



Mimbi Extension Camping Grounds Level 1 Fauna Survey





© Biota Environmental Sciences Pty Ltd 2015
ABN 49 092 687 119
Level 1, 228 Carr Place
Leederville Western Australia 6007
Ph: (08) 9328 1900 Fax: (08) 9328 6138

Job No.: 1066A

Prepared by: P. Brooshoft
S. Ford

Document Quality Checking History

Version: 1.1	Peer review:	N. Watson
Version: 1.2	Director review:	M. Maier
Version: 2	Format review:	F. Hedley

Approved for issue: M. Maier

This document has been prepared to the requirements of the client identified on the cover page and no representation is made to any third party. It may be cited for the purposes of scientific research or other fair use, but it may not be reproduced or distributed to any third party by any physical or electronic means without the express permission of the client for whom it was prepared or Biota Environmental Sciences Pty Ltd.

This report has been designed for double-sided printing. Hard copies supplied by Biota are printed on recycled paper.

This page intentionally blank.

Mimbi Extension Level 1 Fauna Report

Contents

1.0	Executive Summary	7
2.0	Introduction	9
2.1	Project Background	9
2.2	Study Objectives and Scope	10
3.0	Regional Context of the Study Area	13
3.1	IBRA Bioregion and Subregion	13
3.2	Climate	13
3.3	Reserves in the Locality	14
3.4	Land Systems	14
3.5	Beard's Vegetation Units	15
3.6	Significant Communities in the Locality	16
4.0	Approach and Methods	17
4.1	Database Searches	17
4.2	Literature Review	17
4.3	Nomenclature	17
4.4	Reconnaissance Survey Timing and Team	17
4.5	Fauna Habitat Mapping	18
4.6	Site Descriptions	21
4.7	Assessment of Likelihood of Occurrence in the Study Area	28
4.8	Short Range Endemic Invertebrate Sampling	28
4.9	Survey Limitations	29
5.0	Vertebrate Fauna Results	31
5.1	Overview of Potential Fauna Assemblage	31
5.2	Field Survey Records	31
5.3	Conservation Significant Vertebrate Fauna	35
6.0	Short Range Endemic Fauna Results	45
6.1	Overview of Potential SRE Fauna Assemblage	45
6.2	Invertebrate Fauna Recorded in the Study Area	45
7.0	Management Considerations	49
7.1	Protection of Hollow Bearing Trees	49
7.2	Protection of Reedbeds and Minor Drainage Lines	49
7.3	Other Considerations	50
8.0	Glossary	51
9.0	References	53
	Appendix 1	
	NatureMap Search Results	
	Appendix 2	
	Commonwealth EPBC Act Protected Matters Search Results	

Appendix 3

Atlas of Living Australia Database Search Results

Appendix 4

Potential Species List for the Study Area

Appendix 5

Ranking of Conservation Significant Fauna Species in WA

Appendix 6

Echolocation Survey of Bat Activity in the Mimbi Study Area

Tables

Table 3.1:	Land systems within the study area.	14
Table 4.1:	Landforms and fauna habitats identified in the Mimbi Extension study area.	18
Table 4.2:	Habitat descriptions for survey polygons in the Mimbi study area.	21
Table 4.3:	Bat sampling sites and effort during the Mimbi reconnaissance survey.	23
Table 4.4:	Motion camera sites and effort during the Mimbi reconnaissance survey.	24
Table 4.5:	Description of bat sampling and motion camera sites.	24
Table 4.6:	Ranking system used to assign likelihood of occurrence of species in the study area.	28
Table 4.7:	Categories of SRE status and defining criteria.	29
Table 5.1:	Overview of the vertebrate fauna potentially occurring in the study area.	31
Table 5.2:	Vertebrate fauna records from the reconnaissance survey of the Mimbi study area.	32
Table 5.3:	Conservation significant vertebrate fauna species recorded or potentially occurring within the study area.	36
Table 6.1:	Invertebrate fauna potentially occurring within the Mimbi study area.	45
Table 6.2:	Locations of collected land snails during the Mimbi site visit.	46

Figures

Figure 2.1:	Location of the Mimbi Extension study area.	11
Figure 3.1:	Monthly long-term (1997-2015) climate averages recorded at Fitzroy Crossing (data supplied by Bureau of Meteorology).	13
Figure 4.1:	Survey effort undertaken by the zoologist during the Mimbi site visit.	19
Figure 4.2:	Fauna habitats within the study area.	20
Figure 4.3:	Location of site habitat descriptions, and bat surveying and motion camera sites.	27
Figure 5.1:	Locations of conservation significant fauna recorded within the study area during the site visit, and historically in close proximity to the study area.	37
Figure 6.1:	Location of invertebrate fauna records within the Mimbi study area.	47

1.0 Executive Summary

Tourism WA is investigating the development of a number of commercial camping grounds on Aboriginal lands in the Kimberley region of Western Australia. Biota Environmental Sciences (Biota) was commissioned to undertake a Level 1 fauna survey of some of these proposed camping grounds located at Mimbi, approximately 78 km southeast of Fitzroy Crossing. The scope of the survey was principally to identify any conservation significant vertebrate and invertebrate fauna or habitats that could be affected by the proposed development.

A desktop review of relevant databases and literature was undertaken, and a list of vertebrate and invertebrate species that have the potential to occur in the study area was compiled. A site reconnaissance survey was completed in March 2015, with the aim of searching for conservation significant fauna and recording habitat features and opportunistic fauna in the study area.

For each conservation significant vertebrate species potentially occurring in the study area, an assessment was made as to the likelihood of occurrence of the species, and the potential impacts of the proposed project. The assessment was based on the results of the database and literature searches, incorporating a review of species habitat preferences, current known fauna distributions and last known records, as well as a review of the habitats available in the study area.

Habitats were determined based on information collected during the site visit, in conjunction with vegetation descriptions taken from a botanical assessment that was conducted concurrently with the reconnaissance survey (Biota 2015). Four fauna habitats were identified: *Triodia* hummock grassland, tussock grassland, minor drainage line and reedbed.

Database and literature searches yielded a total of 220 vertebrate species as having the potential to occur in the study area, including 23 species of conservation significance. This total comprised 23 non-volant (ground-dwelling) mammal species (including 8 introduced species), 16 volant (bat) mammal species, 55 reptile species, 14 amphibian species and 112 avifauna species.

The site reconnaissance survey recorded a total of 64 species, including six species of conservation significance. This total comprised three non-volant mammal species, 13 volant mammal species, seven reptile species and 41 avifauna species. Two species recorded during the site visit were new records for the locality based on the database and literature review: the Kimberley Mouse (*Pseudomys laborifex*; recorded from mounds only) and the Federally-listed Bare-rumped Sheath-tail-bat (*Saccolaimus saccolaimus nudicluniatus*; recorded from calls).

Six conservation significant species were recorded within the study area:

- Bare-rumped Sheath-tail-bat, *Saccolaimus saccolaimus nudicluniatus* (Federal: Critically Endangered);
- Orange Leaf-nosed Bat, *Rhynonictis aurantius* (State: Schedule 1, Federal: Vulnerable);
- Yellow-lipped Cave Bat, *Vespadelus douglasorum* (Department of Parks and Wildlife: Priority 2);
- Ghost Bat, *Macroderma gigas* (Department of Parks and Wildlife: Priority 4);
- Rainbow Bee-eater, *Merops ornatus* (State: Schedule 3, Federal: Migratory); and
- Star Finch, *Neochmia ruficauda subclaescens* (State: Priority 4).

A further 18 conservation significant fauna species were identified from the database and literature review as having the potential to occur within the study area. Based on likelihood of occurrence assessments, six of these species may potentially occur in the study area:

- Northern Quoll, *Dasyurus hallucatus* (State: Schedule 1, Federal: Endangered);
- Short-tailed Mouse, *Leggadina lakedownensis* (Department of Parks and Wildlife: Priority 4);
- Fork-tailed Swift, *Apus pacificus* (State: Schedule 3, Federal: Migratory);

- Eastern Great Egret, *Ardea modesta* (State: Schedule 3, Federal: Migratory);
- Australian Bustard, *Ardeotis australis* (Department of Parks and Wildlife: Priority 4); and
- Gouldian Finch, *Erythrura gouldiae* (Department of Parks and Wildlife: Priority 4, Federal: Endangered).

The remaining 12 species of conservation significance comprise the Bilby (*Macrotis lagotis*), Northern Marsupial Mole (*Notoryctes caurinus*), Freshwater Crocodile (*Crocodylus johnstoni*), Great Desert Skink (*Liopholis kintorei*), Cattle Egret (*Ardea ibis*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Red Goshawk (*Erythrotriorchis radiatus*), Oriental Plover (*Charadrius veredus*), Australian Painted Snipe (*Rostratula australis*), Marsh Sandpiper (*Tringa stagnatilis*), Chestnut-backed Button-quail (*Turnix castanotus*) and Oriental Pratincole (*Glareola maldivarum*). These species are considered unlikely to occur in the study area.

Database and literature searches for potentially occurring invertebrate fauna yielded a total of seven species from groups known to contain potential Short Range Endemic (SRE) invertebrate fauna. None of these species were considered SREs.

The site reconnaissance survey recorded invertebrate taxa from three groups: pseudoscorpions, mygalomorph spiders and land snails. The SRE status of the pseudoscorpion (*Beierolpium "8/4"*) and mygalomorph spider (*Ctenizidae/Idiopidae* sp.) records remains undetermined. The land snails recorded were from two families: Camaenidae and Succineidae. The species of Camaenidae snails could not be definitively determined as no live specimens were collected (only shell material). However, based on previous collections within the locality, the most likely species is *Westraltrachia ampla*, which is not known to be a SRE. The Succineidae family of snails is common and widespread, and is not considered to contain SRE species.

With the exception of one species (the Bare-rumped Sheath-tail-bat), the conservation significant vertebrate species recorded or potentially occurring within the study area would not be expected to rely solely upon the habitats present. The proposed development is therefore unlikely to affect the conservation status, distribution or abundance of any of these species, and therefore specific management considerations regarding these species have not been made. However, two specific management considerations have been made regarding the occurrence of the Bare-rumped Sheath-tail-bat and the presence of a locally significant habitat within the study area. These considerations are:

1. Protection of Hollow-bearing Trees
The Bare-rumped Sheath-tail-bat utilises tree hollows as roost sites. As the project is likely to involve clearing of native vegetation to establish camping ground areas, there is potential for hollow-bearing trees to be removed, thus removing potential habitat for the species. Suggested management considerations include avoiding clearing of potential hollow-bearing trees (such as *Corymbia* sp.) when developing campsites, and redirecting access routes around such trees.
2. Protection of Reedbeds in Minor Drainage Lines
A permanent spring located within the study area is of local value, as it represents a significant source of water and foraging habitat for a range of different species, including the conservation significant Star Finch, Orange Leaf-nosed bat, Ghost Bat and Yellow-lipped Cave Bat. Visitation by hoofed animals (such as horses, cows, donkeys, camels and pigs) has the potential to deteriorate riparian vegetation and water quality, and ultimately exclude species that rely upon the habitat. To prevent further impacts to the spring and other minor drainage lines supporting ephemeral bodies of water, management considerations include removing or excluding livestock and feral species (e.g. by fencing).

2.0 Introduction

2.1 Project Background

As part of a project entitled 'Camping with Custodians', Tourism WA is investigating the development of a number of commercial campgrounds on Aboriginal lands in the Kimberley region of Western Australia. One of the proposed sites is located at Mimbi (hereafter referred to as the 'study area'), approximately 78 km southeast of Fitzroy Crossing along the Great Northern Highway (Figure 2.1)

Four options for the location of camping grounds are currently proposed for the broad valley between the Emanuel and Lawford Ranges (see Figure 2.1). These are:

1. Camping ground 1: approximately 1.5 km west of the Mimbi community, at the base of the Emanuel Range.
2. Camping ground 2: approximately 1.2 km north-northwest of the Mimbi community, just west of the Mt Pierre Station access road.
3. Camping ground 3: approximately 300 m east of the Mimbi community, in the area southwest of the intersection of the Mimbi community road with the Mt Pierre Station access road. This site was identified by Rosemary Nuggett (traditional owner) in March 2015 while on site with Gary Taylor (Tourism WA).
4. Camping ground 4: approximately 900 m north-northeast of the Mimbi community, at the base of the Lawford Range. This is the least preferred option, as it is located within an area previously nominated by the Department of Parks and Wildlife for inclusion in a regional park.

Each camping ground is located within a larger survey polygon (see Figure 2.1). Camping grounds 1 and 2 are located within the largest polygon (102 ha in size), which stretches between the Mt Pierre Station access road and the Emanuel Range and is notionally labelled 'Mimbi Northwest'. Camping ground 3 is located within a survey polygon 4.3 ha in size, notionally labelled 'Mimbi East'. Camping ground 4 is located within a survey polygon 17 ha in size, notionally labelled 'Mimbi Northeast'.

There is an existing water bore within Mimbi Northeast, which would service camping ground 4, and the location of camping ground 3 is in close proximity to the Mimbi community water tank. Some additional infrastructure would need to be developed to service the proposed camping grounds 1 and 2:

- Two new water supply bores would need to be drilled in Mimbi Northwest (close to the base of the Emanuel Range) to service camping grounds 1 and 2, and associated water pipelines would need to be constructed.
- An access road linking camping grounds 1 and 2 would be required; this would be encompassed within the Mimbi Northwest survey polygon.
- An additional proposed access road to service camping ground 1, linking in with the existing borefield road, is also proposed along the southern boundary of the Mimbi community lease. This would be developed within the 9 ha polygon that is notionally labelled 'Mimbi Corridor' (Figure 2.1).

Clearing of native vegetation on the site will be required in order to establish the camping areas and associated infrastructure. It is likely that the environmental impact assessment (EIA) of this clearing will be undertaken under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

2.2 Study Objectives and Scope

Biota was commissioned to undertake a Level 1 fauna survey to support the EIA process. The specific scope of the study was to:

- undertake a desktop and literature review of relevant databases and biological surveys conducted within the vicinity of the study area;
- conduct a reconnaissance survey of the study area to search for conservation significant vertebrate species and terrestrial short-range endemic (SRE) invertebrate species, and to record fauna opportunistically sighted during the survey;
- determine the fauna habitats present;
- assess habitat suitability for fauna of conservation significance;
- create a potential species list of the vertebrate fauna recorded or expected to occur in the study area;
- identify and assess the local and regional conservation significance of the fauna recorded or that may potentially occur in the study area;
- create maps showing locations of conservation significant taxa recorded from the study area, and habitat types present; and
- provide recommendations for managing any fauna issues identified.

This assessment was undertaken with consideration of the following:

- Environmental Protection Authority (EPA) Guidance Statement No. 56 "Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004);
- EPA and Department of Environment and Conservation (DEC¹) "Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment" (EPA and DEC 2010); and
- EPA Guidance Statement No. 20 "Guidance for the Assessment of Environmental Factors: Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia" (EPA 2009).

¹ Now operating as the Department of Parks and Wildlife.

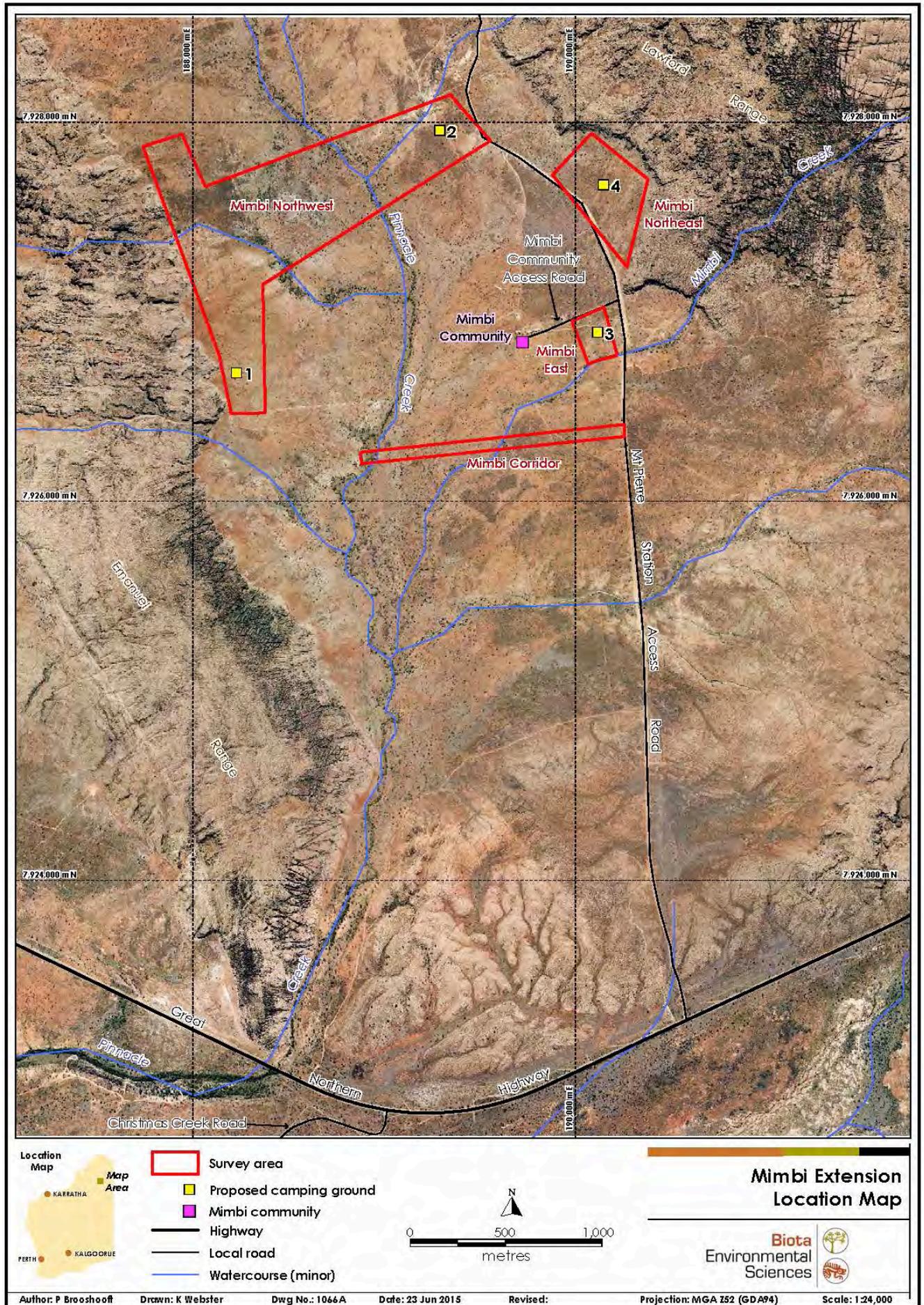


Figure 2.1: Location of the Mimbi Extension study area.

This page intentionally blank.

3.0 Regional Context of the Study Area

3.1 IBRA Bioregion and Subregion

The Interim Biogeographic Regionalisation of Australia (IBRA) recognises 89 geographically distinct bioregions on the basis of common climate, geology, landform, native vegetation and species information (DSEWPaC 2012). The study area is located in the western section of the South Kimberley Interzone subregion (OVP2), in the southwestern section of the Ord Victoria Plains bioregion (DSEWPaC 2012).

A biodiversity audit of Western Australia's subregions was completed by the then department of Conservation and Land Management in 2002 (May and McKenzie 2003). The South Kimberley Interzone subregion was described by Graham (2003a) as level to gently undulating plains with scattered hills on Cambrian volcanics and Proterozoic sedimentary rocks, with vertosols on plains and predominantly skeletal soils on hills. The overall vegetation is grassland, typically comprising scattered bloodwoods (*Corymbia* spp.) and Snappy Gum (*Eucalyptus brevifolia*) over spinifex (*Triodia* spp.) and annual grasses. The climate is dry hot tropical; semi-arid with summer rainfall. The subregional area extends over 3,540,414 ha.

Some features in the vicinity of Mimbi were described in Graham (2003b) under the Fitzroy Trough subregion (DP1) of the Dampierland bioregion. These included the extensive cave system in the Lawford Range (Mimbi Caves), which was described as a wetland of subregional significance (Graham 2003b).

3.2 Climate

The climate of the OVP2 subregion is dry hot tropical, semi-arid with summer rainfall (Graham 2003a). The Kimberley is characterised by a distinct wet season (November to April) and dry season (May to October). The climate pattern of the study area is depicted in Figure 3.1. This consolidates long term (1997-2015) climate averages taken from the nearest meteorological station that records temperature, which is located at Fitzroy Crossing, 78 km northwest of the study area (Bureau of Meteorology 2015).

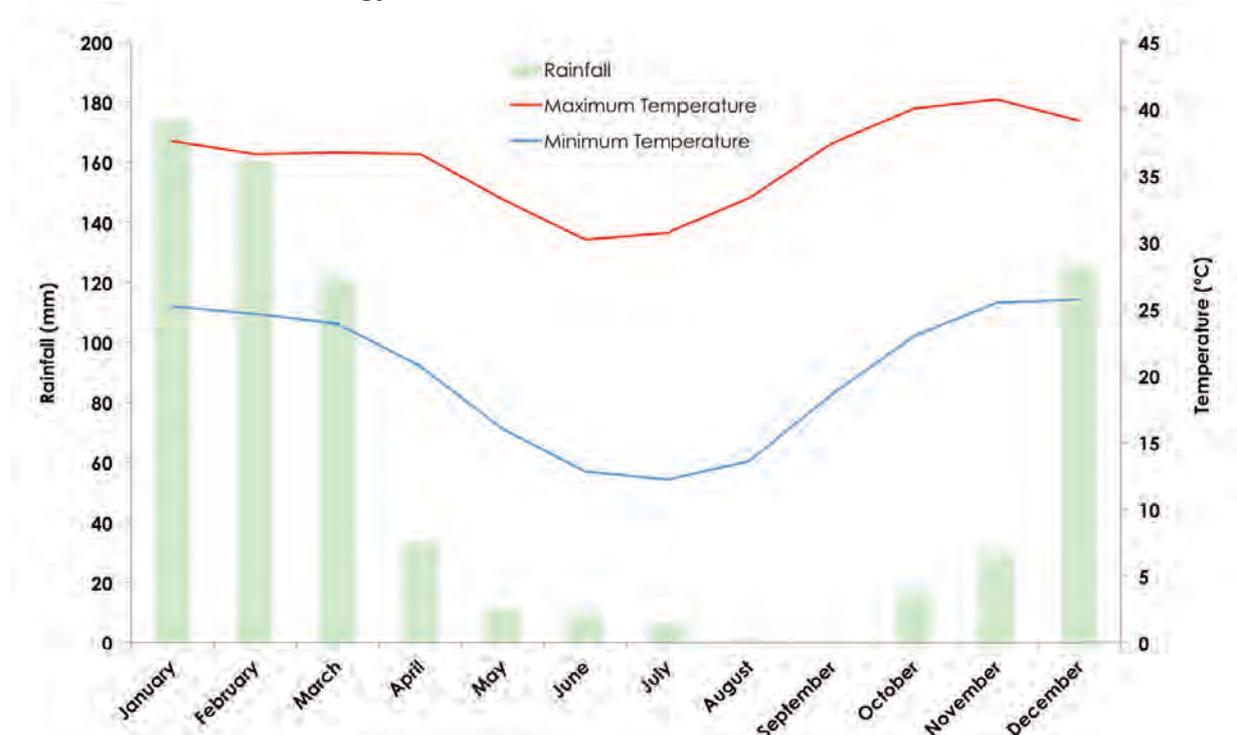


Figure 3.1: Monthly long-term (1997-2015) climate averages recorded at Fitzroy Crossing (data supplied by Bureau of Meteorology).

3.3 Reserves in the Locality

The Mimbi community is central to the four proposed camping ground areas and the proposed access road to camping ground 1. The community is located within a File Notation Area excision from Mt Pierre Station, which is an indigenous-held pastoral lease.

No reserves associated with nature conservation are located in close proximity to the study area but there are a number in the broader locality. The closest of these are:

- Geikie Gorge National Park (a Class A reserve) and the adjoining Geikie Gorge Conservation Park (Class C), located approximately 77 km northwest of the study area;
- Brooking Gorge Conservation Park (Class C), located 94 northwest of the study area; and
- Devonian Reef Conservation Park (Class C), located 130 km northwest of the study area.

The limestone ranges to the east of Mimbi (principally the Lawford Range) were previously under consideration by the Department of Parks and Wildlife for inclusion in a regional reserve, however this proposal was not formally progressed. The proposed camping ground 4 would fall within this area, should the reserve be enacted in future.

3.4 Land Systems

Land systems mapping for the locality has been prepared by Payne and Schoknecht (2011). The extent of these land systems throughout the study area, and the context of these systems within the wider OVP2 subregion are detailed in Table 3.1. The Neillabublica land system dominates all of the areas, while the Windjana land system is associated with the Emanuel and Lawford Ranges along the westernmost and easternmost edges of Mimbi Northwest and Mimbi Northeast respectively.

Table 3.1: Land systems within the study area.

Land System	Extent within OVP2 Subregion (ha)	Presence within Study area	Extent within Study Area (ha)	% of Total within Subregion
Neillabublica	72,100.8	Mimbi Northwest	98.4	0.14
		Mimbi Northeast	14.9	0.02
		Mimbi East	4.3	<0.01
		Mimbi Corridor	8.5	0.01
Windjana	30,090.8	Mimbi Northwest	3.8	0.01
		Mimbi Northeast	2.4	<0.01

3.4.1 Neillabublica Land System

The Neillabublica land system covers a total of 2,494 km² in the eastern Dampierland bioregion and western Ord Victoria Plains bioregion, towards where these bioregions adjoin the Central Kimberley bioregion (Payne and Schoknecht 2011). The Neillabublica land system is summarised by Payne and Schoknecht (2011) as:

“Undulating limestone country with scattered low hills and cracking clay plains. Open grassy woodlands, grasslands, and spinifex. Undulating plains with eucalypt woodlands and mixed grasses. Dipping or gently folded limestone, calcareous sandstone and shale of Devonian age. Formed by partial dissection of the Fitzroy surfaces - undulating terrain: undulating plains in strike belts up to 6.4 m wide and 80 km long, with low interflues and rocky surfaces, comprising plateaus, rounded hills, and cuestas, up to 30 m high; sandy or calcareous alluvial plains in the lowest parts; moderately dense rectangular pattern of strike-controlled drainage; relief mainly less than 9 m.”

Six land units are described by Payne and Schoknecht (2011) for this land system, three of which would be relevant to the current study area:

- Unit 2 - interfluvies: up to 4.8 km wide; pebble-strewn slopes typically less than 2%, with local outcrop; marginally dissected up to 6 m; shallow dark brown to dark grey, loamy to clayey, calcareous soils; spinifex steppe and open woodlands of *Triodia wiseana* and *Corymbia dichromophloia*² alliance;
- Unit 4 – cracking clay plains: up to 1.6 km in extent, with slopes less than 0.5% and hummocky surfaces; supporting tussock grasslands of *Chrysopogon* spp. and *Dichanthium fecundum*, often with scattered *Bauhinia cunninghamii*;
- Unit 6 – channels: up to 45 m wide and 3 m deep; bed-loads range from sand to boulders on bedrock; fringing forests and woodlands of *E. camaldulensis* and *Terminalia platyphylla* community in larger channels, with *Bauhinia cunninghamii* and *Lophostemon grandiflorus* woodlands in smaller streams.

3.4.2 Windjana Land System

The Windjana land system covers a total area of 1,382 km² and is summarised by Payne and Schoknecht (2011) as:

“Rocky limestone hill ranges, outcrop and shallow calcareous earths, spinifex and scattered trees. Local grasslands on cracking clay soils. Geology is dipping or gently folded limestone, calcareous sandstone and shale of Devonian age. Formed by dissection of the Kimberley surface – hill lands: strike belts up to 6.4 km wide and 80 km long, comprising hill ranges, plateaus and cuervas, with narrow bevelled crests and with short lower slopes; restricted cracking clay plains in the lowest parts; sparse to moderately dense rectangular or branching pattern of incised valleys with strike-directed trunk drainage; relief up to 75 m.”

Four land units are described by Payne and Schoknecht (2011) for this land system, of which only one unit would be relevant to the current study area:

- Unit 2 – lower slopes: concave, up to 5% and less than 800 m long; locally with alluvial fans; pebble-strewn surfaces with local outcrop; limestone outcrop with shallow dark brown to dark grey, loamy to clayey calcareous soils; open woodlands, very scattered shrubs and ground storey of *Triodia wiseana* and *Corymbia dichromophloia*² alliances.

3.5 Beard’s Vegetation Units

John Beard prepared a series of maps of the vegetation of Western Australia from the 1960s to the 1980s, at varying scales from 1:250,000 to 1:1,000,000. Beard also identified a number of phytogeographic regions as part of this work.

The study area is located within the Northern Botanical Province, and more specifically in the western section of the Hall Botanical District (Beard 1979), which corresponds approximately to the Ord Victoria Plains bioregion. Beard described the climate of this district as being relatively drier than the other Kimberley districts, with rainfall generally ranging from 350 mm to 500 mm per year and a dry season of 8-9 months (see Section 3.2). The Ord Victoria Plains were described as being underlain by Palaeozoic rocks, including Antrim Plateau Volcanics, limestone, shale and siltstone of Cambrian age and the Elder Sandstone of probably Devonian age. Vegetation was described as being closely correlated with the underlying geology.

The study area contains two vegetation units according to Beard (1979):

- Napier Hills South 746, described as a low tree steppe of bloodwood (*Corymbia dichromophloia*²) over a hummock grassland of Limestone Spinifex (*Triodia wiseana*). This broad vegetation unit occurs over a range of approximately 300 km in the eastern

² NB. All references to *Corymbia dichromophloia* from the broader studies of Payne and Schoknecht (2011) and Beard (1979) would represent *C. opaca* in the current study area.

Dampierland and western Ord Victoria Plains bioregions, and the study area is located towards the southeastern end of this range. Some of the northern stands of the Napier Hills 746 vegetation unit are represented in the conservation estate, occurring within Geikie Gorge National Park, Brooking Gorge Conservation Park and Devonian Reef Conservation Park. This unit is mapped over the western and eastern sections of Mimbi Northwest, the northern section of Mimbi East, and the entirety of Mimbi Northeast.

- Napier Hills South 878, described as sparse tree steppe of Snappy Gum (*Eucalyptus brevifolia*) and bloodwood (*Corymbia dichromophloia*²) over open hummock grassland of Soft Spinifex (*Triodia pungens*) and *Triodia intermedia*. This unit is mapped over the Mimbi Corridor and the midsection of Mimbi Northwest.

3.6 Significant Communities in the Locality

All of the Threatened Ecological Communities (TECs) listed for the Kimberley are associated with tidal mudflats, monsoon vine thickets, rainforest remnants or mound springs (Department of Parks and Wildlife 2014a). All of the Priority Ecological Communities (PECs) are associated with either wetlands (including swamps, mound springs and clay pans), alluvial flats fringing the Ord River, monsoon vine thickets, mangroves, coastal dune and pindan areas, sandstone gorges, caves or limestone hills (Department of Parks and Wildlife 2014b). While a small spring area was identified in Mimbi Northwest, the vegetation at this site did not correspond to any of the described PECs (see Table 4.5). As none of the other landforms are present in the current study area, no TECs or PECs are relevant to this assessment.

4.0 Approach and Methods

4.1 Database Searches

The following databases were searched to assist in the determination of the potential faunal assemblage of the study area:

1. NatureMap database (<http://NatureMap.dec.wa.gov.au>): a joint project of the Department of Parks and Wildlife 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 of the Department of Parks and Wildlife), the WAM Specimen database, and BirdLife Australia's Atlas of Australian Birds. The database search (Appendix 1) was conducted on February 9, 2015 and requested the return of records from a radius of 20 km from a central point within the study area (18°43'32" S, 126°03'14" E).
2. The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters database (Appendix 2). The database search was conducted on February 2, 2015 and requested the return of records from a radius of 10 km around the central point 18°43'32" S, 126°03'14" E.
3. The Atlas of Living Australia (<http://www.ala.org.au/>): a joint project between academic collecting institutions, private individual collectors and community groups. The atlas contains occurrence records, environmental data, images and the conservation status of species throughout Australia. The database search (Appendix 3) was conducted on February 2, 2015 and requested the return of records from a radius of 10 km around the central point 18°43'32" S, 126°03'14" E.

4.2 Literature Review

To complement the results of the database searches, publicly available literature was searched for relevant biological surveys conducted in the vicinity of the study area. Field guides, scientific papers and other publications on the general biology and distribution of the species potentially occurring in the study area were also reviewed. These included the following guides:

1. A Complete Guide to Reptiles of Australia (Wilson and Swan 2013).
2. Field Guide to Frogs of Western Australia (Tyler and Doughty 2009).
3. A Field Guide to the Mammals of Australia (Menkhorst and Knight 2011).

Literature and database searches indicate that there have been no publicly available vertebrate fauna surveys undertaken within close proximity (10 km) or in the locality (up to 50 km) of the study area.

4.3 Nomenclature

Species nomenclature for mammals, reptiles and amphibians follows that of the WA Museum fauna taxonomic checklist, which was last revised in July 2014. Species nomenclature for avifauna follows that of Christidis and Boles (2008), consistent with the requirements of EPA and DEC (2010).

4.4 Reconnaissance Survey Timing and Team

The reconnaissance survey was conducted on the 12th – 15th March 2015 by Dr Stewart Ford (Senior Zoologist with Biota). A botanical survey was run concurrently by Ms Michi Maier (Principal Botanist with Biota) and Mr Tim Willing (an experienced Kimberley biologist); see Biota (2015).

4.5 Fauna Habitat Mapping

The study area was traversed on foot by the zoologist to identify, describe and map the range of fauna habitats present, and record any opportunistic sightings or secondary evidence of fauna (Figure 4.1). The botanists also contributed some records obtained during their foot traverses.

Fauna habitats were mapped based on a combination of Biota's fauna landscape approach (Biota 2013), which identifies patterns (such as flood plains, hills and drainage lines) and smaller landform elements (such as a breakaways, cliffs or hill slopes), with the finer-scale vegetation mapping undertaken by Biota (2015). The distributions of fauna are typically not limited to specific landform elements; rather fauna may utilise many components of a landscape. Therefore, fauna habitats are mapped based on an amalgamation of landform patterns, elements that are considered to represent suitable habitats for species, and the vegetation present.

Based on an assessment of the landforms and vegetation in the study area, four fauna habitats were identified (Table 4.1). The broad distribution of these habitats through the study area is depicted in Figure 4.2 and further described in Table 4.2 and Table 4.5.

Table 4.1: Landforms and fauna habitats identified in the Mimbi Extension study area.

Landform Element	Fauna Habitat	Description
Pediment slopes	<i>Triodia</i> hummock grasslands	Pediment slopes are the large, gently inclined lower slopes below hills underlain by bedrock at varying depths. These account for much of the study area and support <i>Triodia</i> hummock grasslands (mainly <i>T. wiseana</i> , occasionally <i>T. inaequiloba</i>) with scattered <i>Corymbia</i> trees and mixed shrubs.
Colluvial / alluvial plains	Tussock grasslands	Mostly comprising Curly Bluegrass (<i>Dichanthium fecundum</i>) tussock grasses, often with Ribbongrass (<i>Chrysopogon pallidus</i>) and/or Whitegrass (<i>Sehima nervosum</i>), these are smaller areas of more clayey soil dominated by tussock grasses rather than the more common <i>Triodia wiseana</i> hummock grasslands.
Drainages	Minor drainage lines	The drainage lines within the study area are often narrow and deeply incised in the landscape, with a restricted floodout area either side supporting more dense tree and shrub associations.
	Reedbeds	Two small areas of reedbeds were observed in the Mimbi Northwest polygon. One was dry but the other held water, apparently from a permanent spring, which attracted numerous bird species. These reedbeds have been differentiated because of their ability to support species that may not otherwise be present in the minor drainage systems.

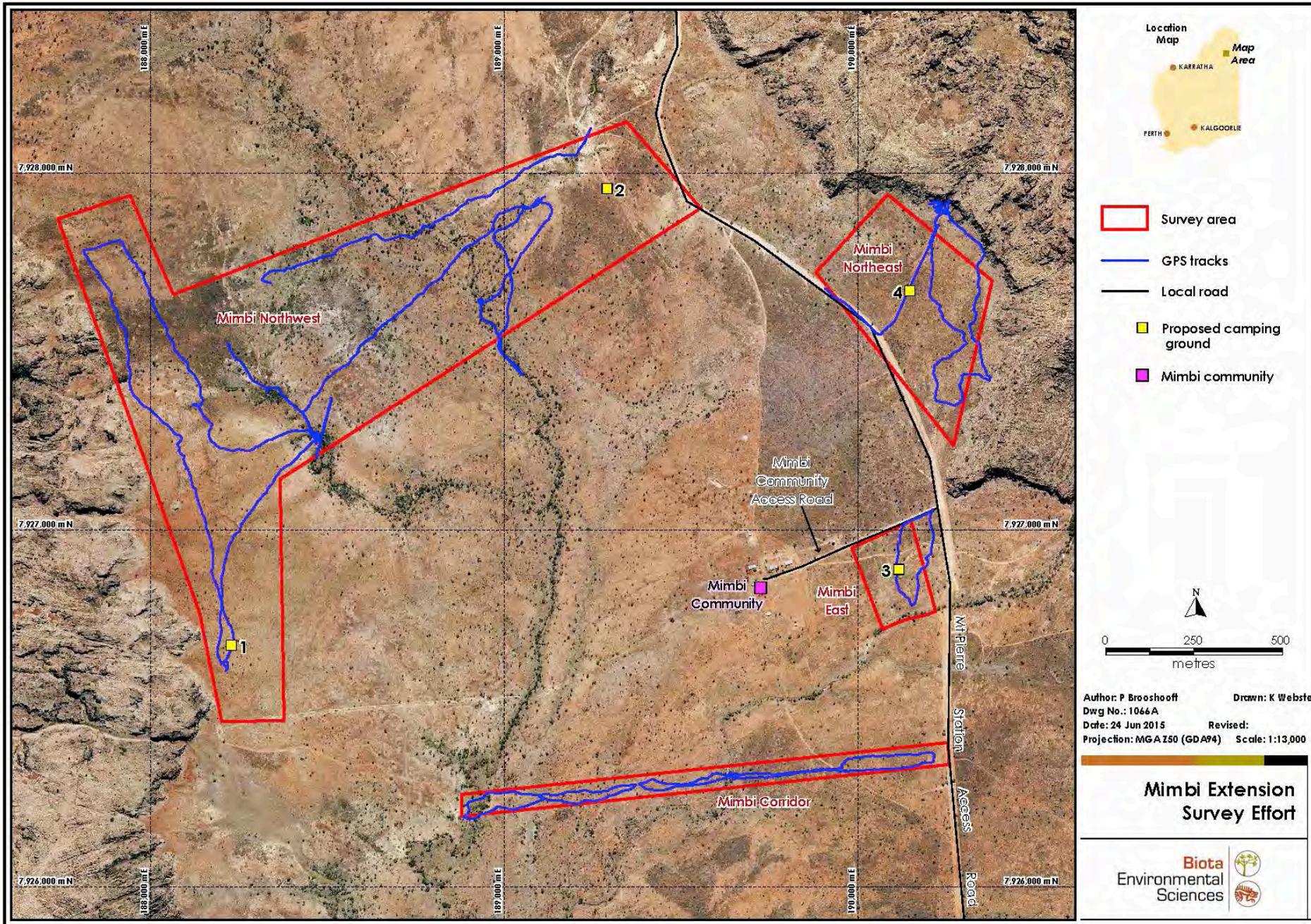


Figure 4.1: Survey effort undertaken by the zoologist during the Mimbi site visit.

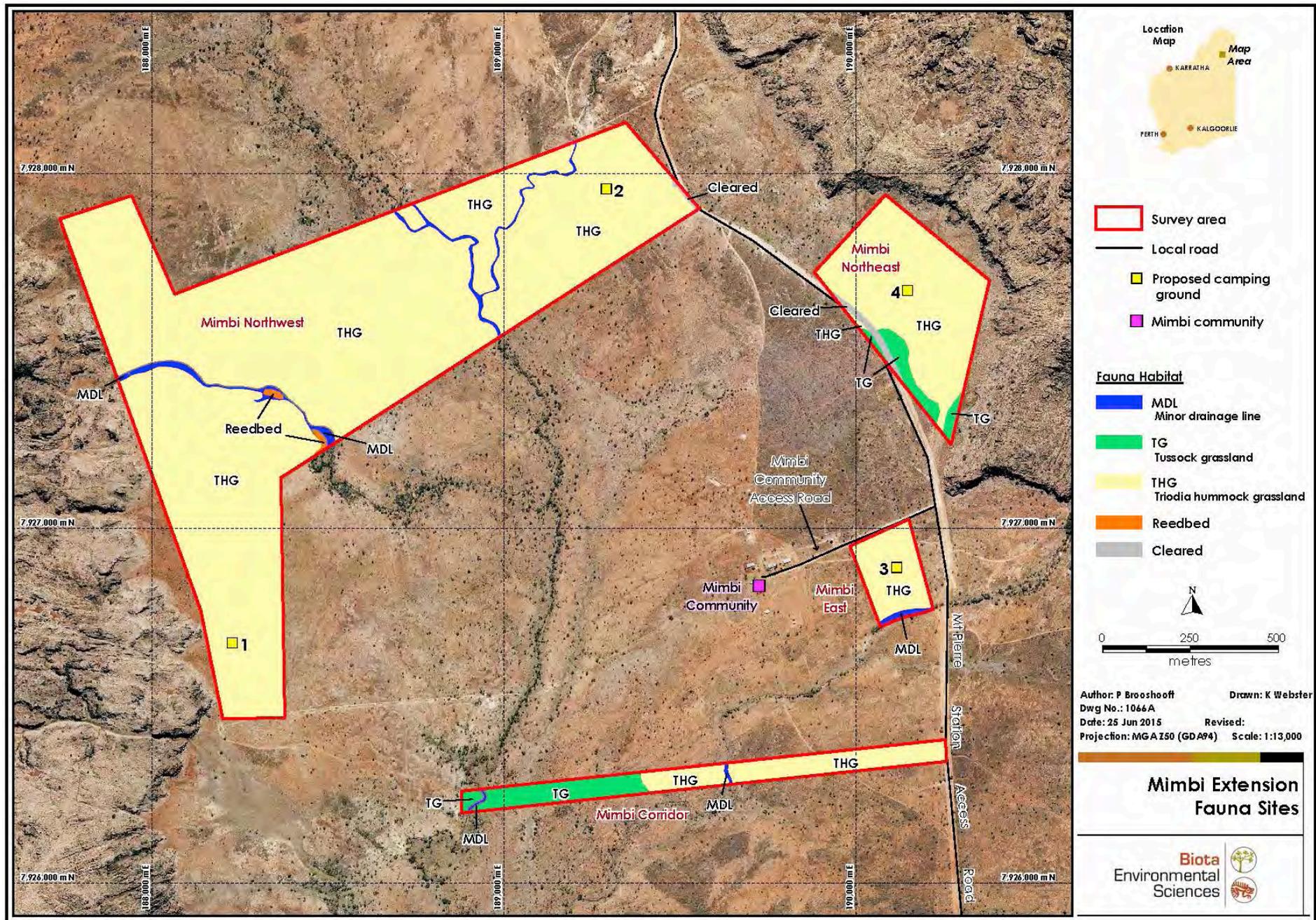


Figure 4.2: Fauna habitats within the study area.

4.6 Site Descriptions

4.6.1 Survey Polygon Habitat Descriptions

Mapping notes, photographs and habitat descriptions were recorded at eight locations in the survey polygons: two locations in Mimbi Northwest, one location in Mimbi Northeast, four locations in the Mimbi Corridor, and one location in Mimbi East (Figure 4.3). Locations and descriptions of these sites are described in Table 4.2. Note that **Cenchrus setiger* and **C. ciliaris* are the introduced Birdwood Grass and Buffel Grass respectively.

Table 4.2: Habitat descriptions for survey polygons in the Mimbi study area.

Site / Location	Fauna Habitat	Description	Photograph
Mimbi Northwest A 18°43'33" S 126°02'36" E	<i>Triodia</i> hummock grassland on pediment slope	Low open woodland of <i>Corymbia opaca</i> over open hummock grassland of <i>Triodia wiseana</i> , with scattered <i>Ptilotus corymbosus</i> and tussock grasses.	
Mimbi Northwest B 18°43'06" S 126°02'28" E	<i>Triodia</i> hummock grassland on pediment slope	Low open woodland of <i>Corymbia opaca</i> over scattered low shrubs of <i>Grevillea pyramidalis</i> over <i>Triodia wiseana</i> hummock grassland. Some rocky limestone outcropping present.	
Mimbi Northeast 18°43'11" S 126°03'46" E	<i>Triodia</i> hummock grassland on pediment slope	Low open woodland of <i>Corymbia opaca</i> over <i>Triodia wiseana</i> hummock grassland. Calcareous clay substrate.	

Site / Location	Fauna Habitat	Description	Photograph
Mimbi Corridor A 18°43'52" S 126°03'43" E	<i>Triodia</i> hummock grassland on colluvial plain	Low open woodland of <i>Corymbia opaca</i> over <i>Triodia wiseana</i> hummock grassland and scattered tussock grasses.	
Mimbi Corridor B 18°43'54" S 126°03'25" E	Minor drainage line (Mimbi Creek)	Woodland of <i>Terminalia carpentariae</i> over * <i>Cenchrus setiger</i> , (* <i>C. ciliaris</i>) closed tussock grassland. Stony calcareous substrate.	
Mimbi Corridor C 18°43'54" S 126°03'16" E	Tussock grassland on colluvial plain	Scattered low trees of <i>Bauhinia cunninghamii</i> over <i>Acacia synchronicia</i> tall open shrubland over * <i>Cenchrus setiger</i> , * <i>C. ciliaris</i> , (<i>Dichanthium fecundum</i>) tussock grassland.	
Mimbi Corridor D 18°43'56" S 126°02'59" E	Tussock grassland on alluvial plain	Low open woodland of <i>Corymbia opaca</i> over mixed open shrubland over <i>Dichanthium fecundum</i> , <i>Chrysopogon pallidus</i> tussock grassland.	

Site / Location	Fauna Habitat	Description	Photograph
Mimbi East 18°43'35" S 126°03'43" E	<i>Triodia</i> hummock grassland on colluvial plain	Low open woodland of <i>Corymbia opaca</i> over scattered mixed shrubs over <i>Triodia wiseana</i> hummock grassland.	

4.6.2 Bat Survey Sites

Bat sampling was undertaken using SongMeter bat detector units (SM2BAT), which detect and record ultrasonic echolocation calls emitted by bats during flight. The selectable filters and triggers, jumper and audio settings used for the SM2BAT followed the manufacturer's recommendations for bat detection contained in the user manual (Wildlife Acoustics 2010).

Bat sampling was undertaken at five locations within or close to the study area (Figure 4.3). Sampling effort is detailed in Table 4.3. Sampling equipment was placed in locations considered likely to represent foraging and roosting opportunities for a range of different species. Such habitats included rock shelter entrances, water sources and drainage lines. The habitat at each of the sites is described in Table 4.5.

Call recordings were analysed by Mr Bob Bullen (Bat Call WA); see report in Appendix 6.

Table 4.3: Bat sampling sites and effort during the Mimbi reconnaissance survey.

Site	Latitude	Longitude	Start Date	End Date	Nights Open
MIMBAT-01	18°43'10" S	126°03'02" E	9/3/15	13/3/15	5
MIMBAT-02	18°42'55" S	126°03'11" E	9/3/15	14/3/15	6
MIMBAT-03	18°43'50" S	126°02'29" E	10/3/15	14/3/15	5
MIMBAT-04	18°43'02" S	126°03'47" E	8/3/15	14/3/15	7
MIMBAT-05	18°43'22" S	126°02'46" E	13/3/15	14/3/15	1
Total call recording effort					24

4.6.3 Motion Camera Sites

Motion cameras were deployed at five locations considered likely to capture fauna foraging and/or moving through habitat, as well as in habitat with the potential to support species of conservation significance (such as the Northern Quoll). These habitats (e.g. drainage lines, ephemeral pools of water and rocky gorges) are the same as those targeted for bat sampling, and the cameras were placed in the same locations as the bat detectors (Table 4.4 and Figure 4.3). The vegetation type and fauna habitat at each motion camera site are described in Table 4.5. All traps were baited with a mixture of peanut butter and rolled oats, which was scattered in front of the camera view range. The bait mixture was a 'universal bait', which is known to be effective at attracting and detecting small to medium-sized mammals (Paull et al. 2011).

Captured images were reviewed by Ms Penny Brooshooft (Zoologist with Biota), and species identifications were confirmed as necessary by Stewart Ford.

Table 4.4: Motion camera sites and effort during the Mimbi reconnaissance survey.

Site	Latitude	Longitude	Start Date	End Date	Nights Open
MIM-MC01	18°43'10" S	126°03'02" E	9/3/15	13/3/15	4
MIM-MC02	18°42'55" S	126°03'11" E	9/3/15	13/3/15	4
MIM-MC03	18°43'50" S	126°02'29" E	10/3/15	13/3/15	3
MIM-MC04	18°43'03" S	126°03'47" E	9/3/15	14/3/15	5
MIM-MC05	18°43'22" S	126°02'46" E	13/3/15	14/3/15	1
Total motion camera effort					17

Table 4.5: Description of bat sampling and motion camera sites.

Site	Fauna Habitat	Description	Photograph
MIMBAT-01 / MIM-MC01	Minor drainage line (Pinnacle Creek)	<p>SM2 unit placed on the grassy bank; motion camera placed in the creek bed facing north. No water in drainage line.</p> <p>Vegetation along the banks of the creek comprised a woodland of <i>Eucalyptus tectifica</i>, <i>Lophostemon grandiflorus</i>, <i>Acacia ampliceps</i> and <i>Flueggea virosa</i> over a closed tussock grassland of mainly <i>Dichanthium fecundum</i>, with patches of <i>Chrysopogon pallidus</i> and <i>Triodia pascoeana</i>.</p>	
MIMBAT-02 / MIM-MC02	Minor drainage line (Pinnacle Creek) (just outside study area)	<p>SM2 unit and motion camera set up next to two small pools of water, captured in limestone outcropping.</p> <p>The rock areas were virtually bare of plants; the creek banks supported <i>Corymbia opaca</i> scattered trees to open woodland over <i>Dichanthium fecundum</i>, <i>Chrysopogon pallidus</i> closed tussock grassland, with occasional sedges (<i>Cyperus</i> and <i>Fimbristylis</i> sp.).</p>	

Site	Fauna Habitat	Description	Photograph
MIMBAT-03 / MIM-MC03	Alcove in gorge through Devonian reef (outside study area)	<p>SM2 unit and motion camera were originally set on the southern side of the gorge (Location 1), before being shifted approximately 50 m west to the northern side two days later, after a rocky overhang area was found (Location 2). Alcove comprised of limestone. No caves at ground level, but some holes higher in the gorge wall.</p> <p>Vegetation along edges of gorge comprised a low woodland of <i>Celtis philippensis</i>, <i>Gyrocarpus americanus</i>, <i>Mallotus nesophilus</i> and <i>Flueggea virosa</i> over a tall open shrubland of <i>Ficus aculeata</i>, with a closed tussock grassland of <i>Sorghum</i> and other grasses present along the base of the gorge.</p>	 <p>(Location 1)</p>  <p>(Location 2)</p>
MIMBAT-04 / MIM-MC04	Rocky hill slope (outside study area)	<p>SM2 unit and motion camera set facing northeast into the hill slope at the edge of the Lawford Range; located near a cave.</p> <p>Hill slope supported scattered trees and hummocks of <i>Triodia wiseana</i> amongst limestone boulders. Pediment slopes at the base of the range supported scattered low trees of <i>Corymbia opaca</i> over <i>Triodia wiseana</i> hummock grassland.</p>	

Site	Fauna Habitat	Description	Photograph
			
<p>MIMBAT-05 / MIM-MC05</p>	<p>Minor drainage line (Pinnacle Creek)</p>	<p>Permanent freshwater pool approximately 10 m long and 3 m wide, coming from a small spring. SM2 unit set on a rock ledge overlooking the pool; motion camera set in the pool facing the bank.</p> <p><i>Lophostemon grandiflorus</i>, <i>Terminalia platyphylla</i>, <i>Ficus aculeata</i> woodland over clumps of Bulrush (<i>Typha domingensis</i>) and sedges (mainly <i>Cyperus vaginatus</i>). <i>Eucalyptus tectifera</i> and <i>Corymbia opaca</i> trees and <i>Acacia ampliceps</i> tall shrubs were present further out from the spring.</p>	

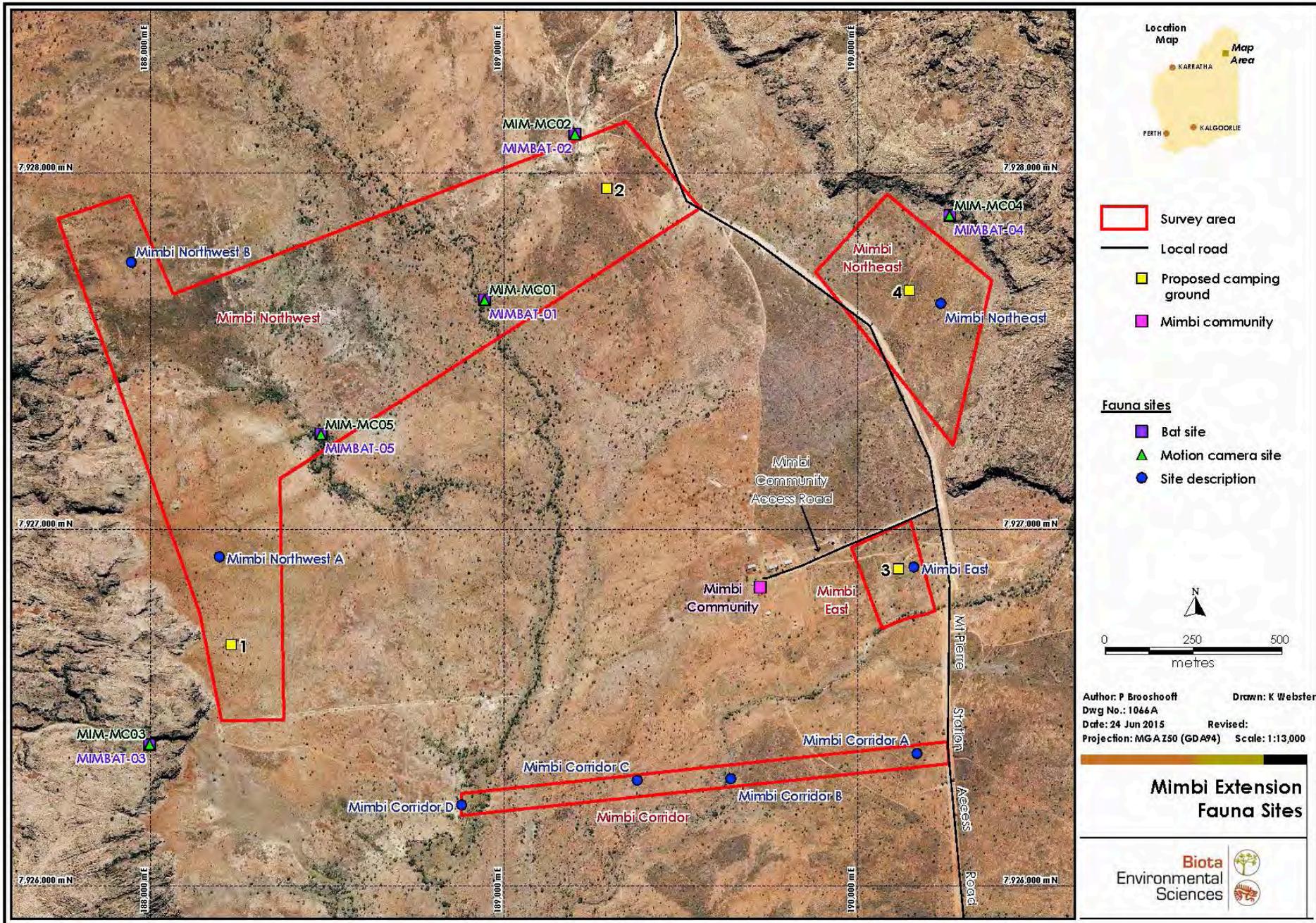


Figure 4.3: Location of site habitat descriptions, and bat surveying and motion camera sites.

4.7 Assessment of Likelihood of Occurrence in the Study Area

In order to determine which vertebrate species of conservation significance had the potential to occur in the study area, the results of the database and literature searches and data collected during the site visit were examined while considering the known habitat preferences and distributions for the species.

For each vertebrate species of conservation significance identified as having the potential to occur in the study area, a set of rankings and criteria was applied to assess the likelihood of occurrence within the study area (Table 4.6). Through the remainder of this report, the term “close proximity” has been defined as being within 20 km of the study area, while the broader “locality” comprises the area up to 40 km from the study area. For each of the potential species of conservation significance identified through the database searches, supplementary NatureMap searches were conducted to 40 km (the maximum allowable radius by that database) to further inform the assessment of likelihood of occurrence within the study area.

Table 4.6: Ranking system used to assign likelihood of occurrence of species in the study area.

Rank	Criteria
Recorded	1. The species has been previously recorded in the study area.
Likely to occur	1. There are existing records of the species in close proximity to the study area (within 20 km); and <ul style="list-style-type: none"> • the species is strongly linked to a specific habitat, which is present in the study area; or • the species has more general habitat preferences, and suitable habitat is present.
May potentially occur	1. There are existing records of the species from the locality (within 40 km), however <ul style="list-style-type: none"> • the species is strongly linked to a specific habitat, of which only a small amount is present in the study area; or • the species has more general habitat preferences, but only some suitable habitat is present. 2. There is suitable habitat in the study area, but the species is recorded infrequently in the locality.
Unlikely to occur	1. The species is linked to a specific habitat, which is absent from the study area; or 2. Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or 3. There is some suitable habitat in the study area, however the species is very infrequently recorded in the locality.
Would not occur	1. The species is strongly linked to a specific habitat, which is absent from the study area; and/or 2. The species' range is very restricted and does not include the study area.

4.8 Short Range Endemic Invertebrate Sampling

SRE invertebrate fauna sampling involved targeted searching of habitats with the potential to contain SREs. The invertebrate groups targeted by this survey included the following:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Scorpionidae (scorpions);
- Pulmonata (land snails); and
- Pseudoscorpiones (pseudoscorpions).

4.8.1 Determining SRE Status

There are limited taxonomic frameworks and ecological knowledge for the majority of potential SRE invertebrate species. Due to the resulting inherent difficulties in assessing the SRE status of invertebrates, a systematic approach was adopted in an attempt to provide a clear and consistent method. The criteria used to assign SRE status are outlined in Table 4.7.

Table 4.7: Categories of SRE status and defining criteria.

SRE Status	Defining Criteria
Known SRE	<ul style="list-style-type: none"> Species, morphotype or genetic type has a documented range of <10,000 km². Species, morphotype or genetic type is well collected, with numerous specimens typed and habitat preferences understood.
Potential SRE	<ul style="list-style-type: none"> Species, morphotype or genetic type has a documented range of <10,000 km² but is poorly sampled. Specimen may not be formally described or assigned to a morphotype / genetic type. Short-range endemism may be common in genus or family. May have been collected from restricted, refugial or isolated habitats.
Unlikely to be an SRE	<ul style="list-style-type: none"> Species, morphotype or genetic type has a documented range of <10,000 km² but is poorly sampled. Specimen may not be formally described or assigned to a morphotype / genetic type. Short-range endemism is not common in the genus or family. Specimen was not collected from restricted, refugial or isolated habitats. Few other individuals of the taxon collected, but records separated by long distances (>100 km).
Not an SRE	<ul style="list-style-type: none"> Specimen formally described or assigned to a morphotype / genetic type. Species, morphotype or genetic type has a documented range of >10,000 km².
Undetermined	<ul style="list-style-type: none"> Taxa where there is insufficient taxonomic framework available to provide any informed comment on the species-level distribution of the fauna or, therefore, the risk of small-scale spatial restrictions.

4.8.2 SRE Search Effort

Visual searches were performed over the duration of the survey to opportunistically locate potential SRE habitats and specimens. Searching was concentrated in fauna habitats considered likely to support SREs, such as alluvial plains (flood plains), colluvial plains and rocky hill slopes. Searches for potential SREs were conducted by looking for burrows (spiders and scorpions), overturning rocks, and foraging under leaf litter and *Triodia* (millipedes, land snails and pseudoscorpions).

4.9 Survey Limitations

This report utilises the results of a desktop review of currently available literature and database searches relevant to the study area, in concert with records of a site reconnaissance survey. No active trapping (e.g. using pitfall traps, funnel traps, Elliott traps or cage traps) was undertaken as part of this assessment. While this is consistent with the requirements for a Level 1 survey (see EPA (2004)), this report should not be treated as an exhaustive or conclusive account of the fauna assemblage occurring in the Mimbi Extension study area.

This page intentionally blank.

5.0 Vertebrate Fauna Results

5.1 Overview of Potential Fauna Assemblage

Database and literature searches yielded a total of 220 potentially occurring vertebrate species, including 23 species of conservation significance (Table 5.1). This total comprised 22 non-volant (ground-dwelling) mammal species (including 8 introduced species), 16 volant (bat) mammal species, 55 reptile species, 14 amphibian species and 112 avifauna species. The search results are provided in Appendix 4.

Table 5.1: Overview of the vertebrate fauna potentially occurring in the study area.

Fauna Group	Potential Species	Potential Conservation Significant Species
Native Non-volant mammals	14	4
Introduced non-volant mammals	8	0
Volant mammals	16	3
Reptiles	55	2
Amphibians	14	0
Avifauna	112	14
Total	220	23

The 14 native non-volant mammals potentially occurring in the study area comprised one species of echidna (Tachyglossidae), three species of carnivorous marsupial (Dasyuridae), one species of bilby (Thylacomyidae), one species of marsupial mole (Notoryctidae), four species of kangaroo and wallaby (Macropodidae) and four species of rodent (Muridae). The eight species of introduced non-volant mammals are house mouse (Muridae), dingo (Canidae), red fox (Canidae), cat (Felidae), donkey and horse (Equidae), pig (Suidae) and camel (Camelidae).

The 16 species of volant mammals (bats) potentially occurring in the study area included one species of flying-fox (Pteropodidae), two species of leaf-nosed bat (Hipposideridae), one species of false vampire bat (Megadermatidae), two species of sheath-tail bat (Emballonuridae), eight species of evening bat (Vespertilionidae) and two species of freetail bat (Molossidae).

The 55 reptile species potentially occurring in the study area included species from 13 families, consisting of one species of crocodile (Crocodylidae), one species of turtle (Cheluidae), 13 species of gecko (Carphodactylidae, Diplodactylidae and Gekkonidae), two species of flat-footed lizard (Pygopodidae), five species of dragon (Agamidae), 18 species of skink (Egerniidae, Eugongylidae and Sphenomorphidae), four species of monitor lizard (Varanidae), two species of blind snake (Typhlopidae), one species of python (Boidae) and eight species of front-fanged snake (Elapidae).

The 14 amphibians included species from three families: nine species of tree frog (Hylidae) and five species of ground-dwelling frog (Limnodynastidae and Myobatrachidae).

The 112 avifauna species included 58 non-passerine species from 22 families, and 53 passerine species from 22 families.

5.2 Field Survey Records

During the reconnaissance survey, a total of 64 species were recorded either opportunistically or from motion camera and bat echolocation recordings, including six species of conservation significance. This total comprised three non-volant mammal species, 13 volant mammal species, seven reptile species and 41 avifauna species. These results are presented in Table 5.2.

Table 5.2: Vertebrate fauna records from the reconnaissance survey of the Mimbi study area.

Scientific Name (Common Name)	Family	Status †	MIM- MC01	MIM- MC02	MIM- MC03	MIM- MC04	MIM- MC05	MIMBAT- 01	MIMBAT- 02	MIMBAT- 03	MIMBAT- 04	MIMBAT- 05	Opp.
NON-VOLANT MAMMALS													
<i>Tachyglossus aculeatus</i> (Short-beaked Echidna)	Tachyglossidae												^ (scats)
<i>Pseudomys laborifex</i> (Kimberley Mouse)	Muridae												^ (2 mounds)
<i>Equus caballus</i> (Horse)	Equidae			•			•						
VOLANT MAMMALS													
<i>Rhinonictis aurantius</i> (Orange Leafnosed-bat)	Hipposideridae	S1						•	•		•	•	
<i>Hipposideros ater</i>	Hipposideridae								•	•		•	
<i>Macroderma gigas</i> (Ghost Bat)	Megadermatidae	P4										•	
<i>Taphozous georgianus</i> (Common Sheathtail-bat)	Emballonuridae							•	•	•	•	•	
<i>Saccolaimus saccolaimus nudiclunatus</i> (Bare-rumped Sheathtail-bat)	Emballonuridae	CE								•			
<i>Saccolaimus</i> sp.**	Emballonuridae									•			
<i>Chalinobius gouldii</i> (Gould's Wattled Bat)	Vespertilionidae							•				•	
<i>Miniopterus schreibersii orianae</i> (Common Bentwing-bat)	Vespertilionidae							•	•	•	•		
<i>Vespadelus caurinus</i> (Western Cave Bat)	Vespertilionidae							•	•	•	•	•	
<i>Vespadelus douglasorum</i> (Yellow-lipped Cave Bat)	Vespertilionidae	P2						•		•	•	•	
<i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)	Vespertilionidae							•	•	•	•	•	
<i>Chaerephon jobensis</i> (Northern Freetail-bat)	Molossidae							•		•	•		
<i>Mormopterus lumsdenae</i> (Beccari's Freetail-bat)	Molossidae							•	•	•	•	•	
REPTILES													
<i>Nephrurus sheai</i>	Carphodactylidae												1
<i>Gehyra australis</i>	Gekkonidae												2
<i>Amphibolurus gilberti</i> (Ta-Ta or Gilbert's Dragon)	Agamidae						•						1
<i>Ctenophorus isolepis</i> (Military Dragon)	Agamidae												1
<i>Tiliqua scincoides</i> (Eastern Blue-tongue)	Egerniidae												1
<i>Cryptoblepharus ruber</i>	Eugongylidae												1
<i>Varanus gouldii</i> (Bungarra or Sand Monitor)	Varanidae						•						
AVIFAUNA													
<i>Ocyphaps lophotes</i> (Crested Pigeon)	Columbidae			•			•						
<i>Geophaps plumifera</i> (Spinifex Pigeon)	Columbidae			•			•						1
<i>Geopelia cuneata</i> (Diamond Dove)	Columbidae			•			•						1
<i>Geopelia striata</i> (Peaceful Dove)	Columbidae						•						2
<i>Hamirostra melanosternon</i> (Black-breasted Buzzard)	Accipitridae												1
<i>Accipiter fasciatus</i> (Brown Goshawk)	Accipitridae												1
<i>Falco cenchroides</i> (Nankeen Kestrel)	Falconidae												1
<i>Nymphicus hollandicus</i> (Cockatiel)	Cacatuidae												3

Scientific Name (Common Name)	Family	Status †	MIM- MC01	MIM- MC02	MIM- MC03	MIM- MC04	MIM- MC05	MIMBAT- 01	MIMBAT- 02	MIMBAT- 03	MIMBAT- 04	MIMBAT- 05	Opp.
<i>Aprosmictus erythropterus</i> (Red-winged Parrot)	Psittacidae												2
<i>Melopsittacus undulatus</i> (Budgerigar)	Psittacidae												1
<i>Chalcites basalis</i> (Horsfield's Bronze-Cuckoo)	Cuculidae												1
<i>Ninox novaeseelandiae</i> (Southern Boobook)	Strigidae												1
<i>Dacelo leachii</i> (Blue-winged Kookaburra)	Halcyonidae												1
<i>Todiramphus sanctus</i> (Sacred Kingfisher)	Halcyonidae												1
<i>Merops ornatus</i> (Rainbow Bee-eater)	Meropidae	S3/M											4
<i>Ptilonorhynchus nuchalis</i> (Great Bowerbird)	Ptilonorhynchidae						•						1
<i>Malurus melanocephalus</i> (Red-backed Fairy-wren)	Maluridae												1
<i>Smicronis brevirostris</i> (Weebill)	Acanthizidae												1
<i>Pardalotus rubricatus</i> (Red-browed Pardalote)	Pardalotidae												1
<i>Lichenostomus plumulus</i> (Grey-fronted Honeyeater)	Meliphagidae												2
<i>Lichenostomus flavescens</i> (Yellow-tinted Honeyeater)	Meliphagidae						•						2
<i>Manorina flavigula</i> (Yellow-throated Miner)	Meliphagidae												1
<i>Lichmera indistincta</i> (Brown Honeyeater)	Meliphagidae						•						2
<i>Melithreptus gularis</i> (Black-chinned Honeyeater)	Meliphagidae						•						2
<i>Philemon citreogularis</i> (Little Friarbird)	Meliphagidae												1
<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)	Campephagidae												1
<i>Coracina papuensis</i> (White-bellied Cuckoo-shrike)	Campephagidae												1
<i>Lalage sueurii</i> (White-winged Triller)	Campephagidae						•						1
<i>Artamus cinereus</i> (Black-faced Woodswallow)	Artamidae												1
<i>Artamus minor</i> (Little Woodswallow)	Artamidae												1
<i>Cracticus nigrogularis</i> (Pied Butcherbird)	Artamidae												2
<i>Rhipidura leucophrys</i> (Willie Wagtail)	Rhipiduridae		•				•						1
<i>Corvus orru</i> (Torresian Crow)	Corvidae			•									1
<i>Myiagra nana</i> (Paperbark Flycatcher)	Monarchidae												1
<i>Grallina cyanoleuca</i> (Magpie-lark)	Monarchidae						•						1
<i>Cincloramphus mathewsi</i> (Rufous Songlark)	Megaluridae												1
<i>Dicaeum hirundinaceum</i> (Mistletoebird)	Nectariniidae												1
<i>Taeniopygia guttata</i> (Zebra Finch)	Estrildidae			•			•						2
<i>Neochmia ruficauda subclarescens</i> (Star Finch)	Estrildidae	P4					•						2
<i>Emblema pictum</i> (Painted Finch)	Estrildidae						•						2
<i>Heteromunia pectoralis</i> (Pictorella Mannikin)	Estrildidae						•						2

† S1 = Schedule 1, S3/M = Schedule 3/Migratory, P2 = Priority 2, P4 = Priority 4, CE = Critically Endangered.

Opp. Opportunistic records.

• Species recorded

^ Secondary evidence recorded

** Two calls recorded were confirmed as *Saccolaimus* sp., however it is unknown if they were *S. saccolaimus nudicluniatu*s or the more common *S. flaviventris*.

5.2.1 Non-Volant Mammals Recorded

Three non-volant mammal species were recorded: the Horse, Short-Beaked Echidna and Kimberley Mouse. A group of horses was recorded drinking from pools of water at motion camera sites MIM-MC02 and MIM-MC05, and were noted to have drunk dry the ephemeral pools of water at site MIM-MC02 after a couple of days. Secondary evidence of the Short-Beaked Echidna was recorded from scats. Two pebble-mounds of the Kimberley Mouse were recorded from the northwestern section of Mimbi Northwest (18°43'9.28" S, 126°2'29.10" E and 18°43'23.98" S, 126°2'35.77" E; Plate 5.1). These mounds did not appear to be particularly active. The Kimberley Mouse was not identified through the database searches as being a potential species for the area, as the closest other records of this species are from near the Cummins Range, approximately 130 km southeast.

No evidence of the Northern Quoll was recorded during the site visit, despite remote camera trapping and targeted searches for secondary signs (e.g. scats) in suitable habitats.



Plate 5.1: Kimberley Mouse (*Pseudomys laborifex*) pebble-mound.

5.2.2 Volant Mammals Recorded

Thirteen bat species were recorded from echolocation call recordings. These represented species from five families, including two species of leaf-nosed bat (Hipposideridae), one species of false vampire bat (Megadermatidae), three species of sheath-tail bat (Emballonuridae), five species of evening bat (Vespertilionidae) and two species of free-tailed bat (Molossidae). All of these species, except the Bare-rumped Sheath-tail-bat, were recorded as potential species for the study area during the database and literature review. The Bare-rumped Sheath-tail-bat was not recorded as a potential species as its documented distribution occurs outside of Western Australia (see Section 5.3.1.4 for more details).

Four bat species of conservation significance were recorded, comprising the Orange Leaf-nosed bat (*Rhinonicteris aurantius*), Ghost Bat (*Macroderma gigas*), Yellow-lipped Cave Bat (*Vespadelus douglasorum*) and Bare-rumped Sheath-tail-bat (*Saccolaimus saccolaimus nudicluniatu*s). Further details on these records are provided in Section 5.3.1.

5.2.3 Reptiles Recorded

The seven reptile species recorded were from six families, including two species of gecko (Carphodactylidae and Gekkonidae), two species of dragon (Agamidae), two species of skink (Egerniidae and Eugongylidae) and one species of monitor lizard (Varanidae). Most of the species recorded were opportunistically encountered whilst traversing the study area, however the gecko species *Nephrurus sheai* was hand-captured while searching rock crevices. The Sand Monitor (*Varanus gouldii*) was only recorded from motion camera footage. All reptile species were identified as potential species for the study area during the database and literature review.

5.2.4 Avifauna Recorded

The 41 species of avifauna recorded comprised 15 non-passerine and 26 passerine species from 22 families. All of the avifauna species recorded during the site visit were identified as being potential species for the study area during the database and literature review.

Two species of conservation significance were recorded from the study area: the Rainbow Bee-eater (*Merops ornatus*) and the Star Finch³ (*Neochmia ruficauda subclarescens*). Further details on these records are provided in Section 5.3.1.

5.3 Conservation Significant Vertebrate Fauna

Threatened fauna are those native species that are rare, threatened with extinction or have high conservation value, and are deemed to be in need of special protection under the WA *Wildlife Conservation Act 1950* or the Commonwealth EPBC Act. Migratory species are also protected under the EPBC Act as species of national environmental significance (Department of the Environment 2014). Descriptions of the conservation status categories under each of these Acts are provided in Appendix 5.

In addition, the Department of Parks and Wildlife maintains a list of fauna that are deemed a priority for conservation, but which have not been assigned statutory protection under the *Wildlife Conservation Act 1950* (Department of Parks and Wildlife 2014c). Species on this list are considered to be of conservation priority because there is insufficient information available to make an assessment of their conservation status, or because they are considered to be rare but not threatened and are in need of monitoring. The five Priority conservation categories are detailed in Appendix 5.

Table 5.3 summarises the conservation significant species that were returned from the database and literature searches of the locality, and those recorded during the site visit. Of the 220 species identified as potentially occurring in the study area through the desktop review, four non-volant mammals, four volant mammals, two reptiles and 14 avifauna species are listed as conservation significant. Figure 5.1 illustrates the locations of records of conservation significant fauna within the study area, along with records of these species in close proximity to the study area (where publicly available).

The likelihood of occurrence of each of these species in the study area was considered by assessing the species' habitat preference, current known distribution and last known records (Table 5.3).

Table 5.3: Conservation significant vertebrate fauna species recorded or potentially occurring within the study area.

CLASS	Conservation Status		Source of Record					Likelihood of Occurrence in the Study Area
	State	Federal	ALA Search	NatureMap Search	EPBC Act Search	Field Guides	Mimbi Site Visit	
MAMMALS								
<i>Dasyurus hallucatus</i> (Northern Quoll)	Schedule 1	Endangered				✓		May potentially occur
<i>Macrotis lagotis</i> (Bilby, Dalgyte)	Schedule 1	Vulnerable	✓	✓	✓	✓		Unlikely to occur
<i>Notoryctes caurinus</i> (Northern Marsupial Mole)	Schedule 1	Endangered			✓			Unlikely to occur
<i>Rhinonicteris aurantius</i> (Orange Leaf-nosed Bat)	Schedule 1	Vulnerable				✓	✓	Recorded
<i>Macroderma gigas</i> (Ghost Bat)	Priority 4		✓	✓		✓	✓	Recorded
<i>Vespadelus douglasorum</i> (Yellow-lipped Cave Bat)	Priority 2		✓	✓		✓	✓	Recorded
<i>Saccolaimus saccolaimus nudicluniatus</i> (Bare-rumped Sheath-tail-bat)		Critically Endangered					✓	Recorded
<i>Leggadina lakedownensis</i> (Short-tailed Mouse)	Priority 4					✓		May potentially occur
REPTILES								
<i>Crocodylus johnstoni</i> (Freshwater Crocodile)	Schedule 4				✓			Unlikely to occur
<i>Liopholis kintorei</i> (Great Desert Skink)	Schedule 1	Vulnerable			✓			Unlikely to occur
AVIFAUNA								
<i>Apus pacificus</i> (Fork-tailed Swift)	Schedule 3	Migratory			✓			May potentially occur
<i>Ardea modesta</i> (Eastern Great Egret)	Schedule 3	Migratory			✓			May potentially occur
<i>Ardea ibis</i> (Cattle Egret)	Schedule 3	Migratory			✓			Unlikely to occur
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	Schedule 3	Migratory			✓			Unlikely to occur
<i>Erythrotriorchis radiatus</i> (Red Goshawk)	Schedule 1	Vulnerable			✓			Unlikely to occur
<i>Ardeotis australis</i> (Australian Bustard)	Priority 4 ³		✓	✓				May potentially occur
<i>Charadrius veredus</i> (Oriental Plover)	Schedule 3	Migratory			✓			Unlikely to occur
<i>Rostratula australis</i> (Australian Painted Snipe)	Schedule 3	Migratory			✓			Unlikely to occur
<i>Tringa stagnatilis</i> (Marsh Sandpiper)	Schedule 3	Migratory	✓					Unlikely to occur
<i>Turnix castanotus</i> (Chestnut-backed Button-quail)	Priority 4		✓					Unlikely to occur
<i>Glareola maldivarum</i> (Oriental Pratincole)	Schedule 3	Migratory			✓			Unlikely to occur
<i>Merops ornatus</i> (Rainbow Bee-eater)	Schedule 3	Migratory	✓	✓	✓		✓	Recorded
<i>Neochmia ruficauda subclarescens</i> (Star Finch)	Priority 4 ³		✓				✓	Recorded
<i>Erythrura gouldiae</i> (Gouldian Finch)	Priority 4	Endangered			✓			May potentially occur

³ Informal advice from the Department of Parks and Wildlife (summary of changes to specially protected fauna supplied via email) indicates that both the Star Finch and Australian Bustard have been removed from the Parks and Wildlife Priority Fauna List (as of 20 December 2014). The revised list has not yet been published on the Department's website and the current published list still includes both species as Priority 4 (http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Threatened_and_Priority_Fauna_Rankings.pdf).

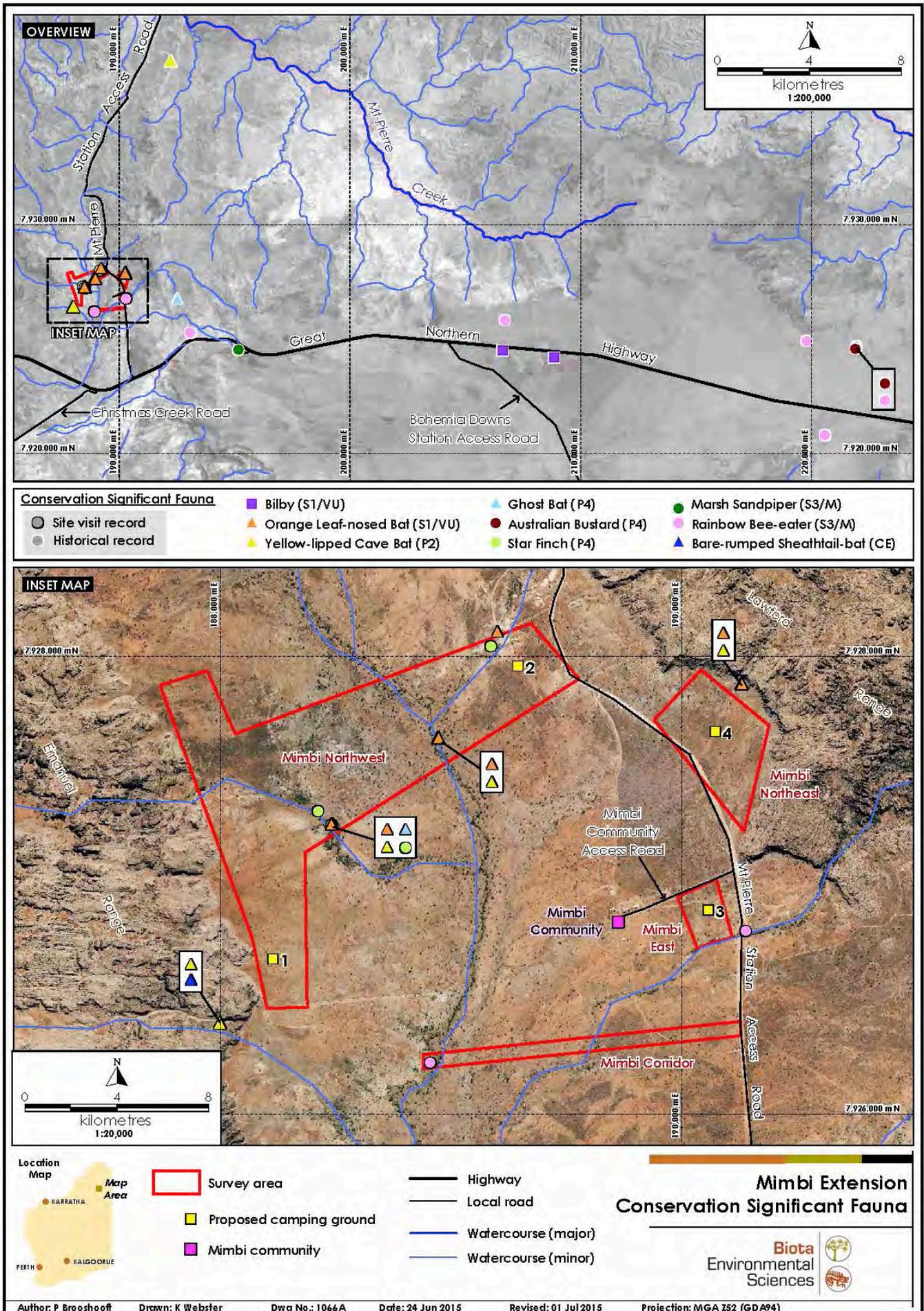


Figure 5.1: Locations of conservation significant fauna recorded within the study area during the site visit, and historically in close proximity to the study area.

5.3.1 Species Recorded from the Study Area

5.3.1.1 Orange Leaf-nosed Bat (*Rhinonictoris aurantius*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Vulnerable under the Commonwealth EPBC Act.

Distribution and Habitat: The Orange Leaf-nosed Bat is distributed across northern Australia from the Kimberley to northwest Queensland, with an isolated population in the Pilbara. The Pilbara population is treated as a separate form to the Kimberley, Northern Territory and Queensland populations. The species is a poor thermoregulator and is very susceptible to dehydration. For this reason it requires small crevices within deep caves or horizontal mine shafts that have stable, warm and humid microclimates for permanent roost sites (Department of the Environment 2015a). For the Orange Leaf-nosed Bat, these parameters are 28-32°C and 96-100% humidity during the dry season (Churchill 2008). Orange Leaf-nosed Bats are sensitive to human intrusion to their roosts (Department of the Environment 2015a). The species forages over a range of open habitats including grassland, open woodland and savanna woodland, where it captures insects in flight (Menkhorst and Knight 2011).

Occurrence within Study Area: This species was recorded in the study area from echolocation calls at sites MIMBAT-01, MIMBAT-02 and MIMBAT-05 in Pinnacle Creek, and site MIMBAT-04 at the edge of the Lawford Range. The detection of this species at most sites may indicate that a roost is located in close proximity to the study area.

5.3.1.2 Ghost Bat (*Macroderma gigas*)

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c).

Distribution and Habitat: The Ghost Bat was previously distributed across most of inland and northern Australia, but is now restricted to the tropical north of the continent (Churchill 2008). It occurs in a broad range of habitats, with distribution being influenced by the availability of suitable caves and mines for roost sites (Churchill 2008). The distribution of Ghost Bats is fragmented, with each population showing some genetic differentiation (Armstrong and Wilmer 2004, Biota 2004). Populations in the Kimberley and Northern Territory appear to be isolated from those in the Pilbara bioregion. A study by McKenzie and Bullen (2009) found that the Ghost Bat is more common than previously thought. Bats forage over large distances, with ranges of ~60 ha, and the size of their foraging area is probably inversely related to the productivity of their landscape.

Occurrence within Study Area: This species was recorded from a weak call at site MIMBAT-05 in Pinnacle Creek. This call may be representative of a bat foraging in the study area.

5.3.1.3 Yellow-lipped Cave Bat (*Vespadelus douglasorum*)

Status: Listed as a Priority 2 species by the WA Department of Parks and Wildlife (2014c).

Distribution and Habitat: The Yellow-lipped Cave Bat is distributed in the west Kimberley, mostly where rainfall exceeds 800 mm per year (Churchill 2008). It has been caught in tropical woodlands, often along streams lined with *Melaleuca* and *Pandanus*. The species utilises sandstone and limestone caves, usually near water (Churchill 2008).

Occurrence within Study Area: This species was recorded in the study area from echolocation calls at sites MIMBAT-01 and MIMBAT-05 in Pinnacle Creek, MIMBAT-03 in a gorge in the Emanuel Range, and MIMBAT-04 at the edge of the Lawford Range. It is likely that this species roosts in caves in the ranges adjacent to the study area and forages through the habitats available in the study area.

5.3.1.4 Bare-rumped Sheath-tail-bat (*Saccolaimus saccolaimus nudicluniatu*)

Status: This species is listed as Critically Endangered in Australia under the Commonwealth EPBC Act, but is not listed as a threatened species in Western Australia (Woinarski et al. 2014). The Action Plan for Australian Mammals recommends that the status of this species be lowered to 'Near Threatened' based on recent genetic analysis, morphological work and advances in echolocation call diagnostics (Woinarski et al. 2014).

Distribution and Habitat: This species has been documented from less than 25 localities from the Northern Territory and northeast Queensland, however there are recent records from the east Kimberley (B. Bullen, Bat Call WA, pers. comm. 2015). The taxonomic status of the two geographic groupings in Australia remains unresolved, however the Queensland and Northern Territory (including Kimberley) entities are referred to as *S. s. nudicluniatu*s under the EPBC Act. The habitat of this species is poorly known, although all confirmed roosting records have come from deep tree hollows in Poplar Gum (*Eucalyptus platyphylla*), Woollybutt (*E. miniata*) and Darwin Stringybark (*E. tetradonta*), particularly in near-coastal environments (Schulz and Thomson 2007). It has been suggested that this species forages over habitat edges such as rainforest edges and forest clearings (Churchill 2008).

Occurrence within Study Area: This species was identified from one echolocation call recording at site MIMBAT-03, located at the small spring in Pinnacle Creek. Two additional calls recorded at this site were confirmed as a *Saccolaimus* sp., however it could not be determined if they were *S. saccolaimus nudicluniatu*s or the more common *S. flaviventris*.

5.3.1.5 **Rainbow Bee-eater (*Merops ornatus*)**

Status: Listed as Schedule 3 (Migratory) under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: The Rainbow Bee-eater occurs through the majority of the western third of Western Australia, usually where free water is readily available. Some individuals migrate northward during winter, either within Australia or as far as Indonesia (Johnstone and Storr 1998). This species occurs in a variety of habitats that are generally well watered, lightly wooded with suitable (sandy) soil for nesting and a tall stratum of vegetation for perching (Higgins 1999).

Occurrence within Study Area: Two records of this species were made opportunistically within the study area in Pinnacle Creek and Mimbi Creek (locations 18°43'56" S, 126°03'00" E and 18°43'38" S, 126°03'47" E). In each case two birds were sighted.

5.3.1.6 **Star Finch (*Neochmia ruficauda subclarescens*)**

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c)³.

Distribution and Habitat: This species occurs in disjunct populations in the Pilbara and Gascoyne, northeast Kimberley and southwest Kimberley. It occurs mainly in long grass, *Typha*, rushes and shrubs in swamps, around lagoons and beside permanent pools (Johnstone and Storr 2004).

Occurrence within Study Area: This species was recorded within the study area from motion camera footage at site MIMMC-05, located at the spring in Pinnacle Creek, and two and four birds were also sighted opportunistically close to the spring (18°43'20" S, 126°02'44" E) and at another location on Pinnacle Creek (18°42'57" S, 126°03'10" E).

5.3.2 **Species that May Potentially Occur**

5.3.2.1 **Northern Quoll (*Dasyurus hallucatus*)**

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Endangered under the Commonwealth EPBC Act.

Distribution and Habitat: This species formerly occurred across much of northern Australia but is now restricted to six main areas: the north and western top end of the Northern Territory, north of Cape York, the Atherton-Cairns area, the Carnarvon Range-Bowen area of Queensland (Menkhorst and Knight 2011), and the northwest Kimberley and Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). The species is most abundant in open, rocky habitat and is commonly found in gorges, rocky free faces and hills, particularly for denning purposes (Van Dyck and Strahan 2008, DEWHA 2010, DSEWPaC 2011). It also occurs near creek lines and drainage lines, where adjacent plains and vegetated areas provide habitats for foraging and dispersal of young (Van Dyck and Strahan 2008).

Likelihood of Occurrence: There are no records of this species from the locality of the study area, however the ranges surrounding the study area may provide suitable habitat, and this species has the potential to occur.

5.3.2.2 Short-tailed Mouse (*Leggadina lakedownensis*)

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c).

Distribution and Habitat: The distribution of this species in Western Australia includes the Pilbara and Kimberley regions (Menkhorst and Knight 2011). This species is known to occur on sandy soils and cracking clays in areas of open tussock and hummock grassland, Acacia shrubland and savanna woodland (Morris et al. 2008).

Likelihood of Occurrence: No recent records of this species have been made from the locality of the study area, however some suitable habitat is present. This species therefore has the potential to occur in the study area.

5.3.2.3 Fork-tailed Swift (*Apus pacificus*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: The Fork-tailed Swift is most often observed following thunderstorms and cyclonic weather patterns and the associated emergence of invertebrate fauna, which are a food source for this species (Johnstone et al. 2013). Fork-tailed Swifts are thought to be exclusively aerial in Australia as they breed in the northern hemisphere, migrating south to the Australasian region from October to April.

Likelihood of Occurrence: This species does not rely on terrestrial habitats, but has the potential to fly over the study area on occasion.

5.3.2.4 Eastern Great Egret (*Ardea modesta*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: This species has a widespread distribution across Australia. It inhabits shallow freshwater and saltwater wetland areas, including river pools, lakes, lagoons, flooded grasslands, salt pans and salt lakes, estuarine mudflats, coastal lagoons and mangrove swamps (Johnstone and Storr 1998).

Likelihood of Occurrence: This species has not been recorded in the locality of the study area, however suitable habitat (e.g. the permanent spring) is available and this species may potentially occur on occasion.

5.3.2.5 Australian Bustard (*Ardeotis australis*)

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c)³.

Distribution and Habitat: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portions of the state (Johnstone and Storr 1998). It is mostly extinct from the settled districts, but common away from settled parts of Western Australia (Pizzey and Knight 2007). Bustards are typically nomadic and occupy large home ranges (Marchant and Higgins 1993) in open or lightly wooded grassland including *Triodia* sandplains (Johnstone and Storr 1998).

Likelihood of Occurrence: This species has been recorded in close proximity to the study area (19 km east) and within the broader locality (33 km east).

5.3.2.6 Gouldian Finch (*Erythrura gouldiae*)

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c), but an Endangered species under the Commonwealth EPBC Act.

Distribution and Habitat: This species occurs in the north Kimberley in grassy open forests and woodlands near water, and often frequents stony hill country supporting *Eucalyptus brevifolia* (Snappy Gum) when breeding (Johnstone and Storr 2004).

Likelihood of Occurrence: There have been no records of this species in the locality, however some suitable habitat is present (the drinking source at the permanent spring in Pinnacle Creek). This species therefore has the potential to occur.

5.3.3 Species Unlikely to Occur

5.3.3.1 Bilby (*Macrotis lagotis*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Vulnerable under the Commonwealth EPBC Act.

Distribution and Habitat: The former range of the Bilby included most of the semi-arid areas of mainland Australia, however it is now confined to *Triodia* hummock grassland and *Acacia* scrub across northern Australia. In Western Australia, there are disjunct populations in the Gibson Desert, south-western Kimberley, inland areas of the Pilbara and northern Great Sandy Desert (Friend 1990). Extant populations of the Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. The species occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in sand plains and dunes, drainage systems, salt lakes and alluvial areas (Southgate 1990). The distribution of the Bilby can be limited by the presence of suitable burrowing substrate, such as dunes, as well as the presence of a dense midstorey and sparse understorey to facilitate foraging and protection.

Likelihood of Occurrence: This species has been recorded in close proximity to the study area (two records approximately 17 km and 20 km east of the study area). However, no suitable habitat was observed within the study area and this species is considered unlikely to occur.

5.3.3.2 Northern Marsupial Mole (*Notoryctes caurinus*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Endangered under the Commonwealth EPBC Act.

Distribution and Habitat: This species is sparsely distributed across much of arid Australia in sandy desert areas (Menkhorst and Knight 2011). It is adapted to living underground where it burrows through sand. It has no functional eyes, small ear holes and its body is covered in a dense, fine, uniformly golden-brown fur. The species primarily lives in sand dunes and sandy soils along river flats, where it forages on ants, beetle larvae and arthropods (Menkhorst and Knight 2011).

Likelihood of Occurrence: There are very few records of this species, with most recorded over a decade ago from the eastern Pilbara, Gibson Desert and Kimberley region (NatureMap database). There is no suitable sandy habitat for this species in the study area, and this species is considered unlikely to occur.

5.3.3.3 Freshwater Crocodile (*Crocodylus johnstoni*)

Status: Listed as a Schedule 4 species under the WA Wildlife Conservation Act 1950.

Distribution and Habitat: This species is restricted to tropical northern Australia where it inhabits almost any type of permanent freshwater habitat, including rivers, creeks, swamps, floodplain lakes and billabongs (Wilson and Swan 2013).

Likelihood of Occurrence: The Freshwater Crocodile has not been recorded from the locality of the study area and the permanent spring on Pinnacle Creek would not be large enough to support a population. This species is therefore considered unlikely to occur.

5.3.3.4 Great Desert Skink (*Liopholis kintorei*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Vulnerable under the Commonwealth EPBC Act.

Distribution and Habitat: This species occurs in a disjunct distribution across Western Australia, the Northern Territory and South Australia, where it inhabits arid sand-flats and clay-based or loamy soils that are vegetated with *Triodia*, with some scattered shrubs and occasional trees (Cogger et al. 1993, Wilson and Swan 2013).

Likelihood of Occurrence: This species has not been recorded from the locality and based on the known distribution of this species, it is considered unlikely to occur within the study area.

5.3.3.5 Cattle Egret (*Ardea ibis*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: The Cattle Egret is largely associated with pastures and wetlands (Simpson and Day 2004), usually in the company of cattle (Johnstone and Storr 1998).

Likelihood of Occurrence: There have been no records of this species in the locality and the preferred habitat of the species is largely absent from the study area. It is unlikely to occur.

5.3.3.6 White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: The White-bellied Sea-eagle is often associated with marine and freshwater systems but has been sighted over inland terrestrial landscapes. It occurs in the lower and middle courses of larger rivers in the Kimberley (Johnstone and Storr 1998).

Likelihood of Occurrence: There are no records of this species from the locality of the study area, and there is very little suitable habitat present. This species is therefore considered unlikely to occur.

5.3.3.7 Red Goshawk (*Erythrotriorchis radiatus*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Vulnerable under the Commonwealth EPBC Act.

Distribution and Habitat: This species is sparsely distributed across coastal areas of Australia, from the western Kimberley to northeastern New South Wales (Marchant and Higgins 1993). It inhabits wooded and forested areas, often near riverine environments that typically support high bird numbers which it requires for prey.

Likelihood of Occurrence: There are very few records of this species from Western Australia (16 in total), all of which are from the northern Kimberley, and little suitable habitat is present within the study area. This species is considered unlikely to occur.

5.3.3.8 Oriental Plover (*Charadrius veredus*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: The Oriental Plover prefers areas such as open plains, bare country, muddy or sandy wastes near inland swamps or tidal mudflats, bare claypans, margins of coastal marshes, grassy airfields, sports fields, lawns and coastal dune areas (Pizzey and Knight 2007).

Likelihood of Occurrence: Records of this species from the inland Kimberley are rare and the plains of the study area do not represent suitable habitat. The Oriental Plover is therefore unlikely to occur in the study area.

5.3.3.9 Australian Painted Snipe (*Rostratula australis*)

Status: Listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Endangered under the Commonwealth EPBC Act.

Distribution and Habitat: This species has been recorded from shallow inland freshwater or brackish wetlands across Australia. Painted Snipe also utilise waterlogged grassland, saltmarsh, rice crops, sewage farms, bore drains and dam areas, typically with emergent tussocks of grass, sedges, rushes, reeds, samphire or sometimes tea-tree (Department of the Environment 2015b).

Likelihood of Occurrence: There are no recent records of this species from the Kimberley region and very limited suitable habitat occurs within the study area. The Australian Painted Snipe would therefore be unlikely to occur in the study area.

5.3.3.10 Marsh Sandpiper (*Tringa stagnatilis*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: This species occurs in coastal and inland wetlands throughout Australia, where it prefers permanent or ephemeral wetlands including swamps, billabongs, salt pans, estuaries, inundated floodplains and intertidal mudflats (Higgins and Davies 1996).

Likelihood of Occurrence: This species has been recorded in close proximity to the study area (approximately 5 km southeast), however there is limited suitable habitat and this species is considered unlikely to occur.

5.3.3.11 Chestnut-backed Button-quail (*Turnix castanotus*)

Status: Listed as a Priority 4 species by the WA Department of Parks and Wildlife (2014c).

Distribution and Habitat: This species has a disjunct distribution in the Northern Territory and coastal Kimberley, where it inhabits short grass in Eucalypt woodlands, particularly on stony or rocky hills (IUCN 2012).

Likelihood of Occurrence: This species has been recorded in close proximity to the study area, however the location of this record is likely to be inaccurate; all other records of the species have come from far north coastal areas in the Kimberley, rather than inland. The current known distribution and records would suggest that this species is unlikely to occur in the study area.

5.3.3.12 Oriental Pratincole (*Glareola maldivarum*)

Status: Listed as Schedule 3 under the WA Wildlife Conservation Act 1950 and Migratory under the Commonwealth EPBC Act.

Distribution and Habitat: This species is widespread along the coasts of the Pilbara, Kimberley and Northern Territory regions, where it inhabits open plains, floodplains, short grassland, farmland and terrestrial wetlands including billabongs, lakes and creeks (Department of the Environment 2015c).

Likelihood of Occurrence: The majority of records of this species have been made from coastal areas around Western Australia, not from the locality of the study area. In addition, little suitable habitat is present within the study area. This species is considered unlikely to occur.

This page intentionally blank.

6.0 Short Range Endemic Fauna Results

6.1 Overview of Potential SRE Fauna Assemblage

Database and literature reviews recorded a total of eight species of invertebrates from groups known to contain potential SRE fauna. This total comprised one pseudoscorpion, six land snail species and one selenopid spider. The SRE status of these species is outlined in Table 6.1.

Table 6.1: Invertebrate fauna potentially occurring within the Mimbi study area.

Group	Order	Family	Species	SRE Status
Pseudoscorpions	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i> sp.	Undetermined
Land snails	Stylommatophora	Pupillidae	<i>Gastrocopta pediculus</i>	Not an SRE
			<i>Pupoides pacificus</i>	Not an SRE
		Helicarionidae	<i>Westracystis lissus</i>	Not an SRE
		Camaenidae	<i>Rhagada</i> sp.	Undetermined
			<i>Westraltrachia ampla</i>	Not an SRE
			<i>Westraltrachia ascita</i>	Not an SRE
Selenopid spiders	Araneae	Selenopidae	<i>Karaops</i> sp.	Undetermined

6.2 Invertebrate Fauna Recorded in the Study Area

The site reconnaissance survey recorded taxa from three invertebrate groups: pseudoscorpions, land snails and mygalomorph spiders. The locations of these records within the study area are depicted in Figure 6.1.

6.2.1 Pseudoscorpions

One pseudoscorpion specimen belonging to the *Beierolpium* genus (family Olpiidae) from the group "8/4" was collected during the site visit from a soil sample taken near the southern corner of Mimbi East (PSOPP-01: 18°43'20" S, 126°03'45" E). The group "8/4" is not in itself a species, but is rather a morphological description based on the pattern of trichobothria (elongated 'hairs') on the chelal hand, or claw (M. Strong, Biota, pers. comm. 2015). The distribution of species in the *Beierolpium* genus is currently not determined, although other members of this genus have previously been considered potential SREs.

6.2.2 Land Snails

Snails from two families (Camaenidae and Succineidae) were collected from the study area during the site visit (Table 6.2). The Camaenid snails belong to the *Westraltrachia* genus. Within the Kimberley, three species of *Westraltrachia* (*W. alterna*, *W. inopinata* and *W. turbinata*) are listed as Schedule 1 under the WA Wildlife Conservation Act 1950 and Vulnerable under the Commonwealth EPBC Act, and a further three species (*W. lievreana*, *W. recta* and *W. subtila*) are listed as Priority 1 species by the WA Department of Parks and Wildlife (Department of Parks and Wildlife 2014c). All of these species have distributions restricted to the Napier Range (*W. alterna*, *W. inopinata* and *W. turbinata*), Oscar Range (*W. lievreana* and *W. subtila*) or the Limestone Billy Hills (*W. recta*). As these species have restricted distributions that occur outside of the study area locality, the collected specimens are unlikely to be any of these conservation significant species. Only shell material was collected during the site visit and so the species cannot be determined genetically. However, the specimens were collected from the vicinity of the Lawford Range, in which the species *W. ampla* is known to occur. It is therefore likely that the collected shells represent *W. ampla*, which is not thought to be an SRE. The Succineidae family is common and widespread, and is not considered to include any SRE species.

Table 6.2: Locations of collected land snails during the Mimbi site visit.

Site	Date	Latitude	Longitude	Taxon	Number
LSOPP-01	12/03/15	18°43'07" S	126°03'46" E	Succineidae sp.	7
				<i>W. ampla</i>	3
LSOPP-02	10/03/15	18°43'53" S	126°03'30" E	Succineidae sp.	1
				<i>W. ampla</i>	3
LSOPP-03	11/03/15	18°43'28" S	126°02'32" E	Succineidae sp.	1
				<i>W. ampla</i>	3
LSOPP-04	14/03/15	18°43'18" S	126°03'51" E	<i>W. ampla</i>	9
LSOPP-05	13/03/15	18°43'01" S	126°03'00" E	Succineidae sp.	3
				<i>W. ampla</i>	2

6.2.3 Mygalomorph Spiders

Three mygalomorph spider burrows were located during the site visit: MOPP-01 (18°43'18" S, 126°03'48" E) and MOPP-02 (18°43'11" S, 126° 3'40" E; Plate 6.1) in Mimbi East; and MOPP-03 (18°43'24" S, 126° 2'32" E; Plate 6.2) in Mimbi Northwest. These burrows were not excavated, as previous experience (Biota database) has shown that specimens dug from burrows are almost always juveniles or females, which cannot be identified to species level on the basis of morphology; rather, a genetic approach is required. It is for this reason that more comprehensive survey effort for mygalomorph spider burrows was not undertaken, as determining potential SRE status of specimens would require genetic analysis, which is outside the scope of this study.

Based on the burrow morphology, it is likely that these spiders belong to one of two mygalomorph families: the Ctenizidae (known to construct burrows with a cork-like lid) or the Idiopidae. A semi-circular row of fine marks on the inside of the lid (see Plate 6.2) indicates where the spider has been holding the lid closed with its pedipalps, which is a behaviour exhibited by spiders in these two families.



Plate 6.1: Mygalomorph spider burrow MOPP-02.



Plate 6.2: Mygalomorph spider burrow MOPP-03.

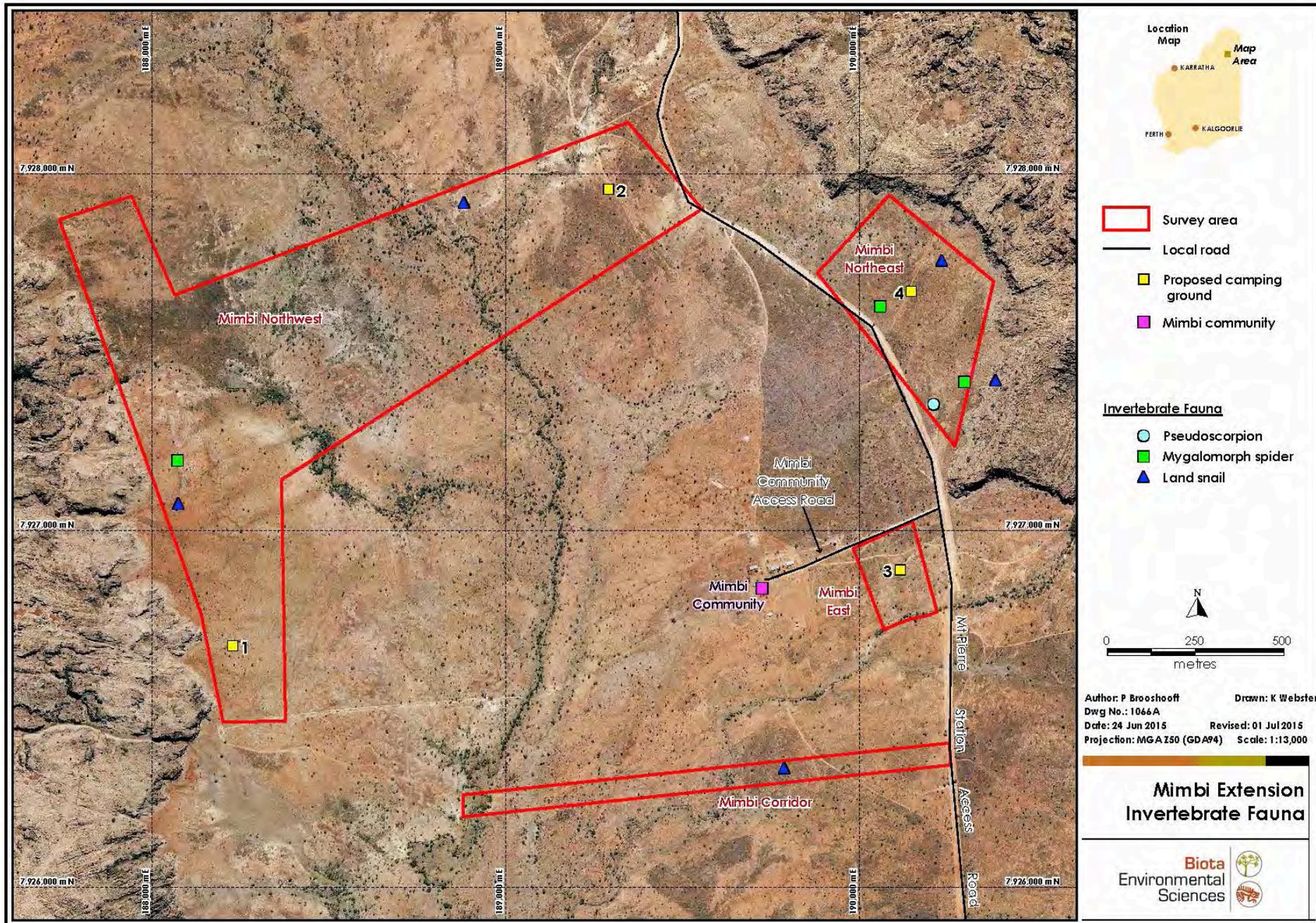


Figure 6.1: Location of invertebrate fauna records within the Mimbi study area.

This page intentionally blank.

7.0 Management Considerations

Six vertebrate species of conservation significance were recorded within the study area during the site reconnaissance. These were the Orange Leaf-nosed Bat (*Rhinonictus aurantius*), Ghost Bat (*Macroderma gigas*), Yellow-lipped Cave Bat (*Vespadelus douglasorum*), Bare-rumped Sheath-tail-bat (*Saccolaimus saccolaimus nudicluniatu*), Rainbow Bee-eater (*Merops ornatus*) and Star Finch³ (*Neochmia ruficauda subclarescens*). A further 18 conservation significant fauna species were identified from the database and literature review as having the potential to occur within the study area. After reviewing species habitat preferences, current known distributions and last known records, six of these species may potentially occur in the study area. These are the Northern Quoll (*Dasyurus hallucatus*), Short-tailed Mouse (*Leggadina lakedownensis*), Fork-tailed Swift (*Apus pacificus*), Eastern Great Egret (*Ardea modesta*), Australian Bustard³ (*Ardeotis australis*) and Gouldian Finch (*Erythrura gouldiae*).

One species, the Bare-rumped Sheath-tail-bat, may be affected by the proposed development; this species is discussed in Section 7.1. None of the other species would be considered likely to rely solely upon the habitats available within the study area, and therefore the proposed development is unlikely to affect the conservation status, distribution or abundance of any of these species. The study area also supports a locally significant habitat (for conservation significant fauna, as well as other native species) and the preservation of this habitat is discussed in Section 7.2.

7.1 Protection of Hollow Bearing Trees

The development of the Mimbi campground is likely to be assessed under the WA Environmental Protection (Clearing of Native Vegetation) Regulations 2004. This requires consideration of ten clearing principles, one of which relates to fauna: "(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia." The presence of the Critically Endangered Bare-rumped Sheath-tail-bat (*Saccolaimus saccolaimus nudicluniatu*) may be affected by clearing of native vegetation, and as such requires specific management.

The identification of the Bare-rumped Sheath-tail-bat within the study area represents a record of this species outside of its current published range (Bullen 2015; see Appendix 6). The species is largely data deficient, however it is known to roost in tree hollows. Roosts have been documented from deep tree hollows (Department of the Environment 2015d), however it is plausible that the species also utilises smaller hollows in *Eucalyptus* and *Corymbia* trees (B. Bullen, Bat Call WA, pers. comm. 2015). Recommendations in the 'Echolocation Survey of Bat Activity' report (Bullen 2015; see Appendix 6) included an investigation of tree hollows to confirm the presence of this species, and to identify any potentially significant roosting hollows. In the event that targeted surveying for the species cannot be undertaken, it is recommended that clearing of potential hollow-bearing trees is avoided in the proposed camping ground areas. In addition, it is recommended that the access routes from the Mt Pierre Station road to campground 1 (the Mimbi Corridor area) and between campgrounds 1 and 2 should be planned in such a way as to direct vehicles around potential hollow bearing trees to avoid clearing. If clearing trees is unavoidable, it is suggested that photographs of individual trees be provided so that they may be assessed for the potential presence of hollows.

Although no large trees with substantial hollows were observed in the study area, it is worth noting that some *Corymbia* trees within the study area were potentially hollow-bearing.

7.2 Protection of Reedbeds and Minor Drainage Lines

The habitats available within the proposed campground areas are widespread and well represented in the locality, and are thus not considered to be of elevated significance in the Kimberley region. However, reedbeds and the small permanent spring at site MIMBAT-05 / MIMMC-05 in Pinnacle Creek are of local value, as they represent a unique habitat for the study

area, which would be a potentially important source of water and foraging habitat for a range of different species (as indicated by the high number of motion camera and echolocation call records). Conservation significant species including the Star Finch³ (*Neochmia ruficauda subclarescens*), Orange Leafnosed-bat (*Rhinonicteris aurantius*), Ghost Bat (*Macroderma gigas*) and Western Cave Bat (*Vespadelus caurinus*) were recorded at the spring, and this area also supports Priority flora species not recorded elsewhere in the study area (see Biota 2015).

It was observed that the introduced species *Equus caballus* (Horse) frequented the spring at site MIMBAT-05 / MIMMC-05. Frequent visitation by this species and other hoofed animals (such as cows, donkeys, camels and pigs) would place this habitat under significant grazing and impact pressure. This would have the potential to cause riparian vegetation and water quality to deteriorate, and ultimately to exclude native species that rely upon the habitat. Given this, consideration should be given to protection of the spring (and other minor drainage lines supporting ephemeral bodies of water) to prevent further impacts, either by removing or excluding livestock and feral species.

7.3 Other Considerations

The potential presence of the Gouldian Finch may be an attractant for prospective tourists to visit the camping ground, therefore tourist information on the species, such as brochures or information boards, may be of value.

To prevent potential outbreak of fire and subsequent habitat destruction, it is recommended that fire bans be enforced during hot and dry weather conditions. If open fire pits are to be permitted in camping ground areas, it is recommended that they be situated in cleared areas away from potentially flammable vegetation.

In addition, it is recommended to ensure that adequate waste management facilities are provided and maintained to minimise the establishment or spread of feral fauna.

8.0 Glossary

ALA	Atlas of Living Australia.
Biota	Biota Environmental Sciences.
Cuesta	A ridge with a gentle slope on one side and a steep slope on the other.
EIA	Environmental impact assessment.
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
EPA	Environmental Protection Authority of Western Australia.
IBRA	Interim Biogeographic Regionalisation for Australia.
Non-volant mammal	Mammal that does not fly (i.e. ground-dwelling species).
PEC	Priority Ecological Community.
SM2BAT	Echolocation call recording device.
sp. (plural: spp.)	Abbreviation of 'species'.
SRE	Short Range Endemic.
TEC	Threatened Ecological Community.
Volant mammal	Flying mammal (i.e. a bat).

This page intentionally blank.

9.0 References

- Armstrong, K. M., and W. J. Wilmer (2004). The importance of determining genetic population structure for the management of Ghost Bats, *Macroderma gigas*, in the Pilbara region of Western Australia. Oral presentation at the 11th Australasian Bat Society Conference, Toowoomba, Queensland.
- Beard, J. S. (1979). Vegetation Survey of Western Australia : Kimberley. 1:1,000,000 Vegetation Series : Map and Explanatory Notes to Sheet 1. University of Western Australia.
- Biota (2004). Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor. Unpublished report prepared for Fortescue Metals Group, Biota Environmental Sciences, Western Australia.
- Biota (2013). Rangelands Landform Field Guide. Biota Environmental Sciences.
- Biota (2015). Mimbi Extension Camping Grounds Rare Flora Survey. Unpublished report prepared for Tourism WA, Biota Environmental Sciences, Western Australia.
- Braithwaite, R., and A. D. Griffiths (1994). Demographic variation and range contraction in the northern quoll, *Dasyurus hallucatus* (Marsupialia: Dasyuridae). *Wildlife Research* 21:203–217.
- Bullen, R. D. (2015). Mimbi Level 1 Fauna survey - Echolocation Survey of Bat Activity. Unpublished report prepared for Biota Environmental Sciences, Bat Call WA.
- Bureau of Meteorology (2015). Bureau of Meteorology Australia [WWW Document]. Retrieved from <http://www.bom.gov.au/>.
- Christidis, L., and W. E. Boles (2008). *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Melbourne.
- Churchill, S. K. (2008). *Australian Bats*, 2nd edition. Allen and Unwin, Australia.
- Cogger, H. G., E. E. Cameron, R. A. Sadler, and P. Egger (1993). *The action plan for Australian Reptiles*. Australian Nature Conservation Agency.
- Department of Parks and Wildlife (2014a). List of Threatened Ecological Communities endorsed by the Western Australian Minister for the Environment. Species and Communities Branch, WA Department of Parks and Wildlife, correct to May 2014.
- Department of Parks and Wildlife (2014b). Priority Ecological Communities for Western Australia, Version 21. Species & Communities Branch, Department of Parks and Wildlife, 4 May, 2014.
- Department of Parks and Wildlife (2014c). Threatened and Priority Fauna List, 3 December 2014. Department of Parks and Wildlife.
- Department of the Environment (2014). *Environment Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool* [WWW Document]. Retrieved from <http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected>.
- Department of the Environment (2015a). *Rhinonicteris aurantia* (Pilbara form) in Species Profile and Threats Database [WWW Document]. Retrieved March 25, 2015, from <http://www.environment.gov.au/sprat>.
- Department of the Environment (2015b). *Rostratula australis* SPRAT Profile [WWW Document]. Retrieved from <http://www.environment.gov.au/sprat>.

- Department of the Environment (2015c). *Glareola maldivarum* SPRAT Profile [WWW Document]. Species Profile and Threats Database. Retrieved from <http://www.environment.gov.au/sprat>.
- Department of the Environment (2015d). *Saccolaimus saccolaimus nudicluniatus* SPRAT profile [WWW Document].
- DEWHA (2010). Northern Quoll (*Dasyurus hallucatus*) listing advice. Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia. Retrieved September 20, 2010, from <http://www.environment.gov.au/biodiversity/threatened/species/dasyurus-hallucatus.html>.
- DSEWPaC (2011). Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll, *Dasyurus hallucatus*. EPBC Act policy statement 3.25, Department of Sustainability, Environment, Water, Population and Communities.
- DSEWPaC (2012). Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions) - States and Territories. Department of Sustainability, Environment, Water, Population and Communities, Canberra. Retrieved from <http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra>.
- Van Dyck, S., and R. Strahan (Eds.) (2008). *The Mammals of Australia*, 3rd edition. Reed New Holland, Sydney.
- EPA (2004). EPA Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*. Environmental Protection Authority, Western Australia.
- EPA (2009). EPA Guidance Statement No. 20: *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*. Environmental Protection Authority, Western Australia.
- EPA and DEC (2010). *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*. Environmental Protection Authority and Department of Environment and Conservation, Western Australia.
- Friend, J. A. (1990). Status of bandicoots in Western Australia. In: *Bandicoots and Bilbies*. Surrey Beatty & Sons, Sydney. Retrieved June 13, 2012, .
- Graham, G. (2003a). Ord Victoria Plains 2 (OVP2 - South Kimberley Interzone subregion). Pages 538–546 in J. E. May and N. L. McKenzie, editors. *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions*. Department of Conservation and Land Management, Western Australia.
- Graham, G. (2003b). Dampierland 1 (DP1 - Fitzroy Trough subregion). Pages 170–178 in J. E. May and N. L. McKenzie, editors. *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions*. Department of Conservation and Land Management, Western Australia.
- Higgins, P. J. (1999). *Handbook of Australian, New Zealand and Antarctic Birds*. Volume 4: Parrots to Dollarbird. Oxford University Press, Melbourne.
- Higgins, P. J., and S. J. J. F. Davies (1996). *Handbook of Australian, New Zealand and Antarctic Birds*. Volume 3: Snipe to Pigeons. Oxford University Press, Melbourne.
- IUCN (2012). *Turnix castanotus* [WWW Document]. Retrieved from <http://www.iucnredlist.org/details/full/22680560/0>.
- Johnstone, R. E., A. H. Burbidge, and J. C. Darnell (2013). Birds of the Pilbara region, including seas and offshore islands, Western Australia: distribution, status and historical changes. *Records of the Western Australian Museum Supplement* 78:343–441.

- Johnstone, R. E., and G. M. Storr (1998). *Handbook of Western Australian Birds Volume I - Non-Passerines (Emu to Dollarbird)*. Western Australian Museum, Perth.
- Johnstone, R. E., and G. M. Storr (2004). *Handbook of Western Australian Birds Volume II - Passerines (Blue-winged Pitta to Goldfinch)*. Western Australian Museum, Perth.
- Marchant, S., and P. J. Higgins (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings*. Oxford University Press, Melbourne.
- May, J. E., and N. L. McKenzie (Eds.) (2003). *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions*. Department of Conservation and Land Management, Western Australia.
- McKenzie, N. L., and R. Bullen (2009). The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. *Records of the Western Australian Museum Supplement* 78:123–155.
- Menkhorst, P., and F. Knight (2011). *A Field Guide to the Mammals of Australia*, 3rd edition. Oxford University Press, Australia.
- Morris, K., J. Woinarski, and K. Aplin (2008). *Leggadina lakedownensis* [WWW Document]. Retrieved June 13, 2012, from <http://www.iucnredlist.org/apps/redlist/details/11384/0>.
- Paull, D. J., A. W. Claridge, and S. C. Barry (2011). There's no accounting for taste: bait attractants and infrared digital cameras for detecting small to medium ground-dwelling mammals. *Wildlife Research* 38:188–195.
- Payne, A. L., and S. Schoknecht (2011). *Technical Bulletin No. 98: Land Systems of the Kimberley Region, Western Australia*. Department of Agriculture and Food, Western Australia.
- Pizzey, G., and F. Knight (2007). *The Field Guide to the Birds of Australia*. (P. Menkhorst, Ed.), 8th edition. Harper Collins Publishers, Sydney.
- Schulz, M., and B. Thomson (2007). National recovery plan for the bare-rumped sheath-tail bat *Saccolaimus saccolaimus nudicluniatu*s. Report to Department of the Environment and Water Resources, Queensland Parks and Wildlife Service, Brisbane.
- Simpson, K., and N. Day (2004). *Field Guide to the Birds of Australia*, 7th edition. The Penguin Group, Victoria.
- Southgate, R. I. (1990). Habitats and diet of the greater bilby *Macrotis lagotis* Reid (Marsupialia: Peramelidae). Pages 303–309 *Bandicoots and Bilbies*. Surrey Beatty & Sons, New South Wales.
- Tyler, M. J., and P. Doughty (2009). *Field Guide to Frogs of Western Australia: Fourth Edition*. Western Australian Museum, Welshpool, Western Australia.
- Wildlife Acoustics (2010). *Song Meter User Manual, Model SM2, with Song Meter SM2BAT 192kHz Stereo or 384kHz Mono Ultrasonic Recorders addendum*.
- Wilson, S., and G. Swan (2013). *A Complete Guide to Reptiles of Australia*, 4th edition. New Holland.
- Woinarski, J. C. Z., A. A. Burbidge, and P. L. Harrison (2014). *The Action Plan for Australian Mammals 2012*. CSIRO Publishing, Victoria.

Appendix 1

NatureMap Search Results



NatureMap Species Report

Created By Guest user on 04/03/2015

Current Names Only Yes
Core Datasets Only Yes
Species Group Mammals
Method 'By Circle'
Centre 126°03' 14" E, 18°43' 32" S
Buffer 20km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	24177 <i>Hipposideros ater subsp. gilberti</i> (Dusky Leafnosed-bat)			
2.	24180 <i>Macroderma gigas</i> (Ghost Bat)		P4	
3.	24168 <i>Macrotis lagotis</i> (Bilby, Dalgyte)		T	
4.	24190 <i>Miniopterus schreibersii subsp. orianae</i> (Common Bentwing-bat)			
5.	24234 <i>Pseudomys delicatulus</i> (Delicate Mouse)			
6.	24239 <i>Pseudomys nanus</i> (Western Chestnut Mouse)			
7.	24175 <i>Taphozous georgianus</i> (Common Sheathtail-bat)			
8.	24203 <i>Vespadelus caurinus</i> (Western Cave Bat)			
9.	24204 <i>Vespadelus douglasorum</i> (Yellow-lipped Cave Bat)		P2	

Conservation Codes

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

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

NatureMap Species Report

Created By Guest user on 04/03/2015

Current Names Only Yes
Core Datasets Only Yes
Species Group Reptiles
Method 'By Circle'
Centre 126°03' 14" E, 18°43' 32" S
Buffer 20km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	30831 <i>Amphibolurus gilberti</i> (Ta-ta, Gilbert's Dragon)			
2.	25241 <i>Antaresia stimsoni</i> subsp. <i>stimsoni</i> (Stimson's Python)			
3.	30890 <i>Cryptoblepharus ruber</i>			
4.	24870 <i>Ctenophorus caudicinctus</i> subsp. <i>macropus</i> (Ring-tailed Dragon)			
5.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
6.	25048 <i>Ctenotus inornatus</i>			
7.	25062 <i>Ctenotus piankai</i>			
8.	25073 <i>Ctenotus saxatilis</i> (Rock Ctenotus)			
9.	24952 <i>Gehyra australis</i>			
10.	24954 <i>Gehyra nana</i>			
11.	24956 <i>Gehyra pilbara</i>			
12.	24958 <i>Gehyra punctata</i>			
13.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
14.	24963 <i>Heteronotia planiceps</i>			
15.	25005 <i>Lialis burtonis</i>			
16.	24964 <i>Nephruirus sheai</i>			
17.	25499 <i>Notoscincus ornatus</i>			
18.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
19.	25210 <i>Varanus brevicauda</i> (Short-tailed Pygmy Monitor)			
20.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			

Conservation Codes

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

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

NatureMap Species Report

Created By Guest user on 04/03/2015

Current Names Only Yes
Core Datasets Only Yes
Species Group Amphibians
Method 'By Circle'
Centre 126°03' 14" E, 18°43' 32" S
Buffer 20km

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	25381	<i>Litoria coplandi</i> (Rock Frog)			
2.	25390	<i>Litoria pallida</i> (Pale Rocket Frog)			
3.	25437	<i>Uperoleia borealis</i> (Northern Taodlet)			
4.	25447	<i>Uperoleia trachyderma</i> (Blacksoil Toadlet)			

Conservation Codes

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

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

NatureMap Species Report

Created By Guest user on 04/03/2015

Current Names Only Yes
Core Datasets Only Yes
Species Group Birds
Method 'By Circle'
Centre 126°03' 14" E, 18°43' 32" S
Buffer 20km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
2.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
3.	24719 <i>Aprosmictus erythropterus</i> (Red-winged Parrot)			
4.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
5.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
6.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
7.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
8.	24355 <i>Artamus minor</i> (Little Woodswallow)			
9.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
10.	25715 <i>Cacatua roseicapilla</i> (Galah)			
11.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
12.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
13.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
14.	25600 <i>Centropus phasianinus</i> (Pheasant Coucal)			
15.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
16.	24834 <i>Cincloramphus mathewsi</i> (Rufous Songlark)			
17.	25756 <i>Cisticola exilis</i> (Golden-headed Cisticola)			
18.	24835 <i>Cisticola exilis</i> subsp. <i>exilis</i> (Golden-headed Cisticola)			
19.	24394 <i>Climacteris melanura</i> subsp. <i>melanura</i> (Black-tailed Treecreeper)			
20.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
21.	24615 <i>Colluricincla woodwardi</i> (Sandstone Shrike-thrush)			
22.	24566 <i>Conopophila rufogularis</i> (Rufous-throated Honeyeater)			
23.	24361 <i>Coracina maxima</i> (Ground Cuckoo-shrike)			
24.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
25.	24362 <i>Coracina novaehollandiae</i> subsp. <i>novaehollandiae</i> (Black-faced Cuckoo-shrike)			
26.	25569 <i>Coracina papuensis</i> (White-bellied Cuckoo-shrike, Little Cuckoo-shrike)			
27.	25593 <i>Corvus orru</i> (Torresian Crow)			
28.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
29.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
30.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
31.	24631 <i>Emblema pictum</i> (Painted Finch)			
32.	24837 <i>Eremiornis carteri</i> (Spinifex-bird)			
33.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
34.	25621 <i>Falco berigora</i> (Brown Falcon)			
35.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
36.	25623 <i>Falco longipennis</i> (Australian Hobby)			
37.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
38.	24402 <i>Geopelia humeralis</i> (Bar-shouldered Dove)			
39.	25585 <i>Geopelia striata</i> (Zebra Dove)			
40.	24403 <i>Geopelia striata</i> subsp. <i>placida</i> (Peaceful Dove)			
41.	24404 <i>Geophaps plumifera</i> (Spinifex Pigeon)			
42.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
43.	24484 <i>Grus rubicunda</i> (Brolga)			
44.	24295 <i>Haliastur spheurnus</i> (Whistling Kite)			
45.	24297 <i>Hamirostra melanosternon</i> (Black-breasted Buzzard)			
46.	24633 <i>Heteromunia pectoralis</i> (Pictorella Mannikin)			
47.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
48.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
49.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
50.	25653 <i>Malurus melanocephalus</i> (Red-backed Fairy-wren)			
51.	24550 <i>Malurus melanocephalus</i> subsp. <i>cruentatus</i> (Red-backed Fairy-wren)			
52.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
53.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
54.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
55.	25542 <i>Milvus migrans</i> (Black Kite)			
56.	25545 <i>Mirafra javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
57.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
58.	24448 <i>Myiagra inquieta</i> subsp. <i>nana</i> (Restless Flycatcher)			
59.	25748 <i>Ninox novaeseelandiae</i> (Boobook Owl)			
60.	24820 <i>Ninox novaeseelandiae</i> subsp. <i>boobook</i> (Boobook Owl)			
61.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
62.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
63.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
64.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
65.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
66.	25668 <i>Philemon citreogularis</i> (Little Friarbird)			
67.	24592 <i>Philemon citreogularis</i> subsp. <i>citreogularis</i> (Little Friarbird)			
68.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
69.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
70.	25725 <i>Ptilonorhynchus nuchalis</i> (Great Bowerbird)			
71.	24758 <i>Ptilonorhynchus nuchalis</i> subsp. <i>nuchalis</i> (Great Bowerbird)			
72.	42322 <i>Ptilotula flavescens</i> subsp. <i>flavescens</i> (Yellow-tinted Honeyeater)			
73.	42342 <i>Ptilotula plumulus</i> (Grey-fronted Honeyeater)			
74.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
75.	30948 <i>Smicromis brevirostris</i> (Weebill)			
76.	42348 <i>Stomiopera unicolor</i> subsp. <i>unicolor</i> (White-gaped Honeyeater)			
77.	25752 <i>Sturnus vulgaris</i> (Common Starling)	Y		
78.	42310 <i>Sugomel niger</i> (Black Honeyeater)			
79.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
80.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
81.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
82.	24756 <i>Trichoglossus versicolor</i> (Varied Lorikeet)			
83.	24848 <i>Turnix pyrrhothorax</i> (Red-chested Button-quail)			

Conservation Codes

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

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

NatureMap Species Report

Created By Guest user on 04/03/2015

Current Names Only Yes
Core Datasets Only Yes
Species Group Invertebrates
Method 'By Circle'
Centre 126°03' 14" E, 18°43' 32" S
Buffer 20km

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	-12672	<i>Argiope dietrichae</i>			
2.	-13371	<i>Hersilia mimbis</i>			Y
3.	-12190	<i>Tamopsis fitzroyensis</i>			
4.	-12271	<i>Thereuopoda lesueurii</i>			

Conservation Codes

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

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

Appendix 2

Commonwealth EPBC Act Protected Matters Search Results





EPBC Act Protected Matters Report

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

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

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

Report created: 04/03/15 11:50:26

[Summary](#)

[Details](#)

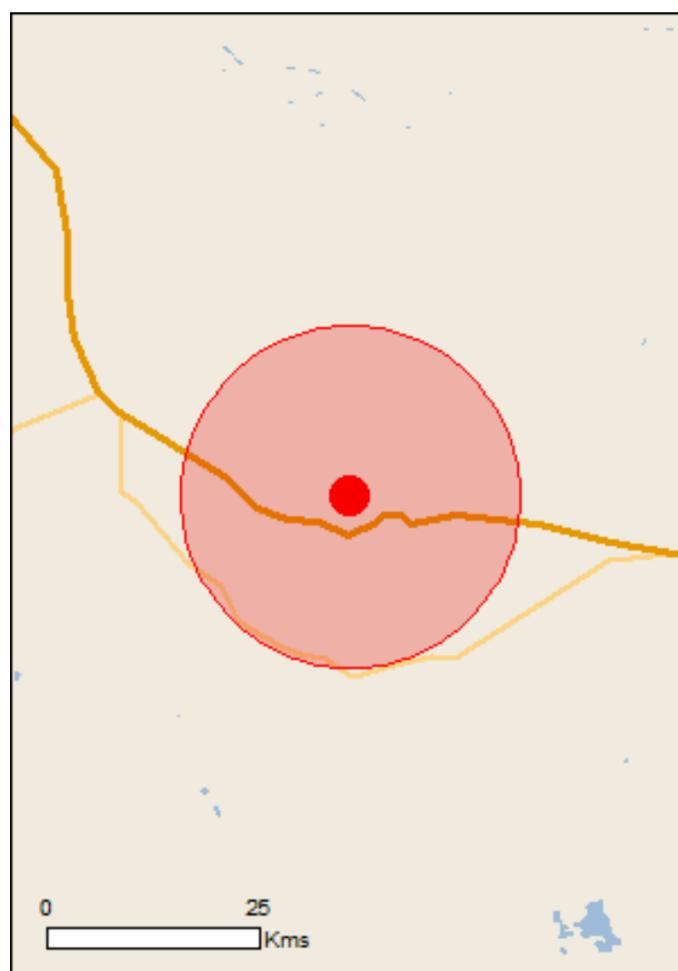
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 20.0Km



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:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	7
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As [heritage values](#) of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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.

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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	2
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The West Kimberley	WA	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Notoryctes caurinus Kakarratul, Northern Marsupial Mole [295]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area
Sharks		
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		habitat may occur within area Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Bugle Gap Geological Monument	WA	Indicative Place
Parts of the Kimberley	WA	Indicative Place

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 Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		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
Mus musculus House Mouse [120]		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		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Coordinates

-18.72556 126.05389

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 Heritage and Register of National Estate properties, Wetlands of International 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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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.

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:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA 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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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.

Appendix 3

Atlas of Living Australia Database Search Results



Mammals

Family	Species Name	Common Name
Emballonuridae	<i>Taphozous georgianus</i>	Common Sheath-tail-bat
Hipposideridae	<i>Hipposideros ater gilberti</i>	Dusky Leaf-nosed-bat
Macropodidae	<i>Macropus robustus</i>	Euro
Macropodidae	<i>Onychogalea unguifera</i>	Northern Nail-tail Wallaby, Karrabul
Macropodidae	<i>Petrogale concinna monastria</i>	Nabarlek
Megadermatidae	<i>Macroderma gigas</i>	Ghost Bat
Muridae	<i>Mus musculus</i>	House Mouse
Muridae	<i>Pseudomys delicatulus</i>	Delicate Mouse
Muridae	<i>Pseudomys nanus</i>	Western Chestnut Mouse
Muridae	<i>Zyomys argurus</i>	Common Rock-rat
Pteropodidae	<i>Pteropus alecto</i>	Black Flying-fox
Thylacomyidae	<i>Macrotis lagotis</i>	Bilby, Dalgyte
Vespertilionidae	<i>Miniopterus schreibersii orianae</i>	Common Bentwing-bat
Vespertilionidae	<i>Vespadelus caurinus</i>	Western Cave Bat
Vespertilionidae	<i>Vespadelus douglasorum</i>	Yellow-lipped Cave Bat
Vespertilionidae	<i>Vespadelus caurinus</i>	Western Cave Bat

Reptiles

Family	Species Name	Common Name
Agamidae	<i>Amphibolurus gilberti</i>	Ta-Ta or Gilbert's Dragon
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon
Agamidae	<i>Ctenophorus isolepis</i>	Military Dragon
Agamidae	<i>Ctenophorus nuchalis</i>	Central Netted Dragon
Boidae	<i>Antaresia stimsoni stimsoni</i>	Stimson's Python
Carphodactylidae	<i>Nephrurus sheai</i>	
Diplodactylidae	<i>Strophurus ciliaris</i>	
Egerniidae	<i>Tiliqua scincoides</i>	Eastern Blue-tongue
Elapidae	<i>Pseudechis australis</i>	Mulga Snake
Eugongylidae	<i>Cryptoblepharus ruber</i>	
Eugongylidae	<i>Morethia ruficauda</i>	
Gekkonidae	<i>Gehyra australis</i>	
Gekkonidae	<i>Gehyra nana</i>	
Gekkonidae	<i>Gehyra occidentalis</i>	
Gekkonidae	<i>Gehyra pilbara</i>	
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's Gecko
Gekkonidae	<i>Heteronotia planiceps</i>	
Pygopodidae	<i>Lialis burtonis</i>	
Sphenomorphidae	<i>Ctenotus inornatus</i>	
Sphenomorphidae	<i>Ctenotus piankai</i>	
Sphenomorphidae	<i>Ctenotus saxatilis</i>	Rock Ctenotus
Sphenomorphidae	<i>Notoscincus ornatus</i>	
Typhlopidae	<i>Anilius diversus</i>	
Varanidae	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor
Varanidae	<i>Varanus tristis tristis</i>	Racehorse Monitor

Amphibians

Family	Species Name	Common Name
Hylidae	<i>Cyclorana australis</i>	Giant Frog
Hylidae	<i>Litoria caerulea</i>	Green Tree Frog
Hylidae	<i>Litoria coplandi</i>	Rock Frog
Hylidae	<i>Litoria inermis</i>	Bumpy Rocket Frog
Hylidae	<i>Litoria pallida</i>	Pale Rocket Frog
Limnodynastidae	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog
Myobatrachidae	<i>Uperoleia borealis</i>	Northern Toadlet
Myobatrachidae	<i>Uperoleia stridera</i>	Mole Toadlet

Avifauna

Family	Common Name	Species
Columbidae	Crested Pigeon	<i>Ocyphaps lophotes</i>
Columbidae	Spinifex Pigeon	<i>Geophaps plumifera</i>
Columbidae	Diamond Dove	<i>Geopelia cuneata</i>
Columbidae	Peaceful Dove	<i>Geopelia striata</i>
Columbidae	Bar-shouldered Dove	<i>Geopelia humeralis</i>
Podargidae	Tawny Frogmouth	<i>Podargus strigoides</i>
Eurostopodidae	Spotted Nightjar	<i>Eurostopodus argus</i>
Anhingidae	Australasian Darter	<i>Anhinga novaehollandiae</i>
Phalacrocoracidae	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Ardeidae	White-necked Heron	<i>Ardea pacifica</i>
Ardeidae	Intermediate Egret	<i>Ardea intermedia</i>
Ardeidae	White-faced Heron	<i>Egretta novaehollandiae</i>
Ardeidae	Nankeen Night-Heron	<i>Nycticorax caledonicus</i>
Accipitridae	Black-shouldered Kite	<i>Elanus axillaris</i>
Accipitridae	Square-tailed Kite	<i>Lophoictinia isura</i>
Accipitridae	Black-breasted Buzzard	<i>Hamirostra melanosternon</i>
Accipitridae	Whistling Kite	<i>Haliastur sphenurus</i>
Accipitridae	Black Kite	<i>Milvus migrans</i>
Accipitridae	Brown Goshawk	<i>Accipiter fasciatus</i>
Accipitridae	Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>
Accipitridae	Spotted Harrier	<i>Circus assimilis</i>
Accipitridae	Wedge-tailed Eagle	<i>Aquila audax</i>
Accipitridae	Little Eagle	<i>Hieraaetus morphnoides</i>
Falconidae	Nankeen Kestrel	<i>Falco cenchroides</i>
Falconidae	Brown Falcon	<i>Falco berigora</i>
Falconidae	Australian Hobby	<i>Falco longipennis</i>
Falconidae	Black Falcon	<i>Falco subniger</i>
Gruidae	Brolga	<i>Grus rubicunda</i>
Otididae	Australian Bustard	<i>Ardeotis australis</i>
Charadriidae	Black-fronted Dotterel	<i>Eseyornis melanops</i>
Scolopacidae	Marsh Sandpiper	<i>Tringa stagnatilis</i>
Turnicidae	Chestnut-backed Button-quail	<i>Turnix castanotus</i>
Turnicidae	Red-chested Button-quail	<i>Turnix pyrrhothorax</i>
Cacatuidae	Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>
Cacatuidae	Galah	<i>Eolophus roseicapillus</i>
Cacatuidae	Little Corella	<i>Cacatua sanguinea</i>
Cacatuidae	Cockatiel	<i>Nymphicus hollandicus</i>
Psittacidae	Varied Lorikeet	<i>Psitteuteles versicolor</i>
Psittacidae	Red-winged Parrot	<i>Aprosmictus erythropterus</i>
Psittacidae	Budgerigar	<i>Melopsittacus undulatus</i>
Cuculidae	Pheasant Coucal	<i>Centropus phasianinus</i>
Cuculidae	Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>
Cuculidae	Pallid Cuckoo	<i>Cacomantis pallidus</i>
Strigidae	Barking Owl	<i>Ninox connivens</i>
Strigidae	Southern Boobook	<i>Ninox novaeseelandiae</i>
Halcyonidae	Blue-winged Kookaburra	<i>Dacelo leachii</i>
Halcyonidae	Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>
Halcyonidae	Sacred Kingfisher	<i>Todiramphus sanctus</i>
Meropidae	Rainbow Bee-eater	<i>Merops ornatus</i>
Climacteridae	Black-tailed Treecreeper	<i>Climacteris melanura</i>
Ptilonorhynchidae	Great Bowerbird	<i>Ptilonorhynchus nuchalis</i>
Maluridae	Red-backed Fairy-wren	<i>Malurus melanocephalus</i>
Maluridae	Variegated Fairy-wren	<i>Malurus lamberti</i>
Acanthizidae	Weebill	<i>Smicronis brevirostris</i>
Pardalotidae	Red-browed Pardalote	<i>Pardalotus rubricatus</i>
Pardalotidae	Striated Pardalote	<i>Pardalotus striatus</i>
Meliphagidae	Singing Honeyeater	<i>Lichenostomus virescens</i>
Meliphagidae	White-gaped Honeyeater	<i>Lichenostomus unicolor</i>
Meliphagidae	Grey-headed Honeyeater	<i>Lichenostomus keartlandi</i>
Meliphagidae	Grey-fronted Honeyeater	<i>Lichenostomus plumulus</i>

Meliphagidae	Yellow-tinted Honeyeater	<i>Lichenostomus flavescens</i>
Meliphagidae	Yellow-throated Miner	<i>Manorina flavigula</i>
Meliphagidae	Rufous-throated Honeyeater	<i>Conopophila rufogularis</i>
Meliphagidae	Black Honeyeater	<i>Sugomel niger</i>
Meliphagidae	Banded Honeyeater	<i>Cissomela pectoralis</i>
Meliphagidae	Brown Honeyeater	<i>Lichmera indistincta</i>
Meliphagidae	Black-chinned Honeyeater	<i>Melithreptus gularis</i>
Meliphagidae	Little Friarbird	<i>Philemon citreogularis</i>
Pomatostomidae	Grey-crowned Babbler	<i>Pomatostomus temporalis</i>
Campephagidae	Ground Cuckoo-shrike	<i>Coracina maxima</i>
Campephagidae	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
Campephagidae	White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>
Campephagidae	White-winged Triller	<i>Lalage sueurii</i>
Pachycephalidae	Rufous Whistler	<i>Pachycephala rufiventris</i>
Pachycephalidae	Sandstone Shrike-thrush	<i>Colluricincla woodwardi</i>
Pachycephalidae	Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Artamidae	White-breasted Woodswallow	<i>Artamus leucorhynchus</i>
Artamidae	Masked Woodswallow	<i>Artamus personatus</i>
Artamidae	Black-faced Woodswallow	<i>Artamus cinereus</i>
Artamidae	Little Woodswallow	<i>Artamus minor</i>
Artamidae	Pied Butcherbird	<i>Cracticus nigrogularis</i>
Artamidae	Australian Magpie	<i>Cracticus tibicen</i>
Rhipiduridae	Willie Wagtail	<i>Rhipidura leucophrys</i>
Corvidae	Little Crow	<i>Corvus bennetti</i>
Corvidae	Torresian Crow	<i>Corvus orru</i>
Monarchidae	Restless Flycatcher	<i>Myiagra inquieta</i>
Monarchidae	Magpie-lark	<i>Grallina cyanoleuca</i>
Petroicidae	Jacky Winter	<i>Microeca fascinans</i>
Alaudidae	Horsfield's Bushlark	<i>Mirafrja javanica</i>
Cisticolidae	Golden-headed Cisticola	<i>Cisticola exilis</i>
Megaluridae	Rufous Songlark	<i>Cincloramphus mathewsi</i>
Megaluridae	Spinifexbird	<i>Eremiornis carteri</i>
Hirundinidae	Fairy Martin	<i>Petrochelidon ariel</i>
Hirundinidae	Tree Martin	<i>Petrochelidon nigricans</i>
Sturnidae	Common Starling	<i>Sturnus vulgaris</i>
Nectariniidae	Mistletoebird	<i>Dicaeum hirundinaceum</i>
Estrildidae	Zebra Finch	<i>Taeniopygia guttata</i>
Estrildidae	Star Finch	<i>Neochmia ruficauda</i>
Estrildidae	Painted Finch	<i>Emblema pictum</i>
Estrildidae	Pictorella Mannikin	<i>Heteromunia pectoralis</i>
Motacillidae	Australasian Pipit	<i>Anthus novaeseelandiae</i>

Invertebrates

Class	Order	Family	Species	Note
Arachnida	Araneae	Araneidae	<i>Argiope dietrichae</i>	Orbweaver spider
Arachnida	Araneae	Ctenidae	Ctenidae sp.	Wandering spider
Arachnida	Araneae	Filistatidae	Filistatidae sp.	Crevice weaver spider
Arachnida	Araneae	Hersiliidae	<i>Hersilia mimbis</i>	Two-tailed spider
Arachnida	Araneae	Hersiliidae	<i>Tamopsis fitzroyensis</i>	Two-tailed spider
Arachnida	Araneae	Lycosidae	Lycosidae sp.	Wolf spider
Arachnida	Araneae	Nephilidae	<i>Nephila edulis</i>	Golden orbweaver spider
Arachnida	Araneae	Oonopidae	<i>Pellicinus</i> sp.	Goblin spider
Arachnida	Araneae	Pholcidae	<i>Physocyclus</i> sp.	Araneomorph spider
Arachnida	Araneae	Selenopidae	<i>Karaops</i> sp.	Selenopid spider
Arachnida	Araneae	Theraphosidae	<i>Selenocosmia</i> sp.	Theraphosid spider
Arachnida	Araneae	Theridiidae	<i>Latrodectus hasseltii</i>	Redback spider
Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i> sp.	Pseudoscorpion
Gastropoda	Hygrophila	Lymnaeidae	<i>Austropeplea caurina</i>	Aquatic snail
Gastropoda	Hygrophila	Lymnaeidae	<i>Peplimnea affinis</i>	Aquatic snail
Gastropoda	Hygrophila	Planorbidae	<i>Gyraulus hesperus</i>	Aquatic snail
Gastropoda	Stylommatophora	Camaenidae	<i>Rhagada</i> sp.	Land snail
Gastropoda	Stylommatophora	Camaenidae	<i>Westraltrachia ampla</i>	Land snail
Gastropoda	Stylommatophora	Camaenidae	<i>Westraltrachia ascita</i>	Land snail
Gastropoda	Stylommatophora	Helicarionidae	<i>Westracystis lissus</i>	Land snail
Gastropoda	Stylommatophora	Pupillidae	<i>Gastrocopta pediculus</i>	Land snail
Gastropoda	Stylommatophora	Pupillidae	<i>Pupoides pacificus</i>	Land snail
Gastropoda	Euomphalina	Platycteratidae	<i>Brokenriveria virginensis</i>	fossil snail
Gastropoda	Euomphalina	Platycteratidae	<i>Straparollus (Euomphalus) sp.</i>	fossil snail
Gastropoda	Murchisoniina	Gosseletinidae	<i>Euconospira nodosa</i>	fossil snail
Gastropoda	Murchisoniina	Gosseletinidae	<i>Mourlonia teichertensis</i>	fossil snail
Gastropoda	Murchisoniina	Murchisoniidae	<i>Murchisonia</i> sp. A	fossil snail
Gastropoda	Murchisoniina	Porcellidae	<i>Hesperella canningensis</i>	fossil snail

Appendix 4

Potential Species List for the Study Area



Mammal species recorded from or potentially occurring in the study area.

Species Name	Common Name	Family	Status	Source				
				ALA	Nature Map	EPBC Act	Menkhorst and Knight (2011)	Recorded This Survey
Non-volant Mammals (ground-dwelling species)								
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	Tachyglossidae					•	•
<i>Dasyurus hallucatus</i>	Northern Quoll	Dasyuridae	Schedule 1				•	
<i>Planigale ingrami</i>	Long-tailed Planigale	Dasyuridae					•	
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	Dasyuridae					•	
<i>Macrotis lagotis</i>	Bilby, Dalgyte	Thylacomyidae	Schedule 1	•	•	•	•	
<i>Notoryctes caurinus</i>	Northern Marsupial Mole	Notoryctidae	Schedule 1			•		
<i>Macropus agilis</i>	Agile Wallaby	Macropodidae					•	
<i>Macropus robustus</i>		Macropodidae		•			•	
<i>Onychogalea unguifera</i>	Northern Nailtail Wallaby, Karrabul	Macropodidae		•			•	
<i>Petrogale concinna monastria</i>	Nabarlek	Macropodidae		•				
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	Muridae	Priority 4				•	
* <i>Mus musculus</i>	House Mouse	Muridae		•		•	•	
<i>Pseudomys delicatulus</i>	Delicate Mouse	Muridae		•	•		•	
<i>Pseudomys laborifex</i>	Kimberley Mouse	Muridae						*
<i>Pseudomys nanus</i>	Western Chestnut Mouse	Muridae		•	•		•	
<i>Zyomys argurus</i>	Common Rock-rat	Muridae		•				
* <i>Canis lupus dingo</i>	Dingo	Canidae					•	
* <i>Vulpes vulpes</i>	Red Fox	Canidae				•		
* <i>Felis catus</i>	Cat	Felidae				•	•	
* <i>Equus asinus</i>	Donkey	Equidae					•	
* <i>Equus caballus</i>	Horse	Equidae					•	•
* <i>Sus scrofa</i>	Pig	Suidae				•		
* <i>Camelus dromedarius</i>	Dromedary, Camel	Camelidae				•		
Volant Mammals (bats)								
<i>Pteropus alecto</i>	Black Flying-fox	Pteropodidae		•				
<i>Hipposideros ater gilberti</i>	Dusky Leafnosed-bat	Hipposideridae		•	•			•
<i>Rhinonictis aurantius</i>	Orange Leafnosed-bat	Hipposideridae	Schedule 1				•	•
<i>Macroderma gigas</i>	Ghost Bat	Megadermatidae	Priority 4	•	•		•	•
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	Emballonuridae					•	•
<i>Saccolaimus saccolaimus</i>	Bare-rumped Sheath-tail-bat	Emballonuridae	Critically Endangered					•

Species Name	Common Name	Family	Status	Source				
				ALA	Nature Map	EPBC Act	Menkhorst and Knight (2011)	Recorded This Survey
<i>Taphozous georgianus</i>	Common Sheathtail-bat	Emballonuridae		•	•		•	•
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Vespertilionidae					•	•
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	Vespertilionidae					•	
<i>Miniopterus schreibersii orianae</i>	Common Bentwing-bat	Vespertilionidae		•	•			•
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	Vespertilionidae					•	
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	Vespertilionidae					•	
<i>Vespadelus caurinus</i>	Western Cave Bat	Vespertilionidae		•	•		•	•
<i>Vespadelus douglasorum</i>	Yellow-lipped Cave Bat	Vespertilionidae	Priority 2	•	•		•	•
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat	Vespertilionidae					•	•
<i>Chaerephon jobensis</i>	Northern Freetail-bat	Molossidae					•	•
<i>Mormopterus lumsdenae</i>	Beccari's Freetail-bat	Molossidae					•	•

* denotes introduced species.

Reptile species recorded from or potentially occurring in the study area.

Species Name	Common Name	Family	Status	Source				
				ALA	NatureMap	EPBC Act	Wilson and Swan (2013)	Recorded This Survey
<i>Crocodylus johnstoni</i>	Freshwater Crocodile	Crocodylidae	Schedule 4			•		
<i>Chelodina oblonga</i>	Northern Snake-necked Turtle	Cheluidae					•	
<i>Nephrurus sheai</i>		Carphodactylidae		•	•			•
<i>Crenadactylus ocellatus</i>	Clawless Gecko	Diplodactylidae					•	
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko	Diplodactylidae					•	
<i>Lucasium stenodactylum</i>		Diplodactylidae					•	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	Diplodactylidae					•	
<i>Strophurus ciliaris</i>		Diplodactylidae		•			•	
<i>Gehyra australis</i>		Gekkonidae		•	•			•
<i>Gehyra nana</i>		Gekkonidae		•	•			
<i>Gehyra occidentalis</i>		Gekkonidae		•				
<i>Gehyra pilbara</i>		Gekkonidae		•	•		•	
<i>Gehyra punctata</i>		Gekkonidae			•			
<i>Heteronotia binoei</i>	Bynoe's Gecko	Gekkonidae		•	•		•	
<i>Heteronotia planiceps</i>		Gekkonidae		•	•			
<i>Delma nasuta</i>		Pygopodidae					•	
<i>Lialis burtonis</i>		Pygopodidae		•	•			
<i>Amphibolurus gilberti</i>	Ta-Ta or Gilbert's Dragon	Agamidae		•	•			•
<i>Amphibolurus longirostris</i>		Agamidae					•	
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	Agamidae		•	•		•	
<i>Ctenophorus isolepis</i>	Military Dragon	Agamidae		•	•		•	•
<i>Ctenophorus nuchalis</i>	Central Netted Dragon	Agamidae		•				
<i>Liopholis kintorei</i>	Great Desert Skink	Egerniidae	Schedule 1			•		
<i>Tiliqua multifasciata</i>	Central Blue-tongue	Egerniidae					•	
<i>Tiliqua scincoides</i>	Eastern Blue-tongue	Egerniidae		•			•	•
<i>Carlia triacantha</i>		Eugongylidae					•	
<i>Cryptoblepharus metallicus</i>		Eugongylidae					•	
<i>Cryptoblepharus ruber</i>		Eugongylidae		•	•		•	
<i>Cryptoblepharus tytthos</i>		Eugongylidae					•	
<i>Menetia greyii</i>		Eugongylidae					•	
<i>Morethia ruficauda</i>		Eugongylidae		•			•	
<i>Proablepharus reginae</i>		Eugongylidae					•	
<i>Ctenotus inornatus</i>		Sphenomorphidae		•	•			

Species Name	Common Name	Family	Status	Source				
				ALA	NatureMap	EPBC Act	Wilson and Swan (2013)	Recorded This Survey
<i>Ctenotus pantherinus</i>	Leopard Ctenotus	Sphenomorphidae					•	
<i>Ctenotus piankai</i>		Sphenomorphidae		•	•		•	
<i>Ctenotus saxatilis</i>	Rock Ctenotus	Sphenomorphidae		•	•		•	
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer	Sphenomorphidae					•	
<i>Lerista bipes</i>		Sphenomorphidae					•	
<i>Lerista greeri</i>		Sphenomorphidae					•	
<i>Notoscincus ornatus</i>		Sphenomorphidae		•	•		•	
<i>Varanus acanthurus</i>	Spiny-tailed Monitor	Varanidae					•	
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor	Varanidae		•	•			
<i>Varanus gouldii</i>	Bungarra or Sand Monitor	Varanidae					•	•
<i>Varanus tristis tristis</i>	Racehorse Monitor	Varanidae		•	•		•	
<i>Anilius diversus</i>		Typhlopidae		•			•	
<i>Anilius grypus</i>		Typhlopidae					•	
<i>Antaresia stimsoni</i>	Stimson's Python	Boidae		•	•		•	
<i>Acanthophis pyrrhus</i>	Desert Death Adder	Elapidae					•	
<i>Brachyuropsis roperi</i>		Elapidae					•	
<i>Demansia angusticeps</i>		Elapidae					•	
<i>Furina ornata</i>	Moon Snake	Elapidae					•	
<i>Pseudechis australis</i>	Mulga Snake	Elapidae		•	•		•	
<i>Pseudonaja mengdeni</i>	Western Brown Snake	Elapidae					•	
<i>Pseudonaja modesta</i>	Ringed Brown Snake	Elapidae					•	
<i>Suta punctata</i>	Spotted Snake	Elapidae					•	

Frog species potentially occurring in the study area.

Species Name	Common Name	Family	Source		
			ALA	NatureMap	Tyler and Doughty (2009)
<i>Cyclorana australis</i>	Giant Frog	Hylidae	•		•
<i>Cyclorana longipes</i>	Long-footed Frog	Hylidae			•
<i>Cyclorana vagitus</i>	Wailing Frog	Hylidae			•
<i>Litoria caerulea</i>	Green Tree Frog	Hylidae	•		
<i>Litoria coplandi</i>	Rock Frog	Hylidae	•	•	•
<i>Litoria inermis</i>	Bumpy Rocket Frog	Hylidae	•		•
<i>Litoria pallida</i>	Pale Rocket Frog	Hylidae	•	•	•
<i>Litoria rothii</i>	Northern Laughing Tree Frog	Hylidae			•
<i>Litoria rubella</i>	Little Red Tree Frog	Hylidae			•
<i>Notaden nichollsi</i>	Desert Spadefoot	Limnodynastidae			•
<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog	Limnodynastidae	•		•
<i>Uperoleia aspera</i>	Derby Toadlet	Myobatrachidae			•
<i>Uperoleia borealis</i>	Northern Toadlet	Myobatrachidae	•	•	
<i>Uperoleia stridera</i>	Mole Toadlet	Myobatrachidae	•	•	•

Bird species recorded from or potentially occurring in the study area.

Species Name	Common Name	Family	Status	Source			
				ALA	NatureMap	EPBC Act	Recorded This Survey
<i>Ocyphaps lophotes</i>	Crested Pigeon	Columbidae		•	•		•
<i>Geophaps plumifera</i>	Spinifex Pigeon	Columbidae		•	•		•
<i>Geopelia cuneata</i>	Diamond Dove	Columbidae		•	•		•
<i>Geopelia striata</i>	Peaceful Dove	Columbidae		•	•		•
<i>Geopelia humeralis</i>	Bar-shouldered Dove	Columbidae		•	•		
<i>Podargus strigoides</i>	Tawny Frogmouth	Podargidae		•	•		
<i>Eurostopodus argus</i>	Spotted Nightjar	Eurostopodidae		•	•		
<i>Apus pacificus</i>	Fork-tailed Swift	Apodidae	Schedule 3			•	
<i>Anhinga novaehollandiae</i>	Australasian Darter	Anhingidae		•			
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	Phalacrocoracidae		•			
<i>Ardea pacifica</i>	White-necked Heron	Ardeidae		•	•		
<i>Ardea modesta</i>	Eastern Great Egret	Ardeidae	Schedule 3			•	
<i>Ardea intermedia</i>	Intermediate Egret	Ardeidae		•			
<i>Ardea ibis</i>	Cattle Egret	Ardeidae	Schedule 3			•	
<i>Egretta novaehollandiae</i>	White-faced Heron	Ardeidae		•			
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron	Ardeidae		•			
<i>Pandion cristatus</i>	Eastern Osprey	Accipitridae				•	
<i>Elanus axillaris</i>	Black-shouldered Kite	Accipitridae		•			
<i>Lophoictinia isura</i>	Square-tailed Kite	Accipitridae		•			
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	Accipitridae		•	•		•
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Accipitridae	Schedule 3			•	
<i>Haliastur sphenurus</i>	Whistling Kite	Accipitridae		•	•		
<i>Milvus migrans</i>	Black Kite	Accipitridae		•	•		
<i>Accipiter fasciatus</i>	Brown Goshawk	Accipitridae		•	•		•
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	Accipitridae		•	•		
<i>Circus assimilis</i>	Spotted Harrier	Accipitridae		•			
<i>Erythrotriorchis radiatus</i>	Red Goshawk	Accipitridae	Schedule 1			•	
<i>Aquila audax</i>	Wedge-tailed Eagle	Accipitridae		•	•		
<i>Hieraaetus morphnoides</i>	Little Eagle	Accipitridae		•			
<i>Falco cenchroides</i>	Nankeen Kestrel	Falconidae		•	•		•
<i>Falco berigora</i>	Brown Falcon	Falconidae		•	•		
<i>Falco longipennis</i>	Australian Hobby	Falconidae		•	•		
<i>Falco subniger</i>	Black Falcon	Falconidae		•			

Species Name	Common Name	Family	Status	Source			
				ALA	NatureMap	EPBC Act	Recorded This Survey
<i>Grus rubicunda</i>	Brolga	Gruidae		•	•		
<i>Ardeotis australis</i>	Australian Bustard	Otididae	Priority 4	•	•		
<i>Charadrius veredus</i>	Oriental Plover	Charadriidae	Schedule 3			•	
<i>Elsyornis melanops</i>	Black-fronted Dotterel	Charadriidae		•			
<i>Rostratula australis</i>	Australian Painted Snipe	Rostratulidae	Schedule 3			•	
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Scolopacidae	Schedule 3	•			
<i>Turnix castanotus</i>	Chestnut-backed Button-quail	Turnicidae	Priority 4	•			
<i>Turnix pyrrhorostrax</i>	Red-chested Button-quail	Turnicidae		•	•		
<i>Glareola maldivarum</i>	Oriental Pratincole	Glareolidae	Schedule 3			•	
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo	Cacatuidae		•	•		
<i>Eolophus roseicapillus</i>	Galah	Cacatuidae		•	•		
<i>Cacatua sanguinea</i>	Little Corella	Cacatuidae		•	•		
<i>Nymphicus hollandicus</i>	Cockatiel	Cacatuidae		•	•		•
<i>Psitteuteles versicolor</i>	Varied Lorikeet	Psittacidae		•	•		
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	Psittacidae		•	•		•
<i>Melopsittacus undulatus</i>	Budgerigar	Psittacidae		•	•		•
<i>Centropus phasianinus</i>	Pheasant Coucal	Cuculidae		•	•		
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo	Cuculidae		•	•		•
<i>Cacomantis pallidus</i>	Pallid Cuckoo	Cuculidae		•	•		
<i>Ninox connivens</i>	Barking Owl	Strigidae		•			
<i>Ninox novaeseelandiae</i>	Southern Boobook	Strigidae		•			•
<i>Ninox novaeseelandiae</i>	Southern Boobook	Strigidae		•	•		•
<i>Dacelo leachii</i>	Blue-winged Kookaburra	Halcyonidae		•			•
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher	Halcyonidae		•	•		
<i>Todiramphus sanctus</i>	Sacred Kingfisher	Halcyonidae		•	•		•
<i>Merops ornatus</i>	Rainbow Bee-eater	Meropidae	Schedule 3	•	•	•	•
<i>Climacteris melanura</i>	Black-tailed Treecreeper	Climacteridae		•	•		
<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird	Ptilonorhynchidae		•	•		•
<i>Malurus melanocephalus</i>	Red-backed Fairy-wren	Maluridae		•	•		•
<i>Malurus lamberti</i>	Variegated Fairy-wren	Maluridae		•	•		
<i>Smicronis brevirostris</i>	Weebill	Acanthizidae		•	•		•
<i>Pardalotus rubricatus</i>	Red-browed Pardalote	Pardalotidae		•	•		•
<i>Pardalotus striatus</i>	Striated Pardalote	Pardalotidae		•	•		
<i>Lichenostomus virescens</i>	Singing Honeyeater	Meliphagidae		•			
<i>Lichenostomus unicolor</i>	White-gaped Honeyeater	Meliphagidae		•	•		

Species Name	Common Name	Family	Status	Source			
				ALA	NatureMap	EPBC Act	Recorded This Survey
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater	Meliphagidae		•			
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater	Meliphagidae		•	•		•
<i>Lichenostomus flavescens</i>	Yellow-tinted Honeyeater	Meliphagidae		•	•		•
<i>Manorina flavigula</i>	Yellow-throated Miner	Meliphagidae		•	•		•
<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater	Meliphagidae		•	•		
<i>Sugomel niger</i>	Black Honeyeater	Meliphagidae		•	•		
<i>Cissomela pectoralis</i>	Banded Honeyeater	Meliphagidae		•			
<i>Lichmera indistincta</i>	Brown Honeyeater	Meliphagidae		•	•		•
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	Meliphagidae		•			•
<i>Philemon citreogularis</i>	Little Friarbird	Meliphagidae		•	•		•
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	Pomatostomidae		•	•		
<i>Coracina maxima</i>	Ground Cuckoo-shrike	Campephagidae		•	•		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Campephagidae		•	•		•
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	Campephagidae		•	•		•
<i>Lalage sueurii</i>	White-winged Triller	Campephagidae		•			•
<i>Pachycephala rufiventris</i>	Rufous Whistler	Pachycephalidae		•	•		
<i>Colluricincla woodwardi</i>	Sandstone Shrike-thrush	Pachycephalidae		•	•		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	Pachycephalidae		•	•		
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	Artamidae		•			
<i>Artamus personatus</i>	Masked Woodswallow	Artamidae		•	•		
<i>Artamus cinereus</i>	Black-faced Woodswallow	Artamidae		•	•		•
<i>Artamus minor</i>	Little Woodswallow	Artamidae		•	•		•
<i>Cracticus nigrogularis</i>	Pied Butcherbird	Artamidae		•	•		•
<i>Cracticus tibicen</i>	Australian Magpie	Artamidae		•	•		
<i>Rhipidura leucophrys</i>	Willie Wagtail	Rhipiduridae		•	•		•
<i>Corvus bennetti</i>	Little Crow	Corvidae		•			
<i>Corvus orru</i>	Torresian Crow	Corvidae		•	•		•
<i>Myiagra inquieta</i>	Restless Flycatcher	Monarchidae		•	•		•
<i>Grallina cyanoleuca</i>	Magpie-lark	Monarchidae		•	•		•
<i>Microeca fascinans</i>	Jacky Winter	Petroicidae		•			
<i>Mirafra javanica</i>	Horsfield's Bushlark	Alaudidae		•	•		
<i>Cisticola exilis</i>	Golden-headed Cisticola	Cisticolidae		•	•		
<i>Cincloramphus mathewsi</i>	Rufous Songlark	Megaluridae		•	•		•
<i>Eremiornis carteri</i>	Spinifexbird	Megaluridae		•	•		
<i>Petrochelidon ariel</i>	Fairy Martin	Hirundinidae		•			

Species Name	Common Name	Family	Status	Source			
				ALA	NatureMap	EPBC Act	Recorded This Survey
<i>Petrochelidon nigricans</i>	Tree Martin	Hirundinidae		•			
<i>Sturnus vulgaris</i>	Common Starling	Sturnidae		•	•		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	Nectariniidae		•	•		•
<i>Taeniopygia guttata</i>	Zebra Finch	Estrildidae		•	•		•
<i>Neochmia ruficauda subclarescens</i>	Star Finch	Estrildidae	Priority 4	•			•
<i>Emblema pictum</i>	Painted Finch	Estrildidae		•	•		•
<i>Erythrura gouldiae</i>	Gouldian Finch	Estrildidae	Priority 4			•	
<i>Heteromunia pectoralis</i>	Pictorella Mannikin	Estrildidae		•	•		•
<i>Anthus novaeseelandiae</i>	Australasian Pipit	Motacillidae		•			

Invertebrates recorded from or potentially occurring in the study area.

Species	Class	Order	Family	Source			Notes
				ALA	Nature Map	Recorded This Study	
<i>Argiope dietrichae</i>	Arachnida	Araneae	Araneidae	•	•		Araneomorph spider; not an SRE
<i>Ctenidae</i> sp.	Arachnida	Araneae	Ctenidae	•			Araneomorph spider; not an SRE
<i>Filistatidae</i> sp.	Arachnida	Araneae	Filistatidae	*			Araneomorph spider; not an SRE
<i>Hersilia mimbi</i>	Arachnida	Araneae	Hersiliidae	•	•		Araneomorph spider; not an SRE
<i>Tamopsis fitzroyensis</i>	Arachnida	Araneae	Hersiliidae	•	•		Araneomorph spider; not an SRE
<i>Lycosidae</i> sp.	Arachnida	Araneae	Lycosidae	*			Araneomorph spider; not an SRE
<i>Nephila edulis</i>	Arachnida	Araneae	Nephilidae	•			Araneomorph spider; not an SRE
<i>Pelicanus</i> sp.	Arachnida	Araneae	Oonopidae	*			Araneomorph spider; not an SRE
<i>Physocyclus</i> sp.	Arachnida	Araneae	Pholcidae	*			Araneomorph spider; not an SRE
<i>Mygalomorph</i> sp.	Arachnida	Araneae	Ctenizidae / Idiopidae			*	Mygalomorph; SRE status undetermined
<i>Karaops</i> sp.	Arachnida	Araneae	Selenopidae	*			Selenopid spider; SRE status undetermined
<i>Selenocosmia</i> sp.	Arachnida	Araneae	Theraphosidae	*			Theraphosid spider; not an SRE
<i>Latrodectus hasseltii</i>	Arachnida	Araneae	Theridiidae	•			Redback spider; not an SRE
<i>Synsphyronus</i> sp.	Arachnida	Pseudoscorpiones	Garypidae	•			Pseudoscorpion; SRE status undetermined
<i>Beierolpium "8/4"</i>	Arachnida	Pseudoscorpiones	Olpiidae			*	Pseudoscorpion; SRE status undetermined
<i>Scolopendra laeta</i>	Chilopoda	Scolopendromorpha	Scolopendridae		•		Centipede; not an SRE
<i>Thereuopoda lesueurii</i>	Chilopoda	Scutigermorpha	Scutigerae		•		Scutigermorph; not an SRE
<i>Austropeplea caurina</i>	Gastropoda	Hygrophila	Lymnaeidae	•			Aquatic snail
<i>Peplimnea affinis</i>	Gastropoda	Hygrophila	Lymnaeidae	•			Aquatic snail
<i>Gyraulus hesperus</i>	Gastropoda	Hygrophila	Planorbidae	•			Aquatic snail
<i>Straparollus (Euomphalus) sp.</i>	Gastropoda	Euomphalina	Euomphalidae	•			Fossil snail
<i>Brokenriveria virginensis</i>	Gastropoda	Euomphalina	Platyceeratidae	•			Fossil snail
<i>Euconospira nodosa</i>	Gastropoda	Murchisoniina	Gosseletinidae	•			Fossil snail
<i>Mourlonia teichertensis</i>	Gastropoda	Murchisoniina	Gosseletinidae	•			Fossil snail
<i>Murchisonia</i> sp. A	Gastropoda	Murchisoniina	Murchisoniidae	•			Fossil snail
<i>Hesperella canningensis</i>	Gastropoda	Murchisoniina	Porcellidae	•			Fossil snail
<i>Rhagada</i> sp.	Gastropoda	Stylommatophora	Camaenidae	•			Land snail; SRE status undetermined
<i>Westraltrachia ampla</i>	Gastropoda	Stylommatophora	Camaenidae	•		* (shells only)	Land snail; not an SRE
<i>Westraltrachia ascita</i>	Gastropoda	Stylommatophora	Camaenidae	•			Land snail; not an SRE
<i>Westracystis lissus</i>	Gastropoda	Stylommatophora	Helicarionidae	•			Land snail; not an SRE
<i>Gastrocopta pediculus</i>	Gastropoda	Stylommatophora	Pupillidae	•			Land snail; not an SRE
<i>Pupoides pacificus</i>	Gastropoda	Stylommatophora	Pupillidae	•			Land snail; not an SRE

Appendix 5

Ranking of Conservation Significant Fauna Species in WA



1. Threatened Species

Conservation significant species are those native species that are rare, threatened with extinction or have high conservation value, and are in need of special protection under the WA *Wildlife Conservation Act 1950* or the Commonwealth EPBC Act. The statutory framework for each of these is outlined below.

1.1 Western Australian *Wildlife Conservation Act 1950*

Under the WA *Wildlife Conservation Act 1950*, classification of rare and endangered fauna are currently provided in the *Wildlife Conservation (Specially Protected Fauna) Notice 2014*, which recognises four distinct schedules of taxa:

1. Schedule 1 taxa that are rare or likely to become extinct and are declared to be fauna in need of special protection;
2. Schedule 2 taxa that are presumed to be extinct and are declared to be fauna in need of special protection;
3. Schedule 3 birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, which are declared to be fauna in need of special protection; and
4. Schedule 4 taxa that are in need of special protection, otherwise than for the reasons mentioned in paragraphs (1), (2) and (3).

1.2 Commonwealth EPBC Act

Fauna species of national environmental significance are listed under the EPBC Act, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk':

- 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, and 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 (Department of the Environment 2014). 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).

2. Department of Parks and Wildlife Priority Fauna Listing

In addition, the Department of Parks and Wildlife maintains a list of fauna that are deemed a priority, but have not been assigned statutory protection under the *Wildlife Conservation Act 1950* (Department of Parks and Wildlife 2014c). Species on this list are considered to be of conservation priority because there is insufficient information available 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, five categories of priority are utilised:

- Priority One Taxa with few, poorly known populations on threatened lands
Taxa that are known from a few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority Two Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands
Taxa that are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority Three Taxa with several, poorly known populations, some on conservation lands
Taxa that are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
- Priority Four Taxa in need of monitoring
Taxa that are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Taxa that are declining significantly but are not yet threatened.
- Priority Five Taxa in need of monitoring
Taxa that are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Appendix 6

Echolocation Survey of Bat Activity in the Mimbi Study Area



**Mimbi Level 1 fauna survey
Kimberley WA,
March 2015**

Echolocation Survey of Bat Activity.

DRAFT A

Prepared for Biota Environmental Sciences

Bat Call WA Pty Ltd
ABN 26 146 117 839
43 Murray Drive
Hillarys Western Australia 6025
bullen2@bigpond.com
+61 8 9402 1987
+61 488 930 735

Prepared by:
R. D. Bullen – Bat Call WA
Issue A
7 April 2015

This document has been prepared to the requirements of Biota Environmental Sciences. It may be cited for the purposes of scientific research or other reasonable use. It may not be reproduced or distributed to any third party by hardcopy or electronic means without the permission of the client or Bat Call WA.

Document Revision History

Date	Issue	Revision History
7 April 2015	Issue A	Initial draft prepared for Biota

Summary

Microbat species presence is presented for eighteen recording nights at Mimbi in the Kimberley, Western Australia (WA). Biota Environmental Sciences carried out a level 1 survey for echolocating bats during March 2015. Bat Call WA has reviewed the recordings made and provided species lists for the bats present.

Thirteen species of echolocating bats were recorded including the Environmental Protection and Biodiversity Conservation Act (EPBC) listed Bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus nudichuniatus*) and WA priority species Orange leaf-nosed bat (*Rhinonicteris aurantia*), Ghost bat (*Macroderma gigas*) and Yellow-lipped cave bat (*Vespadelus douglasorum*).

Recommendations for follow-on survey activity for *S. saccolaimus* are presented.

Habitats

Five sites for the survey were chosen by Biota. Details of the sites are presented in Table 1. Three are in minor drainage lines, one is in a gorge in the limestone range and one is at a cave entrance in the limestone range. The locations of the sites are shown in relation to the locality's features in Figure 1.

Bat Fauna

An assemblage of twelve insectivorous species and one carnivorous species was confirmed as present at the study sites, Tables 2 and 3.

One call recorded on the night of the 12th March at MIMbat-03 has the characteristics of the listed species *S. saccolaimus* (EPBC status Critically Endangered; Woinarski *et al.* 2014 status Near Threatened; WA status not listed). This species is difficult to identify due to its search mode call being similar to *S. flaviventris* and *C. jobensis* nevertheless the call recorded meets the characteristic frequency, frequency variation, Q6dB, pulse duration and temporal spacing characteristics of *S. saccolaimus* and is therefore considered a positive identification.

Three other WA priority species were detected. These are *R. aurantia* (Schedule 1 in WA Wildlife Conservation Act 1950), *M. gigas* (WA DPaW Priority 4) and *V. douglasorum* (WA DPaW Priority 2). *R. aurantia* and *V. douglasorum* were detected generally across the study area with activity levels varying from low to high, see criteria below. One call from *M. gigas* was detected at site '05.

Activity levels for the other species varied from low to high depending upon the site and the recording night. This is expected for the study area habitat and the time of year.

S. saccolaimus roosts in groups in larger tree hollows. The other three priority species are obligate cave roosters.

Survey Timing, Moon Phase and Weather

The survey was conducted between 9th and 13th March 2015. Sampling evenings were hot and mostly dry with minimum overnight temperatures around 25^oC. The moon in this period was at last quarter. These conditions correspond to typical levels of bat echolocation detection for the season.

Survey Team

A team of Biota ecologists conducted the bat sampling work. Bob Bullen of Bat Call WA completed analysis of echolocation recordings.

Sampling

The survey consisted of completing a total of eighteen overnight bat sound recordings, beginning at twilight, at five locations within the survey area, Table 1. The recordings were “continuous” (Hyder *et al.* 2010) made using SM2BAT+ SongMeter (Wildlife Acoustics Inc, USA) detectors.

For the recordings, once reformatted as .wav files, COOL EDIT 2000 (Now available as AUDITION from Adobe Systems Inc.) was used to display each sequence for identification. Calls were identified manually. Only good quality call sequences were used. Details of calls analysed are provided in Table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in McKenzie and Bullen 2009, McKenzie and Bullen 2012 and Milne *et al.* 2009.

Bat activity was characterised as “Low”, “Medium” or “High” based on the rate of call sequences recorded.

- Low species activity is referred when a species is recorded with call spacing less often than ten minutes,
- Medium species activity refers to call recordings more often than 10 minutes but less often than two minutes apart for a at least an hour followed by sporadic records for the remainder of the session.
- High species activity refers to call recording more often than two minutes apart for at least two hours followed by reasonably regular records for the remainder of the session.

Survey Limitations

The sites surveyed were accessible on foot and the SM2, using an omnidirectional microphone, was set on the ground with the microphone horizontal. Species are unlikely to be under-represented as a result.

Bat species density away from cave or adit entrances is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

Recommendations

The identification of *S. saccolaimus* at Mimbi represents a record outside the currently published range for the species (Woinarski *et al.* 2014). Given its EPBC listing, it is recommended that the impact area for the Mimbi project be re-surveyed targeting roosts used by this species. It is known to use tree hollow roosts in a similar manner to *S. flaviventris* (Hall *et al.* 2008). In the western half of its range it is also known to be difficult to identify when in hand or visually from a distance due to its similarity in size and pelage colour to *S. flaviventris* (Milne *et al.* 2009). The targeted survey therefore should include an investigation of all hollow bearing trees in the impact area (after Department of Environment 2010). Hollows within reach should be investigated visually, either manually or by using a video camera. Large hollows out of reach should be investigated using an ultrasonic detector placed as close as possible to the hollow. If a *Saccolaimus* sp. roost is identified within the impact area it is recommended that a specimen be caught using a suitably hung mist net and genetic samples be taken for confirmation of identification.

Opportunistically, caves identified close to the project impact area should be assessed for the three obligate cave roosting priority species identified as present at the site.

I. References

- ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* **27**: 6-9.
- Department of Environment (2010). *Survey guidelines for Australia's threatened bats*. Commonwealth of Australia, pp 25-27.
- Hall, L.S., Thomson, B.G. and Milne, D.J. (2008). Bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus*). In *The mammals of Australia, third edition* (eds S. Van Dyck and R. Strahan) Reed New Holland: Sydney pp 475-476.
- Hyder, B.M., Dell, J. and Cowan, M.A. (eds) (2010). *Technical guide – Terrestrial vertebrate fauna surveys for environmental impact assessment*. Technical report of the Environmental Protection Authority and the Department of Environment and Conservation.
- McKenzie, N.L. and Bullen R.D. (2009). The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. *Records of the Western Australian Museum Supplement* **78**:123-155.
- McKenzie N.L. and Bullen R.D. (2012). An acoustic survey of zoophagic bats on islands in the Kimberley, Western Australia, including data on the echolocation ecology, organisation and habitat relationships of regional communities. *Records of the Western Australian Museum Supplement* **81**: 67-108.
- Milne, D.J., Jackling, F.C., Sidhu, M. and Appleton, B.R. (2009). Shedding new light on old species identifications: morphological and genetic evidence suggest a need for conservation status review of the critically endangered bat, *Saccolaimus saccolaimus*. *Wildlife Research* **36**: 496-508.
- Reardon, T.B., McKenzie, N.L., Cooper, S.J., Appleton, B. Carthew, S. and Adams, M. (2014). A molecular and morphological investigation of species boundaries and phylogenetic relationships in Australian free-tailed bats *Mormopterus* (Chiroptera: Molossidae). *Australian Journal of Zoology*, available on-line 23 April 2014.
- Woinarski, J.C.Z., Burbidge, A.A. and Harrison, P.L. (2014). *The action plan for Australian mammals 2012*. CSIRO Publishing, Collingwood Australia, pp 511-514.

Table 1 Site Specific details.

Location	Detector details	Site description	Latitude	Longitude
MIMbat-01	Four nights recordings using SM2 85-01	Minor ephemeral drainage bed, dry.	-18° 43' 10"	126° 3' 2"
MIMbat-02	Four nights recordings using SM2 93-01	Limestone outcrop in a minor ephemeral drainage line.	-18° 42' 55"	126° 3' 11"
MIMbat-03	Four nights recordings using SM2 98-01	Narrow limestone gorge	-18° 43' 50"	126° 2' 29"
MIMbat-04	Five nights recordings using SM2 84-01	Cave entrance on a limestone slope	-18° 43' 2"	126° 3' 47"
MIMbat-05	One nights recording using SM2 85-02	Permanent pool in a minor drainage line.	-18° 43' 22"	126° 2' 46"

Table 2: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peakC} kHz	Ave. Q	Typical Duration msec	Typical Call Shape
<i>Chaerephon jobensis</i> (Miller 1902)	Northern free-tailed bat	22	5	8 - 15	Shallow FM
<i>Chalinolobus gouldii</i> (Grey 1841)	Gould's wattled bat	32	10	7 - 11	FM
<i>Hipposideros ater</i> Templeton 1848	Dusky leaf-nosed bat	155	35	3-9	CF
<i>Macroderma gigas</i> (Dobson 1880)	Ghost bat	20 – 52 variable	2 – 20 variable	variable	Complex FM
<i>Miniopterus schreibersii orianae</i> Thomas 1922	Northern bent-winged bat	50	8	5 - 8	FM
<i>Mormopterus lumsdenae</i> Reardon 2014	Beccari's free-tailed bat	26	10	8 - 13	Shallow FM
<i>Rhinonictoris aurantia</i> (Gray 1845)	Pilbara leaf-nosed bat	112	30	5 - 8	CF
<i>Saccolaimus flaviventris</i> (Peters 1867)	Yellow-bellied sheath-tailed bat	18	9	12 - 21	CF - FM
<i>Saccolaimus saccolaimus nudicluniatu</i> (De Vis 1905)	Bare-rumped sheath-tailed bat	21	10	8 - 20	CF - FM
<i>Taphozous georgianus</i> Thomas 1915	Common sheath-tailed bat	24.5	14	9 - 18	CF– shallow FM

Genus species Authority	Common name	Typical F_{peakC} kHz	Ave. Q	Typical Duration msec	Typical Call Shape
<i>Vespadelus caurinus</i> (Thomas 1914)	Northern cave bat	60	10	4 - 8	FM
<i>Vespadelus douglasorum</i> (Kitchener 1976)	Yellow-lipped cave bat	51	15	5 - 13	FM
<i>Vespadelus finlaysoni</i> (Kitchener, Jones and Caputi 1987)	Inland cave bat	55	14	4 - 8	FM

Note 1: F_{peakC} and Q are defined in McKenzie and Bullen 2003, 2009.

Note 2: *M. lumsdenae* was known until 2014 as *M. beccarii*

Table 3. Microbat lists obtained by site

Site	Date	<i>Chaerephon jobensis</i>	<i>Chalinolobus gouldii</i>	<i>Hipposideros ater</i>	<i>Macroderma gigas</i>	<i>Miniopterus schreibersii orianae</i>	<i>Mormopterus lumsdenae</i>	<i>Rhinonictus aurantia</i>	<i>Saccolaimus sp. Note 1</i>	<i>Saccolaimus saccolaimus Note 2</i>	<i>Taphozous georgianus</i>	<i>Vespadelus caurinus</i>	<i>Vespadelus douglasorum</i>	<i>Vespadelus finlaysoni</i>
MIMbat-01	9 – 12 Mar	Yes	Yes			Yes	Yes	Yes			Yes	Yes	Yes	Yes
MIMbat-02	9 – 12 Mar			Yes		Yes	Yes	Yes			Yes	Yes		Yes
MIMbat-03	10 – 13 Mar	Yes		Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	
MIMbat-04	9 – 13 Mar	Yes				Yes	Yes	Yes			Yes	Yes	Yes	Yes
MIMbat-05	13 Mar		Yes	Yes	Yes		Yes	Yes			Yes	Yes	Yes	Yes

Note 1: Two calls were recorded that are confirmed as *Saccolaimus* sp. They may be either *S. Saccolaimus* or the more common *S. flaviventris*.

Note 2: One call was recorded that has the characteristics of *S. saccolaimus*.

Figure 1. Location of study area sites in relation to local features.

