



KOJONUP BESS

Reconnaissance and Targeted Flora and Vegetation Survey
and Basic Terrestrial Fauna Survey

FINAL

January 2026



KOJONUP BESS

Reconnaissance and Targeted Flora and Vegetation
Survey and Basic Terrestrial Fauna Survey

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Mint Renewables Pty Ltd

Project Director: **Rob Karelse**
Project Manager: **Megan Stalker**
Technical Director: **Cathy Godden**
Report No. **24484/R03**
Date: **January 2026**



This report was prepared using
Umwelt's ISO 9001 certified
Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

©Umwelt (Australia) Pty Ltd

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Cathy Godden, Wes Bancroft, Megan Stalker	05/02/2025	Rob Karelse	06/02/2025
V2	Cathy Godden, Megan Stalker	10/03/2025	Rob Karelse	27/03/2025
FINAL	Cathy Godden Wes Bancroft	29/01/2026	Megan Stalker	29/01/2026

Table of Contents

1.0	Introduction	1
1.1	Project Overview	1
1.2	Project Location and Survey Area Definitions	1
1.3	Aims and Objectives	3
1.4	Level of Assessment	4
2.0	Background	5
2.1	Climate	5
2.2	Geology, Landform and Soils	6
3.0	Methods	8
3.1	Personnel and Licensing Information	8
3.2	Desktop Assessment	9
3.2.1	Publicly Available Data Review	9
3.2.2	Assessment of Vertebrate Fauna Conservation Significance	10
3.2.3	Likelihood of Occurrence Assessment	11
3.3	Flora and Vegetation Field Survey Methods	14
3.3.1	Reconnaissance Survey	14
3.3.2	Targeted Survey	15
3.3.3	Plant Collection and Identification	17
3.3.4	Vegetation Type and Vegetation Condition Mapping	17
3.3.5	Significant Flora	18
3.3.6	Significant Vegetation	18
3.4	Basic Fauna Field Survey Methods	19
3.4.1	Survey Timing	19
3.4.2	Habitat Assessment	19
3.4.3	Conservation Significant Terrestrial Vertebrate Fauna	20
3.5	Black-cockatoo Habitat Assessment	20
3.5.1	Guidelines	20
3.5.2	Breeding	21
3.5.3	Foraging	24
3.5.4	Night Roosting	27
3.5.5	Watering Points	28
3.6	Survey Limitations	28

4.0	Results	30
4.1	Flora and Vegetation Desktop Assessment	30
4.1.1	Regional Vegetation	30
4.1.2	Local Flora and Vegetation Surveys	32
4.1.3	Significant Flora Taxa	32
4.1.4	Significant Vegetation	35
4.2	Reconnaissance and Targeted Field Survey	38
4.2.1	Flora Census	38
4.2.2	Introduced Flora Taxa	38
4.2.3	Significant Flora Taxa	38
4.2.4	Likelihood of Occurrence of Significant Flora Taxa	38
4.2.5	Vegetation Types and Other Areas Mapped	59
4.2.6	Vegetation Condition	68
4.2.7	Significant Vegetation	70
4.3	Fauna Desktop Assessment	73
4.3.1	Local Fauna Surveys	73
4.3.2	Significant Vertebrate Fauna Taxa	73
4.4	Basic Fauna Survey	76
4.4.1	Fauna Habitat Types of the Survey Area	76
4.4.2	Likelihood of Occurrence of Significant Terrestrial Vertebrate Fauna	79
4.5	Black-cockatoo Habitat Assessment	86
4.5.1	Presence	86
4.5.2	Breeding	88
4.5.3	Foraging	90
4.5.4	Night Roosting	96
4.5.5	Watering Points	96
5.0	Conclusions	98
5.1	Flora and Vegetation	98
5.2	Terrestrial Fauna	98
5.3	Licensing and Permits	101
6.0	References	103

Figures

Figure 1.1	Project Location and Survey Area	2
Figure 2.1	Soil Landscape Units of the Survey Area	7
Figure 3.1	Sample Sites and Track Logs	16
Figure 4.1	Vegetation System Associations of the Survey Area	31
Figure 4.2	Significant Flora Taxa Known from the Desktop Study Area	33
Figure 4.3	DBCA Significant Vegetation Records from the Desktop Study Area	37
Figure 4.4	Vegetation Types of the Survey Area	66
Figure 4.5	Vegetation Condition of the Survey Area	69
Figure 4.6	Eucalyptus Woodlands of the Western Australian Wheatbelt TEC Within the Survey Area	72
Figure 4.7	Significant Fauna Taxa Known from the Desktop Study Area	74
Figure 4.8	Fauna Habitat Types of the Survey Area	77
Figure 4.9	Locations of Western Rosella (inland) Records in the Survey Area	81
Figure 4.10	Known Black-Cockatoo Records of the Desktop Study Area	87
Figure 4.11	Potential Black-cockatoo Breeding Trees of the Survey Area	89
Figure 4.12	Forest Red-tailed Black-Cockatoo FHQS of the Survey Area	92
Figure 4.13	Baudin's Black-Cockatoo FHQS of the Survey Area	93
Figure 4.14	Carnaby's Black-Cockatoo FHQS of the Survey Area	94
Figure 4.15	Known Night Roosting Locations Within the Desktop Study Area	97

Graphs

Graph 2.1	Climate Statistics for Katanning (Station 10916) and Kojonup (Station 10582)	5
-----------	--	---

Tables

Table 2.1	Soil Landscape Units of the Survey Area	6
Table 3.1	Personnel and Licensing Information	8
Table 3.2	Searches Undertaken for the Desktop Assessment of the Desktop Study Area	9
Table 3.3	Categories Given to Threatened and Priority Fauna	10
Table 3.4	Categories for Vertebrate Fauna Likelihood of Occurrence Assessment	12
Table 3.5	Information Recorded at Each Data Recording Point	14
Table 3.6	Vegetation Condition Scale as Described in EPA (2016c) for South West and Interzone Botanical Provinces	18
Table 3.7	Bamford Black-cockatoo Nest-tree Ranks	21
Table 3.8	Draft DCCEEW Habitat Quality Score - Vegetation Condition and Structure Component	25
Table 3.9	Limitations of the Flora, Vegetation and Fauna Survey	28

Table 4.1	Vegetation System Associations of the Survey Area	30
Table 4.2	Significant Vegetation Known from Within the Desktop Study Area	35
Table 4.3	Likelihood of Occurrence of Further Significant Flora Within the Survey Area	40
Table 4.4	Vegetation Types of the Survey Area	61
Table 4.5	Vegetation Condition of the Survey Area	68
Table 4.6	Summary of TEC Criteria Relating to Vegetation in the Survey Area	71
Table 4.7	Fauna Habitat Types of the Survey Area	76
Table 4.8	Summary of the Likelihood of Occurrence of Expected Significant Fauna Taxa	79
Table 4.9	Locations of Western Rosella (inland) within the Survey Area	80
Table 4.11	Bamford FHQS Breakdown for Each Taxon of Black-cockatoo	90
Table 4.12	Bamford Black-cockatoo FHQS for Each Fauna Habitat Type Within the Survey Area	91
Table 4.12	Summary of DCCEEW FHQS of the Survey Area	95

Appendices

Appendix A	Bamford (2020) Scoring system for the Assessment of Foraging Value of Vegetation for Black-cockatoos
Appendix B	Protected Matters Search Tool
Appendix C	Significant Flora Returned from Database Searches
Appendix D	Vascular Flora Taxa Recorded in the Survey Area
Appendix E	Raw Relevé and Vegetation Mapping Note Data
Appendix F	Eucalyptus Woodlands of the Western Australian Wheatbelt TEC Diagnostic Features
Appendix G	Significant Fauna Returned from the Database Searches
Appendix H	Raw Fauna Habitat Type Data
Appendix I	Excluded Conservation Significant Fauna Taxa
Appendix J	Potential Black-cockatoo Breeding Tree Data

1.0 Introduction

1.1 Project Overview

Mint Renewables (Mint) has identified an area near Kojonup, approximately 240 km southeast of Perth, that is potentially suitable for developing a Battery Energy Storage System (BESS) project (the Project). The infrastructure of the Project is likely to include BESS modules, inverters and transformers, access roads, small operations and maintenance facilities, overhead and underground cabling, and other types of ancillary construction and operational infrastructure.

Umwelt was engaged in June 2024 to undertake an analysis of potential environmental, planning, and heritage constraints relevant to the Project (Umwelt, 2024). Subsequently, Mint then engaged Umwelt to conduct flora and fauna studies for the Project to further the understanding of the ecological values associated with the Project. This report presents the findings of both the Reconnaissance and Targeted flora and vegetation assessment, and the Basic fauna assessment.

1.2 Project Location and Survey Area Definitions

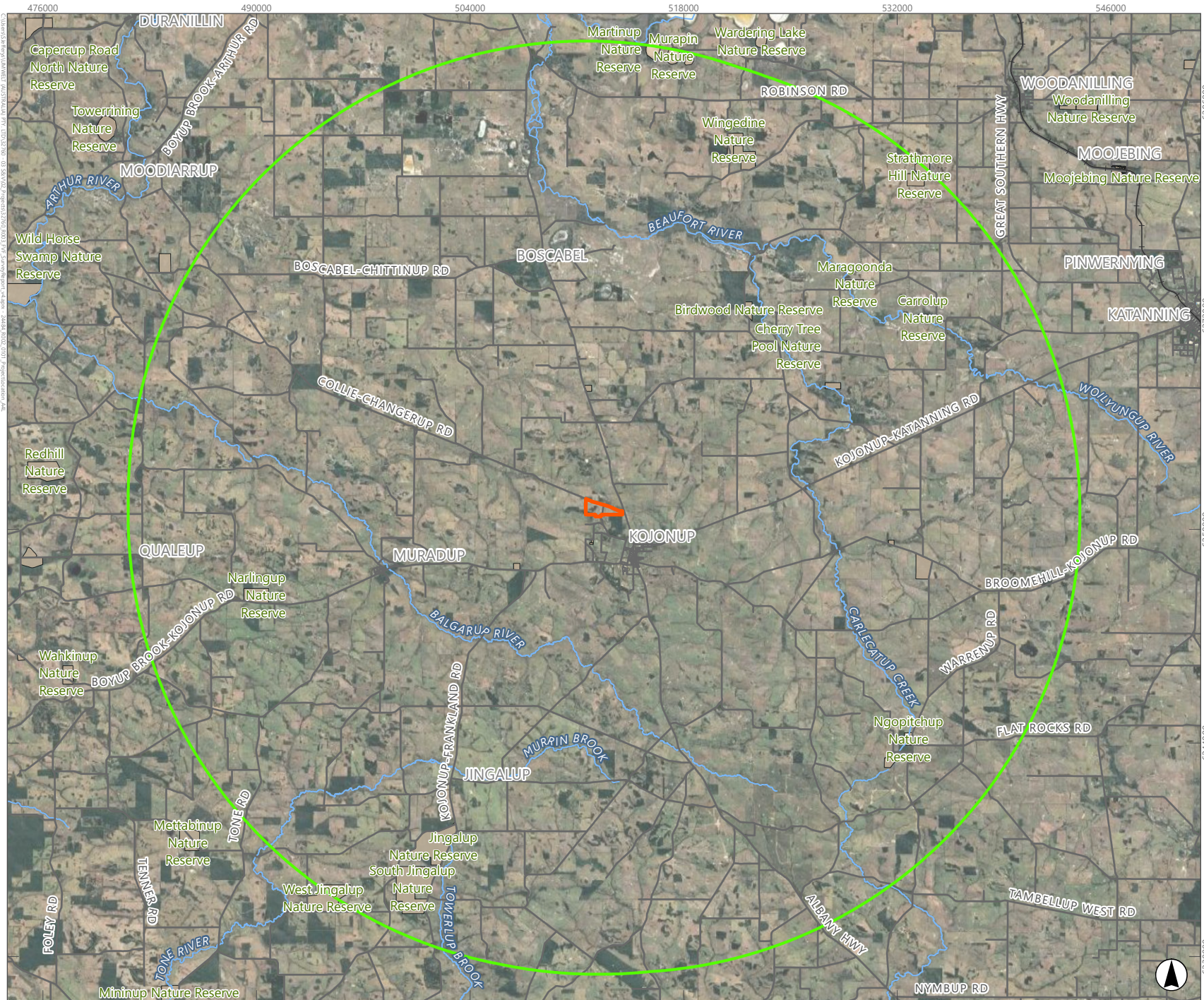
The Project is situated approximately 2.5 km north of the township of Kojonup, within the Shire of Kojonup, encompassing approximately 151.1 hectares (ha) on a single freehold property. As future requirements for access to the property for Project construction and operations is currently uncertain, the Survey Area also includes the adjacent Collie-Changerup road reserve, located north of the private property and as aligned with publicly available cadastre data, to identify ecological constraints recording access directly into the property.

A Desktop Study Area was defined for the purposes of database requests and literature searches to inform the desktop assessment, including the Survey Area with a 30 km buffer.

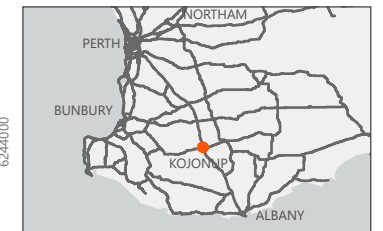
The Project is located within the Intensive Land Use Zone, as defined by the Department of Primary Industries and Regional Development (DPIRD, 2016). The nature reserve 'Myrtle Benn Flora and Fauna Sanctuary' (C 26159) is located directly south of the Project. The Farrar Nature Reserve is located approximately 6km to the south-west of the Survey Area.

The Survey Area and Desktop Study Area, as well as project location are presented on **Figure 1.1**.

FIGURE 1.1
Project Location and Survey Area



- Legend**
- Desktop Study Area
 - Survey Area
 - Road
 - Railway
 - Watercourse
 - Nature Reserve



Scale 1:350,000 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

1.3 Aims and Objectives

The primary aim of this assessment was to determine and validate the ecological values of the Survey Area and its surrounding environment. The specific objectives of the assessment were to:

- Undertake a desktop assessment of all relevant databases and literature to identify key flora, vegetation and vertebrate fauna values potentially present within the Survey Area and use this information to inform the field survey and report design (as per section 4.1 of EPA, (2016c) and section 2 of EPA (2020)).
- Identify, map and describe Vegetation Types (VTs) (as per section 8 of EPA (2016c)) and fauna habitats (as per section 6 of EPA (2020)) that occur within the Survey Area.
- Map the condition of the vegetation in accordance with EPA Technical Guidance (section 5.6 of EPA, 2016c).
- Assess the likelihood of the following occurring within the Survey Area:
 - **Significant flora:** flora taxa that belong to one of the following categories as defined by EPA (2016a, 2016c) (note that conservation codes used by Department of Biodiversity, Conservation and Attractions (DBCA) for significant flora taxa in WA are presented in DBCA (2020)):
 - Taxa identified as a Threatened (T) or Priority (P) species (formally listed significant taxa – includes taxa listed under both State (*Biodiversity Conservation Act 2016* (WA) (BC Act)) and Commonwealth (Cth) (*Environment Protection Biodiversity Conservation Act 1999* (EPBC Act)) legislation, and classified as Priority by DBCA)
 - locally endemic taxa or taxa associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems (GDEs))
 - new species or taxa having anomalous features that indicate a potential new species
 - representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
 - unusual species, including restricted subspecies, varieties or naturally occurring hybrids
 - having a relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.
 - **Significant vegetation:** vegetation communities that belong to one of the following categories as defined by EPA (2016a, 2016c) (note that definitions, categories and criteria used by DBCA for significant vegetation in WA are presented in Department of Environment and Conservation (DEC) (2013)):
 - being identified as a Threatened Ecological Community (TEC) or Priority Ecological Community (PEC) (formally listed significant vegetation – includes vegetation listed under State or Commonwealth legislation, or classified as a PEC by DBCA)
 - having a restricted distribution

- having a degree of historical impact from threatening processes
 - playing a role as a refuge
 - providing an important function required to maintain ecological integrity of a significant ecosystem.
- **Significant vertebrate fauna:** fauna taxa that belong to one of the following categories as defined by EPA (2016b, 2020) (note that conservation codes used by DBCA for significant fauna taxa in WA are presented in DBCA (2020)):
 - taxa identified as a Threatened (T) or Priority (P) species (formally listed significant taxa – includes taxa listed under both State or Commonwealth legislation, and classified as Priority by DBCA)
 - species with restricted distribution
 - having a degree of historical impact from threatening processes
 - providing an important function required to maintain the ecological integrity of a significant ecosystem.
- Where deemed necessary, conduct targeted survey for significant flora and vegetation.
 - Provide recommendations for additional survey based on the results of the Reconnaissance and Basic survey, and likelihood of occurrence assessments, as well as appropriate mitigations to support approvals for the Project.

1.4 Level of Assessment

The flora and vegetation survey of the Survey Area included Reconnaissance and Targeted Survey as defined in Sections 4.1 and 4.2 of the *Technical Guidance for Flora and Vegetation Surveys for Environmental Impact* (EPA, 2016c). The fauna survey involved a Basic Survey as defined in Section 4.1 of the *Technical Guidance for Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020). This level of survey is considered appropriate considering the likelihood of occurrence of significant flora and vegetation (from the desktop assessment), the high degree of historical impacts to vegetation, and the likely low impacts by the Project.

The survey and reporting works comply with the following documents:

- *Statement of environmental principles, factors, objectives and aims of EIA* (EPA, 2023)
- *Environmental Factor Guideline – Flora and Vegetation* (EPA, 2016a)
- *Environmental Factor Guideline – Terrestrial Fauna* (EPA, 2016b)
- *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016c)
- *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020)
- *Referral guideline for 3 WA threatened black-cockatoo species* (DCCEE, 2022).

2.0 Background

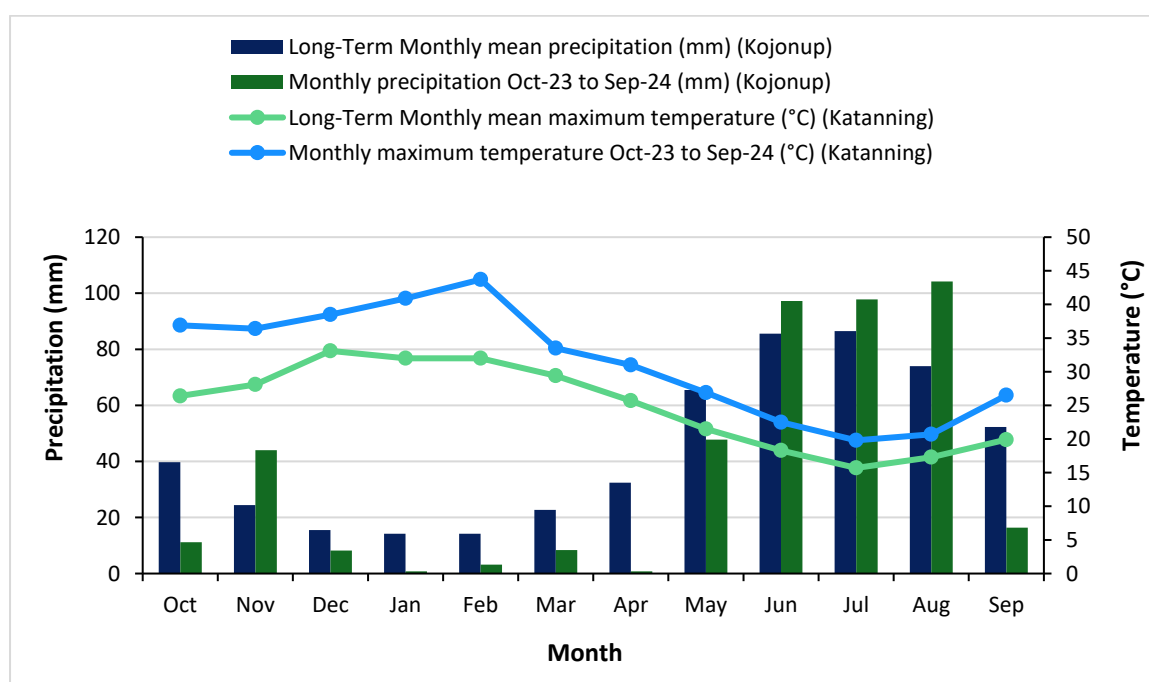
2.1 Climate

The Survey Area is located in the Southern Jarrah Forest (JF2) subregion of the Avon Jarrah Forest Interim Biogeographic Regionalisation of Australia (IBRA) region. The Southern Jarrah Forest subregion is characterised by a warm Mediterranean climate (Hearn et al., 2002), and as such experiences wet, cool winters and hot, dry summers.

Graph 2.1 displays long term mean monthly precipitation and monthly precipitation data for the twelve months preceding the survey at Kojonup Station (10582, data from 1885 to current), as well as the long term mean maximum monthly temperature and monthly maximum temperature for the twelve months preceding the survey at Katanning Station (10916, data from 1999 to current)(BoM, 2024). Temperature data was not sourced from Kojonup Station, as records were discontinued in 1997. Katanning Station is located 45 km northeast of the Survey Area.

Long-term average monthly maximum temperatures at Katanning peak from December to February (33.1 °C – 32.0 °C), while long-term average monthly precipitation at Kojonup peaks from May to August (a total of 311.6 mm received over this period on average) (**Graph 2.1**).

Total precipitation received in the six months prior to the spring field survey, April 2024 to September 2024 (late Autumn – early Spring) (364.2 mm), was less than the long-term average precipitation recorded for this period (396.3 mm), however months June through August received above average precipitation (**Graph 2.1**). The mean maximum temperatures recorded during April 2024 to September 2024 were consistently 3°C – 6°C warmer than the long-term average maximum temperatures for those months (**Graph 2.1**), following on from a trend experienced during the previous Spring - Summer months.



Graph 2.1 Climate Statistics for Katanning (Station 10916) and Kojonup (Station 10582)

2.2 Geology, Landform and Soils

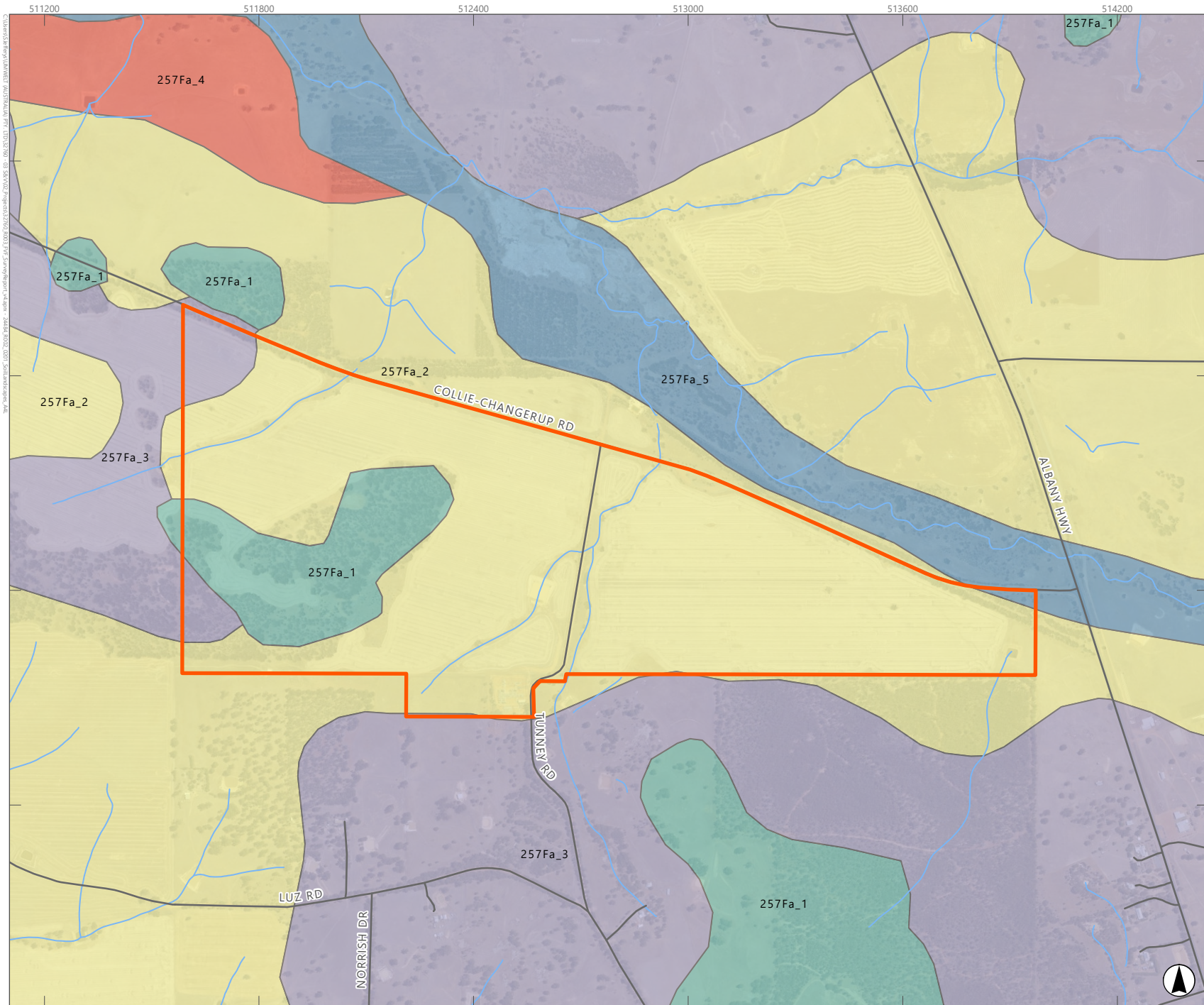
The Southern Jarrah Forest IBRA subregion is dissected by drainage in the west, with broadening and leveling of the surface in the east, with poor drainage resulting in abundant wetlands. The subregion comprises of duricrusted plateau of the Yilgarn Craton, for which the vegetation is characterised by Jarrah-Marri forest on lateritic gravels. In the east, vegetation is largely Wandoo-Marri woodlands on clayey soils (Hearn et al., 2002).

Soil landscape mapping of WA has been compiled from the results of various surveys across WA by the Department of Agriculture (now the Department of Primary Industries and Regional Development (DPIRD) (DPIRD, 2019b). The Survey Area comprises of four soil-landscape units, as summarised in **Table 2.1**, and presented on **Figure 2.1**. The Farrar 2 Subsystem, encompassing the majority of the Survey Area, is characterised by undulating rises and low hills, with mainly grey deep sandy duplex soils (**Table 2.1**).

Table 2.1 Soil Landscape Units of the Survey Area

Soil Landscape Unit	Name	Description	Mapped Extent in Survey Area (ha)
257Fa_1	Farrar 1 Subsystem	Gravelly hill crests and upper slopes with mainly yellowish brown moderately deep to deep sandy gravels.	20.8 (13.8%)
257Fa_2	Farrar 2 Subsystem	Undulating rises and low hills with mainly grey deep sandy duplex soils.	123.2 (81.6%)
257Fa_3	Farrar 3 Subsystem	Rocky undulating rises and low hills with mainly grey deep sandy duplex, red sandy and loamy duplex formed on weathered bedrock.	0.5 (0.3%)
257Fa_5	Farrar 5 Subsystem	Valley flats (200 – 700 m wide) with grey deep sandy duplex soils with sodic, mottled grey and brown clay subsoils, and significant areas of saline wet soils.	6.6 (4.3%)
Total			151.1

FIGURE 2.1
Soil Landscape Units of the Survey Area

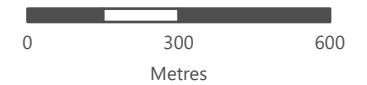


Legend

- Survey Area
- Road
- Railway
- Watercourse

Soil Landscape Units

- 253Bo_2
- 257Fa_1
- 257Fa_2
- 257Fa_3
- 257Fa_4
- 257Fa_5



Scale 1:15,000 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

3.0 Methods

3.1 Personnel and Licensing Information

Table 3.1 lists the personnel involved in fieldwork, plant identifications and report preparation. The Project Technical Lead has considerable previous experience (>20 years) conducting ecological assessments. Other personnel are experienced in undertaking flora and vegetation surveys in the region.

All plant material was collected under the relevant Flora Taking (Biological Assessment) Licence (under Regulation 62 of the Biodiversity Conservation Regulations 2018 (BC Regs)) and Authorisation to Take or Disturb Threatened Species (pursuant to Section 40 of the BC Act) as outlined in **Table 3.1**. Personnel managing plant identifications have had extensive previous experience (>15 years) in plant identifications of flora of the Jarrah Forest region. Plant identifications undertaken by less experienced personnel were checked for accuracy.

Table 3.1 Personnel and Licensing Information

Personnel	Experience	Flora Taking (Biological Assessment) License	Role
Megan Stalker BSc (Conservation Biology)	>15 years	NA	Project Management
Cathy Godden Bsc (Biology) (Hons)	>20 years	NA	Technical Lead
Belinda Howe Bsc (Environmental Science and Management) (Hons)	6 years	NA	Field Team Leader (Fauna)
Diana Barrie Bsc (Agricultural Science and Conservation Biology)	4 years	FB62000443-2 TFL 2223-0143	Field Team Leader (Flora)
Shibi Ullas Chandran Bsc (Zoology) Mstrs (Fisheries Biology and Aquaculture)	10 years	NA	Plant identifications
David Coultas BSc (Hons) Environmental Biology	18 years	NA	Plant identifications Review
Kyler Rowson Bsc (Marine Biology and Biological Sciences)	3.5 years	NA	Reporting
Wes Bancroft BSc (Hons) (Zoology), PhD (Zoology)	28 years	NA	Reporting

3.2 Desktop Assessment

3.2.1 Publicly Available Data Review

Prior to commencement of the field survey, a review of all publicly available flora, vegetation and fauna data relevant to the Desktop Study Area was undertaken. This included searching for reports of previous biological surveys carried out within the vicinity of the Survey Area (where available) (including interrogation of the Index of Biodiversity Surveys for Assessments (IBSA) database), and interrogation of relevant databases and other sources as listed in **Table 3.2** for the Desktop Study Area (**Figure 1.1**). Where TECs or PECs were identified by the desktop assessment, appropriate DBCA or DCCEEW nomination/listing descriptions and recovery plans of the TEC or PEC were also reviewed prior to field survey, as well as the 'Methods for survey and identification of Western Australian threatened ecological communities' report by the DBCA (DBCA, 2024d).

Table 3.2 Searches Undertaken for the Desktop Assessment of the Desktop Study Area

Source	Search Attributes	Purpose
DBCA NatureMap (DBCA, 2007-)	Desktop Study Area. Search undertaken 15 November 2024, reference 20-1124NM, Undertaken to determine any further updates since survey.	Obtain records of DBCA-listed significant flora taxa within the Desktop Study Area.
DBCA Significant Flora Databases (WA Herbarium specimen database and TPFL database) (DBCA, 2024c)	Desktop Study Area boundary. Search undertaken 10 September 2024, reference 20-0924FL.	Obtain records of DBCA-listed significant flora taxa within the Desktop Study Area.
DBCA Threatened and Priority Ecological Communities Database (DBCA, 2024a)	Desktop Study Area boundary. Search undertaken 10 September 2024, reference 08-0924EC.	Obtain records of DBCA-listed TECs and PECs within the Desktop Study Area.
DBCA TEC and PEC lists (DBCA, 2018, 2022)	Manual review of current DBCA TECs and PECs listed.	Identify whether there are any DBCA-listed TECs or PECs that could occur within the Study Area.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool) (DCCEEW, 2024)	Database interrogated using Desktop Study Area boundary. No additional buffer applied. Search undertaken 28 May 2024.	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs listed under the EPBC Act, that occur or have the potential to occur within the Desktop Study Area.
IBSA database (DWER, 2022)	Approximate Desktop Study Area boundary (exact boundary cannot be used).	Obtain copies of reports and associated spatial data (where available) to identify records of significant flora and vegetation and introduced flora in the vicinity of the Study Area.
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (report 3b) (DBCA, 2019) and Pre-European Vegetation spatial data (DPIRD, 2019a)	Survey Area boundary.	Identify extent of Vegetation System Associations (VSAs) within the Study Area.

Source	Search Attributes	Purpose
DBCA Significant Fauna Databases (DBCA, 2024b)	Desktop Study Area boundary. Search undertaken 10 September 2024, reference 07-0924FA.	Obtain records of DBCA-listed significant fauna taxa within the Desktop Study Area.
Atlas of Living Australia (ALA) (ALA, 2024)	Approximate Desktop Study Area boundary. Search undertaken on 2 December 2024.	Identify significant fauna taxa with records in the Approximate Desktop Study Area.

3.2.2 Assessment of Vertebrate Fauna Conservation Significance

Conservation significant fauna taxa are defined as those that are listed under federal and/or state legislation, and/or those ranked as priority species by DBCA. Relevant conservation status categories are outlined in **Section 1.3**. Categories given to fauna protected under state and Commonwealth legislation, and otherwise through DBCA, are detailed in **Table 3.3** below.

Table 3.3 Categories Given to Threatened and Priority Fauna

Act/Category	Category	Description
EPBC Act	Extinct in the wild (EW)	Fauna known to survive only in captivity.
	Critically Endangered (CR)	Fauna facing an extremely high risk of extinction in the wild in the immediate future.
	Endangered (EN)	Fauna facing a very high risk of extinction in the wild in the near future.
	Vulnerable (VU)	Fauna facing a very high risk of extinction in the wild in the medium-term future.
	Migratory (MI)	Fauna listed under international agreements to which Australia is a party.
BC Act	Extinct in the wild (EW)	Fauna known to survive only in captivity.
	Critically Endangered (CR)	Fauna facing an extremely high risk of extinction in the wild in the immediate future.
	Endangered (EN)	Fauna facing a very high risk of extinction in the wild in the near future.
	Vulnerable (VU)	Fauna facing a very high risk of extinction in the wild in the medium-term future.
	Migratory (MI)	A subset of the migratory fauna that are known to visit Western Australia that are protected under the international agreements or treaties, excluding species that are listed as Threatened species.
	Conservation dependent fauna (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	Other specially protected species (OS)	Fauna in need of special protection to ensure their conservation.
DBCA Priority Fauna	Priority 1 (P1)	Poorly known species (on threatened lands).
	Priority 2 (P2)	Poorly known species in few locations (some on conservation lands).
	Priority 3 (P3)	Poorly known species in several locations (some on conservation lands).
	Priority 4 (P4)	Rare, near threatened and other species in need of monitoring.

3.2.3 Likelihood of Occurrence Assessment

3.2.3.1 Significant Flora

Likelihood of occurrence assessment for significant flora taxa as returned from the Desktop Assessment (post survey) undertaken as per the following categories:

- **Unlikely:** Species unlikely to occur in the Survey Area due to lack of suitable preferred habitat; or combination of survey undertaken during correct survey period for identification, adequate survey intensity and/or vegetation condition deemed insufficient for species to occur, in combination with known distribution of taxon and proximity of known records.
- **Potential:** Suitable habitat present in the Survey Area; no known locations in proximity to Survey Area (> 10 km); not recorded during the Survey, however survey intensity not sufficient to reduce likelihood of occurrence to Unlikely.
- **Possible:** Suitable habitat present in the Survey Area; known locations in close proximity to Survey Area (< 10 km); not recorded during the Survey, however survey intensity not sufficient to reduce likelihood of occurrence to Unlikely.
- **Known:** Species known to occur in the Survey Area, either through historical records or through survey findings.

3.2.3.2 Significant Vertebrate Fauna

A Likelihood of Occurrence (LoO) assessment was undertaken for conservation significant fauna. The LoO assessment took into consideration:

- Species biology
- Known range of species
- Habitat requirements and preferences
- Quality and availability of suitable habitat
- Previous records of species within or in close proximity to the Survey Area.

Conservation significant fauna detected during the desktop assessment were assessed and ranked for their likelihood of occurrence within the Survey Area based on the categories presented in **Table 3.4**.

Table 3.4 Categories for Vertebrate Fauna Likelihood of Occurrence Assessment

LoO Code	LoO Category	Explanation	On-site Evidence	Habitat Suitability	Species Occurrence in Region	Nearest Contemporary Records [^]	Site's Representative Proportion of Species' Home Range
K	Known to Occur	Evidence of the species (either direct or indirect) was recorded from the site during the fauna assessment and suitable breeding, foraging and/or dispersal habitat is present at the site. While species presence has been confirmed, the degree to which the site is used by the species is not necessarily known (i.e. individuals may be transient through the site as part of local or regional movements; the site may form part of a permanent home range for individuals, or individuals may wholly reside with the site). The dependence of individuals, local populations, important populations or the species on the site is not necessarily known.	Confirmed	Suitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Site	Complete or substantial
L	Likely	Species is known to occur in the local area and suitable breeding, foraging and/or dispersal habitat is present at the site. It is expected that the species may use the site on a regular and ongoing basis. May include areas that may form a substantial part of a broader home range for resident individuals.	Unconfirmed	Suitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Local	Complete or substantial
P	Possible	Species is known to occur in the local area and suitable breeding, foraging and/or dispersal habitat is present at the site. It is expected that the species may use this at least occasionally. May include areas that may form a minor part of a broader home range for resident individuals.	Unconfirmed	Suitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Local	Minor
LS	Unlikely: low suitability	Species is known to occur in the local area but the habitat present is considered generally unsuitable or low quality for the species, or has tenuous connections to other areas of suitable habitat. Species may pass through, or over site, on an irregular or vagrant basis but is not likely to be dependent on the site for breeding, foraging or dispersal.	Unconfirmed	Low suitability	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Local	Any
V	Unlikely: vagrant	Species has been known to occur in the local area and the habitat present is not unsuited to the species but, by the nature of its ecology, the species occurs unpredictably and/or sporadically. Species may pass through, or over site, but is not likely to be dependent on the site for breeding, foraging or dispersal.	Unconfirmed	Low suitability or better	Erratic	Local	Minor

LoO Code	LoO Category	Explanation	On-site Evidence	Habitat Suitability	Species Occurrence in Region	Nearest Contemporary Records [^]	Site's Representative Proportion of Species' Home Range
FH	Highly Unlikely: fragmented habitat	Species is known to occur in the region but the habitat present is, effectively, prohibitively fragmented (disconnected) from these populations. If ever present, species may pass through, or over the site, as a vagrant.	Unconfirmed	Suitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Regional	Minor
VLS	Highly Unlikely: very low suitability	Species is known to occur in the region but the habitat present is considered generally unsuitable or very low quality for the species, or has tenuous connections to other areas of suitable habitat. Species may pass through, or over site, on an irregular or vagrant basis but is not likely to be dependent on the site for breeding, foraging or dispersal.	Unconfirmed	Very low suitability/ Unsuitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Regional	Minor
LE	Not Expected: locally extinct	Species was once known to occur in the local area (at least in the pre-European colonisation) but is now considered locally extinct (extirpated). Not expected.	Unconfirmed	Suitable/U nsuitable	Regular (e.g. migrant or regular visitor) or permanent (e.g. resident)	Regional	NA
OR	Not Expected: outside of known range	Species is not known from the region. Not expected.	Unconfirmed	Suitable/U nsuitable	Absent	Beyond regional	NA
UH	Not Expected: unsuitable habitat	Species may occur in the local area or region but the habitat present is not suited to use by the species (for breeding, foraging and/or dispersal). Not expected.	Unconfirmed	Unsuitable	Present	Regional or local	NA
EX	Not Expected: extinct	Species is extinct (or extinct in the wild).	NA	NA	NA	NA	NA

[^]Note: Scale relative to species' ecology and movement patterns.

3.3 Flora and Vegetation Field Survey Methods

3.3.1 Reconnaissance Survey

Initial interpretation of ortho-rectified aerial photography at a scale of 1:5,000 was conducted to determine preliminary vegetation patterns present within the Survey Area. The purpose of this was to direct survey efforts for the Reconnaissance survey, with vegetation sampling proposed for each discernible vegetation pattern, and greater sampling proposed for larger or more complex vegetation patterns.

The flora and vegetation Reconnaissance survey was undertaken over a single site visit on 25 and 26 September 2024. The Survey Area was accessed and traversed by vehicle and foot. Appropriate landholder/manager permission was obtained prior to undertaking the survey.

The survey also included an evaluation of species presence and vegetation condition of remnant vegetation to assess potential as the TEC '*Eucalyptus woodlands of the Western Australian Wheatbelt*'.

Field data was collected in the form of data recording points, comprising of either vegetation mapping notes or relevés. Relevés were surveyed in areas of native vegetation and surveyed the area within a radius of approximately 20 m around a central point; vegetation mapping notes recorded pertinent information in degraded areas. **Table 3.5** presents the information that was recorded at each point.

Table 3.5 Information Recorded at Each Data Recording Point

Information	Relevé	Vegetation Mapping Note
Personnel	X	X
Unique site name	X	X
Survey date	X	X
GPS coordinates at centre point of note (recorded using handheld global positioning system (GPS) devices) (Geocentric Datum of Australia (GDA2020) Zone 50)	X	X
Fire history	X	
Notes on disturbance	X	X
Site photograph, at centre point of note	X	
Topography	X	X
Soil colour and type (including the presence of any rock outcropping and surface stones)	X	
Vegetation condition (as per EPA Technical Guidance (2016c) for the South West and Interzone Botanical Provinces)	X	X
Dominant taxa within each vegetation stratum	X	X
Average heights/foliage cover of dominant taxa	X	

All traverses of the Survey Area during the Reconnaissance survey were recorded as track logs and any vegetation mapping notes and relevés recorded as waypoints.

A total of 23 relevés and 26 vegetation mapping notes were assessed in the Survey Area during the Reconnaissance survey over a single site visit.

3.3.2 Targeted Survey

Targeted survey for significant flora taxa was planned to be undertaken in areas of Good or better vegetation condition (as per section 5.6 of EPA (2016c)). Areas of Degraded or Completely Degraded condition were regarded as having very low likelihood of presence of significant flora taxa due to the disturbed nature of the vegetation (generally consisting of a tree layer over pasture weeds, with impacting processes present such as historical clearing and livestock in combination with lack of fences protecting remnant vegetation). The extent of targeted survey was assessed at the time of the fieldwork, dependent on environmental conditions and the environmental factors encountered.

Targeted survey in the form of wandering transects was employed across vegetated areas within the native vegetation block inside the Survey Area; all habitats were subject to targeted survey, although systematic transects at specified spacing were not employed throughout due to the vegetation condition encountered and survey time. Native vegetation on the roadside (approximately 5 m width) was surveyed through a walked transect.

The locations of all relevés, vegetation mapping notes and fauna habitat mapping notes, as well as survey track logs and targeted searching transects are illustrated on **Figure 3.1**.

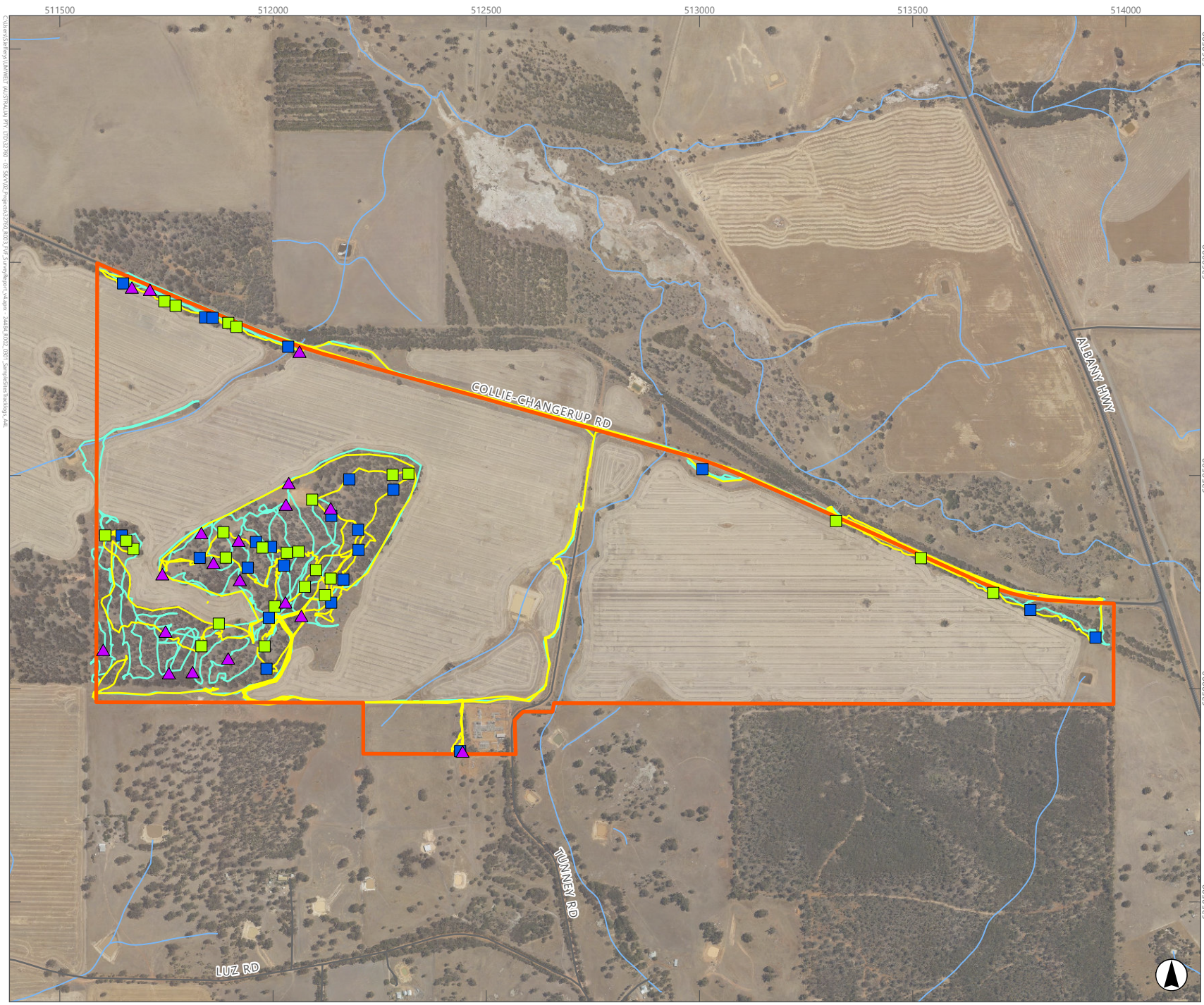
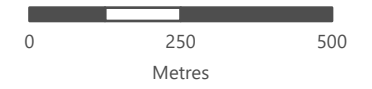


FIGURE 3.1
Sample Sites and Track
Logs

- Legend**
- Survey Area
 - Road
 - Watercourse
 - ▲ Fauna Observations
- Flora Observations**
- Relevé
 - Vegetation Mapping Note
- Track Logs**
- Fauna
 - Flora



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

3.3.3 Plant Collection and Identification

Specimens of any unknown taxa encountered during the field survey were collected and pressed for later identification. Plant identifications were undertaken at the WA Herbarium and under reviewed by a Principal Botanist with significant previous experience (> 15 years) in plant identifications for flora of the Jarrah Forest region (**Section 3.1**). The identification of all taxa (including significant taxa) used the most up to date information available (including taxonomic keys published in books, journals and online, comparison with herbarium specimens, and consultation with taxonomic experts). External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest, including botanists at the WA Herbarium.

Taxon nomenclature generally follows FloraBase (Western Australian Herbarium, 1998) with all names checked against the current DBCA Max database to ensure their validity. However, in cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on FloraBase due to time constraints (Western Australian Herbarium, 1998), nomenclature in the published literature is followed. The conservation status of each taxon was checked against FloraBase, which provides the most up-to-date information regarding the conservation status of flora taxa in Western Australia.

As per section 7.2 of EPA (EPA, 2016c), specimens of interest, including significant flora taxa, taxa representing range extensions, potential new taxa, and key species in new occurrences of TECs and PECs will be sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms (TPFRFs) submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (i.e. Threatened and Priority flora taxa).

3.3.4 Vegetation Type and Vegetation Condition Mapping

Floristic and vegetation structural data recorded as relevés and vegetation mapping notes at waypoints across the Survey Area were examined to define discrete Vegetation Types (VTs) of the Survey Area. Locations of relevés and vegetation mapping notes were used in conjunction with aerial photograph interpretation, digital elevation models, and soil mapping units to generate discrete VT polygons in a Geographic Information Systems (GIS) environment. Mapping boundaries were developed using aerial photography on a scale of 1:5,000 and reflected changes in vegetation patterns visible at this scale.

VT descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 7.0 (NVIS Technical Working Group, 2017). This model follows nationally agreed guidelines to describe and represent VTs and produces data that is comparable and consistent nation-wide. VTs were defined and described using the structural vegetation classification technique as outlined in EPA Technical Guidance (EPA, 2016c). This technique uses vegetation structure and dominant species to describe VTs with information provided on the height of strata, foliage cover, and dominant species, as well as substrate and landscape factors.

Vegetation condition was described using the vegetation condition scale presented by EPA (2016c) for the South West and Interzone Botanical Provinces (**Table 3.6**). Notes on vegetation condition were taken during the Reconnaissance survey at all relevé and vegetation mapping note locations. Vegetation condition classifications were applied to the mapped VTs by either categorising whole polygons where the condition was uniform throughout, or dividing existing VT polygons where a change in condition was observed.

Table 3.6 Vegetation Condition Scale as Described in EPA (2016c) for South West and Interzone Botanical Provinces

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.

3.3.5 Significant Flora

As per EPA (2016c), flora taxa may be significant for a range of reasons, as outlined in **Section 1.3**.

Significant flora taxa recorded within the Survey Area are discussed in **Section 4.2.3** with reference to the above categories. Point locations, individuals and populations of significant flora known from the Survey Area are also presented in this section. Note that a population in the context of this survey is defined as a discrete group of individuals of a taxon separated by more than 500 m from the nearest discrete group of individuals (DBCA, 2017); however, this definition can only be tentatively applied if the intervening 500 m has not been surveyed. Conservation codes for Western Australian flora are presented on the DBCA Threatened species and communities website (DBCA, 2020).

3.3.6 Significant Vegetation

As per EPA (2016c), vegetation may be significant for a range of reasons as outlined in **Section 1.3**.

The vegetation of the Survey Area was manually compared to TEC/PEC descriptions as returned by desktop assessment, and otherwise as relevant to the region, to determine whether any vegetation may represent a TEC or PEC; specifically, comparisons of dominant taxa, soils, topography and geographical distribution of VTs were made to those of any TECs or PECs potentially occurring in the Survey Area. Determination of TECs was undertaken by review of the survey and determination criteria as per DBCA (2023b) where relevant.

A similar process was followed for TECs listed under the EPBC Act, with comparisons made to the appropriate listing and conservation advice for any TECs potentially occurring in the Survey Area. The remaining significant vegetation criteria other than “being identified as a TEC and PEC” were applied to VTs mapped in the Survey Area to determine whether a VT was significant in a local or regional context. However, in a regional context, limited information is available for comparison with VTs in the Survey Area. Significant vegetation is discussed further in **Section 4.2.7**. Definitions, categories and criteria for TECs and PECs in WA are presented on the DBCA Threatened species and communities website (DBCA, 2013).

3.4 Basic Fauna Field Survey Methods

3.4.1 Survey Timing

The Basic fauna survey was undertaken over a single site visit on 25 - 26 September 2024. The Survey Area was accessed and traversed by vehicle and foot. Appropriate landholder/manager permission was obtained prior to undertaking the survey.

3.4.2 Habitat Assessment

Fauna Habitat Type (FHT) assessments were undertaken at 19 points across the Survey Area. At each habitat assessment point the following information was recorded:

- GPS co-ordinates (recorded using handheld global positioning system (GPS) devices) (Geocentric Datum of Australia (GDA2020) Zone 50)
- Representative photographs
- Habitat name
- Landform
- Vegetation (brief description of structure and dominant species, if known)
- Evidence of fire
- Disturbance (e.g., weeds, grazing, firewood collection)
- Soil colour and type
- Rock type and presence of any outcropping
- Important habitat elements, including, but not limited to the presence of:
 - Leaf litter accumulations
 - Woody debris and logs
 - Tree hollows or crevices
 - Soils suitable for burrowing
 - Long-unburnt vegetation

- Water
- Caves or rock crevices
- Dense shelter vegetation
- Important plant species for conservation significant fauna.
- Presence of wetlands
- Any vertebrate fauna present.

The habitat assessments were used in conjunction with aerial photography and land system mapping to delineate fauna habitat types within the Survey Area.

3.4.3 Conservation Significant Terrestrial Vertebrate Fauna

The Survey Area was assessed for the presence or evidence of conservation significant fauna, including direct observation (i.e. visually or aural detection) or indirect signs (such as burrows, diggings, foraging debris, hair/feathers, nests, scats, skeletal remains and/or tracks). Where applicable, field investigations were targeted to habitat features that are known to support conservation significant taxa (e.g. particular vegetation or substrate components).

3.5 Black-cockatoo Habitat Assessment

3.5.1 Guidelines

Guidelines for the referral of actions that may result in impact to black-cockatoos (for assessment under the EPBC Act) are provided by DCCEW (2022). The survey and analysis reported here have been conducted with strong reference to both the existing guidelines as well as the previous guidelines (DoEE, 2017). Survey methodology also followed the recommendations listed on the DCCEW's Species Profile and Threats Database (DCCEW, 2025a, 2025b, 2025c). Ecological values for black-cockatoos within the site were based on the definitions of breeding, foraging and roosting habitat as per the EPBC Act referral guidelines for black-cockatoos (Department of Agriculture, Water and the Environment, 2022).

The DBCA has indicated that methodology developed and applied previously by Bamford (e.g. Bancroft & Bamford, 2021) is an acceptable approach to score breeding value and foraging habitat and, therefore, these methods have been adopted in the present assessment and are detailed further, below.

3.5.2 Breeding

While the *Referral Guideline for 3 WA Threatened Black-cockatoo Species* (Department of Agriculture, Water and the Environment, 2022) has attempted to provide some prescriptive direction as to the methods that should be employed in black-cockatoo assessment this can, in practice and at times, be challenging to apply. With respect to black-cockatoo breeding, the following guidance is provided (in Table A2 of DCCEEW (2022)):

“Types of additional information that might be considered during the assessment and approval stage:

The number and location (e.g., in or adjacent to breeding habitat; in normal breeding range; away from breeding habitat; or outside of known breeding range.) of **known nesting trees**, i.e. trees of each species currently or recently used for breeding.

The number and location of **suitable nesting trees**, i.e. trees of each species with suitable hollows.

An estimated number and location of potential nesting trees. Potential nesting trees have a suitable diameter at breast height (DBH) to develop a nest hollow, but do not have hollows. For most species of trees, suitable nest hollows are only found in live trees with a DBH of at least 500 mm. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.”

In an attempt for clarity and an applied method, the consulting industry has developed a number of systems for the ranking of tree suitability for black-cockatoo breeding. One such method was employed by Bamford Consulting (for example, as applied by Bancroft & Bamford, 2023) and is now widely used across the sector and is used to assess tree hollow entrances from the ground. The Bamford rankings have been developed in conjunction with published information on the qualities/parameters of trees known to be used by black-cockatoos for nesting (e.g. (Johnstone et al., 2013)) and are summarised in **Table 3.7**.

Table 3.7 Bamford Black-cockatoo Nest-tree Ranks

Rank	Description of Tree and Hollows/activity
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8 m; but note that hollow height is contextual. Carnaby’s Black-Cockatoo will nest in hollows <5 m so in a Wheatbelt breeding site a lower criterion may be more appropriate.
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows (nest chamber) are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the species of Black-cockatoo likely to be present.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

These ranks can then be pooled, within reason, to align with DCCEEW's (2022) categories:

- Known nesting trees: Rank 1
- Suitable nesting trees: Rank 2 and Rank 3
- Potential nesting trees: Rank 4 and Rank 5.

It is noted that some trees that are assessed as Rank 3 are unlikely to support breeding (for example, because the internal dimensions - not assessed from ground level - are unsuited to Black-cockatoo nesting; and this may be strongly related to tree species and the propensity to form hollows). Therefore, consideration of a sub-ranking of these trees (to identify those which are considered to be of 'greatest' potential) is sometimes made, where applicable, when undertaking field investigations. This may be of practical importance if further assessment of hollows (e.g. by pole camera or drone) is required.

In assessing the value of breeding trees, the following are considered:

- **Height of nest entrance.** For Carnaby's Black-Cockatoo, a study by Saunders (1979) found that the minimum height of a known nest entrance was c. 3 m (Saunders, 1979) and while nests as low as 2 m (in Wandoo or Salmon Gum) were recorded, 95% of nests were above 3 m. For Forest Red-tailed Black-Cockatoo, a study by Johnstone et al. (2013) found the minimum height of a known nest entrance to be 6.5 m but, in general, the nest-hollows are high in the Marri forest (an average of about 14.5 m). Published data on Baudin's Black-Cockatoo nest heights are scant. Therefore, 3-4 m absolute minimum threshold seems a pragmatic "general" approach to use for the purposes of field work where multiple species are likely to occur (and breed), and multiple tree species are under consideration. It should be noted, however, that this can vary considerably depending on site (and species) context.
- **Tree species.** In the Jarrah forest, Marris are strongly favoured as breeding trees, with more than 90% of Black-cockatoo nests recorded in Marri in a study by Johnstone et al. (2013). While nests in Jarrah are known, these are relatively rare because the heartwood is resistant to termites and, thus, it is uncommon for this species to form the internal hollows of suitable dimensions for black-cockatoo nesting. Smooth, white-barked eucalypts (such as Wandoo and Powderbark Wandoo) have a much greater propensity to form large internal hollows, even in trees that have relatively narrow DBH. Nests in other species such as Flooded Gum, Karri, Tuart and Yarri are known and it is generally considered that a tree of any species may be a breeding site if hollow height, dimensions, and orientation are adequate.
- **Hollow entrance dimensions.** Johnstone et al. (2013) recorded the minimum nest entrance dimensions as 100 x 120 mm but noted that this was an extreme case. On 'average' hollow entrance dimensions were 300 x 340 mm and, in many cases the nest entrance was very much greater.
- **Hollow entrance orientation.** Johnstone et al. (2013) defined a number of hollow entrance types (based on their orientation and location within the tree's structure). These can be condensed to the following categories:
 - Chimney
 - Elbow
 - Spout

- Side entrance (to main trunk)
- Black-cockatoos mainly nested in chimneys, elbows and side entrances and, in virtually every case, the hollow entrance needed to be oriented vertically (chimneys, elbows), near-vertically (some spouts) or outwards (side entrances). Horizontal or downward-facing hollow entrances (even of suitable height and diameter) are undesirable to black-cockatoos.

3.5.2.1 Terminology

The terms adopted by DCCEEW (2022) to categorise black-cockatoo breeding habitat (especially ‘suitable’ and ‘potential’) can be confusing to use in practice. Therefore, we choose to use the term “potential nest-tree” to define any tree that meets the nest-tree criteria of DCCEEW (2022, 2025a, 2025b, 2025c), unless explicitly stated otherwise.

3.5.2.2 Field Investigations

The entire Survey Area was inspected for potential black-cockatoo nest-trees. The following information was recorded for every tree with a diameter at breast height (DBH) equal to or greater than 500 mm (or equal to or greater than 300 mm for *Eucalyptus accedens*, *E. salmonophloia* and *E. wandoo*):

- Tree location
- Tree species
- Life status
- DBH
- Nest-tree rank - trees were assessed (from the ground) for the potential presence/quality of nest-hollows and allocated a nesting rank in accordance with the Bamford ranking system as described in **Table 3.7**.

For trees that were scored as Rank 1, Rank 2 or ‘very high potential’ Rank 3, the following additional information was collected:

- Approximate tree height in m (we have rangefinders for this)
- Hollow entrance characteristics: height, dimensions, compass bearing, and a description of the hollow orientation/type (chimney, elbow, spout, side entrance)
- The presence/absence of chew marks around the hollow (and, if present, whether they are fresh or older)
- A photograph of the tree showing the hollow entrance location.

3.5.3 Foraging

3.5.3.1 Bamford Black-cockatoo Habitat Quality Score

Bamford (2020)) has also developed a foraging value assessment, that was designed to provide the sort of information needed by DCCEEW, Department of Water and Environmental Regulation (DWER) and the Environmental Protection Authority (EPA) to assess impact significance and offset requirements. This document is presented in **Appendix A**. The foraging value of the Survey Area was assessed by calculating a foraging score for areas of similar vegetation type/condition following the rationale laid out by Bamford (2020). The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The Bamford foraging habitat quality score (HQS) system has three components as detailed by Bamford (2020). These three components are drawn from the DCCEEW offset calculator but with the scoring approach developed by Bamford:

- A score out of six for the vegetation composition, condition and structure (as outlined in **Appendix A**)
- A score out of three for the context of the site (see **Appendix A** for details)
- A score out of one for species density (see **Appendix A** for details).

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. A higher score represents better foraging value. The approach to assigning scores for vegetation, context and species density incorporates a range of considerations and circumstances, and these are outlined and discussed by Bamford (2020). It should be noted that foraging HQSs are calculated differently for each of the three conservation significant black-cockatoo taxa that occur in Western Australia; thus a separate score is generally given for each FHT (see **Section 3.4.2**) for each taxon when multiple taxa are potentially present in an area.

3.5.3.2 Draft DCCEEW Habitat Quality Score

In addition to the Bamford HQS system, an unpublished draft ‘habitat scoring system for WA black-cockatoo foraging habitat’ has been obtained from DCCEEW. This takes a very similar approach to the Bamford method. The ‘vegetation condition and structure’ component of this system comprises a score of 0 to 7 and is summarised in **Table 3.8**.

For completeness, the draft DCCEEW HQS system was also used to assess the vegetation condition and structure of the Survey Area.

Table 3.8 Draft DCCEEW Habitat Quality Score - Vegetation Condition and Structure Component

Score	Foraging Value	Details
7	Very High	Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.
		Baudin's Black-Cockatoo
		Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.
6	High	Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or Allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.
		Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.
5	Moderate to High	Baudin's Black-Cockatoo
		Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.
		Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.
5	Moderate to High	Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).
		Baudin's Black-Cockatoo
		Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).
5	Moderate to High	Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30- 40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).

Score	Foraging Value	Details
4	Moderate	Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).
		Baudin's Black-Cockatoo
		Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).
		Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20- 30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).
3	Low to Moderate	Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.
		Baudin's Black-Cockatoo
		Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.
		Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.
2	Low	Carnaby's Black-Cockatoo
		Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.
		Baudin's Black-Cockatoo
		Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.
		Forest Red-tailed Black-Cockatoo
		Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .
1	Negligible to Low	All Species
		Scattered specimens of known food plants but projected foliage cover of these is <2%. May include: paddocks or urban areas with scattered foraging trees.
0	None	All Species
		No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).

3.5.3.3 Foraging Evidence

Black-cockatoo foraging signs were also recorded opportunistically as part of the general site inspection. When observed the following was recorded:

- Location
- Black-cockatoo species
- Forage plant species
- Approximate age of the foraging evidence, as outlined below.

Black-cockatoo foraging evidence may persist for some months or years after the foraging event. There is currently no published documentation of the deterioration process of forage. Factors that help to establish the time since foraging include: the colour of nuts/foilage, the degree of weathering or decay of debris, the presence of small fragments of nut debris, the position/compression of the foraging debris relative to surrounding vegetation and leaf litter, and the strength of the eucalypt smell emitted.

Despite the absence of empirical data, four categories of foraging activity were recognised, based on the time since foraging:

- **Active** – where birds were observed in the act of foraging.
- **Recent** – foraging signs (e.g. chewed nuts or vegetation) were ‘fresh’ (i.e. foraging was likely to have occurred within days to weeks). Recent foraging signs were typically green and/or with very little sign of weathering. Approximately less than four weeks old.
- **Intermediate** – foraging was likely to have occurred within weeks to months previously. Approximately one to six months old.
- **Old** – foraging was likely to have occurred months to years previously. Approximately more than six months old.

3.5.4 Night Roosting

As per the guidance of DCCEEW (2022), areas likely to be used as night roosting sites were noted based on the topographical, physical and vegetation characteristics present (such as sites adjacent to watercourses with large trees) and/or indirect evidence of roosting (e.g. guano deposits, discarded feathers). Areas that had cockatoo activity in the late-afternoon were also recorded.

The BirdLife Australia Great Cocky Count (GCC) database (BirdLife Australia, 2024a) of roost sites was searched for relevant local records.

3.5.5 Watering Points

Black-cockatoos generally choose roost locations within approximately 2 km of a watering point (DCCEEW, 2022) and, therefore, the presence (or absence) of water sources can influence the suitability of a site for use by black-cockatoos or the manner in which they may use that site. The Survey Area was assessed (directly during the field investigations and through the inspection of satellite imagery) for the presence of water sources that may provide potential watering points for black-cockatoos.

3.6 Survey Limitations

Table 3.9 presents the limitations of the flora, vegetation and fauna assessment of the Survey Area in accordance with the requirements of EPA Technical Guidance (2016c, 2020).

Table 3.9 Limitations of the Flora, Vegetation and Fauna Survey

Limitation	Outcome	Comment
Effort and Extent	Not a limitation – Vegetation and Fauna Minor limitation – Targeted Flora Survey	<p>A reconnaissance survey was undertaken across the entire Survey Area. 23 relevés and 26 vegetation mapping notes were recorded within the Survey Area. This amount of relevés is considered adequate to characterise the flora and vegetation of the Survey Area given the limited amount of remnant vegetation present and the size of the Survey Area. Mapping of vegetation boundaries was undertaken using a combination of aerial photography and information collected at the relevé and vegetation mapping note locations.</p> <p>Targeted survey for all significant flora taxa identified by the desktop assessment was conducted in all habitats present across the Survey Area. Data collection through relevés and vegetation mapping notes, and wandering transects were employed rather than a gridded close-spaced transects to ensure coverage across habitats in the Survey Area in the time allocated for the survey.</p> <p>No access constraints prevented appropriate sampling techniques (relevé establishment, foot traverses) being employed. Most areas were easy to access using roads and tracks. The power station was the only area that was not able to be accessed, with the assessment conducted by visual confirmation over the fence. Data reliability is therefore considered to be relatively high.</p> <p>The Basic and Targeted fauna sampling undertaken across the entire Survey Area and was sufficient to assess the potential for the Survey Area to support conservation significant fauna.</p>
Competency/experience of team carrying out the survey	Not a limitation	<p>The flora field team leader for the field survey has > 5 years' experience in conducting flora and vegetation surveys, and the fauna field team leader for the field survey has > 6 years' experience in conducting fauna surveys.</p> <p>Information relating to identifying characteristics of significant flora taxa, vegetation and fauna taxa identified by the desktop assessment as potentially occurring in the Survey Area was provided to all field team members prior to undertaking the field survey.</p> <p>The plant identifications were undertaken by a Senior Ecologist with > 7 years' experience in plant identification for flora.</p> <p>The fauna field investigations were undertaken by a suitably qualified ecologist (> 5 years' experience) and guided by a principal ecologist with > 20 years' experience.</p>

Limitation	Outcome	Comment
Proportion of flora and fauna identified, recorded and/or collected	Not a limitation	<p>All vascular groups that were present in the Survey Area were sampled. A high proportion of perennial vascular taxa were recorded based on the intensity and method of survey. Annual vascular taxa were recorded where identifiable. Any unknown vascular taxa were collected and identified by a highly experienced Senior Ecologist.</p> <p>All fauna recorded were identified.</p>
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	Not a limitation	<p>Good contextual information for the Survey Area was available prior to the survey. Sources of information used included government databases (DBCA, DCCEEW), as well as numerous general sources pertaining to the climate, geomorphology, flora, vegetation and fauna of the region, and flora and vegetation surveys previously conducted in the Desktop Study Area.</p>
Timing/weather/season cycle	Not a limitation	<p>The field survey was conducted in September 2024. This corresponds to the optimum survey timing for the flowering period of the Southern Jarrah Forest bioregion (Spring).</p> <p>The fauna surveys were directed to the assessment of fauna habitat types and values, and this method is not impacted by season or weather. The survey timing did, however, corresponds to the optimum period for Black-cockatoo breeding activity.</p>
Disturbances (e.g. fire, flood, accidental human intervention, etc.), which affected the results of the survey	Not a limitation	<p>There was evidence of significant impact to vegetation composition and structure throughout the Survey Area as a result of human activities, including clearing and very high levels of introduced (weed) taxa. However, these disturbances did not affect the results of the survey, with the vegetation able to be confidently described and mapped, and flora taxa mature enough to be easily identified or collected.</p> <p>The fauna investigations were unimpacted by disturbance.</p>
Remoteness and/or access problems	Not a limitation	<p>The Survey Area was accessed either via roads or on foot. The power station was the only area that was not able to be accessed, with the assessment conducted by visual confirmation over the fence. Therefore, this is not considered to be a limitation of this assessment.</p>

4.0 Results

4.1 Flora and Vegetation Desktop Assessment

4.1.1 Regional Vegetation

The Southern Jarrah Forest subregion largely comprises of Jarrah – Marri forest, as well as woodlands of Wandoo and Marri, with alluvial deposits supporting *Agonis* shrublands. The vegetation of WA as it was presumed to have existed prior to European settlement has been mapped at a scale of 1:250,000 as vegetation system associations (VSAs), with the Pre-European Vegetation spatial database subsequently created (Beard et al., 2013; DPIRD, 2019a).

The Survey Area intersects two VSAs as mapped by DPIRD (2019). These VSAs are summarised in **Table 4.1**, including the current extent remaining in relation to their pre-European extents and the percentage of the current extent presently protected for conservation within the Southern Jarrah Forest IBRA subregion (DBCA, 2019). Both VSAs have less than 30% of its pre-European extent remaining as of 2019. The pre-European extents within the Survey Area are presented on **Figure 4.1**.

Note this dataset is the most current available, however was last updated on 19 April 2019 and therefore current extant areas should be treated with caution. It should be noted that as per DBCA (2019), protected areas in this context are considered to be any areas listed in DBCA-Legislated Lands and Waters dataset (DBCA, 2023a) as either Crown reserves or lands managed under Section 8A of the *Conservation and Land Management Act 1984* (WA) that have an International Union for Conservation of Nature (IUCN) category of I to IV.

Table 4.1 Vegetation System Associations of the Survey Area

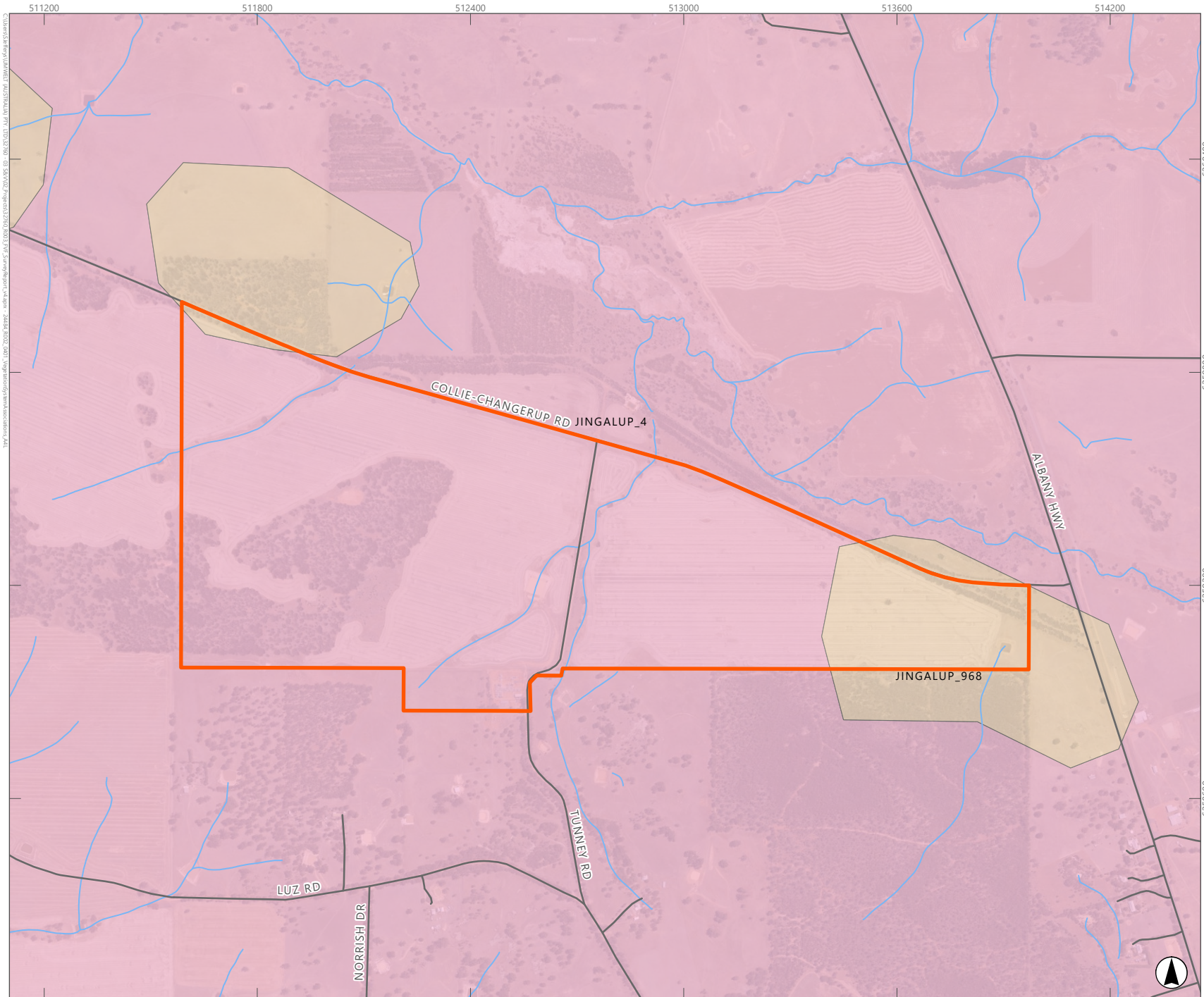
VSA	Name and Description	Current Extent ¹ (ha)	Pre-European Extent Remaining ¹ (%)	Current Extent Protected for Conservation ¹ (%)	Pre-European Extent ² Mapped in Survey Area (ha)
4	Jingalup_4 Jarrah, marri and wandoo <i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i> , <i>E. wandoo</i> .	35,568.5	21.3	1.09	17.3 (11.4%)
968	Jingalup_968 Jarrah, marri and wandoo <i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i> , <i>E. wandoo</i> .	7,735.68	21.1	0	133.8 (88.6%)
Total		151.1			

¹Data source: DBCA Statewide Vegetation Statistics: Full Report (DBCA, 2019),

²Data source: Pre-European Vegetation Mapping (DPIRD, 2019a).

The Jingalup Vegetation system was described by Beard (1979) as containing a well-defined mosaic of Jarrah-marri-wandoo woodland on ironstone gravels and woodland of marri and wandoo on slopes. Brown mallet (*Eucalyptus astringens*) often associates with Jarrah on breakaways, while flooded gum occurs on minor creeks. Woodlands of marri and wandoo dominate scattered small jam (*Acacia acuminata*) and sheoak (*Casuarina* spp.) with some Bull Banksia (*Banksia grandis*) and Christmas trees (*Nuytsia floribunda*).

FIGURE 4.1
Vegetation System Associations of the Survey Area

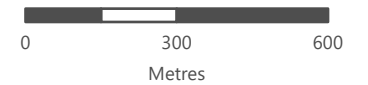


Legend

- Survey Area
- Road
- Watercourse

Vegetation System Associations

- JINGALUP_4
- JINGALUP_968



Scale 1:15,000 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.1.2 Local Flora and Vegetation Surveys

No publicly available previous flora and vegetation surveys were identified within the Desktop Study Area, through review of IBSA or the grey literature.

The Myrtle Benn Reserve is located immediately south of the Survey Area. This area is set aside by the Shire of Kojonup, with two walking trails in use through the Reserve. It is noted that the walking trails pass through Wandoo, Marri and She-Oak Woodland, and that over 200 flora taxa are known to occur in the reserve (Heartland Journeys, 2024).

4.1.3 Significant Flora Taxa

The interrogation of the DBCA WA Herbarium (WAHerb) Specimen Database and TPFL Database (DBCA, 2024c) returned 79 records of listed significant vascular flora taxa in the Desktop Study Area (**Appendix C**). A search of the DBCA NatureMap database (DBCA, 2007-) was also undertaken as part of the desktop assessment to check for any recently added records and confirm the records returned from the DBCA WA Herbarium Specimen Database and TPFL Database search, with no additional taxa returned (**Appendix C**).

The search of the DCCEEW SPRAT Database (DCCEEW, 2024) for MNES listed under the EPBC Act identified an additional seven flora taxa listed as Threatened species, or habitat for such species, that may occur in the Desktop Study Area (**Appendix B**). However, it is worthy of note that the SPRAT database search is based on Threatened flora taxa known from regional areas as opposed to actual records (as per the DBCA database searches) and includes provision of species and species habitat that are 'likely to occur' or 'may occur', as well as those that are 'known to occur' in such areas. Therefore, the interrogation of the SPRAT database returns flora taxa known from a wider area than the DBCA database searches.

In summary, a total of 86 flora taxa were returned from the database searches (DBCA, 2024c, 2007-; DCCEEW, 2024). Of the 86 taxa, a total 23 are Threatened taxa, which includes seven terrestrial orchids, three of which were returned by the DCCEEW SPRAT database only (**Appendix C**).

Figure 4.2 presents the locations of the listed significant flora taxa returned from the DBCA database searches (DBCA, 2024c), within the Desktop Study Area.

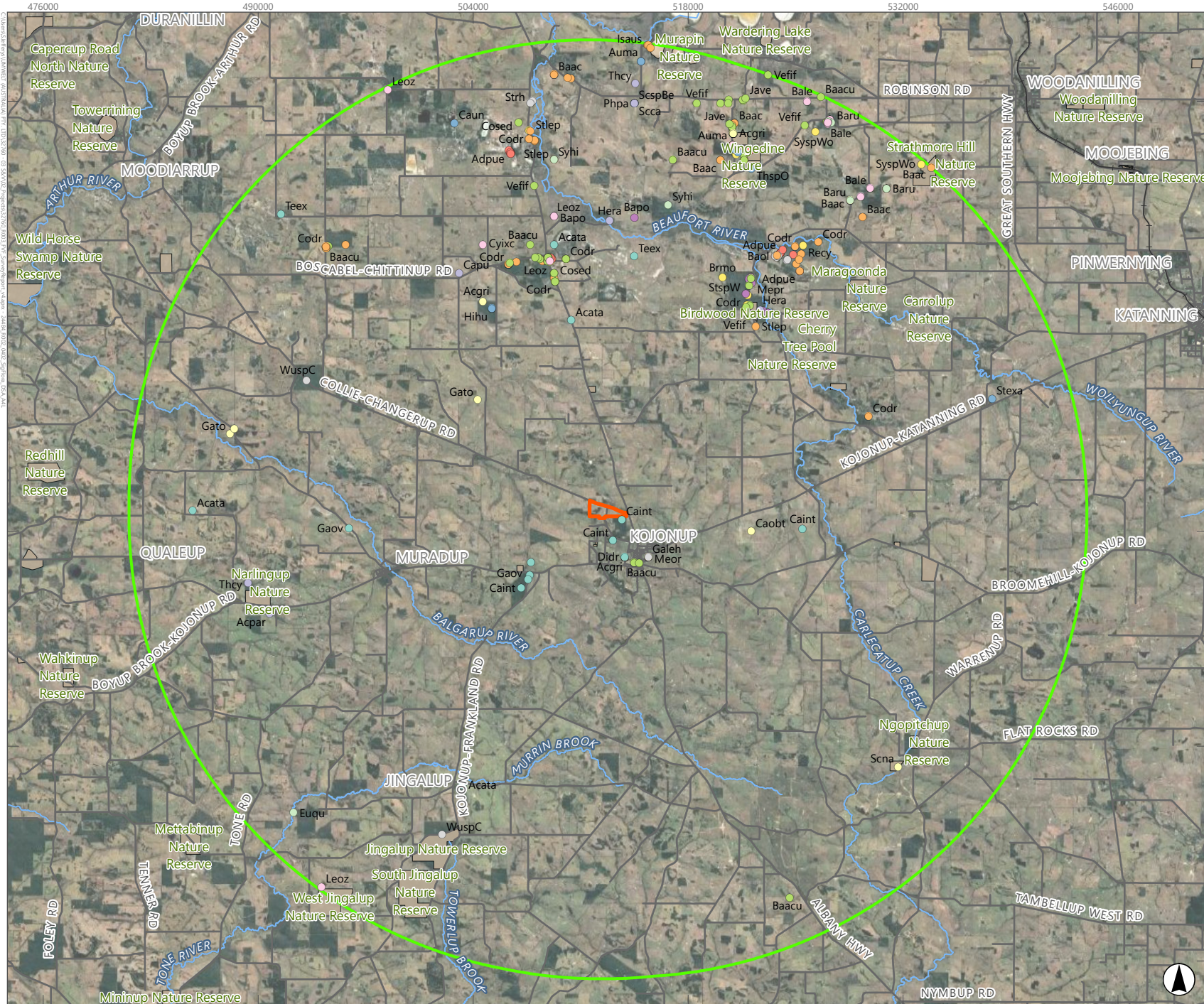


FIGURE 4.2
Significant Flora Taxa
Known from the Desktop
Study Area

Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve



Scale 1:350,000 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

FIGURE 4.2
LEGEND: Significant Flora Taxa Known from the Desktop Study Area

Significant Flora Taxa

- Acata *Acacia ataxiphylla* subsp. *ataxiphylla* (P3)
- Acgri *Acacia grisea* (P4)
- Acpar *Acacia parkerae* (P3)
- Adpue *Adenanthos pungens* subsp. *effusus* (T)
- Auma *Austroparmelina macrospora* (P3)
- Baac *Banksia acanthopoda* (P2)
- Baacu *Banksia acuminata* (P4)
- Bale *Banksia lepidorhiza* (T)
- Baol *Banksia oligantha* (T)
- Bapo *Banksia porrecta* (P4)
- Baru *Banksia rufistylis* (P2)
- Brmo *Brachyloma mogin* (P3)
- Caint *Caladenia integra* (P4)
- Caun *Calandrinia uncinella* (P1)
- Caobt *Calectasia obtusa* (P3)
- Capu *Calytrix pulchella* (P3)
- CaspBo *Caustis* sp. Boyanup (G.S. McCutcheon 1706) (P3)
- Codr *Conostylis drummondii* (T)
- Cosed *Conostylis setigera* subsp. *dasys* (T)
- Cyixc *Cyanicula ixioides* subsp. *candida* (P2)
- Didr *Diuris drummondii* (T)
- Elke *Eleocharis keigheryi* (T)
- Euqu *Eucalyptus quaerenda* (P3)
- Galeh *Gastrolobium lehmannii* (T)
- Gaov *Gastrolobium ovalifolium* (P4)
- Gato *Gastrolobium tomentosum* (P4)
- Hera *Hemigenia ramosissima* (T)
- Heri *Hemigenia rigida* (P1)
- Hihu *Hibbertia humilis* (P2)
- Isaus *Isolepis australiensis* (P3)
- Jave *Jacksonia velveta* (T)
- Leoz *Leucopogon ozothamnoides* (P1)
- Meor *Melaleuca ordinifolia* (P2)
- Mepr *Melaleuca pritzelii* (P3)
- Phpa *Phyllangium palustre* (P2)
- Recy *Regelia cymbifolia* (P4)
- Scca *Schoenus capillifolius* (P3)
- Scna *Schoenus natans* (P4)
- ScspBe *Schoenus* sp. Beaufort (G.J. Keighery 6291) (P1)
- Stco *Stylidium coatesianum* (P2)
- Stexa *Stylidium exappendiculatum* (P3)
- Stlep *Stylidium lepidum* (P3)
- Stmar *Stylidium marradongense* (P3)
- Strh *Stylidium rhipidium* (P3)
- Stpap *Styphelia papillosa* (P3)
- StspW *Styphelia* sp. Wandoo (F. & J. Hort 2441) (P2)
- Syhi *Synaphea hians* (P3)
- SyspWo *Synaphea* sp. Woodanilling (G.J. Keighery & N. Gibson 4614) (P2)
- Teex *Tetratheca exasperata* (P3)
- ThspO *Thelymitra* sp. Ongerup (S. Osborne 142) (P3)
- Thju *Thomasia julietiae* (P1)
- Thbre *Thysanotus brevifolius* (P2)
- Thcy *Thysanotus cymosus* (P3)
- Thte *Thysanotus tenuis* (P3)
- Vefif *Verticordia fimbriolepis* subsp. *fimbriolepis* (T)
- Vehut *Verticordia huegelii* var. *tridens* (P3)
- WuspC *Wurmbea* sp. Cranbrook (A.R. Annels 3819) (P3)

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
 APPROVED FOR AND ON BEHALF OF Umwelt

4.1.4 Significant Vegetation

The interrogation of DBCA’s TEC and PEC Database (DBCA, 2024a) returned two listed significant vegetation communities with records within the Desktop Study Area (**Table 4.2**). Indicative locations of these communities are presented on **Figure 4.3**; these consist of DBCA-applied buffers surrounding known locations or likely to occur locations, ranging from 200-2,000 m (as per the metadata from the DBCA Threatened and Priority Ecological Communities Database interrogation (DBCA, 2024a)). As such, these do not represent verified extents of this community. No TECs or PECs have been mapped within the Survey Area.

The first community listed in **Table 4.2**, ‘Eucalypt Woodlands of the Western Australian Wheatbelt’, is synonymous with the ‘Eucalypt Woodlands of the Western Australian Wheatbelt’ TEC as listed under the EPBC Act.

The second community listed in **Table 4.2**, ‘Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs’, is synonymous with the ‘Clay Pans of the Swan Coastal Plain’ TEC as listed under the EPBC Act. The search of DCCEEW’s SPRAT Database (DCCEEW, 2024) returned one additional Commonwealth-listed TECs as ‘likely’ to occur within the Desktop Study Area, being ‘Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia’. The full results of the DCCEEW Database search are presented in **Appendix B**.

A manual review of current DBCA TEC and PEC lists (DBCA, 2018, 2022) did not identify any additional significant vegetation communities within, or having the potential to occur within, the Survey Area.

Table 4.2 Significant Vegetation Known from Within the Desktop Study Area

Community	Description	Status (WA)	Status (EPBC)	Source ¹
Eucalypt Woodlands of the Western Australian Wheatbelt	The community occurs in the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions. It also includes outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%. The key dominant or co-dominant species of the tree canopy are species of Eucalyptus trees that typically have a single trunk. Native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs.	Priority 3 (iii)	Critically Endangered (CR)	DCCEEW, DBCA

Community	Description	Status (WA)	Status (EPBC)	Source ¹
Claypans with mid dense shrublands of <i>Melaleuca lateritia</i> over herbs	Claypans (predominantly basins) usually dominated by a shrubland of <i>Melaleuca lateritia</i> occurring both on the coastal plain and the adjacent plateau. These claypans are characterized by aquatic (<i>Hydrocotyle lemnoides</i> – Priority 4) and amphibious taxa (e.g. <i>Glossostigma diandrum</i> , <i>Villarsia capitata</i> and <i>Eleocharis keigheryi</i> (T)).	Priority 1	Critically Endangered (CR)	DBCA
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	The ecological community is generally kwongkan shrubland, ranging from sparse to dense, thicket-forming, where Proteaceae species form a significant component. It is confined to the southeast botanical province of Western Australia (<i>sensu</i> (Hopper & Gioia, 2004)) and primarily occurs on sandplains and marine plains and lower to upper slopes and ridges, as well as uplands across this region.	Priority 3 (iii)	Endangered (EN)	DCCEEW

¹Sources: (DCCEEW, 2024), (DBCA, 2024a).

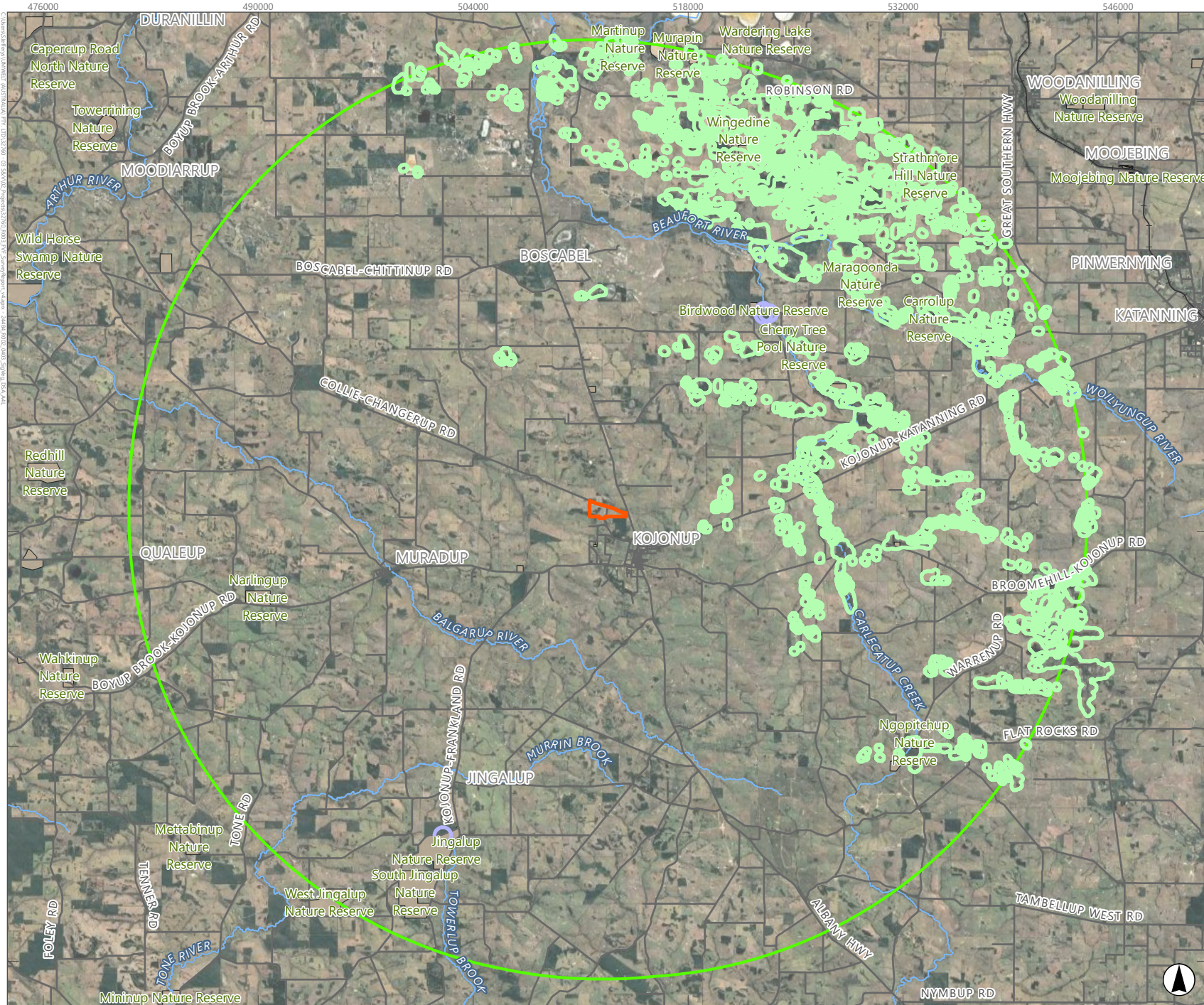


FIGURE 4.3
DBCAs Significant
Vegetation Records from
the Desktop Study Area

Legend

- Desktop Study Area
 - Survey Area
 - Road
 - Railway
 - Watercourse
 - Nature Reserve
- Significant Vegetation**
- Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs
 - Eucalypt woodlands of the Western Australian Wheatbelt



Scale 1:350,000 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.2 Reconnaissance and Targeted Field Survey

4.2.1 Flora Census

The survey recorded a total of 90 discrete flora taxa, including 23 introduced taxa; a total of 31 families were represented, with Poaceae (14 taxa), Fabaceae (13 taxa) and Asteraceae (11 taxa) families with the highest number of taxa recorded.

A full list of vascular flora taxa recorded is presented in **Appendix D**. Note that this list is not an exhaustive list of species of the Survey Area with respect to a Reconnaissance level survey conducted.

The raw relevé and vegetation mapping note data are presented in **Appendix E**.

4.2.2 Introduced Flora Taxa

A high percentage (28% of the total number of taxa recorded) of introduced taxa was recorded, which is representative of the widespread of clearing for agriculture present throughout the Survey Area. Note that one taxon included in this list, *Eucalyptus camaldulensis*, is native to Western Australia however is classified as introduced as it has been planted outside of its natural range.

Although most introduced taxa were common pasture weeds, one Declared Pest under the *Biosecurity and Agriculture Management Act* (2007) (BAM Act) (s22(2)), *Asparagus asparagoides*, was recorded. This taxon falls under the 'Exempt' Keeping Category (s22(2)); no permit or conditions are required for keeping. Although Kojonup represents a locality hole in this taxon's distribution, the Survey Area is located within its known range. It occurs in a variety of habitats although prefers fertile and well drained soils. It is a climbing weed and is known to smother and outcompete native taxa. It has an extensive root system and can spread through underground rhizomes, however it also seeds prolifically. It is spread widely by birds foraging on fruit (and seeds), and as it also has the ability to establish well in undisturbed native vegetation.

4.2.3 Significant Flora Taxa

No significant flora taxa were recorded by the 2024 survey.

4.2.4 Likelihood of Occurrence of Significant Flora Taxa

It is considered that all 86 significant flora taxa returned from the desktop assessment were identifiable during the survey period, either because the survey period coincided with the taxon's flowering period, or the taxon can be identified reliably when in fruit or when sterile. **Table 4.3** displays the likelihood of occurrence for each listed significant flora taxon returned from the desktop assessment, including habitat review and after the Reconnaissance survey was conducted. This likelihood of occurrence assessment has identified:

- 67 taxa are considered *Unlikely* to occur in the Survey Area, either because no potential habitat is present within the Survey Area (due to lack of required substrate, soil or water conditions, or due to degraded nature of the remnant vegetation present), or the Survey Area is outside of the taxon's known range.

- 12 taxa are considered to *Potentially* to occur in the Survey Area, as suitable habitat is known to or may occur in the Survey Area (depending on level of knowledge of the preferred habitat for the taxon), the Survey Area is either within or on the edge of the known range of the taxon, however all records known are >10 km from the Survey Area; and
- Seven taxon are considered *Possible* to occur in the Survey Area; the Survey Area contains suitable habitat for the taxon and known records are within 10 km of the Survey Area.
- No taxa are known to occur in the Survey Area, either through historical records or through the current survey results.
- It must be noted that the taxa considered to Potentially or Possibly occurring within the Survey Area would only occur in the area of remnant vegetation in Good condition. Excluding this vegetation, all taxa identified as potentially occurring in the Survey Area are considered unlikely to occur, due to vegetation condition being too poor to support habitat for such significant flora taxa.

It should be noted that suitable habitat has predominantly been determined utilising details recorded from known locations of specimens lodged with the WA Herbarium (Western Australian Herbarium, 1998). However, for many taxa known within the general vicinity of the Survey Area, suitable habitat is difficult to define as the available information is often vague or very broad and difficult to interpret. Therefore, a precautionary approach has been adopted when assessing whether suitable habitat for the taxon is present in the Survey Area. Additionally, it should be noted that, as per **Section 3.6**, fire does not appear to have affected the majority of the Survey Area for some time; short-lived, disturbance opportunist taxa that rely on fire for germination and subsequent establishment may therefore not have been identifiable at time of survey. It does not appear that any of the aforementioned 86 taxa have this particular life history, although it is noted that *Caladenia dorrienii* (T) flowering is stimulated by fire.

Targeted survey on the transects walked through the Survey Area was conducted (**Figure 3.1**), which intersected habitats and soils throughout the Survey Area. Generally, the understorey of the Survey Area was sparse, and it is considered that significant flora taxa that are cryptic or small in size may not have been identified during the survey if present.

Table 4.3 Likelihood of Occurrence of Further Significant Flora Within the Survey Area

Taxon	Status	Flowering Period¹	Habitat¹	Likelihood of Occurrence in Survey Area
<i>Acacia ataxiphylla</i> subsp. <i>ataxiphylla</i>	P3	October to December	Clay loam, sand with gravel, in <i>Eucalyptus</i> woodland. Shrub to 0.5 m.	Possible Suitable habitat present within Survey Area. Nearest records approximately 10 km from Survey Area; Survey Area is within this taxon's known distribution.
<i>Acacia brachypoda</i>	T VU (BC Act) EN (EPBC Act)	May to July	Low-lying swamp areas, with sandy clay or loam. Shrub to 3 m.	Unlikely Suitable habitat not present within Survey Area. Nearest records approximately 80 km from Survey Area; Survey Area is outside of this taxon's known distribution.
<i>Acacia grisea</i>	P4	July to November	Gravelly loam, flats or slopes, on laterite. Shrub to 0.6 m	Possible Suitable habitat present within Survey Area. Nearest records approximately 5 km from Survey Area (Myrtle Benn Reserve); Survey Area is on edge of this taxon's known distribution.
<i>Acacia parkerae</i>	P3	September to October	Non-lateritic clay or clay loam, in association with <i>Eucalyptus wandoo</i> .	Potential Suitable habitat may be present within the Survey Area. Nearest records are within approximately 25 km of the Survey Area; Survey Area is within this taxon's known distribution.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Adenanthos pungens</i> subsp. <i>effusus</i>	T CR (BC Act) EN (EPBC Act)	August to November	White sand, plains. Shrub to 0.5 m.	Unlikely Suitable habitat not present within Survey Area. Nearest records are approximately 20 km from the Survey Area; Survey Area on edge of this taxon's known distribution.
<i>Adenanthos pungens</i> subsp. <i>pungens</i>	T EN (BC Act) VU (EPBC Act)	August to November	White, grey or pink sand, rocky soils and gypsum. Sand dunes and hill sides. Shrub to 3 m.	Unlikely Suitable habitat not present within Survey Area Nearest records approximately 70 km from Survey Area; Survey Area is outside of this taxon's known distribution.
<i>Andersonia gracilis</i>	T VU (BC Act) EN (EPBC Act)	August to November	Winter-wet areas, near swamps. White-grey sand, sandy clay and gravelly loam. Shrub to 1 m.	Unlikely Suitable habitat not present within Survey Area. Nearest records approximately 200 km from Survey Area; Survey Area is outside of this taxon's known distribution.
<i>Angianthus drummondii</i>	P3	October to December	Seasonally wet flats, grey or brown clay soils, sometimes with ironstone. Annual herb to 0.1 m.	Unlikely Suitable habitat not present within Survey Area. Nearest record approximately 40 km from Survey Area; Survey Area is outside of this taxon's known distribution.
<i>Banksia acanthopoda</i>	P2	July to October	Gravelly clay- sand over laterite; low ridges. Shrub to 3 m.	Unlikely Similar habitat may be present within the Survey Area, however the nearest records are approximately 40 km from the Survey Area and the Survey Area is outside of this taxon's known distribution.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Banksia acuminata</i>	P4	September to October	Over laterite, white-grey sand or brown loam. Slopes and plains. Shrub to 0.2 m.	Possible Suitable habitat present within the Survey Area. Nearest records are approximately 5 km from the Survey Area (Rest Area near Kojonup); Survey Area is within this taxon's known distribution.
<i>Banksia cynaroides</i>	P4	July to October	Orange-brown sandy loam or grey sand over laterite, slopes. Shrub to 1.5 m.	Unlikely Suitable habitat may be present, however the nearest records are approximately 30 km from the Survey Area and the Survey Area is outside of this taxon's known distribution.
<i>Banksia lepidorhiza</i>	T EN (BC Act)	October to November	Gravelly sand or sandy loam. Shrub to 0.3 m.	Unlikely Suitable habitat may be present, however the Survey Area is outside of this taxon's known distribution, with the nearest record being approximately 25 km away.
<i>Banksia oligantha</i>	T EN (BC Act) EN (EPBC Act)	June to November	Dunes, grey or yellow sand. Deep sand. Shrub to 3 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is on the edge of this taxon's known distribution, with the nearest record approximately 20 km away.
<i>Banksia porrecta</i>	P4	May to September	Flats and slopes, yellow-brown sandy clay or white sand; over laterite or granite. Prostrate shrub to 0.35 m.	Potential Suitable habitat may be present within the Survey Area. The nearest records are approximately 20 km from the Survey Area; the Survey Area is within the known range of the taxon (although within a locality hole).

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Banksia rufistylis</i>	P2	July to August	Gravelly loam, laterite. Hills, ridges. Shrub to 1.5 m.	Potential Suitable habitat may be present within the Survey Area. The nearest record is approximately 30 km from the Survey Area; Survey Area on the edge of this taxon's known distribution.
<i>Banksia subpinnatifida</i> var. <i>imberbis</i>	P3	September to October	Slopes and flats with brown sandy clay gravel, on laterite. Shrub 0.3 – 1.5 m	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within the taxon's general distribution, however the known locations are approximately 30 km from the Survey Area.
<i>Bossiaea spinosa</i>	P3	August to October	Undulating plains, gravelly sandy soils. Low shrub to 0.5 m.	Unlikely Suitable habitat may be present within the Survey Area (although undulating plains mostly cleared) The nearest record is approximately 40 km from the Survey Area; Survey Area is on the edge of this taxon's known distribution.
<i>Brachyloma mogin</i>	P3	June	Swamp flats. Compact shrub to 0.4 m.	Unlikely Suitable habitat not present within Survey Area. The nearest records are approximately 20 km from the Survey Area; Survey Area is within this taxon's known distribution.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Caladenia bryceana</i> subsp. <i>bryceana</i>	T EN (BC Act) EN (EPBC Act)	August to October	Slopes with red loam, often on granite. Tuberous perennial herb to 0.1 m.	Unlikely Suitable habitat not present within Survey Area. The nearest record is approximately 40 km from the Survey Area; Survey Area is within this taxon's known distribution.
<i>Caladenia dorrienii</i>	T EN (BC Act) EN (EPBC Act)	September to November. Latest record 1 November.	Clay loam. Adjacent to rivers and seasonal creeks. Tuberous perennial herb to 0.2 m.	Unlikely Suitable habitat not present within Survey Area. The nearest records are approximately 40 km from the Survey Area; Survey Area is within this taxon's known distribution.
<i>Caladenia integra</i>	P4	September to October. Latest record is 29 October.	Flats, gentle slopes. brown loam/sand with laterite or granite. Tuberous perennial herb to 0.2 – 0.5 m.	Possible Suitable habitat may be present; generally recorded near expansive granite outcropping but also known from <i>Eucalyptus wandoo</i> woodland. The Survey Area is within this taxon's known distribution; the nearest record is approximately 5 km from the Survey Area (Myrtle Benn Reserve).
<i>Caladenia luteola</i>	T CR (BC Act) CR (EPBC Act)	September to October. Latest record is 12 October.	Lateritic sand; sandy loam; lateritic sand with gravel; adjacent to granite Tuberous perennial herb to 0.3 m.	Unlikely Suitable habitat potentially present within Survey Area. The Survey Area is outside of this taxon's known distribution, with nearest records approximately 30 km from Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Caladenia x triangularis</i>	P4	September to October. Latest record is 5 October.	Heavy loam. Tuberous perennial herb.	Unlikely Heavy loam soils not present. The Survey Area within the known range of the taxon; nearest record is approximately 40 km from the Survey Area.
<i>Calandrinia uncinella</i>	P1	August - September	Swampy soil, wet flats.	Unlikely Suitable habitat not present within Survey Area. The Survey Area outside of known distribution and nearest record is approximately 30 km from Survey Area.
<i>Calectasia obtusa</i>	P3	August to September	Sand, clay loam with gravel or laterite on flats. Herb to 0.4 m	Unlikely Suitable habitat not present (flats). Nearest known location was recorded on a low flat on grey clay loam, which is unlike the habitat in the Survey Area. The Survey Area just outside of the known distribution and nearest record is approximately 10 km from Survey Area.
<i>Calytrix pulchella</i>	P3	August to November, February	Grey-white sand over laterite. Shrub to 1 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area within known distribution and nearest record is approximately 20 km from Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Caustis</i> sp. Boyanup (G.S. McCutcheon 1706)	P3	February to March	White or grey sand on hills or in depressions. Sedge to 1 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area within known distribution and nearest record is approximately 20 km from Survey Area.
<i>Commersonia erythrogyna</i>	T CR (BC Act) EN (EPBC Act)	August to October	Granite outcrops. Brown peat soil. Shrub.	Unlikely Suitable habitat not present within Survey Area. The Survey Area outside of this taxon's known distribution and nearest record is approximately 50 km from Survey Area.
<i>Conostylis drummondii</i>	T EN (BC Act) ENV (EPBC Act)	Oct to Nov (yellow)	White, grey or yellow sand, gravel. Perennial herb to 0.3 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area at edge of this taxon's known distribution and nearest record is approximately 20 km from Survey Area.
<i>Conostylis setigera</i> subsp. <i>dasys</i>	T CR (BC Act) CR (EPBC Act)	October to November	Sand, gravel, laterite ridges or gentle slopes. Perennial herb to 0.3 m.	Unlikely Suitable habitat may be present within Survey Area, however; The Survey Area outside of this taxon's known distribution; the nearest record is approximately 20 km from Survey Area.
<i>Cryptandra beverleyensis</i>	P3	August to September	Clay soils with sand and laterite gravel, undulating plains. Shrub to 1.3 m.	Unlikely Suitable habitat may be present (although clay soils are not present), however the Survey Area is outside of this taxon's known distribution and nearest record is approximately 35 km from Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Cyanicula ixioides</i> subsp. <i>candida</i>	P2	August to October. Latest record 7 October.	Sand, laterite, gravel. Perennial herb to 0.12 m.	Unlikely Suitable habitat may be present, however nearest record was located on concretionary gravel/red sand unlike that of the Survey Area. Survey Area is within the taxon's known distribution, however only two records are known south of Perth; one in the Stirling Ranges and one recorded approximately 20 km north of the Survey Area.
<i>Diuris drummondii</i>	T EN (BC Act) VU (EPBC Act)	November to January. Latest record 25 January.	Floodplains, winter-wet depressions and swamps. Brown loam, sometimes peaty. Perennial herb to 1.05 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is on the edge of the known range and the nearest record is approximately 5 km from the Survey Area (Kojonup townsite, collected 1957).
<i>Diuris micrantha</i>	T VU (BC Act) VU (EPBC Act)	September to October. Latest record 4 October.	Winter-wet depressions. Brown loamy clay. Winter wet swamps, in shallow water.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution; nearest record approximately 45 km from the Survey Area.
<i>Drakaea micrantha</i>	T EN (BC Act) VU (EPBC Act)	September to November. Latest record 10 November.	Edge of swamps, often found in clearings and tracks. White-grey sand. Perennial herb to 0.3 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution; nearest record approximately 90 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Eleocharis keigheryi</i>	T VU (BC Act) VU (EPBC Act)	August to November	Clay, sandy loam. Emergent in freshwater: creeks, claypans. Sedge to 0.4 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution; nearest record is approximately 20 km from the Survey Area.
<i>Eucalyptus quaerenda</i>	P3	September	White sand, clay loam, somewhat saline. Sandhills and flats. Mallee to 4 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 30 km from the Survey Area.
<i>Gastrolobium lehmannii</i>	T VU (BC Act) VU (EPBC Act)	September to October	Red clay on laterite, breakaways. Shrub to 1.5 m.	Possible Suitable habitat may be present, however there are no breakaways within the Survey Area. Nearest record was recorded on gravel-sand. The Survey Area is on the northern edge of the known distribution of this taxon and the nearest record is approximately 5 km from the Survey Area (Mobrup South Road).
<i>Gastrolobium ovalifolium</i>	P4	August to September	Sandy clay. Gravelly hills. Prostrate shrub to 0.1 m.	Possible Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution with records approximately 5km from the Survey Area (several records from the vicinity of Kojonup).

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Gastrolobium tomentosum</i>	P4	August to November	Gravelly loam or clay, sometimes over sandier substrates. Hills, road verges. Shrub to 1 m.	Possible Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution, and the nearest record is approximately 10 km from the Survey Area.
<i>Grevillea newbeyi</i>	P3	January, June, September to November	Clay loam, sandy gravelly soils. Shrub to 1.5 m.	Unlikely Suitable habitat may be present, however the Survey Area is outside of this taxon's known distribution. The nearest record is approximately 35 km from the Survey Area.
<i>Grevillea</i> sp. Duranillin (E.F. Shedley 180)	P2	November to December	Flood plains with grey/brown sandy clay, seasonally inundated. Shrub.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is outside this taxon's known distribution, with the nearest record approximately 35 km from the Survey Area.
<i>Hemigenia ramosissima</i>	T CR (BC Act) CR (EPBC Act)	November to January	Granite outcrops, lateritic clay soils. Shrub to 0.5 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside this taxon's known distribution, with the nearest records approximately 30 km from the Survey Area.
<i>Hemigenia rigida</i>	P1	October to November	Grey sand with ironstone. Upper slopes. Shrub to 1 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is outside of this taxon's known distribution; the nearest record is approximately 25 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Hibbertia humilis</i>	P2	October to November	Flats with grey sandy clay, hills with granite outcropping.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution, and the nearest record is approximately 15 km from the Survey Area.
<i>Isolepis australiensis</i>	P3	June or September	Lake margins, pools. Annual sedge to 0.055 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 30 km from the Survey Area.
<i>Jacksonia velveta</i>	T EN (BC Act) EN (EPBC Act)	November to December	Slopes, yellow-brown loam, laterite. Shrub to 1.9 m.	Unlikely Suitable habitat may be present within the Survey Area, however: The Survey Area is outside of the known distribution; the nearest record is approximately 25 km from the Survey Area.
<i>Lasiopetalum cardiophyllum</i>	P4	August to January	Slopes, road verges. Brown loam over laterite and granite. Shrub to 0.5 m.	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution; the nearest record approximately 40 km from the Survey Area.
<i>Leucopogon ozothamnoides</i>	P1	August to October	Flats and slopes, grey clayey sand. Shrub to 0.2 m.	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 20 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Lilaeopsis polyantha</i>	P2	November	Sandy mud, lake margins. Perennial herb to 0.4 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 35 km from the Survey Area.
<i>Melaleuca micromera</i>	P3	September to October	Gentle slopes, Gravelly sandy loam or clay. Shrub to 4 m.	Unlikely Suitable habitat may be present, however the Survey Area is outside of the known distribution; the nearest record is approximately 35 km away.
<i>Melaleuca ordinifolia</i>	P2	August to October	Winter wet areas, brown sandy loam, or light grey clay. Shrub to 1.5 m.	Unlikely Suitable habitat not present within Survey Area. Nearest record was recorded on low wet sand. The Survey Area is on the edge of the known distribution; the nearest record is approximately 5 km from the Survey Area.
<i>Melaleuca pritzelii</i>	P3	August to December	Sandy or clay soils in swamp areas. Shrub to 1.6 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record approximately 20 km from the Survey Area.
<i>Microseris walteri</i>	P3	June to October	Salt lake fringes.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is at the edge of this taxon's known distribution; the nearest record approximately 35 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Montia australasica</i>	P2	October to March	Low-lying flats, seasonally inundated.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 40 km from the Survey Area.
<i>Pauridia</i> sp. Beaufort (V. Crowley DKN 629)	P1	September	Flats with wet grey clay.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is outside this taxon's known distribution; the nearest records approximately 30 km from the Survey Area.
<i>Phyllangium palustre</i>	P2	October to November	Seasonal wetlands. Annual herb to 0.02 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is outside this taxon's known distribution; the nearest record approximately 25 km from the Survey Area.
<i>Pterostylis echinulata</i>	P3	June to August. Latest record is 21 Aug.	Gravelly brown clay, damp depressions, creeks. Granite and laterite.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution and the nearest records are approximately 30 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Regelia cymbifolia</i>	P4	August to November	Undulating plains, white, grey or yellow sands. Shrub to 2 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Roycea pycnophylloides</i>	T VU (BC Act) EN (EPBC Act)	September to October	Salt lakes and saline habitats. Perennial herb forming mats to 1 m wide.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution and the nearest record is approximately 100 km from the Survey Area.
<i>Schoenus capillifolius</i>	P3	September to October	Seasonally inundated wetlands. Sedge 0.05 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 30 km from the Survey Area.
<i>Schoenus natans</i>	P4	September to December	Ephemeral wetlands. Sedge to 0.3 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 25 km from the Survey Area.
<i>Schoenus</i> sp. Beaufort (G.J. Keighery 6291)	P1	September to October	Brown or grey clay. Growing in shallow water in creeklines and claypans. Sedge to 0.05 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 30 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Stylidium coatesianum</i>	P2	October to November	Upper slopes, laterite. Red-brown loam. Perennial herb to 0.38 m.	Unlikely Suitable habitat may be present, however the Survey Area is outside of this taxon's known distribution and the nearest records are approximately 25 km from the Survey Area.
<i>Stylidium exappendiculatum</i>	P3	September to October	Slopes and flats. Sandy clay loam over laterite.	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Stylidium lepidum</i>	P3	October to November	Clay plans, clay loam. Perennial herb to 0.05 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 15 km from the Survey Area.
<i>Stylidium marradongense</i>	P3	September to November	Dry brown loam, gravel. Slopes. Perennial herb to 0.5 m.	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Stylidium pseudohirsutum</i>	P3	November to December	Sandy clay, lower hillslopes and depressions. Perennial herb to 0.42 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution and the nearest records are approximately 35 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Stylidium rhipidium</i>	P3	November	Winter wet depressions. Yellow-grey or black sandy clay, loam. Annual herb to 0.05 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 30 km from the Survey Area.
<i>Stylidium tylosum</i>	P2	October to November	Slopes with exposed granite, sandy clay. Perennial herb to 0.13 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution; the nearest record is approximately 30 km from the Survey Area.
<i>Styphelia papillosa</i>	P3	December to May	Upper slopes, brown sand over laterite.	Unlikely Suitable habitat may be present, however the Survey Area is outside of this taxon's known distribution. The nearest record is approximately 25 km from the Survey Area.
<i>Styphelia</i> sp. Wandoo (F. & J. Hort 2441)	P2	December to May	Sandy winter-damp flats. Yellow-Brown-Grey sand-loam-clay.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is outside of the taxon's known distribution; the nearest record is approximately 20 km from the Survey Area.
<i>Synaphea hians</i>	P3	August to November	Hill slopes, red-orange clay loam or grey sand. Shrub to 0.6 m.	Potential Suitable habitat may be present within Survey Area. The Survey Area is on the edge of the known distribution and the nearest record is approximately 20 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Synaphea</i> sp. Woodanilling (G.J. Keighery & N. Gibson 4614)	P2	September to November	White-grey sand, or red-brown gravelly loam on gentle slopes. Sprawling shrub.	Potential Suitable habitat may be present within Survey Area. The Survey Area is also outside of this taxon's known distribution and the nearest records are approximately 25 km from the Survey Area.
<i>Tetratheca exasperata</i>	P3	September to November	Slopes, wetlands. Brown-orange gravel, yellow-brown sand. Shrub to 0.35 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 20 km from the Survey Area.
<i>Thelymitra</i> sp. Ongerup (S. Osborne 142)	P3	November, latest record is 22 November.	Hill sides with ironstone gravel, clay soils.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution and the nearest record is approximately 50 km from the Survey Area.
<i>Thelymitra stellata</i>	T EN (BC Act) EN (EPBC Act)	September to November, latest record is 7 November.	Ridges and tops of lateritic hills with grey or brown sand or loam and lateritic gravel. Perennial herb to 0.25 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution and the nearest record is approximately 200 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Thomasia julietiae</i>	P1	October	Upper slopes, brown sandy loam over laterite.	Unlikely. Suitable habitat not present within Survey Area (known from two records; closest record was recorded on sandplain) The Survey Area is outside of this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Thysanotus brevifolius</i>	P2	October to November	Lateritic upland, grey sand over laterite. Gravel, sandy loam. Perennial herb to 0.25 m.	Potential Suitable habitat may be present within the Survey Area. The Survey Area is within this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Thysanotus cymosus</i>	P3	October to November	Slopes or flats with grey-brown sandy loam. Perennial herb to 0.3 m.	Potential Suitable habitat may be present within the Survey Area The Survey Area is on edge of the known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Thysanotus tenuis</i>	P3	September to October	Upper slopes, brown sandy loam over granite. Perennial herb to 0.2 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is at the edge of this taxon's known distribution and the nearest record is approximately 30 km from the Survey Area.

Taxon	Status	Flowering Period ¹	Habitat ¹	Likelihood of Occurrence in Survey Area
<i>Tribonanthes purpurea</i>	T VU (BC Act) VU (EPBC Act)	July to September	Granite outcrops, slopes, drainage lines. Brown loam. Perennial herb to 0.04 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is at the edge of this taxon's known distribution and the nearest record is approximately 45 km from the Survey Area.
<i>Verticordia fimbrialepis</i> subsp. <i>fimbrialepis</i>	T VU (BC Act) EN (EPBC Act)	November to February	Gentle slopes and flats, white sand over granite. Shrub to 0.7 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is at the edge of this taxon's known distribution and the nearest record is approximately 15 km from the Survey Area.
<i>Verticordia huegelii</i> var. <i>tridens</i>	P3	October to November	Flats, clay loam, over laterite. Shrub to 0.6 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is at the edge of this taxon's known distribution and the nearest record is approximately 25 km from the Survey Area.
<i>Wurmbea</i> sp. Cranbrook (A.R. Annels 3819)	P3	September to October	Valley floors, low-lying swamp areas, seasonally inundated. Perennial herb to 0.25 m.	Unlikely Suitable habitat not present within Survey Area. The Survey Area is also outside of this taxon's known distribution with the nearest record approximately 20 km from the Survey Area.
<i>Xanthorrhoea brevistyla</i>	P4	August to December	Brown clay, laterite gravel. Rolling hills. Tree-like monocot to 3.5 m.	Unlikely Suitable habitat may be present within Survey Area. The Survey Area is outside of this taxon's known distribution with the nearest record approximately 20 km from the Survey Area.

¹Source: (Western Australian Herbarium, 1998-2023)

4.2.5 Vegetation Types and Other Areas Mapped

A total of four Vegetation Types (VTs) were identified in the Survey Area, as summarised in **Table 4.4** and presented on **Figure 4.4**. This area covers 27.1 ha and represents 17.9% of the Survey Area. Remnant vegetation was mapped primarily on the slopes of hills influenced by laterite; these areas being the least favoured for agricultural purposes, and correspond to soil landscape units 257Fa_1 and 257Fa_3 (gravelly hill crests and rocky undulating low rises) in the Survey Area. Otherwise, remnant vegetation on soil landscape-unit 257Fa-2 was preserved by location as a road reserve. The vegetation recorded during the survey was typical of that found in the Jingalup Vegetation System (**Section 4.1.1**), as described below:

- VT1 represents the largest portion of the Survey Area in the context of remnant vegetation (15.1% of the Survey Area). The overstorey consisted of *Eucalyptus wandoo* (Wandoo) with patches of other *Eucalyptus* species present including *Eucalyptus astringens* subsp. *astringens* (Brown mallet), *Eucalyptus marginata* subsp. *marginata* (Jarrah) and *Corymbia calophylla* (Marri). The understorey was generally sparse and consists of isolated shrubs over isolated tussock grasses and forbs. This VT forms the entirety of the remnant bush block within the central portion of the Survey Area.
- VT3 covers 1.9% of the Survey Area and was mapped within the road verge portion of the Survey Area. It consists of an overstorey of mixed species including Marri, Jarrah, Wandoo, Brown mallett and *Allocasuarina hugeliana* (Rock She-Oak), over isolated *Hakea prostrata* (Harsh Hakea) and *Banksia sessilis* var. *sessilis* (Parrot Bush) over isolated shrubs and pasture grasses.
- VT4 covers 0.5% of the Survey Area and was mapped within the internal road verge portion of the property, running north-south. This consists of isolated *Corymbia calophylla* trees, as well as a tall shrubland layer of *Jacksonia sternbergiana* and young *Allocasuarina huegeliana*, over mixed native shrubland and pasture grasses.
- VT2 covers 0.3% of the Survey Area and was mapped adjacent to the substation within the Survey Area. The overstorey of this VT contains a subset of that of VT 3 (Rock She-Oak and Parrot Bush), over isolated shrubs and grassland.


The majority of the vegetation within the Survey Area has been highly modified since European settlement and is no longer considered to be intact remnant vegetation. This is a result of the long history of agricultural activities and other development in the Survey Area, including direct clearing for cropping, pasture, roads and other infrastructure, and grazing by stock. These include areas with primarily isolated native tree species remaining, areas with only planted native trees and shrubs, and areas with almost exclusively weed or crop species. These areas of non-native vegetation were predominantly located on the slopes and flats associated with agricultural soils, corresponding to soil vegetation units 257Fa_2 and 257Fa_5 and to a lesser extent units 257Fa_3 and 257Fa_1.


Areas where natural vegetation has been completely and apparently permanently removed, with either no or very scattered native taxa (trees) remaining, have been mapped as 'Cleared Land' (Cl) (where discernible at 1:5,000 scale). This category mainly consists of paddocks, with tracks and firebreaks providing a minor proportion of this area. A total of 124.4 ha of 'Cleared Land' was mapped, representing 82.4% of the Survey Area (**Table 4.4, Figure 4.4**).


A further 0.3 ha (0.2%) of the Survey Area has been mapped as artificial dams (Dm), where the natural vegetation has been cleared and replaced with standing water.


One small area within the Survey Area (0.1 ha, 0.1%) was mapped as 'Pn', where the overstorey was planted, with an understorey of remnant native shrubs. Another small area was mapped as 'Dr' (0.5 ha, 0.3%), located along the drainage line in the eastern paddock, and consists of isolated trees over pasture weeds.

Table 4.4 Vegetation Types of the Survey Area

VT	Description	Sampling Effort	Extent within Survey Area (ha)	Representative Photo
Native Vegetation				
1	Mid woodland to mid open forest of <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> usually with <i>Eucalyptus astringens</i> subsp. <i>astringens</i> , occasionally with <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and/or <i>Corymbia calophylla</i> , over low isolated clumps of shrubs of <i>Hibbertia commutata</i> and <i>Bossia eriocarpa</i> , over low isolated clumps of tussock grasses of <i>*Vulpia bromoides</i> and <i>*Aira cupaniana</i> , over low isolated clumps of forbs of <i>Millotia tenuifolia</i> var. <i>tenuifolia</i> , <i>Trachymene pilosa</i> and <i>*Romulea rosea</i> , on slopes with grey sandy loam, and laterite coarse fragments.	DMR01, DMR03, DMR04, DMR06, DMR07, DMR08, DMR09, DMR10, DMR11, DMR12, DMR13, DMR14, DMR15, DMR16, DMR21, DMR22	22.9 ha (15.1%)	 <p>Photo: DMR01</p>

VT	Description	Sampling Effort	Extent within Survey Area (ha)	Representative Photo
2	<p>Mid open woodland of <i>Allocasuarina huegeliana</i> over tall shrubland of <i>Banksia sessilis</i> var. <i>sessilis</i>, over low sparse shrubland of <i>Styphelia erectifolia</i>, <i>Hibbertia commutata</i> and <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> over mid isolated clumps of sedges of <i>Lepidosperma leptostachyum</i> over low tussock grassland of <i>*Ehrharta longiflora</i> and <i>Neurachne alopecuroidea</i>, on slopes with brown sandy loam and laterite coarse fragments.</p>	DMR02	0.5 ha (0.3%)	 <p>Photo: DMR02</p>

VT	Description	Sampling Effort	Extent within Survey Area (ha)	Representative Photo
3	<p>Mid open woodland of mixed species including <i>Corymbia calophylla</i>, <i>Eucalyptus marginata</i> subsp. <i>marginata</i>, <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>, <i>Allocasuarina huegeliana</i> and <i>Eucalyptus astringens</i> subsp. <i>astringens</i>, over tall isolated clumps of shrubs of <i>Hakea prostrata</i> and <i>Banksia sessilis</i> var. <i>sessilis</i>, over low isolated clumps of shrubs over closed tussock grassland of pasture weeds.</p>	DMR17, DMR19, DMR20	2.9 ha (1.9%)	 <p>Photo: DMR17</p>

VT	Description	Sampling Effort	Extent within Survey Area (ha)	Representative Photo
4	Low isolated trees of <i>Corymbia calophylla</i> over tall sparse to open shrubland of <i>Jacksonia sternbergiana</i> and/or <i>Allocasuarina huegeliana</i> over mixed native shrubland, over pasture weeds.	NA	0.8 ha (0.5%)	 <p>Photo: supplied by Mint</p>
Highly Modified Areas				
Cl	Cleared paddocks with isolated paddock trees, includes roads, tracks and infrastructure.	NA	123.1 ha (81.5%)	NA
Dm	Artificial dam.	NA	0.3 ha (0.2%)	NA


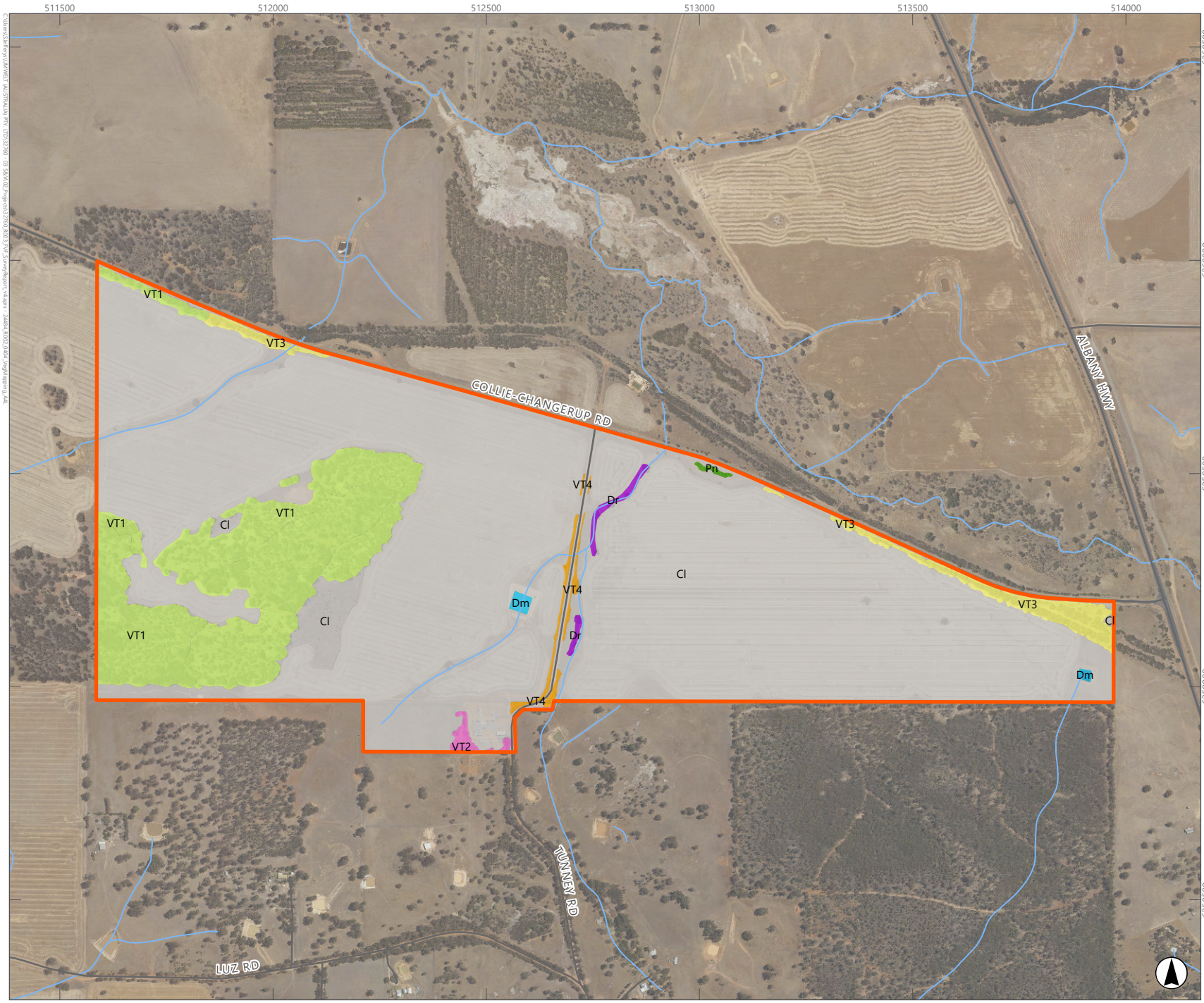
VT	Description	Sampling Effort	Extent within Survey Area (ha)	Representative Photo
Pn	Mid open woodland of planted trees of <i>Eucalyptus camaldulensis</i> over isolated clumps of shrubs to mid open shrubland of remnant native shrubs over tussock grassland of pasture weeds.	DMR18	0.1 ha (0.1%)	 <p>Photo: DMR18</p>
Dr	Low to mid isolated trees of unidentified Eucalypts over closed tussock grassland of pasture weeds, located along a drainage line.	NA	0.5 ha (0.3%)	NA

FIGURE 4.4
Vegetation Types of the Survey Area

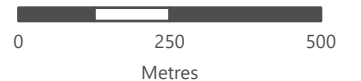


Legend

- Survey Area
- Road
- Railway
- Watercourse

Vegetation Type

- VT1
- VT2
- VT3
- VT4
- CI
- Pn
- Dm
- Dr



Scale 1:12,500 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

4.2.6 Vegetation Condition

The area of each VT and corresponding condition rating (as per EPA (2016c)) mapped by the 2024 survey in the Survey Area is presented in **Table 4.5**. The vegetation condition mapping of the Survey Area is presented on **Figure 4.5**.

The majority of the Survey Area has been mapped as ‘Completely Degraded’ (124.7 ha, 82.5%) (**Table 4.5, Figure 4.5**). This largely consists of areas mapped as Cl, Dm, Dr and Pn areas, in which the land has been cleared for pasture or cropping. Little to no native vegetation remains in these areas, although isolated remnant trees do occur. A small extent (0.7 ha) of VT 3 and VT4 were also mapped as Completely Degraded; in these areas, VT allocation was undertaken due to the extent of remaining tree stratum, or weed overstorey presence, allowing grouping into these VTs rather than being allocated to Cleared land.

A small percentage (10.3%) of the Survey Area was mapped as being in ‘Degraded’ condition (15.5 ha) (**Table 4.5, Figure 4.5**); these areas predominately consisted of native trees over no or very little understorey taxa, and high levels of introduced (weed) taxa.

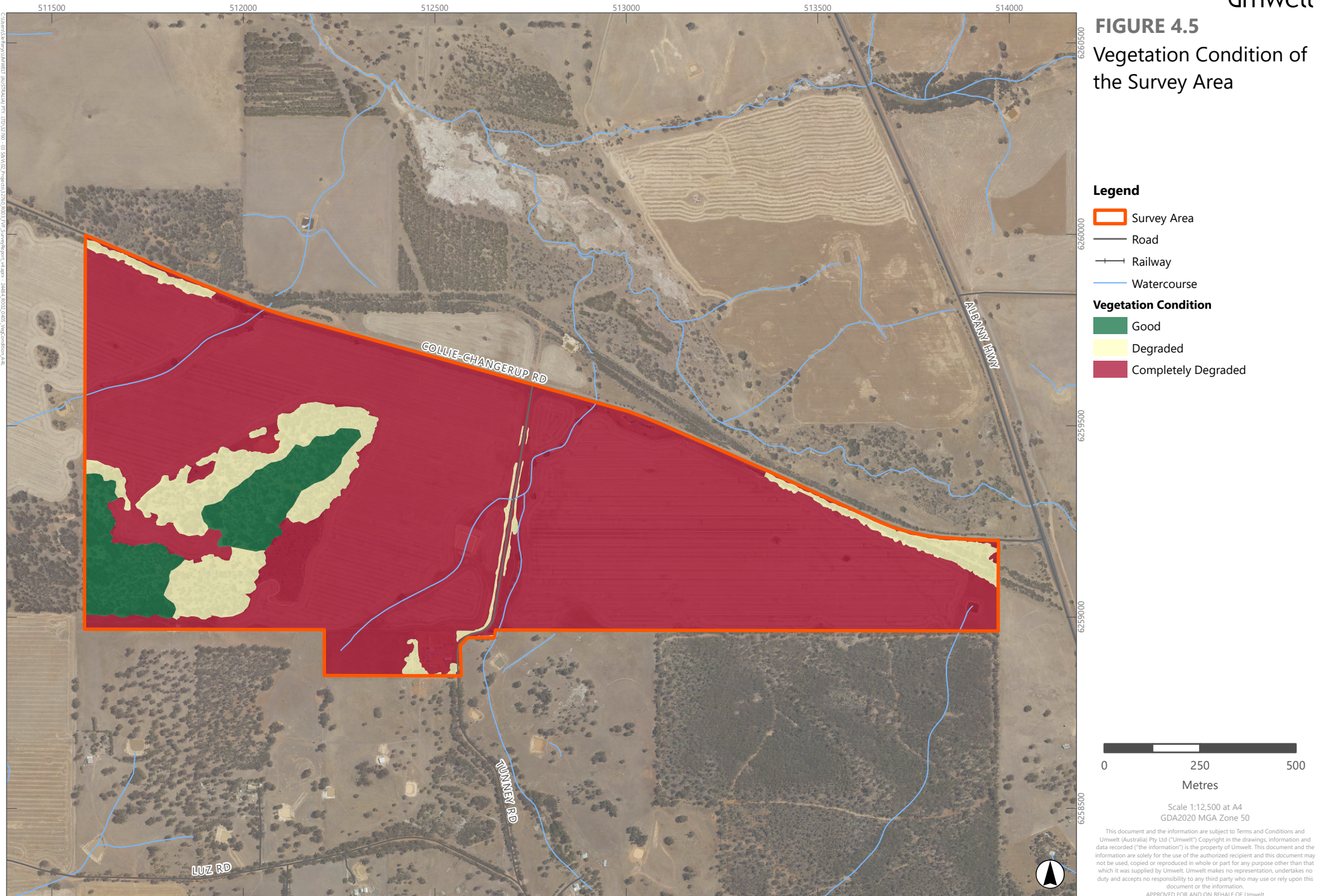
A small portion of the Survey Area was mapped as being in ‘Good’ condition (10.9 ha, 7.2% of the Survey Area) (**Table 4.5, Figure 4.5**). This condition rating was mapped across the internal patch of remnant vegetation and was limited to within VT 1.

Due to the history of clearing, logging and grazing in the Survey Area, no vegetation was considered to be in ‘Pristine’, ‘Excellent’ or ‘Very Good’ condition.

Table 4.5 Vegetation Condition of the Survey Area

VT	Extent in Survey Area (ha)			
	Good	Degraded	Completely Degraded	Total
VT1	10.9	11.9	-	22.9
VT2	-	0.5	-	0.5
VT3	-	2.4	0.5	2.9
VT4	-	0.7	0.1	0.8
Cl	-	-	123.2	123.2
Pn	-	-	0.1	0.1
Dr	-	-	0.5	0.5
Dm	-	-	0.3	0.3
Total (ha)	10.9	15.5	124.7	151.1
Total (%)	7.2	10.3	82.5	100

FIGURE 4.5
Vegetation Condition of
the Survey Area



4.2.7 Significant Vegetation

The vegetation present in the Survey Area was assessed against the three significant communities returned from the Desktop Assessment (**Section 4.1.4**). Two of these communities ('Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs'; 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia') are unlikely to occur in the Survey Area by virtue of soil substrate and species presence/absence.

Upon review of species and structure, the significant community 'Eucalypt Woodlands of the Western Australian Wheatbelt' has been determined to potentially occur in the Survey Area. A summary of the key diagnostics of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC are presented in **Appendix F**.

Each of the VTs described and mapped in the Survey Area were assessed against the key diagnostics in relation to characteristics 2 (Structure); 3 (Key tree species) and 4 (Presence of understorey). The vegetation description and components of VT1 in the Survey Area are considered to potentially represent *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC based on species and structure. VTs 2 and 3 are not considered to represent the TEC and are not discussed further. The final determination of presence and extent of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC is also dependent on both vegetation condition and patch size.

A total of 22.1 ha of vegetation that meets the requirements of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC has been identified within the Survey Area (**Figure 4.6**), across one patch. This patch is represented by VT1 and is in Good to Degraded condition. The remaining VT1 patches within the Survey Area do not meet the requirements of the TEC, mostly due to condition requirements (including dominance of taxa that are listed in Table 2b of DoE (2015) lack of native understorey and covers of introduced taxa exceeding 70% of the understorey in most cases) and patch size. **Table 4.6** summarises the key diagnostic requirements, and how the VT1 patch within the remnant bush block (**Figure 4.6**) fulfills these requirements.

Table 4.6 Summary of TEC Criteria Relating to Vegetation in the Survey Area

Criteria	Fulfilled	Reason
<p>Vegetation is within IBRA subregions:</p> <ul style="list-style-type: none"> • Avon Wheatbelt AVW01 Merredin • Avon Wheatbelt AVW02 Katanning • Mallee MAL02 Western Mallee <p>Some outlying patches of the ecological community may extend into adjacent areas south and east of the primary wheatbelt regions, in the easternmost parts of the Jarrah Forest bioregion. These outlier patches generally occur south of Northam, extending around the vicinity of localities such as Wandering, Williams, Kojonup and Mount Barker, and are limited to areas that are not on the Darling range, receive less than 600 mm mean annual rainfall and overlie the Yilgarn Craton geology.</p>	Y	<p>The Survey Area is located in the Jarrah Forest bioregion;</p> <p>The Survey Area is located within the locality of Kojonup, which receives on average 537 mm of rainfall annually (BoM, 2024).</p> <p>Additionally, the Survey Area is located on the Yilgarn Craton geology (residing on the Farrar Subsystem (DBCA, 2019)).</p>
<p>The dominant trees of the vegetation are Eucalypt species, as listed within Table 2a of DoE (2015). Trees listed in Table 2b of DoE (2015) can be present, but not dominant within the vegetation unit.</p>	Y	<p>The vegetation within the VT 1 vegetation type is represented by <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> and <i>Eucalyptus astringens</i> subsp. <i>astringens</i> woodland, which satisfies this criterion, as both trees are listed in Table 2a in DoE (2015). <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> subsp. <i>marginata</i> are both present but not dominant, as per Table 2b in DoE (2015).</p>
<p>Vegetation patches of Degraded condition must be over 5 ha in size, and 2 ha for Good condition.</p> <p>Condition thresholds of the TEC are further outlined in Table 3 of DoE (2015).</p>	Y	<p>The vegetation within the VT 1 identified as representing the TEC (Figure 4.6) remnant bush block is approximately 22.1 ha in size, with the vegetation condition of the patch being a mixture of Good and Degraded (10.9 ha as 'Good'; 11.9 ha as 'Degraded'). Thus, the minimum patch size requirement is satisfied.</p>

As per the conservation advice (DoE, 2015), a minimum buffer zone of 40 m surrounding the mapped TEC extents is recommended to be excluded from construction activities. It is noted that this buffer zone is not regarded as TEC and is advisory only. The conservation advice states that:

'Where the buffer on a particular property is subject to existing land uses, such as cropping, ploughing, grazing, spraying, etc., they can continue. However, in the interests of protecting adjacent patches of the ecological community, it is requested that care be exercised in the buffer zone to minimise the risk of any significant adverse impacts extending into those patches.'

Figure 4.6 presents the mapped occurrences of the vegetation consistent with the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC, within the Survey Area. The buffer zones are not displayed on this figure.

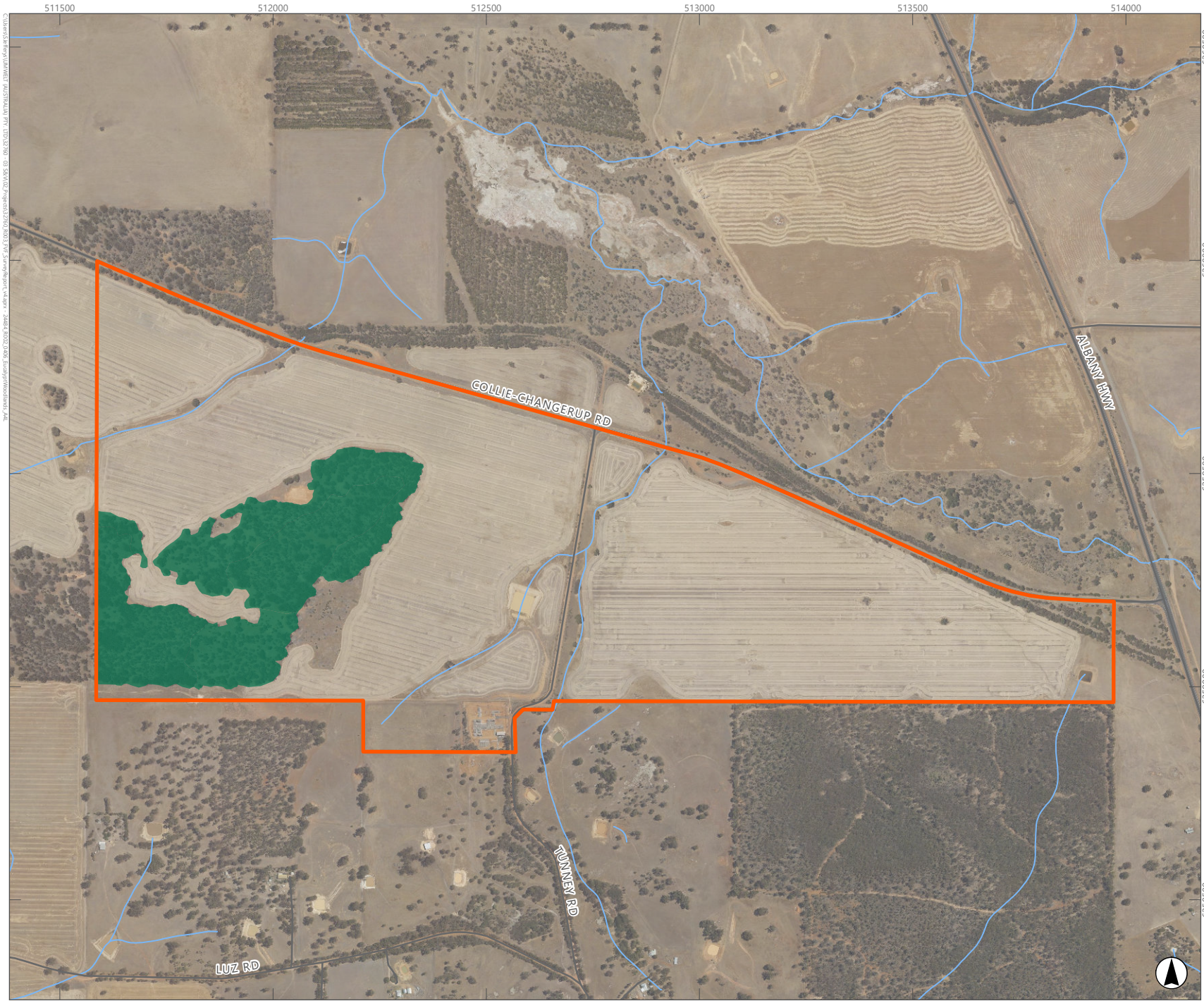
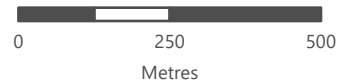


FIGURE 4.6
 Eucalyptus Woodlands of
 the Western Australian
 Wheatbelt TEC Within
 the Survey Area

- Legend**
- Survey Area
 - Road
 - Railway
 - Watercourse
 - TEC



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.3 Fauna Desktop Assessment

4.3.1 Local Fauna Surveys

No publicly available previous vertebrate fauna surveys were identified within the Desktop Study Area, through review of IBSA or the grey literature.

4.3.2 Significant Vertebrate Fauna Taxa

The interrogation of the DBCA Fauna Database (DBCA, 2024b) returned 30 records of listed significant vertebrate fauna taxa in the Desktop Study Area. Searches of the DBCA NatureMap database (DBCA, 2007-) was also undertaken as part of the desktop assessment to check for any recently added records and confirm the records returned from the DBCA Fauna Database search, with no additional taxa returned. The additional search of Atlas of Living Australia (ALA) (2024) likewise returned no additional taxa.

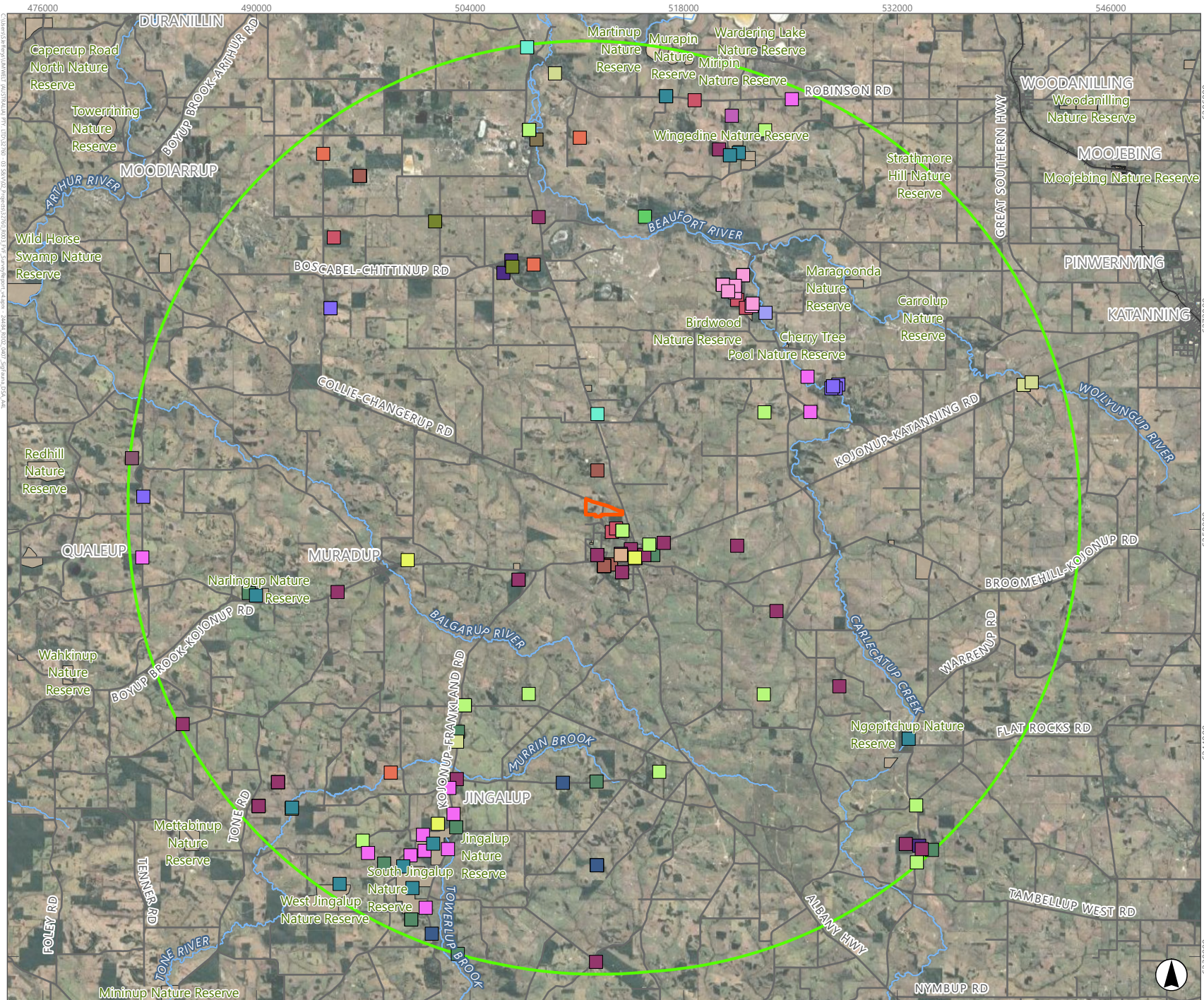
The search of the DCCEEW SPRAT Database (DCCEEW, 2024) for MNES listed under the EPBC Act identified an additional two vertebrate fauna taxa listed as Threatened species (*Aphelocephala leucopsis*, Southern Whiteface (VU), and *Falco hypoleucos*, Grey Falcon (VU)), or habitat for such species, that may occur in the Desktop Study Area (**Appendix B**). However, it is worthy of note that the SPRAT database search is based on Threatened fauna taxa known from regional areas as opposed to actual records (as per the DBCA database searches) and includes provision of species and species habitat that are 'likely to occur' or 'may occur', as well as those that are 'known to occur' in such areas. Therefore, the interrogation of the SPRAT database returns fauna taxa known from a wider area than the DBCA database searches.

A supplementary literature review of sources including BirdLife's Handbook of Australian, New Zealand and Antarctic Birds (HANZAB) (2024b) and Johnstone and Storr (1998) was conducted to identify any additional taxa that may occur within the Desktop Study Area. One additional taxon was returned from this review, *Tyto novaehollandiae novaehollandiae*, Masked Owl (south-west).

In summary, a total of 36 fauna taxa were returned from the database searches (ALA, 2024; DBCA, 2024b, 2007-; DCCEEW, 2024), and the literature review. Of the 26 taxa, a total 15 are Threatened taxa, and two are listed as Extinct (*Bettongia lesueur graii*, Boodie (Inland), and *Onchyogalea lunata*, Crescent Nailtail Wallaby). The total list of significant fauna taxa returned by the database searches is presented in **Appendix G**.

Figure 4.7 presents the locations of the listed significant fauna taxa returned from the DBCA database searches (DBCA, 2024b), within the Desktop Study Area.

FIGURE 4.7
Significant Fauna Taxa of the Desktop Study Area



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve



Scale 1:350,000 at A4
GDA2020 MGA Zone 50













This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
APPROVED FOR AND ON BEHALF OF Umwelt

FIGURE 4.7
LEGEND: Significant
Fauna Taxa of the
Desktop Study Area

Birds

	<i>Oxyura australis</i>	Blue-billed duck
	<i>Leipoa ocellata</i>	Malleefowl
	<i>Botaurus poiciloptilus</i>	Australasian bittern
	<i>Falco peregrinus</i>	Peregrine falcon
	<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo
	<i>Zanda baudinii</i>	Baudin's cockatoo
	<i>Zanda latirostris</i>	Carnaby's cockatoo
	<i>Zanda</i> sp. 'white-tailed black cockatoo'	White-tailed black cockatoo
	<i>Cacatua pastinator pastinator</i>	Muir's corella
	<i>Platycercus icterotis xanthogenys</i>	Western rosella (inland)
	<i>Motacilla flava</i>	Yellow wagtail

Mammals

	<i>Dasyurus geoffroii</i>	Chuditch, western quoll
	<i>Phascogale calura</i>	Red-tailed phascogale, kenngoor
	<i>Phascogale tapoatafa wambenger</i>	South-western brush-tailed phascogale, wambenger
	<i>Myrmecobius fasciatus</i>	Numbat, walpurti
	<i>Isoodon fusciventer</i>	Quenda, southwestern brown bandicoot
	<i>Macrotis lagotis</i>	Bilby, dalgyte, ninu
	<i>Bettongia lesueur graii</i>	Burrowing bettong (inland), boodie (inland)
	<i>Bettongia penicillata ogilbyi</i>	Woylie, brush-tailed bettong
	<i>Notamacropus eugenii derbianus</i>	Tammar wallaby
	<i>Notamacropus irma</i>	Western brush wallaby
	<i>Onychogalea lunata</i>	Crescent nailtail wallaby, tjawalpa
	<i>Hydromys chrysogaster</i>	Water-rat, rakali

C:\Users\sheryl\Documents\umwelt\australia\pvc_1101212700 - 03_SAVO\027\project\2701_0013_MV_Survey\Report\4-Map - 240418\02_2007_Signif Fauna Taxa LEGEND_Atlas

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt"). Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
 APPROVED FOR AND ON BEHALF OF Umwelt

4.4 Basic Fauna Survey

4.4.1 Fauna Habitat Types of the Survey Area

The Survey Area comprised smaller remnant vegetation patches (including road verges) amongst agricultural land. A total of 19 fauna habitat assessments (FHA) were undertaken within the Survey Area to assist the delineation of Fauna Habitat Types (FHTs). Six fauna habitat types were identified during the field investigations, which are presented in **Table 4.7** and mapped in **Figure 4.8**.

While weed invasion and grazing (by domestic stock) has impacted the condition and, hence, value to fauna of many of the native vegetation remnants, they still retain some of their original value to fauna. Connectivity of the remnant vegetation within the Survey Area (for most terrestrial vertebrate fauna) is tenuous with minimal native vegetation (with which to connect) remaining in the surrounding region.

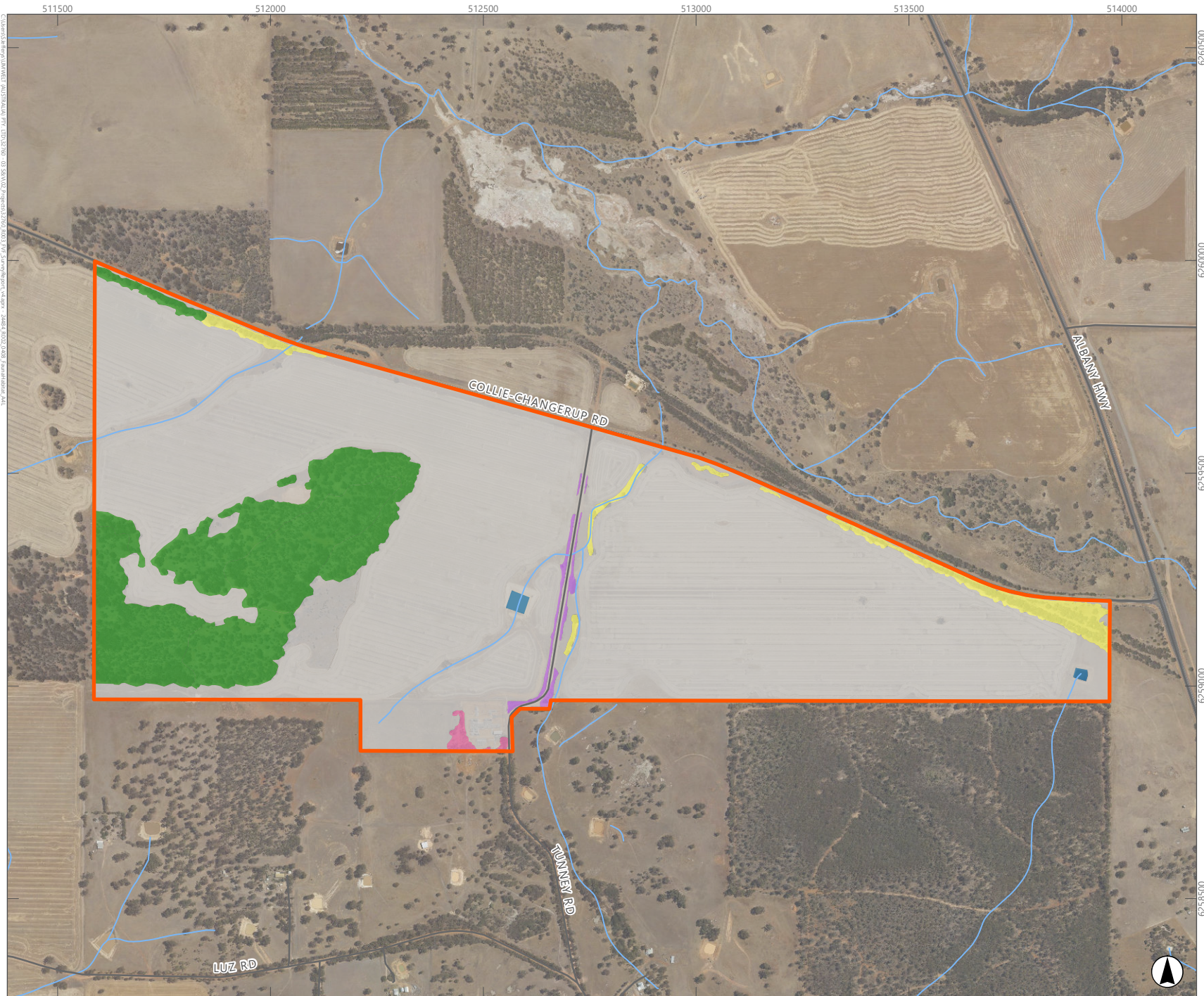
The Survey Area sits within the broader agricultural matrix and is abutted by other farmlands (that include smaller remnant vegetation patches) and the Myrtle Benn Flora and Fauna Sanctuary (to the south).

The raw fauna habitat type data is presented in **Appendix H**.

Table 4.7 Fauna Habitat Types of the Survey Area

Fauna Habitat Type	Description	Associated Vegetation Types	Area (ha) mapped in Survey Area
Eucalyptus Woodland (Ew)	Mid woodland to mid open forest of <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> usually with <i>Eucalyptus astringens</i> subsp. <i>astringens</i> , occasionally with <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and/or <i>Corymbia calophylla</i> , over isolated low shrubs, grasses and forbs, on slopes with grey sandy loam and laterite coarse fragments.	VT1	22.9 ha (15.1%)
Allocasuarina Woodland (Aw)	Mid open woodland of <i>Allocasuarina huegeliana</i> over tall shrubland of <i>Banksia sessilis</i> var. <i>sessilis</i> , over low sparse shrublands, sedges and grasses, on slopes with brown sandy loam and laterite coarse fragments.	VT2	0.5 ha (0.3%)
Mixed Woodland (Mw)	Mid open woodland of mixed species including <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> subsp. <i>marginata</i> , <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> , <i>Allocasuarina huegeliana</i> and <i>Eucalyptus astringens</i> subsp. <i>astringens</i> , over isolated tall shrubs of <i>Hakea prostrata</i> and <i>Banksia sessilis</i> var. <i>sessilis</i> , over pasture weeds.	Dr, Pn, VT3	3.5 ha (2.3%)
Mixed Shrubland (Ms)	Low isolated trees of <i>Corymbia calophylla</i> over tall sparse to open shrubland of <i>Jacksonia sternbergiana</i> and/or <i>Allocasuarina huegeliana</i> over mixed native shrubland, over pasture weeds.	VT4	0.8 ha (0.5%)
Cleared (Cl)	Cleared paddocks with isolated paddock trees, includes roads, tracks and infrastructure.	Cl	123.1 ha (81.5%)
Artificial Dam (Dm)	Artificial dam.	Dm	0.3 ha (0.2%)

FIGURE 4.8
Fauna Habitat Types of
the Survey Area

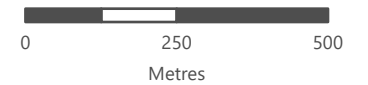


Legend

- Survey Area
- Road
- Railway
- Watercourse

Fauna Habitat Type

- Ew
- Aw
- Mw
- Ms
- CI
- Dm



Scale 1:12,500 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.4.2 Likelihood of Occurrence of Significant Terrestrial Vertebrate Fauna

The database and literature review (as outlined in **Section 3.2**) returned 36 taxa of conservation significant terrestrial vertebrate fauna that may occur within the Desktop Study Area (**Section 4.3.2**). The Desktop Study Area list was refined for the Survey Area in light of observations made during the field investigations (including the FHT present within the Survey Area; see **Section 4.4.1**). As such, 28 of the 36 taxa are not expected to occur within the Survey Area (generally due to the lack of suitable habitat, or the Survey Area falling outside the core known range of the species) and these are listed, along with the reason for their exclusion, in **Appendix I**.

Therefore, there are eight taxa of conservation significant terrestrial vertebrate fauna that are mostly likely to occur within the Survey Area. A list of these species is provided in **Table 4.8**.

One of these, Western Rosella (inland) (*Platycercus icterotis xanthogenys*) was recorded during the field investigations (with a total of 15 individuals recorded across five observations). Locations of the Western Rosella (inland) records are presented in **Table 4.9** and on **Figure 4.9**. The expected presence (i.e. Likelihood of Occurrence) of the remaining seven taxa was assessed and the results are presented in **Table 4.8**.

Accounts for each of these species are presented below.

Table 4.8 Summary of the Likelihood of Occurrence of Expected Significant Fauna Taxa

Scientific Name	Common Name	EPBC Status	WA Status	Source [^]	LoO
Aves					
<i>Falco peregrinus</i>	Peregrine Falcon		OS	DBCA, NatureMap	Possible
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	VU	VU	DBCA, DCCEEW, NatureMap	Likely
<i>Zanda baudinii</i>	Baudin's Black-Cockatoo	EN	EN	ALA, DBCA, DCCEEW, NatureMap	Possible
<i>Zanda latirostris</i>	Carnaby's Black-Cockatoo	EN	EN	ALA, DBCA, DCCEEW, NatureMap	Likely
<i>Platycercus icterotis xanthogenys</i>	Western Rosella (Inland)		P4	DBCA, NatureMap	Known to Occur
Mammalia					
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	ALA, DBCA, DCCEEW, NatureMap	Likely
<i>Phascogale calura</i>	Red-tailed Phascogale	VU	CD	ALA, DBCA, DCCEEW, NatureMap	Likely
<i>Notamacropus irma</i>	Western Brush Wallaby		P4	DBCA, NatureMap	Possible

[^]Sources are: (ALA, 2024; DBCA, 2024b, 2007-; DCCEEW, 2024).

Table 4.9 **Locations of Western Rosella (inland) within the Survey Area**

Location Number	Easting	Northing	Count
1	511957.923	6259070.211	2
2	511765.279	6259128.069	3
3	512443.132	6258891.967	3
4	511688.858	6259069.205	6
5	512424.530	6258859.602	1

Data presented in GDA2020, Zone 50.

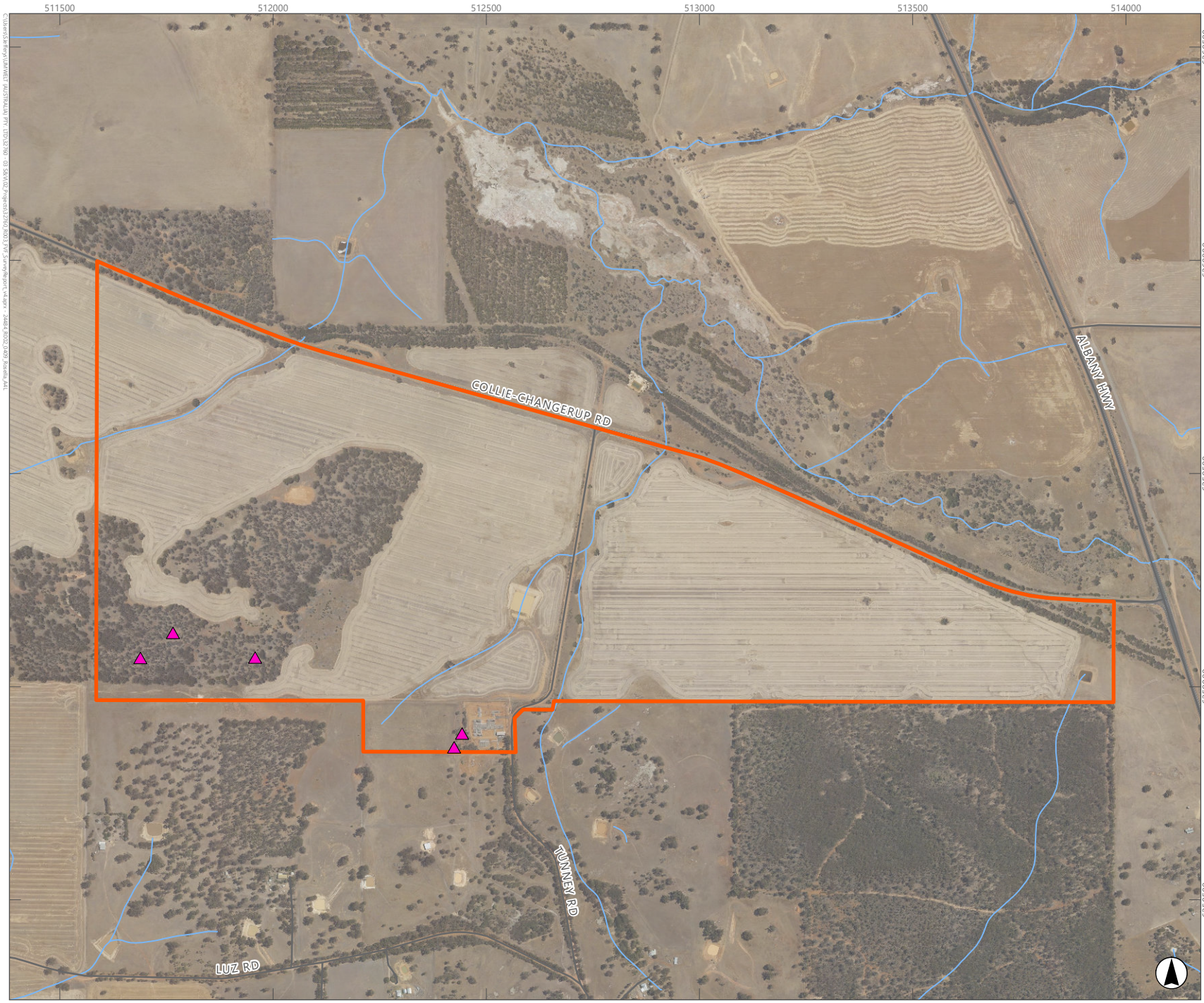
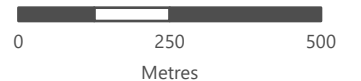


FIGURE 4.9
Locations of Western Inland Rosella Recorded in the Survey Area

- Legend**
- Survey Area
 - Road
 - Railway
 - Watercourse
 - ▲ Western Inland Rosella (*Platycercus icterotis xanthogenys*)



Scale 1:12,500 at A4
GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.4.2.1 Peregrine Falcon (*Falco peregrinus*) – OS (WA BC Act)

Distribution and Habitat

Widespread (but uncommon) and wide-ranging across the whole of Australia. Occurrence within Western Australia is patchy, with a preference for wooded watercourses and ranges with exposed cliff edges. Where it occurs, it is generally present as resident individuals or pairs.

Ecology

A diurnal (or crepuscular) bird of prey that hunts on the wing, predominantly for birds (including pigeons, parrots and passerines) but may also take mammals (e.g. possums, rabbits), reptiles, fish or carrion. Nesting occurs mainly on cliff ledges, granite outcrops and quarry or mine-pit faces but may also use the old nests of other species (e.g. ravens, eagles) in tall trees or ledges on tall buildings.

Threats

Historically, the widespread use of the organochlorin insecticide DDT caused worldwide global decline of the Peregrine Falcon by reducing the thickness of eggshells. While the discontinuation of DDT use has improved the situation, localised threats persist due to illegal persecution by pigeon-fanciers and taking of eggs and nestlings. The main current threat to the species in Australia is habitat loss, particularly woodland trees for nesting.

Expected Occurrence

Possible. The Peregrine Falcon was not recorded during the field investigations but, if present, it is likely to pass through or over the Survey Area (as part of a larger home range) and could use most FHTs for foraging or dispersal. Breeding is unlikely within the Survey Area but the *Eucalyptus Woodland* and *Mixed Woodland* would provide the greatest opportunity for nest sites.

4.4.2.2 Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – VU (EPBC and WA BC Acts)

Distribution and Habitat

Endemic to the deeper south-west of Western Australia, from around Gingin in the north, east to Mount Helena and Narrogin, and south to around Albany (Johnstone & Storr, 1998). Generally associated with areas of Jarrah-Marri forest (or remnants thereof) of the Darling Range and surrounds which provide the preferred food plants for the taxon. Since the early 2000s Forest Red-tailed Black-Cockatoos have re-colonised parts of the Perth metropolitan area (largely due to a shift in diet to exotic species such as the Cape Lilac) and now extend west to the coast of the Swan Coastal Plain. It is generally a sedentary resident.

Two other sub-species occur in Western Australia: *C. b. escondidus* (formerly *C. b. sameuli*) in the western mid-west and Pilbara, and *C. b. macrorhynchus* in the Kimberley (Johnstone & Storr, 1998). Neither of these are conservation significant species.

Ecology

A diurnal granivore, feeding predominantly on the seeds of Jarrah and Marri but is also adapting to foraging on urban (introduced) plant species. Reliant on large tree-hollows in eucalypts (especially Marri) for breeding; often only in trees that are hundreds of years old. Usually occurs in small family flocks, although larger groups may form at some times. Roosts communally.

Threats

Threatened by habitat loss (due to logging and land clearing), habitat degradation, nest hollow shortage, and competition for available nest hollows from other parrots and feral Honeybees. Bushfires and severe weather events can also affect foraging and/or nesting resources.

Expected Occurrence

Likely. While not recorded in the Survey Area during the field investigations, Forest Red-tailed Black-Cockatoos are known from the local area and may use native vegetation remnants within the site for foraging (the *Eucalyptus Woodland*, *Allocasuarina Woodland* and *Mixed Woodland* FHTs) or any part of the site for dispersal. Breeding may also occur where suitable hollow-bearing trees are present (see **Section 4.5.2**).

4.4.2.3 Baudin's Black-Cockatoo (*Zanda baudinii*) – EN (EPBC and WA BC Acts)

Distribution and Habitat

Endemic to the deeper south-west of Western Australia, from around Perth to around Albany. Generally restricted to areas of Jarrah-Marri or Karri forest and farmlands with remnant trees or pine plantations. Known to move seasonally, with a shift north (and away from the main breeding areas in the deeper south) in the late summer and through winter.

Ecology

A diurnal granivore, feeding predominantly on the seeds of Marri but also proteaceous species (e.g. species of *Banksia*, *Grevillea*, *Hakea* etc.). Will also feed on flowers, invertebrates and cultivated fruits. Reliant on large tree-hollows in eucalypts (especially Marri and Karri) for breeding; often only in trees that are hundreds of years old. Predominantly gathers in larger loose flocks, sometimes mixed with other taxa of black-cockatoo. Roosts communally.

Threats

Threatened by habitat loss (due to logging and land clearing), habitat degradation, illegal shooting (particularly by orchardists in an attempt to protect pome fruit crops), nest hollow shortage, and competition for available nest hollows from other parrots and feral Honeybees. Bushfires and severe weather events can also affect foraging and/or nesting resources.

Expected Occurrence

Possible. The Survey Area is at the (eastern) edge of the range for this taxon and, therefore, Baudin's Black-cockatoo may not occur regularly. If present, it may use native vegetation remnants within the site for foraging (the *Eucalyptus Woodland*, *Allocasuarina Woodland* and *Mixed Woodland* FHTs) or disperse across the whole site. Breeding within the Survey Area is not expected.

4.4.2.4 Carnaby's Black-Cockatoo (*Zanda latirostris*) – EN (EPBC and WA BC Acts)

Distribution and Habitat

Endemic to south-western Western Australia, from Kalbarri in the north, east to Merredin and Ravensthorpe, and then further east along the south coast to the Esperance area. Breeds (July to December) predominantly in the east of its range with a migration to coastal areas in the non-breeding period.

Ecology

A diurnal granivore, feeding predominantly on the seeds of Proteaceae (especially *Banksia* spp.) but also known to feed on a very wide variety of plants, including non-native ornamentals and plantation species such as pine. Reliant on large tree-hollows in eucalypts (especially smooth-barked species such as Wandoo and Salmon Gum) for breeding. Gathers in large flocks (although smaller groups are also common), sometimes mixed with other taxa of black-cockatoo. Roosts communally.

Threats

Threatened by habitat loss (due to logging and land clearing), habitat degradation, nest hollow shortage, and competition for available nest hollows from other parrots and feral Honeybees. Bushfires and severe weather events can also affect foraging and/or nesting resources.

Expected Occurrence

Likely. While not recorded in the Survey Area during the field investigations, Carnaby's Black-Cockatoos are known from the local area and may use native vegetation remnants within the site for foraging (the *Eucalyptus Woodland*, *Allocasuarina Woodland* and *Mixed Woodland* FHTs) or any part of the site for dispersal. Breeding may also occur where suitable hollow-bearing trees are present (see **Section 4.5**).

4.4.2.5 Western Rosella (Inland) (*Platycercus icterotis xanthogenys*) – P4 (DBCA)

Distribution and Habitat

Occurs in drier woodland with heath understory in the Wheatbelt region of Western Australia. The Western Rosella (inland) was formerly widely distributed throughout the wheatbelt region but now, because of clearing for agriculture, only occurs where natural ecosystems are heavily fragmented, disturbed and, generally, in very poor condition.

One other, non-listed, subspecies occurs (*P. i. icterotis*) and has a nearer-coastal (and more temperate) distribution in south-western Western Australia.

Ecology

A diurnal ground and tree-foraging granivore, this species generally occurs singly, in pairs or small parties.

Threats

Habitat loss due to land clearing for agriculture and urban development, fragmentation of habitat, and competition for nesting sites from invasive species such as feral Honeybees.

Expected Occurrence

Known from the Survey Area. Likely to forage and disperse in all FHTs (including *Cleared*) and may breed in tree hollows, if they are present, in *Eucalyptus Woodland*.

4.4.2.6 Chuditch (*Dasyurus geoffroii*) – VU (EPBC and WA BC Acts)

Distribution and Habitat

A wide-ranging resident in Marri-Jarrah forest of the south-west of Western Australia and also in heaths and eucalypt woodlands of the eastern wheatbelt and goldfields. This species was formerly distributed throughout much of western and inland Australia but its range has contracted to the region approximately south-west of a line between Shark Bay and Esperance.

Ecology

A nocturnal, predominantly-terrestrial and usually solitary carnivore, feeding mainly on smaller vertebrates (e.g. reptiles, birds and mammals) and large invertebrates. During the day Chuditch shelter in dens; predominantly hollow logs and earth burrows. Chuditch have a large home range, with females in the deeper south-west occupying 55-120 ha and males ranging over 400 ha or more. Further east in a semi-arid area home ranges may be even larger.

Threats

Habitat loss due to land clearing and logging, predation and/or competition by introduced feral predators (foxes and cats) and road mortality.

Expected Occurrence

Likely. While no evidence of Chuditch presence was recorded during the field investigations, the Survey Area may form part of a much larger home range of an individual or two if a population exists in the region. Most FHTs are likely to provide some degree of foraging and/or dispersal habitat but breeding within the Survey Area is highly unlikely (due to the lack of suitable, protected and low-disturbance habitat).

4.4.2.7 Red-tailed Phascogale (*Phascogale calura*) – VU (EPBC Act) and CD (DBCA)

Distribution and Habitat

Once widespread, the Red-tailed Phascogale is now restricted to woodland remnants within the southern Wheatbelt region of Western Australia that are dominated by Rock Sheoak (*Allocasuarina huegeliana*), Wandoo (*Eucalyptus wandoo*) and/or York Gum (*E. loxophleba*). This relatively small area extends from about Brookton in the north to Katanning in the south, and from Williams in the west to Dumbleyung in the east (although outlying records are also known).

Ecology

A small, arboreal, nocturnal carnivore that feeds opportunistically on wide variety of sources including invertebrates, small reptiles, birds and mammals. Ground-based foraging is also common for this taxon. Red-tailed Phascogale generally shelter in tree hollows during the day.

Threats

Habitat clearing and fragmentation, predation by domestic and feral predators (dogs, foxes and cats), loss of tree hollows, drought and fire are all contributing to the decline and restriction of this taxon.

Expected Occurrence

Likely. While no evidence of Red-tailed Phascogale presence was recorded during the field investigations, it is known from nearby areas. The Survey Area may provide suitable foraging and dispersal habitat (in the *Eucalyptus Woodland*, *Allocasuarina Woodland* and *Mixed Woodland* FHTs in particular), and, if suitable tree hollows are present then breeding may be a possibility too.

4.4.2.8 Western Brush Wallaby – P4 (DBCA)

Distribution and Habitat

Endemic to south-western Western Australia, more or less south of line from Geraldton to Esperance, although it has disappeared from much of the Wheatbelt due to clearing. Occurs in a wide range of vegetation types from Eucalypt Woodland to Banksia Woodland, Shrublands and Kwongan. Locally common in dry sclerophyll forest and woodland in the south-west.

Ecology

A largely solitary species that browses on shrubs and bushes; rarely on grass. Rarely drinks free-standing water and rarely ventures from dense vegetation. Individuals occupy home ranges of up to c. 10ha; larger in males than females and those of females overlap.

Threats

Habitat loss, land clearing, fragmentation of habitat, inappropriate fire regimes, predation by feral predators (foxes and cats) and road mortality.

Expected Occurrence

Possible. The Survey Area lacks the dense, closed vegetation preferred by this species but, if it is present elsewhere locally, the Western Brush Wallaby may occasionally use the *Eucalyptus Woodland*, *Allocasuarina Woodland* and *Mixed Woodland* FHTs for dispersal.

4.5 Black-cockatoo Habitat Assessment

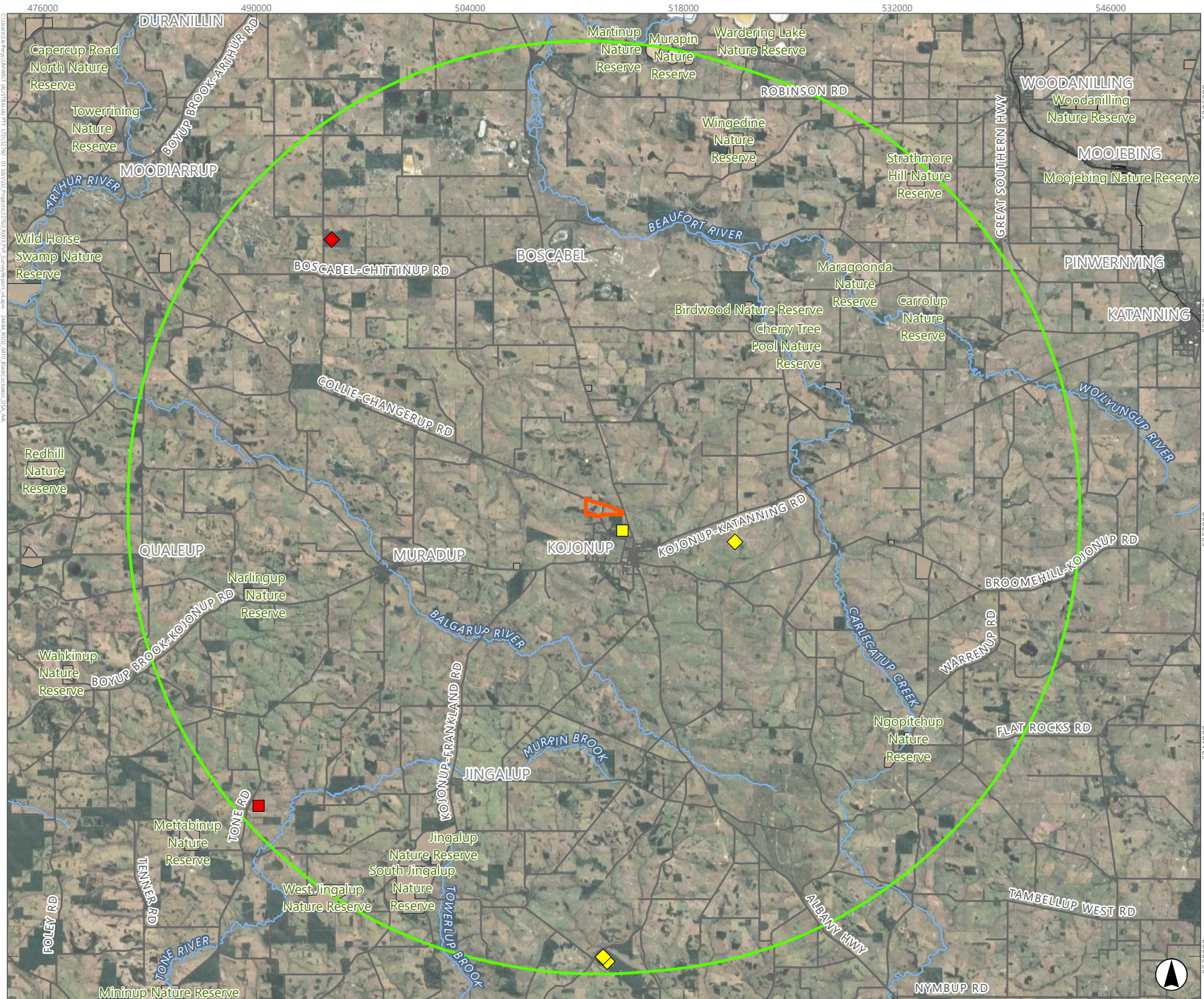
4.5.1 Presence

The Survey Area falls within the modelled distribution of Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo, as shown in DCCEEW (2022) and provided by DCCEEW (2025a, 2025b, 2025c). Records of all three taxa are known from the region (DBCA, 2024b) and those located within the Desktop Study Area are shown in **Figure 4.10**. No black-cockatoos were directly recorded within the Survey Area and no indirect evidence (such as foraging debris, shed feathers; to suggest these species had previously used the site) was located.

It is considered that, currently:

- the Forest Red-tailed Black-Cockatoo is *likely* to occur as a breeding resident in the local area (which may include use of the Survey Area for breeding, foraging and/or dispersal)
- Baudin's Black-Cockatoo may *possibly* occur as a non-breeding visitor/irregular visitor to local area which may include use of the Survey Area for foraging and/or dispersal)
- Carnaby's Black-Cockatoo is *likely* to occur as a breeding migrant to the local area (which may include use of the Survey Area for breeding, foraging and/or dispersal).

FIGURE 4.10
Black-Cockatoo Records
of the Desktop Study
Area



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve
- Forest red-tailed black-cockatoo
- White-tailed black-cockatoo

Great Cockatoo Count (2024)

- Forest red-tailed black-cockatoo
- White-tailed black-cockatoo



Scale 1:350,000 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.5.2 Breeding

A total of 14 trees that met the potential black-cockatoo nest-tree criteria of DCCEEW (2022, 2025a, 2025b, 2025c) were recorded within the Survey Area. All of these trees bore at least one hollow entrance of the height, dimensions and orientation that is preferred by black-cockatoos for nesting (all were scored as Rank 3 according to the Bamford system; see **Section 3.5.3.1**). There was no evidence to suggest that black-cockatoos are currently using (or have historically used) any of these trees for breeding (although no nest-hollow inspections were conducted as part of this assessment). The assessment data (species, life status, DBH and nest-tree rank) for all trees are presented in **Appendix J** and tree locations are mapped in **Figure 4.11**.

Therefore, the Survey Area has potential to support breeding by black-cockatoos (most likely Forest Red-tailed Black-Cockatoo and Carnaby's Black-Cockatoo).

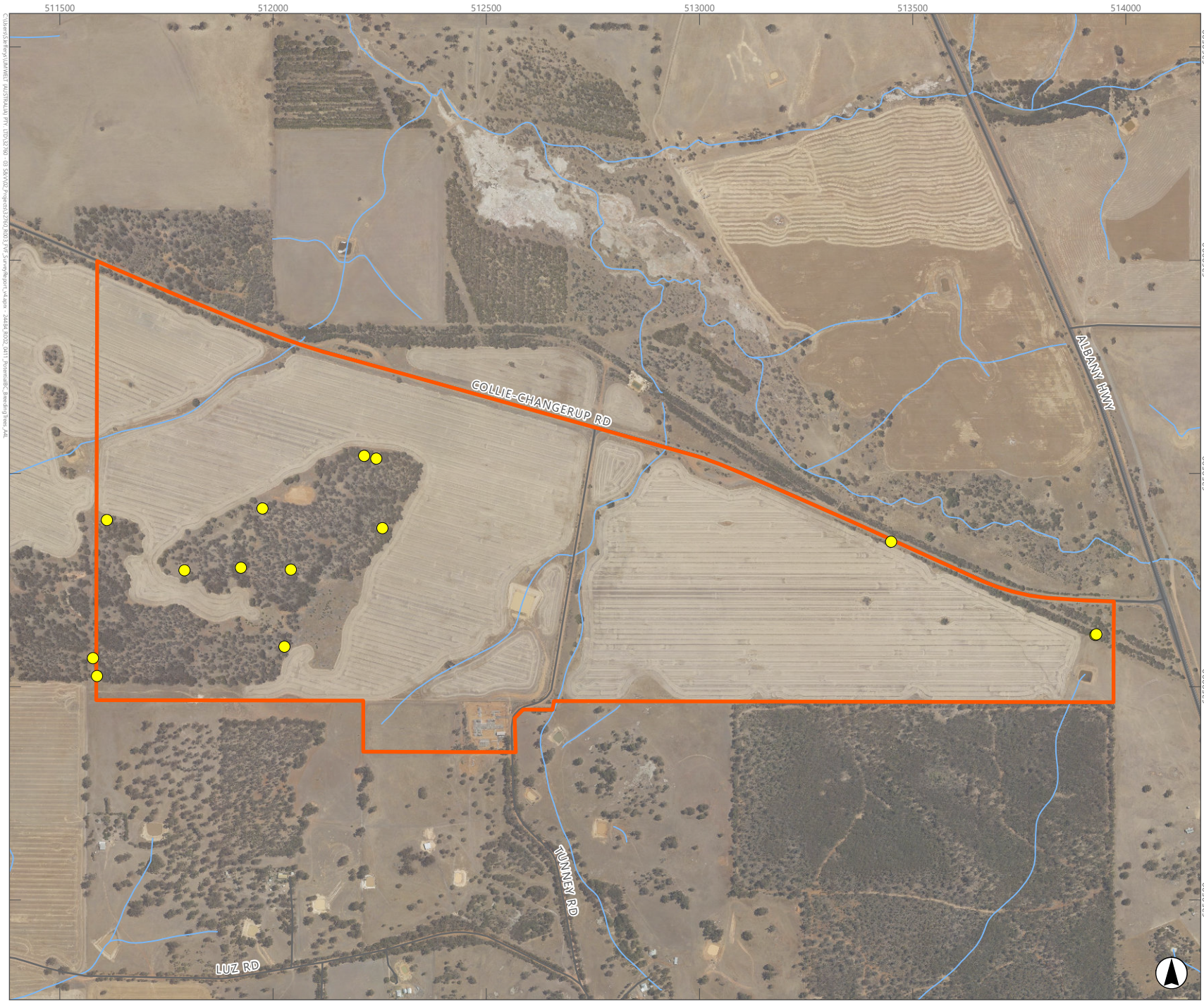
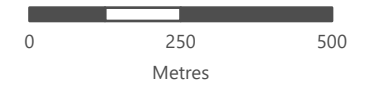


FIGURE 4.11
Potential Black-Cockatoo
Breeding Trees of the
Survey Area

- Legend**
- Survey Area
 - Road
 - Watercourse
 - Breeding Tree



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

4.5.3 Foraging

4.5.3.1 Overview

For most of the FHTs within the Survey Area, there was limited foraging potential for black-cockatoos. This was due to the lack of, or limited presence of, eucalypt or proteaceous plant species known to be favoured as food sources by black-cockatoos. The presence of isolated individuals (or small patches) of Jarrah (*Eucalyptus marginata* subsp. *marginata*), Marri (*Corymbia calophylla*) and Parrot Bush (*Banksia sessilis*) do, however, offer some preferred food sources for black-cockatoos.

4.5.3.2 Foraging Evidence

There was no evidence of foraging by black-cockatoos (i.e. foraging debris) within the Survey Area.

4.5.3.3 Bamford Foraging Habitat Quality Scores

Maps of the Bamford foraging habitat quality scores (FHQS) within the Survey Area are presented in **Figure 4.12** (Forest Red-tailed Black-Cockatoo), **Figure 4.13** (Baudin's Black-Cockatoo) and **Figure 4.14** (Carnaby's Black-Cockatoo), and a summary of the areas of each FHQS category is presented for each taxon of black-cockatoo in **Table 4.10**. A breakdown of the FHQS by FHT is provided for each black-cockatoo taxon in **Table 4.11**, and this also provides a weighted overall FHQS for each taxon.

The Survey Area is, generally, of *low* value for foraging by all three taxa of black-cockatoo (Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo), with an overall weighted FHQS of 2 out of 10 for each, see **Table 4.11**).

Table 4.10 Bamford FHQS Breakdown for Each Taxon of Black-cockatoo

FHQS	Forest Red-tailed Black-Cockatoo		Baudin's Black-Cockatoo		Carnaby's Black-Cockatoo	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
10: Pristine	0	0	0	0	0	0
9: Very high	0	0	0	0	0	0
8: High	0	0	0	0	0	0
7: Moderate to High	0	0	0	0	0	0
6: Moderate	0	0	0	0	0	0
5: Moderate	2.9	1.9	2.9	1.9	14.4	9.5
4: Low to Moderate	0	0	0	0	0	0
3: Low	12.2	8.1	12.7	8.4	13.1	8.7
2: Very Low	135.6	89.7	135.1	89.4	123.3	81.6
1: Negligible	0	0	0	0	0	0
0: Nil	0.4	0.3	0.4	0.3	0.3	0.2
TOTAL	151.1	100	151.1	100	151.1	100

Table 4.11 Bamford Black-cockatoo FHQS for Each Fauna Habitat Type Within the Survey Area

FHT	Area (ha)	%	Vegetation Score (out of 6)	Context (out of 3)	Density (out of 1)	FHQS (out of 10)
Forest Red-tailed Black-Cockatoo						
Eucalyptus Woodland (Ew)	22.9	15.1	1 or 2	0	1	2 or 3
Allocasuarina Woodland (Aw)	0.5	0.3	1	0	1	2
Mixed Woodland (Mw)	3.5	2.3	0 or 3	0 or 1	0 or 1	0 or 5
Mixed Shrubland (Ms)	0.8	0.5	2	0	1	3
Cleared (Cl)	123.1	81.5	1	0	1	2
Artificial Dam (Dm)	0.3	0.2	0	0	0	0
Total	151.1	100.0	Rounded weighted overall FHQS:			2
Baudin's Black-Cockatoo						
Eucalyptus Woodland (Ew)	22.9	15.1	1 or 2	0	1	2 or 3
Allocasuarina Woodland (Aw)	0.5	0.3	2	0	1	3
Mixed Woodland (Mw)	3.5	2.3	0 or 3	0 or 1	0 or 1	0 or 5
Mixed Shrubland (Ms)	0.8	0.5	2	0	1	3
Cleared (Cl)	123.1	81.5	1	0	1	2
Artificial Dam (Dm)	0.3	0.2	0	0	0	0
Total	151.1	100.0	Rounded weighted overall FHQS:			2
Carnaby's Black-Cockatoo						
Eucalyptus Woodland (Ew)	22.9	15.1	2 or 3	0 or 1	1	3 or 5
Allocasuarina Woodland (Aw)	0.5	0.3	3	1	1	5
Mixed Woodland (Mw)	3.5	2.3	1 or 3	0 or 1	1	2 or 5
Mixed Shrubland (Ms)	0.8	0.5	2	0	1	3
Cleared (Cl)	123.1	81.5	1	0	1	2
Artificial Dam (Dm)	0.3	0.2	0	0	0	0
Total	151.1	100.0	Rounded weighted overall FHQS:			2

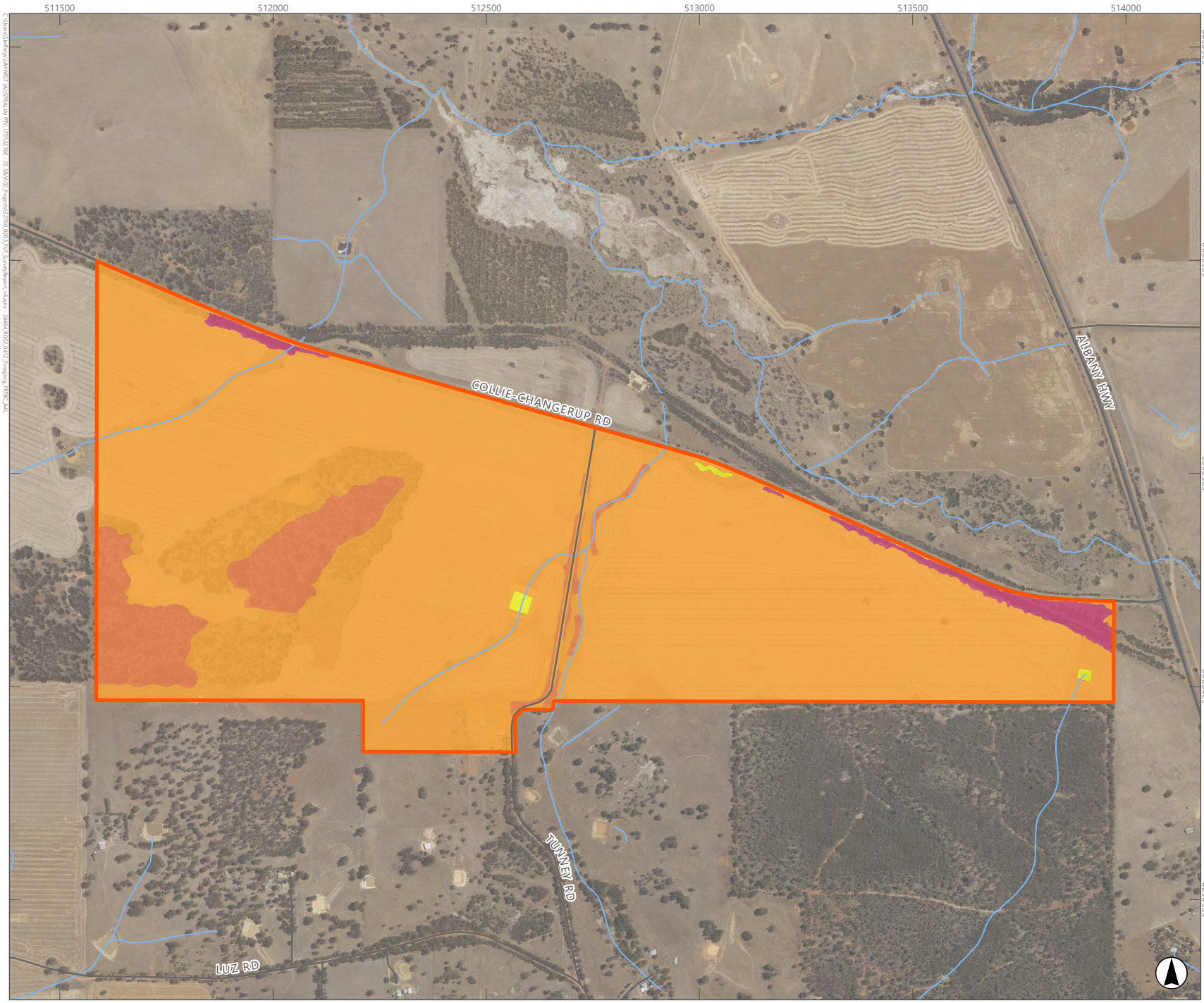


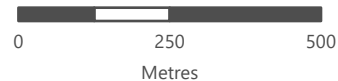
FIGURE 4.12
 Forest Red-tailed Black-Cockatoo Bamford Foraging Habitat Quality Scores of the Survey Area

Legend

- Survey Area
- Road
- Railway
- Watercourse

BCE Foraging Habitat Quality Score

- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
 APPROVED FOR AND ON BEHALF OF Umwelt

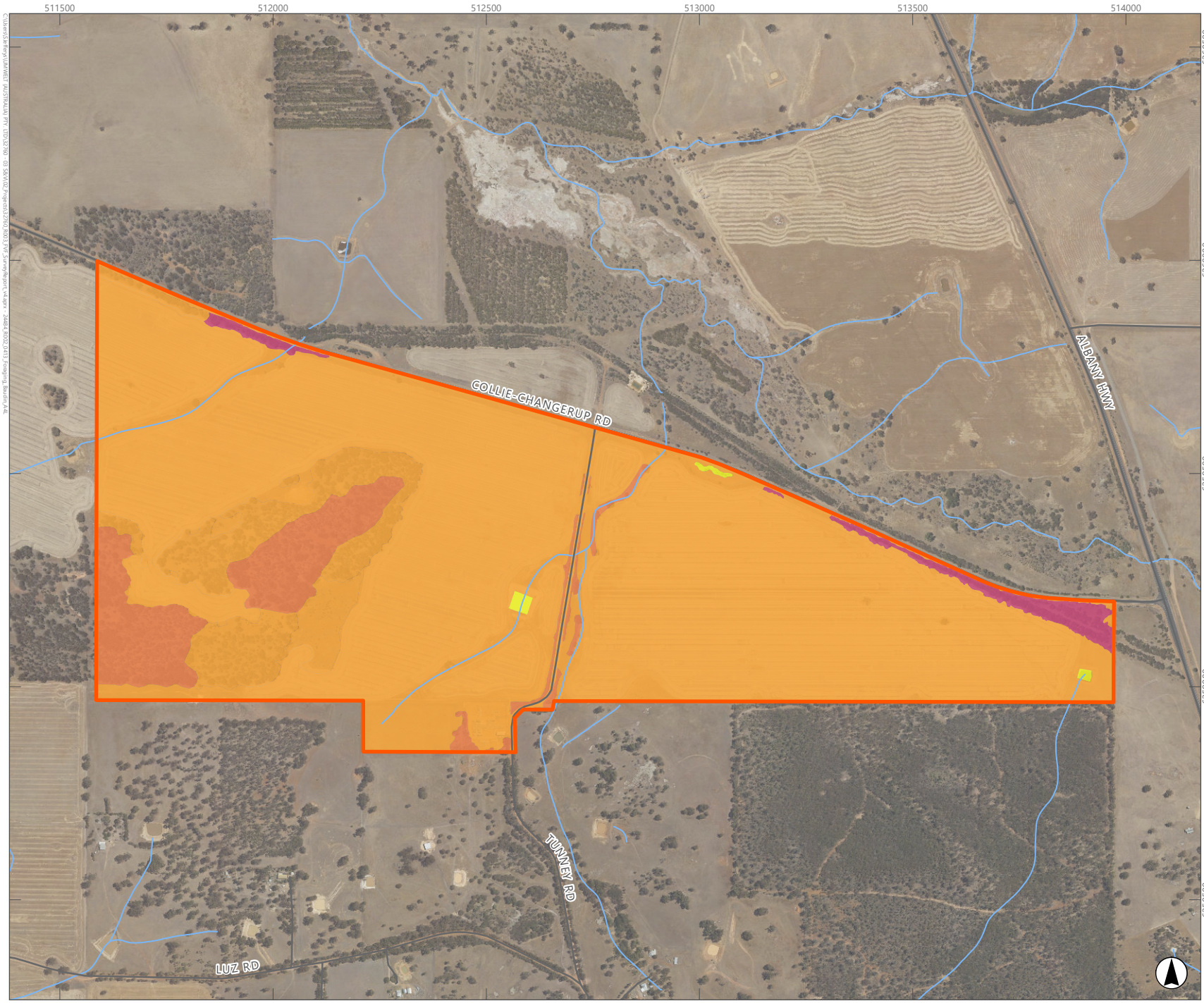


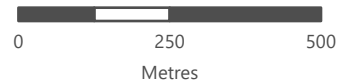
FIGURE 4.13
 Baudin's Black-Cockatoo
 Bamford Foraging
 Habitat Quality Scores of
 the Survey Area

Legend

- Survey Area
- Road
- Railway
- Watercourse

BCE Foraging Habitat Quality Score

- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
 APPROVED FOR AND ON BEHALF OF Umwelt

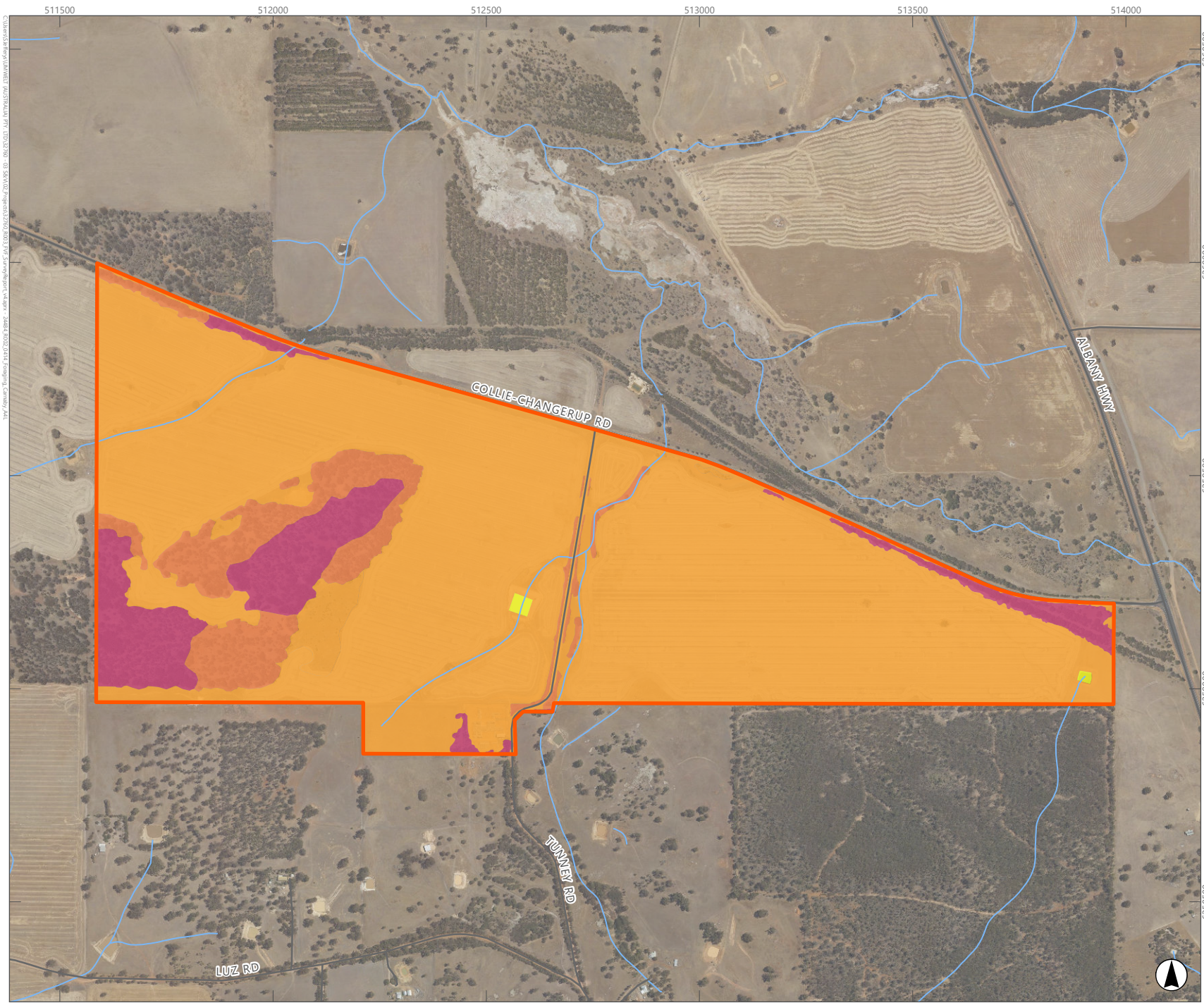


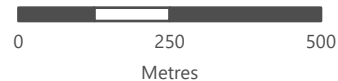
FIGURE 4.14
 Carnaby's Black-Cockatoo Bamford Foraging Habitat Quality Scores of the Survey Area

Legend

- Survey Area
- Road
- Railway
- Watercourse

BCE Foraging Habitat Quality Score

- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0



Scale 1:12,500 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.
 APPROVED FOR AND ON BEHALF OF Umwelt

4.5.3.4 DCCEEW Foraging Habitat Quality Scores

For comparison, the DCCEEW FHQS system was also used to assess the value of the Survey Area for black-cockatoos. **Table 4.12** presents a summary of the DCCEEW FHQS for each taxon of black-cockatoo, with reference to the Fauna Habitat Types of the Survey Area (see **Section 4.4.1**). For detailed descriptions of each FHQS, see **Section 3.5.3.2**.

For all species, all FHT within the Survey Area provide a range of 0 to 4 (None to Moderate, respectively) ranking of the DCCEEW FHQS. The Mixed Woodland (Mw), equivalent to VT3 and Dr, has the highest FHQS for Forest Red-tailed Black-Cockatoos, at a ranking of 3 (Low to Moderate Foraging Value). This FHT holds the same highest FHQS for Baudin's Black-Cockatoo. Lastly, the Allocasuarina Woodland (Aw), and the Mixed Woodland (Mw) have the highest FHQS for Carnaby's Black-Cockatoo, providing Moderate Foraging Value (**Table 4.12**).

Overall, this is a similar result to that from the Bamford FHQS system (see **Section 4.5.3.3**).

Table 4.12 Summary of DCCEEW FHQS of the Survey Area

FHT	FHQS	Foraging Value
Forest Red-tailed Black-Cockatoo		
Eucalyptus Woodland (Ew)	1 (Degraded Vegetation, see Section 4.2.6) 2 (Good Vegetation, see Section 4.2.6)	Negligible to Low Low
Allocasuarina Woodland (Aw)	1	Negligible to Low
Mixed Woodland (Mw)	0 (Pn vegetation, see Section 4.2.5) 3 (VT3, Dr, see Section 4.2.5)	None Low to Moderate
Mixed Shrubland (Ms)	3	Low to Moderate
Cleared (Cl)	1	Negligible to Low
Artificial Dam (Dm)	0	None
Baudin's Black-Cockatoo		
Eucalyptus Woodland (Ew)	1 (Degraded Vegetation, see Section 4.2.6) 2 (Good Vegetation, see Section 4.2.6)	Negligible to Low Low
Allocasuarina Woodland (Aw)	2	Low
Mixed Woodland (Mw)	0 (Pn vegetation, see Section 4.2.5) 3 (VT3, see Section 4.2.5)	None Low to Moderate
Mixed Shrubland (Ms)	3	Low to Moderate
Cleared (Cl)	1	Negligible to Low
Artificial Dam (Dm)	0	None
Carnaby's Black-Cockatoo		
Eucalyptus Woodland (Ew)	2 (Degraded Vegetation, see Section 4.2.6) 3 (Good Vegetation, Section 4.2.6)	Low Low to Moderate
Allocasuarina Woodland (Aw)	4	Moderate
Mixed Woodland (Mw)	1 (Pn vegetation, see Section 4.2.5) 4 (VT3, see Section 4.2.5)	Negligible to Low Moderate

FHT	FHQS	Foraging Value
Mixed Shrubland (Ms)	3	Low to Moderate
Cleared (Cl)	1	Negligible to Low
Artificial Dam (Dm)	0	None

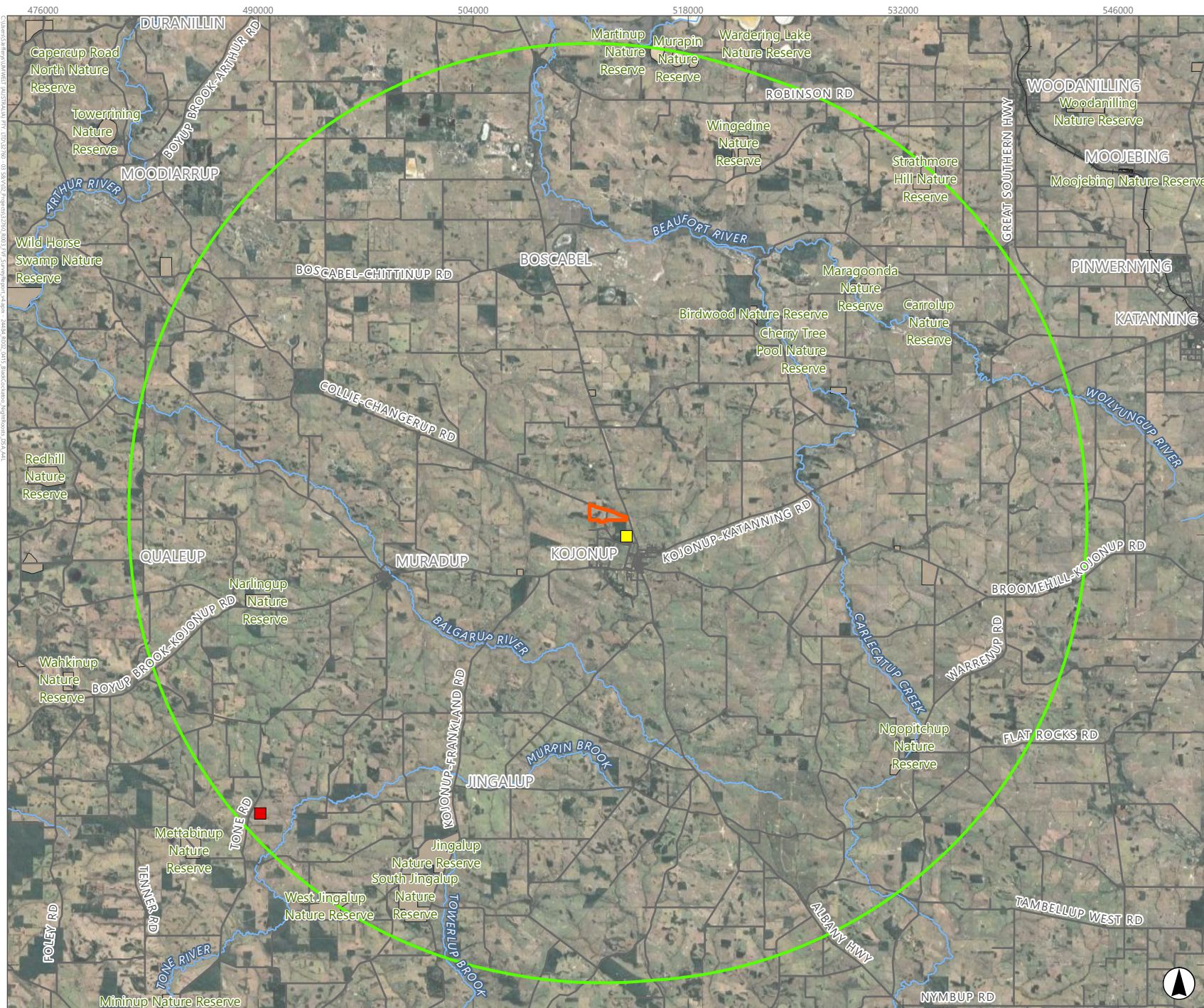
4.5.4 Night Roosting

The area around the Survey Area is known to support black-cockatoo night-roosting and there are two known night-roost locations within the Desktop Study Area (known roost locations from the BirdLife Western Australia’s Great Cocky Count database (2024a)), as presented in **Figure 4.15**. Neither of the known roost sites is within the Survey Area itself (the nearest being approximately 1 km to the south of the Survey Area, adjacent to the Myrtle Benn Flora and Fauna Sanctuary) and, indeed, the Survey Area probably lacks highly desirable features that may support roosting by black-cockatoos (e.g. taller trees, such as *Eucalyptus* spp., that are near water).

4.5.5 Watering Points

Several farm dams were present within the Survey Area may provide potential water sources for black-cockatoos, for at least some of the year (it is uncertain whether these dams provide a year-around water source).

FIGURE 4.15
Known Night Roosts of
the Desktop Study Area



Legend

- Desktop Study Area
- Survey Area
- Road
- Railway
- Watercourse
- Nature Reserve

Great Cockatoo Count (2024)

- Forest red-tailed black-cockatoo
- White-tailed black-cockatoo



Scale 1:350,000 at A4
 GDA2020 MGA Zone 50

This document and the information are subject to Terms and Conditions and Umwelt (Australia) Pty Ltd ("Umwelt") Copyright in the drawings, information and data recorded ("the information") is the property of Umwelt. This document and the information are solely for the use of the authorized recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by Umwelt. Umwelt makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

APPROVED FOR AND ON BEHALF OF Umwelt

5.0 Conclusions

5.1 Flora and Vegetation

A Reconnaissance flora and vegetation assessment has been completed for the Project, with Targeted survey undertaken using wandering transects. The assessment provides a broad understanding of the ecological values and potential constraints associated with the area. The assessment has mapped and described VTs and vegetation condition that occur within the Survey Area, and the likelihood of significant flora and vegetation occurring in the Survey Area has been assessed.

Conclusions and recommendations from this assessment are summarised below:

- The majority of the Survey Area has been highly modified since European settlement as a result of the long history of agricultural activities and other development and is no longer considered to be intact remnant vegetation. The vegetation condition of these areas has been mapped as ‘Completely Degraded’ and include highly modified areas with primarily only native tree species remaining (including isolated trees), areas with only planted native trees that have remnant native shrub understorey, and areas with almost exclusively weed or crop species (Cleared areas).
- Areas where natural vegetation has been completely and apparently permanently removed, with either no or very scattered native taxa (trees) remaining, have been mapped as ‘Cleared’ (CI) (where discernible at 1:5,000 scale). This category mainly consists of paddocks, with tracks and firebreaks providing a minor proportion of this area. A total of 123.1 ha of ‘Cleared Land’ was mapped, representing 81.5% of the Survey Area. Two other highly modified types included an Artificial Dam, and a planted area of *Eucalyptus camaldulensis* over mid open shrubland of native shrubs and pasture grasses (all condition ‘Completely Degraded’).
- A total of four Vegetation Types (VTs) were identified in the Survey Area (covering 27.1 ha, representing 17.9% of the Survey Area), dominated by VT1 (15.1% of the Survey Area). The vegetation condition of these areas was mapped as ‘Good’ or ‘Degraded’, with a small area (0.5 ha) of VT3 and VT4 mapped as ‘Completely Degraded’.
- Targeted flora and vegetation surveys were conducted within the remnant bush block and the road reserve within the Survey Area. No significant flora taxa were recorded during the 2024 survey. It is considered that of the 86 significant flora taxa returned from Desktop Assessment (**Section 4.1.3**), 67 taxa are unlikely to occur either because no potential habitat is present within the Survey Area or the Survey Area is outside of the taxon’s known range. It is considered that of the remaining 19 significant flora taxa, 12 have the Potential to occur and seven Possibly occur in the Survey Area, as the Survey Area contains suitable habitat (or may contain suitable habitat), is located within the known ranges of these taxa and known locations are either >10km from the Survey Area (Potential) or <10km of the Survey Area (Possible). However, these taxa would only potentially occur within suitable habitat within remnant bushland block that has been assessed to be in Good condition.

- One patch of vegetation meeting the requirements of the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC was identified during the 2024 survey, totalling 22.1 ha. This patch encompasses the entirety of the remnant bush block within the Survey Area, mapped as VT1. It is considered to be a mix of Good and Degraded condition, however the whole patch exceeds the minimum requirement of 5 ha in size, thus meeting the condition requirements for the TEC (DoE, 2015).
- Vegetation mapped as 'Good' condition (VT1) in the Survey Area should be avoided as far as possible as part of the ongoing project planning process. This is due to the potential for significant flora taxa to occur in this area (**Section 4.2.4**), the presence of vegetation consistent with the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC, and also in response to relatively scarcity of vegetation in Good or better condition in the general landscape, both at local and regional scale.
- Remaining native vegetation in a highly cleared landscape is considered to have ecological value, despite often being in 'Degraded' condition and therefore having reduced floristic value. Such vegetation represents the remnants of VSAs that mostly have less than 30% of their pre-European extent remaining and provides ecological linkages for terrestrial fauna and bird species. Clearing of any native vegetation in Western Australia, regardless of conservation significance, requires approval under the State *Environmental Protection Act 1986* unless an exemption applies. This includes clearing of individual trees within areas mapped as 'Cl' (Cleared).

5.2 Terrestrial Fauna

A Basic terrestrial vertebrate fauna assessment and targeted black-cockatoo assessment have been completed for the Project and provide a broad understanding of the ecological values and potential constraints associated with the area. Fauna habitat types (FHTs) that occur within the Survey Area were described and mapped, a likelihood of occurrence assessment of conservation significant terrestrial vertebrate fauna within the Survey Area was undertaken, and an assessment black-cockatoo breeding, foraging and roosting habitat assessment was conducted.

Conclusions and recommendations are summarised below.

Fauna Habitat Types

- A total of six FHTs were identified in the Survey Area: Eucalyptus Woodland, Allocasuarina Woodland, Mixed Woodland, Mixed Shrubland, Cleared and Artificial Dams.
- Disturbance (especially clearing, grazing and weed invasion) has reduced the value of most of the Survey Area to fauna.
- The majority of the Survey Area is Cleared Land FHT (81.5%) and this provides very limited ecological value. The Eucalyptus Woodland (15.1% of the Survey Area) and Mixed Woodland (2.3%) FHTs are likely to have the most value to fauna.

Conservation Significant Terrestrial Vertebrate Fauna

- Eight taxa of conservation significant terrestrial vertebrate fauna are mostly likely to occur within the Survey Area: Peregrine Falcon, Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo, Carnaby's Black-Cockatoo, Western Rosella (Inland), Chuditch, Red-tailed Phascogale and Western Brush Wallaby.

- Of these, only the Western Rosella (Inland) was recorded during the field investigations, with four taxa considered 'likely' to occur within the Survey Area, and three taxa considered 'possible'.
- The expected use of the FHTs by these conservation significant species (for breeding, foraging and dispersal) is discussed in the context of the species' ecology and it is anticipated that the Eucalyptus Woodland, Allocasuarina Woodland and Mixed Woodland likely to be of most value to most species.

Black-cockatoo Habitat Assessment

- The Survey Area is within the known distributions of all three taxa of threatened black-cockatoo that occur in south-west Western Australia but there was no evidence to suggest that these taxa presently use the site.
- Nonetheless, there were at least 14 trees considered to be suitable for black-cockatoo breeding within the Survey Area (although no breeding activity was noted) and these may provide nest sites in the future.
- There was limited foraging potential for black-cockatoos within the Survey Area and this was due to the lack of, or limited presence of, eucalypt or proteaceous plant species known to be favoured as food sources by black-cockatoos. No evidence of previous foraging by black-cockatoos was observed. The foraging value of the Survey Area was assessed using the Bamford foraging habitat quality score (FHQS) method, with an overall weighted FHQS of 2 (out of 10; 'low') for each of Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo and Carnaby's Black-Cockatoo. Foraging value maps are provided. Highest foraging value occurs within the Mixed Woodland FHT for Forest Red-tailed Black-Cockatoo and Baudin's Black-Cockatoo, and within the Eucalyptus Woodland and Mixed Woodland FHT for Carnaby's Black-Cockatoo. An assessment using the DCCEEW FHQS system provided similar results to the Bamford FHQS method.
- Black-cockatoo night-roosts are known from the surrounding area but there was no evidence of roosting within the Survey Area itself.
- Farm dams were present within the Survey Area that may provide potential water sources for black-cockatoos.
- No night roosting locations of black-cockatoos were recorded during the 2024 survey.

Implications

While the Survey Area is, generally, of low value to most terrestrial vertebrate fauna (in particular, those of conservation significance) and further disturbance or development of the site is probably of low concern (i.e. risk and consequence) to fauna, there are a few considerations that may assist in minimising impacts to fauna. These include:

- Undertaking development in the Cleared FHT in preference to other areas.
- Avoiding the clearance of native vegetation within the Eucalyptus Woodland, Allocasuarina Woodland and Mixed Woodland FHTs, where practicable. Where this is not possible, consideration should be given to the potential for vegetation to support Red-tailed Phascogale refugia and black-cockatoo habitat (especially areas of higher breeding and foraging quality), and mitigation strategies implemented where applicable.

- Avoiding the disturbance of those tree identified as being suitable for black-cockatoo breeding, where practicable. Where this is not possible, a pre-clearance check of potential black-cockatoo nest-hollows may be warranted.
- The implementation of industry-standard measures for minimising the impacts from vehicle/machine movement, fire, rubbish, dust, noise and light etc. that may be associated with construction and operation.

5.3 Licensing and Permits

The key ecological risks associated with the Survey Area relate to the direct or indirect impacts on remnant native vegetation, some of which comprises an EPBC Act listed TEC / DBCA listed PEC, and potential habitat for conservation significant terrestrial vertebrate fauna.

It is recommended that all portions of the project footprint are situated in areas mapped as Cleared (CI) (**Figure 4.4**), to avoid clearing native vegetation as much as practicable, particularly areas in Good condition or identified as the TEC/PEC or identified as conservation significant fauna habitat. Further, a setback of 40 m is recommended between ground disturbance and the TEC/PEC to mitigate potential indirect impacts. Note that CI consists primarily of cleared pasture, however also includes isolated trees that are considered to be native vegetation for the purposes of clearing. It is also recommended that the project footprint is situated away from the watercourses and dams as indicated on **Figure 4.4**, to avoid both impacts to lands through soil erosion and to project infrastructure through flooding.

If clearing of native vegetation is unavoidable then the following actions should be undertaken:

- Additional targeted flora survey should be undertaken in areas of potential Threatened flora presence (VT 1 in Good condition) (see limitations **Section 3.6**).
- If any potential black-cockatoo habitat trees are proposed to be cleared, a pre-clearance check of potential black-cockatoo nest-hollows may be warranted. Mitigation strategies for any impacts to Red-tailed Phascogale habitat should also be considered.
- An environmental impact assessment should be undertaken to determine the legislative approval pathway. If a significant impact to fauna, flora or vegetation is considered likely, it is recommended that the project should be referred to the Western Australian Environmental Protection Authority (EPA) for assessment under Part IV of the *Environmental Protection Act 1986 (WA)* (EP Act).
- If it is considered that referral to the EPA is not required, or the EPA otherwise decides not to assess the project, clearing of native vegetation will require a Native Vegetation Clearing Permit (NVCP) from the Department of Water and Environmental Regulation (DWER) under Part V of the EP Act unless an exemption applies.
- Approval under Section 40 of the BC Act to impact Threatened flora taxa will be required if impacts to Threatened flora taxa are proposed to occur.

- Assessment of the significance of impact against the Department of Environment (now DCCEEW) Significant Impact Guidelines 1.1 would be required for disturbance to MNES: the *Eucalyptus Woodlands of the Western Australian Wheatbelt* TEC, Threatened Flora taxa (as per **Table 4.3**), if present, and black-cockatoo habitat if proposed to be cleared. Dependent on the assessment outcomes, the project may trigger referral under the EPBC Act. Triggers for referral to DCCEEW for black-cockatoo impacts are 1ha of high-quality foraging habitat or one potential breeding tree (Department of Agriculture, Water and the Environment, 2022). As such, we recommend clearing of any MNES is avoided.

6.0 References

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). *The New Atlas of Australian Birds*. Royal Australasi

ALA. (2024). *Atlas of Living Australia – Open access to Australia’s biodiversity data*. Atlas of Living Australia (ALA). <https://www.ala.org.au/>

Bamford. (2020). *Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos*. Bamford Consulting Ecologists. <https://ecologists.bamford.id.au/ecological-consulting/black-cockatoos>

Bancroft, W., & Bamford, M. (2021). *Perth Airport Pty Ltd: Fauna Impact Assessment for the Airport North Project* (Unpublished Report to Perth Airport Pty Ltd by M. J. and A. R. Bamford Consulting Ecologists).

Bancroft, W., & Bamford, M. (2023). *South32 Collie Offset Areas Threatened Fauna Assessment* (Unpublished Report to South32 Worsley Alumina by M. J. and A. R. Bamford Consulting Ecologists).

Beard, J. S., Beeston, G. R., Harvey, J., Hopkins, A. J. M., & Shepherd, D. P. (2013). The Vegetation of Western Australia at the 1:3,000,000 Scale. Explanatory memoir. (2nd Ed.). *Conservation Science Western Australia, 9*, 1–152.

BirdLife Australia. (2024a). *Great Cocky Count Dataset*. Spatial data. Last updated 18 June 2018. Department of Primary Industries and Regional Development (DPIRD).

BirdLife Australia. (2024b). *Handbook of Australian, New Zealand & Antarctic Birds* [<https://hanzab.birdlife.org.au/>]. Handbook of Australian, New Zealand & Antarctic Birds (HANZAB).

BoM. (2024). *Bureau of Meteorology Climate Data Online*. Commonwealth of Australia, Bureau of Meteorology (BoM). <http://www.bom.gov.au/climate/data/>

DBCA. (2013). *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. January 2013. Department of Biodiversity, Conservation and Attractions (DBCA). <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>

DBCA. (2017). *Threatened and Priority Flora Report Form – Field Manual* (Version 1.3, August 2017). Department of Biodiversity, Conservation and Attractions (DBCA). <https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/forms/threatened-priority-flora-field-manual.pdf>

DBCA. (2018). *List of Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for Environment*. Species and Communities Branch, 28 June 2018. Department of Biodiversity, Conservation and Attractions (DBCA). <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>

DBCA. (2019). *2018 Statewide Vegetation Statistics (formerly the CAR Reserve Analysis): Full Report*. Last updated 30 April 2019. Remote Sensing and Spatial Analysis Program, Department of Biodiversity,

Conservation and Attractions (DBCA). <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>

DBCA. (2020). *Conservation Codes for Western Australian Flora and Fauna*. Last updated 10 December 2020. Department of Biodiversity, Conservation and Attractions (DBCA). <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities>

DBCA. (2022). *Priority Ecological Communities for Western Australia Version 34*. Species and Communities Program, 21 December 2022. Department of Biodiversity, Conservation and Attractions (DBCA). <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>

DBCA. (2023a). *DBCA - Legislated Lands and Waters (DBCA-011)*. Spatial data. Last updated 06 June 2023. Department of Biodiversity, Conservation and Attractions (DBCA). <https://catalogue.data.wa.gov.au/dataset/dbca-legislated-lands-and-waters>

DBCA. (2023b). *Methods for survey and identification of Western Australian threatened ecological communities* (Draft version 4.0, 30 January 2023). Department of Biodiversity, Conservation and Attractions (DBCA), Species and Communities Program. <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>

DBCA. (2024a). *DBCA Threatened and Priority Ecological Communities Database*. Database interrogation. Department of Biodiversity, Conservation and Attractions (DBCA).

DBCA. (2024b). *DBCA Threatened and Priority Fauna Database*. Database interrogation. Department of Biodiversity, Conservation and Attractions (DBCA).

DBCA. (2024c). *DBCA WA Herbarium Specimen and Threatened and Priority Flora (TPFL) Databases*. Database interrogation. Department of Biodiversity, Conservation and Attractions (DBCA).

DBCA. (2024d). *Methods for survey and identification of Western Australian threatened ecological communities* (Draft version 4.3, 23 January 2024). Department of Biodiversity, Conservation and Attractions (DBCA), Species and Communities Program. <https://www.dbca.wa.gov.au/management/threatened-species-and-communities/resources/threatened-ecological-community-monitoring-resources>

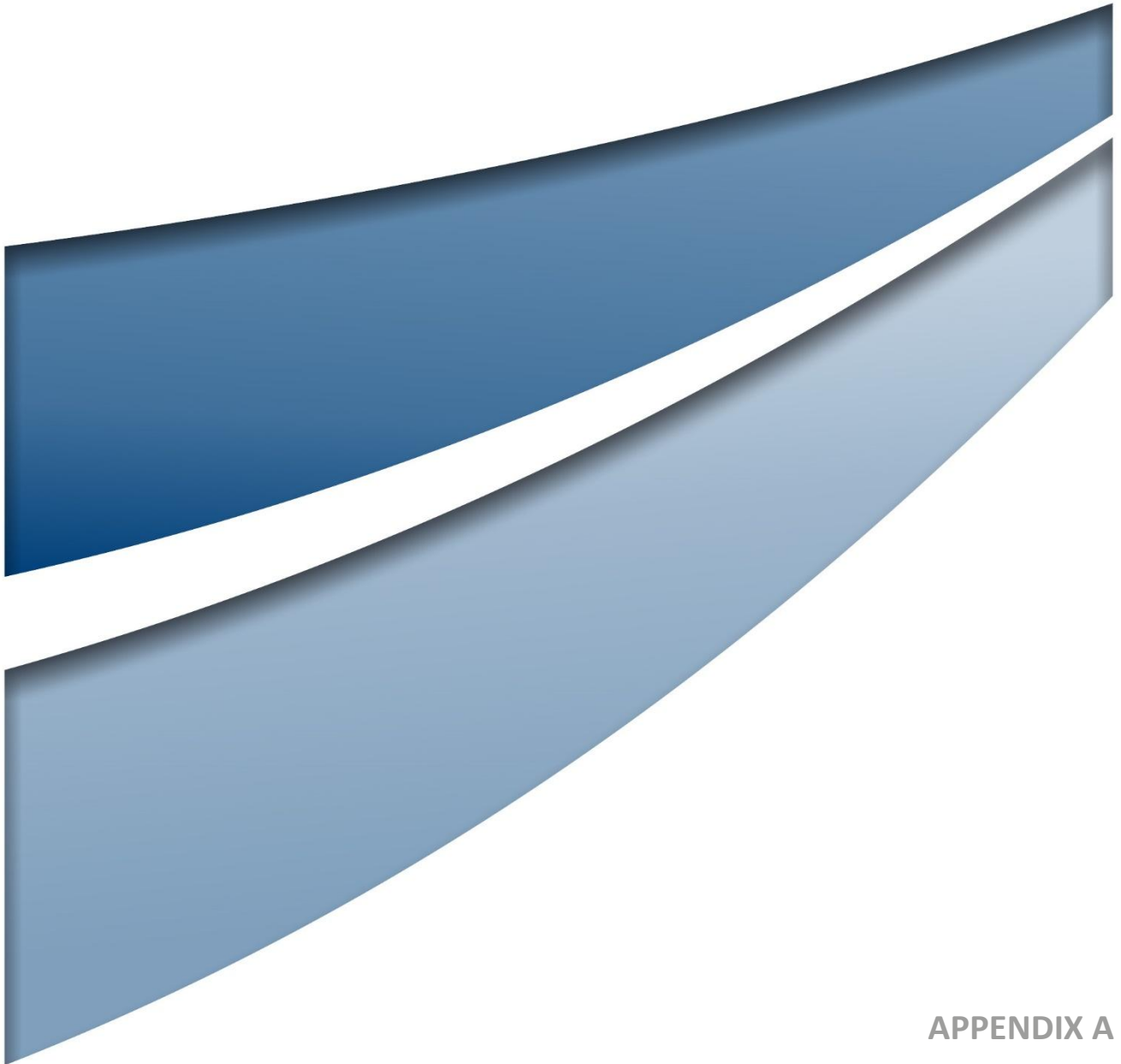
DBCA. (2007-). *NatureMap: Mapping Western Australia's Biodiversity*. Threatened and Priority Flora and WA Herbarium Specimen Databases. Department of Biodiversity, Conservation and Attractions (DBCA).

DCCEEW. (2022). *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo* (p. 42). Department of Climate Change, Energy, the Environment and Water (DCCEEW) as Department of Agriculture, Water and the Environment (DAWE). Canberra, Australian Capital Territory. <https://www.dcceew.gov.au/sites/default/files/documents/referral-guideline-3-wa-threatened-black-cockatoo-species-2022.pdf>

DCCEEW. (2024). *Protected Matters Search Tool: Interactive Map*. Interrogation of Species Profile and Threats (SPRAT) Database Using Protected Matters Search Tool. Department of Climate Change, Energy, the Environment and Water (DCCEEW). <https://pmst.awe.gov.au/>

- DCCEEW. (2025a). *Calyptorhynchus banksii* naso in *Species Profile and Threats Database*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). <https://www.environment.gov.au/sprat>
- DCCEEW. (2025b). *Zanda baudinii* in *Species Profile and Threats Database*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). <https://www.environment.gov.au/sprat>
- DCCEEW. (2025c). *Zanda latirostris* in *Species Profile and Threats Database*. Department of Climate Change, Energy, the Environment and Water (DCCEEW). <https://www.environment.gov.au/sprat>
- Department of Agriculture, Water and the Environment. (2022). *Referral Guideline for 3 WA Threatened Black Cockatoo Species*. <https://www.dcceew.gov.au/sites/default/files/documents/referral-guideline-3-wa-threatened-black-cockatoo-species-2022.pdf>
- DoE. (2015). *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (p. 141). Department of the Environment (DoE). Canberra, Australian Capital Territory. <https://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=128>
- DoEE. (2017). *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*. Department of the Environment and Energy (DoEE). Canberra, Australian Capital Territory.
- DPIRD. (2016). *Intensive land use zone of south west Western Australia*. Geographic Information Services, D. Map. https://library.dpird.wa.gov.au/gis_maps/17/
- DPIRD. (2019a). *Pre-European Vegetation (DPIRD-006)*. Spatial data. Last updated 23 July 2019. Department of Primary Industries and Regional Development (DPIRD). <https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006>
- DPIRD. (2019b). *Soil Landscape Mapping—Best Available (DPIRD-027)*. Spatial data. Last updated 2 August 2019. Department of Primary Industries and Regional Development (DPIRD). <https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available>
- DSEWPaC. (2012). *EPBC Act referral guidelines for three black cockatoo species*. Federal Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- DWER. (2022). *Index of Biodiversity Surveys for Assessments (IBSA)*. Department of Water and Environmental Regulation (DWER). <https://biocollect.ala.org.au/ibsa/>
- EPA. (2016a). *Environmental Factor Guideline—Flora and Vegetation* (p. 6). December 2016. Environmental Protection Authority (EPA). <https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-flora-and-vegetation>
- EPA. (2016b). *Environmental Factor Guideline—Terrestrial Fauna* (p. 5). December 2016. Environmental Protection Authority (EPA). <https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-terrestrial-fauna>
- EPA. (2016c). *Technical Guidance—Flora and Vegetation Surveys for Environmental Impact Assessment*. December 2016. Environmental Protection Authority (EPA). <https://www.epa.wa.gov.au/policies-guidance/technical-guidance-flora-and-vegetation-surveys-environmental-impact-assessment>

- EPA. (2020). *Technical Guidance—Terrestrial vertebrate fauna surveys for environmental impact assessment*. June 2020. Environmental Protection Authority (EPA). <https://www.epa.wa.gov.au/policies-guidance/environmental-factor-guideline-terrestrial-fauna>
- EPA. (2023). *Statement of environmental principles, factors, objectives and aims of EIA*.
- Gosper, C. R., Prober, S. M., & Yates, C. J. (2013). Multi-century changes in vegetation structure and fuel availability in fire-sensitive eucalypt woodlands. *Forest Ecology and Management Journal of Botany*, 310, 102–109.
- Hearn, R., Williams, K., Comer, S., & Beecham, B. (2002, January). *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002—Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)*. Conservation and Land Management.
- Heartland Journeys. (2024). *Myrtle Benn Reserve*. <https://heartlandjourneys.com.au/places/myrtle-benn-reserve/>
- Hopper, S. D., & Gioia, P. (2004). The southwest Australian floristic region: Evolution and conservation of a global hot spot of biodiversity. *Annual Review of Ecology, Evolution, and Systematics*, 35, 623–650.
- Johnstone, R. E., Kirkby, T., & Sarti, K. (2013). The breeding biology of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows. *Pacific Conservation Biology*, 19, 121–142.
- Johnstone, R. E., & Storr, G. M. (1998). *Handbook of Western Australian Birds. Volume 1: Non-passerines (Emu to Dollarbird)*. Western Australian Museum. Perth, Western Australia.
- Keighery, B. J. (1994). *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc.). Nedlands, Western Australia.
- NVIS Technical Working Group. (2017). *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0*. Department of the Environment and Energy. Canberra, Australian Capital Territory.
- RCC. (2015). *Roadside conservation mapping program. Data from surveyed shires. [Links to technical reports and maps completed for individual shires.]*. Roadside Conservation Committee, Western Australia. <http://www.dpaw.wa.gov.au/management/off-reserve-conservation/roadside-conservation/132roadside-conservation-value-mapping-program?showall=&start=2>
- Saunders, D. A. (1979). The availability of tree hollows for use as nest sites by White-tailed Black Cockatoos. *Australian Wildlife Research*, 6(2), 205–216.
- Umwelt. (2024). *Kojonup BESS Constraints Analysis* (Unpublished report (24484/R01) in preparation for Mint Renewables). Umwelt (Australia) Pty Ltd (Umwelt).
- Western Australian Herbarium. (1998). *Florabase: The Western Australian Flora. Department of Biodiversity, Conservation and Attractions*. [Database]. <https://florabase.dpaw.wa.gov.au/>



APPENDIX A

Bamford (2020) Scoring system for the Assessment of Foraging Value of Vegetation for Black-cockatoos

Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos. Revised 5th June 2020

Bamford Consulting Ecologists

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component.

Calculating the total score (out of 10) requires the following steps:

- A Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus
- B Site context. Determining a score out of three for the context of the site; plus
- C Species stocking rate. Determining a score out of one for species density.
- D Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

Calculation of scores and the moderation process are described in detail below.

A. Site condition. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
0	<p>No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass 	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits). 	<p>No foraging value. No eucalypts or other potential sources of food. Examples:</p> <ul style="list-style-type: none"> • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	<p>Negligible to low foraging value. Examples:</p> <ul style="list-style-type: none"> • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual). 	<p>Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.</p>	<p>Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.</p>

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
2	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. <i>Erodium</i> spp.) that represent a short-term and/or seasonal food source. 	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees. 	<p>Low foraging value. Examples:</p> <ul style="list-style-type: none"> • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; • Urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i>.
3	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover. 	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability). 	<p>Low to Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
4	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> Woodland/low forest with tree banksias (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) 20-40% projected foliage cover; Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover. 	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits). 	<p>Moderate foraging value. Examples:</p> <ul style="list-style-type: none"> Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; Sheoak Forest with 40-60% projected foliage cover.
5	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with 40-60% projected foliage cover; Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; Pine plantations with trees more than 10 years old (but see pine note below in moderation section). 	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> Marri-Jarrah Forest with 40-60% projected foliage cover; Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. 	<p>Moderate to High foraging value. Examples:</p> <ul style="list-style-type: none"> Marri-Jarrah Forest with 40-60% projected foliage cover; Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. Sheoak Forest with > 60% projected foliage cover.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
6	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> Banksia Low Forest (of key species <i>B. attenuata</i> and <i>B. menziesii</i>) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). 	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term). 	<p>High foraging value. Example:</p> <ul style="list-style-type: none"> Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Carnaby's are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with DEE, provides a *guide* to the assignment of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Site Context Score	Percentage of the existing native vegetation within the 'local' area that the study site represents.	
	'Local' breeding known/likely	'Local' breeding unlikely
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (eg 0.5% of such habitat within 15km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

C. Species density (stocking rate).

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignment of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is

known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

D. Moderation of scores for the calculation of a value out of 10.

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat (≥ 3). The approach to calculating a score out of 10 can be summarised as follows:

vegetation composition, condition and structure score (out of 6)	context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there

is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

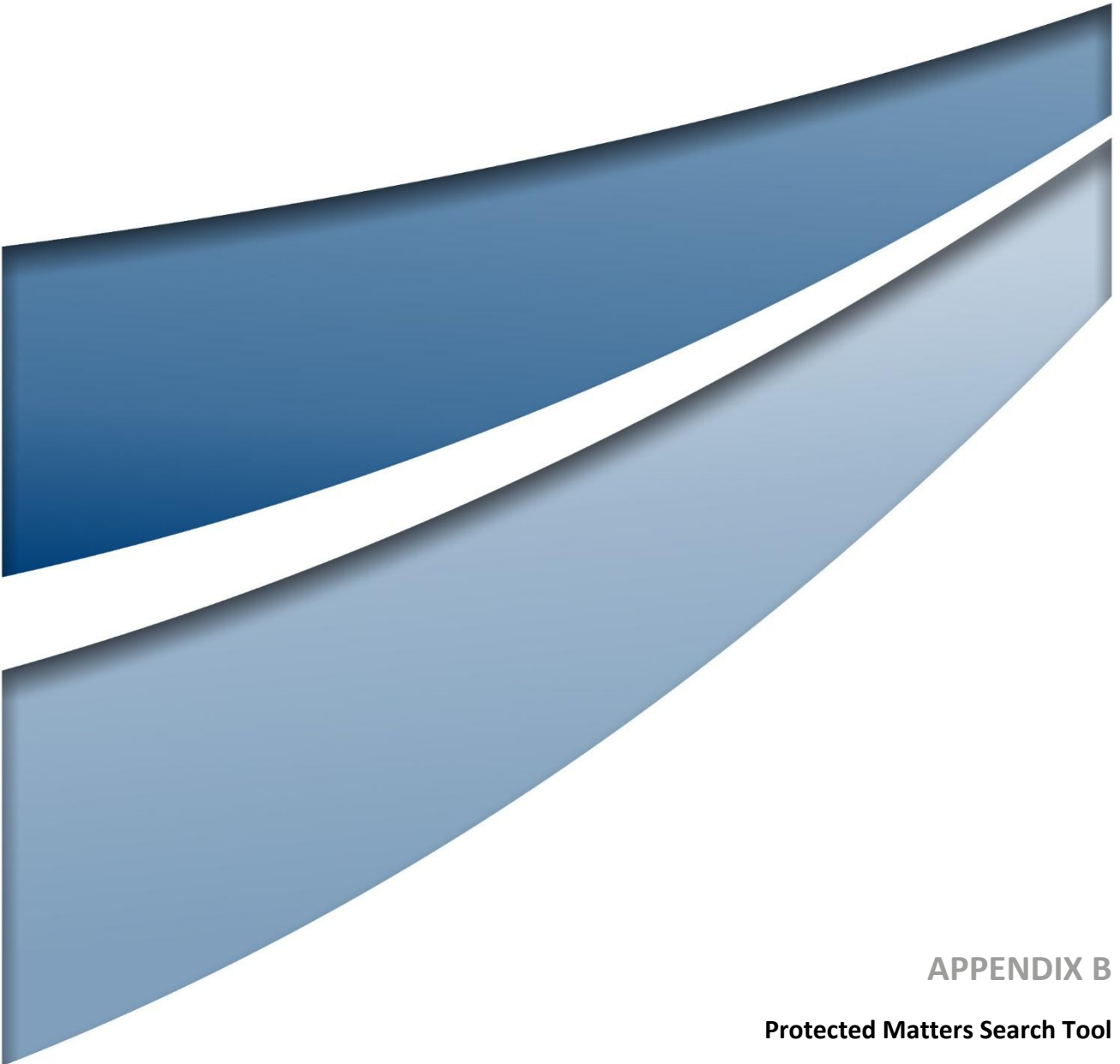
- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

Keighery (1994).

Scott, J. K. and Black, R. (1981). Selective Predation by White-Tailed Black Cockatoos on Fruit of *Banksia attenuata* Containing the Seed-Eating Weevil *Alphitopis nivea*. *Australian Wildlife Research* **8(2)**, 421-430.

Stock, W.D., Finn, H., Parker, J. and Dods, K. (2013). Pine as Fast Food. Foraging Ecology of an Endangered Cockatoo in a Forestry Landscape. *PlosOne* 8: issue 4.



APPENDIX B

Protected Matters Search Tool



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 28-May-2024

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	29
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	9
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	26
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	9
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[[Resource Information](#)]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area	In buffer area only
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area	In feature area
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area	In buffer area only

Listed Threatened Species

[[Resource Information](#)]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only
Zanda baudinii listed as Calyptorhynchus baudinii Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Breeding known to occur within area	In feature area
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
Myrmecobius fasciatus Numbat [294]	Endangered	Species or species habitat known to occur within area	In feature area
Phascogale calura Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
Acacia brachypoda Western Wheatbelt Wattle [55594]	Endangered	Species or species habitat known to occur within area	In buffer area only
Adenanthos pungens subsp. effusus Sprawling Spiky Adenanthos [10742]	Endangered	Species or species habitat known to occur within area	In feature area
Adenanthos pungens subsp. pungens Spiky Adenanthos [19429]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In buffer area only
Banksia oligantha Wagin Banksia [20697]	Endangered	Species or species habitat known to occur within area	In buffer area only
Caladenia dorrienii Cossack Spider-orchid [6596]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caladenia luteola Lemon Spider Orchid [68713]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Conostylis drummondii Drummond's Conostylis [5885]	Endangered	Species or species habitat known to occur within area	In buffer area only
Conostylis setigera subsp. dasys Boscabel Conostylis [5775]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Gastrolobium lehmannii Cranbrook Pea [22282]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Hemigenia ramosissima Branched Hemigenia [18568]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Tribonanthes purpurea Granite Pink [16244]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Verticordia fimbrileps subsp. fimbrileps Shy Featherflower [24631]	Endangered	Species or species habitat known to occur within area	In buffer area only

Listed Migratory Species [[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text	Buffer Status
-----------------	---------------------	---------------	---------------

Migratory Marine Birds

Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
---	--	--	-----------------

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
---	--	--	-----------------

Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
--	--	--	-----------------

Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
--	------------	--	-----------------

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
---	-----------------------	--	-----------------

Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
--	--	--	-----------------

Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
---	--	--	---------------------

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [52039]	WA	In buffer area only
Commonwealth Land - [50986]	WA	In buffer area only
Commonwealth Land - [50985]	WA	In buffer area only
Commonwealth Land - [50994]	WA	In buffer area only
Commonwealth Land - [52033]	WA	In buffer area only
Commonwealth Land - [50992]	WA	In buffer area only
Commonwealth Land - [50991]	WA	In buffer area only
Commonwealth Land - [52138]	WA	In buffer area only
Commonwealth Land - [52046]	WA	In buffer area only

Listed Marine Species [\[Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Beaufort Bridge	Nature Reserve	WA	In buffer area only
Birdwood	Nature Reserve	WA	In buffer area only
Carrolup	Nature Reserve	WA	In buffer area only
Cherry Tree Pool	Nature Reserve	WA	In buffer area only
Jingalup	Nature Reserve	WA	In buffer area only
Kojonup	Conservation Reserve	WA	In buffer area only
Maragoonda	Nature Reserve	WA	In buffer area only
Martinup	Nature Reserve	WA	In buffer area only
Miripin	Nature Reserve	WA	In buffer area only
Murapin	Nature Reserve	WA	In buffer area only
Narlingup	Nature Reserve	WA	In buffer area only
Ngopitchup	Nature Reserve	WA	In buffer area only
NTWA Bushland covenant (0099)	Conservation Covenant	WA	In buffer area only
NTWA Bushland covenant (0108)	Conservation Covenant	WA	In buffer area only
South Jingalup	Nature Reserve	WA	In buffer area only
Strathmore Hill	Nature Reserve	WA	In buffer area only
Unnamed WA02184	Nature Reserve	WA	In buffer area only
Unnamed WA05796	Nature Reserve	WA	In buffer area only
Unnamed WA13102	Nature Reserve	WA	In buffer area only
Unnamed WA15061	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Unnamed WA20435	5(1)(g) Reserve	WA	In buffer area only
Unnamed WA24707	Nature Reserve	WA	In buffer area only
Unnamed WA26158	Nature Reserve	WA	In buffer area only
Unnamed WA39399	Nature Reserve	WA	In buffer area only
Wardering Lake	Nature Reserve	WA	In buffer area only
Wingedine	Nature Reserve	WA	In buffer area only

EPBC Act Referrals [[Resource Information](#)]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Flat Rocks Wind Farm	2022/9154		Completed	In buffer area only
Controlled action				
Road Widening Kojonup South SLK 254.9 to SLK 259.8	2017/7934	Controlled Action	Post-Approval	In buffer area only
Transmission Line Project	2011/6066	Controlled Action	Post-Approval	In feature area
Not controlled action				
Albany Highway Upgrade (242.56 - 248.4 SLK, WA)	2013/6842	Not Controlled Action	Completed	In buffer area only
Albany Highway Upgrade (248.4 - 250.8 SLK) WA	2013/6766	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Upgrade section of Albany Highway, Harold Road Passing Lane, WA	2016/7762	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

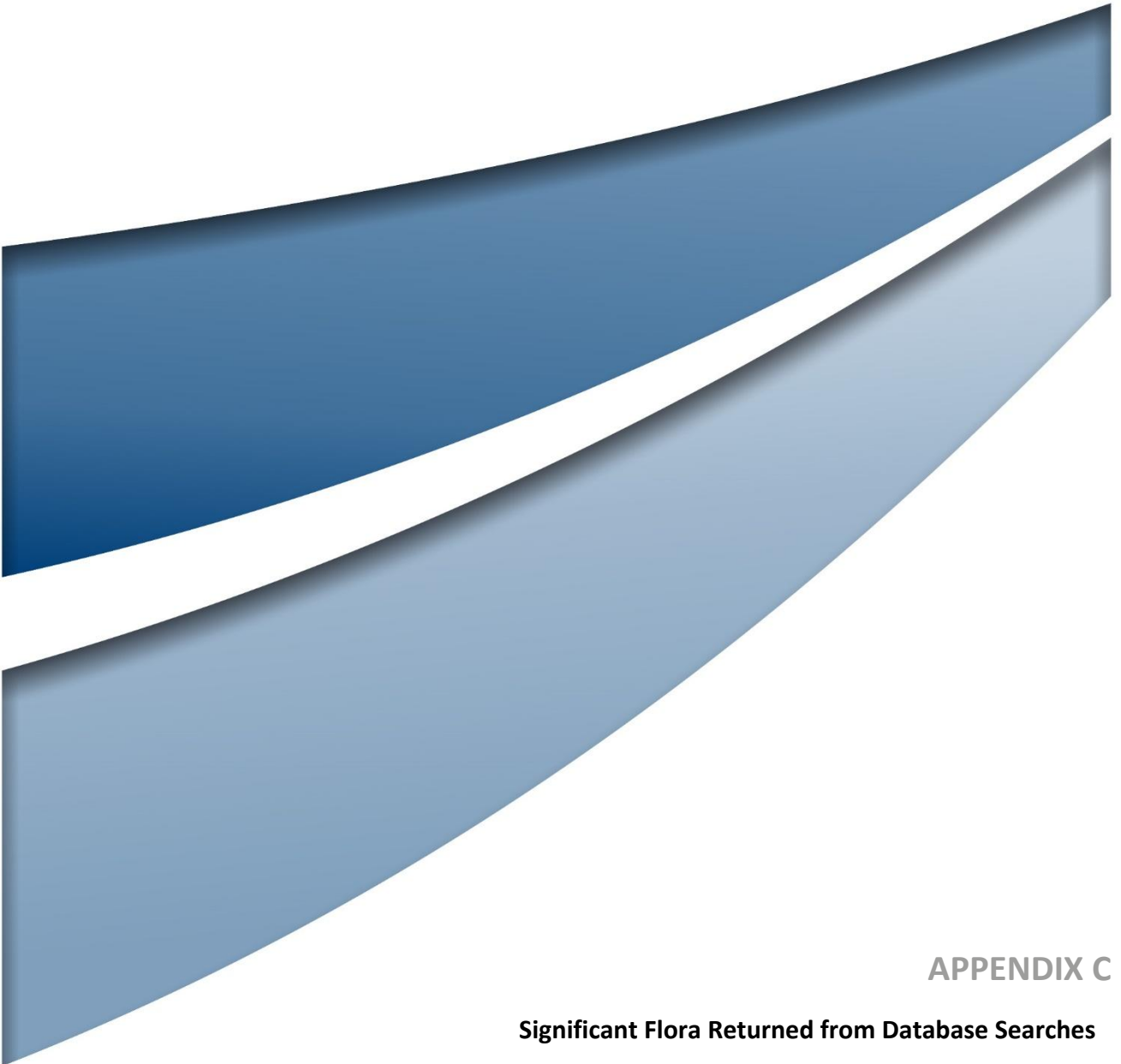
[© Commonwealth of Australia](#)

Department of Climate Change, Energy, the Environment and Water

GPO Box 3090

Canberra ACT 2601 Australia

+61 2 6274 1111



APPENDIX C

Significant Flora Returned from Database Searches

Taxon	Status	Flowering Period	Habitat	Source [^]
<i>Acacia ataxiphylla</i> subsp. <i>ataxiphylla</i>	P3	October to December/January	Clay loam, sand with gravel, gravelly clay loam, white-grey sand, flats, in Eucalyptus woodland.	DBCA, NatureMap
<i>Acacia brachypoda</i>	T	May to July	Low-lying swamp areas, with sandy clay or loam.	DCCEEW
<i>Acacia grisea</i>	P4	July to November	Gravelly loam, flats or slopes, on laterite.	DBCA, NatureMap
<i>Acacia parkerae</i>	P3	September to October	Non-lateritic clay or clay loam, in association with Eucalyptus wandoo.	DBCA, NatureMap
<i>Adenanthos pungens</i> subsp. <i>effusus</i>	T	August to November	White sand, plains.	DBCA, DCCEEW, NatureMap
<i>Adenanthos pungens</i> subsp. <i>pungens</i>	T	August to November	White, grey or pink sand, rocky soils and gypsum. Sand dunes and hill sides.	DCCEEW
<i>Andersonia gracilis</i>	T	August to November	Winter-wet areas, near swamps. White- grey sand, sandy clay and gravelly loam.	DCCEEW
<i>Angianthus</i> <i>drummondii</i>	P3	October to December	Seasonally wet flats, grey or brown clay soils, sometimes with ironstone.	DBCA
<i>Banksia acanthopoda</i>	P2	July to October	Gravelly clay- sand over laterite. Low ridges.	DBCA, NatureMap
<i>Banksia acuminata</i>	P4	September to October	Over laterite, white-grey sand or brown loam. Slopes and plains.	DBCA, NatureMap
<i>Banksia cynaroides</i>	P4	July to October	Orange-brown sandy loam or grey sand over laterite, slopes.	DBCA
<i>Banksia lepidorhiza</i>	T	October to November	Gravelly sand or sandy loam.	DBCA, NatureMap
<i>Banksia oligantha</i>	T	June to November	Dunes, grey or yellow sand. Deep sand.	DBCA, DCCEEW, NatureMap
<i>Banksia porrecta</i>	P4	May to September	Flats and slopes, yellow-brown sandy clay or white sand; over laterite or granite.	DBCA, NatureMap
<i>Banksia rufistylis</i>	P2	July to August	Gravelly loam, laterite. Hills, ridges.	DBCA, NatureMap
<i>Banksia</i> <i>subpinnatifida</i> var. <i>imberbis</i>	P3	September to October	Slopes and flats with brown sandy clay gravel, on laterite.	DBCA
<i>Bossiaea spinosa</i>	P3	August to October	Undulating plains, gravelly sandy soils.	DBCA
<i>Brachyloma mogin</i>	P3	June	Swamp flats.	DBCA, NatureMap
<i>Caladenia bryceana</i> subsp. <i>bryceana</i>	T	August to October	Slopes with red loam, often on granite.	DBCA

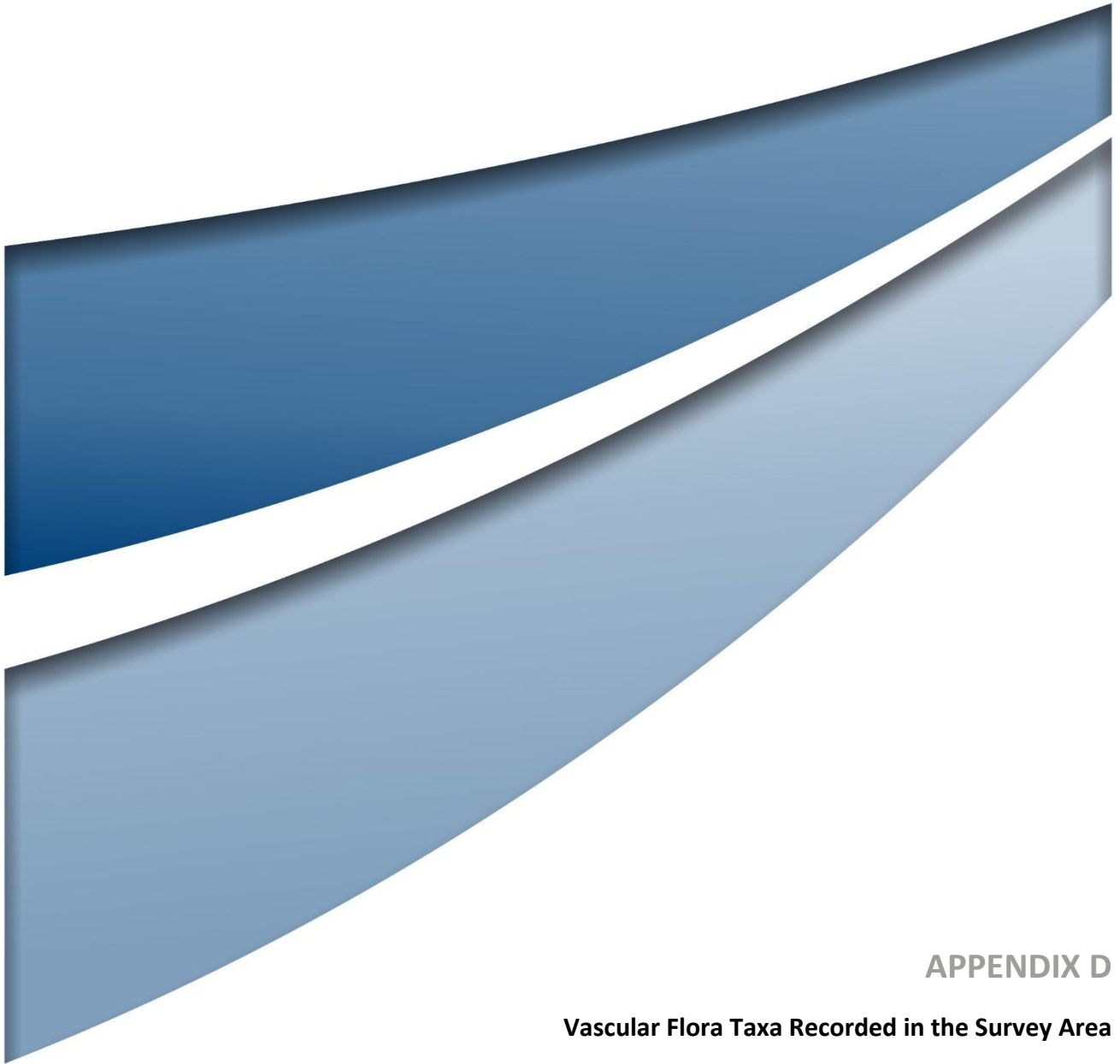
Taxon	Status	Flowering Period	Habitat	Source [^]
<i>Caladenia dorrienii</i>	T	September to November. Latest record 1 November	Clay loam. Adjacent to rivers and seasonal creeks.	DBCA, DCCEEW
<i>Caladenia integra</i>	P4	September to October. Latest record is 29 October	Flats, gentle slopes. brown loam/sand with laterite or granite.	DBCA, NatureMap
<i>Caladenia luteola</i>	T	September to October. Latest record is 12 October	Lateritic sand.	DBCA, DCCEEW
<i>Caladenia x triangularis</i>	P4	September to October. Latest record is 5 October	Heavy loam.	DBCA
<i>Calandrinia uncinella</i>	P1	August - September	Swampy soil, wet flats.	DBCA, NatureMap
<i>Calectasia obtusa</i>	P3	August to September	Sand, clay loam with gravel or laterite on flats.	DBCA, NatureMap
<i>Calytrix pulchella</i>	P3	August to November, February	Grey-white sand over laterite.	DBCA, NatureMap
<i>Caustis</i> sp. Boyanup (G.S. McCutcheon 1706)	P3	February to March	White or grey sand on hills or in depressions.	DBCA, NatureMap
<i>Commersonia erythrogyna</i>	T	August to October	Granite outcrops. Brown peat soil.	DBCA
<i>Conostylis drummondii</i>	T	Oct to Nov (yellow)	White, grey or yellow sand, gravel.	DBCA, DCCEEW, NatureMap
<i>Conostylis setigera</i> subsp. <i>dasys</i>	T	October to November	Sand, gravel, laterite ridges or gentle slopes.	DBCA, DCCEEW, NatureMap
<i>Cryptandra beverleyensis</i>	P3	August to September	Clay soils with sand and laterite gravel, undulating plains.	DBCA
<i>Cyanicula ixioides</i> subsp. <i>candida</i>	P2	August to October. Latest record 7 October	Sand, laterite, gravel.	DBCA, NatureMap
<i>Diuris drummondii</i>	T	November to January. Latest record 25 January	Floodplains, winter-wet depressions and swamps. Brown loam, sometimes peaty.	DBCA, NatureMap
<i>Diuris micrantha</i>	T	September to October. Latest record 4 October	Winter-wet depressions. Brown loamy clay. Winter wet swamps, in shallow water.	DCCEEW
<i>Drakaea micrantha</i>	T	September to November. Latest record 10 November	Edge of swamps, often found in clearings and tracks. White-grey sand.	DCCEEW
<i>Eleocharis keigheryi</i>	T	August to November	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	DBCA, DCCEEW, NatureMap

Taxon	Status	Flowering Period	Habitat	Source [^]
<i>Eucalyptus quaerenda</i>	P3	September	White sand, clay loam, somewhat saline. Sandhills and flats.	DBCA, NatureMap
<i>Gastrolobium lehmannii</i>	T	September to October	Red clay on laterite, breakaways.	DBCA, DCCEEW, NatureMap
<i>Gastrolobium ovalifolium</i>	P4	August to September	Sandy clay. Gravelly hills.	DBCA, NatureMap
<i>Gastrolobium tomentosum</i>	P4	August to November	Gravelly loam or clay, sometimes over sandier substrates. Hills, road verges.	DBCA, NatureMap
<i>Grevillea newbeyi</i>	P3	January, June, September to November	Clay loam, sandy gravelly soils.	DBCA
<i>Grevillea</i> sp. Duranillin (E.F. Shedley 180)	P2	November to December	Flood plains with grey/brown sandy clay, seasonally inundated.	DBCA
<i>Hemigenia ramosissima</i>	T	November to January	Granite outcrops, lateritic clay soils.	DBCA, DCCEEW, NatureMap
<i>Hemigenia rigida</i>	P1	October to November	Grey sand with ironstone. Upper slopes.	DBCA, NatureMap
<i>Hibbertia humilis</i>	P2	October to November	Flats with grey sandy clay, hills with granite outcropping.	DBCA, NatureMap
<i>Isolepis australiensis</i>	P3	June or September	Lake margins, pools.	DBCA
<i>Jacksonia velveta</i>	T	November to December	Slopes, yellow-brown loam, laterite.	DBCA, NatureMap
<i>Lasiopetalum cardiophyllum</i>	P4	August to January	Slopes, road verges. Brown loam over laterite and granite.	DBCA
<i>Leucopogon ozothamnoides</i>	P1	August to October	Flats and slopes, grey clayey sand.	DBCA, NatureMap
<i>Lilaeopsis polyantha</i>	P2	November	Sandy mud, lake margins.	DBCA
<i>Melaleuca micromera</i>	P3	September to October	Gentle slopes, Gravelly sandy loam or clay.	DBCA
<i>Melaleuca ordinifolia</i>	P2	August to October	Winter wet areas, brown sandy loam, or light grey clay.	DBCA, NatureMap
<i>Melaleuca pritzelii</i>	P3	August to December	Sandy or clay soils in swamp areas.	DBCA, NatureMap
<i>Microseris walteri</i>	P3	June to October	Salt lake fringes.	DBCA
<i>Montia australasica</i>	P2	October to March	Low-lying flats, seasonally inundated.	DBCA
<i>Pauridia</i> sp. Beaufort (V. Crowley DKN 629)	P1	September	Flats with wet grey clay.	DBCA
<i>Phyllangium palustre</i>	P2	October to November	Seasonal wetlands.	DBCA, NatureMap

Taxon	Status	Flowering Period	Habitat	Source [^]
<i>Pterostylis echinulata</i>	P3	June to August. Latest record is 21 Aug	Gravelly brown clay, damp depressions, creeks. Granite and laterite.	DBCA
<i>Regelia cymbifolia</i>	P4	August to November	Undulating plains, white, grey or yellow sands.	DBCA, NatureMap
<i>Roycea pycnophylloides</i>	T	September to October	Salt lakes and saline habitats.	DCCEEW
<i>Schoenus capillifolius</i>	P3	September to October	seasonally inundated wetlands.	DBCA, NatureMap
<i>Schoenus natans</i>	P4	September to December	Ephemeral wetlands.	DBCA, NatureMap
<i>Schoenus</i> sp. Beaufort (G.J. Keighery 6291)	P1	September to October	Brown or grey clay. Growing in shallow water in creeklines and claypans.	DBCA, NatureMap
<i>Stylidium coatesianum</i>	P2	October to November	Upper slopes, laterite. Red-brown loam.	DBCA, NatureMap
<i>Stylidium exappendiculatum</i>	P3	September to October	Slopes and flats. Sandy clay loam over laterite.	DBCA, NatureMap
<i>Stylidium lepidum</i>	P3	October to November	Clay plans, clay loam.	DBCA, NatureMap
<i>Stylidium marradongense</i>	P3	September to November	Dry brown loam, gravel. Slopes.	DBCA, NatureMap
<i>Stylidium pseudohirsutum</i>	P3	November to December	Sandy clay, lower hillslopes and depressions.	DBCA
<i>Stylidium rhipidium</i>	P3	November	Winter wet depressions. Yellow-grey or black sandy clay, loam.	DBCA, NatureMap
<i>Stylidium tylosum</i>	P2	October to November	Slopes with exposed granite, sandy clay.	DBCA
<i>Styphelia papillosa</i>	P3	December to May	Upper slopes, brown sand over laterite.	DBCA, NatureMap
<i>Styphelia</i> sp. Wandoo (F. & J. Hort 2441)	P2	December to May	Sandy winter-damp flats. Yellow-Brown-Grey sand-loam-clay.	DBCA, NatureMap
<i>Synaphea hians</i>	P3	August to November	Hill slopes, red-orange clay loam or grey sand.	DBCA, NatureMap
<i>Synaphea</i> sp. Woodanilling (G.J. Keighery & N. Gibson 4614)	P2	September to November	White-grey sand, or red-brown gravelly loam on gentle slopes.	DBCA, NatureMap
<i>Tetrateca exasperata</i>	P3	September to November	Slopes, wetlands. Brown-orange gravel, yellow-brown sand.	DBCA, NatureMap
<i>Thelymitra</i> sp. Ongerup (S. Osborne 142)	P3	November, latest record is 22 November	Hill sides with ironstone gravel, clay soils.	DBCA, NatureMap

Taxon	Status	Flowering Period	Habitat	Source [^]
<i>Thelymitra stellata</i>	T	September to November, latest record is 7 November	Ridges and tops of lateritic hills with grey or brown sand or loam and lateritic gravel.	DCCEEW
<i>Thomasia julietiae</i>	P1	October	Upper slopes, brown sandy loam over laterite.	DBCA, NatureMap
<i>Thysanotus brevifolius</i>	P2	October to November	Lateritic upland, grey sand over laterite. Gravel, sandy loam.	DBCA, NatureMap
<i>Thysanotus cymosus</i>	P3	October to November	Slopes or flats with grey-brown sandy loam.	DBCA, NatureMap
<i>Thysanotus tenuis</i>	P3	September to October	Upper slopes, brown sandy loam over granite.	DBCA, NatureMap
<i>Tribonanthes purpurea</i>	T	July to September	Granite outcrops, slopes, drainage lines. Brown loam.	DBCA, DCCEEW
<i>Verticordia fimbrialepis</i> subsp. <i>fimbrialepis</i>	T	November to February	Gentle slopes and flats, white sand over granite.	DBCA, DCCEEW, NatureMap
<i>Verticordia huegelii</i> var. <i>tridens</i>	P3	October to November	Flats, clay loam, over laterite.	DBCA, NatureMap
<i>Wurmbea</i> sp. Cranbrook (A.R. Annels 3819)	P3	September to October	Valley floors, low-lying swamp areas, seasonally inundated.	DBCA, NatureMap
<i>Xanthorrhoea brevistyla</i>	P4	August to December	Brown clay, laterite gravel. Rolling hills.	DBCA

[^]Sources: DCCEEW (DCCEEW, 2024), NM: NatureMap (DBCA, 2007-), TPFL and WAHerb (DBCA, 2024c).

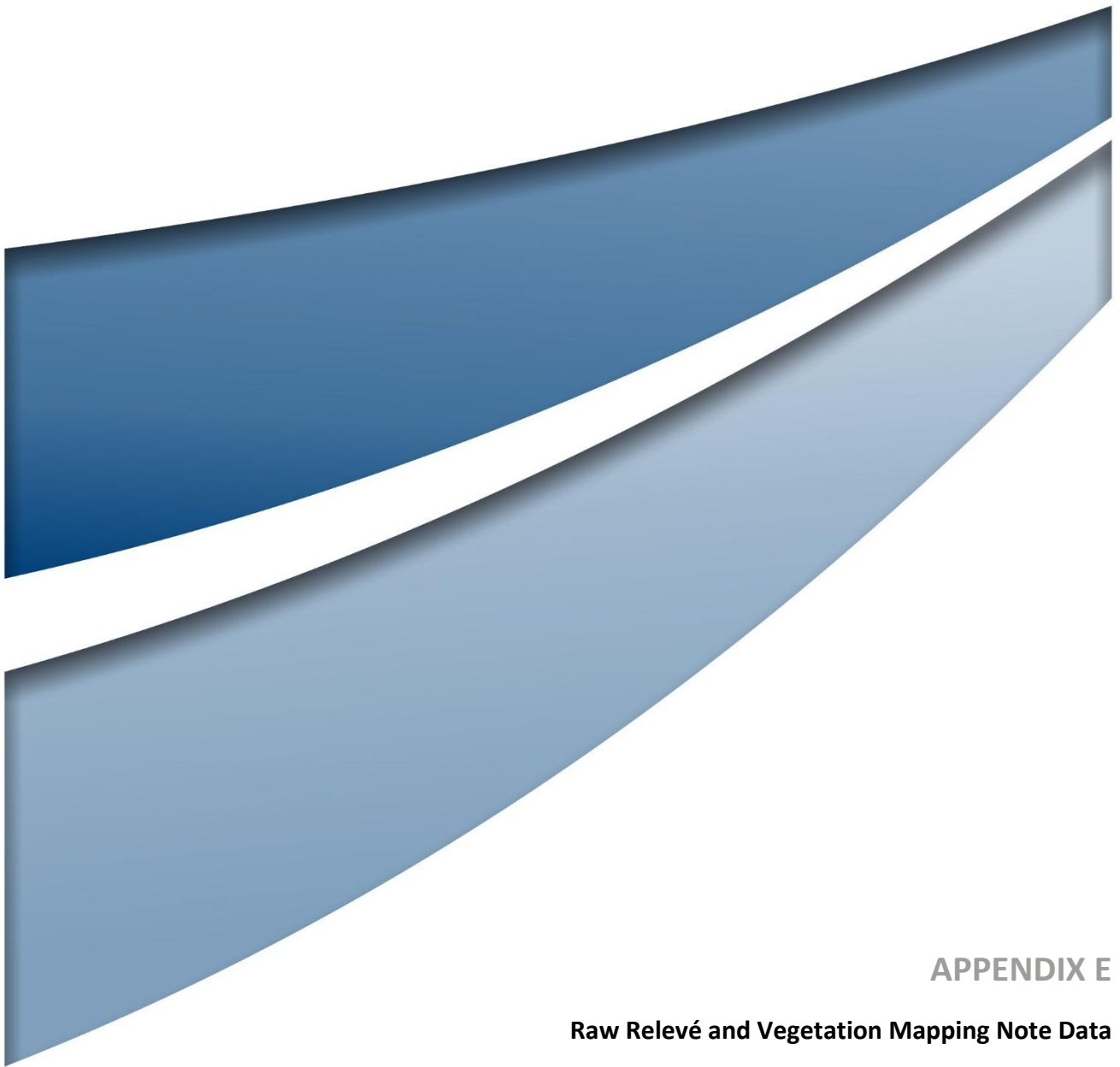


APPENDIX D

Vascular Flora Taxa Recorded in the Survey Area

Apiaceae	<i>Daucus glochidiatus</i>
Araliaceae	<i>Trachymene pilosa</i>
Asparagaceae	<i>Arthropodium curvipes</i> * <i>Asparagus asparagoides</i> <i>Dichopogon capillipes</i> <i>Laxmannia squarrosa</i> <i>Lomandra micrantha</i> subsp. <i>micrantha</i> <i>Sowerbaea laxiflora</i> <i>Thysanotus patersonii</i>
Asteraceae	* <i>Arctotheca calendula</i> * <i>Cotula turbinata</i> * <i>Hypochaeris glabra</i> <i>Lagenophora huegelii</i> <i>Millotia tenuifolia</i> var. <i>tenuifolia</i> <i>Podolepis aristata</i> subsp. <i>aristata</i> <i>Rhodanthe citrina</i> <i>Rhodanthe laevis</i> <i>Rhodanthe manglesii</i> * <i>Sonchus oleraceus</i> * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>
Campanulaceae	<i>Wahlenbergia gracilentia</i>
Caryophyllaceae	* <i>Cerastium glomeratum</i> * <i>Petrorhagia dubia</i>
Casuarinaceae	<i>Allocasuarina huegeliana</i>
Crassulaceae	<i>Crassula colorata</i> <i>Crassula decumbens</i> var. <i>decumbens</i>
Cyperaceae	<i>Lepidosperma leptostachyum</i> <i>Lepidosperma pubisquameum</i>
Dilleniaceae	<i>Hibbertia commutata</i>
Droseraceae	<i>Drosera glanduligera</i> <i>Drosera</i> sp. Branched styles (S.C. Coffey 193)
Ericaceae	<i>Styphelia erectifolia</i>
Fabaceae	<i>Acacia acuminata</i> <i>Acacia lasiocarpa</i> var. <i>bracteolata</i> <i>Acacia saligna</i> <i>Bossiaea eriocarpa</i> <i>Bossiaea ornata</i> <i>Daviesia decipiens</i> <i>Daviesia incrassata</i> subsp. <i>incrassata</i> <i>Dillwynia laxiflora</i> <i>Gastrolobium praemorsum</i> <i>Gastrolobium spinosum</i> <i>Jacksonia sternbergiana</i> <i>Kennedia prostrata</i> <i>Mirbelia ovata</i>
Goodeniaceae	<i>Dampiera sacculata</i>

Hemerocallidaceae	<i>Chamaescilla versicolor</i> <i>Dianella revoluta</i>
Iridaceae	* <i>Freesia</i> sp. <i>Patersonia</i> sp. * <i>Romulea rosea</i>
Montiaceae	<i>Calandrinia calyptata</i>
Myrtaceae	<i>Corymbia calophylla</i> <i>Eucalyptus astringens</i> subsp. <i>astringens</i> <i>Eucalyptus camaldulensis</i> <i>Eucalyptus marginata</i> subsp. <i>marginata</i> <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i> <i>Hypocalymma angustifolium</i> <i>Leptospermopsis erubescens</i>
Orchidaceae	<i>Caladenia falcata</i> <i>Thelymitra graminea</i>
Oxalidaceae	<i>Oxalis perennans</i> * <i>Oxalis purpurea</i>
Pittosporaceae	<i>Billardiera fusiformis</i> <i>Billardiera venusta</i>
Plantaginaceae	* <i>Plantago bellardii</i>
Poaceae	* <i>Aira cupaniana</i> <i>Aristida contorta</i> <i>Austrostipa elegantissima</i> <i>Austrostipa hemipogon</i> * <i>Avena barbata</i> * <i>Briza maxima</i> * <i>Briza minor</i> * <i>Bromus diandrus</i> * <i>Ehrharta calycina</i> * <i>Ehrharta longiflora</i> * <i>Lolium rigidum</i> <i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> * <i>Vulpia bromoides</i>
Primulaceae	* <i>Lysimachia arvensis</i>
Proteaceae	<i>Banksia sessilis</i> var. <i>sessilis</i> <i>Hakea prostrata</i>
Restionaceae	<i>Desmocladus asper</i>
Rhamnaceae	<i>Cryptandra arbutiflora</i> <i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>
Rubiaceae	* <i>Galium murale</i>
Santalaceae	<i>Santalum acuminatum</i>
Sapindaceae	<i>Dodonaea ?pinifolia</i>
Xanthorrhoeaceae	<i>Xanthorrhoea ?preissii</i>



APPENDIX E

Raw Relevé and Vegetation Mapping Note Data

Site Name: DMR01
 Site Type: RELEVE
 Survey Date: 25/09/2024
 GPS Location: GDA2020 Zone 50 511644.83E 6259359.32N
 Landform Type: Lower Slope
 Slope Class: Gently Inclined (3°)
 Aspect: NE
 Soil Type: Sandy Loam
 Soil Colour: Orange
 Rock Outcrop: No bedrock exposed
 CF Abundance: 50-90%
 CF Sizes: 2-6mm, 6-20mm, 20-60mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Grazing - Sheep, Weeds
 Fire: >20yrs
 Habitat: Eucalyptus astringens subsp. astringens and Eucalyptus wandoo subsp. wandoo mid open forest over Ehrharta longiflora low tussock grassland.

SITE POINTS

Label	Easting	Northing	Comments
Other	511645	6259359	

DOMINANT TAXA IN VEGETATION STRATA

Upper Stratum 1: *Eucalyptus astringens* subsp. *astringens*

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Ehrharta longiflora</i>	0.3	40
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	14	31
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	9
* <i>Lolium rigidum</i>	0.2	0.8
* <i>Romulea rosea</i>	0.2	0.1

PHOTOS



Site Name: DMR02
 Site Type: RELEVE
 Survey Date: 25/09/2024
 GPS Location: GDA2020 Zone 50 512438.68E 6258853.73N
 Landform Type: Mid Slope
 Slope Class: Gently Inclined (3°)
 Aspect: N
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: >90%
 CF Sizes: 2-6mm, 6-20mm, 20-60mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Grazing - Sheep , Weeds
 Fire: >20yrs
 Habitat: Allocasuarina huegeliana and Banksia sessilis subsp. sessilis tall sparse shrubland over Styphelia erectifolia low isolated clumps of shrubs over Neurachne alopecoroidea and Ehrharta longiflora low open tussock grassland.
 Comments: Condition is good at site location but transitions to degraded 50m N of WP

SITE POINTS

Label	Easting	Northing	Comments
Other	512439	6258854	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	0.7	0.2
<i>Allocasuarina huegeliana</i>	5	8
* <i>Arctotheca calendula</i>	0.1	0.5
<i>Aristida contorta</i>	0.2	0.1
<i>Banksia sessilis</i> var. <i>sessilis</i>	3	45

<i>Bossiaea eriocarpa</i>	0.3	0.2
<i>Crassula decumbens</i> var. <i>decumbens</i>	0.1	0.1
<i>Dianella revoluta</i>	0.6	0.1
<i>Drosera glanduligera</i>	0.1	0.1
* <i>Ehrharta longiflora</i>	0.2	15
* <i>Galium murale</i>	0.1	0.1
<i>Hibbertia commutata</i>	0.2	0.5
<i>Kennedia prostrata</i>		0.1
<i>Lepidosperma leptostachyum</i>	0.4	0.5
<i>Leptospermopsis erubescens</i>	1.7	0.2
<i>Neurachne alopecuroidea</i>	0.4	2
* <i>Oxalis purpurea</i>	0.1	0.1
* <i>Plantago bellardii</i>	0.1	0.1
* <i>Romulea rosea</i>	0.2	1
<i>Styphelia erectifolia</i>	0.4	3

PHOTOS



Site Name: DMR03
 Site Type: RELEVE
 Survey Date: 25/09/2024
 GPS Location: GDA2020 Zone 50 511984.68E 6259046.68N
 Landform Type: Lower Slope
 Slope Class: Very Gently Inclined (1°)
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm, 6-20mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Grazing - Sheep, Weeds, (other) - Plastic litter
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo mid open forest over Lolium rigidum and Ehrharta longiflora closed tussock grassland.
 Comments: Canopy coverage pictures with site picture

SITE POINTS

Label	Easting	Northing	Comments
Other	511985	6259047	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Cerastium glomeratum</i>	0.2	0.1
* <i>Ehrharta longiflora</i>	0.3	85
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	15	40
* <i>Galium murale</i>	0.1	0.1
* <i>Lolium rigidum</i>	0.3	5
<i>Oxalis perennans</i>	0.1	0.1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	0.2

PHOTOS



Site Name: DMR04
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512282.04E 6259466.74N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: E
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus astringens subsp. astringens and Eucalyptus wandoo subsp. wandoo mid open forest over Ehrharta longiflora and Vulpia bromoides low open tussock grassland.

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Ehrharta longiflora</i>	0.2	4
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	16	25
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	15	18
<i>Thelymitra</i> sp.	0.3	0.1
* <i>Vulpia bromoides</i>	0.2	9

PHOTOS



Site Name: DMR05
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512035.52E 6259802.12N
 Landform Type: Lower Slope
 Slope Class: Level (0°)
 Aspect: None
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: 0%
 Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Ehrharta calycina low closed tussock grassland over Romulea rosea and Hypochaeris glabra sparse forbland.
 Comments: This VT continues to the turn at Tunney Rd

SITE POINTS

Label	Easting	Northing	Comments
Other	512036	6259802	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Arctotheca calendula</i>	0.1	0.5
* <i>Ehrharta calycina</i>	0.5	80
* <i>Hypochaeris glabra</i>	0.1	1
* <i>Romulea rosea</i>	0.2	5

PHOTOS



Site Name: DMR06
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512025.52E 6259288.78N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Soil Type: Sandy Loam
 Soil Colour: Grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: 10-20%
 CF Sizes: 2-6mm, 6-20mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Grazing - Sheep, Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo mid open woodland over Vulpia bromoides, Aira cupaniana and Ehrharta longiflora low sparse tussock grassland over Romulea rosea, Millotia tenuifolia subsp. tenuifolia and Trachymene pilosa isolated clumps of forbs.

SITE POINTS

Label	Easting	Northing	Comments
Other	512026	6259289	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	0.3	0.1
* <i>Aira cupaniana</i>	0.1	1
<i>Austrostipa elegantissima</i>	0.4	0.1
<i>Bossiaea eriocarpa</i>	0.3	0.1
* <i>Briza minor</i>	0.1	0.2
<i>Crassula colorata</i>	0.1	0.1
<i>Crassula decumbens</i> var. <i>decumbens</i>	0.1	0.1

<i>Daucus glochidiatus</i>	0.1	0.1
<i>Drosera</i> sp. Branched styles (S.C. Coffey 193)		0.1
* <i>Ehrharta longiflora</i>	0.2	1
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	15	26
* <i>Freesia</i> sp.	0.3	0.1
<i>Hibbertia commutata</i>	0.1	0.1
<i>Lagenophora huegelii</i>	0.1	0.1
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	0.1	1
<i>Podolepis aristata</i> subsp. <i>aristata</i>	0.1	0.1
<i>Rhodanthe citrina</i>	0.1	0.1
<i>Rhodanthe laevis</i>	0.1	0.1
* <i>Romulea rosea</i>	0.2	2
<i>Thysanotus patersonii</i>		0.1
<i>Trachymene pilosa</i>	0.1	1
* <i>Vulpia bromoides</i>	0.1	3
<i>Wahlenbergia gracilentia</i>	0.1	0.1

PHOTOS



Site Name: DMR07
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511940.55E 6259284.01N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: NNE
 Soil Type: Sandy Clay Loam
 Soil Colour: grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm, 6-20mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Weeds, (other) - historical logging (stumps)
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo and Eucalyptus astringens subsp. astringens mid open forest.
 Comments: High leaf litter, little understory present

SITE POINTS

Label	Easting	Northing	Comments
Other	511941	6259284	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Ehrharta longiflora</i>	0.2	0.1
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	13	60
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	13	8
<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	0.2	0.1

PHOTOS



Site Name: DMR08
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511827.94E 6259306.99N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: NNE
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm, 6-20mm, 20-60mm, 60-200mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Grazing - Sheep, Weeds
 Fire: >20yrs
 Habitat: Eucalyptus marginata subsp. marginata and Eucalyptus wandoo subsp. wandoo mid woodland over Corymbia calophylla low isolated clumps of trees over Acacia acuminata tall isolated clumps of shrubs over Ehrharta longiflora, Ehrharta calycina and Vulpia bromoides low open tussock grassland.

SITE POINTS

Label	Easting	Northing	Comments
Other	511828	6259307	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia acuminata</i>	4.5	0.5
<i>Corymbia calophylla</i>	8	0.5
* <i>Cotula turbinata</i>	0.1	0.1
<i>Crassula colorata</i>	0.1	0.1
* <i>Ehrharta calycina</i>	0.4	5
* <i>Ehrharta longiflora</i>	0.2	10

<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	11	0.5
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	15	15
* <i>Hypochaeris glabra</i>	0.1	0.1
* <i>Lolium rigidum</i>	0.2	0.5
<i>Neurachne alopecuroidea</i>	0.2	0.2
* <i>Plantago bellardii</i>	0.1	0.1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	0.5
* <i>Vulpia bromoides</i>	0.2	6

PHOTOS



Site Name: DMR09
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511995.22E 6259332.72N
 Landform Type: Lower Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: NNW
 Soil Type: Sandy Clay Loam
 Soil Colour: grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Weeds, (other) - Historical logging
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo mid open forest over Ehrharta longiflora and Vulpia bromoides low isolated clumps of tussock grasses over Trachymene pilosa and Romulea rosea over isolated clumps of forbs.

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	0.3	0.1
* <i>Aira cupaniana</i>	0.1	0.1
<i>Arthropodium curvipes</i>	0.2	0.1
<i>Austrostipa elegantissima</i>	0.4	0.2
* <i>Bromus diandrus</i>	0.2	0.1
<i>Daucus glochidiatus</i>	0.1	0.1
* <i>Ehrharta longiflora</i>	0.2	4
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	55
* <i>Freesia</i> sp.	0.2	0.1
<i>Lagenophora huegelii</i>	0.1	0.1
* <i>Lysimachia arvensis</i>	0.1	0.1

<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	0.1	0.1
<i>Oxalis perennans</i>	0.1	0.5
<i>Rhodanthe laevis</i>	0.1	0.1
* <i>Romulea rosea</i>	0.2	1.5
<i>Thysanotus patersonii</i>		0.8
<i>Trachymene pilosa</i>	0.1	3
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	0.1
* <i>Vulpia bromoides</i>	0.2	0.5

PHOTOS



Site Name: DMR10
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512136.3E 6259201.82N
 Landform Type: Lower Slope
 Slope Class: Level (0°)
 Soil Type: Sandy Clay Loam
 Soil Colour: grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm, 6-20mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
 Disturbance: Clearing, Extensive Clearing, Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo low open woodland over Avena barbata and Ehrharta longiflora low closed tussock grassland over Romulea rosea low isolated clumps of forbs.

SITE POINTS

Label	Easting	Northing	Comments
Other	512136	6259202	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	0.5	0.2
* <i>Arctotheca calendula</i>	0.1	0.2
* <i>Asparagus asparagoides</i>	0.2	0.1
* <i>Avena barbata</i>	0.3	80
* <i>Ehrharta calycina</i>	0.4	0.1
* <i>Ehrharta longiflora</i>	0.2	0.5
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	2.5	12
* <i>Romulea rosea</i>	0.2	5

PHOTOS



Site Name: DMR11
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512164.87E 6259256N
 Landform Type: Lower Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: E
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Grazing - sheep, Weeds
 Fire: >20yrs
 Habitat: Corymbia calophylla and Eucalyptus wandoo subsp. wandoo mid open forest over Avena barbata and Ehrharta longiflora low closed tussock grassland over Romulea rosea isolated forbs.
 Comments: This vegetation unit fringes northern boundary of clearing at a width of 50m before returning to Eucalyptus wandoo woodland (also degraded N of here: high weed density).

SITE POINTS

Label	Easting	Northing	Comments
Other	512165	6259256	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Avena barbata</i>	0.3	0.5
<i>Bossiaea eriocarpa</i>	0.4	0.1
<i>Corymbia calophylla</i>	14	15
<i>Drosera glanduligera</i>	0.1	0.1
* <i>Ehrharta longiflora</i>	0.3	75

<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	16	20
* <i>Hypochaeris glabra</i>	0.1	0.1
* <i>Romulea rosea</i>	0.3	6
<i>Thelymitra</i> sp.	0.2	0.1

PHOTOS



Site Name: DMR12
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512199.27E 6259372.71N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: E
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo and Eucalyptus astringens subsp. astringens mid open woodland over Vulpia bromoides low isolated clumps of tussock grasses.
 Comments: Condition transitions to degraded along fence line to the East (this condition bands along fence at a width of 50m).

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Aira cupaniana</i>	0.1	0.1
* <i>Ehrharta longiflora</i>	0.2	0.2
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	14	11
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	14	10
* <i>Lolium rigidum</i>	0.3	0.1
<i>Trachymene pilosa</i>	0.1	0.1
* <i>Vulpia bromoides</i>	0.2	0.5

PHOTOS



Site Name: DMR13
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512136.55E 6259405.39N
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo low open forest over Vulpia bromoides isolated clumps of tussock grasses over Romulea rosea and Milltoia tenuifolia subsp. tenuifolia low forbs.
 Comments: This vegetation type (characterised by no Euc golden bark) extends to the N

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Aira cupaniana</i>	0.1	0.1
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	8	38
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	0.1	0.5
<i>Rhodanthe laevis</i>	0.1	0.1
* <i>Romulea rosea</i>	0.2	0.5
<i>Thysanotus patersonii</i>		0.1
* <i>Vulpia bromoides</i>	0.2	3

PHOTOS



Site Name: DMR14
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512178.69E 6259491.04N
 Landform Type: Lower Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: N
 Soil Type: Sandy Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo mid woodland over Vulpia bromoides and Ehrharta longiflora low open tussock grassland.
 Comments: This veg type extends to the N extent of the study area. Condition change from G to D happens halfway between DMR13 and DMR14.

SITE POINTS

Label	Easting	Northing	Comments
Other	512179	6259491	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Aira cupaniana</i>	0.1	0.1
* <i>Arctotheca calendula</i>	0.1	0.1
<i>Crassula colorata</i>	0.1	0.1
* <i>Ehrharta longiflora</i>	0.3	4
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	14	14
* <i>Freesia</i> sp.	0.2	0.1

* <i>Petrorhagia dubia</i>	0.1	0.1
* <i>Vulpia bromoides</i>	0.3	18

PHOTOS



Site Name: DMR15
 Site Type: RELEVE
 Survey Date: 26/10/2024
 GPS Location: GDA2020 Zone 50 511648.33E 6259950.5N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: SSW
 Soil Type: Sandy Clay Loam
 Soil Colour: Brown
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: 10-20%
 CF Sizes: 2-6mm, 6-20mm, 20-60mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo mid open forest over Banksia sessilis subsp. sessilis tall isolated clumps of shrubs over Styphelia erectifolia, Bossia eriocarpa, Acacia lasiocarpa var. bracteolata and Dillwynia laxiflora low sparse shrubland over Lepidosperma pubisquameum isolated clumps of rushes over Ehrharta calycina and Ehrharta longiflora low isolated clumps of tussock grasses with Desmocladus asper low isolated clumps of herbs.
 Comments: Roadside verge 15m-20m wide, WW TEC?

SITE POINTS

Label	Easting	Northing	Comments
Other	511648	6259951	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	0.2	2
* <i>Aira cupaniana</i>	0.1	0.2

* <i>Asparagus asparagoides</i>	0.1	0.1
<i>Banksia sessilis</i> var. <i>sessilis</i>	2.5	0.5
<i>Billardiera fusiformis</i>	0.6	0.1
<i>Bossiaea eriocarpa</i>	0.3	0.5
* <i>Briza maxima</i>	0.1	0.1
<i>Chamaescilla versicolor</i>	0.2	0.1
<i>Desmocladius asper</i>	0.2	1
<i>Dianella revoluta</i>	0.4	0.1
<i>Dillwynia laxiflora</i>	0.6	0.5
<i>Drosera</i> sp. Branched styles (S.C. Coffey 193)		0.1
* <i>Ehrharta calycina</i>	0.3	0.5
* <i>Ehrharta longiflora</i>	0.2	0.5
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	14	47
<i>Hibbertia commutata</i>	0.2	0.1
<i>Jacksonia sternbergiana</i>	2.5	0.2
<i>Lepidosperma pubisquameum</i>	0.3	0.5
<i>Patersonia</i> sp.	0.3	0.1
* <i>Sonchus oleraceus</i>	0.1	0.1
<i>Styphelia erectifolia</i>	0.2	6
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	0.4	0.1

PHOTOS



Site Name: DMR16
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511840.76E 6259870.77N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: S
 Soil Type: Sandy Clay Loam
 Soil Colour: grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo and Eucalyptus astringens subsp. astringens mid open forest over Banksia sessilis subsp. sessilis tall isolated clumps of shrubs over Billardiera venusta, Dodonaea ?pinifolia and Bossiaea ornata low isolated clumps of shrubs over Ehrharta calycina and Ehrharta longiflora low tussock grassland.
 Comments: WW TEC?

SITE POINTS

Label	Easting	Northing	Comments
Other	511841	6259871	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Asparagus asparagoides</i>	0.3	0.5
<i>Banksia sessilis</i> var. <i>sessilis</i>	3	2
<i>Billardiera fusiformis</i>	0.5	0.2
<i>Billardiera venusta</i>		0.5

<i>Bossiaea ornata</i>	0.2	0.5
<i>Dianella revoluta</i>	0.3	0.2
<i>Dodonaea ?pinifolia</i>	0.5	0.5
* <i>Ehrharta calycina</i>	0.5	45
* <i>Ehrharta longiflora</i>	0.3	0.5
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	13	2
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	35
<i>Gastrolobium praemorsum</i>		0.1
* <i>Lysimachia arvensis</i>	0.1	0.1
<i>Styphelia erectifolia</i>	0.2	0.1

PHOTOS



Site Name: DMR17
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511858.16E 6259869.86N
 Landform Type: Mid Slope
 Slope Class: Very Gently Inclined (1°)
 Aspect: S
 Soil Type: Sandy Clay Loam
 Soil Colour: grey (other)
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus marginata and Eucalyptus wandoo subsp. wandoo mid woodland over Allocasuarina huegeliana and Banksia sessilis subsp. sessilis low woodland over Billardiera fusiformis and Hypocalymma angustifolia mid isolated clumps of shrubs over Ehrharta calycina low tussock grassland over Gastrolobium praemorsum isolated clumps of vines.
 Comments: Transitions out of WW TEC?, this vegetation type continues E along road verge till cleared area (visible on sat). Double check this comment against location of mapping note at WP157.

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>	1	0.1
<i>Allocasuarina huegeliana</i>	5.5	12
* <i>Asparagus asparagoides</i>		0.1
<i>Banksia sessilis</i> var. <i>sessilis</i>	3.2	2
<i>Billardiera fusiformis</i>	1.1	0.5
<i>Bossiaea ornata</i>	0.3	0.2

<i>*Briza maxima</i>	0.2	0.1
<i>Dampiera sacculata</i>	0.3	0.3
<i>Dodonaea ?pinifolia</i>	0.3	0.2
<i>Drosera</i> sp. Branched styles (S.C. Coffey 193)		0.1
<i>*Ehrharta calycina</i>	0.5	35
<i>*Ehrharta longiflora</i>	0.2	0.2
<i>Eucalyptus marginata</i> subsp. <i>marginata</i>	16	20
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	14	4
<i>Gastrolobium praemorsum</i>		5
<i>Hypocalymma angustifolium</i>	1.3	1
<i>*Lolium rigidum</i>	0.3	0.1
<i>Oxalis perennans</i>	0.1	0.1
<i>*Romulea rosea</i>	0.2	0.1
<i>Styphelia erectifolia</i>	0.3	0.1
<i>Thysanotus patersonii</i>		0.1
<i>Xanthorrhoea ?preissii</i>	1.1	0.2

PHOTOS



Site Name: DMR18
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 513006.94E 6259514.78N
 Landform Type: Flat
 Slope Class: Level (0°)
 Aspect: None
 Soil Type: Sandy Loam
 Soil Colour: Grey
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: 2-10%
 CF Sizes: 2-6mm, 6-20mm
 CF Types: Laterite
 Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
 Disturbance: Weeds
 Habitat: Eucalyptus camaldulensis, Acacia saligna and Allocasuarina huegeliana low open woodland over Jacksonia sternbergiana tall isolated clumps of shrubs over Ehrharta calycina and Ehrharta longiflora low tussock grassland over Arctotheca calendula and Romulea rosea isolated clumps of forbs.

SITE POINTS

Label	Easting	Northing	Comments
Other	513007	6259515	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia saligna</i>	5	2
<i>Allocasuarina huegeliana</i>	5	2
* <i>Arctotheca calendula</i>	0.2	2
* <i>Ehrharta calycina</i>	0.6	30
* <i>Ehrharta longiflora</i>	0.3	5
<i>Eucalyptus camaldulensis</i>	10	4
* <i>Hypochaeris glabra</i>	0.1	0.1

<i>Jacksonia sternbergiana</i>	3	0.5
<i>Kennedia prostrata</i>		0.1
* <i>Romulea rosea</i>	0.2	1
* <i>Sonchus oleraceus</i>	0.1	0.2
* <i>Vulpia bromoides</i>	0.2	1

PHOTOS



Site Name: DMR19
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 513928.71E 6259119.87N
 Landform Type: Flat
 Slope Class: Level (0°)
 Aspect: None
 Soil Type: Sandy Loam
 Soil Colour: Grey
 Soil Condition: Dry
 Rock Outcrop: No bedrock exposed
 CF Abundance: <2%
 CF Sizes: 2-6mm
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo subsp. wandoo low woodland over Allocasuarina huegeliana and Acacia acuminata and Eucalyptus wandoo subsp. wandoo low open forest over Ehrharta longiflora tussock grassland over Romulea rosea and Oxalis purpurea sparse forbland.
 Comments: Not on road verge, aligns side of paddock. This veg type continues from study area protrusion to start of road verge. Not WW TEC.

SITE POINTS

Label	Easting	Northing	Comments
Other	513929	6259120	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia acuminata</i>	6.5	2
<i>Allocasuarina huegeliana</i>	5	21
<i>Corymbia calophylla</i>	6.5	0.2
* <i>Ehrharta longiflora</i>	0.2	35

<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	16	21
<i>Hakea prostrata</i>	3	0.2
* <i>Oxalis purpurea</i>	0.1	0.5
* <i>Romulea rosea</i>	0.2	5

PHOTOS



Site Name: DMR20
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 513776E 6259184.63N
 Aspect: None
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Weeds
 Fire: >20yrs
 Habitat: Corymbia calophylla and Eucalyptus wandoo subsp. wandoo mid woodland over Allocasuarina huegeliana low woodland over Hakea prostrata tall isolated clumps of shrubs over Ehrharta longiflora low open tussock grassland over Gastrolobium praemorsum isolated clumps of vines.
 Comments: Not WW TEC

SITE POINTS

Label	Easting	Northing	Comments
Other	513776	6259185	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia acuminata</i>	3	0.2
<i>Allocasuarina huegeliana</i>	8	25
<i>Austrostipa elegantissima</i>	0.3	0.1
<i>Corymbia calophylla</i>	17	20
* <i>Ehrharta longiflora</i>	0.2	25
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	11	2
<i>Gastrolobium praemorsum</i>		0.5
<i>Hakea prostrata</i>	3.5	0.5
* <i>Romulea rosea</i>	0.2	0.1
<i>Xanthorrhoea ?preissii</i>	0.5	0.2

PHOTOS



Site Name: DMR21
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511959.97E 6259344.08N
 Vegetation Condition: Combined Vegetation Condition - D - Degraded
 Habitat: Eucalyptus wandoo subsp. wandoo mid woodland over low hummock grassland of pastoral weeds (total 45% cover).
 Comments: Weed covers not listed in species listed. Total weed coverage = 45% (mostly pastoral grasses)

SITE POINTS

Label	Easting	Northing	Comments
Other	511960	6259344	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Chamaescilla versicolor</i>	0.2	0.1
<i>Dichopogon capillipes</i>	0.4	0.1
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	20
<i>Neurachne alopecuroidea</i>	0.2	0.1
<i>Podolepis aristata</i> subsp. <i>aristata</i>	0.2	2
<i>Styphelia erectifolia</i>	0.4	0.1
<i>Thelymitra</i> sp.	0.2	0.1
<i>Thysanotus patersonii</i>		0.1

PHOTOS



Site Name: DMR22
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 512200.41E 6259325.7N
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Disturbance: Clearing - Historical, Weeds
 Fire: >20yrs
 Habitat: Eucalyptus wandoo mid open forest over Ehrharta longifolia, Vulpia bromoides and Aira cupaniana low sparse tussock grassland over Romulea rosea and Rhodanthe laevis low isolated clumps of forbs.

SITE POINTS

Label	Easting	Northing	Comments
Other	512200	6259326	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Aira cupaniana</i>	0.2	1
* <i>Ehrharta longiflora</i>	0.2	3
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	35
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	0.1	0.2
<i>Rhodanthe laevis</i>	0.2	0.5
* <i>Romulea rosea</i>	0.2	4
<i>Thysanotus patersonii</i>		0.1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	0.2
* <i>Vulpia bromoides</i>	0.2	3

Site Name: DMR23
 Site Type: RELEVE
 Survey Date: 26/09/2024
 GPS Location: GDA2020 Zone 50 511990.2E 6259166.31N
 Aspect: E
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Habitat: Acacia acuminata tall, isolated clumps of shrubs over Romulea rosea, Arctotheca calendula and Oxalis perennans low forbland.

SITE POINTS

Label	Easting	Northing	Comments
Other	511990	6259166	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia acuminata</i>	3.5	2
* <i>Arctotheca calendula</i>	0.1	0.5
* <i>Avena barbata</i>	0.3	0.1
* <i>Ehrharta calycina</i>	0.4	0.1
<i>Oxalis perennans</i>	0.1	0.5
* <i>Romulea rosea</i>	0.3	60

PHOTOS



Site Name: Mapping note (WP102)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 511980.21E 6259099.46N
Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
Comments: Condition degraded; lateritic bedrock is exposed. Eucalyptus wandoo (DBMOP15) over pastoral weeds.

SITE POINTS

Label	Easting	Northing	Comments
Other	511980	6259099	

SPECIES LIST

No species recorded.

Site Name: Mapping note (WP107)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 512135.16E 6259258.26N
Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
Comments: Corymbia calophylla mid sparse woodland along the boundary of clearing.

SITE POINTS

Label	Easting	Northing	Comments
Other	512135	6259258	

SPECIES LIST

No species recorded.

Site Name: Mapping note (WP109)
 Site Type: MAPPING_NOTE
 Survey Date: 25/09/2024
 GPS Location: GDA2020 Zone 50 512003.74E 6259192.79N
 Vegetation Condition: Southern Vegetation Condition - 4 - Good
 Comments: Eucalyptus wandoo subsp. wandoo low open forest over
 Rytidosperma setaceum low isolated clumps of tussock
 grasses over Romulea rosea isolated clumps of forbs.

SITE POINTS

Label	Easting	Northing	Comments
Other	512004	6259193	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	65
<i>Rhodanthe laevis</i>	0.1	0.1
* <i>Romulea rosea</i>	0.2	0.5
<i>Rytidosperma setaceum</i>	0.3	1

Site Name: Mapping note (WP119)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511889.21E 6259307.46N
Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
Comments: Boundary from Good to Degraded condition. Due to higher weed cover, lower canopy cover. Transitions from DMR07 vegetation (With Eucalyptus wandoo subsp. wandoo and Eucalyptus astringens subsp. astringens) to only Eucalyptus wandoo subsp. wandoo at 30% cover at WP.

SITE POINTS

Label	Easting	Northing	Comments
Other	511889	6259307	

SPECIES LIST

No species recorded.

Site Name: Mapping note (WP122)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511883.45E 6259366.9N
Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
Comments: Cleared woodland over pastoral weeds: *Romulea rosea*,
Arctotheca calendula, and *Neurachne alopecuroidea*. Some
recruitment of *Eucalyptus wandoo* subsp. *wandoo* along the
edge of paddock.

SITE POINTS

Label	Easting	Northing	Comments
Other	511883	6259367	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP124)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511974.95E 6259331.08N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition changes from Degraded to Good, is the same as vegetation detailed in site DMR09.

SITE POINTS

Label	Easting	Northing	Comments
Other	511975	6259331	

SPECIES LIST

No species recorded.

Site Name: Mapping note (WP127)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512032.23E 6259318.82N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition remains good, with 50% overstory cover.

SITE POINTS

Label	Easting	Northing	Comments
Other	512032	6259319	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP128)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512059.72E 6259321.44N
Comments: Overstorey includes both Eucalyptus astringens subsp. astringens and Eucalyptus wandoo subsp. wandoo, with a total canopy cover of 40%.

SITE POINTS

Label	Easting	Northing	Comments
Other	512060	6259321	

SPECIES LIST

No species recorded.

Site Name: Mapping note (WP129)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512121.69E 6259219.47N
Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
Disturbance: Grazing, Clearing, Gravel Pit, Weeds
Comments: Condition drops to completely degraded due to high intensity of historical clearing. This area expands 150m to NNE and 50m SSW from WP. At the northern area, breadth is approximately 120m wide spanning E to W, while in the southern extent, area has an E-W breadth of 50m. Overstory is a mix of Eucalyptus wandoo subsp. wandoo and Eucalyptus astringens subsp. astringens. Also, evidence of mechanical excavation of lateritic gravel.

SITE POINTS

Label	Easting	Northing	Comments
Other	512122	6259219	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP140)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512091.62E 6259443.36N
Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
Comments: Gravel pit

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP142)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512280.51E 6259501.78N
Comments: Veg is the same as site DMR14. Eucalyptus wandoo subsp. wandoo 14m, 30%; Eucalyptus astringens subsp. astringens 14m, 6%; Lolium rigidum (DBMOP32) 0.3m, 0.5%.

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP143)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512317.36E 6259504.17N
Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
Comments: Condition is degraded with 80% weed cover of *Ehrharta longiflora*.

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP146)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512100.76E 6259278.48N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition: good. Eucalyptus astringens subsp. astringens:
12m, 65%; Eucalyptus wandoo subsp. wandoo 6m, 5%.

SITE POINTS

Label	Datum	Easting	Northing	Comments
Other	GDA94	512101	6259278	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP147)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 512074.7E 6259239.27N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition: good. Eucalyptus astringens subsp. astringens:
12m, 65%; Eucalyptus wandoo subsp. wandoo: 6m, 5%

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP152)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511745.19E 6259908.36N
Comments: Same veg type as DMR15.

SITE POINTS

Label	Easting	Northing	Comments
Other	511745	6259908	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP153)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511771.56E 6259898.13N
Comments: Similar vegetation community as DMR15, but has *Eucalyptus astringens* subsp. *astringens* present at 16m, 42% present and *Eucalyptus wandoo* subsp. *wandoo* at 15m, making up 37% coverage.

SITE POINTS

Label	Easting	Northing	Comments
Other	511772	6259898	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP157)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511894.99E 6259857.95N
Comments: Transitions back to Eucalyptus wandoo subsp. wandoo WW
TEC. Vegetation= site DMR15.

SITE POINTS

Label	Easting	Northing	Comments
Other	511895	6259858	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP158)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 511914.04E 6259848.61N
Comments: Returns to vegetation described at site DMR17, with Allocasuarina huegeliana present. One collection taken at site (In species. list).

SITE POINTS

Label	Easting	Northing	Comments
Other	511914	6259849	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Sowerbaea laxiflora</i>	0.2	0.1

PHOTOS



Site Name: Mapping note (WP163)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 513688.77E 6259224.78N
Comments: Vegetation same as that in site DMR20. Additional plants to this are detailed in species list.

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Allocasuarina huegeliana</i>	7	2
<i>Cryptandra arbutiflora</i>	0.2	0.1
<i>Santalum acuminatum</i>	2.5	15

Site Name: Mapping note (WP164)
Site Type: ESA
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 513519.23E 6259306.29N
Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
Comments: Vegetation same as DMR20, with a lower canopy cover, and higher weed cover. *Ehrharta calycina* low closed tussock grassland.

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Acacia saligna</i>	4	0.5
* <i>Ehrharta calycina</i>	0.4	90

PHOTOS



Site Name: Mapping note (WP165)
Site Type: MAPPING_NOTE
Survey Date: 26/09/2024
GPS Location: GDA2020 Zone 50 513320.17E 6259393.27N
Vegetation Condition: Southern Vegetation Condition - 6 - Completely Degraded
Comments: Pastoral weeds and no overstorey/midstorey strata present.

SITE POINTS

Label	Easting	Northing	Comments
Other	513320	6259393	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
<i>Drosera glanduligera</i>	0.1	0.1
* <i>Ehrharta calycina</i>	0.6	70
* <i>Ehrharta longiflora</i>	0.4	10
* <i>Romulea rosea</i>	0.2	5

PHOTOS



Site Name: Mapping note (WP89)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 511872.73E 6259152.59N
Comments: Southern edge of Canola crop. Crop lobes in an E-W orientation to the N of the WP.

SITE POINTS

Label	Easting	Northing	Comments
Other	511873	6259153	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP91)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 511832.03E 6259099.76N
CF Abundance: >90%
CF Sizes: 2-6mm, 6-20mm
CF Types: Laterite
Vegetation Condition: Combined Vegetation Condition - D - Degraded
Comments: Low canopy cover of Eucalyptus wandoo subsp. wandoo due to cutting of mature trees, no midstory over 6% pastoral weeds. Stumps remain, over mostly bare lateritic gravel. Degraded area expands N and S of WP for 50m either side. Approx 4% cover of Eucalyptus wandoo subsp. wandoo.

SITE POINTS

Label	Easting	Northing	Comments
Other	511832	6259100	

SPECIES LIST

No species recorded.

PHOTOS



Site Name: Mapping note (WP96)
 Site Type: MAPPING_NOTE
 Survey Date: 25/09/2024
 GPS Location: GDA2020 Zone 50 511672.37E 6259327.8N
 Vegetation Condition: Southern Vegetation Condition - 5 - Degraded
 Comments: Eucalyptus astringens subsp. astringens and Eucalyptus wandoo subsp. wandoo mid tall open woodland over low pastoral weeds.

SITE POINTS

Label	Easting	Northing	Comments
Other	511672	6259328	

SPECIES LIST

Taxon Name	Avg. Height	Cover Alive
* <i>Ehrharta longiflora</i>	0.3	15
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	12	
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	12	
* <i>Lolium rigidum</i>	0.3	17
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	0.01

Site Name: Mapping note (WP97)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 511655.55E 6259347N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition changes from degraded to good. Veg =DMR01

SITE POINTS

Label	Easting	Northing	Comments
Other	511656	6259347	

SPECIES LIST

No species recorded.

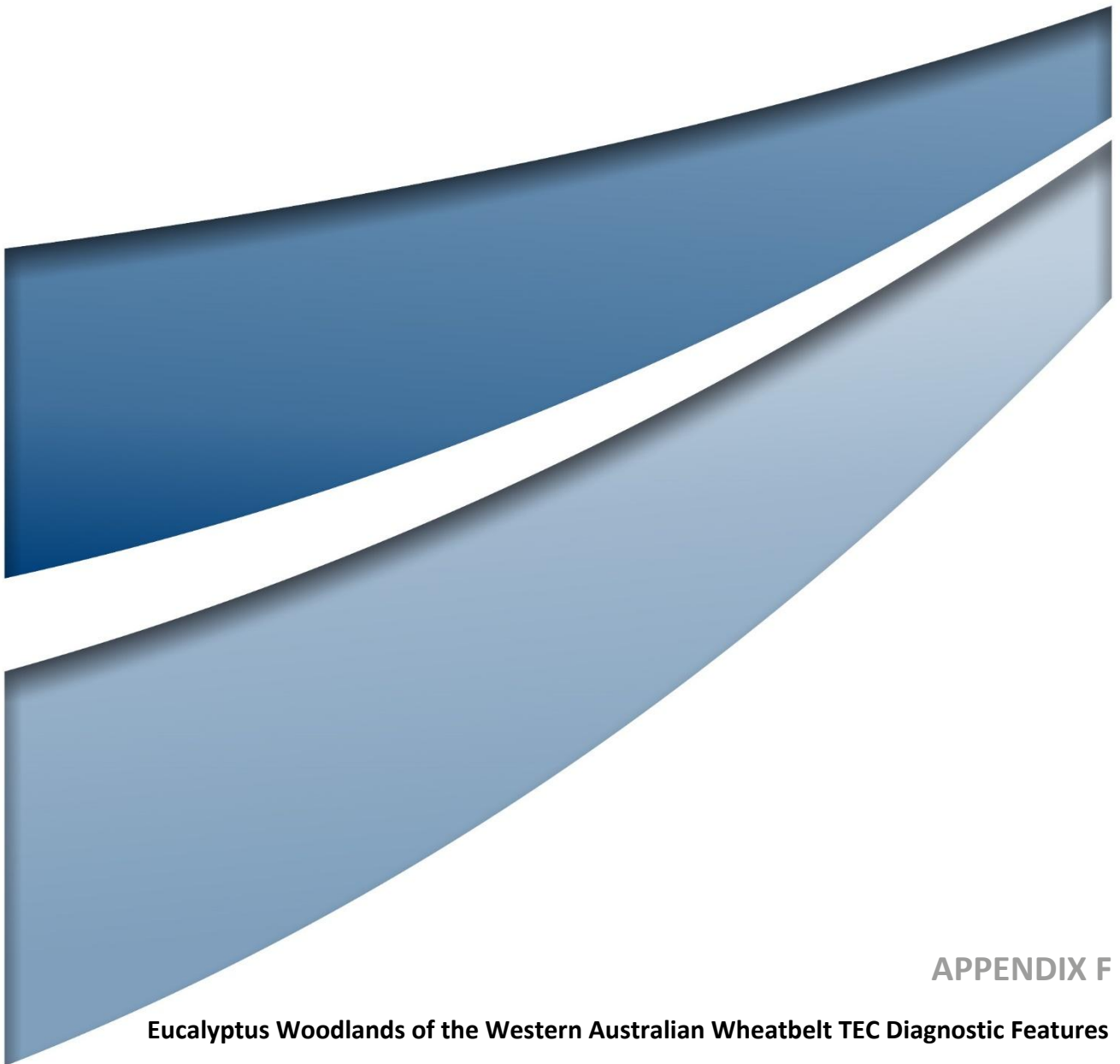
Site Name: Mapping note (WP99)
Site Type: MAPPING_NOTE
Survey Date: 25/09/2024
GPS Location: GDA2020 Zone 50 511606.42E 6259359.48N
Vegetation Condition: Southern Vegetation Condition - 4 - Good
Comments: Condition returns from Degraded to Good.

SITE POINTS

Label	Easting	Northing	Comments
Other	511606	6259359	

SPECIES LIST

No species recorded.



APPENDIX F

Eucalyptus Woodlands of the Western Australian Wheatbelt TEC Diagnostic Features

The following key diagnostic features of the TEC are taken from DoE (2015). With this conservation advice document in mind, as stated on page 19 of DoE (2015):

- ‘For EPBC Act referral, assessment and compliance purposes, the national ecological community is limited to patches that meet the key diagnostic characteristics in section 3.2. PLUS the condition thresholds in section 3.3. The additional factors noted in section 3.4. and critical areas noted in section 3.5. also should be taken into consideration.’
- Key Diagnostic Characteristics of the ecological community (as per Section 3.2 of DoE (2015) and incorporating a summary of relevant general notes as per Section 3.22 of DoE (2015)).
- The key diagnostic characteristics are based on location, structure of the upper stratum, species in the upper stratum and understorey components.

The distribution of the ecological community is limited to these IBRA bioregions and subregions:

- Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning;
- Mallee - MAL02 Western Mallee only; and
- Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. They are effectively an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats.

The ecological community generally occurs within the 300 – 600 mm rainfall isohyets. Within the Jarrah Forest bioregion, the ecological community occurs on landscapes that fall below the 600 mm isohyet, are off the Darling Range, associated with the Yilgarn Craton geology and are generally heavily cleared.

The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque).

Note: The maximum tree canopy cover usually is up to 40%. It may be higher in certain circumstances, for instance: trees with a mallet growth form may be more densely spaced; or disturbances such as fire may result in an increased cover of canopy species during regeneration.

Recent disturbances, such as fire, may cause the loss of a mature tree canopy and a shift to a different, regenerative state for a woodland. Under these circumstances, the loss of a tree canopy is likely to be a temporary phenomenon, if natural regeneration is not interrupted. There should be evidence that: (1) the key eucalypt species typical of the ecological community were formerly present at a site by the presence of stumps, logs, photos, past surveys/knowledge; and (2) that the tree canopy will regenerate from seedlings, saplings or epicormic regrowth. Some wheatbelt woodland eucalypts, including the mallets, gimlet and salmon gum, are killed by fire and regenerate from seeds only, so it may take decades for a mature woodland structure to re-establish (Gosper et al., 2013). This temporary regenerative state is included as part of the ecological community where seedling and sapling eucalypts are clearly present and the other diagnostic features and condition thresholds are met.

The key species of the tree canopy are species of *Eucalyptus* as identified as per **Table E.1**. These are species that typically have a single trunk. One or more of the tree species in **Table E.1** are dominant or co-dominant within a patch of the ecological community. If other species are present in the tree canopy (e.g. species in

Table E.2 or other taxa) then these collectively do not occur as dominants in the tree canopy.

Note: Some woodlands may have a lower tree layer of mallee or non-eucalypt tree species. In this case, the upper tree canopy must comprise mainly of key woodland species in Table 2a and have an upper canopy cover of 10% or more. This helps distinguish woodland with a mallee subcanopy from true mallee communities which may have woodland trees as sparse or occasional emergents.

A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in section 2.3.2 (of DoE (2015)) and in

Table E.2.

Note: Given the WA wheatbelt is a region of high natural biodiversity, this plant species list does not include all plant species that may be encountered in the WA Wheatbelt woodland ecological community.

Contra-indicators: the presence of the following features in the vegetation indicates that the ecological community is not likely to be present:

- A dominant presence of eucalypts with a mallee growth form. However, mallee species can occur as an understorey or minor canopy component of the ecological community, as noted in the diagnostic features, above.
- A dominant presence of non-eucalypt species in the tree canopy, for instance *Acacia acuminata* (Jam) or *Allocasuarina huegeliana* (Rock sheoak). However, these non-eucalypt species can be present as an understorey or minor canopy component of the ecological community.
- Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as ‘derived’ or ‘secondary’ vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland, noted in the diagnostic features, above.
- Woodlands that have the same key eucalypt species but occur in adjacent bioregions, notably the Coolgardie, Esperance Sandplains, Yalgoo and Geraldton Sandplains bioregions. These are not part of the national ecological community. All woodlands that occur in bioregions outside the wheatbelt, as defined in this conservation advice, are not part of the WA Wheatbelt Woodland ecological community.
- Woodlands dominated by eucalypts that are restricted to granite outcrops and rocky rises, for instance *Eucalyptus caesia* (Caesia or Gungurru). However, some woodlands occur on the base around rock outcrops, but not on the actual outcrop, and these may be part of the ecological community, for instance York gum – jam woodlands.

Table E.1 Key Eucalypt Species (presented as Table 2a in DoEE (2015))

Scientific Name	Common Name/s
<i>Eucalyptus accedens</i>	Powder-bark; powder-bark wandoo

Scientific Name	Common Name/s
<i>Eucalyptus aequioperta</i>	Welcome Hill gum
<i>Eucalyptus alipes</i>	Hyden mallet
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	Brown mallet
<i>Eucalyptus capillosa</i>	Wheatbelt wandoo
<i>Eucalyptus densa</i> subsp. <i>densa</i>	Narrow-leaved blue mallet
<i>Eucalyptus extensa</i>	Yellow mallet
<i>Eucalyptus falcata</i>	Silver mallet
<i>Eucalyptus gardneri</i> subsp. <i>gardneri</i>	Blue mallet
<i>Eucalyptus goniocarpa</i>	Lake King mallet
<i>Eucalyptus kondininensis</i>	Kondinin blackbutt
<i>Eucalyptus longicornis</i>	Red morrel
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	York gum
<i>Eucalyptus melanoxylon</i>	Black morrel
<i>Eucalyptus mimica</i> subsp. <i>continens</i>	Hooded mallet
<i>Eucalyptus mimica</i> subsp. <i>mimica</i>	Newdegate mallet
<i>Eucalyptus myriadena</i>	Small-fruited gum; blackbutt
<i>Eucalyptus occidentalis</i>	Flat-topped yate
<i>Eucalyptus ornata</i>	Ornamental silver mallet; ornate mallet
<i>Eucalyptus recta</i>	Mt Yule silver mallet; Cadoux mallet
<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	Flooded gum
<i>Eucalyptus salicola</i>	Salt gum; salt salmon gum
<i>Eucalyptus salmonophloia</i>	Salmon gum
<i>Eucalyptus salubris</i>	Gimlet
<i>Eucalyptus sargentii</i> subsp. <i>sargentii</i>	Salt river gum
<i>Eucalyptus singularis</i>	Ridge-top mallet
<i>Eucalyptus spathulata</i> subsp. <i>spathulata</i>	Swamp mallet
<i>Eucalyptus spathulata</i> subsp. <i>salina</i>	Salt River mallet
<i>Eucalyptus urna</i>	Merrit
<i>Eucalyptus wandoo</i> subsp. <i>pulverea</i>	Wandoo
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	Wandoo

Table E.2 Associated Canopy Species That May Be Present Within the Ecological Community But Are Not Dominant Or Co-dominant (presented as Table 2b in DoEE (2015))

Scientific Name	Common Name/s
<i>Acacia acuminata</i>	Jam
<i>Allocasuarina huegeliana</i>	Rock sheoak
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus annulata</i>	Prickly-fruited mallee
<i>Eucalyptus arachnaea</i> subsp. <i>arachnaea</i>	Black-stemmed mallee

Scientific Name	Common Name/s
<i>Eucalyptus arachnaea</i> subsp. <i>arrecta</i>	Black-stemmed mallet
<i>Eucalyptus armillata</i>	Flanged mallet
<i>Eucalyptus calycogona</i> subsp. <i>calycogona</i>	Square-fruited mallee
<i>Eucalyptus camaldulensis</i> subsp. <i>arida</i>	River red gum
<i>Eucalyptus celastroides</i> subsp. <i>virella</i>	Wheatbelt mallee
<i>Eucalyptus cylindrifolia</i>	Goldfields white mallee
<i>Eucalyptus decipiens</i>	Redheart; moit
<i>Eucalyptus drummondii</i>	Drummond's mallee
<i>Eucalyptus eremophila</i>	Sand mallee
<i>Eucalyptus erythronema</i> subsp. <i>erythronema</i>	Red-flowered mallee
<i>Eucalyptus eudesmioides</i>	Kalbarri mallee
<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i>	Flockton's mallee
<i>Eucalyptus gittinsii</i> subsp. <i>illucida</i>	Northern sandplain mallee
<i>Eucalyptus incrassata</i>	Ridge-fruited mallee
<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>	Trayning mallee
<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>	Merredin mallee; Tammin mallee
<i>Eucalyptus loxophleba</i> subsp. <i>gratae</i>	Lake Grace mallee
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	Smooth-barked York gum
<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	Blackbutt York gum
<i>Eucalyptus macrocarpa</i>	Mottlecah
<i>Eucalyptus marginata</i>	Jarrah
<i>Eucalyptus moderata</i>	Redwood mallee
<i>Eucalyptus obtusiflora</i>	Dongara mallee
<i>Eucalyptus olivine</i>	Olive-leaved mallee
<i>Eucalyptus orthostemon</i>	Diverse mallee
<i>Eucalyptus perangusta</i>	Fine-leaved mallee
<i>Eucalyptus phaenophylla</i>	Common southern mallee
<i>Eucalyptus phenax</i> subsp. <i>phenax</i>	White mallee
<i>Eucalyptus pileata</i>	Capped mallee
<i>Eucalyptus platypus</i> subsp. <i>platypus</i>	Moort
<i>Eucalyptus polita</i>	Parker Range mallet
<i>Eucalyptus sheathiana</i>	Ribbon-barked mallee
<i>Eucalyptus sporadica</i>	Burngup mallee
<i>Eucalyptus subangusta</i> subsp. <i>subangusta</i>	Grey mallee
<i>Eucalyptus tenera</i>	Glazed mallee
<i>Eucalyptus tephroclada</i>	Holleton mallee
<i>Eucalyptus thamnoides</i>	Brown mallee
<i>Eucalyptus transcontinentalis</i>	Redwood
<i>Eucalyptus vegrandis</i>	Ongerup mallee; Cranbrook mallee
<i>Eucalyptus wubinensis</i>	Wubin mallee

Scientific Name	Common Name/s
<i>Eucalyptus yilgarnensis</i>	Yorrel

Table E.3 Understorey Shrubs, Chenopods and Forbs (compiled from Table A1 of DoEE (2015))

Scientific name [^]	Common Name/s
Shrubs	
<i>Acacia acuaria</i>	
<i>Acacia colletioides</i>	Wait-a-while
<i>Acacia erinacea</i>	
<i>Acacia hemiteles</i>	
<i>Acacia lasiocalyx</i>	Silver wattle
<i>Acacia lasiocarpa</i>	Panjang
<i>Acacia leptospermoides</i>	
<i>Acacia mackeyana</i>	
<i>Acacia merrallii</i>	
<i>Acacia microbotrya</i>	Manna wattle
<i>Acacia pulchella</i>	Prickly moses
<i>Allocasuarina acutivalvis</i>	
<i>Allocasuarina campestris</i>	
<i>Allocasuarina humilis</i>	Dwarf sheoak
<i>Allocasuarina lehmanniana</i>	Dune sheoak
<i>Allocasuarina microstachya</i>	
<i>Argyrolottis turbinata</i>	
<i>Banksia armata</i>	Prickly dryandra
<i>Banksia sessilis</i>	Parrot bush
<i>Beyeria brevifolia</i>	
<i>Bossiaea divaricata</i>	
<i>Bossiaea eriocarpa</i>	Common brown pea
<i>Bossiaea halophila</i>	
<i>Callistemon phoeniceus</i>	Lesser bottlebrush
<i>Calothamnus quadrifidus</i>	One-sided bottlebrush
<i>Calothamnus quadrifidus</i> subsp. <i>asper</i>	One-sided bottlebrush
<i>Chorilaena rudis</i>	
<i>Comesperma integerrimum</i>	
<i>Conostylis setigera</i>	
<i>Dampiera lavandulacea</i>	
<i>Darwinia</i> sp. Karonie (K. Newbey 8503)	
<i>Daviesia nematophylla</i>	
<i>Daviesia triflora</i>	

Scientific name^	Common Name/s
<i>Dodonaea bursariifolia</i>	
<i>Dodonaea inaequifolia</i>	
<i>Dodonaea pinifolia</i>	
<i>Dodonaea viscosa</i>	Sticky hopbush
<i>Eremophila decipiens</i>	Slender fuschia
<i>Eremophila ionantha</i>	Violet-flowered eremophila
<i>Eremophila oppositifolia</i>	Weeooka
<i>Eremophila scoparia</i>	Broom bush
<i>Exocarpus aphyllus</i>	Leafless ballart
<i>Gastrolobium microcarpum</i>	Sandplain poison
<i>Gastrolobium parviflorum</i>	Box poison
<i>Gastrolobium spinosum</i>	Prickly poison
<i>Gastrolobium tricuspdatum</i>	
<i>Gastrolobium trilobum</i>	Bullock poison
<i>Grevillea acuaria</i>	
<i>Grevillea huegelii</i>	
<i>Grevillea tenuiflora</i>	Tassel grevillea
<i>Hakea laurina</i>	Pincushion hakea
<i>Hakea lissocarpha</i>	Honey bush
<i>Hakea multilineata</i>	Grass-leaf hakea
<i>Hakea petiolaris</i>	Sea urchin hakea
<i>Hakea preissii</i>	Needle tree
<i>Hakea varia</i>	Variable-leaved hakea
<i>Hibbertia commutata</i>	
<i>Hibbertia exasperata</i>	
<i>Hibbertia hypericoides</i>	Yellow buttercups
<i>Hovea chorizemifolia</i>	Holly-leaved hovea
<i>Hypocalymma angustifolium</i>	White myrtle
<i>Leptomeria preissiana</i>	
<i>Leptospermopsis erubescens</i>	Roadside teatree
<i>Lycium australe</i>	Australian boxthorn
<i>Melaleuca acuminata</i>	
<i>Melaleuca adnata</i>	
<i>Melaleuca atroviridis</i>	
<i>Melaleuca brophyi</i>	
<i>Melaleuca cucullata</i>	
<i>Melaleuca cuticularis</i>	Saltwater paperbark
<i>Melaleuca halmaturorum</i>	
<i>Melaleuca hamata</i>	
<i>Melaleuca hamulosa</i>	

Scientific name^	Common Name/s
<i>Melaleuca lanceolata</i>	Rottnest teatree
<i>Melaleuca lateriflora</i>	Gorada
<i>Melaleuca marginata</i>	
<i>Melaleuca pauperiflora</i>	Boree
<i>Melaleuca radula</i>	Graceful honeymyrtle
<i>Melaleuca raphiophylla</i>	Swamp paperbark
<i>Melaleuca scalena</i>	
<i>Melaleuca strobophylla</i>	
<i>Melaleuca teuthioides</i>	
<i>Melaleuca thyoides</i>	
<i>Melaleuca uncinata</i> group	Broom bush
<i>Melaleuca viminea</i>	Mohan
<i>Olearia muelleri</i>	Goldfields daisy
<i>Olearia</i> sp. Kennedy Range (G. Byrne 7139)	
<i>Petrophile divaricata</i>	
<i>Petrophile shuttleworthiana</i>	
<i>Petrophile squamata</i>	
<i>Petrophile striata</i>	
<i>Phebalium filifolium</i>	Slender phebalium
<i>Phebalium lepidotum</i>	
<i>Phebalium microphyllum</i>	
<i>Phebalium tuberculosum</i>	
<i>Pimelea argentea</i>	Silvery-leaved pimelea
<i>Pittosporum angustifolium</i>	
<i>Platysace maxwellii</i>	Karno
<i>Santalum acuminata</i>	Quandong
<i>Santalum spicatum</i>	Sandalwood
<i>Scaevola spinescens</i>	Currant bush
<i>Senna artemisioides</i>	
<i>Styphelia epacridis</i>	
<i>Styphelia tenuiflora</i>	Common pinheath
<i>Templetonia sulcata</i>	Centipede bush
<i>Trymalium elachophyllum</i>	
<i>Trymalium ledifolium</i>	
<i>Westringia cephalantha</i>	
<i>Xanthorrhoea drummondii</i>	
Chenopods	
<i>Atriplex acutibracteata</i>	Toothed saltbush
<i>Atriplex paludosa</i>	Marsh saltbush
<i>Atriplex semibaccata</i>	Berry saltbush

Scientific name^	Common Name/s
<i>Atriplex stipitata</i>	Mallee saltbush
<i>Atriplex vesicaria</i>	Bladder saltbush
<i>Enchylaena lanata / tomentosa</i> complex	Barrier saltbush
<i>Maireana brevifolia</i>	Small-leaf bluebush
<i>Maireana erioclada</i>	
<i>Maireana marginata</i>	
<i>Maireana trichoptera</i>	Downy bluebush
<i>Rhagodia drummondii</i>	
<i>Rhagodia preissii</i>	
<i>Sclerolaena diacantha</i>	Grey copperburr
<i>Tecticornia</i> spp.	Samphire
<i>Threlkeldia diffusa</i>	Coastal bonefruit
Forbs	
<i>Actinobole uliginosum</i>	Flannel cudweed
<i>Asteridea athrixioides</i>	
<i>Blennospora drummondii</i>	
<i>Borya nitida</i>	Pincushions
<i>Borya sphaerocephala</i>	Pincushions
<i>Brachyscome ciliaris</i>	
<i>Brachyscome lineariloba</i>	
<i>Caesia micrantha</i>	Pale fringe-lily
<i>Caladenia flava</i>	Cowslip orchid
<i>Calandrinia calyptrata</i>	Pink purslane
<i>Calandrinia eremaea</i>	Twining purslane
<i>Calotis hispidula</i>	Bindy eye
<i>Carpobrotus modestus</i>	Inland pigface
<i>Centipeda crateriformis</i> subsp. <i>crateriformis</i>	
<i>Chamaescilla corymbosa</i>	Blue squill
<i>Chamaexeros serra</i>	Little fringe-leaf
<i>Cotula coronopifolia</i>	Waterbuttons
<i>Crassula colorata</i>	Dense stonecrop
<i>Crassula exserta</i>	
<i>Dampiera juncea</i>	Rush-like dampiera
<i>Dampiera lindleyi</i>	
<i>Daucus glochidiatus</i>	Australian carrot
<i>Dianella brevicaulis</i>	
<i>Dichopogon capillipes</i>	
<i>Disphyma crassifolium</i>	Round-leaved pigface
<i>Drosera macrantha</i>	Bridal rainbow
<i>Erodium cygnorum</i>	Blue heronsbill

Scientific name^	Common Name/s
<i>Gilberta tenuifolia</i>	
<i>Gnephosis drummondii</i>	
<i>Gnephosis tenuissima</i>	
<i>Gnephosis tridens</i>	
<i>Gonocarpus nodulosus</i>	
<i>Goodenia berardiana</i>	
<i>Goodenia cycnopotamica</i>	
<i>Helichrysum leucopsideum</i>	
<i>Helichrysum luteoalbum</i>	Jersey cudweed
<i>Lagenophora huegelii</i>	
<i>Lawrencella rosea</i>	
<i>Lepidium rotundum</i>	Veined peppergrass
<i>Podolepis capillaris</i>	Wiry podolepis
<i>Podolepis lessonii</i>	
<i>Podotheca angustifolia</i>	Sticky longheads
<i>Poranthera microphylla</i>	Small poranthera
<i>Pterostylis sanguinea</i>	
<i>Ptilotus spathulatus</i>	
<i>Rhodanthe laevis</i>	
<i>Senecio glossanthus</i>	Slender groundsel
<i>Spergularia marina</i>	
<i>Stylidium calcaratum</i>	Book triggerplant
<i>Thysanotus patersonii</i>	
<i>Trachymene cyanopetala</i>	
<i>Trachymene ornata</i>	spongefruit
<i>Trachymene pilosa</i>	Native parsnip
<i>Waitzia acuminata</i>	Orange immortelle
<i>Zygophyllum ovatum</i>	Dwarf twinleaf
Graminoides	
<i>Amphipogon caricinus / strictus complex</i>	Greybeard grass
<i>Austrostipa elegantissima</i>	
<i>Austrostipa hemipogon</i>	
<i>Austrostipa nitida</i>	
<i>Austrostipa trichophylla</i>	
<i>Centrolepis polygyna</i>	Wiry centrolepis
<i>Desmocladius asper</i>	
<i>Desmocladius flexuosus</i>	
<i>Desmocladius lateriflorus</i>	
<i>Gahnia ancistrophylla</i>	Hook-leaf saw sedge
<i>Gahnia australis</i>	

Scientific name [^]	Common Name/s
<i>Juncus bufonius</i>	Toad rush
<i>Lachnagrostis filiformis</i>	Blowngrass
<i>Lepidosperma leptostachyum</i>	
<i>Lepidosperma resinum</i>	
<i>Lepidosperma sp. aff. tenue</i>	
<i>Lepidosperma tenue</i>	
<i>Lepidosperma viscidum</i>	Sticky sword sedge
<i>Leptocarpus coangustata</i>	
<i>Lomandra effusa</i>	Scented matrush
<i>Lomandra micrantha subsp. micrantha</i>	Small-flower matrush
<i>Lomandra nutans</i>	
<i>Mesomelaena preissii</i>	
<i>Neurachne alopecuroides</i>	Foxtail mulga grass
<i>Rytidosperma caespitosum</i>	
<i>Rytidosperma setaceum group</i>	
<i>Schoenus nanus</i>	Tiny bog-rush
<i>Schoenus sculptus</i>	Gimlet bog-rush
<i>Schoenus subfascicularis</i>	

[^]Note: Names have been updated to reflect current taxonomy where appropriate.

Condition Thresholds for the Ecological Community (as per Section 3.3 of DoE (2015)).

Table E.4 presents the minimum condition for patches of the WA Wheatbelt Woodlands ecological community (as per Table 3 of DoE (2015)). For the purposes of this assessment, minimum patch width for roadsides only has been utilised, due to the nature of the survey area (located within road reserve):

‘For each category, both the weed cover and mature tree presence criteria must apply plus one of either patch size or patch width, depending on whether the patch is a roadside remnant or not.’

Table E.4 Minimum condition thresholds for the Ecological Community

Cover of exotic plants (weeds) AND	Mature trees ¹ AND	Minimum patch size (non-roadside patches) ² OR	Minimum patch width (roadsides only) ³
Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very Good (Keighery, 1994) or a High RCV (RCC, 2015).			
Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees may be present or absent.	2 hectares or more	5 metres or more
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2015), AND retains important habitat features.			

Cover of exotic plants (weeds) AND	Mature trees ¹ AND	Minimum patch size (non-roadside patches) ² OR	Minimum patch width (roadsides only) ³
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 are present with at least 5 trees per 0.5 ha.	2 hectares or more	5 metres or more
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 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 hectares or more	5 metres 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, 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 hectares or more	5 metres or more

Note:

¹: Mature trees have a diameter at breast height (dbh) of 30 cm or above. The dbh for mature trees aligns with the EPBC referral guidelines for the breeding habitat of threatened black cockatoo species (DSEWPoC, 2012). These note that, for salmon gum and wandoo trees, suitable nest hollows can develop in trees with a dbh of 30 cm or more. Note that larger trees may be killed by factors such as intense fire or flood but the patch may still be in reasonable condition if there are immature trees regenerating.

²: The minimum patch size thresholds apply to native vegetation remnants that do not occur along roadsides.

³: Minimum patch width applies only to vegetation remnants along roadsides and tend to be long but narrow. The width here is based on the native understorey component rather than width of the tree canopy. Some allowance must be made for small breaks or variations in native species cover along linear patches. Given the generally open nature of the tree canopy and some understorey structures, a break in the continuity of native vegetation cover of 50 metres or more, is likely to indicate that separate patches are present. An exception is for main, often bitumen-covered, roads that bisect otherwise continuous vegetation; most local government roads in the wheatbelt have a road reserve of 20 metres. In these cases, native vegetation along either side of the road is considered to be a separate patch.

Further information to assist in determination of presence of ecological community.

As per Section 3.4 of DoE (2015), the following further information will apply:

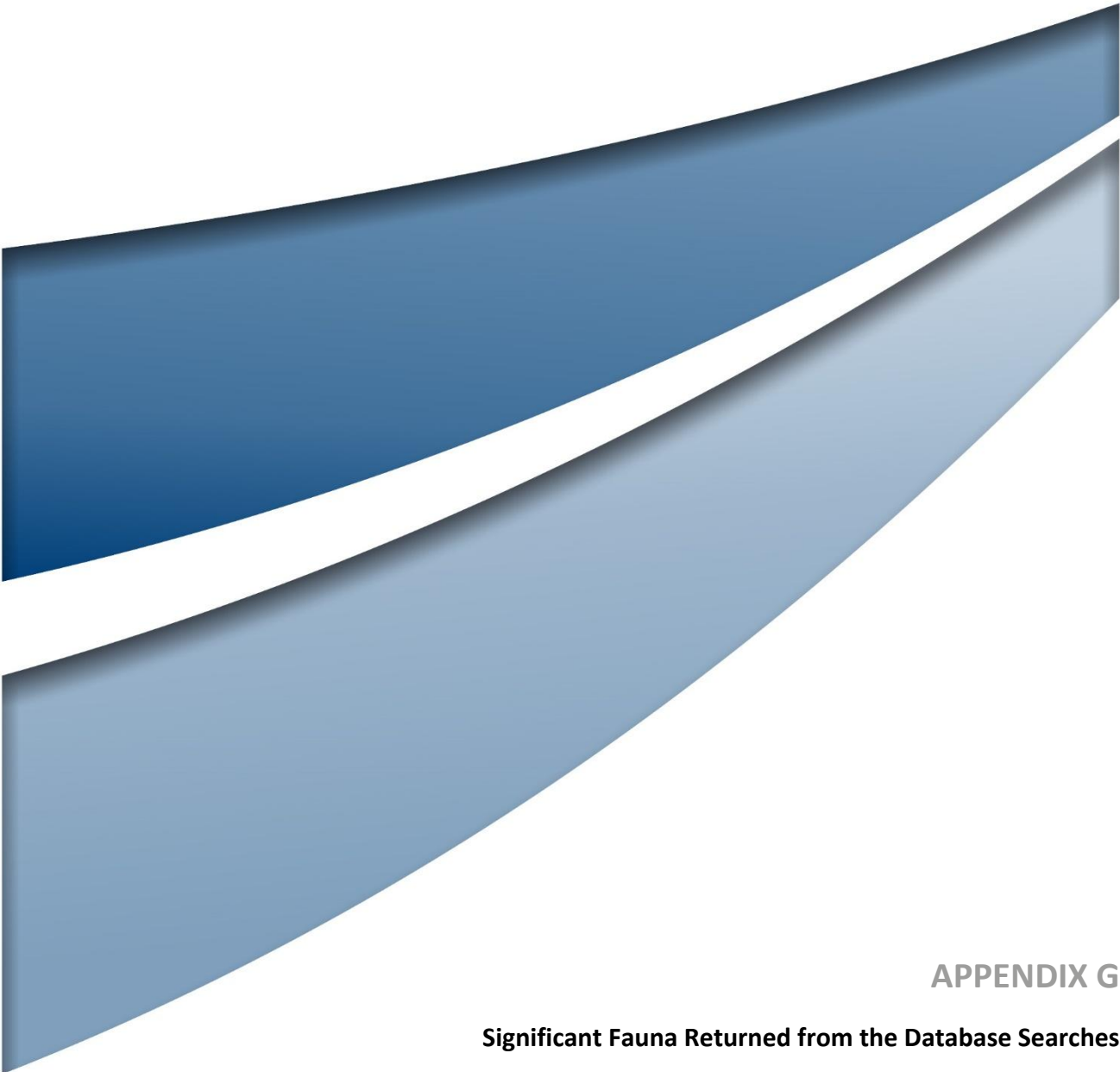
Patch: A patch is defined as a discrete and mostly continuous area of the ecological community. A patch may include small-scale variations and disturbances, such as tracks or breaks, watercourses/drainage lines or localised changes in vegetation that do not act as a permanent barrier or significantly alter its overall functionality. A large break in native vegetation cover, for instance a gap dominated by non-native weed or crop species, is considered to indicate that separate patches occur.

Buffer zone: A buffer zone is the area that lies immediately outside the edge of a patch but is not part of the ecological community. The recommended minimum buffer zone for the ecological community is 40 metres from the edge of a patch as determined from the outer edge of the tree canopy.

Revegetated areas: Revegetated or replanted sites or areas of regrowth are not excluded from the listed ecological community so long as the patch meets the key diagnostic characteristics and condition thresholds.

Sampling protocols: Thorough and representative on-ground surveys are essential to accurately assess the extent and condition of the ecological community. Sampling should begin with a quick reconnaissance to determine the key variations in vegetation, landscape qualities and management history (where possible) across the site. The site should then be thoroughly sampled on a representative basis for vegetation cover and plant species diversity. Sampling based upon an area of at least 10m x 10m, or an equivalently sized shape (i.e. 100 m² = 0.01 ha) would be suitable. Larger and more variable areas of vegetation will need more samples or quadrats to assess a site accurately. Recording the sampling effort (identifying the number of person hours spend per plot across the patch, along with the surveyors' level of expertise) is recommended for referral.

Timing of surveys: Whilst identifying the ecological community and its condition is possible at most times of the year, consideration must be given to the role that season and disturbance history may play in an assessment. For example, flowering may be necessary to identify shrub species; native herbaceous species may not be evident in summer, autumn, or particularly dry winter and spring seasons, and active growth will indicate population sizes of annual weeds. Immediately after a fire one or more vegetation layers, or groups of species (e.g. obligate seeders), may not be evident for a time. Timing of surveys should allow for a reasonable interval after a disturbance (natural or human-induced) to allow for regeneration of species to become evident, and be timed to enable diagnostic species to be identified. At a minimum, it is important to note climate conditions and what kind of disturbance may have happened within a patch, and when that disturbance occurred, as far as possible.



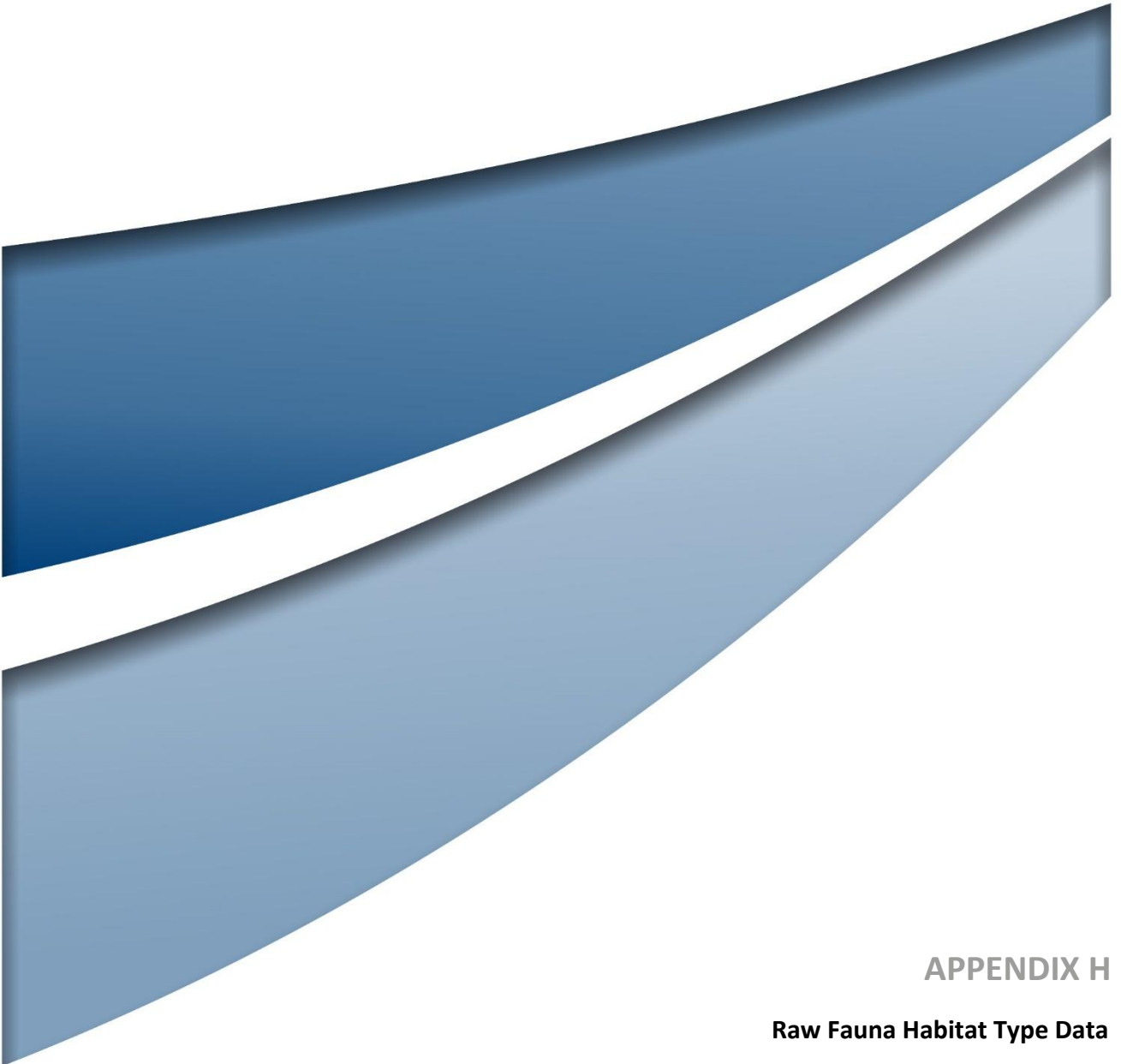
APPENDIX G

Significant Fauna Returned from the Database Searches

Scientific Name	Common Name	WA Status	EPBC Status	Source^
<i>Oxyura australis</i>	Blue-billed Duck	P4		DBCA, NatureMap
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	DBCA, DCCEEW, NatureMap
<i>Thinornis cucullatus</i>	Hooded Plover (Hooded Dotterel)	P4		DBCA
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		VU	ALA, DCCEEW
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	CR	ALA, DCCEEW
<i>Calidris ruficollis</i>	Red-necked Stint	MI	MI	DBCA
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI	DBCA
<i>Tringa glareola</i>	Wood Sandpiper	MI	MI	DBCA
<i>Tringa nebularia</i>	Common Greenshank		EN	ALA, DCCEEW
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	MI	DBCA
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	ALA, DBCA, NatureMap
<i>Ixobrychus dubius</i>	Australian Little Bittern (Black-backed Bittern)	P4		DBCA
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (south-west)	P3		HANZAB (2024), Johnstone and Storr (1998)
<i>Ninox connivens connivens</i>	Barking Owl (southwest)	P3 (southwest population)		DBCA
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	DCCEEW
<i>Falco peregrinus</i>	Peregrine Falcon	S		DBCA, NatureMap
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	DBCA, DCCEEW, NatureMap
<i>Zanda baudinii</i>	Baudin's Cockatoo	EN	EN	ALA, DBCA, DCCEEW, NatureMap
<i>Zanda latirostris</i>	Carnaby's Cockatoo	EN	EN	ALA, DBCA, DCCEEW, NatureMap
<i>Cacatua pastinator pastinator</i>	Muir's Corella	CD		DBCA, NatureMap
<i>Platycercus icterotis xanthogenys</i>	Western Rosella (inland)	P4		DBCA, NatureMap
<i>Aphelocephala leucopsis</i>	Southern Whiteface		VU	DCCEEW
<i>Motacilla tschutschensis</i>	Eastern Yellow Wagtail	MI		DBCA
<i>Dasyurus geoffroii fortis</i>	Western Quoll, Chuditch	VU	VU	ALA, DBCA, DCCEEW, NatureMap
<i>Phascogale calura</i>	Red-tailed Phascogale	CD	VU	ALA, DBCA, DCCEEW, NatureMap
<i>Phascogale tapoatafa wambenger</i>	Wambenger Brush-tailed Phascogale	CD		DBCA, NatureMap

Scientific Name	Common Name	WA Status	EPBC Status	Source [^]
<i>Myrmecobius fasciatus fasciatus</i>	Numbat, Walpurti	EN	EN	ALA, DBCA, DCCEEW, NatureMap
<i>Isoodon fusciventer</i>	Quenda	P4		DBCA, NatureMap
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU	VU	ALA, DBCA, NatureMap
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR	DBCA
<i>Bettongia lesueur graii</i>	Burrowing Bettong, Boodie	EX	EX	DBCA, NatureMap
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie	CR	EN	DBCA, NatureMap
<i>Notamacropus eugenii derbianus</i>	Tammar Wallaby	P4		DBCA, NatureMap
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		DBCA, NatureMap
<i>Onychogalea lunata</i>	Crescent Nailtail Wallaby, Wurrung	EX	EX	ALA, DBCA, NatureMap
<i>Hydromys chrysogaster</i>	Water Rat	P4		DBCA, NatureMap

[^]Sources are: (ALA, 2024; DBCA, 2024b, 2007-; DCCEEW, 2024).

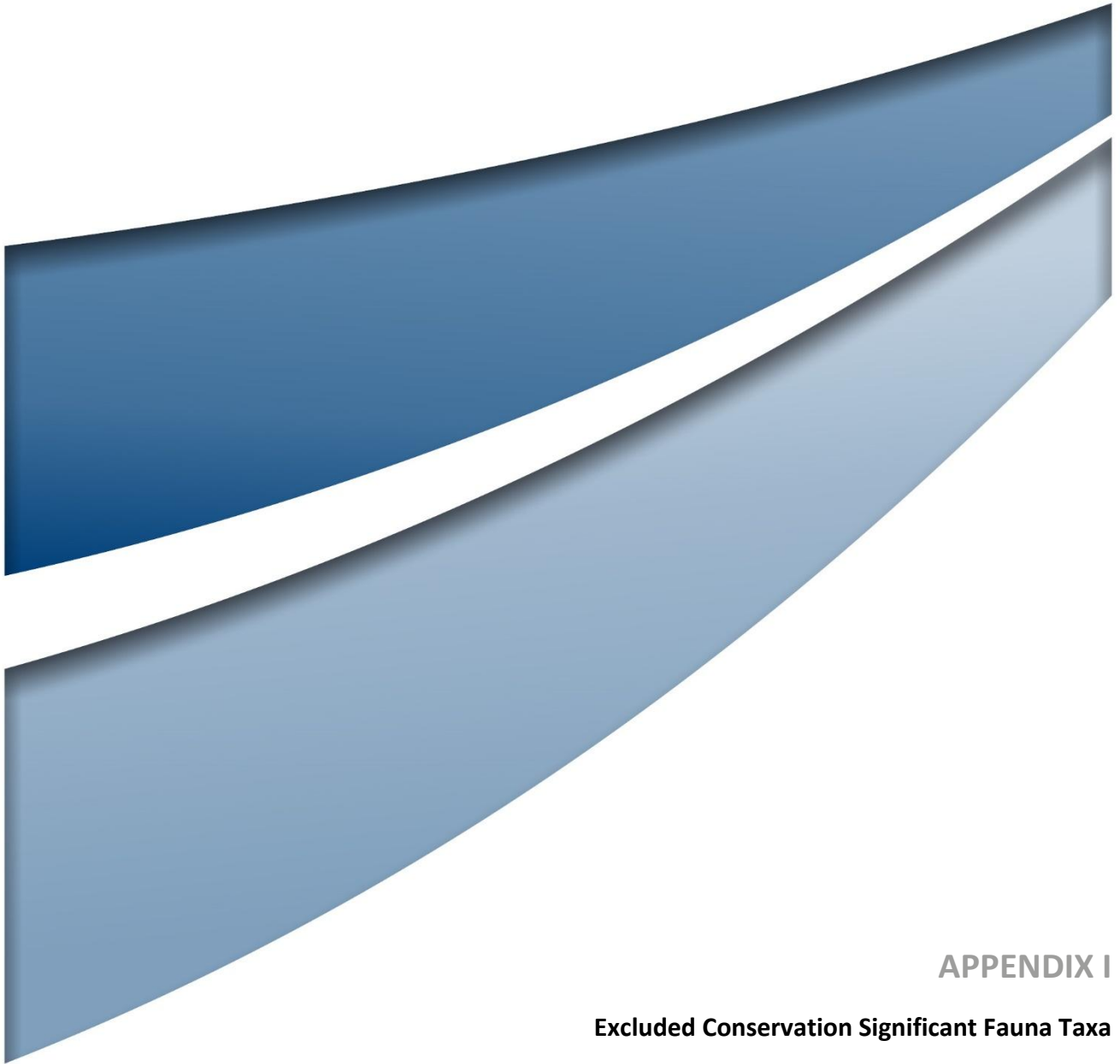


APPENDIX H

Raw Fauna Habitat Type Data

Site	Easting	Northing	Comment
1	511740.3	6259270	Small patch of jarrah.
2	511831.7	6259367	General hollow tree example. Scattered across site. Potential for phascogale and western rosella. Not big enough for black cockatoos.
3	511860.2	6259297	Example of ringbarking. Common over site.
4	511919.2	6259349	Example hollow tree.
5	512030.1	6259434	Quarry.
6	512036.6	6259484	7 jarrah. Same score as previous jarrah patch.
7	512066.3	6259173	Cleared with regrowth. Human made log piles.
8	512135.1	6259425	Parrot forage.
9	511811.2	6259041	End of jarrah. Jarrah to east.
10	511747.7	6259136	Pictures on BH phone. Too many for this waypoint.
11	512062	6259792	Trees to east have been felled based on current satellite image.
12	511711.2	6259937	Three jarrah trees no foraging evidence.
13	511755.7	6259038	Red gum regrown, Sparse small hollows sparse woody debris.
14	511601.6	6259093	Red gum regrown, Sparse small hollows sparse woody debris.
15	511922.1	6259257	Wandoo, Natural log piles and man made log piles scattered across area. Small hollows occasional. Cropping. Grazing. Fox.
16	512444.3	6258855	Banksia and allocasurina patch, Fox, rabbit, human grazing.
17	511894.6	6259073	Wandoo with sparse jarrah, sparse small and medium hollows. No cockatoo hollows observed in area. No mid story. Some woody debris. Fox, rabbit, sheep, human logging (small scale).
18	511668.8	6259943	Wandoo and red gum. Small and medium hollows frequent. Black cockatoo hollows marked separately if present. Frequent woody debris. Soil movement – fox, rabbit, human.
19	512028.9	6259204	Thinned wandoo, sparse fallen logs.

Data presented in GDA2020, Zone 50.

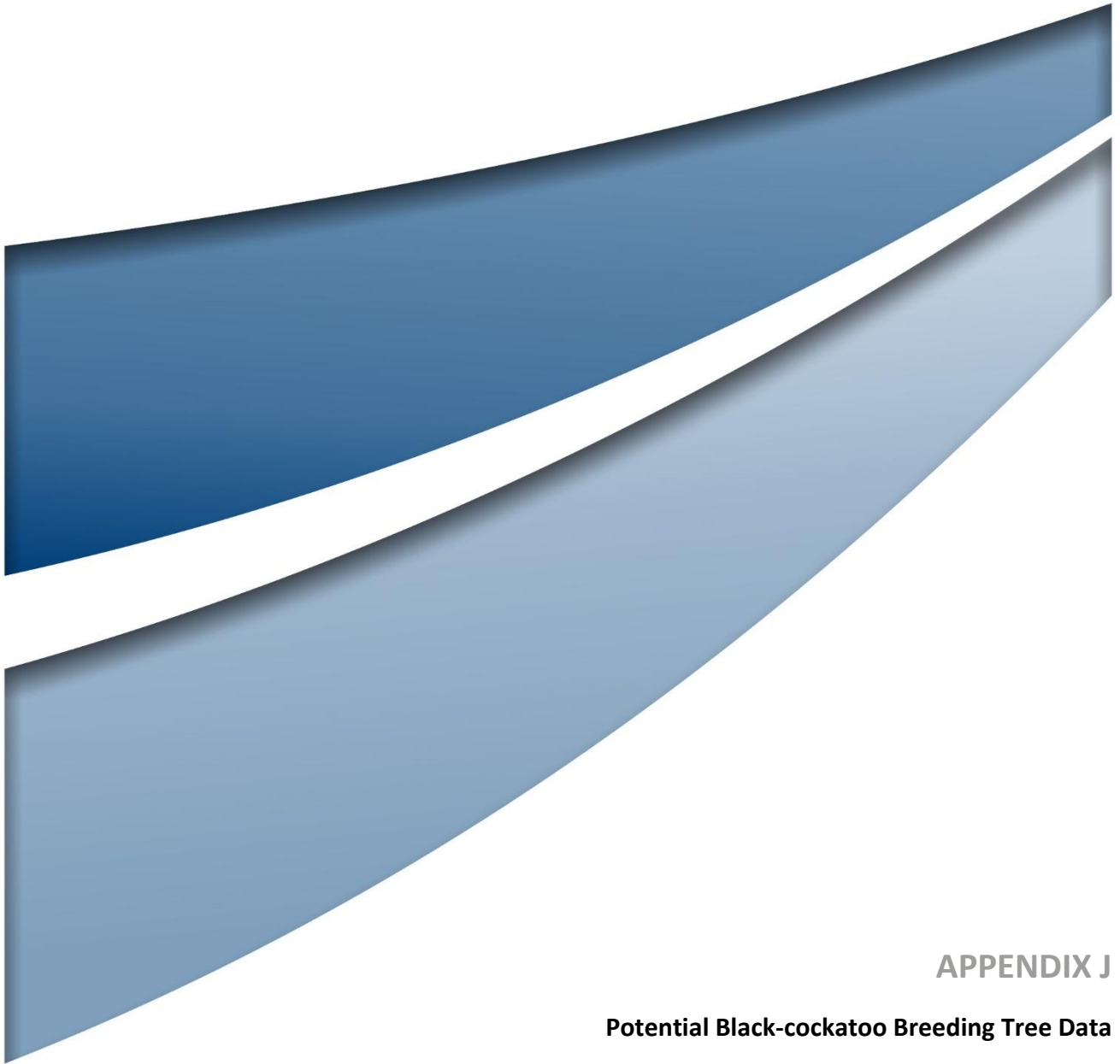


APPENDIX I

Excluded Conservation Significant Fauna Taxa

Taxon	Common Name	EPBC Status	WA Status	Likelihood of Occurrence
AVES				
Blue-billed Duck	<i>Oxyura australis</i>		P4	Not expected: unsuitable habitat.
Malleefowl	<i>Leipoa ocellata</i>	VU	VU	Not expected: unsuitable habitat.
Hooded Plover (Hooded Dotterel)	<i>Thinornis cucullatus</i>		P4	Not expected: unsuitable habitat.
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	VU	MI	Not expected: unsuitable habitat.
Curlew Sandpiper	<i>Calidris ferruginea</i>	CR	CR	Not expected: unsuitable habitat.
Red-necked Stint	<i>Calidris ruficollis</i>	MI	MI	Not expected: unsuitable habitat.
Common Sandpiper	<i>Actitis hypoleucos</i>	MI	MI	Not expected: unsuitable habitat.
Wood Sandpiper	<i>Tringa glareola</i>	MI	MI	Not expected: unsuitable habitat.
Common Greenshank	<i>Tringa nebularia</i>	EN	MI	Not expected: unsuitable habitat.
Glossy Ibis	<i>Plegadis falcinellus</i>	MI	MI	Not expected: unsuitable habitat.
Australasian Bittern	<i>Botaurus poiciloptilus</i>	EN	EN	Not expected: unsuitable habitat.
Australian Little Bittern (Black-backed Bittern)	<i>Ixobrychus dubius</i>		P4	Not expected: unsuitable habitat.
Masked Owl (south-west)	<i>Tyto novaehollandiae novaehollandiae</i>		P3	Highly unlikely: very low suitability.
Barking Owl (southwest)	<i>Ninox connivens connivens</i>		P3 (southwest population)	Not expected: outside of known range.
Grey Falcon	<i>Falco hypoleucos</i>	VU	VU	Not expected: outside of known range.
Muir's Corella	<i>Cacatua pastinator pastinator</i>		CD	Unlikely: low suitability.
Southern Whiteface	<i>Aphelocephala leucopsis</i>	VU		Not expected: outside of known range.
Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>		MI	Not expected: outside of known range.
MAMMALIA				
Wambenger Brush-tailed Phascogale	<i>Phascogale tapoatafa wambenger</i>		CD	Unlikely: low suitability.

Taxon	Common Name	EPBC Status	WA Status	Likelihood of Occurrence
Numbat, Walpurti	<i>Myrmecobius fasciatus fasciatus</i>	EN	EN	Highly unlikely: fragmented habitat.
Quenda	<i>Isodon fusciventer</i>		P4	Unlikely: low suitability.
Bilby, Dalgyte	<i>Macrotis lagotis</i>	VU	VU	Not expected: locally extinct.
Western Ringtail Possum	<i>Pseudocheirus occidentalis</i>	CR	CR	Not expected: unsuitable habitat.
Burrowing Bettong, Boodie	<i>Bettongia lesueur graii</i>	EX	EX	Not expected: locally extinct.
Brush-tailed Bettong, Woylie	<i>Bettongia penicillata ogilbyi</i>	EN	CR	Not expected: locally extinct.
Tammar Wallaby	<i>Notamacropus eugenii derbianus</i>		P4	Highly unlikely: very low suitability.
Crescent Nailtail Wallaby, Wurrung	<i>Onychogalea lunata</i>	EX	EX	Not expected: extinct
Water Rat	<i>Hydromys chrysogaster</i>		P4	Not expected: unsuitable habitat.



APPENDIX J

Potential Black-cockatoo Breeding Tree Data

Tree ID	Easting	Northing	Life Status	Tree Height (m)	Tree DBH (mm)	Hollow Present	Chew Marks	Hollow Type	Hollow Diameter	Activity Observed	Comments	Bamford Rank
BH1	511924.6	6259279	Dead	15	700	Yes	No	Spout	250	No		3
BH2	511792.2	6259273	Alive	15	500	Yes	No	Other	300	No	Chimney with side entrance.	3
BH3	512041.7	6259274	Dead	12	500	Yes	No	Chimney	300	No		3
BH4	511975.1	6259418	Dead	18	400	Yes	No	Elbow	300	No		3
BH5	512026.7	6259094	Dead	20	800	Yes	No	Spout	250	No	Two hollows, both spouts. Smaller hollow is 200 DBH facing east.	3
BH6	512213.6	6259541	Dead	18	750	Yes	No	Side Entrance	150	No		3
BH7	512242.1	6259535	Dead	18	750	Yes	No	Spout	200	No		3
BH8	512256.4	6259372	Dead	22	600	Yes	No	Spout	400	No		3
BH9	511587.1	6259025	Dead	20	900	Yes	No	Side Entrance	500	No		3
BH10	511577.6	6259067	Dead	25	700	Yes	No	Side Entrance	300	No		3
BH11	511610.3	6259391	Dead	12	600	Yes	No	Elbow	450	No		3
BH12	513928.2	6259121	Dead	25	850	Yes	No	Side Entrance	200	No		3
BH13	513930.6	6259123	Dead	15	1000	Yes	No	Elbow	400	No	Active honey bee hive.	3
BH14	513449.4	6259340	Dead	15	600	Yes	No	Spout	200	No		3

Data presented in GDA2020, Zone 50. Note: All trees were identified to be *Eucalyptus wandoo* subsp. *wandoo*.

