

# Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment (Biota 2019b)

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# **Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment**



**Prepared for GHD**

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**Biota**  
Environmental  
Sciences



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# BORR Southern Section Fauna Assessment

## Contents

<b>1.0</b>	<b>Executive Summary</b>	<b>9</b>
1.1	Introduction	9
1.2	Methods	9
1.3	Results	10
<b>2.0</b>	<b>Glossary and Acronyms</b>	<b>11</b>
<b>3.0</b>	<b>Introduction</b>	<b>13</b>
3.1	Proposal	13
3.2	Study Objectives and Scope	13
<b>4.0</b>	<b>Methods</b>	<b>15</b>
4.1	Desktop Review	15
4.2	Conservation Significant Species Likelihood Assessment	15
4.3	Legislation and Policy Conformance	18
4.4	Nomenclature	19
4.5	Timing, Team and Permits	19
4.6	Western Ringtail Possum	21
4.7	Brush-tailed Phascogale and Chuditch	21
4.8	Black-cockatoos	22
4.9	Limitations	26
<b>5.0</b>	<b>Results</b>	<b>27</b>
5.1	Desktop Review	27
5.2	Fauna Habitats	27
5.3	Western Ringtail Possum	33
5.4	Black-cockatoos	35
<b>6.0</b>	<b>Conservation Significant Species</b>	<b>45</b>
6.1	Target Species	49
6.2	Non-target Species with the Potential to Occur	52
6.3	Conservation Significant Species that are Unlikely to Occur	54
<b>7.0</b>	<b>Discussion</b>	<b>57</b>
7.1	Western Ringtail Possum	57
7.2	Black-cockatoos	63
<b>8.0</b>	<b>References</b>	<b>65</b>
	<b>Appendix 1</b>	
	Statutory Framework	
	<b>Appendix 2</b>	
	DBCA Regulation 17 Licence	
	<b>Appendix 3</b>	
	Desktop Review Results	
	<b>Appendix 4</b>	

## NatureMap Database Search Results

**Appendix 5**

## EPBC Act Protected Matters Search Tool Results

**Tables**

Table 4.1:	Categories of likelihood assigned to conservation significant species in desktop search.	15
Table 4.2:	Previous studies reviewed in relation to the Proposal area.	16
Table 4.3:	State and Commonwealth legislation, policy and guidelines of most relevance to this study.	18
Table 4.4:	Summary of survey timing and weather conditions.	19
Table 4.5:	Breeding habitat for the three Threatened black-cockatoo species.	24
Table 4.6:	Categories of hollow suitability for black-cockatoo nesting.	25
Table 4.7:	Assessment against potential survey limitations.	26
Table 5.1:	Broad fauna habitats of the survey area.	29
Table 5.2:	Occurrence of the Swan Coastal Plain vegetation complexes (DPaW 2017) within the Proposal area and out to 12 km.	43
Table 6.1:	Conservation significant fauna returned from the desktop review and their likelihood of occurrence within the Proposal area.	47
Table 7.1:	Results of previous Western Ringtail Possum sampling within the Proposal area (Jilley Road to Bussell Highway) and local context sites within 5 km.	59
Table 7.2:	Population estimates of the Western Ringtail Possum derived from IUCN expert elicitation in 2014 (Burbidge and Zichy-Woinarski 2017) and a 2019 regional population assessment using line transect distance sampling (Biota 2019).	63

**Figures**

Figure 3.1:	Location of the BORR South Proposal area and the survey area.	14
Figure 4.1:	Average monthly weather conditions in the year preceding the field surveys (October 2017 through August 2019) compared with long-term climatological averages (data from the Bureau of Meteorology station at Carey Park, 1995–2018).	20
Figure 4.2:	Survey effort applied to assessing black-cockatoo habitat within the Proposal area.	23
Figure 5.1:	Broad fauna habitats of the Proposal area (northern section, map 1/2).	31
Figure 5.2:	Broad fauna habitats of the Proposal area (southern section, map 2/2).	32
Figure 5.3:	Records of Western Ringtail Possums from strip transects across the Proposal area.	34
Figure 5.4:	Black-cockatoo observations in relation to the Proposal area.	36
Figure 5.5:	Trees >50 cm DBH of hollow-forming species recorded within the Proposal area, including those bearing suitable black-cockatoo breeding hollows (northern section, map 1/2).	37
Figure 5.6:	Trees >50 cm DBH of hollow-forming species recorded within the Proposal area, including those bearing suitable black-cockatoo breeding hollows (southern section, map 2/2).	38
Figure 5.7:	Black-cockatoo breeding hollow suitability (northern section, map 1/2).	40

Figure 5.8: Black-cockatoo breeding hollow suitability (southern section, map 2/2).	41
Figure 5.9: Remnant vegetation and Swan Coastal Plain Vegetation Mapping (DPaW 2017) within a 12 km radius of the Proposal area.	44
Figure 7.1: Results of the strip sampling of the Proposal area in the context of Distance sampling at sites in close proximity.	61

## Plates

Plate 5.1: Forest Red-tailed Black-cockatoo eggshell found on the ground in 2017.	39
Plate 5.2: Common Brushtail Possum in hollow.	39
Plate 5.3: Suitable hollow but containing Wood Duck eggs.	39
Plate 5.4: Carnaby's Black-cockatoo Marri nut chew.	42
Plate 5.5: Baudin's Black-cockatoo Marri nut chews.	42
Plate 5.6: Forest Red-tailed Black-cockatoo Marri nut chews.	42



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# 1.0 Executive Summary

## 1.1 Introduction

Main Roads Western Australia is proposing to construct the Bunbury Outer Ring Road (BORR) Southern Section, a dual carriage highway linking from South Western Highway (near Bunbury Airport) to Bussell Highway (Figure 3.1). The project will include service roads, side road intersections, road overpass, service re-locations, fencing and noise walls. To inform the environmental impact assessment of the Proposal, Biota Environmental Sciences was commissioned to undertake a desktop review and targeted field survey in relation to the following conservation significant species:

- Carnaby's Black-cockatoo (Schedule 2, Endangered);
- Baudin's Black-cockatoo (Schedule 2, Endangered);
- Forest Red-tailed Black-cockatoo (Schedule 3, Vulnerable); and
- Western Ringtail Possum (Schedule 1, Critically Endangered).

Furthermore, likelihood of occurrence was to be assessed for the following conservation significant species:

- Wambenger Brush-tailed Phascogale (hereafter the Brush-tailed Phascogale) (Schedule 6); and
- Chuditch (Schedule 3, Vulnerable).

## 1.2 Methods

This report details surveys conducted at two scales:

- Proposal area: the 296.78 ha area being referred to the EPA; and
- Survey area: a 187.05 ha area within the Proposal area.

Habitat for black-cockatoos was assessed by foot-traversing the survey area (28.3 ha of remnant vegetation remains in unsurveyed gaps between the Proposal area and survey area). In larger vegetation fragments, a systematic approach was applied, whereby transects of 25 m spacing were overlain on the survey area in GIS. A zoologist then walked down the middle of two 25 m transects, effectively using them as the boundary of a strip-search, and recorded habitat trees. This was continued until the entire fragment had been searched. In small fragments or where there were singular trees, foot traverses were also undertaken and recorded via a track file. Foraging habitat descriptions were recorded while conducting foot traverses. For any tree supporting hollow/s, details of the hollows were taken, and a differential GPS was used to record an accurate location of the tree. These trees were also subject to a dedicated breeding hollow assessment, which included the use of a remotely piloted aircraft (RPA) to obtain images of the hollows.

Spotlighting for Western Ringtail Possums was completed over the large majority of the suitable habitat occurring in the Proposal area, using a strip-sampling technique (similar to that described for black-cockatoos) that aimed to record all individuals.

Night-spotting was also used as the search method for the Brush-tailed Phascogale and Chuditch, and was completed in conjunction with the Western Ringtail Possum surveys.

## 1.3 Results

### 1.3.1 Fauna Habitats

Of the 296.78 ha Proposal area, 192.81 ha represents land historically cleared for agriculture, road infrastructure and housing, leaving 103.97 ha of largely native vegetation. Within the Proposal area, a survey area of 187.05 ha was assessed and as far as practicable, all of the vegetation was ground-truthed. Based on the field observations, together with reference to the vegetation mapping of the survey area, the following broad habitats were described for the survey area (from most common to least):

- *Mari/Eucalyptus* woodland (42.55 ha);
- Dampland with *Melaleuca* shrubland and/or woodland (16.36 ha); and
- *Mari/Eucalyptus* in paddocks and road reserves (16.81 ha).

### 1.3.2 Target Species

Black-cockatoo breeding habitat trees were considered to be those of relevant species with a diameter at breast height (DBH) of 50 cm or greater as defined in the draft Commonwealth referral guidelines (DSEWPaC 2012a). A total of 1,017 trees of a suitable DBH were recorded within the survey area. A total of 115 trees were included in a dedicated tree hollow assessment, which incorporated the use of a Remotely Piloted Aircraft. Of the 115 trees, 18 contained hollows that were classified as 'Suitable' for black-cockatoo breeding with eight of these classified as 'Suitable with Evidence of Use', 24 trees had hollows of 'Limited Suitability', 64 trees had hollows that were 'Not Suitable' and nine trees received a 'Ground assessment only' rating as they contained hollows that could not be accessed with the aircraft. The survey area was comprised 59.4 ha of black-cockatoo foraging habitat, and feeding debris of all three black-cockatoo species was identified.

Strip-transect sampling in the Proposal area recorded 73 individual Western Ringtail Possums.

No Brush-tailed Phascogales were recorded within the Proposal area but six individuals were recorded from an adjacent reserve (Reserve 23000 Shire of Capel). Given the habitat availability, this species was considered likely to occur within the Proposal area.

No Chuditch were recorded within the Proposal area and they are considered a possible visitor only.

### 1.3.3 Non-target Conservation Significant Species

In addition to the target conservation significant species, the following seven species were either recorded during this study, or are considered to have some potential to occur within the Proposal area based on habitat availability and previous records in the area:

- Southern Brown Bandicoot, Quenda (Priority 4) – Occurs (recorded);
- Black-striped Dwarf Galaxias, Black-stripe Minnow (Schedule 2, Endangered) – Likely;
- Peregrine Falcon (Schedule 7) – Likely to occur (visitor);
- Coastal Plains Skink (Priority 3) – Possible;
- Western Brush Wallaby (Priority 4) – Possible;
- Western False Pipistrelle (Priority 4) – Possible; and
- Blue-billed Duck (Priority 4) – Possible (visitor).

## 2.0 Glossary and Acronyms

BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i> .
Biota	Biota Environmental Sciences.
BORR	Bunbury Outer Ring Road.
Black-cockatoos	Refers to all three species of black-cockatoo endemic to the south-west of Western Australia: Carnaby's Black-cockatoo, Baudin's Black-cockatoo and Forest Red-tailed Black-cockatoo.
Breeding habitat (black-cockatoo)	Defined in the DSEWPac (2012) referral guidelines as species of trees known to support breeding within the range of the species, which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 50 cm; for Salmon Gum and Wandoo, suitable DBH is 30 cm.
Conservation significant	Defined as those species listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> , the WA <i>Biodiversity Conservation Act 2016</i> or Department of Biodiversity, Conservation and Attractions Priority species list.
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions (formerly the Department of Environment and Conservation).
DBH	Diameter at breast height (approximately 1.3 m from base).
DoEE	Federal Department of Environment and Energy.
EPA	Environmental Protection Authority, Western Australia.
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Foraging habitat (black-cockatoo)	Defined in the DSEWPac (2012) EPBC Act referral guidelines as plants of species known to support foraging within the range of each of the species.
Known nesting trees (black-cockatoo)	Any existing tree in which breeding has been recorded or suspected (e.g. showing evidence of use through scratches or feathers).
Proposal area	The BORR Southern Section Proposal area to be referred to the EPA.
Roosting habitat (black-cockatoo)	Defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the species.
RPA	Remotely-piloted aircraft.
SCP	Swan Coastal Plain.
Survey area	The area of interest to which much of the field work was constrained; in this study, an area included within but not wholly encompassing the Proposal area.
Brush-tailed Phascogale	Wambenger Brush-tailed Phascogale, <i>Phascogale tapoatafa wambenger</i> .
WC Act	Western Australian <i>Wildlife Conservation Act 1950</i> (now repealed).

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## 3.0 Introduction

### 3.1 Proposal

Main Roads Western Australia (Main Roads) is proposing to construct the Bunbury Outer Ring Road (BORR), a dual carriage highway linking Forrest Highway and Bussell Highway, providing a bypass of Bunbury for inter-regional traffic. This report pertains to the Southern Section of the BORR, from South Western Highway (near Bunbury Airport) to Bussell Highway (Figure 3.1) (the Proposal). The Proposal includes service roads, side road intersections, road overpass, service re-locations, fencing and noise walls.

### 3.2 Study Objectives and Scope

Main Roads proposes to refer the BORR Southern Section to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). In order to inform the environmental impact assessment of the Proposal, Biota Environmental Sciences (Biota) was commissioned to undertake the following:

- conduct a desktop review of relevant previous fauna survey work;
- assess black-cockatoo foraging habitat, as well as roosting, potential breeding and actual breeding trees as per Commonwealth guidelines;
- estimate abundance of the Western Ringtail Possum within the Proposal area and place this estimate in the context of previous local and regional surveys;
- provide an assessment of the likelihood of occurrence of other conservation significant fauna (particularly Chuditch and Brush-tailed Phascogale); and
- delineate and map fauna habitats.

The fauna assessments relating to the project commenced in 2017 and are ongoing. The initial survey area for the fauna assessments is shown in Figure 3.1, together with its extent within the Proposal area. At the time of writing, the large majority of the Proposal area has been surveyed for the Western Ringtail Possum, while black-cockatoo assessments had been completed over the survey area portion of the Proposal area.



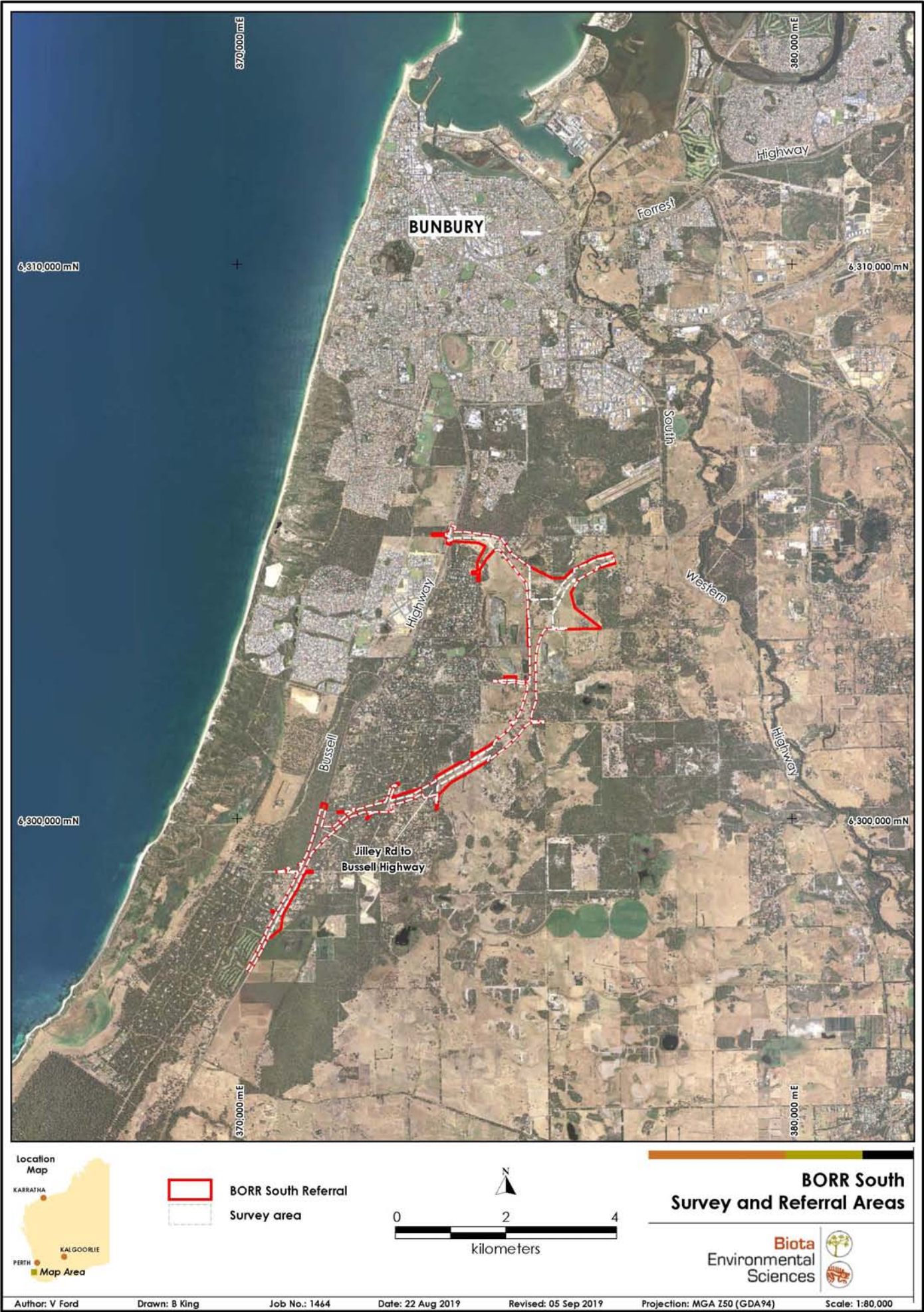


Figure 3.1: Location of the BORR Southern Section Proposal area and the survey area.

## 4.0 Methods

### 4.1 Desktop Review

A literature review was carried out to ascertain previous sampling effort in the local area (within 10 km); in particular, records of the target species (Western Ringtail Possum, black-cockatoos, Chuditch and Brush-tailed Phascogale), but also other conservation significant fauna.

The following sources of information were reviewed to compile a species inventory for the Proposal area:

1. NatureMap database (<http://NatureMap.dec.wa.gov.au>): a joint project of the Department of Biodiversity Conservation and Attractions (DBCA) and the Western Australian Museum (WAM). This database represents the most comprehensive source of information on the distribution of Western Australia's fauna, comprising records from the Fauna Survey Returns database and WA Threatened Fauna Database (both managed by the DBCA), the WAM Specimen database and the Birdlife Australia Birddata database. The database search was completed on 29 October 2018 using a 10 km buffer on a central line described by the coordinates:
  - 33°23'14"S 115°39'49"E;
  - 33°24'50"S 115°39'06"E;
  - 33°26'06"S 115°37'06"E;
  - 33°27'24"S 115°36'11"E.

The raw data returned are included as Appendix 4.

2. The Commonwealth EPBC Act Protected Matters Search Tool database. The database was searched using the same coordinates as the NatureMap search above, on the 29 October 2018. The raw data returned are included as Appendix 5.
3. Biota's internal database. Biota has conducted a number of recent studies associated with the BORR proposal; our database of records was utilised particularly in the context of Western Ringtail Possums and black-cockatoos. These studies are detailed in Table 4.2; and
4. Studies by other authors, as detailed in Table 4.2.

### 4.2 Conservation Significant Species Likelihood Assessment

The conservation significant species returned from the desktop review were assigned to one of four categories, ranging from 'Occurs' to 'Unlikely to occur' as defined in Table 4.1. The number of historical records, and their timing and distance from the Proposal area were considered in the likelihood assessment. Some species returned during the desktop review were confidently assessed as 'Unlikely to occur' due to an absence of specific habitat requirements within the Proposal area, or a well-defined distribution that does not include the Proposal area.

**Table 4.1: Categories of likelihood assigned to conservation significant species in desktop search.**

Status	Description
<b>Occurs</b>	Recorded in current survey through direct sighting or secondary evidence such as nut chews or diggings.
<b>Likely to occur</b>	Recent records (past 5 years) within Proposal area and nearest record <1 km from Proposal area boundary.
<b>Possible</b>	Nearest record <5 km from Proposal area boundary, and suitable habitat present. Lack of records may be due to low survey effort/cryptic behaviour of species or rarity. In some cases the study area lacks core habitat, however, it may occur as a visitor to forage or on route between areas of core habitat.
<b>Unlikely to occur</b>	Few records overall in past 10 years, or no records at all. Nearest record >5 km from Proposal area boundary. Habitat unsuitable or degraded/fragmented.



**Table 4.2: Previous studies reviewed in relation to the Proposal area.**

Report / Survey	Survey Dates (effort)	Survey Description	Records	Proximity to Proposal Area
Lot 1 Wallrodt Road, Picton Environmental Values Assessment (GHD 2010a).	October 2010 (1 day)	Site inspection searching for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	3 km.
Lot 15 Bunbury Outer Ring Road (Stage 2) Environmental Values Assessment (GHD 2010b).	October 2010 (1 day)	Site inspection searching for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	2.5 km.
Western Ringtail Possum Survey & Black Cockatoo Habitat Assessment of Sabina Vale Loc 3819 (Harewood 2013).	(i) 26 March 2013 (ii) 2 April 2013 (1 day, 1 night)	Targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possum (scats, dreys, sightings). Nocturnal survey for Western Ringtail Possums.	1 Western Ringtail Possum, 195 black-cockatoo habitat trees (13 with hollows).	30 km.
Bunbury Outer Ring Road Southern Section, South Western to Bussell Highways (GHD 2012).	21 – 23 September 2011 (3 days)	Targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possum (scats, dreys, sightings).	565 black-cockatoo habitat trees, secondary evidence of Western Ringtail Possum (<3 sightings).	Overlapping Proposal area.
Main Roads Lot 1 Ducane Road Environmental Values Assessment (GHD 2014).	12 – 13 June 2013 (2 days, 1 night)	Level 1 and targeted daytime searches for cockatoo habitat trees and evidence of Western Ringtail Possums (scats, dreys, sightings). Nocturnal survey for Western Ringtail Possums.	38 black-cockatoo habitat trees, 1 Western Ringtail Possum recorded during night survey.	Overlapping Proposal area.
Shire of Dardanup Waterloo Urban and Industrial Expansion Flora and Fauna Survey (GHD 2015).	(i) 13 – 14 August 2014 (ii) 29 – 31 October 2014 (5 days)	Black cockatoo and Western Ringtail Possum habitat assessment. Evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	6 km.
Bunbury Port Access Road Project Stage 2 Rare Fauna Survey (GHD 2010c).	(i) 17 February – 5 March 2009 (ii) 4 – 7 August 2009 (8 days, 5 nights)	Level 1 fauna survey.	3 Western Ringtail Possums, black-cockatoo confirmed.	Partially overlapping.
Bunbury Outer Ring Road (Southern Section) Black Cockatoo Tree Survey (Biota 2018a).	13 – 15 November 2017 (3 days)	Cockatoo habitat tree assessment.	649 black-cockatoo breeding habitat trees (139 with hollows).	Largely within Proposal area.
Bunbury Outer Ring Road, Southern Section Western Ringtail Possum Assessment (Biota 2018b).	25 February – 5 March 2018 (8 nights)	Targeted survey for Western Ringtail Possum within the BORR Proposal area and contextual sites (Reserve 23,000, Lot 1 and Lot 2).	136 Western Ringtail Possums.	Largely within Proposal area.
Phase 1 Survey for the Western Ringtail Possum in the BORR, Lot 1 Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities (Biota 2018c).	10 – 13 July 2018 (3 nights)	Targeted survey for Western Ringtail Possums	73 Western Ringtail Possums.	Some sites overlapping and otherwise all within 5 km.

Report / Survey	Survey Dates (effort)	Survey Description	Records	Proximity to Proposal Area
Phase 2 Survey for the Western Ringtail Possum in the BORR, Lot 1 Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities, Centenary Road, Golf Drive, Picton East (Biota 2018d).	22 August 2018 – 4 September 2018 (12 nights)	Targeted survey for Western Ringtail Possums	114 Western Ringtail Possums.	Some sites overlapping and otherwise all within 5 km.
Phase 3 Survey for the Western Ringtail Possum in the BORR: Southern Lots and Manea Park (Biota in prep.).	30 October – 5 November 2018 (6 nights)	Targeted survey for Western Ringtail Possums	143 Western Ringtail Possums.	Southern Lots are located within 1–6 km of the Proposal area and Manea Park is adjacent to the northern edge of the Proposal area.

### 4.3 Legislation and Policy Conformance

All surveys were completed as far as practicable in accordance with relevant State and Commonwealth policy, and to a standard that would provide adequate information to assess the Proposal against principles and environmental aims relating to the environmental factor 'Terrestrial Fauna' (EPA 2016a). Table 4.3 provides a summary of the most important and relevant legislation, policy and guidelines relating to this study.

**Table 4.3: State and Commonwealth legislation, policy and guidelines of most relevance to this study.**

Legislation, Guideline or Policy	Application to this Study	Regulating Authority
<b>Commonwealth</b>		
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (the EPBC Act).	The Australian Government's central piece of environmental legislation.	The Department of Environment and Energy
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013).	Details the species falling within the MNES category and what constitutes a significant impact.	The Department of Environment and Energy
Significant impact guidelines for the vulnerable western ringtail possum ( <i>Pseudocheirus occidentalis</i> ) in the southern Swan Coastal Plain, Western Australia (DEWHA 2009)	Details habitat classification.	The Department of Environment and Energy
EPBC Act referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo ( <i>Calyptorhynchus latirostris</i> ), Baudin's Cockatoo ( <i>Calyptorhynchus baudinii</i> ) and the Forest Red-tailed Black Cockatoo ( <i>Calyptorhynchus banksii naso</i> ) (DSEWPac 2012)	Details distribution, ecology and recommended survey methodology.	The Department of Environment and Energy
<b>Western Australia</b>		
<i>Biodiversity Conservation Act 2016</i> (BC Act) and Biodiversity Conservation Regulations 2018	Western Australia's central environmental legislation. Came into effect 1 January 2019 and replaces the <i>Wildlife Conservation Act 1950</i> .  Fauna taking (scientific or other purposes) licence	Department of Biodiversity, Conservation and Attractions
<i>Wildlife Conservation Act 1950</i> (WC Act)	Now defunct and replaced by the BC Act, however the most recently published Wildlife Conservation (Specially Protected Fauna) Notice 2018 under this act is current at time of writing.	Department of Biodiversity, Conservation and Attractions
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016a).	Overall aim of the study is to provide adequate information to assess the proposal against the objective of the environmental factor Terrestrial Fauna; stated to be "To protect terrestrial fauna so that biological diversity and ecological integrity are maintained".	Environmental Protection Authority
Western Ringtail Possum ( <i>Pseudocheirus occidentalis</i> ) Recovery Plan. Wildlife Management Program No. 58 (Department of Parks and Wildlife 2017)	Details ecology of the species and priority survey objectives.	Department of Biodiversity, Conservation and Attractions

## 4.4 Nomenclature

Consistent with the EPA (2016b) nomenclature for amphibians, reptiles and mammals follows the standards of the WA Museum fauna taxonomic checklist, which is revised and released every six months or as necessary while avifauna nomenclature is in accordance with Christidis and Boles (2008).

## 4.5 Timing, Team and Permits

The field survey was conducted in five phases over the course of spring and summer 2018, and winter 2019 as detailed in Table 4.4. Multiple phases were conducted as access to private land became available.

In relation to the timing of typical black-cockatoo presence on the Swan Coastal Plain, the surveys in September, October and November should have been well placed to record foraging activity of all species. The timing of breeding peaks in summer for all three species, although this can be flexible in Forest Red-tailed Black-cockatoo, so there was also the possibility of recording the onset of breeding.

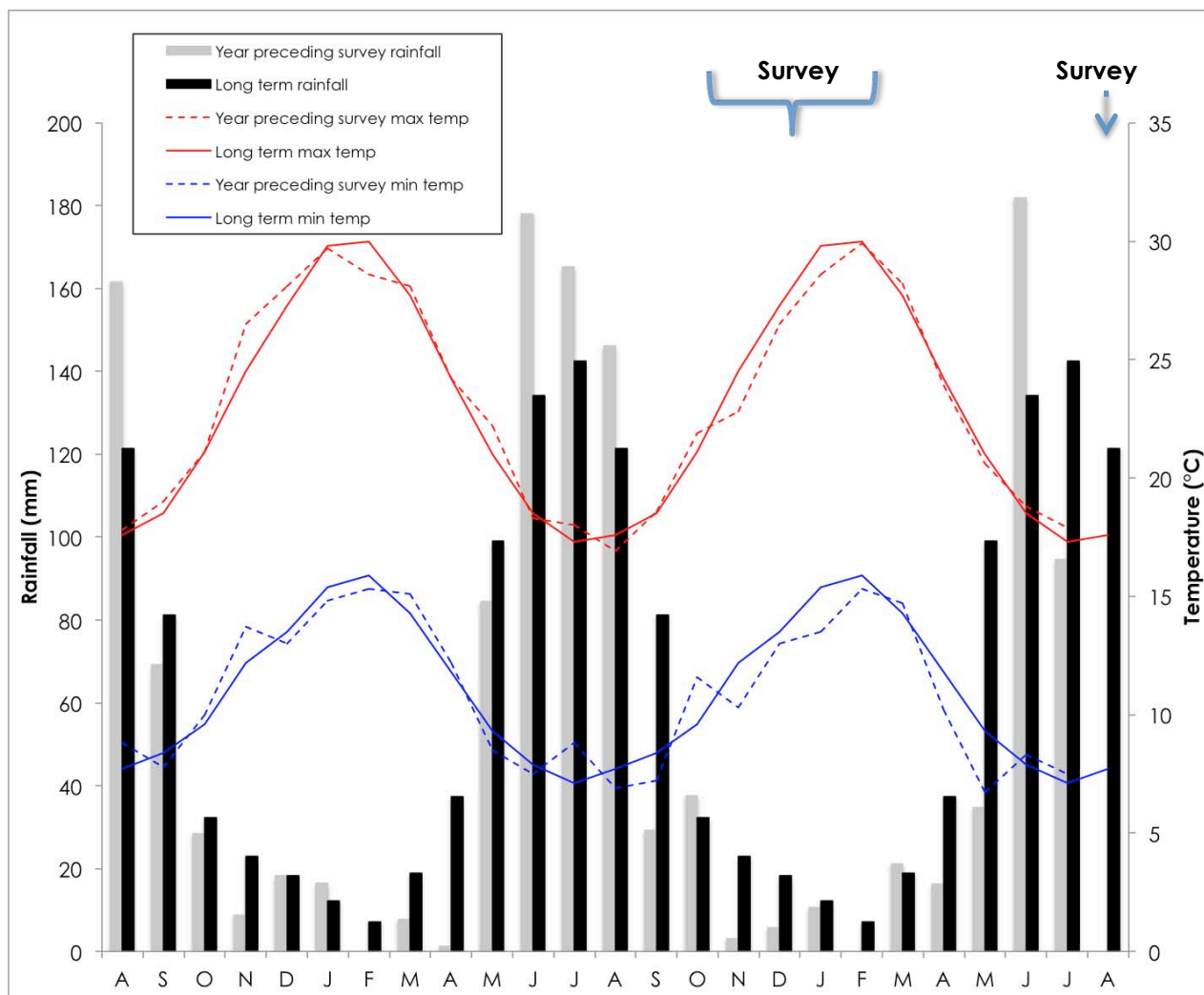
**Table 4.4: Summary of survey timing and weather conditions.**

Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
1/10/18	Black cockatoo habitat assessment, Nocturnal searches	Victoria Ford, Michael Greenham, Joshua Keen, Brandon King	11.3	20.9	0
2/10/18			9.6	21.8	0
3/10/18			10.2	21	0
4/10/18			12.4	22.7	4.4
5/10/18			15.1	20.9	0.2
6/10/18			12.7	21.2	0.6
Avg./Total			11.9	21.4	5.2
30/10/18	Black cockatoo habitat assessment,	Victoria Ford, Joshua Keen, Brandon King	10.7	23.1	0
31/10/18			9.8	22.6	0
1/11/18			7.7	19.4	0
2/11/18			12.1	19.8	0
3/11/18			11.5	22.4	0.2
4/11/18			7.9	20	0
5/11/18			10.6	18.2	0.6
Avg./Total			10.0	20.8	0.8
28/11/18	RPA survey of hollow-bearing trees	Joshua Keen, Shane Priddle	10.3	22.4	0
29/11/18			9.8	24.2	0
30/11/18			7.3	21.3	0
1/12/18			12.7	21.8	0
2/12/18			7.3	24.2	0
3/12/18			11.1	32.3	0
4/12/18			13.8	22.2	0
5/12/18			11.5	21.9	0
6/12/18			12.6	20.7	4.8
7/12/18			7.8	22.1	0
8/12/18			11.8	24.7	0
9/12/18			12.4	29.9	0
			Avg./Total	10.7	24.1
12/12/18				14.6	23.8
29/01/19	Black cockatoo habitat and hollow assessment	Jacinta King, Joshua Keen	11.2	28.3	0
30/01/19			10.4	30.9	0
1/02/19	RPA assessment	Joshua Keen,	17.7	35.0	0

Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
		Shane Priddle			
17/08/19	Western Ringtail Possum Strip Searching	Joshua Keen Pierre-Louis de Kock	7.3	15.7	18.8
18/08/19			2	17.4	0
19/08/19			3.1	18	0
20/08/19			3.3	19.6	0
Avg./Total			3.9	17.7	18.8

Data from Bureau of Meteorology recording station Carey Park (No. 9965), near Bunbury.

Conditions in the year preceding the survey were typical of long-term averages, although the winter immediately preceding the 2018 spring/summer survey work was slightly wetter than average (Figure 4.1). This would be expected to have a positive effect on foliage productivity and food resources for the Western Ringtail Possum and black-cockatoo species.



**Figure 4.1:** Average monthly weather conditions in the year preceding the field surveys (October 2017 through August 2019) compared with long-term climatological averages (data from the Bureau of Meteorology station at Carey Park, 1995–2018).

With the exception of RPA pilot Shane Priddle (SW Environmental), all team members were Biota biologists. GIS mapping and calculations were undertaken by Paul Sawers and Brandon King of Biota.

The fauna survey was conducted under Regulation 17 "Licence to Take Fauna for Scientific Purposes" Permit No. 08-002773-2 issued by the DBCA to Dr Victoria Ford (Appendix 2).

## 4.6 Western Ringtail Possum

The Proposal area was searched for Western Ringtail Possums using a strip-sampling approach, whereby areas of vegetation were mapped and divided into 20 m wide strips using GIS. Strips were loaded onto tablets with a GPS accuracy within 1.5 m and each strip was searched by a zoologist, who walked down the middle of the strip and treated the two edges of the 20 m strip as boundaries. The survey was conducted by two zoologists for four nights from 17 to 21 August 2019. Survey work commenced when conditions became effectively dark (30 minutes after sunset) and were typically complete by 1:00 am. Searching for possums was conducted using a high-powered head torch. In the case of road reserves and where roadside vegetation was continuous, one person walked through the middle of the vegetation. In areas where the road reserve comprised only scattered single trees, spotlighting was conducted from a vehicle. In all cases, the location of an observed possum was recorded while standing directly below the animal.

A 20 m strip-width was used based on modeling of Distance sampling data accumulated from over three thousand detections of Western Ringtail Possums, indicating a probability of detection of greater than 98% at a distance of up to 10 m from a transect (Biota 2018c, 2018d). We are therefore confident that the number of recorded individuals is an accurate estimate of total abundance.

In open pasture with scattered trees, searching individual paddock trees was undertaken in favour of strips searches.

From GPS tracklogs taken during the exercise, 66.5 km was walked on foot while 7.5 km of road reserve was spotlighted from a vehicle. The total area searched for possums was 100 ha. Due to property access restrictions, some small areas of vegetation shown in Figure 5.3 could not be sampled. These restrictions affected 39.8 ha of the Proposal area although not all of this area was vegetated.

### 4.6.1 Data Collected

The following information was recorded with every Western Ringtail Possum (and other species) observation

- Species;
- Observer;
- Animal location using GPS, taken while standing directly underneath;
- Time;
- Number of individuals;
- Age class: Subadult independent, Adult, Adult with young at heel, or Female with young on back;
- Cue: Seen (eyeshine), Seen (no eyeshine), Heard, or Silhouette;
- Drey or hollow at observation point; and
- Dominant habitat.

## 4.7 Brush-tailed Phascogale and Chuditch

The spotlighting methods applied to the sampling of Western Ringtail Possum were considered equally applicable to the Brush-tailed Phascogale and Chuditch.

## 4.8 Black-cockatoos

### 4.8.1 Breeding Habitat Assessment

At the time of writing this report, the field assessment relating to black-cockatoos had been completed over the survey area as shown Figure 3.1 and Figure 4.2, which includes much of the Proposal area but does not wholly encompass it. The unsurveyed gap between the survey area and Proposal area was 109.73 ha, however based on aerial imagery 81.48 ha of this is cleared land, leaving 28.25 ha of remnant vegetation within the Proposal area that is yet to be assessed.

This report provides a synthesis of the black-cockatoo breeding habitat assessment conducted in the Jilley Road to Bussell Highway portion of the survey area in 2017 (Biota 2017) and further surveys to assess the remainder of the survey area in spring 2018 and summer 2018/2019 (see Table 4.4 for dates of survey phases).

The Commonwealth "Referral guidelines for three threatened black cockatoo species: *Carnaby's cockatoo* (endangered), *Calyptorhynchus latirostris*; Baudin's cockatoo (vulnerable), *Calyptorhynchus baudinii*; Forest red-tailed black cockatoo (vulnerable), *Calyptorhynchus banksii naso*" defines breeding habitat as those species of trees known to support breeding within the range of the species, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (DBH greater than 50 cm for most eucalypts, or 30 cm DBH in the case of Wandoo and Salmon Gum) (DSEWPaC 2012a). With regard to foraging habitat for black-cockatoos, the referral guideline states that any area within the range of the black cockatoos that contains known food or nesting plant species is considered to be potential habitat for the species.

The aim was to assess, as far as practicable, all potential breeding habitat trees and foraging habitat quality and extent within the survey area. Two approaches were taken:

1. Larger areas of continuous vegetation were identified from aerial imagery and overlain with 25 m spaced transects in GIS. Using a GPS, a biologist walked up the middle of each 25 m wide transect assessing all trees within it;
2. For smaller areas (e.g. narrow roadside reserves) or areas comprising scattered trees in paddocks, a biologist would maintain a GPS track file while using aerial imagery to visit as many trees as possible.

All individual trees of species with potential to form hollows (primarily Jarrah, Marri, Tuart and Flooded Gum) and with sufficient diameter to be considered breeding habitat trees (DBH >50 cm) were recorded using a GPS (accurate to within 3 m). Furthermore, the position of trees observed to contain hollows potentially suitable for black-cockatoo nesting was recorded using differential GPS (accurate to within 1.5 m) and the following parameters were scored:

- DBH (diameter at breast height; approximately 1.3 m above the ground);
- tree height using a laser rangefinder;
- tree species;
- the number and height above the ground of observed hollows;
- the diameter of each hollow;
- signs of cockatoo use (including wear around hollows, nut chews, scarring, scratch marks on trunks and branches, secondary evidence of feeding sites and moulted feathers); and
- photographs were also taken as a visual reference and to aid future identification of the tree.



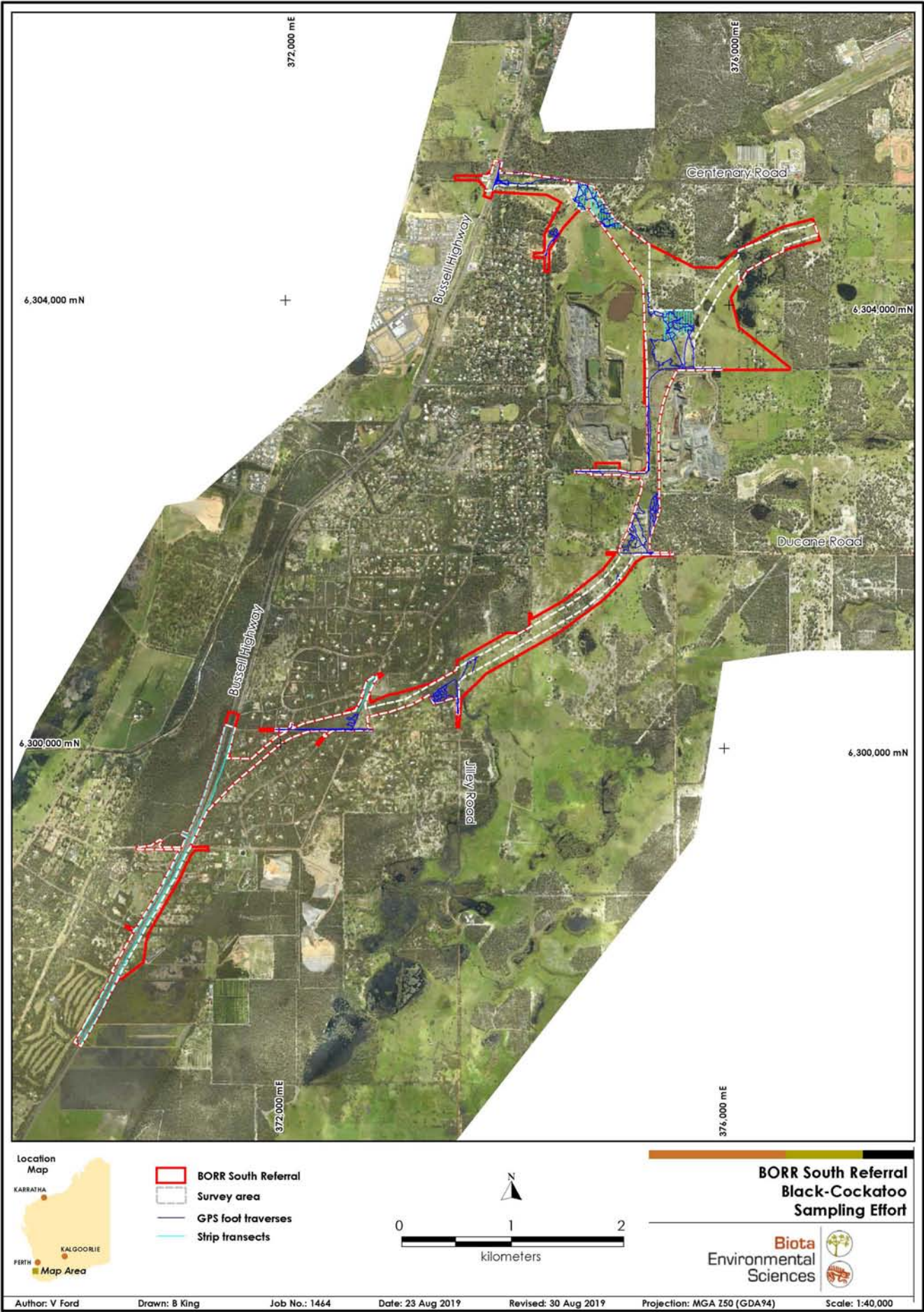


Figure 4.2: Survey effort applied to assessing black-cockatoo habitat within the Proposal area.



#### 4.8.1.1 Black-Cockatoo Breeding Hollow Assessment Field Methodology

Black-cockatoos on the Swan Coastal Plain breed in large hollow-bearing trees, generally within woodlands and forests (Johnstone and Kirkby 2011). Hollow formation results from a number of processes including fungal infection, termite activity and fire, and propensity for hollow formation varies between eucalyptus species (Whitford and Williams 2002). Studies on hollow formation in Jarrah/Marri forests identified a minimum tree age of 130 years before a tree would be suitable for hollow-dependent fauna (Whitford and Williams 2002). Habitat destruction, and the subsequent loss of suitable breeding hollows, has been identified as a process leading to population decline of black-cockatoos (Johnstone and Kirkby 2008). Furthermore, increased competition with both native and introduced species (e.g. ducks, Galahs and European Honey Bees) continues to reduce the availability of such trees for breeding sites (Johnstone et al. 2013).

Studies of the breeding behaviours of the three threatened black-cockatoo species have identified variation between the tree species and characteristics of hollows chosen for nesting (Table 4.5). For example, hollows formed in Jarrah are typically smaller than those in Marri, and Forest Red-tailed Black-cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the Southwest of WA (Johnstone et al. 2013). Breeding records of Carnaby's Black-cockatoo on the Swan Coastal Plain indicate that the majority of their nests are in Tuart (Johnstone and Kirkby 2011).

**Table 4.5: Breeding habitat for the three Threatened black-cockatoo species.**

	<b>Baudin's</b>	<b>Carnaby's</b>	<b>Forest Red-Tailed</b>
Specific breeding habitat for the three black-cockatoo species	Nest in hollows in live or dead trees of Karri, Marri, Wandoo and Tuart.	Nest in hollows in live or dead trees of Salmon Gum, Wandoo, Tuart, Jarrah, Flooded Gum, York Gum, Powderbark, Karri and Marri.	Nest in hollows in live or dead trees of Karri, Marri, Bullich, Swan River Blackbutt, Tuart and Jarrah.
<b>Hollow Characteristics</b>			
Aspect	No preference. Does not affect nesting success (Saunders 1979).	No preference. Does not affect nesting success (Saunders 1979).	–
Depth	Ranges from 0.1 to 2.5+ m (Johnstone and Kirkby 2011).	Majority between 0.5 and over 2.0 m, average just over 1 m (Saunders 1979).	1.0 - 5.0 m (Johnstone and Kirkby 2011).
Height above ground	No preference (Serventy and Whittell 1976).	No evidence that higher hollows are preferred (Saunders 1979).	No preference (Johnstone and Kirkby 2011).
Living or dead	No preference (Saunders 1979).	No preference (Saunders 1979).	No preference (Saunders 1979).
Entrance Diameter	–	–	>12 cm (Johnstone and Kirkby 2011).

For all hollow-bearing trees >50 cm DBH, which also contained hollows greater than approximately 12 cm dimension, a follow-up survey was conducted using a remotely-piloted aircraft (RPA; DJI Mavic Pro) to assess the suitability of these hollows for black-cockatoo breeding. The RPA assessment was applied both to hollows identified during the earlier study in 2017 (Biota 2017) and those recorded in the more recent assessment of additional areas.

The RPA exercise was carried out by two biologists, one of whom was also an experienced RPA pilot (Shane Priddle of SW Environmental). A pre-flight assessment of the tree was completed to ensure proper flight conditions and confirm the order in which hollows would be assessed. Prior to flight, the side of the tree was raked with a branch, which will generally cause any black-cockatoo or other bird species within a hollow to emerge. Not only does this provide an indication of hollow use but also reduces the likelihood of RPA-fauna collision.

During the flight stage of the RPA survey, the pilot was responsible for flying the RPA and the spotter monitored the surroundings to ensure the aircraft was not in close proximity to branches and informed the pilot if any birds fled the hollows.

Photographs of the hollows were then assessed in detail to determine if they actually represented suitable hollows and/or if they showed any signs of current or previous use by black-cockatoos (e.g. chew marks around the hollow entrance).

Breeding suitability of the hollows examined was categorised as per Table 4.6.

**Table 4.6: Categories of hollow suitability for black-cockatoo nesting.**

Category	Characteristics
Suitable	<ul style="list-style-type: none"> <li>Entrance greater than 12 cm.</li> <li>Branch width and depth large enough to support a suitably-sized nesting chamber.</li> <li>Angle of entrance allows egress for black-cockatoo.</li> <li>Entrance is clear of large branches and excessive foliage that would block access for black-cockatoo.</li> </ul>
Suitable with evidence of use	<p>As for "Suitable" above, but also showing evidence of use that may be from black-cockatoos. The following represent the types of use that were observed:</p> <ul style="list-style-type: none"> <li>Fresh chews around the rim and inside of the hollow.</li> <li>Freshly cleared vegetation around the entrance.</li> <li>Eggs that were similar in appearance to those of black-cockatoos.</li> </ul> <p>Neither black-cockatoos at/in hollows or fledglings were observed during the survey, however this may reflect timing of the survey, which preceded the peak breeding period.</p>
Limited suitability	Hollows with an entrance greater than 12 cm, and which included some, but not all of the characteristics of a "Suitable" hollow.
Not Suitable	Not a hollow, or hollow not suitable for black-cockatoo nesting.
Ground assessment only	The hollow could only be assessed from the ground due to limitations with RPA access (e.g. proximity to road traffic, within a prescribed no-fly zone, foliage covering hollow).

#### 4.8.2 Foraging Habitat Assessment

Foraging habitat is defined as areas including plants of species known to support foraging within the range of each cockatoo species. While a broader range of species is utilised for foraging (including introduced species such as pines, *\*Pinus* spp.), Marri and Jarrah woodlands are particularly important to Baudin's Black-cockatoo and the Forest Red-tailed Black-cockatoo, while proteaceous heaths (i.e. shrublands dominated by *Banksia*, *Hakea* and *Grevillea* species) are also utilised by Carnaby's Black-cockatoo (DSEWPac 2012a).

While conducting assessments of breeding habitat in the areas shown in Figure 4.2, foraging habitat and foraging evidence were opportunistically recorded. Not all locations of foraging evidence were recorded, as these were too numerous for this to be practicable. However, generally any first encounter with foraging evidence within a vegetation fragment was recorded and subsequent encounters were also recorded if they were indicative of an additional species utilising the area.

## 4.9 Limitations

A number of potential limitations, including those identified in EPA (2016b), have been considered in relation to the study (Table 4.7).

**Table 4.7: Assessment against potential survey limitations.**

Potential Limitation	Assessment
Availability of contextual information at a regional and local scale	<ul style="list-style-type: none"> <li>To provide context for estimates of Western Ringtail Possum numbers in the Proposal area, additional sites outside the Proposal area were sampled using consistent methodology.</li> <li>Seven surveys targeting Western Ringtail Possums and/or black-cockatoos have been conducted within 20 km of the Proposal area and were reviewed to provide local context.</li> <li>Contextual information was not considered a limitation.</li> </ul>
Competency/ experience of the team carrying out the survey, including experience in the bioregion surveyed	<ul style="list-style-type: none"> <li>The field personnel conducting the work were all suitably qualified.</li> <li>A core group of personnel completed all survey phases to standardise recording as far as practicable.</li> <li>Competency was not considered to be a limitation.</li> </ul>
Proportion of fauna recorded and/or collected, any identification issues	<ul style="list-style-type: none"> <li>This study targeted specific fauna species of conservation significance. The study comprehensively sampled the occurrence of habitat for these species within the Proposal area.</li> <li>There is potential for suitable breeding hollows to be missed, as recorders were limited in detecting hollows from ground level and their view may have been blocked by foliage or the aspect of the hollow entrance.</li> <li>Within the Proposal area, seven trees could not be assessed using the RPA due to foliage obstructing the hollow.</li> </ul>
Appropriate area fully surveyed (effort and extent)	<ul style="list-style-type: none"> <li>As detailed in Section 3.0, the survey area represented a large portion of the Proposal area but not the entirety.</li> <li>The extent of survey was considered to be a limitation in relation to the black-cockatoo habitat assessment of the Proposal area, but was not a limitation for the Western Ringtail Possum targeted work, which were surveyed over the whole Proposal area.</li> </ul>
Access restrictions within the survey area	<ul style="list-style-type: none"> <li>Access was not permitted for some properties occurring within the Proposal area when conducting the Western Ringtail Survey of August 2019, comprising a total of 39.8 ha. This was not considered a limitation to the assessment of WRP occurrence.</li> </ul>
Survey timing, rainfall, season of survey timing / weather / season / cycle	<ul style="list-style-type: none"> <li>Survey timing was not considered to be a limitation to the assessment of breeding habitat for black-cockatoos and the survey of Western Ringtail Possum.</li> </ul>
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey	<ul style="list-style-type: none"> <li>Disturbances were not considered a limitation to the survey.</li> </ul>

## 5.0 Results

### 5.1 Desktop Review

Tables detailing all species returned from the desktop review are presented as Appendix 3. Database search results, together with four studies within 10 km of the Proposal area, yielded a combined species inventory of 223 vertebrate fauna species, comprising 25 mammals (14 native non-volant mammals, one bat and 10 non-native species), 159 birds (63 of which are largely reliant on freshwater or marine habitats), 29 reptiles and 10 amphibians.

A total of 21 of these species are of conservation significance; these are considered in more detail in Section 6.0.

### 5.2 Fauna Habitats

Approximately 192.8 ha of the 296.8 ha Proposal area represents land historically cleared for agriculture, housing and road infrastructure while 104.0 ha of predominantly native vegetation remains. Of this 104.0 ha of native vegetation, ground-truthing and habitat mapping was conducted over the 75.72 ha occurring within the survey area as illustrated in Figure 5.1 and Figure 5.2.

Three broad fauna habitats were described from on-site descriptions and vegetation mapping conducted by the BORR Integrated Project Team (2019). Some refinement of fauna habitat within vegetation units was necessary; for example, Eucalypts within a road reserve were considered to represent a different fauna habitat to a large fragment. The three broad fauna habitats described for the survey area are detailed in Table 5.1, while their extent is illustrated in Figure 5.1 and Figure 5.2. The habitats comprised Marri/*Eucalyptus* woodland (42.55 ha), Marri/*Eucalyptus* scattered trees in paddocks and road reserves and (16.81 ha), and Dampland with *Melaleuca* shrubland and/or woodland (16.36 ha). The mid-storey and lower strata of the Marri/*Eucalyptus* woodland varied throughout the survey area, particularly in the predominance of *Agonis* and *Banksia*.

The Marri/*Eucalyptus* woodland habitat of the survey area was dominant in the Jilley Road to Bussell Highway portion of the Proposal area. Dampland was for the most part located in the northern portion of the survey area. Only one area was found to support free water, despite much higher than average winter rainfall preceding the survey, indicating that these dampland areas are rarely inundated.


A considerable proportion of the vegetation occurred as single trees or small stands within paddocks and road reserves. Both of these habitat types have the potential to represent linkages that allow fauna to disperse throughout the landscape, although their usefulness is likely to vary considerably between species depending on their mobility (e.g. black-cockatoos greater than Western Ringtail Possum). For paddock remnants, their usefulness as stepping-stones may be reduced in instances where they are fenced or there is little or no understorey due to grazing. Utilisation of this habitat type by Western Ringtail Possums was demonstrated in this study, with a relatively high density recorded within Lot 100 Bussell Highway (see Figure 5.3). Although much of the understorey had been grazed and the canopy was not continuous, the possums were distributed throughout. This area of broken habitat was contiguous with Manea Park, an area of continuous woodland habitat also supporting the Western Ringtail Possum.

The Jilley Road to Bussell Highway portion of the Proposal contains areas of uninterrupted woodland. The residential properties surrounding this south-western section of the alignment are also heavily wooded, although they do not support the same degree of canopy connectivity and are subject to anthropogenic disturbance. The Shire of Capel Reserve 23000 directly west of the Bussell Highway at the southern end of the Proposal area also contains areas of similar undisturbed habitat where the Western Ringtail Possum has been recorded.

A limitation of any habitat classification system is that it is not specific to any one species. Rather, the classification provides a convenient framework to summarise species occurrence. When considering habitat for individual species of elevated conservation significance, the habitat availability within the Proposal area has been considered in relation to particular species requirements and this is detailed in Section 6.0.



Table 5.1: Broad fauna habitats of the survey area.

Broad Fauna Habitat	Area (ha)	Example Photographs	
<b>Marri/<i>Eucalyptus</i> woodland</b>  Jarrah ( <i>Eucalyptus marginata</i> ) and Marri ( <i>Corymbia calophylla</i> ) dominated overstorey, varying understorey of Banksia ( <i>Banksia attenuata</i> and <i>B. grandis</i> ) and/or Peppermint ( <i>Agonis flexuosa</i> ).	42.55	 	
<b>Dampland with <i>Melaleuca</i> shrubland and/or woodland</b>  Shrubland or woodland of Moonah ( <i>Melaleuca preissiana</i> ) or Swamp Paperbark ( <i>Melaleuca raphiophylla</i> ), typically over sedges or introduced grasses.	16.36	 	

Broad Fauna Habitat	Area (ha)	Example Photographs	
<p><b>Marri/<i>Eucalyptus</i> in paddocks and road reserves</b></p> <p>Typically occurring as widely spaced trees or occasionally as small stands in paddocks; comprising a mosaic of scattered trees of Marri and/or Flooded Gum. When occurring as small stands, the midstorey typically comprised <i>Melaleuca</i> or Peppermint and the heavily grazed understorey comprised introduced grasses.</p>	16.81		



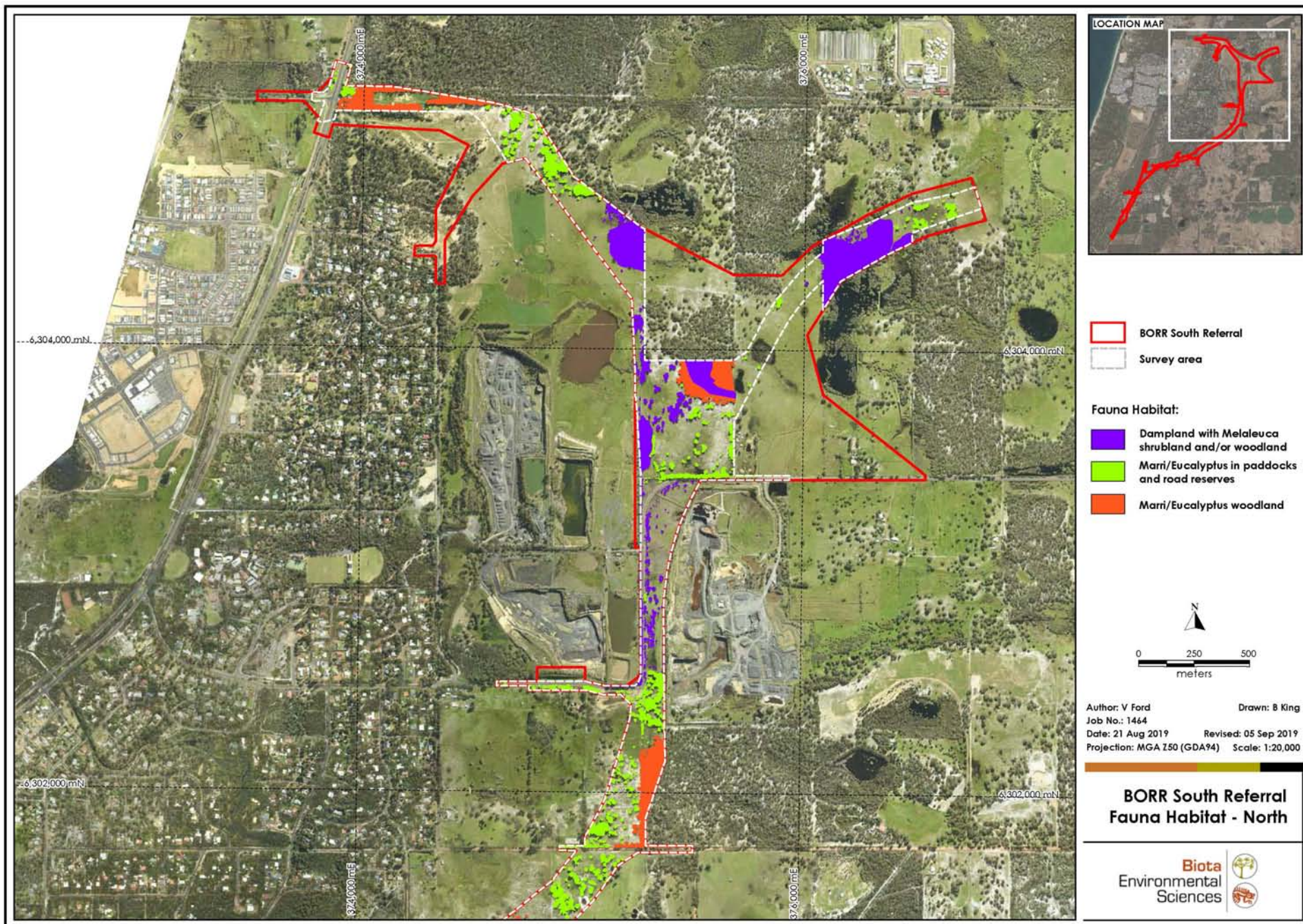


Figure 5.1: Broad fauna habitats of the Proposal area (north map 1/2).



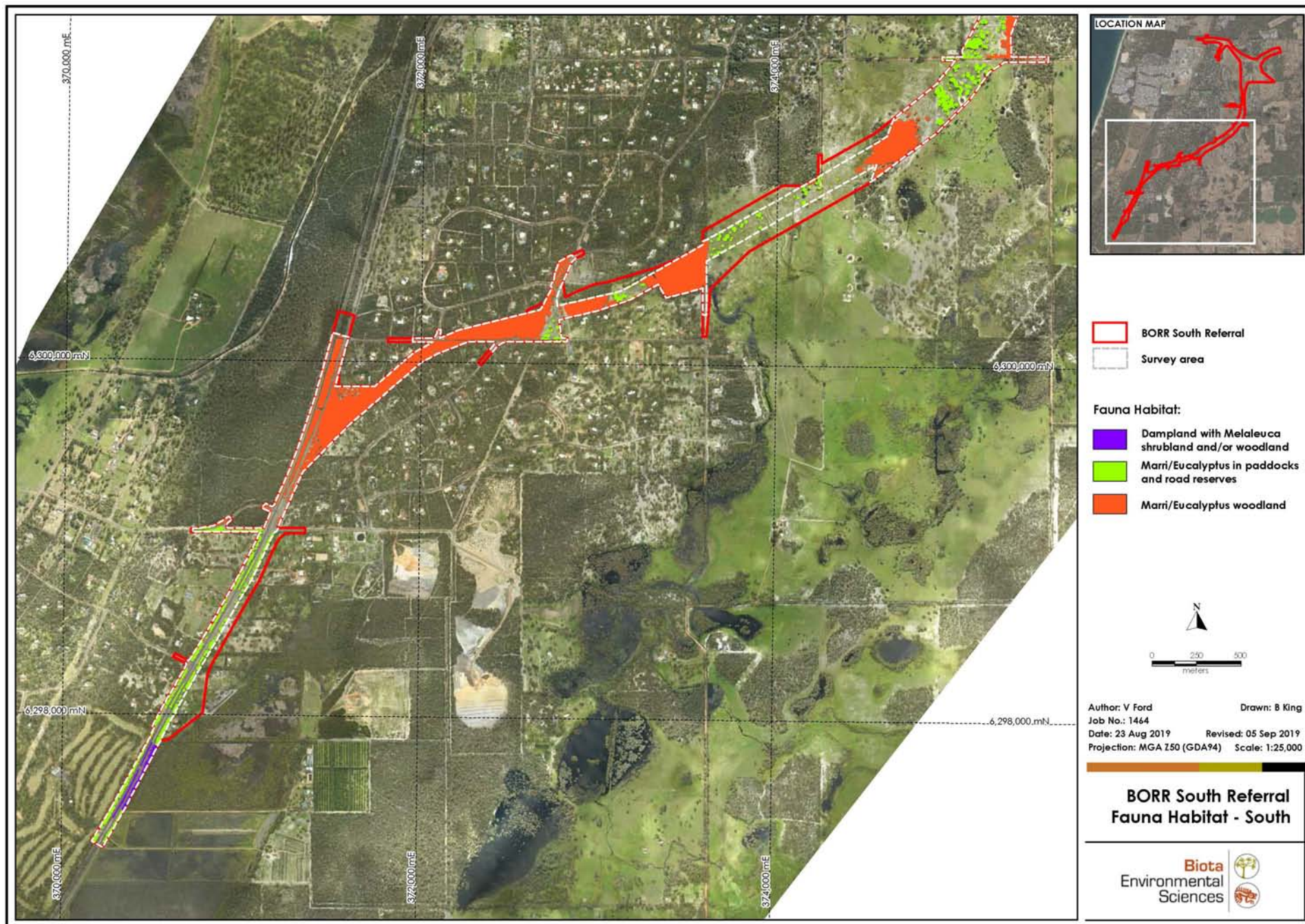


Figure 5.2: Broad fauna habitats of the Proposal area (south map 2/2).

## 5.3 Western Ringtail Possum

The strip sampling of the Proposal area yielded 73 individual Western Ringtail Possums from 59 observations. There were a total of 45 observations of singular adults, while the 14 remaining observations comprised pairs of possums; of the latter, four appeared to be female with young, and there were 10 pairs of adults.

Within the Proposal area, Western Ringtail Possums were found in habitats ranging from relatively isolated individual trees through to remnant vegetation strips (along road reserves and riparian belts) surrounded by cleared land, to larger remnants either isolated from or broadly contiguous with much larger remnants. Observations of possums were predominantly from Jarrah/Marri woodland habitat (28 observations), Peppermint (16 observations) and Banksia (11 observations), with four observations from other habitat types. Generally, the only habitat from which the Western Ringtail Possum was absent was seasonally inundated swamp, although they were found to occur in Peppermint trees bordering this habitat type.

The sampling effort as a track file and locations of observations of Western Ringtail Possums is shown in Figure 5.3. Examination of the track file in relation to vegetation mapped indicates that 81.3 ha of vegetation was searched for a density of 0.98 individuals per hectare searched. However, densities were not uniform throughout the Proposal area, with the highest density occurring in the corridor between Jilley Road and Bussell Highway; a total of 38 individuals were recorded within this 25.1 ha area, giving a density of 1.57 individuals per hectare.



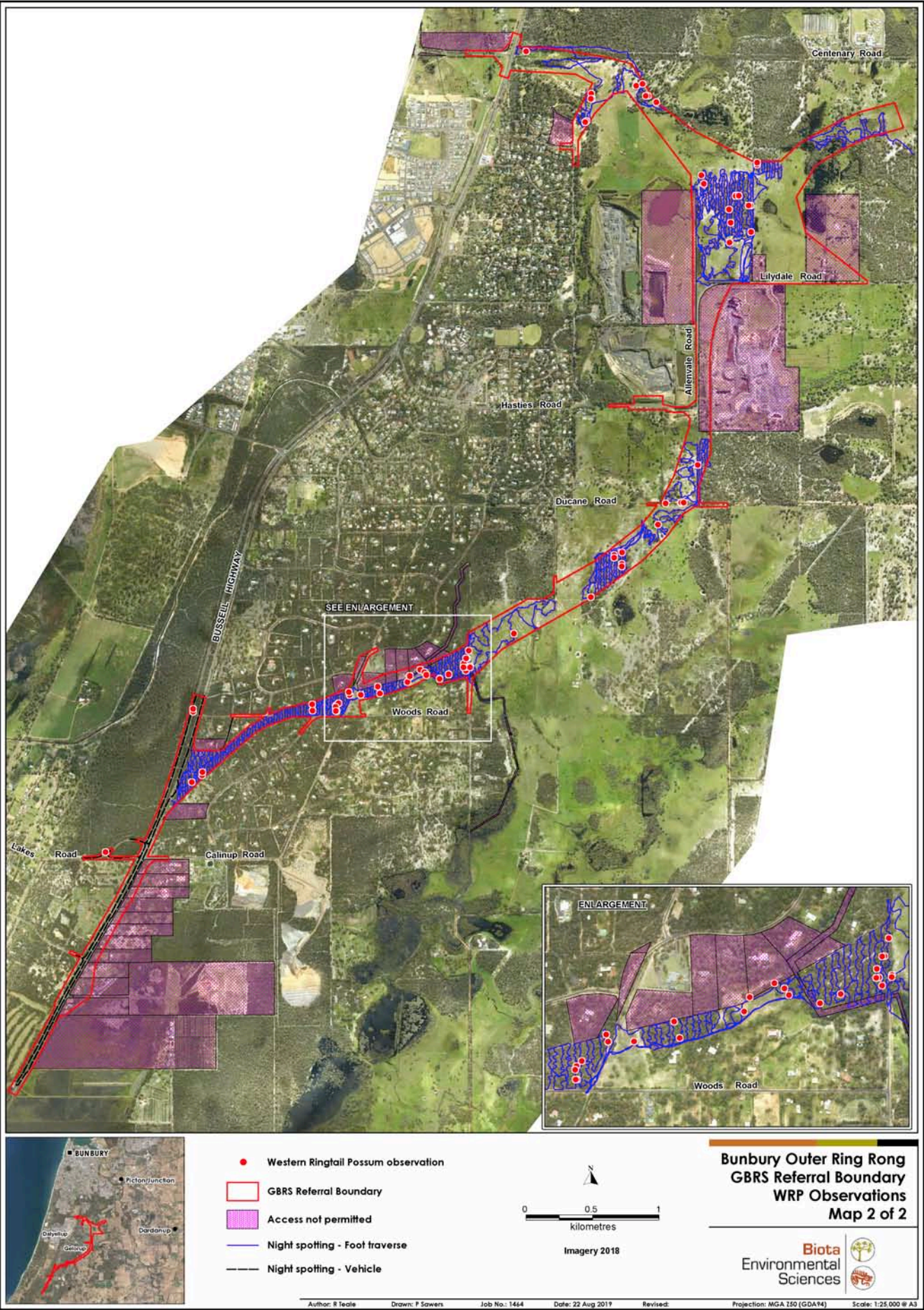


Figure 5.3: Records of Western Ringtail Possums from strip transects across the Proposal area.

## **5.4 Black-cockatoos**

### **5.4.1 Observations**

Black-cockatoos were not observed within the Proposal area, but were seen in close proximity on four occasions. Three of the records were of Forest Red-tailed Black-cockatoos, often observed feeding within Marri woodland, while one group of eight white-tailed black-cockatoos was also observed at a distance (these were not identifiable to species). The locations of black-cockatoo observations are shown in Figure 5.4.

### **5.4.2 Breeding Habitat Assessment**

Black-cockatoo breeding habitat trees were considered to be those of relevant species with a DBH of 50 cm or greater as defined in the Commonwealth referral guidelines (DSEWPaC 2012a). A total of 1,017 suitable DBH trees recorded within the survey area, comprising 551 Marri, 287 Jarrah, 115 Tuart and 64 of indeterminate species (largely dead stags and introduced Eucalypts). Of the 1,017 trees, 115 trees with hollows were the subject of a separate hollow-suitability assessment using an RPA, as described in Section 5.4.2.1.

The survey extent and locations of all trees with greater than 50 cm DBH are shown in Figure 5.5 and Figure 5.6.



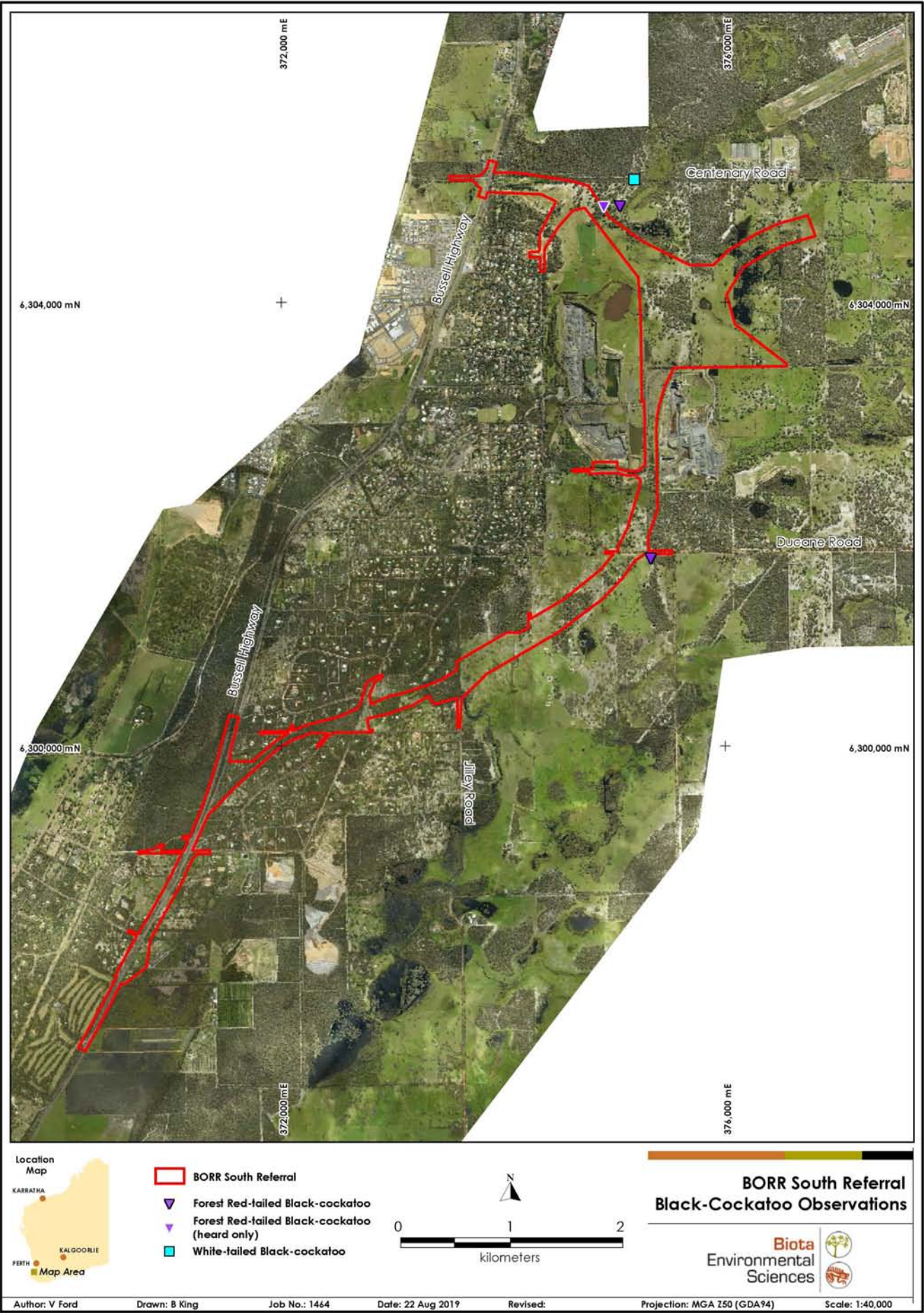
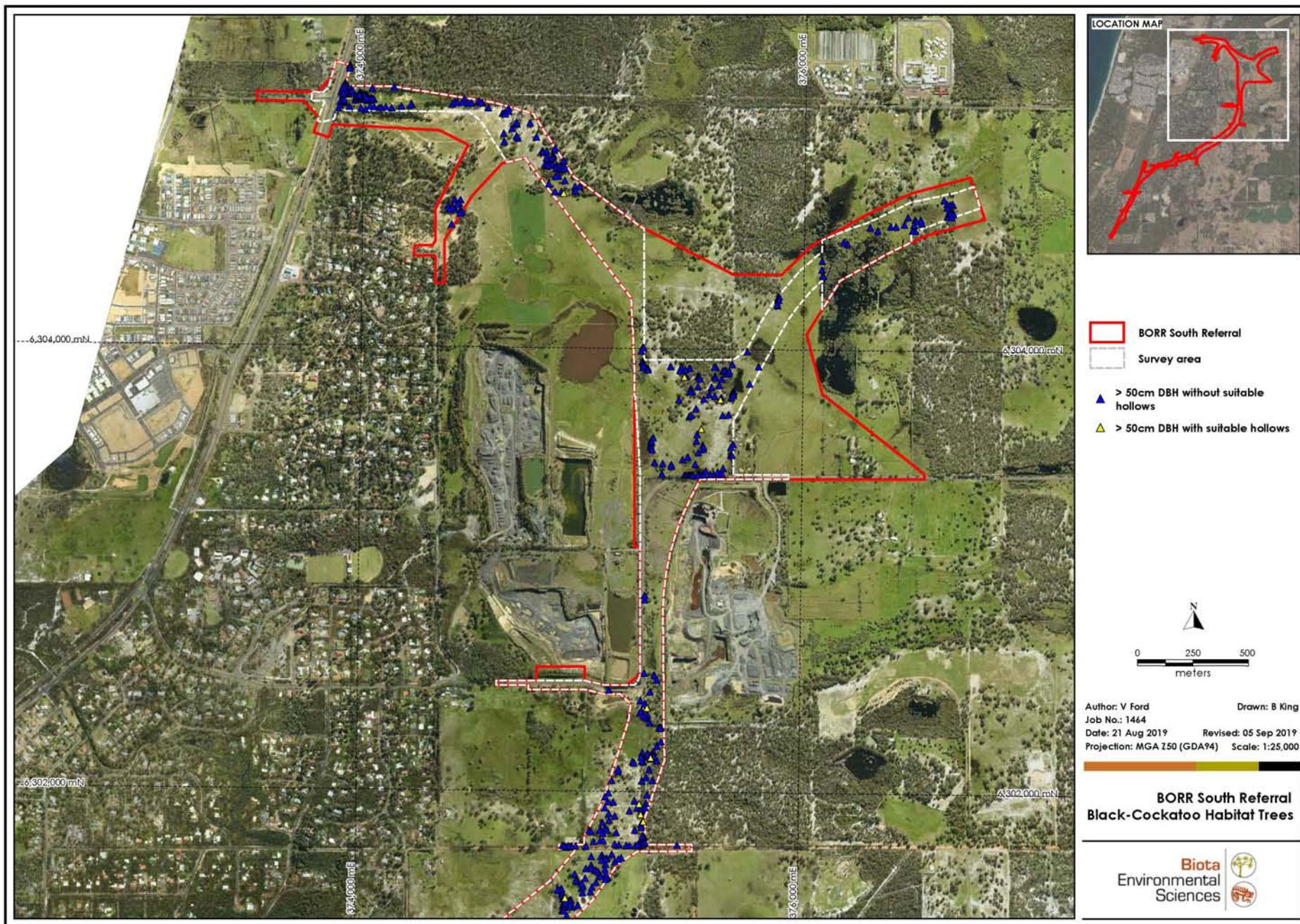


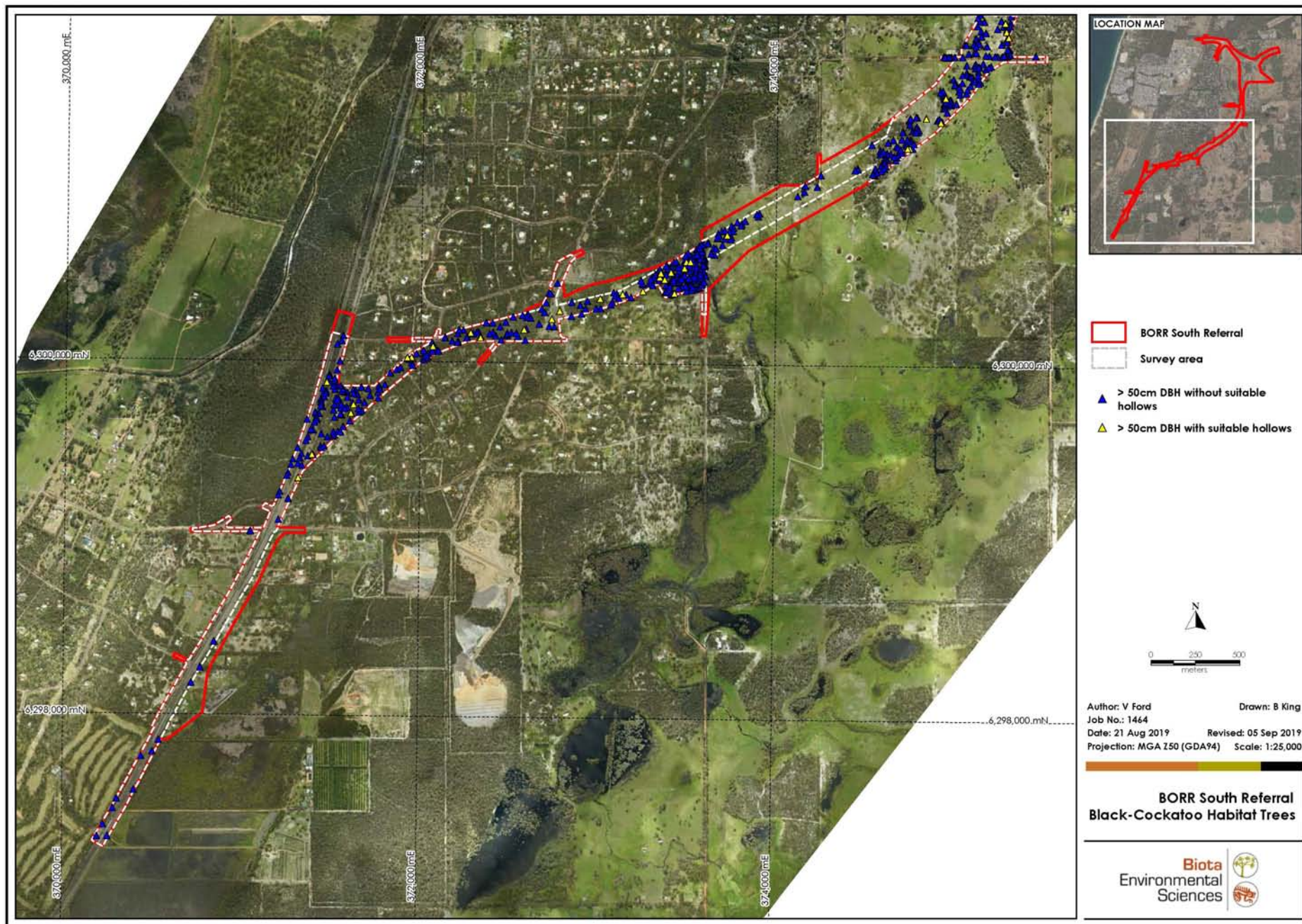
Figure 5.4: Black-cockatoo observations in relation to the Proposal area.





**Figure 5.5:** Trees >50 cm DBH of hollow-forming species recorded within the Proposal area, including those bearing suitable black-cockatoo breeding hollows (north map 1/2).





**Figure 5.6:** Trees >50 cm DBH of hollow-forming species recorded within the Proposal area, including those bearing suitable black-cockatoo breeding hollows (south map 2/2).



#### 5.4.2.1 Cockatoo Hollow Assessment

Of the 115 trees included in the hollow assessment, 18 trees were found to have a hollow suitable for black-cockatoo nesting, including eight that showed evidence of use (although not conclusively that of black-cockatoos); 24 trees had a hollow that fulfilled some but not all suitability criteria and so were designated "Limited suitability"; 64 trees did not contain any suitable hollows; and nine trees supported hollows that were not accessible by drone. A total of 233 hollows were assessed across the 115 trees. The results of the hollow assessment are displayed in Figure 5.7 and Figure 5.8. In this figure, for trees that had multiple hollows, the symbology represents the most suitable hollow.

No direct signs of black-cockatoo breeding were observed during either the current or the 2017 survey; that is, cockatoos were not observed returning to hollows to nest or tend to chicks. However, a Forest Red-tailed Black-cockatoo egg was found on the ground in the vicinity of breeding habitat trees during the 2017 study (Plate 5.1).



**Plate 5.1:** Forest Red-tailed Black-cockatoo eggshell found on the ground in 2017.

Examples of photographs taken from the survey area using the RPA are shown in Plate 5.2 and Plate 5.3.

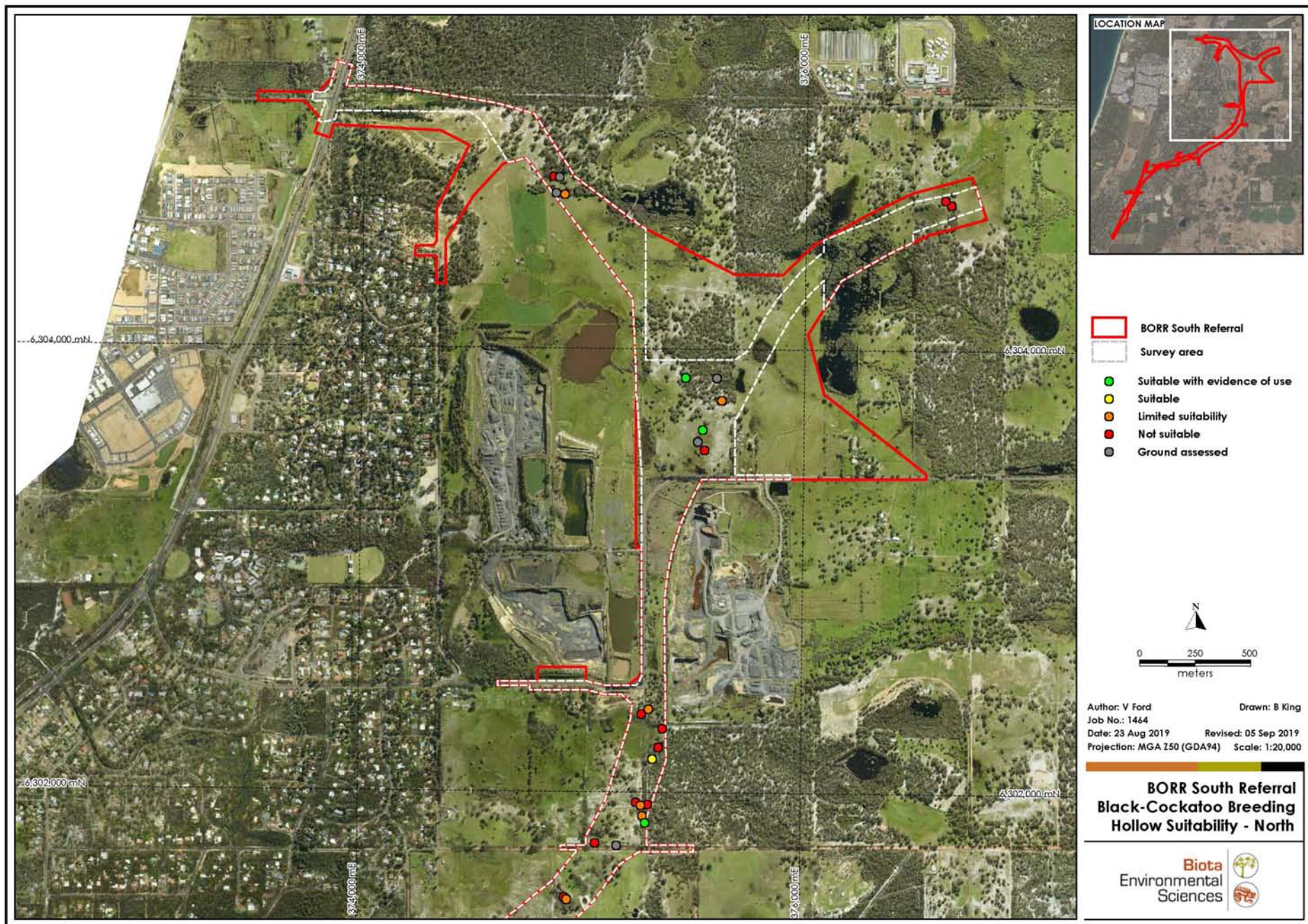


**Plate 5.2:** Common Brushtail Possum in hollow.



**Plate 5.3:** Suitable hollow but containing Wood Duck eggs.

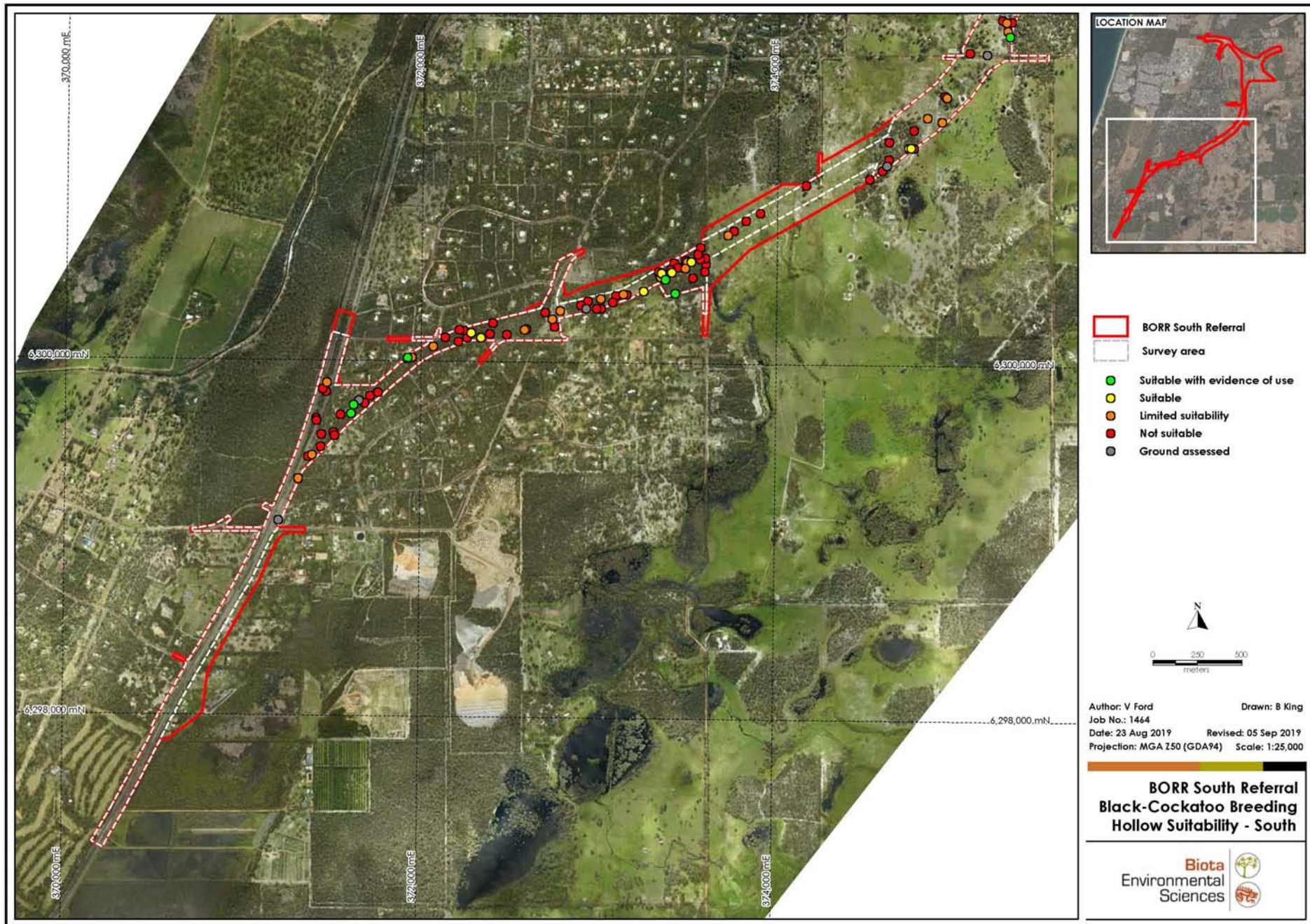




**Figure 5.7: Black-cockatoo breeding hollow suitability (north map 1/2).**

For multi-hollow trees, status of the most suitable hollow shown.





**Figure 5.8: Black-cockatoo breeding hollow suitability (south map 2/2).**  
 For multi-hollow trees, status of the most suitable hollow shown.



### 5.4.2.2 Foraging Habitat

The survey area included 59.36 ha of foraging habitat, primarily comprising Marri and Jarrah woodland. Evidence of all three species of black-cockatoo utilising this habitat was found during the field surveys. The areas of Marri/Eucalyptus woodland (42.6 ha) are considered to represent higher value foraging habitat than the areas of largely scattered Marri/Eucalyptus in paddocks and road reserves (16.8 ha).

Foraging by Forest Red-tailed Black-cockatoos and Carnaby's Black-cockatoo was most commonly recorded but also the more easily identified. However, Marri nuts with chew marks indicative of Baudin's Black-cockatoo were also located. Examples of Marri nuts with chew marks of each black-cockatoo species are shown as Plate 5.4 to Plate 5.6.



**Plate 5.4:** Carnaby's Black-cockatoo Marri nut chew.



**Plate 5.5:** Baudin's Black-cockatoo Marri nut chews.



**Plate 5.6:** Forest Red-tailed Black-cockatoo Marri nut chews.

The black-cockatoo foraging habitat within the Proposal area has been considered in the context of wider availability in Figure 5.9 by mapping the occurrence of each Swan Coastal Plain (DPaW 2017) vegetation complex both within the Proposal area and out to a 12 km radius. This radius was chosen as it represents the typical maximum distance that black-cockatoos will fly from roosting locations to forage.

Four vegetation complexes occur within the Proposal area (SCP Veg. 42, 44, 49 and 56); each is defined in Table 5.2 and their occurrence (in hectares) both within the Proposal area and out to a 12 km radius is presented. The large majority of the vegetation within the study area is mapped as SCP Veg. 44 and 49; together these comprise 93% of the native vegetation and both are dominated by suitable foraging plants for black-cockatoos.

The most common complex within the Proposal area is the Bassendean Complex Central and South (SCP Veg. 44), which occurs in fragments throughout the northern half of the Proposal area. Lot 1 Ducane Road, located directly east and adjacent to the Proposal area, represents an undisturbed example of this habitat type. The Karrakatta Complex-Central and South (SCP Veg. 49) occurs in the Jilley Road to Bussell Highway section of the Proposal area and is continuous with this same complex adjacent to the corridor, although it is interspersed by networks of roads and housing.

The Southern River Complex (SCP Veg. 42) occurs as small isolated fragments within the Proposal area, however significant large areas of the complex occur directly to the north of the Proposal area (e.g. in Manea Park). Little of the Yoongarillup Complex (SCP Veg. 56) remains in the local area. Of the vegetation complexes within the Proposal area, this complex represents lower quality foraging habitat for black-cockatoos, being generally devoid of preferred foraging plants (e.g. Marri, Jarrah and *Banksia*).

**Table 5.2: Occurrence of the Swan Coastal Plain vegetation complexes (DPaW 2017) within the Proposal area and out to 12 km.**

SCP Veg.	Complex Name	Complex Definition	Area in Proposal Area (ha)	Amount Remaining Within 12 km (ha)
44	Bassendean Complex – Central and South	Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (Jarrah) - <i>Allocasuarina fraseriana</i> (Sheoak) - <i>Banksia</i> species to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>Eucalyptus marginata</i> to <i>Eucalyptus todtiana</i> (Pricklybark) in the vicinity of Perth.	50.0	1,162.2
49	Karrakatta Complex – Central and South	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> - <i>Banksia</i> species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.	46.0	2,840.3
42	Southern River Complex	Open woodland of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> species with fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca raphiophylla</i> (Swamp Paperbark) along creek beds.	6.4	2,397.4
56	Yoongarillup Complex	Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterized by <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species open forests.	1.1	336.6



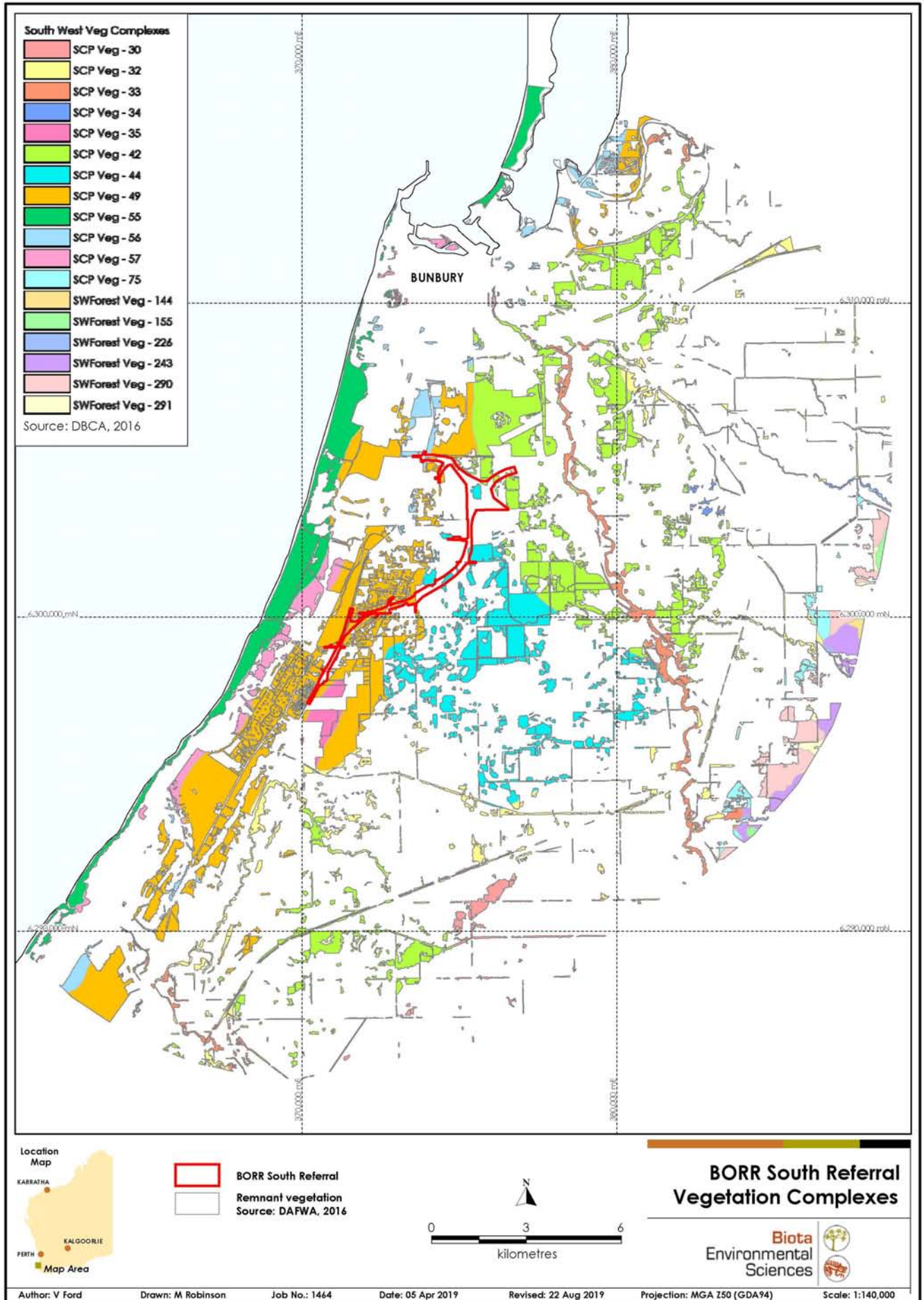


Figure 5.9: Remnant vegetation and Swan Coastal Plain Vegetation Mapping (DPaW 2017) within a 12 km radius of the Proposal area.



## 6.0 Conservation Significant Species

This section provides an assessment of the likelihood of occurrence of the target species and other conservation significant fauna species returned from the desktop; that is, those species protected by the EPBC Act, BC Act or listed as DBCA Priority species. Appendix 1 details categories of conservation significance recognised under these three frameworks.

As detailed in Section 4.2, the assessment of likelihood of occurrence for each species has been made based on availability of suitable habitat, whether it is core or secondary, as well as records of the species during the current or past studies included in the desktop review. Table 6.1 details the likelihood assessment for each conservation significant species returned from the desktop review. Further species information is provided in Sections 6.1 to 6.3.

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Table 6.1: Conservation significant fauna returned from the desktop review and their likelihood of occurrence within the Proposal area.

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	Lot 15 (2010)	BORR (2012)	Lot 1 Ducane (2014)	Waterloo (2015)	Nearest Record in km (year), No. of Nearby Records	Marri / Eucalyptus woodland	Marri / Eucalyptus in paddocks and road reserves	Dampland with Melaleuca shrubland and/or woodland	Notes	Likelihood of Occurrence
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1	CR	•	•	•	•	•	•	0.05 (2017), 1489	Foraging Breeding	Foraging Breeding		Resident.	Occurs
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	S2	EN	•	•					2.4 (1999), 26	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	S2	EN	•	•		•			0.5 (2008), 117	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S3	VU	•					•	1.9 (2000), 31	Foraging Breeding	Foraging Breeding		Foraging visitor, potential breeding.	Occurs
<i>Isodon fusciventer</i>	Southern Brown Bandicoot	P4		•			•	•		0.9 (2008), 29	Foraging Breeding	Foraging Breeding	Foraging Breeding	Resident.	Occurs
<i>Phascogale tapoatafa wambenger</i>	Wambenger Brush-tailed Phascogale	S6		•						6.7 (2013), 35	Foraging Breeding			Requires multiple canopy strata.	Likely to occur
<i>Falco peregrinus</i>	Peregrine Falcon	S7		•					•	9.3 (2006), 2		Foraging		Potential foraging visitor. No breeding habitat available.	Likely to occur
<i>Galaxiella nigrostriata</i>	Black-striped Dwarf Galaxias, Black-stripe Minnow	S2	EN							0.4 (2018)			Foraging Breeding	Ephemeral wetlands.	Likely
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	S3	VU	•	•					0.4 (2004), 5	Foraging Breeding			Foraging visitor.	Possible (foraging visitor)
<i>Ctenotus ora</i>	Coastal Plains Skink	P3		•						7.6 (1982), 2				Lack of species records precludes definitive assessment.	Possible
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle, Western Falsistrelle	P4		•						0.5 (2007), 3	Foraging Breeding			Roosts in tree hollows.	Possible
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		•						0 (1975), 19	Foraging			Rarely recorded on SCP; large woodland areas required to support a resident population. Possible visitor.	Possible
<i>Oxyura australis</i>	Blue-billed Duck	P4		•						5.9 (2002), 84			Foraging		Possible
<i>Setonix brachyurus</i>	Quokka	S3	VU	•	•					0 (1976), 12	Foraging		Foraging	Prefers dense understorey with water nearby. Only one population recorded on the SCP.	Unlikely to occur
<i>Hydromys chrysogaster</i>	Water-Rat	P4		•					•	4.7 (1953), 12				Requires significant drainage / waterbody with riparian cover.	Unlikely to occur
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	S1	EN	•						2.9 (2009), 1	Foraging Breeding				Unlikely to occur
<i>Numenius madagascariensis</i>	Eastern Curlew	S1; S5	CR, MI	•	•					8.6 (2015), 4					Unlikely to occur
<i>Botaurus poiciloptilus</i>	Australasian Bittern	S2	EN	•						2.6 (2011), 1					Unlikely to occur
<i>Calidris ferruginea</i>	Curlew Sandpiper	S1; S5	CR, MI	•	•					9.3 (2001), 1					Unlikely to occur
<i>Oxyura australis</i>	Blue-billed Duck	P4		•						5.9 (2002), 84			Foraging		Unlikely to occur
<i>Westralunio carteri</i>	Carter's Freshwater Mussel	S3	VU	□	□					8 (1905–2016)					Unlikely to occur

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## 6.1 Target Species

### 6.1.1 Western Ringtail Possum

The Western Ringtail Possum or Ngwayir (*Pseudocheirus occidentalis*) is listed as Schedule 1 (Critically Endangered) under the BC Act, a classification that indicates that it is rare or is likely to become extinct as critically endangered fauna. The species is also listed as Critically Endangered under the EPBC Act and is thereby significant in a national context.

The Western Ringtail Possum is a medium-sized arboreal marsupial, endemic to south-western Western Australia. The species is exclusively folivorous, feeding on leaves of myrtaceous species, predominantly Peppermint, but also Marri and Jarrah. During the day, possums rest in tree hollows or dreys (nests constructed from vegetation, which are generally in the canopy but can occasionally be found at ground level). Home range size varies with the productivity of the habitat but is generally less than 5 ha, although densities of up to 20 individuals per hectare have been recorded in Peppermint woodland near Busselton (Department of Parks and Wildlife 2017). Some populations breed throughout the year, but on the southern Swan Coastal Plain females give birth to one young (more rarely up to three) in autumn (April-June); these are weaned and independent at six to seven months (Department of Parks and Wildlife 2017).

The species was once widely distributed across southern and south-western Western Australia but due to habitat clearing and fragmentation for agricultural and urban development, it is now restricted to three areas: the southern Swan Coastal Plain, the Jarrah forests near Manjimup and the south coast between Albany and Walpole (Department of Parks and Wildlife 2017). Habitat loss and fragmentation continue to represent the major threat to the species, while other threats include predation by introduced carnivores, climate change, logging, fire and competition for nest hollows (DBCA 2017).

**Likelihood of occurrence:** The Western Ringtail Possum was recorded throughout the Proposal area wherever woodland fragments, particularly mixed woodland, occurred.

### 6.1.2 Black-cockatoos

Three species of black-cockatoo in the south-west of Western Australia have documented breeding areas overlapping the Proposal area, however it is only located in the typical breeding distribution of the Forest Red-tailed Black-cockatoo (Johnstone and Storr 1998, DSEWPac 2012a). Black-cockatoos require tree hollows with suitable dimensions for nesting and breeding, which typically occur in larger trees over 200 years old (DSEWPac 2012a). As such, breeding habitat trees are defined in the Federal guidelines as any tree with a DBH equal to or greater than 50 cm (DSEWPac 2012a). Activities such as logging and deforestation for agriculture have contributed to a decline in abundance and range of black cockatoos, hence their listing as conservation significant species.

#### 6.1.2.1 Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black-cockatoo is listed as Schedule 2 – Endangered under the BC Act and Endangered under the EPBC Act.

This species is distributed from Kalbarri to Esperance. During the breeding season, between July and November, they have been historically concentrated in the Wheatbelt region (Johnstone and Storr 1998, Saunders et al. 2014b). Here, they primarily nest in Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*) but are also known to nest in Tuart (*E. gomphocephala*), Marri (*Corymbia calophylla*), Red Morrel (*E. longicornis*) and York Gum (*E. loxophleba*) (Johnstone and Storr 1998).

The Swan Coastal Plain has historically been more important as a foraging area than for breeding, with the birds moving into the area after breeding and occurring in the autumn and winter months. However, the species' breeding stronghold in the Wheatbelt has been moving onto the Swan Coastal Plain more recently (DSEWPac 2012). Expansion in the breeding range further south and



west towards the Jarrah - Marri forests of the Darling Scarp and Tuart forests of the Swan Coastal Plain (including near Bunbury) has occurred in the past 10 to 30 years (Johnstone et al. 2010). Long-term studies show that Carnaby's Black-cockatoos utilise hollows ranging from 10 – 65 cm in diameter (average 26 cm) and approximately 130 cm deep (Saunders et al. 2014a, 2014b). They also frequent coastal areas outside of the breeding season where they forage in large flocks (Saunders et al. 2011), feeding on the seeds of *Banksia*, and *Eucalyptus* species such as Jarrah, Marri and Karri (*E. diversicolor*).

**Likelihood of occurrence:** Occurs; foraging evidence was recorded within the Proposal area.

#### 6.1.2.2 Baudin's Black-cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black-cockatoo is listed as Schedule 2 – Endangered under the BC Act and Vulnerable under the EPBC Act.

The species occurs in the humid and subhumid areas of the southwest, distributed from Gidjegannup in the north to Naturaliste National Park and Augusta, also occurring in the Stirling and Porongurup Ranges and east along the south coast to Waychinicup (Johnstone and Storr 1998). Between March and September, the majority of the population migrates north from the cooler Karri forest to the central and northern Darling Range and eastern Swan Coastal Plain (Johnstone et al. 2010). They feed mainly on the seeds of Marri trees, as well as various species of *Banksia* and *Hakea* (Johnstone and Storr 1998).

Although the breeding requirements of this species are still poorly known, breeding has been recorded in the southwest north to Serpentine and east to Kojonup and Albany (Johnstone et al. 2010). Baudin's Black-cockatoos nest mainly in hollows of Karri, Marri and Wandoo trees. Breeding typically occurs between March and October, but egg laying has also been reported less frequently in November and December (Johnstone and Storr 1998, Johnstone et al. 2010). Specific dimensions of hollows used for breeding have not previously been studied for Baudin's Black-cockatoo, but they are likely to be similar to those hollows used by Carnaby's Black-cockatoo.

Bunbury represents a known breeding area for Baudin's Black-cockatoo (DSEWPac 2012).

**Likelihood of occurrence:** Occurs; secondary feeding evidence was recorded in several locations from the distinct chew pattern on Marri nuts.

#### 6.1.2.3 Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black-cockatoo is listed as Schedule 3 – Vulnerable under the BC Act and Vulnerable under the EPBC Act.

This species occurs from Gingin in the north across to near Albany in the south (Johnstone and Storr 1998). It typically nests in Marri, Jarrah and Karri tree hollows with entrance diameters ranging from 12 – 150 cm (average 34 cm) and depths of 100 – 500 cm (average 144 cm) (Johnstone and Storr 1998, Johnstone et al. 2013). Females lay eggs between October and November and incubation is approximately 29 – 31 days, during which time the female stays with the egg and is fed by the male (Johnstone and Storr 1998). They feed mainly on Jarrah and Marri seeds but also Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Persoonia longifolia*) and Swan River Blackbutt (*E. patens*) (Johnstone et al. 2010).

**Likelihood of occurrence:** Occurs. Forest Red-tailed Black-cockatoo were recorded adjacent to the Proposal area by observation of feeding individuals, and within the Proposal area secondarily via feeding evidence.

### 6.1.3 Chuditch (*Dasyurus geoffroii*)

The Chuditch (*Dasyurus geoffroii*) is listed as Schedule 3 – Vulnerable under the BC Act and Vulnerable under the EPBC Act.

Chuditch were previously known from most of Australia, occurring in every mainland state and territory. The species was relatively abundant until European settlement, when it underwent a drastic decline and range contraction. The species went extinct in New South Wales in the 1940s, Victoria in the 1950s and in Queensland between 1880 and 1910. It is now largely restricted to the South-west of Western Australia, with small numbers in the Midwest, Wheatbelt and South Coast regions where continuous forest or suitable fragments remain. Historically, Chuditch inhabited a wide range of habitats, but today this species predominantly occurs in Jarrah (*Eucalyptus marginata*) forest, wet and dry sclerophyll forest, and mallee remnants in Western Australia (Menkhorst and Knight 2011).

Chuditch are seasonal breeders, with mating occurring in late April – early July (Menkhorst and Knight 2011). Chuditch utilise hollow logs and burrows as dens or refuges, and occur in Eucalypt forests, dry woodlands and mallee shrublands (Strahan 1995).

The Chuditch faces a number of threats including predation and competition with the Red Fox and the Feral Cat, altered fire regimes, direct mortality as a result of road trauma, habitat loss and degradation (Morris et al. 2003).

**Likelihood of Occurrence:** Possible. The Chuditch was not recorded within the Proposal area or any contextual sites, despite intensive spotlighting effort. The Chuditch has been assessed as a 'Possible' occurrence within the Proposal area. There are few records of the species in close proximity, with only four records between 1972 and 2012 ranging from 2.9-7.1 km away. While the Proposal area does contain woodland habitat, the Chuditch would only be considered a potential visitor where vegetation within the Proposal area is continuous with larger remnants outside the Proposal area. Such examples include the small southern fringe where Manea Park occurs within the Proposal area; and possibly where the study intersects with Bussell Highway, as Reserve 23000 occurs adjacent to the west (however the Bussell Highway would represent a considerable barrier to movement).

### 6.1.4 Wambenger Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)

The Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) is listed as Schedule 6 – Conservation Dependent Fauna under the BC Act.

Populations of the Brush-tailed Phascogale occur at the extreme coastal extents of Australia and are threatened across most of their range. The Southwest population was described as a distinct subspecies in 2015 (Aplin et al. 2015) and is distributed between Perth and Albany. It occurs at low densities in the northern Jarrah forest, with the highest densities occurring in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DBCA 2012).

The *wambenger* subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. Records from wetter forests are less common. Brush-tailed Phascogales are nocturnal arboreal carnivores that forage for food under the bark of trees (van Dyck and Strahan 2008). This feeding mode and the use of tree hollows for shelter results in a preference for large trees, particularly Jarrah and Marri with over 95 cm DBH (Rhind 1996).

Brush-tailed Phascogales are short-lived, with all males dying at the end of the breeding season and a small number of females living up to 2.5 years, long enough to produce a litter in their second year (Rhind and Bradley 2002). They maintain relatively large territories (over 20 ha) and female territories are exclusive; as a result, densities tend to be low.

**Likelihood of occurrence:** Likely to occur. The Brush-tailed Phascogale was not recorded within the Proposal area, however several individuals were recorded in the adjacent Reserve 23000 and suitable habitat occurs within the Proposal area.

## 6.2 Non-target Species with the Potential to Occur

### 6.2.1 Southern Brown Bandicoot, Quenda (*Isoodon obesulus fusciventer*)

The Southern Brown Bandicoot is listed as a Priority 4 species by the DBCA (see DBCA 2018).

It is patchily distributed, occurring along the Swan Coastal Plain and in Jarrah and Karri forests from just north of Perth to east of Esperance. It occurs in habitats with sandy soil supporting dense vegetation in the lower stratum. Along the Swan Coastal Plain, the species is often associated with wetlands (van Dyck and Strahan 2008, van Dyck et al. 2013).

The Southern Brown Bandicoot is a medium-sized ground-dwelling marsupial that is territorial. Breeding in this species is opportunistic, beginning in winter and peaking in spring, and lasting 6 – 8 months. The species constructs a nest of ground litter over a shallow depression next to or under logs, shrubs or debris piles. It is mostly nocturnal, but is sometimes active during the day when it searches for invertebrates, fungi and subterranean plant material (van Dyck and Strahan 2008, van Dyck et al. 2013).

**Likelihood of occurrence:** Occurs; diggings of the Southern Brown Bandicoot were recorded within the Proposal area. In addition, numerous NatureMap records place the species in close proximity to the Proposal area.

### 6.2.2 Western False Pipistrelle (*Falsistrellus mackenziei*)

This bat is listed as a Priority 4 species by the DBCA (see DBCA 2018).

This species is restricted to the south-western corner of Western Australia and has not been seen in the northern part of its range (north of Collie in the Jarrah forest, north of Mandurah on the Swan Coastal Plain) since 1993 (Armstrong et al. 2017). It occurs in high rainfall areas dominated by Jarrah, Karri, Marri and Tuart. It prefers tall mature forest, but has also been recorded from Banksia woodland on the Swan Coastal Plain (Armstrong et al. 2017). This species forages under the tree canopy and along forest tracks, and roosts within tree hollows and fallen hollow logs. No information on the breeding biology of this species is available (Armstrong et al. 2017).

The Western False Pipistrelle faces multiple threats, including habitat loss as a result of logging, burning and clearing, as well as competition for resources from introduced species such as the European Honey Bee and Rainbow Lorikeet (Armstrong et al. 2017).

**Likelihood of occurrence:** Possible. In recent years, the species has been recorded from near Stratham and Australind. Where woodland habitat in the Proposal area is continuous with larger areas outside, it is possible that this species may occur.

### 6.2.3 Western Brush Wallaby (*Notamacropus irma*)

The Western Brush Wallaby is listed as a Priority 4 species by the DBCA (see DBCA 2018).

This species is endemic to the south-west of Western Australia, where it is distributed from north of Kalbarri to near Cape Arid. It inhabits a wide range of habitats, including open forest and woodland, mallee, heathland, low open grasslands and thickets (Woinarski and Burbidge 2016). It is absent from Karri forests with dense undergrowth.

Breeding occurs between April and May, with young emerging from the pouch from October to November.

Historically, population declines were caused by poachers trading skins, the introduction of the fox and clearing of habitat for agriculture. Foxes are still a threat to the survival of this species, with juveniles most at risk of predation.

**Likelihood of occurrence:** Possible visitor. The Western Brush Wallaby is not commonly recorded in the Bunbury area (based on NatureMap records); the most recent record for the species, almost 5 km from the Proposal area, was in 2015. However, given the availability of woodland habitat within the Proposal area, this species has been assessed as a 'Possible' occurrence.

#### 6.2.4 Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Schedule 7 – Specially Protected under the BC Act.

The Peregrine Falcon has an almost cosmopolitan distribution across Australia, but is absent from most deserts and the Nullarbor Plain (Johnstone and Storr 1998).

This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country (Pizzey and Knight 2007). The Peregrine Falcon, like other birds of prey, is a relatively long-lived species, with low reproductive rates and low population density. These factors, combined with the fact that they are a top-end predator and limited by their prey, make them particularly vulnerable to human impact.

**Likelihood of occurrence:** Likely as a foraging visitor. Although the Proposal area lacks the preferred nesting habitat for the species, it is possible it would forage within it at times.

#### 6.2.5 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as a Priority 4 species by DBCA (see DBCA 2018).

In Western Australia, the Blue-billed duck occurs predominantly in the southwest, with their range extending from Lake Pinjarrega in the north and east across to Esperance (Johnstone and Storr 1998). They are almost exclusively aquatic, with preferred habitat including deep freshwater swamps or lakes and occasionally saltwater lakes or estuaries inundated with fresh water.

Breeding occurs from early August to the end of March; nests are made from trampled bulrushes 10–30 cm above water (Johnstone and Storr 1998).

**Likelihood of occurrence:** Possible visitor. The species has been recorded commonly on the Leschenault Inlet and Collie River. Although no core habitat for the species is present in the Proposal area, it may occasionally occur within it when the ephemeral wetland areas support water.

#### 6.2.6 Black-stripe Minnow, Black-striped Dwarf Galaxias (*Galaxiella nigrostriata*)

The Black-stripe Minnow is listed as Schedule 2 – Endangered BC Act and Endangered under the EPBC Act.

This small freshwater Galaxid fish is endemic to the southwest of Western Australia. The species aestivates in the sediments of seasonal wetlands when the wetlands dry over summer. Once thought to be more extensively distributed in coastal wetlands between Moore River and Albany, this species is now only found in three remnant populations on the Swan Coastal Plain and wetlands between Augusta and Albany (Galeotti et al. 2010).

**Likelihood of occurrence:** Likely. This species has been recorded from ephemeral wetland habitat that is continuous with the north of the Proposal area (WRM 2019a). As such it has been categorised as a likely to occur within the Proposal area, although the extent of wetland habitat is very small.

### 6.2.7 Coastal Plains Skink (*Ctenotus ora*)

The Coastal Plains Skink is listed as a Priority 3 species by the DBCA (see DBCA 2018).

This species is relatively newly described, having been grouped with *Ctenotus labillardieri* prior to 2012 (Kay and Keogh 2012). Records of the species are sparse but it is described as inhabiting open eucalypt woodland over banksia, and low vegetation on sandy coastal plains and dunes.

**Likelihood of occurrence:** Possible. Records of the skink have been largely coastal to date, but include one record from Eaton. Given the paucity of data, a conservative approach has been taken and this species is considered as a possible resident.

## 6.3 Conservation Significant Species that are Unlikely to Occur

The following species were returned from database searches but are considered unlikely to occur in the Proposal area based on habitat preference and known distributions.

### 6.3.1 Woylie, Brush-tailed Bettong (*Bettongia penicillata ogilbyi*)

The Woylie is listed as Schedule 1 – Critically Endangered under the BC Act and Endangered under the EPBC Act.

Once very common and distributed over much of Australia, the species suffered severe decline following European colonisation and the introduction of feral predators. This medium weight range marsupial is nocturnal and forages primarily for native fungi.

**Likelihood of occurrence:** Unlikely to occur. One record of the Woylie was returned from the NatureMap database, however the species is now known to have a distribution restricted to two small areas (the Upper Warren and Dryandra Woodland). Translocated populations occur at Batalling and inside fenced areas in Mt Gibson, Karakamia and Whiteman Park.

### 6.3.2 Quokka (*Setonix brachyurus*)

The Quokka is listed as a Schedule 3 – Vulnerable species under the BC Act and as Vulnerable under the EPBC Act.

The Quokka occurs in isolated populations on Rottnest Island, Bald Island and fragmented areas of the mainland between the Hunter Valley and Jarrah forests south of Perth. The Quokka has specific habitat requirements, preferring dense understorey vegetation or a complex vegetation structure (comprising at least three layers) that provides ample protection from predators. The Quokka also requires water to be nearby and is often found in swampy or riparian areas. Critical habitat in both the northern and southern extent of its range is described as patches of varying fire age, with some areas more recently burnt. This may reflect their preference to feed on new growth vegetation in recently burnt areas.

Historically, disease and the introduction of the Red Fox have been responsible for major population declines. Current threats include uncontrolled fox populations and loss of habitat through inappropriate fire regimes. The Quokka is also indirectly affected by dieback disease, which has the potential to severely alter vegetation structure.

**Likelihood of occurrence:** Unlikely to occur. The nearest record of the species is from swampland near Stratham (<5 km from the Proposal area), however this represents the only known remaining population on the Swan Coastal Plain and appears to be restricted to that particular swamp.



### 6.3.3 Water Rat (*Hydromys chrysogaster*)

The Water Rat or Rakali is listed as a Priority 4 species by the DBCA (see DBCA 2018).

The Water Rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh or brackish water habitats in the southwest of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands (Strahan 1995).

The Water Rat is an opportunistic predator, feeding on large aquatic insects, fish, crustaceans, mussels, frogs, lizards, small mammals, fresh carrion and water birds (van Dyck and Strahan 2008). The Water Rat is not entirely nocturnal; it is most active around sunset but may forage during the day. Breeding occurs throughout the year, but most young are born between spring and late summer (van Dyck and Strahan 2008).

The Water Rat faces predation by the Feral Cat (*Felis catus*) and the European Red Fox (*Vulpes vulpes*), and as such faces the threat of population decline via direct mortality. Swamp reduction and flood mitigation have also removed habitat, and salinity and degradation of waterways have caused significant declines in southwest populations (van Dyck and Strahan 2008).

**Likelihood of occurrence:** The Water Rat was considered 'Unlikely to occur' due to the relatively small and ephemeral nature of watered habitat within the Proposal area. This assessment is supported by the results of an aquatic survey over much of the Proposal area by WRM (2019b).

### 6.3.4 Australasian Bittern (*Botaurus poiciloptilus*)

The Australasian Bittern is listed as Schedule 2 – Endangered under the BC Act and Endangered under the EPBC Act.

The Australasian Bittern is a relatively large bittern with streaked brown and buff plumage. It is secretive and well camouflaged in dense vegetation. It occurs in swamps with tall dense vegetation, especially reeds, rushes and sedges (Menkhorst et al. 2017). In Western Australia, it is primarily found in the deep south-west.

**Likelihood of occurrence:** Unlikely to occur. The Proposal area is generally devoid of the species' preferred habitat, which includes significant reed beds to provide cover and nest within.

### 6.3.5 Curlew Sandpiper (*Calidris ferruginea*) and Eastern Curlew (*Numenius madagascariensis*)

Both the Curlew Sandpiper and Eastern Curlew are listed as Schedule 1 – Critically Endangered and Schedule 5 – Endangered under the BC Act and as Critically Endangered, Marine and Migratory under the EPBC Act.

These small shorebirds are general found in large flocks on intertidal mudflats in sheltered coastal areas and less frequently on inland freshwater wetlands (Geering et al. 2007).

**Likelihood of occurrence:** Unlikely to occur. Both species have been recorded along the Bunbury coast north to Australind, but there are few inland records. These waders may occur as occasional visitors to better watered areas of the Proposal area, but no core (intertidal) habitat is present within the Proposal area.

### 6.3.6 Carter's Freshwater Mussel (*Westralunio carteri*)

Carter's Freshwater Mussel is listed as Schedule 3 – Vulnerable under the BC Act and Vulnerable under the EPBC Act.

The only freshwater mussel in south-west Western Australia, Carter's Freshwater Mussel was added to both State and Federal conservation listings in 2018 following recognition of its declining distribution, thought to be primarily caused by increasing salinity and drying of its habitat. Comparing historical and current records indicates that the species is likely to have undergone a 49% reduction in its distribution in three generations (Klunzinger et al. 2015). Once distributed from Moore River in the north to King George Sound in the south and inland to the Avon River, the species now only occurs within freshwater streams, rivers, reservoirs and lakes within 50 – 100 km of the coast, from Gingin Brook southward to the Kent River, Goodga River and Waychinicup River.

The life-history of the species contributes to its vulnerability, with an age at sexual maturity of 3–6 years and complex maturation stages, including a parasitic larval stage where glochidia must attach to the gills of host fish (Klunzinger et al. 2014).

The species is patchily distributed in sandy/muddy sediments of freshwater lakes, rivers and streams, with greatest densities associated with exposed submerged tree roots of Flooded Gums (*Eucalyptus rudis*), *Melaleuca* spp. and others, woody debris, and overhanging riparian vegetation near stream banks and edges of lakes/dams. Precise habitat requirements and quantification within habitat types are in the early stages of study for this species. Juveniles may require specific micro-habitats and are difficult to locate in the wild.

**Likelihood of occurrence:** Unlikely to occur; there is no suitable habitat within the Proposal area. This assessment is supported by the results of an aquatic survey over much of the Proposal area by WRM (2019b).

## 7.0 Discussion

Based on their known occurrence, habitat suitability and listing at both state and Commonwealth level, the three black-cockatoo species (Forest Red-tailed Black-cockatoo, Carnaby's Black-cockatoo and Baudin's Black-cockatoo) and the Western Ringtail Possum were the primary focus of the current targeted survey work. However, the methods used and intensity of sampling to target these species was also applicable to the detection of most other conservation significant species with the potential to occur within the Proposal area, including the Chuditch and Brush-tailed Phascogale.

### 7.1 Western Ringtail Possum

The Proposal area was strip sampled in August 2019, yielding a total of 73 individual Western Ringtail Possums. This very comprehensive sampling technique affords a high level of confidence in the estimate for this point in time, although it may represent a slight underestimate of the total number of individuals due to access restrictions to some small areas of habitat (see Figure 5.3).

Recent surveying for Western Ringtail Possums at both the local scale (Biota in prep., 2018c, 2018d, 2018e) and regional scale (Biota in prep.) allows for the potential impact to Western Ringtail Possums occurring within the Proposal area to be considered within considerable context.

#### 7.1.1 Local Context

It is possible to provide a broad estimate of Western Ringtail Possum presence and abundance based in the local area using a combination of sampling at local sites together with the habitat mapping of Shedley and Williams (2014). The report of Shedley and Williams (2014) provides broad-scale habitat suitability mapping for the Western Ringtail Possum over the southern Swan Coastal Plain from Binningup to Dunsborough. The mapping is based on a combination of existing landscape scale thematic layers tested against known abundances of Western Ringtail Possums, where these data were available. The factors found to be most important in predicted Western Ringtail Possum presence included habitat quality derived from soil and vegetation attributes, presence and dominance of Peppermint, area of patch, area of other habitat within its neighbourhood and distance to the nearest other high quality patch. The suitability mapping within and surrounding the Proposal area is shown in Figure 7.1.

This habitat mapping is qualitative due to its reliance on existing thematic layers (not ground truthed) and aims to highlight areas of habitat most important to the persistence of the Western Ringtail Possum on the southern Swan Coastal Plain. The reliance on existing thematic layers means that at the scale of Proposal area, gaps of unmapped habitat appear; as such, it should be considered as an underestimate of the total habitat available. This mapping qualitatively describes the majority of the vegetation within the Proposal area as representing Medium quality (62.26 ha), with a portion of the Jilley Road to Bussell Highway section described as High quality (10.34 ha). None of the Proposal area was defined as Very High suitability, while very little of the vegetation was described as Low (3.47 ha) or Very Low (0.41 ha) suitability.

We have chosen the local area of consideration as displayed in Figure 7.1 comprising 10,935 ha; while somewhat arbitrary, this does coincide with obvious breaks in habitat to the north created by metropolitan Bunbury, to the west by the coastline and to the east and south by extensively cleared agricultural land. Within this local context area, Biota has previously sampled five context sites using a line-transect Distance sampling approach: Lot 1 Ducane Road (directly adjacent east the Proposal area), Shire of Capel Reserve 23000 (directly adjacent west), Manea Park (directly adjacent north the Proposal area), Lots 266 – 268 Ducane Road and Southern Lots. The Jilley Road to Bussell Highway portion of the Proposal area has also been previously sampled using line-transect Distance sampling methods (February, July and August 2018). The full methods and results relating to this context work have been reported separately (Biota 2018d, 2019) and results are summarised here. The locations of the context sites in relation to the Proposal area are shown

in Figure 7.1, which also displays the records of Western Ringtail Possums within the context sites together with the records from the Proposal area from the August 2019 strip-sampling exercise. When interpreting this map, it is important to note that the Proposal area and context sites have been sampled at differing intensities and using different techniques (strip sampling at 20 m transect spacing and Distance sampling at 75 m transect spacing).

Comparison of the sites in terms of densities and abundances is presented in Table 7.1. The Jilley Road to Bussell Highway portion of the Proposal area was found to have a lower density during the August 2019 strip sampling survey (1.57 individuals per hectare) than when previously sampled using Distance techniques, which gave an estimate of 2.08 – 2.34 individuals per hectare. At the context sites, the highest densities were recorded at Manea Park ( $1.1 \pm 0.21$  per ha), followed by Lots 266-268 Ducane Road ( $0.8 \pm 0.19$  per ha), Shire of Capel Reserve 23000 ( $0.5 \pm 0.11$  per ha, August 2018), Southern Lots ( $0.4 \pm 0.11$  per ha) and Lot 1 Ducane Road ( $0.26 \pm 0.16$  per ha). The density estimates within the Jilley Road to Bussell Highway portion of the Proposal area have been consistently higher than those at these context sites, although the overall density found within the vegetated portion of the Proposal area (0.73 individuals per hectare from strip-sampling) sits well within the range of densities estimated for the context sites.

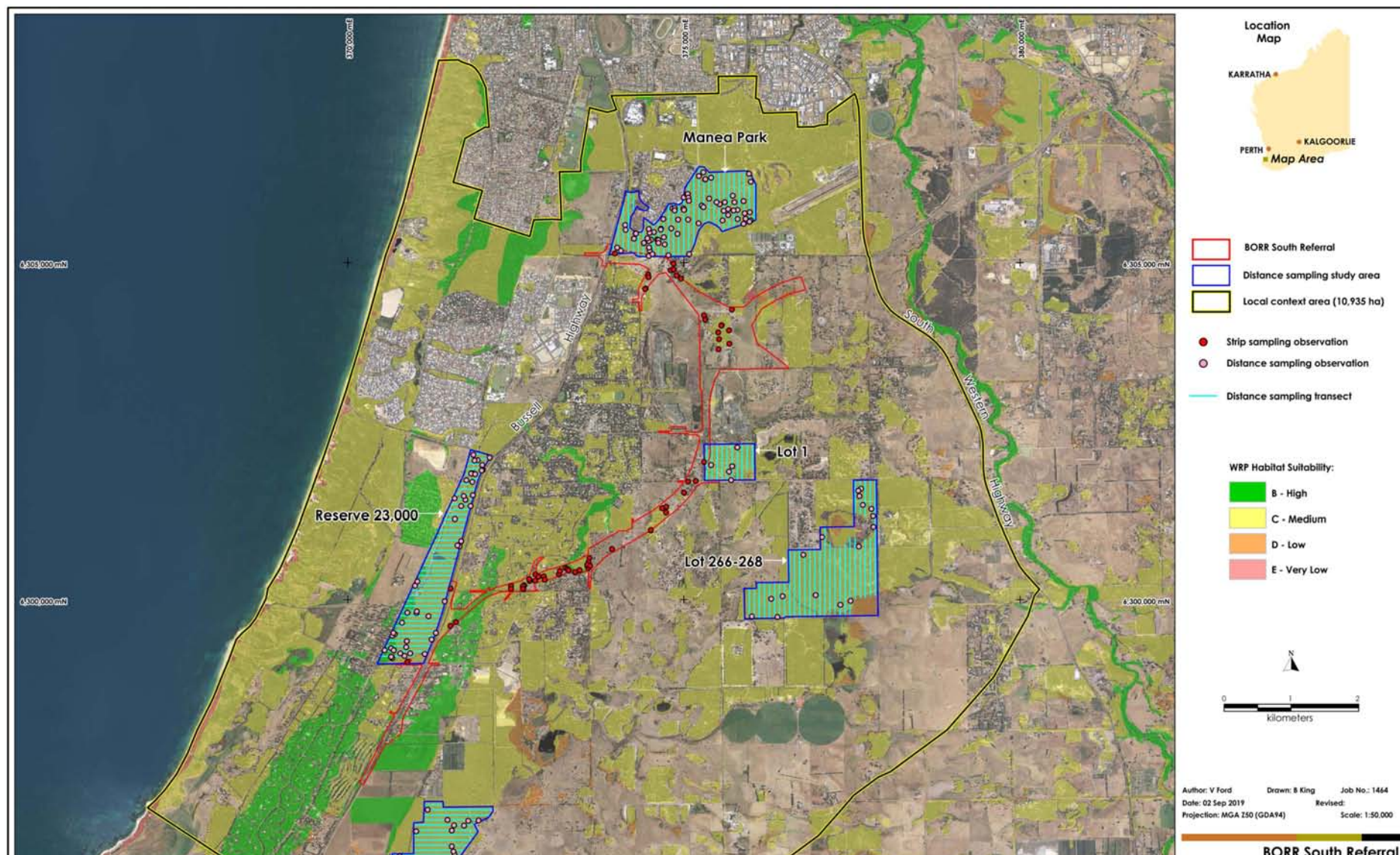


**Table 7.1: Results of previous Western Ringtail Possum sampling within the Proposal area (Jilley Road to Bussell Highway) and local context sites within 5 km.**

Location	Area (ha)	Method	Date	Individuals (Observations)	Density (per ha)	Abundance
Proposal Area						
Entire Proposal Area	296.73	Strip Sampling	August 2019	73 (59)	0.73	73
(Jilley Rd to Bussell Hwy part)	(24.01)			38 (30)	1.57	38
Jilley Rd to Bussell Hwy	24.15	Distance Sampling	February 2018	22 (30)	2.23 ± 0.58	53.85 ± 13.94
			July 2018	20 (26)	2.08 ± 0.45	50.30 ± 10.74
			August 2018	23 (30)	2.34 ± 0.59	56.51 ± 14.30
Context Sites						
Manea Park	155.0	Distance Sampling	October 2018	74 (103)	1.10 ± 0.21	169.99 ± 33.97
Lot 266 -268 Ducane Road	216.2	Distance Sampling	July 2019	55 (45)	0.8 ± 0.19	155 ± 38
Reserve 23,000 Shire of Capel	146.1	Distance Sampling	February 2018	56 (75)	0.78 ± 0.2	114.07 ± 28.94
			August 2018	54 (60)	0.53 ± 0.11	76.77 ± 15.56
Southern Lots	188	Distance Sampling	November 2018	25 (33)	0.39 ± 0.11	73.42 ± 20.08
Lot 1 Ducane Road	40.5	Distance Sampling	February 2018	7 (8)	0.21 ± 0.12	8.53 ± 4.64
			July 2018	8 (10)	0.47 ± 0.27	19.20 ± 11.06
			August 2018	5 (6)	0.26 ± 0.16	10.67 ± 6.47

To provide context to the abundance estimate of 73 individuals recorded within the Proposal area, we may try to coarsely estimate the number of Western Ringtail Possums in the local context area by considering the proportion of habitat that has been sampled and how much other habitat remains. Of the 10,935 ha in this area, 4,818.1 ha has been mapped as Western Ringtail Possum habitat by Shedley and Williams (2014). Of this, 173.6 ha has been mapped as low to very low suitability and as such has been removed from consideration, giving a total of 4,644.5 ha of medium to high quality habitat. Of this 4,644.5 ha of habitat, 783.6 ha (17%) has been sampled as part of this project. Within this sampled area a total abundance of 579 individuals has been estimated, using the abundance from sites that have been sampled on multiple occasions and using the strip-sampling result from within the Proposal area. Extrapolating the individuals within the surveyed areas over the remainder of the local context area results in an estimate of 3,409 individual Western Ringtail Possums in the local context area.

This clearly represents a very broad extrapolation and as such the resultant estimate is indicative only, however we may also consider just the areas that have been sampled and their contiguous habitat. For some context sites, particularly Manea Park and the Southern Lots, the area surveyed represented a subsampling of a continuous and much larger vegetation remnant. The surveyed area of Manea Park represents only a portion (30%) of the total extent of the contiguous remnant patch, which encompasses a further 310 ha of apparently similar habitat (based on aerial imagery). If this supports Western Ringtail Possums at a comparable density to the surveyed section, it would yield a further 342 individuals. The total number of Western Ringtail Possums in this single remnant would therefore be estimated at approximately  $512 \pm 99$  individuals. The Southern Lots remnant similarly extends further to the north and west compared to what was sampled; if this density estimate is likewise extended to the contiguous sections of the remnant (an additional 185 ha), a further  $72 \pm 20$  Western Ringtail Possums are estimated. This would take the total estimate to  $145 \pm 40$  Western Ringtail Possums for the single contiguous remnant (approximately 373 ha in size) of which the Southern Lots forms a part. The last of the contextual sites, Reserve 23000, yielded an abundance estimate of  $77 \pm 16$  individuals; applying the density estimate to the 40 ha remnant to the north of Harewood Road, a further  $21 \pm 4$  individuals are estimated to occur in the broader remnant patch. The Ducane lots were estimated to support  $10.67 \pm 6.47$  in the case of Lot 1 and  $155 \pm 38$  within Lot 266-268 Ducane Road. Together, the number of Western Ringtail Possums across these context sites increases from 506 individuals within the sampled portions to 876 individuals when the density within the sampled areas are extrapolated to the remainder of each vegetation fragment.



### 7.1.2 Regional (Swan Coastal Plain) Contextual Scale

For the purpose of defining this scale, we have adopted the boundary of the Swan Coastal Plain (sub-region SWA02) as defined by the Interim Biogeographic Regionalisation of Australia (DSEWPac 2012b). This sub-region largely coincides with the area of interest considered by Shedley and Williams (2014), but extends further north (Myalup was the northern extent of the Shedley and Williams (2014) mapping) to encompass the population in the Yalgorup National Park. Populations of Western Ringtail Possums on the Swan Coastal Plain are not known from north of the Dawesville Channel.

The mapped occurrence of Western Ringtail Possum habitat (south of Myalup; Shedley and Williams 2014) encompassed by the Swan Coastal Plain IBRA region totals 354 km<sup>2</sup>. Within this same region, Biota sampled approximately 35 km<sup>2</sup> (10%) of the mapped habitat using a line-transect distance sampling approach. A further 12 km<sup>2</sup> of habitat was surveyed in Yalgorup National Park.

The line-transect distance sampling estimated abundance for the surveyed region is  $6,445 \pm 311$  (95% confidence interval: 5,864 – 7,088). The overall abundance within the entire Swan Coastal Plain bioregion will be higher, given that approximately 90% of mapped habitat remains unsurveyed. However, the line-transect distance sampling program did sample most of the very high quality habitat on the Swan Coastal Plain, and much of the remaining habitat would likely support much lower densities than those that contributed to the regional estimate.

The population estimate of 2000 for the Swan Coastal Plain cited in the IUCN assessment (Burbidge and Zichy-Woinarski 2017) was for the adult population, whereas the above estimate (of  $6,445 \pm 311$ ) is for all individuals, including young with their mothers. A second estimate which collapses all detections of multiple individuals to a single observation (thereby excluding young, but also some adults), yielded an estimate of  $4,938 \pm 235$  individuals, which is still two and a half times the IUCN estimate.

### 7.1.3 Estimated Extent of Occupation Contextual Scale

The largest scale of contextual consideration represents the Estimated Extent of Occupation (EEO) for the species, spanning Yalgorup National Park to Albany and encompassing the Swan Coastal Plain, Jarrah Forest and Warren IBRA regions. Within the EEO, surveys using a distance sampling approach to estimate abundance were conducted at 40 locations encompassing a combined area of over 1,050 km<sup>2</sup> (Biota in prep.), representing 3% of the EEO (40,000 km<sup>2</sup>) reported in the IUCN assessment of the species (Burbidge and Zichy-Woinarski 2017) (Table 7.2).

Sites surveyed by the regional distance sampling program broadly fell within the regions encompassing the sub-populations identified in the IUCN assessment (Burbidge and Zichy-Woinarski 2017), namely the Swan Coastal Plain, Cape to Cape, Upper Warren and Around Albany (the Inland Rivers sub-population was not surveyed). The derived population estimates for each of these regions are presented in Table 7.2.

The 2014 population estimates were obtained by expert elicitation and are for the adult population across the entire EEO for the Western Ringtail Possum. The 2019 population estimates are derived from a robust distance sampling program conducted across 40 locations and estimate all individuals (adults and young) but only within the combined extent of the surveyed area (i.e. 1,050 km<sup>2</sup>). The distance program spanned seven months (between January 2019 and August 2019), traversed over 1,100 km of transects and directly observed 3,604 individual Western Ringtail Possums.



**Table 7.2: Population estimates of the Western Ringtail Possum derived from IUCN expert elicitation in 2014 (Burbidge and Zichy-Woinarski 2017) and a 2019 regional population assessment using line transect distance sampling (Biota in prep.).**

IUCN Assessment Sub-population	2014 IUCN Population Estimate (adults)	2019 Distance Sampling Estimate (95% confidence interval) (all individuals)
Swan Coastal Plain	2,000	6,445 ± 311 (5,864 – 7,088)
Cape to Cape	500	2,263 ± 186 (1,924 – 2,661)
Upper Warren	100	7,680 ± 1,774 (4,891 – 12,059)
Other Manjimup Sites	Not assessed	Approx. 250
Around Albany	500	3,045 ± 208 (2,663 – 3,482)
Other Forest Rivers	300	Not assessed
Crooked Brook	Not assessed	721 ± 130 (506 – 1,028)
<b>Total</b>	<b>Approx. 3,400 (40,000 km<sup>2</sup>) *</b>	<b>Approx 20,000 (1,050 km<sup>2</sup>)**</b>

\* 2014 population estimate (adult population) obtained by expert elicitation for the entire Expected Extent of Occupation, equal to 40,000 km<sup>2</sup>.

\*\* 2019 population estimate (all individuals) for the surveyed area of 1,050 km<sup>2</sup> and derived from a robust distance sampling program.

## 7.2 Black-cockatoos

The field survey recorded evidence of all three species of black-cockatoo utilising the survey area for foraging purposes, although no evidence of night roosting was recorded. Areas dominated by Eucalypts and Marri were considered foraging habitat; in some instances this habitat also included lower strata dominated by Banksia. Only the small areas comprising uniform stands of *Melaleuca* shrubs and Peppermint woodland were considered unlikely to contain foraging or breeding habitat.

Suitable foraging habitat comprised 59.36 ha of the survey area. Some gaps between the survey area and Proposal comprising native vegetation area (28.25 ha) remain to be assessed for their quality as foraging and breeding habitat.

The known breeding distribution of all three species of black-cockatoos includes the area south of Bunbury as presented in the EPBC Act referral guidelines (DSEWPaC 2012a). Eucalypt woodland habitat dominated the survey area and a total of 1,017 individual trees met the >50 cm DBH criteria for a potential breeding habitat tree (that is, a tree of a size with potential to form a suitable hollow). Of these 1,017 trees, using photographs from a remotely piloted aircraft, 18 trees were found to support hollows suitable for black-cockatoo nesting. These trees will be revisited shortly to re-assess their breeding status.

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# Appendix 1

## Statutory Framework





## **Commonwealth EPBC Act 1999**

Fauna species of national environmental significance are listed under the Commonwealth *EPBC Act*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk', which are consistent with IUCN categories.

**Critically Endangered (CR):** a taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

**Endangered (EN):** a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

**Vulnerable (VU):** a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

**Lower Risk (LR):** a taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (CD).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (NT).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (LC).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

**Migratory species** are also protected under the *EPBC Act* as species of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. The list of migratory species consists of those species listed under the following international conventions:

1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
2. China-Australia Migratory Bird Agreement (CAMBA);
3. Japan-Australia Migratory Bird Agreement (JAMBA); and,
4. Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

**Marine species** are also protected under the *EPBC Act*, and are listed to ensure the long-term conservation of the species. Marine species include all Australian sea snakes, seals, crocodiles, dugongs, marine turtles, seahorses and seabirds that naturally occur in the Commonwealth marine area.

## **Western Australian Biodiversity Conservation Act 2016**

Classification of rare and endangered fauna under the state *Wildlife Conservation (Specially Protected Fauna) Notice 2018*<sup>1</sup>, recognises seven distinct schedules of taxa:

**Schedule 1:** fauna that are rare or likely to become extinct as critically endangered fauna (CR).

**Schedule 2:** fauna that are rare or likely to become extinct as endangered fauna (EN).

**Schedule 3:** fauna that are rare or likely to become extinct as vulnerable fauna (VU).

**Schedule 4:** fauna presumed to be extinct (EX).

**Schedule 5:** birds that are subject to an agreement between the government of Australia and the governments of Japan, China and the Republic of Korea relating to the protection of

<sup>1</sup> Specially protected fauna notice (September 2018) was issued under the *Wildlife Conservation Act 1950*, which was repealed on 1<sup>st</sup> January 2019. However an updated gazetted notice has not yet been issued under the *Biodiversity Conservation Act 2016*.

migratory birds, and birds in danger of extinction, which are declared to be fauna in need of special protection.

**Schedule 6:** fauna that is of special conservation need as conservation dependent fauna (CD). This category of species contains those taxa that do not meet the criteria for listing as threatened, but which are being maintained by specific management programs.

**Schedule 7:** Other specially protected fauna (OS). This category contains those taxa that are at risk from harvesting, or other human interactions, which have potential to affect their conservation status if not appropriately managed.

### **Department of Biodiversity, Conservation and Attractions Priority Listing**

In addition, the DBCA maintains a list of Priority species that have not been assigned statutory protection under the *Biodiversity Conservation Act 2016*. Species on this list are considered to be of conservation priority because there is insufficient information to make an assessment of their conservation status or they are considered to be rare but not threatened and are in need of monitoring. Under this list, species are classified according to five Priority categories:

#### **Priority One: Taxa with few, poorly known populations on threatened lands**

Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Two: Taxa with few, poorly known populations on conservation lands**

Taxa that are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Three: Taxa with several, poorly known populations, some on conservation lands**

Taxa that are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Four: Taxa in need of monitoring**

Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

#### **Priority Five: Taxa in need of monitoring**

Taxa that are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.



## Appendix 2

### DBCA Regulation 17 Licence





# DEPARTMENT OF PARKS AND WILDLIFE



Department of  
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**PAGE 1**

**NO. 08-002773-2**

## Wildlife Conservation Act 1950

### REGULATION 17

## Regulation 17 – Licence to take fauna for scientific purposes (Regulation 17 - Standard)

**The undermentioned person may take fauna for research or other scientific purposes and where authorised, keep it in captivity, subject to the following and attached conditions, which may be added to, suspended or otherwise varied as considered fit.**

**Director General**

### Conditions

- 1 The licensee must comply with the provisions of the Wildlife Conservation Act 1950, Wildlife Conservation Regulations 1970 and any Notices in force under this legislation.
- 2 The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.
- 3 Unless specifically authorised in the conditions of this Licence or otherwise in writing by the Director General, species of fauna declared as likely to become extinct, rare or otherwise in need of special protection shall not be taken.
- 4 Any by-catch of fauna, which is declared to be rare, likely to become extinct, or otherwise in need of special protection shall be released immediately at the point of capture. Where such fauna taken under this licence is injured or deceased, the licensee shall contact the Department's Wildlife Licensing Section for advice on disposal. Records must be kept of any such fauna so captured and details are to be included in the report required under further condition below.
- 5 Any interaction involving Gazetted Threatened Fauna that may be harmful to the fauna and/or invasive may require approval from the Commonwealth Department of the Environment ph 02 6274 1111. Interaction with such species is controlled by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the Wildlife Conservation Act 1950 and Wildlife Conservation Regulations 1970.
- 6 No fauna shall be taken in areas where it would impinge on pre-existing scientific research programs.
- 7 Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers used, and signs and structures erected by the licensee shall be removed and the environment returned to its original condition.
- 8 Not more than ten specimens of any one protected species of fauna shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.
- 9 The licensee shall not release any fauna or their progeny in any area where it does not naturally occur, nor hand such fauna over to any other person or authority unless approved by the Director General, nor dispose of the remains of such fauna in any manner likely to confuse the natural or present day distribution of the species.
- 10 Bioprospecting involving the removal of sample aquatic and terrestrial organisms for chemical extraction and bioactivity screening shall not be conducted without specific written approval by the Director General.
- 11 No fauna is to be taken from any CALM land, as defined in the Conservation and Land Management Regulations 2002, without prior written approval of the Director General. No fauna is to be taken from any public land without the prior written approval of the Government Authority managing that land.
- 12 The licensee must not enter upon any private property or pastoral lease for the purposes of this licence, nor take any fauna from any private land or pastoral lease without the prior consent in writing of the owner or occupier. Similarly, in the case of Aboriginal lands, the licensee must not enter upon or take fauna from such lands without the written approval of the Department of Aboriginal Affairs and/or the relevant native title holders or applicants.
- 13 Copies of this licence and any written approval or consent required by conditions of this licence must be carried by the licensee and any person/s authorised under the licence at all times when conducting activities relevant to the licence

# DEPARTMENT OF PARKS AND WILDLIFE



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**PAGE 2**

**NO. 08-002773-2**

and must be presented to an authorised officer of the Department upon request.

- 14 All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range shall upon request be donated to the Western Australian Museum.
- 15 To prevent any unnecessary collecting in this State, all specimens and material taken and retained under the authority of this license shall, upon request, be loaned to the Western Australian Museum. Any unused portion or portions of any specimen collected under the authority of this license shall be offered to the Western Australian Museum for inclusion in its collection or made available to other scientific workers if so required.
- 16 Within one month of the expiration of this licence, the holder shall submit an electronic return into the department's Wildlife Licensing System, detailing the locality, site, geocode, date and number of each species of fauna captured, sighted or vouchered during the currency of the licence. A copy of any paper, report or thesis resulting from the research shall upon completion be lodged with the Director General.

## Purpose

Bunbury Outer Ring Road Alternate Alignments Fauna Assessment for Main Roads WA, targeting conservation significant species, including but not limited to; western ringtail possum (*Pseudocheirus occidentalis*), Carnaby's cockatoo (*Calyptorhynchus latirostris*), Baudin's cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), south-western brush-tailed Phascogale (*Phascogale tapoatafa wambenger*), Chuditch (*Dasyurus geoffroii*) and Carter's Freshwater Mussel (*Westralunio carteri*). Fauna surveys by spotlighting / head torching, aural survey, secondary evidence and habitat assessment, and using camera traps, bat detectors, cage traps and Elliott traps. Captured fauna will have morphometrics and physical condition details recorded prior to release at capture site. Location:

## Locations

Bunbury Outer Ring Road Alternate Alignments project area; within City of Bunbury, Shire of Capel and Shire of Dardanup.

## Authorised Person

### Surname

### Given name(s)

Teale

Roy

Ford

Stewart

King

Jacinta

Graff

John

Greenham

Michael

Brooshooft

Penny

Joshua

Keen

Priddle

Shane

King

Brandon



# DEPARTMENT OF PARKS AND WILDLIFE



Department of  
Parks and Wildlife



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**PAGE** 3  
**NO.** 08-002773-2

**Date of Issue** 24/10/2018  
**Valid From** 24/10/2018  
**Date of Expiry** 31/12/2018

**Licensee:** Dr Victoria Anne Cartledge  
**Address** Biota Environmental Sciences  
12 Bates Road  
Innaloo WA 6018  
Australia

Issued by a Wildlife Licensing Officer of the Department of Parks and Wildlife under delegation from the Minister for Environment pursuant to section 133(1) of the Conservation and Land Management Act 1984.



## Appendix 3

### Desktop Review Results







## A3: Mammals

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	Lot 1 Ducane 2014	GHD 2012	Waterloo 2015
<i>Bettongia penicillata ogilbyi</i>	Woylie, Brush-tailed Bettong	S1	EN	•					
<i>Bos taurus</i>	European Cattle			•	•	•	•		
<i>Canis lupus familiaris</i>	Domestic Dog				•		•	•	
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda			•					
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	S3	VU	•	•				
<i>Equus caballus</i>	Horse					•	•		
<i>Falsistrellus mackenziei</i>	Western Falsistrelle	P4		•					
<i>Felis catus</i>	Cat			•	•	•		•	•
<i>Feral Deer</i>	Feral Deer				•				
<i>Hydromys chrysogaster</i>	Water-rat, Rakali	P4		•					•
<i>Isodon fusciventer</i>	Southern Brown Bandicoot	P4		•			•	•	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			•			•	•	•
<i>Mus musculus</i>	House Mouse			•					
<i>Notamacropus irma</i>	Western Brush Wallaby	P4		•					
<i>Oryctolagus cuniculus</i>	Rabbit			•		•	•	•	•
<i>Phascogale tapoatafa wambenger</i>	Wambenger Brush-tailed Phascogale	S6		•					
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1	CR	•	•	•	•	•	•
<i>Rattus fuscipes</i>	Western Bush Rat			•					
<i>Rattus rattus</i>	Black Rat			•				•	
<i>Setonix brachyurus</i>	Quokka	S3	VU	•	•				
<i>Sus scrofa</i>	Pig			•					
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna							•	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum			•			•	•	•
<i>Vulpes vulpes</i>	Fox					•	•	•	•

**A3: Birds**

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Acanthiza apicalis</i>	Inland Thornbill			•					
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			•			•	•	•
<i>Acanthiza inornata</i>	Western Thornbill			•			•	•	
<i>Acanthorhynchus superciliosus</i>	Western Spinebill			•					•
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk			•					
<i>Accipiter fasciatus</i>	Brown Goshawk		MA	•					•
<i>Acrocephalus australis</i>	Australian Reed-Warbler			•					
<i>Actitis hypoleucos</i>	Common Sandpiper	S5	M; MA	•	•				
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar			•					
<i>Anas castanea</i>	Chestnut Teal			•					
<i>Anas gracilis</i>	Grey Teal			•					•
<i>Anas superciliosa</i>	Pacific Black Duck			•			•		•
<i>Anhinga novaehollandiae</i>	Australasian Darter			•					
<i>Anthochaera carunculata</i>	Red Wattlebird			•			•	•	•
<i>Anthochaera lunulata</i>	Western Wattlebird			•			•		
<i>Anthus novaeseelandiae</i>	Australasian Pipit		MA			•	•		•
<i>Apus pacificus</i>	Fork-tailed Swift	S5	M; MA		•				
<i>Aquila audax</i>	Wedge-tailed Eagle			•			•		
<i>Ardea alba</i>	Great Egret			•	•				
<i>Ardea pacifica</i>	White-necked Heron			•					
<i>Arenaria interpres</i>	Ruddy Turnstone	S5	M; MA	•					
<i>Artamus cinereus</i>	Black-faced Woodswallow			•			•		•
<i>Artamus cyanopterus</i>	Dusky Woodswallow			•		•			•
<i>Aythya australis</i>	Hardhead			•					
<i>Barnardius zonarius</i>	Australian Ringneck			•		•	•	•	•
<i>Biziura lobata</i>	Musk Duck		MA	•					•

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Botaurus poiciloptilus</i>	Australasian Bittern	S2	EN	•	•				
<i>Bubulcus ibis</i>	Cattle Egret			•	•				
<i>Burhinus grallarius</i>	Bush Stone-curlew			•					
<i>Butorides striata</i>	Striated Heron								•
<i>Cacatua pastinator</i>	Western Corella	S6		•					
<i>Cacatua sanguinea</i>	Little Corella			•					•
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo		MA	•			•		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	S5	M; MA	•	•				
<i>Calidris alba</i>	Sanderling	S5	M; MA	•					
<i>Calidris ferruginea</i>	Curlew Sandpiper	S1; S5	CR; M; MA	•	•				
<i>Calidris melanotos</i>	Pectoral Sandpiper	S5	M; MA		•				
<i>Calidris ruficollis</i>	Red-necked Stint	S5	M; MA	•					
<i>Calyptrorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S3	VU	•	•		•	•	•
<i>Calyptrorhynchus baudinii</i>	Baudin's Black-Cockatoo	S2	EN	•	•				
<i>Calyptrorhynchus latirostris</i>	Carnaby's Black-Cockatoo	S2	EN	•	•		•	•	
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo			•					
<i>Chenonetta jubata</i>	Australian Wood Duck			•			•		•
<i>Chroicocephalus novaehollandiae</i>	Silver Gull		MA	•					
<i>Cincloramphus mathewsi</i>	Rufous Songlark								•
<i>Circus approximans</i>	Swamp Harrier		MA	•					
<i>Cladorhynchus leucocephalus</i>	Banded Stilt			•					
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			•			•	•	•
<i>Columba livia</i>	Rock Dove			•	•				•
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		MA	•		•	•	•	•
<i>Corvus bennetti</i>	Little Crow								•
<i>Corvus coronoides</i>	Australian Raven			•		•	•	•	•
<i>Coturnix pectoralis</i>	Stubble Quail		MA	•					

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Cracticus nigrogularis</i>	Pied Butcherbird			•					•
<i>Cracticus torquatus</i>	Grey Butcherbird			•			•		•
<i>Cygnus atratus</i>	Black Swan			•					
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			•			•	•	•
<i>Daphoenositta chrysoptera</i>	Varied Sittella			•			•		
<i>Dromaius novaehollandiae</i>	Emu			•					
<i>Egretta garzetta</i>	Little Egret		MA						•
<i>Egretta novaehollandiae</i>	White-faced Heron			•			•		•
<i>Elanus axillaris</i>	Black-shouldered Kite								•
<i>Elseyonis melanops</i>	Black-fronted Dotterel			•					•
<i>Eolophus roseicapilla</i>	Galah			•			•	•	•
<i>Eopsaltria australis</i>	Eastern Yellow Robin			•			•		
<i>Epthianura albifrons</i>	White-fronted Chat			•					•
<i>Eurostopodus argus</i>	Spotted Nightjar		MA	•					
<i>Falco berigora</i>	Brown Falcon			•					•
<i>Falco cenchroides</i>	Nankeen Kestrel		MA	•		•	•		•
<i>Falco longipennis</i>	Australian Hobby			•			•		
<i>Falco peregrinus</i>	Peregrine Falcon	S7		•					•
<i>Falcunculus frontatus</i>	Crested Shrike-tit			•					
<i>Fulica atra</i>	Eurasian Coot			•			•		•
<i>Gallinula tenebrosa</i>	Dusky Moorhen			•					•
<i>Gavicalis virescens</i>	Singing Honeyeater					•	•		•
<i>Gerygone fusca</i>	Western Gerygone			•			•	•	•
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet						•		
<i>Grallina cyanoleuca</i>	Magpie-lark		MA	•			•		•
<i>Gymnorhina tibicen</i>	Australian Magpie			•		•	•	•	•
<i>Haliastur sphenurus</i>	Whistling Kite		MA	•			•	•	



Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Heteroscenes pallidus</i>	Pallid Cuckoo			•					•
<i>Hieraaetus morphnoides</i>	Little Eagle			•					
<i>Himantopus leucocephalus</i>	Pied Stilt			•					
<i>Hirundo neoxena</i>	Welcome Swallow		MA	•			•	•	•
<i>Hypotaenidia philippensis</i>	Buff-banded Rail			•					
<i>Lichmera indistincta</i>	Brown Honeyeater			•		•	•	•	•
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck			•					
<i>Malurus elegans</i>	Red-winged Fairy-wren			•				•	
<i>Malurus splendens</i>	Splendid Fairy-wren			•			•		•
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater			•					
<i>Merops ornatus</i>	Rainbow Bee-eater		MA	•	•	•			
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant			•			•		•
<i>Microeca fascians</i>	Jacky Winter						•		
<i>Motacilla cinerea</i>	Grey Wagtail	S5	M; MA		•				
<i>Neophema elegans</i>	Elegant Parrot			•			•		•
<i>Neophema petrophila</i>	Rock Parrot		MA	•					
<i>Ninox boobook</i>	Southern Boobook					•		•	•
<i>Numenius madagascariensis</i>	Eastern Curlew	S1; S5	CR; M; MA	•	•				
<i>Numenius phaeopus</i>	Whimbrel	S5	M; MA	•					
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron		MA	•					
<i>Ocyphaps lophotes</i>	Crested Pigeon			•					•
<i>Oxyura australis</i>	Blue-billed Duck	P4		•					
<i>Pachycephala pectoralis</i>	Golden Whistler						•	•	
<i>Pachycephala rufiventris</i>	Rufous Whistler			•		•	•	•	•
<i>Pandion haliaetus</i>	Eastern Osprey			•	•				
<i>Pardalotus punctatus</i>	Spotted Pardalote			•					•
<i>Pardalotus striatus</i>	Striated Pardalote			•		•	•		•

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Pelecanus conspicillatus</i>	Australian Pelican		MA	•					
<i>Petrochelidon nigricans</i>	Tree Martin		MA	•			•		
<i>Petroica multicolor</i>	Scarlet Robin			•		•	•	•	
<i>Phalacrocorax carbo</i>	Great Cormorant			•					
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant		MA	•					
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant			•					•
<i>Phalacrocorax varius</i>	Pied Cormorant			•					
<i>Phaps chalcoptera</i>	Common Bronzewing			•			•	•	•
<i>Phaps elegans</i>	Brush Bronzewing			•					
<i>Phylidonyris niger</i>	White-cheeked Honeyeater			•					
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater			•			•	•	•
<i>Platalea flavipes</i>	Yellow-billed Spoonbill			•			•		•
<i>Platalea regia</i>	Royal Spoonbill			•					
<i>Plegadis falcinellus</i>	Glossy Ibis	S5	M; MA	•					
<i>Pluvialis fulva</i>	Pacific Golden Plover	S5	M; MA	•					
<i>Podargus strigoides</i>	Tawny Frogmouth			•			•	•	
<i>Podiceps cristatus</i>	Great Crested Grebe			•					
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe			•					
<i>Polytelis anthopeplus</i>	Regent Parrot			•			•		•
<i>Poodytes gramineus</i>	Little Grassbird			•				•	
<i>Porphyrio porphyrio</i>	Purple Swamphen		MA	•					•
<i>Purpureicephalus spurius</i>	Red-capped Parrot			•		•	•	•	•
<i>Quoyornis georgianus</i>	White-breasted Robin			•					
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet		MA	•					
<i>Rhipidura fuliginosa</i>	Grey Fantail			•		•	•		•
<i>Rhipidura leucophrys</i>	Willie Wagtail			•		•	•	•	•
<i>Rhipidura rufiventris</i>	Northern Fantail			•					

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Rostratula australis</i>	Australian Painted-snipe	S2	EN		•				
<i>Sericornis frontalis</i>	White-browed Scrubwren			•			•		
<i>Smicrornis brevirostris</i>	Weebill			•		•	•	•	•
<i>Spatula rhynchotis</i>	Australasian Shoveler			•					
<i>Stictonetta naevosa</i>	Freckled Duck			•					
<i>Stipiturus malachurus</i>	Southern Emu-wren			•					
<i>Strepera versicolor</i>	Grey Currawong			•			•		•
<i>Streptopelia chinensis</i>	Spotted Dove			•					
<i>Streptopelia senegalensis</i>	Laughing Dove			•	•			•	
<i>Sturnus vulgaris</i>	Common Starling				•				
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe			•					
<i>Tadorna tadornoides</i>	Australian Shelduck			•			•		•
<i>Threskiornis moluccus</i>	Australian White Ibis						•	•	•
<i>Threskiornis spinicollis</i>	Straw-necked Ibis		MA	•			•		•
<i>Todiramphus sanctus</i>	Sacred Kingfisher		MA	•				•	•
<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet			•				•	
<i>Tringa brevipes</i>	Grey-tailed Tattler	S5; P4	M	•					
<i>Tringa glareola</i>	Wood Sandpiper	S5	M; MA	•					
<i>Tringa nebularia</i>	Common Greenshank	S5	M; MA	•	•				
<i>Tringa stagnatilis</i>	Marsh Sandpiper	S5	M; MA	•					
<i>Turnix varius varius</i>	Australian Painted Button-quail								
<i>Vanellus tricolor</i>	Banded Lapwing			•					
<i>Xenus cinereus</i>	Terek Sandpiper	S5	M; MA	•					
<i>Zapornia tabuensis</i>	Spotless Crake			•					
<i>Zosterops lateralis</i>	Silvereye		MA	•			•	•	•

**A3: Reptiles**

Species Name	Common Name	State Listing	C'wealth Listing	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Acriscincus trilineatus</i>	Western Three-lined Skink			•			•		
<i>Aprasia repens</i>	Sand-plain Worm-lizard			•					
<i>Christinus marmoratus</i>	Marbled Gecko			•		•			
<i>Cryptoblepharus buehneri</i>				•			•		
<i>Ctenotus australis</i>				•					
<i>Ctenotus fallens</i>				•					
<i>Ctenotus impar</i>				•					
<i>Ctenotus labillardieri</i>				•					
<i>Ctenotus ora</i>	Coastal Plains Skink	P3		•					
<i>Egernia kingii</i>	King's Skink			•		•			•
<i>Egernia napoleonis</i>				•			•		•
<i>Elapognathus coronatus</i>	Crowned Snake			•					
<i>Hemiergis gracilipes</i>				•					
<i>Hemiergis quadrilineata</i>				•			•		
<i>Lerista distinguenda</i>				•					
<i>Lerista elegans</i>				•					
<i>Lialis burtonis</i>				•					
<i>Lissolepis luctuosa</i>	Western Swamp Skink			•					
<i>Menetia greyii</i>				•		•	•		•
<i>Morethia lineoocellata</i>				•					•
<i>Morethia obscura</i>						•	•		
<i>Neelaps bimaculatus</i>	Black-naped Snake			•					
<i>Notechis scutatus</i>	Tiger Snake			•					
<i>Parasuta gouldii</i>				•					
<i>Parasuta nigriceps</i>				•					
<i>Pogona minor</i>	Dwarf Bearded Dragon			•		•			
<i>Pseudonaja affinis</i>	Dugite			•			•		•
<i>Simoselaps bertholdi</i>	Jan's Banded Snake			•					
<i>Tiliqua rugosa</i>				•		•	•		



**A3: Amphibians**

Species Name	Common Name	State Listing	EPBC Act	NatureMap	EPBC PMST	GHD 2010	GHD 2012	Lot 1 Ducane 2014	Waterloo 2015
<i>Crinia georgiana</i>	Quacking Frog			•					•
<i>Crinia glauerti</i>	Clicking Frog			•			•	•	•
<i>Crinia insignifera</i>	Squelching Froglet			•			•	•	•
<i>Crinia pseudinsignifera</i>	Bleating Froglet			•					
<i>Geocrinia leai</i>	Ticking Frog			•				•	
<i>Heleioporus eyrei</i>	Moaning Frog			•					•
<i>Limnodynastes dorsalis</i>	Western Banjo Frog			•					•
<i>Litoria adelaidensis</i>	Slender Tree Frog			•			•		•
<i>Litoria moorei</i>	Motorbike Frog			•					•
<i>Pseudophryne guentheri</i>	Crawling Toadlet			•					



## Appendix 4

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### NatureMap Database Search Results



# NatureMap Species Report

Created By Guest user on 07/03/2019

Current Names Only Yes

Core Datasets Only Yes

Species Group Mammals

Method 'By Line'

Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27' 24" S, 115° 36' 11" E

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
1.	24208	<i>Arctocephalus forsteri</i> (New Zealand Fur Seal, long-nosed fur-seal)		S	
2.	24209	<i>Arctocephalus tropicalis</i> (Subantarctic fur-seal)		T	
3.	24044	<i>Balaenoptera acutorostrata</i> (Dwarf Minke Whale)			
4.	24162	<i>Betongia penicillata</i> subsp. <i>ogilbyi</i> (Woylie, Brush-tailed Bettong)		T	
5.	24251	<i>Bos taurus</i> (European Cattle)	Y		
6.	24072	<i>Caperea marginata</i> (Pygmy Right Whale)			
7.	24086	<i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
8.	24092	<i>Dasyurus geoffroii</i> (Chuditch, Western Quoll)		T	
9.	24043	<i>Eubalaena australis</i> (Southern Right Whale)		T	
10.	24189	<i>Falsistrellus mackenziei</i> (Western False Pipistrelle, Western Falsistrelle)		P4	
11.	24041	<i>Felis catus</i> (Cat)	Y		
12.	24215	<i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
13.	48588	<i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
14.		<i>Lobodon carcinophaga</i>			
15.	24132	<i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
16.	24051	<i>Megaptera novaeangliae</i> (Humpback Whale)		S	
17.	24076	<i>Mesoplodon bowdoini</i> (Andrew's Beaked Whale)			
18.	24078	<i>Mesoplodon grayi</i> (Gray's Beaked Whale)			
19.	24081	<i>Mesoplodon mirus</i> (True's Beaked Whale)			
20.	24213	<i>Mirounga leonina</i> (Southern Elephant Seal)			
21.	24223	<i>Mus musculus</i> (House Mouse)	Y		
22.	24210	<i>Neophoca cinerea</i> (Australian Sea-lion)		T	
23.	48022	<i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
24.	24085	<i>Oryctolagus cuniculus</i> (Rabbit)	Y		
25.	25508	<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)		S	
26.	48070	<i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
27.	24073	<i>Physeter macrocephalus</i> (Sperm Whale)		T	
28.	24166	<i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		T	
29.	24243	<i>Rattus fuscipes</i> (Western Bush Rat)			
30.	24245	<i>Rattus rattus</i> (Black Rat)	Y		
31.	24145	<i>Setonix brachyurus</i> (Quokka)		T	
32.	48113	<i>Stenella coeruleoalba</i> (Striped Dolphin)			
33.	48114	<i>Stenella longirostris</i> (Spinner Dolphin)		P4	
34.	24259	<i>Sus scrofa</i> (Pig)	Y		
35.	25521	<i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
36.	24158	<i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
37.	30954	<i>Tursiops aduncus</i> (Indo-Pacific Bottlenose Dolphin)			
38.	24069	<i>Tursiops truncatus</i> (Bottlenose Dolphin)			

#### Conservation Codes

T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# NatureMap Species Report

Created By Guest user on 07/03/2019

Current Names Only Yes

Core Datasets Only Yes

Species Group Birds

Method 'By Line'

Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27' 24" S, 115° 36' 11" E

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
1.	24260	<i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261	<i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262	<i>Acanthiza inornata</i> (Western Thornbill)			
4.	24560	<i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
5.	25535	<i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
6.	25536	<i>Accipiter fasciatus</i> (Brown Goshawk)			
7.	25755	<i>Acrocephalus australis</i> (Australian Reed Warbler)			
8.	41323	<i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
9.	25544	<i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
10.	24310	<i>Anas castanea</i> (Chestnut Teal)			
11.	24312	<i>Anas gracilis</i> (Grey Teal)			
12.	24313	<i>Anas platyrhynchos</i> (Mallard)			
13.		<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
14.	24315	<i>Anas rhynchotis</i> (Australasian Shoveler)			
15.	24316	<i>Anas superciliosa</i> (Pacific Black Duck)			
16.	47414	<i>Anhinga novaehollandiae</i> (Australasian Darter)			
17.	24561	<i>Anthochaera carunculata</i> (Red Wattlebird)			
18.	24562	<i>Anthochaera lunulata</i> (Western Little Wattlebird)			
19.	24285	<i>Aquila audax</i> (Wedge-tailed Eagle)			
20.	25558	<i>Ardea ibis</i> (Cattle Egret)			
21.	41324	<i>Ardea modesta</i> (great egret, white egret)			
22.	24340	<i>Ardea novaehollandiae</i> (White-faced Heron)			
23.	24341	<i>Ardea pacifica</i> (White-necked Heron)			
24.	41326	<i>Ardenna carneipes</i> (Flesh-footed Shearwater, Fleishy-footed Shearwater)		T	
25.	25736	<i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
26.	25566	<i>Artamus cinereus</i> (Black-faced Woodswallow)			
27.	24353	<i>Artamus cyanopterus</i> (Dusky Woodswallow)			
28.	24318	<i>Aythya australis</i> (Hardhead)			
29.		<i>Barnardius zonarius</i>			
30.	24319	<i>Biziura lobata</i> (Musk Duck)			
31.	24345	<i>Botaurus poiciloptilus</i> (Australasian Bittern)		T	
32.	24359	<i>Burhinus grallarius</i> (Bush Stone-curlew)			
33.	25714	<i>Cacatua pastinator</i> (Western Long-billed Corella)			
34.	25716	<i>Cacatua sanguinea</i> (Little Corella)			
35.	25598	<i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
36.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
37.	24779	<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
38.	24780	<i>Calidris alba</i> (Sanderling)		IA	
39.	25738	<i>Calidris canutus</i> (Red Knot, knot)		IA	
40.	24784	<i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
41.	24788	<i>Calidris ruficollis</i> (Red-necked Stint)		IA	
42.	24790	<i>Calidris tenuirostris</i> (Great Knot)		T	
43.	25717	<i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
44.	24731	<i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
45.	24733	<i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
46.	24734	<i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
47.	48400	<i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
48.	25575	<i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
49.	24377	<i>Charadrius ruficapillus</i> (Red-capped Plover)			
50.	24321	<i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			



Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
51.	<i>Chroicocephalus novaehollandiae</i>			
52.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagusus</i> (Shining Bronze Cuckoo)			
53.	24288 <i>Circus approximans</i> (Swamp Harrier)			
54.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
55.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
56.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
57.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
58.	25592 <i>Corvus coronoides</i> (Australian Raven)			
59.	24417 <i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
60.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
61.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
62.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
63.	<i>Cracticus torquatus</i>			
64.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
65.	24322 <i>Cygnus atratus</i> (Black Swan)			
66.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
67.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
68.	25618 <i>Diomedea exulans</i> (Wandering Albatross)		T	
69.	30836 <i>Diomedea exulans</i> subsp. <i>exulans</i> (Snowy Albatross)		T	
70.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
71.	<i>Egretta garzetta</i>			
72.	<i>Egretta novaehollandiae</i>			
73.	<i>Elanus axillaris</i>			
74.	47937 <i>Elseymoris melanops</i> (Black-fronted Dotterel)			
75.	<i>Eolophus roseicapillus</i>			
76.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
77.	24652 <i>Eopsaltria georgiana</i> (White-breasted Robin)			
78.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
79.	24813 <i>Eudyptes chrysocome</i> subsp. <i>filholi</i> (Rockhopper Penguin)			Y
80.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
81.	25621 <i>Falco berigora</i> (Brown Falcon)			
82.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
83.	25623 <i>Falco longipennis</i> (Australian Hobby)			
84.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
85.	24616 <i>Falcunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)			
86.	25727 <i>Fulica atra</i> (Eurasian Coot)			
87.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
88.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
89.	24763 <i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
90.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
91.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
92.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
93.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
94.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
95.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
96.	24689 <i>Halobaena caerulea</i> (Blue Petrel)			
97.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
98.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
99.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
100.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
101.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
102.	25638 <i>Larus pacificus</i> (Pacific Gull)			
103.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
104.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
105.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
106.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
107.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
108.	25650 <i>Malurus elegans</i> (Red-winged Fairy-wren)			
109.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
110.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
111.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
112.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
113.	<i>Microcarbo melanoleucos</i>			
114.	48008 <i>Morus serrator</i> (Australasian Gannet)			
115.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
116.	24739 <i>Neophema petrophila</i> (Rock Parrot)			
117.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
118.	25742 <i>Numenius phaeopus</i> (Whimbrel)		IA	
119.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
120.	24497 <i>Oceanites oceanicus</i> (Wilson's Storm-petrel)		IA	

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
121.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
122.	41347 <i>Onychoprion anaethetus</i> (Bridled Tern)		IA	
123.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
124.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
125.	24692 <i>Pachyptila belcheri</i> (Slender-billed Prion)			
126.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
127.	25707 <i>Pachyptila salvini</i> (Salvin's Prion)			
128.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
129.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
130.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
131.	25687 <i>Passer domesticus</i> (House Sparrow)	Y		
132.	24642 <i>Passer montanus</i> (Eurasian Tree Sparrow)	Y		
133.	24649 <i>Pelecanoides urinatrix</i> subsp. <i>exsul</i> (Common Diving Petrel)			
134.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
135.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
136.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
137.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
138.	24664 <i>Phalacrocorax carbo</i> subsp. <i>novaehollandiae</i> (Great Cormorant)			
139.	24665 <i>Phalacrocorax fuscescens</i> (Black-faced Cormorant)			
140.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
141.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
142.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
143.	24668 <i>Phalacrocorax varius</i> subsp. <i>hypoleucos</i> (Pied Cormorant)			
144.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
145.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
146.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
147.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
148.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
149.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
150.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
151.	24745 <i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
152.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
153.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
154.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
155.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
156.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
157.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
158.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
159.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
160.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
161.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
162.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
163.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
164.	24388 <i>Psophodes nigrogularis</i> subsp. <i>nigrogularis</i> (Western Whipbird (western heath))		T	
165.	24702 <i>Pterodroma brevirostris</i> (Kerguelen Petrel)			
166.	24703 <i>Pterodroma lessonii</i> (White-headed Petrel)			
167.	<i>Pterodroma macroptera</i> subsp. <i>macroptera</i>			
168.	25711 <i>Pterodroma mollis</i> (Soft-plumaged Petrel)			
169.	24711 <i>Puffinus assimilis</i> subsp. <i>assimilis</i> (Little Shearwater)			
170.	<i>Purpureicephalus spurius</i>			
171.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
172.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
173.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
174.	25616 <i>Rhipidura rufiventris</i> (Northern Fantail)			
175.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
176.	30948 <i>Sericornis brevirostris</i> (Weebill)			
177.	24522 <i>Sterna bergii</i> (Crested Tern)			
178.	25642 <i>Sterna hirundo</i> (Common Tern)		IA	
179.	48594 <i>Sternula nereis</i> (Fairy Tern)			
180.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
181.	25655 <i>Stipiturus malachurus</i> (Southern Emu-wren)			
182.	24554 <i>Stipiturus malachurus</i> subsp. <i>westernensis</i> (Southern Emu-wren)			
183.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
184.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
185.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
186.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
187.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
188.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
189.	34134 <i>Thalassarche carteri</i> (Indian Yellow-nosed Albatross)		T	

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
190.	44607	<i>Thalassarche melanophris</i> (Black-browed Albatross)		T	
191.	48597	<i>Thalasseus bergii</i> (Crested Tern)		IA	
192.	48135	<i>Thinornis rubricollis</i> (Hooded Plover, Hooded Dotterel)		P4	
193.	24845	<i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
194.	25549	<i>Todiramphus sanctus</i> (Sacred Kingfisher)			
195.	25723	<i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
196.	24755	<i>Trichoglossus haematodus</i> subsp. <i>moluccanus</i> (Rainbow Lorikeet)	Y		
197.	24803	<i>Tringa brevipes</i> (Grey-tailed Tattler)		P4	
198.	24806	<i>Tringa glareola</i> (Wood Sandpiper)		IA	
199.	24808	<i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
200.	24809	<i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
201.	24386	<i>Vanellus tricolor</i> (Banded Lapwing)			
202.	41351	<i>Xenus cinereus</i> (Terek Sandpiper)		IA	
203.	25765	<i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

**Conservation Codes**

T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# NatureMap Species Report

Created By Guest user on 04/09/2019

Current Names Only Yes

Core Datasets Only Yes

Species Group Reptiles

Method 'By Line'

Vertices 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27'

Group By 24° S, 115° 36' 11" E

Species Group

Species Group	Species	Records
Reptile	36	202
<b>TOTAL</b>	<b>36</b>	<b>202</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Reptile</b>				
1.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
2.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
3.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		T	
4.	25336 <i>Chelonia mydas</i> (Green Turtle)		T	
5.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
6.	30893 <i>Cryptoblepharus buehneri</i>			
7.	25027 <i>Ctenotus australis</i>			
8.	25039 <i>Ctenotus fallens</i>			
9.	25047 <i>Ctenotus impar</i>			
10.	25049 <i>Ctenotus labillardieri</i>			
11.	41641 <i>Ctenotus ora</i> (Coastal Plains Skink)		P3	
12.	25096 <i>Egernia kingii</i> (King's Skink)			
13.	25100 <i>Egernia napoleonis</i>			
14.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
15.	30919 <i>Hemiergis gracilipes</i> (skink)			
16.	25119 <i>Hemiergis quadrilineata</i>			
17.	44656 <i>Hydrophis major</i> (Olive-headed seasnake, greater seasnake)			
18.	42410 <i>Hydrophis ornatus</i> (Ornate Reef Seasnake, Sea Snake)			
19.	43384 <i>Hydrophis platurus</i> (Yellow-bellied Seasnake)			
20.	25131 <i>Lerista distinguenda</i>			
21.	25133 <i>Lerista elegans</i>			
22.	25005 <i>Lialis burtonis</i>			
23.	42413 <i>Lissolepis luctuosa</i> (Western Swamp Skink)			
24.	25184 <i>Menetia greyii</i>			
25.	25191 <i>Morethia lineocellata</i>			
26.	25344 <i>Natator depressus</i> (Flatback Turtle)		T	
27.	25248 <i>Neelaps bimaculatus</i> (Black-naped Snake)			
28.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
29.	25253 <i>Parasuta gouldii</i>			
30.	25255 <i>Parasuta nigriceps</i>			
31.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
32.	24907 <i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
33.	25259 <i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
34.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
35.	25519 <i>Tiliqua rugosa</i>			
36.	25207 <i>Tiliqua rugosa subsp. rugosa</i>			

## Conservation Codes

T - Rare or likely to become extinct  
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1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

Name ID Species Name Naturalised Conservation Code <sup>1</sup>Endemic To Query Area

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.





# NatureMap Species Report

Created By Guest user on 04/09/2019

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Species Group** Amphibians  
**Method** 'By Line'  
**Vertices** 33° 23' 14" S, 115° 39' 49" E 33° 24' 50" S, 115° 39' 06" E 33° 26' 06" S, 115° 37' 06" E 33° 27' 24" S, 115° 36' 11" E  
**Group By** Species Group

Species Group	Species	Records
Amphibian	10	300
<b>TOTAL</b>	<b>10</b>	<b>300</b>

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Amphibian</b>				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
5.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
6.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
7.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
8.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
9.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
10.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			

## Conservation Codes

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4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

## Appendix 5

### EPBC Act Protected Matters Search Tool Results





# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 29/10/18 15:42:29

[Summary](#)

[Details](#)

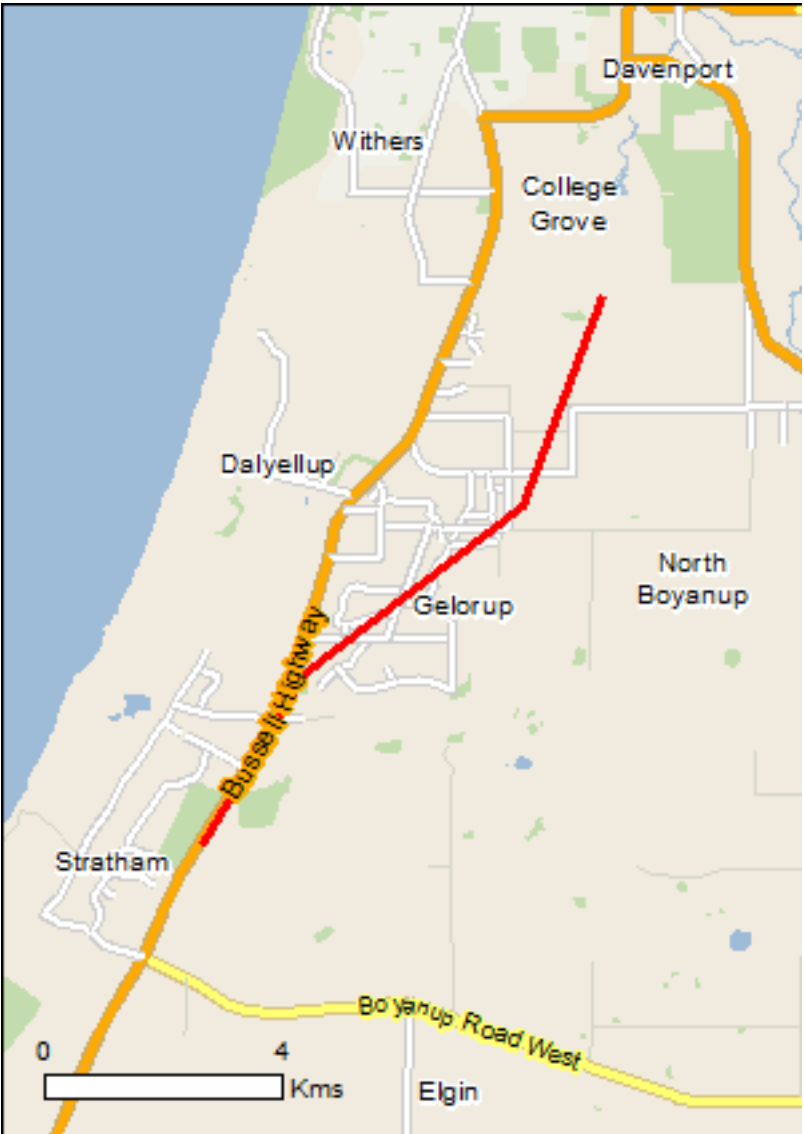
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

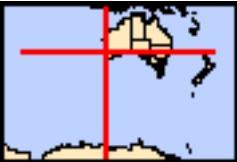
[Acknowledgements](#)



This map may contain data which are  
©Commonwealth of Australia  
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[Coordinates](#)

[Buffer: 10.0Km](#)



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	1
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	1
<a href="#">Listed Threatened Ecological Communities:</a>	3
<a href="#">Listed Threatened Species:</a>	66
<a href="#">Listed Migratory Species:</a>	43

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	2
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	69
<a href="#">Whales and Other Cetaceans:</a>	13
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	1

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	5
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	31
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	2

# Details

## Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[ Resource Information ]
Name	Proximity	
<a href="#">Vasse-wonnerup system</a>	Within 10km of Ramsar	

Commonwealth Marine Area		[ Resource Information ]
Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.		

Name
EEZ and Territorial Sea

Marine Regions		[ Resource Information ]
If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.		

Name
<a href="#">South-west</a>

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

Name	Status	Type of Presence
<a href="#">Banksia Woodlands of the Swan Coastal Plain ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Clay Pans of the Swan Coastal Plain</a>	Critically Endangered	Community likely to occur within area
<a href="#">Subtropical and Temperate Coastal Saltmarsh</a>	Vulnerable	Community likely to occur within area

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
Birds		
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area



Name	Status	Type of Presence
<a href="#">Calyptorhynchus baudinii</a> Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Halobaena caerulea</a> Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
<a href="#">Limosa lapponica baueri</a> Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Limosa lapponica menzbieri</a> Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Pachyptila turtur subantarctica</a> Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<a href="#">Sternula nereis nereis</a> Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour may occur within area
<a href="#">Thalassarche cauta cauta</a> Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche cauta steadi</a> White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
<a href="#">Nannatherina balstoni</a> Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
<a href="#">Setonix brachyurus</a> Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
<a href="#">Westralunio carteri</a> Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
<a href="#">Austrostipa bronwenae</a> [87808]	Endangered	Species or species habitat known to occur within area
<a href="#">Austrostipa jacobiana</a> [87809]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Banksia nivea subsp. uliginosa</a> Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
<a href="#">Banksia squarrosa subsp. argillacea</a> Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
<a href="#">Brachyscias verecundus</a> Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Caladenia busselliana</a> Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
<a href="#">Chamelaucium sp. S coastal plain (R.D.Royce 4872)</a> Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
<a href="#">Diuris drummondii</a> Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Gastrolobium papilio</a> Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
<a href="#">Lambertia echinata subsp. occidentalis</a> Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
<a href="#">Petrophile latericola</a> Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
<a href="#">Synaphea sp. Fairbridge Farm (D. Papenfus 696)</a> Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Synaphea sp. Serpentine (G.R. Brand 103)</a> [86879]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Synaphea stenoloba</a> Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area
<a href="#">Verticordia densiflora var. pedunculata</a> Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area

Reptiles

Name	Status	Type of Presence
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
<a href="#">Carcharias taurus (west coast population)</a> Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species [ <a href="#">Resource Information</a> ]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardenna carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Hydroprogne caspia</a> Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area



Name	Threatened	Type of Presence
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Onychoprion anaethetus</a> Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<a href="#">Thalassarche cauta</a> Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
<a href="#">Balaena glacialis australis</a> Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
<a href="#">Lagenorhynchus obscurus</a> Dusky Dolphin [43]		Species or species habitat may occur within area
<a href="#">Manta alfredi</a> Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
<a href="#">Manta birostris</a> Giant Manta Ray, Chevron Manta Ray, Pacific		Species or species



Name	Threatened	Type of Presence
Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995] <a href="#">Megaptera novaeangliae</a>		habitat may occur within area
Humpback Whale [38]  <a href="#">Natator depressus</a>	Vulnerable	Congregation or aggregation known to occur within area
Flatback Turtle [59257]  <a href="#">Orcinus orca</a>	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Killer Whale, Orca [46]  <a href="#">Rhincodon typus</a>		Species or species habitat may occur within area
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[ Resource Information ]

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

Name
Commonwealth Land - Defence - BUNBURY TRAINING DEPOT

Listed Marine Species

[ Resource Information ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Breeding known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Catharacta skua</a> Great Skua [59472]		Species or species habitat may occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Halobaena caerulea</a> Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Pachyptila turtur</a> Fairy Prion [1066]		Species or species habitat likely to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Phoebetria fusca</a> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pterodroma mollis</a> Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
<a href="#">Puffinus assimilis</a> Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Puffinus carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Sterna anaethetus</a> Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Sterna caspia</a> Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Thalassarche carteri</a> Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<a href="#">Thalassarche cauta</a> Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
<a href="#">Acentronura australe</a> Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
<a href="#">Campichthys galei</a> Gale's Pipefish [66191]		Species or species habitat may occur within area
<a href="#">Heraldia nocturna</a> Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
<a href="#">Hippocampus angustus</a> Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
<a href="#">Hippocampus breviceps</a> Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
<a href="#">Hippocampus subelongatus</a> West Australian Seahorse [66722]		Species or species habitat may occur within area
<a href="#">Histiogamphelus cristatus</a> Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
<a href="#">Lissocampus caudalis</a> Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
<a href="#">Lissocampus fatiloquus</a> Prophet's Pipefish [66250]		Species or species habitat may occur within area
<a href="#">Lissocampus runa</a> Javelin Pipefish [66251]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Maroubra perserrata</a> Sawtooth Pipefish [66252]		Species or species habitat may occur within area
<a href="#">Mitotichthys meraculus</a> Western Crested Pipefish [66259]		Species or species habitat may occur within area
<a href="#">Nannocampus subosseus</a> Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
<a href="#">Phycodurus eques</a> Leafy Seadragon [66267]		Species or species habitat may occur within area
<a href="#">Phyllopteryx taeniolatus</a> Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
<a href="#">Pugnaso curtirostris</a> Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
<a href="#">Solegnathus lettiensis</a> Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
<a href="#">Stigmatopora argus</a> Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
<a href="#">Stigmatopora nigra</a> Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
<a href="#">Urocampus carinirostris</a> Hairy Pipefish [66282]		Species or species habitat may occur within area
<a href="#">Vanacampus margaritifer</a> Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
<a href="#">Vanacampus phillipi</a> Port Phillip Pipefish [66284]		Species or species habitat may occur within area
<a href="#">Vanacampus poecilolaemus</a> Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
<a href="#">Arctocephalus forsteri</a> Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area



Name	Threatened	Type of Presence
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whales and other Cetaceans		[ <a href="#">Resource Information</a> ]
Name	Status	Type of Presence
Mammals		
<a href="#">Balaenoptera acutorostrata</a> Minke Whale [33]		Species or species habitat may occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Delphinus delphis</a> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<a href="#">Lagenorhynchus obscurus</a> Dusky Dolphin [43]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Australian Marine Parks		[ <a href="#">Resource Information</a> ]
Name	Label	
Geographe	Special Purpose Zone (Mining	

Extra Information

State and Territory Reserves		[ Resource Information ]
Name		State
Leschenault Peninsula		WA
NTWA Bushland covenant (0022)		WA
Tuart Forest		WA
Unnamed WA03249		WA
Unnamed WA40552		WA

Invasive Species[ Resource Information ]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade,		Species or species habitat likely to occur

Name	Status	Type of Presence
Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		within area

Key Ecological Features (Marine)

[ [Resource Information](#) ]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
<a href="#">Commonwealth marine environment within and</a>	South-west
<a href="#">Western rock lobster</a>	South-west

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

# Coordinates

-33.38722 115.66361,-33.41389 115.65167,-33.435 115.61833,-33.45667 115.60306



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

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