



# Miling Grain Receival Site Expansion Flora and Fauna Survey

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**CBH Group**

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## DOCUMENT TRACKING

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Template 2.8.1

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## Abbreviations

Abbreviation	Description
BAM Act	Biosecurity and Agriculture Management Act 2007 (Western Australia)
BC Act	Biodiversity Conservation Act 2016 (Western Australia)
BoM	Bureau of Meteorology
CBH	CBH Group
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions (Western Australia)
DBH	Diameter at Breast Height
DotEE	Department of the Environment and Energy (now DAWE)
ELA	Eco Logical Australia
EP Act	Environmental Protection Act 1986 (Western Australia)
EPA	Environmental Protection Authority (Western Australia)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Area
IBRA	Interim Biogeographic Regionalisation for Australia
PEC	Priority Ecological Community
RCC	Roadside Conservation Committee of Western Australia
RCV	Roadside Conservation Value
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
TEC	Threatened Ecological Community
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
Wheatbelt Woodlands TEC	Eucalyptus Woodlands of the Western Australian Wheatbelt Threatened Ecological Community
WoNS	Weed of National Significance

## Executive Summary

Eco Logical Australia was engaged by CBH Group to conduct a Reconnaissance level flora and vegetation survey, a Basic fauna survey and Targeted conservation significant fauna species survey of the CBH Miling Grain Receival Site, totalling approximately 34 hectares (ha).

A desktop assessment reviewed relevant government databases within various buffers of the survey area to evaluate the potential for presence of conservation significant flora and fauna species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Biodiversity Conservation Act 2016* (BC Act) and by the Department of Biodiversity, Conservation and Attractions (DBCA).

The Reconnaissance flora and vegetation survey was undertaken in October 2020 in accordance with the Environmental Protection Authority *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). A total of 79 flora species, representing 23 families and 60 genera, were recorded from a combination of 15 relevés and opportunistic collections. Of these species, 27 introduced (weed) flora species were recorded one of which, *\*Echium plantagineum* (Paterson's curse), is a Declared Pest (s22[2]) under the State *Biosecurity and Management Act 2007*. The high proportion of introduced flora species (33%) was largely expected, given the surrounding pastoral land use.

No Threatened or Priority flora species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area. Of the 51 conservation significant flora species identified from the desktop assessment as possibly occurring within the survey area, one species was identified with the Potential to occur (*Urodon capitatus*), and two species were identified as Likely to occur (*Caladenia drakeoides* and *Caladenia cristata*).

A total of six vegetation communities were delineated and mapped within the survey area, comprising two eucalypt woodland communities (VC1 and VC6), three mixed shrubland communities (VC3, VC4 and VC5) and one samphire shrubland community (VC2). The most widespread community was VC2, which covered 9.44 ha (27.85%) of the survey area. Cleared areas, including roads and tracks, cover the majority (10.65 ha, 31.43%) of the survey area. The following vegetation communities were mapped within the survey area:

- VC1: *Eucalyptus loxophleba* low open mallee woodland;
- VC2: *Tecticornia undulata* and *T. pergranulata* low open samphire shrubland;
- VC3: *Acacia hemiteles* isolated shrubs over *Maireana brevifolia* and *Salsola australis* low open chenopod shrubland;
- VC4: *Casuarina obesa*, *Hakea preissii*, *Melaleuca lateriflora* and *M. stereophloia* tall shrubland;
- VC5: *Acacia lineolata* subsp. *lineolata*, *Melaleuca lateriflora* and *Hakea preissii* tall sparse shrubland; and
- VC6: *E. loxophleba* open woodland.

The *Eucalyptus Woodlands of the Western Australian Wheatbelt* threatened ecological community, listed as Critically Endangered under the EPBC Act, and Priority 3 by the DBCA, potentially occurs within the survey area. An assessment was undertaken utilising the key diagnostic characteristics of the threatened ecological community, as described in *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (Department of the

Environment and Energy [now Department of Agriculture, Water and the Environment] 2015). This key diagnostic assessment concluded that no vegetation communities mapped within the survey area are likely to represent the *Eucalyptus Woodlands of the Western Australian Wheatbelt* threatened ecological community.

A Basic fauna survey and Targeted conservation significant fauna species survey was undertaken within the survey area in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (2020), *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species* (SEWPaC 2012), *Survey Guidelines for Australia's threatened reptiles* (SEWPaC 2011) and EPA *Technical Guidance: Sampling of short range endemic invertebrate fauna* (EPA 2016b). A total of 27 vertebrate fauna species were recorded within the survey area, comprising 23 birds, three mammals and one reptile.

No Threatened or Priority fauna species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area. Of the 23 conservation significant fauna species identified from the desktop assessment as possibly occurring within the survey area, three species were identified as having the Potential to occur (Carnaby's Cockatoo [*Calyptorhynchus latirostris*], Western Spiny-tailed Skink [*Egernia stokesii* subsp. *badia*] and Shield-backed Trapdoor Spider [*Idiosoma nigrum*]).

The Carnaby's Cockatoo habitat assessment identified three potentially suitable breeding trees within the survey area, none of which contained hollows or potentially suitable hollows (over 100 mm in diameter). Foraging habitat within the survey area was classed as 'Poor' quality (5.06 ha, 14.93%), or 'Nil' quality (28.82 ha, 85.04%) where no suitable habitat was found. No evidence of foraging by Carnaby's Cockatoo was observed within the survey area.

Potential habitat was identified by Cardno *Level 1 Flora and Fauna Survey* (2014) for the Western Spiny-tailed Skink and Shield-backed Trapdoor Spider, therefore basic habitat assessments for these species was undertaken during the field survey. No Western Spiny-tailed Skink or Shield-backed Trapdoor Spider individuals or secondary signs were recorded. In the survey area, 'Poor' quality habitat (2.23 ha, 6.58%) was recorded in association with the *Eucalyptus loxophleba* woodland fauna habitat for both species.

Four fauna habitats were recorded within the survey area; *Eucalyptus loxophleba* woodland, Samphire shrubland, Mixed low shrubland and *Hakea* and *Melaleuca* shrubland.

# 1. Introduction

## 1.1 Project Background

Eco Logical Australia (ELA) was engaged by CBH Group (CBH) to conduct a Reconnaissance level flora and vegetation survey, a Basic fauna survey and Targeted conservation significant fauna species survey of the CBH Miling Grain Receival Site (the survey area) totalling approximately 34 ha (**Figure 1**). Miling is in the Shire of Moora, approximately 200 kilometres (km) north-east of Perth, Western Australia.

This survey is to inform the revision of the Miling Environmental Management Plan (EMP) and a future expansion of the Miling Grain Receival Site.



**Figure 1: Site overview**



**Legend**  
[Red Outline] Survey area

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors

0 50 100 200  
Metres

Datum/Projection:  
GDA 1994 MGA Zone 50



## 2. Environmental setting

### 2.1 Climate

The survey area is located in the Avon Wheatbelt bioregion, as defined by the Interim Biogeographic Regionalisation for Australia (IBRA; Department of Agriculture, Water and the Environment [DAWE] 2021). The region is described as having a semi-arid (dry) and warm Mediterranean Climate (Beecham 2001). Based on the Bureau of Meteorology (BoM) Miling weather station (station number 8085, climate data 1924-present), the area receives, on average, 364.3 mm of rainfall a year, with most rainfall occurring during the winter months of June and July (62.3 mm and 62.5 mm respectively; BoM 2021; **Table 1**).

In the 12 months preceding the field survey in October 2020, the area received a total of approximately 271 mm which is significantly below the long-term average (BoM 2021). In the three months preceding the field survey, a total of 97.9 mm of rainfall was recorded from the survey area, which is below the long-term average for the same time period (137.4 mm).

**Table 1: Rainfall data recorded at the Miling weather station (8085) 12 months prior to the field survey compared to the long-term average (BoM 2021)**

Rainfall (mm)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average rainfall (mm) 1924-present	17.9	9.8	9.8	15.4	16.6	19.0	21.4	47.5	62.3	62.5	48.6	26.3	364.3
Rainfall (mm) 2019-2020	0.0	0.0	0.0	0.0	87.7	7.4	6.0	27.8	44.2	24.0	70.2 <sup>1</sup>	3.7 <sup>1</sup>	271 <sup>1</sup>

<sup>1</sup>Miling weather station (8085) did not have any data for August or September 2020, therefore this data is from the next closest weather station, Mindalla (8087) which is 12 km from the survey area

### 2.2 Landform, topography and soils

The survey area is situated on the Goomalling soil landscape system (Landgate 2021 and Purdie et. al. 2004), details of which are given in Table 2.

**Table 2: Soil landscape systems within the survey area**

Soil Landscape System	Soil Landscape Zone	Description
Goomalling System	Xd2	Poorly drained valley flats, in the northern Zone of Rejuvenated Drainage, with grey deep sandy duplex (sometimes alkaline) and saline wet soil. York Gum-Jam-Wandoo-Salmon Gum-Sheoak woodland.

### 2.3 Hydrology

The survey area is located in the Moore-Hill Rivers Basin, within the Moore River catchment. No major or minor drainages run through or are adjacent to the survey area.

### 2.4 Interim Biogeographic Regionalisation for Australia

Under the current version 7 of IBRA, the survey area is situated within the Avon Wheatbelt IBRA Bioregion and AVW02- Katanning subregion (DAWE 2021a). The Avon Wheatbelt bioregion is described as a dissected plateau of Tertiary laterite in the Yilgarn Craton with a semi-arid (dry) warm

Mediterranean climate (Beecham 2001). The AVW02 subregion is further described as comprised of gently undulating rises to low hills with abrupt breakaways; its drainage is rejuvenated and comprises continuous stream channels that flow in most years. Residual lateritic uplands and derived sandplains are covered by areas of proteaceous scrub-heaths (which are rich in endemic species) and quaternary surfaces of erosional slopes and valley floors support woodlands of Wandoo, York gum, Jam and Casuarina (Beecham 2001).

## 2.5 Beard's (1975) Vegetation Mapping

Vegetation type and extent have been mapped at a regional scale by Beard (1975) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:1,000,000, the Department of Primary Industries and Regional Development (previously Department of Agriculture and Food Western Australia) has compiled a list of vegetation extent and types across WA (Shepherd et al. 2002).

Two vegetation associations occur within the survey area, namely Victoria Plains 142 and Victoria Plains 631. Victoria Plains 631 covers almost all of the survey area and Victoria Plains 142 occurs along the south-east border of the survey area. Details of these vegetation associations are given in **Table 3**. Both associations have only have a small proportion of their pre-European extent within the AVW02 IBRA subregion remaining (Government of Western Australia 2019).

**Table 3: Beard's (1975) vegetation associations of the survey area (Government of Western Australia 2019)**

Vegetation association	Description	Pre-European extent within AVW02 subregion (ha)	Current extent within AVW02 subregion (ha)	% remaining within AVW02 subregion
Victoria Plains 142	Medium woodland; York gum & salmon gum	224,265.61	16,054.80	7.16
Victoria Plains 631	Succulent steppe with woodland and thicket; York gum over <i>Melaleuca thyooides</i> & samphire	11,821.43	1,702.93	14.41

## 2.6 Areas of Conservation Significance

Environmentally Sensitive Areas (ESAs) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under s 51B of the State *Environmental Protection Act 1986* (EP Act). ESAs include areas declared as World Heritage, included on the Register of the National Estate, defined wetlands, and vegetation containing rare (Threatened) flora and Threatened Ecological Communities (TECs).

Priority Ecological Communities (PECs) are biological flora or fauna communities that are recognised by the WA Minister for Environment to be of significance, but which do not meet the criteria for a TEC. There are five categories of PECs, none of which are currently protected under State or Federal legislation.

The *Eucalyptus Woodlands of the Western Australian Wheatbelt* (Wheatbelt Woodlands) TEC, listed as Critically Endangered [CR] under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Priority [P] 3 by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA), occurs throughout the wheatbelt region in southwestern Western Australia, in which the survey area is located.

## 3. Methodology

### 3.1 Desktop Assessment

#### 3.1.1 Database Searches

The following Commonwealth and State databases were searched for existing data and information relating to conservation significant flora and ecological communities in order to inform the field survey. Database searches undertaken for the survey area are provided in **Table 4** below. Applied search areas given below are considered suitable based on flora and fauna assemblages expected to occur within the survey area.

**Table 4: Database searches undertaken for the survey area**

Database	Reference	Radius of search area (km)
EPBC Act Protected Matters Search Tool for Threatened species and communities listed under the EPBC Act.	DAWE 2021b	20
DBCA and Western Australian Museum (WAM) NatureMap online database for flora and fauna.	DBCA 2007-2021	20
DBCA Threatened and Priority flora database searches for Declared Rare Flora (DRF) listed under the latest WA Wildlife Conservation (Rare Flora) Notice and Priority Flora.	DBCA 2020a	30
DBCA Threatened and Priority fauna database searches for Scheduled fauna listed under the EPBC Act or latest WA Wildlife Conservation (Specially Protected Fauna) Notice and Priority Fauna.	DBCA 2020b	65
DBCA Threatened and Priority Ecological Communities' database search	DBCA 2020c	20

#### 3.1.2 Likelihood of occurrence assessment

A likelihood of occurrence assessment was undertaken to identify conservation significant flora species that possibly occur within the survey area, identified from a review of key datasets and literature outlined in the above section. Conservation codes, categories and criteria for flora and fauna protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Biodiversity Conservation Act 2016* (BC Act) are provided in **Appendix A**. Criteria used for this assessment are presented in **Appendix B**. The flora likelihood assessment is shown in **Appendix C** and that for fauna in **Appendix D**.

## 3.2 Field Survey

### 3.2.1 Survey Team and Timing

A Reconnaissance level flora and vegetation survey, a Basic fauna survey and a Targeted conservation significant fauna species survey were undertaken over one day on 21<sup>st</sup> October 2020. The survey team's relevant qualifications, experience and licences are provided in **Table 5** below. No rainfall was recorded during the field survey (BoM 2021).

**Table 5: Survey Team**

Name	Qualification	Relevant experience	Licences
Daniel Brassington	BSc. Hons. Environmental Science	Daniel has more than 10 years' experience in botanical surveys and environmental services throughout Western Australia. This includes baseline vegetation studies, threatened and priority flora surveys, weed surveys, rehabilitation and vegetation monitoring.	Flora scientific collection licence: SL012503 DRF permit: TFL 15-1920
Briana Wingfield	BSc. Conservation and Wildlife Biology and Environmental Science (Hons)	Briana has seven years' experience conducting fauna surveys across Western Australia, including basic fauna surveys and targeted black cockatoo habitat assessments.	N/A

### 3.2.2 Flora and Vegetation Survey

A Reconnaissance flora and vegetation survey was conducted in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a).

A total of 15 relevés were established within the survey area (**Figure 2**). Broad vegetation communities were described with respect to dominant species, structure and overall condition. The following data was recorded within each relevé:

- Site details (site name, number, observer/s, date and location);
- Broad vegetation type survey based on an assessment of the dominant flora species for the three traditional strata (upper, mid and ground) and mapping extent; and
- Vegetation condition in accordance with the Keighery (1994) vegetation condition scale, as provided in the EPA Technical Guidance (EPA 2016a).

Suitable habitat within the survey area was searched to identify any conservation significant flora or communities potentially occurring, including:

- Threatened flora or TECs listed under the EPBC Act;
- Threatened (Declared Rare) flora listed under the latest Western Australia Wildlife Conservation (Rare Flora) Notice under the BC Act;
- PECs endorsed by the Western Australian Minister for the Environment; and
- Priority flora listed by Department of Biodiversity, Conservation and Attractions (DBCA).

In addition, any encountered Declared Pests listed under the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weeds of National Significance (WoNS) were recorded and mapped.

Survey methodology involved personnel walking meandering traverses across the survey area, with all relevant vegetation communities visited and areas of potential significant flora habitat traversed at an average spacing of 30 to 50 m, with spacing dependent on factors including suitable habitat, disturbance (e.g. cleared areas) and landform. Locations of survey traverses are presented in **Figure 2** below. Flora species able to be identified in the field were recorded, and specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number. For conservation significant flora species identified in the field, the following was recorded:

- A colour photograph;
- GPS location;
- Population size estimate;
- Location of population boundaries;
- Associated habitat/landscape element;
- Time and date observed;
- Observer details; and
- A specimen suitable for use as a reference specimen (where appropriate).

#### 3.2.2.1 Flora Identification and Nomenclature

Flora specimen identification was undertaken by ELA Botanist Daniel Brassington. Species identification utilised taxonomic literature and keys, and where required specimens were confirmed using the Western Australian Herbarium (WAH) collection. Where considered appropriate, specimens that meet WAH specimen lodgement requirements (e.g. Threatened and Priority Flora, range extensions) may be submitted along with Threatened and Priority Report forms to DBCA. Nomenclature used for the flora species within this report follows the WA Plant Census as available on *FloraBase* (WAH 1998- ).

### 3.2.3 Fauna Survey

#### 3.2.3.1 Basic fauna survey

The Basic fauna survey was conducted in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020). An assessment of fauna habitat in terms of its ability to support and sustain populations of fauna, along with an assessment of the likelihood of occurrence of conservation significant fauna species, was undertaken during the survey. The habitat characteristics and fauna database records used in assessing likelihood of occurrence for fauna included:

- Vegetation community, structure and condition;
- Soil and landform type;
- Extent and connectivity of bushland;
- Fauna species habitat preferences;
- Proximity of conservation significant fauna records; and
- Signs of species presence.

Opportunistic recordings of fauna species were made at all times during the field survey. These included visual sightings of active fauna such as: reptiles and birds; records of bird calls; and signs of species presence such as tracks, diggings, burrows, scats and any other signs of fauna activity.

Nomenclature used for the vertebrate fauna species within this report follows the WAM *Checklist of the Vertebrates of Western Australia* (WAM 2020). Where common names were not stated for certain species, the following references were consulted:

- Amphibians and reptiles: Bush et al. (2010);
- Reptiles: Wilson and Swan (2010);
- Birds: Morcombe (2003); and
- Mammals: Menkhorst and Knight (2011).

### 3.2.3.2 Targeted conservation significant fauna species survey

#### CARNABY'S COCKATOO HABITAT ASSESSMENT

An assessment of Carnaby's Cockatoo habitat was undertaken in accordance with the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) *EPBC Act referral guidelines for three threatened black cockatoo species* (SEWPaC 2012). This involved assessing all significant tree species known to support potential suitable breeding, roosting and foraging habitat. Significant breeding trees are defined as trees of suitable species with a Diameter at Breast Height (DBH) greater than 500 mm; >300 mm for Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*); SEWPaC 2012). Trees with a DBH greater than 500 mm (or >300 mm for Salmon Gum and Wandoo) are large enough to potentially contain hollows suitable for nesting Carnaby's Cockatoo or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). All potential breeding trees with a DBH of 500 mm (300 mm for Salmon Gum and Wandoo) or greater encountered within the survey area were recorded with a handheld GPS unit.

Hollows were considered 'suitable' if the entrance was >100 mm in diameter, >300 mm deep and aligned near vertical. If it was not possible to determine if a hollow was suitable it was categorised as 'potentially suitable'. Hollows that did not meet any of the requirements were categorised as 'unsuitable'. Trees that met the required measurements were inspected with binoculars from the ground to assess suitability of hollows for nesting and/or roosting and evidences of current or previous occupancy, including wear and chew marks around the entrance.

Vegetation present within the survey area was assessed for its potential to provide foraging and roosting habitat for Carnaby's Cockatoo as per the SEWPaC (2012) guidelines, and the extent of potential suitable habitat within the survey area was mapped. Observations were also made of any Carnaby's Cockatoo foraging activity or feeding residue such as chewed *Banksia*, Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) nuts, and any individuals within the survey area.

#### WESTERN SPINY-TAILED SKINK AND SHIELD-BACKED TRAPDOOR SPIDER

Potential habitat was identified by Cardno (2014) for two other conservation significant species, the Western Spiny-tailed Skink (*Egernia stokesii* subsp. *badia*) and Shield-backed Trapdoor Spider (*Idiosoma nigrum*) within the survey area. Therefore, basic habitat assessments for these species was undertaken during the field survey but did not include targeted searches for individuals. This was undertaken in accordance with:

- EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (2020);
- SEWPaC *Survey Guidelines for Australia's threatened reptiles* (2011); and
- EPA *Technical Guidance: Sampling of short range endemic invertebrate fauna* (EPA 2016b).

### 3.3 Limitations

The EPA *Technical Guide: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) recommends including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the survey are summarised in **Table 6**. One potential constraint was identified for this survey.

**Table 6: Survey Limitations**

Potential survey limitation	Impact on survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	<b>Not a constraint.</b> Broad-scale vegetation mapping at a scale of 1:1,000,000 was available. Land system mapping at a scale of 1:2,000,000 and soil and landform mapping was also available. DBCA database searches were undertaken within appropriate buffers. Available information was sufficient to provide context at varying scales and therefore was not considered a limitation.
Scope (i.e. what life forms, etc., were sampled).	<b>Not a constraint.</b> The survey requirement of a Reconnaissance flora and vegetation survey, a Basic fauna survey and a Targeted conservation significant fauna species survey in accordance with relevant State and Federal legislation and EPA guidance documents was adequately met.
Proportion of flora collected and identified (based on sampling, timing and intensity).	<b>Not a constraint.</b> A Reconnaissance level survey records the dominant and abundant species, with little requirement for a comprehensive account of species richness. Data recorded were sufficient for this level of survey.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	<b>Not a constraint.</b> The survey area coverage met the requirements of a Reconnaissance level flora and vegetation survey, as outlined in the scope of work.
Mapping reliability.	<b>Not a constraint.</b> Map coverage of the survey area was considered to be good. High quality aerial maps were used for both the survey and subsequent vegetation mapping. Due to the nature of vegetation in the survey area, mapping boundaries of individual communities were discrete, and thus are considered accurate.
Timing, weather, season, cycle.	<b>Potential constraint.</b> The field survey was undertaken at an appropriate time, as specified by the EPA <i>Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment</i> (2016). Rainfall in the three months prior to the survey was significantly below the long-term average, limiting the presence and flowering of species present. This did not impact the ability to describe the dominant species present to the level of survey required. Two targeted orchid species ( <i>Caladenia drakeoides</i> and <i>Caladenia cristata</i> ) have suitable habitat present within the survey area. They are known from WAH records to flower in September (WAH 1998-), therefore they may have not been able to be identified in the field survey.
Disturbances (fire, flood, accidental human intervention, etc.).	<b>Not a constraint:</b> Disturbances within the survey area included due to agricultural and transport infrastructure, with historical clearing in large portions of the survey area, and weeds dominating the understorey in areas. Disturbances did not impact the ability to meet the requirements of the survey.
Intensity (in retrospect, was the intensity adequate).	<b>Not a constraint.</b> The survey effort was appropriate for a Reconnaissance flora and vegetation survey, Basic fauna survey and Targeted conservation significant fauna species survey.



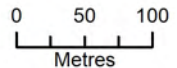
Potential survey limitation	Impact on survey
Resources (i.e. were there adequate resources to complete the survey to the required standard).	<b>Not a constraint.</b> The number of personnel conducting this field survey in the given time was adequate to perform the required level of survey. Additional resources, including equipment available, additional support and personnel were adequate.
Access problems (i.e. ability to access survey area).	<b>Not a constraint.</b> All relevant areas within the survey area were able to be accessed and surveyed.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	<b>Not a constraint.</b> The personnel conducting this field survey were both suitably qualified to identify specimens, having multiple years of field experience in flora and fauna surveys across Western Australia.

Figure 2: Survey effort



- Legend**
- Survey area
  - GPS Track
  - Relevé

Service Layer Credits:  
Google



Datum/Projection:  
GDA 1994 MGA Zone 50



## 4. Results

### 4.1 Desktop assessment

Database searches identified 51 conservation significant flora species as possibly occurring within the survey area (Figure 3<sup>1</sup>); this figure is based on the database searches undertaken in Section 3.1.1 and using criteria outlined in **Appendix B**. These taxa comprise 27 species listed under the EPBC Act and/or BC Act as Threatened flora, and 24 species listed as Priority flora by DBCA. The flora likelihood of occurrence assessment is presented in **Appendix C**.

Database searches identified 23 conservation significant fauna species as possibly occurring within the survey area (Figure 4<sup>2</sup>). These taxa comprise 12 species listed under the EPBC Act and/or BC Act as Threatened and/or Migratory fauna, and 11 species listed as Priority fauna by DBCA. The fauna likelihood of occurrence assessment is presented in **Appendix D**.

One TEC, *Eucalyptus Woodlands of the Western Australian Wheatbelt* (CR under the EPBC Act and P3 by DBCA), was identified by the database searches as potentially occurring near the survey area (Figure 5<sup>3</sup>). Two additional TECs, *Salmon Gum Woodlands of the Wheatbelt* and *York Gum Woodlands of the Wheatbelt* (both CR under the EPBC Act and P3 by DBCA) also occurred approximately 20 km away from the survey area.

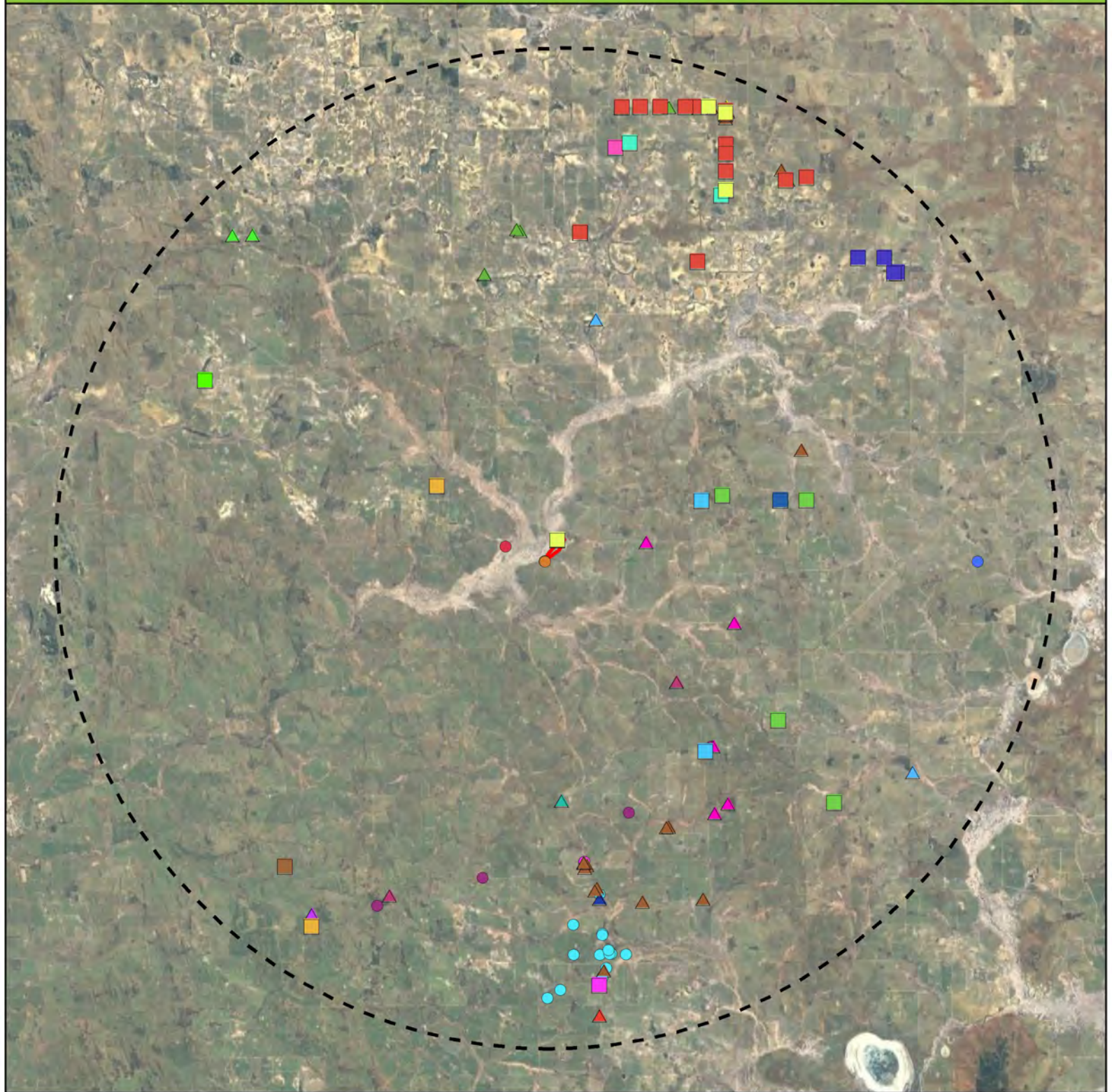
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<sup>1</sup> This figure only shows generalised Threatened and Priority flora locations at a low resolution in line with DBCA's *Threatened and Priority Flora Data Interpretation* (DBCA 2020d)

<sup>2</sup> This figure only shows generalised Threatened and Priority fauna locations at a low resolution in line with DBCA's *Threatened, Specially Protected and Priority Fauna Conditions of Data Supply* (DBCA 2020e)

<sup>3</sup> This figure only shows generalised Threatened and Priority ecological communities' locations in line with DBCA's *Threatened and Priority Ecological Communities Information Conditions in Respect of Supply of Information* (DBCA 2020f)

**Figure 3: Conservation significant flora species recorded in the vicinity of the survey area**



- Legend**
- Survey area
  - 30 km buffer
- Conservation significant flora**
- |  |  |  |
|--|--|--|
| <ul style="list-style-type: none"> <li><span style="color: green;">●</span> <i>Acacia arcuatis</i></li> <li><span style="color: blue;">●</span> <i>Acacia lirellata</i> subsp. <i>compressa</i></li> <li><span style="color: red;">●</span> <i>Acacia trinalis</i></li> <li><span style="color: cyan;">●</span> <i>Acacia vassalii</i></li> <li><span style="color: magenta;">●</span> <i>Androcalva fragifolia</i></li> <li><span style="color: green;">●</span> <i>Caladenia cristata</i></li> <li><span style="color: orange;">●</span> <i>Caladenia drakeoides</i></li> <li><span style="color: purple;">●</span> <i>Calothamnus accedens</i></li> </ul> | <ul style="list-style-type: none"> <li><span style="color: magenta;">▲</span> <i>Chorizema humile</i></li> <li><span style="color: yellow;">▲</span> <i>Dampiera glabrescens</i></li> <li><span style="color: purple;">▲</span> <i>Daviesia debilior</i> subsp. <i>sinuans</i></li> <li><span style="color: green;">▲</span> <i>Daviesia dielsii</i></li> <li><span style="color: red;">▲</span> <i>Eucalyptus macrocarpa</i> x <i>pyriformis</i></li> <li><span style="color: blue;">▲</span> <i>Eucalyptus</i> x <i>carnabyi</i></li> <li><span style="color: orange;">▲</span> <i>Gastrolobium appressum</i></li> <li><span style="color: blue;">▲</span> <i>Gastrolobium hamulosum</i></li> <li><span style="color: red;">▲</span> <i>Gastrolobium rotundifolium</i></li> <li><span style="color: cyan;">▲</span> <i>Grevillea asparagoides</i></li> <li><span style="color: brown;">▲</span> <i>Grevillea bracteosa</i> subsp. <i>bracteosa</i></li> <li><span style="color: green;">▲</span> <i>Grevillea christineae</i></li> </ul> | <ul style="list-style-type: none"> <li><span style="color: green;">■</span> <i>Grevillea haplantha</i> subsp. <i>recedens</i></li> <li><span style="color: green;">■</span> <i>Grevillea pinifolia</i></li> <li><span style="color: blue;">■</span> <i>Grevillea pythara</i></li> <li><span style="color: red;">■</span> <i>Jacksonia pungens</i></li> <li><span style="color: cyan;">■</span> <i>Melaleuca sclerophylla</i></li> <li><span style="color: magenta;">■</span> <i>Persoonia sulcata</i></li> <li><span style="color: orange;">■</span> <i>Stylidium periscelianthum</i></li> <li><span style="color: cyan;">■</span> <i>Thryptomene shirleyae</i></li> <li><span style="color: blue;">■</span> <i>Urodon capitatus</i></li> <li><span style="color: brown;">■</span> <i>Verticordia dasystylis</i> subsp. <i>oestopoa</i></li> <li><span style="color: magenta;">■</span> <i>Verticordia huegelii</i> var. <i>tridens</i></li> <li><span style="color: yellow;">■</span> <i>Verticordia venusta</i></li> </ul> |
|--|--|--|

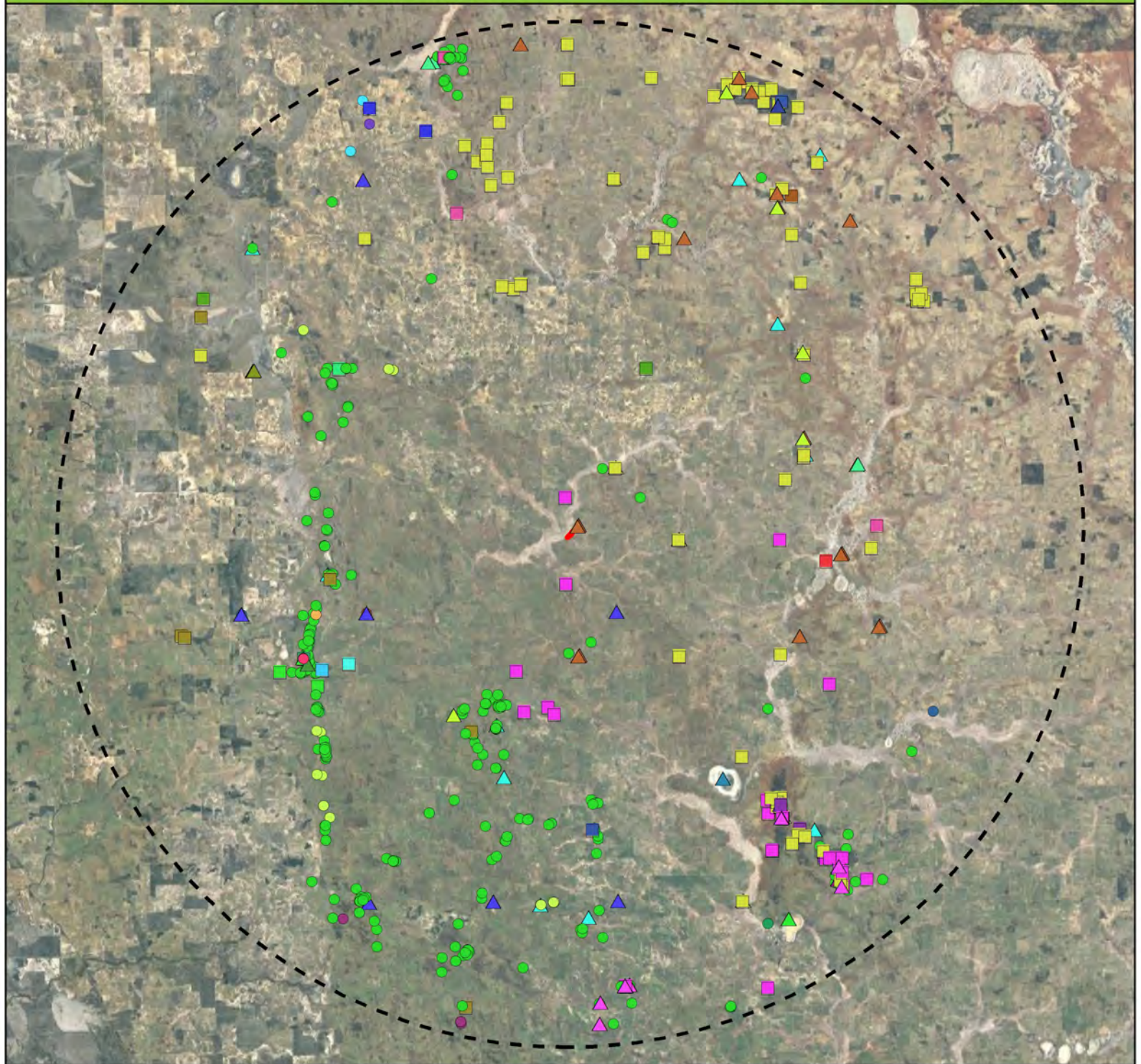
Prepared by: SC Date: 18/02/2021

Service Layer Credits:  
Google

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Datum/Projection:  
GDA 1994 MGA Zone 50



**Figure 4: Conservation significant fauna species recorded in the vicinity of the survey area**



**Legend**

Survey area  
 65 km buffer

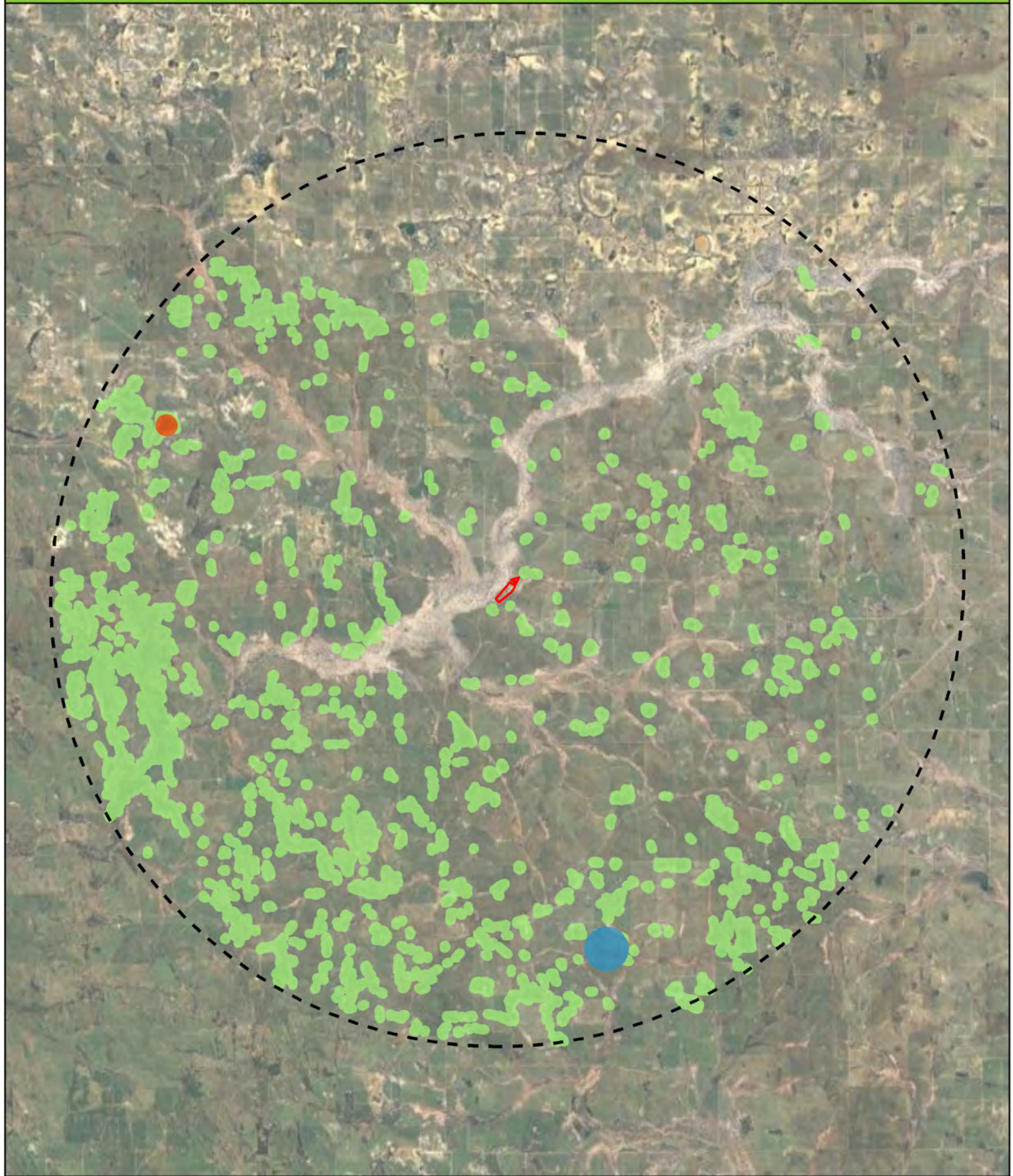
**Conservation significant fauna**

- Australasian bittern
- Australian painted snipe
- Blue-billed duck
- Carnaby's cockatoo
- Chuditch, western quoll
- Common Sandpiper
- Common greenshank, greenshank
- Dandaragan Plateau shield-backed trapdoor spider
- Glossy ibis
- Hooded plover, hooded dotterel
- Julimar shield-backed trapdoor spider

- ▲ Lake Goorly shield-backed trapdoor spider
- ▲ Malleefowl
- ▲ Peregrine falcon
- ▲ Red-necked stint
- ▲ Sharp-tailed sandpiper
- ▲ Shield-backed trapdoor spider
- ▲ South-western brush-tailed phascogale, wambenger
- ▲ Water-rat, rakali
- ▲ Western spiny-tailed skink
- ▲ White-tailed black cockatoo
- ▲ Woma (southwest subpop.)
- ▲ Wood sandpiper
- ▲ a brine shrimp (Wheatbelt)
- ▲ a water flea (inland south west)
- ▲ an Idiosoma trapdoor spider

- barking owl (southwest subpop.)
- blue-billed duck
- chuditch, western quoll
- forest red-tailed black cockatoo
- hooded plover, hooded dotterel
- malleefowl
- pectoral sandpiper
- peregrine falcon
- quenda, southwestern brown bandicoot
- shield-backed trapdoor spider
- tree-stem trapdoor spider
- water-rat, rakali
- western brush wallaby
- western rosella (inland)
- white-tailed black cockatoo
- woma (southwest subpop.)

**Figure 5: Conservation significant ecological communities mapped in the vicinity of the survey area**



**Legend**

- Survey area
- 20 km buffer

**Ecological Communities**

- Eucalypt woodlands of the Western Australian Wheatbelt
- Salmon Gum Woodlands of the wheatbelt
- York Gum Woodlands of the wheatbelt

Service Layer Credits:  
Google

0 2 4  
Kilometres

Datum/Projection:  
GDA 1994 MGA Zone 50

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Prepared by: SC Date: 18/02/2021

## 4.2 Flora

### 4.2.1 Flora overview

A total of 79 flora species, representing 23 families and 60 genera were recorded from a combination of 15 relevés and opportunistic collections. Families with the highest number of species recorded were Poaceae (15 species), Chenopodiaceae (14 species) and Asteraceae (10 species). The best represented genera were *Acacia* (five species), *Atriplex* (four species) and *Eucalyptus* (three species). A full species list is provided in **Appendix E**, species by relevé matrix is provided in **Appendix F** and details of the relevés are presented in **Appendix G**.

### 4.2.2 Conservation significant flora

No Threatened flora species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area during the field survey.

Of the 51 conservation significant flora species identified from the desktop assessment as possibly occurring within the survey area (**Appendix C**), one species was identified with the Potential to occur; *Urodon capitatus* (P3 by DBCA), and two species were identified as Likely to occur; *Caladenia drakeoides* (listed as Endangered [EN] under the EPBC Act and CR under the BC Act) and *Caladenia cristata* (P1 by DBCA). Suitable habitat was present for both of these species, however majority of WAH records indicate these species flower in September (WAH 1998-), therefore they may not have been able to be identified in the field survey.

### 4.2.3 Introduced flora

A total of 27 introduced (weed) flora species were recorded in the survey area. One species, *Echium plantagineum* (Paterson's curse), is listed as a Declared Pest (s22(2)) under the BAM Act (Western Australian Organism List [WAOL]); this was recorded at 10 locations (Figure 6). The remaining 26 species are listed on the WAOL database as s11 (permitted) species, indicating that no specific management of these species is required. The full list of introduced species is included within **Appendix E**.

### 4.2.4 Vegetation communities

A total of six vegetation communities (23.23 ha), comprising two eucalypt woodland communities (VC1 and VC6), three mixed shrubland communities (VC3, VC4 and VC5) and one samphire shrubland community (VC2), were delineated and mapped within the survey area (**Table 7, Figure 6**). The most widespread community was VC2, which covered 9.44 ha (27.85%) of the survey area. Cleared areas, including roads and tracks, cover the majority (10.65 ha, 31.43%) of the survey area.

### 4.2.5 Conservation significant ecological communities

Two vegetation communities delineated within the survey area comprise eucalypt woodlands that have the potential to represent floristic and structural aspects of the Wheatbelt Woodlands TEC, as indicated in the Department of the Environment and Energy (DotEE; now DAWE) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (Approved Conservation Advice; DotEE 2015).

In summary, the Wheatbelt Woodlands TEC is composed of eucalypt-dominated woodlands in the Western Australian Wheatbelt region as defined by the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions, with the specific exceptions of woodlands and forests dominated by Jarrah (*Eucalyptus marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum (*Eucalyptus loxophleba*) present; and non-woodland communities dominated by eucalypts, specifically those

dominated by eucalypts with a mallee growth form. The community is defined primarily by its structure as a woodland. The presence in the canopy layer of eucalypt trees - most commonly Salmon Gum (*E. salmonophloia*), York Gum (*E. loxophleba*), Red Morrel (*E. longicornis*) or Gimlet (*E. salubris*) defines the Wheatbelt woodlands. Several of the other emergent eucalypt species which may be present as a defining species (e.g. Kondinin Blackbutt [*E. kondininensis*], *E. myriadena*, Salt River Gum [*E. sargentii*], Silver Mallet [*E. ornata*] and Mallet [*E. singularis*]) are found only in the Western Australian Wheatbelt.

An assessment, presented in **Appendix H**, was undertaken utilising key diagnostic characteristics of the Wheatbelt Woodlands TEC (DotEE 2015). This key diagnostic assessment concluded that whilst some characteristics represented the Wheatbelt Woodlands TEC, others did not. Whilst crown cover was greater than 10%, VC1 (*Eucalyptus loxophleba* low open mallee woodland) was dominated by a mallee eucalypt. And whilst VC6 (*E. loxophleba* open woodland) contained mature trees, the crown cover was less than 10% (2-5%). Therefore, no vegetation community within the survey area represents the Wheatbelt Woodland TEC.

It is noted that conclusions relating to the presence of this TEC within the survey area are based on results from a Reconnaissance level survey. Given the limitations of such a survey (e.g. relevé data etc.) further work may be required to determine presence/absence with a greater degree of certainty (e.g. single season Detailed flora and vegetation survey utilising quadrat data).

#### 4.2.6 Vegetation condition

Vegetation of the survey area ranged from Completely Degraded to Very Good condition, based on the Keighery (1994) vegetation condition scale provided in EPA (2016) (**Figure 7**). The majority of the survey area was classed as Good condition (11.99 ha, 35.38%). The remaining categories include; Very Good (0.47 ha, 1.39%), Degraded (1.98 ha, 5.84%) and Completely Degraded (8.8 ha, 25.97%). Cleared areas, including roads and tracks, cover 31.43% (10.65 ha) of the survey area.

Primary disturbances within the survey area included clearing for agriculture and infrastructure and the presence of introduced (weed) species.



Table 7: Vegetation communities recorded within the survey area





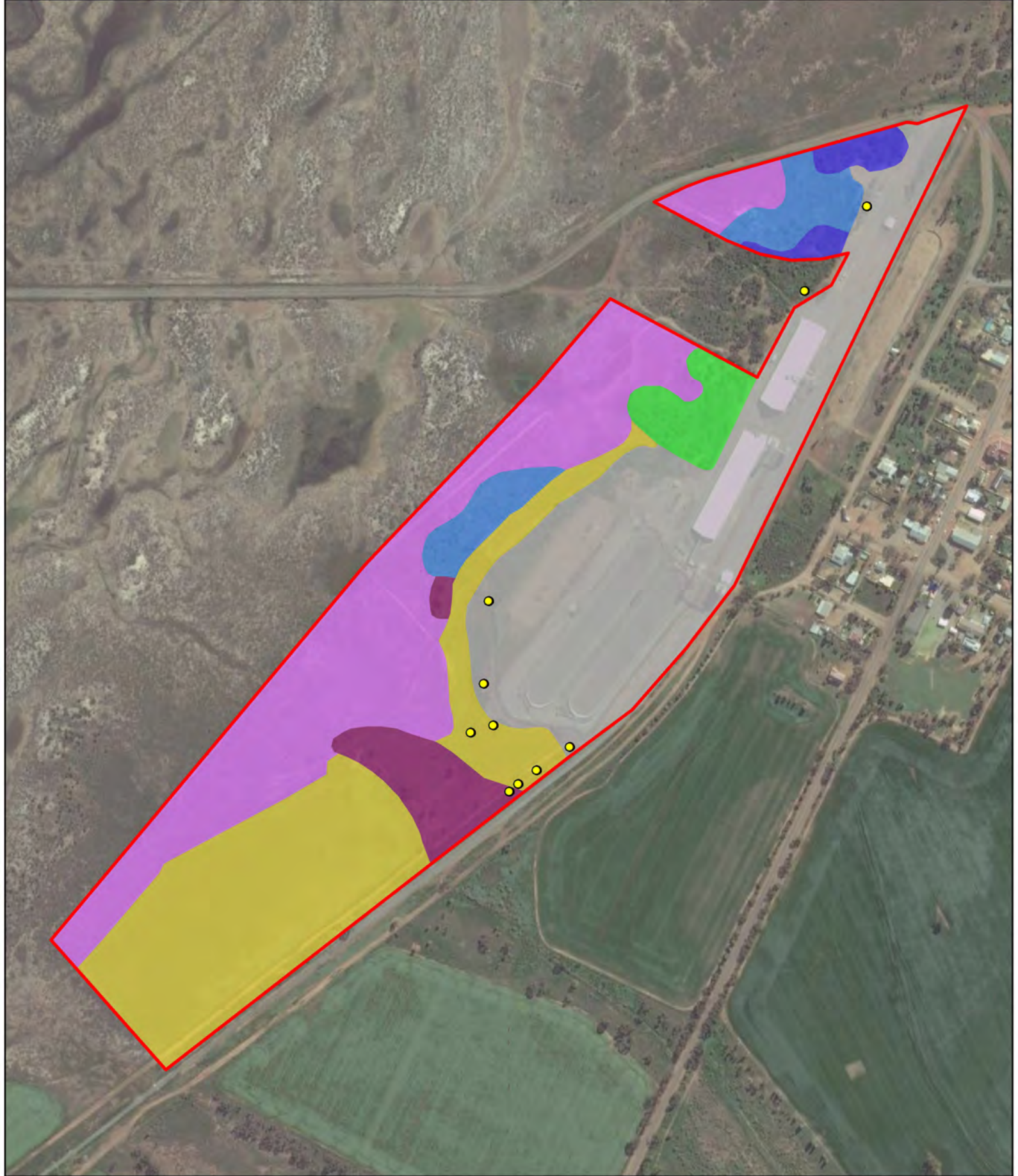
Photo	Vegetation community	Description	Relevé/s	Total area (ha)	Proportion of the survey area (%)
	<b>VC1:</b> <i>Eucalyptus loxophleba</i> low open mallee woodland	<i>Eucalyptus loxophleba</i> low open mallee woodland over <i>Melaleuca stereophloia</i> , <i>Santalum acuminatum</i> tall sparse shrubland over <i>Austrostipa elegantissima</i> and <i>*Avena barbata</i> low sparse grassland.  Other species forming components of the vegetation in areas include <i>*Mesembryanthemum nodiflorum</i> , <i>Ptilotus polystachyus</i> and <i>Sclerolaena diacantha</i> .	ELA01, ELA15	0.64	1.89
	<b>VC2:</b> <i>Tecticornia undulata</i> and <i>T. pergranulata</i> low open samphire shrubland	<i>Tecticornia undulata</i> and <i>T. pergranulata</i> low open samphire shrubland with <i>*Lolium rigidum</i> low sparse grassland and <i>*Mesembryanthemum nodiflorum</i> low sparse forbland.  Other common species include <i>Austrostipa elegantissima</i> , <i>Enchylaena tomentosa</i> , <i>Eragrostis dielsii</i> , <i>Siloxerus multiflorus</i> and <i>*Vulpia myuros</i> forma <i>megalura</i> .	ELA03, ELA07, ELA09	9.44	27.85

Photo	Vegetation community	Description	Relevé/s	Total area (ha)	Proportion of the survey area (%)
	<p><b>VC3:</b> <i>Acacia hemiteles</i> isolated shrubs over <i>Maireana brevifolia</i> and <i>Salsola australis</i> low open chenopod shrubland</p>	<p><i>Acacia hemiteles</i> mid isolated shrubs over <i>Maireana brevifolia</i>, <i>Salsola australis</i>, <i>Atriplex</i> spp. low open chenopod shrubland over <i>*Hordeum leporinum</i> low open grassland and <i>*Mesembryanthemum nodiflorum</i>, <i>*Oncosiphon piliferum</i> low open forbland.</p> <p>Other common species include <i>*Avena barbata</i>, <i>Chloris truncata</i>, <i>Eragrostis dielsii</i>, <i>*Hypochaeris glabra</i>, <i>*Lolium rigidum</i>, <i>Ptilotus exaltatus</i>, <i>P. polystachyus</i> and <i>*Sonchus oleraceus</i>. This vegetation was cleared agricultural pasture lands that has remained undisturbed for an estimated 10 years or greater and is in the early stages of ecological recovery.</p>	<p>ELA10, ELA11, ELA12</p>	<p>8.73</p>	<p>25.76</p>
	<p><b>VC4:</b> <i>Casuarina obesa</i>, <i>Hakea preissii</i>, <i>Melaleuca lateriflora</i> and <i>M. stereophloia</i> tall shrubland</p>	<p><i>Casuarina obesa</i>, <i>Hakea preissii</i>, <i>Melaleuca lateriflora</i> and <i>M. stereophloia</i> tall shrubland over <i>Rhagodia drummondii</i>, <i>Comesperma integerrimum</i> mid isolated shrubs over <i>Austrostipa elegantissima</i>, <i>*Lolium rigidum</i> open grassland.</p> <p>The <i>Casuarina</i> and <i>Melaleuca</i> components of this shrubland can form dense small monoculture stands within this vegetation community.</p>	<p>ELA04, ELA05, ELA06</p>	<p>1.1</p>	<p>3.25</p>

Photo	Vegetation community	Description	Relevé/s	Total area (ha)	Proportion of the survey area (%)
	<p><b>VC5:</b> <i>Acacia lineolata</i> subsp. <i>lineolata</i>, <i>Melaleuca lateriflora</i> and <i>Hakea preissii</i> tall sparse shrubland</p>	<p><i>Acacia lineolata</i> subsp. <i>lineolata</i>, <i>Melaleuca lateriflora</i> and <i>Hakea preissii</i> tall sparse shrubland over <i>Rhagodia drummondii</i>, <i>Maireana brevifolia</i> and <i>Tecticornia pergranulata</i> mid open chenopod shrubland over <i>Aurola elegantissima</i>, <i>Eragrostis dielsii</i>, <i>Vulpia myuros</i> forma <i>megalura</i> low sparse grassland and <i>Mesembryanthemum nodiflorum</i>, <i>Siloxerus multiflorus</i> low sparse forbland.</p> <p>This community occurs fringing the margins or occupying low rises within the saline flats supporting the samphire shrubland.</p>	<p>ELA02, ELA08</p>	<p>1.73</p>	<p>5.10</p>
	<p><b>VC6:</b> <i>Eucalyptus loxophleba</i> open Woodland over mixed low Chenopod Shrubland</p>	<p><i>Eucalyptus loxophleba</i> low open woodland over <i>Hakea preissii</i> tall isolated tall shrubs over <i>Atriplex amnicola</i>, <i>Maireana brevifolia</i> and <i>Tecticornia pergranulata</i> mid open chenopod shrubland and, <i>Hordeum leporinum</i>, <i>Lolium rigidum</i> low open grassland and <i>Mesembryanthemum nodiflorum</i>, <i>Oncosiphon piluliferum</i> and <i>Sonchus oleraceus</i> low open forbland.</p>	<p>ELA13, ELA14</p>	<p>1.59</p>	<p>4.69</p>
<p>Cleared (roads, tracks)</p>			<p>NA</p>	<p>10.65</p>	<p>31.43</p>
<p><b>Total</b></p>				<p><b>33.89</b></p>	<p><b>100</b></p>

**Figure 6: Vegetation communities and significant species**



**Legend**

Survey area

Cleared

**Significant Species**

● Paterson's curse (*Echium plantagineum*)

**Vegetation communities**

<p><span style="background-color: blue; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC1 - <i>Eucalyptus loxophleba</i> low open mallee woodland</p> <p><span style="background-color: magenta; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC2 - <i>Tecticornia undulata</i> and <i>T. pergranulata</i> low open samphire shrubland</p> <p><span style="background-color: yellow; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC3 - <i>Acacia hemiteles</i> isolated shrubs over <i>Maireana brevifolia</i> and <i>Salsola australis</i> low open chenopod shrubland</p>	<p><span style="background-color: green; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC4 - <i>Casuarina obesa</i>, <i>Hakea preissii</i>, <i>Melaleuca lateriflora</i> and <i>M. stereophloia</i> tall shrubland</p> <p><span style="background-color: lightblue; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC5 - <i>Acacia lineolata</i> subsp. <i>lineolata</i>, <i>Melaleuca lateriflora</i> and <i>Hakea preissii</i> tall sparse shrubland</p> <p><span style="background-color: purple; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> VC6 - <i>E. loxophleba</i> open woodland</p>
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Metres

Datum/Projection:  
GDA 1994 MGA Zone 50

**eco logical**  
AUSTRALIA  
A TETRA TECH COMPANY

Prepared by: SC Date: 18/02/2021

**Figure 7: Vegetation condition**



**Legend**

Survey area

Cleared

**Vegetation Condition**

Very Good

Good

Degraded

Completely degraded

Service Layer Credits: Google

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Metres

Datum/Projection: GDA 1994 MGA Zone 50

N

Prepared by: SC Date: 17/02/2021

## 4.3 Fauna

### 4.3.1 Fauna overview

A total of 27 vertebrate fauna species were recorded within the survey area, comprising 23 birds, three mammals and one reptile (**Appendix I**). No evidence of Threatened or Priority fauna species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area.

Of the 23 conservation significant fauna species identified from the desktop assessment as possibly occurring within the survey area (**Appendix D**), three species were identified as having the Potential to occur based on the availability of suitable habitat and close proximity of recent records; Carnaby's Cockatoo (*Calyptorhynchus latirostris*; listed as EN under the EPBC Act and BC Act), Western Spiny-tailed Skink (*Egernia stokesii* subsp. *badia*; listed as EN under the EPBC Act and VU under the BC Act), and Shield-backed Trapdoor Spider (*Idiosoma nigrum*; listed as VU under the EPBC Act and EN under the BC Act). These species are discussed in more detail in Section 4.3.3, 4.3.4 and 4.3.5.

The remaining 20 fauna species are considered as unlikely to occur or do not occur within the survey area, based on lack of suitable habitat for these species and proximity of previous records. Aquatic and marine species were not considered in the likelihood of occurrence assessment as the survey area does not contain core habitat that these species solely rely on for survival.

One introduced (pest) fauna species was recorded within the survey area, namely Cattle (*\*Bos taurus*) indirect evidence (scats).

### 4.3.2 Fauna habitat

A total of four fauna habitats were recorded within the survey area, covering a total of approximately 68.55% (2.83 ha) of the survey area (**Table 8**, Figure 8). The most widespread habitat was samphire shrubland, which covered 9.44 ha (27.85%) of the survey area. Cleared areas, including roads and tracks, covered the majority (10.65 ha, 31.43%) of the survey area.


**Table 8: Fauna habitat within the survey area**


Description	Total area (ha)	Proportion of the survey area (%)
<i>Eucalyptus loxophleba</i> woodland	2.23	6.58
Samphire shrubland	9.44	27.85
Mixed low shrubland	8.73	25.76
<i>Hakea</i> and <i>Melaleuca</i> shrubland	2.83	8.35
Cleared (roads, tracks)	10.65	31.43
<b>Total</b>	<b>33.89</b>	<b>100.00</b>

Figure 8: Fauna habitat recorded within the survey area





**Legend**


 Survey area


 Cleared

**Vegetation communities**

 *Eucalyptus loxophleba* woodland

 Samphire Shrubland


 Mixed low shrubland

 *Hakea* and *Melaleuca* shrubland

Service Layer Credits: Google

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Metres

Datum/Projection: GDA 1994 MGA Zone 50

 **eco logical**  
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### 4.3.3 Carnaby's Cockatoo habitat assessment

#### 4.3.3.1 Foraging habitat

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Carnaby's Cockatoo foraging habitat within the survey area has been determined using vegetation associations defined in the vegetation assessment and from ground-truthing in the field. The quality of foraging habitat for Carnaby's Cockatoo within the survey area (as defined in **Table 9**) has been assessed based on the availability and density of plant food sources as observed on site.

**Table 9: Definition and extent of black cockatoo foraging habitat quality within the survey area**

Foraging quality	Justification	Extent (ha) within survey area	% of survey area
Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (e.g. canopy and midstorey).	0	0
Moderate	Moderate foraging value density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 20-40%) and food sources only present at one or two strata (e.g. canopy and midstorey).	0	0
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy)	5.06	14.93
Nil	Cleared areas or no suitable vegetation present.	28.82	85.04
<b>Total</b>		<b>33.89</b>	<b>100</b>

Some vegetation within the survey area, comprising 5.06 ha, is considered as providing 'Poor' quality foraging habitat for Carnaby's Cockatoo due to a low density of suitable or preferred foraging species. This included the fauna habitats *Eucalyptus loxophleba* woodland and *Hakea* and *Melaleuca* shrubland, due to the presence of *Eucalyptus loxophleba* and *Hakea preissii* (Groom 2011). Cleared areas and unsuitable vegetation, comprising 28.82 ha, provide 'Nil' foraging habitat for Carnaby's Cockatoo. Habitat foraging quality is presented in **Figure 9**. No evidence of foraging by Carnaby's Cockatoo was observed within the survey area.

#### 4.3.3.2 Breeding and roosting habitat

The Carnaby's Cockatoo breeding habitat assessment identified three potentially suitable breeding trees within the survey area comprising three *Eucalyptus* sp. (planted) (**Figure 9; Appendix J**). All potential breeding trees recorded in the survey area also provide potential suitable roosting habitat for Carnaby's Cockatoo as defined by the referral guidelines (SEWPaC 2012). Of these, none contained hollows or potentially suitable hollows (over 100 mm in diameter).



**Figure 9: Potential suitable Carnaby's Cockatoo habitat within the survey area**



**Legend**

- Survey area
- Carnaby's Cockatoo trees**
  - Eucalyptus sp. (planted), DBH > 50cm, No hollow
- Carnaby's Cockatoo habitat**
  - Poor
  - Nil

Service Layer Credits: Google

0 50 100  
Metres

Datum/Projection: GDA 1994 MGA Zone 50

N

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#### 4.3.4 Western Spiny-tailed Skink habitat assessment

No Western Spiny-tailed Skink individuals or secondary signs were recorded in the survey area. In the wheatbelt, most records of the Western Spiny-tailed Skink are in York Gum (*Eucalyptus loxophleba*) woodland in clayey soils predominantly within the Avon Wheatbelt IBRA bioregion (DEC 2012). In the survey area, 'Poor' quality habitat (2.23 ha, 6.58%) was recorded in association with the *Eucalyptus loxophleba* woodland fauna habitat (DEC 2012, How et al. 1999) (**Figure 10**). The low quality is due to the lack of shelter present in the survey area, namely fallen logs and tree stumps, and grazing present by cattle (How et al. 1999).


#### 4.3.5 Shield-backed Trapdoor Spider habitat assessment

No Shield-backed Trapdoor Spider individuals or secondary signs were recorded in the survey area. In the wheatbelt, the Shield-backed Trapdoor Spider inhabits open York Gum (*Eucalyptus loxophleba*) woodland in clayey soils (ACC 2007). In the survey area, 'Poor' quality habitat (2.23 ha, 6.58%) was recorded in association with the *Eucalyptus loxophleba* woodland fauna habitat (ACC 2007) (**Figure 11**). The low quality is due to the lack of ground litter for foraging present in the survey area (ACC 2007).


**Figure 10: Potential suitable Western Spiny-tailed Skink habitat within the survey area**




**Legend**

 Survey area

**Western Spiny-tailed Skink habitat**


 Poor

 Nil

Service Layer Credits: Google

0 50 100  
Metres

Datum/Projection: GDA 1994 MGA Zone 50


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
Figure 11: Potential suitable Shield-backed Trapdoor Spider habitat within the survey area




**Legend**

 Survey area

**Shield-backed Trapdoor Spider habitat**


 Poor

 Nil

Service Layer Credits: Google

0 50 100  
Metres

Datum/Projection: GDA 1994 MGA Zone 50

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## 5. Discussion and Recommendations

### 5.1 Flora

A total of 79 flora species, representing 23 families and 60 genera were recorded from a combination of 15 relevés and opportunistic collections. Of these species, 27 introduced (weed) flora species were recorded during the field survey. This forms a high proportion (35%) of the total number of species recorded during this survey and was largely expected, given the surrounding pastoral land use. The introduced taxa included one Declared Pest, *\*Echium plantagineum* (Paterson's curse), which represents a risk to the structure and composition of native vegetation communities present. Whilst this species is subject to s22(2) of the BAM Act, it is not required to be controlled under the Biosecurity and Agriculture Management Regulations 2013.

No Threatened or Priority flora species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area. Of the 51 conservation significant flora species identified from the desktop assessment as possibly occurring within the survey area, one species was identified with the Potential to occur; *Urodon capitatus*, and two species were identified as Likely to occur (*Caladenia drakeoides* and *Caladenia cristata*).

*Caladenia drakeoides*, listed as EN under the EPBC Act and CR under the BC Act, is known regionally from 42 records, over a range of 255 km, from Coorow in the north-west to Mukinbudin in the east to Goomalling in the south (DBCA 2007-2021). Majority of WAH's records (9 of 11) flowered in the first two weeks of September (WAH 1998-), therefore they may not have been able to be identified in the field survey. Habitat for this species is tall to medium shrubland dominated by *Melaleuca* and *Acacia* species over low shrubs and annuals (Brown et al. 2003), which corresponds to VC5 within the survey area. This species is also known from the edge of salt flats (WAH 1998-). The survey area occurs on the margins of the same lake system that the previous records were recorded in (DBCA 2020a).

*Caladenia cristata*, listed as P1 by DBCA, is known regionally from 17 records, over a range of 105 km, from Coorow in the north-east to Dalwallinu in the south-east (DBCA 2007-2021). Majority of WAH's records (8 of 10) flowered in September (WAH 1998-), therefore they may not have been able to be identified in the field survey. Habitat for this species includes sandy rises on the edge of salt flats and ephemeral waterbodies, which corresponds to VC2 and VC5 within the survey area.

### 5.2 Vegetation

A total of six vegetation communities were delineated and mapped within the survey area, comprising two eucalypt woodland communities (VC1 and VC6), three mixed shrubland communities (VC3, VC4 and VC5) and one samphire shrubland community (VC2). All communities are disjunct remnant patches along the road, rather than contiguous suites of native vegetation.

Two eucalypt woodland communities potentially show characteristics associated with the Wheatbelt Woodlands TEC as indicated in the *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DotEE 2015). This key diagnostic assessment concluded that whilst some characteristics represented the Wheatbelt Woodlands TEC, others did not. Whilst crown cover was greater than 10%, VC1 (*Eucalyptus loxophleba* low open mallee woodland) was dominated by a mallee eucalypt. And whilst VC6 (*E. loxophleba* open woodland) contained mature trees, the crown cover was less than 10% (2-5%). Therefore, no vegetation community within the survey area represents the Wheatbelt Woodland TEC.

It is noted that conclusions relating to the presence of this TEC within the survey area are based on a Reconnaissance level survey. Given the limitations of such a survey (e.g. relevé data etc.) further work may be required to determine presence/absence of the Wheatbelt Woodlands TEC with a greater degree of certainty (e.g. single season Detailed flora and vegetation survey utilising quadrat data).

### 5.3 Fauna

A total of 27 vertebrate fauna species were recorded within the survey area during the Basic fauna survey. No evidence of Threatened or Priority fauna species listed under the EPBC Act or the BC Act, or listed by DBCA were recorded within the survey area.

Of the 23 conservation significant fauna species identified from the desktop assessment as possibly occurring within the survey area, three species were identified as having the Potential to occur based on the availability of suitable habitat and close proximity of recent records; Carnaby's Cockatoo (*Calyptorhynchus latirostris*; listed as EN under the EPBC Act and BC Act), Western Spiny-tailed Skink (*Egernia stokesii* subsp. *badia*; listed as EN under the EPBC Act and VU under the BC Act), and Shield-backed Trapdoor Spider (*Idiosoma nigrum*; listed as VU under the EPBC Act and EN under the BC Act). These species were identified in Cardno (2014) as unlikely (Western Spiny-tailed Skink and Carnaby's Cockatoo) and possible (Shield-backed Trapdoor Spider), however this survey area is larger and likelihoods have been reassessed based on fauna habitats and foraging flora species present.

The survey area is in the breeding range of the Carnaby's Cockatoo (DotEE 2017) and the habitat assessment identified three potentially suitable breeding trees within the survey area, none of which contained hollows or potentially suitable hollows (over 100 mm in diameter). Some of the vegetation within the survey area, is considered as providing 'Poor' quality foraging habitat for Carnaby's Cockatoo due to a low density of suitable or preferred foraging species. This included the fauna habitats *Eucalyptus loxophleba* woodland and *Hakea* and *Melaleuca* shrubland, due to the presence of *Eucalyptus loxophleba* and *Hakea preissii*. Cleared areas and unsuitable vegetation provide 'Nil' foraging habitat for Carnaby's Cockatoo. No evidence of foraging by Carnaby's Cockatoo was observed within the survey area.

Western Spiny-tailed Skink and Shield-backed Trapdoor Spider inhabit in York Gum (*Eucalyptus loxophleba*) woodland in clayey soils. Vegetation associated with the *Eucalyptus loxophleba* woodland fauna habitat provides low quality habitat for both species. The low quality is due to the lack of shelter (e.g. fallen logs and tree stumps) for the Western Spiny-tailed Skink, and lack of ground litter for the Shield-backed Trapdoor Spider.

Four fauna habitats were recorded within the survey area; *Eucalyptus loxophleba* woodland, Samphire shrubland, Mixed low shrubland and *Hakea* and *Melaleuca* shrubland.

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## Appendix A Framework for conservation significant flora and fauna ranking

### CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
<b>Extinct (EX)</b>	There is no reasonable doubt that the last member of the species has died.
<b>Extinct in the Wild (EW)</b>	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa 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.
<b>Critically Endangered (CR)</b>	Taxa considered to be facing an extremely high risk of extinction in the wild.
<b>Endangered (EN)</b>	Taxa considered to be facing a very high risk of extinction in the wild.
<b>Vulnerable (VU)</b>	Taxa considered to be facing a high risk of extinction in the wild.
<b>Near Threatened (NT)</b>	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
<b>Least Concern (LC)</b>	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
<b>Data Deficient (DD)</b>	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
<b>Not Evaluated (NE)</b>	Taxa has not yet been evaluated against the criteria.
<b>Migratory (M)</b>	<p>Not an IUCN category.</p> <p>Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including:</p> <ul style="list-style-type: none"> <li>• the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state;</li> <li>• the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA);</li> <li>• the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or</li> <li>• the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird</li> </ul>

Category	Definition
	conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).

## CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016* (BC Act).

Specially protected fauna or flora are species 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.

### Threatened species (T)

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 BC Act.

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 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.

Category	Code	Description
<b>Critically Endangered species</b>	CR	<p>Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>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 Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.</p>
<b>Endangered species</b>	EN	<p>Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>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 Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.</p>
<b>Vulnerable species</b>	VU	<p>Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”.</p> <p>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.</p>

Category	Code	Description
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Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 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, as follows:

Category	Code	Description
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<b>Extinct species</b>	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
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<b>Extinct in the wild species</b>	EW	Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 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.
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### 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.

Categories are detailed below.

Category	Code	Description
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<b>Migratory species</b>	M	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
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Category	Code	Description
		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 Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
		Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
<b>Species of special conservation interest (conservation dependent fauna)</b>	CD	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 Wildlife Conservation (Specially Protected Fauna) Notice 2018.
<b>Other specially protected species</b>	OS	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 Wildlife Conservation (Specially Protected Fauna) Notice 2018.

### Priority species (P)

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.

Category	Code	Definition
<b>Priority 1</b>	P1	<i>Poorly-known species</i>
		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

Category	Code	Definition
		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.
<b>Priority 2</b>	P2	<p><i>Poorly-known species</i></p> <p>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.</p>
<b>Priority 3</b>	P3	<p><i>Poorly-known species</i></p> <p>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.</p>
<b>Priority 4</b>	P4	<p><i>Rare, Near Threatened and other species in need of monitoring</i></p> <p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

## Appendix B Likelihood of occurrence assessment criteria

Likelihood rating	Criteria
<b>Recorded</b>	The species has previously been recorded within survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WAH.
<b>Likely</b>	<p>The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met):</p> <ul style="list-style-type: none"> <li>the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area</li> <li>core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present</li> <li>there is a medium to high probability that a species uses the survey area</li> </ul>
<b>Potential</b>	<p>The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met):</p> <ul style="list-style-type: none"> <li>targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area</li> <li>the survey area has been assessed as having potentially suitable habitat through habitat modelling</li> <li>the species is known to be cryptic and may not have been detected despite extensive surveys</li> <li>the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys</li> </ul> <p>The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met)</p> <ul style="list-style-type: none"> <li>doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution)</li> <li>coordinates are doubtful</li> </ul>
<b>Unlikely</b>	<p>The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and</p> <ul style="list-style-type: none"> <li>it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded</li> <li>it is unlikely to occur due to few historic record/s and no other current collections in the local area.</li> </ul> <p>The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.</p> <p>The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.</p>
<b>Does not occur</b>	<p>The species is not known to occur within the IBRA bioregion based on current literature and distribution.</p> <p>The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat.</p>



Likelihood rating	Criteria
	<p>The survey area lacks important habitat for a species that has highly selective habitat requirements.</p> <p>The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.</p>

## Appendix C Flora likelihood of occurrence assessment

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
<i>Acacia cochlocarpa</i> subsp. <i>velutinos</i>	CR	CR	Velutinous, sprawling shrub, growing to 1.5m. Occurs on sandy clay or laterite.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Dasymalla axillaris</i>	CR	CR	Shrub, growing to 1.5m high. Occurs in yellow sand.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Gyrostemon reticulatus</i>	CR	CR	Shrub, growing up to 1m high.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Acacia cochlocarpa</i> subsp. <i>cochlocarpa</i>	EN	CR	Glabrous, sprawling shrub, growing to 1.5m. Occurs in clayey, sandy, often gravelly soils.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Acacia vassalii</i>	EN	CR	Semi-prostrate, spreading, rounded shrub, growing to 0.3m high. Occurs on grey/brown or yellow sand, sandy loam.	DBCA 2020a, NatureMap, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Caladenia drakeoides</i>	EN	CR	Tuberous, perennial herb, growing to 0.3m high. Occurs on the margins of salt lakes in grey clayey sand or red sandy loam.	DBCA 2020a, NatureMap, PMST	<b>Likely</b> Closest record 0.5 km south-west of the survey area. Suitable habitat is present (VC5).

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
					Majority of WAH's records (9 of 11) flowered in the first two weeks of September, therefore they may not have been able to be identified in the field survey.
<i>Chorizema humile</i>	EN	CR	Sprawling, prostrate shrub. Occurs on plains in sandy clay or loam.	DBCA 2020a, NatureMap, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Daviesia euphorbioides</i>	EN	CR	Shrub, growing to 0.8m high. Occurs on flats, sandplains, in clayey sand, sandy gravel.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eremophila pinnatifida</i>	EN	CR	Shrub, growing up to 0.6m high. Occurs on loam.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eremophila scaberula</i>	EN	CR	Low compact or sprawling shrub, growing up to 1.5m high. Occurs on winter-wet plains, inundated areas, in clay, sandy clay or loam.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Gastrolobium hamulosum</i>	EN	CR	Low shrub, growing to 0.45m. Occurs on flats, slopes, ridges in sandy, often gravelly soils or clay.	DBCA 2020a, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Grevillea pythara</i>	EN	CR	Suckering shrub, growing to 0.3m high. Occurs in sand or sandy loam with gravel.	DBCA 2020a, PMS	<b>Unlikely</b>

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
					No suitable habitat, no nearby records.
<i>Hemiandra gardneri</i>	EN	CR	Prostrate, pungent shrub, growing to 0.2m high. Occurs on sandplains, in grey or yellow sand, clayey sand.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Jacksonia pungens</i>	EN	CR	Rounded shrub, growing to 0.8m high. Occurs on undulating areas, in yellow sand, gravelly lateritic soils.	DBCA 2020a, NatureMap, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Verticordia staminosa subsp. staminosa</i>	EN	CR	Spreading shrub, growing to 0.6m high. Occurs on granite outcrops, in soil pockets.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Acacia ataxiphylla subsp. magna</i>	EN	EN	Spreading to ascending shrub, growing to 0.6m high. Occurs on lateritic ironstone rises, flats, in sandy soils.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Conospermum densiflorum subsp. unicephalatum</i>	EN	EN	Much-branched shrub, growing to 0.6m high. Occurs in low-lying areas in clay soils.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Daviesia dielsii</i>	EN	EN	Divaricate shrub, growing to 0.9m high. Occurs on sandy, often gravelly soils.	DBCA 2020a, NatureMap, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eremophila viscida</i>	EN	EN	Shrub, growing to 4m high. Occurs on stony gullies, sandplains, in granitic soils, sandy loam.	PMST	<b>Unlikely</b>

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
					No suitable habitat, no nearby records.
<i>Grevillea bracteosa</i> subsp. <i>bracteosa</i>	EN	EN	Shrubs, growing up to 2m high. Occurs in red clay loam over laterite.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Grevillea christineae</i>	EN	EN	Wiry shrub, growing to 0.6m high. Occurs in clay loam, sandy clay, often moist.	DBCA 2020a, PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eucalyptus recta</i>	EN	VU	Tree, growing to 15m high.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Frankenia conferta</i>	EN	VU	Small shrub.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Grevillea dryandroides</i> subsp. <i>hirsuta</i>	EN	VU	Prostrate, vigorously sucking shrub, growing to 0.3m. Occurs in white or yellow sand, laterite.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Roycea pycnophylloides</i>	EN	VU	Perennial, herb, forming densely branched, silvery mats, growing up to 1m high. Occurs on saline flats, in sandy soils.	PMST	<b>Unlikely</b> No suitable habitat, no nearby records.

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
<i>Gastrolobium appressum</i>	VU	EN	Shrub, growing to 0.3m high. Occurs on sandplains, low rises, in white/yellow sand with quartz gravel.	DBCA 2020a, NatureMap, PMST	<b>Unlikely</b> One historic record occurs 50m from the northern boundary of the survey area. If present, this reasonably conspicuous species would have been identified.
<i>Eucalyptus rhodantha</i> var. <i>rhodantha</i>	VU	VU	Spreading mallee, growing to 4m high. Occurs on undulating country, hillslopes.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Acacia trinalis</i>	-	P1	Dense, rounded, bushy shrub or tree, growing to 4m high. Occurs in salt lakes and flats, swampy areas, with brown sand or clay loam.	DBCA 2020a, NatureMap	<b>Unlikely</b> One historic record occurs 50m from the northern boundary of the survey area. If present, this large shrub/tree would have been identified.
<i>Androcalva fragifolia</i>	-	P1	Shrub, growing up to 0.8m high. Occurs in pale brown loamy sand.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Caladenia cristata</i>	-	P1	Tuberous, perennial herb, growing up to 0.4m high. Occurs on sandy rise above salt flats, on sandy clay.	DBCA 2020a, NatureMap	<b>Likely</b> Closest record 50m from the northern boundary of the survey area. One record also occurs 0.5 km

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
					<p>south-west of the survey area. Suitable habitat is present (VC2 and 5).</p> <p>Majority of WAH's records (8 of 10) flowered in September, therefore they may not have been able to be identified in the field survey.</p>
<i>Dampiera glabrescens</i>	-	P1	Perennial herb, growing to 0.9m high. Occurs on gravel pits, roadsides, in white or grey/yellow sand.	DBCA 2020a	<p><b>Unlikely</b></p> <p>No suitable habitat, no nearby records.</p>
<i>Grevillea pinifolia</i>	-	P1	Much-branched shrub, growing to 0.9m high. Occurs on yellow sand, gravel.	DBCA 2020a, NatureMap	<p><b>Unlikely</b></p> <p>No suitable habitat, no nearby records.</p>
<i>Verticordia dasystylis subsp. oestopoa</i>	-	P1	Spreading shrub, growing to 0.4m high. Occurs on outcrops in gritty soils over granite.	DBCA 2020a	<p><b>Unlikely</b></p> <p>No suitable habitat, no nearby records.</p>
<i>Acacia arcuatilis</i>	-	P2	Rounding, spreading shrub, growing to 1.5m high. Occurs on sand or sandy loam, sometimes with lateritic gravel, on undulating plains, rises.	DBCA 2020a	<p><b>Unlikely</b></p> <p>No suitable habitat, no nearby records.</p>
<i>Acacia lirellata subsp. compressa</i>	-	P2	Bushy procumbent, spreading shrub, growing to 1.2m high. Occurs on sandplains, in yellow sand, clayey loam.	DBCA 2020a	<p><b>Unlikely</b></p> <p>No suitable habitat, no nearby records.</p>

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
<i>Guichenotia glandulosa</i>	-	P2	Multi-stemmed shrub, growing to 0.4m high. Occurs in creek lines, littered soil.	NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Thryptomene shirleyae</i>	-	P2	Shrub, growing to 0.7m high. Occurs in yellow sand.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Acacia anarthros</i>	-	P3	Prostrate, spinose shrub, growing to 0.5m high. Occurs in lateritic gravelly soils, slopes.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Daviesia debilior subsp. sinuans</i>	-	P3	Straggling shrub, growing to 0.8m high. Occurs in gravelly lateritic clay.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eucalyptus macrocarpa x pyriformis</i>	-	P3	Open mallee tree, growing to 6m high. Occurs on hills, rocky ironstone ridges, sandplains, in sand, lateritic sandy soils.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Gastrolobium rotundifolium</i>	-	P3	Bushy shrub, growing up to 0.8m high. Occurs in low rises, breakaways, in heavy clay or loam soils, granite, sandstone and quartzite.	DBCA 2020a, NatureMap	<b>Unlikely</b> One historic record occurs 50m from the northern boundary of the survey area. If present, this reasonably conspicuous species would have been identified.



Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
<i>Grevillea asparagoides</i>	-	P3	Dense prickly shrub, growing up to 2m high. Occurs on gravelly loam, white or yellow sand.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Grevillea haplantha subsp. recedens</i>	-	P3	Spreading shrub, growing to 1m high. Occurs on sand, sandy loam.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Melaleuca sclerophylla</i>	-	P3	Spreading to prostrate shrub, growing to 0.9m high. Occurs on granite outcrops, rises, in gravelly sand, clayey sand.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Stylidium periscelanthum</i>	-	P3	Bulb-forming perennial herb, growing to 0.15m high. Occurs on wet flats, low granitic hills, in loamy clay, moist soils pockets.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Urodon capitatus</i>	-	P3	Low spreading or upright shrub, growing to 1.2m. Occurs in sandy gravelly soils on plains.	DBCA 2020a, NatureMap	<b>Potential</b> Closest record 50m from the northern boundary of the survey area. Suitable habitat may be present.
<i>Verticordia huegelii var. tridens</i>	-	P3	Shrub, growing to 0.6m high. Occurs in winter-wet areas, low hills, in sandy or gravelly loam.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Verticordia venusta</i>	-	P3	Spreading shrub, growing to 2m. Occurs in yellow sand, sandy gravels on sandplains.	DBCA 2020a, NatureMap	<b>Potential</b> Closest record 50m from the northern boundary of

Scientific name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
	EPBC Act	BC Act / DBCA			
					the survey area. Suitable habitat may be present.
<i>Calothamnus accedens</i>	-	P4	Slender shrub, growing up to 1.8m. Occurs on road verges in sandy soils over laterite.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Eucalyptus x carnabyi</i>	-	P4	Mallee, growing up to 6m. Occurs lateritic ridges, in grey sand, sandy loam.	DBCA 2020a, NatureMap	<b>Unlikely</b> No suitable habitat, no nearby records.
<i>Persoonia sulcata</i>	-	P4	Spreading to decumbent, growing to 1m high. Occurs in lateritic or granitic soils.	DBCA 2020a	<b>Unlikely</b> No suitable habitat, no nearby records.

## Appendix D Fauna likelihood of occurrence assessment

Scientific name	Common name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
		EPBC Act	BC Act / DBCA			
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	The Night Parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia.	PMST	<b>Unlikely</b> This species is highly elusive and no suitable habitat occurs within the survey area.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	EN	The Australasian bittern is a secretive, stocky, heron-like bird, living in wetlands where it forages.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area.
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	EN	Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland. Forages seasonally in pine plantations, around Perth metropolitan, and forests containing Marri, Karri and Jarrah.	DBCA 2020b, NatureMap, PMST	<b>Potential</b> Two records present 10 km north-east and east of the survey area. Low quality foraging habitat present within the survey area.
<i>Idiosoma kopejtkorum</i>	Lake Goorly shield-backed trapdoor spider	EN	EN	-	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area.
<i>Egernia stokesii</i> subsp. <i>badia</i>	Western Spiny-tailed Skink	EN	VU	The Western Spiny-tailed Skink is known to occur in a broad semi-arid area in south-west WA, between Shark Bay and Minnivale and east to Cue. Much the wheatbelt has been cleared since the 1960s and suitable microhabitat is now far less abundant, although an increasing number of skinks are being located in altered habitat under piles of wood, scrap metal or under buildings on private property.	DBCA 2020b, NatureMap, PMST	<b>Potential</b> Two records less than 1 km north-east of the survey area. Low quality habitat present within the survey area.

Scientific name	Common name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
		EPBC Act	BC Act / DBCA			
<i>Idiosoma nigrum</i>	Shield-backed Trapdoor Spider	VU	EN	In the Wheatbelt, the Shield-backed Trapdoor Spider typically inhabits clay soils. Leaf litter and twigs are extremely important to the species as it provides material for the burrows, reduced soil moisture loss and increased prey availability.	DBCA 2020b, NatureMap, PMST	<b>Potential</b> Two records less than 6 km north and south of the survey area. Low quality habitat present within the survey area.
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	Inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall. Known to feed in more open agricultural areas and metropolitan Perth.	DBCA 2020	<b>Unlikely</b> No suitable habitat occurs within the survey area. Records are 40 km to the west of the survey area.
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	VU	VU	Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The most dense populations have been found in riparian jarrah forest. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive.	DBCA 2020b, PMST	<b>Unlikely</b> No suitable habitat occurs within the survey area. Records are 45 km to the west of the survey area.
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU	Usually confined to the arid inland. It inhabits <i>Triodia</i> grassland, <i>Acacia</i> shrubland, and lightly timbered arid woodland.	PMST	<b>Unlikely</b> Species is rare with a very wide distribution
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	Occurs in scrubland and woodland dominated by mallee and wattle species. In Western Australia they are also found in some shrublands dominated by <i>Acacia</i> , and occasionally in woodlands dominated by eucalypts such as Wandoo ( <i>E. wandoo</i> ), Marri ( <i>Corymbia calophylla</i> ) and Mallet ( <i>E. astringens</i> ).	DBCA 2020b, NatureMap, PMST	<b>Unlikely</b> No suitable habitat occurs within the survey area

Scientific name	Common name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
		EPBC Act	BC Act / DBCA			
<i>Falco peregrinus</i>	Peregrine Falcon	-	OS	The Peregrine Falcon is found across Australia, but is not common anywhere.	DBCA 2020b	<b>Unlikely</b> Very wide distribution and varying habitat requirements
<i>Phascogale tapoatafa wambenger</i>	South-western Brush-tailed Phascogale	-	CD	This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Aspidites ramsayi</i> (southwest subpop.)	Woma (southwest subpop.)	-	P1	The Woma is found in subhumid to arid interior. Woodlands, shrublands, and heath, often with spinifex.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Idiosoma dandaragan</i>	Dandaragan Plateau shield-backed trapdoor spider	-	P2	-	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Idiosoma mccllementsorum</i>	Julimar shield-backed trapdoor spider	-	P2	-	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Ninox connivens connivens</i>	Barking owl (southwest)	-	P3	Barking Owls are found in open woodlands and the edges of forests, often adjacent to farmland.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Aganippe castellum</i>	Tree-stem trapdoor spider	-	P4	-	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area

Scientific name	Common name	Conservation status		Habitat	Source	Likelihood of occurrence and justification
		EPBC Act	BC Act / DBCA			
<i>Hydromys chrysogaster</i>	Water-rat, Rakali	-	P4	The Water-rat generally occurs in permanent fresh or brackish water, although it can also be found in marine environments.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Isoodon fusciventer</i>	Quenda	-	P4	This species prefers areas of scrubby vegetation (often swampy areas) with a dense cover of up to one metre in height. They often forage in adjacent forest and woodland areas that is burnt regularly and in pastures and crops.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Notamacropus irma</i>	Western Brush Wallaby	-	P4	Inhabits open forests or woodlands, preference to open, seasonally wet flats with low grasses and open scrubby thickets.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Oxyura australis</i>	Blue-billed Duck	-	P4	The Blue-billed Duck is endemic to Australia, being found in the temperate wetlands of the south-east and south-west parts of the continent.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Platycercus icterotis xanthogenys</i>	Western Rosella (inland)	-	P4	Western Rosellas are found in open eucalypt forest and timbered areas, including cultivated land and orchards.	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area
<i>Thinornis rubricollis</i>	Hooded Plover	-	P4	In the south-west, Hooded Plovers occur on inland salt lakes	DBCA 2020b	<b>Unlikely</b> No suitable habitat occurs within the survey area

## Appendix E Flora species list

Family	Species
Aizoaceae	<i>*Mesembryanthemum nodiflorum</i>
Amaranthaceae	<i>Ptilotus exaltatus</i>
	<i>Ptilotus polystachyus</i>
Asparagaceae	<i>Acanthocarpus canaliculatus</i>
	<i>Lomandra effusa</i>
	<i>Lomandra</i> sp.
	<i>Thysanotus</i> sp.
Asteraceae	<i>*Arctotheca calendula</i>
	<i>*Hypochaeris glabra</i>
	<i>*Monoculus monstrosus</i>
	<i>*Oncosiphon piluliferum</i>
	<i>*Sonchus asper</i>
	<i>*Sonchus oleraceus</i>
	<i>Erymophyllum ramosum</i>
	<i>Hyalochlamys globifera</i>
	<i>Podolepis capillaris</i>
	<i>Siloxerus multiflorus</i>
Boraginaceae	<i>*Echium plantagineum</i>
	<i>Heliotropium curassavicum</i>
Brassicaceae	<i>*Brassica tournefortii</i>
	<i>*Raphanus raphanistrum</i>
Casuarinaceae	<i>Casuarina obesa</i>
Chenopodiaceae	<i>Atriplex amnicola</i>
	<i>Atriplex codonocarpa</i>
	<i>Atriplex hymenotheca</i>
	<i>Atriplex semibaccata</i>
	<i>Didymanthus roei</i>

Family	Species
	<i>Enchylaena tomentosa</i>
	<i>Maireana brevifolia</i>
	<i>Maireana carnosa</i>
	<i>Rhagodia drummondii</i>
	<i>Salsola australis</i>
	<i>Sclerolaena diacantha</i>
	<i>Sclerolaena eriacantha</i>
	<i>Tecticornia pergranulata</i>
	<i>Tecticornia undulata</i>
Convolvulaceae	<i>Wilsonia humilis</i>
Cyperaceae	<i>Lepidosperma</i> sp.
Fabaceae	* <i>Lupinus angustifolius</i>
	* <i>Trifolium campestre</i>
	* <i>Trifolium glomeratum</i>
	<i>Acacia acuminata</i>
	<i>Acacia aestivalis</i>
	<i>Acacia colletioides</i>
	<i>Acacia hemiteles</i>
	<i>Acacia lineolata</i> subsp. <i>lineolata</i>
	<i>Templetonia sulcata</i>
Geraniaceae	<i>Erodium cygnorum</i>
Hemerocallidaceae	<i>Dianella revoluta</i>
Iridaceae	* <i>Romulea rosea</i>
Myrtaceae	<i>Eucalyptus comitae-vallis</i>
	<i>Eucalyptus horistes</i>
	<i>Eucalyptus loxophleba</i>
	<i>Melaleuca lateriflora</i>
	<i>Melaleuca stereophloia</i>
Plumbaginaceae	* <i>Limonium sinuatum</i>



Family	Species
Poaceae	<i>*Aira cupaniana</i>
	<i>*Avena barbata</i>
	<i>*Bromus diandrus</i>
	<i>*Bromus rubens</i>
	<i>*Cynodon dactylon</i>
	<i>*Ehrharta longiflora</i>
	<i>*Eragrostis curvula</i>
	<i>*Hordeum leporinum</i>
	<i>*Lolium rigidum</i>
	<i>*Triticum aestivum</i>
	<i>*Vulpia myuros forma megalura</i>
	<i>Austrostipa elegantissima</i>
	<i>Chloris truncata</i>
	<i>Eragrostis dielsii</i>
	<i>Vulpia myuros forma. megalura</i>
Polygalaceae	<i>Comesperma integerrimum</i>
Polygonaceae	<i>*Rumex hypogaeus</i>
Proteaceae	<i>Grevillea biternata</i>
	<i>Hakea preissii</i>
Santalaceae	<i>Santalum acuminatum</i>
Sapindaceae	<i>Dodonaea bursariifolia</i>
	<i>Dodonaea inaequifolia</i>
Surianaceae	<i>Stylobasium australe</i>

## Appendix F Species by relevé matrix

Family	Species	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08	ELA09	ELA10	ELA11	ELA12	ELA13	ELA14	ELA15
Aizoaceae	<i>*Mesembryanthemum nodiflorum</i>	x	x	x	x			x	x	x	x	x	x	x	x	
Amaranthaceae	<i>Ptilotus exaltatus</i>										x	x				
Amaranthaceae	<i>Ptilotus polystachyus</i>										x		x	x		x
Asparagaceae	<i>Acanthocarpus canaliculatus</i>	x														
Asparagaceae	<i>Lomandra effusa</i>															x
Asparagaceae	<i>Thysanotus sp.</i>		x													
Asteraceae	<i>*Arctotheca calendula</i>						x					x		x	x	
Asteraceae	<i>*Hypochaeris glabra</i>						x					x	x			
Asteraceae	<i>*Monoculus monstrosus</i>	x		x							x	x	x			x
Asteraceae	<i>*Oncosiphon piluliferum</i>								x		x	x	x	x	x	
Asteraceae	<i>*Sonchus asper</i>									x						
Asteraceae	<i>*Sonchus oleraceus</i>						x	x			x	x	x	x	x	
Asteraceae	<i>Erymophyllum ramosum</i>	x														
Asteraceae	<i>Hyalochlamys globifera</i>			x												
Asteraceae	<i>Podolepis capillaris</i>	x	x													
Asteraceae	<i>Siloxerus multiflorus</i>		x					x	x	x						
Brassicaceae	<i>*Brassica tournefortii</i>	x										x				
Casuarinaceae	<i>Casuarina obesa</i>					x	x									
Chenopodiaceae	<i>Atriplex amnicola</i>												x	x		
Chenopodiaceae	<i>Atriplex codonocarpa</i>	x			x				x		x		x	x		
Chenopodiaceae	<i>Atriplex hymenotheca</i>		x						x	x						
Chenopodiaceae	<i>Atriplex semibaccata</i>	x									x	x	x	x	x	
Chenopodiaceae	<i>Didymanthus roei</i>									x						
Chenopodiaceae	<i>Enchylaena tomentosa</i>							x	x	x						x
Chenopodiaceae	<i>Maireana brevifolia</i>				x		x		x		x	x	x	x	x	
Chenopodiaceae	<i>Maireana carnosa</i>	x	x													
Chenopodiaceae	<i>Rhagodia drummondii</i>	x	x		x	x	x		x	x					x	x
Chenopodiaceae	<i>Salsola australis</i>			x					x		x	x	x			x


Family	Species	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08	ELA09	ELA10	ELA11	ELA12	ELA13	ELA14	ELA15
Chenopodiaceae	<i>Sclerolaena diacantha</i>	x														x
Chenopodiaceae	<i>Sclerolaena eriacantha</i>										x					
Chenopodiaceae	<i>Tecticornia pergranulata</i>		x		x			x	x	x					x	
Chenopodiaceae	<i>Tecticornia undulata</i>			x				x								
Convolvulaceae	<i>Wilsonia humilis</i>				x											
Fabaceae	* <i>Trifolium campestre</i>					x										
Fabaceae	* <i>Trifolium glomeratum</i>										x					
Fabaceae	<i>Acacia acuminata</i>															x
Fabaceae	<i>Acacia hemiteles</i>										x	x	x			
Fabaceae	<i>Acacia lineolata</i> subsp. <i>lineolata</i>		x						x							
Fabaceae	<i>Templetonia sulcata</i>		x													
Geraniaceae	<i>Erodium cygnorum</i>										x					
Hemerocallidaceae	<i>Dianella revoluta</i>	x														x
Iridaceae	* <i>Romulea rosea</i>				x				x							
Myrtaceae	<i>Eucalyptus horistes</i>															x
Myrtaceae	<i>Eucalyptus loxophleba</i>	x												x	x	x
Myrtaceae	<i>Melaleuca lateriflora</i>				x		x		x	x					x	
Myrtaceae	<i>Melaleuca stereophloia</i>	x	x		x	x	x									x
Poaceae	* <i>Aira cupaniana</i>										x					x
Poaceae	* <i>Avena barbata</i>	x	x		x						x	x	x			x
Poaceae	* <i>Bromus diandrus</i>											x				
Poaceae	* <i>Bromus rubens</i>										x					
Poaceae	* <i>Cynodon dactylon</i>												x		x	
Poaceae	* <i>Ehrharta longiflora</i>															x
Poaceae	* <i>Eragrostis curvula</i>					x	x									
Poaceae	* <i>Hordeum leporinum</i>							x	x		x	x	x	x	x	
Poaceae	* <i>Lolium rigidum</i>			x		x	x	x	x	x	x	x	x	x	x	
Poaceae	* <i>Vulpia myuros</i> forma <i>megalura</i>			x	x				x	x	x	x				
Poaceae	<i>Austrostipa elegantissima</i>	x	x	x	x	x	x			x	x			x	x	x
Poaceae	<i>Chloris truncata</i>										x	x	x			

Family	Species	ELA01	ELA02	ELA03	ELA04	ELA05	ELA06	ELA07	ELA08	ELA09	ELA10	ELA11	ELA12	ELA13	ELA14	ELA15
Poaceae	<i>Eragrostis dielsii</i>							x	x	x	x	x	x		x	
Polygalaceae	<i>Comesperma integerrimum</i>	x	x		x	x	x									x
Polygonaceae	* <i>Rumex hypogaeus</i>											x				
Proteaceae	<i>Grevillea biternata</i>					x										
Proteaceae	<i>Hakea preissii</i>		x		x	x	x		x					x	x	
Santalaceae	<i>Santalum acuminatum</i>															x
Sapindaceae	<i>Dodonaea bursariifolia</i>	x														
Surianaceae	<i>Stylobasium australe</i>					x										

## Appendix G Relevé details

Relevé: ELA01						
Date:	21/10/2020	Site:	CBH Miling			
Vegetation Unit:	VC1	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)
Condition:	Good	438692 m E	<i>Eucalyptus loxophleba</i>	15	6-8	
		6626937 m S	<i>Rhagodia drummondii</i>	5	1	
Photograph:				<i>Austrostipa elegantissima</i>	5	1
				<i>Sclerolaena diacantha</i>	3	0.2
<b>Other species</b>						
<i>*Avena barbata</i>						
<i>*Brassica tournefortii</i>						
<i>*Mesembryanthemum nodiflorum</i>						
<i>*Monoculus monstrosus</i>						
<i>Acanthocarpus canaliculatus</i>						
<i>Atriplex codonocarpa</i>						
<i>Atriplex semibaccata</i>						
<i>Comesperma integerrimum</i>						
<i>Dianella revoluta</i>						
<i>Dodonaea bursariifolia</i>						
<i>Erymophyllum ramosum</i>						
<i>Maireana carnosa</i>						
<i>Melaleuca stereophloia</i>						
<i>Podolepis capillaris</i>						



<b>Relevé:</b>	ELA02					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC5	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Good		438629 m E	<i>Hakea preissii</i>	5-10	3-4
			6626916 m S	<i>Acacia lineolata subsp. lineolata</i>	10	2
<b>Photograph:</b>				<i>Austrostipa elegantissima</i>	5	1
				<i>Rhagodia drummondii</i>	3	1
				<i>Tecticornia pergranulata</i>	1	1
	<b>Other species</b>					
	* <i>Avena barbata</i>					
* <i>Mesembryanthemum nodiflorum</i>						
<i>Atriplex hymenotheca</i>						
<i>Comesperma integerrimum</i>						
<i>Maireana carnosae</i>						
<i>Melaleuca stereophloia</i>						
<i>Podolepis capillaris</i>						
<i>Siloxerus multiflorus</i>						
<i>Templetonia sulcata</i>						
<i>Thysanotus sp.</i>						

**Relevé:** ELA03

**Date:** 21/10/2020 **Site:** CBH Miling

**Vegetation Unit:** VC2 **Location (UTM):** 50 J **Dominant species** **Cover (%)** **Height (m)**

**Condition:** Good 438629 m E *Tecticornia undulata* 20 1  
6626916 m S *\*Lolium rigidum* 1 1

**Photograph:** *\*Mesembryanthemum nodiflorum* 15 0.1



*Hyalochlamys globifera* 2 0.01


**Other species**

*\*Monoculus monstrosus*

*\*Vulpia myuros forma megalura*


*Austrostipa elegantissima*


*Salsola australis*


<b>Relevé:</b>	ELA04					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC4	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Good		438542 m E	<i>Melaleuca lateriflora</i>	5-10	3
			6626895 m S	<i>Hakea preissii</i>	1	4
<b>Photograph:</b>				<i>Rhagodia drummondii</i>	5	0.5
				<i>Tecticornia pergranulata</i>	1	0.5
				<i>Austrostipa elegantissima</i>	1	1
				* <i>Mesembryanthemum nodiflorum</i>	3	0.1
				<b>Other species</b>		
				* <i>Avena barbata</i>		
				* <i>Romulea rosea</i>		
				* <i>Vulpia myuros forma megalura</i>		
				<i>Atriplex codonocarpa</i>		
				<i>Comesperma integerrimum</i>		
	<i>Maireana brevifolia</i>					
	<i>Melaleuca stereophloia</i>					
	<i>Wilsonia humilis</i>					





<b>Relevé:</b>	ELA05					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC4	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Degraded/ Good		438535 m E	<i>Melaleuca stereophloia</i>	15	8
			6626681 m S	<i>Casuarina obesa</i>	3	6
<b>Photograph:</b>				<i>Hakea preissii</i>	0.5	3
				<i>*Eragrostis curvula</i>	2	1
				<i>*Lolium rigidum</i>	2	0.5
				<i>Rhagodia drummondii</i>	1	1
				<i>Austrostipa elegantissima</i>	1	1
				<b>Other species</b>		
				<i>*Trifolium campestre</i>		
				<i>Comesperma integerrimum</i>		
				<i>Grevillea biternata</i>		
				<i>Stylobasium australe</i>		


<b>Relevé:</b>	ELA06					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC4	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Degraded		438439 m E	<i>Melaleuca lateriflora</i>	40	4
			6626639 m S	<i>Melaleuca stereophloia</i>	5	4
<b>Photograph:</b>				<i>Casuarina obesa</i>	1	5
				* <i>Lolium rigidum</i>	50	0.5
				* <i>Arctotheca calendula</i>	1	0.2
	<b>Other species</b>					
	* <i>Eragrostis curvula</i>					
	* <i>Hypochaeris glabra</i>					
	* <i>Sonchus oleraceus</i>					
	<i>Austrostipa elegantissima</i>					
	<i>Comesperma integerrimum</i>					
	<i>Hakea preissii</i>					
	<i>Maireana brevifolia</i>					
<i>Rhagodia drummondii</i>						


<b>Relevé:</b>	ELA07					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC2	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Good		438392 m E	<i>Tecticornia undulata</i>	15	1
			6626694 m S	* <i>Lolium rigidum</i>	1	0.5
<b>Photograph:</b>				* <i>Mesembryanthemum nodiflorum</i>	5-10	0.1
				<i>Tecticornia pergranulata</i>	5	0.2
				<b>Other species</b>		
				* <i>Hordeum leporinum</i>		
				* <i>Sonchus oleraceus</i>		
	<i>Enchylaena tomentosa</i>					
	<i>Eragrostis dielsii</i>					
	<i>Siloxerus multiflorus</i>					

Relevé: ELA08									
Date:	21/10/2020	Site:	CBH Miling						
Vegetation Unit:	VC5	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)			
Condition:	Very Good		438264 m E	<i>Melaleuca lateriflora</i>	10	4			
			6626536 m S	<i>Tecticornia pergranulata</i>	5-10	0.6			
Photograph:				<i>Maireana brevifolia</i>	2	0.6			
				<i>Rhagodia drummondii</i>	3	1			
				<i>Austrostipa elegantissima</i>	2	1			
				* <i>Mesembryanthemum nodiflorum</i>	5	0.1			
				<i>Eragrostis dielsii</i>	2	0.1			
				* <i>Vulpia myuros forma megalura</i>	1	0.1			
				<i>Hakea preissii</i>	5	3			
				<b>Other species</b>					
				* <i>Hordeum leporinum</i>					
				* <i>Lolium rigidum</i>					
				* <i>Oncosiphon piluliferum</i>					
				* <i>Romulea rosea</i>					
				<i>Acacia lineolata subsp. lineolata</i>					
				<i>Atriplex codonocarpa</i>					
				<i>Atriplex hymenotheca</i>					
<i>Enchylaena tomentosa</i>									
<i>Salsola australis</i>									
<i>Siloxerus multiflorus</i>									


Relevé: ELA09									
Date:	21/10/2020	Site:	CBH Miling						
Vegetation Unit:	VC2	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)			
Condition:	Good		438117 m E	<i>Tecticornia pergranulata</i>	20	0.5			
			6626385 m S	<i>Rhagodia drummondii</i>	1	0.5			
Photograph:				<i>Atriplex hymenotheca</i>	1	0.4			
				<i>*Lolium rigidum</i>	5	0.5			
				<i>*Mesembryanthemum nodiflorum</i>	5-10	0.1			
				<b>Other species</b>					
				<i>*Sonchus asper</i>					
				<i>*Vulpia myuros forma megalura</i>					
				<i>Austrostipa elegantissima</i>					
				<i>Didymanthus roei</i>					
				<i>Enchylaena tomentosa</i>					
				<i>Eragrostis dielsii</i>					
				<i>Melaleuca lateriflora</i>					
<i>Siloxerus multiflorus</i>									


<b>Relevé:</b>	ELA10						
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling				
<b>Vegetation Unit:</b>	VC3	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>	
<b>Condition:</b>	Degraded/ Completely Degraded		437931 m E	<i>Maireana brevifolia</i>			
			6626119 m S	<i>Salsola australis</i>			
<b>Photograph:</b>				<i>*Oncosiphon piluliferum</i>			
				<i>Atriplex codonocarpa</i>	2	0.2	
				<i>*Lolium rigidum</i>	2	0.4	
				<i>*Hordeum leporinum</i>	1	0.2	
				<i>*Vulpia myuros forma megalura</i>	2	0.1	
	<b>Other species</b>						
				<i>*Aira cupaniana</i>			
				<i>*Avena barbata</i>			
				<i>*Bromus rubens</i>			
				<i>*Mesembryanthemum nodiflorum</i>			
				<i>*Monoculus monstrosus</i>			
				<i>*Sonchus oleraceus</i>			
				<i>*Trifolium glomeratum</i>			
				<i>Acacia hemiteles</i>			
				<i>Atriplex semibaccata</i>			
				<i>Austrostipa elegantissima</i>			
				<i>Chloris truncata</i>			
				<i>Eragrostis dielsii</i>			
			<i>Erodium cygnorum</i>				
			<i>Ptilotus exaltatus</i>				
			<i>Ptilotus polystachyus</i>				
			<i>Sclerolaena eriacantha</i>				


<b>Relevé:</b>	ELA11					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC3	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Completely Degraded		437930 m E	<i>Maireana brevifolia</i>	5	1
			6626001 m S	<i>Salsola australis</i>	7	0.5
<b>Photograph:</b>				<i>*Hordeum leporinum</i>	10	0.2
				<i>Eragrostis dielsii</i>	1	0.02
				<i>Atriplex semibaccata</i>	1	0.2
				<i>*Mesembryanthemum nodiflorum</i>	2	0.1
				<i>*Arctotheca calendula</i>	1	0.1
				<b>Other species</b>		
				<i>*Oncosiphon piluliferum</i>		
				<i>*Avena barbata</i>		
				<i>*Brassica tournefortii</i>		
				<i>*Bromus diandrus</i>		
	<i>*Hypochaeris glabra</i>					
	<i>*Lolium rigidum</i>					
	<i>*Monoculus monstrosus</i>					
	<i>*Rumex hypogaeus</i>					
	<i>*Sonchus oleraceus</i>					
	<i>*Vulpia myuros forma megalura</i>					
	<i>Acacia hemiteles</i>					
	<i>Chloris truncata</i>					
	<i>Ptilotus exaltatus</i>					

Relevé: ELA12						
Date:	21/10/2020	Site:	CBH Miling			
Vegetation Unit:	VC3	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)
Condition:	Completely Degraded		438095 m E	<i>Maireana brevifolia</i>	2	0.6
			6626123 m S	<i>Salsola australis</i>	5	0.5
Photograph:				<i>*Hordeum leporinum</i>	20	0.2
				<i>*Mesembryanthemum nodiflorum</i>	1	0.1
				<i>Atriplex codonocarpa</i>	1	0.2
				<i>Atriplex semibaccata</i>	2	0.2
				<i>Acacia hemiteles</i>	1	0.4
				<b>Other species</b>		
				<i>*Avena barbata</i>		
				<i>*Cynodon dactylon</i>		
				<i>*Hypochaeris glabra</i>		
				<i>*Lolium rigidum</i>		
	<i>*Monoculus monstrosus</i>					
	<i>*Oncosiphon piluliferum</i>					
	<i>*Sonchus oleraceus</i>					
	<i>Atriplex amnicola</i>					
	<i>Chloris truncata</i>					
	<i>Eragrostis dielsii</i>					
	<i>Ptilotus polystachyus</i>					



<b>Relevé:</b>	ELA13					
<b>Date:</b>	21/10/2020	<b>Site:</b>	CBH Miling			
<b>Vegetation Unit:</b>	VC6	<b>Location (UTM):</b>	50 J	<b>Dominant species</b>	<b>Cover (%)</b>	<b>Height (m)</b>
<b>Condition:</b>	Good		438167 m E	<i>Eucalyptus loxophleba</i>	2	10
			6626196 m S	<i>Maireana brevifolia</i>	4	1
<b>Photograph:</b>				<i>Atriplex amnicola</i>	4	1
				<i>*Lolium rigidum</i>	1	0.4
				<i>*Hordeum leporinum</i>	5	0.3
				<i>*Arctotheca calendula</i>	1	0.1
				<i>*Mesembryanthemum nodiflorum</i>	5-10	0.2
				<b>Other species</b>		
				<i>Atriplex semibaccata</i>		
	<i>*Oncosiphon piluliferum</i>					
	<i>*Sonchus oleraceus</i>					
	<i>Atriplex codonocarpa</i>					
	<i>Austrostipa elegantissima</i>					
	<i>Hakea preissii</i>					
	<i>Ptilotus polystachyus</i>					

Relevé: ELA14						
Date:	21/10/2020	Site:	CBH Miling			
Vegetation Unit:	VC6	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)
Condition:	Good	438200 m E	<i>Eucalyptus loxophleba</i>	5	10	
		6626428 m S	<i>Melaleuca lateriflora</i>	1	3	
Photograph:			<i>Maireana brevifolia</i>	5	0.6	
			<i>Tecticornia pergranulata</i>	10	0.5	
			<i>Rhagodia drummondii</i>	2	0.6	
			* <i>Hordeum leporinum</i>	5	0.2	
			* <i>Oncosiphon piluliferum</i>	3	0.3	
			<b>Other species</b>			
			* <i>Arctotheca calendula</i>			
			* <i>Cynodon dactylon</i>			
			* <i>Lolium rigidum</i>			
			* <i>Mesembryanthemum nodiflorum</i>			
			* <i>Sonchus oleraceus</i>			
<i>Atriplex semibaccata</i>						
<i>Austrostipa elegantissima</i>						
<i>Enchylaena tomentosa</i>						
<i>Eragrostis dielsii</i>						
<i>Hakea preissii</i>						

Relevé: ELA15										
Date:	21/10/2020	Site:	CBH Miling							
Vegetation Unit:	VC1	Location (UTM):	50 J	Dominant species	Cover (%)	Height (m)				
Condition:	Good		438613 m E	<i>Eucalyptus horistes</i>	5	5				
			6626812 m S	<i>Santalum acuminatum</i>	5	3				
Photograph:				<i>Melaleuca stereophloia</i>	5	2				
				<i>Rhagodia drummondii</i>	2	1				
				<i>Ptilotus polystachyus</i>	1	0.5				
				<i>Austrostipa elegantissima</i>	1	1				
				* <i>Monoculus monstrosus</i>	2	0.3				
				<i>Eucalyptus loxophleba</i>	5	5				
				<b>Other species</b>						
				* <i>Aira cupaniana</i>						
				* <i>Avena barbata</i>						
				* <i>Ehrharta longiflora</i>						
				<i>Acacia acuminata</i>						
				<i>Comesperma integerrimum</i>						
				<i>Dianella revoluta</i>						
<i>Lomandra effusa</i>										
<i>Salsola australis</i>										
<i>Sclerolaena diacantha</i>										

## Appendix H Assessment of the Eucalypt woodlands of the Western Australia wheatbelt ecological community

### KEY DIAGNOSTIC CHARACTERISTICS

Key diagnostic characteristics (DotEE 2015)	Outcome
<b>Indicators</b>	
<p><u>Location and physical environment</u></p> <p>The distribution of the ecological community is limited to these IBRA bioregions and subregions:</p> <ul style="list-style-type: none"> <li>• Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning;</li> <li>• Mallee - MAL02 Western Mallee only; and</li> <li>• Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. They are effectively an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats.</li> </ul>	<p>Yes.</p> <p>The survey area is located in the Avon Wheatbelt IBRA Bioregion and AVW02 Katanning subregion.</p>
<p><u>Structure</u></p> <p>The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque).</p>	<p>Yes. Crown cover in the woodland community VC1 is &gt;10%.</p> <p>No. Crown cover in the woodland community VC6 is &lt;10%, therefore doesn't fulfil the structure characteristic.</p>
<p><u>Presence of key species</u></p> <p>The key species of the tree canopy are species of <i>Eucalyptus</i> as identified in Table 2a (DotEE 2015). These are species that typically have a single trunk. One or more of the tree species in Table 2a are dominant or co-dominant within a patch of the ecological community. If other species are present in the tree canopy (e.g. species in Table 2b or other taxa) then these collectively do not occur as dominants in the tree canopy.</p>	<p>Yes. The dominant eucalypt in VC1 and VC6 is <i>Eucalyptus loxophleba</i>. There was not enough material to determine if the species was subsp. <i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i> (Table 2a) or <i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>, <i>Eucalyptus loxophleba</i> subsp. <i>supralaervis</i> (Table 2b). Therefore, a precautionary approach was taken, in that the species is a key canopy species.</p>
<p><u>Presence of native understorey</u></p> <p>A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in section 2.3.2 and in Table A1 of Appendix A (DotEE 2015).</p>	<p>Yes.</p> <p>Native understorey is present. 19 of the 51 native flora taxa recorded in the survey area occur within Table A1 of Appendix A (DotEE 2015).</p> <p>It should be noted that the plant species list in Tables A1 and A4 of Appendix A (DotEE 2015) do not include all plant species that may be encountered in the WA Wheatbelt woodland ecological community.</p>

Key diagnostic characteristics (DotEE 2015)	Outcome
<b>Contra-indicators</b>	
<p><u>Mallees dominant</u></p> <p>A dominant presence of eucalypts with a mallee growth form. However, mallee species can occur as an understorey or minor canopy component of the ecological community, as noted in the diagnostic features, above.</p>	<p>Yes. Mallee eucalypts were dominate in VC1.</p> <p>No. Mallee eucalypts are not dominant in vegetation community VC6.</p>
<p><u>Non-eucalypts dominant</u></p> <p>A dominant presence of non-eucalypt species in the tree canopy, for instance <i>Acacia acuminata</i> (jam) or <i>Allocasuarina huegeliana</i> (rock sheoak). However, these non-eucalypt species can be present as an understorey or minor canopy component of the ecological community.</p>	<p>No.</p> <p>Some non-eucalypt species are present but are not dominant in the tree canopy in vegetation community VC1 or VC6.</p>
<p><u>Shrublands or Herblands</u></p> <p>Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as ‘derived’ or ‘secondary’ vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland, noted in the diagnostic features, above.</p>	<p>Yes.</p> <p>Vegetation community VC1 and VC6 have sparse tree canopy layers due to long term disturbance.</p>
<p><u>Adjacent bioregions</u></p> <p>Woodlands that have the same key eucalypt species but occur in adjacent bioregions, notably the Coolgardie, Esperance Sandplains, Yalgoo and Geraldton Sandplains bioregions. These are not part of the national ecological community. All woodlands that occur in bioregions outside the wheatbelt, as defined in this conservation advice, are not part of the WA Wheatbelt Woodland ecological community.</p>	<p>No.</p> <p>The survey area is not located in the Coolgardie, Esperance Sandplains, Yalgoo or Geraldton Sandplains bioregions.</p>
<p><u>Habitat-restricted eucalypt species</u></p> <p>Woodlands dominated by eucalypts that are restricted to granite outcrops and rocky rises, for instance <i>Eucalyptus caesia</i> (caesia or gungurru). However, some woodlands occur on the base around rock outcrops, but not on the actual outcrop, and these may be part of the ecological community, for instance York gum – jam woodlands.</p>	<p>No.</p> <p>The woodlands within the survey area do not occur on granite outcrops or rocky rises.</p>
<b>Condition thresholds and minimum patch size</b>	
<p>Where native vegetation meets the description and key diagnostic characteristics of the WA Wheatbelt Woodland ecological community, above, the condition thresholds and considerations in Table 3 (DotEE 2015) apply. There are four categories a patch can be classified as:</p> <p>Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very Good (Keighery 1994) or a High Roadside Conservation Value (RCV; Roadside Conservation Committee of WA [RCC] 2014).</p>	<p>Parts of the woodland community VC1 meet the following criteria:</p> <p>Category C (for Good condition):</p> <ul style="list-style-type: none"> <li>• Mature trees either absent or when present have &lt; 5 trees per 0.5 ha.</li> <li>• Roadside patch width ≥5 m.</li> </ul>

Key diagnostic characteristics (DotEE 2015)	Outcome
<p>Category B: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014), AND retains important habitat features.</p> <p>Category C: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014).</p> <p>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) BUT retains important habitat features.</p> <p>The criteria for these categories are listed below.</p>	<p>Parts of woodland community VC6 meet the following criteria:</p> <p>Category C (for Good condition):</p> <ul style="list-style-type: none"> <li>• Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).</li> <li>• Mature trees either absent or when present have &lt; 5 trees per 0.5 ha.</li> <li>• Roadside patch width <math>\geq</math> 5 m.</li> </ul>

## CONDITION THRESHOLDS

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

<sup>1</sup> Mature trees have a DBH of 30 cm or above. Trunk diameter varies among eucalypt species, for instance gimlet and mallets tend to have slender trunks (Gosper et al. 2013b, as cited in DotEE 2015). The DBH for mature trees aligns with the EPBC referral guidelines for the breeding habitat of threatened black cockatoo species (SEWPaC 2012). These note that, for salmon gum and wandoo trees, suitable nest hollows can develop in trees with a DBH of 30 cm or more. Note that larger trees may be killed by factors such as intense fire or flood, but the patch may still be in reasonable condition if there are immature trees regenerating.

<sup>2</sup> The minimum patch size thresholds apply to native vegetation remnants that do not occur along roadsides.

<sup>3</sup> Minimum patch width applies only to vegetation remnants along roadsides and tend to be long but narrow. This criterion recognises the importance of native vegetation remnants along road verges, e.g their value as wildlife corridors particularly if linking to other non-roadside remnants, habitat for threatened species and other reasons as detailed by Jackson (2002) and RCC (2015), as cited in DotEE (2015). The width here is based on the native understorey component rather than width of the tree canopy. Some allowance must be made for small breaks or variations in native species cover along linear patches. Given the generally open nature of the tree canopy and some understorey structures, a break in the continuity of native vegetation cover of 50 metres or more, is likely to indicate that separate patches are present. An exception is for main, often bitumen-covered, roads that bisect otherwise continuous vegetation; most local government roads in the Wheatbelt have a road reserve of 20 metres. In these cases, native vegetation along either side of the road is considered to be a separate patch.

## Appendix I Fauna species list

Species	Common Name	Observation Type
<b>Birds</b>		
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	Observed/heard
<i>Anthus novaeseelandiae</i>	Australasian Pipit	Observed/heard
<i>Barnardius zonarius</i>	Australian Ringneck	Observed/heard
<i>Cacatua sanguinea</i>	Little Corella	Observed/heard
<i>Calamanthus campestris</i>	Rufous Fieldwren	Observed/heard
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	Observed/heard
<i>Corvus coronoides</i>	Australian Raven	Observed/heard
<i>Cracticus tibicen</i>	Australian Magpie	Observed/heard
<i>Eolophus roseicapilla</i>	Galah	Observed/heard
<i>Falco cenchroides</i>	Nankeen Kestrel	Observed/heard
<i>Grallina cyanoleuca</i>	Magpie-lark	Observed/heard
<i>Hirundo neoxena</i>	Welcome Swallow	Observed/heard
<i>Malurus leucopterus</i>	White-winged Fairy Wren	Observed/heard
<i>Manorina flavigula</i>	Yellow-throated Miner	Observed/heard
<i>Megalurus mathewsi</i>	Rufous Songlark	Observed/heard
<i>Melopsittacus undulatus</i>	Budgerigar	Observed/heard
<i>Microeca fascinans</i>	Jacky Winter	Observed/heard
<i>Motacilla alba</i>	White Wagtail	Observed/heard
<i>Ocyphaps lophotes</i>	Crested Pigeon	Observed/heard
<i>Purnella albifrons</i>	White-fronted Honeyeater	Observed/heard
<i>Rhipidura leucophrys</i>	Willie Wagtail	Observed/heard
<i>Smicronis brevirostris</i>	Weebill	Observed/heard
<i>Spilopelia senegalensis</i>	Laughing Dove	Observed/heard
<b>Mammals</b>		
<i>*Bos taurus</i>	Cattle	Scats
<i>Osphranter robustus</i>	Common wallaroo (Euro)	Scats
<i>Osphranter rufus</i>	Red kangaroo	Observed
<b>Reptiles</b>		
<i>Pseudonaja nuchalis</i>	Western Brown Snake	Observed



### Appendix J Black cockatoo potentially suitable trees recorded within the survey area

Tree ID	Species	DBH (mm)	Hollow	Hollow type (spout, branch, trunk)	Foraging, roosting, breeding evidence	Easting	Northing
1048	<i>Eucalyptus</i> sp. (planted)	>500	NA	NA	NA	438691	6626897
1049	<i>Eucalyptus</i> sp. (planted)	>500	NA	NA	NA	438691	6626885
1050	<i>Eucalyptus</i> sp. (planted)	>500	NA	NA	NA	438642	6626783

