FLORA, VEGETATION AND FAUNA ASSESSMENT

OF THE FLAT ROCKS WIND FARM

SURVEY AREA

Prepared for

Moonies Hill Energy

Prepared by

Mattiske Consulting Pty Ltd

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Mattiske Consulting Pty Ltd

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Moonies Hill Energy Pty Ltd

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned by the Moonies Hill Energy to undertake a review of the flora, vegetation and fauna values on the proposed Flat Rocks Wind Farm location. The proposed development occurs primarily within cleared agricultural areas. Therefore, the effort concentrated on desktop reviews and an assessment of the main remnants and roadside vegetation that may be disturbed by vehicle movement and installation of the wind farm facilities. Two experienced biologists completed the site assessments on the 29th of September to 1st October, 2010. In addition, a review of the fauna values were discussed with experienced zoologists. In April 2016, Mattiske Consulting Pty Ltd was again commissioned by the Moonies Hill Energy to undertake a review of the flora, vegetation and fauna values on the proposed Flat Rocks Wind Farm location, and update findings from the 2010 assessment.

A total of 76 vascular plant taxa from 57 plant genera and 22 plant families were recorded within the Flat Rocks Wind Farm survey area during the 2010 survey. The majority of taxa was recorded within the Poaceae (17 taxa), Myrtaceae (12 taxa), Fabaceae (9 taxa), and Asteraceae (9 taxa) families (Appendix E). This total included 53 native species and 23 introduced (weed) species.

No threatened and priority flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the Department of Parks and Wildlife were recorded within the Flat Rocks Wind Farm survey area. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* were recorded during the survey within the proposed Flat Rocks Wind Farm survey area.

No threatened ecological communities as defined by the *Environment Protection and Biodiversity Conservation Act 1999* or the Department of Parks and Wildlife were located in this survey area.

Although a range of potential flora and fauna values were sourced from a desktop assessment in the vicinity of the Flat Rocks Wind Farm location; in view of the degree of degradation, unless remnant areas are likely to be disturbed, there should not be any significant issues in relation to the native flora or fauna species.

Should the development of the Flat Rocks Wind Farm go ahead the following recommendations are made as a means of minimizing the impacts of infrastructure activities on the flora, vegetation and fauna values in the area:

- Limit ground disturbance and clearing of vegetation to designated areas and access routes, avoiding habitat trees (larger trees and trees with hollows) wherever possible;
- Maintain existing drainage systems, ensuring tracks and other infrastructure areas do not disrupt or divert historic water flow patterns;
- Remove and stockpile topsoil, log debris and leaf litter where possible for use in future rehabilitation programs. If possible, stockpiled topsoil should be directly replaced on disturbed areas;
- Minimise soil disturbance during clearing and practice standard vehicle hygiene to ensure introduced (exotic) species do not become established within the Flat Rocks Wind Farm survey area;
- Implement a management plan to prevent the spread of **Asparagus asparagoides*, a declared pest species; and
- Minimize all threatening processes to native vegetation.

In summary, there should be no impediments to the development of the wind farm facilities providing the remnant vegetation areas (including less disturbed road verges) are not disturbed.

2. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned in September 2010 by Moonies Hill Energy to undertake a flora and vegetation survey of the proposed Flat Rocks Wind Farm. In April 2016, Mattiske Consulting Pty Ltd was commissioned by the Moonies Hill Energy to undertake a review of the flora, vegetation and fauna values on the proposed Flat Rocks Wind Farm location, and update findings from the 2010 assessment.

The proposed Flat Rocks Wind Farm survey area is located approximately 20km southeast of the town of Kojonup, 27km northwest of Tambellup, 16km west of Broomehill and 27km southwest of Katanning. The survey area is bounded by Broomehill-Kojonup Road in the north, Tambellup West Road in the south, and situated between Potts Road to the east and Palomar Road to the west.

2.1 Climate

The Flat Rocks Wind Farm survey area lies within the Southern Jarrah Forest Subregion on the border of the Avon Wheatbelt subregion. Beard (1990) described the climate of the Southern Jarrah Forest as warm mediterranean with winter precipitation between 600 and 1200mm and 5 - 6 dry months per year. The climate of the Avon Wheatbelt is described as dry, warm mediterranean, with winter precipitation of 300 – 650mm and 7 – 8 dry months per year (Beard 1990).

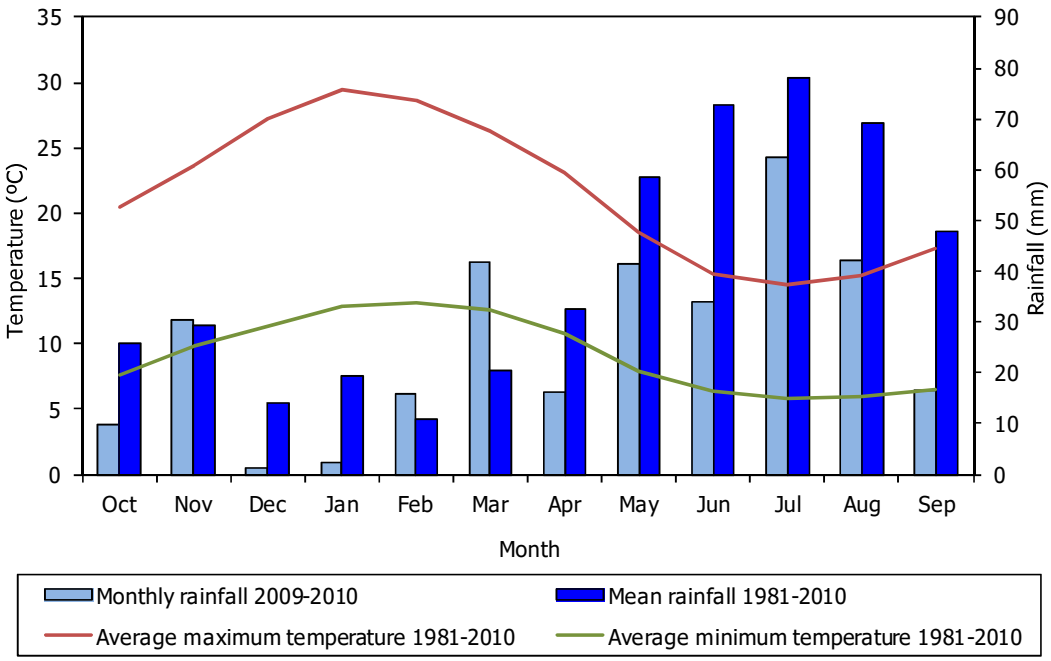


Figure 1: Rainfall and temperature data for Kojonup (Bureau of Meteorology 2016)
Long term average rainfall and temperature data, together with monthly rainfall and average maximum and minimum temperature data for the period October 2009 to September 2010 are shown.

2.2 Regional Vegetation

The Flat Rocks Wind Farm survey area is located within the Southern Jarrah Forest subregion within 5km of the border of the Avon Wheatbelt region. The Southern Jarrah Forest subregion is characterised by jarrah forest on duricrusted plateaus and loam soils of valleys, with marri-wandoo woodlands on laterite-free soils (Beard 1990). Typical vegetation of the Avon Wheatbelt region includes scrub-heath on sandplains, *Acacia-Casuarina* thickets on ironstone gravels, woodlands of *Eucalyptus loxophleba*, *Eucalyptus salmonophloia* and *Eucalyptus wandoo* on varying soil types (Beard 1990). The proximity of Moonies Hill Wind Farm to the border of the Avon Wheatbelt region indicates that characteristics of both regions are likely to be present in the survey area. Katanning and Kojonup are in the Avon Province, which has a range of soil types, which range from sandy duplex soils, ironstone gravelly soils, loamy earth and duplex soils, sandy earth soil, deep sands and wet soils (CSIRO).

2.3 Western Australia's Flora – A Legislative Perspective

Western Australia has a unique and diverse flora, and is recognised as one of the world's 25 biodiversity hotspots (Myers *et al*. 2000). In this context, Western Australia possesses a high degree of species richness and endemism. This is particularly pronounced in the south-west region of the state. There are currently over 12,000 plant species known to occur within Western Australia (Department of Parks and Wildlife 2016a), and scientific knowledge of many of these species is limited.

The legislative protection of flora within Western Australia is principally governed by three Acts. These are:

- The *Wildlife Conservation Act 1950*;
- The *Environmental Protection Act 1986*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices, a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat. The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

At the State level, the *Wildlife Conservation Act 1950* provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Ecological communities that are deemed to be threatened are afforded protection under the *Environmental Protection Act 1986*. Listings of threatened species and communities are reviewed annually by the Western Australian Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the Department of Parks and Wildlife. The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) is made to the Minister for the Environment by the TSSC, via the Director General of the Department of Parks and Wildlife, and the WA Conservation Commission. Under Schedule 1 of the *Wildlife Conservation Act 1950*, the Minister for the Environment may declare a class or description of flora to be threatened flora throughout the State, by notice published in the *Government Gazette* (Department of Parks and Wildlife 2016b).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, a nomination process exists, to list a threatened species or ecological community. Additions or deletions to the lists of Threatened species and communities are made by the Minister for the Environment, on advice from the Federal Threatened Species Scientific Committee. *Environment Protection and Biodiversity Conservation Act 1999* lists of Threatened flora and ecological communities are published on the Department of the Environment website (2016a, 2016b).

2.3.1 Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened flora or priority flora. Where flora has been gazetted as threatened flora under the *Wildlife Conservation Act 1950*, it is an offence "to take" such flora without the written consent of the Minister. The *Wildlife Conservation Act 1950* states that "to take" flora includes to gather, pluck, 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 constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the *Wildlife Conservation Act 1950*. The Department of Parks and Wildlife categorises priority flora according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P5 the least. Priority flora species are regularly reviewed, and may have their priority status changed when more information on the species becomes available. Appendix A1 sets out definitions of both threatened and priority flora (Department of Parks and Wildlife 2016c).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Commonwealth Minister for the Environment. Refer to Appendix A2 for a description of each of these categories of threatened species. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act.

The current *Environment Protection and Biodiversity Conservation Act 1999* list of Threatened flora may be found on the Department of the Environment (2016a) website.

2.3.2 Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A threatened ecological community is defined, under the *Environmental Protection Act 1986*, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories of threatened ecological communities, or TECs: presumed totally destroyed (PD); critically endangered (CR); endangered (EN); and vulnerable (VU) (Department of Parks and Wildlife 2016d). A description of each of these categories of TECs is presented in Appendix A3. Threatened ecological communities are gazetted as such (Department of Parks and Wildlife 2016e).

At the Commonwealth level, some Western Australian TECs are listed as threatened, under the *Environment Protection and Biodiversity Conservation Act 1999*. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have a significant impact on a listed threatened ecological community without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act. A description of each of these categories of TECs is presented in Appendix A4. The current *Environment Protection and Biodiversity Conservation Act 1999* list of threatened ecological communities can be located on the Department of the Environment (2016b) website.

Ecological communities identified as threatened, but not listed as threatened ecological communities, can be classified as priority ecological communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. The Department of Parks and Wildlife categorises priority ecological communities according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such ecological communities, with P1 communities being the most threatened and P5 the least. Appendix A5 sets out definitions of priority ecological communities (Department of Parks and Wildlife 2016d). A list of current priority ecological communities can be viewed at the Department of Parks and Wildlife (2016f) website.

2.3.3 Clearing of Native Vegetation

Under the *Environmental Protection Act 1986*, the clearing of native vegetation requires a permit to do so, from the Department of Environment Regulation or the Department of Mines and Petroleum, unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Under the *Environmental Protection Act 1986*, "native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation. Under the *Environmental Protection Act 1986*, Section 51A, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.

Under the *Environmental Protection Act 1986*, ten principles for clearing native vegetation are set out in Schedule 5, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

a. it comprises a high level of biological diversity;
b. 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. it includes, or is necessary for the continued existence of, threatened flora;
d. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
e. it is significant as a remnant of native vegetation in an area that has been extensively cleared;
f. it is growing in, or in association with, an environment associated with a watercourse or wetland;
g. the clearing of the vegetation is likely to cause appreciable land degradation;
h. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
i. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or
j. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in Section 51C of the *Environmental Protection Act 1986*. However, exemptions under these Regulations do not apply in Environmentally Sensitive Areas (ESA's).

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 6 –"environmentally sensitive areas" include "the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located". Similarly, "the area covered by a threatened ecological community" is listed as an environmentally sensitive area under Regulation 6.

2.4 Declared (Plant) Pest Organisms

The *Biosecurity and Agriculture Management Act 2007* (BAM Act), Section 22, makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under section 26 (1) of the *Biosecurity and Agriculture Management Act 2007*, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food Western Australia.

Under the *Biosecurity and Agriculture Management Regulations 2013*, declared plant pests are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix A6). According to section 30 (3) of the BAM Act, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

The current listing of declared pest organisms and their control category is available on the Western Australian Organism List (WAOL), at the Biosecurity and Agriculture Management website of the Department of Agriculture and Food Western Australia (Department of Agriculture and Food 2016).

2.5 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government.

In regards to flora; species, subspecies, varieties, hybrids and ecotypes may be significant other than as threatened 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 (Environmental Protection Authority 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- 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);
- a restricted distribution (Environmental Protection Authority 2004).

Vegetation communities are locally significant if they contain threatened or priority flora or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant.

Vegetation communities are 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 threatened Flora.

Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

2.6 Western Australia's Fauna – A Legislative Perspective

Australia's faunal biota is recognized as one of the 12 most diverse in the world (Common and Norton 1992). The faunal biota of Western Australia is diverse but incompletely documented (Hopper *et al.* 1996). Although vertebrates are generally considered the most well-known faunal group, their taxonomy is constantly evolving (Clayton *et al.* 2006). New species continue to be described and species and genus level revisions continue to add to our understanding of vertebrate diversity in Australia, especially that of reptiles and mammals (Clayton *et al.* 2006).

The legislative protection of fauna within Western Australia is principally governed by three Acts:

- The *Wildlife Conservation Act 1950*;
- The *Environmental Protection Act 1986*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

There are also a number of international policies and agreements that are a part of the framework for the protection of biodiversity within Western Australia:

- *Convention on Wetlands of International Importance 1971* (RAMSAR Convention);
- *Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment 1974* (Japan-Australia Migratory Bird Agreement – JAMBA);
- *Convention on the Conservation of Migratory Species of Wild Animals 1979* (Bonn Convention, Germany);
- *Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986* (China-Australia Migratory Bird Agreement – CAMBA); and
- *Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds 2007* (Republic of Korea-Australia Migratory Bird Agreement – ROKAMBA).

The unique fauna of Western Australia is potentially under threat due to historical practices associated with European settlement. Activities including mining, agriculture, and establishment of human settlements, excessive exploitation and the introduction of feral animals have impacted Western Australia's fauna. As a consequence of these practices, a number of fauna species have become extinct or have the potential to become extinct as their habitat is impacted by human activity. The following section describes these threatened and priority fauna and outline the legislative protection afforded to them.

2.6.1 Threatened, Priority, and Specially Protected Fauna

Fauna within Western Australia which is considered to be under threat may be classed as threatened fauna, specially protected fauna or priority fauna (Appendix B). The Schedule of Threatened Fauna is reviewed at least every three years by the Threatened Fauna Scientific Advisory Committee established under Policy Statement No 33. Individual taxa may be added or deleted at any time if warranted, e.g. if a threatened species not previously known for the State is discovered. Animals (including fish and invertebrates) that are protected fauna under the *Wildlife Conservation Act 1950* may be declared as threatened fauna by the Minister. Threatened fauna species can be listed as extinct, extinct in the wild, critically endangered, endangered or vulnerable by the Minister for the Environment, after being published in the Government Gazette (Appendix B1). Taxa may also be declared by the Minister if they have been declared to be threatened by other Australian States or Territories or are classified as threatened in a treaty to which Australia is a party, e.g. JAMBA. Section 14(2) (ba) of the *Wildlife Conservation Act 1950* states "the Minister may, from time to time by notice published in the Government Gazette, declare that any fauna specified in the notice is for the purposes of this Act fauna which is likely to become extinct, or is rare, or otherwise in need of special protection and while such declaration is in operation –

i) such fauna is wholly protected throughout the whole of the State at all times; and

ii) a person who commits an offence under section 16 or 16A with respect to or in relation to such fauna is liable, notwithstanding any other provision of this Act, to a penalty of $10,000".

The Schedule of Specially Protected Fauna is dealt with in the same way as the Schedule of Threatened Fauna by the Minister for the Environment under section 14(2) (ba) of the *Wildlife Conservation Act 1950*. Specially Protected fauna species can be listed as Schedule 1 to 7 by the Minister after being published in the Government Gazette (Appendix B1).

The *Wildlife Conservation Act 1950* prohibits the taking of threatened fauna by any person on any land throughout the State without the authority of a license issued by the Executive Director. The illegal destruction of protected fauna is covered in section 6(1) of the *Wildlife Conservation Act 1950*, where the following definition is given - to take, in relation to any fauna, includes "to kill or capture any fauna

by any means or to disturb or molest any fauna by any means or to use any method whatsoever to hunt or kill any fauna whether this results in killing or capturing any fauna or not; and also includes every attempt to take fauna and every act of assistance to another person to take fauna and derivatives and inflections have corresponding meaning".

The destruction or modification of habitat by clearing or other means may result in the demise of sedentary animal species, or the displacement and eventual death of more mobile species, but this is not covered specifically in the definition of "to take". Although it can be argued that to clear habitat would "disturb" the animals and is an indirect and unsatisfactory method of habitat protection.

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent (Appendix B2), by the Federal Minister, after being published in the Commonwealth Government Gazette. Under the *Environment Protection and Biodiversity Conservation Act 1999*, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment, unless those actions are not prohibited under the Act. The current *Environment Protection and Biodiversity Conservation Act 1999* list of threatened fauna may be found on the Australian Department of the Environment website (Department of the Environment 2016c).

Priority fauna constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have the legislative protection afforded under the *Wildlife Conservation Act 1950*. The Department of Parks and Wildlife categorizes priority fauna according to their conservation priority, using four categories, P1 to P4, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P4 the least (Appendix B3). Priority fauna species are regularly reviewed, and may have their priority status changed when more information on the species becomes available. The Department of Parks and Wildlife provide lists of currently threatened and specially protected fauna recognized under the *Wildlife Conservation Act 1950* (Department of Parks and Wildlife 2016h) and the threatened and priority fauna rankings (Department of Parks and Wildlife 2016i).

2.6.2 International Agreements

Over the last three decades, Australia has played an important role in international efforts to conserve migratory birds of the East Asian-Australasian Flyway. The international agreements of JAMBA, CAMBA and ROKAMBA provide protection to a list or terrestrial, water and shorebirds species which migrate between Australia and the respective countries and their habitat. Australia has further international commitments to protect migratory birds under the Ramsar Convention and the Bonn Convention. A list of the range of birds under these Migratory Bird Agreements can be found on the Australian Department of the Environment website (Department of the Environment 2016d). Most of the species listed on the agreements are shorebirds associated with coastal shores or inland saline wetlands.

2.6.3 Short-Range Endemics

Short-range endemism is the prevalence of species with naturally small ranges of less than 10,000 km^2 (Harvey 2002). Among Australian terrestrial fauna there are numerous regions that possess short-range endemics. Some better known short-range endemic species have been listed as threatened or endangered under State or Commonwealth legislation but the majority have not (Environmental Protection Authority 2004). Often the lack of knowledge about these species precludes their consideration for listing as threatened or endangered. Listing under legislation should therefore not be the only conservation consideration in environmental impact assessment (Environmental Protection Authority 2004).

2.6.4 Significant Fauna Habitats

In addition to TECs and PECs, while not defined under any legislation, some fauna habitats within a proposed development site may be locally significant because they:

- support rare or vulnerable species;
- support specialised or habitat specific fauna;
- are regionally or locally uncommon; or
- are restricted in area.

Although not protected under State or Commonwealth legislation, in the interests of good project management, where possible, conservation of such locations within a project area will provide the basis for the fauna component of an environmental management plan to be put in place for the duration of a project.

3. OBJECTIVES

The general aim of this report was to map and undertake a flora, fauna and vegetation assessment of the Flat Rocks Wind Farm. Specifically, the objectives include:

- Search the literature and databases to assess the potential flora and fauna values that may occur within the survey area;
- Search the remnant vegetation and streamzone areas within the Flat Rocks Wind Farm survey area for threatened and priority flora and record any opportunistic fauna sightings during the field study;
- Collect and identify the vascular plant species present in the Flat Rocks Wind Farm survey area;
- Review the conservation status of the vascular plant species and fauna species by reference to current literature and current listings by the Department of Parks and Wildlife (2016g, 2007-), plant collections held at the Western Australian State Herbarium (Department of Parks and Wildlife 2016g), and listed by the Department of the Environment (2016a) under the *Environment Protection and Biodiversity Conservation Act 1999*;
- Define and map the native vegetation communities and their condition;
- Define any management issues related to flora, vegetation and vertebrate fauna values;
- Provide recommendations on the local and regional significance of the vegetation communities; and
- Prepare a report summarising the findings.

4. METHODS

4.1 Desktop Assessment

An desktop assessment and review was conducted to establish the presence of any threatened or priority flora and fauna that may potentially occur within the survey area, using both NatureMap (Department of Parks and Wildlife 2007-), *EPBC Act Protected Matters Search Tool* (Department of the Environment 2013) and the Western Australian Herbarium (Department of Parks and Wildlife 2016g) databases. The desktop search was confined to a 20km radius of the survey area as the footprint of the proposed clearing area is not expected to exceed this amount.

Further desktop reviews were then undertaken utilizing the national datasets as available from the Department of Environment (2016a, 2016b, 2016c).

4.2 Field Survey

The assessment of the flora, vegetation and fauna habitats of the Moonies Hill Energy Wind Farm was undertaken by two experienced biologists from Mattiske Consulting Pty Ltd on Wednesday the 29th September, 2010. All botanists held valid collection licences to collect flora for scientific purposes, issued under the *Wildlife Conservation Act 1950*. Aerial photographs of the survey area were supplied by Dr Sarah Rankin from Moonies Hill Energy. A total of twenty one sampling sites were selected to sample the vegetation types within the remnants at the Flat Rocks Wind Farm survey area. The field survey was conducted according to standards set out in Guidance Statement 51 (Environmental Protection Authority 2004).

The flora and vegetation was described and sampled systematically at each survey site, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted: GPS location, topography, percentage litter cover, soil type and colour, percentage of bare ground, outcropping rocks and their type, gravel type and size, time since fire and the percentage cover and average height of each vegetation stratum. For each vascular plant species, the average height and percent cover (both live and dead material) were recorded.

All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. The plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the Department of Parks and Wildlife (2016g).

Observations were undertaken on the condition of the fauna habitats and remnants.

5. RESULTS

5.1 Desktop Review

5.1.1 Potential Threatened and Priority Flora

A total of 24 threatened and priority flora have been listed as occurring, or potentially occurring, in the vicinity of the Flat Rocks Wind Farm (Department of Parks and Wildlife 2007-). A summary of these species listings at state and federal levels can be found in Table 1 and a description of each taxa can be found in Appendix C. *Amperea protensa* and *Banksia mucronulata* subsp. *retrorsa*, as described in the 2010 Mattiske report (Mattiske Consulting Pty Ltd 2010), are no longer listed as priority flora (Department of Parks and Wildlife 2016g).

5.1.2 Potential Threatened, Specially Protected and Priority Fauna

A total of 25 protected fauna species have been listed as occurring, or potentially occurring, in the vicinity of the Flat Rocks Wind Farm, including 14 birds and 11 mammals (Department of Parks and Wildlife 2007-). A summary of protected fauna listings pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)*, the *Environment Protection and Biodiversity Conservation Act 1999* and the International Union for Conservation of Nature and Natural Resources' Red List, is presented in Table 2 (Department of Parks and Wildlife 2016i, Department of the Environment 2016c, International Union for Conservation of Nature and Natural Resources 2016). Additional information on distribution and habitat of each species can be found in Appendix D. *Ardeotis australis* (Australian Bustard) and *Burhinus grallarius* (Bush Stone-Curlew), as described in the 2010 Mattiske report (Mattiske Consulting Pty Ltd 2010), are no longer listed fauna species.

Table 1: Conservation status of threatened and priority flora potentially occurring in the Flat Rocks Wind Farm survey area
(Department of Parks and Wildlife 2007-, Department of Environment 2016c, International Union for Conservation of Nature and Natural Resources 2016)

Species	Common Name	State Conservation	Federal Conservation	EPBC Listing Status	IUCN Red list	EPBC (20 km)	NatureMap (20 km)
Acacia ataxiphylla subsp. *ataxiphylla*		Priority 3	-	Not Listed	Near Threatened (sans. infra.)		x
Adenanthos filifolius		Priority 4	-	Not Listed	-		x
Adenanthos pungens subsp. *effusus*	Sprawling Spiky Adenanthos	Threatened (Critically Endangered)	Endangered	Endangered	-	x	
Adenanthos pungens subsp. *pungens*	Spiky Adenanthos	Threatened (Endangered)	Vulnerable	Vulnerable	-	x	
Banksia acuminata		Priority 4	-	Not Listed	-		x
Banksia oligantha	Wagin Banksia	Threatened (Endangered)	Endangered	Endangered	-	x	
Banksia subpinnatifida var. *imberbis*		Priority 2	-	Not Listed	-		x
Caladenia integra	Mantis Orchid, Smooth-lipped Spider Orchid	Priority 4	-	Not Listed	-		x
Caladenia x *triangularis*		Priority 4	-	Not Listed	-		x
Calectasia obtusa		Priority 3	-	Not Listed	-		x
Commersonia erythrogyna	Trigwell's Rulingia	Threatened (Critically Endangered)	Endangered	Endangered	-	x	
Darwinia oxylepis	Gillam's Bell	Threatened (Endangered)	Endangered	Endangered	-	x	
Diuris micrantha	Dwarf Bee-orchid	Threatened (Vulnerable)	Vulnerable	Vulnerable	-	x	
Diuris recurva		Priority 4	-	Not Listed	-		x
Gastrolobium lehmannii	Cranbrook Pea	Threatened (Vulnerable)	Vulnerable	Vulnerable	-	x	x
Grevillea bipinnatifida subsp. *pagna*		Priority 1	-	Not Listed	-		x
Hemigenia ramosissima	Branched Hemigenia	Threatened (Critically Endangered)	Critically Endangered	Critically Endangered	-	x	
Hibbertia montana		Priority 4	-	Not Listed	-		x
Melaleuca micromera		Priority 3	-	Not Listed	-		x
Melaleuca ordinifolia		Priority 2	-	Not Listed	-		x
Roycea pycnophylloides	Saltmat	Threatened (Vulnerable)	Endangered	Endangered	-	x	
Schoenus natans	Floating Bog-rush	Priority 4	-	Not Listed	-		x
Verticordia fimbrilepis subsp. *fimbrilepis*	Shy Featherflower	Threatened (Vulnerable)	Endangered	Endangered	-	x	
Verticordia lindleyi subsp. *lindleyi*		Priority 4	-	Not Listed	-		x

Table 2: Conservation status of protected fauna species that potentially occur in the Flat Rocks Wind Farm survey area
(Department of Parks and Wildlife 2007-, Department of Environment 2016c, International Union for Conservation of Nature and Natural Resources 2016)

Species	Common Name	State Conservation	Federal Conservation	EPBC Listing Status	IUCN Red list	EPBC (20 km)	NatureMap (20 km)
Apus pacificus	Fork-tailed Swift	International Agreement	-	Marine / Migratory Marine	Least Concern	x	
Ardea alba	Great Egret, White Egret	-	-	Marine / Migratory Wetlands	Least Concern	x	
Ardea ibis	Cattle Egret	International Agreement	-	Marine / Migratory Wetlands	Least Concern	x	
Bettongia penicillata subsp. *ogilbyi*	Woylie, Brush-tailed Bettong	Threatened (Critically Endangered)	Endangered	Endangered	Critically Endangered (sans. infra.)		x
Cacatua pastinator subsp. *pastinator*	Muir's Corella, Western Corella (southern)	Special (Conservation Dependent)	Vulnerable	Vulnerable	Least Concern	x	x
Calyptorhynchus banksii subsp. *naso*	Forest Red-tailed Black-Cockatoo	Threatened (Vulnerable)	Vulnerable	Vulnerable	Least Concern (sans. infra.)	x	x
Calyptorhynchus baudinii	Baudin's Black-Cockatoo, Long-billed Black-Cockatoo	Threatened (Vulnerable)	Vulnerable	Vulnerable	Endangered	x	x
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Threatened (Endangered)	Endangered	Endangered	Endangered	x	x
Dasyurus geoffroii	Chuditch, Western Quoll	Threatened (Vulnerable)	Vulnerable	Vulnerable	Near Threatened	x	x
Falco peregrinus	Peregrine Falcon	Special	-	Not Listed	Least Concern		x
Haliaeetus leucogaster	White-bellied Sea-Eagle	International Agreement	-	Marine	Least Concern	x	
Isoodon obesulus subsp. *fusciventer*	Quenda, Southern Brown Bandicoot	Priority 5	-	Not Listed	Least Concern (sans. infra.)		x
Leipoa ocellata	Malleefowl	Threatened (Vulnerable)	Vulnerable	Vulnerable	Vulnerable	x	
Macropus eugenii subsp. *derbianus*	Tammar Wallaby	Priority 5	-	Not Listed	Least Concern (sans. infra.)		x
Macropus irma	Western Brush Wallaby	Priority 4	-	Not Listed	Least Concern		x
Macrotis lagotis	Bilby, Dalgyte	Threatened (Vulnerable)	Vulnerable	Vulnerable	Vulnerable		x
Merops ornatus	Rainbow Bee-eater	International Agreement	-	Marine / Migratory Terrestrial	Least Concern	x	x
Motacilla cinerea	Grey Wagtail	International Agreement	-	Marine / Migratory Terrestrial	Least Concern	x	
Myrmecobius fasciatus	Numbat, Walpurti	Threatened (Endangered)	Vulnerable	Vulnerable	Endangered		x
Onychogalea lunata	Crescent Nailtail Wallaby, Wurrung	Extinct (Presumed Extinct)	Extinct	Extinct	Extinct		x

Table 2 (cont.): Conservation status of protected fauna species that potentially occur in the Flat Rocks Wind Farm survey area (Department of Parks and Wildlife 2007-, Department of Environment 2016c, International Union for Conservation of Nature and Natural Resources 2016)

Species	Common Name	State Conservation	Federal Conservation	EPBC Listing Status	IUCN Red list	EPBC (20 km)	NatureMap (20 km)
Pandion haliaetus	Osprey	-	-	Marine / Migratory Wetlands	Least Concern	x	
Phascogale calura	Red-tailed Phascogale	Special (Conservation Dependent)	Endangered	Endangered	Near Threatened	x	x
Phascogale tapoatafa subsp. (WAM M434)	Brush-tailed Phascogale	- (sans. infra.)	-	Not Listed	Near Threatened (sans. infra.)		
Pseudocheirus occidentalis	Western Ringtail Possum	Threatened (Endangered)	Vulnerable	Vulnerable	Vulnerable		x
Thinornis rubricollis	Hooded Plover	-	-	Marine	Vulnerable	x	

5.2. Field Survey

A total of 21 survey sites, both pre-selected and opportunistic, were used to assess the flora and vegetation of the Flat Rocks Wind Farm survey area (Table 3).

Table 3: GPS locations of 21 sites within the Moonies Hill survey area

Site Number	EASTING	NORTHING
	DATUM GDA94 ZONE 50H	
1	533137	6240034
2	529092	6251356
3	529518	6250544
4	532866	6252093
5	531686	6247741
6	531431	6248093
7	531307	6247294
8	531128	6246980
9	534589	6246243
10	536127	6245442
11	535790	6245790
12	536315	6247272
13	533222	6238117
14	531000	6236500
15	529297	6239799
16	529773	6240336
17	529952	6239475
18	530161	6239864
19	529820	6235244
20	528231	6237067
21	528612	6238877

5.2.1 Survey Limitations and Constraints

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the present survey was made (Table 4). Based on this assessment, the present survey has not been subject to constraints which would affect the thoroughness of the survey, and the conclusions which have been formed.

Table 4: Potential Survey Limitations for Survey Area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint:** The study was undertaken in the Avon Botanical District which has been well studied and documented with ample literature available (e.g. Beard 1980, Beard 1990). In addition the databases held at the State and National level were used to assess the potential flora and fauna values.
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint:** Rainfall in the months preceding the time of survey was lower than the average rainfall expected for the area (Bureau of Meteorology 2016). However the month of the survey recorded a higher average of rainfall therefore, it is plausible that life forms were sampled adequately during the time of the survey, including annuals
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint:** 21 survey sites were spread throughout all areas of remnant vegetation. This reflects the difficulty in obtaining adequate replications of sites containing similar species composition, due to the fragmented nature of the vegetation within the survey area. However the survey was conducted in spring and sampling effort was sufficient to capture species present within the survey area.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint:** The information collected during the survey was sufficient to assess the vegetation and potential fauna and flora issues that may be present during the time of the survey.
Mapping reliability.	**Not a constraint:** Aerial photography of a suitable scale was used to map the project area. Sites were chosen from these aerials on the basis of a 50-metre grid design starting at the designated boundary area proposed by the proponent. Sites were chosen in areas of remnant vegetation. Vegetation communities were assigned to each site based on topography, presence/absence and percent foliage cover of flora species.
Timing, weather, season, cycle.	**Not a constraint:** It is generally accepted that flora and vegetation surveys are conducted in spring following autumn rains in the Avon Wheatbelt (Environmental Protection Authority 2004). Kojonup experienced below average rainfall in the few months preceding the time of survey but the month of the survey was above average (Figure 1) (Bureau of Meteorology 2016).
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint:** Human-induced disturbances associated with pastoralism occur near the study area. However, apart from the encroachment of several weed species onto remnant bushland areas and very old rubbish, this should not be a constraint on the survey.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint:** The survey intensity was considered to have been thorough throughout the survey area. 21 sites were chosen in remnant vegetation from a grid placed over the aerial maps for the entirety of the Lots.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint:** The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint:** Existing roads and tracks enabled adequate access to survey representative vegetation and remnant areas within the survey area. Where access was not available by car, it was easily traversed by foot.
Experience levels.	**Not a constraint:** All survey personnel had the appropriate training in sampling and identifying the flora of the region. Experienced botanists were consulted where plants could not be identified in the field and discussions were held with experienced zoologists.

5.2.2 Flora

A total of 76 vascular plant taxa from 57 plant genera and 22 plant families were recorded within the Flat Rocks Wind Farm survey area during the 2010 survey. The majority of taxa was recorded within the Poaceae (17 taxa), Myrtaceae (12 taxa), Fabaceae (9 taxa), and Asteraceae (9 taxa) families (Appendix E). This total included 53 native species and 23 introduced (weed) species.

5.2.3 Threatened and Priority Flora

No threatened and priority flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the Department of Parks and Wildlife (2016g) were recorded within the Flat Rocks Wind Farm survey area. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment 2016a) were recorded during the survey within the proposed Flat Rocks Wind Farm survey area.

5.2.4 Introduced (Exotic) Plant Species

A total of 23 introduced (exotic) taxa were recorded within the Moonies Hill survey area (Appendix E). One species, **Asparagus asparagoides*, is listed as a Declared Pest - S22 (2), category 3 (management), for the whole state (Department of Agriculture and Food 2016; Appendix A6). **Asparagus asparagoides* was recorded at one site within the Flat Rocks Wind Farm survey area. All others are listed as Permitted - s11 for the whole of state and are not assigned to any control category for a local government area at this time (Western Australian Department of Agriculture and Food 2016).

5.3 Vegetation

Five vegetation communities were defined and mapped within the Flat Rocks Wind Farm survey area (Figure 2). The plant communities are summarised below:

E1: Mosaic of Open Woodland of *Eucalyptus rudis* subsp. *rudis – Acacia acuminata -*, *Melaleuca rhaphiophylla* with patches of *Melaleuca cuticularis* over introduced grasses and Chenopod Shrubland of *Tecticornia lepidosperma* over introduced grasses on saline clays and sandy-clays in creeklines.

E2: Open Woodland of *Eucalyptus rudis* subsp. *rudis – Melaleuca rhaphiophylla* over *Acacia saligna*, *Acacia acuminata*, *Jacksonia sternbergiana* over *Ficinia nodosa* and introduced grasses on sandy-loams and clay-loams on fringes of creeklines.

E3: Woodland of *Eucalyptus wandoo* with patches and mixtures of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* abuting *Eucalyptus loxophleba* subsp. *loxophleba* on sandy gravels and *Allocasuarina huegeliana* on granites over low shrubs of *Acacia lasiocarpa* var. *sedifolia*, *Bossiaea eriocarpa*, *Gastrolobium praemorsum*, *Astroloma compactum*, *Acacia pulchella*, *Hibbertia commutata* over low sedges and annuals on sandy-loam gravels on mid and upper slopes.

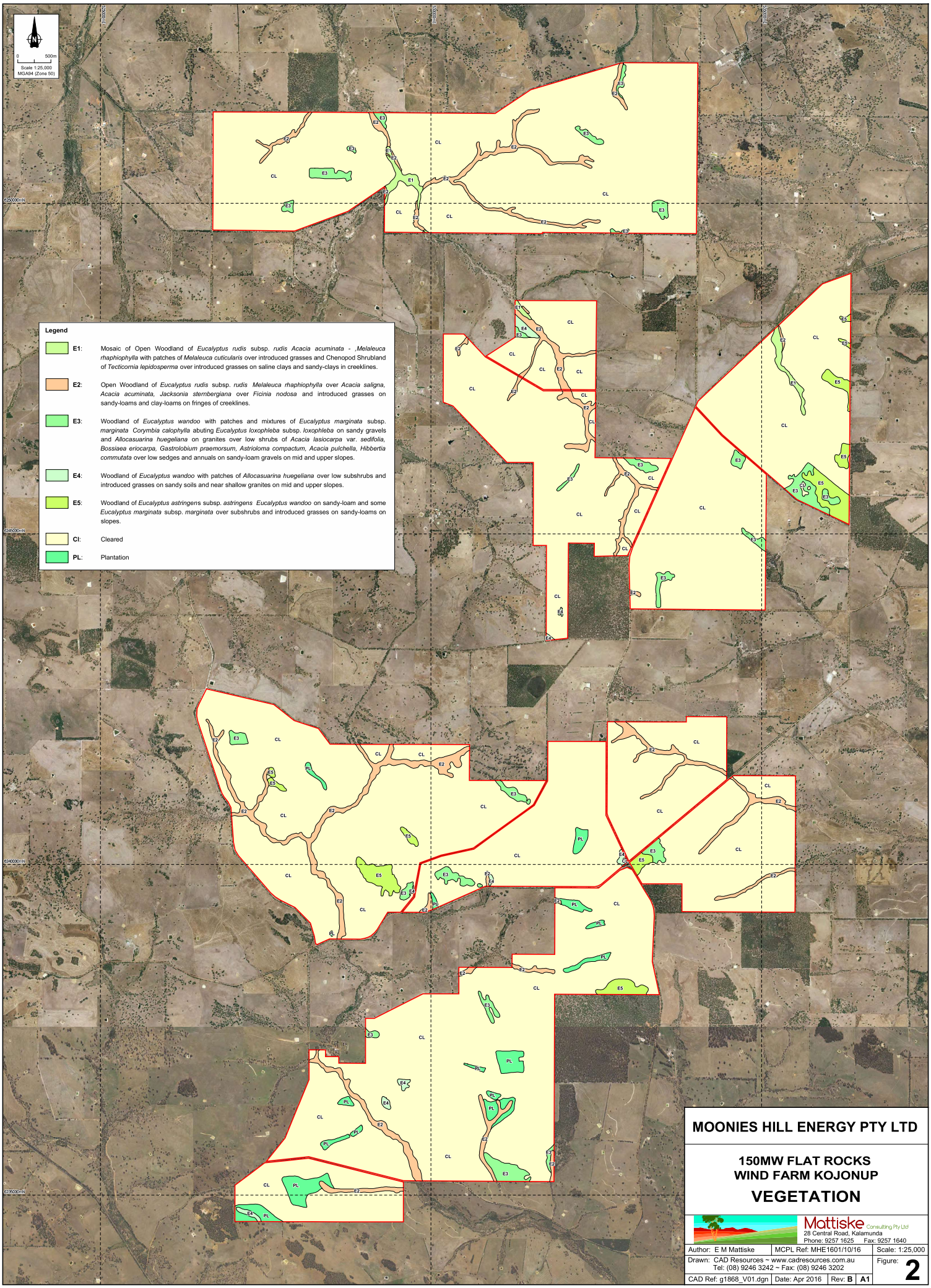
E4: Woodland of *Eucalyptus wandoo* with patches of *Allocasuarina huegeliana* over low subshrubs and introduced grasses on sandy soils and near shallow granites on mid and upper slopes.

E5: Woodland of *Eucalyptus astringens* subsp. *astringens – Eucalyptus wandoo* on sandy-loam and some *Eucalyptus marginata* subsp. *marginata* over subshrubs and introduced grasses on sandy-loams on slopes.

Cl: Cleared

PL: Plantation

No threatened ecological communities as defined by the *Environment Protection and Biodiversity Conservation Act 1999* or the Department of Parks and Wildlife (2016e) were located in this survey area.



MOONIES HILL ENERGY PTY LTD

150MW FLAT ROCKS WIND FARM KOJONUP

VEGETATION

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Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 2
CAD Ref: g1868_V01.dgn	Date: Apr 2016	Rev: B A1

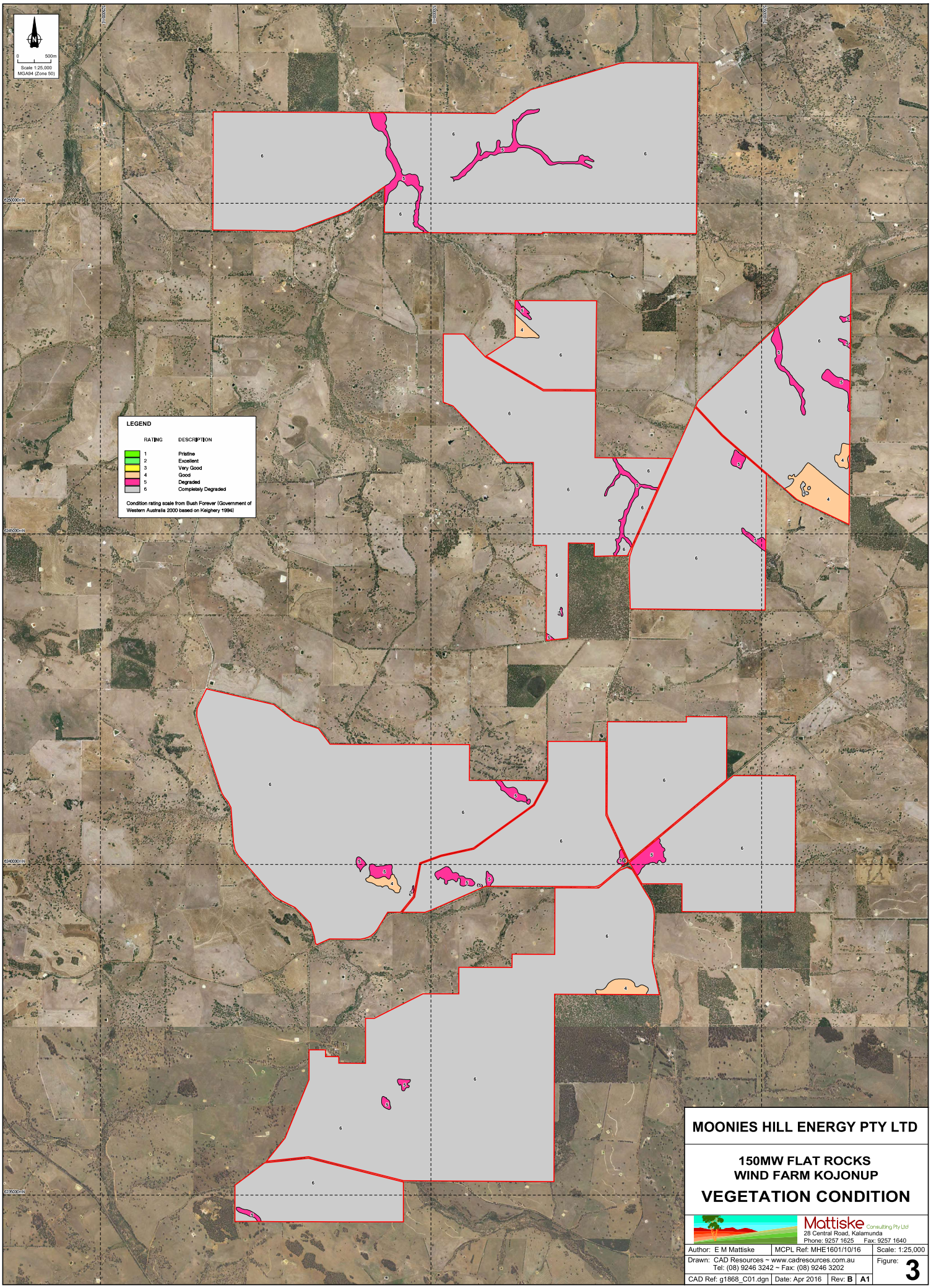
5.4 Vegetation Condition

The plant communities were very disturbed and had been largely grazed or cleared (Figure 3). Consequently the majority of the survey area is completely degraded or degraded.

5.5 Fauna

Discussions were held with Ron Johnstone from the W.A. Museum in regard to the cockatoo species that may occur in the area. As a result it appears that the most likely of the cockatoos in the project area is the Carnaby's cockatoo and as in his opinion the risk of these cockatoos flying into the wind turbine is very low (personal communication between Dr Libby Mattiske and Ron Johnstone, 15 March 2011). The wind farm occurs on the fringes of the other two Cockatoos (Red-Tailed and Baudin) and consequently the potential remains very low for these two species. On the basis of previous studies it appears that the Carnaby's Cockatoo has reasonable night vision and therefore will avoid obstacles. Current studies in areas supporting Cockatoos both north of Perth and near Albany have indicated that these species tend to avoid these facilities and therefore the risk remains very low.

Although a range of potential fauna values were sourced from a desktop assessment; in view of the degree of degradation, unless remnant areas are likely to be disturbed, there should not be any significant issues in relation to the native fauna species. The degree of degradation is evident from the series of photographs in Appendix F.



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VEGETATION CONDITION

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CAD Ref: g1868_C01.dgn	Date: Apr 2016	Rev: B A1

6. DISCUSSION

Mattiske Consulting Pty Ltd was commissioned by the Moonies Hill Energy to undertake a review of the flora, vegetation and fauna values on the proposed Flat Rocks Wind Farm location. The proposed development occurs primarily within cleared agricultural areas. Therefore, the effort concentrated on desktop reviews and an assessment of the main remnants and roadside vegetation that may be disturbed by vehicle movement and installation of the wind farm facilities.

The relatively low range of native species is a reflection of the degree of disturbance and clearing in the Flat Rocks Wind Farm survey area.

No threatened and priority flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the Department of Parks and Wildlife (2016g) were recorded within the Flat Rocks Wind Farm survey area. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment 2016a) were recorded during the survey within the proposed Flat Rocks Wind Farm survey area.

No threatened ecological communities as defined by the *Environment Protection and Biodiversity Conservation Act 1999* or the Department of Parks and Wildlife (2016e) were located in this survey area.

Although a range of potential fauna values were sourced from a desktop assessment; in view of the degree of degradation, unless remnant areas are likely to be disturbed, there should not be any significant issues in relation to the native fauna species.

The areas proposed for the wind farms are all within largely cleared agricultural lands and as such are unlikely to provide any substantial nesting or foraging sites. The remnant vegetation that does occur is restricted to the degraded valley floors and as such is influenced by local salinity and degraded soils. Several smaller remnants occur on the edges of the proposal area, but will not be influenced by the proposed development.

In the highly modified Wheatbelt all areas of remnant native vegetation are significant from a conservation perspective. The proposed areas for the wind turbines of the Flat Rocks Wind Farm project are located almost entirely within cleared farmland and therefore will have a very low impact on native vegetation or native fauna habitats or native species. In the case that clearing of remnant vegetation is unavoidable (e.g. for access points from public roads), it is recommended that effort be made to minimise clearing by routing access points through existing gaps in vegetation such as farm gates or within remnants that do not support significant patches of native species.

To minimize impacts on the environment at all times vehicle hygiene measures should be maintained such as vehicle inspections and under vehicle clearing to minimize the spread of weeds and introduced species in the project area. This survey identified twenty three exotic species; however the total number of exotic species is expected to be higher over the entire proposed wind farm area because the current survey focused only on patches of remnant vegetation, not the highly disturbed cleared agricultural land. One species, **Asparagus asparagoides*, is listed as a Declared Pest - S22 (2), category 3 (management), for the whole state (Department of Agriculture and Food 2016; Appendix A6), and thus special care should be taken to contain and avoid the spread of this species.

In summary, there should be no impediments to the development of the wind farm facilities providing the remnant vegetation areas (including less disturbed road verges) are not disturbed.

7. RECOMMENDATIONS

In response to the proposed clearing of vegetation in the Flat Rocks Wind Farm survey area, it is recommended to:

- Limit ground disturbance and clearing of vegetation to designated areas and access routes, avoiding habitat trees (larger trees and trees with hollows) wherever possible;
- Maintain existing drainage systems, ensuring tracks and other infrastructure areas do not disrupt or divert historic water flow patterns;
- Remove and stockpile topsoil, log debris and leaf litter where possible for use in future rehabilitation programs. If possible, stockpiled topsoil should be directly replaced on disturbed areas;
- Minimise soil disturbance during clearing and practice standard vehicle hygiene to ensure introduced (exotic) species do not become established within the Flat Rocks Wind Farm survey area;
- Implement a management plan to prevent the spread of **Asparagus asparagoides*, a declared pest species; and
- Minimize all threatening processes to native vegetation and potential fauna habitats (creekline vegetation, isolated larger trees with hollows).

8. ACKNOWLEDGEMENTS

The authors would like to thank Dr Sarah Rankin from Moonies Hill Energy and for their assistance with this project.

9. LIST OF PERSONNEL:

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

Name	Position	Project Involvement
Dr E M Mattiske	Managing Director & Principal Ecologist	Planning, Data Interpretation, Management & Reporting
Ms C Reynolds	Experienced Botanist	Assisting with Report preparation
Ms C Bryan	Botanist	Fieldwork, Report preparation
Ms M Barrett	Botanist	Fieldwork, Report preparation

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APPENDIX A1: STATE DEFINITION OF THREATENED AND PRIORITY FLORA SPECIES

Note: Adapted from Department of Parks and Wildlife (2016c).

Category	Definition
T – Threatened	Taxa that 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 (Schedules 1 to 4 of the *Wildlife Conservation (Rare Flora) Notice* under the WC Act). Threatened flora are further ranked by the DPaW to align with IUCN Red List categories and criteria: • **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild (Schedule 1); • **EN:** Endangered – considered to be facing a very high risk of extinction in the wild (Schedule 2); or • **VU:** Vulnerable – considered to be facing a high risk of extinction in the wild (Schedule 3). • **EX:** Presumed Extinct – taxa that have been adequately searched for and there is no reasonable doubt that the last individual has died (Schedule 4)
P1 – Priority 1 (Poorly known taxa)	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2 – Priority 2 (Poorly known taxa)	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3 – Priority 3 (Poorly known taxa)	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4 – Priority 4 (Rare, Near Threatened and other taxa in need of monitoring)	**1. Rare** - Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **2. Near Threatened** - Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **3.** Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: DEFINITION 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.

APPENDIX A3: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

Category Code	Category
PTD	**Presumed Totally Destroyed** An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	**Critically Endangered** An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	**Endangered** An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

APPENDIX A4: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*)

Three categories exist for listing threatened ecological communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Listing Category	Explanation of Category
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

APPENDIX A5: DEFINITION OF PRIORITY ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2016d)

Category Code	Category
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A6: CATEGORIES AND CONTROL OF DECLARED (PLANT) PESTS IN WESTERN AUSTRALIA (Department of Agriculture and Food 2016) (*Biosecurity and Agriculture Management Regulations 2013*)

Control Category	Control Measures
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to — (i) alleviate the harmful impact of the declared pest in the area; or (ii) reduce the number or distribution of the declared pest in the area; or (iii) prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to — (a) alleviate the harmful impact of the declared pest in the area for which it is declared; or (b) reduce the number or distribution of the declared pest in the area for which it is declared; or (c) prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A7: DEFINITION OF STRUCTURAL FORMS OF AUSTRALIAN VEGETATION (Beard 1990)

Structural Forms of Australian Vegetation			
Growth Form of Tallest Stratum	**Foliage Cover of Tallest Stratum**		
	30 – 70%	**10 – 30%**	**less than 10%**
Tall Trees [greater than 30 m]	Tall Forest	Tall Woodland	Open Tall Forest
Medium Trees [10 – 30 m]	Forest	Woodland	Open Woodland
Low Trees [less than 10 m]	Low Forest	Low Woodland	Open Low Woodland
Tall Shrubs [greater than 2 m]	Thicket	Scrub	Open Scrub
Low Shrubs [less than 2 m]	Heath	Low Shrubland	Open Low Shrubland
Grassland [less than 1 m]	Closed Bunch Grassland	Open Bunch Grassland	Hummock Grassland

APPENDIX A8: DEFINITION OF VEGETATION CONDITION SCALE (Trudgen 1988)

Condition Rating	Description
Pristine (1)	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Excellent (2)	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Very Good (3)	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Good (4)	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded (5)	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded (6)	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX C: DESCRIPTION OF THREATENED AND PRIORITY FLORA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of Parks and Wildlife 2016g)

Species	Common Name	State Conservation	Family	Description	Flowers	Habitat	Likelihood of occurrence
Acacia ataxiphylla subsp. *ataxiphylla*		Priority 3	Fabaceae	prostrate, sprawling shrub to 50 cm	yellow, Nov to Dec or Jan	gravelly clay loam, white/grey sand on flats, roadsides	unlikely
Adenanthos filifolius		Priority 4	Proteaceae	erect shrub, to 2(-5) m	cream-white, May or Sep to Dec	white, grey or black peaty sand, sandy clay on rocky hillsides (usually granite, sandstone or quartzite)	unlikely
Adenanthos pungens subsp. *effusus*	Sprawling Spiky Adenanthos	Threatened (Critically Endangered)	Proteaceae	prostrate shrub to 50 cm, forming large mats to 3 m wide	pink, Aug to Nov	white siliceous sand	unlikely
Adenanthos pungens subsp. *pungens*	Spiky Adenanthos	Threatened (Endangered)	Proteaceae	erect shrub to 3 m	pink/red, Aug to Nov	white/grey or pink sand, rocky soils, gypsum on sand dunes, hillsides	unlikely
Banksia acuminata		Priority 4	Proteaceae	prostrate, lignotuberous shrub to 20cm	yellow-orange, Oct	gravelly soils	possible
Banksia oligantha	Wagin Banksia	Threatened (Endangered)	Proteaceae	non-lignotuberous shrub to 3 m	red & cream/orange-brown, Oct to Nov	yellow or yellow-brown sand	unlikely
Banksia subpinnatifida var. *imberbis*		Priority 2	Proteaceae	erect or straggling, non-lignotuberous shrub to 1.5m	yellow, Sep to Oct	lateritic soils	possible
Caladenia integra	Mantis Orchid, Smooth-lipped Spider Orchid	Priority 4	Orchidaceae	tuberous, perennial, herb to 50 cm	green, red	clayey loam on granite outcrops, rocky slopes	possible
Caladenia x *triangularis*		Priority 4	Orchidaceae	tuberous, perennial herb	yellow	loam, low lying areas	possible
Calectasia obtusa		Priority 3	Dasypogonaceae	erect, low herb to 40 cm	blue, Aug to Sep	sand, clay loam, gravel and laterite soils	possible
Commersonia erythrogyna	Trigwell's Rulingia	Threatened (Critically Endangered)	Fabaceae	erect, domed shrub to 1.5m	orange, yellow, red & purple, Sep to Oct	red clay and laterite, on low hilltops and breakaways	unlikely
Darwinia oxylepis	Gillam's Bell	Threatened (Endangered)	Myrtaceae	upright, dense shrub to 1.5 m	red, Aug to Nov	stony, peaty sand in rocky gullies.	unlikely
Diuris micrantha	Dwarf Bee-orchid	Threatened (Vulnerable)	Orchidaceae	tuberous, perennial, herb to 60 cm	yellow & brown, Sep to Oct	brown loamy clay in winter-wet swamps, in shallow water	possible
Diuris recurva		Priority 4	Orchidaceae	tuberous, perennial, herb to 30 cm	yellow & brown, Jul to Aug	loam in winter-wet areas	possible

APPENDIX C: DESCRIPTION OF THREATENED AND PRIORITY FLORA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of Parks and Wildlife 2016g)

Species	Common Name	State Conservation	Family	Description	Flowers	Habitat	Likelihood of occurrence
Gastrolobium lehmannii	Cranbrook Pea	Threatened (Vulnerable)	Fabaceae	erect, domed shrub to 1.5 m	orange-yellow-red-purple, Sep to Oct	red clay, laterite on low hilltop of breakaway	possible
Grevillea bipinnatifida subsp. *pagna*		Priority 1	Proteaceae	prostrate, lignotuberous shrub to 70 cm	red & orange & yellow, Aug or Oct to Nov	grey sandy clay and loam, ironstone in seasonal wetlands, swamps, roadsides	possible
Hemigenia ramosissima	Branched Hemigenia	Threatened (Critically Endangered)	Lamiaceae	slender shrub to 50 cm	blue-purple, Nov to Dec or Jan	lateritic soils, clay on granite outcrops	possible
Hibbertia montana		Priority 4	Dilleniaceae	erect, straggling or sprawling shrub to 70 cm	yellow, Jul to Oct	loam over granite, lateritic soils, gravel on granite rocks, lateritic ridges & boulders, hills	possible
Melaleuca micromera		Priority 3	Myrtaceae	shrub to 4 m	yellow, Sep & Oct	gravelly sandy loam or clay	possible
Melaleuca ordinifolia		Priority 2	Myrtaceae	compact, spreading shrub to 1.5 m	white-cream, Aug to Oct.	sandy loam or clay	possible
Roycea pycnophylloides	Saltmat	Threatened (Vulnerable)	Chenopodiaceae	perennial, herb, forming densely branched, silvery mats to 1 m wide	Sep.	sandy soils, clay on saline flats	possible
Schoenus natans	Floating Bog-rush	Priority 4	Cyperaceae	aquatic annual herb (sedge) to 30 cm	brown, Oct	winter-wet depressions often associated with clayey soils	possible
Verticordia fimbrilepis subsp. *fimbrilepis*	Shy Featherflower	Threatened (Vulnerable)	Myrtaceae	shrub to 70 cm	pink-white, Oct to Dec or Jan	gravelly sandy or clayey soils on flats, road verges	possible
Verticordia lindleyi subsp. *lindleyi*		Priority 4	Myrtaceae	erect shrub to 75 cm	pink, May or Nov to Dec or Jan.	sand, sandy clay in winter-wet depressions	possible

APPENDIX C: DESCRIPTION OF THREATENED AND PRIORITY FLORA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of Parks and Wildlife 2016g)

Species	Common Name	State Conservation	Family	Description	Flowers	Habitat	Likelihood of occurrence
Acacia ataxiphylla subsp. *ataxiphylla*		Priority 3	Fabaceae	prostrate, sprawling shrub to 50 cm	yellow, Nov to Dec or Jan	gravelly clay loam, white/grey sand on flats, roadsides	unlikely
Adenanthos filifolius		Priority 4	Proteaceae	erect shrub, to 2(-5) m	cream-white, May or Sep to Dec	white, grey or black peaty sand, sandy clay on rocky hillsides (usually granite, sandstone or quartzite)	unlikely
Adenanthos pungens subsp. *effusus*	Sprawling Spiky Adenanthos	Threatened (Critically Endangered)	Proteaceae	prostrate shrub to 50 cm, forming large mats to 3 m wide	pink, Aug to Nov	white siliceous sand	unlikely
Adenanthos pungens subsp. *pungens*	Spiky Adenanthos	Threatened (Endangered)	Proteaceae	erect shrub to 3 m	pink/red, Aug to Nov	white/grey or pink sand, rocky soils, gypsum on sand dunes, hillsides	unlikely
Banksia acuminata		Priority 4	Proteaceae	prostrate, lignotuberous shrub to 20cm	yellow-orange, Oct	gravelly soils	possible
Banksia oligantha	Wagin Banksia	Threatened (Endangered)	Proteaceae	non-lignotuberous shrub to 3 m	red & cream/orange-brown, Oct to Nov	yellow or yellow-brown sand	unlikely
Banksia subpinnatifida var. *imberbis*		Priority 2	Proteaceae	erect or straggling, non-lignotuberous shrub to 1.5m	yellow, Sep to Oct	lateritic soils	possible
Caladenia integra	Mantis Orchid, Smooth-lipped Spider Orchid	Priority 4	Orchidaceae	tuberous, perennial, herb to 50 cm	green, red	clayey loam on granite outcrops, rocky slopes	possible
Caladenia x *triangularis*		Priority 4	Orchidaceae	tuberous, perennial herb	yellow	loam, low lying areas	possible
Calectasia obtusa		Priority 3	Dasypogonaceae	erect, low herb to 40 cm	blue, Aug to Sep	sand, clay loam, gravel and laterite soils	possible
Commersonia erythrogyna	Trigwell's Rulingia	Threatened (Critically Endangered)	Fabaceae	erect, domed shrub to 1.5m	orange, yellow, red & purple, Sep to Oct	red clay and laterite, on low hilltops and breakaways	unlikely
Darwinia oxylepis	Gillam's Bell	Threatened (Endangered)	Myrtaceae	upright, dense shrub to 1.5 m	red, Aug to Nov	stony, peaty sand in rocky gullies.	unlikely
Diuris micrantha	Dwarf Bee-orchid	Threatened (Vulnerable)	Orchidaceae	tuberous, perennial, herb to 60 cm	yellow & brown, Sep to Oct	brown loamy clay in winter-wet swamps, in shallow water	possible
Diuris recurva		Priority 4	Orchidaceae	tuberous, perennial, herb to 30 cm	yellow & brown, Jul to Aug	loam in winter-wet areas	possible

APPENDIX C: DESCRIPTION OF THREATENED AND PRIORITY FLORA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of Parks and Wildlife 2016g)

Species	Common Name	State Conservation	Family	Description	Flowers	Habitat	Likelihood of occurrence
Gastrolobium lehmannii	Cranbrook Pea	Threatened (Vulnerable)	Fabaceae	erect, domed shrub to 1.5 m	orange-yellow-red-purple, Sep to Oct	red clay, laterite on low hilltop of breakaway	possible
Grevillea bipinnatifida subsp. *pagna*		Priority 1	Proteaceae	prostrate, lignotuberous shrub to 70 cm	red & orange & yellow, Aug or Oct to Nov	grey sandy clay and loam, ironstone in seasonal wetlands, swamps, roadsides	possible
Hemigenia ramosissima	Branched Hemigenia	Threatened (Critically Endangered)	Lamiaceae	slender shrub to 50 cm	blue-purple, Nov to Dec or Jan	lateritic soils, clay on granite outcrops	possible
Hibbertia montana		Priority 4	Dilleniaceae	erect, straggling or sprawling shrub to 70 cm	yellow, Jul to Oct	loam over granite, lateritic soils, gravel on granite rocks, lateritic ridges & boulders, hills	possible
Melaleuca micromera		Priority 3	Myrtaceae	shrub to 4 m	yellow, Sep & Oct	gravelly sandy loam or clay	possible
Melaleuca ordinifolia		Priority 2	Myrtaceae	compact, spreading shrub to 1.5 m	white-cream, Aug to Oct.	sandy loam or clay	possible
Roycea pycnophylloides	Saltmat	Threatened (Vulnerable)	Chenopodiaceae	perennial, herb, forming densely branched, silvery mats to 1 m wide	Sep.	sandy soils, clay on saline flats	possible
Schoenus natans	Floating Bog-rush	Priority 4	Cyperaceae	aquatic annual herb (sedge) to 30 cm	brown, Oct	winter-wet depressions often associated with clayey soils	possible
Verticordia fimbrilepis subsp. *fimbrilepis*	Shy Featherflower	Threatened (Vulnerable)	Myrtaceae	shrub to 70 cm	pink-white, Oct to Dec or Jan	gravelly sandy or clayey soils on flats, road verges	possible
Verticordia lindleyi subsp. *lindleyi*		Priority 4	Myrtaceae	erect shrub to 75 cm	pink, May or Nov to Dec or Jan.	sand, sandy clay in winter-wet depressions	possible

APPENDIX D: DISTRIBUTION AND HABITAT OF PROTECTED FAUNA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of then Environment 2016c; Department of Parks and Wildlife 2016j)

Species	Common Name	State Conservation	Distribution	Habitat	Likelihood of occurrence
Apus pacificus	Fork-tailed Swift	International Agreement	Non-breeding visitor to Australia. In the forefront of storms in northern Australia, and very occasionally south in locations such as Dryandra NP and the Darling Range.	Almost exclusively aerial over wide range of vegetation types.	unlikely
Ardea alba	Great Egret, White Egret	-	Kimberley and wetter western half of WA.	Large river pools, estuaries, tidal mudflats and sewage ponds.	unlikely
Ardea ibis	Cattle Egret	International Agreement	Wetter northern portion of the Kimberley and south-western WA.	Pastures and paddocks but may be seen in crops.	possible
Bettongia penicillata subsp. *ogilbyi*	Woylie, Brush-tailed Bettong	Threatened (Critically Endangered)	Scattered populations throughout the jarrah forest in the south-west corner of WA. Isolated populations at Francois Peron NP, Kalbarri NP, Nambung NP, Julimar Forest, Avon Valley NP, Dryandra Woodland, Boyagin NR, Tutanning NR and North Karlgarin NR.	Forest to grasslands, coastal and inland. *Gastrolobium* thickets provide refuges for Woylies against introduced predators.	unlikely
Cacatua pastinator subsp. *pastinator*	Muir's Corella, Western Corella (southern)	Special (Conservation Dependent)	Confined to the extreme south-west of Western Australia. Its distribution extends from McAlinden and Qualeup, south to the lower Perup River and Lake Muir, and east to Rocky Gully and Frankland.	Eucalyptus woodlands dominated by *E. wandoo*, *Corymbia calophylla,* or *E. marginata*. Remnant patches in or adjacent to farmland, or along roadsides, paddock boundaries or watercourses, and sometimes as a few, isolated shade trees in otherwise cleared paddocks. Breeds in hollows in large old eucalypts in woodland and remnant woodland, often nest in lone trees in paddocks and along roadsides, especially *C. calophylla*, *E. marginata*, *E. rudis*, *E. cornuta* and *Melaleuca preissiana*.	possible
Calyptorhynchus banksii subsp. *naso*	Forest Red-tailed Black-Cockatoo	Threatened (Vulnerable)	Endemic to south-west WA in an area bounded by Gingin, Mt Helena, Christmas Tree Well, West Dale (rarely to Brookton), North Bannister (rarely to Wandering), Mt Saddleback, Kojonup, Rocky Gully, upper King River and Green Range (east of Albany). most common in the northern Darling Range from about Collie north to Mundaring and is very local throughout the lower south-west.	Inhabits the dense *E. marginata*, *E. diversicolor* and *C. calophylla* forests receiving more than 600 mm average rainfall annually, mainly in the hilly interior. Has been observed in a range of other forest and woodland types, including *E. patens*, *E. wandoo*, *E. gomphocephala*, *E. staeri*, *E. cornuta* and *E. rudis*.	unlikely
Calyptorhynchus baudinii	Baudin's Black-Cockatoo, Long-billed Black-Cockatoo	Threatened (Vulnerable)	South west of WA, extending from Albany northward to Gidgegannup and Mundaring, and inland to the Stirling Ranges and near Kojonup.	Mainly occurs in eucalypt forests, especially *E. marginata*, *C. calophylla*, also *E. diversicolor* forest, less frequently in woodlands of *E. wandoo*, *E. patens*, *E. rudis*, *E. cornuta*, partly cleared farmlands and urban areas including roadside trees and house garden.	possible

APPENDIX D: DISTRIBUTION AND HABITAT OF PROTECTED FAUNA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of then Environment 2016c; Department of Parks and Wildlife 2016j)

Species	Common Name	State Conservation	Distribution	Habitat	Likelihood of occurrence
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Threatened (Endangered)	Endemic to south-western Australia, occurring mostly in the Wheatbelt.	Nests in tall living or dead eucalypts, particularly *E. wandoo* and *E. salmonophloia*.	possible
Dasyurus geoffroii	Chuditch, Western Quoll	Threatened (Vulnerable)	Restricted to the south-west of WA. Present in varying densities throughout Jarrah forest, Kalbarri NP and is sparsely populated in the wheatbelt and goldfields areas.	Eucalypt forest (especially *E. marginata*), dry woodland and mallee shrublands. Moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Densest populations in riparian forest.	unlikely
Falco peregrinus	Peregrine Falcon	Special	An Australia-wide species including some offshore islands, but could be absent from most deserts and the Nullabor Plain.	Near cliffs along the coast and ranges of the interior; also along wooded watercourses and lakes.	unlikely
Haliaeetus leucogaster	White-bellied Sea-Eagle	International Agreement	Mainly coastal and on offshore islands in all States of Australia although it may also be observed along major river systems inland.	Not often seen far from the coast and may be observed hunting over water or patrolling beaches where it may take carrion.	unlikely
Isoodon obesulus subsp. *fusciventer*	Quenda, Southern Brown Bandicoot	Priority 5	Widely distributed near the south west coast from Guilderton to east of Esperance. Patchy distribution through Jarrah and Karri forest, Swan Coastal Plain, and inland as far as Hyden. Translocated to Julimar State Forest, Hills Forest near Mundaring, Tutanning NR, Boyagin NR, Dongolocking NR, Leschenault Conservation Park, Karakamia Sanctuary, Paruna Sanctuary, Yalgorup NP, Creery Wetlands, Avon Valley NP, Nambung NP, Francois Peron NP and Thomson's Lake NR.	Scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting *E. marginata* and *E. wandoo* forests are usually associated with watercourses.	unlikely
Leipoa ocellata	Malleefowl	Threatened (Vulnerable)	Semi-arid regions of southern Australia. Located to the south and west of a line extending from Cape Farquhar, which lies north of Carnarvon, to the Eyre Bird Observatory in the south-east of WA.	Shrublands and low woodlands dominated by mallee vegetation. Eucalypt or *Callitris* woodlands, acacia shrublands, *Melaleuca uncinata* vegetation or coastal heathlands.	unlikely
Macropus eugenii subsp. *derbianus*	Tammar Wallaby	Priority 5	Three islands in the Houtman Abrolhos group (East and West Wallabi Island, and an introduced population on North Island), Garden Island, Middle and North Twin Peak Islands in the Archipelago of the Recherche, and several sites on the mainland (Dryandra, Boyagin, Tutanning, Batalling , Perup, private property near Pingelly, Jaloran Road timber reserve near Wagin, Hopetoun, Stirling Range NP, and Fitzgerald River NP).	Dense, low vegetation for daytime shelter and open grassy areas for feeding. This species inhabits coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland.	unlikely

APPENDIX D: DISTRIBUTION AND HABITAT OF PROTECTED FAUNA SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE FLAT ROCKS WIND FARM SURVEY AREA (Department of then Environment 2016c; Department of Parks and Wildlife 2016j)

Species	Common Name	State Conservation	Distribution	Habitat	Likelihood of occurrence
Macropus irma	Western Brush Wallaby	Priority 4	South-west of WA, from Cape Arid to Kalbarri.	Preferred habitat of opens forest and woodland of mallee, heathland, open low grasses and scrubby thickets.	unlikely
Macrotis lagotis	Bilby, Dalgyte	Threatened (Vulnerable)	Disjunct populations in the Gibson Desert, south-western Kimberley, inland areas of the Pilbara and northern Great Sandy Desert.	Eucalypt open forest and woodland in south-west WA tall shrublands and open woodlands in semi-arid regions, and hummock grasslands in arid Australia.	unlikely
Merops ornatus	Rainbow Bee-eater	International Agreement	Kimberley, Pilbara, Gascoyne and southwest of WA. Appears to be absent from the driest parts of the State.	Lightly wooded country, near water and preferably with sandy soils suitable for their breeding burrows, i.e. soils that are easy to excavate but firm enough to support burrows.	unlikely
Motacilla cinerea	Grey Wagtail	International Agreement	Ashmore Reef, Christmas Island, Adele Island, south coast of WA.	Wetlands, water courses, banks of lakes and marshes, artificial wetlands such as sewage farms, reservoirs and fishponds.	unlikely
Myrmecobius fasciatus	Numbat, Walpurti	Threatened (Endangered)	Two remnant native populations at Dryandra and Perup, WA and several reintroduced populations including Boyagin Nature Reserve, Tutanning NR, Batalling block and Karroun Hill NR.	Eucalypt forests and woodlands dominated by *E. marginata*, *C. calophylla* and *E. wandoo*.	unlikely
Onychogalea lunata	Crescent Nailtail Wallaby, Wurrung	Extinct (Presumed Extinct)	Extinct	Extinct	unlikely
Pandion haliaetus	Osprey	-	Mainly coastal and on offshore islands in all States of Australia although it may also be observed along major river systems inland.	Not often seen far from the coast and may be observed hunting over water or patrolling beaches where it may take carrion.	unlikely
Phascogale calura	Red-tailed Phascogale	Special (Conservation Dependent)	Restricted to remnants of native vegetation throughout the wheat belt of south-western WA. Recorded from as far north as Beverly (south-east of Perth). Recent surveys have extended the eastern range of the species slightly to include Fitzgerald River NP.	*Allocasuarina* woodlands with hollow-containing eucalypts (e.g. *E. wandoo*) and *Gastrolobium* species, woodland of *Casuarina obesa* over samphires, Mallee-Scrub and low forest of *E. platypus*. Prefers long unburnt vegetation, which provides continuous canopy cover to assist their arboreal habits.	unlikely
Phascogale tapoatafa subsp. (WAM M434)	Brush-tailed Phascogale	- (sans. infra.)	South west between Perth and Albany. It occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton.	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees.	unlikely

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Species	Common Name	State Conservation	Distribution	Habitat	Likelihood of occurrence
Pseudocheirus occidentalis	Western Ringtail Possum	Threatened (Endangered)	South-west of WA. Patchy distribution in predominantly two areas: near Bunbury to Leeuwin-Naturalisete NP (with a small translocated subpopulation near Dawesville); and near Albany.	Stands of myrtaceous trees (usually *Agonis flexuosa*)) growing near swamps, water courses or floodplains, and at topographic low points which provide cooler, often more fertile, conditions. Forests and woodlands dominated by *E. marginata*, *C. calophylla*,*E. wandoo*, *E. diversicolor* or *Agonis flexuosa* forest, coastal heath, myrtaceous heaths and shrublands, and *E. megacarpa* dominated riparian zones.	unlikely
Thinornis rubricollis	Hooded Plover	-	Breeds on south-west Western Australian coast, from Cape Naturaliste to Eyre, and on inland lakes as far northeast as L. Cowan and L. Moore and north-west to Yalgorup Lakes, south of Perth. Single birds or non-breeding pairs recorded on L. Arrow, L. Barlee and L. Ballard. After breeding, inland birds appear to move to lakes near the west coast or shores of southern lakes.	Ocean beaches and inland lakes.	unlikely

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT THE PROPOSED MOONIES HILL WINDFARM AREA, KOJONUP, SEPTEMBER/OCTOBER 2010

Note: * denotes introduced species; P1-P4 denote Priority Flora Species (Department of Parks and Wildlife 2016c)

FAMILY		SPECIES
POACEAE		*Austrostipa flavescens*
		Austrostipa juncifolia
		Austrostipa trichophylla
		Austrostipa sp.
	*	*Avena barbata*
	*	*Briza maxima*
	*	*Bromus diandrus*
	*	*Ehrharta longiflora*
		Enneapogon sp.
	*	*Hordeum hystrix*
	*	*Hordeum leporinum*
	*	*Lolium perenne*
		Neurachne alopecuroidea
		Neurachne sp.
	*	*Vulpia ?bromoides*
	*	*Vulpia* sp.
		Poaceae sp.
CYPERACEAE		*Chorizandra enodis*
		Ficinia nodosa
		Lepidosperma leptostachyum
		Tetraria octandra
RESTIONACEAE		*Desmocladus asper*
JUNCACEAE	*	*Juncus acutus*
		Juncus pauciflorus
ASPARAGACEAE	*	*Asparagus asparagoides*
		Chamaescilla corymbosa
		Lomandra micrantha subsp. *micrantha*
		Thysanotus patersonii
ASPHODELACEAE	*	*Asphodelus fistulosus*
HEMEROCALLIDACEAE		*Dianella revoluta*
		Stypandra glauca
		Tricoryne tenella
HAEMODORACEAE		*Conostylis setigera*
IRIDACEAE	*	*Moraea setifolia*
ORCHIDACEAE		*Caladenia sp.*
	*	*Disa bracteata*
CASUARINACEAE		*Allocasuarina huegeliana*
CARYOPHYLLACEAE	*	*Spergularia marina*
CHENOPODIACEAE		*Tecticornia lepidosperma*
CRASSULACEAE		*Crassula decumbens* var. *decumbens*

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Note: * denotes introduced species; P1-P4 denote Priority Flora Species (Department of Parks and Wildlife 2016c)

FAMILY		SPECIES
FABACEAE		*Acacia acuminata*
		Acacia lasiocarpa var. *sedifolia*
		Acacia pulchella
		Acacia saligna subsp. *saligna*
		Bossiaea eriocarpa
		Gastrolobium praemorsum
		Jacksonia sternbergiana
		Kennedia prostrata
	*	*Trifolium arvense*
DILLENIACEAE		*Hibbertia commutata*
MYRTACEAE		*Corymbia calophylla*
		Eucalyptus astringens subsp. *astringens*
	*	*Eucalyptus globulus*
	*	*Eucalyptus leucoxylon*
		Eucalyptus loxophleba subsp. *lissophloia*
		Eucalyptus ?*macrandra*
		Eucalyptus marginata subsp. *marginata*
		Eucalyptus rudis subsp. *rudis*
		Eucalyptus spathulata subsp. *spathulata*
		Eucalyptus wandoo subsp. *wandoo*
		Melaleuca cuticularis
		Melaleuca rhaphiophylla
ERICACEAE		*Astroloma compactum*
		Leucopogon propinquus
CAMPANULACEAE		*Lobelia anceps*
GOODENIACEAE		*Dampiera sacculata*
STYLIDIACEAE		*Stylidium piliferum*
ASTERACEAE	*	*Arctotheca calendula*
	*	*Cotula coronopifolia*
		Helichrysum leucopsideum
	*	*Hypochaeris glabra*
		Lagenophora huegelii
		Podolepis gracilis
		Rhodanthe manglesii
	*	*Sonchus asper*
	*	*Ursinia anthemoides*

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F1: Vegetation at survey Site 01 – Community E3

Photograph F2: Vegetation at survey Site 02 – Community E2

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F3: Vegetation at survey Site 03 – Community E1

Photograph F4: Vegetation at survey Site 04 – Community E1

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F5: Vegetation at survey Site 05 – Community E2

Photograph F6: Vegetation at survey Site 06 – Community E4

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F7: Vegetation at survey Site 07 – Community E2

Photograph F8: Vegetation at survey Site 08 – Community E1

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F9: Vegetation at survey Site 09 – Community E3

Photograph F10: Vegetation at survey Site 10 – Community E5

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F11: Vegetation at survey Site 11 – Community E3

Photograph F12: Vegetation at survey Site 12 – Community E5

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F13: Vegetation at survey Site 13 – Community E5

Photograph F14: Vegetation at survey Site 14 – Community E2 (foreground) and Community E3 (background)

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F15: Vegetation at survey Site 15 – Community E5

Photograph F16: Vegetation at survey Site 16 – Community E5

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F17: Vegetation at survey Site 17 – Planted Eucalypts

Photograph F18: Vegetation at survey Site 18 – Community E3

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F19: Vegetation at survey Site 19 – Community E2

Photograph F20: Vegetation at survey Site 20 – Community E2

APPENDIX F: PHOTOGRAPHIC RECORD OF SITES AT PROPOSED MOONIES HILL ENERGY FARM, KOJONUP, SEPTEMBER 2010

Photograph F21: Vegetation at survey Site 21 – Community E2