



PHOENIX

ENVIRONMENTAL SCIENCES

Terrestrial fauna survey for the Leonora Gold Project

Prepared for Kin Mining Ltd

September 2019

Final Report



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Final Report

Authors: John Scanlon

Reviewer: Jarrad Clark

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[Phoenix Environmental Sciences Pty Ltd](#)

1/511 Wanneroo Rd BALCATTA WA 6021

P: 08 6323 5410

E: admin@phoenixenv.com.au

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EXECUTIVE SUMMARY

Kin Mining Ltd is in the process of seeking approval to develop the Leonora Gold Project, comprising a series of adjoining tenements located 25 km east of Leonora and is approximately 13,924 ha (or 139 km²) in area. Phoenix Environmental Sciences Pty Ltd was commissioned by Kin Mining to undertake a Level 1 terrestrial fauna survey for the LGP.

A Level 1 survey was undertaken 1-4 April 2019. A total of 33 sites were completed (habitat assessment, active searches and timed bird surveys and bat echolocation recordings) in order to characterise the vertebrate fauna assemblage and detect Threatened and Priority species.

The desktop review identified 274 terrestrial vertebrates as potentially occurring, comprising 30 significant terrestrial vertebrate fauna species (23 birds and seven mammals) and two Priority invertebrate taxa.

The field survey identified a total of 65 species (two amphibians, 12 reptiles, 38 birds and 14 mammals), including one extant significant species, Long-tailed Dunnart (P4). Based on the habitats present and historical records in the vicinity of the study area an additional seven significant species are considered to have the potential to occur.

The potential for the study area to support SREs is constrained to significant outcrops, which are few and not proposed to be impacted.

The study area has relatively low relief and rounded hills with few prominent outcrops, which is typical for the East Murchison region. Less typically, it has no desert sandplains or salt lakes, and only small areas of hummock grassland within shrubland or open woodland habitats.

Habitat mapping based on recent vegetation mapping by MWH (2017) and Western Botanical (2019) as well as topography, aerial imagery and field observations during the fauna survey has identified eight broad habitats. These are dominated by Mulga woodland on plains (44%), Shrubland on plains (24%) and *Acacia* shrubland on stony hills (12%). Small but distinctive areas (less than 2% each) of outcropping and breakaway and vegetated gilgai/claypans also occur.

The majority of significant species identified in the desktop study are considered unlikely to occur or may be present only occasionally during wide-ranging foraging (e.g. Peregrine Falcon, Grey Falcon) or dispersal (e.g. Malleefowl), and would not depend on any particular resources or features of the study area.

Significant (but not critical) habitat occurs for three species of conservation significant vertebrates known or likely to be resident:

- potential breeding habitat of Grey Falcon (VU) and Peregrine Falcon (OS) in Mulga woodland on plain (e.g. areas of *Acacia papyrocarpa* woodland with crow nests)
- additional highly suitable breeding habitat for Peregrine Falcon in Cleared areas (specifically, artificial cliffs of old mine pits in Mertondale area)
- overhangs and crevices in outcropping and breakaway habitat inferred to be occupied by Long-tailed Dunnart (P4), and also provide refugia, hunting perches, dens etc. for a range of ecologically significant (but not conservation listed) vertebrates including Wedge-tailed Eagle, Dingo, Euro, Short-beaked Echidna, and formerly for (regionally extinct) Stick-nest Rat (VU).

Calcrete hardpan is present close to the soil surface of hills and plains in much of the study area, associated with burrow complexes of an extinct subspecies of Burrowing Bettong (Boodie). These historic warrens provide important habitat for various species of extant fauna but are not associated with any conservation listed species.

1 INTRODUCTION

Kin Mining Ltd (Kin Mining) is in the process of seeking approval to develop the Leonora Gold Project (LGP), comprising a series of adjoining tenements located 25 km east of Leonora and is approximately 13,924 ha (or 139 km²) in area (Figure 1-1).

Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Kin Mining to undertake a Level 1 terrestrial fauna survey for the LGP.

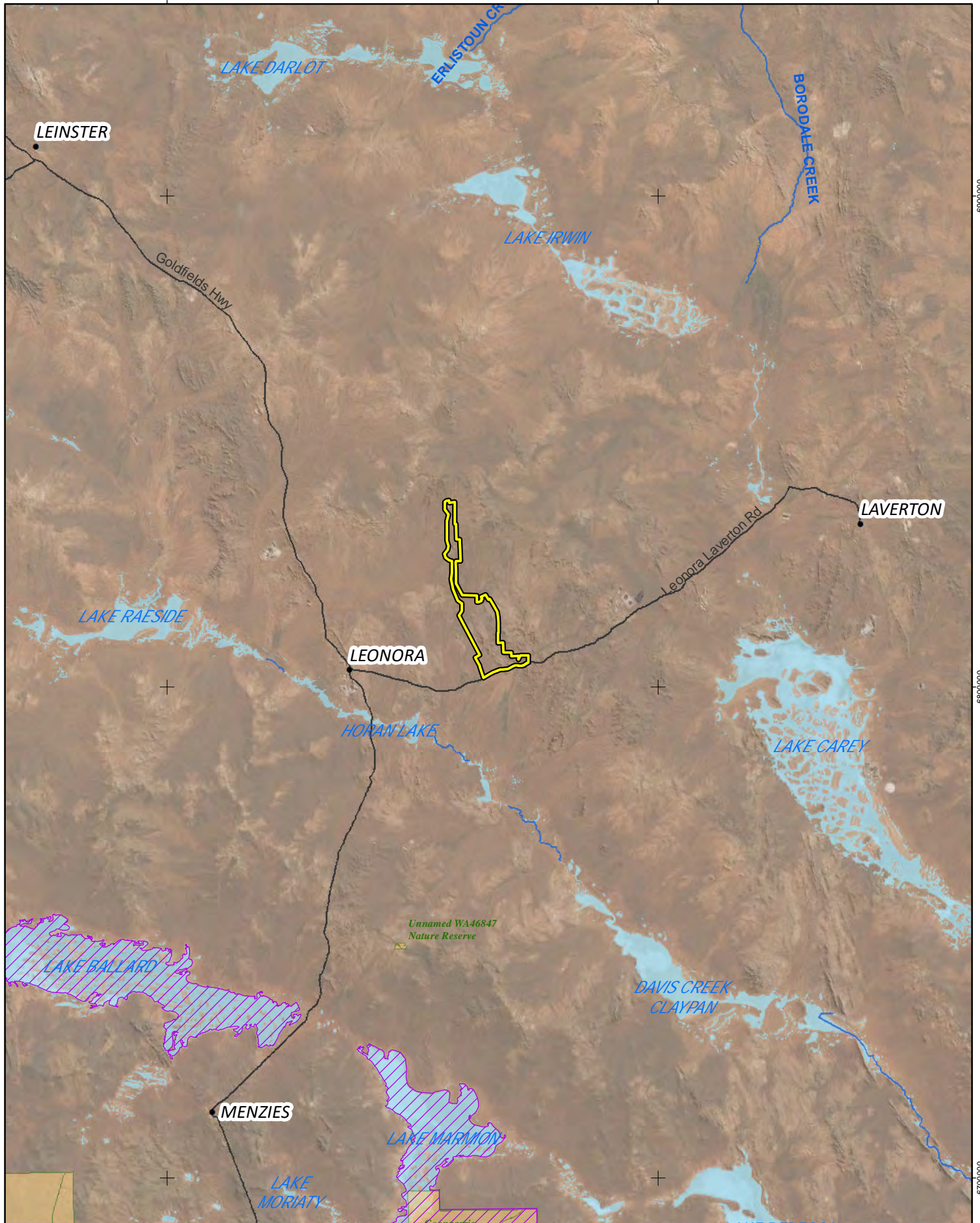
1.1 SCOPE OF WORK

The scope of works was as follows:

- update desktop review conducted as part of previous surveys to include new findings (e.g. new listings of significant taxa, name changes etc.) and changes to taxa in databases
- conduct Level 1 vertebrate fauna survey that includes –
 - general species inventory through
 - timed avifauna surveys
 - active diurnal and nocturnal foraging
 - echolocation recording for bats
 - targeted searches for significant species such as Malleefowl and Night Parrot, if required
 - fauna habitat mapping for –
 - significant species
 - general fauna habitat, based on the vegetation spatial dataset (Western Botanical 2019)
- prepare a terrestrial fauna technical report, including short-range endemic (SRE) desktop assessment, to document the survey findings
- prepare maps showing significant species records and fauna habitats in the study area.

1.2 STUDY AREA

The study area is a single contiguous area covering a total of 13,924 ha (Figure 1-1).



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Kin Mining Terrestrial Fauna Survey for the Leonora Gold Project		
Project No	1249	
Date	15-Aug-19	
Drawn by	AL	
Map author	JS	1:1,000,000 (at A4)
		GDA 1994 MGA Zone 51

- Study area
- Road
- Environmentally Sensitive Area (ESA)
- Conservation Reserve (CAPAD)

Figure 1-1
Project location and study area



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2 LEGISLATIVE CONTEXT

The protection of flora and fauna in Western Australia (WA) is principally governed by three acts:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *State Biodiversity Conservation Act 2016* (BC Act)
- *State Environmental Protection Act 1986* (EP Act).

The BC Act came into full effect on 1 January 2019 and replaced the functions of the *Wildlife Conservation Act 1950* (WC Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of the Environment and Energy (DoEE). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance (NES), require approval from the Australian Government Minister for the Environment through a formal referral process. The EPBC Act provides for the listing of Threatened native fauna as matters of NES.

Conservation categories applicable to Threatened fauna species under the EPBC Act are as follows:

- Extinct (EX)¹ – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)¹ – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

The EPBC Act is also the enabling legislation for protection of Migratory species as matters of NES under several international agreements:

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

2.2 STATE

2.2.1 Threatened and Priority species

¹ Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

In WA, the BC Act provides for the listing of Threatened fauna species in the following categories:

- critically endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future²
- endangered (EN) – species facing a very high risk of extinction in the wild in the near future²
- vulnerable (VU)– species facing a high risk of extinction in the wild in the medium-term future².

Species may also be listed as specially protected under the BC Act in the one or more of the following categories:

- species of special conservation interest – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- Migratory species
- cetaceans
- species subject to international agreement
- the category of species otherwise in need of special protection.

The Department of Biodiversity Conservation and Attractions (DBCA) administers the BC Act and maintains a non-statutory list of Priority fauna. Priority species are still considered to be of conservation significance – that is they may be rare or threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority fauna list are assigned to one of four Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a Threatened Ecological Community and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Other significant fauna

Under the Environmental Protection Authority's (EPA) environmental factor guideline (EPA 2016c), terrestrial fauna may be considered significant for a range of reasons other than listing as a Threatened or Priority species. EPA (2016c) identifies the following attributes that may constitute significant fauna:

- species with restricted distribution
- species subject to a degree of historical impact from threatening processes
- providing an important function required to maintain the ecological integrity of a significant ecosystem.

2.2.4 Short-range endemic invertebrates

SRE fauna are defined as animals that display restricted geographic distributions, nominally less than 10,000 km², that may also be disjunct and highly localised (Harvey 2002; Ponder & Colgan 2002). Short-

² As determined in accordance with criteria set out in the ministerial guidelines.

range endemism in terrestrial invertebrates is believed to have evolved through two primary processes (Harvey 2002), relictual short-range endemism – where drying climate has forced range contraction into small pockets with remaining moist conditions (e.g. south-facing rock faces or slopes of mountains or gullies) – and habitat specialist SREs that may have settled in particular isolated habitat types (e.g. rocky outcrops) by means of dispersal and evolved in isolation into distinct species. However, SRE invertebrates have also been reported in more widespread habitats such as spinifex plains or woodlands, mainly in groups with low dispersal capabilities, for example mygalomorph spiders and millipedes.

There can be uncertainty in categorising a specimen as SRE due to several factors including poor regional survey density, lack of taxonomic research and problems of identification, i.e. specimens that may represent SREs cannot be identified to species level based on the life stage at hand. For example, in contrast to mature males, juvenile and female millipedes, mygalomorph spiders and scorpions cannot be identified to species level. Molecular techniques such as ‘barcoding’ (Hebert *et al.* 2003a; Hebert *et al.* 2003b) are routinely employed to overcome taxonomic or identification problems.

Currently, there is no accepted system to determine the likelihood that a species is an SRE. The WA Museum applies four categories which were adopted in this assessment: confirmed, potential, uncertain and not SRE. Confirmed SREs are taxa for which the distribution is known to be less than 10,000 km², the taxonomy is well known and the group is well represented in collections and/ or via comprehensive sampling (Western Australian Museum 2013). Potential SREs include those taxa for which there is incomplete knowledge of the geographic distribution of the group and its taxonomy, and the group is not well represented in collections.

The EPA’s environmental factor guideline for Terrestrial Fauna (EPA 2016c) identifies species with restricted distributions as being significant fauna in the context of environmental impact assessments (EIA). SRE fauna need to be considered in EIA as localised, small populations of species that are generally at greater risk of changes in conservation status due to environmental change than other, more widely distributed taxa. The likelihood of SRE occurrence therefore needs to be considered early in the environmental scoping stage of any proposal (EPA 2016h).

3 EXISTING ENVIRONMENT

3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) defines 'bioregions' as large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems (DoE 2012; Thackway & Cresswell 1995b). They categorise the large-scale geophysical patterns that occur across the Australian continent that are linked to fauna and flora assemblages and processes at the ecosystem scale (Thackway & Cresswell 1995a).

The study area is situated within the Eastern Murchison subregion (MUR01) of the Murchison bioregion (Figure 3-1). The Eastern Murchison subregion is characterised by Cowan (2001) as:

- Extensive areas of elevated red desert sandplains with minimal dune development with internal drainage
- Salt lake systems associated with the occluded Palaeodrainage system
- Broad plains of red-brown soils and breakaway complexes as well as red sandplains
- Vegetation dominated by Mulga woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands
- Arid climate, with mainly winter rainfall (200 mm).

Rare features within the subregion include calcrete aquifers in the northern part of the subregion known to support a wide range of subterranean fauna and the Lake Barlee salt lake (~153 km west of the study area) which acts a refuge site for Migratory shorebirds following intermittent inundation (Cowan 2001).



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Kin Mining Terrestrial Fauna Survey for the Leonora Gold Project		
Project No	1249	
Date	04-Jul-19	
Drawn by	AL	
Map author	JS	
1:1,300,000 (at A4)		GDA 1994 MGA Zone 51

- Study area
- IBRA region, subregion
- Murchison, Eastern Murchison
- Great Victoria Desert, Shield

Figure 3-1
Study area in relation to IBRA bioregions and subregions



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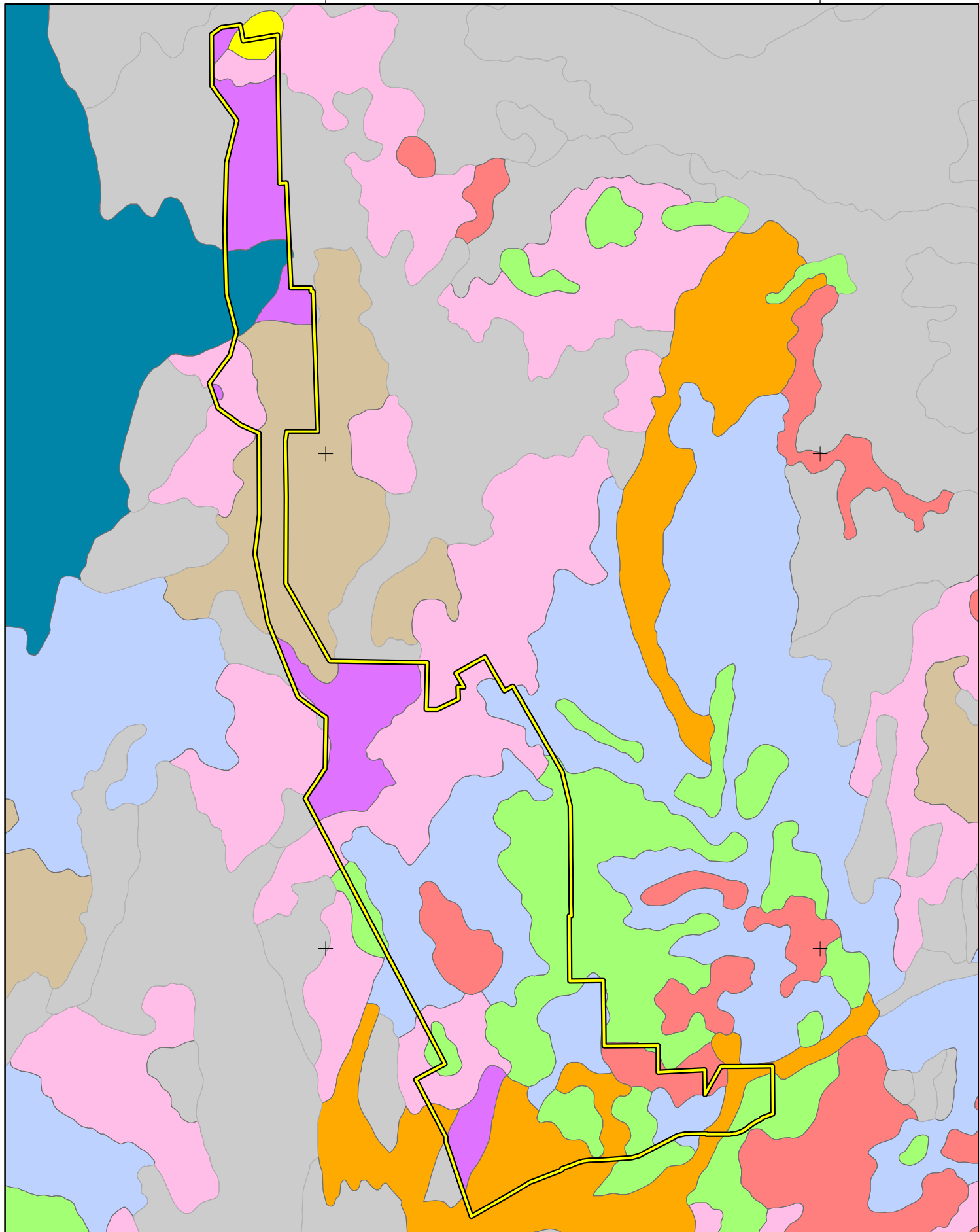
3.2 LAND SYSTEMS

The study area intersects nine land systems mapped by the Department of Agriculture and Food (DAFWA) (Table 3-1; Figure 3-2). No single system predominates, with substantial areas of Gundockerta, Jundee, Leonora, and Nubev land systems occupying similarly large areas (>15%). The remaining five land systems combined occupy 27% of the study area.

Table 3-1 **Extent of each land system in the study area**

Land system	Description	Area (ha)	% of study area
Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.	3,004.52	21.58%
Jundee System	Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved Mulga shrublands.	2,470.82	17.74%
Laverton System	Greenstone hills and ridges with <i>Acacia</i> shrublands.	803.86	5.77%
Leonora System	Low greenstone hills and stony plains supporting mixed chenopod shrublands.	2,230.62	16.02%
Monitor System	Distributary alluvial fans and wash plains supporting Mulga - chenopod shrublands.	1,171.5	8.41%
Monk System	Hardpan plains with occasional sandy banks supporting Mulga tall shrublands and wanderrie grasses.	363.34	2.61%
Nubev System	Gently undulating stony plains, minor limonitic low rises and drainage floors supporting Mulga and halophytic shrublands.	2,499.04	17.95%
Violet System	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved Mulga and bowgada shrublands and occasionally chenopod shrublands.	1,295.5	9.30%
Wyarri System	Granite domes, hills and tor fields with gritty-surfaced fringing plains supporting Mulga and granite wattle shrublands.	85.06	0.61%
Total		13,924.26	100%

In the Soil_landscapeSystemsDAFWA_019_1 shapefile (DAFWA 2014), part of the study area was identified as Mindura LS, which is not mentioned in the relevant documentation (Pringle *et al.* 1994). Mindura LS is only described from the Murchison region, in a different report (Hennig *et al.* 1994). In a new edition of the dataset (SoilLandscapeMapping_RangelandsDPIRD_063, Department of Primary Industries and Regional Development 2019) the same area is correctly identified as Monitor LS.



Kin Mining
Terrestrial Fauna Survey for the Leonora Gold Project

Project No	1249
Date	11-Jul-19
Drawn by	AL
Map author	JS

0 1.25 2.5 5
Kilometres

1:150,000(at A4) GDA 1994 MGA Zone 51

- Study area
- Land System**
- Gundockerta System
- Laverton System
- Leonora System

- Monitor System
- Monk System
- Nubev System
- Violet System
- Wyarri System
- Other Land Systems

Figure 3-2
Land systems of the study area



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3.3 CLIMATE AND WEATHER

The climate of the East Murchison subregion is described as arid with winter rainfall (Cowan 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Laverton Aero (no. 012305, Latitude: 28.61°S Longitude: 122.42°E), approximately 80 km east-northeast of the study area. Laverton Aero records the highest mean maximum monthly temperature (35.5°C) in January and the lowest in June (18.4°C). The lowest minimum mean monthly temperature occurs in July (5.9°C) and the highest in January (21.5°C) (BoM 2019) (Figure 3-3). Average annual rainfall is 302.8 mm with February, January and March recording the highest monthly averages historically (61.1, 48.8 and 42.6 mm, respectively). Tropical rain-bearing depressions moving southwards from north-western WA waters can sometimes cause heavy rainfall events during the summer months (BoM 2019) (Figure 3-3).

Daily mean temperatures preceding the surveys from April 2018 to March 2019 fluctuated above and below the long-term annual averages (Figure 3-3). Mean minimum and maximum temperatures recorded were close to annual averages, with the exception of April 2018 and in the lead-up to and during the survey; January-March 2019 recorded maximum temperatures that were 3–5 degrees higher than average for those months.

Rainfall in the 12 months preceding the survey was highly variable when compared to the long-term averages (Figure 3-3). Far above average rainfall was recorded for the months of November and December, but with almost none recorded in January and February, and was well below average in March immediately preceding the survey.

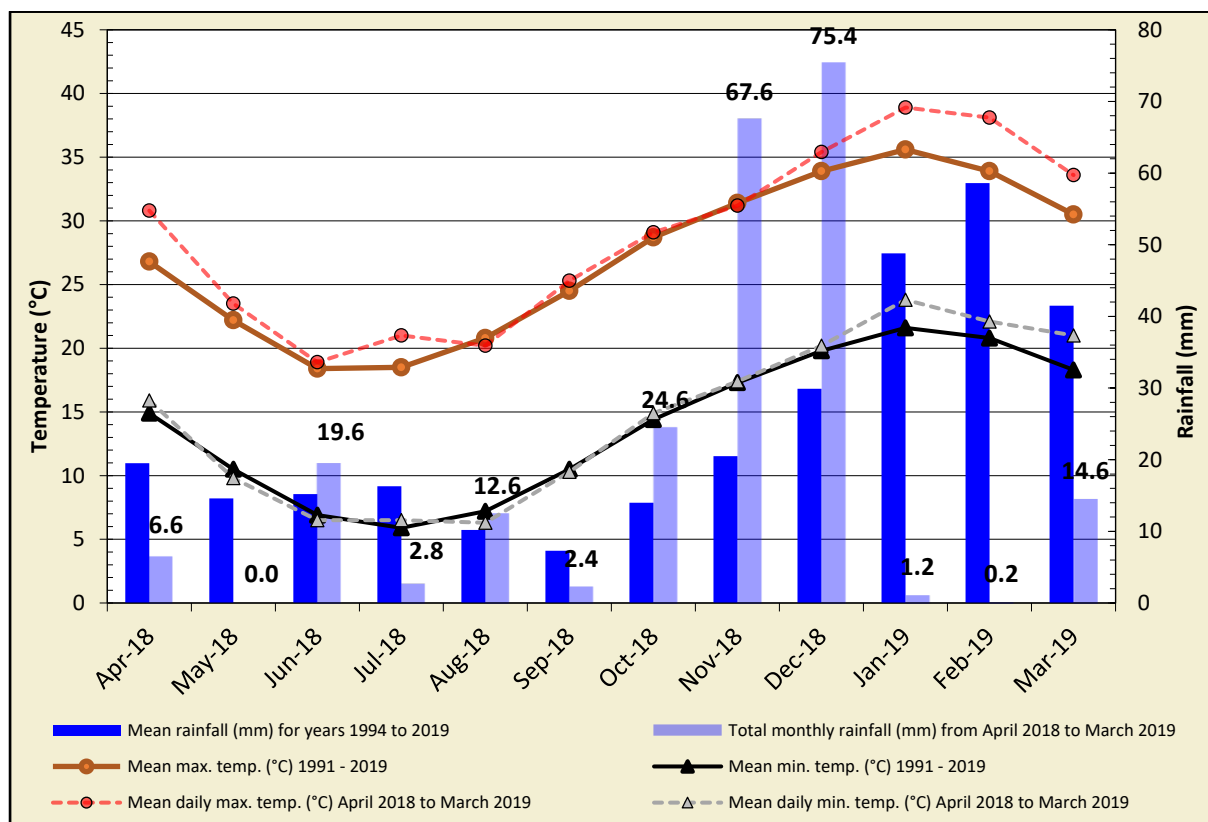


Figure 3-3 Annual climate and weather data for Laverton Aero (no. 012305) and mean monthly data for the 12 months preceding the field surveys (BoM 2019).

3.4 LAND USE

The dominant land use within the Eastern Murchison subregion is pastoral land with native pasture grazing, which occurs over approximately 85.47% of the subregion, followed by Crown Reserves (11.34%) (Cowan 2001). Land occupancy for mineral exploration and mining activities, particularly nickel and gold, are considerable within the subregion; however, most occur on pastoral lands where grazing occurs (Cowan 2001).

3.5 CONSERVATION RESERVES AND ENVIRONMENTALLY SENSITIVE AREAS

The study area is not situated within any conservation reserves or Environmentally Sensitive Areas (ESA's) (Figure 1-1). The nearest conservation reserve, an unnamed nature reserve, is located approximately 52 km south-southwest of the study area, followed by Goongarie National Park, approximately 95 km south of the study area (Figure 1-1). The nearest ESA is located approximately 70 km south-southwest of the study area and occurs within a large portion of the Goongarie National Park; however, it is not known what criteria this site meets as an ESA (Figure 1-1).

4 METHODS

The biological survey was conducted in accordance with relevant survey guidelines and guidance, including:

- EPA *Statement of Environmental Principles, Factors and Objectives* (EPA 2016d)
- EPA *Environmental Factor Guideline: Terrestrial fauna* (EPA 2016b)
- EPA *Technical Guidance: Terrestrial fauna surveys* (EPA 2016f)
- EPA *Technical Guidance: Sampling methods for terrestrial vertebrate fauna* (EPA 2016e).

4.1 DESKTOP REVIEW

4.1.1 Database searches and literature review

Database searches and a literature review were undertaken to identify the significant fauna values that may occur within the study area. Desktop review methods entailed:

- a review of existing environmental information relevant to the biological values of the study area including
 - base environmental datasets to define the physical characteristics of the study area
 - searches of relevant biological databases (Table 4-1)
- review of the most recent vegetation mapping for the project (Western Botanical 2019)
- assessment of ‘likelihood of occurrence’ of Threatened and Priority species.

Table 4-1 Database searches conducted for the desktop review

Database	Target group/s	Search coordinates and extent
Protected Matters Search Tool (DoEE 2019a)	EPBC Act Threatened flora and fauna	Approximate centre point of study area (-28.7538°, 121.5611°) with 40 km buffer
DBCA Threatened and Priority Fauna Database (DBCA 2019b)	Threatened and Priority fauna	As above
DBCA/WAM NatureMap Database (DBCA 2019a)	Fauna	As above.
Atlas of Living Australia area search (ALA 2019)	Fauna	As above.
WA Museum Arachnid and Myriapod Database (WAM 2019)	Arachnid and Myriapod SREs	100km ² search area encompassing the study area between -28.49°, 121.43° (northwest corner) and -28.99°, 121.81° (southeast corner)
WA Museum Mollusca Database (WAM 2019)	Mollusc SREs	As above

Table 4-2 Survey reports and datasets incorporated in the desktop review

Report author	Survey type	Project
Phoenix Environmental Sciences (2019)	Flora, vegetation and fauna surveys	Murrin Murrin Nickel Cobalt Project
Western Botanical (2019)	Flora, vegetation and fauna surveys	Leonora Gold Project (same area as this study)
Stantec Australia (2018b)	Flora, vegetation and fauna surveys	Leonora Gold Project (Mertondale haul road and pipeline deviation, Cardinia access road)
Stantec Australia (2018a)	Flora, vegetation and fauna surveys and habitat mapping	Leonora Gold Project (Cardinia, Raeside)
MWH Australia (2017)	Flora, vegetation and fauna surveys	Leonora Gold Project (Mertondale, Cardinia and Raeside)
Ecosmart Ecology (2012)	Level 2 fauna survey	Murrin Murrin Nickel Cobalt Project

4.2 FIELD SURVEY

4.2.1 Fauna and fauna habitat

Field work for the terrestrial fauna survey was conducted over four consecutive days from 1–4 April 2019.

Survey methods for terrestrial vertebrate fauna included standardised Level 1 fauna survey sites. A total of 31 Level 1 sites were surveyed within the study area (;). Survey methods for terrestrial vertebrates comprised the following:

- habitat assessment (for details see section 4.2.1.1)
- active searches (see 4.2.1.2)
- avifauna surveys (see 4.2.1.3)
- bat echolocation recordings (see 4.2.1.4).

4.2.1.1 Habitat assessment

Initial habitat characterisation was undertaken using various remote geographical tools, including aerial photography (Google Earth®), land system maps and topographic maps. Habitats with the potential to support conservation significant terrestrial fauna species were identified based on known habitats of such species within the Murchison bioregion.

Survey site selection considered aspect, topography and land systems. At the finer scale, consideration was given to proximity to water bodies (drainage lines and creek), vegetation complexes and condition, and soil type. Sites were primarily chosen to represent examples of distinct habitats within the broader habitat associations of the survey area, with a focus on habitat potentially suitable for species of conservation significance identified in the desktop review. Habitat descriptions and characteristics were recorded at all 31 Level 1 survey sites (; Appendix 1).

4.2.1.2 Active searches

Active searches were undertaken at each of the Level 1 survey sites (Figure 4-2; Table 4-3) and primarily targeted diurnal herpetofauna and mammals from direct sightings and secondary evidence. Searches were conducted by the zoologist and field assistant and focused primarily on conservation significant species identified in the desktop review as potentially occurring within the study area including Malleefowl. Opportunistic searches were also conducted at two sites with disturbed/modified habitat (Figure 4-2; Table 4-3).

Searches were undertaken in any observable microhabitats considered likely to support mammals, reptiles and amphibians. Techniques included: raking leaf and bark litter, overturning logs, searching beneath the bark of trees, investigating dead trees and logs, investigating burrows, investigating infrastructure ruins or disused building materials such as tin piles, and identifying any secondary evidence including tracks, diggings, scats, fur or sloughs (shed skins), predation or feeding sites, and fauna constructed structures such as pebble mounds or nests. A minimum of one-person hour was spent active searching at each site for a total of 32.5 hours over the duration of the field survey ().

4.2.1.3 Avifauna surveys and recordings

Twenty-minute avifauna surveys were undertaken at each of the Level 1 survey sites (Figure 4-2; Table 4-3). Avifauna surveys were confined to the habitat type (up to 2 ha) represented by each site to collect assemblage data for each habitat. Avifauna surveys were undertaken throughout the day with a focus on periods of higher activity around sunrise and sunset; each site was surveyed once, except for the three 'BAT' sites which were each visited twice. Surveys consisted of bird recordings from visual sightings and call recognition. A total of approximately 11.6 person hours (700 min) of avifauna census was undertaken during the field survey (Table 4-3).

Additional avifauna observations were also recorded at opportunistically while other field work was being completed, including observations made during travel and active searches.

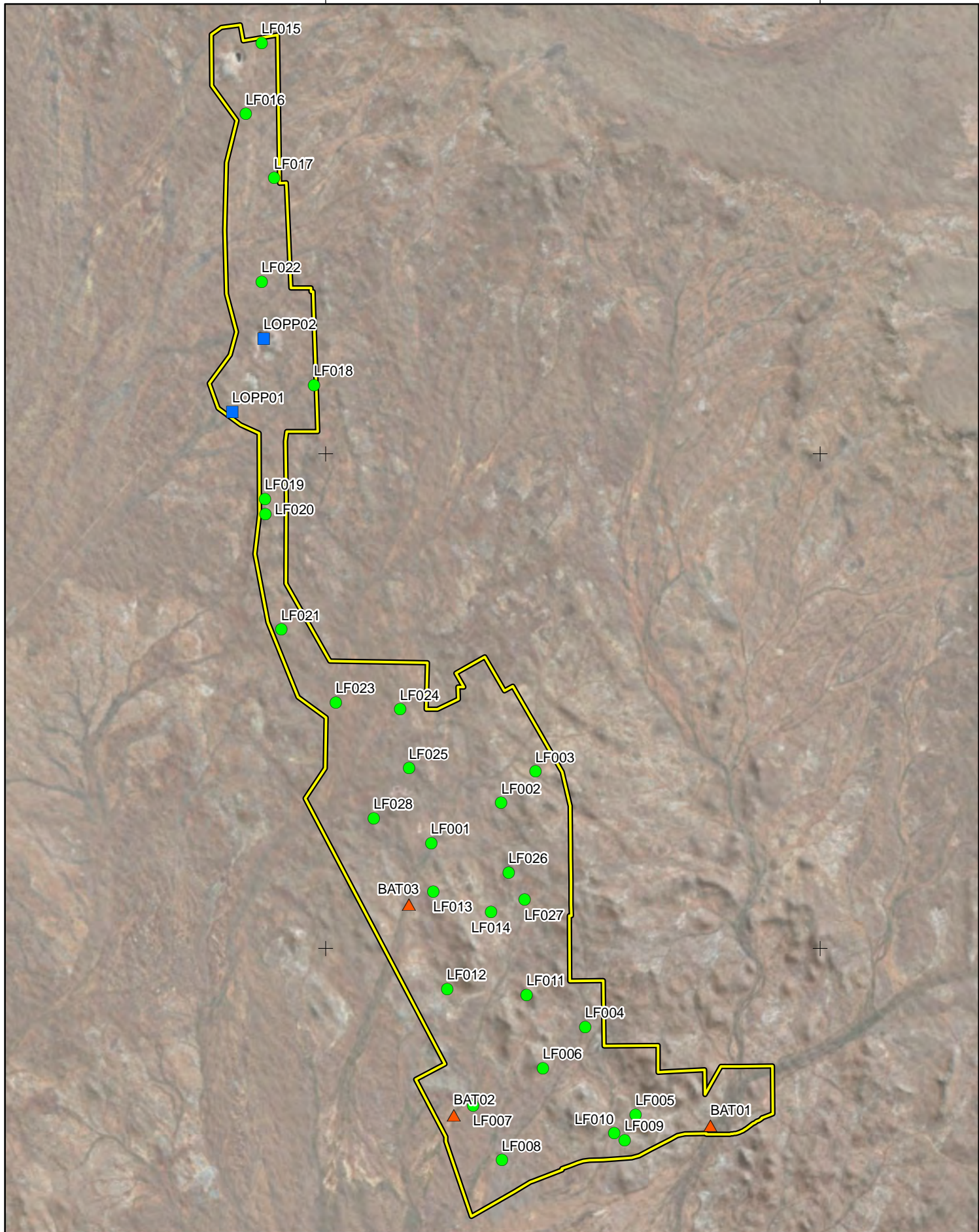
4.2.1.4 Bat echolocation recordings

SongMeter SM2 recording devices were used to record bat echolocation calls at three Level 1 sites during the field survey (BAT01-03; Figure 4-2; Table 4-3). Recording devices were deployed at each site for one night of recording for approximately 12 continuous hours per night (sunset-sunrise). Devices were aimed at a 45° angle to the ground. Recording sites were in areas of habitat likely to have increased insect activity and to attract bats (i.e. likely foraging areas or movement corridors) and/or potential roosting sites.

Table 4-3 Terrestrial fauna survey site locations and survey effort

Site	Site type	Latitude	Longitude	Vertebrate fauna		
				Active searches (hr)	Avifauna (min)	SongMeter (night)
LF001	Level 1 Fauna site	-28.8017	121.5982	1	20	
LF002	Level 1 Fauna site	-28.7909	121.6202	1	20	
LF003	Level 1 Fauna site	-28.7823	121.6308	1	20	
LF004	Level 1 Fauna site	-28.8524	121.6454	1	20	


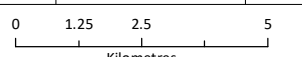
Site	Site type	Latitude	Longitude	Vertebrate fauna		
				Active searches (hr)	Avifauna (min)	SongMeter (night)
LF005	Level 1 Fauna site	-28.8766	121.6608	1	20	
LF006	Level 1 Fauna site	-28.8635	121.6321	1	20	
LF007	Level 1 Fauna site	-28.8736	121.6103	1	20	
LF008	Level 1 Fauna site	-28.8886	121.6191	1	20	
LF009	Level 1 Fauna site	-28.8835	121.6573	1	20	
LF010	Level 1 Fauna site	-28.8816	121.6541	1	20	
LF011	Level 1 Fauna site	-28.8434	121.6273	1	20	
LF012	Level 1 Fauna site	-28.8417	121.6026	1	20	
LF013	Level 1 Fauna site	-28.8149	121.5987	1	20	
LF014	Level 1 Fauna site	-28.8208	121.6166	1	20	
LF015	Level 1 Fauna site	-28.582	121.5486	1	20	
LF016	Level 1 Fauna site	-28.6015	121.5433	1	20	
LF017	Level 1 Fauna site	-28.6191	121.5519	1	20	
LF018	Level 1 Fauna site	-28.6759	121.5635	1	20	
LF019	Level 1 Fauna site	-28.7068	121.5478	1	20	
LF020	Level 1 Fauna site	-28.7111	121.5479	1	20	
LF021	Level 1 Fauna site	-28.7427	121.5524	1	20	
LF022	Level 1 Fauna site	-28.6475	121.5476	1	20	
LF023	Level 1 Fauna site	-28.7628	121.5691	1	20	
LF024	Level 1 Fauna site	-28.7649	121.5892	1	20	
LF025	Level 1 Fauna site	-28.7811	121.5917	1	20	
LF026	Level 1 Fauna site	-28.8099	121.6223	1	20	
LF027	Level 1 Fauna site	-28.8174	121.627	1	20	
LF028	Level 1 Fauna site	-28.7947	121.5805	1	20	
BAT01	Level 1 Fauna site + Ultrasonic recording	-28.8798	121.684	1	40	1
BAT02	Level 1 Fauna site + Ultrasonic recording	-28.8762	121.6042	1	40	1
BAT03	Level 1 Fauna site + Ultrasonic recording	-28.8183	121.5911	1	40	1
LOPP01	Opportunistic site	-28.683	121.538	1	20	
LOPP02	Opportunistic site	-28.663	121.5481	0.5		
Total				32.5	700	3




6625000

6610000



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 Study area

Survey site




-  Level 1 fauna site
-  Level 1 fauna site and Audio recording
-  Opportunistic site

Figure 4-1
Terrestrial fauna survey sites



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4.3 COMPARISON OF METHODS AGAINST APPLICABLE GUIDELINES

An assessment of the applied survey methods against numerous State and/or Federal government guidelines determined that the methods applied adhered to all applicable guidelines (Table 4-4).

Table 4-4 Assessment of survey methods against applicable guidelines

Guideline	Jurisdiction	Adherence	Comment
<i>Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA 2016g)</i>	State of Western Australia	Yes – Level 1 survey	Level 2 methods inappropriate for all significant species potentially occurring.
<i>Environmental Factor Guideline: Terrestrial fauna. (EPA 2016c)</i>	State of Western Australia	Yes – Level 1 survey	Level 2 methods inappropriate for all significant species potentially occurring.
<i>Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA 2016h)</i>	State of Western Australia	Yes – reconnaissance survey	No sampling required as survey indicated no habitat for SREs present.
<i>Interim guideline for preliminary surveys of Night Parrot (Pezoporus occidentalis) in Western Australia (DPaW 2017)</i>	State of Western Australia	Yes – reconnaissance survey	No sampling required as habitat assessment indicated no habitat present.
<i>National manual for the Malleefowl monitoring system. Standards, protocols and monitoring procedures (Natural Heritage Trust 2007)</i>	Australia – not legislated	Yes – reconnaissance survey	No targeted surveys required as Level 1 assessment and habitat assessment indicated species unlikely to occur.

4.4 ANALYSIS

4.4.1 Habitat classification

Mapped vegetation unit polygons (MWH Australia 2017; Western Botanical 2019) were assigned to fauna habitat types and aggregated taking into account:

- vegetation description and structure
- field observations made during the fauna survey, particularly substrate
- topography (outcrop/breakaway, stony hills, plains, drainage lines, and claypans/gilgai)
- inspection of aerial images

4.4.2 Likelihood of occurrence assessment

The potential occurrence in the study area of any significant fauna identified in the database searches was assessed prior and following the field survey. The assessment was based on the following information

- habitat preference (soils, landforms, elevation and vegetation associations) and habitats presence and condition in the study area
- known biology
- distance (km) of database records from the study area.

The assessment assigned each taxon to one of four ratings:

1. recorded – species recorded within the study area by current or previous surveys
2. likely – study area within known range of species; suitable or optimal habitat occurring within the study area and/or with current and/or previous records in the vicinity of the study area
3. possible – within known range of species; suitable habitat present within study area, though not optimal; no records in the vicinity of the study area
4. unlikely – outside of the species current known range; no records in the vicinity of the study area and/or no suitable habitat present within the study area. Also includes species considered locally or regionally Extinct in relation to the study area due to historic declines.

4.5 SURVEY PERSONNEL

The personnel involved in the survey are presented (Table 4-5).

Table 4-5 Project team

Name	Qualifications	Role/s
Mr Jarrad Clark	BSc. (Env. Mgmt)	Project management and report review
Dr John Scanlon	PhD (Zoology)	Field survey, data analysis, report writing
Ms Gemma Grigg (Senior Field Technician, Kin Mining)	BSc.	Field survey assistant, opportunistic sighting records
Ms Anna Leung	BSc. (Environmental Science) Honours	Spatial data analysis and mapping

5 RESULTS

5.1 DESKTOP REVIEW

5.1.1 Terrestrial vertebrate fauna

Records for 274 terrestrial vertebrate fauna species were identified as potentially occurring within the study area in the desktop review. These comprised seven frogs, 55 reptiles, 174 birds (including two naturalised species) and 38 mammals (including 12 introduced) (Appendix 2).

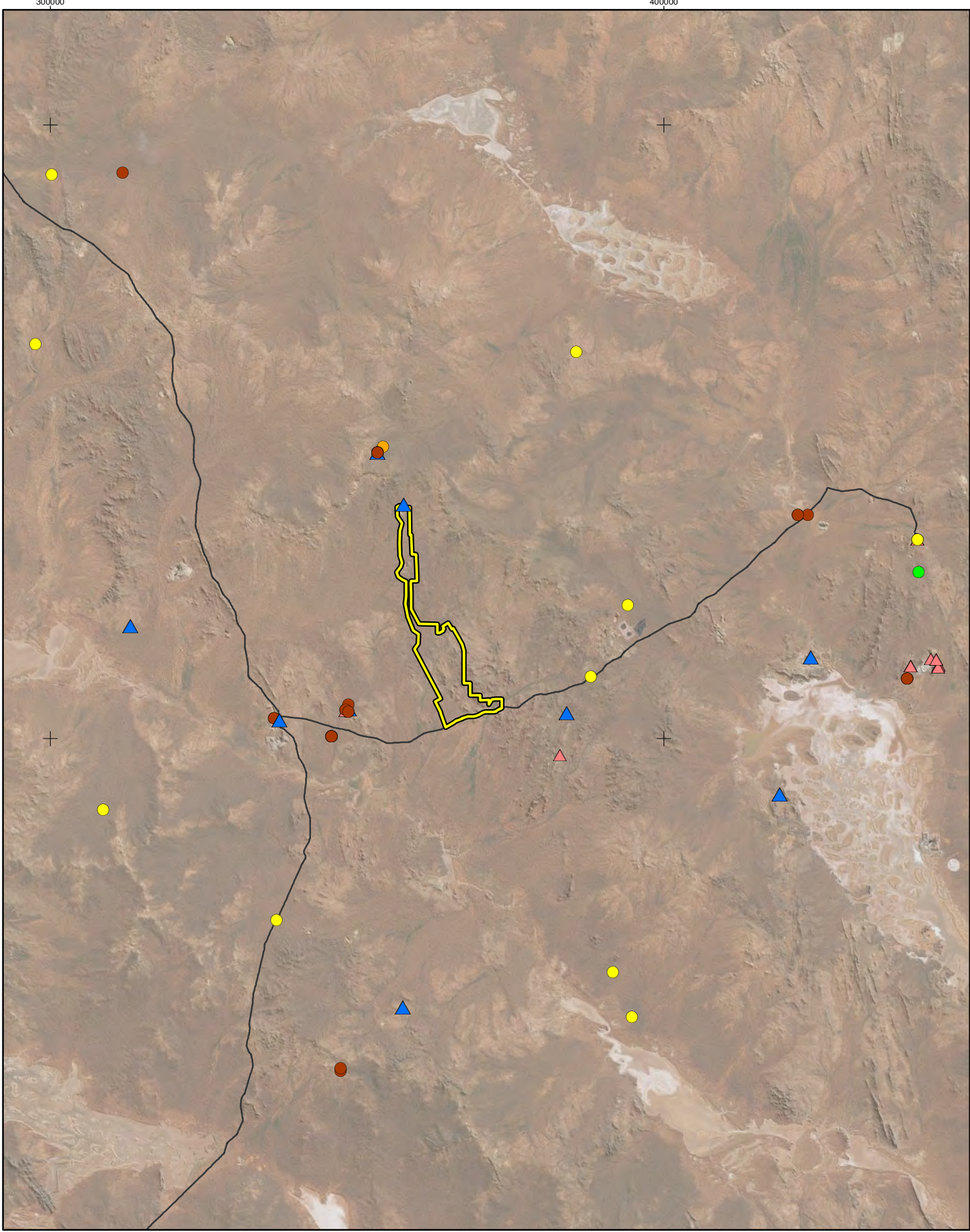
A total of 30 species of conservation significant vertebrate taxa were identified in the desktop review (23 birds, seven mammals) as potentially occurring, including 13 species listed under the EPBC Act and/or BC Act as Threatened or Specially Protected (Table 5-1). Seventeen species are listed as Migratory under the EPBC Act and BC Act (two also listed as Threatened). A further three are listed as Priority species by the DBCA (Table 5-1). The table also includes one taxon listed as Extinct at subspecies level, but Vulnerable in remaining parts of the species range.


Table 5-1 Conservation significant vertebrate fauna species identified in the desktop review

Species	Common name	Conservation status ¹		
		EPBC Act	BC Act	DBCA list
Birds (23)				
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	
<i>Apus pacificus</i>	Fork-tailed Swift	Mig	Mig	
<i>Plegadis falcinellus</i>	Glossy Ibis	Mig	Mig	
<i>Falco hypoleucos</i>	Grey Falcon		VU	
<i>Falco peregrinus</i>	Peregrine Falcon		OS	
<i>Charadrius veredus</i>	Oriental Plover	Mig	Mig	
<i>Thinornis rubricollis</i>	Hooded Plover			P4
<i>Pluvialis fulva</i>	Pacific Golden Plover	Mig	Mig	
<i>Limosa lapponica</i>	Bar-tailed Godwit	VU/Mig	VU/Mig	
<i>Actitis hypoleucos</i>	Common Sandpiper	Mig	Mig	
<i>Tringa nebularia</i>	Common Greenshank	Mig	Mig	
<i>Tringa glareola</i>	Wood Sandpiper	Mig	Mig	
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mig	Mig	
<i>Calidris canutus</i>	Red Knot	EN/Mig	Mig	
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mig	Mig	
<i>Calidris ruficollis</i>	Red-necked Stint	Mig	Mig	
<i>Calidris subminuta</i>	Long-toed Stint	Mig	Mig	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mig	Mig	
<i>Gelochelidon nilotica</i>	Gull-billed Tern	Mig	Mig	
<i>Polytelis alexandrae</i>	Princess Parrot	VU		P4
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	
<i>Motacilla cinerea</i>	Grey Wagtail	Mig	Mig	
<i>Motacilla flava</i>	Yellow Wagtail	Mig	Mig	
Mammals (7)				
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P4

Species	Common name	Conservation status ¹		
		EPBC Act	BC Act	DBCA list
<i>Myrmecobius fasciatus</i>	Numbat	VU	VU	
<i>Macrotis lagotis</i>	Greater Bilby	VU	VU	
<i>Bettongia lesueur</i>	Boodie	VU/EX	VU/EX	
<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	VU	VU	
<i>Leporillus conditor</i>	Greater Stick-nest Rat	VU	VU	

¹ CR – Critically Endangered; EN – Endangered; VU – Vulnerable; OS – Specially Protected; Mig – Migratory; P4 – Priority 4.



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 Study area	 Migratory
Conservation Code	 Vulnerable
 Endangered	 Other Specially Protected
 Endangered and Mig.	 P4

Figure 5-1
Desktop records of conservation significant vertebrate fauna



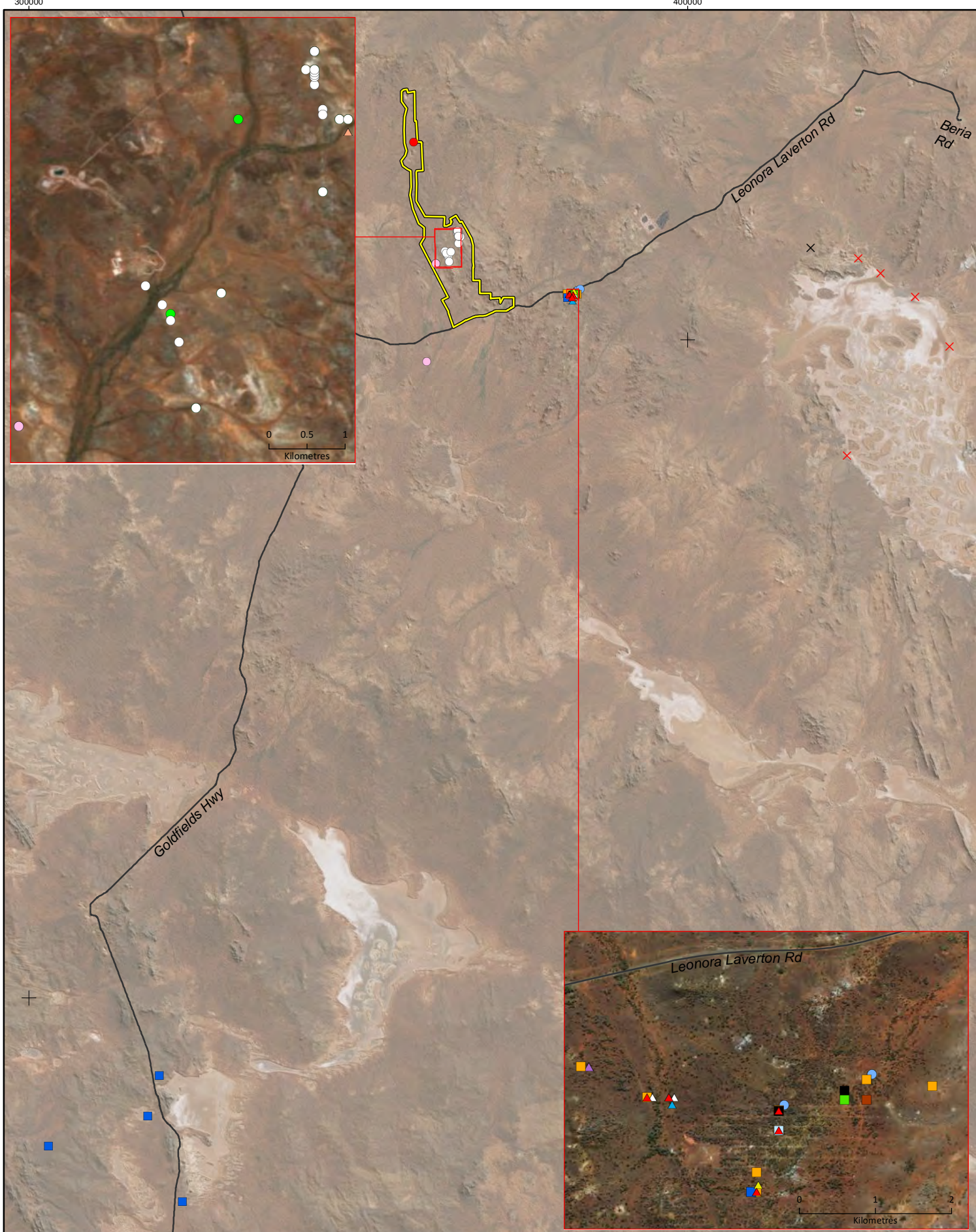
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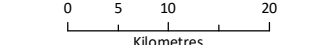
5.1.2 SRE invertebrate fauna

The WA Museum database searches (WAM 2019) returned 42 records of terrestrial invertebrate taxa, none were potential or confirmed SREs. (Table 5-2; Figure 5-2). No molluscs were returned. The DBCA Threatened fauna database (DBCA 2019b) returned six records, representing two taxa of fairy shrimp. Both are P1 species and are currently, confirmed SREs. They are associated with Lake Carey, which is located approximately 50km to the east of the study area.

Table 5-2 Terrestrial invertebrate taxa identified in the desktop review

Taxa	Source
Anostraca (2)	
Thamnocephalidae (2)	
<i>Branchinella apophysata</i>	DBCA (2019b)
<i>Branchinella simplex</i>	DBCA (2019b)
Araneae (13)	
Araneomorphae (new world spiders) (12)	
Gnaphosidae (2)	
<i>Eilica?</i> `sp.`	WAM (2019)
<i>Encoptarthria</i> `Leonora sp. 1`	WAM (2019)
Miturgidae (2)	
<i>Miturga</i> `Leonora sp. 1`	WAM (2019)
<i>Miturga</i> `Leonora sp. 1`?	WAM (2019)
Sparassidae (1)	
<i>Neosparassus</i> `Leonora sp. 1`	WAM (2019)
Trochanteriidae (1)	
Longrita millewa	WAM (2019)
Zodariidae (6)	
<i>Leonora</i> gen. 1` `Leonora sp. 1`	WAM (2019)
<i>Habronestes</i> `Leonora sp. 1`	WAM (2019)
<i>Habronestes</i> `Leonora sp. 2`	WAM (2019)
<i>Neostorena</i> `Leonora sp. 1`	WAM (2019)
<i>Neostorena</i> `Leonora sp. 2`	WAM (2019)
<i>Storena</i> `sp.`	WAM (2019)
Mygalomorphae (trap-door spiders) (1)	
Idiopidae (2)	
<i>Eucyrtops eremaea</i>	WAM (2019)
Scolopendrida (1)	
Scolopendridae (1)	
<i>Cormocephalus</i> `sp. (fragment)`	WAM (2019)




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- Study area**
- Species**
- × *Branchinella apophysata* (Confirmed)
 - × *Branchinella simplex* (Confirmed)
 - *Harpacticoida* 'Leonora'
 - *Cormocephalus* 'sp. (fragment)'
 - *Encoptarthria* 'Leonora sp. 1'
 - *Eucyrtops eremaea*
 - *Habronestes* 'Leonora sp. 1'
 - *Habronestes* 'Leonora sp. 2'
 - *Longrita millewa*
 - *Miturga* 'Leonora sp. 1'
 - *Miturga* 'Leonora sp. 1'?
 - *Neosparassus* 'Leonora sp. 1'
 - △ *Neostorena* 'Leonora sp. 1'
 - △ *Neostorena* 'Leonora sp. 2'
 - ▲ *Storena* 'sp.'
 - ▲ *Eillica?* 'sp.'
 - ▲ *'Leonora gen. 1'* 'Leonora sp. 1'

Figure 5-2

Desktop records of invertebrate fauna (DBCA 2019b; WAM 2019)



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5.2 FIELD SURVEY

5.2.1 Fauna habitats

The study area forms part of an undulating plain sloping down from northeast to southwest, with low stony hills (mainly Leonora, Laverton and Wyarri land systems) and plains dissected by shallow, seasonal or ephemeral drainage lines. In terms of topography, hydrology and vegetation it has relatively low diversity (e.g. lacking major rock outcrops or natural clifflines, lakes, saltlakes, perennial streams, sandplains, *Triodia* hummock grasslands, or eucalypt-dominated woodland or mallee).

Seven broad fauna habitats were mapped within the study area (Table 5-3; Figure 5-3):

1. Mulga woodland on plain (6,073.62 ha)
2. Shrubland on plain (3,356.2 ha)
3. *Acacia* shrubland on stony hills (1,714.79 ha)
4. *Acacia* woodland in drainage lines and groves (1,570.13 ha)
5. Mulga woodland on stony hills (944.08 ha)
6. Cleared (212.99 ha)
7. Outcropping and breakaway (40.22 ha)
8. Vegetated gilgai/claypan (12.23 ha)

Mulga woodland on plain was the dominant habitat, occupying approximately 44% of the study area, followed by Shrubland on plain (24%), with the remaining fauna habitats occupying less than 35% of the study area combined (Table 5-3; Figure 5-3).

Individuals of most fauna species would use a combination of different habitat types within their home range for foraging, resting, breeding etc. Outcropping and breakaway habitats appear to have important ecological functions relative to their small area, providing both refuges (e.g. crevices used by Short-beaked Echidna, small dasyurids tentatively identified as Long-tailed Dunnart, and formerly by Stick-nest Rat; none of these species recorded in other habitat types) and dens or hunting perches of larger predators (Dingo, Wedge-tailed Eagle).

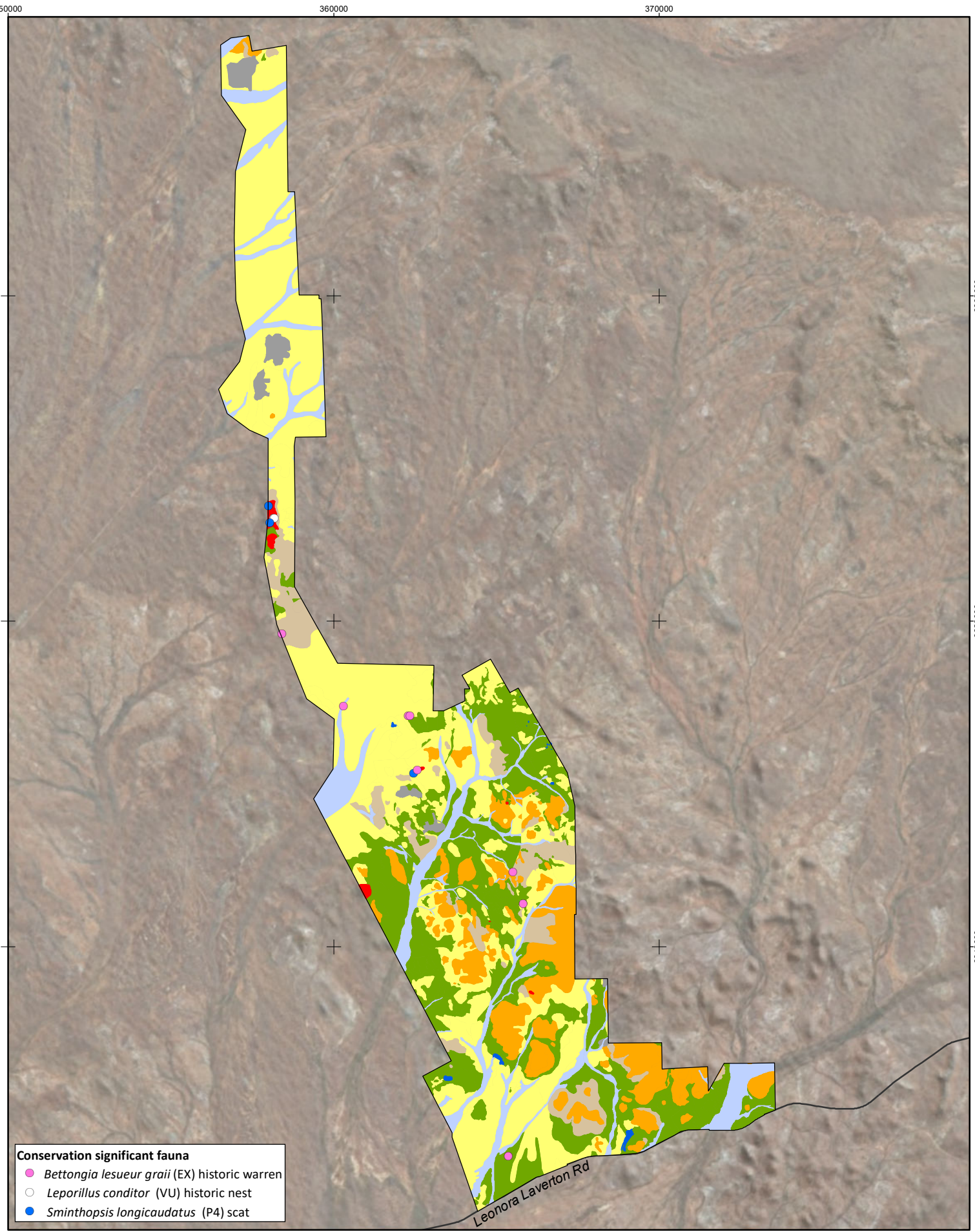
Calcrete hardpan is present at or just below the soil surface in much of the study area, including hills and plains, and associated with different vegetation types; Consequently, it is not used in the habitat classification. Where exposed either by abiotic weathering or by burrowing activity (e.g. old warrens of the regionally extinct Boodie) it provides similar habitat values (refugia) to outcrop and breakaway. However, most evidence of current use (fresh diggings, tracks and scats) represented monitor lizards and rabbits, which were broadly present in all habitat types.

Artificial outcrop and cliffs formed by mining activity within areas mapped as 'Cleared' are potentially important habitat to some species, e.g. Peregrine Falcon (see below). Artificial lakes are present in several old mine pits but are not treated as a distinct habitat; waterbirds were not observed in or around water during a brief visit to the two Mertondale pits, but are considered likely to offer very limited habitat value at present due to a lack of productive shallow-water habitat, level shorelines and lack of fringing vegetation (cf. Mine Lakes Consulting 2018). The value of these old pits to aquatic fauna was not investigated but is expected to be similarly low for the same reasons given above with respect to waterbirds. Indeed, if a diverse and abundant aquatic fauna assemblage were present, waterbirds would also be expected to be present.

Table 5-3 Fauna habitats of the study area

Habitat	Corresponding vegetation types and mapping units	Corresponding fauna sites	Area (ha)	% of study area
Mulga woodland on plain: Open to sparse woodland or shrubland of Mulga (<i>Acacia aneura</i> group) or Bastard Mulga (<i>A. papyrocarpa</i>) over varying mid- and understorey of lower shrubs and/or grasses.	Stantec: AaArEsp., AaAtEp, AaAtEsp., AcAtEo, AiElEc, AiMsTd, AkHpEs, Asp.MsEs, WB: Aa over Esp194, AaArAqEp, AaArEpLPoU, AaEmP, AaEpLEm, AaEpLSppPoUMt, AaMsPoUMt, AaMsSsNPoG, AaPoUMt, ApEsMspp, ApMt, ApPoUMt, ApTdS, HPDS, HPMS, MUWA, SAES, mosaics M2, M3	LF003, LF010, LF016, LF017, LF018, LF022, LF024, LF027, LOPP01	6,071.59	43.62
Shrubland on plain: Open to sparse shrubland dominated by shrub Mulga, other <i>Acacia</i> species, <i>Hakea</i> , chenopods or hummock grasses on a range of substrates.	Stantec: HpCsMp, MpTdSd WB: AaEpLSppPoUMt, AmCs, AvS, Cpn-B, EsFsppSpp, Fspp, HpEsMt, HpMpCs, HpMpEs, HpMpMsp59, HpPoGMt, HpTdMpS, MpMg, MpMsFspp, Msp59, Td, MtFsp, TdFsppMsp#59, mosaic M4	LF007, LF008, LF012, LF014	3,355.09	24.10
Acacia shrubland on stony hills: Rolling hills with gravel or cobble substrate, with shrubland vegetation dominated by <i>Acacia</i> other than Mulga.	Stantec: A?rSaMs, AkAbMs WB: AaEpLEm, AaEpLSppPoUMt, AaMsSsNPoG, AaPoUMt, AbPoG, AdAspMPPoG, Amp, AmpAsAa, AvS, EsFsppSpp	LF005, LF006	1,714.20	12.31
Acacia woodland in drainage lines and groves: Drainage lines with associated riparian vegetation, usually Mulga or other <i>Acacia</i> over variable understory cover, often dominated by dense grass cover nearer to drainage line.	Stantec: AbAtTt WB: DRAbS, DRMS, GRMU	BAT01, BAT02, BAT03, LF001, LF004, LF013, LF023	1,569.58	11.28

Habitat	Corresponding vegetation types and mapping units	Corresponding fauna sites	Area (ha)	% of study area
Mulga woodland on stony hills: Mulga (<i>Acacia aneura</i> group) woodland on hill slopes and tops; also includes patches of <i>Casuarina pauper</i> woodland on calcrete outcrop.	Stantec: AaArAq, AaSaMs, AcHpEp, CpArEo WB: AaArEpLPoU, AaEpLEm, AaMsPoUMt, AaMsSsNPoG, AaPoUMt, AbSafAmpMt, HPMS, SIMS AaEcEf, SIMS AaEISE, CpW , WABS, mosaic M1	LF015, LF021, LF026, LF028	943.71	6.78
Cleared: Existing cleared and/or disturbed areas (i.e. existing tracks, roads and clearing for previous exploration or mining operations)	Disturbed	LOPP02	212.94	1.53
Outcropping and breakaway: Outcrop of calcrete, basalt or other rock types with boulder piles, small caves or crevices on hilltops, slopes and breakaways; woodland or shrubland vegetation.	Stantec: AiMsTd, AkAbMs WB: AaArEpLPoU, EsFsppSspp, Amp, AmpAsAa	LF002, LF011, LF019, LF020, LF025	40.22	0.29
Vegetated gilgai/claypan: Drainage foci with clay soils and perennial grasses, and with or without shrub vegetation.	WB: CPN-G, Gilgai	LF009	12.22	0.09
Total:			13,919.54	100



Conservation significant fauna

- *Bettongia lesueur graii* (EX) historic warren
- *Leporillus conditor* (VU) historic nest
- *Sminthopsis longicaudatus* (P4) scat



Kin Mining
Terrestrial Fauna Survey for the Leonora Gold Project

Project No	1249
Date	15-Aug-19
Drawn by	AL
Map author	JS

0 1.25 2.5 5
Kilometres

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Study area

Fauna habitat

- Acacia shrubland on stony hills
- Acacia woodland in drainage lines and groves
- Cleared
- Mulga woodland on plain
- Mulga woodland on stony hills
- Outcropping and breakaway
- Shrubland on plain
- Vegetated gilgai/claypan

Figure 5-3
Fauna habitats and conservation significant records in the study area



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5.2.2 Vertebrate fauna

A total of 65 terrestrial vertebrate fauna species were recorded during the field survey (Table 5-4; Appendix 2). This represents just under 24% of the species identified as potentially occurring based on the desktop review. Birds were the most diverse class of vertebrates recorded, consistent with the results of the desktop review. Of the 14 mammal species recorded during the field survey, seven were introduced species.

Table 5-4 Number of vertebrate taxa recorded and potentially occurring in the Project area

Taxa	No. of species recorded during field survey	No. of species potentially occurring from desktop
Amphibians	2	7
Reptiles	12	55
Birds – native	38	172
Birds - introduced	0	2
Mammals - native	7	26
Mammals - introduced	7	12
Total	65	274

No conservation significant species were positively identified as currently occurring during the field survey, but three were recorded based on secondary evidence (Figure 5-3):

1. Long-tailed Dunnart (P4)
2. Burrowing Bettong (EX)
3. Greater Stick-nest Rat (VU)

Long-tailed Dunnart is recorded provisionally based on small dasyurid scats associated with crevices on rocky hills and breakaways at three sites. Morphologically these could not be directly identified to the species and are also consistent with the other *Sminthopsis*, *Ningau* or *Antechinomys* species that occur in the general area. However, the habitat is most-suitable for *S. longicaudata* denning and refuge sites, whereas the other small dasyurid species are not associated with rocky hills but inhabit grassland, heath, shrub and woodland. Long-tailed Dunnart may also occur more broadly across habitats surrounding denning sites to forage or disperse when conditions and cover are suitable.

Burrowing Bettong (Boodie) and Greater Stick-nest Rat were both recorded from historic secondary evidence within the study area. Evidence of past occurrence of Burrowing Bettong was recorded from six sites in the form of burrow complexes (warrens) extending under a layer of hardpan calcrete on plains or lower slopes of hills, and the Greater Stick-nest Rat from two old nests located in a breakaway (Figure 5-3).

The deposition of calcrete spoil on the surface (some due to continued use by varanids and/or rabbits) makes Boodie warrens quite conspicuous, and each of the sites identified as such in the field is also visible as a distinct light-coloured patch in aerial images. Many additional light patches can be seen that suggest these are abundant and widespread in the region (occurring in Nubev, Violet, Gundockerta, Leonora and Monitor land systems, but apparently absent in Jundee and Laverton), though some similar traces are certainly results of historic mining exploration. Despite this evidence of former occupation, both species are considered Extinct in the region (the inland Boodie subspecies,

Bettongia lesueur graii, is listed as completely Extinct) and are unlikely to be occurring within the study area currently (Burbidge 2004; Van Dyck & Strahan 2008).

Suitable habitat for (at least) foraging and dispersal was identified for a further seven conservation significant species identified in the desktop review (Table 5-5).

Fork-tailed Swift are likely to forage in the airspace above the study area; however, it is unlikely to land or nest as the species is a non-breeding visitor and almost exclusively aerial (DoEE 2019b).

Grey Falcon is likely to occur at least occasionally within the study area, as the species is broadly distributed in the area and individuals have large foraging ranges. Breeding could also occur, using stick nests of corvids or other raptors in tall trees (e.g. stands of *Acacia papyrocarpa* with crow nests at site LF010, previously reported as used for nesting by Australian Hobby; Western Botanical 2019) or power and telecommunications towers (if and when they are built). This species is not reported to nest on cliffs (Debus 2012).

Peregrine Falcon is known to occur adjacent to the study area, and this versatile aerial predator may use all habitat types present for foraging. Due to low relief of outcrop in the area, cliff-ledge nesting sites as typically used by this species do not naturally occur; however, stick nests of crows or other raptors may also be used (as in the case of Australian Hobby or Grey Falcon), and the steep rock walls of old mine pits and quarries provide highly suitable nesting sites (and hunting perches) within the study area.

Oriental Plover has been recorded close to the study area (ALA 2019) and ranges widely through coastal and inland northern parts of Australia during the non-breeding season (September to March), using a range of habitats including flat, open semi-arid grasslands and claypans (DoEE 2019b). It may therefore be expected to visit the study area occasionally.

Sharp-tailed Sandpiper mainly feeds in wetlands like other shorebirds, but is also recorded as foraging in open grassy areas after rain (DoEE 2019b), so may use parts of the study area occasionally.

While there are records of Malleefowl in the vicinity (Figure 5-3), habitat in the study area is generally of low suitability for this species. Nesting habitat requires sandy substrates and abundant leaf litter, whereas vegetation cover throughout much of the study area is open and sparse, with denser vegetation and canopy cover restricted to drainage lines and some hill slopes, where litter tends to be removed or disturbed during rainfall events, or overgrown with grass. Some litter suitable for foraging does occur in Mulga woodland habitats (including *A. papyrocarpa* and *Casuarina*), but of relatively low value due to its patchy occurrence and the mostly open canopy (cf. Benshemesh 2007). The species may occasionally occur when dispersing between areas of suitable habitat outside of the study area; however, it is unlikely to be a frequent visitor.

Typical habitats of Princess Parrot (sand dunes, open savannah eucalypt woodland, *Triodia* grassland) are not present within the study area, but it may also use a wider range of woodland and riparian habitat, and is an irregular and infrequent visitor to most sites within its range (DoEE 2019b). It is considered possible that the Princess Parrot will occur in the study area occasionally when conditions are favourable, particularly following rainfall in its core range, in the arid areas east and north of the study area.

The remaining conservation significant species identified in the desktop review (16 birds, four mammals) are considered unlikely to occur either due to lack of suitable habitat (i.e. suitable salt lakes or other wetlands for Migratory shorebirds), or lack of extant regional populations due to historic declines of Critical Weight Range mammals (Burbidge & McKenzie 1989) (Table 5-5).

Table 5-5 Likelihood of occurrence for conservation significant fauna in the Project area

Species	Common name	Conservation status ¹			Likelihood of occurrence	Fauna habitat							Summary of records and occurrence	Nearest record	
		EPBC Act	BC Act	DBCA List		Outcropping & breakaway	Shrubland on stony hills	Mulga on stony hills	Mulga on plain	Shrubland on plain	Drainage lines & groves	Vegetated claypan			Cleared
Invertebrate (2)															
<i>Branchinella apophysata</i>	a fairy shrimp (Laverton)			P1	Unlikely									One record, associated with Lake Carey.	~50 km E
<i>Branchinella simplex</i>	a fairy shrimp (inland WA)			P1	Unlikely									Five records, associated with lake Carey.	~50 km E
Birds (23)															
<i>Leipoa ocellata</i>	Malleefowl	VU	VU		Possible			•	•	•	•			Previously recorded at Murrin Murrin (Ecosmart Ecology 2012); however, unlikely to be resident due to the lack of suitable nesting habitat within the study area. Small areas of Mulga habitat potentially suitable for foraging, but likely to occur only infrequently during dispersal.	17 km E
<i>Apus pacificus</i>	Fork-tailed Swift	MI	MI		Possible	•	•	•	•	•	•	•	•	Species forages aerially in a variety of habitats, including those within the study area, but unlikely to land or nest.	~180 km SSW
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~60 km E

Species	Common name	Conservation status ¹			Likelihood of occurrence	Fauna habitat								Summary of records and occurrence	Nearest record
		EPBC Act	BC Act	DBCA List		Outcropping & breakaway	Shrubland on stony hills	Mulga on stony hills	Mulga on plain	Shrubland on plain	Drainage lines & groves	Vegetated claypan	Cleared		
<i>Falco hypoleucos</i>	Grey Falcon		VU		Likely		•	•	•	•	•	•		Likely to occur within the study area occasionally to forage. Breeding might also occur, as potential nesting habitat (crow nests in tall <i>Acacia papyrocarpa</i>) has recently been recorded as used by a breeding pair of Hobby (<i>F. longipennis</i> ; Western Botanical 2019). (Western Botanical 2019).	~25 km E
<i>Falco peregrinus</i>	Peregrine Falcon		OS		Likely	•	•	•	•	•	•	•	•	Recorded (2009) at a drainage line that passes through the northern part of the study area. Likely to forage occasionally in any habitats within the study area. Less likely than other falcons to breed in stick nests of crows, but (contrary to MWH 2017) suitable nesting sites occur in artificial cliff faces of mines and quarries.	<1 km N
<i>Charadrius veredus</i>	Oriental Plover	MI	MI		Possible					•		•		Open areas of short, sparse grass and claypans are suitable foraging habitat for this non-breeding migrant. May occur occasionally.	~10 km W
<i>Thinornis rubricollis</i>	Hooded Plover			P4	Unlikely									Suitable salt lake habitat not present within study area.	~15 km W
<i>Pluvialis fulva</i>	Pacific Golden Plover	MI	MI		Unlikely									Rarely occurs inland; suitable riverine habitat not present within study area.	~19 km SW

Species	Common name	Conservation status ¹			Likelihood of occurrence	Fauna habitat							Summary of records and occurrence	Nearest record	
		EPBC Act	BC Act	DBCA List		Outcropping & breakaway	Shrubland on stony hills	Mulga on stony hills	Mulga on plain	Shrubland on plain	Drainage lines & groves	Vegetated claypan			Cleared
<i>Limosa lapponica</i>	Bar-tailed Godwit	CR/VU, MI	CR/VU, MI		Unlikely									Rarely occurs inland; suitable wetland habitat not present within study area.	~400 km WNW
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~15 km W
<i>Tringa nebularia</i>	Common Greenshank	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~10 km N
<i>Tringa glareola</i>	Wood Sandpiper	MI	MI		Unlikely									Recorded at Leonora, but suitable wetland habitat not present within study area.	~26 km SW
<i>Tringa stagnatilis</i>	Marsh Sandpiper	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~220 km NE
<i>Calidris canutus</i>	Red Knot	EN, MI	MI		Unlikely									Rarely occurs inland; suitable wetland habitat not present within study area.	~9 km N
<i>Calidris melanotos</i>	Pectoral Sandpiper	MI	MI		Unlikely									Rarely occurs inland; suitable wetland habitat not present within study area.	>320 km NW
<i>Calidris ruficollis</i>	Red-necked Stint	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~65 km E
<i>Calidris subminuta</i>	Long-toed Stint	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~500 km W
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI		Possible					•		•		Open grassy areas in study area may be suitable for foraging after rain, but no suitable habitat at other times.	~18 km W

Species	Common name	Conservation status ¹			Likelihood of occurrence	Fauna habitat							Summary of records and occurrence	Nearest record	
		EPBC Act	BC Act	DBCA List		Outcropping & breakaway	Shrubland on stony hills	Mulga on stony hills	Mulga on plain	Shrubland on plain	Drainage lines & groves	Vegetated claypan			Cleared
<i>Gelochelidon nilotica</i>	Gull-billed Tern	MI	MI		Unlikely									Suitable wetland habitat not present within study area.	~60 km E
<i>Polytelis alexandrae</i>	Princess Parrot	VU		P4	Possible				•		•			Recorded at Leonora; not resident in area but may occasionally occur when conditions permit, particularly following rainfall in more arid areas to the east and north of the study area.	~75 km E
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR		Unlikely									Not recorded from Murchison region; suitable <i>Triodia</i> or similar refuge habitat not present within study area.	>350 km NNE
<i>Motacilla cinerea</i>	Grey Wagtail	MI	MI		Unlikely									Rare vagrant in WA; suitable habitat not present within study area.	~500 km NW
<i>Motacilla flava</i>	Yellow Wagtail	MI	MI		Unlikely									Not recorded from inland WA; suitable habitat not present within study area.	>900 km NNW
Mammals (7)															
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU		Unlikely									Study area outside of species current known distribution. Recorded from an unconfirmed sighting at Goongarrie (2008), but considered regionally Extinct beyond the Wheatbelt (Burbidge 2004; Van Dyck & Strahan 2008).	~140 km SSW

Species	Common name	Conservation status ¹			Likelihood of occurrence	Fauna habitat								Summary of records and occurrence	Nearest record	
		EPBC Act	BC Act	DBCA List		Outcropping & breakaway	Shrubland on stony hills	Mulga on stony hills	Mulga on plain	Shrubland on plain	Drainage lines & groves	Vegetated claypan	Cleared			
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P4	Likely	•	•	•							Known to occur in vicinity (Ecosmart Ecology 2012), recorded from secondary evidence in this study.	~12 km SE
<i>Myrmecobius fasciatus</i>	Numbat	VU	VU		Unlikely										Recorded near Laverton (1918) but now regionally Extinct.	~75 km E
<i>Macrotis lagotis</i>	Greater Bilby	VU	VU		Unlikely										Nearest sighting reported in 1981, but no later records within 400 km and considered regionally Extinct in the wild.	~65 km NW
<i>Bettongia lesueur graii</i>	Burrowing Bettong	EX	EX		Recorded historical evidence/ Unlikely										Recorded only from secondary evidence (historic warrens). Considered regionally Extinct(Burbidge 2004; Van Dyck & Strahan 2008) and unlikely to still occur.	~100 km SSE (2012), ~9 km SE (2018)
<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	VU	VU		Unlikely										Recorded sighting at Laverton (1910), but Extinct on the mainland.	~76 km E
<i>Leporillus conditor</i>	Greater Stick-nest Rat	VU	CD		Recorded historical evidence/ Unlikely										Recorded only from secondary evidence (historic nests). Considered Extinct in the wild on the mainland (Burbidge 2004; Van Dyck & Strahan 2008) and unlikely to still occur.	>340 km WSW (1973), 10-20 km E (2018)

¹ CR – Critically Endangered; EN – Endangered; VU – Vulnerable; OS – Specially Protected CD – Conservation Dependent; MI – Migratory; P4 – Priority 4.

5.2.3 SRE invertebrate fauna

As detailed in section 5.2.1 the study area is located within an area of low habitat and topographical diversity (e.g. hydrology, lacking major rock outcrops or natural clifflines, lakes, saltlakes, perennial streams, sandplains, or eucalypt-dominated woodland or mallee) and consequently no SRE sampling was undertaken.

The most prospective habitat for SREs in the study area are areas of significant outcropping, identified as having an important ecological function for vertebrate fauna (relative to its small area; providing both refuges and dens or hunting perches for larger predators) (see section 5.2.1); However, this habitat is generally limited and not planned to be impacted.

5.3 SURVEY LIMITATIONS

The limitations of the terrestrial fauna survey have been considered (Table 5-6) in accordance with Technical Guidance: Terrestrial fauna surveys for Environmental Impact Assessment (EPA 2016f).

Table 5-6 Survey limitations from EPA Technical Guidance: Terrestrial fauna surveys (EPA 2016f)

Limitations	Limitation for this survey?	Comments
Competency/experience of survey personnel, including taxonomy	No	The field personnel and report author have extensive experience in terrestrial fauna surveys within the region and across WA.
Scope and completeness - were all target groups sampled, were all planned survey methods implemented successfully, was the study area fully surveyed	No	All target groups, significant species and habitats within the study area were surveyed in accordance with the scope of work.
Intensity - in retrospect, was the intensity adequate	No	The survey intensity was appropriate for the area that was surveyed, and faunal groups targeted, including significant species.
Proportion of fauna identified, recorded and/or collected	No	All vertebrate fauna was identified to species level in the field apart from analysis of predator scats and bat echolocation recordings which were undertaken in Perth.
Availability of adequate contextual information	No	Previous survey reports and spatial datasets were available for the Leonora project area and the nearby Murrin Murrin project, providing adequate contextual information for the Project.
Timing, weather, season, cycle	No	Weather in several months preceding the survey was hot and dry relative to annual averages for previous years, so that fauna activity and observed diversity of mobile species was lower than expected. This does not represent a significant limitation in Level 1 survey.
Disturbances which affected the results of the survey	No	No disturbances occurred during the field survey which are considered to have impacted the overall results.

Limitations	Limitation for this survey?	Comments
Remoteness and/or access problems	No	All areas of the study area were accessible by vehicle or on foot.

6 DISCUSSION

In assessing development proposals, the EPA has the objective of protecting flora and vegetation, and terrestrial fauna so that biological diversity and ecological integrity are maintained (EPA 2016a, b). Considerations for flora, vegetation and terrestrial fauna in EIA at the State level include significance of values present, current state of knowledge of those values, potential impacts and the scale at which the impacts are assessed (EPA 2016a, b). At the Federal level, the Commonwealth publishes guidelines on assessing on significance of impacts to matters of NES (Department of the Environment 2013). The potential biological values of the study area are discussed below to inform an EIA for the Project.

Eight broad fauna habitats were mapped within the study area (Table 5-3) and all are well represented in the broader vicinity outside the study area and across the Eastern Murchison subregion.

In accordance with EPA (2016c), fauna habitats may be considered significant if they provide habitat important to the life history of a significant species or are unique or isolated within a landscape (see section 2.2.2). All habitats occurring within the study area have the potential to support significant fauna species at various capacities, but do not necessarily meet the criteria to be considered significant. Up to eight significant vertebrate fauna species have the potential to occur within the study area based on habitat suitability and presence, proximity of desktop records and current known distributions.

Of the eight significant vertebrate species known or considered to potentially occur within the study area, three have the potential to be resident: Grey Falcon (VU), Peregrine Falcon (OS) and Long-tailed Dunnart (P4). Both falcon species have large foraging ranges encompassing various habitats widespread inside and outside the study area. Potential nesting sites occur for both species, including stick nests constructed by crows or other raptors in tall *Acacia* woodland (recently reported being used by Australian Hobby; Western Botanical 2019), and artificial cliffs of old mine pits which are especially suitable for Peregrine Falcon nesting.

Most surface rocks in the study area are highly weathered and fragmented, forming a mantle on rounded hills and plains; the few small areas of more prominent natural outcrop and breakaway had abundant signs of use by vertebrate fauna, including scats likely to represent Long-tailed Dunnart. This species is therefore considered a likely resident.

The remaining significant species that may occur would be transient or occasional visitors, occurring within the study area while foraging and/or dispersing between other areas of suitable habitat outside of the study area.

The occurrence of Princess Parrot (VU) within the study area is likely to be infrequent and largely driven by rainfall in the areas to the east and north of the study area when the species may move into the study area when conditions and food resources are more favourable; no habitats in the study area are particularly suitable. Fort-tailed Swift (Mig.), Oriental Plover (Mig.), and Sharp-tailed Sandpiper (Mig.) are other species that may use habitats of the study area as part of their very wide foraging range but would be short-term and very occasional visitors.

Malleefowl (VU) will forage within and disperse across a range of habitats, including some present within the study area; however, the absence of suitable nesting habitat (sandy substrates and leaf litter accumulation) for mound construction indicates the species is likely an infrequent visitor and not a resident. Although the species was recorded within 20 km of the study area in 2011, habitat for the species in that area was considered marginal (Ecosmart Ecology 2012; MWH Australia 2018; Phoenix 2019), indicating the specimen recorded was likely a transient individual. The study area is dominated by sparse, open vegetation with stony substrates and sparse leaf litter cover, which do not provide optimal nesting conditions for the species. No habitats within the study area are considered significant for the species.

Historic evidence of two regionally Extinct species (Burrowing Bettong and Greater Stick-nest Rat) were also recorded. Both are today known only from translocated or managed populations across the remainder of their range.

Considering potential for breeding and refugia by conservation significant species likely to occur, the most significant vertebrate fauna habitats of the study area are the artificial cliffs of old mine pits, stands of relatively tall trees (e.g. *Acacia papyrocarpa*) previously used for nesting by crows and raptors, and the small areas of outcropping and breakaway with crevices and overhangs.

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Appendix 1 Terrestrial fauna survey site descriptions

Site: LF001 (Fauna site) (-28.801652, 121.598226)

Habitat description: Mulga shrubland with some taller tree mulga, over other *Acacia* shrubs

Habitat type: shrubland

Topography: drainage line

Slope: moderate

Soil: sandy loam

Soil colour: red–orange

Rock type: basalt

Fire age: > 5 years



Disturbance: road/tracks, clearing and mining operations adjacent, cattle grazing

Site: LF002 (Fauna site) (-28.790903, 121.620173)

Habitat description: Open Mulga shrubland over *Tecticornia* and mixed low shrubs, sparse grass

Habitat type: shrubland

Topography: hill top

Slope: moderate

Soil: clay loam

Soil colour: brown, grey

Rock type: quartz, calcrete

Fire age: >5 years



Disturbance: exploration (drill pads and access tracks)

Site: LF003 (Fauna site) (-28.782345, 121.630846)

Habitat description: *Acacia papyrocarpa* open woodland over *Maireana* spp. chenopod shrubland

Habitat type: open woodland

Topography: undulating plain

Slope: gentle

Soil: clay loam

Soil colour: red–orange, brown

Rock type: ferrous - Ironstone, quartz

Fire age: > 5 years

Disturbance: none



Site: LF004 (Fauna site) (-28.852419, 121.645414)

Habitat description: Mulga and some taller Acacia over mixed shrubs, grasses on creekline

Habitat type: shrubland

Topography: drainage line

Slope: gentle

Soil: sandy loam

Soil colour: red–brown

Rock type: quartz, basalt

Fire age: > 5 years

Disturbance: grazing – medium, livestock tracks



Site: LF005 (Fauna site) (-28.876619, 121.660756)

Habitat description: Mostly low-mid shrubs over sparse tussocks and herbs

Habitat type: shrubland

Topography: hill top

Slope: moderate

Soil: clay loam

Soil colour: red–orange

Rock type: quartz, basalt

Fire age: > 5 years

Disturbance: none



Site: LF006 (Fauna site) (-28.863535, 121.632144)

Habitat description: *Acacia* shrubland over sparse ground cover

Habitat type: shrubland

Topography: hill slope

Slope: gentle

Soil: sandy loam

Soil colour: red–orange

Rock type: ferrous - Ironstone,
basalt

Fire age: > 5 years

Disturbance: none



Site: LF007 (Fauna site) (-28.873601, 121.610308)

Habitat description: Mulga shrubland over low shrubs and tussocks

Habitat type: shrubland

Topography: plain

Slope: negligible

Soil: clay loam

Soil colour: red–orange

Rock type: ferrous - Ironstone, quartz

Fire age: > 5 years

Disturbance: none



Site: LF008 (Fauna site) (-28.888624, 121.619058)

Habitat description: *Acacia* open woodland/shrubland

Habitat type: open woodland

Topography: plain

Slope: negligible

Soil: clay loam

Soil colour: red–orange, brown, yellow

Rock type: ferrous - Ironstone, quartz, calcrete

Fire age: > 5 years

Disturbance: none



Site: LF009 (Fauna site) (-28.883498, 121.657341)

Habitat description: Shrubs over grass, surrounded by open shrubland

Habitat type: shrubland

Topography: plain

Slope: negligible

Soil: clay loam

Soil colour: red–orange

Rock type: ferrous - Ironstone,
quartz

Fire age: > 5 years

Disturbance: grazing – medium, livestock tracks, weed infestation



Site: LF010 (Fauna site) (-28.881628, 121.654117)

Habitat description: *Acacia papyrocarpa* open woodland over low shrubs and herbs

Habitat type: woodland

Topography: plain

Slope: negligible

Soil: sandy loam

Soil colour: red–orange, brown

Rock type: ferrous - Ironstone,
quartz, calcrete

Fire age: > 5 years

Disturbance: none



Site: LF011 (Fauna site) (-28.843421, 121.627296)

Habitat description: Scattered tall/mid shrubs over low shrubs, grass, herbs

Habitat type: shrubland

Topography: hill top

Slope: moderate

Soil: sandy loam, clay loam

Soil colour: red–orange

Rock type: basalt

Fire age: > 5 years

Disturbance: none



Site: LF012 (Fauna site) (-28.841669, 121.602585)

Habitat description: Chenopod and *Acacia* spp. over grazed tussock grass and herbs

Habitat type: chenopod shrubland

Topography: plain

Slope: negligible

Soil: clay loam

Soil colour: red–orange

Rock type: ferrous - Ironstone, quartz, basalt

Fire age: > 5 years

Disturbance: grazing – medium



Site: LF013 (Fauna site) (-28.814909, 121.598694)

Habitat description: *Acacia* riparian open woodland, low shrubs, grass and herbs

Habitat type: woodland

Topography: drainage line

Slope: gentle

Soil: sandy loam

Soil colour: red–orange

Rock type: basalt

Fire age: > 5 years

Disturbance: grazing – medium



Site: LF014 (Fauna site) (-28.820789, 121.616648)

Habitat description: Scattered *Acacia* and *Allocasuarina* spp. over low to mid open shrubland over grass

Habitat type: chenopod shrubland

Topography: undulating plain

Slope: gentle

Soil: sandy loam

Soil colour: brown, yellow

Rock type: ferrous - Ironstone,
quartz

Fire age: > 5 years

Disturbance: grazing – medium, livestock tracks, weed infestation



Site: LF015 (Fauna site) (-28.582003, 121.548582)

Habitat description: *Acacia* mid tall open shrubland over scattered low shrubs and grasses

Habitat type: shrubland

Topography: hill top

Slope: gentle

Soil: clay loam, rocks

Soil colour: red–orange, yellow

Rock type: granite - rocks

Fire age: > 5 years

Disturbance: none



Site: LF016 (Fauna site) (-28.601465, 121.543295)

Habitat description: Low open Mulga woodland over new grass

Habitat type: open woodland

Topography: plain

Slope: negligible

Soil: clay loam, clay

Soil colour: red–orange

Rock type: quartz

Fire age: > 5 years

Disturbance: none



Site: LF017 (Fauna site) (-28.619092, 121.551895)

Habitat description: Mid tall Mulga shrubland over grass

Habitat type: shrubland

Topography: plain

Slope: negligible

Soil: sandy clay

Soil colour: red–orange

Rock type: granite - rocks, quartz

Fire age: > 5 years

Disturbance: none



Site: LF018 (Fauna site) (-28.675869, 121.563497)

Habitat description: Mid open Mulga shrubland over sparse low shrubs

Habitat type: shrubland

Topography: hill slope

Slope: gentle

Soil: sandy clay

Soil colour: red–orange

Rock type: ferrous - Ironstone,
granite - rocks, quartz,
basalt

Fire age: > 5 years

Disturbance: none



Site: LF019 (Fauna site) (-28.706839, 121.547845)

Habitat description: Scattered *Eucalyptus ?lucasia* over open Mulga shrubland over *Eremophila* and other low shrubs

Habitat type: open woodland

Topography: breakaway

Slope: moderate

Soil: sandy loam, rocks

Soil colour: brown, yellow

Rock type: ferrous - Ironstone, quartz, calcrete

Fire age: > 5 years

Disturbance: none



Site: LF020 (Fauna site) (-28.711125, 121.547937)

Habitat description: Open low to mid shrubland

Habitat type: shrubland

Topography: breakaway

Slope: moderate

Soil: sandy clay, rocks

Soil colour: red-orange, brown

Rock type: ferrous - Ironstone, gypsum

Fire age: > 5 years

Disturbance: none



Site: LF021 (Fauna site) (-28.742749, 121.552399)

Habitat description: Scattered trees over mid tall open Mulga shrubland over mixed low shrubs and grass

Habitat type: shrubland

Topography: hill top

Slope: gentle

Soil: sandy loam

Soil colour: brown, yellow

Rock type: ferrous - Ironstone

Fire age: > 5 years

Disturbance: none



Site: LF022 (Fauna site) (-28.647504, 121.547584)

Habitat description: Mid tall Mulga shrubland over mixed low-mid shrubs, sparse grass and herbs

Habitat type: shrubland

Topography: hill slope

Slope: gentle

Soil: sandy clay, clay loam

Soil colour: red-orange, brown

Rock type: ferrous - Ironstone,
quartz

Fire age: > 5 years

Disturbance: none



Site: LF023 (Fauna site) (-28.762849, 121.569145)

Habitat description: Mulga shrubland over low shrubs

Habitat type: shrubland

Topography: drainage line

Slope: gentle

Soil: sandy clay, sandy loam, clay

Soil colour: red-orange

Rock type: ferrous - Ironstone, quartz, siltstone / mudstone

Fire age: > 5 years

Disturbance: livestock tracks



Site: LF024 (Fauna site) (-28.764927, 121.58915)

Habitat description: Low open Mulga woodland and mid-tall shrubs over grass

Habitat type: open woodland

Topography: plain

Slope: negligible

Soil: clay loam, rocks

Soil colour: red-orange

Rock type: ferrous - Ironstone, calcrete, basalt

Fire age: > 5 years

Disturbance: none



Site: LF025 (Fauna site) (-28.781098, 121.591659)

Habitat description: Mid tall open Mulga woodland over mixed low to mid shrubs and almost no grass

Habitat type: open woodland

Topography: hill top

Slope: moderate

Soil: sandy loam

Soil colour: red–orange

Rock type: ferrous - Ironstone

Fire age: > 5 years

Disturbance: none



Site: LF026 (Fauna site) (-28.809893, 121.622255)

Habitat description: Mulga woodland over mixed shrubs, herbs and grass

Habitat type: open woodland

Topography: drainage line

Slope: gentle

Soil: sandy loam

Soil colour: red–orange, brown

Rock type: quartz, basalt

Fire age: > 5 years

Disturbance: none



Site: LF027 (Fauna site) (-28.817392, 121.627016)

Habitat description: Mulga low open woodland or tall shrubland over mixed lower shrubs, patchy grass and herbs

Habitat type: open woodland

Topography: undulating plain

Slope: gentle

Soil: sandy clay

Soil colour: red-brown,
red-orange

Rock type: quartz, calcrete, basalt

Fire age: > 5 years

Disturbance: none



Site: LF028 (Fauna site) (-28.794687, 121.580542)

Habitat description: Mulga and *Casuarina* low open woodland over mixed shrubs and herbs

Habitat type: shrubland

Topography: hill top

Slope: moderate

Soil: sandy clay, sandy loam

Soil colour: brown, yellow

Rock type: granite - rocks, quartz

Fire age: > 5 years

Disturbance: none



Appendix 2 Vertebrate species records from desktop review and this survey

Family	Species	Common name	Conservation status	Protected Matters (DoEE)	Threatened fauna (DBCA)	NatureMap (DBCA 2019a)	ALA (ALA 2019)	Ecosmart Ecology (2012)	Phoenix (2019)	MWH Australia (2017, 2018)	This survey
Amphibians											
Hylidae	<i>Cyclorana maini</i>	Sheep Frog				•	1	•			
	<i>Cyclorana occidentalis</i> (ex <i>C. platycephala</i>)	Western Water-holding Frog				•	38	•	•		1
	<i>Litoria rubella</i>	Little Red Tree Frog				•	4	•	•		1
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Kunapalari Frog				•	3				
	<i>Neobatrachus sutor</i>	Shoemaker Frog				•		•			
	<i>Notaden nicholli</i>	Desert Spadefoot				•					
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet				•		•			
Reptiles											
Cheluidae	<i>Chelodina steindachneri</i>	Dinner-plate Turtle					1				
Agamidae	<i>Ctenophorus caudicinctus</i>	Ringtailed Dragon							•		
	<i>Ctenophorus isolepis</i>	Military Dragon				•	6				
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon				•	3				1
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon				•	5	•			
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon				•	1	•	•		
	<i>Ctenophorus</i> sp. indet.										1
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon				•				•	
	<i>Moloch horridus</i>	Thorny Devil					1		•		
	<i>Pogona minor</i>	Western Bearded Dragon				•	2	•			
	<i>Tympanocryptis pseudopsephos</i> (ex <i>T. cephalus</i>)	Goldfields Pebble Dragon				•	5				
Gekkonidae	<i>Gehyra montium</i>								•		

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	<i>Gehyra purpurascens</i>	Purple Dtella				•		•			
	<i>Gehyra variegata</i>	Common Dtella				•	9	•	•	•	2
	<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko				•	19	•	•	•	2
Carphodactylidae	<i>Nephrurus vertebralis</i>	Midline Knob-tailed Gecko				•	1				
	<i>Nephrurus w. wheeleri</i>	Banded Knob-tailed Gecko				•	4				
	<i>Underwoodisaurus milii</i>	Barking Gecko				•	2	•	•		
Diplodactylidae	<i>Diplodactylus conspicillatus</i> (s.l.)	Fat-tailed Gecko				•	1				
	<i>Diplodactylus granariensis rex</i>	Western Stone Gecko				•	1				
	<i>Diplodactylus pulcher</i>	Fine-faced Gecko				•	4	•	•		
	<i>Lucasium squarrosom</i>	Spotted Ground Gecko				•	3				
	<i>Rhynchoedura ornata</i>	Western Beaked Gecko				•	5	•			
	<i>Strophurus assimilis</i>	Goldfields Spiny-tail Gecko				•					
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tail Gecko				•	5	•		•	
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard				•	2				
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot				•	3	•			
Scincidae	<i>Cryptoblepharus australis</i>	Inland Snake-eyed Skink				•	1	•			
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink				•			•		
	<i>Ctenotus inornatus</i>	Plain Ctenotus					7				
	<i>Ctenotus leonhardii</i>	Leonhard's Ctenotus				•	3			•	
	<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus				•	3				
	<i>Ctenotus severus</i>	Stern Ctenotus				•					
	<i>Ctenotus uber uber</i>	Spotted Ctenotus				•	2	•	•		1
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink				•			•	•	1

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	<i>Eremiascincus richardsonii</i>	Broad-banded Sandswimmer				•					1
	<i>Lerista desertorum</i>	Central Deserts Robust Slider				•	5	•	•		2
	<i>Lerista kingi</i>	King's Three-toed Slider					1				
	<i>Lerista timida</i>	Timid Slider				•	7	•	•		
	<i>Liopholis inornata</i>	Desert Skink				•	1				
	<i>Menetia greyii</i>	Common Dwarf Skink				•	2		•		
	<i>Morethia butleri</i>	Woodland Morethia Skink				•	9	•			
	<i>Tiliqua rugosa rugosa</i>	Bobtail							•		
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor				•	2	•	•	•	
	<i>Varanus gouldii</i>	Gould's Sand Monitor				•	1		•		
	<i>Varanus panoptes</i>	Yellow-spotted Monitor				•		•	•	•	19
Typhlopidae	<i>Anilius hamatus</i>	Pale-headed Blindsnake				•	9				
	<i>Anilius waitii</i>	Beaked Blindsnake				•	2				
	<i>Anilius sp. indet.</i>								•		
Pythonidae	<i>Antaresia stimsoni</i>	Stimson's Python				•					1
Elapidae	<i>Parasuta monachus</i>	Monk Snake				•	2	•			
	<i>Pseudechis australis</i>	Mulga Snake, King Brown				•	1				
	<i>Pseudechis butleri</i>	Spotted Mulga Snake					1				1
	<i>Pseudonaja mengdeni</i>	Western Brown Snake				•	3				1
	<i>Pseudonaja modesta</i>	Ringed Brown Snake				•	3				
	<i>Suta fasciata</i>	Rosen's Snake				•	3	•	•		
Birds											
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu				•	49		•	•	6

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Family	Species	Common name	Conservation status	Protected Matters (DoEE)	Threatened fauna (DBCA)	NatureMap (DBCA 2019a)	ALA (ALA 2019)	Ecosmart Ecology (2012)	Phoenix (2019)	MWH Australia (2017, 2018)	This survey
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl	VU (EPBC & BC Acts)	•	•	•	1	•			(1)
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail					1				
Anatidae	<i>Cygnus atratus</i>	Black Swan				•	44				
	<i>Tadorna tadornoides</i>	Australian Shelduck				•	45				
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck				•	25				
	<i>Chenonetta jubata</i>	Australian Wood Duck				•	36				
	<i>Anas superciliosus</i>	Pacific Black Duck				•	28	•			
	<i>Anas rhynchotis</i>	Australian Shoveler					2				
	<i>Anas gracilis</i>	Grey Teal				•	56	•	•		
	<i>Aythya australis</i>	Hardhead				•	18				
	<i>Biziura lobata</i>	Musk Duck				•	8				
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe				•	15				
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe				•	37				
	<i>Podiceps cristatus</i>	Great Crested Grebe				•	1				
Columbidae	* <i>Columba livia</i>	Rock Dove, Feral Pigeon		•		•	4				
	* <i>Streptopelia senegalensis</i>	Laughing Dove		•		•	1				
	<i>Phaps chalcoptera</i>	Common Bronzewing				•	39	•		•	•
	<i>Ocyphaps lophotes</i>	Crested Pigeon				•	125	•	•	•	2
	<i>Geopelia cuneata</i>	Diamond Dove				•	14	•		•	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth				•	4	•			1
Eurostopodidae	<i>Eurostopodus argus</i>	Spotted Nightjar				•	13	•		•	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet Nightjar				•	4	•			
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	Mig. (EPBC & BC Acts)	•							

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Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian Darter				•	7				
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant				•	20				
	<i>Phalacrocorax carbo</i>	Great Cormorant				•	6				
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant				•	33				
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican				•	20				
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron				•	43		•		
	<i>Ardea modesta</i>	Eastern Great Egret		•		•	6				
	<i>Egretta novaehollandiae</i>	White-faced Heron				•	44				1
	<i>Nycticorax caledonicus</i>	Nankeen Night-heron					2				
Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis	Mig. (EPBC & BC Acts)		•						
	<i>Threskiornis moluccus</i>	Australian White Ibis				•	2				
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis				•	8		•		
	<i>Platalea regia</i>	Royal Spoonbill					1				
	<i>Platalea flavipes</i>	Yellow-billed Spoonbill				•	15				
Accipitridae	<i>Elanus caeruleus axillaris</i>	Black-shouldered Kite				•	6	•		•	
	<i>Lophoictinia isura</i>	Square-tailed Kite					2				
	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard					1				
	<i>Haliastur sphenurus</i>	Whistling Kite				•	31				2
	<i>Milvus migrans</i>	Black Kite				•	9				
	<i>Accipiter fasciatus</i>	Brown Goshawk				•	6			•	
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk				•	9	•		•	
	<i>Circus assimilis</i>	Spotted Harrier				•	10	•			
<i>Circus approximans</i>	Swamp Harrier				•	2					

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	<i>Aquila audax</i>	Wedge-tailed Eagle				•	66	•	•	•	2
	<i>Hieraeetus morphnoides</i>	Little Eagle				•	4				
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel				•	80	•	•		4
	<i>Falco berigora</i>	Brown Falcon				•	44	•	•		
	<i>Falco longipennis</i>	Australian Hobby				•	33	•	•		
	<i>Falco hypoleucos</i>	Grey Falcon	VU (BC Act)		•	•					
	<i>Falco subniger</i>	Black Falcon					2				
	<i>Falco peregrinus</i>	Peregrine Falcon	OS (BC Act)		•	•	2	•	•		
Rallidae	<i>Gallinula tenebrosa</i>	Dusky Moorhen					3				
	<i>Tribonyx ventralis</i>	Black-tailed Native-hen				•	31		•		
	<i>Fulica atra</i>	Eurasian Coot				•	29				
Otididae	<i>Ardeotis australis</i>	Australian Bustard				•	6	•	•		1
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew				•	2	•	•		
Recurvirostridae	<i>Cladorhynchus leucocephalus</i>	Banded Stilt					5				
	<i>Himantopus himantopus</i>	Black-winged Stilt				•	21	•			
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet				•	20				
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover				•	44				
	<i>Charadrius veredus</i>	Oriental Plover	Mig. (EPBC & BC Acts)	•			1				
	<i>Elsayornis melanops</i>	Black-fronted Dotterel				•	51	•			
	<i>Peltohyas australis</i>	Inland Dotterel					6				
	<i>Thinornis rubricollis</i>	Hooded Plover	P4 (DBCA list)	•	•	•	1				
	<i>Erythrogonys cinctus</i>	Red-kneed Dotterel				•	17				
	<i>Pluvialis fulva</i>	Pacific Golden Plover	Mig. (EPBC & BC Acts)		•		1				

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	<i>Vanellus tricolor</i>	Banded Lapwing				•	31	•	•		
Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed Godwit	VU/Mig. (EPBC & BC Acts)				2				
	<i>Actitis hypoleucos</i>	Common Sandpiper	Mig. (EPBC & BC Acts)	•	•	•	10				
	<i>Tringa nebularia</i>	Common Greenshank	Mig. (EPBC & BC Acts)	•	•	•	11				
	<i>Tringa glareola</i>	Wood Sandpiper	Mig. (EPBC & BC Acts)		•	•	4				
	<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mig. (EPBC & BC Acts)				1				
	<i>Calidris canutus</i>	Red Knot	EN/Mig. (EPBC & BC Acts)		•		1				
	<i>Calidris melanotos</i>	Pectoral Sandpiper	Mig. (EPBC & BC Acts)	•							
	<i>Calidris ruficollis</i>	Red-necked Stint	Mig. (EPBC & BC Acts)		•						
	<i>Calidris subminuta</i>	Long-toed Stint	Mig. (EPBC & BC Acts)								
	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)	•	•		5				
Turnicidae	<i>Turnix velox</i>	Little Button-quail				•	6	•			
Laridae	<i>Gelochelidon nilotica</i>	Gull-billed Tern	Mig. (EPBC & BC Acts)		•						
	<i>Chlidonias hybrida</i>	Whiskered Tern				•	14				
	<i>Chroicocephalus novaehollandiae</i>	Silver Gull				•	8				
Cacatuidae	<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo					2				
	<i>Eolophus roseicapillus</i>	Galah				•	78	•			1
	<i>Nymphicus hollandicus</i>	Cockatiel				•	32	•			
Pstittaculidae	<i>Barnardius zonarius</i>	Australian Ringneck				•	61	•	•	•	6
	<i>Psephotus varius</i>	Mulga Parrot				•	40	•	•	•	
	<i>Melopsittacus undulates</i>	Budgerigar				•	41	•	•	•	
	<i>Neophema splendida</i>	Scarlet-chested Parrot					3				
	<i>Neopsephotus bourkii</i>	Bourke's Parrot				•	22	•		•	

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	<i>Pezoporus occidentalis</i>	Night Parrot	EN (EPBC Act), CR (BC Act)	•							
	<i>Polytelis alexandrae</i>	Princess Parrot	VU (EPBC Act), P4 (DBCA)	•	•						
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo				•	9	•			
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo		•			5	•	•		
	<i>Cacomantis pallidus</i>	Pallid Cuckoo				•	25	•			
Strigidae	<i>Ninox boobook</i> (ex <i>novaeseelandiae</i>)	Boobook Owl					6	•			
Tytonidae	<i>Tyto javanica</i> (= <i>N. alba</i>)	Eastern Barn Owl				•	9				
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher				•	30	•			
	<i>Todiramphus sanctus</i>	Sacred Kingfisher				•	1				
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater		•		•	11		•		2
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper				•	11				
	<i>Climacteris rufa</i>	Rufous Treecreeper					2				
Ptilonorhynchidae	<i>Ptilonorhynchus guttatus</i>	Western Bowerbird				•	21	•	•	•	1
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren				•	20	•	•	•	
	<i>Malurus leucopterus leuconotus</i>	White-winged Fairy-wren				•	20	•	•	•	1
	<i>Malurus lamberti</i>	Variiegated Fairy-wren				•	5	•	•	•	1
	<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren				•					
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat				•	4	•	•	•	
	<i>Smicronis brevirostris</i>	Weebill				•	15	•			1
	<i>Gerygone fusca</i>	Western Gerygone					9				1
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill				•	8	•	•	•	
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				•	45	•		•	2
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill				•	31	•	•	•	4

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	<i>Acanthiza iredalei</i>	Slender-billed Thornbill							•		4
	<i>Acanthiza apicalis</i>	Broad-tailed (Inland) Thornbill				•	21	•		•	
	<i>Aphelocephala leucopsis</i>	Southern Whiteface				•	32	•	•	•	
Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote				•		•			
	<i>Pardalotus striatus</i>	Striated Pardalote				•	29				
Meliphagidae	<i>Sugomel niger</i>	Black Honeyeater					1				
	<i>Certhionyx variegatus</i>	Pied Honeyeater				•	12		•		
	<i>Lichmera indistincta</i>	Brown Honeyeater				•	13		•		
	<i>Epthianura tricolor</i>	Crimson Chat				•	43	•			
	<i>Epthianura aurifrons</i>	Orange Chat				•	20				
	<i>Epthianura albifrons</i>	White-fronted Chat				•	11				
	<i>Lacustroica whitei</i>	Grey Honeyeater					1				
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater				•	95	•	•		13
	<i>Gavicalis virescens</i>	Singing Honeyeater				•	131	•	•	•	18
	<i>Manorina flavigula</i>	Yellow-throated Miner				•	106	•	•	•	6
	<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater					1				
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater				•	4				
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater				•	3				
	<i>Purnella albifrons</i>	White-fronted Honeyeater				•	30	•			
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler				•	29	•	•	•	3
Cinclosomatidae	<i>Cinclosoma clarum</i> (ex <i>C. castanotum</i>)	Copperback Quail-thrush					3			•	
	<i>Cinclosoma marginatum</i> (ex <i>C. castaneothorax</i>)	Western Quail-thrush				•	22	•			
Psophodidae	<i>Psophodes occidentalis</i>	Chiming Wedgebill				•	23				

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Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sitella								•	
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-shrike				•	18	•			
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				•	64	•	•	•	2
	<i>Lalage tricolor (=L. sueurii)</i>	White-winged Triller				•	32	•	•		1
Pachycephalidae	<i>Pachycephala occidentalis</i>	Western Golden Whistler				•	1				
	<i>Pachycephala rufiventris</i>	Rufous Whistler				•	41	•	•	•	5
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush				•	36	•	•	•	
	<i>Oreoica gutturalis</i>	Crested Bellbird				•	92	•	•	•	12
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow				•	28	•	•		
	<i>Artamus cinereus</i>	Black-faced Woodswallow				•	92	•	•	•	5
	<i>Artamus minor</i>	Little Woodswallow				•	2	•		•	
Cracticidae	<i>Cracticus torquatus</i>	Grey Butcherbird				•	49	•	•		2
	<i>Cracticus nigrogularis</i>	Pied Butcherbird				•	88	•	•	•	6
	<i>Cracticus tibicen</i>	Australian Magpie				•	69	•	•	•	5
	<i>Strepera versicolor</i>	Grey Currawong				•	17	•		•	
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail				•	4				
	<i>Rhipidura leucophrys</i>	Willie Wagtail				•	97	•	•	•	5
Corvidae	<i>Corvus coronoides</i>	Australian Raven				•	5		•		
	<i>Corvus bennetti</i>	Little Crow				•	88	•	•	•	5
	<i>Corvus orru</i>	Torresian Crow				•	15	•		•	
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-Lark				•	111	•	•	•	2
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter				•	2	•			
	<i>Petroica goodenovii</i>	Red-capped Robin				•	71	•	•	•	5

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	<i>Melanodryas cucullata</i>	Hooded Robin				•	31	•		•	
Megaluridae	<i>Cincloramphus mathewsi</i>	Rufous Songlark				•	17	•			
	<i>Cincloramphus cruralis</i>	Brown Songlark				•	28	•			
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow				•	40	•		•	
	<i>Hirundo neoxena</i>	Welcome Swallow				•	94	•	•	•	
	<i>Petrochelidon ariel</i>	Fairy Martin				•	26	•			
	<i>Petrochelidon nigricans</i>	Tree Martin				•	44	•		•	
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird				•	8	•		•	
Estrildidae	<i>Emblema pictum</i>	Painted Finch					3				
	<i>Taeniopygia guttata</i>	Zebra Finch				•	103	•	•	•	9
Motacillidae	<i>Anthus australis</i>	Australasian Pipit				•	98	•			1
	<i>Motacilla cinerea</i>	Grey Wagtail	Mig. (EPBC & BC Acts)	•							
	<i>Motacilla flava</i>	Yellow Wagtail	Mig. (EPBC & BC Acts)	•							
Mammals											
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna				•		•			2
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr				•	1	•			
	<i>Dasyurus geoffroii</i>	Chuditch	VU (EPBC & BC Acts)	•							
	<i>Ningauai ridei</i>	Wongai Ningauai				•					
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart				•		•			
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart				•		•			
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	P4 (DBCA list)			•		•			(3)
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				•					
Myrmecobiidae	<i>Myrmecobius fasciatus</i>	Numbat	VU (EPBC & BC Acts)		•						

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Thylacomyidae	<i>Macrotis lagotis</i>	Bilby	VU (EPBC & BC Acts)		•						
Potoroidae	<i>Bettongia lesueur graii</i>	Burrowing Bettong, Boodie	EX (EPBC & BC Acts)						•		(5)
Macropodidae	<i>Osphranter robustus</i> (ex <i>Macropus</i>)	Euro, Biggada				•		•	•	•	29
	<i>Osphranter rufus</i> (ex <i>Macropus</i>)	Red Kangaroo, Marlu				•		•	•	•	•
	<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	VU (EPBC & BC Acts)		•						
Emballonuridae	<i>Taphozous hilli</i>	Hill's Sheathtail-bat				•					
Molossidae	<i>Ozimops petersi</i> (= <i>Mormopterus</i> sp. 3)	Inland Free-tailed Bat				•					
	<i>Austronomus australis</i> (ex <i>Tadarida</i>)	White-striped Freetail-bat				•					
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				•			•		3
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat							•		
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat				•	1				
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				•					
	<i>Vespadelus baverstocki</i>	Inland Forest Bat				•			•		
	<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat				•			•		
Muridae	<i>Leporillus conditor</i>	Greater Stick-nest Rat	VU (EPBC & BC Acts)						•		(1)
	<i>Notomys alexis</i>	Spinifex Hopping-mouse				•		•			
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				•	1	•			
	* <i>Mus musculus</i>	House Mouse				•	7	•	•		1
Leporidae	* <i>Oryctolagus cuniculus</i>	Rabbit		•		•		•	•	•	12
Camelidae	* <i>Camelus dromedaries</i>	Camel		•			1			•	
Bovidae	* <i>Bos taurus</i>	Domestic Cattle							•	•	18
	* <i>Capra hircus</i>	Goat		•				•	•		3
	* <i>Ovis aries</i>	Sheep									

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Suidae	* <i>Sus scrofa</i>	Pig				•					
Equidae	* <i>Equus asinus</i>	Donkey		•						•	5
	* <i>Equus caballus</i>	Horse							•	•	
Canidae	* <i>Canis familiaris</i>	Dog/Dingo		•			8		•	•	9
	* <i>Vulpes vulpes</i>	Red Fox		•				•			
Felidae	* <i>Felis catus</i>	Domestic Cat		•		•		•	•	•	3

