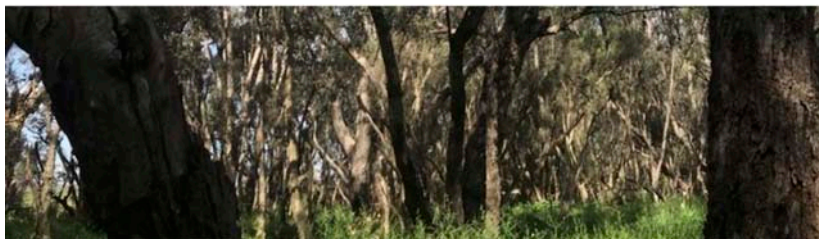
APPENDIX E

BORR Northern and Central Section Targeted Fauna Assessment (Biota 2020)

Biota Environmental Sciences

Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment



Prepared for GHD

December 2019

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Document Quality Checking History
Version: Rev A
Peer review: S. Ford
Director review: M. Maier
Format review: S. Schmidt, M. Maier

Approved for issue: M. Maier

BORR Northern and Central Section Fauna

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1.0 Executive Summary

1.1 Introduction

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Northern and Central sections of the Bunbury Outer Ring Road (BORR) project. The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway, and will provide a high standard route for access to the Bunbury Port. The completed BORR will also provide an effective bypass of Bunbury for inter-regional traffic and freight, reducing traffic on the local road network, and facilitate proposed development to the east of the city of Bunbury.

The BORR forms a major component of the planned regional road network for the Greater Bunbury area. The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road;
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway (south) (an existing 4 km section which was completed in May 2013), along with a 3 km extension of Willinge Drive southwards to South Western Highway; and
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This document pertains to the proposal area in relation to the BORR Northern and Central Sections only.

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 (Endangered);
- Baudin's Black-Cockatoo (Endangered);
- Forest Red-tailed Black-Cockatoo (Vulnerable);
- Western Ringtail Possum (Critically Endangered); and
- Carter's Freshwater Mussel (Vulnerable).

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

- Wambenger Brush-tailed Phascogale (hereafter the Brush-tailed Phascogale) (Conservation Dependent Fauna); and
- Chuditch (Vulnerable).

1.2 Methods

This report refers to survey work at two scales:

- Proposal Area: the 624.24 ha; and
- North Environmental Survey Area: a 1,068.45 ha area encompassing the Proposal Area and surrounded by a buffering context area, referred to throughout this report as the wider Survey Area.

To assess the Proposal Area for roosting and breeding habitat, all woodland habitat (including areas of scattered trees in paddocks) was foot traversed. In larger vegetation fragments, a systematic approach was applied, whereby transects of 25 m spacing were overlain on aerial imagery in GIS. A zoologist then used a GPS to search each 25 m wide strip for all trees of hollow-forming species within the strip. This was continued until the entire fragment had been searched.

In small fragments or where there were singular trees, traverses between trees were undertaken in favour of strip transects and the area of search was recorded via a track file. For any tree supporting hollow/s, details of the hollows were taken and a differential GPS (or GPS with accuracy to within 1.5 m) was used to record the location. These trees were also subject to a dedicated assessment of potential breeding hollows, which included the use of a remotely piloted aircraft (RPA) to obtain images of hollows.

Any evidence of black-cockatoo foraging was recorded while conducting foot traverses and for non-woodland areas, vegetation mapping conducted by GHD (2019) was reviewed for the presence of preferred foraging plants.

During the black-cockatoo habitat assessment, any areas representing habitat for Carter's Freshwater Mussels were described and searched for evidence of the mussel.

Western Ringtail Possums were surveyed at night using a strip sampling approach over as much vegetation within the Proposal Areas as could practicably be accessed, with the aim of gaining a robust estimate of total abundance. In larger areas of vegetation, 20 m wide strips were overlain on aerial imagery in GIS and loaded onto a GPS, with each transect searched by a zoologist. In areas of scattered trees, all potential habitat trees were visited as far as possible. This exercise was carried out on three occasions; mid-August, mid-October and early-December 2019. To place the Proposal Area in local context, Distance sampling was undertaken at five large vegetation fragments within 10 km of the Proposal Area.

Night-spotting for the Western Ringtail Possum was also used as the search method for the Brush-tailed Phascogale and Chuditch.

1.3 Results

1.3.1 Fauna Habitats

The large majority of the 624.24 ha Proposal Area has been cleared historically for agriculture and road infrastructure, with 92 ha of native vegetation remaining (including 19 ha of revegetation).

As far as practicable, all of the vegetation in the Proposal Area was ground-truthed for habitat type. Based on the field observations together with reference to vegetation mapping (GHD 2019), the following broad habitats were described, listed from most common to least:

- Dampland with *Melaleuca* shrubland and/or woodland (31.94 ha);
- Marri/*Eucalyptus* in paddocks and road reserves (20.09 ha);
- Marri/*Eucalyptus* woodland (12.79 ha);
- Peppermint woodland (6.06 ha);
- Riparian woodland (4.88 ha); and
- Artificial wetland (2.76 ha).

Three low value habitats were also identified, comprising:

- Highly modified/cleared areas (531.24 ha);
- Cleared with early revegetation (9.71 ha); and
- Non-native vegetation (4.76 ha).

1.3.2 Target Species

A total of 19.4 ha of vegetation within the Proposal Area comprised vegetation units dominated by suitable foraging plants for black-cockatoo species; mainly Marri woodland or Jarrah woodland, which also often included Banksia species in the mid-storey. A further 11.9 ha

represented vegetation units that included scattered foraging plants, for example, woodland mosaics and isolated foraging trees in paddocks.

A total of 711 trees of hollow-forming species with diameter at breast height >50 cm were recorded within the Proposal Area. A follow-up dedicated assessment of breeding hollows was carried out at those trees initially appraised as having hollows of suitable size and orientation. This assessment looked at 17 trees and included the use of a remotely piloted aircraft and found that two trees had hollows with potential to support black-cockatoo nesting. Taking a conservative approach, a third tree, not accessible with the aircraft, was assessed as having potentially suitable hollows in as much as could be assessed from ground level.

The August 2019 phase of strip-sampling for Western Ringtail Possums recorded 22 individuals within the Proposal Area, the October phase 20 and the December phase 15. Using an identified 75.77 ha of habitat for Western Ringtail Possums within the Proposal Area, the average number of recorded individuals across the three phases was 19 giving an average density of 0.3 individuals per hectare. This Proposal Area density estimate is lower than the range of density estimates calculated for the five contextual sites: the lowest being 0.39 ± 0.11 per ha at the Southern Lots site and the highest being 1.5 ± 0.25 per ha at the Lot 2 Boyanup–Picton Rd site.

No Brush-tailed Phascogales were recorded within the Proposal Area, however, ten individuals were recorded within 5 km, either within the wider Survey Area or at context sites. The species is considered likely to occur within the Proposal Area.

Carter's Freshwater Mussel was recorded in the wider Survey Area in the Preston River adjacent the Proposal Area while a separate study by aquatic specialists recorded the species within the Proposal Area (WRM 2019).

No Chuditch were recorded within the Proposal Area despite intensive spotlighting effort in the area over the past two years. Based on recent regional records and availability of habitat, the species was assessed as a possible transient occurrence in the Proposal Area and unlikely to be resident.

1.3.3 Non-target Conservation Significant Species

In addition to the target species, it was determined that the following five conservation significant species have some potential to occur within the Proposal Area:

- Southern Brown Bandicoot, Quenda (Priority 4) – Likely to occur;
- Blue-billed Duck (Priority 4) – Likely to occur;
- Water Rat (Priority 4) – Possible;
- Western False Pipistrelle (Priority 4) – Possible; and
- Western Brush Wallaby (Priority 4) – Possible.

None of these species were recorded within the Proposal Area during the field survey.

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2.0 Glossary and Acronyms

BC Act	Western Australian *Biodiversity Conservation Act 2016*.
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 Commonwealth referral guidelines (DSEWPaC 2012) 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 500 mm; for Salmon Gum and Wandoo, suitable DBH is 300 mm.
Conservation significant species	Defined as those species listed under the Commonwealth EPBC Act, the Western Australian BC Act, or the Department of Biodiversity, Conservation and Attractions Priority species list.
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions.
DBH	Diameter at breast height (approximately 1.3 m from base).
DotEE	Federal Department of the Environment and Energy.
EPA	Environmental Protection Authority, Western Australia.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Foraging habitat (black-cockatoo)	Defined in the Commonwealth referral guidelines (DSEWPaC 2012) 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 (i.e. showing evidence of use through scratches or feathers).
PDF	Probability density function.
Proposal Area	The area proposed for the development of the Northern and Central Sections
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.
Suitable nest hollow (black-cockatoo)	Any hollow that appears to be deep enough and with an opening large enough to be used by black-cockatoos.
SCP	Swan Coastal Plain.
Survey Area	The wider survey area representing the scope of targeted pre-feasibility work, which encompassed the Proposal Area with buffers and additions.
Brush-tailed Phascogale	Wambenger Brush-tailed Phascogale, *Phascogale tapoatafa wambenger*.

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3.0 Introduction

3.1 The Proposal

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Northern and Central sections of the Bunbury Outer Ring Road (BORR). The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway, and will provide a high standard route for access to the Bunbury Port. The completed BORR will also provide an effective bypass of Bunbury for inter-regional traffic and freight, reducing traffic on the local road network, and facilitate proposed development to the east of the city of Bunbury.

The BORR forms a major component of the planned regional road network for the Greater Bunbury area. The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road;
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway (south) (an existing 4 km section which was completed in May 2013), along with a 3 km extension of Willinge Drive southwards to South Western Highway; and
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

This report details the methods and results of a desktop assessment and targeted field fauna assessment over the 624.24 ha Proposal Area (Figure 3.1). It has been prepared to address the EPA's 3 July 2019 request for additional information to support an assessment on Referral Information, specifically including updated assessment of impacts to threatened fauna informed by the results of additional targeted surveys.

3.2 Study Objectives and Scope

In order to inform the environmental impact assessment of the BORR project, 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, and roosting, potential breeding and actual breeding trees as per Commonwealth guidelines;
- estimate abundance of the Western Ringtail Possum;
- assess the likelihood of occurrence of Carter's Freshwater Mussel;
- assess the likelihood of occurrence of the Brush-tailed Phascogale and Chuditch; and
- identify and map fauna habitats.

Results from within the Proposal Area were considered within a framework of recent contextual work, including intensive sampling over a wider Survey Area of 1,068.45 ha, which encompasses the Proposal Area. In the case of the Western Ringtail Possum, targeted sampling was also undertaken at context sites within 10 km of the Proposal Area.

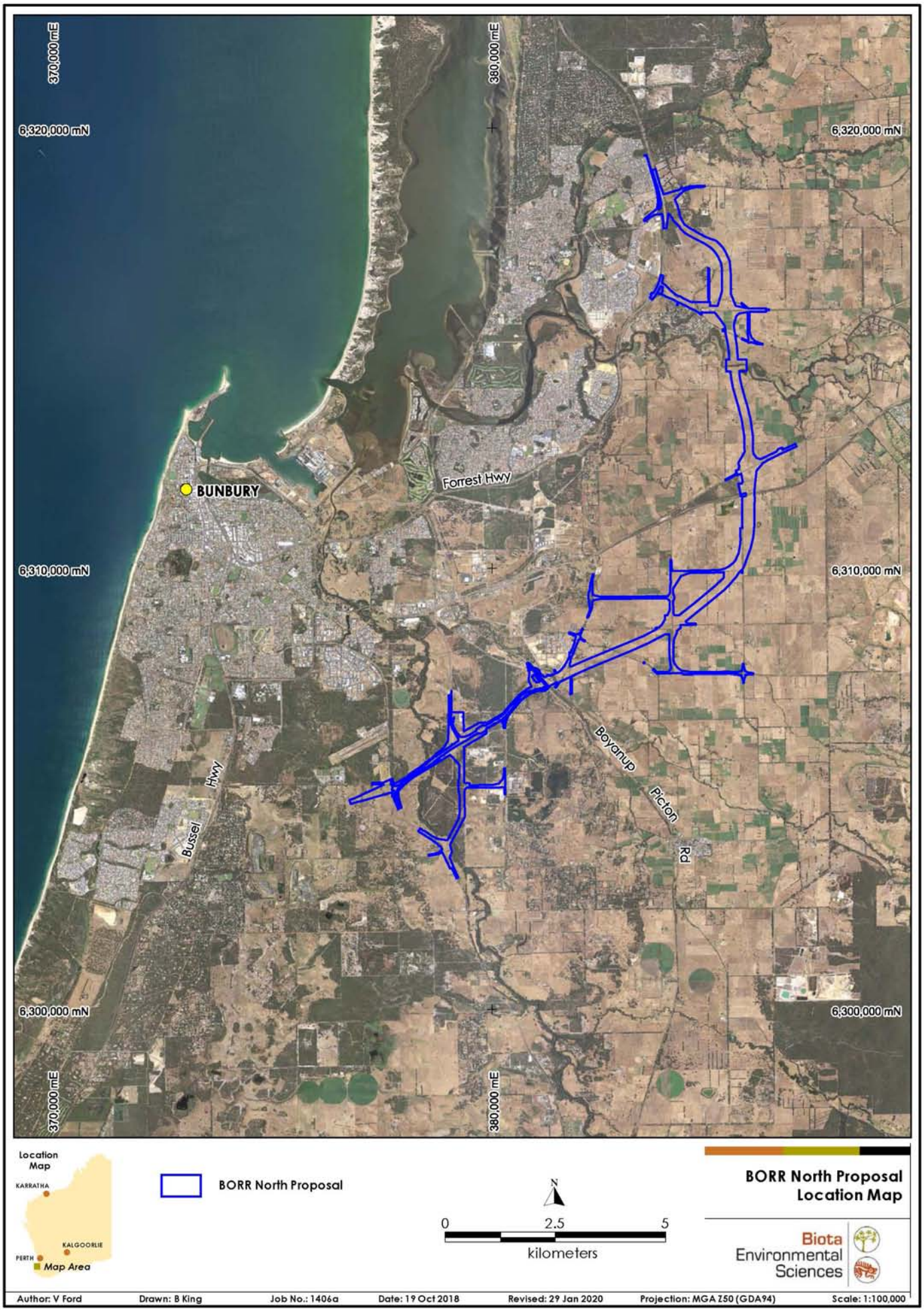

Figure 3.1: Location of the Proposal Area.

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, Brush-tailed Phascogale and Carter's Freshwater Mussel), 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 Birdata database. The database search was completed on 25 October 2018 using a 10 km buffer on a central line described by the coordinates:
   - 33°15'7.57"S 115°44'56.34"E;
   - 33°20'31.1"S 115°46'14.11"E;
   - 33°24'8.66"S 115°40'42.65"E.

   The raw data returned are included as Appendix 1.
2. The Commonwealth EPBC Act Protected Matters Search Tool database. The database was searched using the same coordinates as the NatureMap search above, on 25 October 2018. The raw data returned are included as Appendix 2.
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 4.1.
4. Studies by other authors, as detailed in Table 4.1.

Table 4.1: Previous studies reviewed in relation to the Proposal Area.

Report / Survey	Survey Dates (effort)	Survey Description	Key Findings	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.	0.5 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.	Adjacent to middle eastern portion of Proposal Area.
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 Possum.	1 Western Ringtail Possum, 195 cockatoo habitat trees (13 with hollows).	40 km.
Bunbury Outer Ring Road Southern Section, South Western to Bussell Highway (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).	Adjacent to southern end.
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 Possum (scats, dreys, sightings). Nocturnal survey for Western Ringtail Possum.	38 black-cockatoo habitat trees, 1 Western Ringtail Possum recorded during night survey.	3 km.
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. Searches for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black-cockatoo species confirmed.	Partially overlapping.
Bunbury Port Access Road Project Stage 2 Rare Fauna Survey (GHD 2010c)	(i) 17 Feb. – 5 March 2009 (ii) 4 – 7 August 2009 (8 days, 5 nights)	Level 1 fauna survey.	3 Western Ringtail Possum, black-cockatoo confirmed.	Overlapping.
Bunbury Outer Ring Road (Southern Section) Black Cockatoo Tree Survey (Biota 2017)	13 – 15 November 2017 (3 days)	Black-cockatoo habitat tree assessment.	649 black-cockatoo breeding habitat trees (139 with hollows).	Adjacent to southern end.
Bunbury Outer Ring Road, Southern Section Western Ringtail Possum Assessment (Biota 2018a)	25 February – 5 March 2018 (8 nights)	Targeted survey for Western Ringtail Possum within the BORR alignment and contextual sites (Reserve 23,000, Lot 1 and Lot 2).	136 Western Ringtail Possum.	Adjacent to southern end, plus contextual sites within 18 km.
Phase 1 Survey for the Western Ringtail Possum in the BORR, Lot 1, Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities (Biota 2018b)	10 – 13 July 2018 (3 nights)	Targeted survey for Western Ringtail Possum within the BORR alignment and contextual sites (Lot 1, Bussell Highway, Maidment Parade Road Reserve, Gelorup and Davenport Localities).	73 Western Ringtail Possum.	Adjacent to southern end, plus contextual sites within 18 km.

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 4.2. The number of historical records were considered in the likelihood assessment, as well as their timing and distance from the Proposal Area. 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 4.2: Categories of likelihood assigned to conservation significant species in desktop search.

Status	Description
Occurs	Recorded in current survey through direct sighting or secondary evidence such as nut chews or diggings.
Likely to Occur	Recent records (past 5 years) within Proposal Area and nearest record <1 km from Proposal Area boundary.
Possible	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.
Unlikely to Occur	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.

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	Agency
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act).	The Australian Government's central environmental legislation. Used to define conservation significant fauna.	Department of the Environment and Energy
Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia (DEWHA 2009)	Details ecology and habitat requirements.	Department of the Environment and Energy
EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (Calyptorhynchus latirostris), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (DSEWPaC 2012)	Details distribution, ecology and recommended survey methodology.	Department of the Environment and Energy
Western Australia		
Environmental Protection Act 1986	Western Australia's central environmental legislation for the prevention, control and abatement of environmental pollution and for the conservation, preservation, protection, enhancement and management of the environment.	Department of Water and Environmental Regulation
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
Biodiversity Conservation Act 2016 (BC Act) and Biodiversity Conservation Regulations 2018	Western Australia's biodiversity conservation legislation. Partially came into effect 2 December 2016, with the full Act and Regulations promulgated 1 January 2019, replacing the *Wildlife Conservation Act 1950*. Used to define conservation significant fauna.	Department of Biodiversity, Conservation and Attractions
Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58 (DPaW 2017)	Details ecology of the species and priority survey objectives.	Department of Biodiversity, Conservation and Attractions

4.4 Timing, Team and Permits

The field survey was conducted in several phases commencing in September 2018 and continuing through to December 2019, as detailed in Table 4.4. The extended nature of the survey work reflects early contextual work over the wider Survey Area, with follow-up resurvey work focusing on the Proposal Area once this was finalised.

With the exception of RPA pilot Shane Priddle (SW Environmental), all team members were biologists from Biota. GIS mapping and calculations were undertaken by Paul Sawers, Brandon King and Melissa Robinson 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 3).

Table 4.4: Summary of survey timing and weather conditions.[1]

	Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
Phase 1	10/9/18	Black-cockatoo habitat assessment, Nocturnal searches	Roy Teale, Victoria Ford	11.9	19.4	1.4
	11/9/18			3.4	16.3	1.4
	12/9/18			6.5	17.1	0.2
	13/9/18			12.0	18.2	1.0
	14/9/18			11.1	15.6	0.4
	15/9/18			1.8	15.5	0
			Avg./Total	**7.8**	**17.0**	**4.4**
Phase 2	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	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**
Phase 3	22/10/18	RPA survey of hollow-bearing trees	Joshua Keen, Shane Priddle	12.7	18.9	0.2
	23/10/18			8.5	19.5	0
	24/10/18			7.9	19.7	0
	25/10/18			12.0	26.9	0
	26/10/18			11.3	26.1	0
			Avg./Total	**10.5**	**22.2**	**0.2**
Phase 4	30/10/18	Black-cockatoo habitat assessment, Nocturnal searches	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	0
	5/11/18			10.6	18.2	0.6
			Avg./Total	**10.0**	**20.8**	**0.8**
Phase 5	16/08/19	Proposal Area Strip Sample Phase 1	Roy Teale, Joshua Keen, Louis de Kock	10.4	18.3	0
	17/08/19			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
	21/08/19			3.2	21.1	0
			Avg./Total	**4.9**	**18.4**	**3.1**

	Date	Methods	Personnel	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
Phase 6	23/09/19	Drone resurvey of suitable hollows	Brandon King, Shane Priddle	5.8	22.2	0
	24/09/19			5.5	22.1	0
			Avg./Total	**5.7**	**22.2**	**0**
Phase 7	17/10/19	Proposal Area Strip Sample Phase 2	John Graff, Nathan Beerkens	4.3	19.6	0
	18/10/19			7.5	22.3	0
	19/10/19			10.1	28.7	0
	20/10/19			15.2	22.1	0
			Avg./Total	**9.3**	**23.2**	**0**
Phase 8	2/12/19	Proposal Area Strip Sample Phase 3	John Graff, Joshua Keen	15.5	31.9	0
	3/12/19			15.9	35.4	0
	4/12/19			17.5	35.2	0
	5/12/19			14.3	33.2	0
	6/12/19			22	36.9	**0**
			Avg./Total	**17.0**	**34.5**	**0**

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

Conditions in the year preceding the surveys were largely typical of long-term averages, although the winter immediately preceding the survey work was slightly wetter than average (Figure 4.1). This would be expected to have had a positive effect on foliage productivity and food resources for the Western Ringtail Possum and black-cockatoo species. During the survey period, rainfall was unusually high in early winter (June) followed by considerably lower than average rainfall for the July, August and September 2019 months.

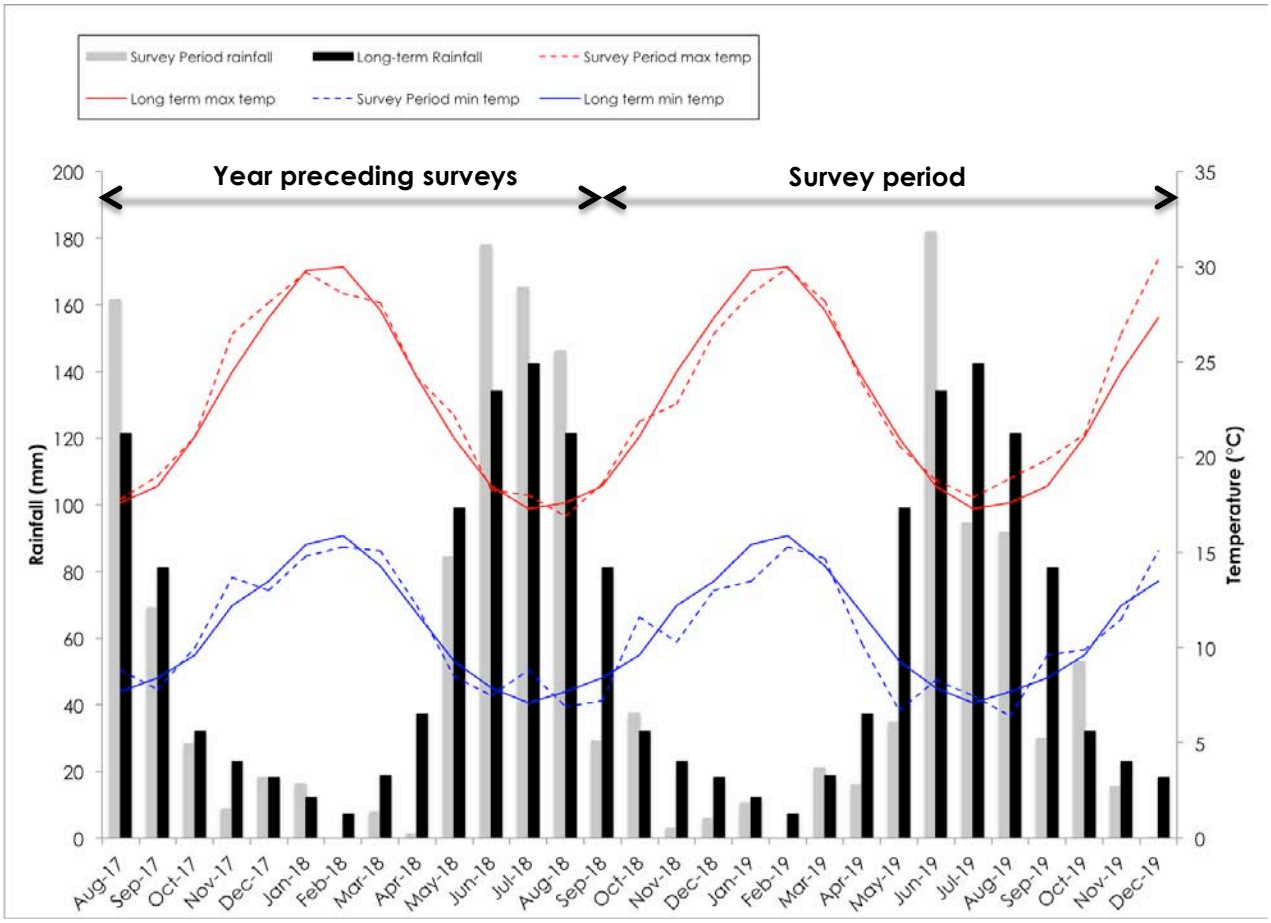

Figure 4.1: **Average monthly weather conditions in the year preceding the surveys, then throughout the survey period and through to November 2019, compared with long-term climatological averages** (data from the Bureau of Meteorology station at Carey Park, 1995–2019).

4.5 Western Ringtail Possum

4.5.1 Proposal Area

A strip-sampling approach was applied to the entirety of the Proposal Area. Many adjacent areas of habitat, often continuous with the Proposal Area, were also surveyed to assess areas of potential movement in and out of the Proposal Area. This strip-sampling exercise was undertaken on three occasions (mid-August, mid-October and early-December 2019) to examine temporal variation in abundance throughout the Proposal Area. Transect coverage within the Proposal Area and adjacent areas is shown in Figure 4.2 to Figure 4.4.

Strips of 20 m width were pre-loaded onto map imagery and displayed on tablets with a GPS accuracy typically to within 1.5 m. The 20 m width of the strip transects was chosen based on modelling of distance data (Biota in prep.) accumulated from over three thousand detections of Western Ringtail Possums; this indicates a probability of detection of greater than 98% up to a distance of 10 m from a transect. It is therefore assumed that the number of Western Ringtail Possums counted when using this approach approximates the real abundance of the Proposal Area, although it is likely to represent a slight underestimate. In open pasture with scattered trees, searching individual paddock trees was undertaken in favour of searches of strips. In addition to the Western Ringtail Possum, observations of the Common Brushtail Possum and Brush-tailed Phascogale were also recorded. Approximately 37.9 km of transect was walked inside the Proposal Area and 17.4 km of transect was walked in adjacent areas.

The following information was recorded with every observation:

- Species;
- Observer;
- Animal location using GPS, taken while standing directly beneath;
- 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 at observation point.

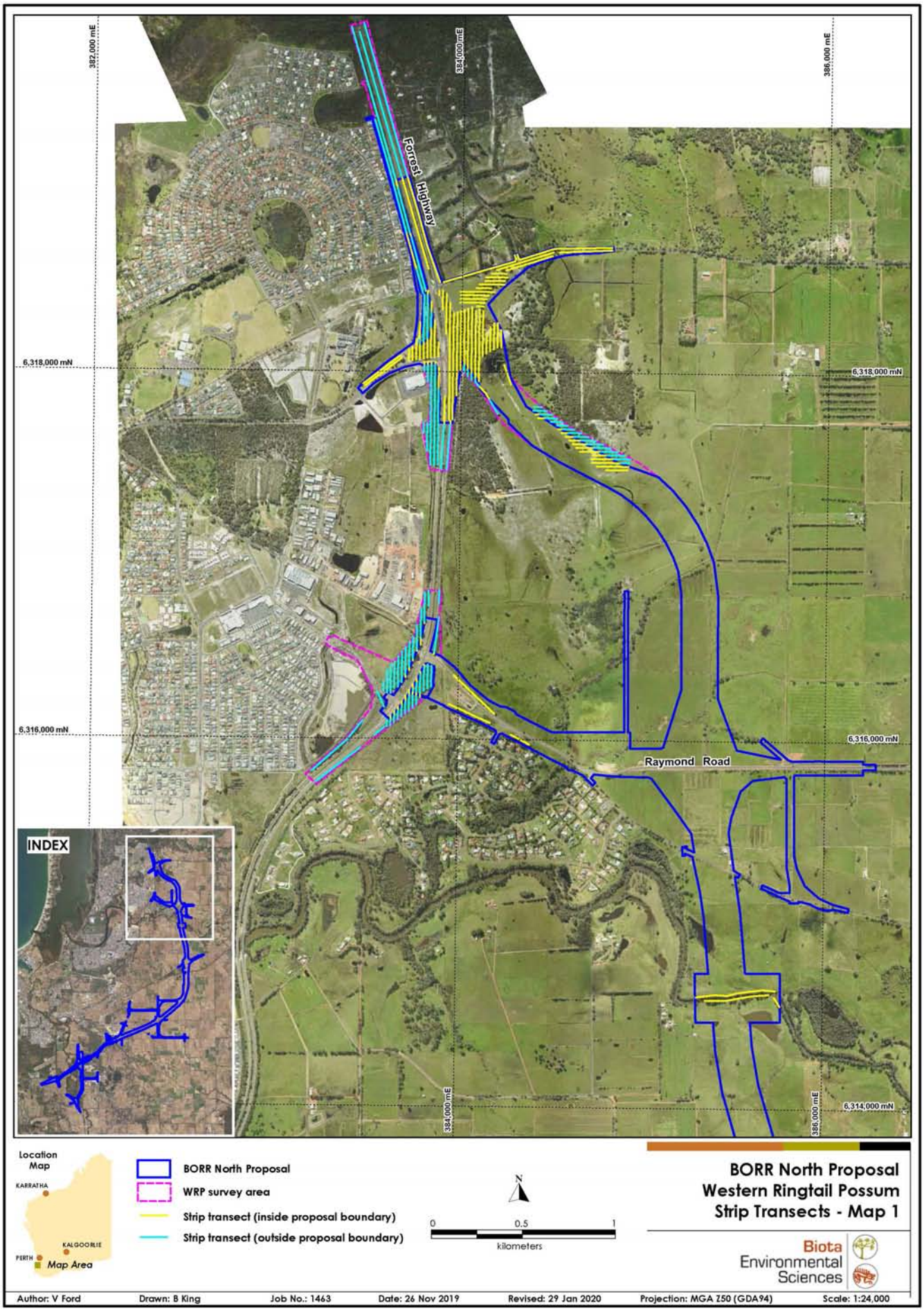

Figure 4.2: Western Ringtail Possum strip-sampling transects within the Proposal Area and adjacent areas (northern section, map 1/3.

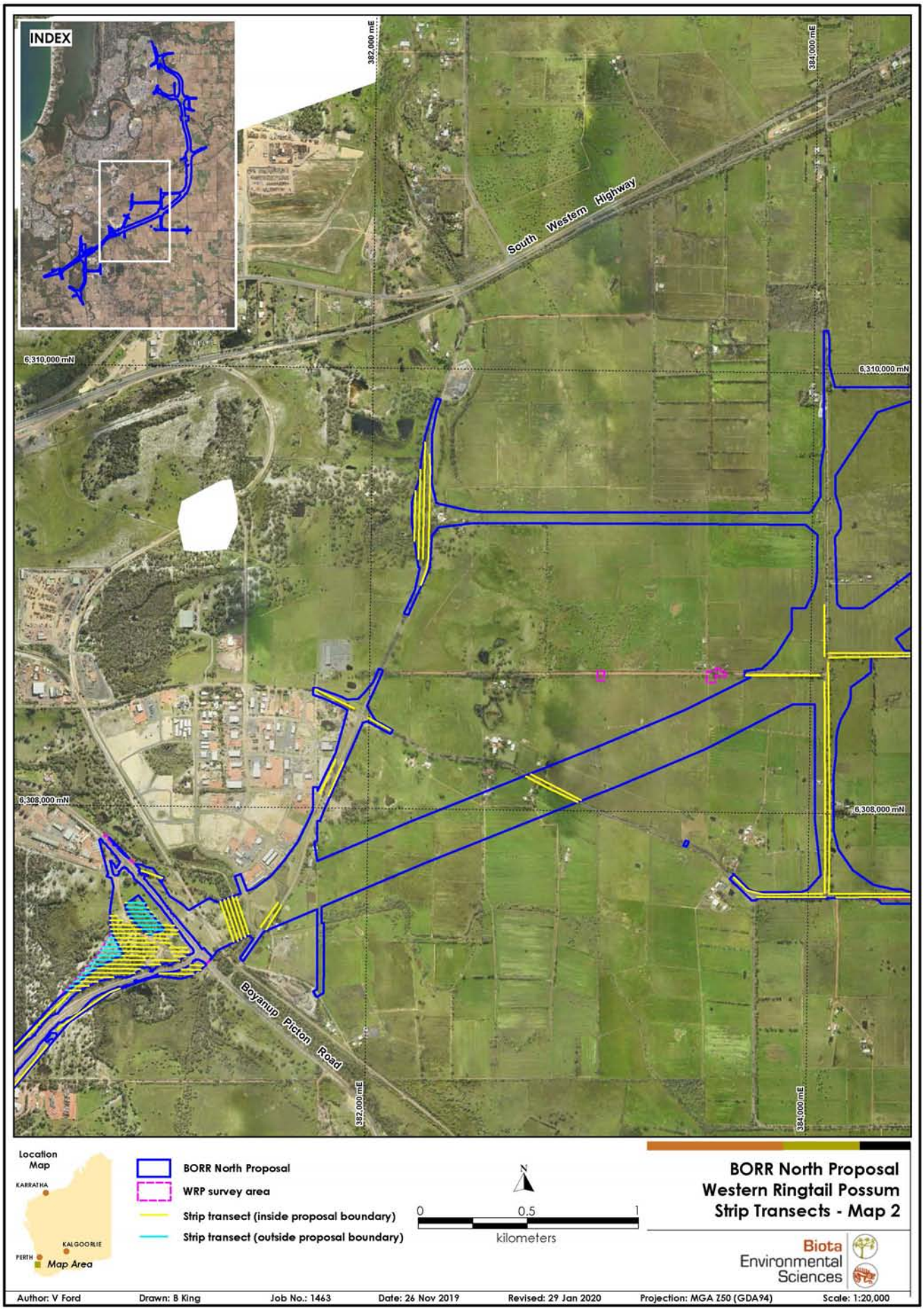

Figure 4.3: Western Ringtail Possum strip-sampling transects within the Proposal Area and adjacent areas (middle section, map 2/3).

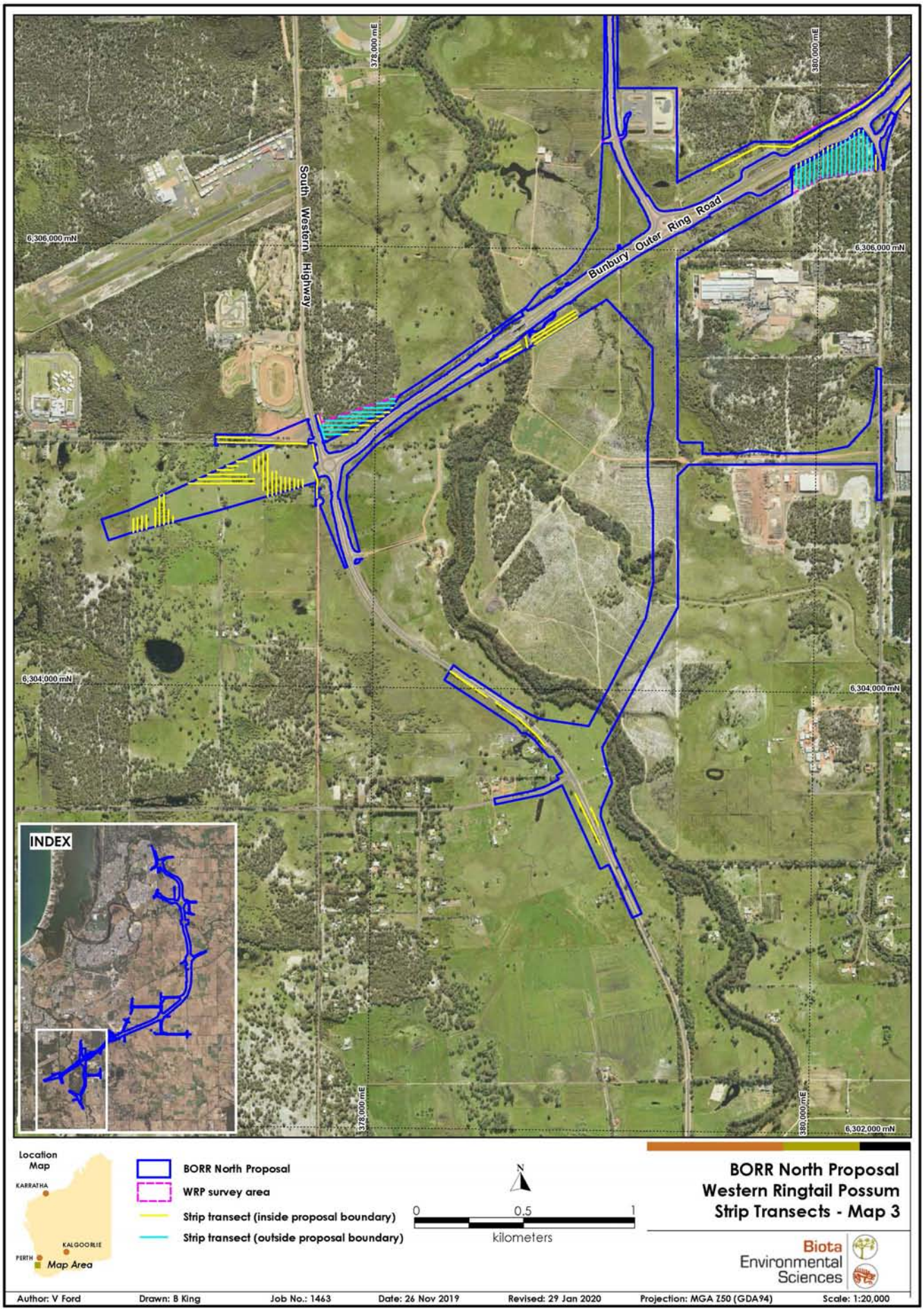

Figure 4.4: Western Ringtail Possum strip-sampling transects within the Proposal Area and adjacent areas (southern section, map 3/3).

4.5.2 Context Sites

Targeted surveying for the Western Ringtail Possum was also undertaken at five context sites, which comprised large vegetation remnants within 10 km of the Proposal Area. The locations of the context sites in relation to the Proposal Area are shown in Figure 4.5.

Given the large size of these remnants, a Distance sampling approach was used, whereby transects spaced at 75 m intervals were pre-loaded onto a GPS and each walked by one observer. Perpendicular distances from transects to possum observations were analysed using the mrds (Laake et al. 2013) and Distance (Miller 2013) packages in R statistical software (R Core Team 2013). Probability detection functions (PDFs) were modelled based on the histogram of perpendicular distance measurements to observations.

Histograms were right truncated as necessary to achieve better model fit, optimally at the distance at which detection probability was 0.15 as recommended by Buckland et al. (2001), but other truncation distances were also tested as part of the model selection phase. Akaike's Informative Criterion (AIC) is a quantitative method of model selection and was used to select between potential models (Buckland et al. 2001). In addition to AIC, candidate models were also compared using visual inspection of their fit to histograms of the perpendicular distance, goodness of fit quantile-quantile (Q-Q) plots, Kolmogorov-Smirnov (K-S) and Cramér-von Mises (CvM) test statistics (Buckland et al. 2004). The half-normal and hazard rate keys were used for modelling the PDF, with or without adjustment terms (Buckland et al. 2001).

The selected model was used to estimate the following parameters:

1. the encounter rate (n/L), where n was the number of observed clusters and L was the total length of the transect;
2. the average probability of detection (p);
3. a density estimate (D); and
4. an estimate of the number of animals in the specified area (N).

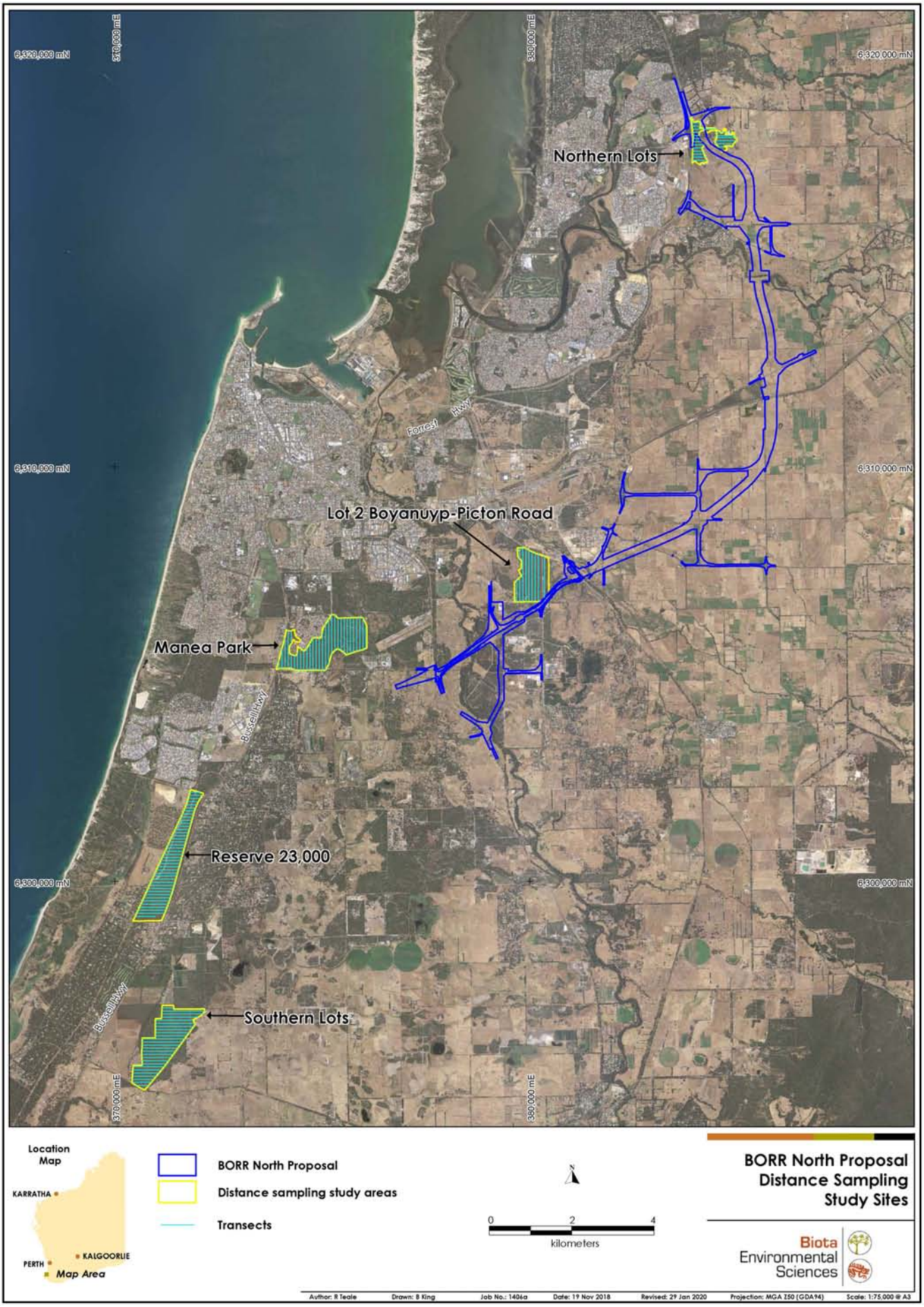

Figure 4.5: Location of Western Ringtail Possum context sites.

The combined transect length and area searched at each context site is given in Table 4.5.

Table 4.5: Number of transects and total effort for each site used to sample for the Western Ringtail Possum at context sites.

Proposal Area	Number of Transects	Effort (km)	Area (ha)
Northern Lots (partially overlaps Proposal Area)	16	4.3	33.3
Reserve 23,000 (Shire of Capel)	41	18.6	146.1
Lot 2 Boyanup–Picton Rd	9	5.1	87.62
Southern Lots	27	22.1	188.0
Manea Park	28	20.4	155.0
Total	**121**	**70.5**	**610.02**

The timing of surveys at the context sites is given in Table 4.6; Lot 2 and Reserve 23,000 were surveyed twice.

Table 4.6: Summary of sites and survey timing for the line-transect Distance sampling, and data incorporated into the Distance analyses.

Study Site	February 2018	August 2018	October 2018	November 2018
Northern Lots (partially overlaps Proposal Area)		✓		
Lot 2 Boyanup–Picton Rd	✓	✓		
Reserve 23,000 (entire), Shire of Capel	✓	✓		
Manea Park			✓	
Southern Lots				✓

4.5.3 Pre-feasibility Strip Sampling

Throughout 2018, a number of targeted strip-sampling surveys for the Western Ringtail Possum were conducted in selected areas of the wider Survey Area as well as context sites. This previous sampling is considered superseded by the introduction of strip-sampling over the refined Proposal Area (see Section 4.5.1), especially as much of the area that was strip-sampled has since been removed from the Proposal Area following refinement of this boundary. For completeness, the methods and results of this historical strip sampling are presented in Appendix 4.

4.6 Black-cockatoos

4.6.1 Breeding Habitat Assessment

The field assessment aimed to determine whether suitable breeding habitat for black-cockatoos was present within the Proposal Area. The Commonwealth *referral guideline for three black cockatoo species* (DSEWPaC 2012) defines breeding habitat as species of trees known to support breeding within the range of the black-cockatoo species, which either have a suitable nest hollow or are of a suitable diameter at breast height to develop a nest hollow (being greater than 50 cm DBH for most Eucalypts, or 30 cm in the case of Wandoo and Salmon Gum).

The aim was to assess, as far as practicable, all potential breeding trees within the Proposal 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. In smaller treed areas (e.g. roadside verges and paddocks containing singular trees), 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 the potential to form hollows (primarily Jarrah, Marri and Tuart) and with sufficient diameter to be considered breeding habitat trees (DBH >50 cm) were recorded using a standard GPS (accurate to within 3 m). Furthermore, the positions of trees observed to contain hollows that were potentially suitable for black-cockatoo nesting were recorded using a differential GPS (accurate to within 1.5 m) and the following parameters were scored:

- tree height using a laser rangefinder;
- tree species;
- the number and height above the ground of observed hollows;
- the estimated size of entry of the hollow (being greater than 10 cm);
- whether the hollow was suitably open for access (i.e. not covered by branches);
- whether the orientation of the hollow was suitable for access (i.e. horizontal to upright; downward-facing hollows being unsuitable);
- whether the location of the hollow allowed for the formation of a nesting cavity (e.g. if on a spout branch, was the branch large enough to support a nesting cavity);
- signs of cockatoo use (including wear around hollows, nut chews, scarring, scratch marks on trunks and branches); and
- photographs were taken as a visual reference and to aid future identification of the tree.

4.6.2 Breeding Hollow Assessment

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. Galahs, ducks 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 4.7). 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 South-west (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 4.7: Breeding habitat for the three Threatened black-cockatoo species.

	Baudin's	Carnaby's	Forest Red-Tailed
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.
Hollow Characteristics			
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 preferenced (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 trees with hollows that appeared potentially suitably for breeding during the ground assessment (Section 4.6.1), a follow-up survey was conducted using a using a remotely-piloted aircraft (RPA; DJI Mavic Pro) to more fully assess the suitability of the hollows for black-cockatoo breeding. Within the Proposal Area, all potentially suitable hollows were subject to drone assessment twice; once in spring (at this time, survey work took place over the entire North Environmental Survey Area), with a follow-up resurvey of potentially suitable hollows within the Proposal Area in September 2019 to determine if any nesting activity could be detected.

The RPA exercise was carried out by two biologists, one of whom is also an experienced RPA pilot. 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. This provides an indication of hollow use and also reduces the likelihood of RPA-fauna collision.

During the flight stage of the RPA survey, the two participants were each tasked with a specific duty: (i) the pilot was responsible for flying the RPA, and (ii) 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 hollow entrance). Breeding suitability of the hollows examined was categorised as per Table 4.8.

Table 4.8: Categories of hollow suitability for black-cockatoo nesting.

Category	Characteristics
Potentially Suitable (with evidence consistent with black-cockatoo use)	As for "Potentially suitable" below, but also showing evidence of use that may be from black-cockatoos. The following represent the types of use that were observed: • Fresh chews around the rim and inside of the hollow. • Eggs that were similar in appearance to those of black-cockatoos.
Potentially Suitable	• Entrance greater than 12 cm. • Branch width and depth large enough to support a nesting chamber. • Angle of entrance/egress suitable for black-cockatoo.
Unlikely Suitable	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	From the ground there appeared to be a potentially suitable hollow, however 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, etc).

4.6.3 Foraging Habitat Assessment

Foraging habitat is defined as areas including plants of species known to support foraging within the range of each black-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 2012). The detailed vegetation mapping of the Proposal Area (GHD 2019) was used in conjunction with the on-site breeding habitat assessment to draw conclusions regarding foraging habitat quality.

While conducting assessments of breeding habitat, notes on foraging habitat and foraging evidence were also 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.

4.7 Brush-tailed Phascogale and Chuditch

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

4.8 Carter's Freshwater Mussel

Surveying for Carter's Freshwater Mussel was undertaken in drainage areas. This comprised walking along the bank and searching for individuals, which are readily detectable in this habitat given their considerable adult size. A separate study targeting aquatic species has been completed (WRM 2019), so the results of the current study are supplemental to that more intensive work.

4.9 Limitations of the Study

A number of potential limitations have been considered in relation to this study, none of which are considered applicable (Table 4.9).

Table 4.9: Assessment against potential survey limitations identified in EPA (2016b).

Potential Limitation	Assessment
Availability of contextual information at a regional and local scale	• 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. • Seven surveys targeting Western Ringtail Possum and/or black-cockatoos have been conducted within 20 km of the Proposal Area; these were reviewed to provide local context. • Contextual information was not considered a limitation.
Competency / experience of the team carrying out the survey, including experience in the bioregion surveyed	• The field personnel conducting the work were all suitably qualified. • The use of RPAs to conduct hollow assessments is a relatively new approach. Improvements were made to the methodology and interpretations throughout the survey work. • A core group of personnel completed all survey phases to standardise recording as far as practicable. • Competency was not considered to be a limitation.
Proportion of fauna recorded and/or collected, any identification issues	• In some cases, identifying white-tailed black-cockatoos to species level was not possible when they were at a distance or heard only. • In some areas, discerning Flooded Gum (*Eucalyptus rudis*) from Tuart (*E. gomphocephala*) was difficult due to lack of visible fruit. In this situation, species was assigned based on habitat and other elements of tree morphology (for example, Flooded Gum tended to be more stunted and have lower branches). • 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. • This study targeted specific fauna species of conservation significance and did not represent an inventory style survey. However, the target species (particularly Western Ringtail Possum and black-cockatoos) were intensively surveyed and proportion of fauna and identification issues were not considered a limitation.
Appropriate area fully surveyed (effort and extent)	• This study targeted specific fauna species of conservation significance, and comprehensively sampled the occurrence of habitat for these species within the Proposal Area. • Sufficient time was allocated to the field survey component to allow for all potential habitat for the target conservation significant species to be surveyed. • The extent of survey was not considered to be a limitation.
Access restrictions within the survey area	• Access within the survey area was not considered a limitation for the current study.
Survey timing, rainfall, season of survey (timing / weather / season / cycle)	• 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.
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey	• Disturbances were not considered a limitation to the survey.

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5.0 Results

5.1 Desktop Review

Tables detailing all species returned from the desktop review are presented in Appendix 5. Database search results, together with four studies within 10 km of the Proposal Area, yielded a combined species inventory of 230 vertebrate fauna species, comprising 28 mammals (14 native non-volant mammals, five bats and nine non-native species), 159 birds (72 of which are largely reliant on freshwater or marine habitats), 33 reptiles and 10 amphibians.

Seventeen of these species are of conservation significance; these are considered in more detail in Section 6.0.

5.2 Fauna Habitats

Much of the area has been historically cleared for agriculture and road infrastructure, while approximately 92 ha of native vegetation remains within the 624.24 ha Proposal Area. The large majority of this vegetation was ground-truthed over the course of field surveys. Fauna habitats were refined using on-site descriptions combined with vegetation mapping of the Proposal Area (GHD 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, even if the two had similar floral composition.

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 the particular species' requirements, as detailed in Section 6.0.

Six broad fauna habitats were described for the Proposal Area, as detailed in Table 5.1 and mapped in Figure 5.1 to Figure 5.3. The maps also display contextual habitat mapping over the wider Survey Area. These habitats comprised:

- Dampland with *Melaleuca* woodland and shrubland in paddocks and road reserves (31.94 ha). Common in paddocks and occasionally road reserves throughout the Proposal Area.
- Marri/*Eucalyptus* in paddocks and road reserves (20.09 ha)
  Scattered trees in lower-lying paddock areas were typically Flooded Gum (*Eucalyptus rudis*), while those in road reserves were typically Marri (*Corymbia calophylla*). The understorey typically comprised introduced weedy grasses.
- Marri/*Eucalyptus* woodland (12.79 ha)
  Refers to the larger remnants of Marri/*Eucalyptus* woodland within the Proposal Area,
- Peppermint woodland (6.06 ha)
  While Peppermint (*Agonis flexuosa*) occurred as a mid-storey species in mixed woodland habitats, some homogenous stands of Peppermint were considered as a distinct fauna habitat due to their distinct three dimensional structure.
- Riparian woodland (significant drainage) (4.88 ha)
  Woodlands of the upper banks and floodplains of significant drainages (Preston River, Collie River and Brunswick River).
- Artificial wetland (2.76 ha)
  Occurred at two locations in the Northern Lots, where man-made drains have been used to create areas of semi-permanent water.

The following cleared areas/vegetation types were considered largely devoid of fauna habitat:

- Highly modified / cleared (531.24 ha)
  Land cleared for agriculture, housing, roads and other infrastructure.
- Early revegetation (9.71 ha)
  Some areas of early growth of planted vegetation in roadside reserves.
- Non-native vegetation (4.76 ha)
  Mature planted vegetation including *Eucalyptus* species along internal fence lines, driveways and landscaping.

A considerable proportion of the vegetation within the Proposal Area 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 are more mobile than Western Ringtail Possums). For paddock remnants, their usefulness as stepping stones may be reduced in instances where they are heavily fenced or where there is little or no understorey due to grazing.

The vegetation within the road reserves varied broadly in species composition and connectivity. As fauna habitat, it was separated into two types; areas dominated by *Melaleuca* shrubland and areas supporting scattered trees or woodland. Road reserve woodland comprised native species (including *Corymbia calophylla*, *Eucalyptus marginata*, *E. rudis*, occasionally *E. gomphocephala* and some distinct areas of *Casuarina obesa*), but also non-native *Eucalyptus* species. The section of Forrest Highway road reserve adjacent to the Northern Lots (104, 5 and 131) and extending north to the end of the Proposal Area was considered to represent a potentially important habitat linkage for the Western Ringtail Possum. This section of the road reserve was found to support a high abundance of possums at some times of year and connects to the riparian habitat of the Collie River.

The riparian woodland of the Preston River is likely to represent a habitat linkage for the Western Ringtail Possum; individuals have been recorded in this habitat, at times in high number (see Appendix 4, Figure 2) and this long strip of woodland habitat connects a number of widely separated reserve areas occurring outside the Proposal Area (e.g. Manea Park and Franklandia Nature Reserve).

Table 5.1: Broad fauna habitats of the Proposal Area.

Broad Fauna Habitat	Area (ha)	Example Photograph/s
Dampland with *Melaleuca* woodland and shrubland in paddocks and road reserves Very open woodland of Swamp Paperbark (*Melaleuca rhaphiophylla*) over herbs and weeds in road reserves, and over introduced grasses in paddocks and very occasionally road reserves. When occurring in paddocks, the understorey was heavily grazed.	31.94	 
Marri/*Eucalyptus* in paddocks and road reserves Typically occurring as widely spaced trees or occasionally as small stands in paddocks; comprising a mosaic of scattered trees of *Melaleuca*, Marri (*Corymbia calophylla*) and/or Flooded Gum (*Eucalyptus rudis*). The understorey was usually heavily grazed. Roadside species composition was variable including native tree species as above, areas of *Casuarina* (see photograph), as well as planted introduced *Eucalyptus*.	20.09	 

Broad Fauna Habitat	Area (ha)	Example Photograph/s
Marri/*Eucalyptus* woodland Jarrah (*Eucalyptus marginata*) +/- Marri (*Corymbia calophylla*) dominated overstorey, varying understorey of Banksia (*Banksia attenuata* and *B. grandis*) or Peppermint (*Agonis flexuosa*).	12.79	 
Peppermint woodland While Peppermint was more commonly found as a midstorey species within Marri/Eucalypt woodland, it did occur in uniform stands in some areas, often over introduced pasture grasses.	6.06	 

Broad Fauna Habitat	Area (ha)	Example Photograph/s
Riparian woodland (significant drainage) The Proposal Area intersected sections of the Preston, Collie and Brunswick Rivers. This habitat comprised: • Woodland of Flooded Gum and Marri over Swamp Paperbark on Preston River; • Woodland of Swamp Paperbark, Flooded Gum and Swamp Sheoak (*Casuarina obesa*) fringing Collie River. • Open forest of Flooded Gum on the banks/floodplain of the Brunswick River.	4.88	 
Artificial wetland Man-made drainage channels have been used to create small artificial wetlands in two locations within the Proposal Area, the most notable being south of Clifton Road (pictured). Very open woodland of Swamp Paperbark over introduced grasses and herbs in paddocks and road reserves.	2.76	

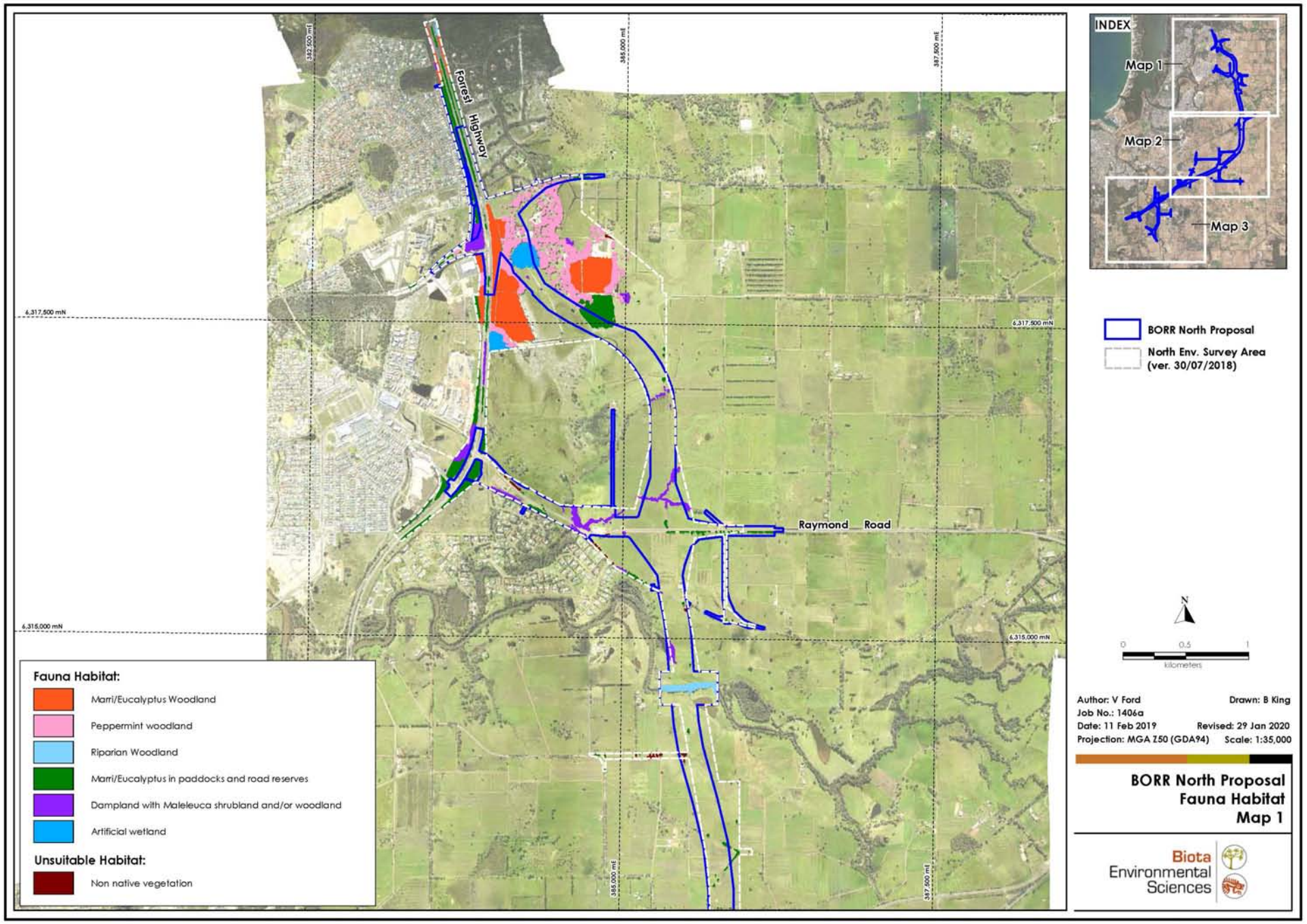

Figure 5.1: Broad fauna habitats of the Proposal Area (northern section, map 1/3).

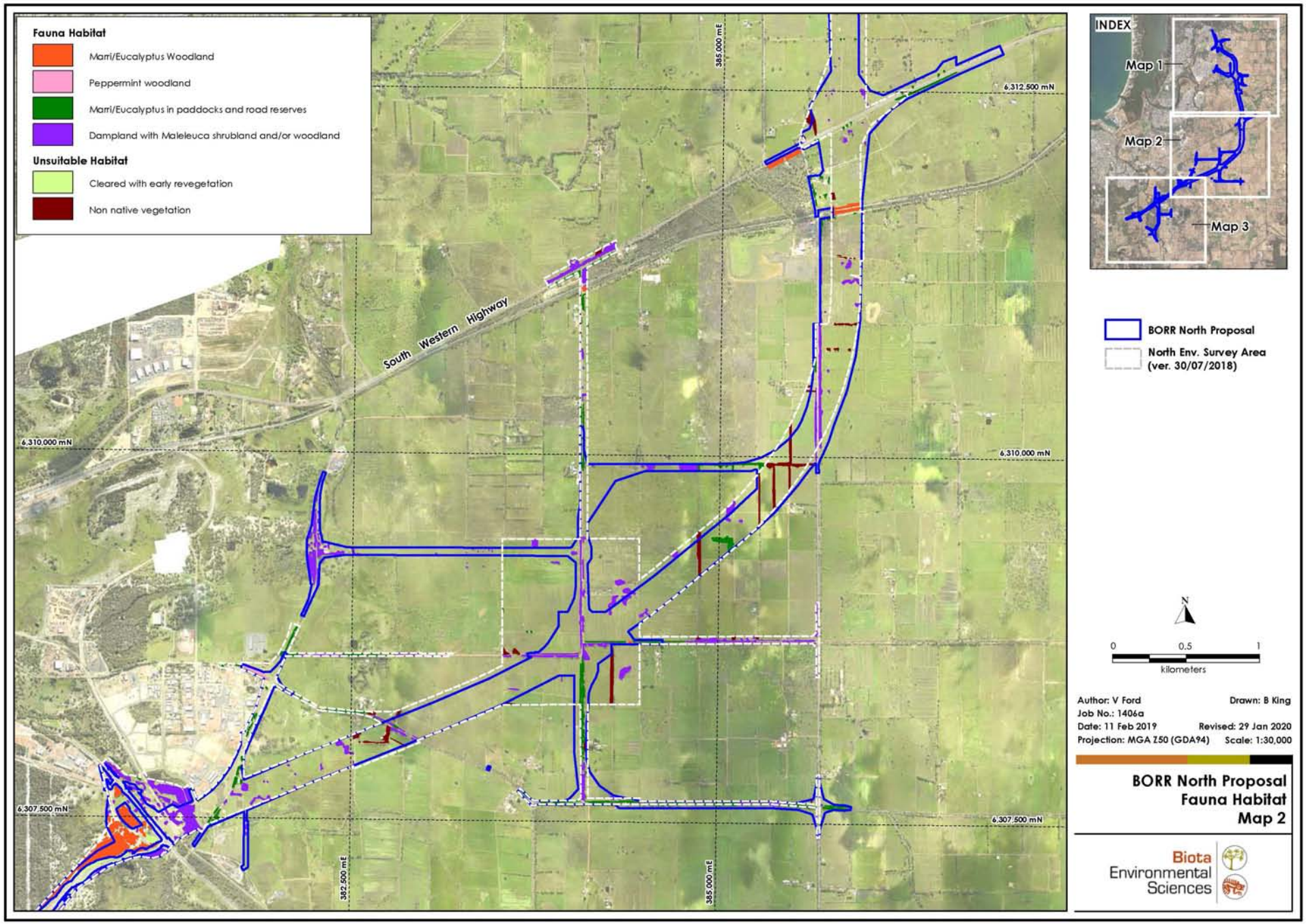

Figure 5.2: Broad fauna habitats of the Proposal Area (middle section, map 2/3).

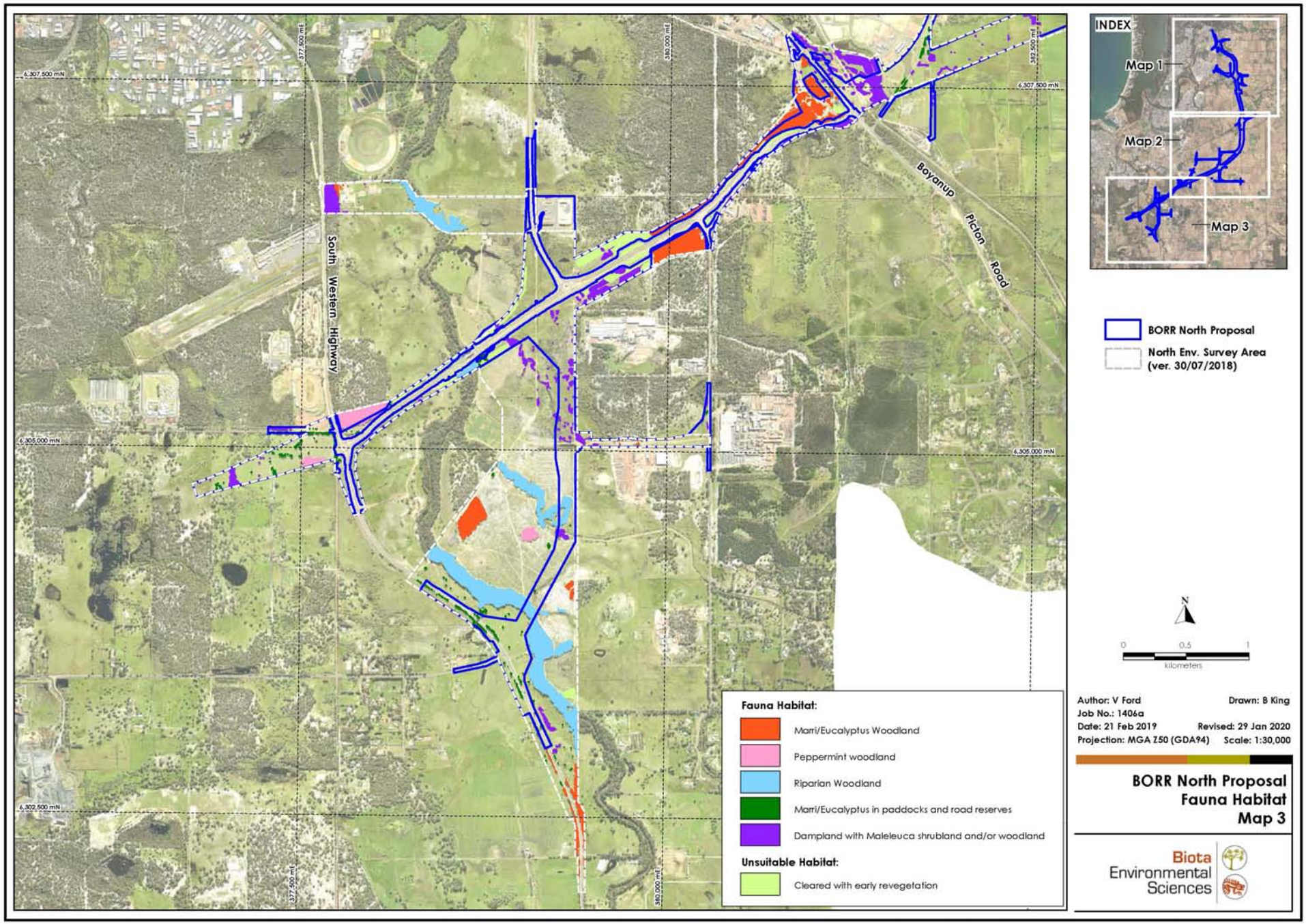

Figure 5.3: Broad fauna habitats of the Proposal Area (southern section, map 3/3).

5.3 Western Ringtail Possum

5.3.1 Proposal Area

The number of Western Ringtail Possum observations and the total number of individuals recorded for the three phases of strip-sampling conducted in 2019 is presented in Table 5.2 for both the Proposal Area and adjacent areas. The total number of individuals (Proposal Area plus adjacent areas) in each survey phase has ranged from 43 to 59. Inside the Proposal Area, the number of individuals recorded ranged from 15 – 22 while in the adjacent areas numbers were more variable, ranging from 21 – 39 individuals per survey phase (Table 5.2).

The locations of Western Ringtail Possums observations during the three phases of strip-sampling survey are displayed in Figure 5.4 to Figure 5.6. Comparing the distribution of observations between the three phases indicates areas of consistent records across all three phases as follows: (i) the lots south of the intersection of Clifton Road and Forrest Highway; (ii) further south along Forrest Highway where Raymond Road intersects; (iii) where Moore Road intersects the existing section of the central BORR; and (iv) where the existing section of BORR and South Western Highway intersect. Also evident is that some areas were used intermittently. For example, the October and December phases of survey identified records of ringtail possums in new localities where individuals were not recorded in August, such as along Martin Pelusey Road and within the Forrest Highway road reserve at the northernmost extent of the Proposal Area. Interestingly, this northernmost road reserve was also the site of numerous records during pre-referral work in October 2018, with 12 individuals recorded from 10 observations all in one night. Further north of the Proposal Area, this portion of the survey area runs nearby the Brunswick River.

Table 5.2: Strip-sampling results for both the Proposal Area and adjacent areas.

	August 2019		October 2019		December 2019	
Observation Type	**Proposal**	**Adjacent**	**Proposal**	**Adjacent**	**Proposal**	**Adjacent**
Adult	8	15	16	22	13	22
Adult pair	1	3	-	-	-	3
Mother with subadult (at heel)	6	-	2	7	1	3
Mother with two juveniles	-	-	-	1	-	-
Total Observations	**15**	**18**	**18**	**30**	**14**	**28**
Total Individuals	**22**	**21**	**20**	**39**	**15**	**34**

Sampling for the Western Ringtail Possum was conducted in five of the six habitats occurring within the Proposal Area. The only habitat not surveyed for Western Ringtail Possums was the 2.76 ha of artificial wetland that was often full of water and contained marginal habitat for the possum (scattered Swamp Paperbark over sedges and grasses). The Western Ringtail Possum was recorded in all five of the habitats surveyed. The number of individuals in each habitat type in each phase of survey is given in Table 5.3 with an approximate density within each habitat, based on the area of each.

The average density over all habitats was 0.25 individuals per hectare in the Proposal Area. Densities were highest, by a considerable margin, in the Peppermint Woodland habitat (average of 1.54 individuals per hectare over the three phases). Amongst other habitats, Riparian Woodland and Marri/*Eucalyptus* Woodland supported similar densities ranging from 0.26 – 0.27 per hectaure. Densities within the Marri/*Eucalyptus* in Paddocks and Road Reserves and Dampland with *Melaleuca* Shrubland and/or Woodland were notably lower at only 0.1 individuals per hectare on average, however, densities within these habitat types varied markedly through time.

Table 5.3: Western Ringtail Possum individuals in relation to habitats of the Proposal Area

		August 2019		October 2019		December 2019	
Habitat Type	**Habitat Area (ha)**	**Individuals**	**Density (per ha)**	**Individuals**	**Density (per ha)**	**Individuals**	**Density (per ha)**
Dampland with *Melaleuca* Shrubland and/or Woodland	31.94	2	0.06	7	0.22	-	0.00
Marri/*Eucalyptus* in Paddocks and Road Reserves	20.09	-	0.00	1	0.05	5	0.25
Marri/*Eucalyptus* Woodland	12.79	1	0.08	3	0.23	6	0.47
Peppermint Woodland	6.06	17	2.81	8	1.32	3	0.50
Riparian Woodland	4.88	2	0.41	1	0.20	1	0.20
Total	**75.77**	**22**	**-**	**20**	**-**	**15**	**-**

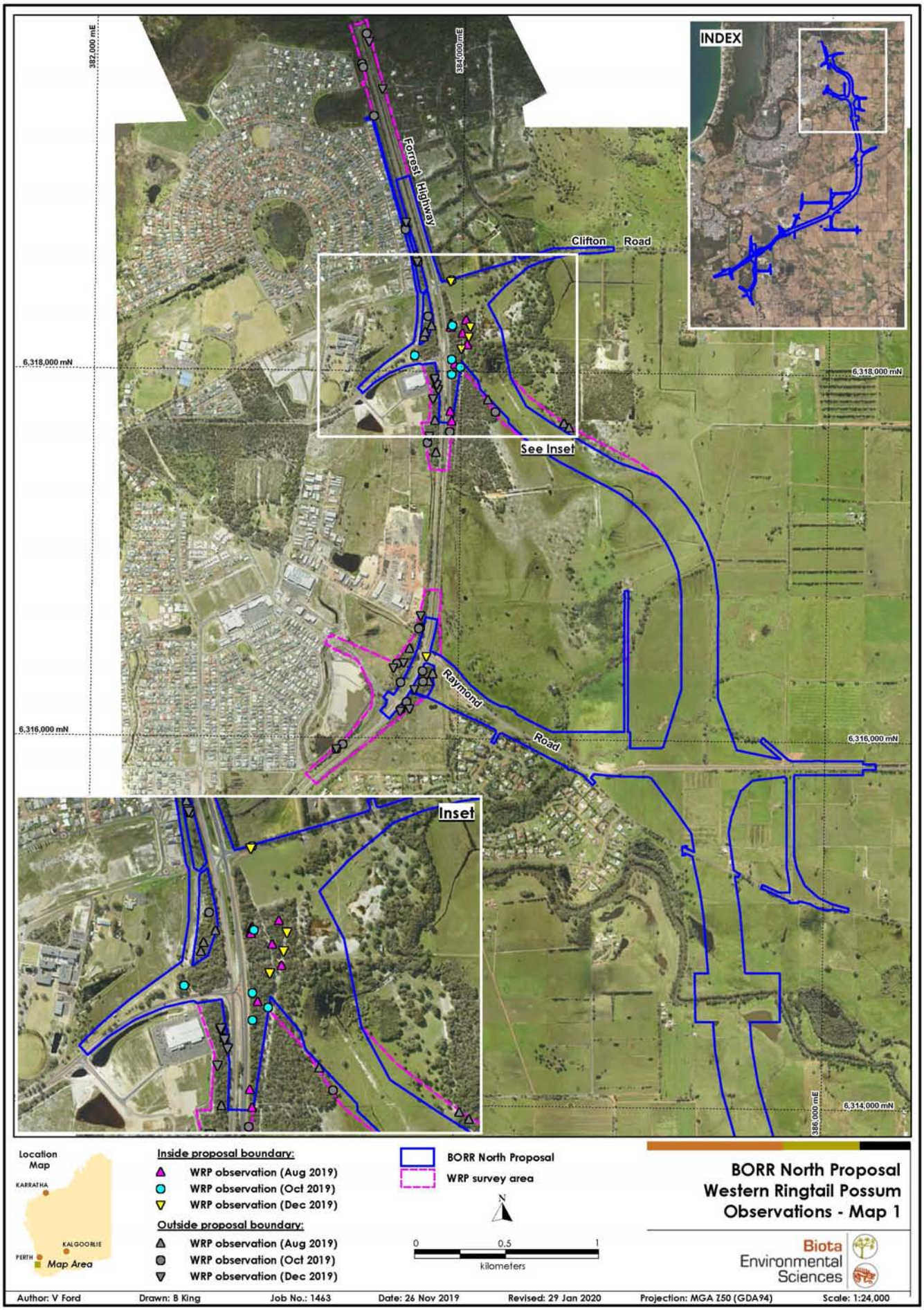

Figure 5.4: Records of Western Ringtail Possums obtained from bi-monthly strip sampling (northern section, map 1/3).

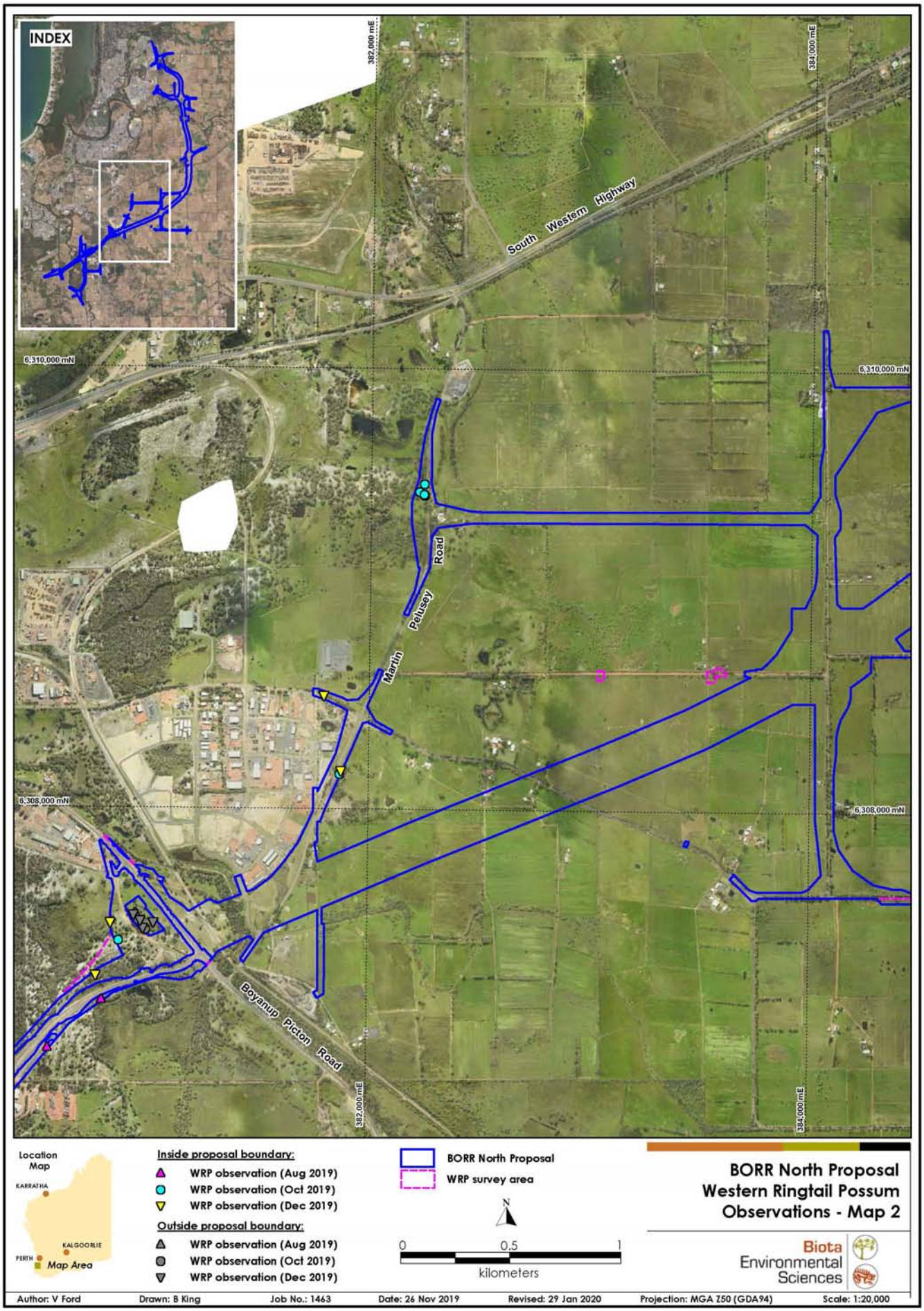

Figure 5.5: Records of Western Ringtail Possums obtained from bi-monthly strip sampling (middle section, map 2/3).

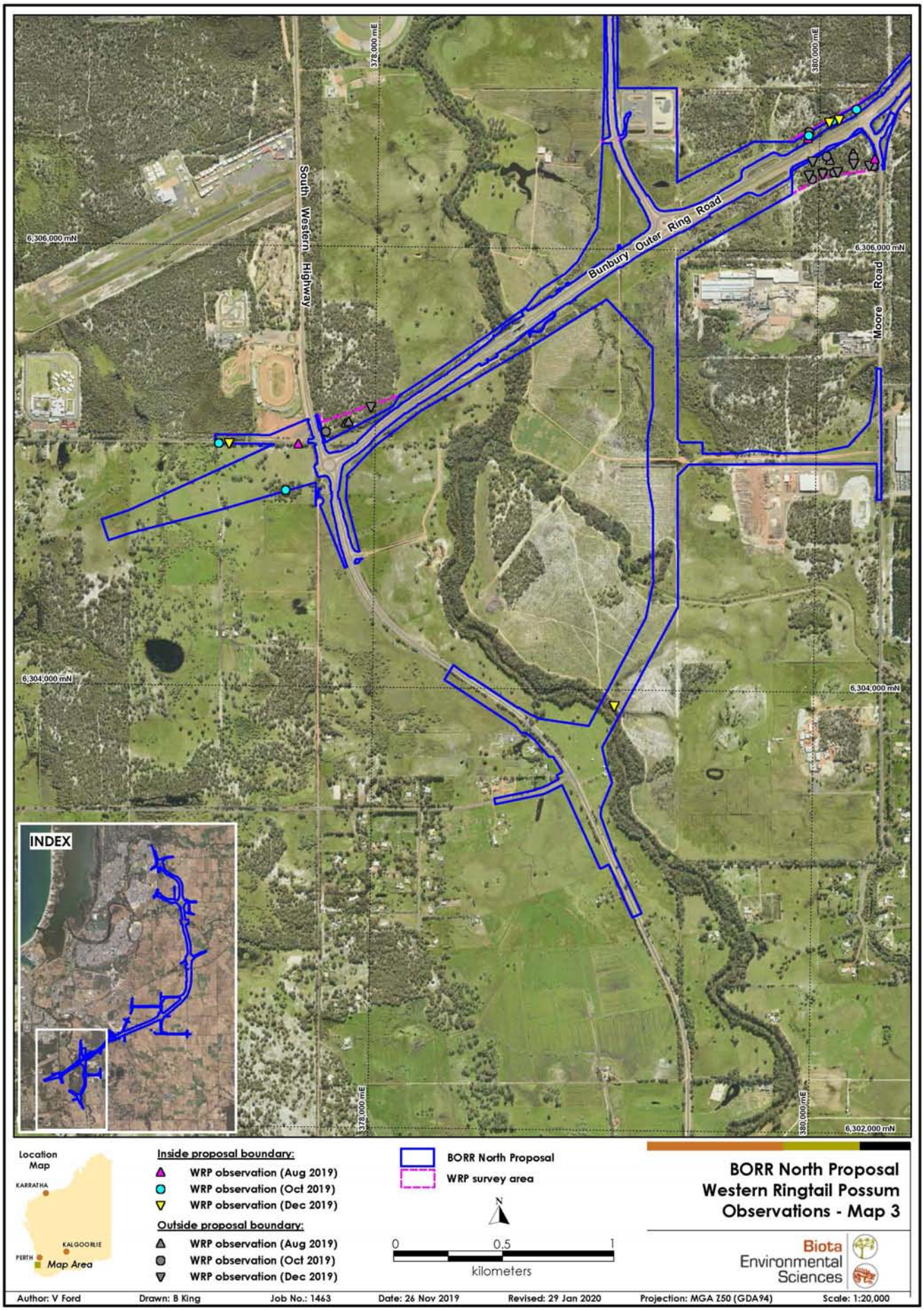

Figure 5.6: Records of Western Ringtail Possums obtained from bi-monthly strip sampling (southern section, map 3/3).

5.3.2 Context Sites: Density Estimates of Western Ringtail Possum

Distance sampling at five context sites (including seasonal repeats) together yielded 317 observations and 400 individual Western Ringtail Possums (Table 5.4).

Table 5.4: Number of observations and individuals (in parentheses) of Western Ringtail Possums at context sites during Distance sampling surveys.

Study Site	February 2018	August 2018	September 2018	October 2018	November 2018
Northern Lots	-	-	11 (18)	-	-
Lot 2 Boyanup–Picton Rd	51 (59)	54 (60)	-	-	-
Manea Park	-	-	-	74 (103)	-
Reserve 23,000 (entire) Shire of Capel	56 (75)	46 (52)	-	-	-
Southern Lots	-	-	-	-	25 (33)

Figure 5.7 displays the records of Western Ringtail Possums at each context site. For those sites sampled on multiple occasions, only results of the most recent survey are shown.

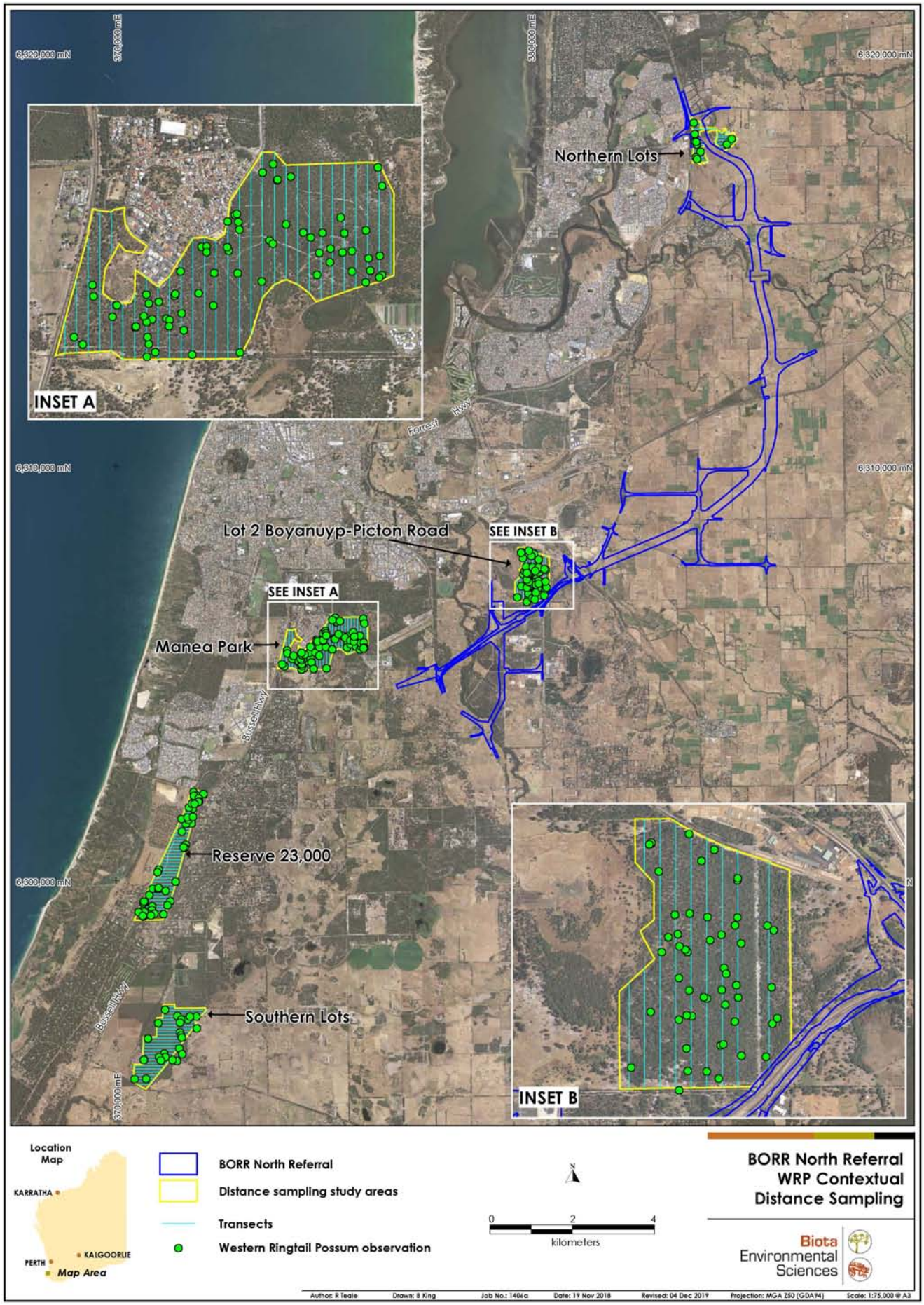

Figure 5.7: Records of Western Ringtail Possums obtained from distance sampling surveys at context sites.

When examining the data from the line-transect Distance sampling, stepped lower initial intervals that increase away from the centreline can indicate movement of individuals away from the observers; while initially high then decreasing intervals indicate relatively little movement away from the observers (Buckland et al. 2001). Both can lead to bias in density estimation. The histogram of detection distances generated in the present study did not indicate Western Ringtail Possum movement either toward or away from the observer (Figure 5.8).

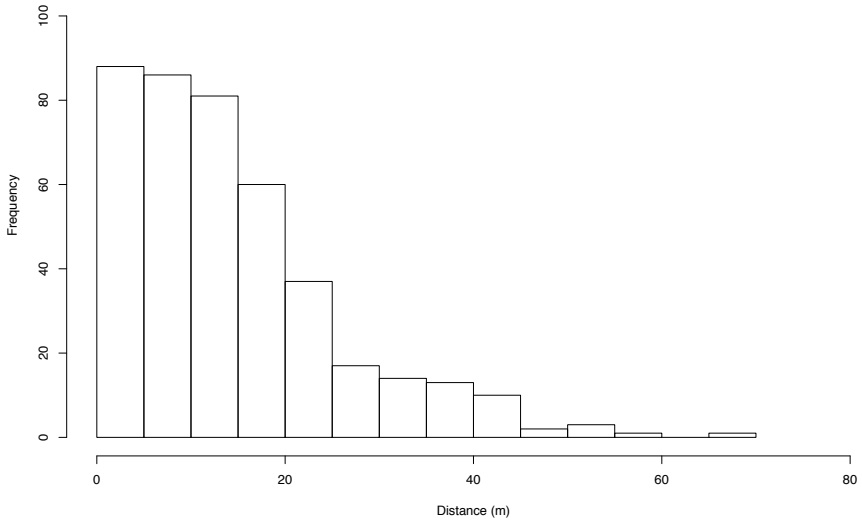

Figure 5.8: Histogram of all Western Ringtail Possum observations (n=413) from all surveys included in the distance sampling analyses.

The best overall model fit of the combined data was a half-normal key with no adjustment terms and no covariates (truncation = 18 m, n = 298, K-S p = 0.999, CvM p = 0.999) (Figure 5.9).

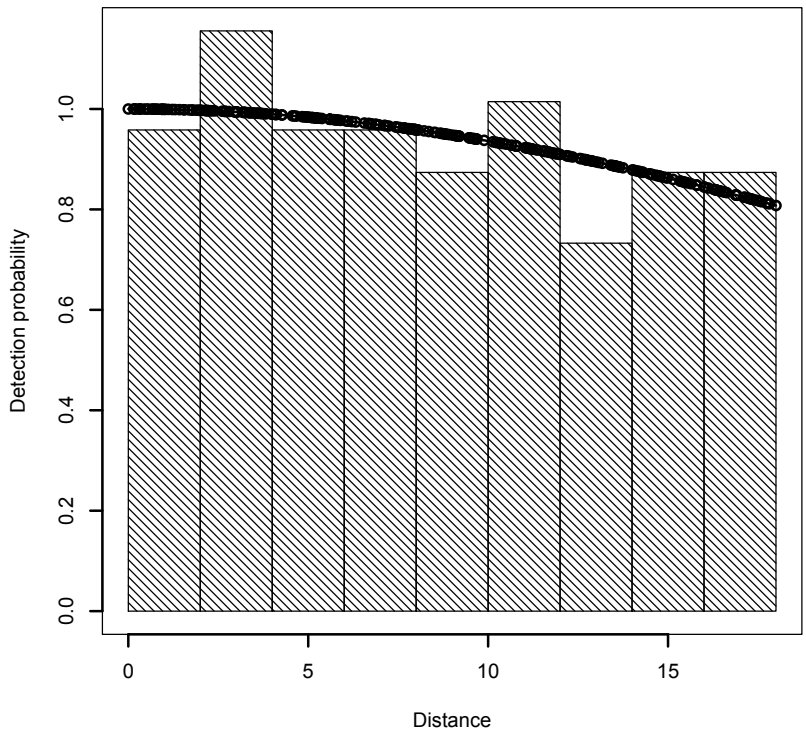

Figure 5.9: Histogram of Western Ringtail Possum observations from the combined surveys with half-normal probability detection function and truncation at 18 m.

Effort and encounter rate data are presented in Table 5.5. Data were post-stratified by study site to provide parameter estimates for each area separately (Table 5.6), which in turn enabled the calculation of abundances as provided in Table 5.7.

The highest density estimates were recorded from two contextual sites, Lot 2 Boyanup–Picton Rd and Manea Park; these yielded 1.37 ± 0.19 (August phase) and 1.201 ± 0.267 individuals per ha (October phase) respectively. These density estimates resulted in abundance estimates of 121 ± 17 (August survey) and 186 ± 41.45 individuals based on the surveyed area polygons (i.e. the polygons depicted in Figure 5.7).

A much lower density of Western Ringtail Possums (0.39 ± 0.11 per ha) was estimated from the Southern Lots. Reserve 23,000 yielded a density estimate of 0.56 ± 0.11 individuals per ha (August survey), which translates to an estimate of 82 ± 16 individuals. The Northern Lots area, overlapping the Proposal Area, yielded a density estimate of 0.62 ± 26 individuals per ha; this equates to approximately 21 ± 9 individuals based on the estimated remnant size of 33.3 ha.

Table 5.5: Key summary statistics from the Distance sampling programme for Western Ringtail Possums at five context sites surveyed in 2018.
(n = number of observations (equals clusters), k = number of transects, ER = Encounter Rate, se = standard error, cv = coefficient of variation.)

Study Site	Area (ha)	Covered Area (ha)	Effort (km)	n	k	ER per km	se.ER	cv.ER
Northern Lots								
September	33.3	15.50	4.29	6	16	1.40	0.56	0.40
Lot 2 Boyanup–Picton Rd								
February	87.62	34.98	9.72	42	9	4.32	0.71	0.16
August	87.62	34.98	9.72	40	9	4.12	0.59	0.14
Manea Park								
October	155.0	73.28	20.40	51	28	2.51	0.41	0.16
Reserve 23,000 Shire of Capel								
February	146.1	67.20	18.60	38	41	2.03	0.49	0.24
August	146.1	67.20	18.60	30	41	1.60	0.30	0.19
Southern Lots								
November	188.0	79.58	22.10	22	27	1.00	0.17	0.07

Table 5.6: Density estimates for Western Ringtail Possums (individuals per hectare) at five context sites.
(se = standard error, cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit, df = degrees of freedom.)

Study Site	Density per ha	se	cv	lcl	ucl	df
Northern Lots						
September	0.62	0.26	0.42	0.26	1.48	15.66
Lot 2 Boyanup–Picton Rd						
February	1.50	0.25	0.17	1.04	2.16	10.78
August	1.37	0.19	0.16	0.94	1.93	10.90
Manea Park survey						
October	1.201	0.267	0.20	0.73	1.64	33.05
Reserve 23,000 Shire of Capel						
February	0.78	0.20	0.25	0.47	1.29	45.24
August	0.56	0.11	0.20	0.35	0.79	48.66
Southern Lots survey						
November	0.39	0.11	0.27	0.26	0.68	28.90

Table 5.7: Abundance estimates for Western Ringtail Possums (individuals) in the study sites relevant to the Proposal Area.
(se = standard error, cv = coefficient of variation, lcl = lower confidence limit, ucl = upper confidence limit, df = degrees of freedom.)

Study Site	Abundance Estimate	se	cv	lcl	ucl	df
Northern Lots survey						
September	20.78	8.82	0.42	8.75	49.36	15.66
Lot 2 Boyanup–Picton Rd 2018 surveys						
February	131.51	21.92	0.17	91.25	189.51	10.78
August	121	17	0.16	82.49	169.06	10.90
Reserve 23,000 Shire of Capel 2018 surveys						
February	114.07	28.94	0.25	68.98	188.61	45.25
August	82	16	0.20	51.29	114.91	48.66
Manea Park survey						
October	186	41.45	0.20	113.65	254.25	33.06
Southern Lots survey						
November	73.42	20.08	0.27	42.38	127.18	28.90

5.4 Black-cockatoos

5.4.1 Observations

Two observations of white-tailed black-cockatoos flying over the Proposal Area were recorded; a single individual and a group of three. The birds could not be distinguished to species level (i.e. Carnaby's Black-Cockatoo versus Baudin's Black-Cockatoo) at a distance. A small group of calling white-tailed black-cockatoos was heard but not seen. The location of these records is shown in Figure 5.10.

5.4.2 Breeding Habitat Assessment

Potential 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 2012). A total of 711 trees matching these criteria were recorded within the Proposal Area: 330 Marri, 208 Jarrah, 132 Flooded Gum, and 41 Eucalypts of other species (either introduced species, or dead stags that could not be identified). The location of all trees with a DBH greater than 50 cm DBH is shown in Figure 5.11 to Figure 5.13, including those that support hollows potentially suitable for breeding (more detail provided in Section 5.4.2.1). For contextual purposes, trees within the wider Survey Area are also displayed.

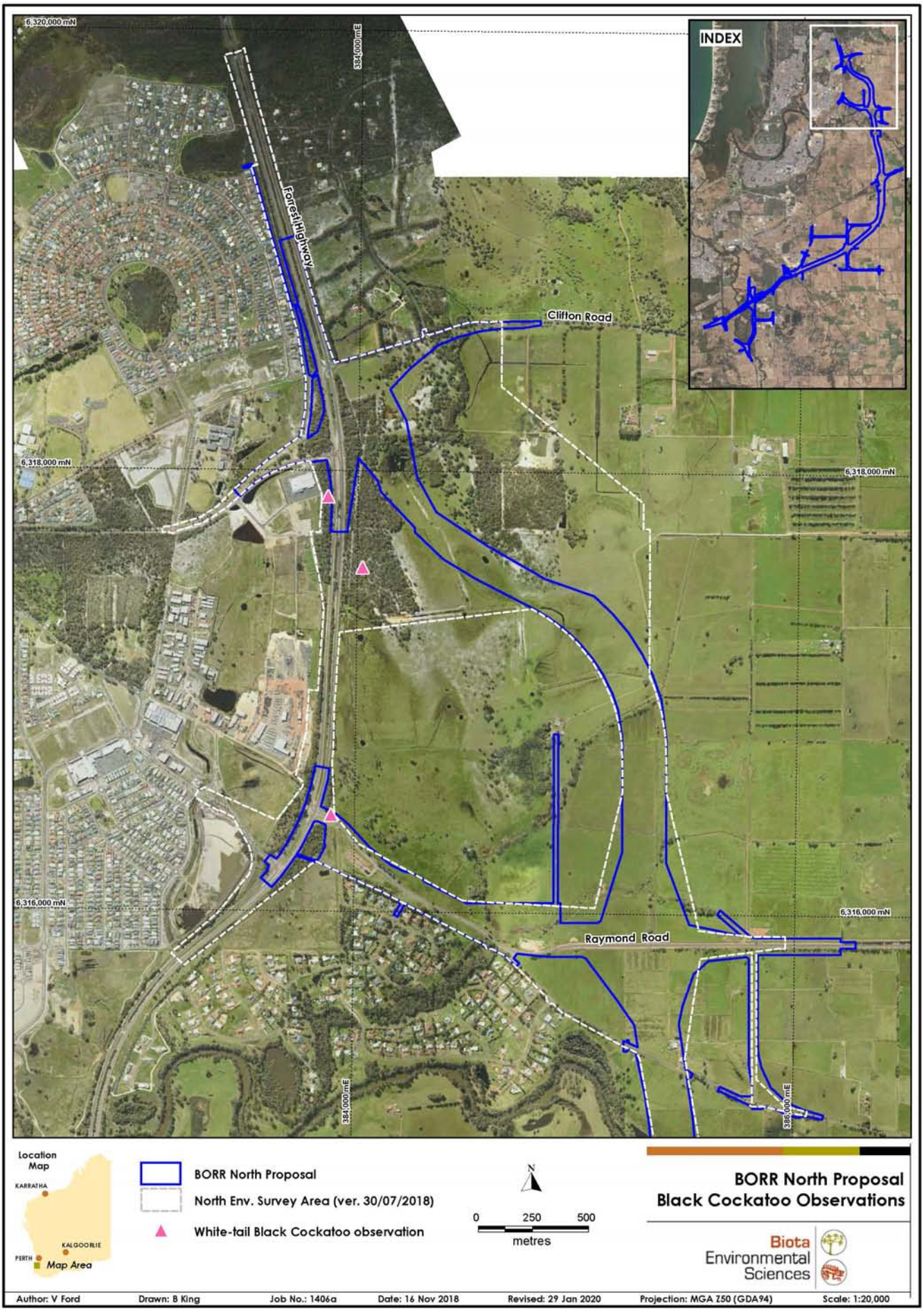

Figure 5.10: Records of white-tailed black-cockatoos.

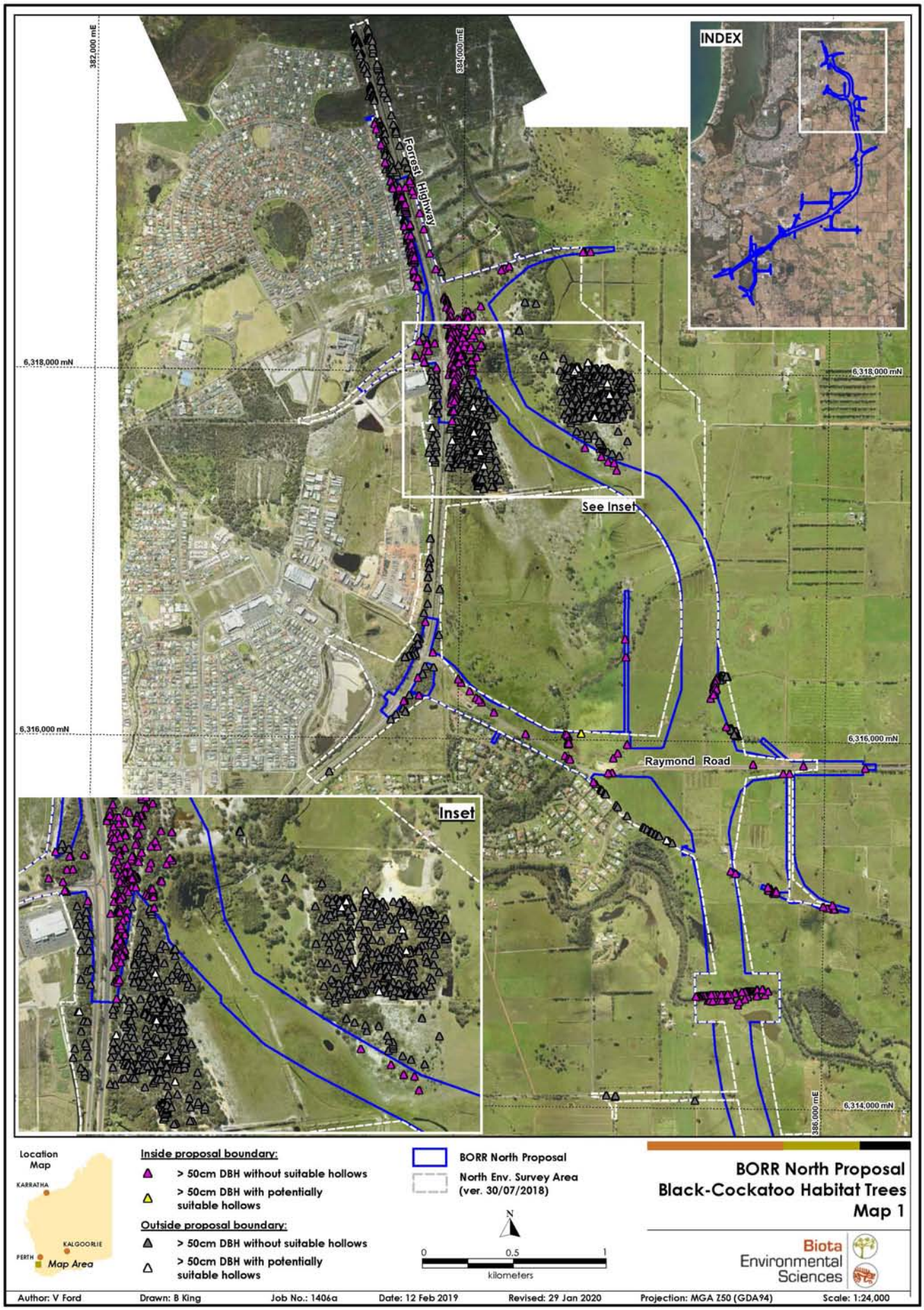

Figure 5.11: Trees >50 cm DBH of hollow-forming species recorded within the Proposal Area, including those bearing suitable hollows (northern section, map 1/3).

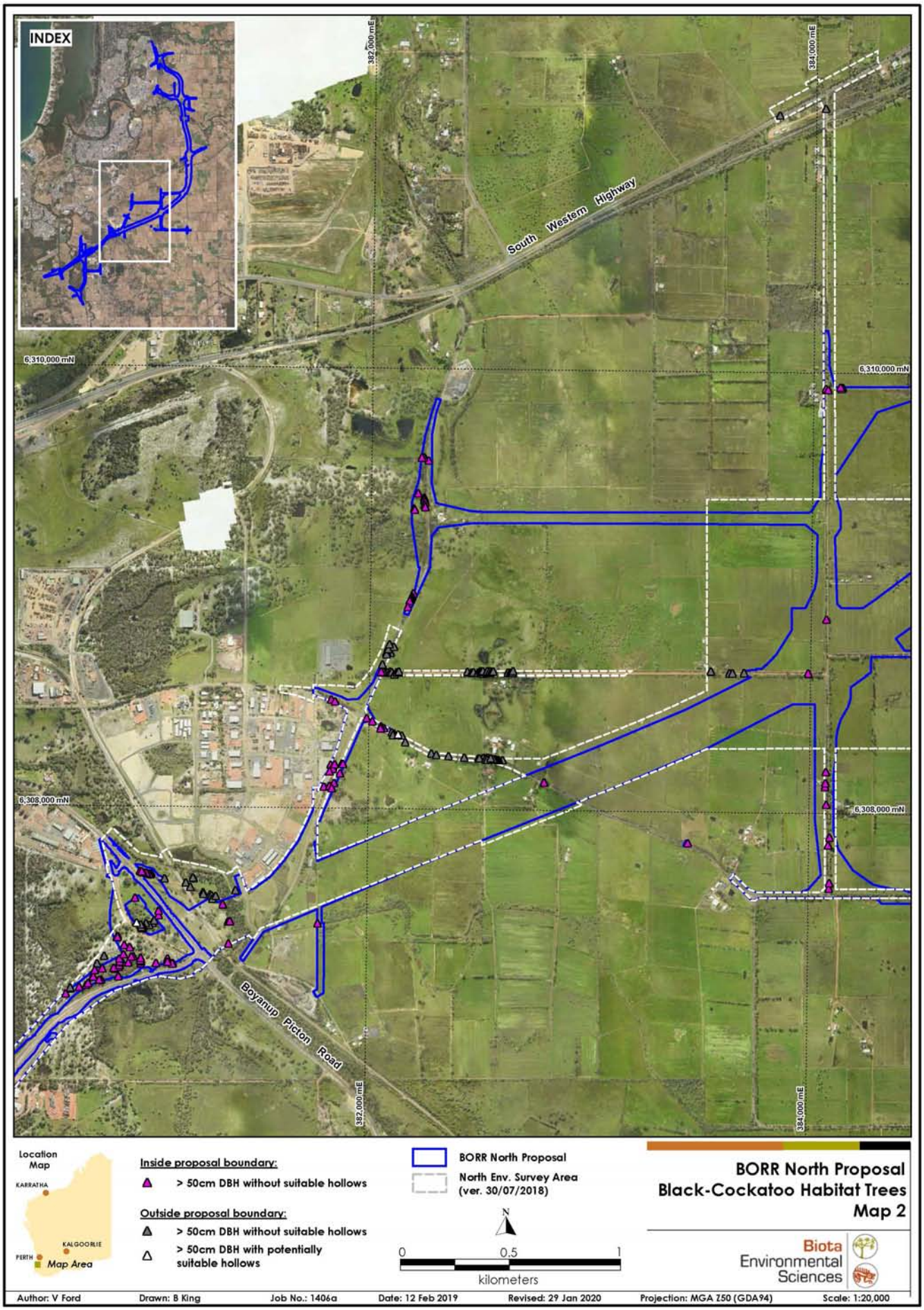

Figure 5.12: Trees >50 cm DBH of hollow-forming species recorded within the Proposal Area, including those bearing suitable hollows (middle section, map 2/3).

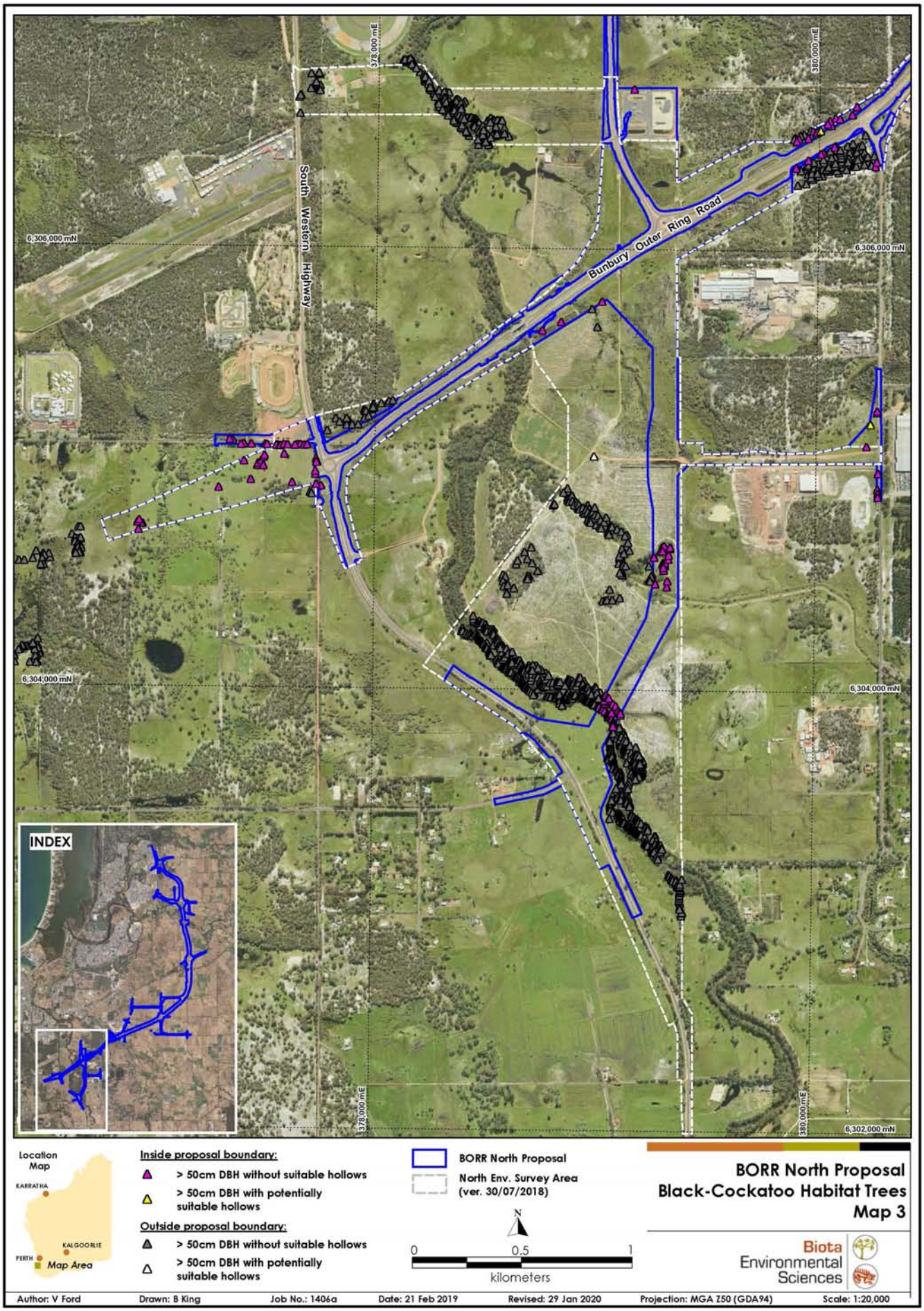

Figure 5.13: Trees >50 cm DBH of hollow-forming species recorded within the Proposal Area, including those bearing suitable hollows (southern section, map 3/3).

5.4.2.1 Black-Cockatoo Breeding Hollow Assessment

No confirmed evidence of black-cockatoo nesting such as black-cockatoos at/in hollows, eggs in nests or fledglings were observed within the Proposal Area or wider Survey Area. No hollows showed evidence of black-cockatoo use within the Proposal Area, while in the wider survey area a small number of trees were seen with wear and chew marks consistent with black-cockatoos and in one case, what may have potentially been a black-cockatoo nest from the previous breeding season (two broken eggs of a size and colour consistent with black-cockatoos) was recorded. Example photographs taken using the RPA during the survey (some from the wider Survey Area) are shown in Plate 5.1 to Plate 5.4.

Plate 5.1: RPA photo of hollow with chew marks.

Plate 5.2: RPA photo of hollow with chew marks.

Plate 5.3: RPA photo showing nest and potential black-cockatoo eggs.

Plate 5.4: RPA photo of Common Brushtail Possum in hollow.

Within the Proposal Area, 63 hollows from 17 trees were assessed; Table 5.8 presents the highest hollow suitability ranking for each tree assessed. Using the RPA, two trees were assessed as having hollows potentially suitable for black-cockatoo breeding (one Marri and one Jarrah), and one tree appeared to have a potentially suitable hollow from the ground but could not be accessed with the RPA. The assessment indicated that the remainder of the hollows were unlikely to be suitable, with some but not all criteria for suitability fulfilled, or were otherwise definitively not suitable. The locations of the trees assessed are shown in Figure 5.14 to Figure 5.15 for both the Proposal Area and the wider Survey Area.

Table 5.8: Summary of hollow assessment results; the highest hollow suitability ranking for each tree is shown.

Suitability Category	Marri	Jarrah	Unknown (includes stags)	Grand Total
Potentially suitable	1	1		2
Ground assessed - Potentially suitable	1			1
Unlikely suitable		5	3	8
Not suitable	2	2	2	6
Grand Total	**4**	**8**	**5**	**17**

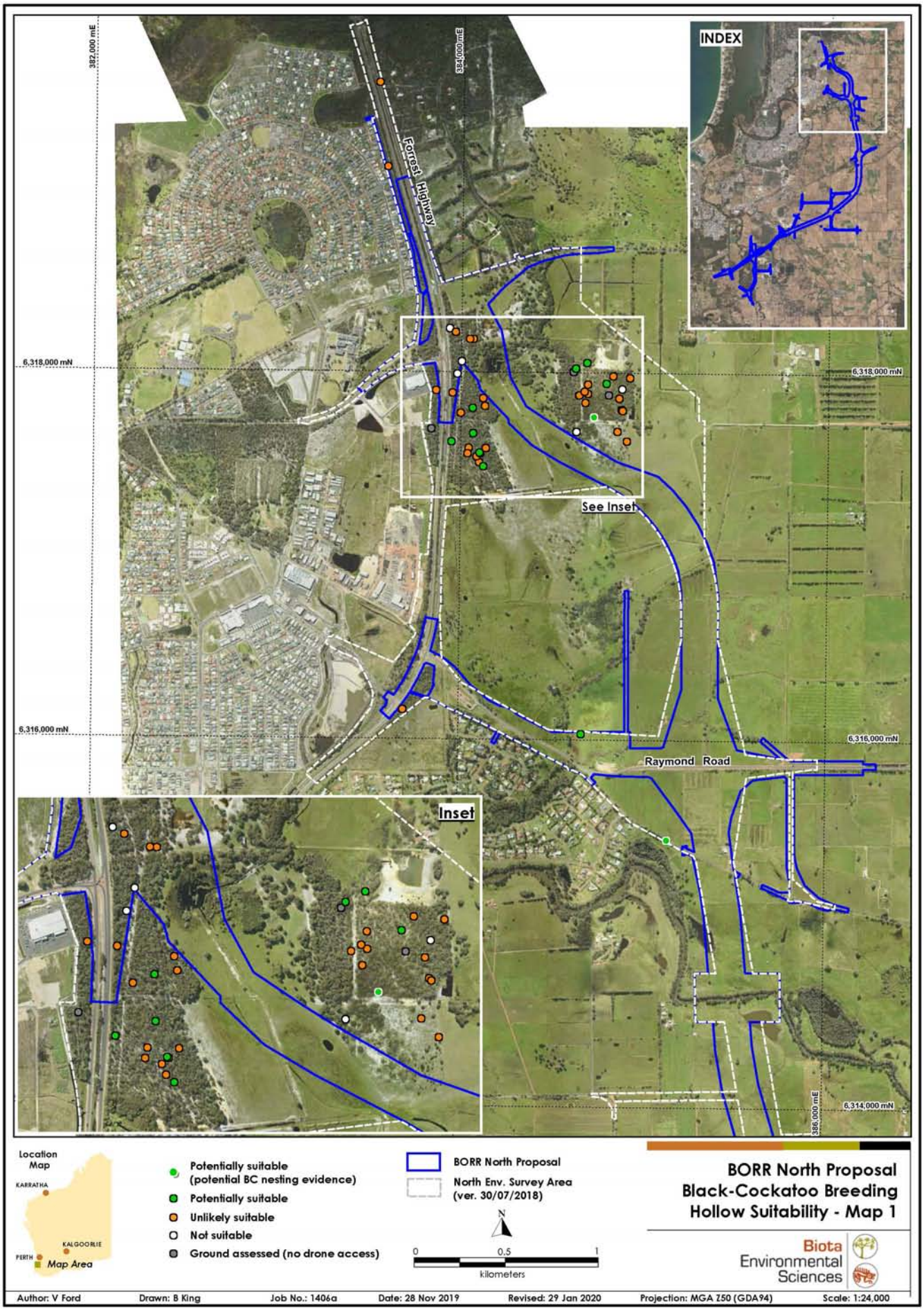

Figure 5.14: Tree hollow assessment results (northern section, map 1/2).

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

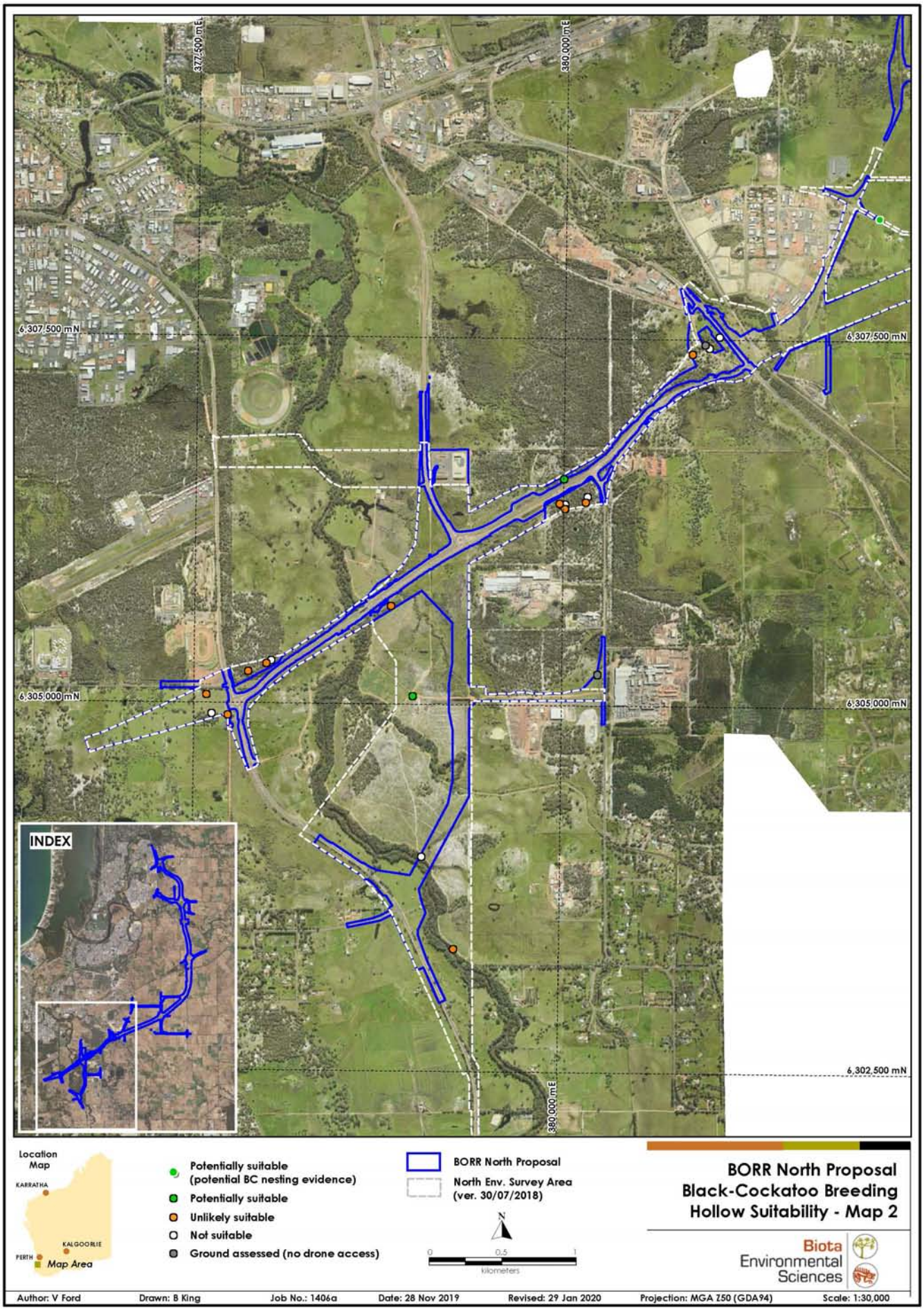

Figure 5.15: Tree hollow assessment results (southern section, map 2/2).

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

5.4.3 Foraging Habitat

The Swan Coastal Plain is generally more important to black-cockatoo species as a feeding ground, and only small areas support breeding (DotEE 2017). As such, consideration of available foraging habitat is perhaps the important aspect when considering potential impacts to black-cockatoos. Evidence of foraging by all three species of black-cockatoo was found within the Proposal Area. Foraging evidence consistent with Forest Red-tailed Black-Cockatoos and Carnaby's Black-Cockatoo was most common, but Marri nuts with chew marks indicative of Baudin's Black-Cockatoo were also located. Examples of Marri nuts with chew marks of each black-tailed cockatoo species are shown in Plate 5.5 to Plate 5.7

A total of 19.4 ha of vegetation within the Proposal Area comprised vegetation units dominated by foraging plants; this was mainly Marri woodland or Jarrah woodland, which also often included Banksia species in the mid-storey. A further 11.9 ha comprised vegetation units with scattered foraging plants, such as woodland mosaics and isolated foraging trees in paddocks.

Much of the Proposal Area was devoid of black-cockatoo foraging habitat entirely, having been cleared, or consisting of non-native vegetation or native vegetation that did not contain foraging plants (e.g. uniform stands of peppermint, *Melaleuca* shrubland or woodland, *Astartea* shrubland). Together these areas represented 592.90 ha or 95.0% of the Proposal Area.

Plate 5.5: Carnaby's Black-Cockatoo nut chew.

Plate 5.6: Baudin's Black-Cockatoo nut chew.

Plate 5.7: Forest Red-tailed Black-Cockatoo nut chews.

5.5 Brush-tailed Phascogale

No Brush-tailed Phascogales were observed within the Proposal Area, however, 12 were recorded within 5 km of the Proposal Area (Figure 5.16). All individuals were observed while conducting nocturnal searches targeting the Western Ringtail Possum. Lot 2 Boyanup-Picton Road has been a common site of records as has been the Preston River where the species was recorded directly adjacent the Proposal Area.

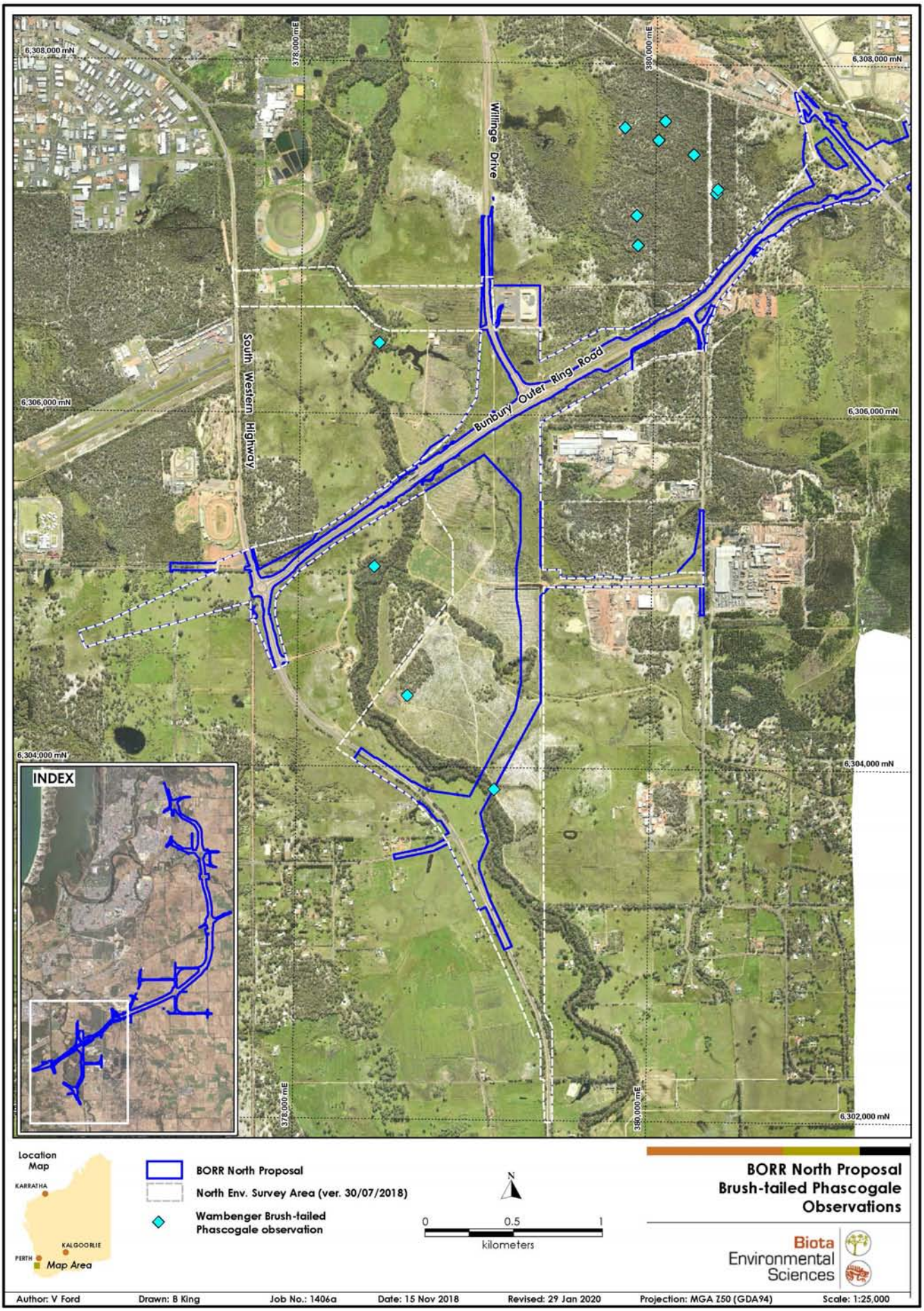

Figure 5.16: Records of the Brush-tailed Phascogale from within the Proposal Area and contextual sites nearby.

5.6 Carter's Freshwater Mussel

Carter's Freshwater Mussel was not recorded within the Proposal Area but was recorded in the wider Survey Area in the branch of the Preston River that passes through the Proposal Area (see Plate 5.8 and Plate 5.9; Figure 5.17).

Plate 5.8: Carter's Freshwater Mussel shells on the bank of the Preston River.

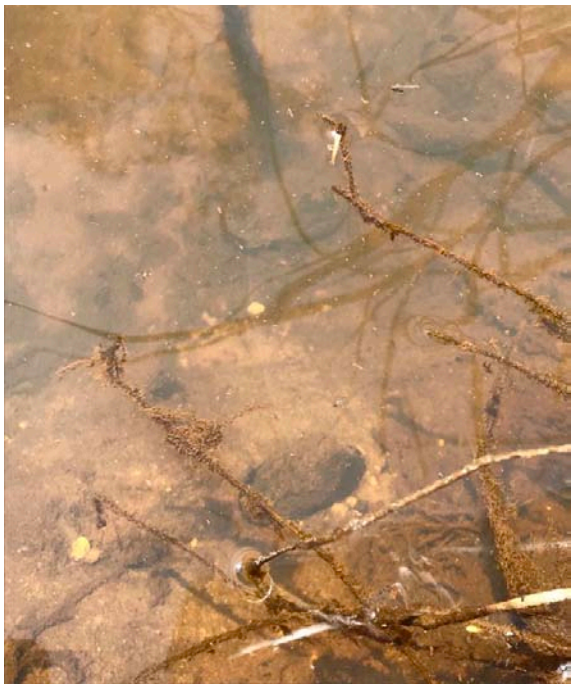

Plate 5.9: Live Carter's Freshwater Mussel *in situ* in the shallow banks of the Preston River.

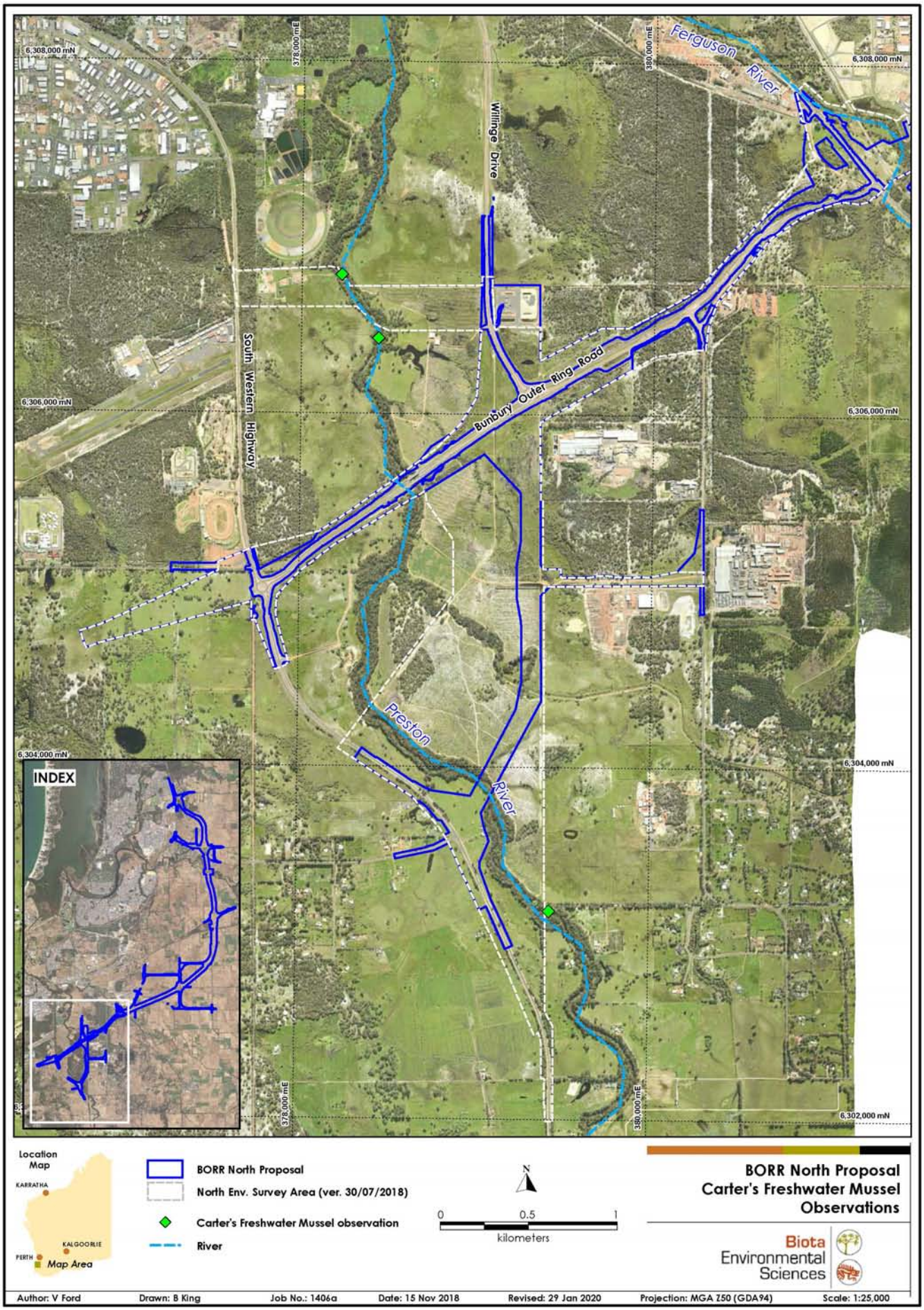

Figure 5.17: Records of Carter's Freshwater Mussel from the wider Survey Area.

6.0 Conservation Significant Species

This section provides an assessment of the likelihood of occurrence of the target species and other conservation significant vertebrate fauna species returned from the desktop review; that is, those species protected by the EPBC Act, BC Act or listed as DBCA Priority species. Appendix 6 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 and whether available habitat 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. For those species recorded or assessed as having the potential to occur within the Proposal Area, further species information is provided in Sections 6.1 and 6.2.

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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)	Sabina Vale (2013)	Lot1 Ducane (2014)	Waterloo (2015)	No. of Records within 10 km (years spanning)	Marri/ *Eucalyptus* woodland	Marri/*Eucalyptus* in paddocks and road reserves	*Melaleuca* woodland and shrubland in paddocks and road reserves	Riparian woodland	Peppermint woodland	Dampland	Artificial Wetland	Notes	Likelihood of Occurrence
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CR	•	•	•	•	•	•	•	1563 (1991–2018)	Foraging Breeding	Foraging Breeding		Foraging Breeding	Foraging Breeding				Occurs
Calyptorhynchus baudinii	Baudin's Black-Cockatoo	EN	EN	•	•						14 (1939–2018)	Foraging Breeding	Foraging Breeding		Foraging Breeding					Occurs
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	EN	EN	•	•		•	•	•		118 (1939–2018)	Foraging Breeding	Foraging Breeding		Foraging Breeding					Occurs
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	VU	VU	•	•		•	•	•	•	60 (1998–2018)	Foraging Breeding	Foraging Breeding		Foraging Breeding					Occurs
Westralunio carteri	Carter's Freshwater Mussel	VU	VU	•	•					•	8 (1905–2016)								Aquatic: Restricted to major creeklines with shallow sandy banks.	Occurs
Phascogale tapoatafa wambenger	Brush-tailed Phascogale	CD		•							34 (1999–2018)	Foraging Breeding			Foraging Breeding				Requires multiple canopy strata.	Likely to occur
Isoodon fusciventer	Southern Brown Bandicoot, Quenda	P4		•			•		•		21 (1992–2018)	Foraging Breeding	Foraging Breeding	Foraging Breeding	Foraging Breeding	Foraging Breeding	Foraging Breeding	Foraging Breeding	Requires thick layer shrub/ground cover, often in association with wetlands on the SCP.	Likely to occur
Oxyura australis	Blue-billed Duck	P4		•							90 (1990–2018)				Foraging			Foraging	Almost wholly aquatic.	Likely to occur
Notamacropus irma	Western Brush Wallaby	P4		•							7 (1975–2015)	Foraging							Rarely recorded on SCP; large woodland areas required to support a resident population.	Possible (visitor)
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU	•	•						4 (1972–2012)	Foraging							Rarely recorded on SCP; large woodland areas required to support a resident population.	Possible (foraging visitor)
Falco peregrinus	Peregrine Falcon	OS		•						•	5 (1975–2014)				Foraging				No breeding habitat available.	Possible (foraging visitor)
Ctenotus ora	Coastal Plains Skink	P3		•							2 (1982)	Foraging Breeding							Lack of species records precludes definitive assessment.	Possible (resident)
Falsistrellus mackenziei	Western False Pipistrelle	P4		•							2 (2007 & 2014)	Foraging Breeding			Foraging Breeding				Roosts in tree hollows.	Possible (resident)
Hydromys chrysogaster	Water-rat, Rakali	P4		•					•		11 (1957–2017)				Foraging Breeding			Foraging Breeding	Significant drainage/waterbody with riparian cover.	Possible (resident)
Setonix brachyurus	Quokka	VU	VU	•	•						12 (1975–2008)								Prefers dense understorey with water nearby.	Unlikely to occur
Myrmecobius fasciatus	Numbat	EN	EN	•							1 (unknown)	Foraging Breeding							No recent records.	Unlikely to occur
Bettongia penicillata ogilbyi	Woylie, Brush-tailed Bettong	CR	EN	•	•						1 (2009)	Foraging Breeding			Foraging Breeding				Restricted to Dryandra and upper Warren.	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 Critically Endangered under both the BC Act and EPBC Act.

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 (DPaW 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 (DPaW 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 (DPaW 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). The population size in the Bunbury to Dunsborough region has been estimated to be between 2,000 and 5,000 animals (DPaW 2017).

Likelihood of occurrence: The Western Ringtail Possum was recorded within the Proposal Area wherever Marri/Eucalypt woodland and Peppermint woodland fragments occurred, and also occasionally within the scattered tree habitat.

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 2012). Black-cockatoos require tree hollows with suitable dimensions for nesting and breeding, which typically occur in larger trees over 200 years old (DSEWPaC 2012). 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 2012). 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 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. The species' breeding stronghold is in the Wheatbelt, but has been moving onto the Swan Coastal Plain more recently (DotEE 2017). Expansion in 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 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 Endangered under the BC Act and Vulnerable under the EPBC Act.

Life history and distribution of Baudin's Black-Cockatoo is less well known than that of Carnaby's Black-Cockatoo because earlier research and publications did not distinguish between Baudin's and Carnaby's, which were not taxonomically split until 1948. Baudin's Black-Cockatoo occurs in the humid and subhumid areas of the southwest (Johnstone et al. 2010).

While there is very little breeding information available for the species (Johnstone et al. 2010), the "extrapolated" (DotEE 2017) breeding distribution of the species is generally described as occurring between Leschenault, Collie and Albany. Bunbury is included as a known breeding area for Baudin's Black-Cockatoo in the Proposal guidelines (DSEWPaC 2012). Marri and Tuart are amongst the preferred nesting trees of the species and occur within the Proposal Area. Although the specific dimensions of hollows used for breeding have not previously been studied for Baudin's Black-Cockatoo, they are likely to be similar to those hollows used by Carnaby's Black-Cockatoo, and this was the assumption applied during the breeding hollow assessment. Egg-laying occurs mainly from August to December with 1-2 eggs incubated by the female alone (Johnstone et al. 2010).

Between March and September, the majority of the population migrates north from the cooler Karri forest to the central and northern Darling Range and 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).

Likelihood of occurrence: Occurs. Secondary feeding evidence was recorded in several locations from the distinct chew pattern on Marri nuts. NatureMap records also place the species within the Proposal Area.

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

The Forest Red-tailed Black-Cockatoo is listed as 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. Feeding evidence recorded and direct observation of the species in the local area (Victoria Ford, Biota, pers. obs.).

6.1.3 Chuditch (*Dasyurus geoffroii*)

The Chuditch is listed as 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. It 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 visitor. The Chuditch was not recorded within the Proposal Area or any contextual sites, despite intensive spotlighting effort over an almost two-year period. The species has been assessed as a 'Possible' occurrence within the Proposal Area. There are few records of Chuditch in close proximity to the Proposal Area, with four records between 1972 and 2012 ranging from 2.9 - 7.1 km away. Where woodland habitat occurs within the Proposal Area, it represents the fringes of fragments largely occurring outside the boundary and so there is a small change of the Chuditch occurring as a visitor. Examples of this are Lot 2 Boyanup-Picton Road and the riparian vegetation corridor along the Preston River, which may represent desirable habitat at drier times of year.

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

The Brush-tailed Phascogale is listed as 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 South-west 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 are less common from wetter forests. 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 recorded on numerous occasions nearby the Proposal Area and suitable habitat occurs.

6.1.5 Carter's Freshwater Mussel (*Westralunio carteri*)

Carter's Freshwater Mussel is listed as 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: Occurs. While not recorded within the Proposal Area in this study it was recorded along the Preston River nearby. The species was recorded within the Proposal Area by WRM (2019).

6.2 Non-Target Species with 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.

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).

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).

Likelihood of occurrence: Likely to occur. The Southern Brown Bandicoot was categorised as 'Likely to occur' based on the presence of suitable habitat, together with diggings observed within the wider Survey Area. NatureMap includes numerous recent records of the species in the local area, with the closest record 320 m from the Proposal Area.

6.2.2 Western False Pipistrelle (*Falsistrellus mackenziei*)

This bat is listed as a Priority 4 species by the DBCA.

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 the species may occur.

6.2.3 Water Rat (*Hydromys chrysogaster*)

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

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: Likely to occur. The Water Rat is considered 'Likely to occur' given the close proximity of previous records and presence of suitable habitat, primarily the Preston River. There are 11 records within 10 km of the Proposal Area, with the closest record <1 km away.

6.2.4 Western Brush Wallaby (*Notamacropus irma*)

The Western Brush Wallaby is listed as a Priority 4 species by the DBCA.

This species is endemic to the South-west of Western Australia, where it is distributed from north of Kalbarri to near Cape Arid. It occurs in a wide range of habitats, including open forest and woodland, mallee, heathland, low open grasslands and thickets (Woinarksi 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. The species is not commonly recorded in the Bunbury area (based on NatureMap records). The most recent record for the Western Brush Wallaby was almost 5 km from the Proposal Area, recorded in 2015. However, given the availability of woodland habitat, this species has been assessed as a possible occurrence within the Proposal Area.

6.2.5 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as a Priority 4 species by the 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, with nests made out of trampled bulrushes 10–30 cm above water (Johnstone and Storr 1998).

Likelihood of occurrence: Likely to occur. There have been 90 records of the Blue-billed Duck near the Proposal Area since 1990, with the closest record 200 m away. The Proposal Area also intersects a portion of the Preston River, which is fringed by vegetation in some areas, and may serve as suitable habitat.

6.2.6 Coastal Plains Skink (*Ctenotus ora*)

The Coastal Plains Skink is listed as a Priority 3 species by the DBCA.

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

6.3 Non-target 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 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 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.

6.3.3 Numbat (*Myrmecobius fasciatus*)

The Numbat is listed as Endangered under the BC Act and Endangered under the EPBC Act.

The Numbat is a small marsupial with a distinctive striped appearance, and because of its specialised diet (eating termites only), it is the sole animal placed in the family Myrmecobiidae.

Prior to European settlement, the Numbat had distributions in New South Wales, South Australia and Western Australia, but it is now only known to be surviving in small areas of Jarrah forest at Dryandra and in the Upper Warren area. Land clearing, altered fire regimes and the introduction of feral predators are all likely factors in their decline (Department of Biodiversity, Conservation and Attractions 2017).

Likelihood of occurrence: Unlikely to occur. While one record of the Numbat was returned from the NatureMap database, this is likely to be very old. The species is now considered restricted to Dryandra and the Upper Warren.

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7.0 Discussion

7.1 Western Ringtail Possum

This study assessed the importance of identified Western Ringtail Possum habitat within the Proposal Area by direct comparison with habitat in a local setting (five contextual sites within 10 km of the Proposal Area). The density of possums within the context sites was estimated using Distance sampling, while the Proposal Area was comprehensively searched using 20 m wide strips over as much habitat as could be practicably accessed. Within the Proposal Area, Western Ringtail Possums were found within habitat ranging from relatively isolated individual trees, through to remnant vegetation strips (along road reserves and riparian belts) surrounded by cleared land, to woodland habitat broadly contiguous with much larger remnants outside the Proposal Area.

The estimated abundance of the Western Ringtail Possum within the Proposal Area and each context site is given in Table 7.1. Three phases of strip sampling within the Proposal Area yielded an average abundance of 19 Western Ringtail Possum individuals. Context was considered at the local scale by comparison with the density estimates yielded from the distance sampling program in the four relatively large context sites (greater than 87 ha) and a smaller site that partially overlapped the Proposal Area. The distance sampling yielded a total population estimate of approximately 483 individuals for the sampled areas of the contextual sites.

The estimate increases to approximately 899 individuals if unsampled habitat contiguous with each of the study sites is assumed to support equivalent densities. For example, the surveyed area of Manea Park represents only a portion (30%) of the total extent of the contiguous remnant patch, which extends further to the east and north. The extension encompasses a further 258 ha of apparently similar habitat (based on aerial imagery); if this area supports a comparable density to the surveyed section, it would yield a further 309 Western Ringtail Possums. The total number of Western Ringtail Possums in this single remnant would then be estimated at approximately 495.

A much lower density of Western Ringtail Possums (0.39 ± 0.11 per ha) was estimated from the Southern Lots. However, this remnant extends further to the north and west beyond the area sampled, and if this density estimate is likewise extended to the contiguous sections of the remnant (an additional 211 ha), then a further 82 individuals are estimated. This would take the total estimate to approximately 156 ± 17 for the single contiguous remnant (approximately 399 ha in size), of which the Southern Lots forms a part. The last of the contextual sites, Reserve 23,000, yielded a density estimate of 0.56 ± 0.11 individuals per ha (August survey), which translates to an estimate of 82 ± 16 individuals. If this estimate is applied to the 40 ha remnant to the north of Harewood Road, a further 22 ± 4 individuals are estimated to occur in the broader remnant patch.

The combined tally from the four large contextual remnants in which distance sampling was undertaken is estimated to be approximately 483 individuals. This increases to approximately 899 individuals if density estimates are interpolated into contiguous (or nearly so) sections of the surveyed remnants.

Table 7.1: Western Ringtail Possum sightings and abundance estimates within the Proposal Area and context sites.

Study Sites	Sightings	Estimated in Surveyed Area	Estimated in Contiguous Unsurveyed Areas †	Total
Proposal Area				
August 2019	22	22	N/A	22
October 2019	20	20	N/A	20
December 2019	15	15	N/A	15
Average	**19**	**19**	**N/A**	**19**
Context Sites[1]				
Northern Lots	18	21 ± 9	NA	21 ± 9
Lot 2 Boyanup–Picton Rd	60	121 ± 17	NA	121 ± 17
Manea Park	103	186 ± 41	309 ± 83	495 ± 132
Reserve 23,000	52	82 ± 16	22 ± 4	104 ± 12
Southern Lots	33	73 ± 20	82 ± 9	155 ± 17
Total	**266**	**483 ± 103**	**416 ± 95**	**899 ± 187**

† This assumes equivalent habitat and equivalent density to the contiguous surveyed area, an assumption that has not been tested.

1. Context sites were surveyed in 2018.

7.2 Black-cockatoos

The Proposal Area falls within the known breeding areas shown in DSEWPaC (2012) for all three species of black-cockatoo. However, while 711 trees of hollow-forming species with DBH greater than 50 cm were recorded within the Proposal Area, only two trees were found to support hollows potentially suitable for black-cockatoo nesting after using an RPA to take photos of the hollows (hollows on a third tree could not be accessed with the RPA but appeared suitable from ground level).

The field survey recorded evidence of all three species of black-cockatoo foraging within the Proposal Area and both white-tailed black-cockatoos and Forest Red-tailed Black-Cockatoos have been observed either within the Proposal Area or nearby. Although much of the Proposal Area has been cleared historically, 19.4 ha of vegetation remaining within the Proposal Area represents high quality foraging habitat, and a further 11.9 ha represents moderate quality foraging habitat. The black-cockatoo foraging habitat within the Proposal Area has been considered in the context of wider availability in Figure 7.1 by mapping the occurrence of each Swan Coastal Plain (SCP) vegetation complex (Government of Western Australia 2019), both within the Proposal Area and their occurrence in remnant vegetation out to a 12 km radius around the Proposal Area. The figure clearly illustrates the limited amount of remnant vegetation remaining in the immediate vicinity of the Proposal Area.

Four vegetation complexes are intersected by the Proposal Area: SCP Veg. 32, 33, 42 and 44 (see Table 7.2). The occurrence of the Bassendean Complex Central and South (SCP Veg. 44) within the Proposal Area is continuous with larger extents in the wider area. The same was generally true for the Southern River Complex (SCP Veg. 42), with the exception of the area of this vegetation complex in the northernmost lots of the Proposal Area, which is generally isolated from the wider occurrence of this complex. As proportions of their extent within 12 km, the 13.7 ha of Guildford Complex (SCP Veg. 32) within the Proposal Area represents the highest proportion of its occurrence in the wider area at 1.3%; and this area does contain foraging plants, particularly Marri. Both the Southern River Complex and Bassendean Complex also contain foraging habitat, with their extent within the Proposal Area representing 0.3% and 0.2% of their occurrence within a 12 km radius respectively.

Table 7.2: Occurrence of the Swan Coastal Plain vegetation complexes (Government of Western Australia 2019) within the Proposal Area and in remnants in the broader surrounds (up to 12 km).

SCP ID	Complex Name	Complex Definition	Area (ha) in:	
			Proposal Area	Remnants within 12 km
32	Guildford Complex	A mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah), and woodland of *Eucalyptus wandoo* (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark).	13.7	1,021.8
33	Swan Complex	Fringing woodland of *Eucalyptus rudis - Melaleuca rhaphiophylla* with localised occurrence of low open forest of *Casuarina obesa* (Swamp Sheoak) and *Melaleuca cuticularis* (Saltwater Paperbark).	3.0	716.3
42	Southern River Complex	Open woodland of *Corymbia calophylla - Eucalyptus marginata - Banksia* species with fringing woodland of *Eucalyptus rudis - Melaleuca rhaphiophylla* along creek beds.	6.3	2,045.7
44	Bassendean Complex-Central and South	Vegetation ranges from woodland of *Eucalyptus marginata - Allocasuarina fraseriana* (Sheoak) - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *Eucalyptus m*arginata (Jarrah) to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth.	8.1	3,834.2

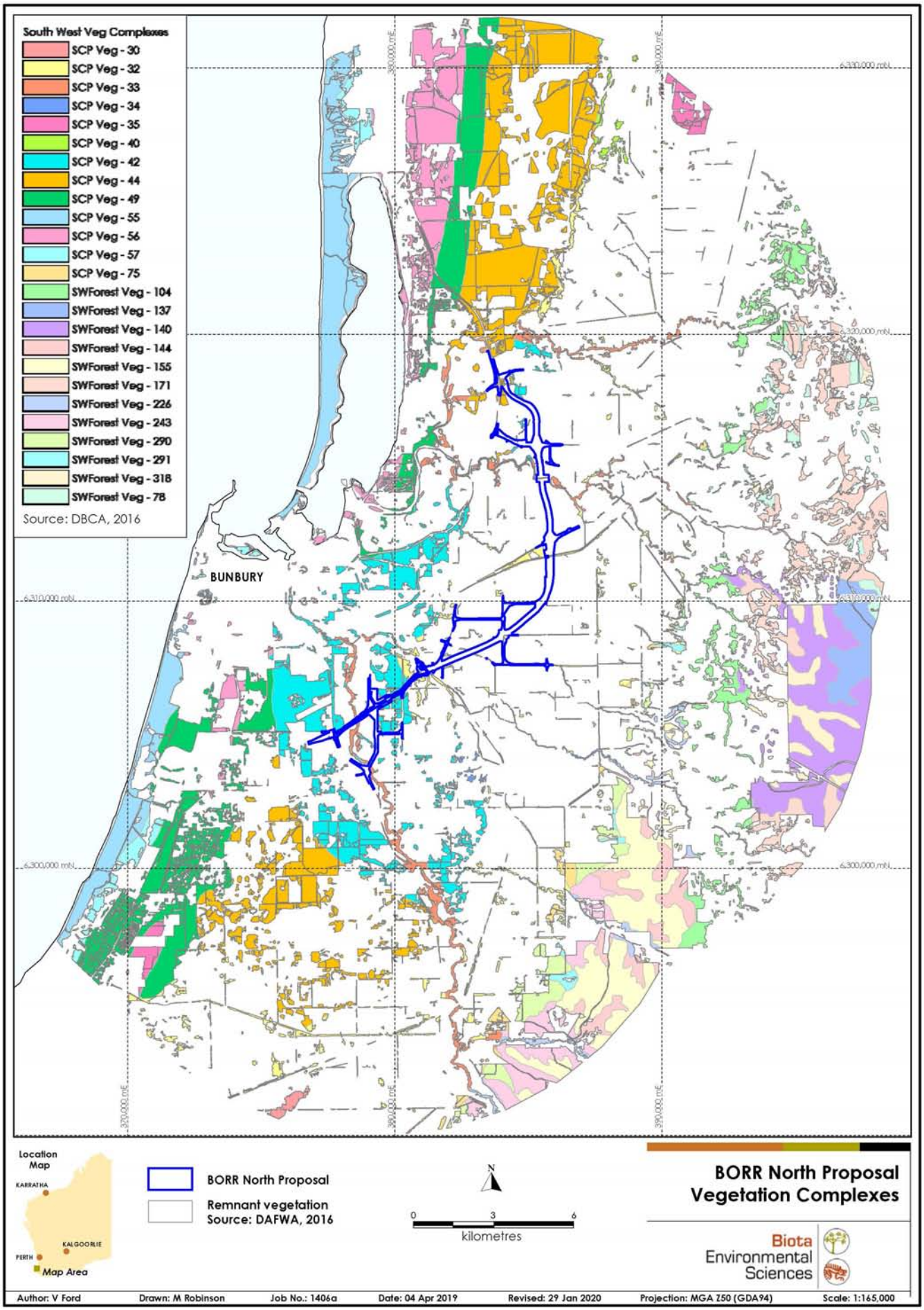

Figure 7.1: Remnant vegetation and Swan Coastal Plain Vegetation Complex mapping (Government of Western Australia 2019) within a 12 km radius of the Proposal Area.

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Appendix 1

NatureMap Database Search Results

NAME	NAME_ID	FAMILY	GENUS	SPECIES	VERNACULAR	KINGDOM	DIVISION	CLASS	ORDER	SUP_CODE	SUP_NAME
Crinia georgiana	25398	Myobatrachidae	Crinia	georgiana	Quacking Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Crinia glauerti	25399	Myobatrachidae	Crinia	glauerti	Clicking Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Crinia insignifera	25400	Myobatrachidae	Crinia	insignifera	Squelching Froglet	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Crinia pseudinsignifera	25401	Myobatrachidae	Crinia	pseudinsignifera	Bleating Froglet	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Geocrinia leai	25404	Myobatrachidae	Geocrinia	leai	Ticking Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Heleioporus eyrei	25410	Limnodynastidae	Heleioporus	eyrei	Moaning Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Heleioporus inornatus	25411	Limnodynastidae	Heleioporus	inornatus	Whooping Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Limnodynastes dorsalis	25415	Limnodynastidae	Limnodynastes	dorsalis	Western Banjo Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Litoria adelaidensis	25378	Hylidae	Litoria	adelaidensis	Slender Tree Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Litoria moorei	25388	Hylidae	Litoria	moorei	Motorbike Frog	Animalia	Chordata	Amphibia	Anura	AMPHI	Amphibian
Acanthiza apicalis	24260	Acanthizidae	Acanthiza	apicalis	Broad-tailed Thornbill, Inland Thornbill	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Acanthiza chrysorrhoa	24261	Acanthizidae	Acanthiza	chrysorrhoa	Yellow-rumped Thornbill	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Acanthiza inornata	24262	Acanthizidae	Acanthiza	inornata	Western Thornbill	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Acanthorhynchus superciliosus	24560	Meliphagidae	Acanthorhynchus	superciliosus	Western Spinebill	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Accipiter cirrocephalus	25535	Accipitridae	Accipiter	cirrocephalus	Collared Sparrowhawk	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Accipiter fasciatus	25536	Accipitridae	Accipiter	fasciatus	Brown Goshawk	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Acrocephalus australis	25755	Sylviidae	Acrocephalus	australis	Australian Reed Warbler	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Actitis hypoleucos	41323	Scolopacidae	Actitis	hypoleucos	Common Sandpiper	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Anas castanea	24310	Anatidae	Anas	castanea	Chestnut Teal	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Anas gracilis	24312	Anatidae	Anas	gracilis	Grey Teal	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Anas platyrhynchos	24313	Anatidae	Anas	platyrhynchos	Mallard	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Anas rhynchotis	24315	Anatidae	Anas	rhynchotis	Australasian Shoveler	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Anas superciliosa	24316	Anatidae	Anas	superciliosa	Pacific Black Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Anhinga novaehollandiae	47414	Anhingidae	Anhinga	novaehollandiae	Australasian Darter	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Anous tenuirostris subsp. melanops	24506	Laridae	Anous	tenuirostris	Australian Lesser Noddy	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Anthochaera carunculata	24561	Meliphagidae	Anthochaera	carunculata	Red Wattlebird	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Anthochaera lunulata	24562	Meliphagidae	Anthochaera	lunulata	Western Little Wattlebird	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Aquila audax	24285	Accipitridae	Aquila	audax	Wedge-tailed Eagle	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Ardea ibis	25558	Ardeidae	Ardea	ibis	Cattle Egret	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Ardea modesta	41324	Ardeidae	Ardea	modesta	great egret, white egret	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Ardea novaehollandiae	24340	Ardeidae	Ardea	novaehollandiae	White-faced Heron	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Ardea pacifica	24341	Ardeidae	Ardea	pacifica	White-necked Heron	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Ardenna carneipes	41326	Procellariidae	Ardenna	carneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Arenaria interpres	25736	Scolopacidae	Arenaria	interpres	Ruddy Turnstone	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Artamus cinereus	25566	Artamidae	Artamus	cinereus	Black-faced Woodswallow	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Artamus cyanopterus	24353	Artamidae	Artamus	cyanopterus	Dusky Woodswallow	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Aythya australis	24318	Anatidae	Aythya	australis	Hardhead	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Biziura lobata	24319	Anatidae	Biziura	lobata	Musk Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Burhinus grallarius	24359	Burhinidae	Burhinus	grallarius	Bush Stone-curlew	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Cacatua pastinator	25714	Psittacidae	Cacatua	pastinator	Western Long-billed Corella	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Cacatua sanguinea	25716	Psittacidae	Cacatua	sanguinea	Little Corella	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Cacomantis flabelliformis	25598	Cuculidae	Cacomantis	flabelliformis	Fan-tailed Cuckoo	Animalia	Chordata	Aves	Cuculiformes	BIRD	Bird
Cacomantis pallidus	42307	Cuculidae	Cacomantis	pallidus	Pallid Cuckoo	Animalia	Chordata	Aves	Cuculiformes	BIRD	Bird
Calidris acuminata	24779	Scolopacidae	Calidris	acuminata	Sharp-tailed Sandpiper	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Calidris canutus	25738	Scolopacidae	Calidris	canutus	Red Knot, knot	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Calidris ferruginea	24784	Scolopacidae	Calidris	ferruginea	Curlew Sandpiper	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Calidris ruficollis	24788	Scolopacidae	Calidris	ruficollis	Red-necked Stint	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Calidris tenuirostris	24790	Scolopacidae	Calidris	tenuirostris	Great Knot	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Calyptorhynchus banksii	25717	Psittacidae	Calyptorhynchus	banksii	Red-tailed Black-Cockatoo	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Calyptorhynchus banksii subsp. naso	24731	Psittacidae	Calyptorhynchus	banksii	Forest Red-tailed Black Cockatoo	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Calyptorhynchus baudinii	24733	Psittacidae	Calyptorhynchus	baudinii	Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Calyptorhynchus latirostris	24734	Psittacidae	Calyptorhynchus	latirostris	Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Calyptorhynchus sp.	48400	Psittacidae	Calyptorhynchus	sp.	white-tailed black cockatoo	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Charadrius leschenaultii	25575	Charadriidae	Charadrius	leschenaultii	Greater Sand Plover	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Charadrius ruficapillus	24377	Charadriidae	Charadrius	ruficapillus	Red-capped Plover	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Chenonetta jubata	24321	Anatidae	Chenonetta	jubata	Australian Wood Duck, Wood Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Chrysococcyx lucidus	25601	Cuculidae	Chrysococcyx	lucidus	Shining Bronze Cuckoo	Animalia	Chordata	Aves	Cuculiformes	BIRD	Bird
Circus approximans	24288	Accipitridae	Circus	approximans	Swamp Harrier	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird

NAME	NAME_ID	FAMILY	GENUS	SPECIES	VERNACULAR	KINGDOM	DIVISION	CLASS	ORDER	SUP_CODE	SUP_NAME
Cladorhynchus leucocephalus	24774	Recurvirostridae	Cladorhynchus	leucocephalus	Banded Stilt	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Colluricincla harmonica	25675	Pachycephalidae	Colluricincla	harmonica	Grey Shrike-thrush	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Columba livia	24399	Columbidae	Columba	livia	Domestic Pigeon	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Coracina novaehollandiae	25568	Campephagidae	Coracina	novaehollandiae	Black-faced Cuckoo-shrike	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Corvus coronoides	25592	Corvidae	Corvus	coronoides	Australian Raven	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Coturnix pectoralis	24671	Phasianidae	Coturnix	pectoralis	Stubble Quail	Animalia	Chordata	Aves	Galliformes	BIRD	Bird
Cracticus nigrogularis	24420	Cracticidae	Cracticus	nigrogularis	Pied Butcherbird	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Cracticus tibicen	25595	Cracticidae	Cracticus	tibicen	Australian Magpie	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Cracticus torquatus	25596	Cracticidae	Cracticus	torquatus	Grey Butcherbird	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Cygnus atratus	24322	Anatidae	Cygnus	atratus	Black Swan	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Dacelo novaeguineae	30901	Halcyonidae	Dacelo	novaeguineae	Laughing Kookaburra	Animalia	Chordata	Aves	Coraciiformes	BIRD	Bird
Daphoenositta chrysoptera	25673	Neosittidae	Daphoenositta	chrysoptera	Varied Sittella	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Diomedea exulans	25618	Diomedeidae	Diomedea	exulans	Wandering Albatross	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Diomedea exulans subsp. exulans	30836	Diomedeidae	Diomedea	exulans	Snowy Albatross	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Dromaius novaehollandiae	24470	Casuariidae	Dromaius	novaehollandiae	Emu	Animalia	Chordata	Aves	Struthioniformes	BIRD	Bird
Elseyornis melanops	47937	Charadriidae	Elseyornis	melanops	Black-fronted Dotterel	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Eopsaltria australis subsp. griseogularis	24651	Petroicidae	Eopsaltria	australis	Western Yellow Robin	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Eopsaltria georgiana	24652	Petroicidae	Eopsaltria	georgiana	White-breasted Robin	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Epthianura albifrons	24567	Meliphagidae	Epthianura	albifrons	White-fronted Chat	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Erythrogonys cinctus	24379	Charadriidae	Erythrogonys	cinctus	Red-kneed Dotterel	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Eudyptes chrysocome subsp. filholi	24813	Spheniscidae	Eudyptes	chrysocome	Rockhopper Penguin	Animalia	Chordata	Aves	Sphenisciformes	BIRD	Bird
Eudyptula minor	25746	Spheniscidae	Eudyptula	minor	Little Penguin	Animalia	Chordata	Aves	Sphenisciformes	BIRD	Bird
Falco berigora	25621	Falconidae	Falco	berigora	Brown Falcon	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Falco cenchroides	25622	Falconidae	Falco	cenchroides	Australian Kestrel, Nankeen Kestrel	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Falco longipennis	25623	Falconidae	Falco	longipennis	Australian Hobby	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Falco peregrinus	25624	Falconidae	Falco	peregrinus	Peregrine Falcon	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Falcunculus frontatus subsp. leucogaster	24616	Pachycephalidae	Falcunculus	frontatus	Western Shrike-tit, Crested Shrike-tit	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Fulica atra	25727	Rallidae	Fulica	atra	Eurasian Coot	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Gallinula tenebrosa	25729	Rallidae	Gallinula	tenebrosa	Dusky Moorhen	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Gallirallus philippensis	25730	Rallidae	Gallirallus	philippensis	Buff-banded Rail	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Gerygone fusca	25530	Acanthizidae	Gerygone	fusca	Western Gerygone	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Grallina cyanoleuca	24443	Dicruridae	Grallina	cyanoleuca	Magpie-lark	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Haematopus longirostris	24487	Haematopodidae	Haematopus	longirostris	Pied Oystercatcher	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Haliaeetus leucogaster	24293	Accipitridae	Haliaeetus	leucogaster	White-bellied Sea-Eagle	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Haliastur sphenurus	24295	Accipitridae	Haliastur	sphenurus	Whistling Kite	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Halobaena caerulea	24689	Procellariidae	Halobaena	caerulea	Blue Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Hieraaetus morphnoides	47965	Accipitridae	Hieraaetus	morphnoides	Little Eagle	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Himantopus himantopus	25734	Recurvirostridae	Himantopus	himantopus	Black-winged Stilt	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Hirundo neoxena	24491	Hirundinidae	Hirundo	neoxena	Welcome Swallow	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Hydroprogne caspia	48587	Laridae	Hydroprogne	caspia	Caspian Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Larus novaehollandiae subsp. novaehollandiae	24511	Laridae	Larus	novaehollandiae	Silver Gull	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Larus pacificus	25638	Laridae	Larus	pacificus	Pacific Gull	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Lichmera indistincta	25661	Meliphagidae	Lichmera	indistincta	Brown Honeyeater	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Limosa lapponica	30932	Scolopacidae	Limosa	lapponica	Bar-tailed Godwit	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Limosa limosa	25741	Scolopacidae	Limosa	limosa	Black-tailed Godwit	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Macronectes giganteus	24690	Procellariidae	Macronectes	giganteus	Southern Giant Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Malacorhynchus membranaceus	24326	Anatidae	Malacorhynchus	membranaceus	Pink-eared Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Malurus elegans	25650	Maluridae	Malurus	elegans	Red-winged Fairy-wren	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Malurus splendens	25654	Maluridae	Malurus	splendens	Splendid Fairy-wren	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Megalurus gramineus	25758	Sylviidae	Megalurus	gramineus	Little Grassbird	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Melithreptus brevirostris	25663	Meliphagidae	Melithreptus	brevirostris	Brown-headed Honeyeater	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Merops ornatus	24598	Meropidae	Merops	ornatus	Rainbow Bee-eater	Animalia	Chordata	Aves	Coraciiformes	BIRD	Bird
Morus serrator	48008	Sulidae	Morus	serrator	Australasian Gannet	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Myiagra inquieta	25610	Dicruridae	Myiagra	inquieta	Restless Flycatcher	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Neophema elegans	24738	Psittacidae	Neophema	elegans	Elegant Parrot	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Neophema petrophila	24739	Psittacidae	Neophema	petrophila	Rock Parrot	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Numenius madagascariensis	24798	Scolopacidae	Numenius	madagascariensis	Eastern Curlew	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Numenius phaeopus	25742	Scolopacidae	Numenius	phaeopus	Whimbrel	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird

NAME	NAME_ID	FAMILY	GENUS	SPECIES	VERNACULAR	KINGDOM	DIVISION	CLASS	ORDER	SUP_CODE	SUP_NAME
Nycticorax caledonicus	25564	Ardeidae	Nycticorax	caledonicus	Rufous Night Heron	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Oceanites oceanicus	24497	Hydrobatidae	Oceanites	oceanicus	Wilson's Storm-petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Ocyphaps lophotes	24407	Columbidae	Ocyphaps	lophotes	Crested Pigeon	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Onychoprion anaethetus	41347	Laridae	Onychoprion	anaethetus	Bridled Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Oxyura australis	24328	Anatidae	Oxyura	australis	Blue-billed Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Pachycephala rufiventris	25680	Pachycephalidae	Pachycephala	rufiventris	Rufous Whistler	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Pachyptila belcheri	24692	Procellariidae	Pachyptila	belcheri	Slender-billed Prion	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pachyptila desolata	24693	Procellariidae	Pachyptila	desolata	Antarctic Prion	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pachyptila salvini	25707	Procellariidae	Pachyptila	salvini	Salvin's Prion	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pandion cristatus	48591	Accipitridae	Pandion	cristatus	Osprey, Eastern Osprey	Animalia	Chordata	Aves	Falconiformes	BIRD	Bird
Pardalotus punctatus	25681	Pardalotidae	Pardalotus	punctatus	Spotted Pardalote	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Pardalotus striatus	25682	Pardalotidae	Pardalotus	striatus	Striated Pardalote	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Passer domesticus	25687	Passeridae	Passer	domesticus	House Sparrow	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Passer montanus	24642	Passeridae	Passer	montanus	Eurasian Tree Sparrow	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Pelecanoides urinatrix subsp. exsul	24649	Pelecanoididae	Pelecanoides	urinatrix	Common Diving Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pelecanus conspicillatus	24648	Pelecanidae	Pelecanus	conspicillatus	Australian Pelican	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Petrochelidon nigricans	48061	Hirundinidae	Petrochelidon	nigricans	Tree Martin	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Petroica boodang	48066	Petroicidae	Petroica	boodang	Scarlet Robin	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Phalacrocorax carbo	25697	Phalacrocoracidae	Phalacrocorax	carbo	Great Cormorant	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Phalacrocorax fuscescens	24665	Phalacrocoracidae	Phalacrocorax	fuscescens	Black-faced Cormorant	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Phalacrocorax melanoleucos	25698	Phalacrocoracidae	Phalacrocorax	melanoleucos	Little Pied Cormorant	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Phalacrocorax sulcirostris	24667	Phalacrocoracidae	Phalacrocorax	sulcirostris	Little Black Cormorant	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Phalacrocorax varius	25699	Phalacrocoracidae	Phalacrocorax	varius	Pied Cormorant	Animalia	Chordata	Aves	Pelecaniformes	BIRD	Bird
Phaps chalcoptera	24409	Columbidae	Phaps	chalcoptera	Common Bronzewing	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Phaps elegans	25587	Columbidae	Phaps	elegans	Brush Bronzewing	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Phylidonyris niger	48071	Meliphagidae	Phylidonyris	niger	White-cheeked Honeyeater	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Phylidonyris novaehollandiae	24596	Meliphagidae	Phylidonyris	novaehollandiae	New Holland Honeyeater	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Platalea flavipes	24841	Threskiornithidae	Platalea	flavipes	Yellow-billed Spoonbill	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Platalea regia	24842	Threskiornithidae	Platalea	regia	Royal Spoonbill	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Platycercus icterotis	25720	Psittacidae	Platycercus	icterotis	Western Rosella	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Platycercus spurius	24747	Psittacidae	Platycercus	spurius	Red-capped Parrot	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Platycercus zonarius	25721	Psittacidae	Platycercus	zonarius	Australian Ringneck, Ring-necked Parrot	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Plegadis falcinellus	24843	Threskiornithidae	Plegadis	falcinellus	Glossy Ibis	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Pluvialis fulva	24382	Charadriidae	Pluvialis	fulva	Pacific Golden Plover	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Pluvialis squatarola	24383	Charadriidae	Pluvialis	squatarola	Grey Plover	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Podargus strigoides	25703	Podargidae	Podargus	strigoides	Tawny Frogmouth	Animalia	Chordata	Aves	Caprimulgiformes	BIRD	Bird
Podiceps cristatus	25704	Podicipedidae	Podiceps	cristatus	Great Crested Grebe	Animalia	Chordata	Aves	Podicipediformes	BIRD	Bird
Poliocephalus poliocephalus	24681	Podicipedidae	Poliocephalus	poliocephalus	Hoary-headed Grebe	Animalia	Chordata	Aves	Podicipediformes	BIRD	Bird
Polytelis anthopeplus	25722	Psittacidae	Polytelis	anthopeplus	Regent Parrot	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Porphyrio porphyrio	25731	Rallidae	Porphyrio	porphyrio	Purple Swamphen	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Porzana fluminea	24769	Rallidae	Porzana	fluminea	Australian Spotted Crake	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Porzana tabuensis	24771	Rallidae	Porzana	tabuensis	Spotless Crake	Animalia	Chordata	Aves	Gruiformes	BIRD	Bird
Psophodes nigrogularis subsp. nigrogularis	24388	Cinclosomatidae	Psophodes	nigrogularis	Western Whipbird (western heath)	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Pterodroma brevirostris	24702	Procellariidae	Pterodroma	brevirostris	Kerguelen Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pterodroma lessonii	24703	Procellariidae	Pterodroma	lessonii	White-headed Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Pterodroma mollis	25711	Procellariidae	Pterodroma	mollis	Soft-plumaged Petrel	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Puffinus assimilis subsp. assimilis	24711	Procellariidae	Puffinus	assimilis	Little Shearwater	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Recurvirostra novaehollandiae	24776	Recurvirostridae	Recurvirostra	novaehollandiae	Red-necked Avocet	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Rhipidura albiscapa	48096	Dicruridae	Rhipidura	albiscapa	Grey Fantail	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Rhipidura leucophrys	25614	Dicruridae	Rhipidura	leucophrys	Willie Wagtail	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Rhipidura rufiventris	25616	Dicruridae	Rhipidura	rufiventris	Northern Fantail	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Sericornis frontalis	25534	Acanthizidae	Sericornis	frontalis	White-browed Scrubwren	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Smicrornis brevirostris	30948	Acanthizidae	Smicrornis	brevirostris	Weebill	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Sterna bergii	24522	Laridae	Sterna	bergii	Crested Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Sterna hirundo	25642	Laridae	Sterna	hirundo	Common Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Sternula nereis	48594	Laridae	Sternula	nereis	Fairy Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Stictonetta naevosa	24329	Anatidae	Stictonetta	naevosa	Freckled Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Stipiturus malachurus	25655	Maluridae	Stipiturus	malachurus	Southern Emu-wren	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird

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Strepera versicolor	25597	Cracticidae	Strepera	versicolor	Grey Currawong	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Streptopelia chinensis	25589	Columbidae	Streptopelia	chinensis	Spotted Turtle-Dove	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Streptopelia senegalensis	25590	Columbidae	Streptopelia	senegalensis	Laughing Turtle-Dove	Animalia	Chordata	Aves	Columbiformes	BIRD	Bird
Tachybaptus novaehollandiae	25705	Podicipedidae	Tachybaptus	novaehollandiae	Australasian Grebe, Black-throated Grebe	Animalia	Chordata	Aves	Podicipediformes	BIRD	Bird
Tadorna tadornoides	24331	Anatidae	Tadorna	tadornoides	Australian Shelduck, Mountain Duck	Animalia	Chordata	Aves	Anseriformes	BIRD	Bird
Thalassarche carteri	34134	Diomedeidae	Thalassarche	carteri	Indian Yellow-nosed Albatross	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Thalassarche melanophris	44607	Diomedeidae	Thalassarche	melanophris	Black-browed Albatross	Animalia	Chordata	Aves	Procellariiformes	BIRD	Bird
Thalasseus bergii	48597	Laridae	Thalasseus	bergii	Crested Tern	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Thinornis rubricollis	48135	Charadriidae	Thinornis	rubricollis	Hooded Plover, Hooded Dotterel	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Threskiornis spinicollis	24845	Threskiornithidae	Threskiornis	spinicollis	Straw-necked Ibis	Animalia	Chordata	Aves	Ciconiiformes	BIRD	Bird
Todiramphus sanctus	25549	Halcyonidae	Todiramphus	sanctus	Sacred Kingfisher	Animalia	Chordata	Aves	Coraciiformes	BIRD	Bird
Trichoglossus haematodus	25723	Psittacidae	Trichoglossus	haematodus	Rainbow Lorikeet	Animalia	Chordata	Aves	Psittaciformes	BIRD	Bird
Tringa brevipes	24803	Scolopacidae	Tringa	brevipes	Grey-tailed Tattler	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Tringa glareola	24806	Scolopacidae	Tringa	glareola	Wood Sandpiper	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Tringa nebularia	24808	Scolopacidae	Tringa	nebularia	Common Greenshank, greenshank	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Tringa stagnatilis	24809	Scolopacidae	Tringa	stagnatilis	Marsh Sandpiper, little greenshank	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Turnix varius	48147	Turnicidae	Turnix	varius	Painted Button-quail	Animalia	Chordata	Aves	Turniciformes	BIRD	Bird
Tyto alba subsp. delicatula	24852	Tytonidae	Tyto	alba	Barn Owl	Animalia	Chordata	Aves	Strigiformes	BIRD	Bird
Vanellus miles	25577	Charadriidae	Vanellus	miles	Masked Lapwing	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Vanellus tricolor	24386	Charadriidae	Vanellus	tricolor	Banded Lapwing	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Xenus cinereus	41351	Scolopacidae	Xenus	cinereus	Terek Sandpiper	Animalia	Chordata	Aves	Charadriiformes	BIRD	Bird
Zosterops lateralis	25765	Zosteropidae	Zosterops	lateralis	Grey-breasted White-eye, Silvereye	Animalia	Chordata	Aves	Passeriformes	BIRD	Bird
Arctocephalus forsteri	24208	Otariidae	Arctocephalus	forsteri	New Zealand Fur Seal, long-nosed fur-seal	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Arctocephalus tropicalis	24209	Otariidae	Arctocephalus	tropicalis	Subantarctic fur-seal	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Balaenoptera acutorostrata	24044	Balaenopteridae	Balaenoptera	acutorostrata	Dwarf Minke Whale	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Bettongia penicillata subsp. ogilbyi	24162	Potoroidae	Bettongia	penicillata	Woylie, Brush-tailed Bettong	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Bos taurus	24251	Bovidae	Bos	taurus	European Cattle	Animalia	Chordata	Mammalia	Artiodactyla	MAMMAL	Mammal
Cercartetus concinnus	24086	Burramyidae	Cercartetus	concinnus	Western Pygmy-possum, Mundarda	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Chalinolobus gouldii	24186	Vespertilionidae	Chalinolobus	gouldii	Gould's Wattled Bat	Animalia	Chordata	Mammalia	Chiroptera	MAMMAL	Mammal
Dasyurus geoffroii	24092	Dasyuridae	Dasyurus	geoffroii	Chuditch, Western Quoll	Animalia	Chordata	Mammalia	Dasyuromorphia	MAMMAL	Mammal
Eubalaena australis	24043	Balaenidae	Eubalaena	australis	Southern Right Whale	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Falsistrellus mackenziei	24189	Vespertilionidae	Falsistrellus	mackenziei	Western False Pipistrelle, Western Falsistrelle	Animalia	Chordata	Mammalia	Chiroptera	MAMMAL	Mammal
Felis catus	24041	Felidae	Felis	catus	Cat	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Hydromys chrysogaster	24215	Muridae	Hydromys	chrysogaster	Water-rat, Rakali	Animalia	Chordata	Mammalia	Rodentia	MAMMAL	Mammal
Isoodon fusciventer	48588	Peramelidae	Isoodon	fusciventer	Quenda, southwestern brown bandicoot	Animalia	Chordata	Mammalia	Peramelemorphia	MAMMAL	Mammal
Macropus fuliginosus	24132	Macropodidae	Macropus	fuliginosus	Western Grey Kangaroo	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Megaptera novaeangliae	24051	Balaenopteridae	Megaptera	novaeangliae	Humpback Whale	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Mesoplodon bowdoini	24076	Ziphiidae	Mesoplodon	bowdoini	Andrew's Beaked Whale	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Mesoplodon grayi	24078	Ziphiidae	Mesoplodon	grayi	Gray's Beaked Whale	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Mirounga leonina	24213	Phocidae	Mirounga	leonina	Southern Elephant Seal	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Mus musculus	24223	Muridae	Mus	musculus	House Mouse	Animalia	Chordata	Mammalia	Rodentia	MAMMAL	Mammal
Myrmecobius fasciatus	24146	Myrmecobiidae	Myrmecobius	fasciatus	Numbat, Walpurti	Animalia	Chordata	Mammalia	Dasyuromorphia	MAMMAL	Mammal
Neophoca cinerea	24210	Otariidae	Neophoca	cinerea	Australian Sea-lion	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Notamacropus irma	48022	Macropodidae	Notamacropus	irma	Western Brush Wallaby	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Nyctophilus geoffroyi	24194	Vespertilionidae	Nyctophilus	geoffroyi	Lesser Long-eared Bat	Animalia	Chordata	Mammalia	Chiroptera	MAMMAL	Mammal
Nyctophilus gouldi	24195	Vespertilionidae	Nyctophilus	gouldi	Gould's Long-eared Bat	Animalia	Chordata	Mammalia	Chiroptera	MAMMAL	Mammal
Oryctolagus cuniculus	24085	Leporidae	Oryctolagus	cuniculus	Rabbit	Animalia	Chordata	Mammalia	Lagomorpha	MAMMAL	Mammal
Phascogale tapoatafa	25508	Dasyuridae	Phascogale	tapoatafa	Brush-tailed Phascogale	Animalia	Chordata	Mammalia	Dasyuromorphia	MAMMAL	Mammal
Phascogale tapoatafa subsp. wambenger	48070	Dasyuridae	Phascogale	tapoatafa	South-western Brush-tailed Phascogale, Wambenger	Animalia	Chordata	Mammalia	Dasyuromorphia	MAMMAL	Mammal
Pseudocheirus occidentalis	24166	Pseudocheiridae	Pseudocheirus	occidentalis	Western Ringtail Possum, ngwayir	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Rattus fuscipes	24243	Muridae	Rattus	fuscipes	Western Bush Rat	Animalia	Chordata	Mammalia	Rodentia	MAMMAL	Mammal
Rattus rattus	24245	Muridae	Rattus	rattus	Black Rat	Animalia	Chordata	Mammalia	Rodentia	MAMMAL	Mammal
Setonix brachyurus	24145	Macropodidae	Setonix	brachyurus	Quokka	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Stenella coeruleoalba	48113	Delphinidae	Stenella	coeruleoalba	Striped Dophin	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Sus scrofa	24259	Suidae	Sus	scrofa	Pig	Animalia	Chordata	Mammalia	Artiodactyla	MAMMAL	Mammal
Trichosurus vulpecula	25521	Phalangeridae	Trichosurus	vulpecula	Common Brushtail Possum	Animalia	Chordata	Mammalia	Diprotodontia	MAMMAL	Mammal
Tursiops aduncus	30954	Delphinidae	Tursiops	aduncus	Indo-Pacific Bottlenose Dolphin	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal
Tursiops truncatus	24069	Delphinidae	Tursiops	truncatus	Bottlenose Dolphin	Animalia	Chordata	Mammalia	Cetacea	MAMMAL	Mammal

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Vespadelus regulus	24206	Vespertilionidae	Vespadelus	regulus	Southern Forest Bat	Animalia	Chordata	Mammalia	Chiroptera	MAMMAL	Mammal
Vulpes vulpes	24040	Canidae	Vulpes	vulpes	Red Fox	Animalia	Chordata	Mammalia	Carnivora	MAMMAL	Mammal
Acritoscincus trilineatus	42368	Scincidae	Acritoscincus	trilineatus	Western Three-lined Skink	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Caretta caretta	25335	Cheloniidae	Caretta	caretta	Loggerhead Turtle	Animalia	Chordata	Reptilia	Testudines	REPTILE	Reptile
Chelodina colliei	43380	Cheluidae	Chelodina	colliei	South-western Snake-necked Turtle	Animalia	Chordata	Reptilia	Testudines	REPTILE	Reptile
Christinus marmoratus	24980	Gekkonidae	Christinus	marmoratus	Marbled Gecko	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Cryptoblepharus buchananii	30893	Scincidae	Cryptoblepharus	buchananii		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Ctenotus australis	25027	Scincidae	Ctenotus	australis		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Ctenotus fallens	25039	Scincidae	Ctenotus	fallens		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Ctenotus impar	25047	Scincidae	Ctenotus	impar		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Ctenotus labillardieri	25049	Scincidae	Ctenotus	labillardieri		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Ctenotus ora	41641	Scincidae	Ctenotus	ora	Coastal Plains Skink	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Echiopsis curta	25251	Elapidae	Echiopsis	curta	Bardick	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Egernia kingii	25096	Scincidae	Egernia	kingii	King's Skink	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Egernia napoleonis	25100	Scincidae	Egernia	napoleonis		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Elapognathus coronatus	25250	Elapidae	Elapognathus	coronatus	Crowned Snake	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Hemiergis gracilipes	30919	Scincidae	Hemiergis	gracilipes	skink	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Hemiergis quadrilineata	25119	Scincidae	Hemiergis	quadrilineata		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Hydrophis platurus	43384	Elapidae	Hydrophis	platurus	Yellow-bellied Seasnake	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Lerista distinguenda	25131	Scincidae	Lerista	distinguenda		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Lerista elegans	25133	Scincidae	Lerista	elegans		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Lialis burtonis	25005	Pygopodidae	Lialis	burtonis		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Lissolepis luctuosa	42413	Scincidae	Lissolepis	luctuosa	Western Swamp Skink	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Menetia greyii	25184	Scincidae	Menetia	greyii		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Morelia spilota subsp. imbricata	25240	Boidae	Morelia	spilota	Carpet Python	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Morethia lineoocellata	25191	Scincidae	Morethia	lineoocellata		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Natator depressus	25344	Cheloniidae	Natator	depressus	Flatback Turtle	Animalia	Chordata	Reptilia	Testudines	REPTILE	Reptile
Neelaps bimaculatus	25248	Elapidae	Neelaps	bimaculatus	Black-naped Snake	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Notechis scutatus	25252	Elapidae	Notechis	scutatus	Tiger Snake	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Parasuta gouldii	25253	Elapidae	Parasuta	gouldii		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Pogona minor	25510	Agamidae	Pogona	minor	Dwarf Bearded Dragon	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Pseudonaja affinis	25511	Elapidae	Pseudonaja	affinis	Dugite	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Simoselaps bertholdi	25266	Elapidae	Simoselaps	bertholdi	Jan's Banded Snake	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Tiliqua rugosa	25519	Scincidae	Tiliqua	rugosa		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Tiliqua rugosa subsp. rugosa	25207	Scincidae	Tiliqua	rugosa		Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Underwoodisaurus milii	24983	Gekkonidae	Underwoodisaurus	milii	Barking Gecko	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Varanus gouldii	25218	Varanidae	Varanus	gouldii	Bungarra or Sand Monitor	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Varanus rosenbergi	25225	Varanidae	Varanus	rosenbergi	Heath Monitor	Animalia	Chordata	Reptilia	Squamata	REPTILE	Reptile
Eolophus roseicapillus		Cacatuidae	Eolophus	roseicapillus		Animalia				BIRD	Bird

Appendix 2

EPBC Act Protected Matters Search Tool Results

Australian Government
Department of the Environment and Energy

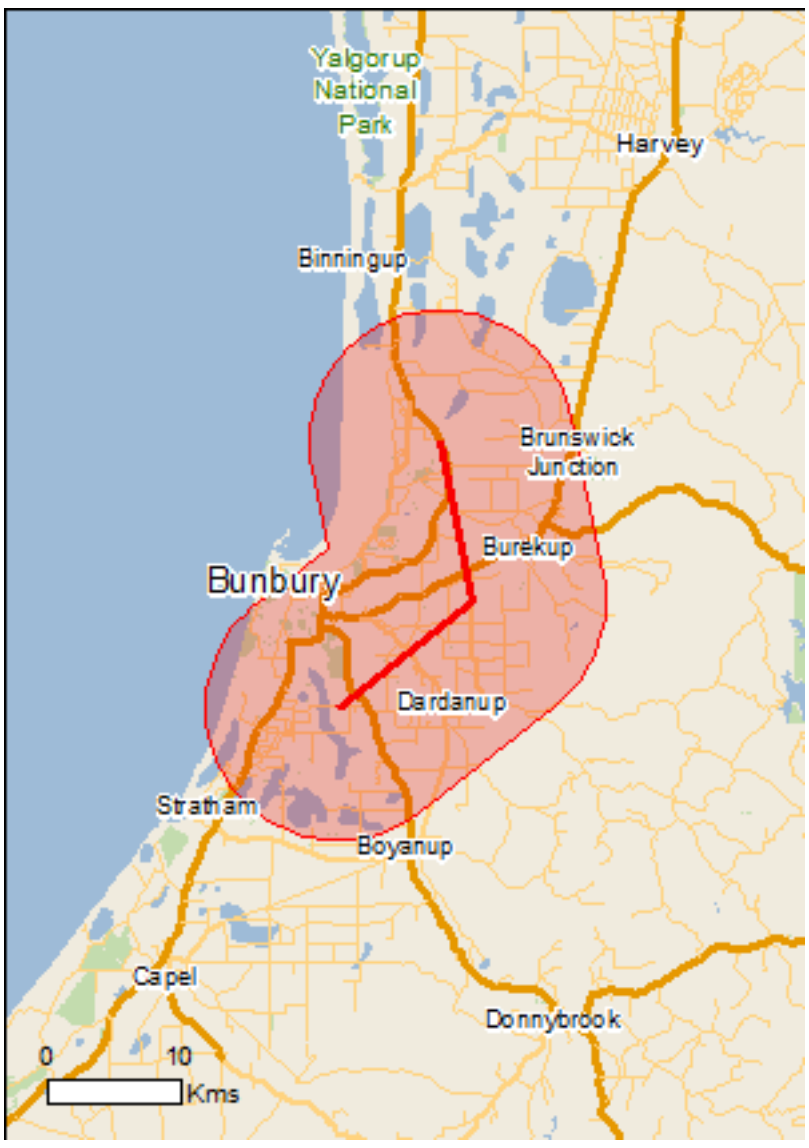
EPBC Act Protected Matters Report

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.

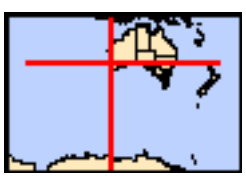
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/10/18 18:48:25



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	69
Listed Migratory Species:	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.

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	69
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	9
Regional Forest Agreements:	1
Invasive Species:	29
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Peel-yalgorup system	Within 10km of Ramsar

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
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata		
Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat likely to occur within area
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Austrostipa bronwenae		
[87808]	Endangered	Species or species habitat known to occur within area
Austrostipa jacobsiana		
[87809]	Critically Endangered	Species or species habitat known to occur within area
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat likely to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known

Name	Status	Type of Presence
		to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia		
Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Manta alfredi 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
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
[Pandion haliaetus](#) Osprey [952]		Breeding known to occur within area
[Tringa nebularia](#) 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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Dardanup	WA
Leschenault Peninsula	WA
Morangarel	WA
NTWA Bushland covenant (0022)	WA
NTWA Bushland covenant (0146)	WA
NTWA Bushland covenant (0150)	WA
Unnamed WA40552	WA
Unnamed WA40564	WA
Unnamed WA46108	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

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
Mammals		
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

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

-33.25222 115.74889,-33.34194 115.77056,-33.4025 115.67861

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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Appendix 3

DBCA Regulation 17 Licence

DEPARTMENT OF PARKS AND WILDLIFE

Department of Parks and Wildlife

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9219 9000
Facsimile: 08 9219 8242
Web Site: https://wildlifelicensing.dpaw.wa.gov.au
Correspondance: **Locked Bag 30**
Bentley Delivery Centre WA 6983

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

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Bentley Delivery Centre WA 6983

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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Bentley Delivery Centre WA 6983

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 4

Pre-feasibility Western Ringtail Possum Sampling

Pre-feasibility Surveying for Western Ringtail Possums over the Wider Survey Area

Effort (combined transect length) and the area (hectares) of each of the study sites included in earlier strip-sampling over the wider Survey Area and context areas is given in Table 1, while their locations are illustrated in Figure 1.

Table 1: Strip transects: summary of locations and timing for each of the study sites within the wider Survey Area and for the contextual sites.

Study Site	Jul 2018	Aug/Sep 2018	Oct 2018
Wider Survey Area			
Brunswick River to Raymond Road			✓
Part Davenport Localities (part surveyed in July, entirety surveyed in August)	✓	✓	
Picton East (surveyed in July and again in August)	✓	✓	
Contextual sites			
Part Davenport Localities	✓		
Gelorup	✓	✓	
Maidment Parade Road Reserve	✓	✓	

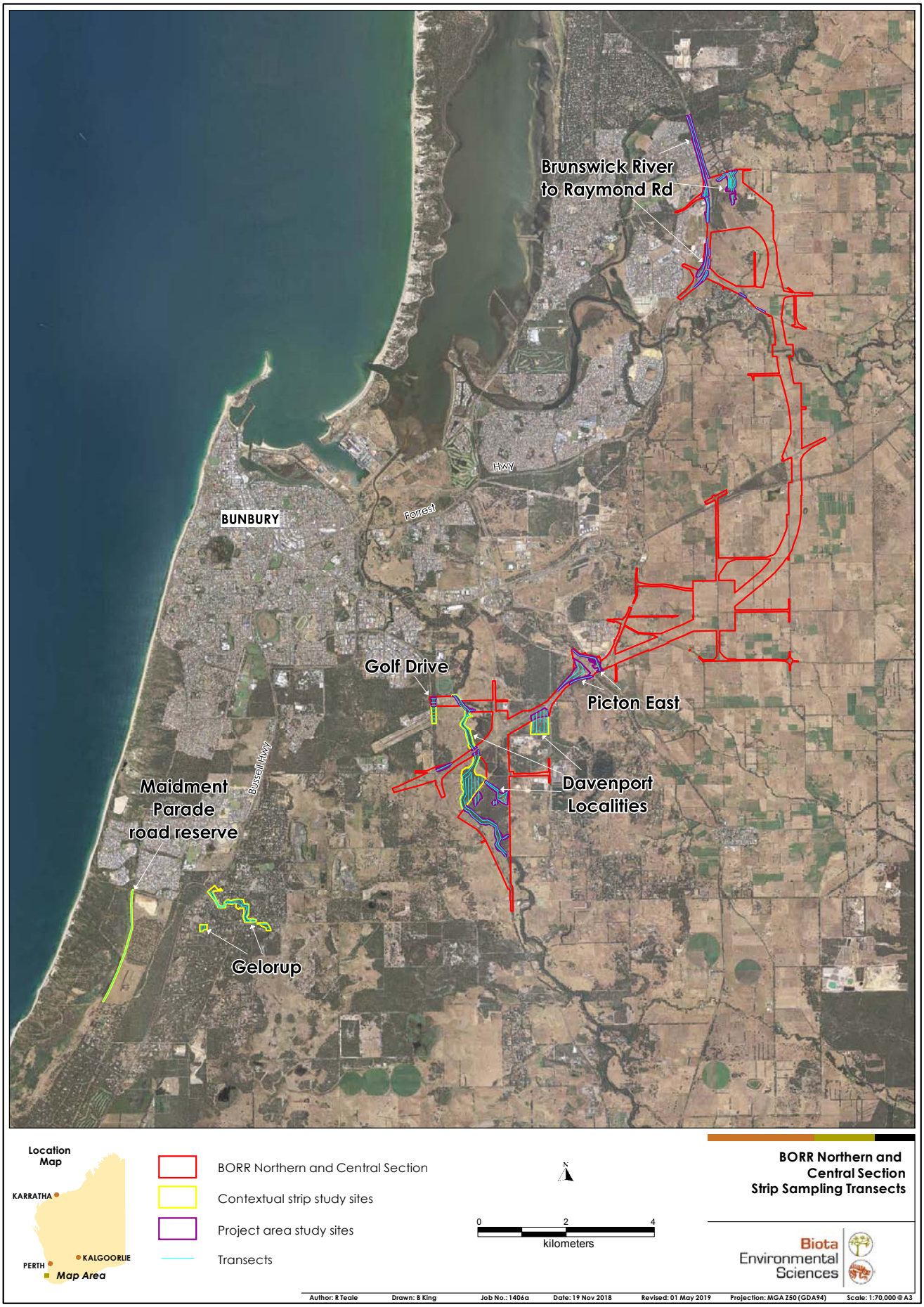

Figure 1: Location of strip transects within the North Environmental Survey Area and context sites.

Results of strip sampling conducted in the wider Survey Area and context sites is detailed in Table 2, while locations of observations are displayed in Figure 2.

Table 2: Number of observations and total number of individuals (in parentheses) of Western Ringtail Possums recorded from strip transects within the wider Survey Area and at contextual sites.
Bold numbers indicate those counts used to obtain the sub-totals and grand total (assumed to represent a count of unique individuals).

Study Site	Number of Observations (Sightings)		
	July 2018	Aug/Sep 2018	Oct 2018
Wider Survey Area			
Brunswick River to Raymond Road	-	-	**17 (21)**[1]
Davenport Localities (part Moore Road)	1 (1)	2 (2)	**3 (4)**
Davenport Localities (part Picton River)	2 (3)	**6 (6)**	-
Davenport Localities (Timber Mill Place)	-	-	**4 (4)**
Golf Drive – part	-	**2(2)**	-
Picton East	-	6 (6)	**8 (9)**
Sub-total	**40 (46)**		
Contextual Sites			
Davenport Localities (part Moore Road)	3 (3)	**4 (5)**	-
Davenport Localities (part Picton River)	-	**2 (2)**	-
Golf Drive – part	-	**2 (4)**	-
Gelorup	11 (12)	**11 (14)**	-
Maidment Parade road reserve	1 (2)	**2 (2)**	-
Sub-total	**21 (27)**		
Grand Total	**61 (73)**		

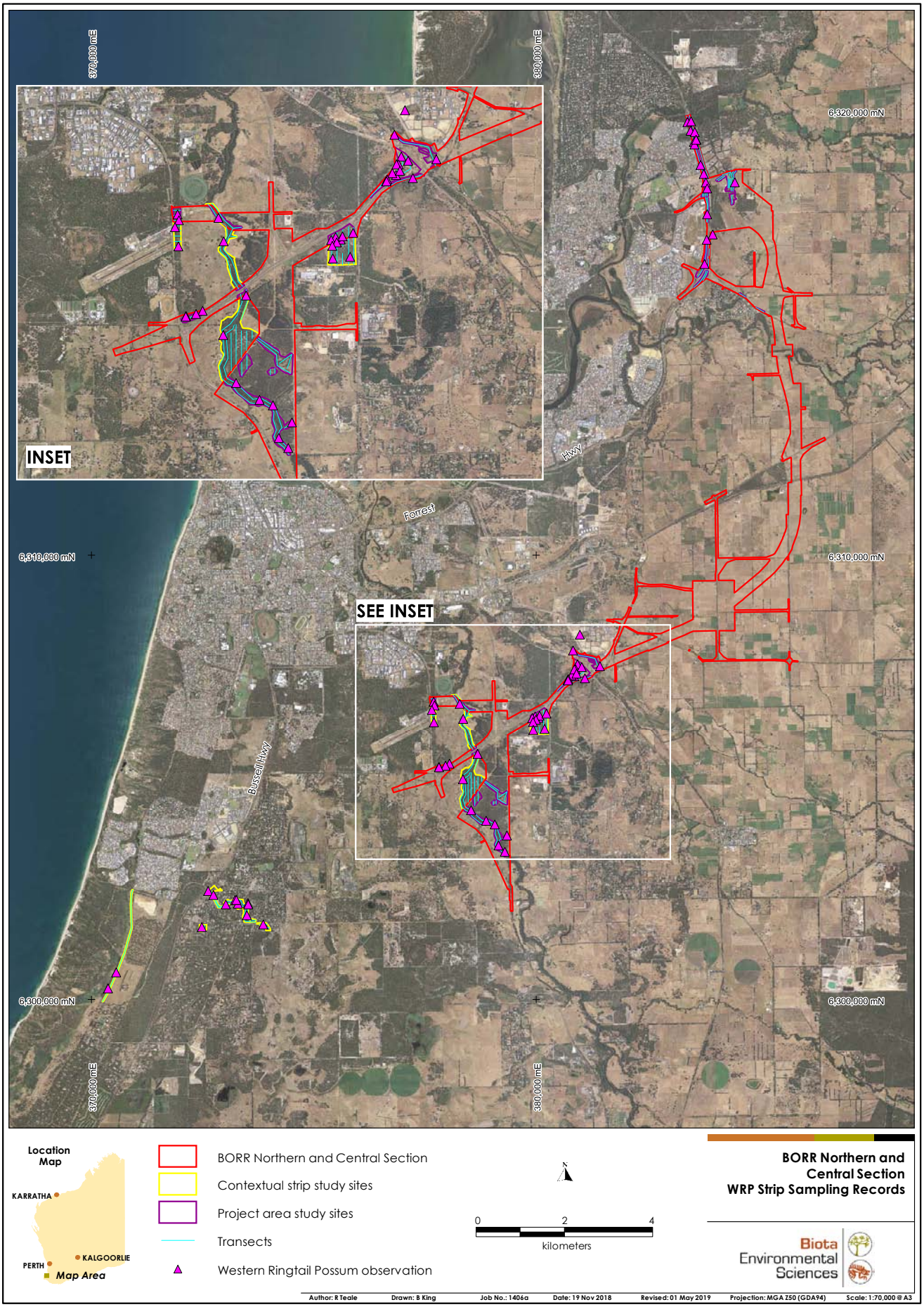

Figure 2: **Records of Western Ringtail Possums from strip transects within the wider Survey Area and contextual sites.**

Appendix 5

Desktop Review Results

A3: Mammals

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lot 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Bettongia penicillata ogilbyi	Woylie, Brush-tailed Bettong	CR	EN	•	•				
Bos taurus	European Cattle			•		•		•	
Canis lupus	Domestic Dog				•		•	•	
Cercartetus concinnus	Western Pygmy-possum			•					
Chalinolobus gouldii	Gould's Wattled Bat			•					
Dasyurus geoffroii	Chuditch	VU	VU	•	•				
Equus caballus	Horse					•		•	
Falsistrellus mackenziei	Western False Pipistrelle	P4		•					
Felis catus	Cat			•	•	•	•		•
Hydromys chrysogaster	Water-rat	P4		•				•	
Isoodon fusciventer	Southern Brown Bandicoot	P4		•			•	•	
Macropus fuliginosus	Western Grey Kangaroo			•		•	•	•	•
Mus musculus	House Mouse			•	•				
Myrmecobius fasciatus	Numbat	EN	EN	•					
Notamacropus irma	Western Brush Wallaby	P4		•					
Nyctophilus geoffroyi	Lesser Long-eared Bat			•					
Nyctophilus gouldi	Gould's Long-eared Bat			•					
Oryctolagus cuniculus	Rabbit			•	•	•	•	•	•
Phascogale tapoatafa wambenger	Wambenger Brush-tailed Phascogale	CD		•					
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CR	•	•	•	•	•	•
Rattus fuscipes	Western Bush Rat			•					
Rattus rattus	Black Rat			•	•		•		
Setonix brachyurus	Quokka	VU	VU	•	•				
Sus scrofa	Pig			•	•		•		
Tachyglossus aculeatus	Short-beaked Echidna						•		
Trichosurus vulpecula	Common Brushtail Possum			•			•	•	•
Vespadelus regulus	Southern Forest Bat			•					
Vulpes vulpes	Red Fox			•	•	•	•	•	•

A3: Birds

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Acanthiza apicalis	Inland Thornbill			•					
Acanthiza chrysorrhoa	Yellow-rumped Thornbill			•			•	•	•
Acanthiza inornata	Western Thornbill			•			•	•	
Acanthorhynchus superciliosus	Western Spinebill			•					•
Accipiter cirrocephalus	Collared Sparrowhawk			•					
Accipiter fasciatus	Brown Goshawk		Ma	•					•
Acrocephalus australis	Australian Reed-Warbler			•					
Actitis hypoleucos	Common Sandpiper	Ml	Ml; Ma	•	•				
Anas castanea	Chestnut Teal			•					
Anas gracilis	Grey Teal			•					•
Anas superciliosa	Pacific Black Duck			•			•		•
Anhinga novaehollandiae	Australasian Darter			•					
Anthochaera carunculata	Red Wattlebird			•			•	•	•
Anthochaera lunulata	Western Wattlebird			•			•		
Anthus novaeseelandiae	Australasian Pipit					•	•		•
Aquila audax	Wedge-tailed Eagle			•			•		
Ardea alba	Great Egret		Ma	•	•				
Ardea pacifica	White-necked Heron			•					•
Arenaria interpres	Ruddy Turnstone	Ml	M; Ma	•					
Artamus cinereus	Black-faced Woodswallow			•			•		•
Artamus cyanopterus	Dusky Woodswallow			•		•			•
Aythya australis	Hardhead			•					
Barnardius zonarius	Australian Ringneck			•		•	•	•	•
Biziura lobata	Musk Duck		Ma	•					•
Bubulcus ibis	Cattle Egret		Ma	•	•				
Burhinus grallarius	Bush Stone-curlew			•					
Butorides striata	Striated Heron								•
Cacatua pastinator	Western Corella			•					
Cacatua sanguinea	Little Corella			•					•

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Cacatua tenuirostris	Long-billed Corella						•		
Cacomantis flabelliformis	Fan-tailed Cuckoo		Ma	•			•		
Calidris acuminata	Sharp-tailed Sandpiper	MI	M; Ma	•	•				
Calidris canutus	Red Knot		EN; M; Ma	•	•				
Calidris ferruginea	Curlew Sandpiper	CR; MI	CR; M; Ma	•	•				
Calidris melanotos	Pectoral Sandpiper	MI	M; Ma		•				
Calidris ruficollis	Red-necked Stint	MI	M; Ma	•					
Calidris tenuirostris	Great Knot	CR; MI	CR; M; Ma	•					
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	VU	VU	•	•		•	•	•
Calyptorhynchus baudinii	Baudin's Black-Cockatoo	EN	EN	•	•				
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	EN	EN	•	•		•	•	
Chalcites lucidus	Shining Bronze-Cuckoo			•					
Charadrius ruficapillus	Red-capped Plover		Ma	•					
Chenonetta jubata	Australian Wood Duck			•			•		•
Chroicocephalus novaehollandiae	Silver Gull		Ma	•					
Cincloramphus mathewsi	Rufous Songlark								•
Circus approximans	Swamp Harrier		Ma	•					
Cladorhynchus leucocephalus	Banded Stilt			•					
Colluricincla harmonica	Grey Shrike-thrush			•			•	•	•
Columba livia	Rock Dove			•	•				•
Coracina novaehollandiae	Black-faced Cuckoo-shrike		Ma	•		•	•	•	•
Corvus bennetti	Little Crow								•
Corvus coronoides	Australian Raven			•		•	•	•	•
Coturnix pectoralis	Stubble Quail		Ma	•					
Cracticus nigrogularis	Pied Butcherbird			•					•
Cracticus torquatus	Grey Butcherbird			•			•		•
Cygnus atratus	Black Swan			•					
Dacelo novaeguineae	Laughing Kookaburra			•			•	•	•
Daphoenositta chrysoptera	Varied Sittella			•			•		
Egretta garzetta	Little Egret								•

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Egretta novaehollandiae	White-faced Heron			•			•		•
Elanus axillaris	Black-shouldered Kite								•
Elseyornis melanops	Black-fronted Dotterel			•					•
Eolophus roseicapilla	Galah						•	•	•
Eopsaltria griseogularis	Western Yellow Robin			•			•		
Epthianura albifrons	White-fronted Chat			•					•
Erythrogonys cinctus	Red-kneed Dotterel			•					
Falco berigora	Brown Falcon			•					•
Falco cenchroides	Nankeen Kestrel		Ma	•		•	•		•
Falco longipennis	Australian Hobby			•			•		
Falco peregrinus	Peregrine Falcon	OS		•					•
Falcunculus frontatus	Crested Shrike-tit	P4	VU	•					
Fulica atra	Eurasian Coot			•			•		•
Gallinula tenebrosa	Dusky Moorhen			•					•
Gavicalis virescens	Singing Honeyeater					•	•		•
Gerygone fusca	Western Gerygone			•			•	•	•
Glossopsitta porphyrocephala	Purple-crowned Lorikeet						•		
Grallina cyanoleuca	Magpie-lark		Ma	•			•	•	•
Gymnorhina tibicen	Australian Magpie			•		•	•	•	•
Haliaeetus leucogaster	White-bellied Sea-Eagle		Ma	•	•				
Haliastur sphenurus	Whistling Kite		Ma	•			•	•	
Heteroscenes pallidus	Pallid Cuckoo		Ma	•					•
Hieraaetus morphnoides	Little Eagle			•					
Himantopus leucocephalus	Pied Stilt		Ma	•					
Hirundo neoxena	Welcome Swallow		Ma	•			•	•	•
Hydroprogne caspia	Caspian Tern	MI	M	•	•				
Hypotaenidia philippensis	Buff-banded Rail			•					
Lichmera indistincta	Brown Honeyeater			•		•	•	•	•
Limosa lapponica	Bar-tailed Godwit	MI	M; Ma	•	•				
Limosa limosa	Black-tailed Godwit	MI	M; Ma	•					

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Malacorhynchus membranaceus	Pink-eared Duck			•					
Malurus elegans	Red-winged Fairy-wren			•				•	
Malurus splendens	Splendid Fairy-wren			•			•		•
Melithreptus brevirostris	Brown-headed Honeyeater			•					
Merops ornatus	Rainbow Bee-eater		Ma	•	•	•			
Microcarbo melanoleucos	Little Pied Cormorant			•			•	•	
Microeca fascinans	Jacky Winter						•		
Myiagra inquieta	Restless Flycatcher			•					
Neophema elegans	Elegant Parrot			•			•		•
Ninox boobook	Southern Boobook					•		•	•
Numenius madagascariensis	Eastern Curlew	CR; MI	CR	•	•				
Numenius phaeopus	Whimbrel	MI	M; Ma	•					
Nycticorax caledonicus	Nankeen Night-Heron		Ma	•					
Ocyphaps lophotes	Crested Pigeon			•					•
Oxyura australis	Blue-billed Duck	P4		•					
Pachycephala pectoralis	Golden Whistler						•	•	
Pachycephala rufiventris	Rufous Whistler			•		•	•	•	•
Pandion haliaetus	Eastern Osprey	MI	Ma	•	•				
Pardalotus punctatus	Spotted Pardalote			•					•
Pardalotus striatus	Striated Pardalote			•		•	•		•
Pelecanus conspicillatus	Australian Pelican		Ma	•					
Petrochelidon nigricans	Tree Martin		Ma	•			•		
Petroica multicolor	Scarlet Robin			•		•	•	•	
Phalacrocorax carbo	Great Cormorant			•					
Phalacrocorax sulcirostris	Little Black Cormorant			•					•
Phalacrocorax varius	Pied Cormorant			•					
Phaps chalcoptera	Common Bronzewing			•			•	•	•
Phaps elegans	Brush Bronzewing			•					
Phylidonyris niger	White-cheeked Honeyeater			•					
Phylidonyris novaehollandiae	New Holland Honeyeater			•			•	•	•

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Platalea flavipes	Yellow-billed Spoonbill			•			•		•
Platycercus icterotis	Western Rosella			•					
Plegadis falcinellus	Glossy Ibis	MI	M; Ma	•					
Pluvialis fulva	Pacific Golden Plover	MI	M; Ma	•					
Podargus strigoides	Tawny Frogmouth			•			•	•	
Podiceps cristatus	Great Crested Grebe			•					
Poliocephalus poliocephalus	Hoary-headed Grebe			•					
Polytelis anthopeplus	Regent Parrot			•			•		•
Poodytes gramineus	Little Grassbird			•				•	
Porphyrio porphyrio	Purple Swamphen		Ma	•					•
Porzana fluminea	Australian Spotted Crake			•					
Purpureicephalus spurius	Red-capped Parrot			•		•	•	•	•
Quoyornis georgianus	White-breasted Robin			•					
Recurvirostra novaehollandiae	Red-necked Avocet		Ma	•					
Rhipidura fuliginosa	Grey Fantail			•		•	•	•	•
Rhipidura leucophrys	Willie Wagtail			•		•	•	•	•
Rostratula australis	Australian Painted-snipe	EN	EN		•				
Sericornis frontalis	White-browed Scrubwren			•			•		
Smicrornis brevirostris	Weebill			•		•	•	•	•
Spatula rhynchotis rhynchotis	Australian Shoveler			•					
Stictonetta naevosa	Freckled Duck			•					
Stipiturus malachurus	Southern Emu-wren			•					
Strepera versicolor	Grey Currawong			•			•		•
Streptopelia chinensis	Spotted Dove			•	•				
Streptopelia senegalensis	Laughing Dove			•	•			•	
Tachybaptus novaehollandiae	Australasian Grebe			•					
Tadorna tadornoides	Australian Shelduck			•			•		•
Threskiornis moluccus	Australian White Ibis						•	•	•
Threskiornis spinicollis	Straw-necked Ibis		Ma	•			•		•
Todiramphus sanctus	Sacred Kingfisher		Ma	•				•	•

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lo 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Trichoglossus moluccanus	Rainbow Lorikeet			•				•	
Tringa brevipes	Grey-tailed Tattler	MI; P4	M	•					
Tringa glareola	Wood Sandpiper	MI	M; Ma	•					
Tringa nebularia	Common Greenshank	MI	M; Ma	•	•				
Tringa stagnatilis	Marsh Sandpiper	MI	M; Ma	•					
Turnix varius	Painted Button-quail	VU	VU	•			•		
Tyto alba	Barn Owl			•					
Vanellus tricolor	Banded Lapwing			•					
Zapornia tabuensis	Spotless Crake		Ma	•					
Zosterops lateralis	Silvereye		Ma	•			•	•	•

A3: Reptiles

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lot 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Acritoscincus trilineatus	Western Three-lined Skink			•			•		
Chelodina colliei	South-western Snake-necked Turtle			•					
Christinus marmoratus	Marbled Gecko			•		•			
Cryptoblepharus buchananii				•			•		
Ctenotus australis				•					
Ctenotus fallens				•					
Ctenotus impar				•					
Ctenotus labillardieri				•					
Ctenotus ora	Coastal Plains Skink	P3		•					
Echiopsis curta	Bardick			•					
Egernia kingii	King's Skink			•		•			•
Egernia napoleonis				•			•		•
Elapognathus coronatus	Crowned Snake			•					
Hemiergis gracilipes				•					
Hemiergis quadrilineata				•			•		
Lerista distinguenda				•					
Lerista elegans				•					
Lialis burtonis				•					
Lissolepis luctuosa	Western Swamp Skink			•					
Menetia greyii				•		•	•		•
Morelia spilota	Carpet Python			•					
Morethia lineoocellata				•					•
Morethia obscura						•	•		
Neelaps bimaculatus	Black-naped Snake			•					
Notechis scutatus	Tiger Snake			•					
Parasuta gouldii				•					

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lot 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Pogona minor	Dwarf Bearded Dragon			•		•			
Pseudonaja affinis	Dugite			•			•		•
Simoselaps bertholdi	Jan's Banded Snake			•					
Tiliqua rugosa				•		•	•		
Underwoodisaurus milii	Barking Gecko			•					
Varanus gouldii	Bungarra or Sand Monitor			•					
Varanus rosenbergi	Heath Monitor			•					

A3: Amphibians

Species Name	Common Name	State Listing	Federal Listing	Nature Map	EPBC PMST	Lot 15 2010	BORR 2012	Lot 1 Ducane 2014	Waterloo 2015
Crinia georgiana	Quacking Frog			•					•
Crinia glauerti	Clicking Frog			•			•	•	•
Crinia insignifera	Squelching Froglet			•			•	•	•
Crinia pseudinsignifera	Bleating Froglet			•					
Geocrinia leai	Ticking Frog			•				•	
Heleioporus eyrei	Moaning Frog			•					•
Heleioporus inornatus	Whooping Frog			•					
Limnodynastes dorsalis	Western Banjo Frog			•					•
Litoria adelaidensis	Slender Tree Frog			•			•		•
Litoria moorei	Motorbike Frog			•					•

Appendix 6

Threatened Fauna Statutory Framework – Western Australia

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*

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

Threatened Species

- **Critically Endangered (CR):** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines.
- **Endangered (EN):** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
- **Vulnerable (VU):** Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines".

Extinct Species

- **Extinct Species (EX):** Species where "there is no reasonable doubt that the last member of the species has died"
- **Extinct in the wild (EW):** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form"

Specially Protected Species

- **Migratory (MI):** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth.

  Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program
- **Species of special conservation interest (conservation dependent fauna) (CD):** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
- **Other specially protected fauna (OS):** Fauna otherwise in need of special protection to ensure their conservation

Department of Biodiversity, Conservation and Attractions Priority Listing

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 four Priority categories:

Priority 1: Poorly known species
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

Priority 2: Poorly known species
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Priority 3: Poorly known species
Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Priority 4: Rare, Near Threatened and other species in need of monitoring
(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy. conservation lands.