priority species should be protected.

2. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned by the Bayley Environmental Services on behalf of Collgar wind Farm in July 2008, to undertake a botanical assessment of the proposed development area north of Merredin. As the proposed development occurs primarily within largely cleared agricultural areas, the survey effort concentrated on remnant areas that may be disturbed by vehicle movement and installation of the wind farm facilities.

2.1 Location

The survey area is located north of Merredin in the Wheatbelt of Western Australia. The proposed development is located within the Avon Botanical District of the Wheatbelt Region as defined by Beard (1990).

2.2 Climate

The survey area north of Merredin has a dry warm Mediterranean climate: winter precipitation of 326.4mm per annum, with seven to eight dry months a year (Bureau of Meteorology 2008, Beard, 1990). The minimum temperatures range from 5.4°C to 17.6°C and the maximum temperatures range from 16.3 to 33.7°C (Bureau of Meteorology, 2008).

2.3 Declared Rare, Priority and Threatened Species

Species of flora and fauna are defined as Declared Rare or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Conservation and Land Management recognizes these threats of extinction and consequently applies regulations towards population and species protection.

Rare Flora species are gazetted under subsection 2 of section 23F of the Wildlife Conservation Act (1950) and therefore it is an offence to "take" or damage rare flora without Ministerial approval. Section 23F of the Wildlife Conservation Act (1950-1980) defines "to take" as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority Flora are under consideration for declaration as 'rare flora', but are in urgent need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four). Table 1 presents the definitions of Declared Rare and the four Priority ratings under the Wildlife Conservation Act (1950) as extracted from Department of Environment and Conservation 2008a, 2008b.

Table 1: Definition of Rare and Priority Flora Species (Department of Environment and Conservation, 2008)

Conservation Code	Category
R	**Declared Rare Flora – Extant Taxa** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such."
P1	**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. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P2	**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 (not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P3	**Priority Three – Poorly Known Taxa** "Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but need further survey."
P4	**Priority Four – Rare Taxa** "Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years."

Threats of extinction of species are also recognized at a Federal level and are categorized according to the Environment Protection and Biodiversity Conservation Act, 1999. Categories of threatened species are summarized in Table 2.

Table 2: Categories of Threatened Flora Species (Environment Protection and Biodiversity Conservation Act, 1999)

Category Code	Category
Ex	**Extinct** Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

2.4 Clearing of Native Vegetation

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* dictate that any clearing of native vegetation in Western Australia requires a permit to do so from the Department of Environment and Conservation unless covered by an exemption listed in the Regulations. Native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Clearing is defined as the: killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above.

Native Vegetation Clearing Principles:

a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia.

c) Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.

d) Native vegetation should not be cleared if it compromises the whole or part of, or is necessary for the maintenance of a threatened ecological community.

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

f) Native vegetation should not be cleared if it is growing in, or in association with, and environment associated with a watercourse or wetland.

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

2.5 Local and Regional Significance

The Environmental Protection Authority (2004) in Guidance Statement 51 stated that species, subspecies, varieties, hybrids and ecotypes may be significant other than as Declared Rare Flora or Priority Flora, for a variety of reasons, including:

". a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;

. relic status;

. anomalous features that indicate a potential new discovery;

. being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);

. the presence of restricted subspecies, varieties, or naturally occurring hybrids;

. local endemism/a restricted distribution; and

. being poorly reserved."

Plant communities or vegetation may be significant for a range of reasons, other than a statutory listing as a Threatened Ecological Community or because the extent is below a threshold level. The Environmental Protection Authority (2004) in Guidance Statement 51 stated that significant vegetation may include communities that have:

". scarcity;

. unusual species;

. novel combinations of species;

. a role as a refuge;

. a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;

. being representative of the range of a unit (particularly, a good local and/or regional example of a unit in "prime" habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and

. a restricted distribution."

The application of the degree of significance may apply at a range of scales. Plant communities may be referred to as locally significant where the presence of Priority Flora species has been recorded, where they provide a range extension of particular taxa from previously recorded locations, or where they are very restricted to one or two locations or where they occur as small isolated communities. In addition, communities that exhibit unusually high structural and species diversity are also of local significance (Mattiske EM, pers. comm.). Plant communities may be referred to as regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of Declared Rare Flora (Mattiske EM, pers. comm.).

2.5 Threatened Ecological Communities

Communities are described as 'Threatened Ecological Communities' (TEC's) if they have been defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee and found to be Presumed Totally Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). For definitions of TEC categories and criteria refer to English and Blyth (1997, 1999).

Selected plant communities have also been listed as 'Threatened Ecological Communities' under the EPBC Act (1999). The TEC's at the national level are defined on the Environment Australia website (www.ea.gov.au).

3. OBJECTIVES

The general objectives were to:

- Collect and identify the vascular plant species present in the survey area;
- Review the conservation status of the vascular plant species by reference to current literature and current listings by the Department of Environment and Conservation (2008a, 2008b) and the Environment Protection Biodiversity Conservation Act (1999) and with plant collections held at the State Herbarium.
- Define the plant communities present;
- Review the local and regional significance of the plant communities recorded; and
- Submit a report that summarizes the finding.

4. METHODS

The Collgar Wind Farm was assessed in July 2008 by traversing the areas on foot and by car. Detailed recordings were undertaken along the main access routes and within any remnant areas that occurred near the proposed installations or on the routes between the wind farm installations.

4.1 Flora

The flora of the survey area was described and collected systematically at each survey site, selected due to differences in floristic features and composition, by botanists from Mattiske Consulting Pty Ltd during July 2008. Selective opportunistic collecting was further undertaken at additional sites in plant communities of like structure and floristic composition.

All plant specimens collected during the field survey were dried and fumigated in accordance with the requirements of the West Australian Herbarium. The plant species were identified and then compared with pressed specimens housed at the West Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded follows West Australian Herbarium (2008a, 2008b).

4.2 Vegetation

The plant communities occurring within the survey area were described in detail. The use of a standard data collection form ensured the data was collected in a systematic and consistent manner. At each site the following records were made: topography, percentage litter cover, soil ratio, percentage of bare ground, outcropping rocks and their type, pebble type and size, and age since fire. For each species recorded, the average height and percent foliage cover of species both alive and dead was noted.

5. RESULTS

5.1 Flora

A total of 77 taxa (including subspecies and varieties) from 42 genera and 21 families were recorded within the survey area during the July 2008 survey. The full species list of the survey area is presented in Appendix A.

Most of the survey area has been largely cleared for agricultural activities and consequently the number of species is relatively low and reflects the vast amount of clearing in the project area.

One introduced (weed) species, **Briza maxima was* recorded within the remnant areas. The numbers of introduced species is much higher, however disturbed areas were not assessed. None of the introduced species recorded are listed as Declared Plants, by the Department of Agriculture and Food (2008).

5.2 Rare and Priority Flora

No plant taxa located in the survey area are gazetted as Declared Rare Flora pursuant to subsection (2) of section 23F of the Wildlife Conservation Act (1950).

No plant taxa listed as Threatened pursuant to Schedule 1 of the Environmental Protection Biodiversity Conservation Act (1999) were located in the survey area.

Two Priority flora species were recorded in the survey area and these should be avoided in any construction activities. If the remnant areas of native vegetation are avoided the latter should readily be addressed. The two species were *Banksia shanklandiorum* (Priority 4) and *Synaphea* ?*constricta* (Priority 3). The latter species could not be confirmed as the specimen was lacking flowering material and the State Herbarium was not open part of this week.

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Another species of interest, *Melaleuca* sp. was recorded in remnant areas of native vegetation near GDA94 - 639292mE: 6512381mN and 636300mE: 6507100mN. The latter results reflect the significance of the road verges and remnant vegetation in the survey area.

5.3 Vegetation

A total of 4 plant communities were defined within the survey area. In addition, a plantation (PL) site was assessed. The communities are described as follows:

***Eucalyptus* Woodlands**

Community E1: Low Open Woodland of *Eucalyptus capillosa, Eucalyptus pluricaulis* over *Allocasuarina acutivalvis, Allocasuarina corniculata, Acacia neurophylla, Gastrolobium spinosum* and low subshrubs and grasses on sandy-loams.

Community E2:

Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* over *Acacia acuaria, Allocasuarina acutivalvis, Exocarpos aphyllus* and *Senna artemisioides* subsp. *filifolia* on sandy-loams

Shrublands

Community A1: Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina campestris, Allocasuarina corniculata, Isopogon gardneri, Melaleuca cordata* and *Thryptomene kochii* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus obtusiflora* over low subshrubs and herbs on sandy soils.

Community A2: Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina corniculata, Hakea francisiana, Hakea scoparia, Acacia resinosa* and *Melaleuca cordata* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus leptopoda* subsp. *leptopoda* over low subshrubs and herbs on sandy soils.

(d) Denotes disturbed and degraded community.
PL Denotes plantation area.

None of the plant communities described are considered Threatened Ecological Communities pursuant to Schedule 2 of the Environmental Protection Biodiversity Conservation Act (1999). Whilst the latter is the case, in the highly modified Wheatbelt all areas of remnant native vegetation are significant from a conservation perspective. The latter is particularly evident from the Biodiversity Audit of Western Australia by May and McKenzie 2003 and from the specific section within this document on the Avon Wheatbelt IBRA regions (Beecham 2002a, 2002b).

6. DISCUSSION

Mattiske Consulting Pty Ltd was commissioned by Bayley Environmental Services on behalf of Collgar wind Farm in July 2008, to undertake a botanical assessment of the proposed development area north of Merredin. As the proposed development occurs primarily within largely cleared agricultural areas, the survey effort concentrated on remnant areas that may be disturbed by vehicle movement and installation of the wind farm facilities.

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A total of 4 plant communities were defined within the survey area. All communities were slightly degraded as a result of the degree of fragmentation within the survey area. The majority of the sites occurred in narrow strips along road verges or in localized remnant areas within the agricultural farming properties. In addition, a plantation (PL) site was assessed.

Detailed vegetation mapping during the 1980's by Beard describes the Guangan system, which the survey area occurs in, as a "Mallee and Casuarina thicket" (Beard 1980). Vegetation mapping by Beard (1980) at a scale of 1:250 000 reveals that on close examination there is found to be a mosaic, too intricate to be mapped at 1:250, 000 and determined by soil variations. Beard's description of the area is as a "Mallee and Casuarina Thicket". This community is widespread and not significant in a regional context.

None of the plant communities described are considered Threatened Ecological Communities pursuant to Schedule 2 of the Environmental Protection Biodiversity Conservation Act (1999). Whilst the latter is the case, in the highly modified Wheatbelt all areas of remnant native vegetation are significant from a conservation perspective. The latter is particularly evident from the Biodiversity Audit of Western Australia by May and McKenzie 2003 and from the specific section within this document on the Avon Wheatbelt IBRA regions (Beecham 2002a, 2002b).

To minimize impacts on the environment clearing of native vegetation should be minimised and at all times vehicle hygiene measures should be maintained to minimize the spread of weeds and introduced species. If the areas of native vegetation are avoided then the populations of Priority species should be protected.

7. RECOMMENDATIONS

The following recommendations are made as a means of minimizing the impacts of infrastructure activities on the botanical values in the area:

- Clearing and other disturbances should be limited to that which is absolutely necessary for construction and operations.
- Areas that support Priority flora should be avoided.
- Areas that support any remnant trees should be avoided (due to the habitat potential for avifauna).
- Vehicle and machinery hygiene measures are taken to reduce the spread of introduced (weed) species into adjacent remnant vegetation.
- All threatening processes to native vegetation are minimized.

8. LIST OF PARTICIPANTS

The following personnel of Mattiske Consulting Pty Ltd have been involved with this project:

Principal Ecologist:	Dr E M Mattiske
Senior Ecologist:	Dr F Itzstein - Davey
Botanists:	Mr M Boardman Ms J Jones Ms F Smith Ms F Chandler Ms R Chesney Mr R Burrows

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D A1(d) E1(d) A2(d) PL

LEGEND

***Eucalyptus* Woodlands**

Community E1:

Low Open Woodland of *Eucalyptus capillosa, Eucalyptus pluricaulis* over *Allocasuarina acutivalvis, Allocasuarina corniculata, Acacia neurophylla, Gastrolobium spinosum* and low subshrubs and grasses on sandy-loams.

Community E2:

Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* over *Acacia acuaria, Allocasuarina acutivalvis, Exocarpos aphyllus* and *Senna artemisioides* subsp. *filifolia* on sandy-loams

Shrublands

Community A1:

Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina campestris, Allocasuarina corniculata, Isopogon gardneri, Melaleuca cordata* and *Thryptomene kochii* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus obtusiflora* over low subshrubs and herbs on sandy soils.

Community A2:

Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina corniculata, Hakea francisiana, Hakea scoparia, Acacia resinosa* and *Melaleuca cordata* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus leptopoda* subsp. *leptopoda* over low subshrubs and herbs on sandy soils.

(d) Denotes disturbed and degraded community.
PL Denotes plantation area.

D Disturbed or Cleared Land

N

0 150 300m

Scale 1:15,000
MGA94 (Zone 50)

COLLGAR WIND FARM

VEGETATION

SHEET 1 OF 3

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Author: E M Mattiske	MCPL Ref: BES0801/050/08	Scale: 1:15,000
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LEGEND

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Community E2:

Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* over *Acacia acuaria, Allocasuarina acutivalvis, Exocarpos aphyllus* and *Senna artemisioides* subsp. *filifolia* on sandy-loams

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Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina campestris, Allocasuarina corniculata, Isopogon gardneri, Melaleuca cordata* and *Thryptomene kochii* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus obtusiflora* over low subshrubs and herbs on sandy soils.

Community A2:

Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina corniculata, Hakea francisiana, Hakea scoparia, Acacia resinosa* and *Melaleuca cordata* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus leptopoda* subsp. *leptopoda* over low subshrubs and herbs on sandy soils.

(d) Denotes disturbed and degraded community.
PL Denotes plantation area.

D Disturbed or Cleared Land

N

0 150 300m

Scale 1:15,000
MGA94 (Zone 50)

COLLGAR WIND FARM

VEGETATION

SHEET 2 OF 3

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Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: **1.02**
CAD Ref: g1637_V02.dgn	Date: Aug 2008	Rev: **A** **A1**

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A1(d)
A2(d)
D
PL

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LEGEND

***Eucalyptus* Woodlands**

Community E1:

Low Open Woodland of *Eucalyptus capillosa, Eucalyptus pluricaulis* over *Allocasuarina acutivalvis, Allocasuarina corniculata, Acacia neurophylla, Gastrolobium spinosum* and low subshrubs and grasses on sandy-loams.

Community E2:

Low Open Woodland of *Eucalyptus loxophleba* subsp. *loxophleba* over *Acacia acuaria, Allocasuarina acutivalvis, Exocarpos aphyllus* and *Senna artemisioides* subsp. *filifolia* on sandy-loams

Shrublands

Community A1:

Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina campestris, Allocasuarina corniculata, Isopogon gardneri, Melaleuca cordata* and *Thryptomene kochii* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus obtusiflora* over low subshrubs and herbs on sandy soils.

Community A2:

Tall Shrubland of *Allocasuarina acutivalvis, Allocasuarina corniculata, Hakea francisiana, Hakea scoparia, Acacia resinosa* and *Melaleuca cordata* with patchy emergent *Eucalyptus burracoppinensis* and *Eucalyptus leptopoda* subsp. *leptopoda* over low subshrubs and herbs on sandy soils.

(d) Denotes disturbed and degraded community.
PL Denotes plantation area.

D Disturbed or Cleared Land

0 150 300m
Scale 1:15,000
MGA94 (Zone 50)

COLLGAR WIND FARM
VEGETATION
SHEET 3 OF 3

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CAD Ref: g1637_V03.dgn	Date: Aug 2008	Rev: A	A1