Basic Vertebrate Fauna Survey
Pit 7 Study Area

Prepared for Premier Coal Ltd
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EXECUTIVE SUMMARY

Onshore Environmental Consultants Pty Ltd (Onshore Environmental) was commissioned by Premier Coal Limited (Premier Coal) to undertake a basic vertebrate fauna survey at the Pit 7 Project area, located approximately 10 km east-south-east of the Collie townsite in southwest Western Australia.

The field survey was completed over six person days between the 15th and 18th December 2021, and the 27th January 2022. A total of 50 vertebrate fauna species were recorded during the field survey, including three reptiles, 41 birds and six mammals.

Two vertebrate fauna species listed as under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Western Australian *Biodiversity Conservation Act 2016* (BC Act) were recorded from the study area; Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) listed as Vulnerable, and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) listed as Endangered.

Two Priority fauna species, as recognised by the Department of Biodiversity Conservation and Attractions (DBCA) were also recorded from the study area; Quenda (*Isoodon fusciventer*) and Western Brush Wallaby (*Notamacropus irma*). Both species are listed as Priority 4 taxa.

Three introduced fauna species (feral animals) were recorded within the study area during the field survey; European Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*) and Cat (*Felis catus*).

Three fauna habitats were mapped within the study area; Jarrah/Marri Forest on hillslopes, Wetland/Drainage zones, and Pine Plantations. None of these habitats were determined to be regionally or locally restricted. Habitat condition was variable and in places had been severely reduced by hardwood logging and associated management, clearing for pine plantation, and disturbance by historical mining.

Habitats within the study area were assessed for the use by, and suitability for, conservation significant fauna species. The majority of the study area was deemed to be suitable foraging habitat for Black Cockatoos. A total of 21 potential habitat trees (diameter >50 cm) were recorded at an average density of 6.5 habitat trees per hectare (ha) across the 13 plots assessed. The density of potential habitat trees was higher within the Jarrah/Marri Forest habitat with 16.0 trees per ha recorded. A total of 15 trees with hollows potentially suitable for use by Black Cockatoos were recorded across the wider study area, with five of these classified as supporting usable hollows. None of the hollows observed showed signs of use by Black Cockatoos.

Ten additional species of conservation significance were considered likely to occur within the study area but were not recorded during the survey. These species may utilise habitats within the study area;

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Peregrine Falcon (*Falco peregrinus*);
- Woylie (*Bettongia penicillata*);
- Chuditch (*Dasyurus geoffroii*);
- Western False Pipistrelle (*Falsistrellus mackenziei*);
- Water-rat (*Hydromys chrysogaster);*
- Tammar Wallaby (*Notamacropus eugenii derbianus*);

- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*);
- Western Ringtail Possum (*Pseudocheirus occidentalis*); and
- Darling Range South-west Ctenotus (*Ctenotus delli*).

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1.0 INTRODUCTION

1.1 Preamble

Premier Coal commissioned Onshore Environmental to undertake a basic vertebrate fauna survey at the Pit 7 Project area, herein referred to as the study area. The study area is located in close proximity to the existing Premier Coal mining operations, approximately 10 km east-south-east of the Collie townsite (Figure 1). The fauna survey was completed over six person-days in December 2021 and January 2022.

1.2 Climate

The climate of south-west Western Australia is Mediterranean, with hot, dry summers and mild, wet winters. The nearest weather station with complete rainfall records is at the nearby town of Collie and has been operational since 1899. Rainfall peaks in June and July with both months recording average falls greater than 170 mm. The average annual rainfall for Collie is 927.7 mm (Bureau of Meteorology (BOM) 2022). Rainfall received in 2021 was above average with an annual total of 1007.4 mm (Figure 2). Rainfall for October 2021 was above average, while November and December 2021 were both below average. A total of 5 mm of rainfall was recorded at Collie during the survey on the 17th December 2021, however no rainfall was observed within the study area.

The maximum average summer temperature for Collie is 30.5°C during January, with the minimum winter average dropping to 4.2°C during July (Figure 2). Maximum temperatures at the time of the field survey were slightly cooler than average, with a range of 20.8 - 27.7°C degrees across the field survey in December 2021 (long term average for December: 28.3°C) and a maximum of 29.2°C on 27th of January.

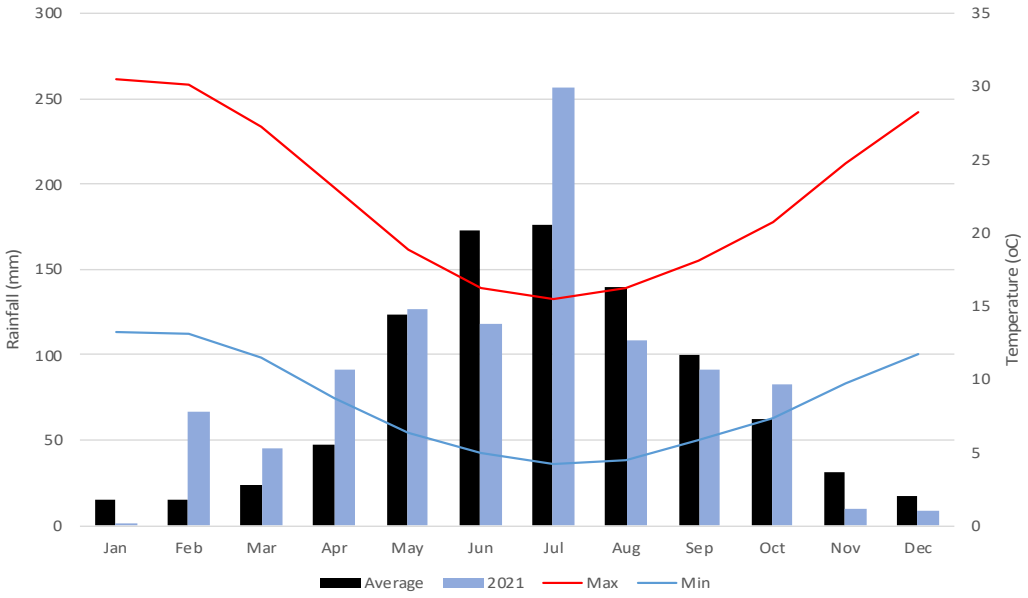
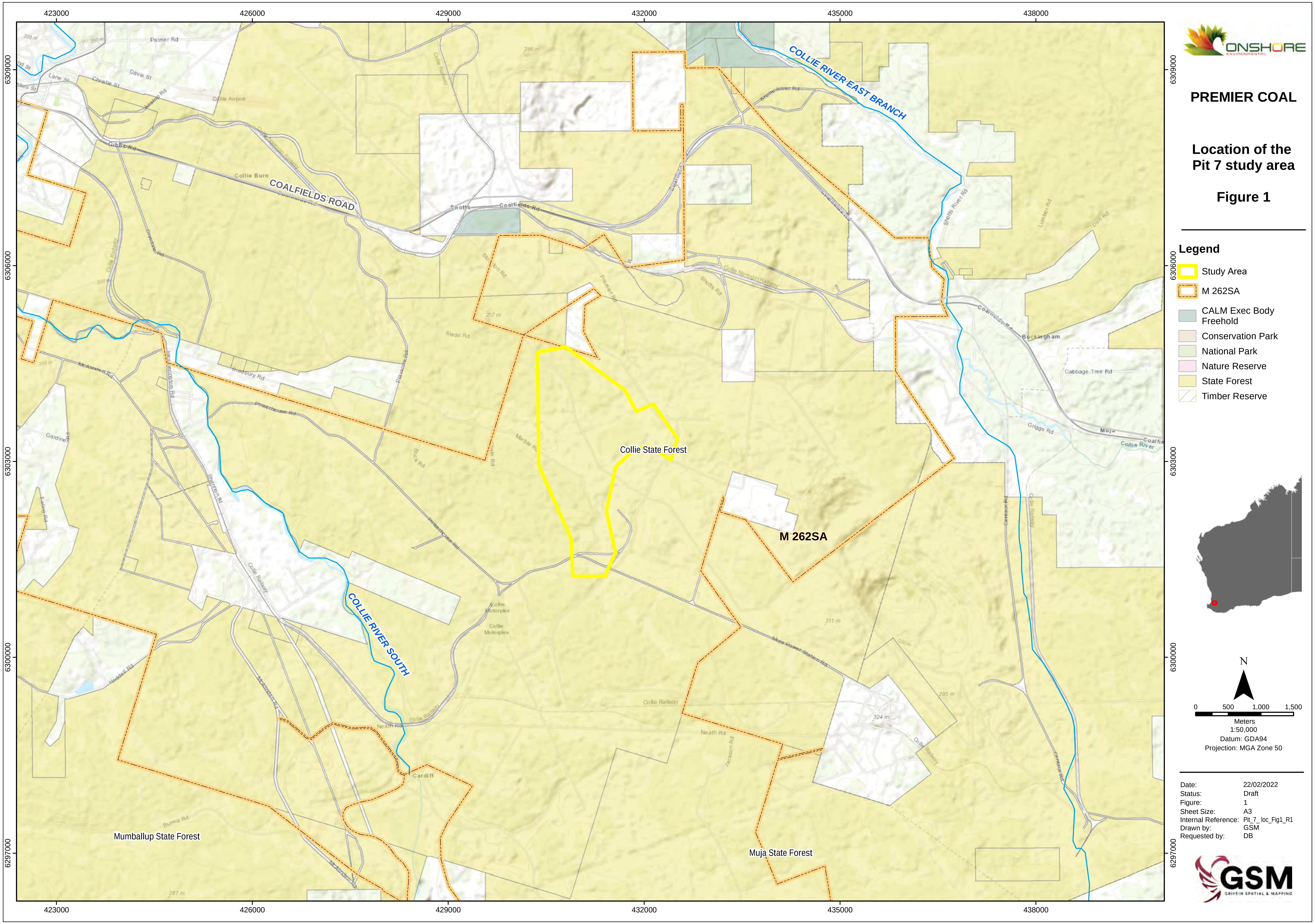


Figure 2 Rainfall and climatic data recorded at the Collie weather station from January to December 2021, with long term average (1899-2021) (BOM 2022).



PREMIER COAL
Location of the Pit 7 study area
Figure 1
Legend
Study Area
M 262SA
CALM Exec Body Freehold
Conservation Park
National Park
Nature Reserve
State Forest
Timber Reserve
N
0 500 1,000 1,500
Meters
1:50,000
Datum: GDA94
Projection: MGA Zone 50
Date: 22/02/2022
Status: Draft
Figure: 1
Sheet Size: A3
Internal Reference: Pit_7_loc_Fig1_R1
Drawn by: GSM
Requested by: DB
ONSHORE
GSM
COLLIE RIVER EAST BRANCH
COLLIE RIVER SOUTH
COALFIELDS ROAD
Collie State Forest
M 262SA
Mumballup State Forest
Muja State Forest
423000
426000
429000
432000
435000
438000
6309000
6306000
6303000
6300000
6297000

1.3 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of the Environment and Energy [DoEE] 2018). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study area is located within the Southern Jarrah Forest (JF2) sub-region within the Jarrah Forest bioregion and is close to the border of the Northern Jarrah Forest sub-region. The Southern Jarrah Forest sub-region is described as, “Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. The climate is Warm Mediterranean” (Hearn *et al*. 2002).

The vegetation of the Southern Jarrah Forest sub-region is described as “Jarrah-Marri forest in the west grading to Marri and Wandoo woodlands in the east. There are extensive areas of swamp vegetation in the south-east, dominated by Paperbarks and Swamp Yate. The understorey component of the forest and woodland reflects the more mesic nature of this area. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions” (Hearn *et al*. 2002).

1.4 Geology

The geology of the study area and the wider Collie region has been described by Wild and Walker (1982). The study area lies within the Collie Basin on the Darling Plateau. Permian sedimentary rocks occur in north north-west trending depressions on the Darling Plateau, and are completely covered by Tertiary sediments. The largest, the Collie Basin, contains 1,300 m of strata, whilst the smaller Wilga Basin contains 360 m of sediments. Both depressions contain similar sedimentary sequences and are believed to have resulted from glacial scouring into the Archaean basement rocks.

The Collie Basin is approximately 26 km long by 13 km wide and stretches south-east from Allanson (to the west of Collie). There are three sub-basins; Cardiff, Shotts and Muja. These sub-basins are comprised of the lower Permian unit, the Stockton Formation and the overlying Collie Coal Measures. The Stockton Formation rests on a glacially striated granite pavement, and consists of a basal tillite, which is overlain by sandstone, siltstone and mudstone. The Collie Coal Measures are composed of a conglomerate, sandstone, siltstone, shale and intercalated seams of sub-bituminous coal.

1.5 Landforms and Soils

Tille (1996) mapped the soils and landforms of the Wellington-Blackwood District including the town of Collie and surrounds. The study area lies within the Western Darling Range Zone, which overlies granite and gneiss of the Archaean Yilgan Craton and is bounded by the Darling Fault to the west and the Eastern Darling Range Zone to the east. The zone comprises three systems; Darling Plateau System, Lowden Valleys System and the Coalfields System. The study area lies within the

Coalfields System described as Permian sedimentary basins containing coal. There are three subsystems occurring in the vicinity of the study area:

- Collie Subsystem: Broad lateritic divides and crests with deep sands and sandy gravels;
- Cardiff Subsystem: Low lying, poorly drained flats with sands; and
- Stockton Subsystem: Shallow, swampy minor valleys with sands and gravels.

The Australian Soil Resource Information System (ASRIS) provides soil and land resource information across Australia. The following soil type occurs within the study area (CSIRO 2015):

- Cb44: The Collie basin area, generally flat to strongly undulating land with many sandy flats and swamps: chief soils seem to be leached sands (Uc2.33) in the lower and more swampy sites and (Uc2.21), often containing ironstone gravels, on flat to gently sloping areas. Associated are soils containing ironstone gravels on the undulating areas.

2.0 METHODOLOGY

2.1 Legislation and Guidance Statements

The basic vertebrate fauna survey was carried out in a manner that was compliant with the EPA requirements for the environmental surveying and reporting of vertebrate fauna in Western Australia:

- Statement of Environmental Principles, Factors and Objectives (EPA 2020a);
- Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020b); and
- Environmental Factor Guideline - Terrestrial Fauna (EPA 2016).

Other guidelines relevant to the survey include:

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a) Survey Guidelines for Australia's Threatened Bats;
- DEWHA (2010b) Survey Guidelines for Australia's Threatened Birds;
- DEWHA (2010c) Survey Guidelines for Australia's Threatened Frogs;
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011a) Survey Guidelines for Australia's Threatened Mammals; and
- DSEWPC (2011b) Survey Guidelines for Australia's Threatened Reptiles.

2.2 Desktop Assessment

2.2.1 Literature Review

A review of all relevant publicly available literature for surveys completed in close proximity to the study area was undertaken, including a search of the Department of Water and Environmental Regulation's (DWER) Index of Biodiversity Surveys for Assessment (DWER 2021). While there is no publicly available record of any previous fauna survey work being completed from within the study area, extensive baseline and targeted survey work has been undertaken at nearby tenements for both Premier Coal and the second local coal mining company Griffin Coal. Results from recent surveys undertaken in the area are described in more detail in Section 3.1.1.

Recent survey work includes a fauna survey of the nearby Pit 2 exploration area for Premier Coal in September 2020 (Onshore Environmental 2021). Additionally, Onshore Environmental has undertaken a detailed flora and vegetation survey within the study area (Onshore Environmental 2020a). This survey provided detailed vegetation mapping which was utilised to inform habitat mapping of the study area.

2.2.2 Database Searches

The desktop assessment included searches of several databases relating to significant fauna previously collected or described within, or in close proximity to, the study area. For this report the search was extended beyond the study area to place fauna values into a local and regional context. The following databases were searched:

- DBCA Threatened and Priority Fauna database search (20 km radial search conducted);
- EPBC Act Protected Matters database (50 km radial search conducted);
- BirdLife Australia's Birdata dataset (10 km radial search conducted); and
- Atlas of Living Australia database (10 km radial search conducted).

The NatureMap database search platform is currently unavailable, therefore the results from the NatureMap search from the nearby Pit 2 study area were included in the desktop assessment (Onshore Environmental 2021, DBCA 2021).

The results from the above database searches and literature review were compiled to provide a list of fauna species that could potentially occur within or surrounding the study area.

2.2.3 Assessment of Conservation Significance

The conservation significance of fauna and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

International Level:

- IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1); and
- International Conventions: Migratory taxa listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Commonwealth Level:

- EPBC Act: The Department of Agriculture, Water and the Environment (DAWE) lists Threatened fauna, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of six categories (Appendix 2).

State Level:

- Biodiversity Conservation (BC) Act: At a State level, native fauna species are protected under the BC Act – Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations (Appendix 3); and
- DBCA Priority list: DBCA produces a list of Priority species that have not been assigned statutory protection under the BC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 3).

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.
-

2.2.4 Assessment of Likelihood of Occurrence in the study area

A list of conservation significant species occurring within a 50 km radius of the study area was compiled from the above database searches and literature review. The likelihood of each taxon occurring within the study area was assessed based on habitat availability, the age and proximity of previous records, and regional occurrence of the species (Table 1). Habitat availability and suitability was assessed based on aerial imagery and previous knowledge of the study area and surrounds.

Table 1 Ranking system used to assign the likelihood that a species would occur in the study area.

Rank	Criteria
Recorded	The species has been recorded in the study area.
Likely to occur	Suitable habitat exists within the study area and the species has been recorded within 20km in the last 10 years.
Possible to occur	Suitable habitat exists within the study area and the species has been recorded within 50km in the last 20 years.
Unlikely to occur	No suitable habitat occurs within the study area; and/or there are no previous records within a 50 km radius of the study area and/or previous records are >20 years old.

2.3 Field Survey Methodology

2.3.1 Timing and Personnel

The vertebrate fauna survey was completed by Senior Ecologist Ms Jessica Waters accompanied by Principal Botanists Dr Darren Brearley and Dr Jerome Bull. The survey was undertaken over a total of a six person between the 15th to 18th of December 2021 and 27th of January 2022.

2.3.2 Surveying of Study Area

The study area was walked to assess and document habitat characteristics including evaluation of habitats suitable to support conservation significant fauna. Low intensity sampling was undertaken throughout the study area involving bird census and active foraging. Targeted searches (as detailed below) were also undertaken for conservation significant fauna species identified during the database review.

The following parameters were recorded for all conservation significant fauna observed:

- Co-ordinate location;
- Description of habitat in which the species was located; and
- Photograph of the species, evidence and/or habitat.

Camera Traps

Motion cameras were set up within all habitats identified throughout the study area. Cameras were strategically placed to target habitat features that were most likely to be utilised by species of conservation significance, including potential den sites (Chuditch), trees with suitable hollows (Phasogales), and dense undergrowth in drainage areas (Quenda). Motion cameras were baited with universal bait. A total of five cameras were deployed on the 15th December 2021 and retrieved on the 27th January 2022 (Table 2, Figure 3). At the time of collection one of the cameras was could not be relocated and is presumed to be stolen.

Active Foraging

Active foraging, involving raking litter and turning over rocks, was completed throughout the study area. Records were captured for any conservation significant species sighted during foraging.

Table 2 Locations for camera traps situated throughout the study area.

Camera Number	Date Deployed	Date Collected	Easting	Northing	Habitat
Cam 01	15/12/21	27/10/22	431254	6304006	Jarrah/Marri Hillslope
Cam 02	15/12/21	NA[1]	430997	6303055	Wetland/Drainage zone
Cam 03	15/12/21	27/10/22	430595	6303128	Wetland/Drainage zone
Cam 04	15/12/21	27/10/22	431004	6301657	Jarrah/Marri Hillslope
Cam 05	15/12/21	27/10/22	431188	6303339	Wetland/Drainage zone

2.3.3 Targeted Surveys for Conservation Significant Species

Tree Hollow Searches and Tree Density Assessments

Tree hollows were actively searched for during transect walks within the study area. Each tree hollow encountered was assessed for its suitability to provide habitat for conservation significant fauna species. Those hollows deemed appropriate (i.e. sufficient size) for black cockatoo species were assessed further as described below.

In order to determine approximate densities of potential future habitat trees (i.e. diameter at breast height (DBH) ≥50 cm) tree counts were conducted with each fauna habitat type identified. Tree counts provide an indicator of the current and future value of fauna habitats for use as black cockatoo breeding habitat. Target tree species included Marri, Jarrah and any other *Corymbia* and *Eucalyptus* species of a suitable size that were present. A total of 13 randomly located quadrats each 50 m by 50 m in dimension were assessed across the study area (Figure 3). Tree numbers within these areas were then extrapolated to provide an average density per hectare for each habitat type.

Black Cockatoo Searches

Habitats used by black cockatoos have been placed into three categories by DSEWPC (2012), these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

[1] Camera 2 could not be relocated and is presumed stolen.

Breeding habitat for black cockatoos was assessed by identifying all suitable breeding trees that had a DBH ≥50 cm. Trees were examined to identify hollows using binoculars and evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Any potential nesting hollows observed were categorised, based on the size of the hollow entrance (i.e. hollows >10 cm in diameter) and suitability of the hollow for black cockatoo use (i.e. deep enough) (Table 3). The location of each tree identified with suitable nesting hollows was recorded along with details on the number and size of hollows present.

Any evidence of foraging (e.g. chewed fruits around the base of trees) was recorded, and the type of foraging was also detailed. Potential foraging habitat was documented notwithstanding the presence of foraging evidence. Evidence of roosting (e.g. branch clippings, droppings or moulted feathers) within trees was also recorded.

Table 3 Categories for tree hollows potentially utilised for nesting by black cockatoos identified within the study area.

Category	Description
Unsuitable	Hollow <10cm
Marginal	Hollow is of a suitable size for nesting i.e. 10 cm or greater. However, these hollows are considered marginal for use by black cockatoos as nesting sites for one or more of the following reasons: • small entrance; • unlikely to have a large internal space for nesting, or sufficient depth inside the hollow (i.e. less than 0.5 m); • evidence of use by other competitive species i.e. bees, other birds or possums. While these hollows are not currently high-quality nest sites they have the potential to become nest sites in the future.
Usable	Hollow is of suitable size, is likely to be of sufficient depth, and no competitive species are noted. No evidence of use.
Chewed	Evidence of chew marks or other signs of use on edge of hollow indicating recent or historical usage.
Used	Cockatoos seen entering or exiting hollow.

Drey Searches

Dreys were actively searched to provide evidence of the presence of Western Ringtail Possums. Each drey encountered was photographed (where possible) and a GPS point recorded.

2.3.4 Fauna Habitat Mapping

Assessments were undertaken throughout the study area to document habitat characteristics and map fauna habitat types. The fauna habitat mapping utilised high-resolution aerial photography of the study area at a scale of 1:10,000. Ground-truthing of the study area was completed during the survey with habitat characteristics recorded at each habitat assessment site, and the habitat type coded for each polygon. Vegetation association mapping (Onshore Environmental 2020a) was utilised to further aid in characterising the habitat map accuracy across the full extent of the study area.

2.3.5 Species Identification and Nomenclature

Vertebrate fauna species were identified at the time of observation in the field and by photographs from motion cameras by the Senior Ecologist. All species were able to be fully identified with no specimens needed to be taken for further examination. Nomenclature and conservation significance rankings used in this report are in accordance with the current listing of WA fauna recognised by the WA Museum (WAM), as listed on the Checklist of the Terrestrial Vertebrae of Western Australia (WAM 2021) for mammals and herpetofauna, and the Australian Faunal Directory for birds (DAWE 2021a).

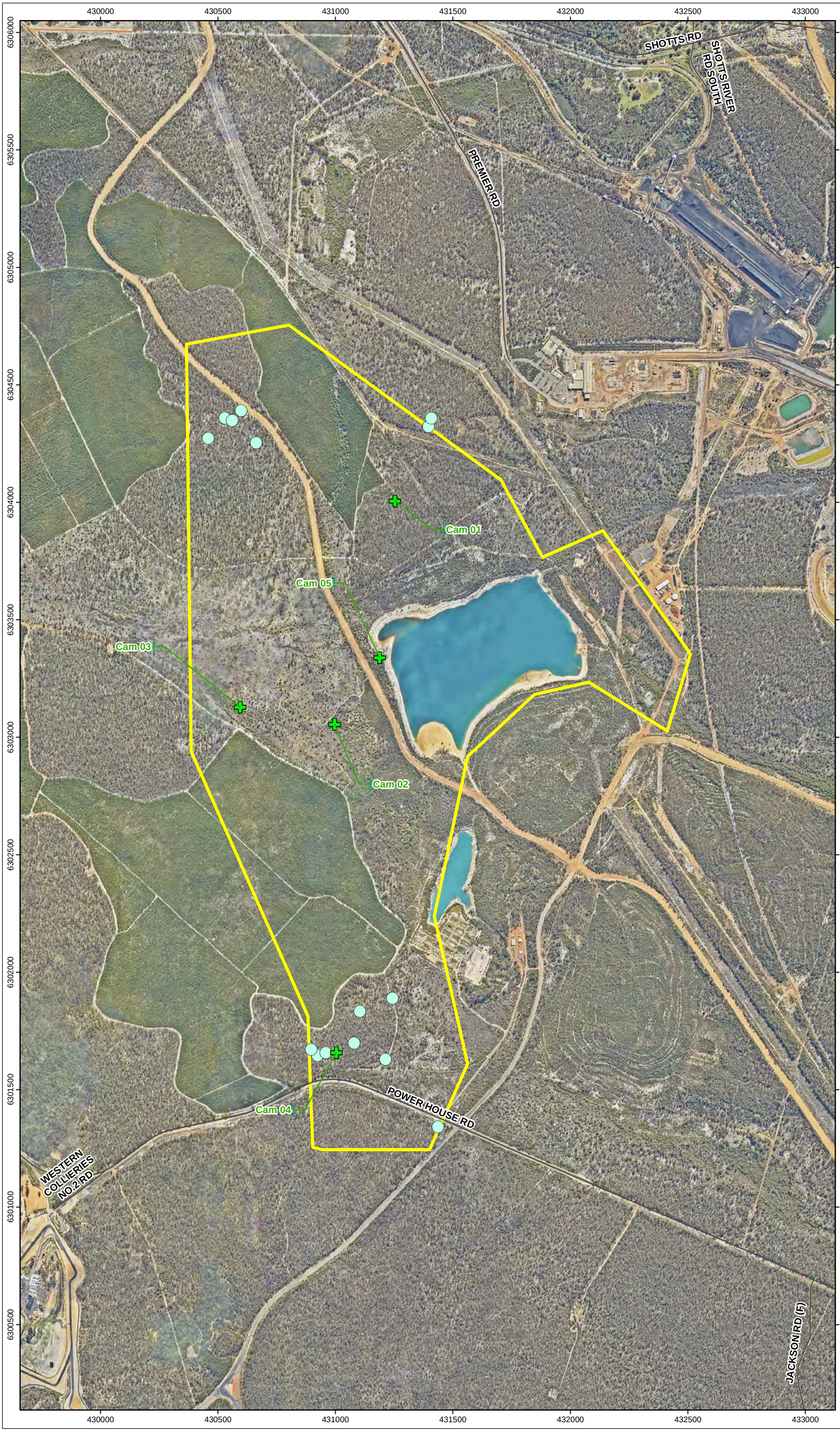
2.4 Field Survey Constraints

The EPA Technical Guidance (EPA 2020b) lists potential limitations that field surveys may encounter. Limitations associated with the basic vertebrate fauna survey, are addressed in Table 4. There were no survey-specific limitations identified.

Table 4 Relevance of limitations, as identified by EPA (2020), to the vertebrate survey.

Variable	Impact on Survey Outcomes
Availability of data and information	The desktop searches provided an extensive species list, background information and regional context for the study area. While no issues with the reliability or accuracy of the desktop searches or the previous surveys were identified it is acknowledged that there may be errors in the data presented from these sources.
Experience levels	The Senior Ecologist and Principal Botanists who executed this survey are practitioners suitably qualified in their respective fields; Jessica Waters has ten years' experience and the Principal Botanists each have >20 years' experience. All personnel have completed numerous surveys in the south-west region and in close proximity to the study area.
Scope (fauna groups sampled)	All allocated tasks were achieved during the survey, with motion cameras deployed and habitat assessments, foraging, opportunistic bird surveys and targeted searches undertaken.
Timing, weather, and season	The survey was undertaken in December 2021/January 2022 (summer) and within the recommended survey season for this region (EPA 2020b). The weather during the survey and for the three months prior was consistent with the climate data for the region. Rainfall for the Collie area for October 2021 was above average, while November and December were both below average. A total of 5 mm of rainfall was recorded at Collie during the survey on the 17th December 2021. A trapping program and additional surveys for amphibians following heavy rainfall events would likely increase the number of species recorded. However, the timing of the survey is not considered to be a constraint to the basic survey outcomes.
Disturbance to site which may affect survey results	Disturbances within the study area included logging, fire wood cutting and vehicle tracks. Parts of the study area have been previously cleared and rehabilitated. There are also large areas of pine plantation within the study area. None of the disturbances were a constraint to the completeness of the survey.

Variable	Impact on Survey Outcomes
Adequacy of the survey intensity and proportion of survey achieved	There were no weather, access, or timing issues relating to this survey that would affect the outcome and it is therefore considered to be a complete survey. All tasks from the scope of works were completed within the timeframe and the study area was extensively ground truthed.
Remoteness and/or access	There was no access restrictions experienced during the survey. The study area was accessible by vehicle and on foot.
Proportion of fauna identified, recorded or collected	All fauna species observed were easily identified in the field during the survey or from motion sensitive camera images. The survey was a basic survey providing an indication of the species present within the study area and species of conservation significance likely to occur. A detailed survey including a trapping program would be required to provide a more complete inventory of fauna species present.



PREMIER COAL

Locations for camera traps and habitat tree quadrats within the study area

Figure 3

Legend

- Survey Area
- Camera_Locations
- Habitat_Trees

N

0 100 200 300

Meters

1:15,000

Datum: GDA94
Projection: MGA Zone 50

Date:	22/02/2022
Status:	Draft
Figure:	3
Sheet Size:	A3
Internal Reference:	PC_pit_7_camera_R1
Drawn by:	GSM
Requested by:	DB

3.0 RESULTS

3.1 Desktop Assessment

3.1.1 Literature Review

While no fauna surveys have been previously completed within the study area there are a large number of surveys that have been undertaken within the general area. Onshore Environmental has recently completed surveys at Premier Coal's nearby Pit 2 exploration area, and at Bowelling approximately 20 km south-east of the study area (Onshore Environmental 2020b). Additionally, Onshore Environmental completed surveys of Premier Coal's Wilga tenements in early 2020 (Onshore Environmental 2020c, 2020d). The Wilga tenements are situated approximately 20 km south of the study area. The results from previous vertebrate fauna surveys completed within close proximity to the study area are presented in Table 5.

There have been numerous targeted Black Cockatoo tree habitat assessments undertaken in the vicinity of Collie. These surveys are listed below:

- Woodman Environmental (2015) Black-Cockatoo Assessment, Muja Power Station;
- Harewood (2018a) Mungalup Road - Collie - Black Cockatoo Habitat Tree Survey;
- Harewood (2018b) CPS 8063/1 - Patstone Road – Slk 3.73 To 5.50 - Black Cockatoo Habitat Tree Survey; and
- Harewood (2020) Concession Street - Mungalup - Slk 0.00 To 1.88 - Black Cockatoo Habitat Tree Survey.

Chewed hollows were observed during a number of these surveys indicating that Black Cockatoo breeding is potentially occurring in the general area. Additionally, a detailed flora and vegetation survey has recently been completed within the study area (Onshore Environmental 2020a). The flora and vegetation survey informed the fauna survey by providing preliminary habitat information.

Table 5 Results from vertebrate fauna surveys previously completed within the vicinity of the study area.

Survey	Consultant	Field Survey Date	Survey Level	Conservation Significant Fauna Species Recorded
Basic Vertebrate Fauna Survey Pit 2 Study Area	Onshore Environmental	23 - 25 of September 2020	Basic (Level 1)	Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable under the EPBC Act and the BC Act; Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act; and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) - listed as Endangered under the EPBC Act and the BC Act.
Lot 4095 Bowelling-McAlinden Road, Bowelling Vegetation Mapping & Targeted Flora Survey and Fauna Assessment	Onshore Environmental	15-17 April 2020	Basic (Level 1)	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; and Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act.
Level 2 Vertebrate Fauna Survey Wilga Tenements E70/4678 & E70/4868	Onshore Environmental	17-21 February 2020	Detailed (Level 2)	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act; South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) –Conservation Dependent under the BC Act; Western Brush Wallaby (*Notamacropus irma*) – DBCA Priority 4; and Quenda (*Isoodon fusciventer*) – DBCA Priority 4.
Level 2 Vertebrate Fauna Survey Wilga West Tenement M70 930	Onshore Environmental	16-21 March 2020	Detailed (Level 2)	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act; Chuditch (*Dasyurus geoffroii*) –Vulnerable under the EPBC Act and the BC Act; South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) –Conservation Dependent under the BC Act; and Western Brush Wallaby (*Notamacropus irma*) – DBCA Priority 4.

Survey	Consultant	Field Survey Date	Survey Level	Conservation Significant Fauna Species Recorded
Targeted Fauna Assessment at the Minninup Pool Project Development Investigation Area, Prepared for the Shire of Collie	EcoEdge (2019)	September 2018 to January 2019.	Targeted	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Western Brush Wallaby (*Notamacropus irma*) – DBCA Priority 4; Western False Pipistrelle (*Falsistrellus mackenziei* DBCA Priority 4
Fauna Assessment of Benjinup Project, Boyup Brook	Bamford Consulting Ecologists (2016)	9-12 June 2014, 2-10 December 2014, 2-5 June 2015, 29 September - 1 October 2015	Detailed (Level 2)	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act; South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) –Conservation Dependent under the BC Act; Chuditch (*Dasyurus geoffroii*) –Vulnerable under the EPBC Act and the BC Act; Western Brush Wallaby (*Notamacropus irma*) – DBCA Priority 4; and Quenda (*Isoodon fusciventer*) – DBCA Priority 4.
Greenbushes Level 1 Fauna Survey	Biologic Environmental Survey (2011)	13-17 Oct 2011	Basic (Level 1)	South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) – listed as Conservation Dependent under the BC Act; Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Baudin's Cockatoo (*Calyptorhynchus baudinii*) - Endangered under the EPBC Act and the BC Act.; and Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered under the EPBC Act and the BC Act.
Black Cockatoo Survey	Kirkby (2018)	22 Jan – 12 Feb 2018	Targeted	Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the EPBC Act and the BC Act; Baudin's Cockatoo (*Calyptorhynchus baudinii*) - EPBC Act Endangered, BC Act Schedule 2, IUCN Endangered Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - EPBC Act Endangered under the EPBC Act and the BC Act

3.1.2 Database Searches

Threatened Fauna listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken for a 50 km buffer around the study area (DAWE 2021b). The database search listed 21 Threatened vertebrate fauna species, or species habitat, that may occur in the study area:

Mammals:

- Woylie (*Bettongia penicillata*) – listed as Endangered;
- Chuditch (*Dasyurus geoffroii*) – listed as Vulnerable;
- Numbat (*Myrmecobius fasciatus*) – listed as Endangered;
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – listed as Critically Endangered;
- Red-tailed Phascogale (*Phascogale calura*) – listed as Vulnerable; and
- Quokka (*Setonix brachyurus*) – listed as Vulnerable.

Birds:

- Australasian Bittern (*Botaurus poiciloptilus)* – listed as Endangered;
- Australian Fairy Tern (*Sternula nereis nereis*) – listed as Vulnerable;
- Australian Painted Snipe (*Rostratula australis)* – listed as Endangered;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) – listed as Endangered;
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – listed as Endangered;
- Curlew Sandpiper (*Calidris ferruginea*) – listed as Critically Endangered;
- Eastern Curlew (*Numenius madagascariensis*) – listed as Critically Endangered;
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable;
- Greater Sand Plover (*Charadrius leschenaultii)* – listed as Vulnerable;
- Grey Falcon (*Falco hypoleucos)* – listed as Vulnerable;
- Malleefowl (*Leipoa ocellata*) – listed as Vulnerable;
- Noisy Scrub-bird (*Atrichornis clamosus*) – listed as Endangered; and
- Red Knot (*Calidris canutus)* - listed as Endangered.

Fish:

- Balston's Pygmy Perch (*Nannatherina balstoni)* – listed as Vulnerable; and
- Black-stripe Minnow (*Galaxiella nigrostriata*) – listed as Endangered.

The database search also identified seven migratory bird species, or species habitat, that may occur in the study area:

- Fork-tailed Swift (*Apus pacificus);*
- Common Sandpiper (*Actitis hypoleucos);*
- Sharp-tailed Sandpiper (*Calidris acuminata);*
- Pectoral Sandpiper (*Calidris melanotos);*
- Common Greenshank (*Tringa nebularia);*
- Grey Wagtail (*Motacilla cinerea);* and
- Osprey (*Pandion haliaetus).*

Threatened Fauna listed under the BC Act

The Atlas of Living Australia and DBCA database searches (ALA 2022, DBCA 2022) identified seven species listed under the BC Act:

Mammals:

- Quokka (*Setonix brachyurus*) - Vulnerable; and
- Chuditch (*Dasyurus geoffroii*) - Vulnerable.

Birds:

- Peregrine Falcon (*Falco peregrinus*) – Other Specially Protected Fauna;
- Australasian Bittern (*Botaurus poiciloptilus*) – Endangered;
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable;
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - Endangered; and
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) - Endangered.

Priority Fauna recognised by the DBCA

The Atlas of Living Australia and DBCA database searches (ALA 2021, DBCA 2022) identified eight Priority fauna species as potentially occurring:

Birds:

- Australian Little Bittern (*Ixobrychus dubius*) – Priority 4;
- Barking Owl (*Ninox connivens connivens* (southwest subpopulation) – Priority 3; and
- Masked Owl (*Tyto novaehollandiae novaehollandiae*) Priority 3.

Mammals:

- Water-rat (*Hydromys chrysogaster)* - Priority 4;
- Quenda (*Isoodon fusciventer*) - Priority 4; and
- Western Brush Wallaby (*Notamacropus irma*) - Priority 4.

Fish:

- Pouch Lamprey (*Geotria australis)* - Priority 3.

Reptiles:

- Dell's Skink (*Ctenotus delli*) - Priority 4.

3.1.3 Potentially Occurring Significant Fauna

A total of 43 conservation significant species were identified during the desktop assessment, comprising 13 mammals, 26 birds, three fish and one reptile species. Based on the known distribution and habitat preference of these species, and comparison with the habitats identified and mapped within the study area, fourteen species were determined as being “likely” to occur within the study area (Table 6);

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*);
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*);
- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Peregrine Falcon (*Falco peregrinus*);
- Woylie (*Bettongia penicillata*);
- Chuditch (*Dasyurus geoffroii*);
- Western False Pipistrelle (*Falsistrellus mackenziei*);
- Water-rat (*Hydromys chrysogaster);*
- Quenda (*Isoodon fusciventer*);
- Tammar Wallaby (*Notamacropus eugenii derbianus*);
- Western Brush Wallaby (*Notamacropus irma*);
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*);
- Western Ringtail Possum (*Pseudocheirus occidentalis*); and
- Darling Range South-west Ctenotus (*Ctenotus delli*).

An additional nine species were determined as “possible” to occur within the study area, and the remaining 20 species were identified as “unlikely” to occur in the study area (Table 6).

Table 6 Conservation significant fauna species identified during the desktop assessment.

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
BIRDS								
Actitis hypoleucos	Common Sandpiper	MI			Edge of sheltered waters, salt or fresh, estuaries, river pools, claypans, drying swamps (Johnstone & Storr 1998)	Yes	Unlikely	Suitable habitat present. An uncommon migrant species which may occasionally utilise parts of the study area.
Apus pacificus	Fork-tailed Swift	MI			Entirely aerial species (Johnstone & Storr 1998)	Yes	Possible	May fly over study area.
Atrichornis clamosus	Noisy Scrub-bird, Tjimiluk	EN	EN		Dense, long-unburnt vegetation characterised as low forest (5-15 m high), scrub/thicket and (rarely) heath	No	Unlikely	Protected matters search indicated species or species habitat may occur within the search area. A translocated population occurs 60 km north. Nearest natural population is 250km south-east.
Botaurus poiciloptilus	Australasian Bittern	EN	EN		Reedbeds, and other vegetation in water such as cumbungi, lignum and sedges	No	Unlikely	Habitat largely unsuitable. May fly over.
Calidris acuminata	Sharp-tailed Sandpiper	MI			Coastal and inland areas saline and fresh or brackish wetlands (Geering et al. 2007)	Yes	Unlikely	Suitable habitat present. A migrant species which may occasionally utilise parts of the study area.
Calidris canutus	Red Knot	EN &MI	CR		Coastal habitats including intertidal mudflats, sandflats, beaches, estuaries, bays, inlets, lagoons and harbours	No	Unlikely	No suitable habitat.
Calidris ferruginea	Curlew Sandpiper	CR	CR		Intertidal mudflats and ephemeral and permanent lakes	Yes	Unlikely	Suitable habitat present. A migrant species which may occasionally utilise parts of the study area.
Calidris melanotos	Pectoral Sandpiper	MI			Shallow fresh to saline wetlands	Yes	Unlikely	Suitable habitat present. An uncommon migrant species which may occasionally utilise parts of the study area.
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo, Karrak	VU	VU		Eucalypt forests, areas of seeding Marri, Jarrah, Blackbutt, Karri and Sheoak (Johnstone & Storr 1998)	Yes	Likely	Recorded 300m south of the study area and numerous locations in close proximity. Roosting occurs in close proximity (DBCA 2022).
Calyptorhynchus baudinii	Baudin's Black Cockatoo	EN	EN		Eucalypt forest, areas of Marri, Karri and Wandoo (Johnstone & Storr, 1998, Johnstone & Kirkby 2008)	Yes	Likely	Recorded 300m south of the study area and numerous locations in close proximity. Breeding and roosting

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
								occur in close proximity (DBCA 2022).
Calyptorhynchus latirostris	Carnaby's Black-cockatoo	EN	EN		Eucalypt woodlands and forests and adjacent area of *Proteaceous* scrubs and heaths (Johnstone & Storr 1998)	Yes	Likely	Recorded 2km NW of the study area and numerous locations in close proximity. Breeding and roosting occur in close proximity (DBCA 2022)
Charadrius leschenaultii	Greater Sand Plover	VU & MI	VU		Coastal or estuarine habitats including beaches, mudflats, sandbanks and lagoons	No	Unlikely	No suitable habitat.
Falco hypoleucos	Grey Falcon	VU	VU		Shrubland, grassland and wooded watercourses, wetlands	Yes	Unlikely	Protected matters search indicated species or species habitat may occur within the search area. No records from nearby.
Falco peregrinus	Peregrine Falcon			OS	Will utilise most habitats prefers coastal and inland cliffs or open woodlands near water, and also city buildings	Yes	Likely	Recorded 3km NE of the study area (DBCA 2022).
Ixobrychus dubius	Australian Little Bittern			P4	Swamps, lakes and rivers with well vegetated margins	Yes	Possible	DBCA database search indicated that this species may occur within the search area (DBCA 2022).
Ixobrychus flavicollis australis (southwest subpop.)	Black Bittern			P2	Dense vegetation and trees at the edges of water bodies	No	Unlikely	Nearby record is historical (DBCA 2022).
Leipoa ocellata	Malleefowl	VU	VU		Semi-arid mallee scrub on the fringes of the relatively fertile areas of southern Australia	No	Unlikely	No suitable habitat.
Motacilla cinerea	Grey Wagtail	MI			Various habitats with open waterbodies (Johnstone & Storr 2004)	Yes	Unlikely	Protected matters search indicated species or species habitat may occur within the search area. No records from nearby.
Ninox connivens connivens	Barking Owl			P3	Open country with tree lined water courses, open woodlands and forest edges	Yes	Possible	DBCA database search indicated that this species may occur within the search area (DBCA 2022).
Numenius madagascariensis	Eastern Curlew	CR & MI	CR		Tidal mudflats, also reef flats, sandy beaches (Johnstone & Storr 1998)	No	Unlikely	No suitable habitat.
Pandion haliaetus	Osprey	MI			Sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, and large river pools (Johnstone et al. 2013)	No	Unlikely	No suitable habitat.

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Oxyura australis	Blue-billed Duck			P4	Well vegetated dams, lakes and swamps	Yes	Possible	Birddata search indicates has been recorded in the area. The date of the record is uncertain.
Rostratula australis	Australian Painted Snipe	EN	EN		Shallow inland wetlands, either freshwater or brackish	Yes	Possible	Protected matters search indicated species or species habitat likely to occur within the search area. No records from nearby.
Sternula nereis nereis	Australian Fairy Tern	VU	VU		Sheltered sandy beaches, spits and banks above the high tide line and below vegetation	No	Unlikely	No suitable habitat.
Tringa nebularia	Common Greenshank	MI			Intertidal mudflats and ephemeral and permanent lakes	Yes	Possible	Protected matters search indicated species or species habitat likely to occur within the search area. No records from nearby.
Tyto novaehollandiae novaehollandiae	Masked Owl			P3	Forests, woodlands, timbered waterways and open country	Yes	Possible	DBCA database search indicated that this species may occur within the search area (DBCA 2022).
FISH								
Galaxiella nigrostriata	Black-stripe Minnow	EN	EN		Ephemeral wetlands of the south-west (Bray and Gomon 2020)	Yes	Possible	Protected matters search indicated species or species habitat likely to occur within the search area. No records from nearby.
Geotria australis	Pouch Lamprey			P3	Rivers and streams, estuaries and coastal waters	No	Unlikely	No suitable habitat. Historical record in close proximity (DBCA 2022).
Nannatherina balstoni	Balston's Pygmy Perch	VU	VU		Coastal peat flats, rivers	No	Unlikely	No suitable habitat within the study area. Known from the nearby Collie River.
MAMMALS								
Bettongia penicillata ogilbyi	Woylie	EN	CR		Woodlands and adjacent heaths with a dense understorey of shrubs (Woinarski et al. 2014)	No	Likely	Recorded 3km SE in 2015 with numerous additional records nearby (DBCA 2022).
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU		Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell & Morris 1994)	Yes	Likely	Previous record within the study area (2006). Additional recent records nearby (DBCA 2022).
Falsistrellus mackenziei	Western False Pipistrelle			P4	Wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts	Yes	Likely	Recently recorded from Collie (EcoEdge 2019).
Hydromys chrysogaster	Water-rat			P4	Permanent bodies of fresh or brackish water, subalpine streams	Yes	Likely	Recent record 4km ESE (DBCA 2022).

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
					to lakes and farm dams (Van Dyck & Strahan 2008)			
Isoodon fusciventer	Quenda			P4	Jarrah forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper 1998, Woinarski et al. 2014).	Yes	Likely	Recent record 10km NE (DBCA 2022).
Macrotis lagotis	Bilby	VU	VU		Mixture of woodland including Jarrah, Marri and Wandoo in the south-west (Abbott 2001).	Yes	Unlikely	Nearby records are historical (DBCA 2022).
Myrmecobius fasciatus	Numbat	EN	EN		Eucalypts forests and woodland, notably wandoo and jarrah woodland (Van Dyck & Strahan 2008)	Yes	Unlikely	Nearby records are historical (DBCA 2022).
Notamacropus eugenii derbianus	Tammar Wallaby			P4	Dense, low vegetation for daytime shelter and open grassy areas for feeding. This species inhabits coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland (Maxwell et al. 1996)	Yes	Likely	Recorded 15km NE of the study area (DBCA 2022)
Notamacropus irma	Western Brush Wallaby			P4	Wide-range of habitats including low Banksia woodlands, Jarrah/Marri woodlands and moist Melaleuca lowlands, favours open, grassy areas (Wann & Bell 1997, Woinarski et al. 2014)	Yes	Likely	Recent record 500m east of the study area (DBCA 2020)
Phascogale calura	Red-tailed Phascogale	VU	CD		Wandoo-rock sheoak uplands, and lowland habitat with riverine fringing vegetation of swamp sheoak, York Gum and Wandoo (Short et al. 2011)	Yes	Unlikely	No records within 50km.
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale		CD		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees with a sparse ground cover (Woinarski *et al.* 2014).	Yes	Likely	Numerous recent records in close proximity (DBCA 2022).
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CR		Coastal *Agonis flexuosa* forest or eucalypt woodland or forest with a mid-story of *Agonis flexuosa* (DPaW 2017, Jones *et al.* 1994). Additionally, inland forest areas that	Yes	Likely	Recent record 10km NE (DBCA 2022).

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
					have been unlogged and unburnt for long periods (Wayne et al. 2006)			
Setonix brachyurus	Quokka	VU	VU		Habitat varies, but prefer *Acacia* and *Melaleuca* thickets. Associated with *Taxandria linearifolia* in Jarrah Forest (de Tores 2008)	Yes	Possible	Recorded 17km north (2011), However nearby records are historical (DBCA 2022).
REPTILES								
Ctenotus delli	Darling Range South-west Ctenotus			P4	Jarrah and Marri woodlands with shrub dominated understorey on laterite, sand or clay soils (Bush et al 2010).	Yes	Likely	Recent record within 20km (ALA 2022).

3.2 Fauna Habitats

3.2.1 Fauna Habitat Type

Three fauna habitat types were identified and mapped within the study area during the field survey (Figure 4, Table 7):

- Jarrah/Marri Forest on hillslopes;
- Wetland/Drainage Zone; and
- Pine Plantation.

The majority of the study area was mapped as Forest on Hillslopes/Hillcrests with Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest and an open low/mid shrub understorey. This habitat provided hollows in large old Marri and Jarrah trees and has good potential for hollows to form in the future, potentially providing breeding habitat for black cockatoos. Additional habitat features include areas with large dead logs (suitable as den sites for Chuditch), dense leaf litter, and scattered areas of laterite outcropping.

Wetland and drainage zone habitat occurs on flats with grey clayey sands within the southern and central parts of the study area (Figure 4). This habitat is characterised by a more open tree overstorey comprised of a Woodland of *Melaleuca preissiana* with Jarrah and Flooded Gum (*Eucalyptus rudis)* scattered. This habitat supported fewer large trees compared to the hillslopes habitat and therefore has a lower density of hollow bearing trees. The understorey vegetation was variable ranging from open to a very dense cover of shrubs and sedges. Dense understorey within this habitat provides good cover for small mammals, reptiles and birds. This habitat is likely to hold small pools of water during winter. Two large artificial waterbodies occur within the study area adjacent to this habitat. The quality of the water within these waterbodies is uncertain and the absence of dense fringing vegetation may limit the usability to local fauna.

Two large areas of pine plantation occur within the study area. The habitat consists of plantation of **Pinus radiata* on grey sands on hillslopes. These areas have little value as a fauna habitat, but does provide foraging value for Baudin's and Carnaby's Black Cockatoos. The habitat provides dense leaf litter cover and may be utilised as a corridor by fauna moving between areas of native vegetation.

3.2.2 Fauna Habitat Condition

Habitat quality was variable across the study area, with logging, fire, rubbish dumping, mine activity and access tracks noted as the major contributors to decreased habitat condition. Habitat condition was rated as *very good to excellent* within remnant bushland across the study area. Pine plantation was rated as *completely degraded.* Parts of the study area have been heavily logged and burnt with areas of the Jarrah Marri hillslopes habitat having been cleared and rehabilitated post-mining. These areas are characterised by the absence of large trees and a more open understorey structure. These disturbances have reduced the availability of hollows and increased pressure from feral animal predation. Firewood cutting has also reduced the availability of log litter on the ground for use as shelter and den sites. Disturbance by feral animals noted within the study area included grazing by pigs, rabbit latrines and warrens, and bees occupying suitable tree hollows.

Table 7 Fauna habitats mapped within the study area.

Name Jarrah/Marri Forest on Hillslopes	**Description** Jarrah/Marri Forest on hillslopes with grey sands	
Landform	Hillslopes and hillcrests	
Vegetation Description	Forest of *Eucalyptus marginata*, *Corymbia calophylla* occasionally with *Allocasurina fraseriana* and Shrubs of *Xanthorrhoea preissii.* Understorey species include *Bossiaea* spp, *Hibbertia* spp. and *Dasypogon bromeliifolius*.	
% GroundCover	Rock	0-10%
	Leaf Litter	30-70%
	Logs	2-10%
	Vegetation	30-70%
Rocks	Type	Laterite
	Size	1-20 cm
Soil	Type	Sand
	Colour	Grey
Habitat Features Habitat includes areas with many logs and log piles, dense leaf litter, larger trees occur within this habitat providing some hollows.	Slope	Low
	Water	None
	Woody Debris	Moderate
	Peeling Bark	Minor
	Rock Crevices	Minor
	Burrowing Suitability	Low
	Tree Hollows (<10cm)	Present
	Tree Hollows (>10cm)	Occasional
Condition	Condition	Good- Very Good
	Disturbances	Mining Exploration, fire, roads/access tracks, logging, areas previously cleared and rehabilitated, rubbish, weeds, rabbits.
	Fire Age	Moderate-Old

Name Wetlands/Drainage zones	**Description** Wetlands and drainage areas/flats with *Melaleuca pressiana*	
Landform	Wetlands and sandy flats	
Vegetation Description	Woodland of *Melaleuca pressiana* with occasional *Eucalyptus marginata* and *Eucalyptus rudis*. Understorey shrubs include *Melaleuca* spp, *Taxandria linearifolia* and *Hypocalymma angustifolia*	
% Ground Cover	Rock	0%
	Leaf Litter	0-20%
	Logs	0-10%
	Vegetation	30-70%
Rocks	Type	None
	Size	0 cm
Soil	Type	Sandy clay
	Colour	Grey
Habitat Features Habitat contains some Jarrah with small hollows, areas of dense understory cover including low shrubs and sedges, adjacent to areas of water and may hold shallow pools in winter	Slope	Flat
	Water	Large artificial water bodies present, flats and wetlands may have non permentant shallow pools in winter.
	Woody Debris	Moderate
	Peeling Bark	Minor
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10cm)	Occasional
	Tree Hollows (>10cm)	None
Condition	Condition	Very Good-Excellent
	Disturbances	Fire, access tracks, ground disturbance, artificial reservoir, altered surface flows,
	Fire Age	Moderate-Old

Name Pine Plantations	**Description** Areas of planted introduced *Pinus* spp.	
Landform	Hillslopes	
Vegetation Description	Forest of *Pinus radiata* with occasional native species	
% Ground Cover	Rock	0%
	Leaf Litter	70-100%
	Logs	0-10%
	Vegetation	70-100%
Rocks	Type	None
	Size	0 cm
Soil	Type	Sandy loam
	Colour	Grey
Habitat Features Monoculture of pines with occasional native species. Some foraging value for Black Cockatoos, no hollows, dense leaf litter with bare understory.	Slope	Low
	Water	None
	Woody Debris	Moderate
	Peeling Bark	Minor
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None
Condition	Condition	Completley Degraded
	Disturbances	Planted pines, logging, weeds, roads/access tracks
	Fire Age	Old

PREMIER COAL

PIT 7 EXPLORATION AREA

Fauna habitats mapped within the study area

Figure 4

Legend

- Survey Area

Habitat Types

- Jarrah/Marrri Hillslopes
- Pine Plantation
- Powerline
- Road
- Water
- Wetland/Drainage Zone

PREMIER RD

POWER HOUSE RD

WESTERN COLLIERIES NO.2 RD

430000 430500 431000 431500 432000 432500

6305000 6304500 6304000 6303500 6303000 6302500 6302000 6301500 6301000

N

0 100 200 300

Meters

1:12,500

Datum: GDA94
Projection: MGA Zone 50

Date:	22/02/2022
Status:	Draft
Figure:	4
Sheet Size:	A3
Internal Reference:	PC_Pit7_HT_R1
Drawn by:	GSM
Requested by:	DB

3.3 Vertebrate Fauna Assemblage

3.3.1 Fauna Assemblage

The combined desktop searches identified a total of 235 vertebrate fauna taxa including ten amphibians, 161 birds, four fish, 30 mammals and 30 reptiles which have the potential to occur within or surrounding the study area (Table 8, Appendix 4).

A total of 50 vertebrate fauna species were recorded during the basic fauna survey. The total included 41 bird species, six mammal species and three reptiles (Table 8). A full list of fauna species recorded from the field survey is provided in Appendix 5.

Table 8 Vertebrate fauna species recorded from the desktop searches and field survey.

Group	Potentially Occurring (from Desktop Searches)	Recorded (from Field Survey)
Amphibians	10	0
Birds	161	41
Fish	4	0
Mammals	30	6
Reptiles	30	3
Total	235	50

3.3.2 Introduced Fauna Species

Three introduced fauna species (feral animals) were observed within the study area during the field survey:

- European Rabbit (*Oryctolagus cuniculus*);
- Pigs (*Sus scrofa*); and
- Cat (*Felis catus*).

The European Rabbit was observed within the study area during daytime surveys and from latrines, along with pig diggings and cat tracks.

The Laughing Kookaburra (*Dacelo novaeguineae*) was also recorded during the survey. This species was previously referred to as introduced species but is now considered naturalised in the area.

3.4 Fauna of Conservation Significance

3.4.1 Threatened Fauna listed under the BC Act and EPBC Act

Two vertebrate fauna species listed as scheduled species under the BC Act and/or listed as Threatened Fauna under the EPBC Act were recorded from the study area (Figure 5, Appendix 6):

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - listed as Vulnerable under the EPBC Act and the BC Act; and
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) - listed as Endangered under the EPBC Act and the BC Act.

The Forest Red-tailed Black Cockatoo was recorded from two locations within the study area. This species was identified by calls and recent foraging evidence. Baudin's Black Cockatoo was recorded from two locations on hillslopes within the study area through direct observation and calls. Carnaby's Black Cockatoo was not recorded but is considered likely to occur within the study area.

Habitats within the study area were assessed for the use by, and suitability for, black cockatoos. Habitat across the majority of the study area was deemed to be suitable foraging habitat for all three species. Plants within the study area suitable for foraging by black cockatoos included Jarrah, Marri and *Banksia* on the hills and lower slopes, *Hakea* and *Banksia* species within the wetland habitats, and *Pinus radiata* within the plantation habitat. Roosting and nesting sites of Black Cockatoos are known to occur within 20km of the study area (DBCA 2022). However, no evidence of roosting or nesting was observed within the study area.

Assessment of Habitat Trees

A total of 21 potential habitat trees (with DBH >50 cm) were recorded across the thirteen, 50 m by 50 m plots assessed, at an average density of 6.5 habitat trees per hectare (Table 9). The density of potential habitat trees varied between fauna habitats. The highest density of potential habitat trees was recorded within the Jarrah/Marri Forest on hillslopes habitat (16 trees per ha). The wetland habitat and pine plantation supported no or few potential habitat trees with a DBH >50 cm.

The density of potential habitat trees within the Jarrah/Marri hillslopes habitat was comparable to densities recorded at Premier Coal's Pit 2 tenement (18 trees per ha, Onshore Environmental 2021), the Wilga tenement (15.2 trees per ha, Onshore Environmental 2020c) and Wilga West tenement (23 trees per ha, Onshore Environmental 2020d). The density of potential habitat trees has been reduced across the study area by disturbances such as hardwood logging, clearing, fire and firewood cutting.

Table 9 Habitat trees recorded from thirteen 50m by 50m plots within the study area.

Site	Fauna Habitat	Tree Species	No. Pot. Habitat Trees >50cm DBH per ha	Total No Trees per ha
PT01	Wetland/Drainage zone	None	0	0
PT02	Jarrah/Marri Hillslopes	*Eucalyptus marginata*	4	16
PT03	Wetland/Drainage zone	*Melaleuca preissiana*	0	0
PT04	Wetland/Drainage zone	None	0	0
PT05	Wetland/Drainage zone	*Melaleuca preissiana*	0	0
PT06	Wetland/Drainage zone	*Eucalyptus marginata*	1	4
PT07	Pine Plantation	None	0	0
PT08	Jarrah/Marri Hillslopes	*Eucalyptus marginata, Corymbia calophylla*	6	24
PT09	Wetland/Drainage zone	*Melaleuca preissiana*	0	0
PT10	Jarrah/Marri Hillslopes	*Eucalyptus marginata, Corymbia calophylla*	5	20
PT11	Jarrah/Marri Hillslopes	None	0	0
PT12	Jarrah/Marri Hillslopes	*Eucalyptus marginata*	5	20
PT13	Wetland/Drainage zone	None	0	0

Potential nesting trees with suitable nesting hollows were also recorded from the wider study area during ground traverses. A total of 15 trees with hollows determined to be potentially suitable for use by black cockatoos were recorded within the study area (Figure 5). These trees contained a hollow which was assessed as being a suitable breeding size for black cockatoos. Of these hollows,

none were chewed (showed evidence of use or chew marks), five were usable (suitable size and depth/orientation for use), and ten were marginal (small or occupied by other species), according to the criteria listed in Table 3. A full list of the hollows identified within the study area is presented in Appendix 7.

3.4.2 Priority Fauna listed by the DBCA

Two Priority fauna species, as listed by the DBCA, were recorded from the study area (Figure 5, Appendix 6):

- Quenda *(Isoodon fusciventer)* - Priority 4; and
- Western Brush Wallaby *(Notamacropus irma)* - Priority 4.

Western Brush Wallaby

The Western Brush Wallaby is known to inhabit a wide-range of habitats including low *Banksia* woodlands, Jarrah/Marri woodlands and moist *Melaleuca* lowlands. It favours open, grassy areas (Wann and Bell 1997, Woinarski *et al.* 2014). A single Western Brush Wallaby was sighted in the early morning during the survey. The Western Brush Wallaby was observed from the Jarrah/Marri hillslope habitat but is also likely to utilise the wetland/drainage zone habitat within the study area.

Quenda

The Quenda is found in dense shrublands and forests in the south-west of Western Australia. Evidence of the distinctive cone-shaped diggings were recorded in the Jarrah/Marri hillslopes and wetland/drainage zone habitats within the study area (Figure 5). Predation from Cats and Foxes is likely to have reduced the density of this species within the study area. Quenda diggings were observed on seasonal wetland flats and lower sandy slopes within the study area.

3.4.3 Potentially occurring Threatened and Priority Fauna

Nine additional species of conservation significance were identified from the desktop searches as likely to occur within the study area. The suitability of habitat within the study area for these species was assessed as part of the field survey and is discussed below.

Peregrine Falcon

The Peregrine Falcon is listed as 'other specially protected fauna' under the BC Act. It inhabits diverse habitats including cliffs, gorges, timbered watercourses, drainage lines and rivers, wetlands, plains, and open woodlands. This species has previously been recorded 3km north-east of the study area (DBCA 2022).

The Peregrine Falcon may occasionally utilise habitats within the survey areas for foraging and may fly over the study area. However, they are unlikely to breed within the study area due to the absence of suitable breeding habitat.

South-western Brush-tailed Phascogale

The South-western Brush-tailed Phascogale is known to inhabit dry sclerophyll forests and open woodlands that contain hollow-bearing trees with a sparse ground cover (Woinarski *et al.* 2014). This species is considered likely to occur within the Jarrah/Marri Hillslopes habitat as it contains areas with suitable hollows required by this species. However, it was not recorded from motion camera traps placed within suitable habitat.

Water-Rat

The Water-Rat inhabits permanent bodies of fresh or brackish water. This species occurs from the Kimberley to Queensland, New South Wales, Victoria, Tasmania and eastern South Australia as well as the south-west of Western Australia. The two waterbodies within the study area represent potential habitat for this species. However, there is an absence of the preferred dense vegetation on the banks of these waterbodies therefore the habitat is considered marginal for this species.

Chuditch

The Chuditch inhabits Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell and Morris 1994). This species has previously been recorded from within the study area in 2006 (DBCA 2022) and it is considered likely to occur. Within the study area this species may utilise all habitats with the exception of the Pine plantation for foraging or dispersing. Suitable den sites for this species were recorded within the Jarrah/Marri Hillslopes habitat, however it was not recorded on motion camera traps. The fragmented nature of the study area and surrounding bushland, and the long history of logging and other disturbances reduce the likelihood of this species occurring within the study area.

Western False Pipistrelle

The Western False Pipistrelle is an insectivorous bat species that uses tree hollows as roost sites. It inhabits wet Karri forest and also occurs in Jarrah or Tuart forest or woodlands. Habitat within the study area is suitable for this species and there is a recent record from the Collie area at Minninup Pool (EcoEdge 2019). This species is considered likely to utilise the study area for foraging and may also utilise tree hollows within the Jarrah/Marri hillslopes habitat for roosting.

Western Ringtail Possum

The Western Ringtail Possum Recovery Plan (Department of Parks and Wildlife [DPaW] 2017) identifies critical habitat for the species in the southern forest zone near Manjimup as forest dominated by Jarrah (*Eucalyptus marginata*) or Marri (*Corymbia calophylla*). Within these inland forests, Western Ringtail Possums are most abundant in areas with minimal disturbance (ie unlogged and unburnt) that have been subject to fox control (Wayne *et al.* 2006).

There are several nearby records of Western Ringtail Possums with recent records from Collie (10km NE, DBCA 2022). No scats or dreys were observed during the active searches undertaken within the study area. This species may occasionally utilise the wetland and hillslope habitats within the study area. Hollows identified within the study area may also be utilised by Western Ringtail Possums. However, habitat within the majority of the study area is considered to be largely unsuitable for this species due to the lack of dense well-connected mid-storey and upper-storey vegetation, and/or lack of mature trees due to historical logging and rehabilitation.

Tammar Wallaby

The Tammar Wallaby inhabits coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland (Maxwell et al. 1996). Habitats that are ideal for this species include dense low vegetation for daytime shelter and open grassy areas for feeding. Populations persist at several locations on mainland WA in areas that are subject to fox control and on offshore islands. This species has been recorded 15km north-east of the study area from the Leach Forest Block (DBCA 2022). Wetland and hillslope habitats within the study area are suitable for this species. However, predation by foxes and the relatively open understory and mid -story within the study area reduce the likelihood of the species utilising habitats within the study area.

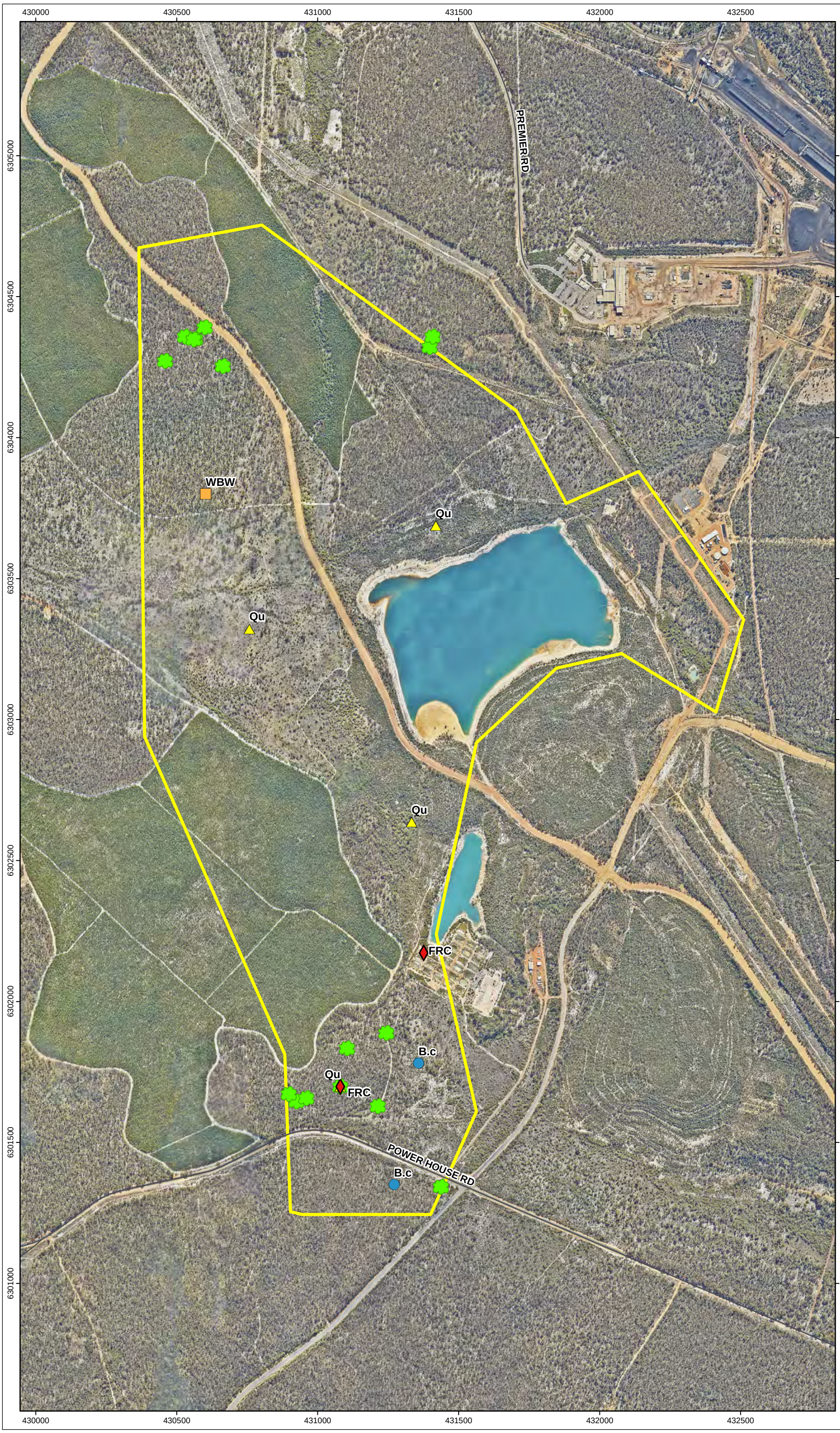
Woylie

The Woylie is a small marsupial which once occurred across much of mainland Australia but is now primarily restricted to the south-west of Western Australia and translocated populations. It occurs in woodlands and adjacent heaths with a dense understorey of shrubs (Woinarski et al. 2014). Habitat identified as critical to the survival of this species include tall eucalypt forest and woodland, dense myrtaceous shrubland or kwongan (proteaceous) or mallee heath with adequate fox and cat control programs (DEC 2012). This species shelters in dense vegetation and builds nests of long grasses and bark.

No evidence of this species was recorded from the study area. Wetland and hillslope habitats within the study area are suitable for this species and given the proximity to known populations it is considered likely to occur. However, predation by foxes and the relatively open understory and mid-story within the study area reduce the likelihood of the species utilising habitats within the study area.

Dell's Skink

Dell's Skink occurs in Jarrah and Marri woodlands with shrub dominated understorey on laterite, sand or clay soils (Bush *et al.* 2010). This species was recorded 300m south of the study area in 2006 (DBCA 2022). Habitat within the study area is suitable for this species and it is likely to occur within the study area.



PREMIER COAL

PIT 7 EXPLORATION AREA

Conservations significant fauna and potential nesting trees recorded within the study area

Figure 5

Legend

- Study Area
- Habitat Trees

Conservations significant fauna observations

Endagered

- Baudin's Cockatoo (B.c)

Priority 4

- Quenda (Qu)
- Western Brush Wallaby (WBW)

Vunerable

- Forest Red-tailed Black Cockatoo (FRC)

N

0 100 200 300

Meters

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Date:	22/02/2022
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Figure:	5
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Drawn by:	GSM
Requested by:	DB

4.0 SUMMARY

The basic vertebrate fauna survey was completed in mid December 2021 and late January 2022. A total of 50 vertebrate fauna species were recorded, including three reptiles, 41 birds and six mammals. Two vertebrate fauna species recorded from the study area were listed as Threatened Fauna under the Commonwealth EPBC Act or listed under the Western Australian BC Act:

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) - listed as Vulnerable under the EPBC Act and the BC Act;
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) - listed as Endangered under the EPBC Act and the BC Act.

Two Priority fauna species, as listed by the DBCA, were also recorded from the study area; Quenda (*Isoodon fusciventer*) and the Western Brush Wallaby (*Notamacropus irma*). Both species are listed as Priority 4 fauna taxa.

Three introduced fauna species (feral animals) were observed within the study area during the survey; European Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*) and Cat (*Felis catus*).

Three fauna habitats were mapped within the study area:

- Jarrah/Marri Forest on hillslopes;
- Wetland/Drainage Zone; and
- Pine Plantations.

None of the fauna habitats were determined to be regionally or locally restricted. Habitat condition was variable and in places had been severely reduced by hardwood logging and associated management, clearing for pine plantation, and disturbance by historical mining.

Fauna habitats were assessed for the use by, and suitability for, conservation significant species. Habitat across the majority of the study area was deemed to be suitable foraging habitat for black cockatoos. A total of 21 potential habitat trees were recorded across the 13 plots assessed, at an average density of 16 habitat trees per hectare within the Jarrah/Marri Hillslopes habitat. A total of 15 trees with hollows potentially suitable for use by black cockatoos were recorded within the study area.

Ten additional species of conservation significance are considered likely to occur within the study area, but were not recorded during the field survey;

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Peregrine Falcon (*Falco peregrinus*);
- Woylie (*Bettongia penicillata*);
- Chuditch (*Dasyurus geoffroii*);
- Western False Pipistrelle (*Falsistrellus mackenziei*);
- Water-rat (*Hydromys chrysogaster);*
- Tammar Wallaby (*Notamacropus eugenii derbianus*);
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*);
- Western Ringtail Possum (*Pseudocheirus occidentalis*); and
- Darling Range South-west Ctenotus (*Ctenotus delli*).

5.0 STUDY TEAM

The basic vertebrate fauna survey was planned, co-ordinated and executed by the following personnel:

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Dr Jerome Bull	PhD	Principal Scientist
Mr Todd Griffin	BSc	GIS and Mapping Specialist

6.0 REFERENCES

Atlas of Living Australia (2022) *Spatial Portal,* Retrieved February 2022, from https://www.ala.org.au/

Department of Biodiversity, Conservation and Attractions (2022) Threatened and Priority Fauna Database Search. Request for Threatened and Priority Fauna Information, letter from Threatened Fauna Database Officer, February 2022.

DEC (2012) National Recovery Plan for the Woylie *Bettongia penicillata ogilbyi*, Wildlife Management Program No. 51.

Abbott, I. (2001) The Bilby *Macrotis lagotis* (Marsupialia: Peramelidae) in south-western Australia: original range limits, subsequent decline, and presumed regional extinction, records of the Western Australian Museum, 20, 271-305.

Bamford Consulting Ecologists (2016) Fauna Assessment of Benjinup Project, Boyup Brook. Prepared for The Griffin Coal Mining Company.

Biologic Environmental Survey (2011) Greenbushes Level 1 Fauna Survey, report prepared for Talison Lithium Pty Ltd.

Bray, D.J. & Gomon, M.F. 2020, *Galaxiella nigrostriata* in Fishes of Australia, accessed 07 Feb 2022, https://fishesofaustralia.net.au/home/species/2130

Bureau of Meteorology (2022) Climate Data Online, available from: http://www.bom.gov.au/climate/data/.

Bush B, Maryan B, Browne-Cooper R and Robinson D (2010) Field guide to Reptiles and Frogs of the Perth Region. Western Australian Museum

Cooper, M. L. (1998) Geographic variation in size and shape in the Southern Brown Bandicoot, *Isoodon obesulus* (Peramelidae: Marsupialia), in Western Australia. Australian Journal of Zoology, 46, 145-152.

CSIRO (2015) Australian Soil Resource Information System (ASRIS), Available from: http://www.asris.csiro.au/index.html,

de Tores, P. (2008) Quokka *Setonix brachyurus*; in S. Van Dyck & R. Strahan, The Mammals of Australia (third edition).

Department of Agriculture, Water and Environment (DAWE) (2021a) Australian Faunal Directory Available from: https://biodiversity.org.au/afd/home

Department of Agriculture, Water and Environment (DAWE) (2021b) EPBC Act Protected Matters Report, available from: http://www.environment.gov.au/epbc/pmst/.

Department of Biodiversity, Conservation and Attractions (DBCA) (2021) NatureMap Mapping Western Australia's Biodiversity, available from https://naturemap.dbca.wa.gov.au/.

Department of Parks and Wildlife (DPaW) (2017) Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan, Wildlife Management Program No. 58, Department of Parks and Wildlife, Perth, WA.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011a) Survey Guidelines for Australia's Threatened Mammals, Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011b) Survey Guidelines for Australia's Threatened Reptiles, Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2012) EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species, Commonwealth of Australia.

Department of the Environment and Energy (DoEE) (2018) Australia's bioregions (IBRA), available from: http://www.environment.gov.au/land/nrs/science/ibra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a) Survey Guidelines for Australia's Threatened Bats, Commonwealth of Australia.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010b) Survey Guidelines for Australia's Threatened Birds, Commonwealth of Australia.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010c) Survey Guidelines for Australia's Threatened Frogs, Commonwealth of Australia.

Department of Water and Environmental Regulation (DWER) (2021) Index of Biodiversity Surveys for Assessments (IBSA) Available from: biocollect.ala.org.au/ibsa

EcoEdge (2019) Targeted Fauna Assessment at the Minninup Pool Project Development Investigation Area, Prepared for the Shire of Collie

Environmental Protection Authority (2016) Environmental Factor Guideline Terrestrial Fauna, EPA, Perth.

Environmental Protection Authority (EPA) (2020a) Statement of Environmental Principles, Factors and Objectives. EPA, Perth

Environmental Protection Authority (EPA) (2020b) Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment. EPA, Perth

Harewood G (2018) Mungalup Road – Collie - Black Cockatoo Habitat Tree Survey, Report prepared for the Shire of Collie

Harewood G (2018b) CPS 8063/1 - Patstone Road – Slk 3.73 To 5.50 - Black Cockatoo Habitat Tree Survey, Report prepared for the Shire of Collie

Harewood G (2020) Concession Street – Mungalup – Slk 0.00 To 1.88 - Black Cockatoo Habitat Tree Survey, Report prepared for the Shire of Collie

Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, pg. 382-403, Jarrah Forest 2 (JF2 - Southern Jarrah Forest subregion).

Johnstone, R. and Storr, G. M. (1998) Handbook of Western Australian Birds Volume I – Non-passerines (Emu to Dollarbird), Perth, Western Australian Museum.

Johnstone, R. and Storr, G. M. (2004) Handbook of Western Australian Birds Volume II – Passerines (Blue-winged Pitta to Goldfinch), Perth, Western Australian Museum.

Johnstone, R. E. and Kirkby, T. (2008) Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (Calyptorhynchus baudinii) in South-west Western Australia, records of the Australian Museum, 25, 107-118.

Johnstone, R. E., Burbidge, A. H. and Darnell, J. C. (2013) Birds of the Pilbara region, including seas and offshore islands, Western Australia distribution, status and historical changes, records of the Western Australian Museum Supplement, 78, 343-441.

Jones, B. A., How, R. A. and Kitchener, D. J. (1994) A field study of Pseudocheirus occidentalis (Marsupialia: Petauridae), Distribution and Habitat, Wildlife Research, 21, 175-187.

Kirkby, T. (2018) Black Cockatoo Survey, Talison Mining, Greenbushes, report prepared for Talison Lithium Pty Ltd.

Maxwell, S., A.A. Burbidge & K. Morris (1996). The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia, Environment Australia. Available from: http://webarchive.nla.gov.au/gov/20130409085156/http://www.environment.gov.au/biodiversity/threatened/publications/action/marsupials/index.html.

Onshore Environmental (2020a) Detailed Flora and Vegetation Survey Pit 7 Exploration Area, Prepared for Premier Coal Pty Ltd

Onshore Environmental (2020b) Lot 4095 Bowelling-McAlinden Road, Bowelling Vegetation Mapping & Targeted Flora Survey and Fauna Assessment. Prepared for Talison Lithium Australia

Onshore Environmental (2020c) Level 2 Vertebrate Fauna Survey Wilga Tenements E70/4678 & E70/4868. Prepared for Talison Lithium Australia

Onshore Environmental (2020d) Level 2 Vertebrate Fauna Survey Wilga West Tenement M70 930. Prepared for Talison Lithium Australia

Onshore Environmental (2021) Basic Vertebrate Fauna Survey Pit 2 Study Area, Prepared for Premier Coal Pty Ltd

Orell, P. and Morris, K. (1994) Chuditch Recovery Plan. Wanneroo, Western Australia.

Short, J., Hide, A. and Stone, M. (2011) Habitat requirements of the endangered red-tailed phascogale, *Phascogale calura*. Wildlife Research, 38, 359-369.

Tille, P.J. (1996) Wellington-Blackwood Land Resources Survey: Land Resources Series No 14. ISSN 1033-1670. Natural Resources Assessment Group, Agriculture Western Australia.

Van Dyck, S. and Strahan, R. (2008) The Mammals of Australia (third edition), Sydney, New South Wales, Australian Museum Trust and Queensland Museum.

Wann, J. M. and Bell, D. T. (1997) Dietary preferences of the Black-gloved Wallaby (*Macropus irma*) and the Western Grey Kangaroo (*Macropus fuliginosus*) in Whiteman Park, Perth, Western Australia, Journal of the Royal Society of Western Australia, 80, 55-62.

Wayne, A.F.; Cowling, A.; Lindenmayer, D.B.; Ward, C.G.; Vellios, C.V.; Donnelly, C.F. and Calver, M.C. (2006). The abundance of a threatened arboreal marsupial in relation to anthropogenic disturbances at local- and landscape- scales in Mediterranean-type forest in Western Australia. Biological Conservation 127: 463-476.

Western Australian Museum (2020) Checklist of the Terrestrial Vertebrate Fauna of Western Australia. Available from: http://museum.wa.gov.au/research/departments/terrestrial-zoology/checklist-terrestrial-vertebrate-fauna-western-australia

Wilde SA and Walker IW (1982) *1:250000 Geological Series –Explanatory Notes Collie Western Australia,* Perth Western Australia

Woinarski, J. C. Z., Burbidge, A. A. and Harrison, P. L. (2014) The Action Plan for Australian Mammals 2014, Collingwood, Victoria, CSIRO Publishing.

Woodman Environmental (2015) Black-Cockatoo Assessment, Muja Power Station, Report prepared for Synergy

APPENDIX 1

Status codes for species listed on the IUCN 'Red List'

Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

APPENDIX 2

Conservation categories for fauna species listed under the EPBC Act

Category	Description
Extinct (EX)	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (EW)	Taxa known to survive only in captivity.
Critically Endangered (CE)	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 future.
Migratory (MG)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA) China-Australia Migratory Bird Agreement (CAMBA) Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

APPENDIX 3

Conservation Codes for Western Australian Flora and Fauna

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

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

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

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Conservation codes for Western Australian flora and fauna

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that "*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

Conservation codes for Western Australian flora and fauna

P **Priority species**

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 **Priority 1: Poorly-known species**

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

2 **Priority 2: Poorly-known species**

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

3 **Priority 3: Poorly-known species**

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

4 **Priority 4: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens
[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Last updated 3 January 2019

APPENDIX 4

Potentially occurring vertebrate fauna list for the study area from results of the database searches

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Amphibians	Crinia georgiana	Quacking Frog			x		x		
Amphibians	Crinia glauerti	Clicking Frog			x		x		
Amphibians	Geocrinia leai	Ticking Frog					x		
Amphibians	Heleioporus eyrei	Moaning Frog			x		x		
Amphibians	Heleioporus inornatus	Plains Frog			x		x		
Amphibians	Heleioporus psammophilus	Sand Frog					x		
Amphibians	Limnodynastes dorsalis	Western Banjo Frog					x		
Amphibians	Litoria adelaidensis	Slender Tree Frog			x		x		
Amphibians	Litoria moorei	Motorbike Frog					x		
Amphibians	Neobatrachus pelobatoides	Humming Frog			x		x		
Birds	Acanthagenys rufogularis	Spiny-cheeked Honeyeater				x	x		
Birds	Acanthiza apicalis	Inland Thornbill			x	x	x		
Birds	Acanthiza chrysorrhoa	Yellow-rumped Thornbill			x	x	x		
Birds	Acanthiza inornata	Western Thornbill			x	x	x		
Birds	Acanthiza uropygialis	Chestnut-rumped Thornbill			x				
Birds	Acanthorhynchus superciliosus	Western Spinebill			x	x	x		
Birds	Accipiter fasciatus	Brown Goshawk				x			
Birds	Acrocephalus australis	Australian Reed-Warbler				x			
Birds	Actitis hypoleucos	Common Sandpiper	MI					x	
Birds	Anas gracilis	Grey Teal			x	x	x		
Birds	Anas superciliosa	Pacific Black Duck			x	x	x		
Birds	Anhinga novaehollandiae	Australasian Darter			x	x	x		
Birds	Anthochaera carunculata	Red Wattlebird			x	x	x		
Birds	Anthochaera lunulata	Western Wattlebird				x	x		
Birds	Anthus novaeseelandiae	Australasian Pipit			x	x			

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Apus pacificus	Fork-tailed Swift	MI					x	
Birds	Aquila audax	Wedge-tailed Eagle			x	x	x		
Birds	Ardea alba	Great Egret				x			
Birds	Ardea pacifica	White-necked Heron				x	x		
Birds	Artamus cinereus	Black-faced Woodswallow				x	x		
Birds	Artamus cyanopterus	Dusky Woodswallow			x	x	x		
Birds	Atrichornis clamosus	Noisy Scrub-bird	EN					x	
Birds	Aythya australis	Hardhead				x			
Birds	Barnardius zonarius	Australian Ringneck			x	x	x		
Birds	Biziura lobata	Musk Duck			x	x	x		
Birds	Botaurus poiciloptilus	Australasian Bittern	EN					x	x
Birds	Bubulcus ibis	Cattle Egret				x			
Birds	Burhinus grallarius	Bush Stone-curlew					x		
Birds	Cacomantis flabelliformis	Fan-tailed Cuckoo			x	x	x		
Birds	Cacomantis pallidus	Pallid Cuckoo					x		
Birds	Cairina moschata	Muscovy Duck				x			
Birds	Calidris acuminata	Sharp-tailed Sandpiper	MI					x	
Birds	Calidris canutus	Red Knot	EN					x	
Birds	Calidris ferruginea	Curlew Sandpiper	CR					x	
Birds	Calidris melanotos	Pectoral Sandpiper	MI					x	
Birds	Calidris ruficollis	Red-necked Stint				x			
Birds	Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	VU		x	x	x	x	x
Birds	Calyptorhynchus baudinii	Baudin's Black Cockatoo	EN		x	x	x	x	x
Birds	Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	EN		x	x	x	x	x
Birds	Chalcites basalis	Horsfield's Bronze-cuckoo			x	x			

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Chalcites lucidus	Shining Bronze-cuckoo			x	x			
Birds	Charadrius leschenaultii	Greater Sand Plover	VU					x	
Birds	Charadrius ruficapillus	Red-capped Plover				x			
Birds	Chenonetta jubata	Australian Wood Duck			x	x	x		
Birds	Chroicocephalus novaehollandiae	Silver Gull				x			
Birds	Chrysococcyx lucidus plagosus	Shining Bronze Cuckoo					x		
Birds	Cincloramphus mathewsi	Rufous Songlark				x			
Birds	Circus approximans	Swamp Harrier				x			
Birds	Climacteris rufus	Rufous Treecreeper			x	x			
Birds	Colluricincla harmonica	Grey Shrike-thrush			x	x	x		
Birds	Columba livia	Rock Dove		Yes	x	x			
Birds	Coracina novaehollandiae	Black-faced Cuckoo-shrike			x	x	x		
Birds	Corvus bennetti	Little Crow					x		
Birds	Corvus coronoides	Australian Raven			x	x	x		
Birds	Coturnix pectoralis	Stubble Quail				x			
Birds	Cracticus nigrogularis	Pied Butcherbird				x	x		
Birds	Cracticus torquatus	Grey Butcherbird			x	x	x		
Birds	Cygnus atratus	Black Swan				x	x		
Birds	Dacelo novaeguineae	Laughing Kookaburra		Yes	x	x	x		
Birds	Daphoenositta chrysoptera	Varied Sittella			x	x	x		
Birds	Dicaeum hirundinaceum	Mistletoebird				x	x		
Birds	Dromaius novaehollandiae	Emu			x	x	x		
Birds	Egretta novaehollandiae	White-faced Heron			x	x	x		
Birds	Elanus axillaris	Black-shouldered Kite			x	x	x		
Birds	Elseyornis melanops	Black-fronted Dotterel			x	x	x		

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Eolophus roseicapilla	Galah			x	x	x		
Birds	Eopsaltria georgiana	White-breasted Robin					x		
Birds	Eopsaltria griseogularis	Western Yellow Robin			x	x	x		
Birds	Epthianura albifrons	White-fronted Chat				x			
Birds	Falco berigora	Brown Falcon				x	x		
Birds	Falco cenchroides	Nankeen Kestrel			x	x	x		
Birds	Falco hypoleucos	Grey Falcon	VU (WA)					x	
Birds	Falco longipennis	Australian Hobby				x			
Birds	Falco peregrinus	Peregrine Falcon	OS			x	x		x
Birds	Fulica atra	Eurasian Coot			x	x	x		
Birds	Gallinula tenebrosa	Dusky Moorhen				x	x		
Birds	Gavicalis virescens	Singing Honeyeater			x	x			
Birds	Gerygone fusca	Western Gerygone			x	x	x		
Birds	Gliciphila melanops	Tawny-crowned Honeyeater			x	x	x		
Birds	Grallina cyanoleuca	Magpie-lark			x	x	x		
Birds	Gymnorhina tibicen	Australian Magpie			x	x	x		
Birds	Haliastur sphenurus	Whistling Kite				x	x		
Birds	Heteroscenes pallidus	Pallid Cuckoo			x	x			
Birds	Hieraaetus morphnoides	Little Eagle			x	x	x		
Birds	Himantopus leucocephalus	Black-winged Stilt				x			
Birds	Hirundo neoxena	Welcome Swallow			x	x	x		
Birds	Ixobrychus dubius	Australian Little bittern	P4						x
Birds	Ixobrychus flavicollis australis	Black Bittern	P2		x		x		x
Birds	Lalage tricolor	White-winged Triller			x	x			
Birds	Leipoa ocellata	Malleefowl	VU					x	

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Lichmera indistincta	Brown Honeyeater			x	x	x		
Birds	Lophoictinia isura	Square-tailed Kite				x			
Birds	Malacorhynchus membranaceus	Pink-eared Duck				x			
Birds	Malurus elegans	Red-winged Fairy-wren			x	x	x		
Birds	Malurus splendens	Splendid Fairy-wren			x	x	x		
Birds	Melanodryas cucullata	Hooded Robin			x	x	x		
Birds	Melithreptus brevirostris	Brown-headed Honeyeater			x	x	x		
Birds	Melithreptus chloropsis	Gilbert's Honeyeater			x		x		
Birds	Melithreptus lunatus	White-naped Honeyeater			x	x			
Birds	Merops ornatus	Rainbow Bee-eater			x	x	x		
Birds	Microcarbo melanoleucos	Little Pied Cormorant			x	x	x		
Birds	Microeca fascinans	Jacky Winter				x			
Birds	Motacilla cinerea	Grey Wagtail	MI					x	
Birds	Myiagra inquieta	Restless Flycatcher			x	x	x		
Birds	Neophema elegans	Elegant Parrot			x	x	x		
Birds	Ninox boobook	Southern Boobook				x			
Birds	Ninox connivens connivens	Barking Owl	P3						x
Birds	Numenius madagascariensis	Eastern Curlew	CR					x	
Birds	Nycticorax caledonicus	Nankeen Night-Heron				x			
Birds	Ocyphaps lophotes	Crested Pigeon				x	x		
Birds	Oxyura australis	Blue-billed Duck	P4			x			
Birds	Pachycephala occidentalis	Western Whistler			x				
Birds	Pachycephala pectoralis	Golden Whistler			x	x			
Birds	Pachycephala rufiventris	Rufous Whistler			x	x	x		
Birds	Pandion haliaetus	Osprey	MI					x	

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Pardalotus punctatus	Spotted Pardalote			x	x	x		
Birds	Pardalotus striatus	Striated Pardalote			x	x	x		
Birds	Parvipsitta porphyrocephala	Purple-crowned Lorikeet			x	x			
Birds	Pelecanus conspicillatus	Australian Pelican				x			
Birds	Petrochelidon nigricans	Tree Martin			x	x	x		
Birds	Petroica boodang	Scarlet Robin			x	x	x		
Birds	Petroica goodenovii	Red-capped Robin			x	x	x		
Birds	Phalacrocorax carbo	Great Cormorant			x	x	x		
Birds	Phalacrocorax sulcirostris	Little Black Cormorant				x	x		
Birds	Phalacrocorax varius	Pied Cormorant			x				
Birds	Phaps chalcoptera	Common Bronzewing			x	x	x		
Birds	Phaps elegans	Brush Bronzewing					x		
Birds	Phylidonyris niger	White-cheeked Honeyeater				x	x		
Birds	Phylidonyris novaehollandiae	New Holland Honeyeater			x	x	x		
Birds	Platalea flavipes	Yellow-billed Spoonbill			x	x	x		
Birds	Platycercus icterotis	Western Rosella			x	x	x		
Birds	Podargus strigoides	Tawny Frogmouth				x	x		
Birds	Podiceps cristatus	Great Crested Grebe				x	x		
Birds	Poliocephalus poliocephalus	Hoary-headed Grebe				x	x		
Birds	Polytelis anthopeplus	Regent Parrot				x			
Birds	Poodytes gramineus	Little Grassbird				x			
Birds	Porphyrio porphyrio	Purple Swamphen			x	x	x		
Birds	Psephotellus varius	Mulga Parrot				x			
Birds	Purpureicephalus spurius	Red-capped Parrot			x	x	x		
Birds	Quoyornis georgianus	White-breasted Robin			x	x	x		

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Birds	Rhipidura albiscapa	Grey Fantail			x	x	x		
Birds	Rhipidura leucophrys	Willie Wagtail			x	x	x		
Birds	Rhipidura rufiventris	Northern Fantail					x		
Birds	Rostratula australis	Australian Painted Snipe	EN					x	
Birds	Sericornis frontalis	White-browed Scrubwren			x	x	x		
Birds	Smicrornis brevirostris	Weebill			x	x	x		
Birds	Spatula rhynchotis	Australasian Shoveler				x			
Birds	Stagonopleura oculata	Red-eared Firetail			x	x	x		
Birds	Sternula nereis nereis	Australian Fairy Tern	VU					x	
Birds	Strepera versicolor	Grey Currawong			x	x	x		
Birds	Streptopelia senegalensis	Laughing Dove		Yes	x	x	x		
Birds	Tachybaptus novaehollandiae	Australasian Grebe			x	x	x		
Birds	Tadorna tadornoides	Australian Shelduck			x	x	x		
Birds	Threskiornis moluccus	Australian White Ibis			x	x			
Birds	Threskiornis spinicollis	Straw-necked Ibis				x			
Birds	Todiramphus sanctus	Sacred Kingfisher			x	x	x		
Birds	Tribonyx ventralis	Black-Tailed Native-Hen				x	x		
Birds	Tringa nebularia	Common Greenshank	MI					x	
Birds	Turnix varius	Painted Button-quail				x	x		
Birds	Tyto novaehollandiae novaehollandiae	Masked Owl	P3						x
Birds	Zosterops lateralis	Silvereye			x	x	x		
Fish	Galaxiella nigrostriata	Black-stripe Minnow	EN (WA)					x	
Fish	Geotria australis	Pouch Lamprey	P3		x				x
Fish	Liza argentea	Tygum			x				
Fish	Nannatherina balstoni	Balston's Pygmy Perch	VU					x	

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Mammals	Antechinus flavipes leucogaster	Yellow-footed Antechinus			x		x		
Mammals	Bettongia penicillata ogilbyi	Woylie	EN (Federal), CR (WA)				x	x	x
Mammals	Cercartetus concinnus	Western Pygmy-possum			x		x		
Mammals	Chalinolobus gouldii	Gould's Wattled Bat					x		
Mammals	Chalinolobus morio	Chocolate Wattled Bat					x		
Mammals	Dasyurus geoffroii	Chuditch	VU		x		x	x	x
Mammals	Falsistrellus mackenziei	Western False Pipistrelle	P4				x		x
Mammals	Felis catus	Cat		Yes			x		
Mammals	Hydromys chrysogaster	Water-rat	P4		x		x		x
Mammals	Isoodon fusciventer	Quenda	P4		x		x		x
Mammals	Macropus fuliginosus	Western Grey Kangaroo					x		
Mammals	Macrotis lagotis	Bilby	VU				x		x
Mammals	Mus musculus	House Mouse		Yes			x		
Mammals	Myrmecobius fasciatus	Numbat	EN				x	x	x
Mammals	Notamacropus eugenii subsp. derbianus	Tammar Wallaby	P4				x		x
Mammals	Notamacropus irma	Western Brush Wallaby	P4		x		x		x
Mammals	Nyctophilus geoffroyi	Lesser Long-eared Bat					x		
Mammals	Oryctolagus cuniculus	Rabbit		Yes			x		
Mammals	Ovis aries	Sheep		Yes			x		
Mammals	Phascogale calura	Red-tailed Phascogale	VU (Federal), CD (WA)					x	
Mammals	Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale	CD				x		x
Mammals	Pseudocheirus occidentalis	Western Ringtail Possum	CR				x	x	x
Mammals	Rattus norvegicus	Brown Rat		Yes			x		
Mammals	Rattus rattus	Black Rat		Yes			x		

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Mammals	Setonix brachyurus	Quokka	VU		x		x	x	x
Mammals	Sus scrofa	Pig		Yes			x		
Mammals	Tachyglossus aculeatus	Short-beaked Echidna					x		
Mammals	Trichosurus vulpecula	Common Brushtail Possum			x		x		
Mammals	Vespadelus regulus	Southern Forest Bat					x		
Mammals	Vulpes vulpes	Red Fox		Yes			x		
Reptiles	Acritoscincus trilineatus	Western Three-lined Skink			x		x		
Reptiles	Anilios australis	Southern Blind Snake			x				
Reptiles	Anilios pinguis	Rotund Blind Snake			x				
Reptiles	Aprasia pulchella	Pretty Worm-lizard			x		x		
Reptiles	Aprasia repens	Sedgelands Worm-lizard			x		x		
Reptiles	Christinus marmoratus	Marbled Gecko					x		
Reptiles	Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink			x		x		
Reptiles	Ctenotus delli	Darling Range South-west Ctenotus	P4		x		x		x
Reptiles	Ctenotus impar	Odd-striped Ctenotus			x		x		
Reptiles	Ctenotus labillardieri	Common South-West Ctenotus					x		
Reptiles	Diplodactylus calcicolus	South Coast Gecko					x		
Reptiles	Diplodactylus lateroides	Speckled Stone Gecko			x				
Reptiles	Diplodactylus polyophthalmus						x		
Reptiles	Egernia napoleonis	South-western Crevice-skink			x		x		
Reptiles	Hemiergis gracilipes	South-western Mulch-skink			x		x		
Reptiles	Hemiergis initialis subsp. initialis	Southwestern Earless Skink					x		
Reptiles	Hemiergis peronii subsp. tridactyla	Lowlands Earless Skink			x		x		
Reptiles	Lerista distinguenda	South-western Orange-tailed Slider			x		x		
Reptiles	Menetia greyii	Common Dwarf Skink			x		x		

Species Group	Species Name	Common Name	Conservation Status	Introduced	ALA	Birddata	NatureMap	Protected Matters	DBCA
Reptiles	Morelia spilota subsp. imbricata	Carpet Python					x		
Reptiles	Morethia obscura	Shrubland Morethia Skink			x		x		
Reptiles	Notechis scutatus	Tiger Snake			x		x		
Reptiles	Parasuta gouldii						x		
Reptiles	Parasuta nigriceps						x		
Reptiles	Pogona minor subsp. minor	Dwarf Bearded Dragon					x		
Reptiles	Pseudonaja affinis subsp. affinis	Dugite			x		x		
Reptiles	Tiliqua occipitalis	Western Bluetongue					x		
Reptiles	Tiliqua rugosa subsp. rugosa	Shingle-Back					x		
Reptiles	Varanus gouldii	Sand Monitor					x		
Reptiles	Varanus rosenbergi	Heath Monitor			x		x		

APPENDIX 5

Vertebrate fauna recorded from the study area

Species Group	Common Name	Taxon Name
Birds	Australian Magpie	*Cracticus tibicen*
Birds	Australian Raven	*Corvus coronoides*
Birds	Australian Ringneck	*Barnardius zonarius*
Birds	Baudin's Cockatoo	*Calyptorhynchus baudinii*
Birds	Brown Honeyeater	*Lichmera indistincta*
Birds	Brush Bronzewing	*Phaps elegans*
Birds	Common Bronzewing	*Phaps chalcoptera*
Birds	Dusky Woodswallow	*Artamus cyanopterus*
Birds	Elegant Parrot	*Neophema elegans*
Birds	Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*
Birds	Golden Whistler	*Pachycephala pectoralis*
Birds	Grey Currawong	*Strepera versicolor*
Birds	Grey Fantail	*Rhipidura albiscapa*
Birds	Grey Shrikethrush	*Colluricincla harmonica*
Birds	Inland Thornbill	*Acanthiza apicalis*
Birds	Laughing Kookaburra	*Dacelo novaeguineae*
Birds	Little Black Cormorant	*Phalacrocorax sulcirostris*
Birds	New Holland Honeyeater	*Phylidonyris novaehollandiae*
Birds	Pacific Black Duck	*Anas superciliosa*
Birds	Rainbow Bee-eater	*Merops ornatus*
Birds	Red Wattlebird	*Anthochaera carunculata*
Birds	Red-winged Fairywren	*Malurus elegans*
Birds	Rufous Treecreeper	*Climacteris rufus*
Birds	Singing Honeyeater	*Gavicalis virescens*
Birds	Splendid Fairywren	*Malurus splendens*
Birds	Striated Pardalote	*Pardalotus striatus*
Birds	Tawny crowned Honeyeater	*Gliciphila melanops*
Birds	Tree Martin	*Petrochelidon nigricans*
Birds	Varied Sittella	*Daphoenositta chrysoptera*
Birds	Wedge-tailed Eagle	*Aquila audax*
Birds	Weebill	*Smicrornis brevirostris*
Birds	Western Gerygone	*Gerygone fusca*
Birds	Western Grey Kangaroo	*Macropus fuliginosus melanops*
Birds	Western Thornbill	*Acanthiza inornata*
Birds	Whistling Kite	*Haliastur sphenurus*
Birds	White Browed Scrubwren	*Sericornis frontalis*
Birds	White-cheeked Honeyeater	*Phylidonyris niger*
Birds	White-eared Honeyeater	*Nesoptilotis leucotis*
Birds	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Birds	Fairy Martin	*Petrochelidon ariel*
Birds	Silvereye	*Zosterops lateralis*
Mammal	Cat	*Felis catus*
Mammal	Pig	*Sus scrofa*
Mammal	Quenda	*Isoodon fusciventer*
Mammal	Rabbit	*Oryctolagus cuniculus*
Mammal	Western Brush Wallaby	*Notamacropus irma*
Mammal	Western Grey Kangaroo	*Macropus fuliginosus melanops*
Reptiles	Bobtail	*Tiliqua rugosa rugosa*
Reptiles	Dugite	*Pseudonaja affinis affinis*
Reptiles	Heath Monitor	*Varanus rosenbergi*

APPENDIX 6

Location of conservation significant fauna within the study area

Common Name	Taxon Name	Zone	Easting	Northing	Observation Type	Observation Method
Baudin's Cockatoo	*Calyptorhynchus baudinii*	50 H	431271	6301350	Observed	Day Sighting
Baudin's Cockatoo	*Calyptorhynchus baudinii*	50 H	431358	6301781	Observed	Bird Census
Quenda	*Isoodon fusciventer*	50 H	430758	6303322	Observed	Diggings
Quenda	*Isoodon fusciventer*	50 H	431419	6303688	Observed	Diggings
Quenda	*Isoodon fusciventer*	50 H	431080	6301698	Observed	Diggings
Quenda	*Isoodon fusciventer*	50 H	431333	6302637	Observed	Diggings
Western Brush Wallaby	*Notamacropus irma*	50 H	430603	6303800	Observed	Day Sighting
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	50 H	431376	6302172	Observed	Calls
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	50 H	431080	6301698	Observed	Chewed Nuts

APPENDIX 7

Location and details of trees containing potential nesting hollows within the study area

Waypoint	Species	Hollow Dimensions (cm)	Usability	Zone	Easting	Northing
MA01	*Corymbia calophylla*	20 x 15	Marginal	50 H	431397	6304321
EW01	*Eucalyptus wandoo*	15 x 10	Marginal	50 H	431408	6304358
EM01	*Eucalyptus marginata*	15 x 10	Marginal	50 H	431243	6301888
EM02	*Eucalyptus marginata*	10 x 10	Marginal	50 H	431437	6301342
EM03	*Eucalyptus marginata*	<10 x 10	Unsuitable	50 H	431213	6301628
EM04	*Eucalyptus marginata*	5 x 5 - 15 x 15	Marginal	50 H	430459	6304272
EM06	*Eucalyptus marginata*	15 x 10	Marginal	50 H	430565	6304349
PS02	*Eucalyptus marginata*		Marginal	50 H	430924	6301645
PS03	Unknown		Marginal	50 H	430897	6301671
PS05	*Eucalyptus marginata*		Marginal	50 H	431104	6301833
PS06	*Eucalyptus marginata*		Marginal	50 H	431080	6301698
EM05	*Eucalyptus marginata*	40 x 20	Usable	50 H	430529	6304358
EM07	*Eucalyptus marginata*	?15 x 15	Usable	50 H	430599	6304390
EM08	*Eucalyptus marginata*	20 x 15	Usable	50 H	430663	6304253
Emx	*Eucalyptus marginata*		Usable	50 H	430560	6304348
PS01	*Eucalyptus marginata*		Usable	50 H	430959	6301657