



CBH CRANBROOK ENVIRONMENTAL SURVEY

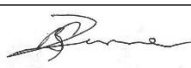
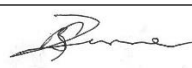
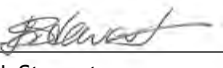
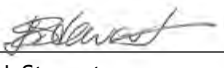
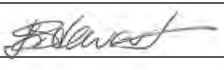
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SUMMARY

CBH Group is currently in pre-feasibility phase for the Cranbrook Rail Outloading Project which will focus on improving grain storage capacity and outloading time and includes constructing sidings to accommodate longer trains to minimise the time that trains block access roads in the vicinity.

CBH appointed Ecoscape to conduct a detailed spring flora and vegetation survey and basic fauna survey to inform the environmental approvals process. The total extent of the survey area was 25.13 ha.

The significant findings of the desktop assessment were:

- the pre-European vegetation association intersecting the survey area has between 16.86% (at state-wide scale) and 23.09% (at IBRA region and subregion scales) remaining
- the survey area is included in mapped extents of the EPBC-listed *Eucalypt Woodlands of the Western Australian Wheatbelt* Threatened Ecological Community and its Western Australian equivalent Priority Ecological Community
- 36 Threatened Flora (TF) are known or likely to occur within 50 km of the survey area; 91 Priority Flora (PF) species have been recorded from within 20 km
- no Threatened or Priority Flora have been recorded from within the survey area, although two TF and seven PF were considered to have a Possible likelihood of occurring at desktop assessment stage
- no Threatened, Priority-listed, or otherwise significant fauna species were known to occur within the survey area, although two EPBC-listed species was considered a High likelihood of occurring at desktop assessment stage
- the survey area is within the mapped extent considered as Carnaby's Cockatoo breeding habitat and this species has been recorded in close proximity in recent years
- Baudin's Cockatoo is 'likely to occur' and Forest Red-tailed Black Cockatoo 'may occur' within the survey area, although neither species has been recorded from within 10 km of the survey area within the previous 20 years.

The flora and vegetation survey identified the following from the survey area:

- 113 vascular flora taxa recorded from six floristic quadrats, four relevés and opportunistic observations:
 - no conservation-listed species, and none are considered likely to occur
 - 19 introduced species including one Declared Pest plant and WoNS species; **Asparagus asparagoides* (Bridal Creeper) that has no management requirements in relation to its presence
- four native vegetation types, plus a mosaic of the two woodland types:
 - **EdMW**: *Eucalyptus decipiens* mid mallee woodland (0.58 ha)
 - **EoW**: *Eucalyptus occidentalis* low open woodland (1.72 ha)
 - **EwEoW**: *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland (5.67 ha)
 - mosaic of **EwEoW** and **EoW** (1.87 ha)
 - **LeCqApS**: *Leptospermum erubescens*, *Calothamnus quadrifidus* and **Acacia pycnantha* mid shrubland (0.93 ha).
- where meeting the extent and condition criteria, parts of vegetation types **EwEoW** and the mosaic with vegetation type **EoW** were considered to represent the *Eucalypt Woodlands of the Western Australian Wheatbelt* TEC and PEC (7.53 ha)
- more than half of the survey area did not have native vegetation (57.17%) including areas occupied by infrastructure, cleared (e.g. tracks) and weedy areas devoid of native species. The vegetation condition in areas of native vegetation ranged from Good to Very Good.

The vertebrate fauna survey that incorporated a Black Cockatoo habitat assessment identified the following from the survey area:

- 30 vertebrate fauna species including two introduced species (Rabbit and Red Fox) and one conservation-listed species:
 - *Calyptorhynchus latirostris* (Carnaby's Cockatoo), listed as Endangered under the Commonwealth EPBC and Western Australian BC Acts
- three fauna habitat types (Woodland, Shrubland and Grassland, this latter type being dominated by weedy grasses)
- 175 trees of suitable size to be considered as Black Cockatoo habitat trees although only eight of these had hollows that potentially may be suitable for nesting
- the Woodland habitat type (8.11 ha) was considered as not suitable for Carnaby's Cockatoo or Black Cockatoo foraging, but 'valued' as foraging for Forest Red-tailed Black Cockatoo
- the Shrubland habitat type (2.65 ha) was assessed as being 'valued' for foraging for Forest Red-tailed Black Cockatoo, although this was noted to be likely an overstatement due to ambiguities in definitions, but not significant for Carnaby's Cockatoo or Baudin's Cockatoo
- the Grassland habitat type (5.29 ha) was not assessed for suitability as it met none of the criteria to be considered as Black Cockatoo habitat
- the post-survey likelihood assessment considered that Baudin's Cockatoo and Forest Red-tailed Black Cockatoo have a Low and Very Low likelihood of occurring within the survey area
- Chuditch (*Dasyurus geoffroyi*) is considered to have a High post-survey likelihood of occurring within the survey area.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms and abbreviations	
BAM Act	Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAFWA	Department of Agriculture and Food, Western Australia (2006-2017, now DPIRD)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height (1.3 m)
DEWHA	Commonwealth Department of the Environment, Water, Heritage, and the Arts (2007-2010, now DAWE)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DoE	Commonwealth Department of the Environment (2013-2016, now DAWE)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DPIRD	Western Australian Department of Primary Industries and Rural Development
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DAWE)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDA 94	Geographic Datum of Australia 1994
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
km	kilometre/kilometres
m	metre/metres
MGA	Map Grid of Australia
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act)
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
S1	Schedule 1 Fauna species listed under the BC Act
TEC	Threatened Ecological Community

Acronyms and abbreviations	
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
WONS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

CBH Group is a large co-operative in the grain industry with operations in grain storage, handling, transport, marketing, and processing. CBH Group is currently in pre-feasibility phase for the Cranbrook Rail Outloading Project which will focus on improving grain storage capacity and outloading time and includes constructing sidings to accommodate longer trains to minimise the time that trains block access roads in the vicinity. Land clearing will be required to accommodate the potential works thus CBH Group requires a spring flora and fauna survey to inform the environmental approvals process.

1.2 SURVEY AREA

The CBH Cranbrook project area, known as the 'survey area' in this report, is located within the Shire of Cranbrook in the Great Southern region approximately 300 km south of Perth (**Figure 1**). The survey area is 25.13 ha in size and falls within the rail and Great Southern Highway reserves.



Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

CBH's requirements were to conduct environmental surveys that were:

- compliant with CBH OHS requirements
- compliant with current Western Australian legislation and guidelines.

1.4 COMPLIANCE

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

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability Environment Water Population and Communities (DSEWPoC 2011a) *Survey guidelines for Australia's threatened mammals*
- DSEWPoC (2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (2010a) *Survey guidelines for Australia's threatened bats*
- DEWHA (2010b) *Survey guidelines for Australia's threatened birds*
- DSEWPoC (2012) *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*, known in this document as the Black Cockatoo Referral Guidelines*
- Commonwealth of Australia (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, known in this document as the Revised Draft Referral Guideline*
- Department of the Environment (DoE 2014) *Approved Conservation Advice for Proteaceae Dominated Kwongan Shrublands of the southeast coastal floristic province of Western Australia*
- Threatened Species Scientific Committee (TSSC 2015) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.*

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

- EPA (2020a) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2020b) *Statement of Environmental Principles, Factors and Objectives.*

1.4.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities, and heritage areas listed under the Act. Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 18** in **Appendix One**. Threatened Ecological Communities are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

1.4.2 WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

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

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

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

1.4.3 WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

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

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 19** in **Appendix One**; these categories align with those of the EPBC Act.

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

The most recent flora and fauna listings were published in the *Government Gazette* on 11 September 2018 (Government of Western Australia 2018a).

1.5 FLORA

1.5.1 THREATENED AND PRIORITY FLORA

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as Threatened by the Western Australian DBCA and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 18** in **Appendix One** for conservation status category descriptions).

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

There are seven categories covering Western Australian-listed TF and PF species which are outlined in **Table 19** in **Appendix One**. PF for Western Australia are regularly reviewed by the DBCA whenever new

information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 19**.

1.5.2 OTHER SIGNIFICANT FLORA

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

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

1.5.3 INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2020) and are designated with an asterisk (*) in this document.

1.5.3.1 Weeds of National Significance

At a national level there are 36 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2020). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

1.5.3.2 Declared Pest Plants

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

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

1.6 ECOLOGICAL COMMUNITIES/VEGETATION

Most, although not all, conservation-listed ecological communities are defined by vegetation, usually within the context of a defined landform or unique habitat. Although 'vegetation' and 'ecological communities' are not interchangeable terms, this assessment describes the vegetation of the survey area with conservation status taking into consideration the interactions of the vegetation with the biological and physical environment within which it occurs (i.e. the ecological community as a whole).

1.6.1 EPBC-LISTED THREATENED ECOLOGICAL COMMUNITIES

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (DBCA 2020). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. Ecological communities are categorised as Critically Endangered, Endangered and Vulnerable as described in **Table 18** in **Appendix One**.

1.6.2 WESTERN AUSTRALIAN THREATENED ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act. TECs are categorised much like those of the EPBC Act, shown in **Table 20** in **Appendix One**.

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

1.6.3 WESTERN AUSTRALIAN PRIORITY ECOLOGICAL COMMUNITIES

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

Currently described PECs are listed on the DBCA website, with the most recent list dated 28 July 2020 (Species and Communities Program, DBCA 2020).

1.6.4 OTHER SIGNIFICANT VEGETATION

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

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

1.7 FAUNA

1.7.1 EPBC-LISTED THREATENED FAUNA

At a Commonwealth level, Threatened Fauna are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 18** in **Appendix One**).

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DotEE 2020):

Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

Species listed by the following international agreements are currently protected under the EPBC Act:

- *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)
- *China-Australia Migratory Bird Agreement* (CAMBA)
- *Japan-Australia Migratory Bird Agreement* (JAMBA)

- *Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).*

1.7.2 WESTERN AUSTRALIAN BC ACT-LISTED FAUNA

Threatened fauna that meet the categories listed within the BC Act are protected and require authorisation by the Minister to take or disturb. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act.

Fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. These are known as Specially Protected Species in the BC Act.

The categories covering State-listed threatened fauna species are outlined in **Table 19** in **Appendix One**.

1.7.3 WESTERN AUSTRALIAN PRIORITY FAUNA

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 19** in **Appendix One**.

1.8 ENVIRONMENTALLY SENSITIVE AREA

There are a number of areas around Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs) and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

1.9 CONSERVATION ESTATE

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

2 EXISTING ENVIRONMENT (DESKTOP ASSESSMENT)

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

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

According to the Köppen-Geiger climate classification, the survey area has a temperate climate with dry, warm summers (Class CSb) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a warm summer Mediterranean climate where the coldest month averages above 0°C and the hottest month is above 22°C, and at least 4 months have average temperatures over 10°C. Summer rainfall is less than one third of winter rainfall.

The closest Bureau of Meteorology (BoM) station with long term rainfall records is Cranbrook (BoM 2020b station no. 10537, operating since 1891) located approximately 0.6 km from the survey area. The mean annual rainfall is 499.2 mm with 64.18 % falling from May to September (late autumn to early spring).

The closest Bureau of Meteorology (BoM) station with long term temperature records is Mount Barker (BoM 2020b station no. 9581, operating since 1886) located approximately 37 km south of the survey area. January is the hottest month with a mean maximum temperature of 26.3°C and minimum of 12.8°C. July is the coldest month with a mean maximum of 14.4°C and minimum of 6.1°C.

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

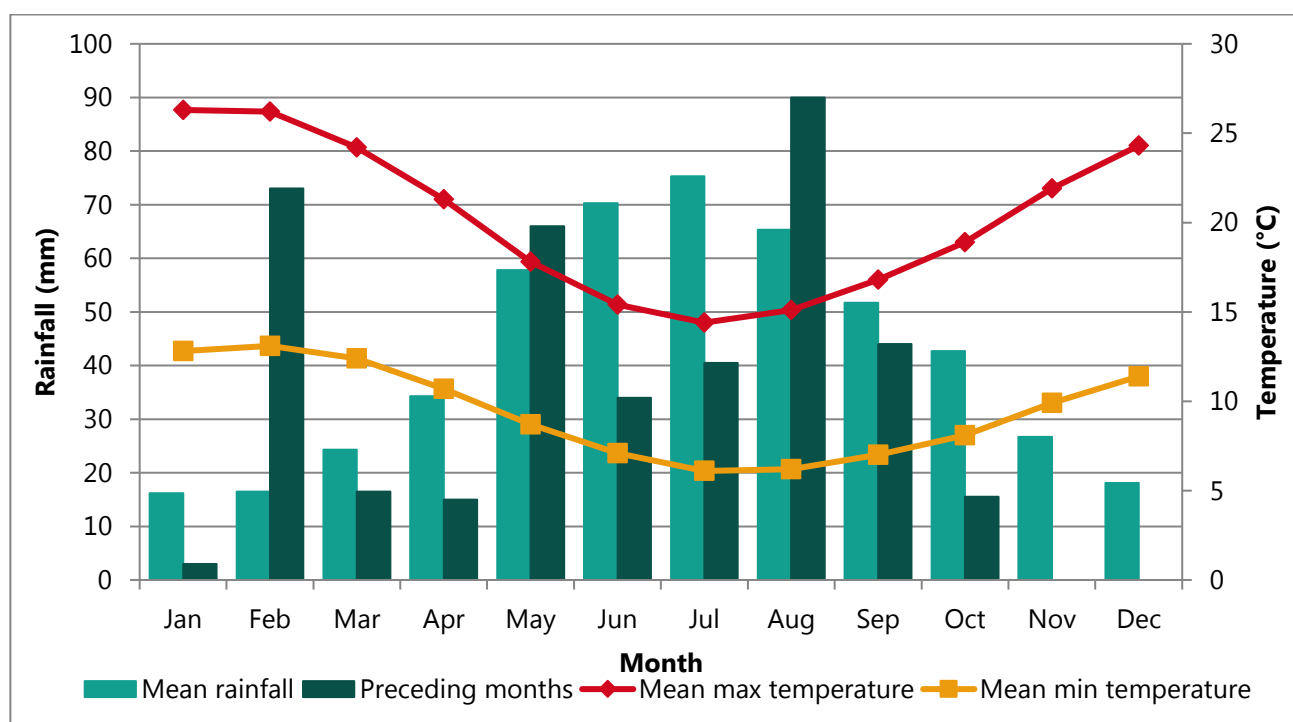


Figure 2: Rainfall (Cranbrook) and temperature data (Mount Barker) for the survey area (BoM 2020)

2.1.2 LAND SYSTEMS

According to Department of Primary Industries and Rural Development (DPIRD 2019a) soil landscape mapping, the following land systems intersect the survey area (**Table 2** and **Map 1**).

Table 2: Land systems (Department of Primary Industries and Rural Development 2019a)

Mapping unit	Land system	Description	Extent (ha)	%
248Jf	Jaffa 2 Subsystem	Footslopes, gently undulating rises and undulating plains. Grey deep sandy duplex is widespread with grey shallow sandy duplex and semi-wet soil	8.41	33.44
248Jf	Jaffa 3 Subsystem	Mid to upper slopes and hillcrest areas dominated by rock outcrop. Grey deep sandy duplex, grey shallow loamy duplex, bare rock, and shallow gravel are common.	2.13	8.47
248Nt	North Stirling 1 subsystem	Basin floor with salt lakes, lunettes, and saline flats. Saline groundwater close to the surface. Alkaline grey deep sandy duplex and grey deep sandy duplex soil, with saline wet soil, salt lake soil and semi-wet soil	14.61	58.09

2.1.3 WETLANDS AND DRAINAGE

The survey area is in the Nornalup Inlet Frankland River catchment (Landgate 2020). The survey area is intersected by a minor non-perennial drainage line (Pinjalup Creek) at the northern end.

2.1.4 ENVIRONMENTALLY SENSITIVE AREAS

The survey area is not included in any ESAs. Two ESAs occur nearby:

- approximately 2 km to the west of the survey area

- approximately 10 km to the north-east of the survey, linking to Stirling Range National Park.

2.1.5 CONSERVATION LANDS

The survey area does not directly intersect any conservation lands. Several areas with flora and fauna conservation significance occur nearby, the closest ones are listed below:

- Orchid Nature Reserve, approximately 5 km south of the survey area
- Tenterden Nature Reserve, approximately 6 km south of the survey area
- Twongkup Nature Reserve, approximately 9 km to the west of the survey area
- Pootenup Nature Reserve, approximately 12 km to the north-east of the survey area
- Stirling Range National Park, approximately 13 km east of the survey area.

2.1.6 LAND USE HISTORY

The survey area is immediately adjacent to south of the township of Cranbrook and includes remnant native vegetation adjacent to dirt tracks, railway and the CBH facility.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

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

The survey area is located in the Avon Wheatbelt IBRA region in the Avon Wheatbelt P2 subregion (AW2, Rejuvenated Drainage subregion), described as (Beecham 2001):

The Avon Wheatbelt is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. Gently undulating landscape of low relief. Proteaceous scrubheaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, Allocasuarina huegeliana and Jam-York Gum woodlands on Quaternary alluvials and eluvials. Within this, AW2 is the erosional surface of gently undulating rises to low hills with abrupt breakaways. Continuous stream channels that flow in most years. Colluvial processes are active. Soil formed in colluvium or in-situ weathered rock. Includes woodland of Wandoo, York Gum and Salmon Gum with Jam and Casuarina. The climate is Semi-arid (Dry) Warm Mediterranean, and area is 3,012,977 ha.

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019b). Extents are updated every two years by DBCA (2019a). This mapping indicates that the survey areas intersects one pre-European vegetation unit: Association 967: described as mixed heath with scattered tall shrubs *Acacia* spp. Proteaceae and Myrtaceae.

The pre-European vegetation association identified from the survey area (DPIRD 2019b) and its pre-European and current extent are listed in **Table 3** (DBCA 2019a).

Table 3: Pre-European vegetation association representation (DBCA 2019a)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% remaining
Western Australia	967	216684.92	36536.07531	16.86
IBRA biogeographic region (Jarrah Forest)	967	29340.13	6773.33	23.09
IBRA biogeographic sub-region (Southern Jarrah forest)	967	29340.13	6773.33	23.09
LGA (Shire of Cranbrook)	967	77064.58	15137.68	19.64

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Protected Matters Search Tool (PMST) search (Australian Government & DAWE 2020; search reference PMST_TQN100) using a 20 km buffer around a point approximating the centre of the survey areas identified two EPBC-listed TECs that are 'likely to occur':

- *Eucalypt Woodlands of the Western Australian Wheatbelt* (Critically Endangered)
- *Proteaceae dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia* (Endangered).

The DBCA database search (search reference 19-1020EC using a 20 km buffer around a point approximating the centre of the survey area) identified the following three PECs:

- *Eucalyptus Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)* – Priority 3
- *Montane mallee thicket community of the Stirling Range* – Priority 1
- *Proteaceae dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia* – Priority 3.

Map 2 shows the locations of ecological communities identified by the DBCA database search.

The two EPBC-listed TECs are considered to be largely synonymous with the Western Australian PECs of the same names. Both TECs have an Approved Conservation Advice (DoE 2014; TSSC 2015) to assist with determination of inclusion; these are summarised in **Appendix Two**.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified eight EPBC-listed TF that are 'known to occur' within the 20 km search buffer area and 24 as 'species or habitat likely to (or may) occur within area'.

The requested DBCA databases (search reference 46-0920FL) was conducted using a 20 km buffer around a point approximating the centre of the survey area. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium.

The combined database searches identified the species listed in **Table 30** in **Appendix Three**, consisting of 36 TF (23 from records known to occur within the database search buffer and a further 12 from the PMST where associated habitat is known to/ is likely to/may occur), seven P1, 26 P2, 22 P3 and 36 P4.

Map 2 shows the locations of conservation-listed flora identified by the DBCA database search.

2.2.4.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify TF and PF species that have potential to occur within the survey area. The likelihood of a species occurring is based on the following attributes, as listed on *FloraBase* (WAH 1998-2020, 2020, including specimen collection information), incorporating an assessment of habitats likely to be present in the survey area. The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded from within approximately 10 km of the survey area (considered as 'nearby') taking locational accuracy into account
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection.

The likelihood rating is assigned using the categories listed in **Table 4**.

Table 4: Categories for likelihood of occurrence of TF and PF

Likelihood	Category
Recorded	Species recorded within the survey area.
Possible	May occur within the survey area (but has not been recorded); broadly, 2-4 of the required attributes (but always including records from nearby) are present in the survey area.
Unlikely	Could occur but is not expected; 1-3 of the required attributes are present in the survey area but: • it is not known from nearby, or • it is known from nearby but has no other required attributes, or • it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area), or • it is known from nearby but: - o the record is old (>25 years), or - o the locational data is highly likely to be inaccurate, or - o the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area.
Highly unlikely	The species characteristics include only one or none of the required attributes of soil, landform, associated vegetation and having previously been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.

The likelihood assessment is available in **Table 30** in **Appendix Three**. Two Threatened Flora, two P1, one P2, one P3 and three P4 were identified as having been recorded previously or a Possible likelihood of occurring based on the information available during the desktop assessment. These were considered the most likely to occur and were prioritised for field survey.

Following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.2**.

2.2.5 THREATENED AND PRIORITY FAUNA

2.2.5.1 NatureMap

NatureMap (DBCA 2007-2020) is maintained collaboratively by the DBCA and the WAM. These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database maintained by the DBCA.

The *NatureMap* search identified 251 fauna species previously recorded within the applied 20 km buffer area including 29 (16 birds and 13 mammals) that are conservation-listed. *NatureMap* results are incorporated into **Table 31** in **Appendix Three**.

2.2.5.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: 2020/000669 #6459) using a 20 km buffer around a point approximating the centre of the survey area. Twenty-nine conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of:

- 10 mammals
- 19 birds.

The results incorporate the conservation-listed species identified from the *NatureMap* search (as above), with following additional species:

- *Actitis hypoleucos* (Common Sandpiper) – MI EPBC Act, MI BC Act
- *Pandion cristatus* (Osprey (eastern)) – MI EPBC Act, MI BC Act
- *Pezoporus flaviventris* (Western Ground Parrot) – CR EPBC Act, CR BC Act
- *Thalasseus bergii* (Crested Tern) – MI EPBC Act, MI BC Act.

DBCA database search results are incorporated into **Table 31** in **Appendix Three** and shown on **Map 3**.

2.2.5.3 Protected Matters Search

The Protected Matters Search Tool (PMST) search (Australian Government & DAWE 2020; search reference PMST_95VIBD) using a 20 km buffer around a point approximating the centre of the survey area, identified:

- four mammals: two 'species or species habitat known to occur within area', two 'species or species habitat likely to occur within area',
- nine birds: two 'species or species habitat known to occur within area', three 'species or species habitat likely to occur within area', four 'species or species habitat may occur within area'
- one fish: 'species or species habitat likely to occur within area'.

The PMST results are incorporated into **Table 31** in **Appendix Three**. Not all species identified by the PMST search have DBCA/Western Australian Museum (WAM) records (*NatureMap* and DBCA database searches; see below). The following were identified by the PMST search but not by the *NatureMap* and DBCA database searches:

- *Botaurus poiciloptilus* (Australasian Bittern)
- *Falco hypoleucos* (Grey Falcon)
- *Numenius madagascariensis* (Eastern Curlew)
- *Parantechinus apicalis* (Dibbler)
- *Pezoporus occidentalis* (Night Parrot).

2.2.5.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of occurrence of significant fauna species identified by the database and literature searches was assessed using the following criteria:

- suitability of habitat types present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 5**.

Table 5: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood	Category
Recorded	Species recorded within the survey area within a reasonable timeframe (0-25 years)
High	Species recorded in close proximity to the survey area (<5 km) within the past 25 years; and suitable habitat occurs within the survey area
Medium	Species historically recorded in close proximity (<5 km) to the survey area, more than 25 years ago; and suitable habitat may exist within the survey area
Low	Species not recorded in the proximity of the survey area or rarely recorded within 10 km of the survey area; and suitable habitat unlikely to occur within the survey area
Very Low	Species not recorded by multiple surveys/databases within 20 km of the survey area and suitable habitat does not occur within the survey area, however, species or suitable habitat is listed as potentially occurring in the wider region

The likelihood of species occurring within the survey area are indicated in **Table 31** in **Appendix Three**. Two species were assessed as having a High likelihood of occurring within the survey area:

- *Dasyurus geoffroii* (Western Quoll)
- *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo).

Following the field survey when actual survey area characteristics are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.3.3.1**.

2.3 LITERATURE REVIEW

No surveys are known to have been previously conducted within or at least partly within the survey area. The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2020) was searched for recent environmental surveys in the vicinity of the survey area; none were identified from within 50 km of the survey area.

The following documents were identified as having relevance to the survey area:

- Department of Environmental Regulation (2017) *Clearing Permit CPS 7411/1 Purpose Permit, Shire of Cranbrook*. Permit plan and decision report, including background environmental information, for Motocross facilities. Prior to clearing the Shire was required to conduct Black Cockatoo surveys. Fauna

habitat (Principle B) was assessed as 'may be at variance' in regard to Black Cockatoo species. Principle H, regarding impacts on conservation areas, was also assessed as 'may be at variance'.

- Roadside Conservation Committee (2015) *Roadside vegetation and conservation values in the Shire of Cranbrook*. This report describes the conservation status of road reserve vegetation in the Shire and includes information that can assist with some conservation-listed flora and fauna identifications.
- Shire of Cranbrook (2016) *Local Planning Strategy 2016-2023*. Section 6 describes the physical and biological environment of the Shire; Section 7 describes the traffic, transport, and infrastructure of the Shire, including identifying that rail networks require review and possible upgrades at the CBH facility.

3 METHODS

3.1 SURVEY AIMS

The aims of the biological survey were to:

- conduct a detailed flora and vegetation survey
- conduct a Basic fauna survey
- identify Black Cockatoo breeding and foraging habitat.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016). The EPA considers that a detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys, and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition, and condition.

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

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

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

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

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016), conducted as a single phase survey.

Conservation criteria used in this assessment are included in **Table 18**, **Table 19** and **Table 20** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values, and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension for mid and ground strata and 20 m x 20 m in dimension (effectively 5 m additional on all sides to the measured mid and ground stratum quadrat) for the upper stratum where present, as required according to the Flora and Vegetation Technical Guidance (EPA 2016). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 400 m² for the upper stratum.

The following information was collected from within each quadrat:

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

At least three quadrats (or relevés) were recorded per vegetation type for the detailed survey where there was sufficient extent. Relevés were recorded in Degraded-Completely Degraded condition vegetation; whilst unmeasured a similar level of detail was recorded. All quadrat and relevé locations are displayed in the **Map 4** series.

3.3.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Due to the linear nature of the survey area, the entire area was extensively searched during site traverses.

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

- observer, date, and time
- reproductive status and other features such as health of plants, percentage flowering and fruiting
- local abundance/population size and/or population boundary

- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.3.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.3.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 21** and **Table 22** in **Appendix One**). Up to three species per stratum from each stratum (upper, mid, and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the series of letter codes referring to the component species (upper case first letter referring to the genus, lower case letters referring to the species e.g. **EwEoW** refers to *Eucalyptus wandoo* and *Eucalyptus occidentalis* low open woodland).

3.3.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Southwest Botanical Province (EPA 2016) (**Table 23** in **Appendix One**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.3.1.6 Field Survey Timing

The field survey was conducted during 3-6 November 2020 which is within the optimal period for a primary survey within the bioregion according the Flora and Vegetation Technical Guidance (EPA 2016). The flora and vegetation survey was conducted concurrently with the fauna survey.

3.3.2 STATISTICAL ANALYSIS

3.3.2.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey effort and habitat known to occur in the survey area and updated the desktop likelihood assessment.

3.3.2.2 Floristic Analysis

PATN© software (Belbin & Collins 2006) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

We used the Bray Curtis similarity coefficient for rows (species) and Kulczynski similarity coefficient for columns (sites) as this provides a good estimation of association for ecological applications (Belbin & Collins 2006). For this analysis we used presence-absence data, removing singletons.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.3.2.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

3.4 FAUNA FIELD SURVEY

3.4.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020a), conducted as a basic survey.

Conservation criteria used in this assessment are included in **Table 18** and **Table 19** in **Appendix One**.

Survey method details are outlined below.

3.4.1.1 Fauna Survey

The Basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020a) including habitat assessment, active diurnal searches, raking of spoil heaps and leaf litter, searches for secondary evidence such as scats and tracks and opportunistic searches.

Terrestrial vertebrate fauna were the main targets of the field fauna survey. Survey techniques included:

- opportunistic bird observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath
- raking of litter beds to locate fossorial reptile species
- tree hollow inspection to detect evidence of arboreal fauna.

Fauna species were identified opportunistically based on sightings, calls, remains, diggings, and other signs. Potential habitats for conservation significant species were identified and evaluated and their likelihood of occurrence assessed.

3.4.1.2 Fauna Habitat Assessment

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

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

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

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

3.4.1.3 Targeted Survey Methods

Black Cockatoo Assessment

Black Cockatoo Species (Carnaby's Cockatoo; Baudin's Cockatoo EN, Forest Red-tailed Black-cockatoo VU (EPBC Act, BC Act))

Potential and active (actual) Black Cockatoo breeding trees were assessed as per Commonwealth guidance (DSEWPaC 2012). Relevant aspects of the recent draft referral guidelines (Commonwealth of Australia 2017) were also incorporated into the survey as this allows data to be gathered that could potentially be used when the updated referral guidelines are finalised.

Potential and actual Black Cockatoo habitat trees are:

- listed tree species as provided in the Commonwealth guidance (DSEWPaC 2012)
- minimum size of 500 mm diameter at breast height (DBH) for most species, or 300 mm DBH for Salmon Gum and Wandoo.

The following were recorded for each potential and actual habitat tree:

- location, recorded using a handheld GPS device with an accuracy of approximately 5 m
- species and DBH
- identifying if tree hollows of suitable size and orientation are present, and recording evidence of use by cockatoos such as chewing at the hollow entrance
- habitat value according to the scoring system developed by Dr Mike Bamford (2016); this score reflects the existing value of the tree characteristics with respect to its potential to be used as a nesting tree (as per **Table 24 in Appendix One**)
- photograph of each tree, showing hollows if possible
- known nesting trees as per DBCA data.

The suitability of the survey area for breeding (additional to the specific tree survey) and as foraging habitat (as per the Commonwealth (2017) scoring tool; **Table 25** in **Appendix One**) was also assessed and mapped, taking into consideration:

- the presence of species favoured for foraging (as listed in the Commonwealth guidance, including Proteaceous species, Eucalypt species, *Pinus* species etc.)
- evidence of foraging e.g. chewed Eucalypt nuts
- location of known nesting or night roosting trees
- surrounding vegetation, up to at least 12 km from the survey area and taking into consideration the proximity to any known breeding habitat and watering points
- presence of disease, such as *Phytophthora cinnamomi* or Marri Canker (*Quambalaria coyrecup*).

Chuditch (*Dasyurus geoffroii*) VU (EPBC Act, BC Act)

The suitability of the survey area for Chuditch, such as the presence of fallen hollow logs and hollow standing trees, was recorded.

Targeted searches were undertaken looking for tracks, scats, and dens in areas of woodland habitat within the survey area.

4 FIELD SURVEY RESULTS

4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by Terri Jones (Senior Ecologist, Flora Collecting Permit FB62000191; Threatened Flora Collecting Permit TFL- 2021) during 3-6 November 2020. The flora and vegetation survey was conducted concurrently with the fauna survey.

4.1.1 FLORA

4.1.1.1 Flora Inventory

Six floristic quadrats and four relevés were recorded from within the survey area.

A total of 113 vascular flora species were recorded from 80 genera and 32 families from the quadrats, relevés, opportunistic observations and searches for conservation-listed flora. Of these, 19 were introduced (16.81%) and nine (7.96%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Myrtaceae (21 taxa), Fabaceae (16 taxa) and Poaceae (15 taxa). The most commonly represented genera were *Eucalyptus* and *Melaleuca*, with seven and five species, respectively.

The number of species per quadrat/relevé ranged from six (quadrat QCR03) to 29 (relevé R03), with an average species diversity per sample site of 14.9. The most commonly recorded species were *Eucalyptus occidentalis* which was recorded from eight quadrats, **Briza maxima* and **Ehrharta calycina* recorded from six quadrats each, and **Hypochaeris glabra*, **Ehrharta longiflora* and **Ursinia anthemoides* recorded from five quadrats each.

The combined flora inventory is presented in **Table 32** in **Appendix Four**. Quadrat data is presented in **Appendix Five**.

4.1.1.2 Conservation-listed Flora

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed Threatened Flora were recorded during the field survey.

Priority Flora

No Priority-listed flora were recorded during the field survey.

4.1.1.3 Other Significant Flora

No flora taxa having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

4.1.1.4 Flora of Taxonomic Interest

No flora of taxonomic interest were recorded during the field survey.

4.1.1.5 Introduced Flora

Nineteen introduced flora species (weeds) were recorded during the field survey, representing 16.81% of the overall flora inventory. Most are commonly occurring weeds within the agricultural area. The most commonly

encountered species were **Briza maxima* (Blowfly Grass) and **Ehrharta calycina* (Perennial Veldt Grass) recorded in six quadrats and relevés, **Ehrharta longiflora* (Annual Veldt Grass), **Hypochaeris glabra* (Flatweed) and **Ursinia anthemoides* (Ursinia) (in five) and **Asparagus asparagoides* (Bridal Creeper) (in four).

One of the introduced flora, **Asparagus asparagoides* (**Image 1**) is a Declared Pest plant and WoNS species.



Image 1: **Asparagus asparagoides* (Bridal Creeper)

4.1.2 VEGETATION

4.1.2.1 Vegetation Types

Four native vegetation types were recorded from within the survey area (**Table 6, Map 4**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.1.2.1**) and subsequent desktop review. Two of these types co-occurred forming a fine-scale mosaic.

The vegetation types within the survey area were:

- **EdMW:** *Eucalyptus decipiens* mid mallee woodland
- **EoW:** *Eucalyptus occidentalis* low open woodland
- **EwEoW:** *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland
- mosaic of **EwEoW** and **EoW**
- **LeCqApS:** *Leptospermum erubescens*, *Calothamnus quadrifidus* and **Acacia pycnantha* mid shrubland.

Table 6: Vegetation types

Mapping unit	Vegetation type	Floristic quadrats /relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
EdMW	<i>Eucalyptus decipiens</i> mid mallee woodland over <i>Baumea juncea</i> and <i>*Asparagus asparagoides</i> low closed sedgeland/vineland	R04		<i>Billardiera fusiformis</i> <i>Briza maxima</i> <i>Ehrharta longiflora</i> Indicator species: <i>Baumea juncea</i> <i>Eucalyptus decipiens</i>	0.58 ha 2.31%
EoW	<i>Eucalyptus occidentalis</i> low open woodland over <i>Melaleuca cuticularis</i> tall open shrubland over <i>Leptocarpus kraussii</i> , <i>*Lolium rigidum</i> and <i>Gahnia trifida</i> low sedgeland/grassland	QCR03 QCR04 QCR05		<i>Briza maxima</i> , <i>Hypochaeris glabra</i> , <i>Rytidosperma caespitosum</i> , <i>Ursinia anthemoides</i> Indicator species: <i>Melaleuca cuticularis</i>	1.72 ha 6.85%
EwEoW/ EoW mosaic	Mosaic of <i>Eucalyptus wandoo</i> and <i>Eucalyptus occidentalis</i> mid woodland and <i>Eucalyptus occidentalis</i> low open woodland				1.87 ha 7.43%

Mapping unit	Vegetation type	Floristic quadrats /relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
EwEoW	<i>Eucalyptus wandoo</i> and <i>Eucalyptus occidentalis</i> mid woodland over <i>Gahnia trifida</i> , <i>Lepidosperma</i> sp. and <i>Hakea marginata</i> low sedgeland/shrubland	QCR01 QCR02 QCR06		<i>Asparagus asparagoides</i> , <i>Ehrharta calycina</i> , <i>Ehrharta longiflora</i> , <i>Neurachne alopecuroidea</i> , <i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897) Indicator species: <i>Eucalyptus wandoo</i> <i>Lepidosperma pubisquameum</i>	5.67 ha 22.55%
LeCqApS	<i>Leptospermum erubescens</i> , <i>Calothamnus quadrifidus</i> and * <i>Acacia pycnantha</i> mid shrubland over <i>Verticordia subulata</i> , <i>Banksia fraseri</i> var. <i>fraseri</i> and <i>Melaleuca carrii</i> low open shrubland with <i>Allocasuarina huegeliana</i> and <i>Eucalyptus occidentalis</i> low isolated trees	R01 R02 R03		<i>Acacia stenoptera</i> , <i>Borya sphaerocephala</i> , <i>Briza maxima</i> , <i>Dianella revoluta</i> , <i>Disa bracteata</i> , <i>Hakea prostrata</i> , <i>Hypochaeris glabra</i> , <i>Kunzea recurva</i> , <i>Neurachne alopecuroidea</i> , <i>Stackhousia monogyna</i> , <i>Ursinia anthemoides</i> Indicator species: <i>Leptospermum erubescens</i> <i>Melaleuca carrii</i> <i>Stackhousia monogyna</i> <i>Verticordia subulata</i>	0.93 ha 3.69%
Not native vegetation (infrastructure, tracks and weedy grasses)					14.37 ha 57.17%
TOTAL EXTENT					25.13 ha 100%

4.1.2.1 Floristic Analysis

The floristic analysis dendrogram (**Figure 3**) indicates that floristic analysis supports the field interpretation (that was based on species composition and structure) of three of the four vegetation types within the survey area. Vegetation type **EoW** is less well supported by floristics but is retained as a vegetation type due to its distinctive mid stratum.

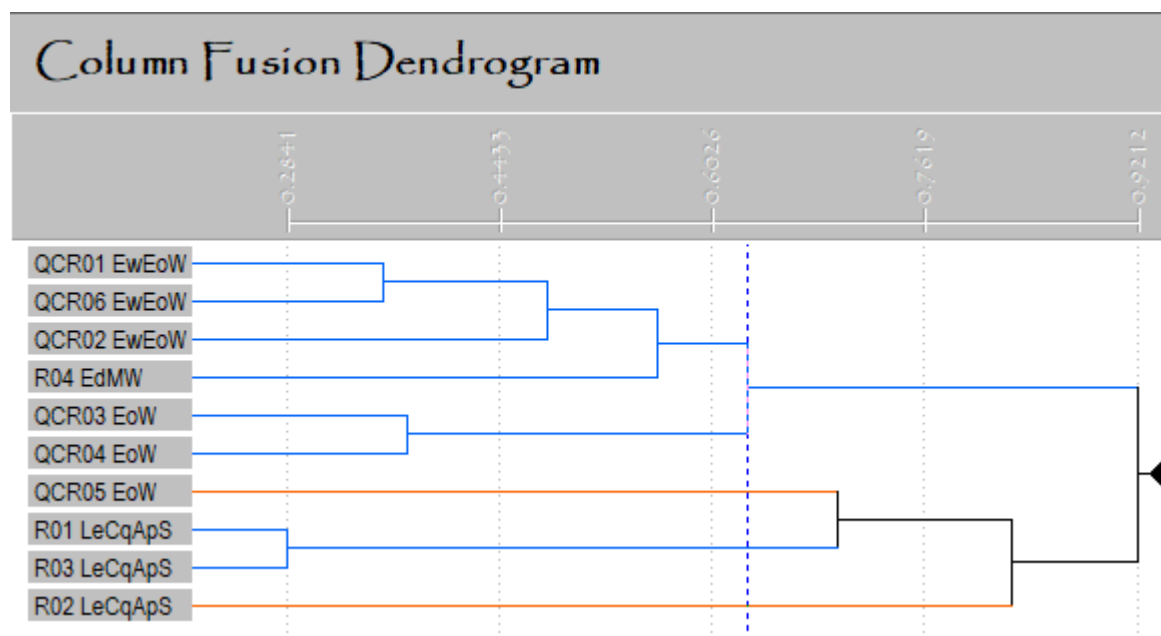


Figure 3: Floristic analysis dendrogram

4.1.2.2 Vegetation Significance

TECs and PECs

Database searches (**Section 2.2.3**) identified the two EPBC-listed TECs, both of which have Western Australian PEC equivalents, and an additional Western Australian PEC have been mapped as occurring nearby.

No vegetation similar to either the EPBC-listed *Proteaceae dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia* TEC (assessment criteria are summarised in **Appendix Two**) and its Western Australian PEC equivalent or *Montane mallee thicket community of the Stirling Range* Western Australian PEC occurs within the survey area.

The survey area has been entirely included in numerous indicatively mapped occurrences of the Wheatbelt Woodlands TEC. According to basic criteria outlined in the Approved Conservation Advice (TSSC 2015):

- vegetation type **EdMW** is not representative as it is not a woodland, being characterised by a mallee species
- vegetation type **LeCqApS** is not representative as it has only a scattered (i.e. <2% cover) tree stratum that does not meet the requirement of >10% crown cover. It is therefore a shrubland with only emergent trees, not all of which are Eucalypts
- vegetation type **EoW**, being an open woodland, does not meet the crown cover requirement of >10% cover
- vegetation type **EwEoW** (and possibly the mosaic with **EoW**) meets the basic descriptive requirements to be considered for inclusion, subject to meeting condition and extent thresholds, of being a Eucalypt woodland characterised by two of the listed dominant species with a combined crown cover of >10%.

The majority of the southern portion of the survey area is representative of vegetation type **EwEoW** (and mosaic), and most of the area with native vegetation (i.e. excluding the railway and cleared and/or disturbed areas including tracks adjacent to the railway) is in Good or Very Good condition. The Approved Conservation Advice (TSSC 2015) outlines the requirement to treat patches of suitable vegetation as being separate for extent calculations where they are separated by more than 50 m or divided by a sealed road, however, does not provide advice if this is applicable to railway lines. As the distance between the edges of the native vegetation portions is at times (measured across the railway) greater than 50 m they are, herein, being considered to represent separate patches.

The combined extents of vegetation type **EwEoW** and mosaic (included under the precautionary principle) within the survey area, on the two sides of the railway line, are as per **Table 7**.

Table 7: Extents of vegetation potentially representative of the Wheatbelt Woodlands TEC

	Vegetation type	Very Good condition (ha)	Good condition (ha)	Combined (ha)
East	EwEoW	1.37	0.33	1.69
East	EwEoW/EoW mosaic	0.54	1.33	1.87
East combined		1.91	1.65	3.56
West	EwEoW	2.45	1.52	3.97

According to the extent and condition thresholds required for inclusion in the TEC (TSSC 2015), vegetation type **EwEoW** on the western side of the railway meets the criteria to be considered as a Category A or, if taking weed cover in some patches into consideration, Category B representative of the Wheatbelt Woodlands TEC as there is >2 ha in Good-Very Good condition.

Vegetation type **EwEoW** and mosaic (combined) on the eastern side of the railway almost meets the lower extent requirement of 2 ha threshold to be included in the TEC when considering only the extent of the Very Good condition vegetation as the total in this condition is 1.91 ha. However, when including the Good condition vegetation the extent of suitable vegetation meets the criteria to be considered as a Category B representative of the Wheatbelt Woodlands TEC. The extent is also likely to increase as the vegetation continues in a similar condition to the south, which would also be taken into consideration when calculating extents.

Vegetation likely to be representative of the Wheatbelt Woodlands TEC is indicated on **Map 4**.

4.1.2.3 Other Significant Vegetation

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

4.1.2.4 Vegetation Condition

The vegetation condition within the survey area ranged from Good to Very Good condition, with the majority in Good condition (**Table 8, Map 5**). The main factors affecting vegetation condition were weed invasion and previous clearing.

Table 8: Vegetation condition

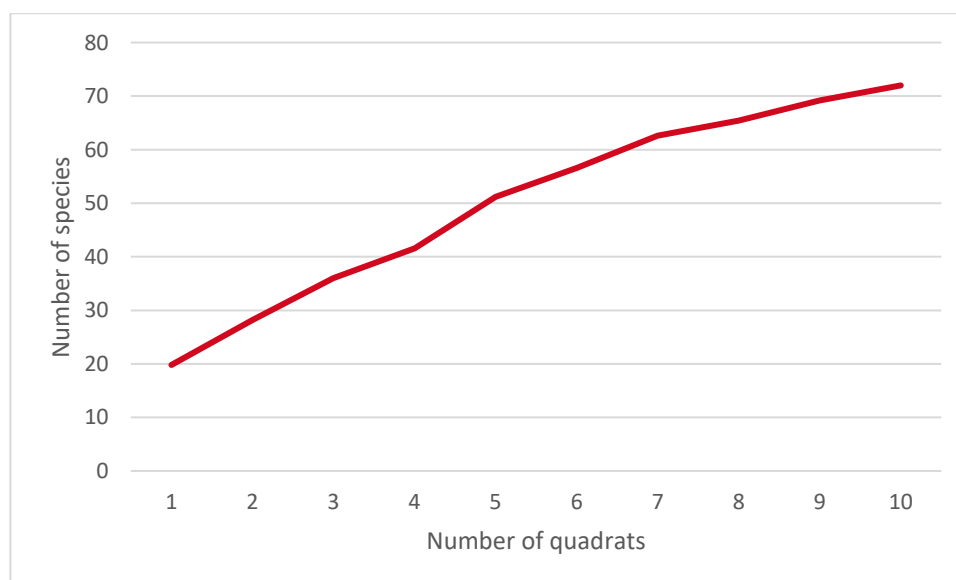
Vegetation condition	Extent (ha)	Proportion (%)
Pristine	-	-
Excellent	-	-
Very Good	4.68	18.61
Good	6.09	24.22
Degraded	5.29	21.06
Completely Degraded	-	-
Not native species; not vegetated	14.37	57.17

4.1.2.5 Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (**Figure 4**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that additional quadrats would likely have resulted in recording additional flora species. However, the Bootstrap estimate of species richness is 86.42 which, when taking opportunistic records into account, is less than the total species richness recorded on the site (119 species). Therefore, the survey is considered as having been adequate to describe the floristic diversity of the survey area.

**Figure 4: Species accumulation curve**

4.1.3 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation significant flora.

Survey type: Detailed flora and vegetation survey with extensive searches for significant flora searches conducted over a single phase. The survey area was adequately surveyed through the use of floristic quadrats to sample vegetation types, and targeted searches for conservation significant flora.

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

A summary of botanical limitations is presented in **Table 9**.

Table 9: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate, or negligible	Comment
Availability of contextual information at a regional and local scale	Negligible	There is little contextual information available to inform the results of the flora and vegetation survey.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	Negligible	The lead botanist conducting the field survey has over 10 years' experience conducting flora and vegetation surveys in Western Australia.
Proportion of the flora recorded and/or collected, and any identification issues	No	113 vascular flora taxa were recorded during the field survey of which 7.96% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered to not represent a constraint as none of the unidentified taxa are considered likely to represent any conservation-listed flora from the region.
Was the appropriate area fully surveyed (effort and extent)	No	The survey area had six quadrats and four relevés recorded. Despite being unmeasured a similar level of detail was recorded in relevés as for quadrats thus this is not considered a constraint. Vegetation type EdMW had only one relevé recorded from within it due to its small extent (0.58 ha).
Access restrictions within the survey area	No	The survey area was entirely accessible.
Survey timing, rainfall, season of survey	Negligible	The field survey was conducted during November which is within the primary season for survey in the bioregion. The rainfall in the 6 months prior to the field survey was 79.87% the mean for this period (Figure 2), also indicated by the rainfall deciles (Figure 5). This represents a negligible constraint as the rainfall is sufficient for most annual and ephemeral species to have flowered (particularly as August rainfall was above average), although the amount of flowers and plant size is likely to have been reduced.

Possible limitations	Constraints (yes/no): Significant, moderate, or negligible	Comment
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt.

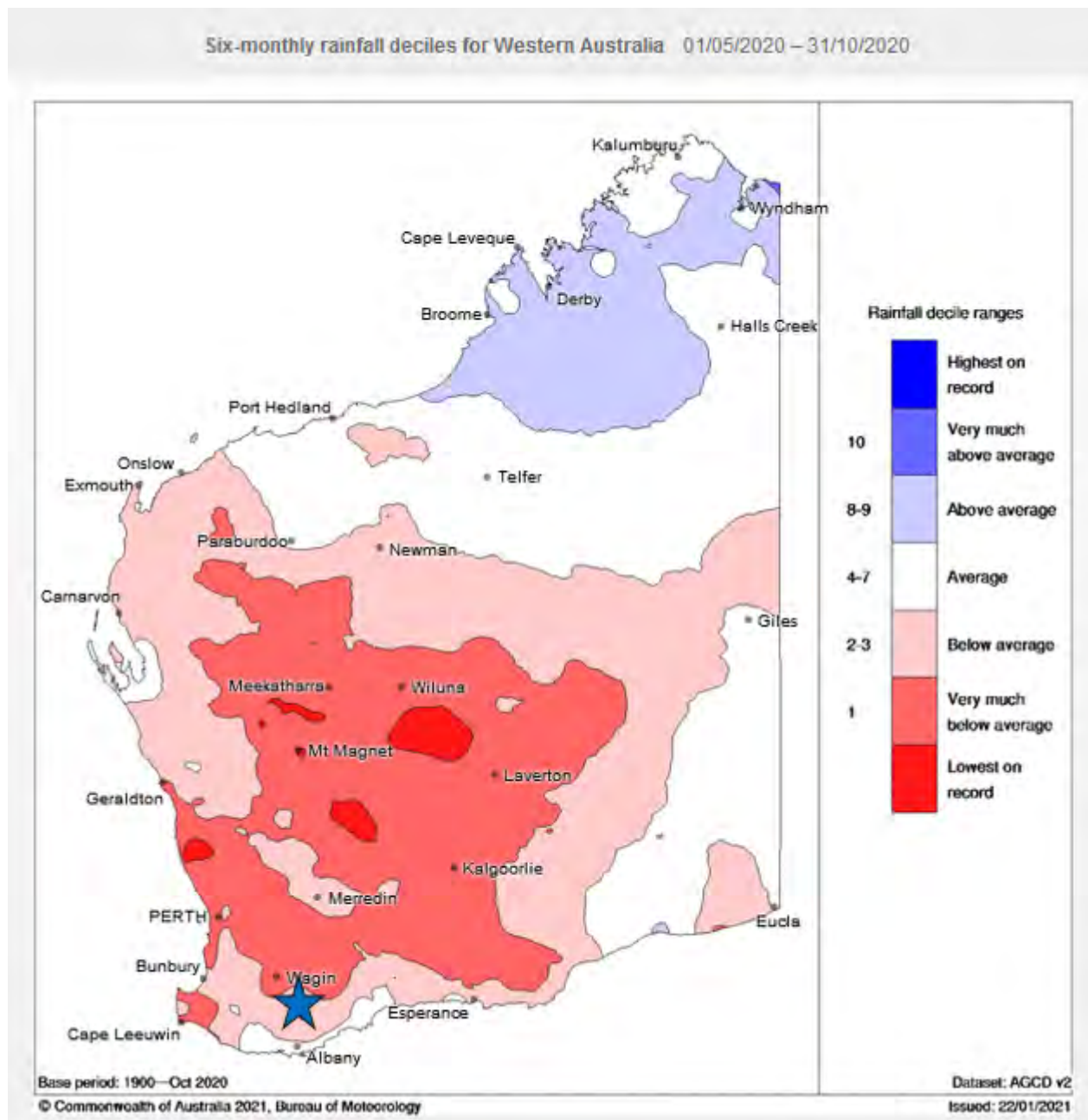


Figure 5: Rainfall deciles for the 6 months prior to the field survey (the star indicates the approximate survey area location)

4.2 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Terri Jones (Senior Ecologist) during 3-6 November 2020. The survey was conducted in accordance with the requirements outlined in the Fauna Technical Guidance (EPA 2020a).

The entire site was traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species. The fauna survey tracks are shown on **Map 5**.

4.2.1 FAUNA ASSEMBLAGE

Thirty vertebrate fauna species were recorded during the survey, as listed in **Table 33** in **Appendix Four**.

Of these, two are introduced (Rabbit and Red Fox) and one is conservation-listed:

- *Calyptorhynchus latirostris* (Carnaby's Cockatoo); EPBC Act EN; BC Act EN, observed flying at low height in survey corridor.

Survey sites are listed in **Table 34** in **Appendix Four**.

4.2.2 FAUNA HABITAT

Three fauna habitat types were recorded within the survey area (**Table 10**):

- Woodland
- Shrubland
- Grassland.

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

Table 10: Fauna habitat types

Habitat type	Description	Photograph
Woodland	Woodland of Eucalypt trees, low understorey. The woodland habitat consists of Eucalypt trees (Wandoo <i>Eucalyptus wandoo</i> and Swamp Yate <i>Eucalyptus occidentalis</i>) over a low understorey of sedges, grasses (at times largely introduced species) and low shrubs, typically without a middle shrub that would provide shelter from native and introduced predators and food sources for a range of mainly avian species. Due to the lack of shelter, the Woodland provides suitable habitat and foraging resources for more generalist bird species including leaf gleaning insectivorous birds, aerial insectivores and some seed eaters that inhabit the tree canopy. The grassy and sedgy understorey provides resources for larger parrots and cockatoos. Swamp Yate rarely produces tree hollows of any significant size whereas Wandoo can develop tree hollows suitable for a wide range of bird species. The lack of ground shelter and hard and frequently wet soil surface restricts the suitability of this habitat type for fossorial species including reptiles. Extent: 8.11 ha; 32.29%	

Habitat type	Description	Photograph
Shrubland	Shrubs with occasional emergent trees The Shrubland habitat consisted of two broad subunits, with one having more shrub species and one being largely species poor and occurring in damper parts of the survey area. The shrubland habitat provides shelter from predators and suitable nesting sites for smaller bird species and also provides a range of food sources including nectar from flowering shrubs, insects that are attracted to flowering shrubs and various leaf types available in this more diverse habitat, and seed sources. Some Proteaceous species are present and may be used by Black Cockatoos as a food source, however, they are not dominant and form only a relatively minor component of available resources. Other fauna suites are also likely to be attracted to the diversity of shelter and food sources available including fossorial species including reptiles (and amphibians in wetter areas). Extent: 2.65 ha; 10.54%	
Grassland	Grassland of mainly introduced annual and perennial grasses This habitat type provides shelter for smaller fauna species, reptiles, grass seeds for granivore bird species and habitat for a range of insect species. Extent: 5.29 ha; 21.06%	

4.2.3 SIGNIFICANT FAUNA AND ASSOCIATED HABITAT

One significant fauna species (Carnaby's Cockatoo) was observed during the field survey.

4.2.3.1 Carnaby's Cockatoo (*Calyptorhynchus latirostris*); EN; EN,

Carnaby's Cockatoo is a large species of cockatoo endemic to south-western Western Australia which has predominantly black plumage with white cheek patches and tail feather panels. The known distribution for the species runs roughly south-west of a line between Kalbarri and Esperance, extending along the south coast to Cape Arid National Park (Commonwealth of Australia 2017) with birds foraging in proteaceous woodlands and shrublands in coastal areas from January to July, the moving inland to woodlands with suitable nesting hollows during the breeding season of late July to December (Saunders 1980). There has been an estimated 50% decline in Carnaby's Cockatoo numbers over the last 70 years, primarily due to loss of foraging habitat and nesting hollows of suitable size in breeding areas (DPaW 2013b), and the taxon is classified as Endangered under both the BC Act and EPBC Act. The survey area is within the modelled breeding range of this species (DSEWPac 2012).

The species occurs in uncleared or remnant native eucalypt woodlands and shrubland or kwongan heathland dominated by *Hakea*, *Banksia* and *Grevillea* species (DPaW 2013b). It is a seasonal visitor to plantations of exotic pines (*Pinus* spp.), and sometimes occurs in forests.

An individual of this species was opportunistically observed flying and calling over the survey area on one occasion. It was not seen to alight within the survey boundary. There are suitable resources within the Woodland and Shrubland habitat types within the survey area to provide some potential nest sites for this species and a limited amount of foraging habitat, discussed in **Sections 4.2.4 and 4.2.5**.

4.2.4 BLACK COCKATOO BREEDING HABITAT

Assessment for potential and active Black Cockatoo breeding trees was undertaken throughout the survey area. A list of trees is provided in **Table 35** in **Appendix Four**. Each tree was assessed for the potential to provide breeding habitat for the Black Cockatoo species as per Commonwealth guidelines (Commonwealth of Australia 2017).

A total of 175 trees were recorded, consisting of primarily of Wandoo (*Eucalyptus wandoo*) and Flat-Topped Yate (*Eucalyptus occidentalis*), with three trees recorded as *Eucalyptus* sp. unable to be identified to species level. The recorded trees were all scored using the scale (**Table 24** in **Appendix One**) developed by Dr Mike Bamford (2016) to further refine nesting value to the Black Cockatoo species and results recorded.

None of the trees examined showed evidence of use for nesting by Black Cockatoos. Eight trees were assessed as Class 3 trees, observed to have hollows present of a suitable size for Black Cockatoos to utilise but no evidence of recent use. Two of these trees were dead; the others were Wandoo. Photographs of the Class 3 trees are included in **Appendix Four**.

The remaining trees recorded were of Class 4 (no suitable hollows) or Class 5 (no hollows present), with 99 and 68 trees recorded, respectively. The Class 4 and 5 trees do not currently exhibit the characteristics necessary for Black Cockatoo to use for nesting, however, they have potential to may develop a hollow in the future, and Wandoo species in particular are known to support breeding as per Commonwealth guidelines (Commonwealth of Australia 2017).

The survey area has potential to provide breeding habitat for Black Cockatoo species as it contains suitable tree species of sufficient size to form hollows.

4.2.5 BLACK COCKATOO FORAGING HABITAT

Both Woodland (8.11 ha) and Shrubland (2.65 ha) habitat types have the potential to be used as foraging by Carnaby's Cockatoo.

A more detailed assessment of habitat quality, using the tool in the *Revised Draft Referral Guidelines for the three Black Cockatoo species* (Commonwealth of Australia 2017) was used for each habitat type (below). Baudin's Cockatoo is listed as 'species likely to occur' and Forest Red-tailed Black Cockatoo as 'species may occur' in the Referral Guidelines (DSEWPaC 2012) although they were not recorded during the field survey.

4.2.5.1 Carnaby's Cockatoo

Table 11: Foraging habitat scoring tool – Carnaby's Cockatoo (Woodland habitat)

Habitat Summary for Carnaby's Cockatoo Foraging Habitat		Score
Starting Score:		
Individual foraging plants or small stand of foraging plants		+1
Attributes improving functionality of foraging habitat:		
Contains trees with potential to be used for breeding (Wandoo DBH >500 mm)		+2
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		0

Table 12: Foraging habitat scoring tool – Carnaby's Cockatoo (Shrubland habitat)

Habitat Summary for Carnaby's Cockatoo Foraging Habitat		Score
Starting Score:		
Native shrubland dominated by Proteaceous species		+7
Attributes improving functionality of foraging habitat:		
None		0
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		4

The score (0 of a possible total of 21) indicated in **Table 11** identifies the Woodland habitat as not being suitable for Carnaby's Cockatoo. The Shrubland habitat (score 4; **Table 12**) is considered as 'valued' for Carnaby's Cockatoo, however, the score is likely to be overstated as Proteaceous species are present but not dominant.

¹ There are no confirmed or unconfirmed roosting sites within 50 km of the survey area (Landgate 2020), although the survey area is within the buffers of a 'Black Cockatoo breeding site' (unspecified species).

4.2.5.2 Baudin's Cockatoo

Table 13: Foraging habitat scoring tool – Baudin's Cockatoo (Woodland habitat)

Habitat Summary for Baudin's Cockatoo Foraging Habitat		Score
Starting Score:		
Individual foraging plants		+1
Attributes improving functionality of foraging habitat:		
Contains trees with potential to be used for breeding (Wandoo DBH >500 mm)		+2
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		0

Table 14: Foraging habitat scoring tool – Baudin's Cockatoo (Shrubland habitat)

Habitat Summary for Baudin's Cockatoo Foraging Habitat		Score
Starting Score:		
Native Eucalypt woodlands and forest, Proteaceous woodlands, and heaths		+7
Attributes improving functionality of foraging habitat:		
None		0
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		4

The score (0 of a possible total of 21) indicated in **Table 13** identifies the Woodland habitat as not being suitable for Black Cockatoo. The Shrubland habitat (score 4, **Table 14**) identifies the habitat is considered as 'valued' for Baudin's Cockatoo, however, the score is likely to be overstated as Proteaceous species are present but not dominant.

4.2.5.3 Forest Red-tailed Black Cockatoo

Table 15: Foraging habitat scoring tool – Forest Red-tailed Black Cockatoo (Woodland habitat)

Habitat Summary for Forest Red-tailed Black Cockatoo Foraging Habitat		Score
Starting Score:		
Wandoo woodland within the range of the subspecies ²		+7
Attributes improving functionality of foraging habitat:		
Contains trees with potential to be used for breeding (Wandoo DBH > 500 mm)		+2
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		6

Table 16: Foraging habitat scoring tool – Forest Red-tailed Black Cockatoo (Shrubland habitat)

Habitat Summary for Forest Red-tailed Black Cockatoo Foraging Habitat		Score
Starting Score:		
Individual foraging plants		+1
Attributes improving functionality of foraging habitat:		
None		0
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known roosting site ¹		-1
FINAL SCORE		-2

The score (6 of a possible total of 21) indicated in **Table 15** identifies the Woodland habitat as 'High Quality' for Forest Red-tailed Black Cockatoo, although the database search results indicate this species has only infrequently been recorded from the vicinity of the survey area. This foraging score may also be inaccurate as the definition attributable to the starting score is not clearly defined.

Table 16 identifies the Shrubland habitat to be not significant for Forest Red-tailed Black Cockatoo (-2 of a possible total of 21).

² The full requirement for the starting score is "Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA."

4.2.6 FAUNA SURVEY LIMITATIONS

Table 17: fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate, or negligible	Comment
Availability of data and information	Negligible	There are no known fauna surveys that have been conducted within the survey area or nearby.
Competency/experience of the survey team, including bioregion experience	Negligible	The ecologist conducting the survey has conducted similar surveys elsewhere in the Wheatbelt for 10 years.
Scope of survey e.g. excluded fauna groups	No	The scope of works indicated that all terrestrial vertebrate fauna species were included in the survey.
Timing, weather, season	No	The survey timing and season was suitable to conduct the fauna survey.
Disturbances that may have affected results	No	There were no recent disturbances that would have affected the results.
Proportion of fauna identified, recorded, or collected	No	No fauna species that were recorded could not be identified to species level.
Adequacy of survey intensity and proportion of survey achieved	No	The survey was of sufficient intensity to adequately describe the fauna species and habitat present within the survey area.
Access	No	The survey area was entirely accessible.
Data and analysis issues including sampling biases	No	No significant data analysis was required.

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

A total of 113 vascular flora species were recorded from the floristic quadrats, relevés and opportunistic observations.

5.1.1 LOCAL AND REGIONAL ASSESSMENT OF FLORA SIGNIFICANCE

5.1.1.1 Conservation-listed Flora

Threatened Flora

No TF listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded. None have previously been recorded from the survey area, as indicated by DBCA database searches (**Section 2.2.4**). None of the species that could not be identified with certainty resembled any currently described TF taxa.

Priority Flora

No PF were recorded during the field survey. None have previously been recorded from the survey area, as indicated by DBCA database searches (**Section 2.2.4**). None of the species that could not be identified with certainty resembled any currently described PF taxa.

5.1.1.2 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, disturbances, actual habitat availability and search effort, is included in **Table 30** in **Appendix Three**.

Nine taxa were considered at desktop assessment stage to have a Possible likelihood of occurring; their re-evaluated likelihood of occurring is discussed below. Two, both small herbs, have retained this likelihood post-survey.

Acacia prismifolia (presumed extinct)

Whilst technically considered as extinct this species has been recently rediscovered (2018) but not yet had its status amended.

This species has been re-evaluated as being Unlikely to occur due to its statistical unlikelihood (i.e. has only been recorded from very few locations) and it being a small shrub with distinctive foliage (WAH, DBCA & Shire of Dalwallinu 2020) that, given the search effort, is unlikely to have been overlooked during the field survey. If it does occur it would most likely be in vegetation type **LeCqApS** that is consistent with the vegetation type that it has been recorded from in 2018 (WAH 2021 specimen details).

Diuris drummondii (TF)

Diuris drummondii is a tall Donkey Orchid generally 1 m high that grows in swamps (WAH 1998-2021). Whilst there is some damp habitat within the survey area there are no swamps thus the habitat is considered only marginal at best. Given the size of the plant, that the genus is distinctive and that the survey was conducted during its flowering period where it should have been readily visible, it has been re-evaluated as being Unlikely to occur within the survey area.

***Acacia microneura* (P1)**

This species is a medium-sized shrub to 1.5 m high (WAH 1998-2021). As such, mature plants are unlikely to have been overlooked during the field survey and *Acacia microneura* has been re-evaluated as being Unlikely to occur within the survey area.

***Thomasia dielsii* (P1)**

Thomasia dielsii is a low, spreading shrub with blue-purple flowers (WAH 1998-2021). As the survey was conducted during its flowering period it is unlikely to have been overlooked as therefore has been re-evaluated as being Unlikely to occur within the survey area.

***Stylidium diuroides* subsp. *nanum* (P1)**

Stylidium diuroides subsp. *nanum* is a small herb that has been collected from within 2 km of the survey area within the last 10 years. Most descriptions (WAH 2021 specimen details) indicate that this species is diminutive and, as such, may have been overlooked during the field survey. It therefore retains its Possible likelihood of occurring, most likely within vegetation type **EdMW** as this is consistent with the vegetation type of one of the nearby records for this species listed in the WAH.

***Stylidium exappendiculatum* (P3)**

Stylidium exappendiculatum is small herb to only approximately 5 cm high that has been recorded from *Eucalyptus wandoo* woodlands less than 1 km from the survey area (WAH 2021 specimen details). As broadly suitable habitat occurs within the survey area and it is a small plant that may have been overlooked during the field survey, it retains its Possible likelihood of occurring.

***Calothamnus microcarpus* (P4)**

This species is an erect or spreading shrub to 1 m high (WAH 1998-2021) and as such is unlikely to have been overlooked during the field survey. It has been re-evaluated as being Unlikely to occur within the survey area.

***Eucalyptus erectifolia* (P4)**

Eucalyptus erectifolia is a mallee to 4 m high (WAH 1998-2021). It has smooth bark and would have been identifiable as a different species if observed within the survey area. As such it is unlikely to have been overlooked during the field survey and has been re-evaluated as Unlikely to occur within the survey area.

***Orthrosanthus muelleri* (P4)**

This species is a tufted perennial herb with blue flowers (WAH 1998-2021). Although suitable habitat occurs within the survey area it is unlikely to have been overlooked as has been re-evaluated as Unlikely to occur within the survey area.

5.1.1.3 Other Significant Flora

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

5.1.1.4 Introduced Flora

Nineteen introduced flora species (weeds) were recorded during the field survey, representing 16.81% of the overall flora inventory. One is a Declared Pest plant and WoNS species (**Asparagus asparagoides*, Bridal Creeper) although there are no management requirements in relation to its presence.

5.2 VEGETATION SIGNIFICANCE

Four native vegetation types, plus a mosaic of two of the two woodland types, were recorded from the survey area:

- **EdMW:** *Eucalyptus decipiens* mid mallee woodland over *Baumea juncea* and **Asparagus asparagoides* low closed sedgeland/vineland
- **EoW:** *Eucalyptus occidentalis* low open woodland over *Melaleuca cuticularis* tall open shrubland over *Leptocarpus kraussii*, **Lolium rigidum* and *Gahnia trifida* low sedgeland/grassland
- **EwEoW:** *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland over *Gahnia trifida*, *Lepidosperma* sp. and *Hakea marginata* low sedgeland/shrubland
- mosaic of **EwEoW** and **EoW**
- **LeCqApS:** *Leptospermum erubescens*, *Calothamnus quadrifidus* and **Acacia pycnantha* mid shrubland over *Verticordia subulata*, *Banksia fraseri* var. *fraseri* and *Melaleuca carrii* low open shrubland with *Allocasuarina huegeliana* and *Eucalyptus occidentalis* low isolated trees.

5.2.1 LOCAL AND REGIONAL ASSESSMENT OF VEGETATION SIGNIFICANCE

The significance of Eucalypt woodlands within the agricultural region of Western Australia is recognised by the listing of such woodlands as TEC protected under the EPBC Act (where they meet certain criteria).

The vegetation of the survey area was assessed against the criteria for inclusion in the Wheatbelt Woodlands TEC as outlined in the Approved Conservation Advice (TSSC 2015), resulting in one vegetation type (**EwEoW**) being considered as representing the TEC where it was in Good or better condition. Under the precautionary principle, this vegetation type where it occurred in a mosaic with vegetation type **EoW** (that was excluded in its 'pure' formation due to the cover of Eucalypts being less than the 10% canopy cover required for inclusion) was also considered likely to represent the Wheatbelt Woodlands TEC. Overall, 7.53 ha of vegetation is considered to represent the TEC.

Parts of the survey area considered representative of the Wheatbelt Woodlands TEC are also representative of the Western Australian PEC equivalent.

The vegetation representative of the TEC and PEC is considered as locally and regionally significant. No other parts of the survey area are likely to be considered as having any particular significance.

5.2.2 VEGETATION CONDITION

The native vegetation within the survey area ranged in condition from Good to Very Good, with almost half (10.76 ha; 42.83%) in Good or Very Good condition. Weed invasion was the most common reason for assessing the vegetation in the poorer condition classes.

5.3 FAUNA SIGNIFICANCE

5.3.1 FAUNA HABITAT TYPES

Three fauna habitat types were recorded from the survey area: Woodland (8.08 ha; 32.17%), Shrubland (2.65 ha; 10.54%) and Grassland (5.29 ha; 21.06%) that represented the more disturbed parts of the survey area.

5.3.1.1 Woodland

The Woodland habitat type provides suitable habitat for a range of species, particularly birds that forage above (aerial insectivores) and in tree canopies (leaf gleaning insectivores and seed eaters), and species that forage

at ground level, although the lack of cover in the mid stratum and at ground level, coupled with the narrow width of vegetation that provides limited escape routes, restricts its use by animals that forage in the lower levels, including birds, reptiles and mammals, and those that burrow (reptiles and amphibians).

The Woodland habitat provides nesting resources for birds that breed in tree hollows including, potentially, Black Cockatoo species. A total of 175 trees of sufficient size to potentially have or develop suitable hollows were recorded although only eight had hollows of sufficient size although not having the features preferred by Black Cockatoos (Class 3 trees according to the Bamford (2016) scale). Flat-topped Yate (*Eucalyptus occidentalis*) generally has branches that markedly narrow towards the top of the tree and would rarely form hollows of sufficient size for Black Cockatoos; none of the Class 3 trees were this species with all being Wandoo (*Eucalyptus wandoo*).

However, there are few foraging (food source) species present, and the habitat is unlikely to be significance for foraging by Black Cockatoo species, particularly the white-tailed species (Carnaby's Cockatoo and Black Cockatoo). The habitat quality score (Commonwealth of Australia 2017) for Forest Red-tailed Black Cockatoo, however, considered the Woodland habitat as being High quality due to the presence of *Eucalyptus wandoo*, although there were few other attributes that would attract this species to the site.

5.3.1.2 Shrubland

The Shrubland habitat provides shelter in mid to ground stratum and a diversity of flowering plants that also attract insects. As such, this habitat is suitable for a wide range of bird species due to the array of food sources (nectar, insects) and shelter, including for species that nest in shrub foliage. This habitat also includes some wetter areas likely to be suitable for amphibians, although none were recorded during the field survey.

The Shrubland habitat was assessed as being of 'valued' for foraging by Carnaby's Cockatoo and Black Cockatoo using the habitat quality scoring tool (Commonwealth of Australia 2017). This is due to the presence of Banksia species within the vegetation, however, the score obtained using this tool is likely to be overstated as, while present, Proteaceous species are not dominant, and the vegetation is not accurately described as 'Proteaceous heath'. Therefore, while having some potential to be utilised as foraging for Black Cockatoo species, realistically foraging within the Shrubland habitat is unlikely to occur except rarely and only if more frequently used resources are unavailable e.g. following fires in the Stirling Range.

5.3.1.3 Grassland

The Grassland habitat is suitable only for larger species during traverses and some smaller species, particularly reptiles and invertebrates, and provides a food source for granivore species or herbivores.

5.3.2 FAUNA ASSEMBLAGE

Thirty vertebrate fauna species were recorded during the field survey, including two introduced species (*Oryctolagus cuniculus*, Rabbit and *Vulpes vulpes*, Red Fox) and one conservation-listed species. Carnaby's Cockatoo (*Calyptorhynchus latirostris*), listed as Endangered under the EPBC and BC Acts, was observed overflying the survey area, however, was not observed to land in the survey area.

5.3.3 CONSERVATION-LISTED SPECIES

One conservation-listed species was recorded, Carnaby's Cockatoo (*Calyptorhynchus latirostris*), and is discussed below.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*); EPBC and BC Act – EN

This large species of cockatoo endemic to south-western Western Australia is classified as Endangered under both the BC Act and EPBC Act. It has experienced an estimated 50% decline primarily due to habitat loss and woodland with suitably sized potential nesting trees and nearby foraging resources is considered habitat critical to survival of the species (DPaW 2013b). The survey area is within the area modelled breeding range of Carnaby's Cockatoo (DSEWPac 2012).

An individual Carnaby's Cockatoo was opportunistically observed flying and calling over the survey area on one occasion. It was not seen to alight within the survey boundary, however, there are suitable nesting resources in the survey area for this species. The Shrubland habitat type was assessed as being 'valued' for foraging by this species due to the presence of Proteaceous species, including Banksias and Hakeas. Nearby water sources, and Proteaceous heath vegetation as indicated from pre-European vegetation mapping (DPIRD 2019b) are also available in close proximity (<5 km) thus indicating that the survey area could be utilised by Carnaby's Cockatoo for both breeding and, occasionally, foraging.

5.3.3.1 Post-survey Likelihood Assessment

One conservation-listed fauna species identified during the desktop assessment as having a High likelihood of occurring retained this likelihood following the field survey (Chuditch). Whilst not identified as having a High likelihood of occurring based on either desktop or post-survey assessment, other Black Cockatoo species are also discussed below with respect to habitat requirements, taking into consideration the findings of the field survey and survey effort.

The post-survey likelihood assessment is incorporated into **Table 31** in **Appendix Three**.

Chuditch (*Dasyurus geoffroii*); EPBC and BC Act – VU

This species, currently classed as vulnerable under the BC Act and EPBC Act, is the largest carnivorous marsupial extant within Western Australia and constitutes an important keystone species for ecosystems it inhabits. It forages nocturnally for small mammals, birds and invertebrates and shelters during the day in hollow logs or burrows (DAWE 2020b). It is restricted to the south-west corner of WA, typically within eucalypt woodland, forest, or mallee. The Chuditch occupies only 5% of its former distribution (DEC 2012).

No presence of Chuditch was observed during survey, however, there are a number of certain records of this species in close proximity to the survey area (<5 km) and suitable habitat is present to provide for foraging and dens. Given the large home ranges of up to 15 km² required by individual Chuditch in order to meet high resource needs (DEC 2012), and a dispersal range of more than 10 km for juveniles (Soderquist & Serena 2000), it is highly likely that Chuditch could either utilise or disperse into habitat of the survey area.

Baudin's Cockatoo (*Calyptorhynchus baudinii*); EPBC and BC Act – EN

Baudin's Cockatoo was assessed as being a Low likelihood of occurring during the desktop assessment. The DBCA database search identified seven records from within 20 km of the survey area, however, none of the records from the previous 20 years are from within 10 km of Cranbrook.

According to the Referral guidelines (DSEWPac 2012), Baudin's Cockatoo is 'likely to occur' in the survey area but is not known to breed in the vicinity. Baudin's Cockatoo is endemic to the high rainfall areas of the South-west of Western Australia and nest in Marri (*Corymbia calophylla*), Karri (*E. diversicolor*), Tuart (*Eucalyptus gomphocephala*) and Wandoo (*Eucalyptus wandoo*), this latter species occurring in the survey area. Their preferred food items include Marri seeds, flowers, nectar and grubs, and Proteaceous trees and shrubs. As

such, the habitat is only marginal for this species with only few possible nest sites in Wandoo trees and only small amounts of Proteaceous shrubs for foraging (and lacking the preferred large-seeded Eucalypt species) and, post survey, the likelihood of occurring within the survey area is still considered Low.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*); EPBC and BC Act – VU

The Forest Red-tailed Black Cockatoo was assessed as being a Low likelihood of occurring during the desktop assessment. The DBCA database search identified five records from within the 20 km search buffer, although none from within 10 km of the survey area from within the previous 20 years.

According to the Referral guidelines (DSEWPac 2012), Forest Red-tailed Black Cockatoo 'may occur' within the survey area. They generally breed in woodlands or forests, using a range of tree species including Wandoo that occurs within the survey area. They forage within similar vegetation to their preferred nesting areas, feeding on a range of seeds, particularly Eucalypts, but also *Allocasuarina* cones. As such, the habitat is only marginal for this species with only few possible nest sites in Wandoo trees and only small amounts of foraging species including Wandoo, which has smaller fruit and seeds than their more preferred species, and *Allocasuarina* cones. Post survey, the likelihood of occurring within the survey area has been re-evaluated as Very low.

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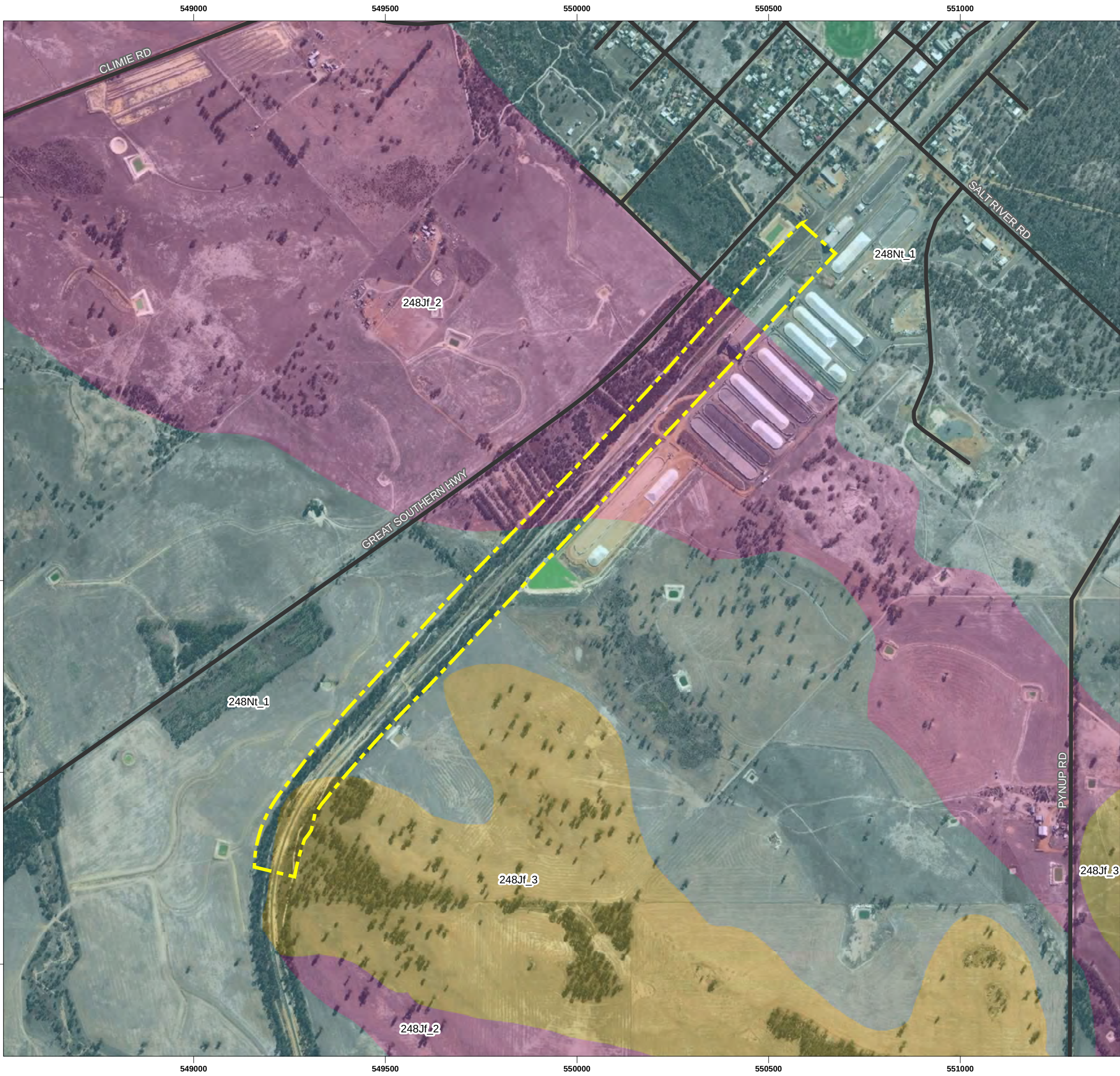
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- Western Australian Herbarium, Department of Biodiversity Conservation and Attractions & Shire of Dalwallinu 2019, *World Wide Wattle ver. 2*. Available from: <http://worldwidewattle.com/>.
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MAPS



LEGEND

- Survey Area
- Roads

Soil Land Systems

248Nt_1 - North Stirling 1 Subsystem: Basin floor with salt lakes, lunettes and saline flats. Saline groundwater close to the surface. Alkaline grey deep sandy duplex and grey deep sandy duplex soil, with saline wet soil, salt lake soil and semi-wet soil

248Jf_2 - Jaffa 2 Subsystem: Foothills, gently undulating rises and undulating plains. Grey deep sandy duplex is widespread with grey shallow sandy duplex and semi-wet soil.

248Jf_3 Jaffa 3 Subsystem: - Mid to upper slopes and hillcrest areas dominated by rock outcrop. Grey deep sandy duplex, grey shallow loamy duplex, bare rock and shallow gravel are common.

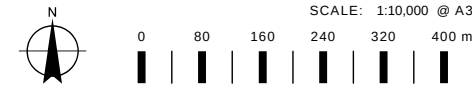
DATASOURCES:
SOURCE DATA: SOIL-LANDSCAPE MAPPING WESTERN AUSTRALIA - BEST AVAILABLE SOILS (2019), TRANSPORT ROAD CENTRELINES (MRWA 2012)
AERIAL: ESRI BASEMAP (2018)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY



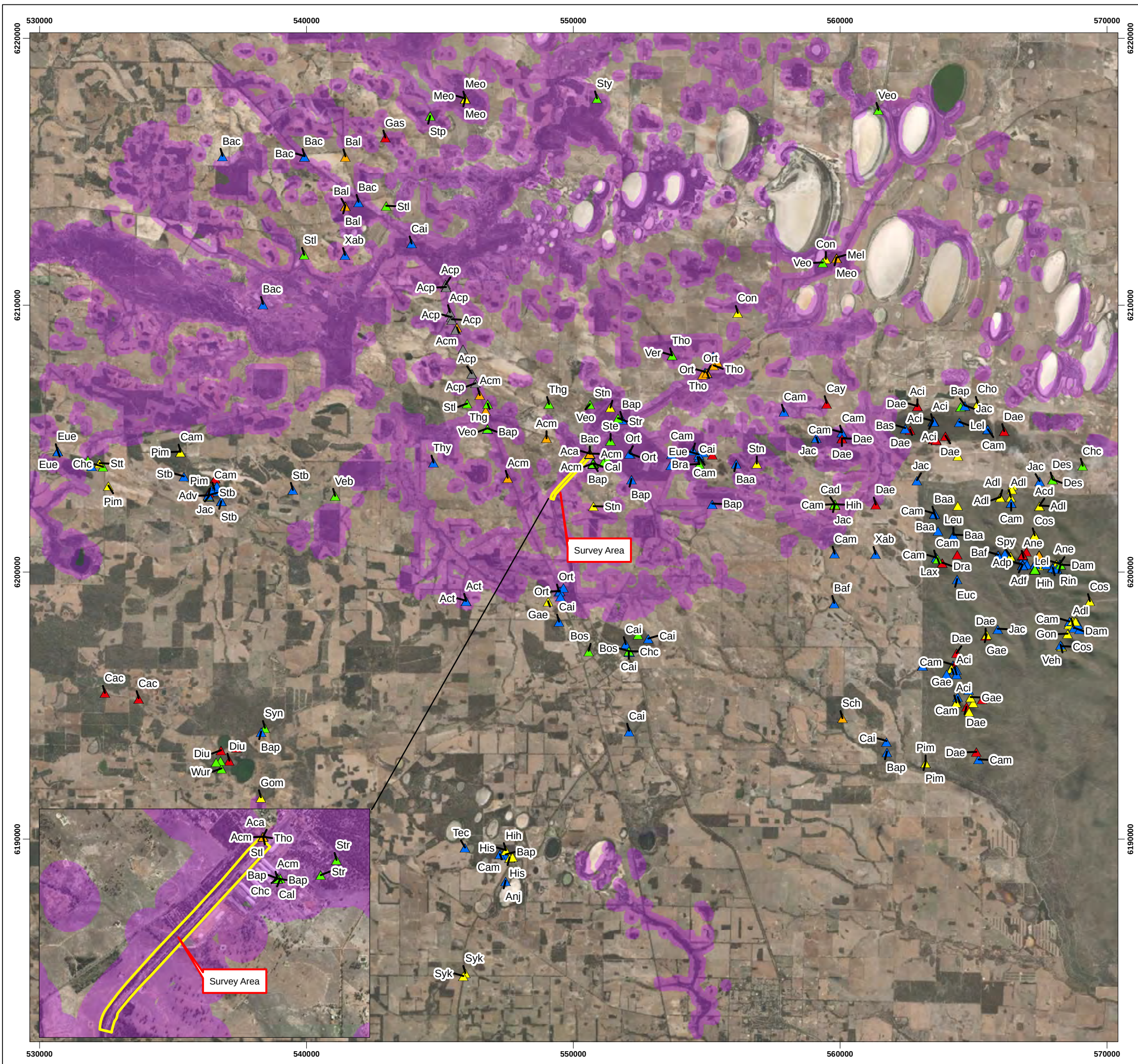
SOIL LANDSCAPE MAPPING
CBH CRANBROOK
ENVIRONMENTAL SURVEY



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



PROJECT NO: 4570-20			
REV	AUTHOR	APPROVED	DATE
00	LC	SB	16/02/2020



LEGEND

Survey Area

Conservation Significant Flora (DBCA 2020)

Extinct

Threatened

Priority 1

Priority 2

Priority 3

Priority 4

TEC/PEC (DBCA 2020)

Wheatbelt Woodlands

Code	Taxon	Status	Code	Taxon	Status	Code	Taxon	Status
Aca	Acacia ataxiphylloides subsp. ataxiphylloides	3	Dar	Darwinia collina	T	Mui	Muiranthus hasselii	4
Acd	Acacia declinata	4	Dah	Darwinia hypericifolia	4	Ort	Orthostichus muelleri	4
Aci	Acacia imparilis	4	Dam	Darwinia macrostegia	4	Pet	Petrophile carduacea	2
Acm	Acacia microneura	1	Dae	Darwinia meeboldii	T	Pim	Pimelea neokrya	2
Acp	Acacia prismifolia	X	Dao	Darwinia oxylepis	T	Re	Pterostylis hadra	1
Act	Acacia trulliformis	4	Das	Darwinia squarrosa	T	Rho	Rhodanthe fuscescens	1
Adl	Adenanthos filifolius	4	Daw	Darwinia wittwerorum	T	Rin	Rinzia longifolia	3
Adl	Adenanthos linearis	2	Dav	Daviesia mesophylla	2	Sch	Schoenus sp. Mt Barker (G.J. Keighery 9679)	1
Adp	Adenanthos pungens subsp. pungens	T	Dap	Daviesia pseudaphylla	T	Spd	Sphenotoma drummondii	T
Adv	Adenanthos velutinus	T	Des	Desmodium biflorum	3	Sph	Sphenotoma sp. Stirling Range (P.G. Wilson 4235)	4
Ane	Andersonia echinocephala	4	Diu	Diuris drummondii	T	Spm	Spyridium montanum	2
Anj	Andersonia grandiflora	4	Dra	Drakea confinis	T	Spy	Spyridium villosum	2
Anj	Andersonia sp. Jamesii (J. Liddell 84)	4	Dro	Drosera huegelii var. phillmanniana	2	Std	Stylidium diplectroglossum	1
Baa	Banksia aculeata	4	Euc	Eucalyptus erectifolia	4	Stn	Stylidium diuroides subsp. nanum	2
Bac	Banksia acuminata	4	Eum	Eucalyptus marginata x pachyphloea	4	Ste	Stylidium exappendiculatum	3
Ban	Banksia ananthe	T	Euc	Eucalyptus x kaiganiensis	4	Stl	Stylidium lepidum	3
Baf	Banksia foliolata	4	Gac	Gastrolobium crenulatum	2	Stp	Stylidium pseudohirsutum	3
Bah	Banksia hirta	4	Gae	Gastrolobium elegans	2	Str	Stylidium rhipidum	3
Bal	Banksia lepidophylla	1	Gah	Gastrolobium humile	T	Sty	Stylidium roseonanthum	3
Bap	Banksia porrecta	4	Gal	Gastrolobium leakeanum	2	Stt	Stylidium tylosum	2
Bar	Banksia rufa subsp. pumila	T	Gas	Gastrolobium lehmannii	T	Stb	Styphelia blepharolepis	4
Bas	Banksia senecifolia	4	Gom	Gompholobium sp. Stirling Range (C.F. Wilkins et al. CW 2513)	2	Stc	Styphelia cymbiformis	2
Bor	Boronia crenulata var. angustifolia	4	Gon	Gonocarpus rudis	2	Syn	Synaphea preissii	3
Bos	Boronia crenulata var. angustifolia	4	Hem	Hemigenia platyphylla	4	Syk	Synaphea sp. Koorinup (D. Trenoulen 429)	2
Bra	Brachyotum mogin	3	Hib	Hibbertia helianthemoides	4	Tec	Tecticornia uniflora	4
Cac	Caladenia christinae	T	Hs	Hibbertia sejuncta	2	Thb	Thomasia brachystachys	2
Cad	Caladenia dorrnieri	T	Hb	Hibbertia seikii	2	Tho	Thomasia dielsii	1
Cai	Caladenia integra	4	Hyp	Hypocalymma philippii	4	Ths	Thysanotus brevifolius	2
Cau	Caladenia ultima	2	Iso	Isopogon latifolius	4	Thg	Thysanotus gageoides	3
Cay	Calceolaria cyanea	T	Jac	Jacksonia calycina	4	Thy	Thysanotus parviflorus	4
Cam	Calothamnus microcarpus	4	Laf	Lambertia fairallii	T	Veb	Verticordia brevifolia subsp. brevifolia	3
Cal	Calytrix pulchella	3	Lam	Lasiopetalum membraniflorum	4	Vec	Verticordia carinata	T
Cho	Chordiflex ornatus	2	Las	Lasiopetalum monticola	3	Veo	Verticordia coronata	3
Chc	Chorizandra carinata	3	Lax	Laxmannia grandiflora subsp. stirlingensis	3	Veh	Verticordia harveyi	4
Cos	Conospermum spectabile	2	Leu	Leucopogon acicularis	2	Ver	Verticordia huegelii var. tridens	3
Com	Conostylis misera	T	Lel	Leucopogon lasiophyllus	4	Wur	Wurmbea sp. Cranbrook (A.R. Annel 3819)	3
Con	Conostylis seorsiflora subsp. Nyabing (A. Coates s.n. 210/1988)	2	Meo	Melaleuca ordinifolia	2	Xab	Xanthorrhoea brevistyla	4
Dac	Darwinia carnea	T	Mel	Melaleuca pritzelii	3	Xan	Xanthosia collina	3

DATASOURCES:

SOURCE DATA: CS FLORA AND TEC/PEC DATA (DBCA 2020)

AERIAL: ESRI BASEMAP (2018)

BASEMAP: GEOSCIENCE AUSTRALIA

SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

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FLORA & COMMUNITIES
DATABASE SEARCH RESULTS
CBH CRANBROOK
ENVIRONMENTAL SURVEY

CBHGROUP

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

PROJECTION: TRANSVERSE MERCATOR

DATUM: GDA 1994

UNITS: METRE

0 1 2 3 4 5 km

SCALE: 1:140,000 @ A3

PROJECT NO: 4570-20

REV

AUTHOR

APPROVED

DATE

00

LC

SB

16/02/2021

MAP

2



LEGEND

 Survey Area

Conservation Significant Fauna (DBCA 2020)

- Critically Endangered
- Endangered
- Vulnerable
- Migratory
- Conservation Dependent
- Other Specially Protected
- Priority 3
- Priority 4

Code	Taxon	Status
Ahy	<i>Actitis hypoleucos</i>	MI
Bpe	<i>Bettongia penicillata agilybi</i>	CR
Cac	<i>Calidris acuminata</i>	MI
Cfe	<i>Calidris ferruginea</i>	CR
Cru	<i>Calidris ruficollis</i>	MI
Cbn	<i>Calyptorhynchus banksii naso</i>	VU
Cba	<i>Calyptorhynchus baudinii</i>	EN
Cla	<i>Calyptorhynchus latirostris</i>	EN
Csp	<i>Calyptorhynchus</i> s. sp. 'white-tailed black cockatoo'	EN
Cle	<i>Charadrius leschenaultii</i>	VU
Dge	<i>Dasyurus geoffroii</i>	VU
Fpe	<i>Falco peregrinus</i>	OS
Ifu	<i>Isoodon fusciventer</i>	P4
Loc	<i>Leipoa ocellata</i>	VU
Mfa	<i>Myrmecobius fasciatus</i>	EN
Neu	<i>Notamacropus eugenii derbianus</i>	P4
Nir	<i>Notamacropus irma</i>	P4
Oau	<i>Oxyura australis</i>	P4
Pcr	<i>Pandion cristatus</i>	MI
Pfl	<i>Pezoporus flaviventris</i>	CR
Pca	<i>Phascogale calura</i>	CD
Pta	<i>Phascogale tapoatafa wambenger</i>	CD
Poc	<i>Pseudocheirus occidentalis</i>	CR
Psc	<i>Pseudomys occidentalis</i>	P4
Pni	<i>Psophodes nigrogularis</i>	EN
Pno	<i>Psophodes nigrogularis oberon</i>	P4
Tbe	<i>Thalasseus bergii</i>	MI
Tru	<i>Thinornis rubricollis</i>	P4
Tne	<i>Tringa nebularia</i>	MI
Tno	<i>Tyto novaehollandiae novaehollandiae</i>	P3

DATASOURCES :

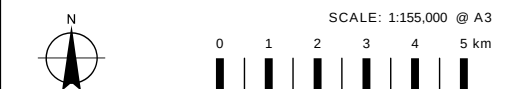
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AERIAL: ESRI BASEMAP (2018)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

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FAUNA DATABASE SEARCH RESULTS
CBH CRANBROOK
ENVIRONMENTAL SURVEY



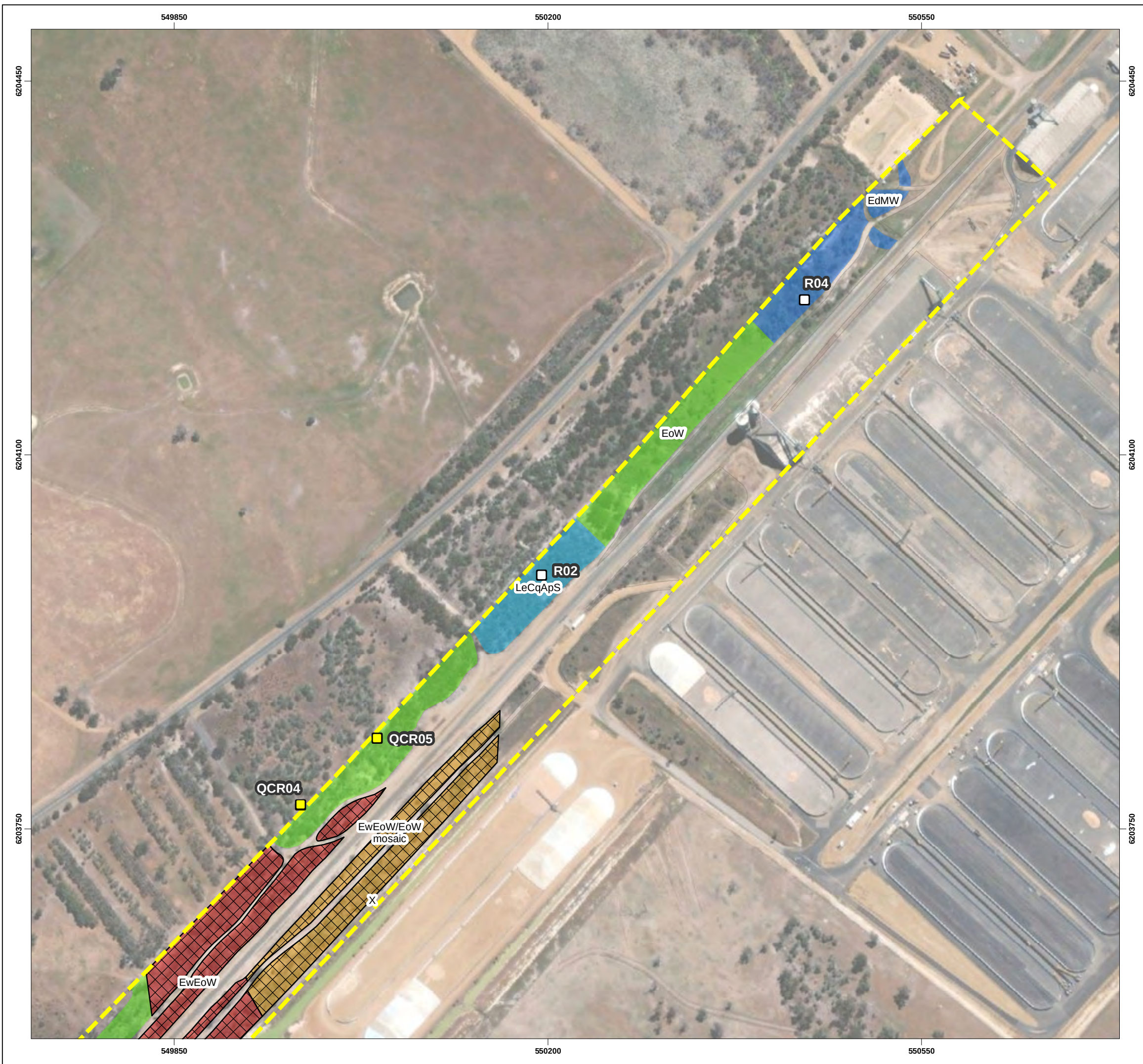
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PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4570-20

REV	AUTHOR	APPROVED	DATE
00	LC	SB	16/02/2021

MAP 3



LEGEND

Survey Area

Quadrat

Relevé

Vegetation Units

EdMW: *Eucalyptus decipiens* mid mallee woodland over *Baumea juncea* and **Asparagus asparagoides* low closed sedgeland/vineland

LeCqApS: *Leptospermum erubescens*, *Calothamnus quadrifidus* and **Acacia pycnantha* mid shrubland over *Verticordia subulata*, *Banksia fraseri* var. *fraseri* and *Melaleuca carrii* low open shrubland with *Allocasuarina huegeliana* and *Eucalyptus occidentalis* low isolated trees

EwEoW: *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland over *Gahnia trifida*, *Lepidosperma* sp. and *Hakea marginata* low sedgeland/grassland

EoW: *Eucalyptus occidentalis* low open woodland over *Melaleuca cuticularis* tall open shrubland over *Leptocarpus kraussii*, **Lolium rigidum* and *Gahnia trifida* low sedgeland/grassland

EwEoW/EoW mosaic: Mosaic of *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland and *Eucalyptus occidentalis* low open woodland

X: Cleared/No Native Vegetation

Wheatbelt Woodlands TEC

DATASOURCES :

SOURCE DATA: QUADRATS AND VEGETATION (ECOSCAPE 2022)

BASEMAP: ESRI BASEMAP (2020)

SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

VEGETATION TYPES AND QUADRATS

CBH CRANBROOK

ENVIRONMENTAL SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

PROJECTION: TRANSVERSE MERCATOR

DATUM: GDA 1994

UNITS: METER

SCALE: 1:3,500 @ A3

PROJECT NO: 4570-20

REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	24/11/2022

MAP

4A



LEGEND

- Survey Area
- Quadrat
- Relevé
- Vegetation Units**
 - LeCqApS: *Leptospermum erubescens*, *Calothamnus quadrifidus* and **Acacia pycnantha* mid shrubland over *Verticordia subulata*, *Banksia fraseri* var. *fraseri* and *Melaleuca carrii* low open shrubland with *Allocasuarina huegeliana* and *Eucalyptus occidentalis* low isolated trees
 - EwEoW: *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland over *Gahnia trifida*, *Lepidosperma* sp. and *Hakea marginata* low sedgeland/grassland
 - EoW: *Eucalyptus occidentalis* low open woodland over *Melaleuca cuticularis* tall open shrubland over *Leptocarpus kraussii*, **Lolium rigidum* and *Gahnia trifida* low sedgeland/grassland
 - EwEoW/EoW mosaic: Mosaic of *Eucalyptus wandoo* and *Eucalyptus occidentalis* mid woodland and *Eucalyptus occidentalis* low open woodland
 - X: Cleared/No Native Vegetation
 - Wheatbelt Woodlands TEC

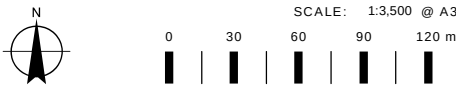
DATASOURCES :
SOURCE DATA: QUADRATS AND VEGETATION (ECOSCAPE 2022)
BASEMAP: ESRI BASEMAP (2020)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



VEGETATION TYPES AND QUADRATS
CBH CRANBROOK
ENVIRONMENTAL SURVEY



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



PROJECT NO: 4570-20			
REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	24/11/2022

MAP
4B



LEGEND

- Survey Area
- Survey Track
- *Asparagus asparagoides
- Quadrat / Relevé Condition**
 - Good
- Vegetation Condition**
 - Very good
 - Good
 - Cleared

DATASOURCES :
SOURCE DATA: QUADRATS AND VEGETATION (ECOSCAPE 2022)
BASEMAP: ESRI BASEMAP (2020)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



VEGETATION CONDITION AND
SIGNIFICANT WEEDS
CBH CRANBROOK
ENVIRONMENTAL SURVEY



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



PROJECT NO: 4570-20

REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	24/11/2022

MAP
5A



LEGEND

- Survey Area
- Survey Track
- *Asparagus asparagoides
- Quadrat / Relevé Condition**
 - Good
- Vegetation Condition**
 - Very good
 - Good
 - Cleared

DATASOURCES :
SOURCE DATA: QUADRATS AND VEGETATION (ECOSCAPE 2022)
BASEMAP: ESRI BASEMAP (2020)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY



VEGETATION CONDITION AND
SIGNIFICANT WEEDS
CBH CRANBROOK
ENVIRONMENTAL SURVEY



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



PROJECT NO: 4570-20			
REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	24/11/2022

MAP
5B



LEGEND

- Survey Area
- Habitat Assessment Point
- Habitat Trees**
 - Eucalyptus occidentalis*
 - Class 4
 - Class 5
 - Eucalyptus wandoo*
 - Class 3
 - Class 4
 - Class 5
- Other**
 - Class 3
 - Class 4
- Fauna Habitat Types**
 - Woodland
 - Shrubland
 - Grassland
 - No habitat

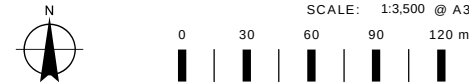
DATASOURCES:
SOURCE DATA: FAUNA DATA (ECOSCAPE 2022)
BASEMAP: ESRI BASEMAP (2020)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

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**FAUNA SITES, HABITAT AND
SIGNIFICANT FAUNA LOCATIONS
CBH CRANBROOK
ENVIRONMENTAL SURVEY**



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



PROJECT NO: 4570-20

REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	26/11/2022

**MAP
6A**



LEGEND

- Survey Area
- Habitat Assessment Point
- Calyptorhynchus latirostris*

Habitat Trees

Eucalyptus occidentalis

- Class 4
- Class 5

Eucalyptus wandoo

- Class 3
- Class 4
- Class 5

Other

- Class 3
- Class 4

Fauna Habitat Types

- Woodland
- Shrubland
- Grassland
- No habitat

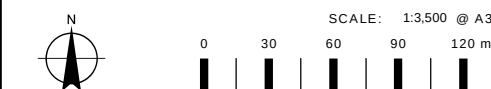
DATASOURCES :
SOURCE DATA: FAUNA DATA (ECOSCAPE 2022)
BASEMAP: ESRI BASEMAP (2020)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

ecoscape

FAUNA SITES, HABITAT AND SIGNIFICANT FAUNA LOCATIONS CBH CRANBROOK ENVIRONMENTAL SURVEY



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



PROJECT NO: 4570-20

REV	AUTHOR	APPROVED	DATE
0	NW	LA	18/03/2022
1	NW	LA	26/11/2022

**MAP
6B**

APPENDIX ONE

DEFINITIONS AND CRITERIA

Table 18: EPBC Act categories for flora, fauna, and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered, or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

Table 19: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> and the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> have been transitioned under regulations 170, 171 and 172 of the <i>Biodiversity Conservation Regulations 2018</i> to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the <i>Biodiversity Conservation Act 2016</i>.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered, or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	Critically endangered species Threatened species considered to be "<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.
EN	Endangered species Threatened species considered to be "<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.
VU	Vulnerable species Threatened species considered to be "<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.
Extinct species	
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	Extinct species Species where "<i>there is no reasonable doubt that the last member of the species has died</i>", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
EW	Extinct in the wild species Species that "<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Conservation Codes for Western Australian Flora and Fauna	
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered, or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
P	Priority species Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Conservation Codes for Western Australian Flora and Fauna	
3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
4	Priority 4: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
¹ The definition of flora includes algae, fungi, and lichens. ² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Table 20: DBCA definitions and criteria for TECs and PECs (DEC 2013)

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

Criteria	Definition
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences, but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	<i>Poorly known ecological communities</i> Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	<i>Poorly known ecological communities</i> Communities that are known from few small occurrences, all, or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.

Criteria	Definition
Priority Three	<i>Poorly known ecological communities</i> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. i. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	<i>Conservation Dependent Ecological Communities</i> Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table 21: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group; DotEE 2017)

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

Table 22: NVIS height classes (NVIS Technical Working Group; DotEE 2017)

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

Source: (based on Walker & Hopkins 1990)

Table 23: Vegetation condition scale for the South West and Interzone Botanical Provinces (EPA 2016)

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

Table 24: Grading system for the assessment of potential nest trees for Black Cockatoos (Bamford M 2016)

Class	Description of tree and hollows/activity
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow.
2	Hollow of suitable size and angle (i.e. near-vertical) visible with chew marks around entrance.
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10m).
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows 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.
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.

Table 25: Commonwealth Black Cockatoo foraging quality scoring tool (Commonwealth of Australia 2017)

	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for Forest Red-tailed Black cockatoo
Starting Score			
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10
7 (High quality)	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under an RFA	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under an RFA	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under an RFA
5 (Quality)	Pine plantation or introduced eucalypts	Pine plantation or introduced eucalypts	Pine plantation or introduced eucalypts
1 (Low quality)	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants

Additions	Foraging habitat for Carnaby's Cockatoo Context adjustor - attributes improving functionality of foraging habitat	Foraging habitat for Baudin's Cockatoo Context adjustor - attributes improving functionality of foraging habitat	Foraging habitat for Forest Red-tailed Black cockatoo Context adjustor - attributes improving functionality of foraging habitat
+3	Is within the Swan Coastal Plain (important foraging area).	Is within the known foraging area (see map).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows	Contains trees with suitable nest hollows	Contains trees with suitable nest hollows
+2	Primarily contains marri	Primarily contains marri	Primarily contains marri and/or jarrah
+2	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)
+1	Is known to be a roosting site	Is known to be a roosting site	Is known to be a roosting site
Subtractions	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat
-2	No clear evidence of feeding debris	No clear evidence of feeding debris	No clear evidence of feeding debris
-2	No other foraging habitat within 6 km	No other foraging habitat within 6 km	No other foraging habitat within 6 km
-1	Is > 12 km from a known breeding location	Is > 12 km from a known breeding location	Is > 12 km from a known breeding location
-1	Is > 12 km from a known roosting site	Is > 12 km from a known roosting site	Is > 12 km from a known roosting site
-1	Is > 2 km from a watering point	Is > 2 km from a watering point	Is > 2 km from a watering point
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)

APPENDIX TWO

EPBC-LISTED TEC ASSESSMENT CRITERIA

EUCALYPT WOODLANDS OF THE WESTERN AUSTRALIAN WHEATBELT TEC

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

The key characteristics for vegetation to be included in this TEC (Threatened Species Scientific Committee 2015) are that:

- it occurs in the Western Australian Wheatbelt (and a few occurrences on adjacent IBRA regions), located on the Yilgarn Craton and receives less than 600 mm mean annual rainfall
- it has a tree canopy dominated by one or more of 31 taxa of Eucalypt (*Eucalyptus*) species having tree or mallet form (i.e. a single trunk) (**Table 26**). These Eucalypts do not include those that are limited to specified landscapes (e.g. granite outcrops, lateritic hills, or other rocky rises) or whose main distribution is outside the Wheatbelt.
- the upper stratum (tree canopy) in a mature woodland must be greater than 10% crown cover (unless the loss of canopy cover is temporary e.g. fire)
- the associated non dominant (or not co-dominant) canopy species are listed; these include *Acacia acuminata* (Jam), *Allocasuarina huegeliana* (Rock Oak), *Corymbia calophylla* (Marri) and a number of other (mostly mallee-form) *Eucalyptus* species (although the list provided is not considered to be comprehensive)
- the understorey (mid and ground strata) is highly variable, and includes sparse to absent forms, herbs, scrubs and heaths, chenopods, thickets (predominantly *Melaleuca* species) and salt tolerant species (including *Tecticornia*). The species must be predominantly native.
- meets the condition threshold, according to the table below (**Table 27**)
- it includes the following DBCA-listed Priority Ecological Communities: Brown mallet (*Eucalyptus astringens*) communities in the western Wheatbelt on alluvial flats (Priority 1), Red Morrel woodland of the Wheatbelt (Priority 1), Yate (*Eucalyptus occidentalis*) dominated alluvial claypans of the Jingalup soil system (Priority 2).

Table 26: Key dominant or co-dominant Eucalypt species of the Wheatbelt Woodlands TEC (Threatened Species Scientific Committee 2015)

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

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

- the dominant Eucalypts have a mallee form
- the dominant canopy tree is not a Eucalypt
- tree canopy is less than 10% cover
- the woodland is in an adjacent bioregion
- the woodland is on a granite outcrop or rocky rise, although woodlands at the base of outcrops may be included
- the woodland is a small, fragmented patch^A (including isolated paddock trees, narrow stands including windbreaks or shelterbelts)
- narrow roadside (or other) remnants <5 m wide including where the tree canopy is <10% cover or the understorey has lost considerable elements of its native structure or diversity.

Table 27: Minimum condition for patches of Eucalypt Woodlands of the Western Australian Wheatbelt TEC

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

(1) Mature trees have a minimum diameter at breast height (DBH) of 30 cm.

(2) Minimum patch size thresholds apply to native vegetation remnants, not to road verges where width thresholds apply.

(3) This applies only to narrow roadside remnants and recognises their importance as wildlife corridors, habitats for threatened species or other reasons as defined by Jackson (2002) and RCC (DPaW 2015). The defined width is that of the native understorey component, not tree canopy width. Breaks of over 50 m or separation by a sealed road define separate 'patches'.

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

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

Assessment differences between the TEC and PEC

Although the EPBC-listed TEC and Western Australian-listed PEC are largely considered to be synonymous the requirements for inclusion in the TEC (see above) are more rigorous than for the PEC (Species and Communities Program, DBCA 2020). The following are notable differences with regards to inclusion:

- the PEC is also defined by tree-form Eucalypts, however, there is no list of definitive species and other *Eucalyptus* species can be included if they meet the required form e.g. *Eucalyptus loxophleba* subsp. *supralaevis* can be definitive of the PEC if it is tree-form
- there are no extents applicable to the PEC so smaller areas can meet the requirements for inclusion in the PEC that are too small to be representative of the TEC. This includes road reserve width.

Both require vegetation to be in Good or better condition for inclusion.

PROTEACEAE DOMINATED KWONGKAN SHRUBLANDS OF THE SOUTHEAST COASTAL FLORISTIC PROVINCE OF WESTERN AUSTRALIA TEC

The *Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia* ('Kwongkan Shrublands') TEC is listed as Endangered under the EPBC Act. It occurs along the southeast coast of Western Australia largely within the Esperance Sandplains bioregion and adjacent parts of the Mallee and Jarrah Forest bioregions and is defined as a Proteaceous species dominated shrubland (known more generally as 'kwongan' or 'kwongkan') that ranges from being sparse to a dense thicket (DoE 2014).

According to the Approved Conservation Advice (DoE 2014) the key diagnostic characters for inclusion in this TEC are:

- location within the Southeast Coastal Floristic Province
- being a shrubland characterised by Proteaceae species having >30% cover OR having two or more diagnostic Proteaceae species (**Table 28**) present as a significant component
- meeting the condition and extent thresholds (**Table 29**).

Table 28: Diagnostic species for the Kwongkan Shrublands TEC (DoE 2014)

Stirling (west)	Fitzgerald (central)	Esperance (east)
<i>Adenanthos apiculatus</i>	<i>Adenanthos cuneatus</i>	<i>Adenanthos cuneatus</i>
<i>Adenanthos cuneatus</i>	<i>Adenanthos oreophilus</i>	<i>Banksia alliaacea</i>
<i>Banksia aculeata</i>	<i>Adenanthos venosus</i>	<i>Banksia armata</i>
<i>Banksia armata</i>	<i>Banksia armata</i>	<i>Banksia cirsioides</i>
<i>Banksia attenuata</i>	<i>Banksia attenuata</i>	<i>Banksia media</i>
<i>Banksia baxteri</i>	<i>Banksia baueri</i>	<i>Banksia nivea</i>
<i>Banksia biterax</i>	<i>Banksia baxteri</i>	<i>Banksia nutans</i>
<i>Banksia brownii</i>	<i>Banksia cirsioides</i>	<i>Banksia obovata</i>
<i>Banksia brunnea</i>	<i>Banksia coccinea</i>	<i>Banksia occidentalis</i>
<i>Banksia coccinea</i>	<i>Banksia falcata</i>	<i>Banksia petiolaris</i>
<i>Banksia formosa</i>	<i>Banksia foliisissima</i>	<i>Banksia pilostylis</i>
<i>Banksia ilicifolia</i>	<i>Banksia heliantha</i>	<i>Banksia plumosa</i>
<i>Banksia mucronulata</i>	<i>Banksia laevigata</i> subsp. <i>laevigata</i>	<i>Banksia prolata</i>
<i>Banksia nutans</i>	<i>Banksia lemanniana</i>	<i>Banksia pulchella</i>
<i>Banksia obovata</i>	<i>Banksia media</i>	<i>Banksia speciosa</i>
<i>Banksia occidentalis</i>	<i>Banksia nutans</i>	<i>Banksia tenuis</i>
<i>Banksia plumosa</i>	<i>Banksia obovata</i>	<i>Grevillea concinna</i>
<i>Banksia tenuis</i>	<i>Banksia pilostylis</i>	<i>Hakea cinerea</i>
<i>Hakea ambigua</i>	<i>Banksia plumosa</i>	<i>Hakea corymbosa</i>
<i>Hakea baxteri</i>	<i>Banksia repens</i>	<i>Hakea drupacea</i>
<i>Hakea corymbosa</i>	<i>Banksia speciosa</i>	<i>Hakea nitida</i>
<i>Hakea cucullata</i>	<i>Banksia tenuis</i>	<i>Hakea obliqua</i>
<i>Hakea ferruginea</i>	<i>Grevillea coccinea</i>	<i>Hakea pandanicaarpa</i>
<i>Hakea lasiantha</i>	<i>Grevillea concinna</i>	<i>Hakea trifurcata</i>
<i>Hakea marginata</i>	<i>Hakea corymbosa</i>	<i>Isopogon formosus</i>
<i>Hakea trifurcata</i>	<i>Hakea cucullata</i>	<i>Isopogon heterophyllus</i>
<i>Hakea victoria</i>	<i>Hakea obliqua</i>	<i>Isopogon polycephalus</i>
<i>Isopogon teretifolius</i> subsp. <i>teretifolius</i>	<i>Hakea obtusa</i>	<i>Isopogon trilobus</i>
<i>Lambertia ericifolia</i>	<i>Hakea pandanicaarpa</i> subsp. <i>crassifolia</i>	<i>Lambertia inermis</i>
<i>Lambertia inermis</i>	<i>Hakea verrucosa</i>	
<i>Petrophile crispata</i>	<i>Hakea victoria</i>	
<i>Petrophile divaricata</i>	<i>Isopogon trilobus</i>	
<i>Petrophile squamata</i> subsp. <i>squamata</i>	<i>Lambertia inermis</i>	

Table 29: Condition and extent thresholds for inclusion in the Kwongkan Shrublands TEC (DoE 2014)

Condition Category	Minimum patch size	Weeds	Dieback
High:	1 ha	≤ 30% perennial weed cover	No known dieback infestation
Moderate:	0.05 ha (e.g. 10 m x 50 m, or 5 m x 100 m, in roadside scenario)	≤ 70% perennial weed cover	May be present or absent.

APPENDIX THREE DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 30: Flora database search results, habitat, and likelihood assessment

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

DBCA*	PMST**	Species name	Habitat from: • <i>FloraBase</i> (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
		Threatened Flora***				
	Likely	<i>Acacia insolita</i> subsp. <i>recurva</i>	Lateritic Ridges.		Highly unlikely	Highly unlikely
WAH		<i>Acacia prismifolia</i> (presumed extinct) – recently rediscovered but not yet changed listing	Grey sand. Or brown gravelly sandy loam. Rocky slopes or flats, disturbed road verges.		Possible	Unlikely
	Known	<i>Adenanthos pungens</i> subsp. <i>effusus</i>	White siliceous sand.	Aug – Nov	Unlikely	Unlikely
TP / WAH	Known	<i>Adenanthos pungens</i> subsp. <i>pungens</i>	White / grey or pink sand and rocky soils (gypsum). Sand dunes and hillsides.	Aug – Nov	Unlikely	Unlikely
TP / WAH	Known	<i>Adenanthos velutinus</i>	Black sandy clay and rocky sandy soils.	Jan or Aug	Highly unlikely	Highly unlikely
WAH	Known	<i>Banksia anatona</i>	Grey sand over gravelly shale, rocky silty clay loam. Lower slopes of ranges.	Jan – Mar	Highly unlikely	Highly unlikely
	Likely	<i>Banksia brownii</i>	Sand over laterite, gravel, loam over granite. In gullies.	Mar – Jul	Highly unlikely	Highly unlikely
	May	<i>Banksia oligantha</i>	Yellow or yellow-brown sand.	Oct – Nov	Highly unlikely	Highly unlikely
	Likely	<i>Banksia pseudoplumosa</i>	Gravelly soils.	Nov – Dec	Highly unlikely	Highly unlikely
WAH	Likely	<i>Banksia rufa</i> subsp. <i>pumila</i>	Rocky shale slopes.	Aug – Oct	Highly unlikely	Highly unlikely
TP / WAH	Likely	<i>Caladenia christineae</i>	Sand, clayey loam, laterite. In the margins of winter-wet flats, swamps, and freshwater lakes.	Sep – Nov	Highly unlikely	Highly unlikely
WAH	Likely	<i>Caladenia dorrienii</i>	Clayey loam, moist sites adjacent to rivers and seasonal creeks.	Sep – Nov	Highly unlikely	Highly unlikely
WAH		<i>Calectasia cyanea</i>	White, grey, or yellow sand, gravel.	Jun – Oct	Unlikely	Highly unlikely
WAH	Likely	<i>Conostylis misera</i>	White or grey sand, sandy loam. Near winter-wet flats.	Oct – Nov	Highly unlikely	Highly unlikely
WAH		<i>Darwinia carnea</i>	Lateritic loam & gravel.	Oct – Dec	Highly unlikely	Highly unlikely
WAH	May	<i>Darwinia collina</i>	Peaty sand. Rocky quartzite slopes.	Sep – Nov	Highly unlikely	Highly unlikely
TP / WAH	Known	<i>Darwinia meeboldii</i>	Peaty soils over quartzite on hill slopes.	Aug – Nov	Highly unlikely	Highly unlikely
WAH	Likely	<i>Darwinia oxylepis</i>	Stony, peaty sand. In rocky gullies.	Aug – Nov	Highly unlikely	Highly unlikely
WAH		<i>Darwinia squarrosa</i>	Shallow peaty rocky soils. Steep rocky slopes, quartzite rocks.	Sep – Dec	Highly unlikely	Highly unlikely
WAH	May	<i>Darwinia wittwerorum</i>	Clay loam, sandy clay. Roadsides, slopes.	Sep – Dec	Highly unlikely	Highly unlikely
	May	<i>Daviesia obovata</i>	Stony loam, sandy loam. On hillslopes and outcrops.	Sep – Nov	Highly unlikely	Highly unlikely
WAH	Likely	<i>Daviesia pseudaphylla</i>	Shallow stony sandy soils. Plains at the base of slopes.		Highly unlikely	Highly unlikely
	May	<i>Deyeuxia drummondii</i>	Skeletal grey loam soil. Slope or summit.		Highly unlikely	Highly unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: • <i>FloraBase</i> (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
TP / WAH	Known	<i>Diuris drummondii</i>	Low-lying depressions or swamps.	Nov – Dec or Jan	Possible	Unlikely
	May	<i>Diuris micrantha</i>	Brown loamy clay. In shallow waters of winter-wet swamps.	Sep – Oct	Unlikely	Unlikely
TP / WAH	Known	<i>Drakaea confluens</i>	White-grey sand.	Oct – Nov	Unlikely	Unlikely
	May	<i>Drakaea micrantha</i>	White-grey sand.	Sep – Oct	Unlikely	Unlikely
WAH	Likely	<i>Gastrolobium humile</i>	Red brown clay/sandy loam on granite. Slope.	Sep – Oct or Dec	Highly unlikely	Highly unlikely
TP / WAH	Known	<i>Gastrolobium lehmannii</i>	Red clay, laterite on low hilltops of breakaway.	Sep – Oct	Unlikely	Highly unlikely
WAH	Likely	<i>Lambertia fairallii</i>	Skeletal rocky soils, sandy or silty clay over shale-stone or quartzite. Low to mid slopes of range, edge of breakaway.	May or Sep or Nov or Jan	Highly unlikely	Highly unlikely
	May	<i>Latrobea colophona</i>	Sandy clay on quartzite or sandstone shale. Montane areas.		Highly unlikely	Highly unlikely
	May	<i>Leucopogon gnaphalioides</i>	Shallow rocky soils. Rocky slopes & plateaus.	Jul or Oct – Dec	Highly unlikely	Highly unlikely
	May	<i>Persoonia micranthera</i>	Sandy, stony soils. Summit of plateau.	Aug	Highly unlikely	Highly unlikely
	Likely	<i>Roycea pycnophylloides</i>	Sandy soils, clay. Saline flats.	Sep	Highly unlikely	Highly unlikely
WAH	Likely	<i>Sphenotoma drummondii</i>	Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Sep – Dec	Highly unlikely	Highly unlikely
WAH	May	<i>Verticordia carinata</i>	Grey sand over sandstone.	Mar – May	Highly unlikely	Highly unlikely
		DBCA Priority 1				
TP / WAH		<i>Acacia microneura</i>	Sand to loam over granite. Heathlands and disturbed road verges.	Aug – Oct	Possible	Unlikely
WAH		<i>Banksia lepidorrhiza</i>	Gravelly sand or sandy loam.	Oct – Nov	Unlikely	Unlikely
WAH		<i>Pterostylis hadra</i>			Unlikely	Unlikely
WAH		<i>Rhodanthe fuscescens</i>	Stony soils, red clay, loam. Low ridges and colluvial flats.	Aug – Sep	Highly unlikely	Highly unlikely
WAH		<i>Schoenus</i> sp. Mt Barker (G.J. Keighery 9679)	Sandy clay loam.		Unlikely	Unlikely
WAH		<i>Stylidium diplectroglossum</i>	Loamy sands. Low bushland, plains.	Oct – Dec	Unlikely	Unlikely
TP / WAH		<i>Thomasia dielsii</i>	Sandy or gravelly loam. Flats.	Nov – Dec	Possible	Unlikely
		DBCA Priority 2				
TP / WAH		<i>Adenanthos linearis</i>	Sandy soils, gravel.	Jan – Mar	Highly unlikely	Highly unlikely
WAH		<i>Caladenia ultima</i>	Winter-wet situations, summer burnt areas.	Nov – Dec	Highly unlikely	Highly unlikely
TP / WAH		<i>Chordifex ornatus</i>	Grey-white sand, sandy clay. Sandy rises.	Oct	Unlikely	Unlikely
TP / WAH		<i>Conospermum spectabile</i>	Sandy soils.	Oct – Nov	Highly unlikely	Highly unlikely
TP / WAH		<i>Conostylis seorsiflora</i> subsp. Nyabing (A. Coates s.n. 2/10/1988)	Lateritic soils.		Unlikely	Highly unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: • <i>FloraBase</i> (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
WAH		<i>Daviesia mesophylla</i>	Peaty or white sand. Rocky slopes.	Jan – Ma	Highly unlikely	Highly unlikely
WAH		<i>Drosera huegelii</i> var. <i>phillmanniana</i>	Skeletal, grey/brown sand over quartzite. Hillside.	Aug – Oct	Highly unlikely	Highly unlikely
WAH		<i>Gastrolobium crenulatum</i>	Skeletal sediment. Mountain slopes.	Sep – Nov	Highly unlikely	Highly unlikely
TP / WAH		<i>Gastrolobium elegans</i>	Skeletal stony quartz. Hillsides.	Sep – Oct	Highly unlikely	Highly unlikely
WAH		<i>Gastrolobium leakeanum</i>	Skeletal sandy soils. Mountain peaks.	Sep	Highly unlikely	Highly unlikely
WAH		<i>Gompholobium glabristylum</i> (formerly <i>Gompholobium</i> sp. Stirling Range (C. F. Wilkins et al. CW 2513))	Brown sand clay loam. Slopes.	Oct – Nov	Highly unlikely	Highly unlikely
TP / WAH		<i>Gonocarpus rudis</i>	Peaty sands. Seepages and roadsides.		Unlikely	Unlikely
WAH		<i>Hibbertia sejuncta</i>	White / grey wet sand on slopes		Highly unlikely	Highly unlikely
WAH		<i>Hibbertia selkii</i>	Sandy clay, rocky silt. Rocky slopes.	May – Jun	Highly unlikely	Highly unlikely
WAH		<i>Leucopogon acicularis</i>	Sandy and clayey soils. Steep slopes.	Aug	Highly unlikely	Highly unlikely
TP / WAH		<i>Melaleuca ordinifolia</i>	Sandy loam or clay.	Aug – Oct	Unlikely	Unlikely
WAH		<i>Petrophile carduacea</i>	Gravelly soils.	Sep – Oct	Highly unlikely	Highly unlikely
TP / WAH		<i>Pimelea neokyrea</i>	White sandy loam clay, gravel, quartzite. Flat sites, upper slopes.	Aug – Oct	Unlikely	Unlikely
WAH		<i>Spyridium montanum</i>	Sandstone or shale. Mountains, gullies.	Apr – Jul or Oct	Highly unlikely	Highly unlikely
TP / WAH		<i>Spyridium villosum</i>	Sand over sandstone.	Oct – Nov	Unlikely	Unlikely
WAH		<i>Stylidium diuroides</i> subsp. <i>nanum</i>	Wet sand.	Oct	Possible	Possible
WAH		<i>Stylidium tylosum</i>	Sandy clay. Hillslopes, or adjacent to granite outcrops.	Oct – Nov	Highly unlikely	Highly unlikely
TP		<i>Styphelia cymbiformis</i>	White sand over laterite or brown clay/gravelly loam. Flats or slopes.		Unlikely	Unlikely
WAH		<i>Synaphea</i> sp. Kwoncup (D. Trenowden 429)	Brown sandy loam, granitic outcrops. Flats or slopes.	Sep	Unlikely	Unlikely
WAH		<i>Thomasia brachystachys</i>	Littered, organic brown soil.		Highly unlikely	Highly unlikely
WAH		<i>Thysanotus brevifolius</i>	Gravel, sandy loam.	Nov	Unlikely	Unlikely
		DBCA Priority 3				
WAH		<i>Acacia ataxiphylla</i> subsp. <i>ataxiphylla</i>	Gravelly clay loam, white / grey sand. Flats, roadsides.	Nov – Dec or Jan	Unlikely	Unlikely
WAH		<i>Bossiaea lalagoides</i>	Winter wet flats with grey sandy loam.		Unlikely	Unlikely
WAH		<i>Brachyloma mogin</i>	Grey clayey sand. Swamp flat.	Jun	Unlikely	Unlikely
WAH		<i>Calytrix pulchella</i>	Grey or white sand over laterite. Ridges, flats.	Aug – Nov	Unlikely	Unlikely
WAH		<i>Chorizema carinatum</i>	Sand, sandy clay.	Oct - Dec	Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: • <i>FloraBase</i> (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
WAH		<i>Desmocladius biformis</i>	Sand, sandy clay, lateritic soils. Dry sites.	Sep – Oct	Unlikely	Unlikely
WAH		<i>Lasiopetalum monticola</i>	Rocky soils. Steep slopes, gullies.	Aug – Oct	Highly unlikely	Highly unlikely
WAH		<i>Laxmannia grandiflora</i> subsp. <i>stirlingensis</i>	White sand, sandy clay. Winter-wet locations.	Sep – Nov	Unlikely	Unlikely
WAH		<i>Melaleuca pritzelii</i>	Sandy or clayey soils. Swampy areas.	Aug – Oct or Dec	Unlikely	Unlikely
WAH		<i>Rinzia longifolia</i>	Sand, clay. Low rises.	Aug – Nov	Unlikely	Unlikely
WAH		<i>Stylidium exappendiculatum</i>	Winter-wet flat; grey / brown sandy loam.		Possible	Possible
WAH		<i>Stylidium lepidum</i>	Gravelly sand or loam, clay. Winter-wet depressions.	Oct – Nov	Unlikely	Unlikely
WAH		<i>Stylidium pseudohirsutum</i>	Sandy clay. Lower hillslopes and depressions. Mallee, acacia or myrtaceous shrubland.	Nov – Dec	Unlikely	Unlikely
TP / WAH		<i>Stylidium rhipidium</i>	Sandy soils. Wet creek flats, swamps, granite outcrops.	Oct – Nov	Unlikely	Unlikely
WAH		<i>Stylidium roseonatum</i>	Swamps.	Oct	Highly unlikely	Highly unlikely
TP		<i>Synaphea preissii</i>	Sand, gravelly loam.	Jul – Nov	Unlikely	Unlikely
WAH		<i>Thysanotus gageoides</i>	Sand, clay, granite, sandstone, laterite.	Oct – Nov	Unlikely	Unlikely
TP / WAH		<i>Verticordia brevifolia</i> subsp. <i>brevifolia</i>	Gravelly loam & clay. Road verges.	Oct – Nov	Unlikely	Unlikely
WAH		<i>Verticordia coronata</i>	Clay loam, clay, and sandy loam, sometimes gravelly.	Sep – Dec	Unlikely	Unlikely
TP / WAH		<i>Verticordia huegelii</i> var. <i>tridens</i>	Sandy or gravelly loam. Winter-wet areas, low hills.	Sep – Nov	Unlikely	Unlikely
TP / WAH		<i>Wurmbea</i> sp. Cranbrook (A. R. Annels 3819)	Valley floor.	Sep	Highly unlikely	Highly unlikely
WAH		<i>Xanthosia collina</i>	Stony loam or peaty sand, sandy clay over quartzite. Winter-wet areas, swamps, hilltops.	Sep – Oct	Highly unlikely	Highly unlikely
		DBCA Priority 4				
WAH		<i>Acacia declinata</i>	Loamy or sandy clay.	Aug – Sep	Highly unlikely	Highly unlikely
TP / WAH		<i>Acacia imparilis</i>	Rocky hills.	Oct	Highly unlikely	Highly unlikely
WAH		<i>Acacia trulliformis</i>	Sandy loam.	Sep	Unlikely	Unlikely
WAH		<i>Adenanthos filifolius</i>	White, grey, or black peaty sand, sandy clay. Rocky hillsides (usually granite, sandstone, or quartzite).	May or Sep – Dec	Highly unlikely	Highly unlikely
TP / WAH		<i>Andersonia echinocephala</i>	Shallow skeletal rocky silty soils over quartzite or shale stone. Rocky slopes & summits.	Oct – Nov	Highly unlikely	Highly unlikely
WAH		<i>Andersonia grandiflora</i>	Stony soils, sandy soils over sandstone. Boggy flats, rocky slopes.	Jul – Oct	Highly unlikely	Highly unlikely
WAH		<i>Andersonia</i> sp. Jamesii (J. Liddelow 84)	Grey / yellow sand / clay. On the flats and gentle slopes.		Unlikely	Unlikely
TP / WAH		<i>Banksia aculeata</i>	Sand over laterite.	Feb – March	Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: • FloraBase (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
WAH		<i>Banksia acuminata</i>	Gravelly soils.	Oct	Unlikely	Highly unlikely
WAH		<i>Banksia foliolata</i>	Sandy soils. Rocky quartzite slopes.	Sep – Nov	Highly unlikely	Highly unlikely
WAH		<i>Banksia hirta</i>	Sandy clay over sandstone, gravelly loam.	May – Oct	Highly unlikely	Highly unlikely
WAH		<i>Banksia porrecta</i>	White / grey sand, sandy loam.	Jul – Aug	Unlikely	Unlikely
WAH		<i>Banksia seneciifolia</i>	Sandy loam, sand. Rocky hillslopes.	Jun or Aug	Highly unlikely	Highly unlikely
WAH		<i>Boronia crenulata</i> subsp. <i>crenulata</i> var. <i>angustifolia</i>	Rocky sandy & clayey soils. Damp areas near creeks.	Sep – Oct	Highly unlikely	Highly unlikely
TP / WAH		<i>Caladenia integra</i>	Clayey loam. Granite outcrops, rocky slopes.	Sep – Oct	Unlikely	Unlikely
TP / WAH		<i>Calothamnus microcarpus</i>	Lateritic clay, sandy soils.	Sep – Nov	Possible	Unlikely
WAH		<i>Darwinia hypericifolia</i>	Peaty sand. Mountain slopes.	Jun or Oct – Nov	Highly unlikely	Highly unlikely
TP / WAH		<i>Darwinia macrostegia</i>	Stony soils, peaty sand. Rocky hillsides, gullies.	May – Jun or Aug – Nov	Highly unlikely	Highly unlikely
WAH		<i>Eucalyptus erectifolia</i>	White sand, sandy loam & gravel. Hillslopes and sandplains.	Mar – May	Possible	Unlikely
WAH		<i>Eucalyptus marginata</i> x <i>pachyloma</i>	Sandy loam or loam & gravel, sand & gravel. Plains, hills.		Unlikely	Unlikely
WAH		<i>Eucalyptus</i> x <i>kalganensis</i>	Sand / sandy clay over laterite / limestone.	Sep – Oct	Unlikely	Highly unlikely
WAH		<i>Hemigenia platyphylla</i>	Sandy & loamy soils. Granite rocks, slopes.	Sep – Nov	Highly unlikely	Highly unlikely
TP / WAH		<i>Hibbertia helianthemoides</i>	Clay sand over sandstone or loam over quartzite. Hills and scree slopes.	Jul or Sep – Oct	Highly unlikely	Highly unlikely
WAH		<i>Hypocalymma phillipsii</i>	Black peaty sand, loam. Hillslopes.	Sep – Nov	Highly unlikely	Highly unlikely
WAH		<i>Isopogon latifolius</i>	Stony sandy soils on sandstone, quartzite, or schistose rocks. Rocky slopes & summits of hills.	Aug – Dec	Highly unlikely	Highly unlikely
WAH		<i>Jacksonia calycina</i>	Gravelly sandy or clay soils. Sandplains, low rises, hillslopes.	Sep – Nov	Unlikely	Unlikely
WAH		<i>Lasiopetalum membraniflorum</i>	Brown clay loam or sandy loam over sandstone. Creek bank or slope.	Sep – Dec	Highly unlikely	Highly unlikely
TP		<i>Leucopogon lasiophyllus</i>	Sandy loam over quartzite, sand over pink sandstone, stony soils. Hillsides.	Aug – Oct	Highly unlikely	Highly unlikely
WAH		<i>Muiriantha hassellii</i>	Peaty sand, stony clay. Hillsides and summits.	Apr – Oct	Highly unlikely	Highly unlikely
TP / WAH		<i>Orthrosanthus muelleri</i>	Sand.	Sep – Oct	Possible	Unlikely
WAH		<i>Sphenotoma</i> sp. Stirling Range (P. G. Wilson 4235)	Skeletal soils over granite pr quartzite. Rocky slopes & plateaus, gullies.	Aug – Dec	Highly unlikely	Highly unlikely
TP / WAH		<i>Styphelia blepharolepis</i>	Grey / white sand. Lower slopes.		Highly unlikely	Highly unlikely
WAH		<i>Tecticornia uniflora</i>	Clay, sandy clay, loam. Salt lakes and creeks.		Highly unlikely	Unlikely
WAH		<i>Thysanotus parviflorus</i>	Grey sand.	Oct – Nov	Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	Species name	Habitat from: • <i>FloraBase</i> (WAH 1998-2020) • (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
					Desktop	Post-survey
WAH		<i>Verticordia harveyi</i>	White sand. Low hills.	Jan – Feb or Apr	Highly unlikely	Highly unlikely
WAH		<i>Xanthorrhoea brevistyla</i>	Sand, clay, laterite.	Oct – Dec	Unlikely	Unlikely

* WAH = herbarium record (vouchered specimen)

TP = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen

** PMST likelihood of occurrence or likelihood of habitat occurring

Table 31: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; dark blue shading indicates that the species was recorded

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	Western Australian	PMST**	DBCA	NatureMap	Desktop	Post-survey
Mammals								
<i>Bettongia penicillata</i> subsp. <i>ogilbyi</i>	Brush-tailed bettong	EN	CR		X	X	Medium	Very low
<i>Dasyurus geoffroii</i>	Western Quoll	VU	VU	Likely	X	X	High	High
<i>Isodon fusciventer</i>	Southwestern Brown Bandicoot		P4		X	X	Medium	Low
<i>Macrotis lagotis</i>	Bilby	VU	VU			X	Very low	Very low
<i>Myrmecobius fasciatus</i>	Numbat			Known (translocated population)	X	X	Medium	Very low
<i>Notamacropus eugenii</i> subsp. <i>derbianus</i>	Tammar Wallaby		P4		X		Low	Very low
<i>Notamacropus irma</i>	Western Brush Wallaby		P4		X	X	Low	Low
<i>Parantechinus apicalis</i>	Dibbler	EN	EN	Known (translocated population)			Very low	Very low
<i>Perameles bougainville</i>	Western Barred Bandicoot	EN	VU			X	Very low	Very low
<i>Phascogale calura</i>	Red-tailed Phascogale	VU	CD	Likely	X	X	Medium	Low
<i>Phascogale tapoatafa</i> subsp. <i>wambenger</i>	South-western Brush-tailed Phascogale		CD		X	X	Very low	Very low
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	CR	CR		X	X	Medium	Very low
<i>Pseudomys occidentalis</i>	Western Mouse		P4		X	X	Medium	Medium
Birds								
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI		X		Very low	Very low
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	May			Very low	Very low
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI		X	X	Very low	Very low
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR & MI	CR	May	X	X	Very low	Very low
<i>Calidris ruficollis</i>	Red-necked Stint	MI	MI		X	X	Very low	Very low
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	VU	VU	Known	X	X	Low	Very low
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	EN	EN	Likely	X	X	Low	Low
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	Breeding known to occur within area	X	X	High	Recorded
<i>Charadrius leschenaultii</i>	Greater Sand Plover	VU & MI	VU		X	X	Very low	Very Low

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	Western Australian	PMST**	DBCA	NatureMap	Desktop	Post-survey
<i>Falco peregrinus</i>	Peregrine Falcon		OS		X	X	Medium	Medium
<i>Falco hypoleucos</i>	Grey Falcon		VU	Likely			Very low	Very low
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	Likely	X	X	Medium	Very low
<i>Numenius madagascariensis</i>	Eastern Curlew	CR & MI	CR	May			Very low	Very low
<i>Oxyura australis</i>	Blue-billed Duck		P4		X	X	Very low	Very low
<i>Pandion cristatus</i>	Osprey (eastern)	MI	MI		X		Very low	Very low
<i>Pezoporus flaviventris</i>	Western Ground Parrot	CR	CR		X		Very low	Very low
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	May			Very low	Very low
<i>Psophodes nigrogularis</i>	Western Whipbird		EN or P4***		X	X	Very low	Very low
<i>Thalasseus bergii</i>	Crested Tern	MI	MI		X		Very low	Very low
<i>Thinornis rubricollis</i>	Hooded Plover		P4		X	X	Very low	Very low
<i>Tringa nebularia</i>	Common Greenshank	MI	MI		X	X	Very low	Very low
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl (southwest)		P3		X	X	Very low	Very low
Fish								
<i>Nannoperca pygmaea</i>	Little Pigmy Perch	EN		Likely			Very low	Very low

* introduced

** PMST likelihood of occurrence or likelihood of habitat occurring

*** conservation status in Western Australia is depending on subsp.

APPENDIX FOUR

FIELD SURVEY RESULTS

Table 32: Flora inventory (site x species)

Family	Species	Naturalised	Cons. status	QCR01	QCR02	QCR03	QCR04	QCR05	QCR06	R01	R02	R03	R04	Opps
Amaranthaceae	<i>Ptilotus manglesii</i>													X
Asparagaceae	<i>Asparagus asparagoides</i>	*		X	X		X						X	
	<i>Chamaexeros serra</i>													X
Asteraceae	<i>Angianthus preissianus</i>						X							
	<i>Cotula coronopifolia</i>	*												X
	<i>Hypochaeris glabra</i>	*		X		X	X			X		X		
	<i>Podolepis gracilis</i>						X							
	<i>Pterochaeta paniculata</i>							X		X				
	<i>Ursinia anthemoides</i>	*		X			X	X		X		X		
Boryaceae	<i>Borya sphaerocephala</i>									X		X		
Casuarinaceae	<i>Allocasuarina campestris</i>													X
	<i>Allocasuarina huegeliana</i>										X			
	<i>Allocasuarina microstachya</i>													X
Celastraceae	<i>Stackhousia monogyna</i>									X		X		
Centrolepidaceae	<i>Centrolepis polygyna</i>													X
Chenopodiaceae	<i>Atriplex semibaccata</i>													X
	<i>Tecticornia</i> sp.													X
Crassulaceae	<i>Crassula colorata</i>			X								X		
Cupressaceae	<i>Callitris pyramidalis</i>													X
Cyperaceae	<i>Baumea juncea</i>												X	
	<i>Chaetospora curvifolia</i>									X				
	<i>Gahnia aristata</i>								X					
	<i>Gahnia trifida</i>			X		X	X		X					
	<i>Lepidosperma leptostachyum</i>											X		
	<i>Lepidosperma pubisquameum</i>			X	X				X					
	<i>Lepidosperma</i> sp.							X	X					
	<i>Mesomelaena pseudostygia</i>											X		
	<i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897)			X	X			X				X		
Droseraceae	<i>Drosera leucoblasta</i>									X				
	<i>Drosera</i> sp.										X			
Ericaceae	<i>Leucopogon</i> sp. Coujinup (M.A. Burgman 1085)										X			
	<i>Styphelia epacridis</i>													X
Fabaceae	<i>Acacia lasiocarpa</i> var. <i>bracteolata</i>													X
	<i>Acacia pycnantha</i>	*									X		X	
	<i>Acacia saligna</i>													X
	<i>Acacia stenoptera</i>									X		X		
	<i>Bossiaea eriocarpa</i>			X										
	<i>Daviesia ?purpurescens</i>													X
	<i>Daviesia decipiens</i>										X			
	<i>Eutaxia parvifolia</i>													X
	<i>Fabaceae</i> sp.											X		

Family	Species	Naturalised	Cons. status	QCR01	QCR02	QCR03	QCR04	QCR05	QCR06	R01	R02	R03	R04	Opps
	<i>Gompholobium tomentosum</i>										X			
	<i>Kennedia prostrata</i>													X
	<i>Lotus subbiflorus</i>	*												X
	<i>Mirbelia spinosa</i>									X				
	<i>Mirbelia subcordata</i>													X
	<i>Pultenaea empetrifolia</i>							X						
	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	*							X					
Goodeniaceae	<i>Goodenia coerulea</i>													X
	<i>Goodenia micrantha</i>						X							
Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>													X
	<i>Conostylis pusilla</i>											X		
	<i>Haemodorum simplex</i>													X
Hemerocallidaceae	<i>Dianella revoluta</i>				X					X		X		
	<i>Stypandra glauca</i>									X				
INDETERMINANT	Indeterminant spp.													X
Iridaceae	<i>Romulea rosea</i>	*		X			X							
	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	*												X
Juncaceae	<i>Juncus acutus</i>	*												X
Lamiaceae	<i>Hemigenia podalyrina</i>													X
Lauraceae	<i>Cassytha glabella</i>											X		
Myrtaceae	<i>Astartea glomerulosa</i>							X						
	<i>Callistemon phoeniceus</i>													X
	<i>Calothamnus quadrifidus</i>									X		X		
	<i>Calytrix leschenaultii</i>													X
	<i>Eucalyptus decipiens</i>												X	
	<i>Eucalyptus occidentalis</i>			X	X	X	X	X	X			X	X	
	<i>Eucalyptus phaenophylla</i>				X									
	<i>Eucalyptus redunca</i> subsp. <i>pluricaulis</i>													X
	<i>Eucalyptus</i> sp.													X
	<i>Eucalyptus thamnoides</i>													X
	<i>Eucalyptus wandoo</i>			X	X				X					
	<i>Kunzea recurva</i>										X	X		
	<i>Leptospermum erubescens</i>									X	X	X		
	<i>Melaleuca carrii</i>									X		X		
	<i>Melaleuca cuticularis</i>					X	X	X						
	<i>Melaleuca hamata</i>													X
	<i>Melaleuca</i> sp.						X							
	<i>Melaleuca viminea</i> subsp. <i>viminea</i>													X
	<i>Rinzia fumana</i>													X
	<i>Verticordia plumosa</i> var. <i>brachyphylla</i>													X
	<i>Verticordia subulata</i>									X		X		
Orchidaceae	<i>Disa bracteata</i>	*		X							X	X		
Pittosporaceae	<i>Billardiera fusiformis</i>											X	X	
	<i>Billardiera venusta</i>													X

Family	Species	Naturalised	Cons. status	QCR01	QCR02	QCR03	QCR04	QCR05	QCR06	R01	R02	R03	R04	Opps
Poaceae	<i>Amphipogon turbinatus</i>											X		
	<i>Austrostipa elegantissima</i>				X			X						
	<i>Austrostipa juncifolia</i>													X
	<i>Austrostipa pycnostachya</i>													X
	<i>Austrostipa variabilis</i>			X										
	<i>Briza maxima</i>	*		X			X	X		X		X	X	
	<i>Briza minor</i>	*					X							
	<i>Bromus diandrus</i>	*												X
	<i>Ehrharta calycina</i>	*		X	X		X		X			X	X	
	<i>Ehrharta longiflora</i>	*		X	X	X			X				X	
	<i>Eragrostis curvula</i>	*												X
	<i>Lolium rigidum</i>	*		X		X	X							
	<i>Neurachne alopecuroidea</i>			X					X	X		X		
	<i>Pentameris airoides</i>	*		X				X				X		
	<i>Rytidosperma caespitosum</i>						X	X				X		
Polygalaceae	<i>Comesperma polygaloides</i>								X					
Proteaceae	<i>Banksia dallanneyi</i>													X
	<i>Banksia fraseri</i> var. <i>fraseri</i>									X		X		
	<i>Hakea lissocarpa</i>													X
	<i>Hakea marginata</i>				X									
	<i>Hakea prostrata</i>									X	X			
	<i>Petrophile seminuda</i>													X
Restionaceae	<i>Desmocladus asper</i>			X										
	<i>Desmocladus fasciculatus</i>			X										
	<i>Lepidobolus</i> sp.				X							X		
	<i>Leptocarpus kraussii</i>				X		X							
Rubiaceae	<i>Opercularia vaginata</i>			X										
Sapindaceae	<i>Dodonaea humifusa</i>													X
Stylidiaceae	<i>Levenhookia pusilla</i>									X				

Table 33: Recorded fauna species

Species	Common name	EPBC Act status	Western Australian status
Mammals			
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	-	-
* <i>Oryctolagus cuniculus</i>	Rabbit	Introduced	Introduced
* <i>Vulpes vulpes</i>	Red Fox	Introduced	Introduced
Birds			
<i>Anthochaera carunculata</i>	Red Wattlebird	-	-
<i>Cacatua roseicapilla</i>	Galah	-	-
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Endangered	Rare or likely to become extinct (Schedule 1, WC Act)
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	-	-

Species	Common name	EPBC Act status	Western Australian status
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	-	-
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	-	-
<i>Corvus coronoides</i>	Australian Raven	-	-
<i>Cracticus tibicen</i>	Australian Magpie	-	-
<i>Falco cenchroides</i>	Australian Kestrel	-	-
<i>Gavicalis virescens</i>	Singing Honeyeater	-	-
<i>Gerygone fusca</i> subsp. <i>fusca</i>	Western Gerygone	-	-
<i>Grallina cyanoleuca</i>	Magpie-lark	-	-
<i>Hirundo nigricans</i>	Tree Martin	-	-
<i>Lichmera indistincta</i>	Brown Honeyeater	-	-
<i>Malurus splendens</i>	Splendid Fairy-wren	-	-
<i>Neophema elegans</i>	Elegant Parrot	-	-
<i>Ocyphaps lophotes</i>	Crested Pigeon	-	-
<i>Pachycephala rufiventris</i>	Rufous Whistler	-	-
<i>Pardalotus striatus</i>	Striated Pardalote	-	-
<i>Parvipsitta porphyrocephala</i>	Purple-crowned Lorikeet	-	-
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	-	-
<i>Platycercus spurius</i>	Red-capped Parrot	-	-
<i>Platycercus zonarius</i> subsp. <i>semitorquatus</i>	Twenty-eight Parrot	-	-
<i>Polytelis anthopeplus</i>	Regent Parrot	-	-
<i>Rhipidura leucophrys</i>	Willie Wagtail	-	-
<i>Smicrornis brevirostris</i>	Weebill	-	-
<i>Anthochaera carunculata</i>	Red Wattlebird	-	-

Table 34: Fauna sites (GDA94, Zone 50)

Site Name	Site Type	Easting	Northing
CR01	Fauna: Habitat Assessment	549334.426	6202934.221
CR02	Fauna: Habitat Assessment	549567.136	6203197.238
CR03	Fauna: Habitat Assessment	549333.51	6203057.202
CR04	Fauna: Habitat Assessment	549610.007	6203334.735
CR05	Fauna: Habitat Assessment	549814.165	6203537.573
CR06	Fauna: Habitat Assessment	549987.932	6203768.736
CR07	Fauna: Habitat Assessment	550202.851	6203984.483
CR08	Fauna: Habitat Assessment	550257.515	6203967.778
CR09	Fauna: Habitat Assessment	549980.867	6203651.897
CR10	Fauna: Habitat Assessment	549656.09	6203314.197
F01	Fauna: Burrow / Mound	549398.599	6203029.247
F02	Fauna: Sighting	549455.875	6203089.822
F03	Fauna: Sighting	549488.531	6203140.325
F04	Fauna: Sighting	549374.455	6203004.757
F05	Fauna: Tracks / Diggings / Scratching	549445.15	6203185.01
F06	Fauna: Sighting	549926.916	6203698.426
F07	Fauna: Sighting	549642.162	6203290.541

Site Name	Site Type	Easting	Northing
F08	Fauna: Sighting	549889.674	6203547.816
F09	Fauna: Sighting	549756.885	6203390.618

Table 35: Potential Black Cockatoo Trees

Tree Number	Tree Species	DBH (mm)	Number of Hollows	Bees Present	Tree Class
1	Eucalyptus occidentalis	660	0	no	5 No Hollows
2	Wandoo (>300mm)	920	3	yes	4 Hollows not suitable
3	Eucalyptus occidentalis	510	1	no	4 Hollows not suitable
4	Eucalyptus occidentalis	540	4	no	4 Hollows not suitable
5	Eucalyptus occidentalis	600	0	no	5 No Hollows
6	Wandoo (>300mm)	520	1	no	4 Hollows not suitable
7	Eucalyptus occidentalis	670	1	no	4 Hollows not suitable
8	Wandoo (>300mm)	430	2	no	4 Hollows not suitable
9	Wandoo (>300mm)	340	0	no	5 No Hollows
10	Wandoo (>300mm)	410	1	no	4 Hollows not suitable
11	Wandoo (>300mm)	660	0	no	5 No Hollows
12	Wandoo (>300mm)	330	3	no	4 Hollows not suitable
13	Wandoo (>300mm)	350	2	no	4 Hollows not suitable
14	Wandoo (>300mm)	370	2	no	4 Hollows not suitable
15	Wandoo (>300mm)	430	2	no	4 Hollows not suitable
16	Eucalyptus occidentalis	890	6	no	4 Hollows not suitable
17	Eucalyptus occidentalis	540	1	no	4 Hollows not suitable
18	Wandoo (>300mm)	400	0	no	5 No Hollows
19	Wandoo (>300mm)	370	0	no	5 No Hollows
20	Eucalyptus occidentalis	520	2	no	4 Hollows not suitable
21	Eucalyptus occidentalis	620	0	no	5 No Hollows
22	Eucalyptus occidentalis	580	5	no	5 No Hollows
23	Eucalyptus occidentalis	520	2	no	4 Hollows not suitable
24	Wandoo (>300mm)	390	0	no	5 No Hollows
25	Wandoo (>300mm)	350	1	no	4 Hollows not suitable
26	Wandoo (>300mm)	320	1	no	4 Hollows not suitable
27	Wandoo (>300mm)	1020	1	no	4 Hollows not suitable
28	Wandoo (>300mm)	390	0	no	5 No Hollows
29	Wandoo (>300mm)	500	1	no	4 Hollows not suitable
30	Wandoo (>300mm)	480	3	no	4 Hollows not suitable
31	Wandoo (>300mm)	460	0	no	5 No Hollows
32	Eucalyptus occidentalis	650	0	no	5 No Hollows
33	Eucalyptus occidentalis	510	1	no	4 Hollows not suitable
34	Wandoo (>300mm)	660	1	no	4 Hollows not suitable
35	Wandoo (>300mm)	540	2	no	4 Hollows not suitable
36	Wandoo (>300mm)	570	0	no	5 No Hollows
37	Wandoo (>300mm)	460	2	no	4 Hollows not suitable
38	Wandoo (>300mm)	490	1	no	4 Hollows not suitable

Tree Number	Tree Species	DBH (mm)	Number of Hollows	Bees Present	Tree Class
39	Wandoo (>300mm)	440	0	no	5 No Hollows
40	Eucalyptus occidentalis	630	1	no	4 Hollows not suitable
41	Wandoo (>300mm)	340	0	no	5 No Hollows
42	Eucalyptus occidentalis	530	1	no	4 Hollows not suitable
43	Eucalyptus occidentalis	580	0	no	5 No Hollows
44	Wandoo (>300mm)	430	0	no	5 No Hollows
45	Eucalyptus occidentalis	590	0	no	5 No Hollows
46	Wandoo (>300mm)	350	0	no	5 No Hollows
47	Wandoo (>300mm)	360	0	no	5 No Hollows
48	Wandoo (>300mm)	390	1	no	4 Hollows not suitable
49	Wandoo (>300mm)	790	5	no	3 Hollow no chew marks
50	Wandoo (>300mm)	700	4	no	4 Hollows not suitable
51	Wandoo (>300mm)	450	2	no	4 Hollows not suitable
52	Wandoo (>300mm)	590	4	no	4 Hollows not suitable
53	Wandoo (>300mm)	430	2	no	4 Hollows not suitable
54	Wandoo (>300mm)	930	7	no	3 Hollow no chew marks
55	Wandoo (>300mm)	540	4	no	4 Hollows not suitable
56	Wandoo (>300mm)	320	0	no	5 No Hollows
57	Wandoo (>300mm)	490	0	no	5 No Hollows
58	Wandoo (>300mm)	470	0	no	5 No Hollows
59	Wandoo (>300mm)	350	0	no	5 No Hollows
60	Wandoo (>300mm)	320	0	no	5 No Hollows
61	Wandoo (>300mm)	430	0	no	5 No Hollows
62	Wandoo (>300mm)	860	4	no	4 Hollows not suitable
63	Wandoo (>300mm)	400	0	no	5 No Hollows
64	Wandoo (>300mm)	390	0	no	5 No Hollows
65	Wandoo (>300mm)	530	0	no	5 No Hollows
66	Wandoo (>300mm)	420	1	no	4 Hollows not suitable
67	Wandoo (>300mm)	670	2	no	4 Hollows not suitable
68	Wandoo (>300mm)	690	4	no	4 Hollows not suitable
69	Wandoo (>300mm)	320	0	no	5 No Hollows
70	Wandoo (>300mm)	400	0	no	5 No Hollows
71	Wandoo (>300mm)	530	1	no	4 Hollows not suitable
72	Wandoo (>300mm)	420	2	no	4 Hollows not suitable
73	Wandoo (>300mm)	420	0	no	5 No Hollows
74	Wandoo (>300mm)	800	2	no	4 Hollows not suitable
75	Wandoo (>300mm)	540	1	no	4 Hollows not suitable
76	Wandoo (>300mm)	750	0	no	5 No Hollows
77	Wandoo (>300mm)	830	9	no	3 Hollow no chew marks
78	Eucalyptus occidentalis	650	1	no	4 Hollows not suitable
79	Eucalypt sp. (unknown)	450	6	no	4 Hollows not suitable
80	Wandoo (>300mm)	740	6	no	4 Hollows not suitable
81	Eucalyptus occidentalis	550	2	no	4 Hollows not suitable

Tree Number	Tree Species	DBH (mm)	Number of Hollows	Bees Present	Tree Class
82	Wandoo (>300mm)	580	0	no	5 No Hollows
83	Wandoo (>300mm)	920	0	no	5 No Hollows
84	Wandoo (>300mm)	360	0	no	5 No Hollows
85	Wandoo (>300mm)	430	1	no	4 Hollows not suitable
86	Wandoo (>300mm)	520	0	no	5 No Hollows
87	Wandoo (>300mm)	380	0	no	5 No Hollows
88	Wandoo (>300mm)	470	3	no	4 Hollows not suitable
89	Wandoo (>300mm)	330	2	no	4 Hollows not suitable
90	Wandoo (>300mm)	870	5	no	4 Hollows not suitable
91	Wandoo (>300mm)	440	0	no	5 No Hollows
92	Wandoo (>300mm)	440	1	no	4 Hollows not suitable
93	Wandoo (>300mm)	340	0	no	5 No Hollows
94	Wandoo (>300mm)	500	0	no	4 Hollows not suitable
95	Wandoo (>300mm)	800	5	no	4 Hollows not suitable
96	Wandoo (>300mm)	500	1	no	4 Hollows not suitable
97	Eucalyptus occidentalis	950	1	no	4 Hollows not suitable
98	Eucalyptus occidentalis	630	1	no	4 Hollows not suitable
99	Wandoo (>300mm)	470	0	no	5 No Hollows
100	Wandoo (>300mm)	970	10	no	3 Hollow no chew marks
101	Wandoo (>300mm)	750	1	no	4 Hollows not suitable
102	Wandoo (>300mm)	580	0	no	5 No Hollows
103	Wandoo (>300mm)	630	1	no	4 Hollows not suitable
104	Wandoo (>300mm)	570	1	no	4 Hollows not suitable
105	Wandoo (>300mm)	500	1	no	4 Hollows not suitable
106	Wandoo (>300mm)	540	2	no	4 Hollows not suitable
107	Wandoo (>300mm)	540	0	no	5 No Hollows
108	Wandoo (>300mm)	530	1	no	4 Hollows not suitable
109	Wandoo (>300mm)	720	6	no	4 Hollows not suitable
110	Wandoo (>300mm)	410	0	no	5 No Hollows
111	Wandoo (>300mm)	340	1	yes	4 Hollows not suitable
112	Wandoo (>300mm)	400	0	no	5 No Hollows
113	Wandoo (>300mm)	410	3	no	4 Hollows not suitable
114	Wandoo (>300mm)	440	0	no	5 No Hollows
115	Wandoo (>300mm)	640	2	no	4 Hollows not suitable
116	Wandoo (>300mm)	530	5	no	4 Hollows not suitable
117	Wandoo (>300mm)	570	2	no	4 Hollows not suitable
118	Wandoo (>300mm)	720	4	no	4 Hollows not suitable
119	Wandoo (>300mm)	360	1	no	4 Hollows not suitable
120	Wandoo (>300mm)	480	1	no	4 Hollows not suitable
121	Wandoo (>300mm)	490	1	no	4 Hollows not suitable
122	Wandoo (>300mm)	580	3	no	4 Hollows not suitable
123	Wandoo (>300mm)	900	2	no	4 Hollows not suitable
124	Wandoo (>300mm)	670	6	no	4 Hollows not suitable
125	Wandoo (>300mm)	730	5	no	4 Hollows not suitable

Tree Number	Tree Species	DBH (mm)	Number of Hollows	Bees Present	Tree Class
126	Wandoo (>300mm)	390	0	no	5 No Hollows
127	Wandoo (>300mm)	520	2	no	4 Hollows not suitable
128	Wandoo (>300mm)	620	2	no	4 Hollows not suitable
129	Wandoo (>300mm)	470	1	no	4 Hollows not suitable
130	Wandoo (>300mm)	530	0	no	5 No Hollows
131	Wandoo (>300mm)	340	0	no	5 No Hollows
132	Wandoo (>300mm)	480	0	no	5 No Hollows
133	Wandoo (>300mm)	760	4	no	4 Hollows not suitable
134	Wandoo (>300mm)	520	0	no	5 No Hollows
135	Wandoo (>300mm)	520	2	no	4 Hollows not suitable
136	Wandoo (>300mm)	330	0	no	5 No Hollows
137	Wandoo (>300mm)	630	3	no	4 Hollows not suitable
138	Wandoo (>300mm)	890	6	no	3 Hollow no chew marks
139	Eucalyptus occidentalis	520	0	no	5 No Hollows
140	Eucalypt sp. (unknown)	700	3	no	3 Hollow no chew marks
141	Wandoo (>300mm)	320	0	no	5 No Hollows
142	Wandoo (>300mm)	820	7	no	4 Hollows not suitable
143	Wandoo (>300mm)	340	1	no	4 Hollows not suitable
144	Wandoo (>300mm)	500	0	no	5 No Hollows
145	Wandoo (>300mm)	390	0	no	5 No Hollows
146	Wandoo (>300mm)	380	1	no	4 Hollows not suitable
147	Wandoo (>300mm)	470	0	no	5 No Hollows
148	Wandoo (>300mm)	590	0	no	5 No Hollows
149	Wandoo (>300mm)	590	3	yes	4 Hollows not suitable
150	Wandoo (>300mm)	600	3	no	4 Hollows not suitable
151	Wandoo (>300mm)	1060	8	no	3 Hollow no chew marks
152	Wandoo (>300mm)	350	0	no	5 No Hollows
153	Wandoo (>300mm)	490	4	no	4 Hollows not suitable
154	Wandoo (>300mm)	340	0	no	5 No Hollows
155	Wandoo (>300mm)	450	2	no	4 Hollows not suitable
156	Wandoo (>300mm)	320	0	no	5 No Hollows
157	Wandoo (>300mm)	450	1	no	4 Hollows not suitable
158	Wandoo (>300mm)	340	1	no	4 Hollows not suitable
159	Wandoo (>300mm)	370	0	no	5 No Hollows
160	Eucalyptus occidentalis	660	0	no	5 No Hollows
161	Wandoo (>300mm)	400	0	no	5 No Hollows
162	Wandoo (>300mm)	420	2	no	4 Hollows not suitable
163	Wandoo (>300mm)	380	0	no	5 No Hollows
164	Eucalyptus occidentalis	530	0	no	5 No Hollows
165	Wandoo (>300mm)	530	4	no	4 Hollows not suitable
166	Wandoo (>300mm)	830	2	no	4 Hollows not suitable
167	Wandoo (>300mm)	740	4	no	4 Hollows not suitable

Tree Number	Tree Species	DBH (mm)	Number of Hollows	Bees Present	Tree Class
168	Eucalypt sp. (unknown)	760	6	no	3 Hollow no chew marks
169	Eucalyptus occidentalis	800	3	no	4 Hollows not suitable
170	Wandoo (>300mm)	580	5	no	4 Hollows not suitable
171	Wandoo (>300mm)	420	0	no	5 No Hollows
172	Wandoo (>300mm)	390	1	no	4 Hollows not suitable
173	Wandoo (>300mm)	350	3	no	4 Hollows not suitable
174	Eucalyptus occidentalis	920	5	no	4 Hollows not suitable
175	Wandoo (>300mm)	420	0	no	5 No Hollows



X49_Wandoo...300mm.



X54_Wandoo...300mm.



X77_Wandoo...300mm.



X100_Wandoo...300mm.



X138_Wandoo...300mm.



X140_Eucalypt.sp...unknown.



X151_Wandoo...300mm.



X168_Eucalypt.sp...unknown.

QCR01

Staff TCJ **Date** 3/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549437 mE** **6203064 mN** **Lat.** -34.3125 **Long.** 117.5373
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown sandy loam
Rock Type Weathered granite
Loose Rock 2-10 % cover; 20-60 mm in size **Litter** 85 % cover ; 5 cm in depth
Bare ground 5 % cover **Weeds** 65 % cover
Vegetation U+ ^*Eucalyptus wandoo*,^*Eucalyptus occidentalis*\^tree\7\i;G ^^*Gahnia trifida*,*Ehrharta calycina*,
Bossiaea eriocarpa\^hummock grass,tussock grass,shrub\1\c
Veg. Condition Good
Disturbance Track, rail
Fire Age >5 years
Notes Upper storey 20x20m



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>*Asparagus asparagoides</i>		0.3	<1	
<i>Austrostipa variabilis</i>		0.3	<1	
<i>Bossiaea eriocarpa</i>		0.3	5	
<i>*Briza maxima</i>		0.3	<1	
<i>Crassula colorata</i>		0.1	<1	

<i>Desmocladius asper</i>	0.2	0.5
<i>Desmocladius fasciculatus</i>	0.2	<1
* <i>Disa bracteata</i>	0.2	<1
* <i>Ehrharta calycina</i>	0.4	10
* <i>Ehrharta longiflora</i>	0.4	<1
<i>Eucalyptus occidentalis</i>	15	8
<i>Eucalyptus wandoo</i>	11	12
<i>Gahnia trifida</i>	0.6	22
* <i>Hypochaeris glabra</i>	0.3	<1
<i>Lepidosperma pubisquameum</i>	0.4	<1
* <i>Lolium rigidum</i>	0.3	<1
<i>Neurachne alopecuroidea</i>	0.1	<1
<i>Opercularia vaginata</i>	0.2	<1
* <i>Pentameris airoides</i>	0.1	<1
* <i>Romulea rosea</i>	0.2	<1
<i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897)	0.3	<1
* <i>Ursinia anthemoides</i>	0.2	<1

QCR02

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549166 mE** **6202768 mN** **Lat.** -34.3152 **Long.** 117.5344
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown sandy loam
Rock Type Granite
Loose Rock <2 % cover; 2-6 mm in size **Litter** 40 % cover ; 2 cm in depth
Bare ground 1 % cover **Weeds** <1 % cover
Vegetation U+ ^*Eucalyptus wandoo*,^*Eucalyptus occidentalis*\^tree\7\i;G ^^*Leptocarpus kraussii*,*Lepidobolus* sp.,*Hakea marginata*\^sedge,shrub\1\i
Veg. Condition Good
Disturbance Tracks, rail
Fire Age >5 years
Notes Adjacent to grazed paddock, upper storey 20x20m



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>*Asparagus asparagoides</i>		0.2	<1	
<i>Austrostipa elegantissima</i>		0.5	<1	
<i>Dianella revoluta</i>		0.4	<1	
<i>*Ehrharta calycina</i>		0.7	<1	
<i>*Ehrharta longiflora</i>		0.6	1	

<i>Eucalyptus occidentalis</i>	14	6
<i>Eucalyptus phaenophylla</i>	4.5	<1
<i>Eucalyptus wandoo</i>	16	13
<i>Hakea marginata</i>	0.4	<1
<i>Lepidobolus</i> sp.	0.3	3
<i>Lepidosperma pubisquameum</i>	0.4	<1
<i>Leptocarpus kraussii</i>	0.15	4
<i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897)	0.2	<1

QCR03

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549736 mE** **6203513 mN** **Lat.** -34.3084 **Long.** 117.5405
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown loam
Rock Type
Loose Rock 0 % cover **Litter** 90 % cover ; 3 cm in depth
Bare ground 0 % cover **Weeds** 80 % cover
Vegetation U+ ^*Eucalyptus occidentalis*\^tree\6\r;M ^*Melaleuca cuticularis*\^shrub\4\i;G ^*Lolium rigidum*,
^*Gahnia trifida*\^other grass,tussock grass\2\d
Veg. Condition Good
Disturbance Tracks, rail
Fire Age >5 years
Notes Very weedy, low-lying.



Species	WA Cons.	Height (m)	Cover (%)	Count
		0.4	2	
<i>*Ehrharta longiflora</i>		0.5	2	
<i>Eucalyptus occidentalis</i>		10	3	
<i>Gahnia trifida</i>		0.9	25	
<i>*Hypochaeris glabra</i>		0.3	<1	

<i>*Lolium rigidum</i>	0.4	65
<i>Melaleuca cuticularis</i>	4	16

QCR04

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549968 mE** **6203773 mN** **Lat.** -34.3061 **Long.** 117.5430
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown loam
Rock Type
Loose Rock 0 % cover **Litter** 40 % cover ; 1 cm in depth
Bare ground 5 % cover **Weeds** 8 % cover
Vegetation U ^*Eucalyptus occidentalis*^tree\6\r;M+ ^*Melaleuca* sp.,^*Melaleuca cuticularis*^shrub\3\i;G
^*Leptocarpus kraussii*,^*Romulea rosea*,*Podolepis gracilis*^sedge,other grass,forb\1\i
Veg. Condition Good
Disturbance Tracks, rail
Fire Age >5 years
Notes Upper storey 20x20m



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Angianthus preissianus</i>		0.05	1	
* <i>Asparagus asparagoides</i>		0.3	<1	
* <i>Briza maxima</i>		0.4	<1	
* <i>Briza minor</i>		0.2	<1	
* <i>Ehrharta calycina</i>		0.5	<1	

<i>Eucalyptus occidentalis</i>	8	2
<i>Gahnia trifida</i>	0.4	1
<i>Goodenia micrantha</i>	0.1	<1
* <i>Hypochaeris glabra</i>	0.3	<1
<i>Leptocarpus kraussii</i>	0.3	5
* <i>Lolium rigidum</i>	0.4	<1
<i>Melaleuca cuticularis</i>	3.5	3
<i>Melaleuca</i> sp.	1.7	26
<i>Podolepis gracilis</i>	0.3	3
* <i>Romulea rosea</i>	0.3	4
<i>Rytidosperma caespitosum</i>	0.4	<1
* <i>Ursinia anthemoides</i>	0.1	<1

QCR05

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 **550040 mE** **6203835 mN** **Lat.** -34.3055 **Long.** 117.5438
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown loam
Rock Type
Loose Rock **Litter** 25 % cover ; <1 cm in depth
Bare ground 4 % cover **Weeds** 1 % cover
Vegetation U ^*Eucalyptus occidentalis*\^tree\7\bi;M+ ^*Melaleuca cuticularis*\^shrub\4\c;G ^*Lepidosperma* sp.,
^*Astartea glomerulosa*\^sedge,shrub\1\r
Veg. Condition Good
Disturbance Tracks, rail, rubbish
Fire Age >5 years
Notes Some road base mix scattered trough a and some rubbish. Upper storey 20x20m



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Astartea glomerulosa</i>		0.4	1	
<i>Austrostipa elegantissima</i>		0.5	<1	
* <i>Briza maxima</i>		0.3	1	
<i>Eucalyptus occidentalis</i>		13	2	
<i>Lepidosperma</i> sp.		0.4	2	

<i>Melaleuca cuticularis</i>	3.2	45
<i>*Pentameris airoides</i>	0.1	<1
<i>Pterochaeta paniculata</i>	0.1	<1
<i>Pultenaea empetrifolia</i>	0.2	<1
<i>Rytidosperma caespitosum</i>	0.3	<1
<i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897)	0.2	<1
<i>*Ursinia anthemoides</i>	0.2	<1

QCR06

Staff TCJ **Date** 5/11/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location Cranbrook
MGA Zone 50 549614 mE 6203252 mN **Lat.** -34.3108 **Long.** 117.5392
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown sandy loam
Rock Type
Loose Rock <2 % cover **Litter** 50 % cover ; <3 cm in depth
Bare ground 0 % cover **Weeds** 3 % cover
Vegetation U+ ^*Eucalyptus wandoo*,^*Eucalyptus occidentalis*\^tree\7\i;G ^*Lepidosperma* sp.,^*Gahnia trifida*,
Ehrharta longiflora\^sedge,tussock grass,other grass\1\c
Veg. Condition Good
Disturbance Tracks, rail
Fire Age >5 years
Notes Upper storey 20x20m. Lots of bridal creeper.



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Comesperma polygaloides</i>		0.2	<1	
* <i>Ehrharta calycina</i>		0.4	<1	
* <i>Ehrharta longiflora</i>		0.4	2	
<i>Eucalyptus occidentalis</i>		15	6	
<i>Eucalyptus wandoo</i>		15	13	

<i>Gahnia aristata</i>	0.3	<1
<i>Gahnia trifida</i>	0.5	3
<i>Lepidosperma pubisquameum</i>	0.3	1
<i>Lepidosperma</i> sp.	0.2	8
<i>Neurachne alopecuroidea</i>	0.2	<1
* <i>Trifolium angustifolium</i> var. <i>angustifolium</i>	0.2	<1

R01

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549614 mE** **6203332 mN** **Lat.** -34.3101 **Long.** 117.5392
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown sandy loam
Rock Type Weathered granite
Loose Rock 20-50 % cover **Litter** 20 % cover
Bare ground 3 % cover **Weeds** <1 % cover
Vegetation M+ ^*Calothamnus quadrifidus*,^*Leptospermum erubescens*\^shrub\3\c;G ^^*Verticordia subulata*,
Melaleuca carrii,*Borya sphaerocephala*\^shrub,forb\1\i
Veg. Condition Good
Disturbance Tracks, rail
Fire Age
Notes Very small patch 80x30m but diff veg



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia stenoptera</i>		0.3	<1	
<i>Banksia fraseri</i> var. <i>fraseri</i>		0.4	1	
<i>Borya sphaerocephala</i>		0.1	5	
* <i>Briza maxima</i>		0.2	<1	
<i>Calothamnus quadrifidus</i>		1.8	15	

<i>Chaetospore curvifolia</i>	0.2	<1
<i>Dianella revoluta</i>	0.9	<1
<i>Drosera leucoblasta</i>	0.2	<1
<i>Hakea prostrata</i>	1.8	<1
* <i>Hypochaeris glabra</i>	0.3	<1
<i>Leptospermum erubescens</i>	1.5	6
<i>Levenhookia pusilla</i>	0.1	<1
<i>Melaleuca carrii</i>	0.5	3
<i>Mirbelia spinosa</i>	0.3	<1
<i>Neurachne alopecuroidea</i>	0.3	<1
<i>Pterochaeta paniculata</i>	0.15	<1
<i>Stackhousia monogyna</i>	0.3	<1
<i>Stypandra glauca</i>	0.4	<1
* <i>Ursinia anthemoides</i>	0.1	<1
<i>Verticordia subulata</i>	0.3	5

R02

Staff TCJ **Date** 4/11/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Cranbrook
MGA Zone 50 **550194 mE** **6203988 mN** **Lat.** -34.3041 **Long.** 117.5455
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown loam
Rock Type
Loose Rock **Litter** 15 % cover
Bare ground 15 % cover **Weeds** 2 % cover
Vegetation U ^*Allocasuarina huegeliana*^tree\6\bi;M+ ^*Leptospermum erubescens*,^*Acacia pycnantha*^shrub\3\di;
Veg. Condition Good
Disturbance Tracks, rail, road base material
Fire Age
Notes Small but distinct patch of veg ~80x30. Road base gravel as substrate over soil.



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Acacia pycnantha</i>		2.5	2	
<i>Allocasuarina huegeliana</i>		6	<1	
<i>Daviesia decipiens</i>		0.4	<1	
* <i>Disa bracteata</i>		0.2	<1	
<i>Drosera</i> sp.		0.5	<1	

<i>Gompholobium tomentosum</i>	0.3	<1
<i>Hakea prostrata</i>	1.7	<1
<i>Kunzea recurva</i>	1.3	<1
<i>Leptospermum erubescens</i>	1.6	80
<i>Leucopogon</i> sp. Coujinup (M.A. Burgman 1085)	0.4	<1

R03

Staff TCJ **Date** 5/11/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Cranbrook
MGA Zone 50 **549634 mE** **6203314 mN** **Lat.** -34.3102 **Long.** 117.5394
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Brown sandy loam
Rock Type Weathered granite
Loose Rock 2-10 % cover **Litter** 10 % cover
Bare ground 25 % cover **Weeds** 1 % cover
Vegetation U ^*Eucalyptus occidentalis*^tree\6\bi;M+ ^^*Leptospermum erubescens*,*Calothamnus quadrifidus*,
Kunzea recurva^shrub\3\c;G ^^*Banksia fraseri* var. *fraseri*,*Melaleuca carrii*,*Neurachne alopecuroidea*^shrub,other grass\1\i
Veg. Condition Good
Disturbance Tracks, rail
Fire Age
Notes Small patch w leptospermum, approx 10m x 80m along rail side of track



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia stenoptera</i>		0.3	<1	
<i>Amphipogon turbinatus</i>		0.2	<1	
<i>Banksia fraseri</i> var. <i>fraseri</i>		0.2	4	
<i>Billardiera fusiformis</i>		0.7	<1	

<i>Borya sphaerocephala</i>	0.1	1
* <i>Briza maxima</i>	0.3	1
<i>Calothamnus quadrifidus</i>	1.3	4
<i>Cassytha glabella</i>	0.1	<1
<i>Conostylis pusilla</i>	0.1	<1
<i>Crassula colorata</i>	0.1	<1
<i>Dianella revoluta</i>	0.5	<1
* <i>Disa bracteata</i>	0.2	<1
* <i>Ehrharta calycina</i>	0.4	<1
<i>Eucalyptus occidentalis</i>	4	1
Fabaceae sp.	0.2	<1
* <i>Hypochaeris glabra</i>	0.2	<1
<i>Kunzea recurva</i>	1.2	8
<i>Lepidobolus</i> sp.	0.2	<1
<i>Lepidosperma leptostachyum</i>	0.1	<1
<i>Leptospermum erubescens</i>	1.6	20
<i>Melaleuca carrii</i>	0.3	3
<i>Mesomelaena pseudostygia</i>	0.3	<1
<i>Neurachne alopecuroidea</i>	0.1	1
<i>Neurachne alopecuroidea</i>	0.2	<1
* <i>Pentameris airoides</i>	0.1	<1
<i>Rytidosperma caespitosum</i>	0.2	<1
<i>Stackhousia monogyna</i>	0.3	<1
<i>Tetraria</i> sp. Mt Madden (C.D. Turley 40 BP/897)	0.1	<1
* <i>Ursinia anthemoides</i>	0.2	<1
<i>Verticordia subulata</i>	0.2	<1

R04

Staff TCJ **Date** 6/11/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location Cranbrook
MGA Zone 50 550440 mE 6204245 mN **Lat.** -34.3018 **Long.** 117.5481
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type
Rock Type
Loose Rock **Litter** 65 % cover
Bare ground 0 % cover **Weeds** 10 % cover
Vegetation U+ ^*Eucalyptus decipiens*\^tree mallee\6\i;G ^*Baumea juncea*,*Asparagus asparagoides*\^sedge, vine\1\d
Veg. Condition Good
Disturbance Tracks, rail, infrastructure adjacent
Fire Age
Notes Small patch 100mx20m, significant bridal creeper infestation.



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Acacia pycnantha</i>		2	<1	
* <i>Asparagus asparagoides</i>		0.5	8	
<i>Baumea juncea</i>		0.5	90	
<i>Billardiera fusiformis</i>		0.9	<1	
* <i>Briza maxima</i>		0.3	<1	

<i>*Ehrharta calycina</i>	0.5	1
<i>*Ehrharta longiflora</i>	0.5	<1
<i>Eucalyptus decipiens</i>	6	12
<i>Eucalyptus occidentalis</i>	12	<1
