APPENDIX A - Ecoscape (2023) Kondinin Wind Farm Biological Survey, WestWind Energy Pty Ltd

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind Energy Pty Ltd

ecoscape

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EXECUTIVE SUMMARY

JV Kondinin Energy is a joint venture between Shell and Foresight that has recently acquired the Kondinin Wind and Solar Farm located 5 km north‐east of Kondinin, Western Australia. WestWind Energy Management Pty Ltd (WestWind Energy) will be supporting JV Kondinin Energy in matters relating to community and stakeholder management, planning and detailed design. Development Approval was granted in 2018, subject to various conditions.

While not a specific requirement of the Development Approval, JV Kondinin Energy engaged Ecoscape to undertake a Flora and Vegetation survey and Fauna survey of the project site (September 2023), that concentrated on confirming previous survey results. A small area within this larger project site was identified as requiring additional survey as it has since been identified as requiring some clearing for infrastructure.

VERIFICATION SURVEY

The majority of the site had previously been assessed and was reported upon by SW Environmental (2017).

The Ecoscape 2023 survey confirmed the following significant features of the site:

- three conservation-listed flora species (*Eucalyptus erythronema* subsp. *inornata*, P3; *Eucalyptus ornata*, P3; *Grevillea asteriscosa*, P4) occurred within areas that are not proposed to be cleared. A fourth Priority Flora species identified by SW Environmental was found to have been incorrectly identified.
- the *Eucalypt Woodlands of the Western Australian Wheatbelt* Threatened Ecological Community has been indicatively mapped as intersecting the survey areas. Roadside vegetation along Notting-Karlgarin Road was confirmed as being representative, however, farm bushland remnants were identified as not meeting the thresholds for inclusion thus none were representative.

The fauna field survey identified:

- four fauna habitats: Woodland, Shrubland, Rocky Escarpment, and Drainage line. None are of local nor regional significance.
- forty vertebrate fauna species were recorded, with none that are conservation-listed
- fauna habitat quality was reduced due to small vegetation patch sizes, high levels of fragmentation and proximity to cropland
- the recorded habitat was not suitable for conservation-listed species and no historical signs of conservation-listed species, e.g. Malleefowl mounds, were observed.

ADDITIONAL SURVEY AREA

A Reconnaissance-level flora and vegetation survey was conducted of the 4.17 ha area that may require clearing. The significant findings were:

- two vegetation types, neither of which were of significance i.e. not representative of any conservation-listed ecological community:
  - **AcMfTOS**: *Allocasuarina campestris* and *Melaleuca fulgens* tall open shrubland
  - **EcEfEtMMW**: *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus flocktoniae* subsp. *flocktoniae* and *Eucalyptus tenera* mid mallee woodland.
- no conservation-listed flora species
- the road reserve portion of the additional survey area was in Very good-Excellent condition; the unmade road reserve that was grazed was in Degraded to Completely Degraded condition.

The Basic fauna survey identified:

- one fauna habitat, Woodland, which was considered to be poor to degraded fauna habitat quality
- no additional fauna species were recorded in the additional survey area
- the additional survey area was not suitable for conservation-listed species and no historical signs of conservation-listed species, e.g. Malleefowl mounds, were observed.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms	
BAM Act	Western Australian *Biosecurity and Agriculture Management Act 2007*
BC Act	Western Australian *Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-2022, now DCCEEW)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height (1.3 m)
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DCCEEW)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DCCEEW)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian *Environmental Protection Act 1986*
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDA 94	Geographic Datum of Australia 1994
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
MA	Marine species (fauna; protected under international agreements and EPBC Act)
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act, also EPBC Act)
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DCCEEW, used to search for MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
TEC	Threatened Ecological Community
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WoNS	Weeds of National Significance
*****	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

JV Kondinin Energy is a joint venture between Shell and Foresight with both partners holding a 50% share. They have recently acquired the Kondinin Wind and Solar Farm located 5 km north-east of Kondinin, Western Australia. WestWind Energy Management Pty Ltd ('WestWind Energy') will be supporting JV Kondinin Energy in matters relating to the secondary approvals under the approved DA, as well as community and stakeholder management, planning and detailed design. The project is still in the development phase, with approval for up to 46 wind turbines and 125 ha of solar, energy storage and associated infrastructure. The project will be constructed in stages and Stage One of the project consists of 21 x 6.2 MW wind turbines, with the remaining turbines, solar array and BESS likely forming part of Stage Two of the project.

Development Approval was granted in 2018, subject to various conditions. While not a specific requirement of the Development Approval, given the length of time since the previous ecological surveys, JV Kondinin Energy engaged Ecoscape to undertake a Flora and Vegetation survey and Fauna survey of the project site, that concentrated on confirming previous survey results.

1.2 SURVEY AREA

The JV Kondinin Energy project area, known as the 'survey area' in this report, is located within the Shire of Kondinin in the Mallee bioregion, approximately 245 km east of Perth and 5 km north of Kondinin (**Figure 1**). The survey area is approximately 3,105 ha is largely cropped and grazed agricultural land with some remnant native vegetation areas.

Since the environmental approvals have been granted an additional area (known herein as the 'additional survey area') has been identified as potentially requiring some clearing.

Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to:

- confirm the findings of the previous assessment (SW Environmental 2017) that intersects the majority of the current proposed development area, with the major difference in survey area being the addition of an approximate 120 ha area towards the east that is largely cropped lands
- undertake a Detailed flora and vegetation survey of areas of native bushland that may be cleared according to WestWind Energy's current understanding of its requirements, including:
  - recording floristic quadrats
  - targeted searches for conservation-listed flora
- a Basic fauna survey incorporating:
  - a reassessment of the fauna sites surveyed by SW Environmental in 2017
  - fauna habitat assessment and mapping, including identification of habitat types suitable for significant fauna species that have been recorded or potentially occur
  - inventory of fauna species
  - targeted searches for species identified by the desktop study.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability Environment Water Population and Communities (DSEWPaC 2011a) *Survey guidelines for Australia's threatened mammals*
- DSEWPaC (2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (2010) *Survey guidelines for Australia's threatened birds*
- Department of Agriculture Water and the Environment (DAWE 2022) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo*
- Environmental Protection Authority (EPA 2019) *EPA Advice: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region*
- Threatened Species Scientific Committee (TSSC 2015) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.*

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix One**.

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2016b) *Environmental Factor Guideline – Flora and Vegetation*
- EPA (2016c) *Environmental Factor Guideline – Terrestrial Fauna*
- EPA (2018) *Environmental Factor Guideline – Landforms*

- EPA (2016d) *Environmental Factor Guideline – Terrestrial Environmental Quality*
- EPA (2021) *Statement of environmental principles, factors, objectives and aims of EIA*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix One**.

2 DESKTOP ASSESSMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The southwest of Western Australia is generally described as having a Mediterranean-type climate of mild, wet winters and warm to hot, dry summers. The climate of the region is strongly influenced by the position of a band of high pressure known as the sub-tropical ridge. For much of the year the ridge is located to the south allowing the east or south easterly winds to prevail. During the cooler months the ridge periodically moves to the north, allowing cold fronts to pass over the west coast and deliver much of the annual rainfall (Beard 1990).

According to the Köppen-Geiger climate classification, the survey area has a temperate climate with hot, dry summers (Class Csa) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a Mediterranean climate where average summer maximum temperatures exceed 22°C and the average coldest month maximum is between 18° and -3°C, and summer rainfall is less than one third of winter rainfall.

The closest Bureau of Meteorology (BoM) station with long term rainfall records is Hartwood (BoM 2023a station 10603, operating since 1913) which is located approximately 10 km west of the survey area. The mean annual rainfall is 317 mm with most falling from May to August. The rainfall during the 6 month period prior to the field survey was 94% of the long-term average for this period.

The closest Bureau of Meteorology (BoM) station with long term temperature records is Corrigin (BoM 2023a station 10536, operating since 1910) which is located approximately 41 km northwest of the survey area. December is the hottest month with a mean maximum temperature of 36.6°C and minimum of 26.7°C. July is the coldest month with a mean maximum of 17.4°C and minimum of 13.4°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year preceding the field survey.

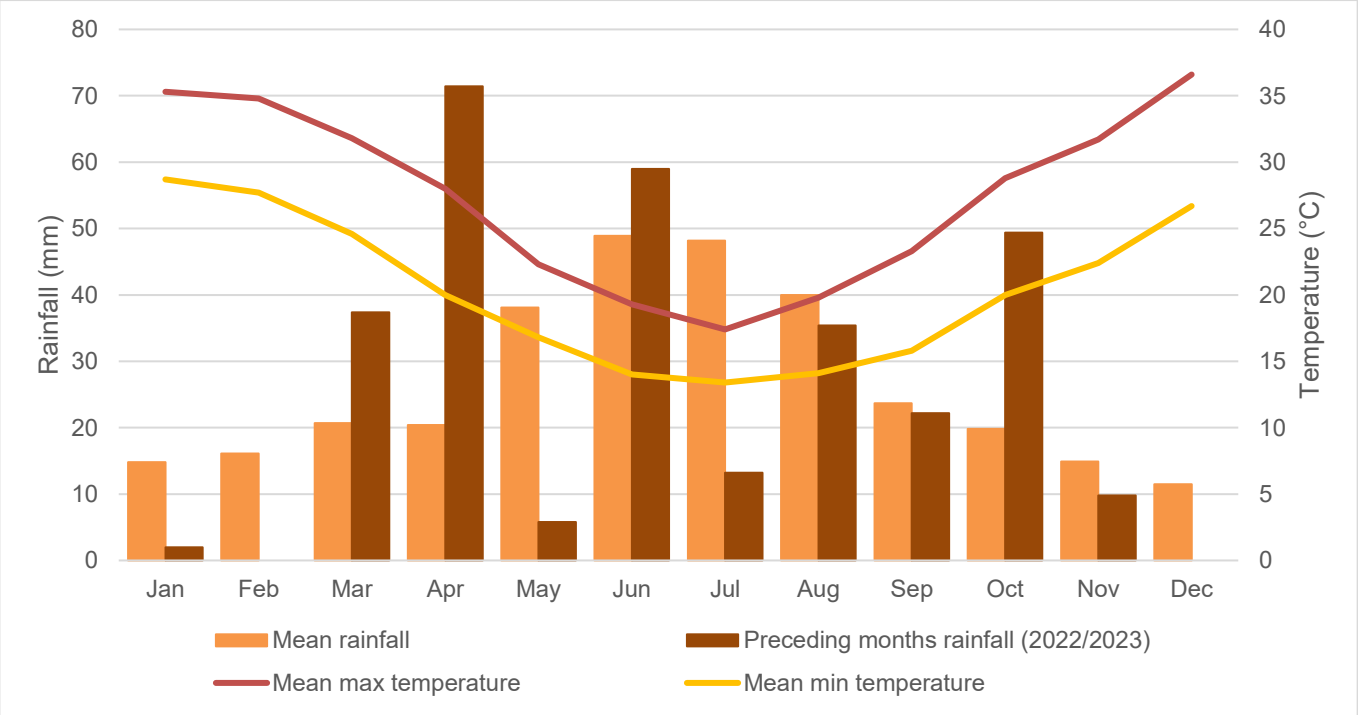

Figure 2: Rainfall and temperature data for the survey area (BoM 2023a)

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Department of Agriculture Water and the Environment 2020a).

The survey area is located in the Mallee IBRA region in the Western Mallee subregion (MAL02), described as (Beecham & Danks 2002):

> *The Mallee bioregion is the south-eastern part of Yilgarn Craton. Its landscape is gently undulating, with partially occluded drainage. Mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils are common. Melaleuca shrublands characterise alluvia, and Halosarcia low shrublands occur on saline alluvium. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. Landscape is fragmented with particular surface-types almost completely cleared as wheatfields.*
>
> *Western Mallee (MAL2) subregion has more relief than its eastern counterpart: main surface-types comprise clays and silts underlain by Kankar, exposed granite, sandplains and laterite pavements. Salt lake systems on a granite basement. Occluded drainage system. Mallee communities occur on a variety of surfaces; Eucalyptus woodlands occur mainly on fine textured soils, with scrub-heath on sands and laterite. The climate is warm Mediterranean and annual rainfall is 250-500mm. Total area of the subregion is 4,763,963 ha.*

2.2.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Threatened and Priority Ecological Communities (TECs and PECs) intersecting the survey area and nearby were identified by a *Protected Matters Search Tool* (PMST) search (DCCEEW 2023a, using a 50 km buffer) and DBCA database search request (search reference 10-0823EC-Kondinin-Ecoscape using a 20 km buffer).

The results of these searches are indicated in **Table 2** and, for the DBCA data, shown on **Map 1** noting that the single occurrence of the *Assemblages of gypsum dunes of the central and southern Wheatbelt* PEC is located approximately 12 km to the south southeast associated with the Kondinin Saltmarsh but is not clearly visible on the map.

Table 2: TECs and PECs identified by PMST and DBCA database searches

PMST	DBCA database	Ecological Community	C'wealth Status	WA status
'likely'	**x**	*Eucalypt Woodlands of the Western Australian Wheatbelt*	CR	P3
n/a	**x**	*Assemblages of gypsum dunes of the central and southern Wheatbelt*	-	P3

Sixteen indicatively mapped representatives of *Eucalypt Woodlands of the Western Australian Wheatbelt* TEC ('Wheatbelt Woodlands TEC') or its buffers intersect the survey area (DBCA data).

SW Environmental (2017) considered that seven representatives of the TEC (four bushland remnants and three road reserve sections) occurred within its survey area that largely corresponds with the current survey area. SW Environmental's interpreted Wheatbelt Woodlands TEC representatives, including road reserve sections not included in its (or Ecoscape's) survey area, are shown on **Map 2**.

The Wheatbelt Woodlands TEC has a detailed assessment methodology to determine if vegetation is representative (TSSC 2015), summarised in **Appendix Three**.

2.2.3 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified 16 EPBC-listed TF that are known (or their habitat is known) to occur within the 50 km search buffer area, three as 'species or habitat likely to occur within area' and 10 as 'species or species habitat may occur within area'.

The requested DBCA databases (search reference 18-0823FL) was conducted using a 30 km buffer around the supplied shapefiles. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium. **Map 1** shows the locations of conservation-listed flora identified by the DBCA database search. Seventy-one vascular flora species were identified from this search.

The combined database searches identified 93 species, listed in **Table 20** in **Appendix Four**, consisting of 29 TF (noting that 22 of these are from the PMST search and have not been recorded from within the DBCA search buffer), 12 P1, 11 P2, 31 P3 and 10 P4.

The previous survey by SW Environmental (2017) recorded four Priority-listed flora species (**Map 2**):

- *Eucalyptus erythronema* subsp. *inornata* (P3)
- *Eucalyptus ornata* (P3)
- *Eremophila veneta* (P4), noting that the photograph presented in the SW Environmental (2017) report (**Figure 3**) is not of this species (**Figure 4**)
- *Grevillea asteriscosa* (P4).

Figure 4-6 *Eremophila veneta* (left); E
2016).

Figure 3: Purported *Eremophila veneta* from SW Environmental (2017)

Figure 4*: Eremophila veneta* from *FloraBase* (Western Australian Herbarium 1998-2023)

2.2.3.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify the TF and PF species that have potential to occur within the survey area. Information to assess the likelihood of a species occurring includes the following sources: ecology as listed on *FloraBase* (WAH 1998-2023, 2023).

The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded near the survey area ('proximity' or 'close proximity'; see **Table 3**) taking locational accuracy into consideration
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection
- reliability of record: species identified by only a TPFL record, without an accompanying verified vouchered specimen, may have been incorrectly identified or been subject to taxonomic updates since the record was entered

- number of records for the species
- if the record is for a not naturally occurring population (planted)
- previous survey results.

The likelihood rating is assigned using the categories listed in **Table 3**.

Table 3: Categories for likelihood of occurrence of TF and PF

Likelihood Category	Criteria
Known to occur	Species previously recorded within the survey area.
Likely to occur	Suitable habitat is known to occur within the survey area and multiple records of the species exist within close proximity*
May occur	Suitable habitat is expected to occur within the survey area and the species has previously been recorded within proximity**
Unlikely to occur	Suitable habitat is expected to occur within the survey area however previous records are limited and/or historic and/or not in proximity** OR Suitable habitat is not expected to occur within the survey area although previous records exist in proximity**
Very Unlikely to occur	Suitable habitat is not expected to occur in the survey area AND/OR previous records are limited and/or historic and/or not in proximity**

* close proximity = 7.5 km (¼ of the distance of the database search buffer)
** proximity = 15 km (½ of the distance of the database search buffer)

The likelihood assessment is available in **Table 20** in **Appendix Four**. The DBCA database search identified two species (*Eucalyptus ornata* (P3) and *Grevillea asteriscosa* (P4)) have been previously recorded from within the survey area.

SW Environmental (2017) recorded the above species and also indicated that *Eucalyptus erythronema* subsp. *inornata* (P3) and *Eremophila veneta* (P4) occurred within the survey area, however, no voucher specimens have been accepted into the WAH collections thus they are unverified. Additionally, the photograph purporting to be *Eremophila veneta* from the SW Environmental (2017) report does not match taxonomic literature and is therefore considered dubious as it was unknown (prior to field survey) if the incorrect photograph was used in the report or if the identification was incorrect. All purported populations were visited during the field survey for verification.

As the site had largely been previously surveyed it was considered that there was only a low likelihood of additional species being recorded.

The likelihood of occurrence was re-evaluated following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) were better understood, and the level of survey effort was considered. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.3.1.2**.

2.2.4 THREATENED AND PRIORITY FAUNA

Combined database search results are incorporated into **Table 21** in **Appendix Four**.

Species identified by these database searches that are excluded from the field survey and further assessments (including likelihood assessments) are listed in **Table 22** along with the reason for their exclusion (e.g. marine species whose habitat does not occur within the survey area, invertebrates are not within the scope of the survey). Such excluded species are not further referenced in this document.

2.2.4.1 EPBC-listed Threatened Fauna

The *Protected Matters Search Tool* (PMST) search (DCCEEW 2023a, using a 50 km buffer), identified the following as having been recorded or having potential to occur within the search area buffer i.e. ‘species or

species habitat known to occur within the area' (or buffer) or 'species or species habitat likely to occur within area' (or buffer):

- five mammals
- 16 birds.

2.2.4.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: FAUNA#7839) using a 50 km buffer around the provided shapefiles of the survey area. Fifteen conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of six mammals and nine birds.

2.2.4.3 Atlas of Living Australia (ALA)

A search of the ALA databases was conducted using a 50 km buffer around the provided shapefiles of the survey area. Nine conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of two mammals and seven birds.

2.2.4.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of conservation-listed fauna species, as identified by the database and literature searches, occurring within the survey area was assessed using the following criteria:

- suitability of habitat types likely to be present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical)
- the record is naturally occurring (not from a sanctuary or translocated population).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours, size and mobility of species
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 4**.

Table 4: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood Category	Criteria
Known to occur	Species previously recorded within the survey area within 25 years.
Likely to occur	Suitable habitat is expected to occur within the survey area and records of the species within 25 years exist within close proximity*
May occur	Suitable habitat is expected to occur within the survey area and historic records of the species exist within close proximity* OR Suitable habitat is expected to occur within the survey area and recent (<25yrs) records exist within the database search buffer but not in close proximity*
Unlikely to occur	Suitable habitat is expected to occur within the survey area however previous records are limited and/or historic and/or not in proximity** OR Suitable habitat is not expected to occur within the survey area and recent (<25yrs) records do not occur in close proximity*
Very Unlikely to occur	Suitable habitat is not expected to occur in the survey area AND/OR previous records are limited and/or historic and/or not in proximity**

* close proximity = 12.5 km (¼ of the distance of the database search buffer)

** proximity = 25 km (½ of the distance of the database search buffer)

The likelihood of species occurring within the survey area are indicated in **Table 21** in **Appendix Four**. Three species were assessed as being Likely to occur within the survey area:

- *Phascogale calura* (Red-tailed Phascogale)
- *Falco peregrinus* (Peregrine Falcon)
- *Leipoa ocellata* (Malleefowl).

Likelihood of occurrence does not take into consideration factors such as frequency that a species occurs (or may occur), the duration that such species occupies (or may occupy) the survey area or dependence on habitat or resources within the survey area. Highly mobile species potentially only occur within (or for birds, overflying) the survey area for very brief periods and/or on very infrequent intervals. If a previous observation included in the database search records corresponds with this event it is listed as 'Recorded'; if such a transient visitation is possible in the future the likelihood of such species occurring is likely listed as 'Likely'.

Following the field survey, when actual survey area characteristics are better understood and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.2.1** including providing an indication of dependence of species on the habitat and resources available within the survey area.

2.2.4.5 Black Cockatoos

According to DBCA mapping the survey area is located approximately:

- 37 km, north-west from a confirmed Carnaby's Cockatoo roost site (DBCA 2018c).

2.2.5 FAUNA HABITAT

The literature review (SW Environmental 2017) identified the following broad habitat types occur within the survey area or are known from nearby:

- Tall woodland
- Mallee
- Shrubland
- Cropped land
- Farm dams
- Granite outcrops.

2.3 RELEVANT LITERATURE

2.3.1 PREVIOUS SURVEYS

The majority of the survey area had been assessed earlier, documented in:

- SW Environmental (2017) *Level 1 Flora and Fauna Assessment, Kondinin Wind Farm*.

SW Environmental identified the following significant features within its survey area which largely corresponded with the current survey area:

- two of the three pre-European vegetation associations intersecting the survey area (960, 1023) have less than 30% of their original extent remaining
- the survey area intersects indicatively mapped representatives of the EPBC-listed critically endangered *Eucalypt Woodlands of the Western Australian Wheatbelt* TEC, with SW Environmental identifying representatives occurring along the Notting-Karlgarin Road reserve and on four isolated bushland remnants
- 40 conservation-listed flora have been recorded from within 20 km of the survey area; four Priority-listed flora were recorded by SW Environmental from the survey area: *Eucalyptus erythronema* subsp. *inornata* (P3), *Eucalyptus ornata* (P3), *Eremophila veneta* (P4), *Grevillea asteriscosa* (P4).
- 17 conservation-listed fauna were identified as having been recorded 'locally'. Only one conservation-listed species was recorded: Central Long-eared Bat (*Nyctophilus major tor*, P4)
- Carnaby's Cockatoo was not considered likely to occur.

2.3.2 IBSA DATA SEARCH

The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2023) was searched for recent environmental surveys in the vicinity of the survey area.

The search, conducted on 15 September 2023, identified four environmental surveys that have been conducted within 50 km of the survey area. Two of these listings did not have data accessible for review i.e. contained metadata only. The following documents had relevance to current survey:

- Ecoscape (2020) *Hyden Flora, Vegetation and Fauna Surveys*. The survey of a 5.39 ha area adjacent to the CBH facility did not identify any significant features. This survey was largely corresponding with an earlier assessment (Ecoscape 2010).
- Mattiske Consulting (2020) T*hreatened and Priority Flora Assessment, Earl Grey Lithium Project, Pre-Clearance Surveys*. This report was for an area with little similarity to the current survey area thus of little relevance aside from proximity.

2.3.3 OTHER LITERATURE

Department of Water (2009a) *Waterway assessment of the upper Lockhart River: Camm River confluence to Newdegate WRM 58*. The survey (conducted by Ecoscape) of bushland adjacent to the Lockhart River, south of Kondinin, assessed the vegetation in a number of remnants largely on private property. The aim was to determine the main threats to the waterway. There were no significant findings of relevance to the current survey area.

Department of Water (2009b) Waterway assessment of the upper Lockhart River: Camm River confluence to Hyden WRM 57. The survey (conducted by Ecoscape) of bushland adjacent to the Lockhart River, south of Kondinin, assessed the vegetation in a number of remnants largely on private property. The aim was to determine the main threats to the waterway. There were no significant findings of relevance to the current survey area.

3 METHODS

3.1 SURVEY AIMS

The aims of the survey were to:

- verify the results of the previous survey (SW Environmental 2017), updating results where necessary
- undertake assessments of areas not included in the SW Environmental survey area
- conduct more detailed assessments of areas since identified as potentially requiring clearing based on WestWind Energy's most recent plans.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a Reconnaissance survey according to the Flora and Vegetation Technical Guidance (EPA 2016a). The EPA recommends a Reconnaissance survey should:

- provide context and gather broad information
- verify the findings of the desktop assessment
- include low intensity sampling of the flora and vegetation to describe the general vegetation characteristics and condition
- clarify if the area may support any significant flora and vegetation
- identify if a Detailed survey is required.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

The fauna and fauna habitat survey was conducted as a Basic survey according to the Fauna Technical Guidance (EPA 2020). The EPA recommends a Basic survey should:

- be conducted as a low intensity survey to gather broad fauna and habitat information
- verify the adequacy of the desktop assessment
- map, describe and photograph habitats
- record opportunistic fauna observations
- identify possible future survey site locations, access and logistics
- determine if a Detailed survey is required.

Targeted surveys were also conducted to gather information on significant fauna and habitats.

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016a), conducted as a single-phase Reconnaissance survey that concentrated on confirming previous survey results, except in previously unsurveyed areas and where proposed development had been identified since the previous (SW Environmental 2017) survey.

Conservation criteria used in this assessment are outlined in **Table 12**, **Table 13** and **Table 14** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Confirmation of Previous Survey/Specific requirements

The significant findings of the SW Environmental (2017) assessment requiring confirmation were:

- all populations of conservation-listed flora *Eucalyptus erythronema* subsp. *inornata* (P3), *Eucalyptus ornata* (P3), *Eremophila veneta* (P4), *Grevillea asteriscosa* (P4), in particular confirming if the identification of *Eremophila veneta* is correct

- if the identified representatives of the Wheatbelt Woodlands TEC are accurately interpreted according to the Approved Conservation Advice (TSSC 2015).

In addition to confirming the above, searches for additional populations of the above conservation-listed flora and other previously unrecorded species were conducted, as well as flora and vegetation assessment of areas recently identified as potentially requiring clearing.

3.3.1.2 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension for mid and ground strata and 20 m x 20 m in dimension (effectively 5 m additional on all sides to the measured mid and ground stratum quadrat) for the upper stratum where present, as required according to the Flora and Vegetation Technical Guidance (EPA 2016a). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 400 m^2 for the upper stratum.

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

Quadrat locations are displayed on **Map 5**.

3.3.1.3 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat.

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

Due to uncertainty regarding the identification of *Eremophila veneta* (P4) (see **Section 2.2.3**) all populations identified by SW Environmental (2017) were visited for verification.

3.3.1.4 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory. No specific searches were conducted for significant weeds.

3.3.1.5 Vegetation Description and Classification

Floristic quadrats were recorded only in areas having potential to be cleared and (in one case) to verify if the vegetation was representative of the Wheatbelt Woodlands TEC.

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 15** and **Table 16** in **Appendix Two**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first series of letter codes referring to the component species (upper case first letter referring to the genus, lower case letter referring to the specie (excluding subsp), with the upper case letters at the end referring to the stratum structure e.g. **AcMfTOS** refers to ***A**llocasuarina **c**ampestris* and ***M**elaleuca **f**ulgens **t**all **o**pen **s**hrubland*.

3.3.1.6 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Southwest Botanical Province (EPA 2016a) (**Table 17** in **Appendix Two**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.3.1.7 Field Survey Timing

The field survey was conducted during 26-28 September which is within the optimal period for a primary survey within the bioregion according the Flora and Vegetation Technical Guidance (EPA 2016a).

3.3.2 DATA MANAGEMENT AND ANALYSIS

3.3.2.1 Taxonomic Plant Identification

Any plants that could not be identified with certainty in the field, having potential to be conservation-listed, introduced species and having significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) were collected during the field survey using Western Australian Herbarium collecting protocols.

The majority of post-survey plant collection identification was undertaken by Ecoscape taxonomists (primarily Dr Udani Sirisena) using relevant literature, taxonomic keys and reference specimens held at the WA Herbarium, including seeking assistance from specialist taxonomists where necessary.

3.3.2.2 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey results (incorporating both the SW Environmental (2017) and current surveys), survey effort and habitat identified within in the survey area.

3.3.2.3 TEC Assessment Criteria

SW Environmental identified seven (or eight, depending on interpretation) occurrences of the Wheatbelt Woodlands TEC.

Where there was vegetation potentially representative of the Wheatbelt Woodlands, the TEC was assessed against the criteria outlined in the Approved Conservation Advice for the community (TSSC 2015).

Reasons that vegetation was considered clearly not representative of the TEC in an indicatively mapped occurrence include the vegetation being a different type to that of the TEC, vegetation condition clearly not

meeting the condition thresholds (i.e. Degraded-Completely Degraded condition), and extents too small for inclusion. These can be demonstrated with a photograph.

3.4 FAUNA FIELD SURVEY

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020), conducted as a Basic survey. The two key outcomes of the survey were to revisit the sites surveyed by SW Environmental (2017), and re-assess the fauna habitat quality, and assess a portion of the wider survey area (as indicated on **Map 5**) that may be potentially cleared for crossovers and other infrastructure.

Conservation criteria used in this assessment are included in **Table 12** and **Table 13** in **Appendix One**.

Survey method details are outlined below.

3.4.1 FAUNA SURVEY METHODS

The Basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020) including habitat assessment, active searches, searches for secondary evidence such as mounds, nests, burrows, remains, diggings, scats and tracks. Fauna species were also identified opportunistically based on sightings and calls. Potential habitats for conservation significant species were identified and evaluated (see **Section 4.2.1**) and their likelihood of occurrence re-assessed.

Based on the desktop assessment, the following were considered to have a high likelihood of occurring in the survey area and they, and habitat suitable to support them, were targeted during the field survey:

- *Phascogale calura* (Red-tailed Phascogale)
- *Falco peregrinus* (Peregrine Falcon)
- *Leipoa ocellata* (Malleefowl).

3.4.1.1 Fauna Habitat Assessment

The fauna habitats present within the survey areas were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristic
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

3.4.1.2 Other Species of Conservation Significance

Other conservation-listed species, including migratory birds, with the potential to occur, such as *Phascogale calura* (Red-tailed Phascogale), *Falco peregrinus* (Peregrine Falcon), *Leipoa ocellata* (Malleefowl), and *Platycercus icterotis xanthogenys* (Western Rosella) were targeted using active searches (incorporating avian surveys) during the field survey.

4 FIELD SURVEY RESULTS

4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by Lyn Atkins (Principal Ecologist, Flora Collecting Permit FB62000003-2; Threatened Flora Collecting Permit TFL 2223-0089 during 26-28 September 2023.

4.1.1 CONFIRMATION OF PREVIOUS SURVEY (SW ENVIRONMENTAL 2017)

4.1.1.1 Conservation-Listed Flora

No additional conservation-listed flora were identified during the field survey; species recorded by SW Environmental (2017) are discussed below.

Populations of conservation-listed flora recorded during the field survey are indicated on **Map 4** and their locations listed in **Table 24** in **Appendix Five**. No Threatened or Priority Flora Report Forms have been completed as they are known populations.

***Eucalyptus erythronema* subsp. *inornata* (P3)**

SW Environmental (2017) identified *Eucalyptus erythronema* subsp. *inornata* from one road reserve location (Notting-Karlgarin Road) towards the west of its survey area. The road reserve was not included in the current survey area.

Four groups of plants of this species *sens. lat*. were recorded from the SW Environmental location (one group of 15 plants on the southern road reserve; three groups of three, four and six plants on the northern road reserve; **Image 1**). Only one individual had buds within reach that confirmed the subspecies (cream flowers for P3-listed *Eucalyptus erythronema* subsp. *inornata* compared with red for the unlisted *Eucalyptus erythronema* subsp. *erythronema*), thus confirming the SW Environmental record. No additional observations of this taxon were recorded.

WestWind Energy is not proposing to clear in this portion of the road reserve, nor is it within the survey area being on an adjacent road reserve.

Image 1: *Eucalyptus erythronema* subsp. *inornata*

***Eucalyptus ornata* (P3)**

SW Environmental (2017) recorded *Eucalyptus ornata* (**Image 2** and **Image 3**) from two locations, one of which had three records along Notting-Karlgarin Road and the other being a bushland remnant to the north.

Ecoscape confirmed these locations and previous DBCA records, recording 16 individuals. It is also highly likely that additional groups of plants or isolated individuals occur along the road reserve.

WestWind Energy is not proposing to disturb the locations where *Eucalyptus ornata* occurred.

Image 2: *Eucalyptus ornata* form

Image 3: *Eucalyptus ornata* buds and fruit

Eremophila veneta (P4)

SW Environmental (2017) reported five groups (populations or sub-populations) of *Eremophila veneta*, however, the photograph in the SW Environmental report (**Figure 3** in **Section 2.2.3**) did not match literature and photographs of this species (e.g. **Figure 4** in **Section 2.2.3**).

All of the SW Environmental locations were visited and all corresponded with the *Eremophila* species as per the photograph in its report (**Image 4** from this survey; compare with **Figure 3** in **Section 2.2.3**), which was formally identified as *Eremophila lehmanniana* (**Image 5**) which does not have any conservation status.

No plants of actual *Eremophila veneta* were recorded thus it has been concluded that it (*Eremophila veneta*) does not occur within the survey area.

Image 4: *Eremophila lehmanniana* (Ecoscape 2023)

Image 5: *Eremophila lehmanniana* (Atlas of Living Australia 2023, image attributed to Steve Drew)

Grevillea asteriscosa (P4)

SW Environmental (2017) recorded two groups (three records) of *Grevillea asteriscosa*. These were confirmed and additional observations recorded. Based on its locations within the survey area this species favour disturbed areas, including a previous gravel pit, and due to its hard and prickly leaves, even as a small seedling, is likely to be resistant to grazing by domestic livestock, feral animals and kangaroos.

No *Grevillea asteriscosa* plants occurred in areas that are proposed for clearing.

Image 6: *Grevillea asteriscosa* flowers

Image 7: *Grevillea asteriscosa* habit and habitat

4.1.1.2 Vegetation

Where accessible, all areas with natural bushland within the SW Environmental (2017) survey area were visited for confirmation of vegetation type and vegetation condition. Where not readily accessible (i.e. they were surrounded by crops) they were viewed from a distance using binoculars – this readily confirmed vegetation type but only provided an indication of vegetation condition based on expected understorey presence or absence. In general, in Ecoscape's opinion, the interpretation of vegetation type by SW Environmental was appropriate for the area and vegetation condition generally similar to what Ecoscape would have assessed it.

As none is proposed to be cleared (excluding an area reported on separately in following sections) and the majority of this survey was only for confirmation purposes, there was no requirement for re-mapping unless significant errors were observed.

WHEATBELT WOODLANDS TEC

SW Environmental (2017) identified three road reserve sections and four remnant patches of bushland within the current survey area that it considered represented the Wheatbelt Woodlands TEC (**Map 2**). All were visited or viewed for confirmation, despite there being no proposal to clear any. According to the DBCA database search data, none are within areas indicatively mapped as the Wheatbelt Woodlands TEC.

The road reserve sections identified along Notting-Karlgarin Road (**Map 4**) conformed with the requirements to be representative of the Wheatbelt Woodlands TEC according to the criteria outlined in the Approved Conservation Advice for the TEC (TSSC 2015), although finer scale mapping would have removed intermittent patches of the total mapped extent where it was dominated by mallee Eucalypts. The relevant sections of road reserve complied with the requirements to be considered as Category A. However, clearing is not anticipated to be required within this portion of the survey area.

One of the purported Wheatbelt Woodlands TEC patches was located to the northeast of the above road reserve section (Patch 1 on **Map 2**). A floristic relevé (K23R01; see **Appendix Six** for details) was recorded within this patch to describe the conditions present. Ecoscape recorded the vegetation type as '*Eucalyptus capillosa* and *Acacia acuminata* low open woodland over *Allocasuarina acutivalvis* and *Melaleuca spicigera* tall open shrubland over **Hypochaeris glabra*, *Desmocladus asper* and *Waitzia acuminata* var. *acuminata* low forbland/sedgeland' (**Image 8**) and the vegetation condition of the majority of the bushland remnant as 'Good'.

However, the extent of the vegetation within this remnant that was Eucalypt woodland was less than the 2 ha threshold for the vegetation condition according to the Approved Conservation Advice (TSSC 2015) and the Eucalypt tree canopy cover was less than the required 10%, thus this remnant is not representative of the TEC.

Patch 2 on **Map 2** (**Image 9**) was assessed by SW Environmental (2017) as being in Good condition, however, there was virtually no understorey and it was densely covered with weeds thus more appropriately is in Degraded or Completely Degraded condition. As such it does not meet the condition threshold to be representative of the Wheatbelt Woodlands TEC.

Image 8: Relevé K23R01 in Patch 1

Image 9: Patch 2

Patches 3 and 4 on **Map 2** (**Image 10** and **Image 11**) were not accessible as they were surrounded by crops. SW Environmental (2017) assessed these as being in Good condition although it is more likely that they were in Degraded-Completely Degraded condition. Regardless, neither meet the minimum extent criteria of 5 ha as a Category C or D representative. As there are unlikely to be important habitat features present as they are small and isolated patches of bushland, Category B, requiring 2 ha of woodland (Patch 4 is approximately 2 ha; Patch 3 is smaller) is unlikely to be applicable. Therefore, these Patches are not representative of the Wheatbelt Woodlands TEC.

Image 10: Patch 3

Image 11: Patch 4

4.1.2 ADDITIONAL SURVEY AREA

This report section pertains only to the portion of the wider survey area that may be potentially cleared for crossovers and other infrastructure, as indicated on **Map 5**.

4.1.2.1 Flora

Flora Inventory

Four floristic quadrats were recorded from within the additional survey area.

Eighty-four vascular flora were recorded from 62 genera and 31 families from the quadrats and opportunistic observations in this area. Of these, 19 were introduced (22.6%) and one (1.2%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were *Poaceae* (13 taxa), *Asteraceae* (12) and *Myrtaceae* (11). The most commonly represented genera were *Acacia* with six taxa, *Melaleuca* (five) and *Eucalyptus* (four).

The number of species per quadrat ranged from 27 in quadrat K2302 to 14 in quadrats K2301 and K2304, with an average species diversity per quadrat of 18.25. The most commonly recorded species were *Austrostipa elegantissima* recorded from four quadrats and *Rytidosperma acerosum* and **Hypochaeris glabra* (three quadrats).

The combined flora inventory is presented in **Table 23** in **Appendix Five**. Quadrat data is presented in **Appendix Six**.

Conservation-listed Flora

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed TF were recorded during the additional area field survey. No taxa that was not identified with certainty resembled any currently described TF.

Priority Flora

No Priority-listed flora were recorded during the additional area field survey. No taxa that was not identified with certainty resembled any currently described PF.

Other Significant Flora

One taxon having 'other significance' according to the Flora and Vegetation Technical Guidance (EPA 2016a) was recorded during the field survey. *Phebalium multiflorum* subsp. *baccharoides* (**Image 12**) was recorded as having minor range extension of approximately 70 km (according to *FloraBase* (WAH 1998-2023) records) and was a dominant ground stratums species in the mallee woodland.

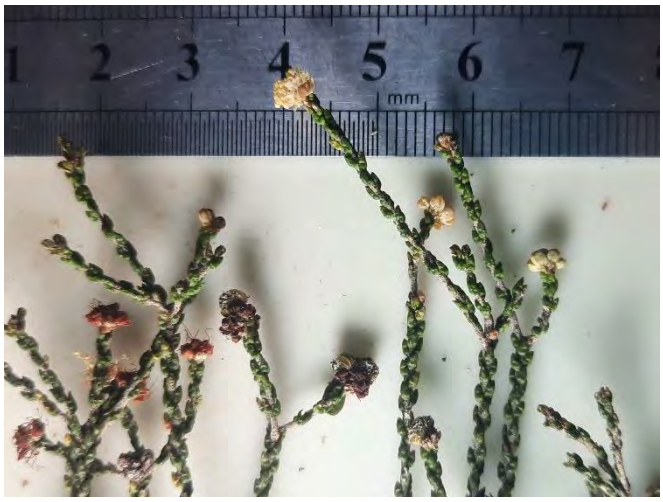

Image 12: *Phebalium multiflorum* subsp. *baccharoides*

Introduced Flora

Nineteen introduced flora species (weeds) were recorded during the field survey, representing 22.6% of the overall flora inventory.

None of the introduced flora have any specific significance i.e. none are Declared Pest plants or WoNS species.

4.1.2.2 Vegetation

Vegetation Types

Two vegetation types were recorded from within the survey area (**Table 5**, **Map 5**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.1.2.4**) and subsequent desktop review.

The vegetation types (upper stratum) within the survey area were:

- **AcMfTOS**: *Allocasuarina campestris* and *Melaleuca fulgens* tall open shrubland
- **EcEfEtMMW**: *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus flocktoniae* subsp. *flocktoniae* and *Eucalyptus tenera* mid mallee woodland.

Table 5: Vegetation types

The photograph is of the quadrat indicated in **bold** font.

Mapping unit	Vegetation type	Floristic quadrats	Representative photograph	Other characteristic species	Area (ha) and extent (%)
AcMfTOS	*Allocasuarina campestris and Melaleuca fulgens* tall open shrubland over **Vulpia myuros* forma *myuros*, *Austrostipa elegantissima* and **Hypochaeris glabra* low grassland/tussock grassland/forbland **NVIS**: M+ ^*Allocasuarina campestris*,^*Melaleuca fulgens*\^shrub\4\i;G ^^*Vulpia myuros* forma *myuros*,*Austrostipa elegantissima*,*Hypochaeris glabra*\^other grass,tussock grass,forb\1\c	K2301 **K2303**		*Acacia lasiocalyx* **Arctotheca calendula* *Austrostipa scabra* **Avena barbata* **Bromus diandrus* *Cryptandra nutans* *Dampiera lavandulacea* **Ehrharta longiflora* *Erodium cygnorum* **Lolium perenne* *Opercularia vaginata* **Pentameris airoides* *Podolepis aristata subsp. aristata* *Rytidosperma acerosum* *Stackhousia monogyna* **Trifolium subterraneum* *Ursinia anthemoides* *Waitzia acuminata var. acuminata*	1.12 ha 26.86%
EcEfEtMMW	*Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus flocktoniae* subsp. *flocktoniae* and *Eucalyptus tenera* mid mallee woodland over *Melaleuca adnata*, *Melaleuca marginata* and *Melaleuca acuminata* mid open shrubland over *Phebalium multiflorum* subsp. *baccharoides*, *Olearia muelleri* and *Rytidosperma acerosum* low open shrubland/tussock grassland **NVIS**: U+ ^^*Eucalyptus calycogona* subsp. *calycogona*,*Eucalyptus flocktoniae* subsp. *flocktoniae*,*Eucalyptus tenera*\^tree mallee\6\i;M ^^*Melaleuca adnata*,*Melaleuca marginata*,*Melaleuca acuminata*\^shrub\3\i;G ^^*Phebalium multiflorum* subsp. *baccharoides*,*Olearia muelleri*,*Rytidosperma acerosum*\^shrub,tussock grass\2\i	**K2302** K2304		*Acacia brachyclada* *Acacia erinacea* **Arctotheca calendula* *Atriplex semibaccata* *Austrostipa elegantissima* **Brassica tournefortii* *Crassula colorata* *Cryptandra nutans* *Dodonaea bursariifolia* *Enchylaena tomentosa var. tomentosa* *Eucalyptus phenax subsp. phenax* *Grevillea huegelii* **Hypochaeris glabra* **Lolium perenne* *Maireana brevifolia* *Phebalium tuberculosum* *Sclerolaena diacantha* **Sonchus oleraceus* *Templetonia sulcata* *Westringia rigida*	3.05 ha 73.14%
	TOTAL EXTENT				**4.17 ha**

Vegetation Significance

4.1.2.3 TECs and PECs

No vegetation recorded from the survey area was assessed as being representative of any currently described TEC or PEC.

The DBCA database search (**Section 2.2.2**) did not identify this area as being within the Wheatbelt Woodlands TEC that has been indicatively mapped, and verified by this survey and that of SW Environmental (2017) from nearby.

Other Significant Vegetation

No vegetation types having 'other significance' according to the Flora and Vegetation Technical Guidance (EPA 2016a) were recorded during the field survey.

4.1.2.4 Statistical Analysis

Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area. However, it should not be expected that a Reconnaissance flora and vegetation survey would record a complete flora inventory.

A species accumulation curve (Pisces Conservation Ltd 2010) was generated using quadrat data (**Figure 5**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that the majority of species would have been recorded as the curve is approaching an asymptote. The Bootstrap estimate of species richness is 54.52 which, when taking opportunistic records into account, is less than the number of recorded species (84).

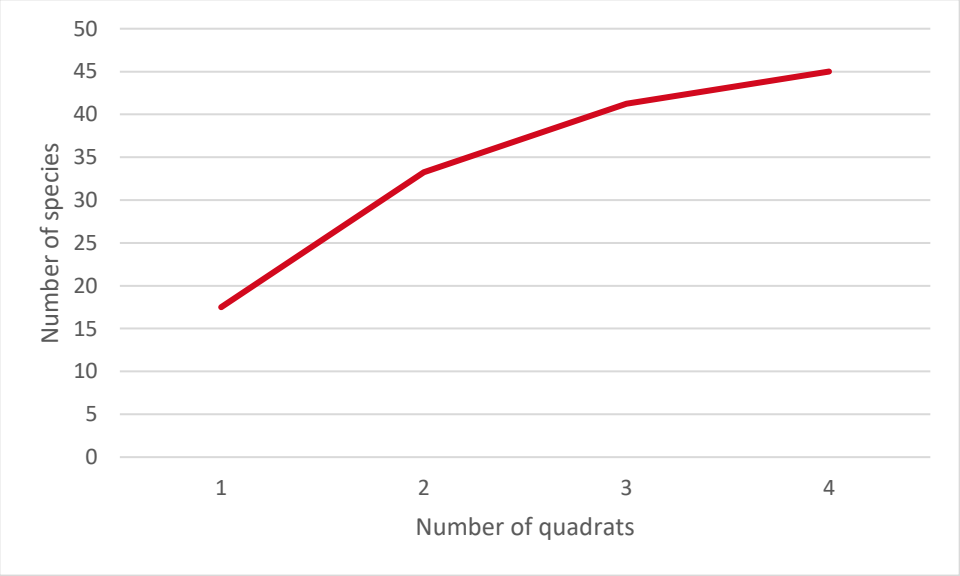

Figure 5: Species accumulation curve

4.1.2.5 Vegetation Condition

The vegetation condition within the additional survey area ranged from Degraded to Excellent condition, with the majority in Excellent condition (**Table 6**, **Map 5**). The main factor/s affecting vegetation condition were weed invasion due to either having been previously grazed or being in close proximity to grazed areas and thus weed seeds.

Table 6: Vegetation condition

Vegetation condition	Extent (ha)	Proportion (%)
Excellent	1.91	45.80
Very Good	0.74	17.75
Degraded	1.25	29.98
Completely Degraded	0.27	6.47

4.1.3 BOTANICAL LIMITATIONS

Survey design and type: The major aspect of the survey was to verify the findings of the previous survey by SW Environmental (2017). A small area (4.17 ha) was identified where native vegetation clearing is proposed. Within this area a single phase, quadrat-based flora and vegetation survey was conducted. Results from previous surveys were considered as part of survey design and the desktop assessment.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

A full summary of botanical limitations is presented in **Table 7**.

Table 7: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No constraints	The majority of the survey area had been previously surveyed providing relevant contextual information.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No constraints	The lead botanist conducting the field survey has over 35 years' experience conducting flora and vegetation surveys in the Avon Wheatbelt and Mallee bioregions, including near to the current survey area.
Proportion of the flora recorded and/or collected, and any identification issues	No constraints	Eighty-four vascular flora taxa were recorded during the field survey of which only one specimen could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered to not represent a constraint as it is unlikely that it represents conservation-listed flora from the region.
Was the appropriate area fully surveyed (effort and extent)	No constraints	The majority of the assessment was for verification of previous survey. A small extent (4.17 ha of native bushland) was assessed during a Reconnaissance-level survey which was of sufficient intensity to adequately describe the botanical conditions present.

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Access restrictions within the survey area	Negligible constraints	Some small farm remnant areas were completely surrounded by cropland and could not be accessed. This was only a negligible constraint as these were for verification purposes only and WestWind Energy is not proposing to clear them.
Survey timing, rainfall, season of survey	No constraints	The field survey was conducted during September which is optimal for survey in the bioregion. The rainfall in the 6 months prior to the field survey was 94% of the mean for this period (**Section 2.1.1**), also indicated by the rainfall deciles (see below). This represents no constraint to the survey findings.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No constraints	There were no recent disturbances that would have affected the results of the survey.

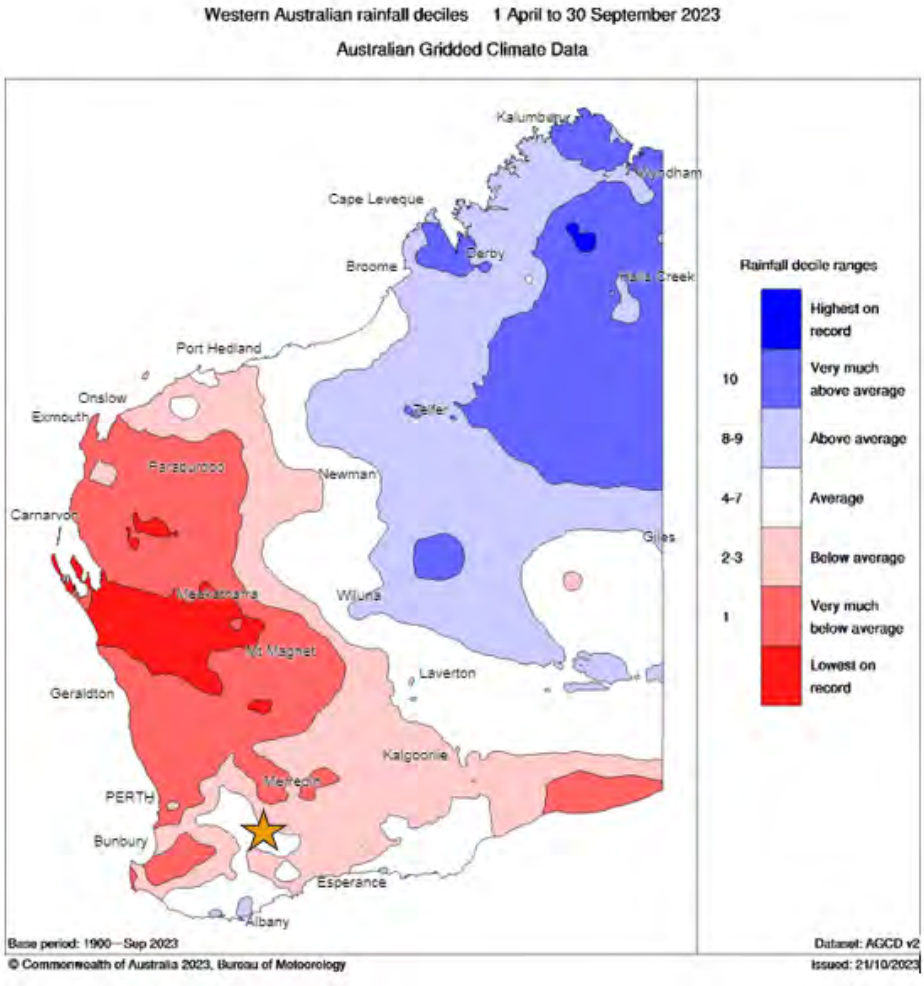

Figure 6: Rainfall deciles for the 6 months prior to the field survey (BoM 2023b)**.**

The star in **Figure 6** indicates the approximate location of the field survey.

4.2 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Robert Hemsworth (Senior Zoologist) during 26-28 of September 2023.

The survey was conducted in accordance with the requirements for a Basic survey as outlined in the Fauna Technical Guidance (EPA 2020).

The entire site was traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species.

4.2.1 FAUNA HABITAT

All fauna sites surveyed by SW Environmental (2017), that did not have restricted access, were revisited for re-assessment. Four fauna habitat types were recorded within the survey area (**Table 8**):

- Woodland
- Shrubland
- Rock escarpment
- Drainage line.

An assessment was also made of a portion of the wider survey area (as indicated on **Map 6**) that may be potentially cleared for crossovers and other infrastructure. Only the Woodland habitat type was recorded and its quality as fauna habitat was considered to be poor to degraded.

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape.

Table 8: Fauna habitat types

Extents in this table refer to native vegetation portions (remnant bushland) and do not include cleared areas including cropland.

Habitat type	Description	Photograph
Woodland	Open woodland of dominated by mallee and/or Salmon gum *Eucalyptus salmonophloia* over *Acacia* species, mixed shrubs, tussock grass and/or herbs. Soil was sand, sandy-clay or clay with variable litter cover (10-100%). Fire age <5 to >10 years. Disturbance is high and overall habitat quality is good to degraded. **Extent**: 112.99 ha; 76.65%	

Habitat type	Description	Photograph
Shrubland	Open mixed shrubland dominated by Acacia and Melaleuca species over tussock grass, sedges, and herbs. Soil is sand, sandy-clay or clay with variable litter cover (20-80%). Fire age >10 years. Disturbance is high and overall habitat quality is average to degraded. **Extent**: 21.01 ha; 14.25%	
Rocky Outcrop	Large granite outcrops fringed by mallee, *Acacia* and mixed shrubs. Low number of rocky crevices. Litter cover is low (10-20%) and dependent on surrounding vegetation. Fire age is >10 years. Overall habitat quality is average. **Extent**: 9.93ha; 6.74%	
Drainage line	Seasonally inundated minor drainage lines, fringed by mallee, mixed shrubs or no understory over tussock grass. Soil is sandy-clay or clay with 30-90% litter cover. Fire age is >10 years. Disturbance is high and overall habitat quality is poor. **Extent**: 3.49 ha; 2.37%	

Habitat type	Description	Photograph
Cropped Land	Not considered habitat	

4.2.2 FAUNA ASSEMBLAGE

Forty vertebrate fauna species (five mammals, two reptiles, 33 birds), including three that are introduced, were recorded during the survey (**Table 9**). No conservation-listed species were recorded.

Table 9: Fauna species

Species	Common name	EPBC Act status	Western Australian status
Mammals			
*Felis catus**	Cat		
Macropus fuliginosus melanops	Western Grey Kangaroo		
*Oryctolagus cuniculus**	Rabbit		
Tachyglossus aculeatus acanthion	Short-beaked Echidna		
*Vulpes vulpes**	Red Fox		
Birds			
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		
Accipiter fasciatus	Brown Goshawk		
Anthochaera carunculata	Red Wattlebird		
Anthus australis	Australian Pipit		
Artamus personatus	Masked Woodswallow		
Barnardius zonarius	Australian Ringneck		
Chenonetta jubata	Australian Wood Duck		
Colluricincla harmonica	Grey Shrikethrush		
Coracina novaehollandiae	Black-faced Cuckooshrike		
Corvus coronoides	Australian Raven		
Coturnix pectoralis	Stubble Quail		
Cracticus torquatus	Grey Butcherbird		
Elanus axillaris	Black-shouldered Kite		
Eolophus roseicapilla	Galah		
Epthianura albifrons	White-fronted Chat		
Eurostopodus argus	Spotted Nightjar		
Falco berigora	Brown Falcon		
Falco cenchroides	Australian Kestrel		
Gavicalis virescens	Singing Honeyeater		

Species	Common name	EPBC Act status	Western Australian status
Grallina cyanoleuca	Magpie-lark		
Gymnorhina tibicen	Australian Magpie		
Neophema elegans	Elegant Parrot		
Ocyphaps lophotes	Crested Pigeon		
Phaps chalcoptera	Common Bronzewing		
Phylidonyris novaehollandiae	New Holland Honeyeater		
Podargus strigoides	Tawny Frogmouth		
Pomatostomus superciliosus	White-browed Babbler		
Psephotellus varius	Mulga Parrot		
Purnella albifrons	White-fronted Honeyeater		
Rhipidura leucophrys	Willie Wagtail		
Smicrornis brevirostris	Weebill		
Todiramphus pyrrhopygius	Red-backed Kingfisher		
Reptiles			
Tiliqua rugosa rugosa	Bobtail		
Varanus gouldii	Bungarra or Sand Goanna		

* introduced species. Survey sites are listed in **Table 25** in **Appendix Five**.

4.2.2.1 Black Cockatoo Habitat Assessment

The survey area is within the mapped distribution of the Carnaby's Cockatoo (DAWE 2022). No Carnaby's Cockatoos were recorded during the field survey. No suitable Black Cockatoo habitat trees were observed or assessed during the field survey.

4.2.3 FAUNA SURVEY LIMITATIONS

Table 10: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information	No	No constraints in obtaining data.
Competency/experience of the survey team, including bioregion experience	No	Field survey staff were experienced with the fauna survey methods used and with the identification of fauna and fauna habitat.
Scope of survey e.g. excluded fauna groups	No	Targeted species adequately sampled, and no sampling methods were constrained due to external factors.
Timing, weather, season	No	No constraints.
Disturbances that may have affected results	No	All disturbances are long term features of the landscape e.g., clearing for agriculture, and are unlikely to affect the overall survey results.
Proportion of fauna identified, recorded, or collected	No	The primary focus of the field survey was to determine if conservation-listed species or their habitat occurred within the survey area, and the definition of overall fauna habitat types.
Adequacy of survey intensity and proportion of survey achieved	No	All major fauna habitat types including those favoured by conservation significant fauna were investigated and defined.
Access	Yes (negligible)	Some areas of vegetation were surrounded by crops and could not be accessed without damaging the crops; all other areas adequately surveyed.
Data and analysis issues including sampling biases	No	There were no issues with data and analysis. A basic fauna survey does not have extensive data analysis requirements.

5 DISCUSSION

5.1 VERIFICATION SURVEY

The majority of the survey effort was to verify the findings of the previous (SW Environmental 2017) survey.

5.1.1 FLORA SIGNIFICANCE

The verification survey concentrated on verifying and searching for additional representatives of the conservation-listed species recorded previously by SW Environmental (2017) and additional conservation-listed flora.

5.1.1.1 Conservation-listed Flora

SW Environmental (2017) did not record any Threatened Flora, nor were any recorded by Ecoscape during the verification survey.

SW Environmental (*ibid.)* recorded four Priority-listed flora, however, one was an incorrect identification (*Eremophila lehmanniana* that was incorrectly identified as *Eremophila veneta* (P4)) and did not occur within the survey area.

Three conservation-listed flora were recorded by both SW Environmental (2017) and Ecoscape (this survey):

- *Eucalyptus erythronema* subsp. *inornata* (P3) – 28 individuals although these were on the road reserve adjacent to the survey area (rather than within it)
- *Eucalyptus ornata* (P3) – 16 individuals from both the Notting-Karlgarin Road reserve and farm bush remnants
- *Grevillea asteriscosa* (P4) – 121 individuals from farm bush remnants.

For these species, the Ecoscape survey confirmed the findings of both the SW Environmental (*ibid.)* survey and the majority of DBCA records within the survey area.

5.1.1.2 Post-survey Likelihood

No additional conservation-listed flora species were considered Likely to occur within the survey area. This likelihood assessment takes into consideration that the survey area has been assessed twice and the majority of native bushland is currently or previously grazed by farm livestock. If conservation-listed flora do occur it is only likely on road reserves which, for the most part, are not proposed to be cleared.

5.1.2 VEGETATION SIGNIFICANCE

SW Environmental (2017) identified 19 vegetation units within its survey area. Although there were some minor inconsistencies in the SW Environmental mapping, broadly these vegetation units (also known as vegetation types) are appropriate for the survey area.

Aside from vegetation representative of the Wheatbelt Woodlands TEC (see below), none is considered to have any specific local or regional significance.

5.1.2.1 Assessment Against the Wheatbelt Woodlands TEC Criteria

SW Environmental (2017) identified seven representatives of the Wheatbelt Woodlands TEC and its Western Australian PEC equivalent. Those occurring on the Notting-Karlgarin Road reserve were considered to have been accurately identified as they met the extent (road reserve >5 m wide), condition (Good or better) and basic description of being a Eucalypt woodland with >10% canopy cover (TSSC 2015), noting that the extent mapped may be potentially less as some portions were dominated by mallee Eucalypts. However, none of the road reserve vegetation (excluding the portion below, which is not Wheatbelt Woodlands TEC) is proposed for clearing.

SW Environmental (2017) identified four farm remnants as being representative of the Wheatbelt Woodlands TEC. However, none met the extent or condition thresholds according to the Approved Conservation Advice (TSSC 2015), thus none are considered to represent the TEC.

5.1.3 VEGETATION CONDITION

All accessible areas previously assessed by SW Environmental (2017) were revisited to confirm vegetation condition. Overall, Ecoscape agreed with the majority of vegetation condition ratings given, with the exception of one of the remnant identified as being a representative of the Wheatbelt Woodlands TEC (see **Section 4.1.1.2**). There is no significance in regard to minor differences in vegetation condition assessment as clearing is not proposed except as below which is discussed separately (**Section 5.4.3**).

5.2 FAUNA SIGNIFICANCE

5.2.1 FAUNA SIGNIFICANCE

All fauna sites surveyed by SW Environmental (2017), that did not have restricted access, were revisited for re-assessment. In addition, a portion of the larger survey area (**Map 6**) was surveyed, as it was the proposed site of additional infrastructure. Four fauna habitat types were recorded during the field survey (**Section 4.2.1**):

- Woodland
- Shrubland
- Rock escarpment
- Drainage line.

Ecoscape's assessment has shown that the habitat condition and quality to be unchanged since the surveys conducted by SW Environmental (2017). The available fauna habitat consists of small remnant patches of vegetation that are isolated from areas of larger habitat such as nearby reserves. Where fauna habitat was considered good, it was only suitable for small vertebrates and is unlikely to be of any significant habitat value to conservation-listed species.

The Woodland and Shrubland habitat types consist of areas of remnant vegetation surrounded by large expanses of crops. Habitat quality is largely dependent on the size of the remnant and the composition of the vegetation present. Habitat quality was recorded as degraded to good, with the larger patches generally better quality and with more available resources such as hollow logs. These areas provide habitat for a common bird assemblage which use them for foraging, nesting or as corridors to move between areas of larger habitat. Many of these areas are small and narrow and therefore provide little habitat value for species with more specific habitat requirements e.g. Malleefowl, Red-tailed Phascogales.

The Rocky escarpment habitat type consisted of large granite outcrops and a small limestone breakaway. The granite outcrops were predominantly homogenous but had small plates of sheared off granite which may provide habitat for small reptiles or frogs. These were low in number, infrequently dispersed, and not large enough for other species of vertebrate fauna. Likewise, the small limestone breakaway had few rocky crevices available for fauna to shelter.

The Drainage line habitat type comprised of small remnant stretches of shallow, seasonally inundated creeks that are no longer connected and are typically alongside fields of crops. The banks of the drainage lines are typically eroded and are lined with sparse remnant vegetation of mallee, mixed shrubs, and tussock grass. These areas may provide habitat for small reptiles, frogs, and birds.

The fauna habitats recorded in the survey area are typical for the local area and representative of the Western Mallee subregion, thus they are not of particular local or regional significance. There were also signs of introduced species (cats, foxes, rabbits) in all recorded habitat types. The recorded habitats provide resources for the generalist fauna assemblage, however, high levels of degradation from agricultural activities may have reduced the suitability of the survey area for some species.

5.2.2 FAUNA ASSEMBLAGE

Forty vertebrate fauna species (five mammals, two reptiles, 33 birds) were recorded during the field survey, none were conservation-listed (**Section 4.2.2**). The fauna assemblage is considered to be similar across the survey area, including SW Environmental reassessment sites and the additional portion surveyed (**Map 6**), with no additional species recorded in this portion. All species recorded were expected to occur and were considered typical for the region and the habitat surveyed.

5.2.2.1 Post-survey Likelihood Assessment

The post-survey likelihood assessment is incorporated into **Table 21** in **Appendix Four**.

Conservation-listed fauna species identified during the desktop assessment as having a High or Medium likelihood of occurring that were not recorded during the field survey are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort.

High Likelihood Species

Red-tailed Phascogale – VU EPBC status; CD BC status

The Red-tailed Phascogale is a small (38-68 g) arboreal dasyurid, named because of rust red colour of its upper tail (Van Dyck & Strahan 2008). This species was formerly widespread in woodland habitats in inland south and central Australia but is now mainly restricted to remnant woodlands of mature Wandoo (*Eucalyptus wandoo*) or Rock Oak (*Allocasuarina huegeliana*) in the south of the Western Australian wheatbelt (Menkhorst & Knight 2004). Highest densities occur where the habitat is long unburnt and is comprised of dense *A. huegeliana* interspersed with hollow-forming senescent *E. wandoo*, which provide nesting sites (Kitchener 1981; Short, Hide & Stone 2011).

Twenty-one recent (<25 years) DBCA records occur within the survey area buffer (50 km), with one of these records within 12.5 km of the survey area. However, due to the lack of suitable habitat for the species in the survey area, the post-survey likelihood of the species occurring is 'Unlikely'.

Peregrine Falcon – OS BC status

This bird of prey saw large population decline in the 1960s and 1970s due to the use of the pesticide DDT. Although populations in Australia have recovered better than elsewhere in the world, the Peregrine Falcon remains a conservation-listed species. This species is not confined to a specific habitat, although it is usually seen perching on poles, fences, or dead trees in agricultural areas. It nests on cliffs, buildings, or the old stick nests of other species e.g. Ravens (DAWE 2020b).

No Peregrine Falcons were recorded in the survey area. Eight recent (<25 years) DBCA records indicate that this species occurs within the survey area buffer (50 km), with two of these records from within 25 km, and two from within 12.5 km of the survey area. Foraging habitat for this species occurs throughout the survey area, however, suitable breeding habitat is limited. Peregrine Falcon would likely only be transient and not dependent on any resources occurring in the survey area.

The post-survey likelihood of the species occurring is 'May Occur'.

Malleefowl – VU EPBC status; VU BC status

The Malleefowl belongs to the family *Megapodiidae*, or the mound builders, and uses external heat to incubate its eggs (Benshemesh 2007). This species inhabits the inland interior of Australia in dry scrub and low mallee woodlands habitat (Simpson & Day 2010b). A sandy substrate and abundance of leaf litter are clear requirements for the construction of the birds' incubator-nests (Benshemesh 2007).

The DBCA database records show 216 recent (<25 years) records from within the 50 km survey area buffer, with 31 of these being within 25 km, and 14 being within 12.5 km of the survey area. No evidence of Malleefowl or their mounds were found within the survey area. Suitable Malleefowl habitat did occur in the survey area, however, it was small in nature and highly fragmented, rendering it unsuitable for this species. Additionally,

high levels of disturbance due to agricultural activities further reduce the likelihood that Malleefowl are present in the survey area.

The post-survey likelihood of occurrence of this species is 'Unlikely'.

Medium Likelihood Species

Western Rosella – P4 DBCA status

The Western Rosella only occurs in the south-west of Western Australia and is Western Australia's only rosella species. The subspecies, *Platycercus icterotis xanthogenys*, occurs in the drier inland areas. This species feeds both in trees and on the ground and is sometimes seen eating spilt grain along roadsides.

There is one recent (<25 years) DBCA record within 25 km of the survey area. However, any suitable habitat within the survey area is highly disturbed and fragmented due to agricultural activities. If this species does occur in the survey area, it is likely utilising the vegetation as a corridor to move to more suitable habitat.

The post-survey likelihood of occurrence of this species is 'May Occur'.

5.3 ADDITIONAL SURVEY AREA

This report section refers to the portion that WestWind Energy may require some clearing for crossovers and other infrastructure and support.

5.3.1 FLORA SIGNIFICANCE

A total of 84 vascular flora species were recorded from four floristic quadrats and opportunistic observations, including during searches for conservation-listed flora. Almost one quarter of the total flora inventory (19 species; 22.6%) were introduced species reflecting the level of disturbance in the additional survey area, some of which was previously or currently grazed.

5.3.1.1 Conservation-listed Flora

Threatened Flora

No Threatened Flora species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded in the survey area. None of the unidentified taxa resemble any currently described TF.

Priority Flora

No Priority-listed Flora species were recorded. None of the unidentified taxa resemble any currently described PF taxa.

5.3.1.2 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 20** in **Appendix Four**.

Given the small extent of the additional survey area and survey effort it is very unlikely that conservation-listed species would have been overlooked. None had been previously recorded from within it and the nearest records (of *Eucalyptus ornata*; P3) are possible (for one) and inaccurately located (in a paddock). Regardless, this species was not recorded from within the survey area.

5.3.1.3 Other Significant Flora

One taxon having 'other significance' according to the Flora and Vegetation Technical Guidance (EPA 2016a) was recorded during the field survey. *Phebalium multiflorum* subsp. *baccharoides* (**Image 12**) was recorded as having minor range extension of approximately 70 km (according to *FloraBase* (WAH 1998-2023) records) and was a dominant ground stratums species in the mallee woodland. However, a range extension species is unlikely to be of any particular significance, rather represents a lack of local survey effort.

5.3.1.4 Introduced Flora

No declared Pest or WoNS species were recorded. All of the recorded weeds are considered to be commonly occurring agricultural weeds of the region.

5.3.1.5 Local and Regional Significance of Flora

The survey area is unlikely to have any specific locally or regionally significant flora except for the PF listed above.

5.4 VEGETATION SIGNIFICANCE

Two vegetation types were recorded from the survey area:

- **AcMfTOS**: *Allocasuarina campestris* and *Melaleuca fulgens* tall open shrubland
- **EcEfEtMMW**: *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus flocktoniae* subsp. *flocktoniae* and *Eucalyptus tenera* mid mallee woodland.

Neither is considered to have any specific significance as both occur commonly in the local area and, for **AcMfTOS**, occurs broadly over a wide regional area.

5.4.1 ASSESSMENT AGAINST THE WHEATBELT WOODLANDS TEC CRITERIA

None of the vegetation in the additional survey area meets the requirements to be representative of the Wheatbelt Woodlands TEC as it is not a Eucalypt woodland, rather it is a mallee woodland or shrubland.

5.4.2 LOCAL AND REGIONAL SIGNIFICANCE OF VEGETATION

Neither of the vegetation types within the additional survey area is considered to have any specific significance as both occur commonly in the local area and, for **AcMfTOS**, occurs broadly over a wide regional area.

5.4.3 VEGETATION CONDITION

The road reserve portion of the survey area is in either Excellent or Very good condition, which is as observed for the majority of the road reserve.

The remaining portion of the additional survey area was within an unmade road reserve that, while largely uncleared, has been grazed and is Degraded-Completely Degraded condition as a result.

5.5 FAUNA SIGNIFICANCE

The additional portion that was surveyed consisted of only the Woodland habitat type and was considered to be poor fauna habitat due to high fragmentation, proximity to roads and agricultural areas, and low habitat complexity e.g. no hollows, logs, or rocky crevices for shelter. This additional portion is very unlikely to be of any significant habitat value for conservation-listed species and is only suitable for small common vertebrate species.

No additional species were recorded in this portion that weren't recorded in the greater survey area.

The post-survey likelihood assessment is as per the greater survey area. No additional conservation-listed fauna have a high likelihood of occurring due to the small extent of habitat available. Two species, Peregrine Falcon and Western Rosella, 'may occur' in the survey area, however, would not be dependent on the resources available and would be transient only.

6 CONCLUSIONS/DWER'S 10 CLEARING PRINCIPLES AND RECOMMENDATIONS

6.1 DWER'S 10 CLEARING PRINCIPLES

The following table is provided to summarise the likely significant findings of the survey and how they are likely to be assessed, based on DWER's 10 clearing principles (Department of Environment Regulation 2014).

This assessment takes into consideration that WestWind Energy is not proposing to clear bushland except in part of a small extent herein referred to as the 'additional survey area'.

Table 11: Assessment against DWER's 10 clearing principles

Principle	Assessment	Outcome
Principle (a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The majority of the bushland portions of the survey area are not proposed to be cleared. The small areas to be cleared are unlikely to be considered as having a high level of biodiversity with the shrubland (vegetation type AcMfTOS) has a species richness of 16 species from the representative quadrats and mallee woodland (vegetation type **EcEfEtMMW**) has a species richness of 20.5. The faunal species richness is also likely to be low due to the fragmentation of native bushland in the survey area.	Unlikely to be at variance
Principle (b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	No conservation-listed fauna species were recorded nor is the native vegetation within the survey area likely to be significantly utilised by transient species.	Unlikely to be at variance
Principle (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No rare (Threatened) flora were recorded, nor P1 or P2 flora species. None are likely to occur in either the wider survey area or area that is proposed to be cleared.	Unlikely to be at variance
Principle (d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	The Eucalypt Woodlands of the Western Australian Wheatbelt TEC occurs along road reserves within the wider survey area. However, no areas of TEC are proposed to be cleared.	Unlikely to be at variance
Principle (e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area proposed for clearing is within pre-European vegetation association 960 which has 13.78% of its original extent remaining[1]. However, despite clearing being 'at variance' as a result of its remaining extent, the small extent to be cleared will have a negligible impact on the association and local area as a whole.	At variance
Principle (f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	The portion wherein clearing is proposed is not associated with any watercourses or wetlands.	Unlikely to be at variance

[1] (DBCA 2019)

Principle	Assessment	Outcome
Principle (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The small amount of proposed clearing is unlikely to cause any appreciable land degradation due to its small extent and it not being associated with an area that may cause indirect impacts (e.g. dust, erosion, excessive runoff, contamination).	Unlikely to be at variance
Principle (h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no nearby conservation lands.	Unlikely to be at variance
Principle (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The proposed clearing is not likely to affect any surface or underground water.	Unlikely to be at variance
Principle (j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The small extent of proposed clearing is unlikely to cause any additional rainwater runoff.	Unlikely to be at variance

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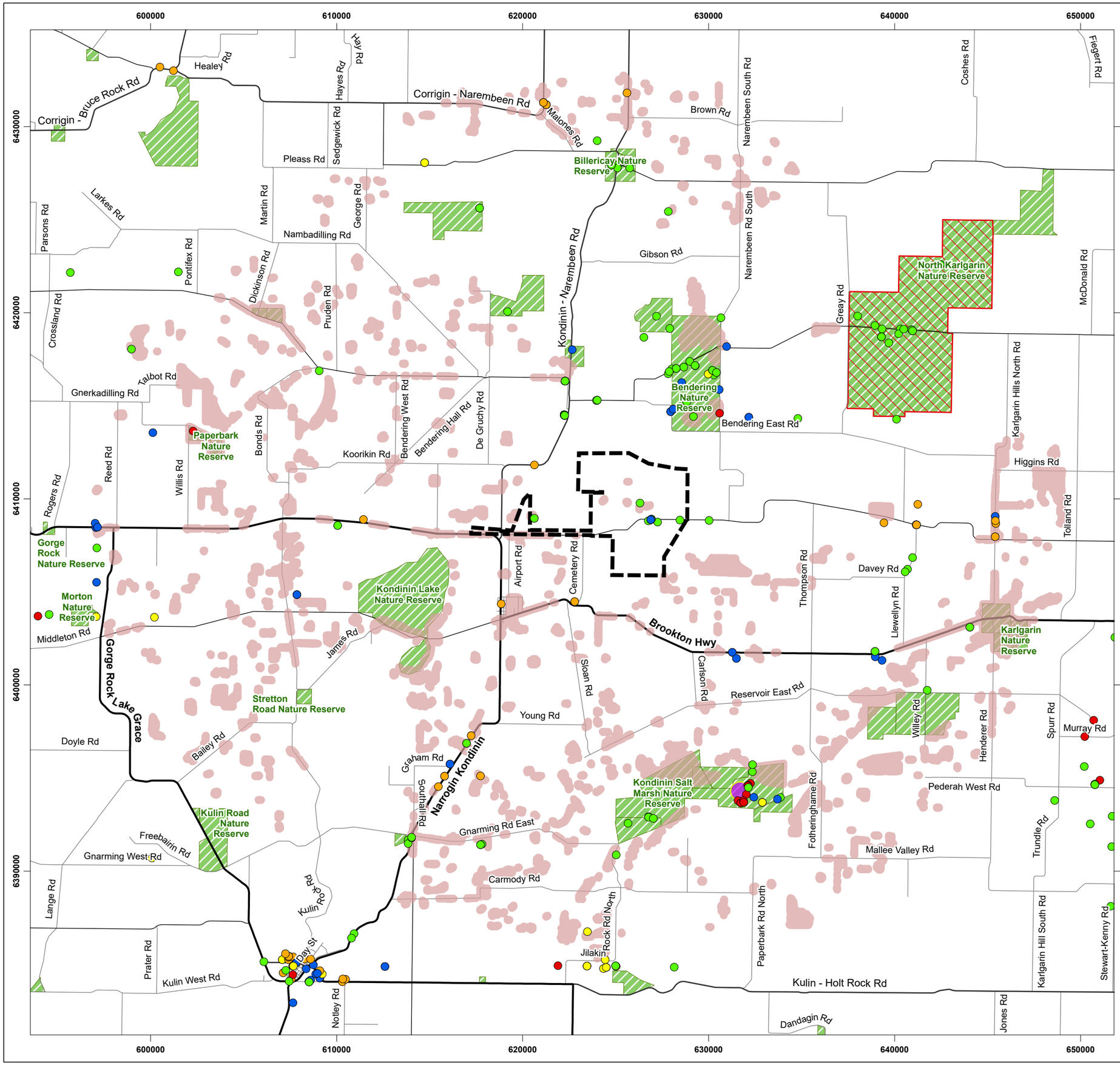
MAPS



LEGEND

- Survey Area
- Environmentally Sensitive Areas (DWER-046)
- DBCA Legislated Lands and Waters (DBCA-011)

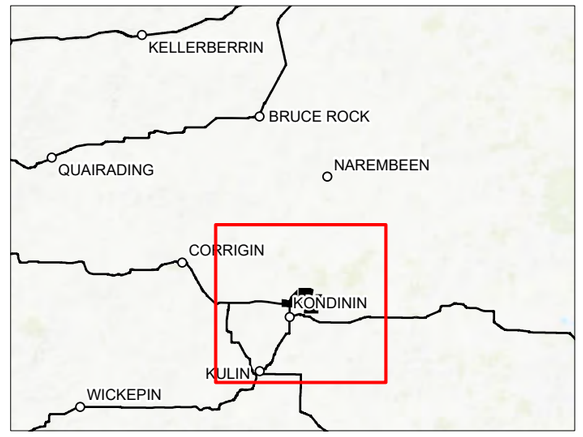
Threatened Ecological Communities (DBCA, 2023)

- Gypsum Dunes (PEC)
- Wheatbelt Woodlands (TEC)

Conservation Significant Flora (DBCA, 2023)

- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

DATA SOURCES:
SOURCE DATA: CLEARING REGULATIONS - ENVIRONMENTALLY SENSITIVE AREAS (DWER-046) (DWER 2021). DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2022). ROAD NETWORK (MRWA 2023).
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, USGS



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DBCA DATABASE SEARCH RESULTS FLORA AND COMMUNITIES

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

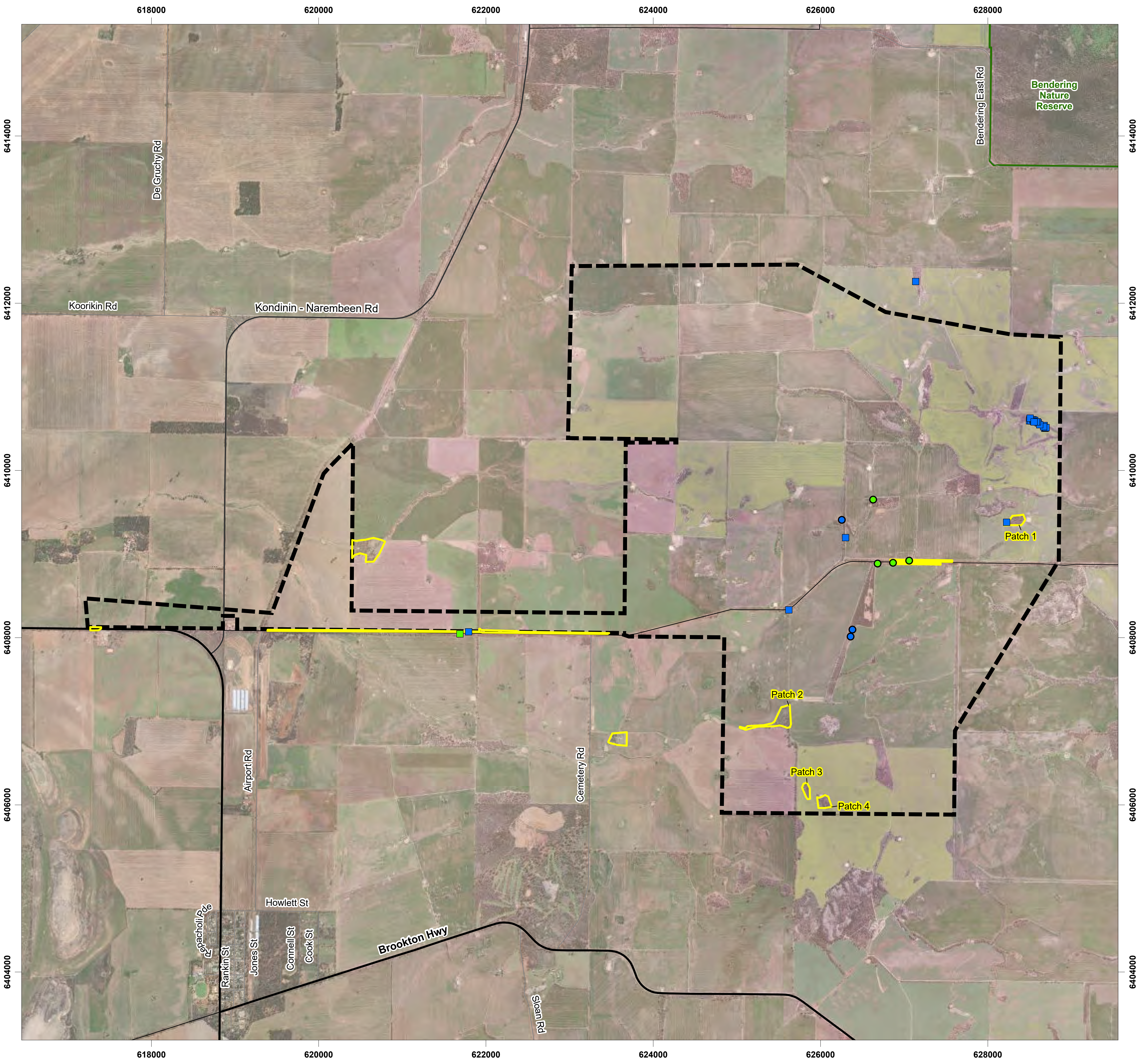
SCALE: 1:200,000 @ A3

0 2 3 5 6 8 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 01



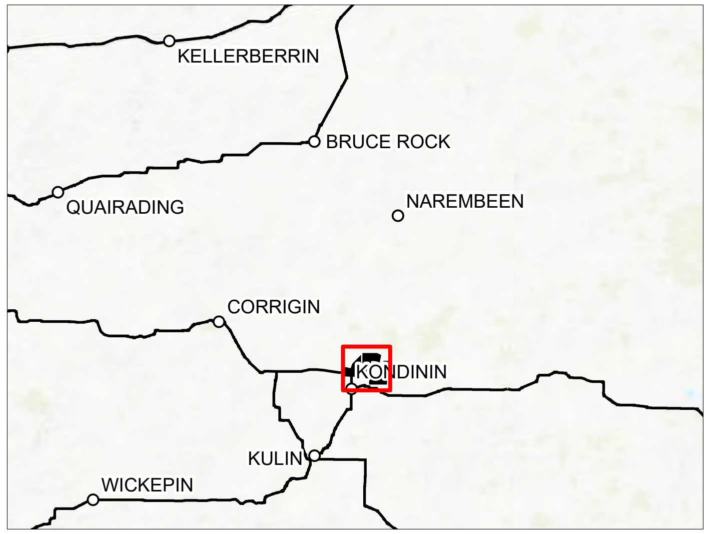
LEGEND

- 2023 Survey Area
- DBCA Legislated Lands and Waters (DBCA-011)
- Threatened Ecological Communities (SW Environmental, 2017)

Conservation-listed flora (SW Environmental, 2017)

- *Eremophila veneta* (P4)
- *Eucalyptus erythronema* subsp. *inornata* (P3)
- *Eucalyptus ornata* (P3)
- *Grevillea asteriscosa* (P4)

DATA SOURCES:
SOURCE DATA: DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2022). ROAD NETWORK (MRWA 2023).
IMAGERY: ESRI BASEMAP, 2022
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, USGS
WORLD IMAGERY: MAXAR



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SW ENVIRONMENTAL 2017 SURVEY RESULTS

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

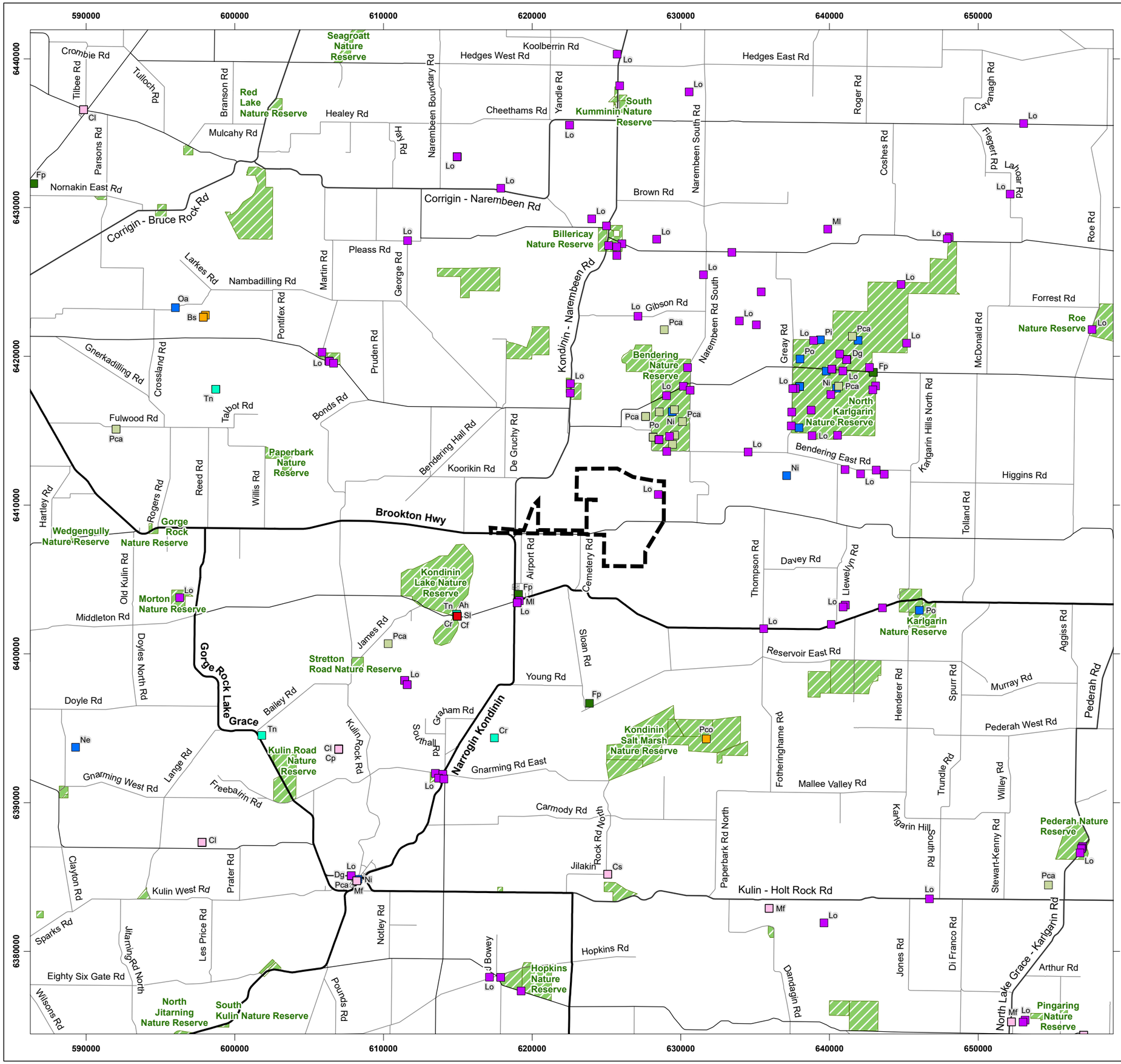
SCALE: 1:45,000 @ A3

0 1 2 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 02



LEGEND

- Survey Area
- DBCA Legislated Lands and Waters (DBCA-011)

Conservation Significant Fauna (DBCA, 2023)

- Critically Endangered
- Endangered
- Vulnerable
- Migratory Species
- Conservation Dependent
- Other Specially Protected
- Priority 1
- Priority 4

Label	Taxon	Status
Ah	*Actitis hypoleucos*	MI
Bp	*Bettongia penicillata ogilbyi*	CR
Bs	*Branchinella simplex*	P1
Cp	*Cacatua pastinator pastinator*	CD
Cf	*Calidris ferruginea*	CR
Cr	*Calidris ruficollis*	MI
Cl	*Calyptorhynchus latirostris*	EN
Cs	*Calyptorhynchus* sp. 'white-tailed black cockatoo'	EN
Dg	*Dasyurus geoffroii*	VU
Fp	*Falco peregrinus*	OS
If	*Isoodon fusciventer*	P4
Lf	*Lagostrophus fasciatus fasciatus*	VU
Lo	*Leipoa ocellata*	VU
Ml	*Macrotis lagotis*	VU
Mf	*Myrmecobius fasciatus*	EN
Ne	*Notamacropus eugenii derbianus*	P4
Ni	*Notamacropus irma*	P4
Oa	*Oxyura australis*	P4
Pco	*Parartemia contracta*	P1
Pca	*Phascogale calura*	CD
Pi	*Platycercus icterotis xanthogenys*	P4
Po	*Pseudomys occidentalis*	P4
Sl	*Stercorarius longicaudus*	MI
Tn	*Tringa nebularia*	MI

DATA SOURCES:
SOURCE DATA: CLEARING REGULATIONS - ENVIRONMENTALLY SENSITIVE AREAS (DWER-046) (DWER 2021). DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2022). ROAD NETWORK (MRWA 2023).
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, USGS

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DBCA DATABASE SEARCH RESULTS FAUNA

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:250,000 @ A3

0 2 4 6 8 10 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 03

618000 620000 622000 624000 626000 628000

6414000 6412000 6410000 6408000 6406000 6404000

De Gruchy Rd
Koorikin Rd
Kondinin - Narembeen Rd
Bendering East Rd
Airport Rd
Cemetery Rd
Howlett St
Brookton Hwy
Sloan Rd
Rankin St
Jones St
Connell St
Cook St

Grevillea asteriscosa
Eucalyptus ornata
Eucalyptus erythronema subsp. *inornata*
K23R01

LEGEND

- 2023 Survey Area
- 2023 Flora Survey Tracks
- Flora Relevé (Ecoscape, 2023)

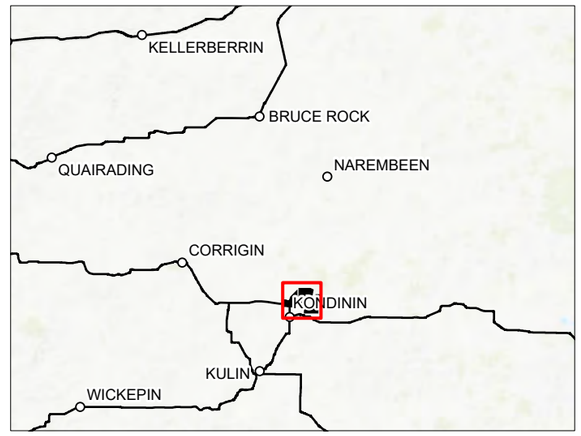
Conservation-listed flora (SW Environmental, 2017)

- *Eucalyptus erythronema* subsp. *inornata* (P3)
- *Eucalyptus ornata* (P3)
- *Grevillea asteriscosa* (P4)

Conservation-listed flora (Ecoscape, 2023)

- Priority 3
- Priority 4

DATA SOURCES:
SOURCE DATA: ROAD NETWORK (MRWA 2023).
IMAGERY: ESRI BASEMAP, 2022
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, USGS
WORLD IMAGERY: MAXAR



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CONSERVATION-LISTED FLORA

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

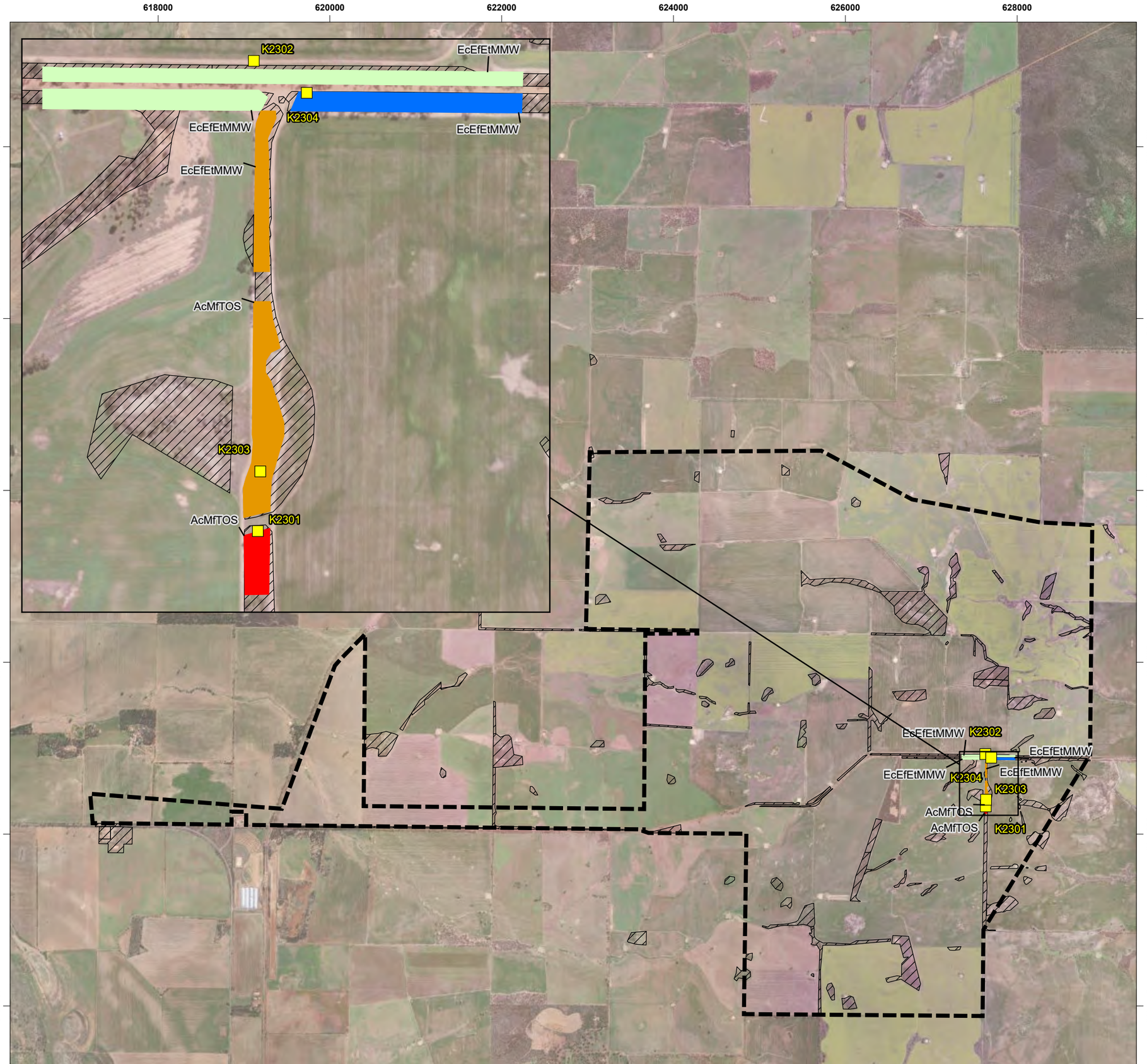
SCALE: 1:45,000 @ A3

0 1 2 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 04



LEGEND

- Flora Quadrats (Ecoscape, 2023)
- 2023 Survey Area
- 2017 Vegetation Survey (SW Environmental)

Vegetation Condition

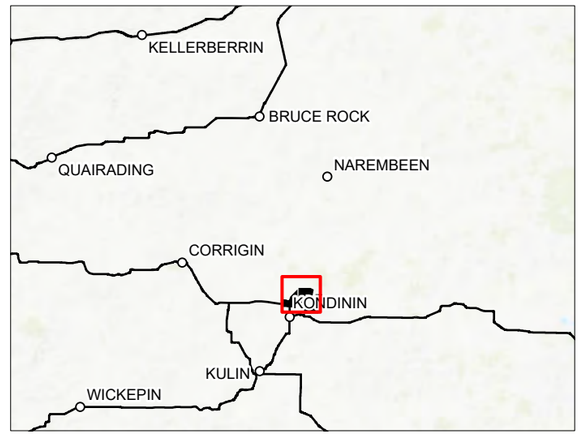
- Excellent
- Very Good
- Degraded
- Completely Degraded

Vegetation Types

AcMfTOS: *Allocasuarina campestris* and *Melaleuca fulgens* tall open shrubland over **Vulpia myuros forma myuros, Austrostipa elegantissima* and **Hypochaeris glabra* low grassland/tussock grassland/forbland

EcEfEtMMW: *Eucalyptus calycogona* subsp. *calycogona*, *E. flocktoniae* subsp. *flocktoniae* and *E. tenera* mid mallee woodland over *Melaleuca adnata, M. marginata* and *M. acuminata* mid open shrubland over *Phebalium multiflorum* subsp. *baccharoides, Olearia muelleri* and *Rytidosperma acerosum* low open shrubland/tussock grassland

DATA SOURCES:
SOURCE DATA: ROAD NETWORK (MRWA 2023).
IMAGERY: ESRI BASEMAP, 2022
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, FAO, USGS
WORLD IMAGERY: MAXAR



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VEGETATION TYPES AND CONDITION (ADDITIONAL AREA)

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:45,000 @ A3

0 1 2 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 05

618000 620000 622000 624000

6412000 6410000 6408000 6406000

De Gruchy Rd
Koorikin Rd
Kondinin - Narembeen Rd
Brookton Hwy
Airport Rd
Cemetery Rd

5 4 3 20 19 30 29 31 28

0

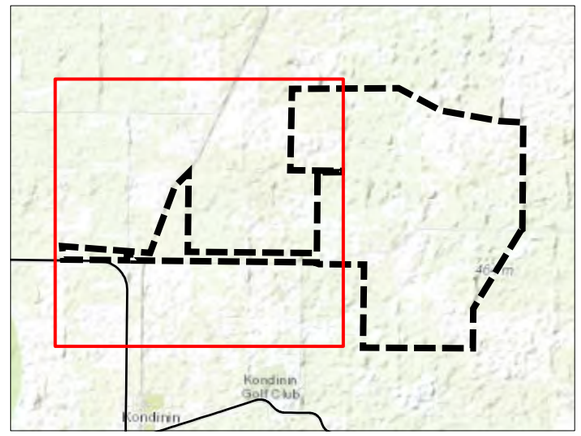
LEGEND

- 2023 Survey Area
- Fauna Survey Tracks (Ecoscape, 2023)
- Fauna Habitat Assessment Site (Ecoscape, 2023)

Fauna Habitat (Ecoscape, 2023)

- Drainage Line
- Rock Outcrop
- Shrubland
- Woodland

DATA SOURCES:
SOURCE DATA: ROAD NETWORK (MRWA 2023).
IMAGERY: ESRI BASEMAP, 2022
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, USGS, NGA
WORLD IMAGERY: MAXAR



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FAUNA HABITAT

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

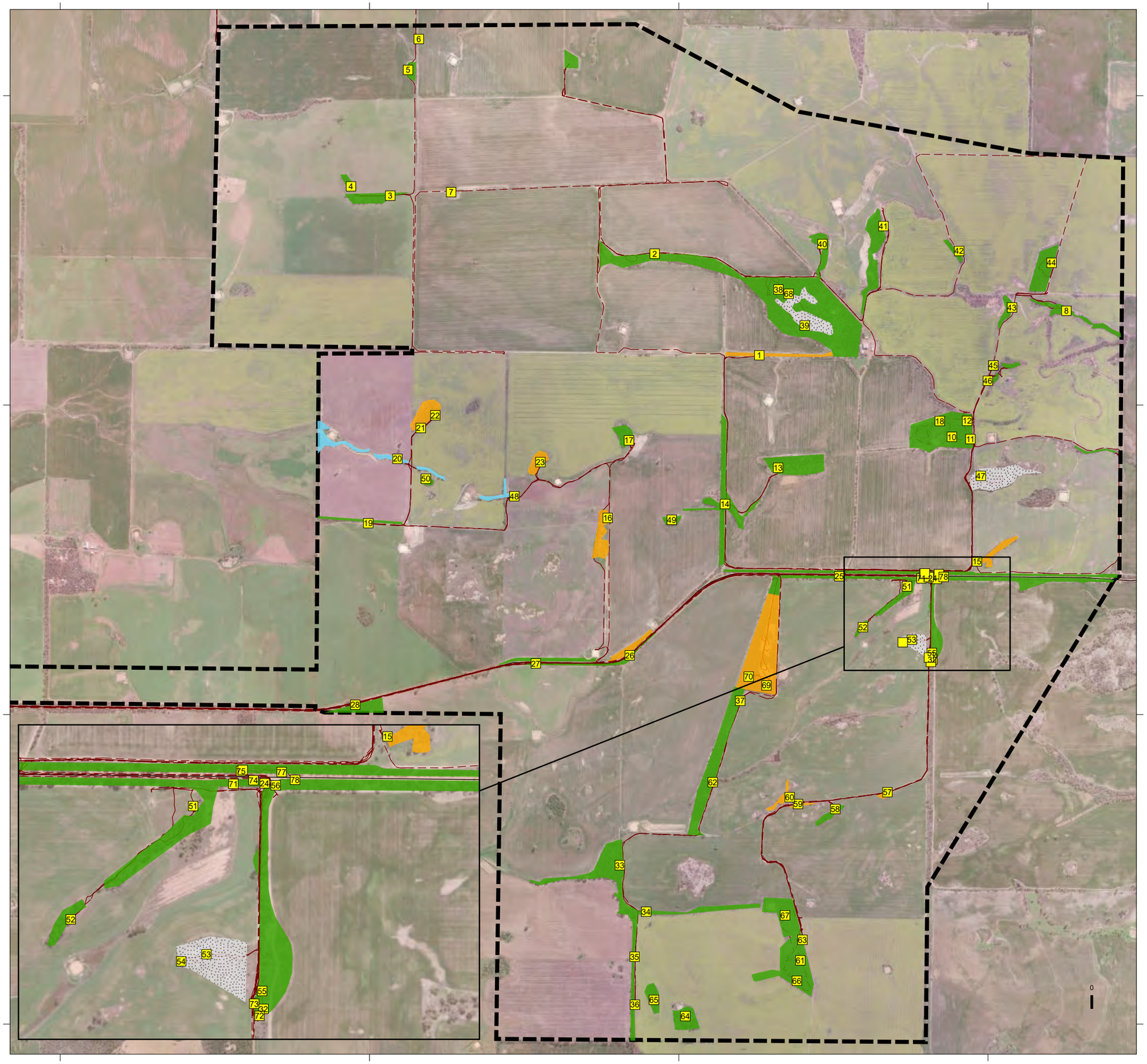
SCALE: 1:25,000 @ A3

1 2 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 6A



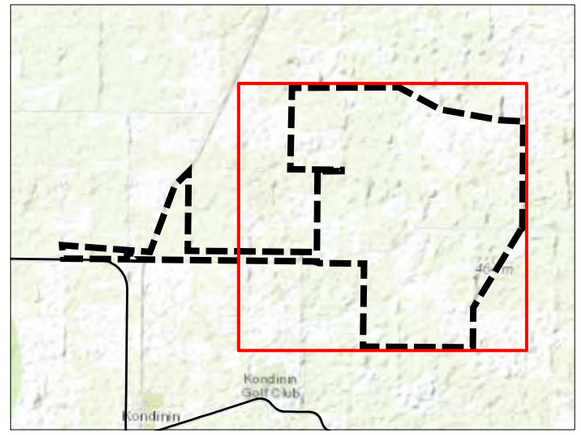
LEGEND

- 2023 Survey Area
- Fauna Survey Tracks (Ecoscape, 2023)
- Fauna Habitat Assessment Site (Ecoscape, 2023)

Fauna Habitat (Ecoscape, 2023)

- Drainage Line
- Rock Outcrop
- Shrubland
- Woodland

DATA SOURCES:
SOURCE DATA: ROAD NETWORK (MRWA 2023).
IMAGERY: ESRI BASEMAP, 2022
SERVICE LAYERS: WORLD TOPOGRAPHIC MAP: ESRI, HERE, GARMIN, USGS, NGA
WORLD IMAGERY: MAXAR



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FAUNA HABITAT

KONDININ WIND FARM BIOLOGICAL SURVEY

WestWind ENERGY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:25,000 @ A3

1 2 km

PROJECT NO: 4840-23

REV	AUTHOR	APPROVED	DATE
0	SB	LJA	07/12/2023

MAP 6B

APPENDIX ONE LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 12**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DCCEEW 2023b). The list of migratory species established under section 209 of the EPBC Act comprises:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 12: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) 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.	n/a
Critically Endangered (CR)	A native species is eligible to be included in the *critically endangered* category 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.	An ecological community is eligible to be included in the *critically endangered* category 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
Endangered (EN)	A native species is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Category	Threatened species	Threatened Ecological Communities
Vulnerable (VU)	A native species is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) 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; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 13**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 12** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 30 September 2022 (Government of Western Australia 2022).

PRIORITY-LISTED FLORA AND FAUNA

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 13**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 13**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as 'specially protected species' in the BC Act.

Table 13: Conservation codes for Western Australian flora and fauna (DBCA 2020)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. **The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.** **Categories of Threatened, Extinct and Specially Protected fauna and flora are:**	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). **Threatened fauna** is the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species. **Threatened flora** is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species. The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline (Number 1) and Ministerial Guideline (Number 2) that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria4, and is based on the national distribution of the species

Conservation Codes for Western Australian Flora and Fauna	
CR	**Critically endangered species** Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as critically endangered undersection 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	**Endangered species** Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.
VU	**Vulnerable species** Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as vulnerable undersection 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.
Extinct species **Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.**	
EX	**Extinct species** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	**Extinct in the wild species** Species that "*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25of the BC Act).
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
MI	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
CD	**Species of special conservation interest (conservation dependent)** Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act)
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18of the BC Act).
P	**Priority species** Priority is not a listing category under the BC Act. All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land). Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened. Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Conservation Codes for Western Australian Flora and Fauna	
1	**Priority 1: Poorly-known species – known from few locations, none on conservation lands** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, for example, agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. These species are in urgent need of further survey.
2	**Priority 2: Poorly-known species – known from few locations, some on conservation lands** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, for example, national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.
3	**Priority 3: Poorly-known species – known from several locations** Species that are known from several locations and the species does not appear to be under imminent threat or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. These species need further survey.
4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species 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. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
[1] The definition of flora includes algae, fungi and lichens. **[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).**	

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 14**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018b).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 21 December 2022 (Species and Communities Program, DBCA 2022). Definitions and criteria for PECs are shown in **Table 14**.

Table 14: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. 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 (A or B): A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. 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. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. 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. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Criteria	Definition
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	*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. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	*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, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.
Priority Three	*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 may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	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. i. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	*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.

FLORA CRITERIA

OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (WAH 1998-2023) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2021). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

VEGETATION CRITERIA

OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as

Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018).

APPENDIX TWO FIELD SURVEY CRITERIA

Table 15: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group & DotEE 2017)

	Cover characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 16: NVIS height classes (NVIS Technical Working Group & DotEE 2017)

Height		Growth form				
Height Class	**Height Range (m)**	**Tree, vine (M & U), palm (single-stemmed)**	**Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)**	**Tree mallee, mallee shrub**	**Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)**	**Bryophyte, lichen, seagrass, aquatic**
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low
Source: (based on Walker & Hopkins 1990)						

Table 17: Vegetation condition scale for the South West and Interzone Botanical Provinces (EPA 2016a)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.

APPENDIX THREE WHEATBELT WOODLANDS TEC ASSESSMENT CRITERIA

The *Eucalypt Woodlands of the Western Australian Wheatbelt* was listed as a Critically Endangered TEC under the EPBC Act. This TEC occurs in the southwest of Western Australia, between the Darling Range and western edge of the goldfields, in the Avon Wheatbelt IBRA region and the Mallee IBRA subregion MAL02 Western Mallee. The TEC is defined as being dominated by eucalypt species with a tree or mallet form over a highly variable understorey (TSSC 2015).

The key characteristics for vegetation to be included in this TEC (TSSC 2015) are that:

- it occurs in the Western Australian Wheatbelt (and a few occurrences on adjacent IBRA regions), located on the Yilgarn Craton and receives less than 600 mm mean annual rainfall
- it has a tree canopy dominated by one or more of 31 taxa of Eucalypt (*Eucalyptus*) species having tree or mallet form (i.e. a single trunk) (Table 24). These Eucalypts do not include those that are limited to specified landscapes (e.g. granite outcrops, lateritic hills or other rocky rises) or whose main distribution is outside the Wheatbelt.
- the upper stratum (tree canopy) in a mature woodland must be greater than 10% crown cover (unless the loss of canopy cover is temporary e.g. fire)
- the associated non dominant (or not co-dominant) canopy species are listed; these include *Acacia acuminata* (Jam), *Allocasuarina huegeliana* (Rock Oak), *Corymbia calophylla* (Marri) and a number of other (mostly mallee-form) *Eucalyptus* species (although the list provided is not considered to be comprehensive)
- the understorey (mid and ground strata) is highly variable, and includes sparse to absent forms, herbs, scrubs and heaths, chenopods, thickets (predominantly *Melaleuca* species) and salt tolerant species (including *Tecticornia*). The species must be predominantly native.
- meets the condition threshold, according to the table below (**Table 18**)
- it includes the following DBCA-listed Priority Ecological Communities: Brown mallet (*Eucalyptus astringens*) communities in the western Wheatbelt on alluvial flats (Priority 1), Red Morrel woodland of the Wheatbelt (Priority 1), Yate (*Eucalyptus occidentalis*) dominated alluvial claypans of the Jingalup soil system (Priority 2).

Table 18: Key dominant or co-dominant Eucalypt species of the Wheatbelt Woodlands TEC (TSSC 2015)

Species		
Eucalyptus accedens	*Eucalyptus longicornis*	*Eucalyptus salicola*
Eucalyptus aequioperta	*Eucalyptus loxophleba* subsp. *loxophleba*	*Eucalyptus salmonophloia*
Eucalyptus alipes	*Eucalyptus melanoxylon*	*Eucalyptus salubris*
Eucalyptus astringens subsp. *astringens*	*Eucalyptus mimica* subsp. *continens*	*Eucalyptus sargentii* subsp. *sargentii*
Eucalyptus capillosa	*Eucalyptus mimica* subsp. *mimica*	*Eucalyptus singularis*
Eucalyptus densa subsp. *densa*	*Eucalyptus myriadena*	*Eucalyptus spathulata* subsp. *spathulata*
Eucalyptus extensa	*Eucalyptus occidentalis*	*Eucalyptus spathulata* subsp. *salina*
Eucalyptus falcata	*Eucalyptus ornata*	*Eucalyptus urna*
Eucalyptus gardneri subsp. *gardneri*	*Eucalyptus recta*	*Eucalyptus wandoo* subsp. *pulverea*
Eucalyptus goniocarpa	*Eucalyptus rudis* subsp. *rudis*	*Eucalyptus wandoo* subsp. *wandoo*
Eucalyptus kondininensis		

The following characteristics indicate that the TEC is unlikely to be present (i.e. contraindications):

- the dominant Eucalypts have a mallee form (including *Eucalyptus loxophleba* subsp. *supralaevis* that can be tree or mallee form, this taxon has been explicitly excluded from being representative of the TEC)
- the dominant canopy tree is not a Eucalypt
- tree canopy is less than 10% cover
- the woodland is in an adjacent bioregion

- the woodland is on a granite outcrop or rocky rise, although woodlands at the base of outcrops may be included
- the woodland is a small, fragmented patch[A] (including isolated paddock trees, narrow stands including windbreaks or shelterbelts)
- narrow roadside (or other) remnants <5 m wide including where the tree canopy is <10% cover or the understorey has lost considerable elements of its native structure or diversity.

Table 19: Minimum condition for patches of Eucalypt Woodlands of the Western Australian Wheatbelt TEC (TSSC 2015)

Cover of exotic plants (weeds) AND	Mature trees (1) AND	Minimum patch size (non-roadside patches) (2) AND	Minimum patch width (roadside patches only) (3)
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very Good (Keighery 1994) or a High RCV (RCC 2014, available in DPaW 2015)(RCC 2014, available in DPaW 2015).			
Exotic plant species account for 0 to 30% of total vegetation cover in the understory layers (i.e. below the tree canopy).	Mature trees may be present or absent.	2 ha or more	5 m or more
Category B: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014, available in DPaW 2015) AND retains important habitat features.			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understory layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	2 ha or more	5 m or more
Category C: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014, available in DPaW 2015).			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees either absent or less than 5 trees per 0.5 ha are present.	5 ha or more	5 m or more
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery 1994) or a Medium-Low to Medium-High RCV (RCC 2014, available in DPaW 2015) BUT retains important habitat features.			
Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	5 ha or more	5 m or more

(1) Mature trees have a minimum diameter at breast height (DBH) of 30 cm.
(2) Minimum patch size thresholds apply to native vegetation remnants, not to road verges where width thresholds apply.
(3) This applies only to narrow roadside remnants and recognises their importance as wildlife corridors, habitats for threatened species or other reasons as defined by Jackson (2002) and RCC (DPaW 2015). The defined width is that of the native understorey component, not tree canopy width. Breaks of over 50 m or separation by a sealed road define separate 'patches'.

[A] A 'patch' refers to an area of the same broad vegetation within a larger remnant. Remnants may have several patches of the same vegetation that are not joined i.e. they are separated by vegetation of a different type or significant roads.

For this TEC a 'patch' refers to a combined Eucalypt woodland regardless of characteristic species and may include more than one woodland vegetation type the extents of which are combined (when adjacent) to form the extents used to calculate if the appropriate thresholds are met.

APPENDIX FOUR DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 20: Flora database search results, habitat and likelihood assessment

Blue shading indicates high likelihood; dark blue indicates species is known (recorded) from the survey area

Database		Taxon	BC status**	EPBC status**	Description and habitat (*FloraBase*; WAH 1998-2023)	Likelihood of occurrence	
PMST*	DBCA					Desktop	Post-survey
		Threatened					
May		*Acacia ataxiphylla* subsp. *magna*	EN	EN	Spreading to ascending shrub, 0.3-0.6 m high. Fl. yellow, Jun to Jul. Sandy soils. Lateritic ironstone rises, flats.	Very Unlikely	Very Unlikely
May		*Acacia lanuginophylla*	VU	EN	Dense shrub, 0.5-1.2 m high. Fl. yellow, Jul to Oct. White/grey sand, clayey sand, gravelly soils. Flats, along drainage lines.	Very Unlikely	Very Unlikely
May		*Andersonia gracilis*	VU	EN	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Very Unlikely	Very Unlikely
May		*Banksia oligantha*	EN	EN	Non-lignotuberous shrub, to 3 m high. Fl. red & cream/orange-brown, Oct to Nov. Yellow or yellow-brown sand.	Very Unlikely	Very Unlikely
May		*Banksia sphaerocarpa* var. *dolichostyla* (more recently known as *Banksia dolichostyla* in WA)	VU	VU	Lignotuberous shrub, 1-3 m high. Fl. yellow-orange, Mar to May. Lateritic gravel, grey sand.	Very Unlikely	Very Unlikely
Known	x	*Boronia capitata* subsp. *capitata*	VU	EN	Slender shrub, 0.3-1.3 m high. Fl. pink, Aug to Dec or Feb. Sand, often over laterite. Sandplains.	Unlikely	Unlikely
Known	x	*Caladenia graniticola*	EN	EN	Tuberous, perennial, herb, to 0.21 m high, plant usually single flowered. Fl. green-yellow, Oct. Gritty sandy clay, granite. Near low exposed rock outcrops.	Very Unlikely	Very Unlikely
Known		*Caladenia hoffmanii*	EN	EN	Tuberous, perennial, herb, 0.13-0.3 m high. Fl. green & yellow & red, Aug to Oct. Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Very Unlikely	Very Unlikely
May		*Caladenia melanema*	CR	CR	Tuberous, perennial, herb, 0.08-0.15 m high. Fl. cream & red & black, Aug to Sep. Sandy-clay loam. Rises above salt lakes.	Very Unlikely	Very Unlikely
Known		*Calectasia pignattiana*	EN	VU	Rhizomatous, prickly herb, to 0.5 m high. Fl. blue-purple, Aug to Oct. Sand to sandy clay over granite or laterite, gravel. Plains and gentle slopes.	Very Unlikely	Very Unlikely
Known		*Conospermum galeatum*	CR	CR	Open shrub, ca 0.9 m high. Fl. white, Aug to Sep. Yellow sand.	Very Unlikely	Very Unlikely
Known	x	*Conostylis rogeri*	VU	VU	Rhizomatous, tufted perennial, grass-like or herb, 0.025-0.05 m high. Fl. yellow, Sep. Sandy loam.	Very Unlikely	Very Unlikely
May		*Dasymalla axillaris*	CR	CR	Diffuse shrub, 0.15-0.3 m high. Fl. red, Jul to Dec. Sandy soils.	Very Unlikely	Very Unlikely
Likely		*Duma horrida* subsp. *abdita*	EN	CR	Shrub, 0.6-1.2 m high. Waterlogged silt, sand. Partially submerged in freshwater lakes.	Very Unlikely	Very Unlikely
May		*Eremophila resinosa*	EN	EN	Spreading shrub, 0.4-0.8 m high, to 1 m wide. Fl. blue-purple-white, Apr or Oct to Nov. Clay loam, gravelly sandy clay. Road verges.	Very Unlikely	Very Unlikely
Known	x	*Eremophila verticillata*	CR	EN	Low spreading shrub, up to 0.8 m high, to 1 m wide. Fl. purple-violet, Nov to Dec. Clay loam, loam over limestone.	Very Unlikely	Very Unlikely
May		*Eremophila viscida*	EN	EN	Shrub, 1.2-4 m high. Fl. green-white-yellow, Sep to Nov. Granitic soils, sandy loam. Stony gullies, sandplains.	Very Unlikely	Very Unlikely

Database		Taxon	BC status**	EPBC status**	Description and habitat (*FloraBase*; WAH 1998-2023)	Likelihood of occurrence	
PMST*	DBCA					Desktop	Post-survey
Likely		*Gastrolobium diabolophyllum*	CR	CR	Erect, open, robust shrub, to 1.5 m high. Fl. orange&yellow&pink&red, Sep. Yellow-brown sand over laterite. Broadly undulating dunes.	Very Unlikely	Very Unlikely
Known		*Grevillea dryandroides* subsp. *hirsuta*	VU	EN	Prostrate, vigorously suckering shrub, 0.05-0.3 m high. Fl. red/pink-red, May or Sep to Nov. White or yellow sand, laterite.	Very Unlikely	Very Unlikely
May		*Grevillea involucrata*	EN	EN	Prostrate to low-domed open shrub, 0.15-0.3 m high, up to 2 m wide. Fl. pink/pink-red, Jun or Oct. Gravelly sand.	Very Unlikely	Very Unlikely
Known	x	*Grevillea scapigera*	CR	EN	Suckering, prostrate to weakly ascending shrub, 0.15-0.4 m high, up to 1.8 m wide. Fl. white/yellow-green, Feb or Oct to Nov. Sandy or gravelly lateritic soils.	Very Unlikely	Very Unlikely
Known		*Guichenotia seorsiflora*	CR	CR	Multi-stemmed shrub, to 0.6 m high. Fl. pink/pink-cream, Jul to Sep. Sandy clay with lateritic gravel. Breakaways.	Very Unlikely	Very Unlikely
Known		*Rhizanthella gardneri*	CR	CR	Tuberous, perennial, herb, flowers develop under the surface and break through as they mature; flowers c. 6 mm long, 5 mm wide. Fl. pink-purple, May to Jul. Sand. Grows in association with Melaleuca uncinata.	Very Unlikely	Very Unlikely
Known	x	*Roycea pycnophylloides*	VU	EN	Perennial, herb, forming densely branched, silvery mats to 1 m wide. Fl. Sep. Sandy soils, clay. Saline flats.	Very Unlikely	Very Unlikely
Known		*Stylidium applanatum*	CR	CR	Rosetted perennial, herb, 0.12-0.35 m high. Fl. yellow, Sep to Oct. Clay loam over laterite. Hillslopes, Mallee shrubland.	Very Unlikely	Very Unlikely
Known	x	*Symonanthus bancroftii*	CR	EN	Shrub, 0.15-0.25 m high. Fl. white, Sep. Clay over granite; wetland edges.	Very Unlikely	Very Unlikely
Known		*Thelymitra stellata*	EN	EN	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown, Oct to Nov. Sand, gravel, lateritic loam.	Very Unlikely	Very Unlikely
Likely		*Tribonanthes purpurea*	VU	VU	Tuberous, perennial, herb, 0.03-0.04 m high. Fl. pink-purple, Aug. Seasonally wet soils in moss swards & herbfields among granite rocks.	Very Unlikely	Very Unlikely
Known		*Verticordia staminosa* var. *cylindracea*	CR	EN	Spreading shrub, 0.3-0.8 m high. Fl. green-yellow/yellow-brown, Jul to Oct. Soil pockets. Granite outcrops.	Very Unlikely	Very Unlikely
		Priority 1					
	x	*Acacia kulinensis*			Intricately branched, prickly shrub 0.5–1.5 m tall, terminal branches relatively undivided. Bark grey. Grows in often gravelly sand or sandy loam over clay in low shrubland.	Very Unlikely	Very Unlikely
	x	*Acacia sclerophylla* var. *teretiuscula*			Spreading, much-branched shrub, 0.25-2.5 m high. Fl. yellow, Sep to Oct. Clay & loamy soils.	Very Unlikely	Very Unlikely
	x	*Acacia tetraneura*			Low spreading shrub, 0.3-0.4 m high. Fl. yellow, May to Jul. Clay & lateritic gravel. Ridges & low rises.	Very Unlikely	Very Unlikely
	x	*Acacia torticarpa*			Shrub (?). Fl. Jul. Sandplain.	Very Unlikely	Very Unlikely
	x	*Brachyloma delbi*			Erect, open shrub, to 1 m high. Fl. red, May. Gravel pit.	Very Unlikely	Very Unlikely
	x	*Chamelaucium* sp. Parker Range (B.H. Smith 1255)			Sandplain; laterite	Very Unlikely	Very Unlikely
	x	*Dampiera scaevolina*			Erect to ascending perennial, herb or shrub, 0.2-0.5 m high. Fl. blue/white, Sep to Nov. Sandy & gravelly soils.	Very Unlikely	Very Unlikely
	x	*Eremophila rarissima*			Low-growing, spreading shrub 30-50 cm high. Pale brown clay loam; adjacent to salt lakes	Very Unlikely	Very Unlikely

Database		Taxon	BC status**	EPBC status**	Description and habitat (*FloraBase*; WAH 1998-2023)	Likelihood of occurrence	
PMST*	DBCA					Desktop	Post-survey
	x	*Hibbertia* sp. Bendering (J.W. Horn 4101)			Dense shrubs 0.3-0.6 m in height. Corolla yellow. Androecium zygomorphic; carpels 2. Vegetation is thicket dominated by Allocasuarina and Acacia, with frequent Grevillea, Leptospermum and Micromyrtus. Soil is laterite, with duricrust not far from the soil surface.	Unlikely	Unlikely
	x	*Hysterobaeckea glandulosa*			Shrub 0.5–2 m high, 0.35–3 m wide, with prominent glands on young stems, peduncles and pedicels; Gently undulating site with sandy soil and low open woodland.	Very Unlikely	Very Unlikely
	x	*Melaleuca grieveana*			Compact shrub, to 0.75 m high. Fl. yellow, Jul. Well-drained orange-brown loam, brown clay. Plains, gentle slopes, edge of crop paddocks.	Very Unlikely	Very Unlikely
	x	*Pterostylis elegantissima*			Elegant rufous greenhood. Stems 150-450 mm high. Shallow soil on granite outcrops.	Very Unlikely	Very Unlikely
		Priority 2					
	x	*Acacia arcuatilis*			Rounded, spreading shrub, 0.4-1.5 m high, to 2 m wide. Fl. yellow, Jun to Aug. Sand or sandy loam, sometimes with lateritic gravel. Undulating plains, rises.	Unlikely	Unlikely
	x	*Acacia cowaniana*			Shrub or tree, 1-5(-8) m high, bark fibrous. Fl. white-cream/cream-yellow, Apr to Jul. Soil pockets. Granite outcrops.	Very Unlikely	Very Unlikely
	x	*Acacia sclerophylla* var. *pilosa*			Low spreading to erect shrub, 0.2-1 m high. Fl. yellow, Aug to Oct. Sandy loam or clay.	Very Unlikely	Very Unlikely
	x	*Banksia dallanneyi* subsp. *agricola*			Prostrate, lignotuberous shrub. Fl. yellow, Sep to Oct. Sandy loam or sand over laterite.	Very Unlikely	Very Unlikely
	x	*Banksia densa*			Shrub, (0.2-)0.6-3 m high. Fl. yellow, Jun to Sep. . Sand, clay, loam, gravel, laterite	Very Unlikely	Very Unlikely
	x	*Banksia epimicta*			Prostrate, spreading, lignotuberous shrub. Fl. brown-red, Jul to Sep. Sandy loam, white sand.	Very Unlikely	Very Unlikely
	x	*Desmocladus eludens*			Perennial sedge to 0.15 m. Slopes with sandy soil.	Very Unlikely	Very Unlikely
	x	*Leucopogon amplectens*			Erect shrub, 0.3-0.75 m high. Fl. white, Apr to Jul. Sandy soils.	Very Unlikely	Very Unlikely
	x	*Millotia steetziana*			Erect annual, herb, 0.015-0.03 m high. Fl. white, Sep. Sand. Under Melaleuca.	Very Unlikely	Very Unlikely
	x	*Synaphea flexuosa*			Much-branched, tangled shrub, ca 0.2 m high. Fl. yellow, Sep to Oct. Sandy loam, brown sand.	Very Unlikely	Very Unlikely
	x	*Thysanotus brachiatus*			Rhizomatous, leafless perennial, herb, to 0.3 m high. Fl. purple, Nov to Dec. Grey sand.	Very Unlikely	Very Unlikely
		Priority 3					
	x	*Acacia deflexa*			Prostrate to straggling or erect shrub, 0.15-2 m high. Fl. yellow, Aug to Sep. Yellow & gravelly lateritic sand, gravelly sandy loam. Plains.	Unlikely	Unlikely
	x	*Acacia inophloia*			Shrub or tree, 1-4 m high, bark fibrous & stringy. Fl. yellow, Aug to Oct. Yellow sand, gravelly granitic soils.	Unlikely	Unlikely
	x	*Acacia lanei*			Spreading shrub 2 m high. Grows with Eucalyptus loxophleba or E. salmonophloia along creek and drainage lines, in red or brown clay, clay loam or gravelly loam	Very Unlikely	Very Unlikely
	x	*Acacia undosa*			Dense, spreading shrub, 0.3-1.5 m high. Fl. yellow, Jul to Sep. Sandy clay loam, clayey sand. Undulating plains, low-lying areas.	Very Unlikely	Very Unlikely
	x	*Anticoryne melanosperma*			Shrub 0.2-1 m high. Terminal flowers. Sandplain.	Very Unlikely	Very Unlikely
	x	*Banksia erythrocephala* var. *inopinata*			Prickly, erect, lignotuberous shrub, 0.6-1 m high. Fl. yellow, Apr. White sand over laterite, gravelly clay.	Very Unlikely	Very Unlikely

Database		Taxon	BC status**	EPBC status**	Description and habitat (*FloraBase*; WAH 1998-2023)	Likelihood of occurrence	
PMST*	DBCA					Desktop	Post-survey
	x	*Banksia fasciculata*			Columnar, non-lignotuberous shrub, 1-2.5 m high. Fl. cream-yellow, May to Aug. Lateritic clay, sand over laterite.	Very Unlikely	Very Unlikely
	x	*Banksia rufa subsp. obliquiloba*			Ascending, lignotuberous shrub, to 1 m high. Fl. yellow, Sep to Oct. Gravelly loam. Sand over laterite.	Unlikely	Unlikely
	x	*Banksia xylothemelia*			Often sprawling, lignotuberous shrub, to 1 m high, sometimes suckering. Fl. yellow, Sep to Oct. Sandy loam, usually over laterite. Sandplains.	Very Unlikely	Very Unlikely
	x	*Brachyloma mogin*			Compact shrub, 0.4 m high. Fl. red/pink/white, Jun. Grey clayey sand. Swamp flat.	Very Unlikely	Very Unlikely
	x	*Calytrix nematoclada*			Shrub, 0.15-0.5(-1) m high. Fl. purple-pink, Sep or Nov to Dec or Jan. Yellow or grey sand. Sandplains.	Very Unlikely	Very Unlikely
	x	*Daviesia implexa*			Spreading or sprawling shrub, 0.4-1 m high. Fl. yellow/orange & red, Sep. Sand & laterite.	Very Unlikely	Very Unlikely
	x	*Dicrastylis reticulata*			Woolly shrub, (0.15-)0.6-1.2(-1.5) m high. Fl. white, Sep to Dec. Sandy soils, often over granite. Amongst granite rock, hills, flats.	Very Unlikely	Very Unlikely
	x	*Dielsiodoxa leucantha* subsp. *leucantha*			Open woodland, heathland or open shrub mallee and are usually associated with breakaways, often with white soils and quartz and/or lateritic gravel.	Very Unlikely	Very Unlikely
	x	*Eucalyptus erythronema* subsp. *inornata*			White-barked mallee. Non-glaucous branchlets/buds. Cream-yellow flowers. Sandy-loam soils.	Known	Known
	x	*Eucalyptus exigua*			(Mallee), 2-5 m high, bark smooth. Fl. white-cream, Mar. Sandy loam, white sand. Sandplains.	Very Unlikely	Very Unlikely
	x	*Eucalyptus ornata*			Tree, 6-10 m high, bark smooth, grey. Fl. white. Laterite. Ridges.	Known	Known
	x	*Eucalyptus spathulata* subsp. *salina*			(Mallett), to 8 m high, bark smooth, silvery grey over copper; leaves glossy olive-green. Fl. white. Grey-white sand, pale brown sandy clay over granite, saline soils. Flats, broad valley floors, saline depressions, edges salt lakes, rises.	Very Unlikely	Very Unlikely
	x	*Frankenia drummondii*			Prostrate shrub. Fl. white. Sand. Lake edges.	Very Unlikely	Very Unlikely
	x	*Hibbertia glabriuscula*			Erect, spindly shrub, 0.2-0.5 m high. Fl. yellow, Sep. Yellow sand over laterite. Sandplains with some laterite breakaways.	Very Unlikely	Very Unlikely
	x	*Lasiopetalum fitzgibbonii*			Erect, spreading shrub, 0.3-1.5 m high. Fl. blue-purple-pink, Sep to Nov. Sand, clay loam, lateritic soils. Undulating plains, hills.	Very Unlikely	Very Unlikely
	x	*Microcorys cephalantha*			Decumbent to ascending shrub, 0.1-0.45 m high. Fl. pink-white, Oct to Dec. . Sandy loam with lateritic gravel. Rises, sandplains	Very Unlikely	Very Unlikely
	x	*Oxymyrrhine plicata*			Shrub 0.3-0.7 m high. Fl. Dec-Jan. Sandy soils.	Very Unlikely	Very Unlikely
	x	*Pterostylis echinulata*			Hairy leafed snail orchid. Stems 40-80 mm high, densely hairy. Open woodland.	Very Unlikely	Very Unlikely
	x	*Salicornia globosa*			Hairy leafed snail orchid. Stems 40-80 mm high, densely hairy.	Very Unlikely	Very Unlikely
	x	*Stylidium sejunctum*			Caespitose perennial, herb, 0.25-0.45 m high. Fl. white/pink-purple, Sep to Nov. Clayey sand or loam, laterite. Outcrops, upper slopes, breakaways. Mallee and Allocasuarina shrubland.	Very Unlikely	Very Unlikely
	x	*Styphelia* sp. Dumbleyung (A.J.G. Wilson 146) PN			Dense, compact (domed) shrub to 1 m high or spreading dense shrub to 50 cm high. Dark green foliage, erect red flowers May-Nov. Sand, sand over laterite, laterite, decomposed granite.	Very Unlikely	Very Unlikely
	x	*Synaphea constricta*			Compact, tufted shrub, 0.2-0.5 m high. Fl. yellow, Jun to Sep. Sand or sandy clay-loam over laterite.	Very Unlikely	Very Unlikely
	x	*Synaphea drummondii*			Shrub. Fl. yellow, Jul to Sep. Sand over laterite.	Very Unlikely	Very Unlikely

Database		Taxon	BC status**	EPBC status**	Description and habitat (*FloraBase*; WAH 1998-2023)	Likelihood of occurrence	
PMST*	DBCA					Desktop	Post-survey
	x	*Thomasia tenuivestita*			Shrub, 0.6-2.5 m high. Fl. purple-pink, Jul to Oct. Granite, loam.	Very Unlikely	Very Unlikely
	x	*Thysanotus cymosus*			Caespitose perennial, herb (with fibrous roots with ellipsoidal tubers), to 0.3 m high. Fl. purple, Sep to Oct. . Clay, granitic or lateritic sand	Very Unlikely	Very Unlikely
		Priority 4					
	x	*Banksia parva*			Shrub 0.7-1.5 m high. Fl. Jun to Aug. Sand, sandy clay loam over laterite	Very Unlikely	Very Unlikely
	x	*Caladenia x triangularis*			Tuberous, perennial, herb.	Very Unlikely	Very Unlikely
	x	*Calothamnus brevifolius*			Erect, spreading shrub, 0.3-0.6(-0.8) m high. Fl. red, Jan to Feb or Apr. White/grey or yellow sand.	Very Unlikely	Very Unlikely
	x	*Eremophila caerulea* subsp. *merrallii*			Spreading or sprawling shrub, to 0.35 m high, to 0.8 m wide. Fl. blue-purple, Oct to Dec. Sand, clay or loam. Undulating plains.	Very Unlikely	Very Unlikely
	x	*Eremophila veneta*			Spreading or straggly shrub, 0.3-1.2 m high, to 1.8 m wide. Fl. green & yellow & purple, Oct to Nov. Clay to loam, white/grey sand. Plains & flats, slopes.	Known+	Very unlikely
	x	*Eucalyptus dissimulata* subsp. *dissimulata*			(Mallee), 1.7-4 m high, bark smooth, grey. Fl. cream, Dec. White or yellow sand. Sandplains.	Very Unlikely	Very Unlikely
	x	*Gastrolobium densifolium*			Low, dense shrub, to 0.7 m high. Fl. orange&purple, Sep to Oct. Sandy soils. Undulating dunes.	Very Unlikely	Very Unlikely
	x	*Grevillea asteriscosa*			Divaricately branched shrub, 0.3-2.6 m high. Fl. red, May or Jul to Nov. Gravelly or granitic soils. Gravel rises, granite outcrops.	Known	Known
	x	*Ptilotus fasciculatus*			Perennial, herb, with linear leaves. Fl. pink. Low-lying sandy soild, often saline.	Very Unlikely	Very Unlikely
	x	*Rinzia affinis*			Rounded or erect shrub, 0.2-0.7 m high. Fl. white/pink, Jul to Nov. Yellow sand, loam or sand with lateritic pebbles. Hills.	Very Unlikely	Very Unlikely

* PMST likelihood of occurrence or likelihood of habitat occurring

** Commonwealth EPBC Act and Western Australian BC Act conservation status

\+ SW Environmental (2017)

Table 21: Fauna database results and likelihood assessments

Blue shading indicates a high likelihood species. Species identified by database searches but not included in this assessment are listed in **Table 22**, along with the reason for their exclusion.

Species	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	WA	PMST**	DBCA	ALA	Desktop	Post-survey
Mammals								
Bettongia penicillata ogilbyi	Woylie	EN	EN	Known			Unlikely	Very Unlikely
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU	Likely	X		Unlikely	Unlikely
Macrotis lagotis	Bilby, Dalgyte, Ninu	VU	VU		X		Very Unlikely	Very Unlikely
Myrmecobius fasciatus	Numbat, Walpurti	EN	EN	Known	X		Very Unlikely	Very Unlikely
Notamacropus irma	Western Brush Wallaby		P4		X	X	Unlikely	Unlikely
Phascogale calura	Red-tailed Phascogale, Kenngoor	CD	VU	Known	X		Likely	Unlikely
Pseudomys occidentalis	Western Mouse		P4		X	X	Unlikely	Unlikely
Pseudomys shortridgei	Heath Mouse, Dayang, Heath Rat	EN	EN	Likely			Very Unlikely	Very Unlikely
Birds								
Actitis hypoleucos	Common Sandpiper	MI	MI	Known	X	X	Unlikely	Very Unlikely
Aphelocephala leucopsis	Southern Whiteface	VU	VU	Likely			Unlikely	Unlikely
Apus pacificus	Fork-tailed Swift	MI	MI	Likely			Unlikely	Unlikely
Bubulcus ibis	Cattle Egret	MI	MI	May			Unlikely	Unlikely
Cacatua pastinator pastinator	Muir's Corella	CD			X		Unlikely	Unlikely
Calidris acuminata	Sharp-tailed Sandpiper	MI	MI	May			Very Unlikely	Very Unlikely
Calidris ferruginea	Curlew Sandpiper	CR, MI	MI	Known	X	X	Unlikely	Very Unlikely
Calidris melanotos	Pectoral Sandpiper	MI	MI	May			Very Unlikely	Very Unlikely
Calidris ruficollis	Red-necked Stint	MI	MI		X	X	Unlikely	Very Unlikely
Chalcites osculans	Black-eared Cuckoo	MI	MI	Likely			Unlikely	Unlikely
Falco hypoleucos	Grey Falcon	VU	VU	May			Very Unlikely	Very Unlikely
Falco peregrinus	Peregrine Falcon	OS			X	X	Likely	May Occur
Leipoa ocellata	Malleefowl	VU	VU	Known	X		Likely	Unlikely
Merops ornatus	Rainbow Bee-eater	MI	MI	May			Unlikely	Unlikely
Motacilla cinerea	Grey Wagtail	MI	MI	May			Unlikely	Unlikely
Pezoporus occidentalis	Night Parrot	EN	EN	May			Very Unlikely	Very Unlikely
Platycercus icterotis xanthogenys	Western Rosella (inland)		P4		X		May Occur	May Occur
Stercorarius longicaudus	Long-tailed Jaeger, Long-tailed Skua	MI	MI		X	X	Unlikely	Very Unlikely

Species	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	WA	PMST**	DBCA	ALA	Desktop	Post-survey
Thinornis cucullatus	Hooded Plover, Hooded Dotterel	MI	MI	May			Very Unlikely	Very Unlikely
Tringa nebularia	Common Greenshank	MI	MI	May	X	X	Unlikely	Very Unlikely
Zanda baudinii	Baudin's Cockatoo	EN	EN			X	Unlikely	Unlikely
Zanda latirostris	Carnaby's Cockatoo	EN	EN	Likely			Unlikely	Unlikely

Table 22: Excluded species and reason for exclusion

Species	Common name	Conservation status		Reason excluded from assessment
		EPBC Act	WA	
Parartemia contracta	a brine shrimp (Wheatbelt)		P1	Invertebrate; not within the scope of the project
Branchinella simplex	a fairy shrimp (inland WA)		P1	Invertebrate; not within the scope of the project
Haliaeetus leucogaster	White-bellied Sea-Eagle			Migratory marine, no suitable habitat
Lagostrophus fasciatus fasciatus	Banded Hare-wallaby	VU	VU	Translocated into fenced reserve

APPENDIX FIVE FIELD SURVEY RESULTS

Table 23: Flora inventory (site x species matrix); additional survey area

Family	Taxa	Naturalised	K2301	K2302	K2303	K2304	K23opp
Aizoaceae	*Mesembryanthemum nodiflorum*	*					X
Asparagaceae	*Thysanotus patersonii*						X
Asteraceae	*Arctotheca calendula*	*	X	X			
	Calocephalus multiflorus						X
	Cotula bipinnata	*					X
	Hypochaeris glabra	*	X	X	X		
	Olearia muelleri			X		X	
	Olearia sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)						X
	Podolepis aristata subsp. *aristata*				X		
	Siemssenia capillaris						X
	Sonchus oleraceus	*		X			
	Ursinia anthemoides	*			X		
	Vittadinia gracilis						X
	Waitzia acuminata var. *acuminata*		X		X		
Boryaceae	*Borya constricta*						X
	Borya sphaerocephala						X
Brassicaceae	*Brassica tournefortii*	*		X		X	
Casuarinaceae	*Allocasuarina acutivalvis*						X
	Allocasuarina campestris		X		X		
Celastraceae	*Stackhousia monogyna*				X		
Chenopodiaceae	*Atriplex semibaccata*			X		X	
	Enchylaena lanata						X
	Enchylaena tomentosa var. *tomentosa*			X		X	
	Maireana brevifolia			X			
	Rhagodia drummondii						X
	Rhagodia preissii subsp. *preissii*						X
	Sclerolaena diacantha			X		X	
Convolvulaceae	*Wilsonia humilis*						X
Crassulaceae	*Crassula colorata*			X			
Cyperaceae	*Lepidosperma drummondii*						X
Droseraceae	*Drosera macrantha*						X
Fabaceae	*Acacia acanthoclada*						X
	Acacia acanthoclada subsp. *acanthoclada*						X
	Acacia brachyclada			X			
	Acacia erinacea					X	
	Acacia lasiocalyx				X		
	Acacia leptopetala						X
	Templetonia sulcata			X			
	Trifolium subterraneum	*	X				
Geraniaceae	*Erodium botrys*	*					X
	Erodium cygnorum				X		

Family	Taxa	Naturalised	K2301	K2302	K2303	K2304	K23opp
Goodeniaceae	*Coopernookia strophiolata*						X
	Dampiera lavandulacea				X		
Haloragaceae	*Glischrocaryon aureum*						X
Hemerocallidaceae	*Stypandra glauca*						X
Iridaceae	*Moraea setifolia*	*					X
Lamiaceae	*Westringia rigida*			X			
Myrtaceae	*Calothamnus quadrifidus*						X
	Eucalyptus calycogona subsp. *calycogona*			X		X	
	Eucalyptus flocktoniae subsp. *flocktoniae*			X		X	
	Eucalyptus phenax subsp. *phenax*			X		X	
	Eucalyptus tenera					X	
	Leptospermopsis erubescens						X
	Melaleuca acuminata			X			
	Melaleuca adnata			X			
	Melaleuca elliptica						X
	Melaleuca fulgens		X				
	Melaleuca marginata			X		X	
Orobanchaceae	*Parentucellia latifolia*	*					X
Pittosporaceae	*Billardiera* sp.						X
Poaceae	*Aristida contorta*						
	Austrostipa elegantissima		X	X	X	X	
	Austrostipa scabra		X		X		
	Avena barbata	*	X		X		
	Bromus diandrus	*	X				
	Bromus rubens	*					X
	Ehrharta longiflora	*	X		X		
	Hordeum leporinum	*					X
	Lolium perenne	*	X	X			
	Neurachne alopecuroidea						X
	Pentameris airoides	*	X		X		
	Rytidosperma acerosum			X	X	X	
	Vulpia myuros forma *myuros*	*	X		X		
Polygonaceae	*Muehlenbeckia adpressa*						X
Proteaceae	*Grevillea huegelii*			X		X	
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*						X
Rhamnaceae	*Cryptandra nutans*			X	X		
Rubiaceae	*Opercularia vaginata*				X		
Rutaceae	*Phebalium multiflorum* subsp. *baccharoides*			X			
	Phebalium tuberculosum			X			
Santalaceae	*Santalum acuminatum*						X
Sapindaceae	*Dodonaea adenophora*						X
	Dodonaea bursariifolia			X			
	Dodonaea viscosa						X

Table 24: Conservation-listed flora locations (GDA94, Zone 50)

Species	Status	Easting	Northing
Eucalyptus erythronema subsp. *inornata*	P3	621669.5	6408075
Eucalyptus erythronema subsp. *inornata*	P3	621715	6408073
Eucalyptus erythronema subsp. *inornata*	P3	621717.6	6408049
Eucalyptus erythronema subsp. *inornata*	P3	621744	6408062
Eucalyptus ornata	P3	627533.6	6409722
Eucalyptus ornata	P3	627598.8	6409723
Grevillea asteriscosa	P4	626219.9	6409438
Grevillea asteriscosa	P4	626288.3	6410099
Grevillea asteriscosa	P4	626300.1	6409847
Grevillea asteriscosa	P4	626301.8	6410642
Grevillea asteriscosa	P4	626303.9	6410785
Grevillea asteriscosa	P4	626316.9	6409435
Grevillea asteriscosa	P4	626374.5	6408205
Grevillea asteriscosa	P4	626398.2	6408073
Grevillea asteriscosa	P4	626419.4	6408901
Grevillea asteriscosa	P4	626424.4	6408152
Grevillea asteriscosa	P4	626491.2	6408147
Grevillea asteriscosa	P4	626629.3	6408144
Grevillea asteriscosa	P4	626673.7	6408207
Grevillea asteriscosa	P4	626878.2	6408944
Grevillea asteriscosa	P4	626917.8	6408936
Grevillea asteriscosa	P4	627637.2	6409920
Grevillea asteriscosa	P4	627717.3	6409944
Grevillea asteriscosa	P4	627751.8	6409952

Table 25: Fauna sites (GDA94, Zone 50)

Site Name	Site Type	Easting	Northing
HAB01	Habitat Assessment	626521.74	6410323.47
HAB02	Habitat Assessment	625845.34	6410979.87
HAB03	Habitat Assessment	624135.21	6411354.81
HAB04	Habitat Assessment	623881.32	6411414.79
HAB05	Habitat Assessment	624250.21	6412167.53
HAB06	Habitat Assessment	624319.86	6412367.08
HAB07	Habitat Assessment	624529.00	6411377.70
HAB08	Habitat Assessment	628507.70	6410610.75
HAB09	Habitat Assessment	628035.35	6410257.67
HAB10	Habitat Assessment	627767.14	6409796.62
HAB11	Habitat Assessment	627886.98	6409782.07
HAB12	Habitat Assessment	627865.81	6409899.60
HAB13	Habitat Assessment	626643.29	6409596.55
HAB14	Habitat Assessment	626299.99	6409362.15
HAB15	Habitat Assessment	627929.25	6408991.79
HAB16	Habitat Assessment	625541.36	6409272.47
HAB17	Habitat Assessment	625678.89	6409773.61
HAB18	Habitat Assessment	627688.58	6409898.79
HAB19	Habitat Assessment	623993.14	6409238.23
HAB20	Habitat Assessment	624182.01	6409654.51

Site Name	Site Type	Easting	Northing
HAB21	Habitat Assessment	624332.40	6409853.47
HAB22	Habitat Assessment	624426.51	6409935.52
HAB23	Habitat Assessment	625106.05	6409633.05
HAB24	Habitat Assessment	627643.24	6408882.69
HAB25	Habitat Assessment	627039.21	6408895.38
HAB26	Habitat Assessment	625683.92	6408384.61
HAB27	Habitat Assessment	625076.38	6408331.94
HAB28	Habitat Assessment	623908.81	6408065.33
HAB29	Habitat Assessment	617591.72	6408094.30
HAB30	Habitat Assessment	617305.82	6408090.28
HAB31	Habitat Assessment	617899.83	6408106.66
HAB32	Habitat Assessment	627640.64	6408358.07
HAB33	Habitat Assessment	625619.98	6407028.36
HAB34	Habitat Assessment	625790.29	6406727.88
HAB35	Habitat Assessment	625715.71	6406437.10
HAB36	Habitat Assessment	625717.41	6406126.90
HAB37	Habitat Assessment	626398.41	6408091.02
HAB38	Habitat Assessment	626645.53	6410748.63
HAB39	Habitat Assessment	626815.42	6410515.83
HAB40	Habitat Assessment	626929.93	6411041.99
HAB41	Habitat Assessment	627324.19	6411158.31
HAB42	Habitat Assessment	627814.26	6410997.50
HAB43	Habitat Assessment	628155.89	6410632.43
HAB44	Habitat Assessment	628412.05	6410921.08
HAB45	Habitat Assessment	628034.92	6410257.22
HAB46	Habitat Assessment	627999.58	6410158.78
HAB47	Habitat Assessment	627954.32	6409544.16
HAB48	Habitat Assessment	624937.50	6409412.55
HAB49	Habitat Assessment	625955.45	6409260.45
HAB50	Habitat Assessment	624365.84	6409525.68
HAB51	Habitat Assessment	627476.72	6408829.93
HAB52	Habitat Assessment	627191.85	6408566.31
HAB53	Habitat Assessment	627507.80	6408485.15
HAB54	Habitat Assessment	627449.06	6408468.59
HAB55	Habitat Assessment	627637.42	6408399.81
HAB56	Habitat Assessment	627668.96	6408878.21
HAB57	Habitat Assessment	627350.62	6407499.94
HAB58	Habitat Assessment	627013.26	6407391.24
HAB59	Habitat Assessment	626772.36	6407423.63
HAB60	Habitat Assessment	626718.08	6407467.52
HAB61	Habitat Assessment	626787.37	6406413.29
HAB62	Habitat Assessment	626220.43	6407564.70
HAB63	Habitat Assessment	626800.59	6406546.37
HAB64	Habitat Assessment	626043.36	6406052.97

Site Name	Site Type	Easting	Northing
HAB65	Habitat Assessment	625840.24	6406157.99
HAB66	Habitat Assessment	626764.89	6406281.39
HAB67	Habitat Assessment	626688.21	6406704.14
HAB68	Habitat Assessment	626711.70	6410720.54
HAB69	Habitat Assessment	626567.75	6408190.04
HAB70	Habitat Assessment	626453.24	6408247.11
HAB71	Habitat Assessment	627570.57	6408881.53
HAB72	Habitat Assessment	627631.35	6408341.96
HAB73	Habitat Assessment	627618.95	6408370.12
HAB74	Habitat Assessment	627617.28	6408890.04
HAB75	Habitat Assessment	627588.40	6408911.26
HAB76	Habitat Assessment	627592.22	6408913.95
HAB77	Habitat Assessment	627682.79	6408908.98
HAB78	Habitat Assessment	627714.05	6408890.99

APPENDIX SIX FLORISTIC QUADRAT DATA

APPENDIX B - SW (2017) Level 1 Flora and Fauna Assessment Kondinin Wind Farm

Level 1 Flora and Fauna Assessment

Kondinin Wind Farm

OCTOBER 2017

SW environmental

Prepared for
Kondinin Energy Pty Ltd

Version control

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Approved by	Shane Priddle
Client review by	James Townsend
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SW Environmental is a registered business name trading under SW Environmental Pty Ltd, ABN: 52 605 825 367

Acknowledgements:

Ecoedge (2017) was engaged by SW Environmental to prepare the flora and vegetation components (Level 1 flora survey) of this report. SW Environmental has relied on the accuracy and information supplied by Ecoedge directly in the preparation of the relevant (flora and vegetation) sections of the reports cited below.

- Ecoedge (2017) Report of a Level 1 Flora and Vegetation Survey at Kondinin. Unpublished report to SW Environmental.
- Ecoedge (2017) Targeted Rara Flora Survey – Proposed Wind farm, Kondinin. Unpublished report to SW Environmental.

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COMMON TERMS / ACRONYMS

BC Act	WA *Biodiversity Conservation Act 2016*
DBCA	WA Department of Biodiversity, Conservation and Attractions Parks and Wildlife Service, including the Parks and Wildlife Service
DotEE	Department of the Environment and Energy
EP Act	WA *Environmental Protection Act 1986*
EPBC Act	Federal *Environment Protection and Biodiversity Conservation Act 1999*
ESAs	Environmentally sensitive areas
IBAs	Important Bird Areas
OEPA	Office of the Environmental Protection Authority
project	The proposed wind farm development
project area	The study area, including the broader development area
project site	the proposed infrastructure footprint
PEC	Priority ecological community
PMST	EPBC Act Protected Matters Search Tool
TEC	threatened ecological community
WA	Western Australia
WC Act	WA *Wildlife Conservation Act 1950*

EXECUTIVE SUMMARY

Kondinin Energy Pty Ltd is proposing to develop a wind farm north of Kondinin, WA. A flora and fauna survey was required to support the development application for the project and guide the project design.

Surveys included a spring reconnaissance flora survey carried out in 2016 by Ecoedge, across the whole project area (circa 4740 ha at that time) and targeted surveys at proposed impact sites (three access points and the proposed circa one hectare transmission line easement). The substation lot and transmission line tie-in location were not included in the 2016 surveys. Follow-up targeted spring flora surveys were required in 2017, to address additional potential impact locations for access points. Note the project area was reduced to approximately 3237 ha for the 2017 surveys to focus surveys on the current project design. Level 1 fauna surveys were also carried out in spring 2017 with additional survey elements targeting fauna groups considered to be 'at risk' in relation to wind farms. The additional survey or 'targeted surveys' included:

- Hollow bearing tree (black cockatoo breeding) assessment at potential clearing (access and transmission line) locations,
- Additional survey effort for bats (bat call analysis), and a
- Bird and bat risk assessment.

Desktop and site surveys found the following values within the project area:

- Nineteen native vegetation units varying in condition from completely degraded to excellent condition, across >75 patches (the largest at 24 ha) totalling approximately 153 ha.
- Several structural fauna habitats occur at the site with poor to good fauna habitat value, including:
    - Tall woodland,
    - Mallee,
    - Shrubland,
    - Cropped land,
    - Farm dams (approximately 30),
    - Granite outcrops.
- Beard vegetation associations 1023 and 960 that are considered over-cleared (less than 30% remaining) and under-reserved (less than 10% reserved) (DAFWA 2016) occur across the project area.
- Priority flora (4 taxa) and fauna (1 taxa) were identified as occurring within the project area, an additional 46 flora and seven fauna of conservation significance may potentially occur at the site.
- One hundred and thirty vascular flora taxa were identified within the project area, of which three were introduced species (partial list only).
- Sixty-three fauna species were identified during the field visit; 44 of these were birds.
- The presence of 29.4 ha of federally-listed "Eucalypt Woodlands of the Western Australian Wheatbelt" (also P3) across the project area.

Clearing impacts proposed are summarised below:

- Clearing includes up to 0.15 ha at three locations (approximately 0.1% of the native vegetation within the project area).
- No flora of conservation significance will need to be impacted (proposed impacts are 20m away based on infrastructure locations provided).
- The TEC will require pruning based on current designs. It should be avoided if possible, as outlined below.

- Threatened fauna are unlikely to be significantly impacted by the clearing proposed. Based on Table 5-1 the proposal is not likely to trigger the need for federal referral for Carnaby's Black Cockatoo based on clearing (note collision impact risks below).
- The bird and bat risk assessment (Appendix A.5) identified:
    - A number of common and secure species as 'at risk' species, indicating that they have potential to suffer collision mortality at the proposed wind farm from time to time, should they occur on site.
    - Carnaby's Black Cockatoo and Rainbow Bee-eater as being 'at risk' conservation significant species. A qualitative risk assessment found Carnaby's Black Cockatoo to have a rare likelihood of collision as individuals would normally fly below the RSA height, but a moderate risk, mainly due to the endangered status of the population rather than the likelihood of collision. Rainbow Bee-eater was found to be low risk species.
    - Given that Carnaby's Black Cockatoo was found to be a moderate risk species for the wind farm based on bird and bat risk assessment, the proponent may wish to liaise further with Department of the Environment and Energy (DotEE) in relation to whether the project should be for referred for legal certainty.
    - The Kondinin Wind Farm presents an overall low risk to birds and bats as a potential wind farm site.

Clearing impacts proposed are likely to be very low in scale and nature if the recommendations below are incorporated. Recommendations to avoid and mitigate potential impacts of the proposal include:

- Minimise disturbance to remnant native vegetation.
- Minimise impact at the TEC locations where pruning of trees will currently be required, north of the substation (617362E 6408104S) and the existing entrance to Lot 16619 off Notting-Karlgarrin Road (621930E 6408104S). This should be possible by aligning the transmission line to avoid most of the large trees north of the substation, and by relocating the easement north by approximately 30m, away from the TEC along the Notting-Karlgarrin Road. If significant pruning is required within the TEC then an Assessment of Significance should be carried out to determine if a significant impact is likely, and therefore the need to refer to DotEE.
- Avoid disturbing mapped populations of Priority flora.
- Avoid paddock trees >30cm DBH that may support hollows. If any hollow bearing paddock trees do require clearing, schedule clearing outside of Black Cockatoo key breeding periods (August-February). Ensure an experienced and licensed fauna specialist is present during clearing of hollow trees to manage any displaced/injured wildlife.

1 INTRODUCTION

1.1 Background

Kondinin Energy Pty Ltd is proposing to develop a wind farm north of Kondinin, WA, herein referred to as the 'project'. A flora and fauna survey was required to support the development application for the project and guide the project design.

1.1.1 Project description

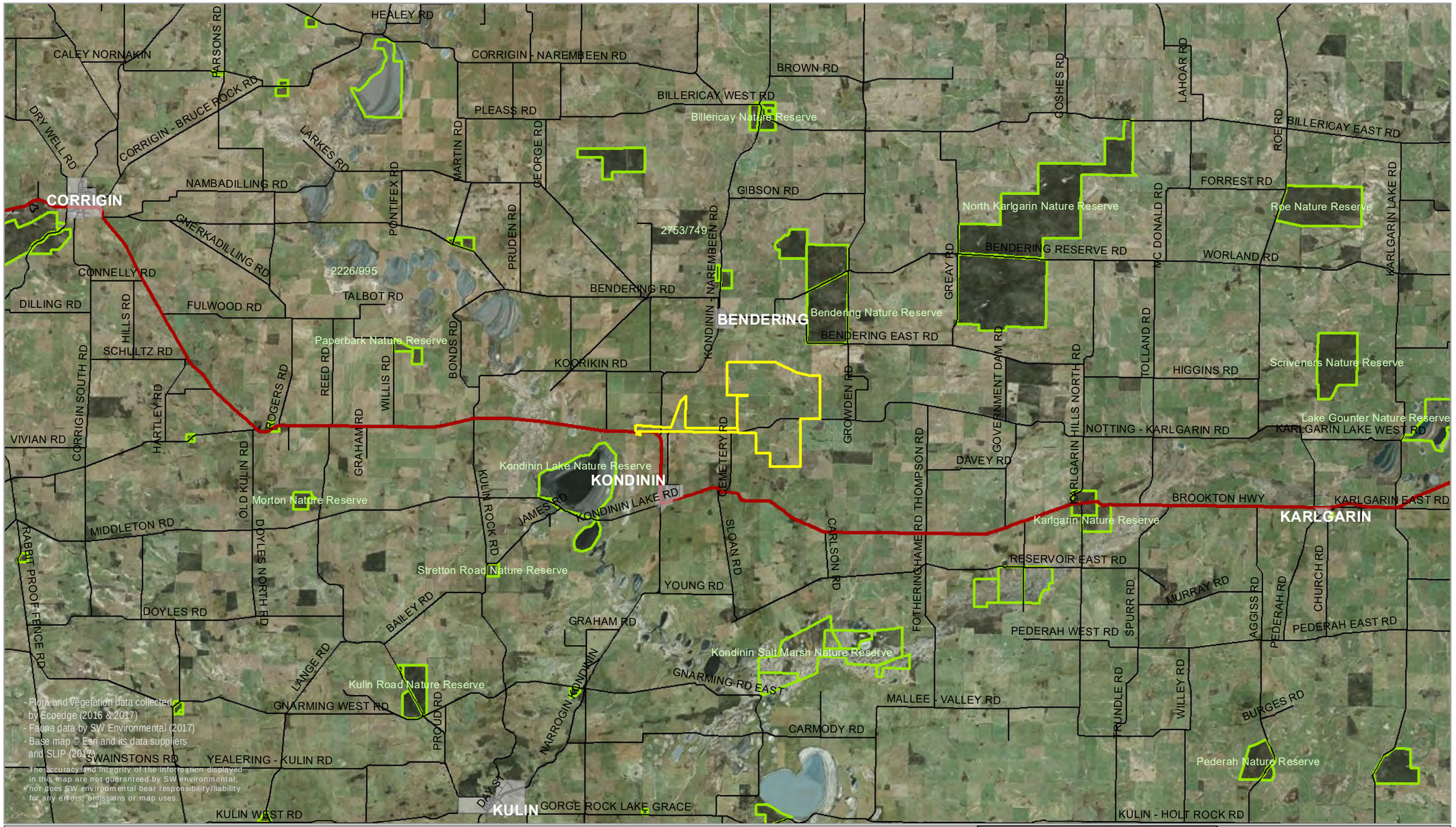
The project involves the development of a large scale wind farm, consisting of the following components:

- Compound batching plant x 2, at 3.0 and 2.8 ha footprint each (no clearing required),
- Solar farm, 131.5 ha footprint (possible clearing of <10 isolated paddock trees),
- Substations x 3 at 2.5, 4.1 and 4.2 ha footprint each (impacts associated with the 2.5 ha site adjacent to the existing substation are outside of the scope of this project),
- Forty-six turbines and associated hardstand areas (no clearing required):
    - Turbines will be 185m in height from the base to the tip, with a hub height of approximately 115m,
    - Blade diameter will be 140m, with a blade elevation of approximately 45m,
    - The overall footprint at each turbine, including hardstand is approximately 100m by 50m. Turbine sites have been selected so the footprints can be orientated to avoid vegetation clearing.
- Four met masts (no clearing required),
- Access tracks (construction access and service), approximately 33.8km by six metres wide (maximum clearing footprint of 20m wide will impact a total of approximately 0.15ha of native vegetation at three points),
- Transmission line with associated easement,
    - Easement will be 30m wide but will remain uncleared,
    - Minor pruning will be required within the easement for trees over five metres high.

The 'project site' includes the proposed infrastructure footprint, described above. Considerable effort has been taken by the proponent to avoid the need to clear native vegetation in the location of infrastructure.

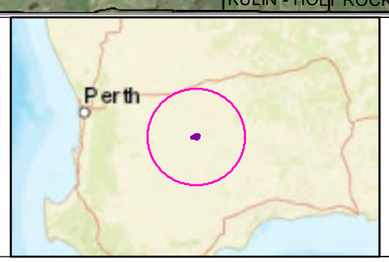
1.1.2 Location

The project is situated in the Shire of Kondinin in the eastern-central wheatbelt, approximately 240 km east-southeast of Perth (Figure 1-1). It extends from 4.2 km north and east of the Kondinin town site to 13.6 km north east of the town, over an area of approximately 3237 ha. The infrastructure is shown in Figure 1-2.



Town
Park/Reserve
Project boundary
Highway
Road

Figure 1-1 Project location



0 2.5 5 10 Kilometres

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Author: SP
Ref: SW140

NORTH

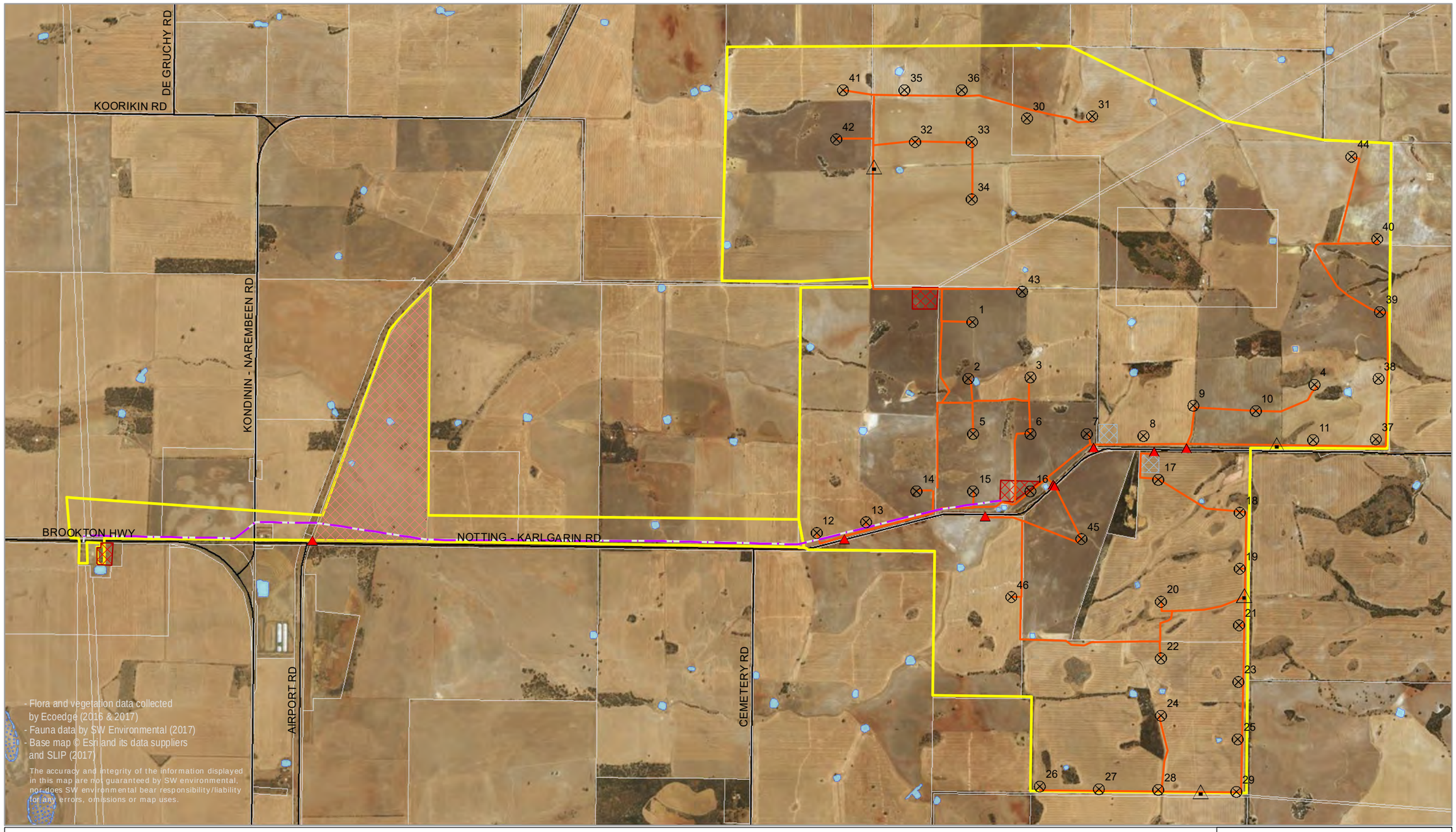


Figure 1-2 Project site showing remnant vegetation and proposed infrastructure

1.2 Scope of works

A Level 1 Flora and Fauna Assessment report was required for the proposed wind farm development. Due to the large scale of the project and the minimal clearing of native vegetation required, a combination of reconnaissance and targeted surveys were proposed in line with relevant EPA guidelines (refer to *Section 1.3.2*). Specifically, the survey scope included:

- 2016 Level 1 (reconnaissance and targeted) spring flora and vegetation surveys,
- 2017 Level 1 fauna survey and additional targeted spring flora surveys.

2016 Level 1 (reconnaissance and targeted) spring flora and vegetation surveys

A reconnaissance survey was carried out in 2016 by Ecoedge (contract botanists), across the whole project area (circa 4740 ha at that time) and targeted surveys at proposed impact sites (three access points and the proposed circa one hectare transmission line easement). The substation lot and transmission line tie-in location were not included in the 2016 surveys.

2017 Level 1 fauna survey and additional targeted spring flora surveys

A Level 1 fauna survey was required to supplement the flora report, and to be compiled into a single Level 1 Flora and Fauna Assessment report.

The Level 1 fauna survey contained additional survey elements targeting fauna groups considered to be 'at risk' in relation to wind farms. The additional survey or 'targeted surveys' included:

- Hollow bearing tree (black cockatoo breeding) assessment at potential clearing (access and transmission line) locations,
- Additional survey effort for bats (bat call analysis), and a
- Bird and bat risk assessment.

Follow-up targeted spring flora surveys were also required in 2017, to target additional potential impact locations associated with several access points. Note the project area was reduced to approximately 3237 ha for the 2017 surveys to focus surveys on the current project design.

1.3 Regulatory context

1.3.1 Legislative framework

The conservation status of flora, fauna and ecological communities in Western Australia (WA) is assessed under the WA administered *Wildlife Conservation Act 1950 (*WC Act*)* and federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) The new WA *Biodiversity Conservation Act 2016* (BC Act) is also partly in force which will eventually repeal the WC Act. The *Environmental Protection Act 1986* (EP Act) may also be relevant, in relation to clearing of native vegetation.

Species listed as threatened or migratory under the above legislation are referred to collectively in this document as being 'conservation significant' or 'target' species. These terms include species and communities listed under the former Department of Parks and Wildlife's Priority lists.

EP Act

Clearing of native vegetation in WA is primarily regulated under Part V of the EP Act, through the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and amendments. A Clearing Permit may be required for the clearing of native vegetation if the project is not required to be assessed by the EPA.

WC Act

The WC Act allows for the statutory protection of fauna or flora species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Threatened species are those published as Specially Protected under the WC Act, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (may also be referred to as Declared Rare Flora).

- S1 - Critically endangered species,
- S2 – Endangered species,
- S3 - Vulnerable species,
- S4 - Presumed extinct species,
- S5 - Specially Protected: Migratory birds protected under an international agreement,
- S6 - Conservation dependent fauna,
- S7 - Other specially protected fauna.

A full description of conservation codes is provided in Appendix A.6.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

BC Act

The former WA Department of Parks and Wildlife has been identifying and listing threatened ecological communities (TECs) since 1994 through a non-statutory process if the community is presumed to be totally destroyed or at risk of becoming totally destroyed. Some TECs, or components of them, are also listed under the EPBC Act. Ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened, are placed on the Priority list and referred to as priority ecological communities (PECs).

The BC Act 2016 will eventually fully replace the WC Act. On 2 December 2016, several parts of the new Act were proclaimed in the Government Gazette. These parts came into effect on 3 December 2016, and cover (amongst other things) coverage for flora and fauna as provided in the WC Act but also provides coverage of additional matters including habitats, communities (TECs), threatening processes, environmental pests and weeds.

EPBC Act

In accordance with Commonwealth legislation, the EPBC Act provides a list of matters of 'National Environmental Significance' (NES), which includes significant fauna, flora and communities. Under the EPBC Act flora, fauna or ecological community matters of NES may be listed in any one of the following categories as defined in *Section 179* of the Act:

- Extinct,
- *Extinct in the wild,
- *Critically endangered,
- *Endangered,
- *Vulnerable,
- Conservation dependent.

*Only these categories are matters of NES under the Act.

The EPBC Act also lists migratory species that are recognized under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals).

IUCN Red List

The IUCN Red List is an inventory of the global conservation status of species and used to assist DBCA and other agencies in attributing a given threatened species status. It does not have any statutory authority and is not considered in detail in this assessment.

1.3.2 Guidelines

This report was prepared in line with the requirements of a level 1 survey in:

- *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016)
- *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016)

The following were also generally considered:

- Commonwealth *Matters of National Environmental Significance – Significant impact guidelines 1.1 Environmental Protection and Biodiversity Conservation Act 1999, Department of the Environment, Water, Heritage and the Arts* (DEWHA)', (2009).
- Commonwealth *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered), Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable), Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso* (SEWPaC 2012).
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection*. Position Statement No. 3, EPA (2002).

2 METHODS

The primary aim of the assessment was to determine the likelihood of any species of conservation significance occurring over the project and the likely impacts upon them. The desktop assessment reviewed available information on the habitat requirements of the species of conservation significance that may occur in the area. Field surveys identified the likelihood of target flora, fauna and communities occurring in the area and the significance of the area to them.

2.1 Flora and vegetation

2.1.1 Desktop assessment

Desktop assessments were carried out by Ecoedge in 2016. No flora or vegetation assessments had previously been carried out within the project area. However, surveys had been undertaken in the nearby Bendering and West Bendering Nature Reserves. Flora surveys, assessments and reviews have also been undertaken in nearby areas, although not all are publicly available and therefore could not be referenced. The most relevant and/or significant of those available that were referred to during the preparation of this report are listed below:

- Muir, B.G. (1979). *Some Nature Reserves of the Western Australian Wheatbelt. Part 20*. Kondinin Shire. Unpublished report prepared for the Department of Fisheries and Wildlife. Perth, Western Australia.
- Muir, B.G. (1977a). *Biological Survey of the Western Australian Wheatbelt. Part II. Vegetation and habitat of Bendering Reserve*. Records of the West Australian Museum, Supplement No. 3.
- Muir, B.G. (1977b). *Biological Survey of the Western Australian Wheatbelt. Part IV: Vegetation of West Bendering Nature Reserve.* Records of the West Australian Museum, Supplement No. 5.

Prior to the field survey, a desktop assessment was carried out by searching the DBCA and Western Australian Museum's Rare and Priority flora databases, and from Naturemap to produce a list of all flora (including rare flora) occurring within 10 km of the project. A Protected Matters Search Tool report (PMST) was also generated, detailing all species listed under the EPBC Act that may potentially occur or have habitat occurring within 20 km of the project. Database search results are provided in Appendices A.1 and A.2. Flora of conservation significance that may occur within the project area are provided in Appendix A.3.

2.1.2 Field survey

The initial field survey was carried out by Russell Smith (Senior Botanist, Ecoedge) over three days from 3rd – 5th October 2016 as per the requirements for a Level 1 flora and vegetation assessment (reconnaissance survey and targeted survey; EPA and DPaW Technical Guide, 2015). The targeted survey was limited to the transmission line easement and three of the proposed wind farm access points, shown in Figure 2-1. A distance of approximately 50m was surveyed either site of the road at each of the access point locations.

The field survey was guided by the desktop survey and preliminary viewing of the areas of remnant vegetation using Google Earth. Information was collected on the dominant vascular flora present and the condition of the vegetation at 65 survey points along roadsides and within more than 30 vegetation remnants within the project area. Photographs were also taken to record the variation within vegetation types.

Taxonomy and conservation status was checked against DPaW (2016e). Notes were taken on species not able to be identified in the field, and they were photographed for later identification.

Additional targeted surveys (EPA and DPaW Technical Guide, 2016) were carried out on 1st September, 2017, targeting the additional areas including the substation site and additional potential access (impact) areas shown in Figure 2-1.

Vegetation condition was assessed using the categories of the EPA and DPaW (2015), defined in Table 2-1.

Table 2-1 Vegetation condition scale (EPA and DPaW, 2015).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.1.3 Flora survey limitations

Potential limitations of the assessment are addressed in Table 2-2.

Table 2-2 Limitations of flora assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	Negligible	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements. As per a Level 1 survey, field work was targeted to detect conservation significant species and their habitat. Therefore, a comprehensive vegetation survey was not undertaken (i.e. a partial vegetation list for the site was produced)
Availability of contextual information	Moderate	A detailed regional vegetation survey (as exists for the Swan Coastal Plain, for instance) – has not been carried out for the Wheatbelt/Mallee region.
Completeness of the survey	Negligible	A Level 1 reconnaissance survey was carried out in all significant patches of remnant vegetation on private property, and roadside vegetation was sampled. Detailed surveys were conducted at all of the potential impact areas (transmission line easement, entrance points and proposed substation site).
Skill and knowledge of the botanists	Negligible	The senior field botanist (Russell Smith, Ecoedge) conducting the survey has had extensive experience in botanical survey in south west Australia over a period of 25 years.

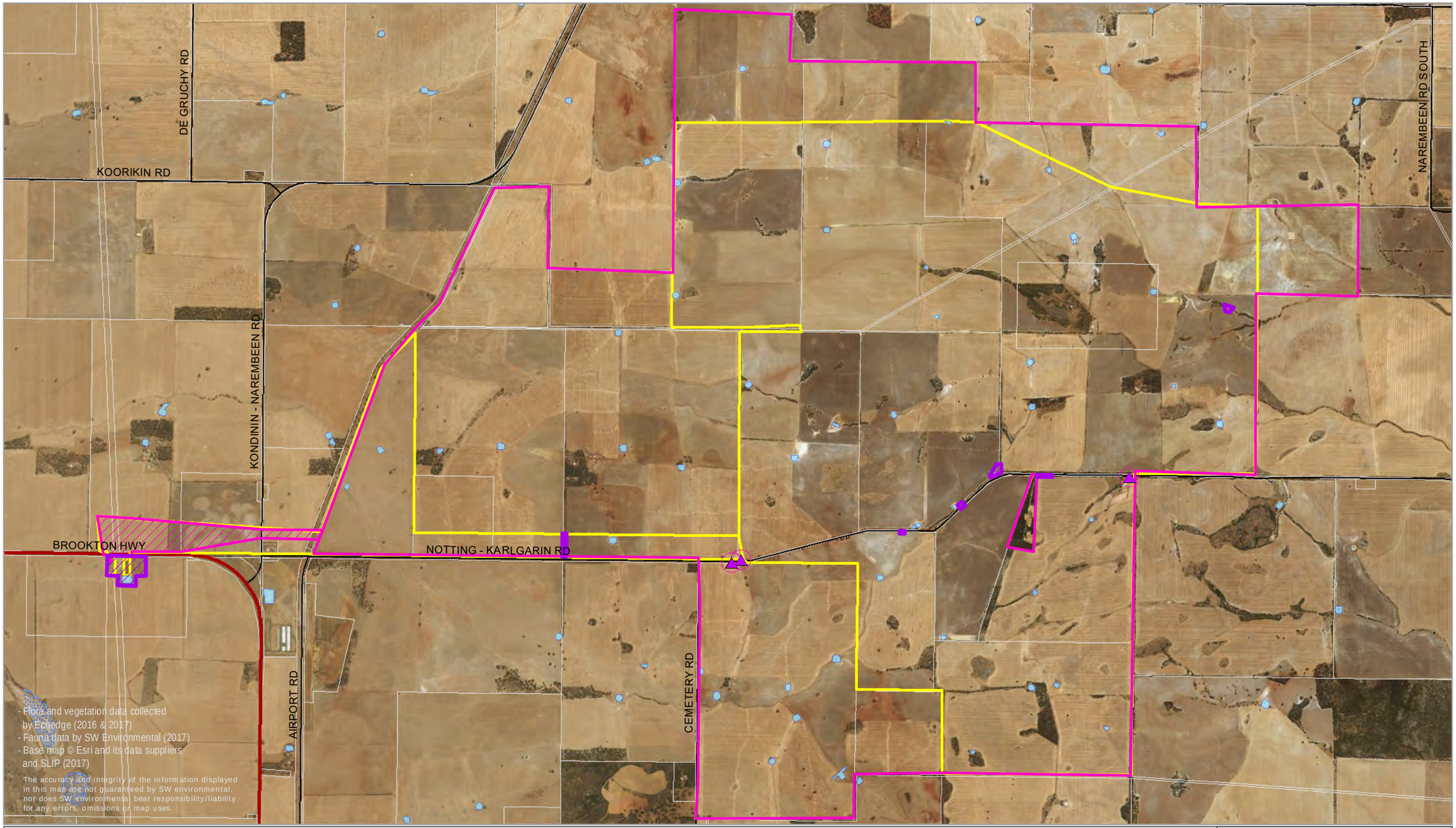


Figure 2-1 Flora survey areas

2.2 Fauna

2.2.1 Desktop assessment

Prior to field surveys, a desktop assessment was undertaken to develop an understanding of the ecological values of the project area and to assist in identifying the likelihood of target fauna species occurring. This involved a review of relevant databases, management plans, recovery plans, books, scientific journals and other publications, previous survey reports and consultation results.

Database search results within the locality were amalgamated from the Naturemap (20km) (DPaW 2017), Atlas of Living Australia (50km) (ALA) (2017) databases and PMST (20km) (DotEE 2017). The Naturemap and ALA database amalgamates records from sources including but not limited to WA Museum, Birdlife Australia, DBCA's threatened fauna and Fauna Survey Returns databases.

GIS datasets were also queried, including:

- Beard vegetation mapping dataset from the Department of Agriculture and Food WA (DAFWA) 'Native vegetation extent' dataset (current July 2013),
- Soils mapping datasets from DAFWA (2004),
- Aerial photography (ESRI and its data providers),
- GIS datasets (e.g. drainage lines and wetlands) sourced from the Shared Land Information Platform (SLIP) (2017).

A list of fauna species that may occur at the site is provided in Appendix B.1. Fauna of conservation significance that may occur locally are listed in Appendix A.4.

2.2.2 Publications

Publications consulted for general distribution of fauna included, but was not limited to:

- A Field Guide to the Mammals of Australia (Menkhorst and Knight, 2011),
- Field Companion to The Mammals of Australia (Van Dyck *et al.*, 2013),
- Field guide to frogs of Western Australia (Doughty and Tyler, 2009)
- Frogs of Western Australia (Thomson-Dans and Wardell-Johnson, 2002)
- Scats, Tracks and Other Traces: A field guide to Australian mammals (Triggs, 2008),
- Australian Bats (Churchill, 2008),
- The Field Guide to the Birds of Australia (Pizzey and Knight, 2012),
- The New Atlas of Australian Birds (Barrett *et al.,* 2003),
- Michael Morcombe's Birds of Australia eGuide, (Michael Morcombe, 2011),
- Handbook of Western Australian Birds (Volume 1 & 2)(Johnstone and Storr, 1998, 2004),
- A Complete Guide to Reptiles of Australia (Wilson and Swann, 2017),
- Reptiles and Frogs in the Bush: Southwestern Australia (Bush *et al.*, 2007),
- Reptiles and Amphibians of Australia (Cogger 2014),
- Tadpoles and Frogs of Australia (Anstis, 2013),
- Field guide to frogs of Western Australia (Doughty and Tyler, 2009),
- Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia (Morgan *et al.* 2011),
- Waterbirds of South-west Wetlands (Thomson-Dans and Halse, 2001),
- Numerous online publications and other general species references (see *References* section).

2.2.3 Taxonomy and nomenclature

The taxonomy and nomenclature used in this report follows several sources, depending on the faunal group. It primarily follows the Naturemap database (DPaW 2017) but also the following:

- Amphibians: Bush *et al.* (2007),
- Aves: Pizzey and Knight (2007),
- Mammals: Menkhorst and Knight (2011),
- Reptiles: Bush *et al.* (2007).

2.2.4 Field survey

Fieldwork consisted of a site reconnaissance carried out over four days on 29-31st of August and 1st of September 2017, by experienced fauna and habitat surveyor Shane Priddle and senior zoologist Greg Harewood. The site reconnaissance included a mixture of general and targeted fauna surveys:

- Habitat assessment plots and desktop validation,
- Targeted surveys:
    - HBT mapping and black cockatoo surveys,
    - Diurnal bird surveys,
    - Acoustic bat recordings,
    - Motion sensing infrared cameras ("camera traps"),
    - Opportunistic surveys.

Weather conditions

The weather conditions were generally conducive for a Level 1 survey. The Corrigin weather station (about 30km west of the site, from Weatherzone, 2017) recorded minimum and maximum temperatures up to four degrees warmer than average at:

- 10-20ºC on 29/08/2017 with no rain,
- 9-20ºC on 30/08/2017 with no rain,
- 7-18ºC on 31/08/2017 with intermittent rain on site in the afternoon,
- 6-16ºC on 1/09/2017 with intermittent rain on site.

The cooler temperatures associated with later winter/early spring would have affected the activity of some fauna groups, such as reptiles, amphibians and bats, and therefore their ability to be detected. The abundance of farm dams and local water may also have spread water birds to lower densities on site, with the timing too early to have identified most migratory birds should they frequent local wetlands.

2.2.5 Habitat assessment

Vegetation units identified during the flora and vegetation survey (Appendix C.2: Ecoedge 2016) were used to define broad fauna habitat types across the site. Habitats identified during the desktop study were validated by walking over the study area and sampling for fauna habitat attributes (using 10x10m habitat assessment plots) within each structural fauna habitat type. Sampling included at least one plot within each broad structural habitat type. Specifically, the assessment included visiting 65 of the (approximately 70) vegetation patches mapped by Ecoedge (2016); see Figure 4-1. The remaining patches that were not assessed were unable to be easily accessed and deemed to be represented adequately by other plots. The results (Appendix C.3) are summarised in *Section 4-2*.

Micro habitat elements assessed included vegetation structure, habitat condition, ground cover, presence of rocky outcrops, ground litter, type of substrate, presence/absence of habitat trees, termite mounds, fallen logs and the presence or absence of ephemeral or permanent drainage

features. In particular, habitat attributes were considered with respect to species of conservation significance. Photos were taken and notes were made about the quality of habitat based on the descriptions in Table 2-3 below.

Fauna observations were recorded along with secondary evidence of fauna such as tracks, nests, scat, bones, diggings and characteristic feed signs.

Table 2-3 Fauna habitat quality categories and descriptions

Quality	Description
Good	• Native vegetation with habitat structure diverse and intact, with different vegetation age classes present at most stratum levels (ground, understorey, midstorey, canopy). • Forest/woodland: abundant hollow-bearing trees, including those with or likely to develop large hollows. Mature trees also produce more foraging resources for nectar and seed eating fauna. • Presence of shelter/refuges at ground level (dense understorey plants, tussock, rocky outcrop, hollow logs). • High habitat complexity (ecotones between vegetation types or areas forming a habitat mosaic). This increases the range of foraging and shelter opportunities within a habitat. • Presence of key foraging and microhabitat components for target species. • Little to no obvious weed invasion or evidence of grazing. • May be large patch and/or connected to other areas of native vegetation.
Moderate	• Native flora species dominant with moderate complexity of habitat structure appropriate to vegetation type. Ground litter layer intact or slightly disturbed. More than one age class present. • Forest/woodland: low to moderate abundance of hollow-bearing trees or trees likely to develop hollows. • Some shelter and refuge present for ground dwelling fauna. • Some habitat complexity (ecotones between vegetation types or areas forming a habitat mosaic). • Marginal presence of key microhabitat components for target species. • May be small or large in scale, and isolated or well connected.
Poor	• Habitat highly disturbed and simplified with very little structural complexity. Ground litter layer absent or highly modified. Complexity reduced by only one age class present. • Little or no shelter and refuge for ground dwelling fauna. • Forest/woodland: not likely to support hollow-bearing trees. • Lack of key foraging and microhabitat components for target species. • May have evidence of weed invasion or grazing. • May be narrow or small area and substantially influenced by edge effects, and isolated from other areas of native vegetation.

2.2.6 Targeted surveys

HBT mapping and black cockatoo surveys

Hollow bearing trees (HBT) may provide breeding habitat for a number of threatened species, including Carnaby's Black Cockatoo, or roosting sites for bats. HBT surveys were carried out within the targeted survey areas (the proposed substation and potential access sites). These surveys did not include targeted HBT surveys of paddock trees across the site.

HBT locations, hollow heights, sizes, and diameter at breast height (DBH) classes, for tree species that typically form hollows, were recorded where present. Presence or absence of black cockatoo forage habitat and roosting evidence was also noted.

Diurnal bird surveys

Four bird survey transects were carried out through remnant vegetation patches, shown below (refer to Figure 2-2 for transect locations). Species within the search area, flying overhead and outside the search area were recorded by sight and vocalisations along with estimated flight height in metres above the ground level. The survey effort (transect location, length, duration and date) is shown below:

- Transect 1: 600m, 50 mins, 30/08/2017,
- Transect 2: 600m, 50 mins, 30/08/2017,
- Transect 3: 180m, 20 mins, 30/08/2017,
- Transect 4: 600m, 30 mins, 31/08/2017.

Opportunistic observations of birds were also made during other phases of the fauna survey.

Acoustic bat recordings

Acoustic recordings were undertaken at three sites for one night each (see Table 2-4) using a Wildlife Acoustics SongMetre SM2BAT+ Ultrasonic Bat Detector (refer to Figure 2-2). The detector was located to target key habitat features such as large remnant vegetation patches, flight corridors, watering points, and set to record between sunset and sunrise. The detectors convert ultrasonic echolocation signals produced by bats into audible electronic signals that are then recorded. The recordings were later processed by Bat Call WA Pty Ltd (Bob Bullen) to determine the presence of specific species.

Table 2-4 Acoustic bat recording survey effort

Recording ID	mE	mN	Open	Closed	Nights	Comments
Bat 1	625836	6408549	29/08/2017	30/08/17	1	Road verge adjacent to farm dam; Mallee
Bat 2	626950	6410525	30/08/2017	31/08/17	1	Rocky outcrop; Shrubland
Bat 3	626621	6406772	31/08/2017	1/09/17	1	Remnant vegetation with farm dam; Mallee

Motion sensing infrared cameras

Four camera traps were deployed at five locations around the site (one camera trap was moved after the first night). Acorn brand LTL 5210A and 5310 model units were deployed and set to record three 12MP photographs in succession on each trigger event. Camera traps were baited with fish oil to target carnivorous mammals.

Table 2-5 Camera trap effort

Name	Open	Closed	mE	mN	Days
CAM1	29/08/2017	1/09/2017	626619	6408874	4
CAM2	30/08/2017	1/09/2017	626457	6410802	3
CAM3	29/08/2017	30/08/2017	626290	6408926	1
CAM4	29/08/2017	1/09/2017	627127	6408892	4
CAM5	29/08/2017	1/09/2017	623786	6408033	4

Opportunistic surveys

Non-systematic opportunistic observations of fauna species were made and recorded. Secondary evidence of fauna such as tracks, diggings and scats were also noted. Active searching was undertaken in specific areas to locate frog and reptile species. Searches generally included investigating burrows, investigating scats, tracks and other traces, turning fallen timber, roofing tin and rocks, etc.

Invertebrates and short range endemics

Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002). Invertebrate surveys were not part of the scope of work, however, the presence/absence of any invertebrates of conservation significance was noted.

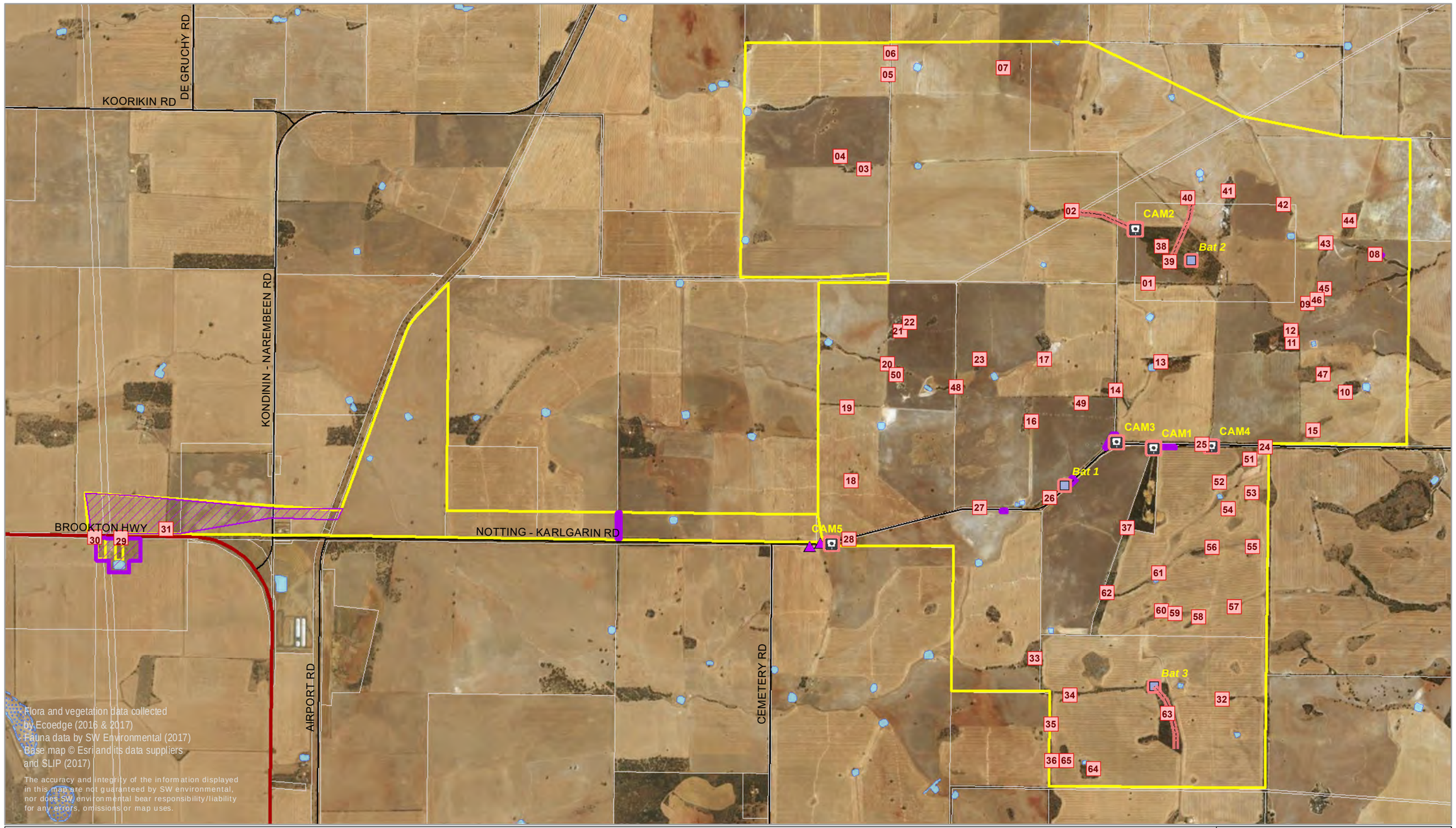


Figure 2-2 Fauna survey locations

2.2.7 Fauna survey limitations

Certain species may not have been detected during field investigations due to:

- seasonal inactivity during field survey (e.g. frogs and reptiles),
- species present within micro habitats not surveyed,
- cryptic species able to avoid detection, and
- transient wide-ranging species not present during survey period.

Some species may be present in the general area but may only use the study area itself on rare occasions or as vagrants. Any lack of observational data should not be taken as indicating that a species is absent from the site.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to include/exclude species from the potential list based on the apparent presence or absence of a specific habitats or microhabitats within the study area. A precautionary approach has been adopted for this survey. Any fauna species that would possibly occur within the study area (or immediately adjacent), as identified in the desktop assessment, has been assumed to potentially occur in the project area. The potential fauna list produced for this report (Appendix B.1) is likely an overestimation of those species that actually utilise the site.

In accordance with the EPA *Guidance Statement No. 56*, potential limitations of the fauna survey are identified below.

Table 2-6 Limitations of fauna assessment adequacy and accuracy

Aspect	Constraint	Comment
Competency	No	Suitably qualified individuals carried out the survey work: senior zoologist Greg Harewood and Shane Priddle (Certified Environmental Practitioner No.310).
Scope	Yes, negligible	A Level 1 fauna survey was undertaken and supplemented with desktop research, field survey and targeted surveys for fauna groups potentially at risk of wind farm development (birds and bats). Given that the clearing of native vegetation will be minimal the scope is considered adequate to have met the scale of works and budget.
Proportion of fauna identified, recorded and/or collected	No	Sixty-three fauna species were observed at the site; approximately one quarter of the species recorded locally, including two bats and one bird that were not previously identified locally from the desktop assessment. Additional survey effort may increase the total number of species found, but would be unlikely to identify any additional fauna of conservation significance given they have been considered through a precautionary approach.
Sources of information	Yes, negligible	The desktop assessment was based on Naturemap (20km) and ALA (50km) databases and PMST (20km) for target species. There may be additional surveys that have been carried out with results that were not provided submitted through DBCA Fauna Survey Returns, in the above datasets. The wide search ranges have been adopted in an attempt to address this limitation.
The proportion of the task achieved and further work	No	The field survey was completed adequately, with the survey carried out to a sufficient level with respect to required scope of works.
Timing/weather/season/cycle	Yes, negligible	Field surveys were undertaken in winter/spring and conditions considered suitable for a Level 1 assessment. The cool weather would have affected species counts for frogs and reptiles, however, given there are no locally occurring threatened

Aspect	Constraint	Comment
		species from these groups the survey is considered to have been adequate.
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey	No	None observed.
Intensity (in retrospect, was the intensity adequate)	No	Based on the results the survey is considered adequate to meet the project scope.
Completeness (e.g. was relevant area fully surveyed);	No	Survey effort was considered adequate and of a higher intensity than typically required by a Level 1 survey.
Resources (e.g. degree of expertise available in animal identification to taxon level);	No	No unresolved problems/uncertainties arose with respect to identifying observed fauna species.
Remoteness and/or access problems;	No	Most of the study area was easily accessed by foot traverse or vehicle.
Availability of contextual (e.g. biogeographic) information on the region.	No	ALA and Naturemap databases which includes previous local fauna survey data, specialist books/publications and data were consulted.

3 DESKTOP REVIEW

3.1 Environmental context

3.1.1 Interim Biogeographic Regionalisation of Australia (IBRA) values

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. IBRA also provides for the national and regional planning framework for the systematic development of a comprehensive, adequate and representative (CAR) National Reserve System, endorsed by all levels of government as a key tool for identifying land for conservation under Commonwealth's *Australia's Strategy for the National Reserve System 2009-2030* (DE, 2017).

The project is located in the Western Mallee (MAL2) sub region of the Mallee Bioregion, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (DE, 2017). The Mallee Bioregion is the south-eastern part of Yilgarn Craton. Its landscape is gently undulating, with partially occluded drainage, and is fragmented with particular surface-types almost completely cleared as wheatfields (Beecham and Danks, 2001).

3.1.2 Landform, geology, soils and climate

Beecham and Danks (2001) describe the Western Mallee (MAL2) sub region as having more relief than its eastern counterpart: main surface-types comprise clays and silts underlain by Kankar, exposed granite, sandplains and laterite pavements. It is characterised by salt lake systems on a granite basement and occluded drainage. Mallee communities occur on a variety of surfaces; *Eucalyptus* woodlands occur mainly on fine-textured soils, with scrub-heath on sands and laterite. The climate is warm Mediterranean and annual rainfall is 250-500 millimetres.

The project is in the South-eastern Zone of Ancient Drainage (SZAD) in the Avon Province. The SZAD extends from Corrigin east through Hyden to the edge of the intensive agricultural zone (clearing line), and south to the north-eastern part of the Shire of Gnowangerup (Verboom and Galloway, 2004). It is described by Schoknecht, *et al.* (2004) as a smooth to irregularly undulating plain dominated by salt lake chains in the main valleys. Duplex and lateritic soils on the uplands are characterised by Mallee vegetation (on duplex soils) and Proteaceous vegetation on gravels and sands (Schoknecht, *et al.* 2004). Within the SZAD, the project is situated on soils of the Corrigin East (250Ci) soil landscape system. A small section of the transmission line easement also crosses the Kondinin (250Ki) soil landscape system. These are described in Table 3-1.

Table 3-1 Soil Mapping Units occurring within the project area (Tille and Lantzke, 1990).

Soil Landscape	Description
250Co	Gently undulating rises to undulating low hills in the southern wheatbelt, with laterite, sandy & loamy gravels, duplexes & loamy earths & clays over mixed mafic rock. Heath & Mallee on lateritic uplands. Mallees on upper colluvial slopes, Salmon gum on lower colluvial slopes.
250Ki	Broad flat valleys of the southern Ancient drainage zone with fine textured alluvial soils derived mainly from mafic parent material. Mainly *Eucalyptus* woodlands, including *E. loxophleba, E. salmonophloia, E. capillosa, E. salubris* & halophytes.

3.1.3 Brief land use summary

The project, and broader Western Mallee sub region, fall within the wheatbelt and Intensive Land-use Zone (ILZ) (DAFWA, 2016). The ILZ has been mostly cleared and developed for intensive agriculture such as cropping and livestock production with only 31% of native vegetation remaining in the area. About 10% of the subregion is reserved for conservation, containing about 25% of the remaining vegetation (Shepherd et al, 2002). The project area itself is located within active agricultural land, primarily cleared but with narrow linear remnant vegetation strips still intact. Most of the site is cropped with canola or wheat. Fallow fields were grazed with sheep, many patches of remnant vegetation were not fenced and therefore also grazed.

3.1.4 Conservation lands

The nearest conservation lands include:

- Kondinin Lake Nature Reserve (~1700 ha); 8 km west from the closest proposed turbine, 2 km south west of the proposed substation;
- Bendering Nature Reserve (~1900 ha); 2 km north of the project site;
- Bendering West Nature Reserve (~100 ha); 4.5 km north of the project site;
- North Kalgarin Nature Reserve (~5800 ha); 9.2 km north east of the project site;
- Kondinin Salt Marsh Nature Reserve (~2200 ha); 9.5 km south of the project site;
- Kalgarin Nature Reserve and an unnamed reserve (~1400 ha); 14 km south east of the project site;

(SLIP 2017)

The Bendering and North Kalgarin Nature Reserves appear to be relatively intact from aerial photo interpretation and contain a number of threatened fauna records on Naturemap (2017). Given they are the largest contiguous patches of local native vegetation they are also likely to have best flora and fauna habitat values locally.

Kondinin Lake and Salt Marsh Nature Reserves are large seasonally inundated lakes that support a variety of wetland birds at certain times of the year. Kondinin Lake is used locally for water sports. They may provide habitat for the threatened Fairy Shrimp.

3.1.5 Important Bird Areas (IBA)

Important Bird Areas (IBAs) are areas identified by Birdlife International. IBAs are considered conservation priorities, sites able to be conserved in their entirety and are usually part of a protected-area network or recognised as having global bird conservation importance (Birdlife International, 2017).

No IBAs occur in the immediate vicinity of the subject site. The closest (Birdlife International, 2017) is the Dragon Rocks IBA, within the Dragon Rock Nature Reserve, situated approximately 75 kilometres east of the project.

The Dragon Rocks IBA supports the endangered Carnaby's Black-Cockatoo, the vulnerable Malleefowl, and four species restricted to the Mallee and the south-western biome: Western Rosella, Blue-breasted Fairy-wren, Purple-gaped Honeyeater and Western Yellow Robin.

The Holleton IBA, is the next closest at 77km north east of the site. It encompasses a number of nature reserves. The Holleton IBA supports important habitat for the vulnerable Malleefowl and four species restricted to the Mallee and the south-western biome: Rufous Treecreeper, Blue-breasted Fairy-wren, Purple-gaped Honeyeater and Western Yellow Robin.

3.1.6 Wetlands and migratory flyways

Irregular flooding and resource booms occur in many parts of Australia; this is particularly true for Australia's interior water bodies. There are 37 types of shorebirds that annually migrate to Australia to utilise waterbodies and shorelines along flyways. Flyways are broad corridors used by migrating birds. The East Asian-Australasian Flyway is one of eight identified around the world, extending from within the Arctic Circle, through East and South-east Asia, to Australia and New Zealand, stretching across 22 countries. The numbers of waders in the East Asian-Australasian Flyway are unknown but there are probably a minimum of two million migratory waders within Australia (Birdlife Australia, 2017). The flyway includes a number of staging sites as well as an indication of the regular routes used by thousands of migrating birds (Birdlife International 2017).

Little is known about the movement corridors and flyways used by migratory species within Australia (both international and endemic species) and that uncertainty adds to the risk posed by wind farms to migrating birds. Movement appears to vary species by species, with some showing high fidelity to certain sites and routes, and varies according to the boom-and-bust style of flooding and drying cycles of the Australian climate (Bianca Heinze *pers.comm*. with Rob Clemens, Shorebirds 2020, Bird Australia, 22/12/09).

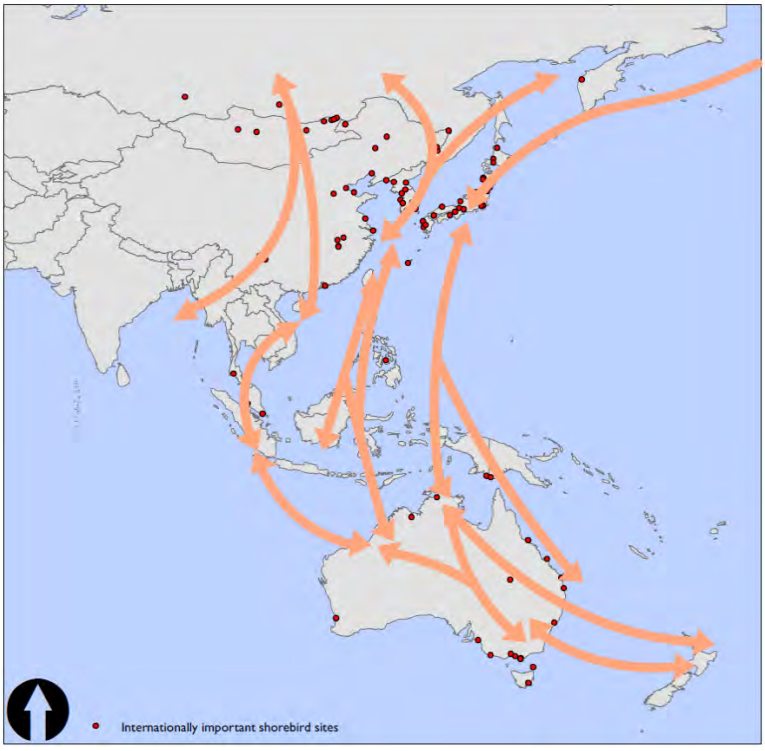


Figure 3-1 The East Asia / Australasia Flyway routes shown with arrows (Extract from: University of QLD, undated)

Wind farms have the potential to significantly increase bird mortalities where they are constructed along a major migratory bird flyway. Figure 3-1 shows the general location of routes used in the East Asia / Australasia Flyway; note that there is not a route near the site.

The Kondinin Wind Farm would be located in an area of mostly cleared agricultural land in the crook of the confluence of Lockhart River and Camm River. The closest wetlands to the project are the Kondinin Lake Nature Reserve which is part of a band of seasonal lakes; eight kilometres west from the closest proposed turbine, two kilometres south west of the proposed substation. It is not listed in the Directory of Important Wetlands in Australia (nor is it a RAMSAR site), which indicates that the local ephemeral lake system is unlikely to provide important habitat for nomadic or migratory waterbirds. The nearest RAMSAR site is Toolibin Lake about 80km southwest of the site.

The likely impact of the project on wetland birds is considered in more detail *Section 3.3.5*, and in the *General synopsis of operational impact upon birds and bat (risk assessment)* in Appendix A.5.

3.1.7 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are declared by the Minister for Environment under section 51B of the *Environmental Protection Act 1986* (EP Act). ESAs are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and are selected for their environmental values at state or national levels. They include;

- Defined wetlands and riparian vegetation within 50 m;
- Areas covered by Threatened Ecological Communities;
- Area of vegetation within 50 m of Declared Rare Flora;
- Bush Forever sites; and
- Declared World Heritage property sites.

According to the SLIP (2017), there are no known ESAs within the project area. The closest ESA is the Bendering Nature Reserve.

3.2 Flora and vegetation

3.2.1 Vegetation types

The project lies within the Roe district of the South-western Botanical Province (Beard, 1980). A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which generally described vegetation systems at a scale of 1: 250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent. The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd *et al.* (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 'Broad Floristic Formation' for the National Vegetation Inventory System (NVIS) (state-wide to regional scale). Three vegetation associations are mapped as occurring within the project area, these are described in Table 3-2 and shown in Figure 3-2.

Table 3-2 Description of Beard Vegetation Associations mapped within the project area (Beard, 1972).

Vegetation Association	Description
1023	Medium woodland; York gum, wandoo & salmon gum (*E. salmonophloia*)
960	Shrublands; mallee scrub, redwood & black marlock
128	Bare areas; rock outcrops

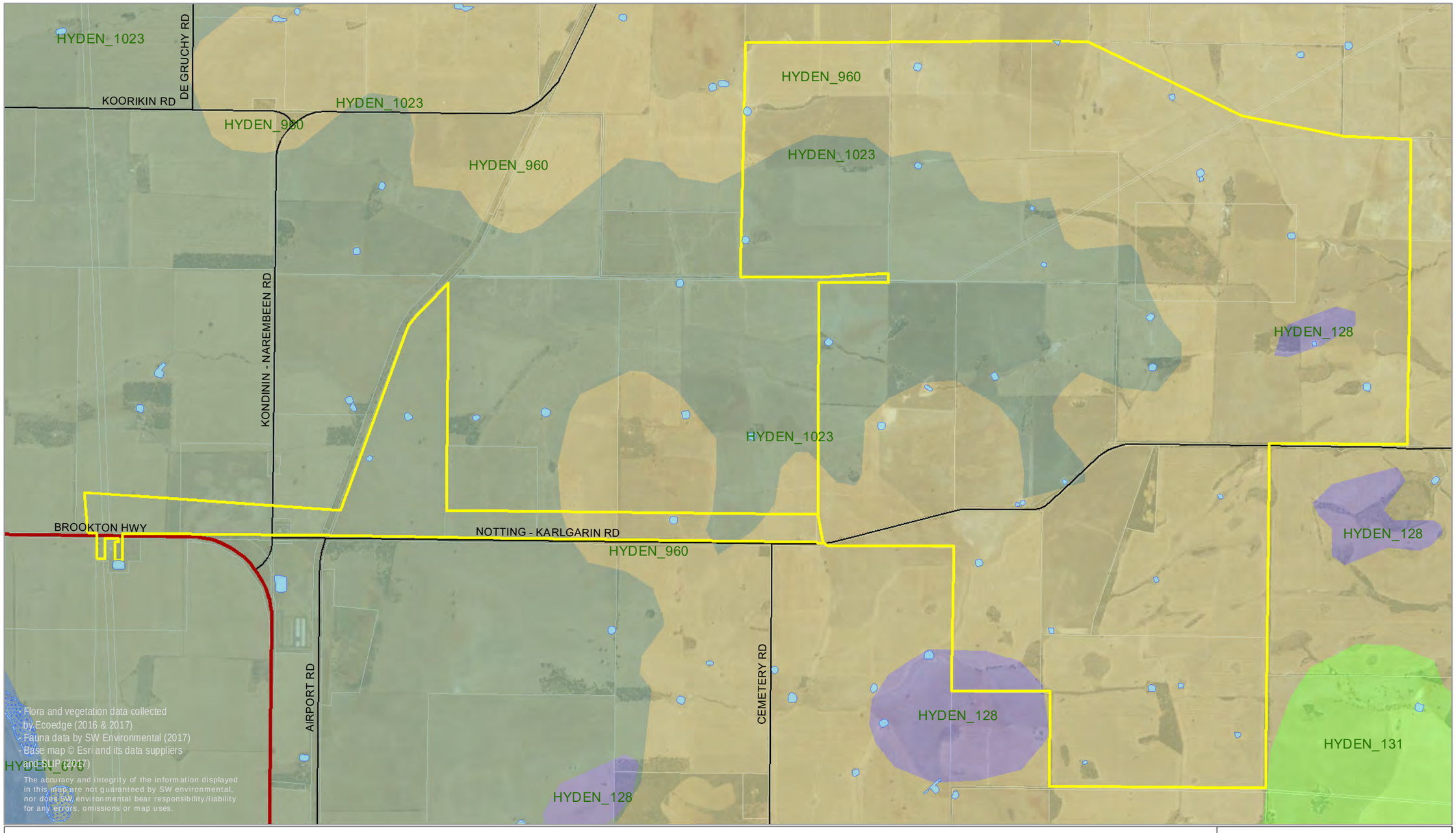


Figure 3-2 Beard Vegetation Associations mapped within the project area (Beard, 1972)

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30% or more of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia, 2001). This level of recognition is in keeping with the targets set in the EPA's Position Statement on the *Environmental protection of native vegetation in Western Australia: clearing of native vegetation, with particular reference to the agricultural area* (EPA, 2000). With regard to conservation status, the EPA has set a target of 15% of pre-European extent for each ecological community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

The Government of Western Australia, in its report on the *Statewide Vegetation Statistics incorporating the CAR Reserve Analysis,* provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the Comprehensive, Adequate and Representative (CAR) reserve system for WA (Government of Western Australia, 2016). This system is also based on retention targets of 30% overall and 15% of pre-European native vegetation in reserves managed by DBCA under the *Conservation and Land Management Act 1984* (Government of Western Australia, 2016), in line with the Commonwealth and EPA targets detailed above. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the CAR Reserve Analysis. For this analysis, the Beard vegetation associations are used, as this is the only mapping dataset that covers the entire state. An assessment of the vegetation associations in the Project Area against the *Statewide Vegetation Statistics* is presented in Table 3-3.

Table 3-3 Beard Vegetation Associations of the project area assessed against the Statewide Vegetation Statistics (Government of Western Australia, 2016).

Beard Vegetation Association Code	% Remaining of pre-European extent	% of pre-European extent in all DPaW managed land
1023	10.84%	1.35%
960	13.78%	5.00%
128	87.54%	21.29%

3.2.2 Threatened ecological communities

Ecological communities are defined by DBCA as *...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services.* (DEC, 2010). The conservation status and protection of ecological communities are described in *Section 1.3.1* and Appendix A.6.

A PMST query for communities listed under the EPBC Act occurring within a 20 km radius of the project was undertaken (DotEE, 2016c), and the current DBCA TEC and PEC listings were consulted (DPaW 2016a; 2016b). Threatened or priority ecological communities known to occur or possibly occurring within 20 km of the project area are listed in Table 3-4.

Table 3-4 Threatened and Priority Ecological Communities known to occur within 20 km of the Project Area (DPaW 2016a; 2016b; DotEE, 2016c).

Community Name	Community Description	Status (WA)	Status (*EPBC Act*)
Eucalypt Woodlands of the Western Australian Wheatbelt	Eucalypt-dominated woodlands in the Western Australian Wheatbelt region as defined by the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions.	P3	CE

Community Name	Community Description	Status (WA)	Status (*EPBC Act*)
	The community is defined by its woodland structure woodland with eucalypt trees in the canopy layer - most commonly salmon gum (*Eucalyptus salmonophloia*), York gum (*Eucalyptus loxophleba*), red morrell (*Eucalyptus longicornis*) or gimlet (*Eucalyptus salubris*). Several of the other emergent eucalypt species which may be present as characteristic species (e.g. Kondinin blackbutt (*E. kondinensis*), *E. myriadena*, salt river gum (E. *sargentii*), silver mallet (*E. ornata*) and mallet (*E. singularis*) are found only in the Western Australian Wheatbelt. The following are not included in the community description: woodlands and forests dominated by Jarrah (E. *marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum present; and non-woodland communities dominated by eucalypts, specifically those with a mallee growth form.		

3.2.3 Conservation significant flora

Thirteen threatened flora and 37 Priority flora may occur locally based on database searches within 20 km of the project (NatureMap and the PMST report) (Appendices A.1-A.2). These are listed in Table 3-5 below. Appendix A.3 includes an evaluation of the likelihood of these conservation significant species occurring at the site.

Based on an assessment of their known distributions and preferred habitats some of the species listed in Table 3-5 could potentially occur within the project area. The majority of species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

Table 3-5 Threatened and Priority flora species known to occur within 20 km of the project area (DPaW 2016c; DotEE, 2016c).

Conservation status			
Threatened	**Priority**	**Priority** *(continued)*	**Priority** *(continued)*
Dasymalla axillaris T (CE)	*Acacia sclerophylla var. teretiuscula* P1	*Baeckea sp. Hyden (J.M. Brown 141)* P3	*Opercularia rubioides* P3
Duma horrida subsp. abdita T (CE)	*Chamelaucium sp. Parker Range (B.H. Smith 1255)* P1	*Banksia rufa subsp. obliquiloba* P3	*Oxymyrrhine plicata* P3
Guichenotia seorsiflora T (CE)	*Darwinia divisa* P1	*Banksia xylothemelia* P3	*Podotheca pritzelii* P3
Acacia lanuginophylla T (EN)	*Eucalyptus mimica subsp. continens* P1	*Calytrix nematoclada* P3	*Sarcocornia globosa* P3
Boronia capitata subsp. capitata T (EN)	*Melaleuca grieveana* P1	*Dielsiodoxa leucantha subsp. Leucantha* P3	*Stylidium sejunctum* P3
Eremophila verticillata T (EN)	*Pterostylis echinulata* P1	*Eucalyptus erythronema subsp. inornata* P3	*Synaphea constricta* P3
Grevillea dryandroides subsp. hirsuta T (EN)	*Acacia arcuatilis* P2	*Eucalyptus exigua* P3	*Thomasia tenuivestita* P3
Grevillea involucrata T (EN)	*Eremophila sargentii* P2	*Eucalyptus microschema* P3	*Thysanotus cymosus* P3
Grevillea scapigera T (EN)	*Millotia steetziana* P2	*Eucalyptus ornata* P3	*Diuris recurva* P4
Ptilotus fasciculatus T (EN)	*Acacia deflexa* P3	*Eucalyptus spathulata subsp. salina* P3	*Eremophila veneta* P4

Conservation status			
Threatened	**Priority**	**Priority** *(continued)*	**Priority** *(continued)*
Roycea pycnophylloides T (EN)	*Acacia inophloia* P3	*Frankenia drummondii* P3	*Grevillea asteriscosa* P4
Symonanthus bancroftii T (EN)	*Acacia undosa* P3	*Hibbertia glabriuscula* P3	
Verticordia staminosa var. cylindracea T (EN)	*Angianthus micropodioides* P3	*Lasiopetalum fitzgibbonii* P3	

3.3 Fauna

3.3.1 *Fauna and habitats*

General habitat

From the landscape scale Beard vegetation mapping (Table 3-3) key structural vegetation types of remnant vegetation include woodland, shrublands/mallee scrub and bare areas/rocky outcrops. From aerial photo interpretation, most of the site has been cleared and is cropped with canola and wheat with only narrow, mostly linear remnant vegetation strips still intact.

There are a number of ephemeral natural drainage features over the site, however they are all degraded and in most cases completely cleared of native vegetation. There are approximately 30 farm dams, varying in size from about 0.1-0.4 ha, located at various locations around the site. They are generally devoid of native vegetation along the banks. There are no other wetlands at the site.

Local records

Local records amalgamated from the Naturemap (20km) (DPaW 2017) and Atlas of Living Australia (50km) (ALA) (2017) databases, supplemented by species that may occur locally listed in the PMST report (2017), are provided in Appendix B.1. A total of 257 species have been recorded locally, with birds by far the most abundant class.

Class	Species
Amphibian	9
Bird	165
Mammal	30
Reptile	53
TOTAL	257

At least eight of the listed fauna are introduced species. Invertebrates, marine or aquatic dependant species (fish) are not included. Some near coastal or wetland taxa may be included in the list even though they do not use the site.

3.3.2 *Conservation significant fauna*

Of the 257 species that have been recorded locally (not necessarily at the site), 17 species are of conservation significance. Appendix A.3 provides an evaluation of the likelihood of relevant terrestrial conservation significant species occurring at the site. One Priority 4 invertebrate, Fairy Shrimp (*Parartemia contracta*) may also occur locally.

Class	Species
Bird	9
Mammal	9
Reptile	0
TOTAL	18

Table 3-6 Threatened and Priority fauna recorded, or that may occur, within 50 km of the project area (Naturemap 2017; ALA, 2017; PMST, 2017).

Group	Name	Vernacular	Conservation status (see Appendix A.6)
BIRDS	*Calidris ferruginea*	Curlew Sandpiper	WA (T)|EPBC Act (T) (IA)
	Calidris ruficollis	Red-necked Stint	EPBC Act (IA)
	Ardea (Bubulcus) ibis	Cattle Egret	IA
	Ardea (Casmerodius) modesta	Great Egret	IA
	Merops ornatus	Rainbow Bee-eater	IA
	Leipoa ocellata	Malleefowl	WA (T)|EPBC Act (T)
	Calyptorhynchus baudinii	Baudin's Black Cockatoo	WA (T)|EPBC Act (T)
	Calyptorhynchus latirostris	Carnaby's Black Cockatoo	WA (T)|EPBC Act (T)
	Pezoporus occidentalis	Night Parrot	WA (T)|EPBC Act (T)
MAMMALS	*Dasyurus geoffroii geoffroii*	Chuditch	WA (T)|EPBC Act (T)
	Phascogale calura	Red-tailed Phascogale	WA (S)|EPBC Act (T)
	Notamacropus irma	Western Brush Wallaby	WA (P4)
	Pseudomys occidentalis	Western Mouse	WA (P4)
	Myrmecobius fasciatus fasciatus	Numbat	WA (T)|EPBC Act (T)
	Bettongia penicillata penicillata	Brush-tailed Bettong	WA (T)|EPBC Act (T)
	Macrotis lagotis	Bilby	WA (T)|EPBC Act (T)
	Nyctophilus major tor	Greater Long-eared Bat	WA (P4)

3.4 Birds, bats and windfarm operations

Operational wind turbines present a risk to a range of birds and bats. The main risk is mortality through collision with moving turbine blades (blade-strike), although alienation (behavioural avoidance of suitable habitat near infrastructure) is also an important issue. A *General synopsis of operational impact upon birds and bats (risk assessment)* for the proposed wind farm is provided in Appendix A.5, based on the desktop considerations below.

Collision impacts

Fatality and injury may be caused by collision with the moving blades, or by being swept down by the wake behind a blade (Winkelman 1994) or for microbats, via barotrauma. Barotrauma is a *"traumatic [usually fatal] respiratory tract injury caused as a result of a sudden air pressure differential that may occur near moving wind turbine rotors"* (EPHC 2010 p136). In this report, barotrauma and blade-strike are referred to collectively as 'collision' impacts. Key factors when considering the potential rates of collision at a wind farm include the proposed configuration in

relation to habitat (such as good quality forest) and topographical features (such as steep slopes providing updraughts).

Birds and bats flying within or close to the rotor swept area (RSA) are at risk of collision impacts. The RSA is the area of air space defined by the rotation of the turbine blade. As well as direct collision with infrastructure, the rotating blades produce a wake which may draw animals into the blades; the wake is principally behind the turbine within the same plane (Sandersee 2009). The lateral extent of the wake is not well studied (Maalouf *et al.* 2009). In summary, the wind turbine primarily presents a collision risk to birds and bats that fly within or close to RSA *height*. Therefore, the ground clearance of the RSA relative to the flying height of bird and bat species is a key consideration.

The earliest large-scale wind farms, such as Altamont Pass in California, experienced high levels of avian collision mortality, mainly of migrating raptors. Turbine design and wind farm layouts have since progressed. While bird and bat fatalities continue to be recorded at modern wind farms, these are at substantially lower rates (EPHC 2010).

Alienation impacts

Operational wind turbines may cause changes in bird and bat behaviour. Where such behaviour includes avoiding nesting or foraging resources or diverging around the broad area where turbines are located, this is termed an 'alienation' or 'barrier' effect. The turbines, in these instances, act to 'sterilise' otherwise suitable areas of habitat or movement pathways. Alienation may affect local sedentary birds in their daily traverses for foraging, roosting and breeding sites or may cause migratory birds to shift migratory flyways. Birds and bats may be forced to change their flight behaviour to avoid collisions with turbines, subsequently impacting on their breeding and foraging success (Drewitt and Langston 2006). Alienation of hunting habitat for raptors such as Wedge-tailed Eagle may be of particular concern (Smales 2006) for local populations. The distance over which disturbance effects can extend from a wind farm varies considerably. A distance of 600 m is often reported as the zone of disturbance around turbines, however this ranges from 80 m (for a grassland songbird), to 800 m (for waterfowl) and four kilometres (for seabirds) (Sharp 2010). Barrier effects have been demonstrated at offshore wind farms in Europe, however there is little evidence at onshore farms (EPHC 2010, Hull 2013).

For both collision and alienation impacts, many species appear to habituate to the presence of turbines, after an initial acclimation period, reducing the effect of these impacts (Auswind 2006, Hull 2013, De Lucas *et al.* 2008).

3.4.2 Fauna factors

Birds

Generally speaking, birds at risk of collision are those that frequent the rotor sweep area (Hull 2013). Not all species of bird are at equal risk of collision with turbines. Generally, the identified groups at higher risk are (Kingsley and Whittam 2003, Kunz *et al.* 2007, Hull 2013):

- Raptors: Soaring birds use landform features such as elevation, ridges and slopes to cruise and take ascendance. Further, they are generally higher order species, meaning they are less abundant and therefore more susceptible to population level impacts.

- Passerines: Passerines have been among the most frequently reported fatalities at wind farms in Europe, America and Australia. Breeding birds in the vicinity of wind farms may be at greater collision risk if displaying aerial courtship. Migrating and nomadic passerines typically fly at altitudes of 150m or higher.

- Waterbirds: waterbird (i.e. grebes, cormorants, ducks, waders, cranes, rails, crakes, gulls, shorebirds) fatalities have been reported worldwide at wind farms close to staging, breeding and wintering areas.

In addition, wind farm sites may be frequented by scavenger species (e.g. crows, raptors), attracted by crops, livestock or carrion, resulting of collisions with turbines.

However, publicly available carcass monitoring data from Australian wind farms, which is restricted to several facilities in Tasmania, have found *no single foraging or taxonomic guild* to predominate amongst mortalities. Species colliding with wind farms include *carnivores, scavengers, nectivores and ground- and aerial-feeders* (Woehler and Belbin undated). In Victoria, the species most often discovered in mortality surveys are, in descending order, Australian Magpie, Brown Falcon and Nankeen Kestrel (Smales pers. comm. May 2016).

Australian carcass monitoring results reviewed by Hull (2013) suggest that approximately 20 percent of the bird assemblage present at the wind farm are involved in collisions; common species were found to be at most risk of colliding with turbines rather than rare or threatened species, based on their higher abundance. However De Lucas *et al.* (2008) found no clear relationship between species abundance and species mortality (overseas study).

Bats

Bats, specifically microbats, are also impacted by collision impacts at wind farms worldwide (Cryan and Brown 2007, Kunz *et al.* 2007). In terms of blade-strike, Australian species that appear to be most at risk are those that forage above canopy height (i.e. in open airspace) and move through their environment at high speeds, such as the White-striped Freetail Bat. These species are more likely to travel at blade-sweep height. Collisions result either where the individual fails to detect the moving blades or is unable to manoeuvre around them.

Another group of microbats that appears to be at high risk from wind farms, based on international studies, are those that migrate (Baerwald & Barclay 2009). Migrating bats are thought to travel high in the air column on 'auto-pilot'. That is they appear to rely less on echolocation when migrating, instead navigating using alternative spatial senses or orographic features such as mountain ranges (Baerwald & Barclay 2009). Consequently migrating bats may fail to detect wind turbines.

Based on the above, two groups of Australian bats can be identified as higher risk from blade-strike impacts:

- Non-migrating, high-flying microbats (e.g. Gould's Wattled Bat)
- Migrating, high-flying microbats (e.g. White-striped Freetail Bat), particularly those of conservation concern (e.g. threatened) (e.g. Eastern Bentwing Bat)

3.4.3 Site factors

Siting and configuration of turbines is the primary factor influencing alienation impacts; inappropriate layout (such as lines of turbines between important habitat features) can create a barrier effect, resulting in habitat loss or fragmentation (Brett Lane & Associates 2009). Turbines are generally placed to maximise wind values and to minimise turbulence from topographic features and other turbines. In practice, this means there are usually large and variable spaces between turbines (Smales 2006). Rows of turbines throughout the project area could in effect act as multiple barriers to the movement of birds and bats.

Within a wind farm design layout there is potential for some turbines to result in higher collision risk to bird and bat species due to proximity to:

- Steep topography: gully heads, ridge lines, deep valleys and escarpments. These areas can concentrate migrating birds along relatively narrow pathways. They also provide updraughts utilised by swifts, swallows, martins, gulls and raptors.

- Wetlands: marsh, pond, lake, stream, and/or river. Higher concentrations of birds and bats would be encountered near water sources. Water bodies may also provide staging areas for migrating waterbirds.
- Dense vegetation areas: woodland, forest, tree lines, tree clusters.
- Habitat resources such as hollow-bearing trees, caves (narrow flight corridors usually occur near cave entrances) or through gaps between habitat patches. Waterbird staging, wintering or breeding areas.

(Thelander 2004, Kunz *et al.* 2007, Hull 2013).

3.4.4 *Turbine parameter factors*

The parameters of the turbines under consideration for the proposed Kondinin Wind Farm are shown in Table 3-7. The key concerns for birds and bats are:

- Minimum lower rotor-swept area (RSA), (i.e. the ground clearance).
- The height profile of the RSA.

Table 3-7 Turbine parameters under consideration at the proposed Kondinin Wind Farm

Parameter	Approximate dimensions
Hub height	115 m
Blade diameter	140 m
Rotor-swept area (RSA) height profile	45 m – 185 m
Ground clearance (minimum lower RSA)	45 m
Number of turbines	46

RSA height profile

The RSA would occupy the airspace between 45 m and 185 m above the ground - at the lowest point in its arc, the moving blade would travel within approximately 45 m of the ground.

The flying heights of bird species vary considerably (Sharp 2010). While flight-height data collected in south-eastern Australia indicates that many bird taxa rarely fly above 25 metres (EPHC 2010), this is influenced by site and species specific factors. Most birds and bats fly within or just above vegetation canopy height (Smales, I. *pers.comm*, May 2016; *pers.obs.* B, Heinze, Churchill 2008).

The majority of birds and bats fly well below the minimum RSA height proposed. Species that regularly fly high while foraging would be most at risk from the turbine parameters under consideration. This includes common species such as Welcome Swallow and Wedge-tailed Eagle. This is considered further in Section 5.3.

4 RESULTS

4.1 Flora and vegetation results

4.1.1 Vegetation types

Nineteen vegetation units were recognised within the project area (Table 4-1). Their distribution is mapped in Figure 4-1 and a species list for and photograph of each of the vegetation units is provided in Appendix B.2. The structure of most of the vegetation units is Mallee, with some woodland units containing the trees *Eucalyptus salmonophloia* and *E. loxophleba* subsp. *lissophloia* and (rarely) *E. ornata*. There are several shrubland units and one unit (O), is comprised primarily of a lithic herbland complex over granite outcrops. A similar range of structural formations was found in the vegetation of West Bendering Reserve, immediately to the north of the Project Area, by Muir (1977b).

Several of the vegetation units within the Project Area fit the definition of the Federally-listed threatened ecological community "Eucalypt Woodlands of the Western Australian Wheatbelt". In particular, those patches of vegetation units A, E, I and P which fit the area and condition criteria as outlined in Commonwealth of Australia (2016) would likely qualify (Figure 4-4). There were no State-listed threatened ecological communities within the Project Area, however, the federally-listed "Eucalypt Woodlands of the Western Australian Wheatbelt" is also listed as a State-listed Priority 3 ecological community.

Table 4-1 Vegetation units within the Project Area. Units which qualify as WA Wheatbelt Woodlands TEC are marked with an asterisk*.

Code	Description	Simplified structural vegetation type
A.*	Open woodland of *Eucalyptus salmonophloia* and *E. loxophleba* subsp. *lissophloia*, with patches of Mallee on red-brown or yellow-brown loam.	Tall woodland
A.(vd)	Open woodland of *Eucalyptus salmonophloia* on yellow-grey sandy loam. (Very Degraded)	Tall woodland
B.	Mallee/tall shrubland of *Eucalyptus calycogona* subsp. *calycogona*, *E. loxophleba* subsp. *lissophloia* (mallee), *Allocasuarina acutivalvis*, *Callitris canescens* and *Santalum spicatum* on red-brown or yellow-brown loam with patches of granite outcrop.	Tall woodland
C.	Open Mallee of *Eucalyptus calycogona* subsp. *calycogona* below breakaways	Mallee
D.	Open Mallee of *Eucalyptus capillosa subsp. polyclada, E. cylindriflora, E. neutra, E. pluricaulis subsp. pluricaulis* and *E. tenera* on rocky yellow-brown loam.	Mallee
E.*	Open woodland/low woodland of *Eucalyptus capillosa* subsp. *polyclada* and *E. phaenophylla*, with occasional emergent *E. salmonophloia* on rocky/gravelly yellow-brown sandy loam.	Mallee
F.	Shrubland of *Acacia acanthoclada, A. dissona var. dissona, Allocasuarina acutivalvis, Banksia armata, Calytrix breviseta subsp. stipulosa* and various other species on yellow-grey loamy sand.	Shrubland
G.	Low Mallee of *Eucalyptus phaenophylla* on grey-brown sandy loam.	Mallee
H.	Very open Mallee of *Eucalyptus celastroides* subsp. *virella* on gravelly sandy loam.	Mallee
I.*	Woodland of *Eucalyptus ornata* and *E. salmonophloia* on yellow-brown loam.	Tall woodland
J.	Low Mallee of *Eucalyptus phaenophylla*, *E. phenax* and *E. tenera* on gritty yellow-brown sandy loam.	Mallee
K.	Open Mallee of *Eucalyptus platycorys* on yellow-brown sandy loam.	Mallee
L.	Tall shrubland of *Acacia acuminata* with emergent *Eucalyptus loxophleba* subsp. *lissophloia* on gritty brown sandy loam, associated with granite outcrops.	Shrubland

Code	Description	Simplified structural vegetation type
M.	Low Mallee of *Eucalyptus eremophila* and occasional *E. calycogona* subsp. *calycogona*, *E. capillosa* subsp. *polyclada*, *E. celastroides* subsp. *virella*, *E. sporadica* and *Callitris canescens* grey-brown gritty sandy clay with occasional sandstone outcrops.	Mallee
N.	Shrubland of *Allocasuarina acutivalvis, Gastrolobium spinosum, Hakea preissii, H. francisiana, Phebalium tuberculosum* and *Santalum spicatum* on lateritic breakaway.	Shrubland
O.	Tall shrubland of *Acacia acuminata* surrounding a lithic herbland complex on shallow gritty loam, associated with granite outcrops.	Shrubland
P.*	Open woodland of *Eucalyptus salmonophloia* on yellow-grey sandy loam.	Tall woodland
Q.	Open Mallee of *Eucalyptus gardneri* subsp. *gardneri* and *E. loxophleba* subsp. *lissophloia* on yellow-brown loamy sand.	Mallee
PL	Planted/Plantation	Mallee

As shown in Table 4-2, the site is dominated by completely degraded native vegetation, paddock trees and cropped areas (95.3% of the site). Mallee accounts for 3.2% of the site area, native shrubland for 1.2% and woodland occupies only 0.3% of the site.

Table 4-2 Vegetation areas of each simplified structural type within the project area.

Condition	Area (ha)	%
Tall woodland	11	0.3
Mallee	103	3.2%
Shrubland	38	1.2%
Unmapped (completely degraded native vegetation, paddock trees, cropped areas)	3085	95.3%
Total	*3237*	*100.0*

4.1.2 Vegetation condition

Most of the remnant native vegetation in the project area was rated as either Excellent (where it was protected from grazing by livestock) or Completely Degraded (where it was completely open to grazing by livestock) (Table 4-3) (EPA and DPaW 2015).

In the eastern part of the project, there are several substantial areas (> 5 ha) of remnant vegetation that have been fenced off from livestock since the land was first cleared and which show almost no signs of degradation. In contrast are the many small patches of completely degraded vegetation which consist almost entirely of mallee eucalypts and pasture grasses, which have been subject to livestock grazing probably since the land was first cleared. The completely degraded areas have not been mapped.

Table 4-3 Vegetation areas in each condition class within the project area.

Condition	Area (ha)	%
Excellent	52.08	0.24
Very Good	37.17	0.17
Good	33.42	0.16
Degraded	28.92	0.14
Completely Degraded	61.30	0.29
Total	*212.90*	*100.0*

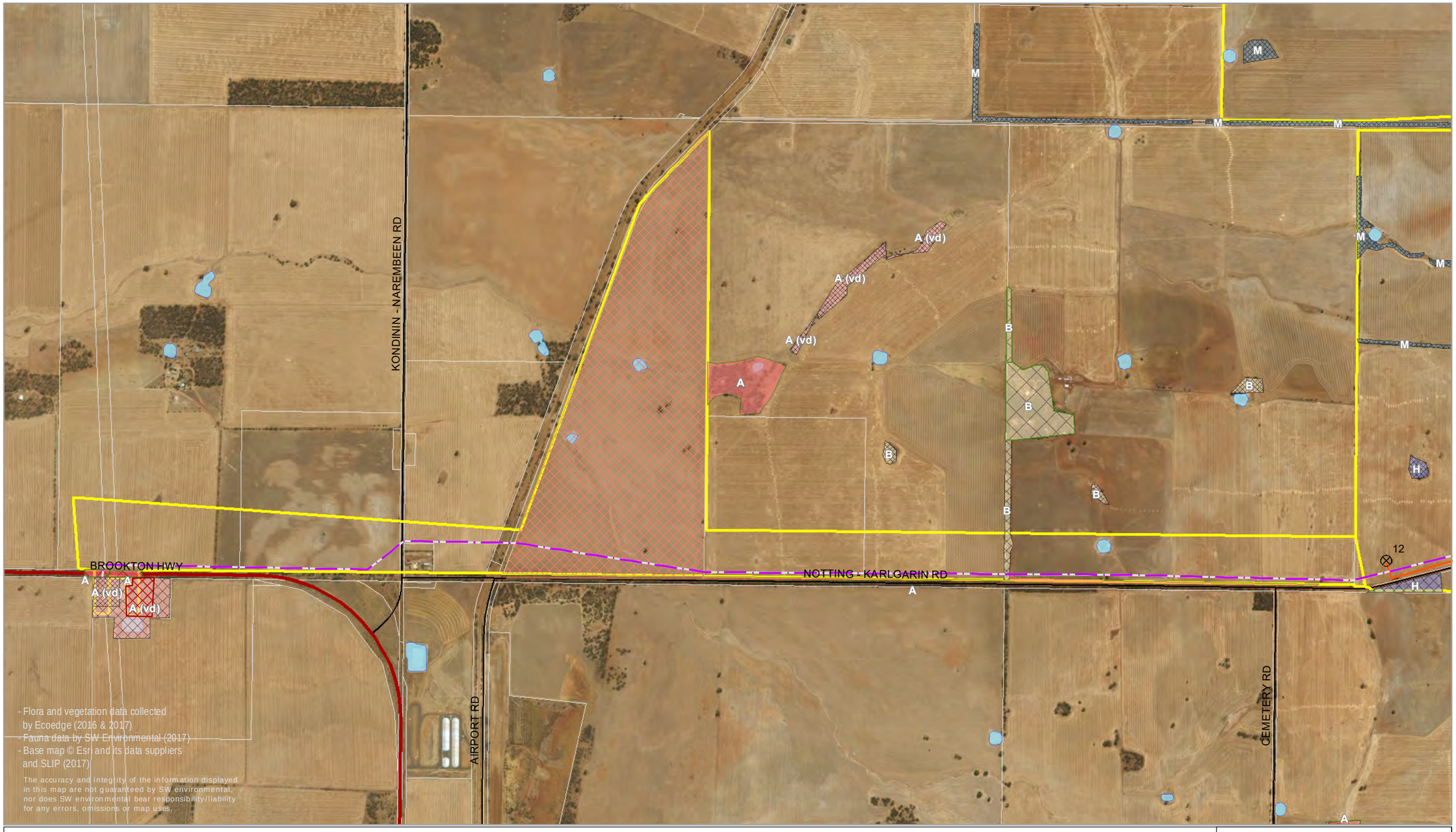


Figure 4-1 Vegetation types and condition mapped across the substation / transmission line section of the project area (adapted from Ecoedge, 2017)

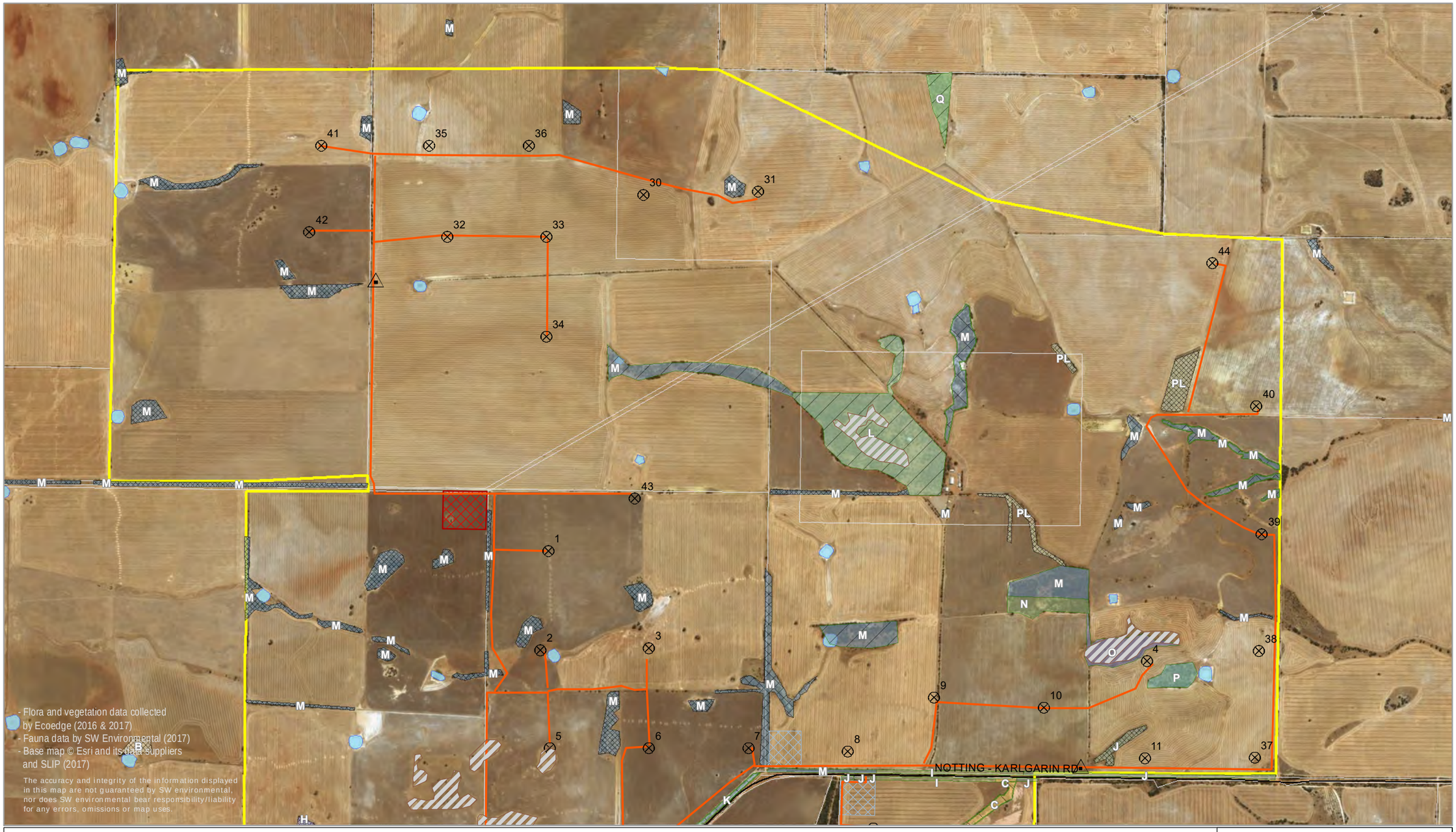


Figure 4-2 Vegetation types and condition mapped across the wind farm area – northern section (adapted from Ecoedge, 2017)

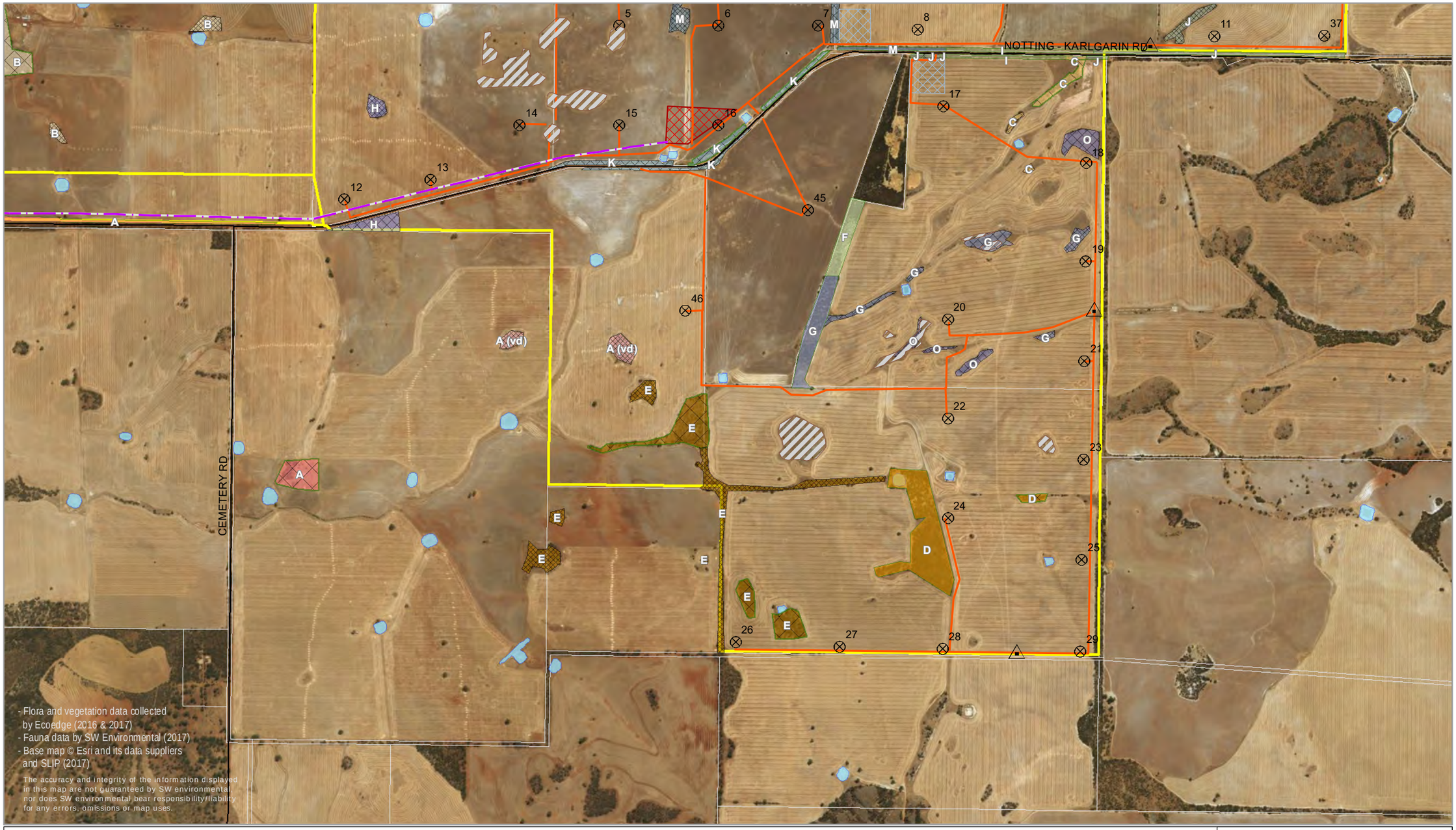


Figure 4-3 Vegetation types and condition mapped across the wind farm area – southern section (adapted from Ecoedge, 2017)

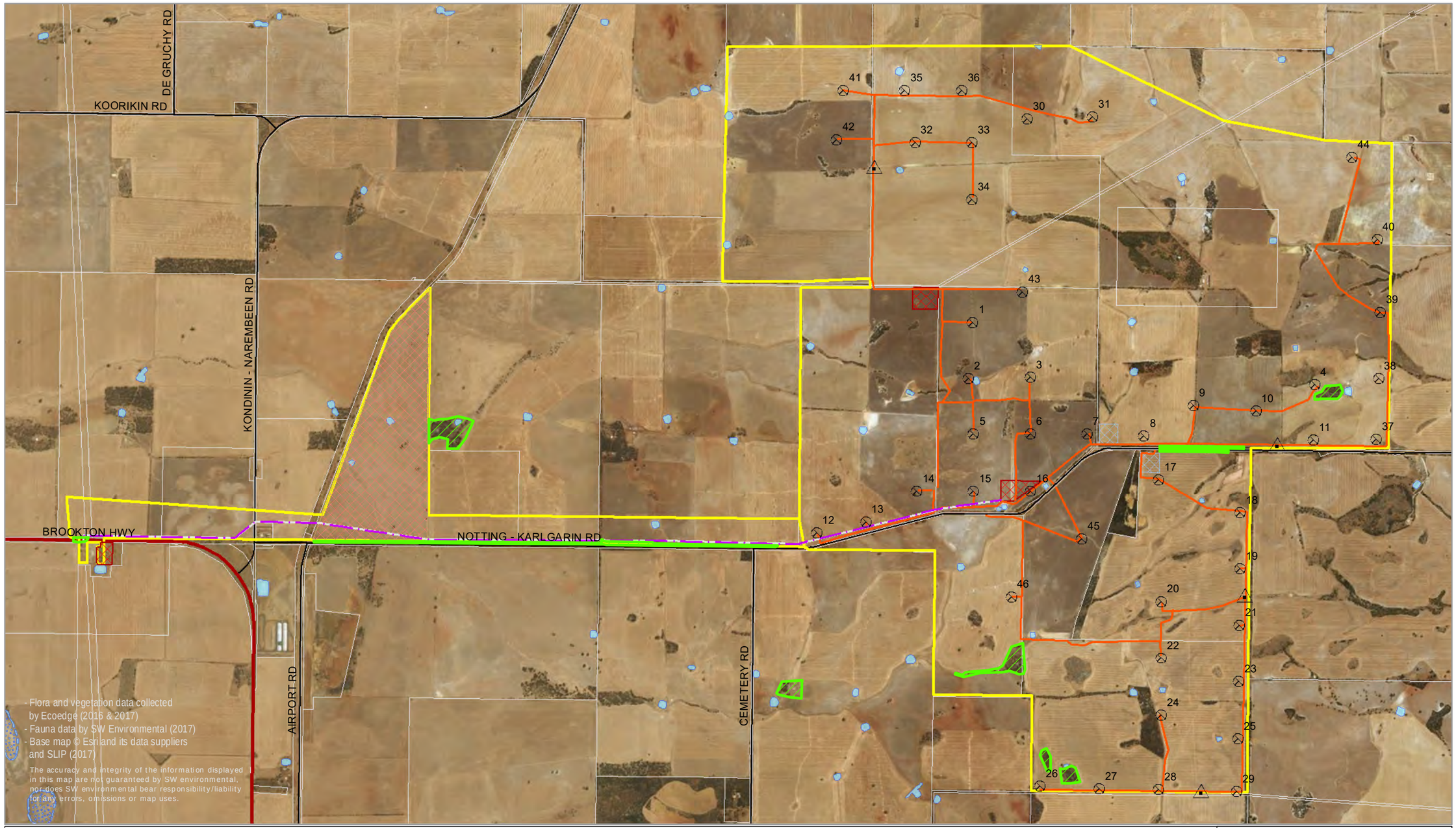


Figure 4-4 Threatened ecological community "Eucalypt Woodlands of the Western Australian Wheatbelt' extent across the site (adapted from Ecoedge, 2017)

4.1.3 Flora

One hundred and thirty vascular flora taxa were identified within the project area, of which three were introduced species (Appendix B.2). This list contains only a partial list of vascular flora within the project area; provision of a complete list of vascular flora was outside the scope of the Project (refer to Table 2-2 Limitations of flora assessment adequacy and accuracy. Table 2-2). A high proportion of the upper storey taxa were identified, but perhaps only 50% of the shrub and herbaceous layer species are listed. Only about one hectare of remnant vegetation was subjected to a comprehensive survey (impact locations at the proposed access points and proposed powerline easement) due to high potential for conservation significant species to occur there.

Photographs of vegetation typical of the access point survey areas are provided in Appendix C.1.

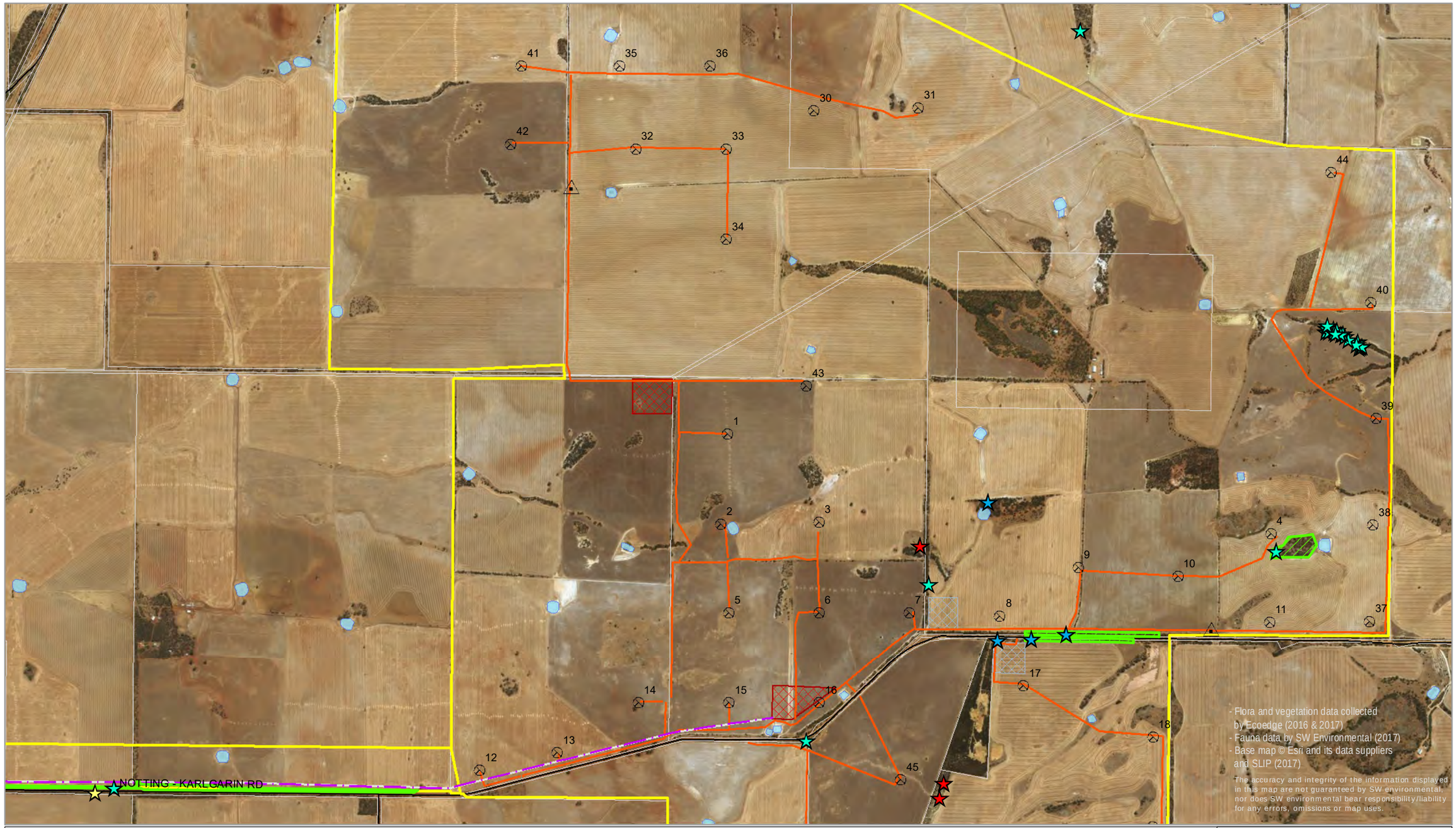
4.1.4 Conservation significant flora

Four Priority-listed taxa were found in the project area (Figure 4-5):

- *Eucalyptus erythronema* subsp. *inornata* (Priority 3),
- *E. ornata* (Priority 3),
- *Eremophila veneta* (Priority 4),
- *Grevillea asteriscosa* (Priority 4).

Other conservation significant vascular flora have potential to occur within remnant vegetation within the project area that are not proposed to be impacted (refer to Section 2 for methods).

In the areas subject to detailed vegetation survey in 2016 (i.e. entrance points and powerline easement), no threatened flora were found. In the areas subject to detailed survey in 2017, two priority species were found (included in the list above).



Eremophila veneta, P4
Eucalyptus erythronema subsp. inornata, P3
Eucalyptus ornata, P3
Grevillea asteriscosa, P4
Threatened ecological community "Eucalypt Woodlands of the Western Australian Wheatbelt'
Turbine (proposed)
Metmast (proposed)
Transmission line (proposed)
Road (proposed)
Substation (proposed)
Compound batching plant (proposed)
Farm dam
Project boundary
Road
Cadastre

0 0.25 0.5 1 Km
A3 @1:22000
Author: SP
Ref: SW140
NORTH

Figure 4-5 Location of Priority flora observed within the project area

Eremophila veneta (P4)

Eremophila veneta (Metallic-flowered Eremophila), Figure 4-6, a shrub with silvery to lilac flowers found in the southern wheatbelt from Corrigin to Gnowangerup, is represented by 74 records in DBCA databases. Six populations of *E. veneta* were found within the project area, two of them in Tall woodland on the verge of Notting-Karlgarin Road and four in remnant patches on farms and Tall woodland / Mallee.

Figure 4-6 *Eremophila veneta* (left); *Eucalyptus erythronema* subsp. *inornata* (right) (Ecoedge 2016).

Eucalyptus erythronema subsp. inornata (P3)

Eucalyptus erythronema subsp. *inornata* is a small mallee with creamy yellow flowers that is restricted to the central wheatbelt of Western Australia (Figure 4-6), where it is distributed in a crescent from south of Wyalkatchem southwards and then south-east to south of Kulin and Pingaring (Nicolle and French, 2012). It is represented by 36 records in DBCA databases. One population was found within the project area, in Tall woodland on the verge of Notting-Karlgarin Road.

Eucalyptus ornata (P3)

Eucalyptus ornata (Ornate Mallet) is a small tree, or mallet, to 6-10 m in height, sometimes with a slightly buttressed trunk, with smooth grey or silvery bark and white flowers (Figure 4-7). It is restricted to the southern wheatbelt, from east of Narembeen to east of Lake Grace, and is represented by 27 records in DBCA databases. It is found mainly on road verges, although there are several populations within Nature Reserves. Four populations were found within the project area high in the landscape,

- one a known occurrence (DBCA database) in Tall woodland,
- one on the verge of Notting-Karlgarin Road in Tall woodland,
- another within a private property remnant north of the roadside population in Mallee.
- An additional plant was found just east of the gravel pit entrance, near a proposed clearing area in Tall woodland.

Figure 4-7 *Eucalyptus ornata* beside Notting-Karlgarin Road.

Grevillea asteriscosa (P4)

Grevillea asteriscosa (Star-leaf Grevillea), is a shrub, 0.3 to 2 m in height, with red flowers (Figure 4-8), found in the central and southern wheatbelt from Merredin to Gnowangerup. It is represented by 50 records in DBCA databases. Two populations, both in private property remnants (in Mallee and Shrubland), were found within the project area.

Figure 4-8 *Grevillea asteriscosa*.

4.2 Fauna results

4.2.1 Habitat assessment

General habitat units

Fauna habitats are generally associated with the vegetation, type soils and other microhabitat features. Over the site they vary for different fauna groups but for the purposes of this assessment have been grouped into structural vegetation types adapted from Ecoedge (2017):

- Tall woodland,
- Mallee,
- Shrubland.

Additional habitats across the site include:

- Cropped land,
- Farm dams,
- Granite outcrops.

Habitat quality

The remnant vegetation patches (tall woodland, mallee and shrubland) provide the dominant fauna habitat at the site. Habitat quality varies across the site and is dependent on the size of the patch and the condition/diversity of vegetation. Typically, the narrow width and isolated nature of many of the remnant vegetation patches are unlikely to provide good habitat for larger species, particularly native mammals, due to a lack of cover and food resources, exposure to predators and edge effects affecting vegetation condition (sheep grazing, weeds). Fenced areas are typically less degraded and offer better fauna habitat opportunities, unfenced areas (most of the smaller patches) are of low habitat quality and likely to be used mostly by birds.

Cropped areas mostly provide habitat on the fringes between ecotones, primarily for foraging. Raptors may forage in these areas. Rocky outcrops (particularly where there is layering/crevices), rock piles and dead timber are found throughout the project area (naturally occurring some in better quality patches and as artificial piles in degraded patches). And provide essential habitat components (e.g. shelter) for a variety of fauna. The invertebrate, microbial and vertebrate species supported by decaying wood provides food for a number of other species. Intact islands of vegetation may still provide habitat for a range of birds, reptiles and bats.

There are a number of ephemeral natural drainage features over the site, however they are all degraded and in most cases completely cleared of native vegetation. They generally exist as washouts that would only contain pools or running water immediately during or after a rainfall event. As noted there are approximately 30 farm dams, varying in size from about 0.1-0.4 ha, scattered over the project area. The banks are typically cleared offering little opportunity for fauna refuge. They do however provide vital watering opportunities for native fauna and may concentrate fauna activity, particularly dams located within and adjacent to remnant vegetation.

Granite outcrops occur in the project area (mapped in Figure 4-1). Where they occur on site, they are often exposed massive bedrock, providing fairly homogenous habitat without variations such as fissures, boulders and layering that offer refuge for fauna. Weathering can form small crevices in some outcrops which provide refuge for small animals such as skinks, though these are fairly rare. Seeps have formed at the edges of some outcrops and these maybe used as water points or as habitat by frogs – small pools containing tadpoles were observed during the field survey. Figure 4-19 shows a typical granite outcrop in the project area.

Photos of representative habitat types are provided below, generally in order of abundance across the site (starting with the most common):

Figure 4-9 Cropped land

Figure 4-10 Mallee (poor habitat value)

Figure 4-11 Mallee (good habitat value)

Figure 4-12 Shrubland (poor habitat value)

Figure 4-13 Shrubland (moderate to good habitat value)

Figure 4-14 Tall woodland (poor habitat value)

Figure 4-15 Tall woodland (good habitat value)

Figure 4-16 Planted vegetation

Figure 4-17 Farm dam

Figure 4-18 Drainage line

Figure 4-19 Granite outcrop

Potential habitat trees

Potential habitat trees are those that are hollow bearing or greater than 30 cm[1] at breast height that may develop large hollows in the future - not those that are multi-stemmed with small branches above breast height. Hollow bearing trees are critical elements for many fauna species; including some arboreal mammals (such as bats, phascogales and possums) and many bird species (such as owls and black cockatoos). Hollows take many years to form. For example, a study by Mawson *et al.* (1994) found that hollows utilised by the medium sized Long-billed Corella (which can utilise smaller hollows than black cockatoos) may take an average of 450 years to form in Marri and over 1000 years in Jarrah (as stags).

Numerous potential habitat trees, some with large hollows, occur throughout the site, particularly in the tall woodland areas or as paddock trees. There were no hollow bearing trees within the areas proposed to be cleared (access areas or transmission line easement). Most trees at these locations were in mallee form, or multi-stemmed at or above breast height, and not likely to develop large hollows.

4.2.2 *Species recorded*

Sixty-three fauna species were identified during the field visit; 44 of these were birds (refer to Table 4-4 and Appendix B.1). A species of note was the *Neophema splendida* (Scarlet-chested Parrot) with an individual was found in the woodland south of proposed Turbine 4. Scarlet-chested Parrot, whilst not conservation significant in WA or nationally (the species is Vulnerable in NSW, Least Concern: IUCN), it is highly nomadic, fairly uncommon and rarely seen locally. The proposal area is probably at the far west of its distribution (though there are a couple of records around Perth; ALA, 2017).

Class	Species
Amphibian	1
Bird	44
Mammal	13
Reptile	5
TOTAL	63

Table 4-4 Fauna observed within the project area

Class	Scientific Name	Vernacular Name
Frogs	*Limnodynastes dorsalis*	Western Banjo Frog
Birds	*Chenonetta jubata*	Australian Wood Duck
	Anas (Nettion) gracilis	Grey Teal
	Phaps chalcoptera	Common Bronzewing
	Ocyphaps lophotes	Crested Pigeon
	Chrysococcyx basalis	Horsfield's Bronze-cuckoo
	Cacomantis (Vidgenia) pallidus	Pallid Cuckoo
	Elanus axillaris	Black-shouldered Kite

[1] Typically 50cm at DBH is the considered a potential habitat tree, except for Salmon Gum and Wandoo which may develop large hollows at 30 cm DBH. Therefore 30cm DBH was considered in this assessment, with trees (some larger than 30/50 cm at DBH but multi stemmed/mallee generally not considered potential habitat trees if based on the particular tree, were not considered likely to develop hollows.

Class	Scientific Name	Vernacular Name
	Falco longipennis	Australian Hobby
	Falco (Ieracidea) berigora	Brown Falcon
	Falco (Tinnunculus) cenchroides	Nankeen Kestrel
	Coturnix pectoralis	Stubble Quail
	Smicrornis brevirostris	Weebill
	Gerygone fusca	Western Gerygone
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Cracticus tibicen	Australian Magpie
	Artamus (Angroyan) cinereus	Black-faced Woodswallow
	Cracticus torquatus	Grey Butcherbird
	Strepera (Neostrepera) versicolor	Grey Currawong
	Cracticus nigrogularis	Pied Butcherbird
	Lalage (Lalage) sueurii	Australian White-winged Triller
	Coracina (Coracina) novaehollandiae	Black-faced Cuckoo-shrike
	Corvus coronoides	Australian Raven
	Petrochelidon (Hylochelidon) nigricans	Tree Martin
	Hirundo neoxena	Welcome Swallow
	Cincloramphus cruralis	Brown Songlark
	Lichmera indistincta	Brown Honeyeater
	Melithreptus (Eidopsarus) brevirostris	Brown-headed Honeyeater
	Anthochaera carunculata	Red Wattlebird
	Gavicalis virescens	Singing Honeyeater
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater
	Epthianura albifrons	White-fronted Chat
	Manorina (Myzantha) flavigula	Yellow-throated Miner
	Grallina cyanoleuca	Magpie-lark
	Anthus (Anthus) novaeseelandiae	Australian Pipit
	Pachycephala (Alisterornis) rufiventris	Rufous Whistler
	Pardalotus striatus	Striated Pardalote
	Petroica goodenovii	Red-capped Robin
	Rhipidura albiscapa	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
	Eolophus roseicapillus	Galah
	Barnardius zonarius	Australian Ringneck
	Neophema splendida	Scarlet-chested Parrot
	Neophema (Neonanodes) elegans	Elegant Parrot
	Polytelis anthopeplus	Regent Parrot
	Coturnix pectoralis	Stubble Quail
Mammals	*Ovis aries*	Sheep
	Vulpes vulpes	Red Fox
	Felis catus	House Cat

Class	Scientific Name	Vernacular Name
	Oryctolagus cuniculus	European Rabbit
	Macropus fuliginosus	Western Grey Kangaroo
	Austronomus australis	White-striped Free-tailed Bat
	Tachyglossus aculeatus	Short-beaked Echidna
	Chalinolobus morio	Chocolate Wattled Bat
	Chalinolobus gouldii	Gould's Wattled Bat
	Nyctophilus geoffroyi	Lesser Long-eared bat
	Vespadelus regulus	Southern Forest Bat
	Nyctophilus major tor	Greater Long-eared Bat
	Mormopterus (Ozimops) kitcheneri	South-western Freetail Bat
Reptiles	*Gehyra variegata*	Variegated Dtella
	Delma australis	Marble-faced Delma
	Tiliqua rugosa	Bobtail
	Cryptoblepharus buchananii	Buchanans snake-eyed skink
	Tiliqua occipitalis	Western Bluetongue

As noted, microbats and raptors are identified as key risk groups for wind farms. The list includes four raptors: Black-shouldered Kite, Australian Hobby, Brown Falcon and Nankeen Kestrel. Other raptors may also use the site as part of a larger home range, e.g. Wedge-tailed Eagle.

In addition to the five bats identified within 50km of the site (ALA, 2017) (White-striped Free-tailed Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Lesser Long-eared bat, Southern Forest Bat) the field surveys identified Central Long-eared Bat (*Nyctophilus major tor*) (P4) and South-western Freetail Bat (*Mormopterus (Ozimops) kitcheneri*). Microbats are known to forage considerable distances from their roost sites (15 – 30 km; Churchill 2008), so it is unclear whether the recorded bats are roosting within the project area or are only foraging.

Figure 4-20 A group of passerine birds (Black-faced Woodswallow, White-fronted Chat and Horsfield's Bronze-cuckoo) perching on a farm fence

Reptiles were only found during active searches due to the cool climate at the time of the survey. It is likely that there are many more taxa occurring within the project area than the five observed, including snakes.

The mammalian fauna observed included Short-beaked Echidna, Western Grey Kangaroo, microbats and exotic species, including cats, foxes, rabbits and sheep. Cats and foxes pose a significant threat to a number of native animals including threatened species such as Malleefowl and Red-tailed Phascogale. Native populations persisting in narrow remnants are known to be particularly at risk of predation from species such as cats and foxes, due to edge effects.

Figure 4-21 Fox and Cat recorded by infrared camera traps

4.2.3 Conservation significant fauna

The only conservation significant fauna identified within the project area was the Central Long-eared Bat (P4). Based on the site survey and the threatened fauna evaluation table, five birds of conservation significance and two mammals have potential to occur within the project area. An extract of the threatened fauna evaluation table (Appendix A.4) is given below (Table 4-5).

Table 4-5 Fauna of conservation significance that may occur within the project area

Family Genus species	Vernacular	Status Federal	Stat. WA	Presence of habitat	Likelihood of occurrence
ARDEIDAE *Ardea ibis*	Cattle Egret	IA	IA	Marginal	Possible, infrequent visitor with abundant similar habitat locally
Ardea modesta	Great Egret	IA	IA		
CACATUIDAE Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	EN	Present	Possible, site located towards the eastern edge of known distribution
FALCONIDAE *Falco peregrinus*	Peregrine Falcon	-	OS	Present	Possible
MEROPIDAE *Merops ornatus*	Rainbow Bee-eater	IA	IA	Present	Possible
DASYURIDAE *Phascogale calura*	Red-tailed Phascogale	VU	CD	Present	Possible
MURIDAE *Pseudomys occidentalis*	Western Mouse	-	P4	Marginal	Possible, but dense native vegetation is generally rare over the site
VESPERTILIONIDAE *Nyctophilus major tor*	Central Long-eared Bat	-	P4	Present	Present

5 POTENTIAL IMPACTS

Impacts to flora, fauna and vegetation may be associated with construction and operation of the wind farm. Construction impacts may be both direct (e.g. clearing) and indirect (e.g. edge effects). Operational impacts would be mostly direct (e.g. bird and bat blade strike) although indirect impact may also occur (e.g. alienation). These are discussed below.

5.1 Clearing of native vegetation

Typical impacts potentially associated with clearing native vegetation include:

- Direct loss of habitat and mortality of individual plants and animals. Loss of nesting habitat has greater impacts during spring, the nesting period for most fauna.
- Loss of mature vegetation (which also provides more flowers, nectar, fruit, seeds, refuge for fauna).
- Loss of below ground biomass (such as seed banks).
- Changes to vegetation and fauna assemblages within affected vegetation patches.
- Fragmentation of habitat connectivity and populations.

The total clearing proposed is less than 0.15 of degraded vegetation, consisting of:

- Less than 0.15 ha of clearing of degraded vegetation at three locations, allowing for a 20 m wide 'worst case scenario' (actual access track will likely be four metres wide)
    - <0.07 ha of vegetation Unit K,
    - <0.04 ha of vegetation Unit M,
    - <0.04 ha of vegetation Unit J.
- Potential clearing of paddock trees where they cannot be avoided (e.g. less than 10 trees associated with the solar farm).
- Pruning of vegetation over five metres high within the proposed 30 m wide transmission line easement.

Considering the size of the project area, the clearing impact associated with the proposed wind farm development will be very low (less than 0.1% of vegetation across the project area). Photos of the proposed clearing locations are shown below. Habitat connectivity will not be impacted at either site or landscape scales by the clearing proposed.

Figure 5-1 Proposed substation site, showing highly disturbed, degraded vegetation of Type A(vd). Photo taken from Habitat Plot 29.

Figure 5-2 Degraded vegetation Type K that will require clearing at Crossing 1

Figure 5-3 Degraded vegetation Type M that will require clearing at Crossing 2

Figure 5-4 Degraded vegetation Type J that will require clearing at Crossing 3

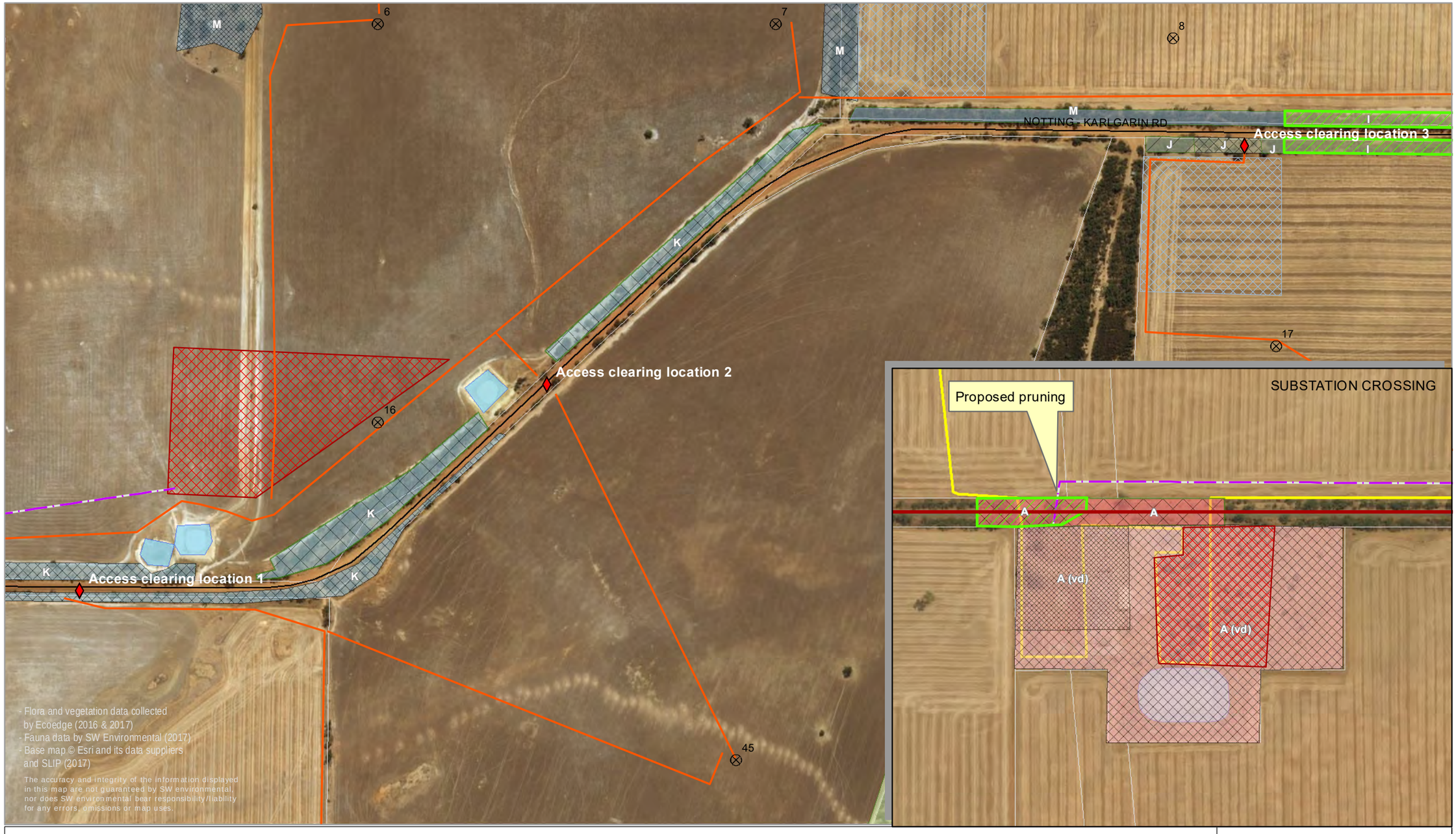


Figure 5-5 Proposed clearing locations

5.2 Indirect impacts / construction environment

Construction, including clearing, may lead to a number of indirect impacts. Indirect impacts may be associated with the construction period (short term) and cumulative impacts associated with ongoing land management (long term). Activities that are likely to cause indirect impacts include:

- Deliberate/accidental clearing or disturbance of native vegetation,
- Machinery access,
- Compaction of soils,
- Noise, dust and vibration, and
- Increased visitation and use of the site by humans and introduced species.

Indirect impacts include:

- Increased negative edge effects causing ingress of weeds, changes to microhabitat and increased access for invasive predators such as foxes and cats. Foxes, cats and rabbits already occur at the site and compete with native fauna, such as macropods, for feed resources; habitat degradation caused by rabbits is well documented (DEWHA 2008). Populations of small mammals and birds may be impacted further by foxes and cats. Domestic animals may also act as vectors for weeds.
- Disruptions to fauna breeding cycles. Birds disturbed from the nest (for example, from excessive noise or changes to light) may disrupt incubation or cease to feed their young (Webster 1999). Many marsupials display a strong fidelity to their territory (Rhind 2003), and therefore disturbance can cause stress. An example of a stress factor may include loss of foraging resources (such as through a high intensity burn or clearing), thereby necessitating an increase in foraging effort, potential for loss of physical condition and potential for neglect or ejection of young.

The indirect impacts of the proposal would be very low, considering:

- The minimal ground disturbance with existing tracks and cleared areas being utilised,
- The small scale of clearing restricted to degraded vegetation,
- Remnant native vegetation patches will largely be left intact.

Potential indirect impacts will be able to be mitigated through appropriate environmental management and implementing the recommendations made in Section 6.

5.3 Operational impacts: Bird and bat collision risk

5.3.1 Topography, wetlands, vegetation communities and habitat resources

The factors described in the *Bird and bat risk assessment (Section 3.3.3)*; topography, wetlands and habitat resources, are considered below specifically for the proposed site in relation to birds and bats.

Topography

The topography of the region is generally flat (DoW 2008). Site surveys found the land to be generally low undulating hills with few prominent topographical features.

Wetlands

At first glance, the siting (effectively surrounded by a wetland system; *Section 3.1.6*) suggests that the proposed wind farm could be established in an area frequented by wetland bird species, and that the proposal would represent a risk to such birds. However, looking more closely at the nature of the wetlands, it can be seen that the majority provide little in the way of habitat for nomadic and migratory species most of the time.

DoW (2008) describe the Lockhart River and salt-lake system as in generally degraded condition with the majority of the lakes in vicinity of the proposed wind farm being secondarily salinized. Secondary salinized wetlands are characterised by simplified ecological communities based on cyanobacteria. Most of the fringing vegetation is cleared or degraded, with the majority of the wetlands being open or dominated by *Samphire* spp. vegetation (DoW 2008).

While waterbirds are reported to frequent the local lakes (Central Wheatbelt Visitor Centre 2017), Halse *et al.* (1995) report that open wetlands are strongly avoided by most wetland species. Further, most waterbird species typical of naturally saline wetlands are rarely found at secondarily saline wetlands (Halse *et al.* 2004). In a survey of wetlands of south-western Western Australia, Halse *et al.* (1994) also found that the majority of breeding waterbirds surveyed showed strong preference for wetlands with more complex fringing vegetation communities rather than open wetlands or those with only samphire communities.

Several of the nearby lakes are protected areas, such as Lake Kondinin Nature Reserve and Kondinin Salt Marsh Nature Reserve. However, these areas appear to have more value for recreation than conservation and little information can be found as to their ecological significance. Lake Kondinin was inspected during the site survey. There was little fringing vegetation and the lake appeared to provide low quality waterbird habitat. Ducks and swans were observed utilising the wetland, but the simplicity of the habitat suggests that Lake Kondinin is unlikely to regularly support significant flocks of these species nor breeding flocks.

It would be expected that Lake Kondinin and other nearby wetlands have the capacity to support larger flocks or rare species from time to time in ideal conditions. However, given the degraded state of the river system, this is likely to be a rare occurrence. Therefore, it is considered that the surrounding wetlands do not present a significant site collision risk for the proposed Kondinin Wind Farm.

Vegetation communities and habitat resources

The region is heavily cleared and many of the vegetated corridors, such as those along the Lockhart River, are in poor condition and provide poor linkage between vegetation remnants (DoW 2008). Site surveys identified small to medium sized vegetation remnants of shrubland, mallee and tall woodland communities, in Completely degraded to Excellent condition (refer to *Section 4.1*). Hollow-bearing trees, locally significant corridors, caves and other important habitat resources for birds and bats were generally absent or in low abundance in the vicinity of the turbines. Isolated paddock trees with potential to contain hollows occur sporadically across the project area. The vegetation across the site is fairly typical of local landscape patterns. The proximity of important habitat resources is not considered a significant site collision risk factor for the proposal. Additionally, bird and bat species are unlikely to be alienated from an area of important habitat by the proposal.

Summary

The local and regional setting for the proposed wind farm do not appear to present significant operational impact risks on the basis of topography, wetlands or habitat resources.

5.3.2 RSA minimum heights

The RSA would occupy the airspace between 45 m and 185 m above the ground - at the lowest point in its arc, the moving blade would travel within approximately 45 m of the ground.

Shrubland and mallee vegetation is generally lower than 10 m high. Tall woodland areas grow up to approximately 25 m high at some locations and are arguably higher risk areas for birds and bats where it is in close proximity to turbines. Tall woodland, however, is mainly found in the transmission line and Notting-Karlgarin Road areas (Figure 5-6). Tall woodland areas mapped within the wind farm (turbine locations) are limited to the following:

- 1.37 ha completely degraded patch of A(vd), 315m southwest of Turbine 46.
- 2.4 ha lineal road verge patches of Unit I along Notting-Karlgarin Road in excellent condition, 165m south east of Turbine 8.

- 2.25 ha patch of excellent condition of Unit P remnant vegetation, 100 m from Turbine 4.

The blades pass by approximately 35 m above the main vegetation (Mallee) canopy height and there are no turbines *within* native vegetation patches. This is considered a sufficient vertical buffer to protect the majority of birds and bats that fly within or just above canopy height; the majority of species are unlikely to encounter the turbine blades during normal daily activities.

As noted in Section 3.4, the flying heights of bird species vary considerably but most birds and bats fly within or just above vegetation canopy height and well below the minimum RSA height proposed. Species that regularly fly high while foraging would be most at risk from the turbine parameters under consideration. This includes common species such as Welcome Swallow and Wedge-tailed Eagle.

5.3.3 Turbine layout factors

In terms of topography concentrating bird and bat movements, the proposed site and the proposed layout present little risk. The turbines in closer proximity to tall woodland patches may have a higher localised collision risk for birds or bats.

The turbine most likely to present a collision risk is Turbine 4, which is located within the <135 m wide cleared corridor between excellent condition tall woodland and shrubland. The main risk would be to birds and bats moving between vegetation patches. Although many small birds would avoid crossing such large open gaps, bats frequently forage around the edges of bushland and between patches (Churchill 2008). The siting of this particular turbine has some potential (more so than other turbines) to be problematic for high-flying microbats, such as White-striped Freetail Bats, and high-flying generalist birds such as cockatoos, raptors, Australian Magpie, ravens and crows passing between patches. However, given the generally low vegetation height (refer *Section 5.3.2*) the risk to most species is still considered low.

There are numerous farm dams within 100-300 m of turbines (see *Section 4.2.1*); aerial imagery and site inspection shows most of these to be generally devoid of fringing native vegetation. Turbines that are positioned between a dam and better quality remnants may present a higher risk for bats in particular. However, given the high level of existing clearing across the site, the positioning of turbines at least 20 m from vegetation and good clearance between average vegetation height and the minimum RSA (refer to *Section 5.3.2*), these risks should be minimised.

5.3.4 Summary

The results of the risk evaluation and assessment show that the Kondinin Wind Farm presents an overall low risk to birds and bats as a potential wind farm site. This is on account of:

- There is no significant or important bird or bat habitat nearby,
- The proposed turbine model includes a minimum RSA height which is well above the average height of vegetation,
- The proposed layout includes at least a 20 m buffer from vegetation remnants.

Figure 5-6 Tall woodland areas over the project area, in proximity to turbines

5.4 Potential impact to conservation significant species

5.4.1 Threatened Ecological Communities

The 'Eucalypt Woodlands of the Western Australian Wheatbelt' TEC occurs over approximately 29.4 ha of the survey area. It occurs in remnant native vegetation Types A, E, I and P, typically[2] in good or better condition. It occurs mostly along the Corrigan-Kondinin Road (Brookton Highway) and Notting-Karlgarrin Road reserves, but also as several discreet patches within paddock areas.

The project will not require the clearing of any TEC. There are however two points where the proposed transmission line easement (30m) may cross areas of mapped TEC and pruning of trees will be required at these locations:

1. At the north west entry to the substation (617362E 6408104S)
2. The entrance to Lot 16619 off Notting-Karlgarrin Road (621930E 6408104S).

It may be possible to minimise the impact (pruning) upon the TEC by micro-siting the easement between large trees near the existing substation and by moving the easement north by approximately 30m away from the TEC along the Notting-Karlgarrin Road. This is included as a recommendation in *Section 6*.

5.4.2 Flora

Based on the infrastructure locations proposed, no conservation significant flora will be directly impacted by clearing. Several populations of Priority flora were located across the site however none of these are within 20 m of the proposed infrastructure locations and all should be able to be avoided.

5.4.3 Fauna

Eight conservation significant fauna were identified (Appendix A.4) as potentially occurring or having suitable habitat within the project area:

- Red-tailed Phascogale (*Phascogale calura*) (VU, CD),
- Western Mouse (*Pseudomys occidentalis*) (P4),
- Greater Long-eared Bat Central Form (*Nyctophilus major tor*) (P4),
- Cattle Egret (*Ardea ibis*) (IA, IA),
- Great Egret (*Ardea modesta*) (IA, IA),
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) (EN, EN),
- Peregrine Falcon (*Falco peregrinus*) (OS), and
- Rainbow Bee-eater (*Merops ornatus*) (IA, IA).

Clearing impacts are unlikely to impact the fauna above considering the small amount of clearing (total less than 0.15 ha of the 153 ha of mapped native vegetation) across the 3237 ha project area, within degraded patches. Red-tailed Phascogale and Western Mouse require good quality vegetation and/or large patches (not associated with the proposed impact areas). The birds and bats above are mobile species and unlikely to be impacted by the small scale and nature of clearing proposed.

A number of common and secure species have been identified as 'at risk' species, indicating that they have potential to suffer collision mortality at the proposed wind farm from time to time, should they occur on site.

[2] A section of Good condition Type A vegetation type north of the existing substation is not TEC due to species composition, however the adjacent section is still considered TEC.

- Birds and bats evaluated as 'at risk' are all common and secure species, apart from Carnaby's cockatoo which whilst being of moderate risk, is probably occurs only rarely at the site and likely would fly below the RSA height.

The risk assessment (Appendix A.5) on operational impacts of the wind farm on birds and bats using ecological and biological information about each species against risk factors, identified Carnaby's Black Cockatoo and Rainbow Bee-eater as being at 'at risk' conservation significant species. A qualitative risk assessment found Carnaby's Black Cockatoo to be a moderate risk species for collision, mainly due to the endangered status of the population rather than the likelihood of collision. The likelihood of collision was considered rare as individuals would fly below the RSA height. Rainbow Bee-eater was found to be low risk species.

Consideration against EPBC Act referral guidelines for Carnaby's Black Cockatoo

A proposal that is likely to result in a significant impact to Carnaby's Black Cockatoos will require referral to DotEE for assessment in accordance with the EPBC Act. An assessment against the EPBC significance criteria is outlined in Table 5-1.

Based on the Table 5-1 the proposal is not likely to trigger the need for referral based on clearing (if the recommendations included in Section 6 are adopted, including avoiding paddock trees where possible). However given that Carnaby's Black Cockatoo was found to be a moderate risk species for the wind farm based on the assessment criteria the proponent may wish to liaise further with DotEE and refer the project for legal certainty.

Table 5-1 EPBC Act significant impact trigger criteria from 'Referral guidelines for three species of Western Australian black cockatoos', SEWPAC 2012.

High risk of significant impacts: EPBC referral recommended	
Trigger	**Triggered?**
Clearing of any known nesting tree	Unlikely. No hollow bearing trees were identified in the proposed clearing areas (substation, transmission line and access points). Paddock trees may contain hollows however these should be able to be avoided over most of the project area. If individual trees are unable to be avoided then potential nesting trees would be managed as per the recommendations in Section 6.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat.	Unlikely. As above, a recommendation has been made to avoid paddock trees.
Clearing of more than 1 ha of quality foraging habitat.	No. The 2.5 ha substation site, which may require some clearing but is outside of the scope of this report, contains *Eucalyptus kondinensis* and *E. salmonophloia* over *Acacia acuminata* over *Enchylaena tomentosa, Exocarpos sparteus* over grassland/herbland of pasture species in a very degraded condition. Most of this area is unlikely to be considered 'quality foraging habitat' with *E. salmonophloia* being the only potential feed species present (DEC, 2011) and only present as isolated trees. The 0.15 ha proposed to be cleared within this assessment is considered marginal foraging habitat and well under 1 ha in area.
Clearing or degradation (including pruning of top canopy) of a known roosting site.	No, no evidence of roost sites were identified during the surveys within the proposed clearing areas.

Creating a gap or greater than 4 km between patches of Black Cockatoo Habitat (breeding, foraging or roosting).	No, the clearing would not create habitat fragmentation at the landscape scale.
Uncertainty: Referral recommended or contact DotEE	
Trigger	**Triggered?**
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	No, clearing is addressed above. No additional degradation is anticipated.
Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological changes, increase human visitation or fire.	No, clearing impacts will be minor in relation to Black Cockatoos.
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	No.
Actions with the potential to introduce known plant diseases such as Phytophthora spp. to an area where the pathogen was not previously known.	Unlikely given extensive areas of similar or better habitat are available locally.
Low Risk of significant impacts: referral may not be required but you may refer for legal certainty	
Trigger	**Triggered?**
Actions that do not affect black cockatoo habitat or individuals.	No.
Actions whose impacts occur outside the modelled distribution of the three Black Cockatoos.	No.

5.5 Proposed clearing against relevant guidelines

The project also falls within the agricultural area defined in *Position Statement No. 2* (EPA 2000). Guidelines that the proposal must be considered against to gain permission for clearing of native vegetation, include

- Four points for clearing remnant native vegetation in agricultural areas from *Position Statement No. 2* (EPA 2000),
- Eight points for clearing remnant native vegetation in WA generally from *Position Statement No. 2* (EPA 2000), and
- Ten clearing principles under the Environmental Protection Act 1986.

The federally-listed "Eucalypt Woodlands of the Western Australian Wheatbelt" (also P3) occurs within the project area. The Beard vegetation associations 1023 and 960 are considered over-cleared (less than 30% remaining) and under-reserved (less than 10% reserved) (DAFWA 2016). Priority flora (4 taxa) and fauna (1 taxa) were identified as occurring within the project area, an additional 49 flora and eight fauna of conservation significance may potentially occur at the site.

The proposal has been briefly considered against the above guidelines, and discussed below.

Clearing remnant native vegetation in agricultural areas

In principal, the EPA does not support any further clearing of remnant native vegetation in the agricultural area (EPA 2000). The following is a preliminary analysis of EPA requirements for clearing in the agriculture area from Section 4.2 of EPA (2000):

1. Alternative mechanisms are addressed to protect biodiversity (e.g. rehabilitation or offset),
2. Clearing area is relatively small over the area in consideration, including the extent of vegetation in the surrounding area,
3. Impacts of clearing are consistent with the requirements of Section 4.3 in the EPA (2000), and
4. Other processes of land degradation would not be exacerbated as a result of the proposal.

The level of clearing associated with the proposed wind farm development is very low, with the clearing of less than 0.15 ha of highly disturbed, degraded vegetation proposed. The total clearing accounts for approximately well under 1% of the remnant vegetation surveyed, with all areas of good or better quality vegetation to be avoided. The clearing proposed is not likely to conflict with the EPA values described above.

Clearing remnant native vegetation in WA

The following is a preliminary analysis of EPA requirements from Section 4.3 of EPA (2000):

1. A comparison of development scenarios, or options, to evaluate protection of biodiversity at the species and ecosystem levels, and demonstration that all reasonable steps have been taken to avoid disturbing native vegetation.
2. No known species of plant or animal is caused to become extinct as a consequence of the development and the risks to threatened species are considered to be acceptable.
3. No association or community of indigenous plants or animals cease to exist as a result of the project.
4. There would be an expectation that a proposal would demonstrate the vegetation removal would not compromise any vegetation type by taking it below the 'threshold level' of 30% of the pre-clearing extent of the vegetation type.
5. Where a proposal would result in a reduction below the 30% level, the EPA would expect alternative mechanisms to be put forward to address the protection of biodiversity.
6. There is comprehensive, adequate and secure representation of scarce or endangered habitats within the project area and/or in areas which are biologically comparable to the project area, protected in secure reserves.
7. If the project area is large (and what is meant by large will vary depending on where in the State) the project areas itself should include a comprehensive and adequate network of conservation areas and linking corridors whose integrity and biodiversity is secure and protected.
8. The on-site and off-site impacts of the project are identified and the proponent demonstrates that these impacts can be managed.

The project will avoid the clearing of remnant native vegetation in good or better condition. A recommendation has been given to avoid the occurrences Priority flora and TEC. No flora or fauna are likely to become extinct as a result of the project. The Beard vegetation associations across the site are already in completely degraded and degraded condition. They are not considered to be representative of the Beard communities that have been mapped and addressed in the CAR reserve system. The clearing proposed is not likely to conflict with the EPA values described above.

Clearing principles

The following is a preliminary analysis the proposal against the clearing principles:

1. Native vegetation should not be cleared if it comprises a high level of biological diversity.

2. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.
3. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.
4. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.
5. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
6. Native vegetation should not be cleared if it is growing in, or association with, an environment associated with a watercourse or wetland.
7. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
8. Native vegetation should not be cleared if the clearing of the vegetation is likely to an adverse impact on the environmental values of any adjacent or nearby conservation areas.
9. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.
10. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The proposal is unlikely to be at variance with any of these principles providing the Priority flora and TEC are avoided.

6 CONCLUSIONS AND RECOMMENDATIONS

A Level 1 flora and fauna assessment has been carried out for the proposed wind farm at Kondinin. Desktop and site surveys found the following values within the project area:

- Nineteen vegetation units varying in condition from Completely degraded to Excellent condition, across >75 patches (the largest at 24 ha).
- Several structural fauna habitats occur at the site with poor to good fauna habitat value, including:
    - Tall woodland
    - Mallee
    - Shrubland
    - Cropped land
    - Farm dams (approximately 30)
    - Granite outcrops
- Beard vegetation associations 1023 and 960 that are considered over-cleared (less than 30% remaining) and under-reserved (less than 10% reserved) (DAFWA 2016) occur in the project area.
- Priority flora (4 taxa) and fauna (1 taxa) were identified as occurring within the project area, an additional 46 flora and seven fauna of conservation significance may potentially occur at the site.
- One hundred and thirty vascular flora taxa were identified within the project area, of which three were introduced species (partial list only).
- Sixty-three fauna species were identified during the field visit; 44 of these were birds.
- The presence of 29.4 ha of federally-listed "Eucalypt Woodlands of the Western Australian Wheatbelt" TEC (also P3) in the project area.

Clearing impacts are summarised below:

- No flora of conservation significance will be impacted (proposed impacts are 20m away based on infrastructure locations provided).
- The TEC will require pruning based on current designs. It should be avoided if possible, as outlined below.
- Threatened fauna are unlikely to be significantly impacted by the clearing proposed. Based on the Table 5-1 the proposal is not likely to trigger the need for federal referral for Carnaby's Black Cockatoo based on clearing.
- The bird and bat risk assessment (Appendix A.5) identified:
    - A number of common and secure species have been identified as 'at risk' species, indicating that they have potential to suffer collision mortality at the proposed wind farm from time to time, should they occur on site.
    - Carnaby's Black Cockatoo and Rainbow Bee-eater as being 'at risk' conservation significant species. A qualitative risk assessment found Carnaby's Black Cockatoo to have a rare likelihood of collision as individuals would normally fly below the RSA height, but a moderate risk, mainly due to the endangered status of the population rather than the likelihood of collision. Rainbow Bee-eater was found to be low risk species.
    - Given that Carnaby's Black Cockatoo was found to be a moderate risk species for the wind farm based on bird and bat risk assessment, the proponent may wish to liaise further with Department of the Environment and Energy (DotEE) in relation to whether the project should be for referred for legal certainty.
    - The Kondinin Wind Farm presents an overall low collision risk to birds and bats as a potential wind farm site.

Clearing impacts proposed (0.15 ha of degraded vegetation) would be very minor in scale and nature, if the recommendations below are incorporated. Recommendations to avoid and mitigate potential impacts of the proposal include:

- Minimise disturbance to remnant native vegetation.
- Minimise impact at the TEC locations where pruning of trees will currently be required, north of the substation (617362E 6408104S) and the existing entrance to Lot 16619 off Notting-Karlgarrin Road (621930E 6408104S). This should be possible by aligning the transmission line to avoid most of the large trees north of the substation, and by relocating the easement north by approximately 30m, away from the TEC along the Notting-Karlgarrin Road. If significant pruning is required within the TEC then an Assessment of Significance should be carried out to determine if a significant impact is likely, and therefore the need to refer to DotEE.
- Avoid disturbing mapped populations of Priority flora.
- Avoid paddock trees >30cm DBH that may support hollows. If any hollow bearing paddock trees do require clearing, schedule clearing outside of Black Cockatoo key breeding periods (August-February). Ensure an experienced and licensed fauna specialist is present during clearing of hollow trees to manage any displaced/injured wildlife.

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