

## **Level 1 Fauna Risk Assessment for the ‘Jackson Block’ of Lot 3 Buller Road, Waroona**



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Prepared for:

MDW Environmental Services  
Unit 1, 22 Elmsfield Road,  
Midvale WA 6056

By:

Terrestrial Ecosystems  
10 Houston Place  
Mt Claremont WA 6010

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Front Cover: King Skink (*Egernia kingii*)

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## EXECUTIVE SUMMARY

It is proposed that much of the vegetation on the Jackson Block (i.e. project area) of Lot 3 Buller Road, Waroona will be cleared of vegetation and the area will be used as a sand extraction pit. Lot 3 is approximately 8km west of the town of Waroona which is situated on the South Western Highway.

The Jackson Block is part of a larger remnant patch of vegetation that straddles Buller Road and is approximately 4.7km by 1.2km. It includes Lots 702 and 1245 and parts of Lots 341, 89 and 1312. The area south of Buller Road is part of the conservation estate managed by the Department of Parks and Wildlife. The remnant contains a couple of highly disturbed areas in Lot 702, and there is a power line easement that runs approximately north-south through the entire remnant patch of vegetation.

The project area supports a jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*), sheoak (*Allocasuarina fraseriana*) and *Banksia* sp. woodland over sparsely vegetated shrubs over grasses and herbs on grey sands. There is a large cleared section of native vegetation that was previously used to extract sand on the eastern side and another disused mining area in the south-west corner that abuts the regrown vegetation in the power line corridor. Approximately 45% of the project area has been used for historical sand extraction and mining. There is a small section west of the central point that supports dense shrubs on white sands that extends to the track that runs north-south through the project area.

The impact of clearing the 20ha of vegetation on Black-Cockatoos has been assessed against the criteria listed in the Commonwealth Government referral guidelines for black cockatoos, and such an action would trigger at least one of the criterion for a referral to the Commonwealth Government under the EPBC Act (1999).

Brush-tailed Phascogales were reported as present in the vicinity of the project area, but were not caught during fauna surveys at the nearby minerals sands project. The size of the remnant patch of vegetation is large enough to sustain a population of Brush-tailed Phascogale and some of the habitat is suitable. Chuditch, Carpet Pythons and Coastal Plains Skink have not been caught in the vicinity of the project area but this could be due to a lack of survey efforts. The presence of these four species can only be determined by a trapping program. Other conservation significant species such as the Rainbow Bee-eater, Peregrine Falcon and White-bellied Sea-eagles that may infrequently be seen in the project area and will move into adjacent areas once clearing commences and will not be significantly impacted.

Clearing the vegetation will result in the loss of numerous small vertebrates. It is highly probable the area supports Brush-tailed Possums, which should be addressed in the fauna management plan for the area.

### Recommendations

It is recommended that:

- the proposed action is referred to the Commonwealth Government under the EPBC Act; and
- a vertebrate fauna management plan is prepared and implemented prior to and during the vegetation clearing program to protect and mitigate impacts on vertebrate fauna.

# 1 INTRODUCTION

## 1.1 Background

It is proposed that much of the vegetation on the Jackson Block (i.e. project area) of Lot 3 Buller Road, Waroona is cleared of vegetation and used as a sand extraction pit. Lot 3 is approximately 8km west of the town of Waroona which is situated on the South Western Highway (Figure 1).

Lot 3 is part of a larger remnant patch of vegetation that is approximately 4.7km by 1.2km and straddles Buller Road and includes Lots 702 and 1245 and parts of Lots 341, 89 and 1312. Lot 702 includes a couple of highly disturbed areas and there is a power line easement that runs approximately north-south through the entire remnant patch of vegetation. There is regrowth of vegetation under the power line.

The surrounding area is mostly cleared paddocks used as pasture to graze cattle with fragmented remnant native vegetation joining a wetland to the north of the project area.

Terrestrial Ecosystems was commissioned by MDW Environmental Services on behalf of its client to undertake a level 1 fauna risk assessment. The purpose of this level 1 fauna risk assessment is to provide information to the appropriate government regulators to enable them to assess the potential impact of vegetation clearing on the fauna assemblage in the project area. The methodology broadly follows that described in the Environmental Protection Authority (EPA) *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002), *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) and the EPA/Department of Environment and Conservation (DPAW) *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA / DEC 2010).

A Level 1 fauna risk assessment involves undertaking a desktop review and site inspection. The objectives of this fauna risk assessment were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, small mammals and birds) on and in the vicinity of the project area;
- identify the presence and/or potential risks of impacting on species of conservation significance that are present or likely to be present in the project area;
- determine if any additional surveys are required to assess the potential impact on fauna assemblages in the project area, in particular, impacts on species of conservation significance; and
- make recommendations that mitigate or minimise potential impacts on resident fauna.

To achieve these objectives, Terrestrial Ecosystems has:

- reviewed Terrestrial Ecosystems fauna survey database [includes Western Australian Museum (WAM), and DPaW records] to identify potential vertebrate fauna within the area;
- reviewed DPaW listed Threatened and Priority species as recorded in NatureMap that are likely to be in the area;
- searched the Atlas of Living Australia's online database;
- searched the Commonwealth government's on-line database to identify fauna species of national environmental significance that are protected under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)* potentially occurring in the area;
- reviewed previous fauna surveys conducted in the region;
- undertaken a site visit to identify available fauna habitat types and habitat condition and to mapped Black-Cockatoo foraging habitat and significant trees;
- undertaken an assessment of the potential risks to the fauna associated with clearing additional areas of native vegetation;
- provided a discussion of the likelihood of *EPBC Act 1999* and Western Australian (WA) *Wildlife Conservation Act 1950* listed species being present in the project area; and
- provided management recommendations to mitigate and minimise potential impacts on the fauna in the project area.

## 2 EXISTING ENVIRONMENT

### 2.1 Survey area

Lot 3 Buller Road is approximately 100km south of the Perth CBD and 8km west of the town of Waroona on the Southwest Highway.

There is a large cleared section of native vegetation (Figure 2) that has historically been used for sand extraction on the eastern side and another disused mining area in the south-west corner that abuts the regrown vegetation in the power line corridor. The cleared area represents approximately 45% of the assessed project area. Most of the remaining area (~20ha) is a woodland of jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*), sheoak (*Allocasuarina fraseriana*) and *Banksia* sp. over sparsely vegetated shrubs over grasses and herbs on grey sands. There is a small section west of the central point that is dense shrubs on white sands that extends to the track that runs north-south through the project area.

The project area is part of a larger remnant patch of native vegetation, with the bushland in this remnant south of Buller Road being part of the conservation estate managed by the Department of Parks and Wildlife (DPAW).

### 2.2 Climate

The southwest of WA experiences a Mediterranean climate with mild-hot summers from December to March and mild-cool winters from May to August (Gentilli 1972). Chart 1 shows the average mean monthly maximum and minimum temperatures and rainfall for Harvey, the closest weather station that is on approximately the same longitude as the project area. Temperatures are highest in January – February. Harvey and the project area receive the majority of its annual rainfall in winter. This rain is usually the result of low pressure cells moving in a westerly direction which bring moisture bearing clouds over the south-west of Western Australia.

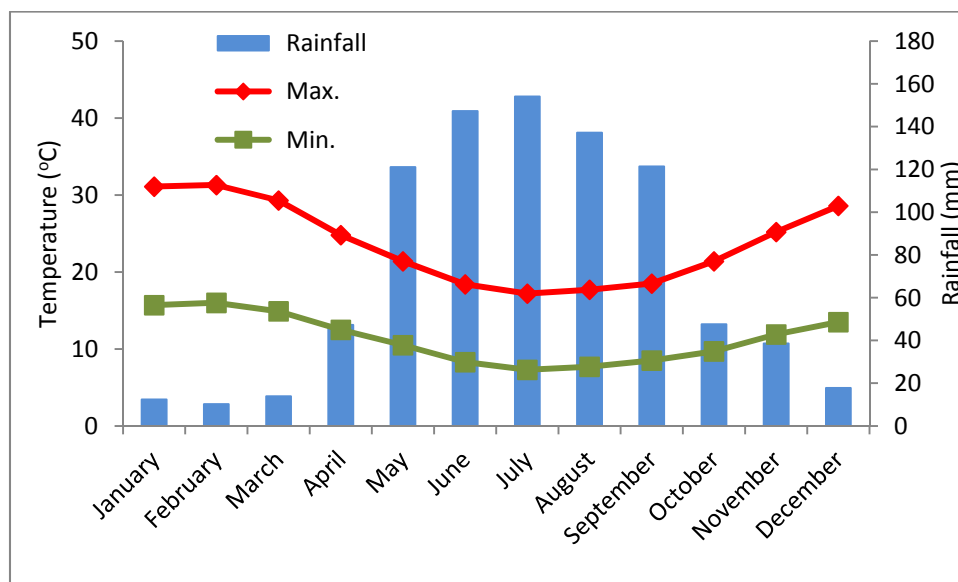


Chart 1. Mean monthly maximum and minimum temperatures and rainfall for Harvey (BOM May 2015)

### 2.3 Land use

The dominant land use in the general area is grazing cattle. There is a large mineral sands operation approximately 7km southeast of the project area.

## **2.4 Biological context for the project area**

The following two fauna surveys undertaken for the Waroona mineral sands project provided data on frogs, reptiles, mammals and birds in the vicinity of the project area:

- GHD (2004) Environmental Assessment Flora and Fauna Survey. Unpublished report for Iluka Resources Ltd, Waroona.
- Ninnox Wildlife Consulting (2005) Vertebrate Fauna Assessment Waroona Mineral Sands Project Area. Unpublished report for Iluka Resources, Perth.

In addition to the above reports, Terrestrial Ecosystems fauna survey database contains records from NatureMap and the Western Australian Museum collection for this area. The Atlas of Australia was searched for 10km around the project area for vertebrate species that had been recorded in the area. These databases include historical and incidental records that very often remain unreported.



### 3 METHODOLOGY

#### 3.1.1 Conservation significant species

A review of the *EPBC Act 1999* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government. The search coordinates were 32.8603°S, 115.8356°E with a 10km buffer (Appendix A). This area was selected as it excluded the coastal zone and the upland areas to the east of Waroona. In addition, a desktop search of the Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in the relevant section of the bioregion in the vicinity of the project area. The DPaW threatened and priority species database was searched via the records in NatureMap.

Other more general texts were also used to provide supplementary information on vertebrates in the bioregion, including Tyler *et al.* (2000) for frogs; Storr *et al.* (1983, 1990, 1999, 2002) for reptiles; Johnstone and Storr (1998, 2004) for birds; and Van Dyck and Strahan (2008) for mammals.

Collectively these sources of information were used to create lists of species expected to utilise the project area and broader bioregion. It should be noted that these lists will include species that have been recorded in the general region but are possibly vagrants and they will not generally be found in the project area due to a lack of suitable habitat (e.g. wetland and shore birds). Vagrants can be recorded almost anywhere. Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the project area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the project area. As a consequence many species will be included in the lists produced from database searches but will not be present in the actual project area.

#### 3.1.2 Black-Cockatoo habitat assessment

All eucalypt trees with a trunk diameter of 50cm or greater at breast height were recorded during the site survey in May 2015. The tree species and those with hollows were recorded as part of this survey. In addition, the project area was searched for evidence of Black-Cockatoo foraging and tree hollows were examined from the ground for chewing around the entrance that might indicate a nesting site.

Trees that were thought to have hollows that may be suitable as a nest site were not climbed and inspected. It is therefore probable that upon closer inspection many of the tree hollows recorded would be unsuitable for nesting because the hollows were not deep enough, they were internally too small, too large, had been burnt, or had a jagged and unsuitable floor, etc.

#### 3.2 Survey staff

Drs Graham and Scott Thompson undertook the reconnaissance site visit on 5 May 2015 and recorded Black-Cockatoo foraging habitat and significant trees. Graham and Scott have multiple years of experience in undertaking fauna assessments, Black-Cockatoo habitat assessments and are familiar with the fauna and fauna habitat in the bioregion.

#### 3.3 Limitations

This level 1 fauna risk assessment is based on information contained in the Commonwealth Government database and other published and unpublished fauna survey data for the bioregion and a site visit. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to fully appreciate the fauna assemblage in the project area.

Trees nominated as containing a hollow that may be suitable for a black-cockatoo nesting site were not climbed and hollows were not closely inspected. It is likely that many of these hollows, when examined more closely,

would be unsuitable nesting sites, so the actual number of trees with suitable nesting hollows will almost certainly be less than the number recorded.

The EPA *Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56* (2004) suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 1.

**Table 1. Fauna survey limitations and constraints**

<b>Possible limitations</b>	<b>Constraint (yes/no); significant, moderate or negligible</b>	<b>Comment</b>
Competency and experience of the consultant carrying out this assessment	No	The environmental scientists that undertook the field work and prepared this assessment are familiar with the vertebrate fauna of this bioregion.
Scope	No	All aspects of the scope of works have been addressed.
Proportion of fauna identified, recorded and/or collected	No	Not applicable.
Accuracy of previous survey work	Yes, negligible	Terrestrial Ecosystems has reported fauna survey data recorded by various authors, but is not in a position to vouch for the accuracy of this information. It is acknowledged that the taxonomy of Western Australian vertebrates is continually being revised and the nomenclature of some of the species listed in the appendices may have changed since publication by the authors.
Sources of information	Yes, negligible	Vertebrate fauna information was available from an on-line database and unpublished and published reports of surveys conducted in the bioregion in a variety of habitat types. Many of these surveys employed a low level of trapping effort which significantly impacts on the capacity of these data to represent the fauna assemblages in the areas surveyed.
Timing/weather/season/ cycle	No/moderate	Weather was suitable during the site visit, although the field assessment was outside the recognised breeding season for black-cockatoos.
Disturbances which affected results of the survey	No	A large section of the project area has been used for sand extraction. This disturbance has been factored into the assessment.
Intensity of survey effort	No	The entire project area was searched for trees of a suitable size, signs of fauna and evidence of foraging by black-cockatoos.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	There were no problems with access.
Availability of contextual information on the region	Moderate	There are very limited fauna survey data available for the general area and most come from the sand mine some 7km south-east of the project area.

Negligible – less than 20%; moderate -20-60%; significant – greater than 80%

## 4 RESULTS

### 4.1 Fauna habitats and condition

There are three broad fauna habitat types present in the project area; plus the areas previously cleared for sand extraction. The bushland is generally in good condition and largely undisturbed except for firebreaks and a few tracks throughout the area. The area used for sand extraction has shrubs and a few trees growing on the flat and planted vegetation on the slopes very few of which appear to have grown (Plate 1).

There is a small section west of the central point that is dense shrubs on white sands and this same habitat is also evident along the edge of the track that ran north-south west of this area (Plate 2). The majority of the undisturbed area is a woodland of jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*), sheoak (*Allocasuarina fraseriana*) and *Banksia* sp. over sparsely distributed shrubs over grasses, herbs and leaf litter on grey sands (Plates 3-5). There is a line of scattered trees along the eastern boundary that had little understorey, so they were not mapped as foraging habitat (Figure 2), although Black-Cockatoos had chewed on some of the marri nuts present. There is substantial regrowth of shrubs in the power line corridor which is along the western boundary of the project area (Plate 6).



**Plate 1. Sand extraction area**



**Plate 2. Shrubs mostly on white sandy soil**



**Plate 3. Jarrah, marri, sheoak and *Banksia* woodland**



**Plate 4. Jarrah, marri, sheoak and *Banksia* woodland**



**Plate 5. Jarrah, marri, sheoak and *Banksia* woodland**



**Plate 6. Regrowth under the power lines**

## 4.2 Vertebrate fauna

Appendix B provides a summary of the fauna survey data that are available in the vicinity of the project area. There are two sources of these data, namely data from species lists generated over many years from multiple unnamed sources included in the DPaW's NatureMap, Western Australian Museum and the Atlas of Living Australia. Because the sources of these data are unknown, it is likely that many of the records have been duplicated and some could be old and the species long since become locally extinct.

There are two survey reports available for the Waroona mineral sands project (GHD 2004, Ninnox Wildlife Consulting 2005) which provide fauna survey data for around the mine.

Tables 2-5 provide a list of vertebrate species potentially found in the vicinity of the project area that have been compiled based on the fauna survey report results and database lists shown in Appendix B. Lists in these Tables are a significant over estimate of the actual species likely to be present as many of these species have specific habitat requirements not available in the project area, because the project area is small, although adjacent to a larger remnant supporting very similar habitat.

**Table 2. Birds potentially found in the vicinity of the project area**

Family	Species	Common Name	Family	Species	Common Name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu		<i>Plegadis falcinellus</i>	Glossy Ibis
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite		<i>Threskiornis molucca</i>	Australian White Ibis
	<i>Lophoictinia isura</i>	Square-tailed Kite		<i>Threskiornis spinicollis</i>	Straw-necked Ibis
	<i>Haliastur sphenurus</i>	Whistling Kite	Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove
	<i>Accipiter fasciatus</i>	Brown Goshawk		<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk		<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Aquila audax</i>	Wedge-tailed Eagle		<i>Phaps elegans</i>	Brush Bronzewing
	<i>Ardea modesta</i>	Great Egret	Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra
	<i>Hieraaetus morphnoides</i>	Little Eagle		<i>Todiramphus sanctus</i>	Sacred Kingfisher
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck	Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	Cuculidae	<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth		<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill		<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo

Family	Species	Common Name
	<i>Cacomantis pallidus</i>	Pallid Cuckoo
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook
Falconidae	<i>Falco berigora</i>	Brown Falcon
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco longipennis</i>	Australian Hobby
	<i>Falco peregrinus</i>	Peregrine Falcon
Otididae	<i>Ardeotis australis</i>	Australian Bustard
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren
	<i>Smicronis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza inornata</i>	Western Thornbill
	<i>Acanthiza apicalis</i>	Inland Thornbill
Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cracticus tibicen</i>	Australian Magpie
	<i>Strepera versicolor</i>	Grey Currawong
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-Shrike
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike
	<i>Lalage sueurii</i>	White-winged Triller
Atrichornithida	<i>Atrichornis clamosus</i>	Noisy Scrub-bird
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper
Corvidae	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus coronoides</i>	Australian Raven
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Petrochelidon ariel</i>	Fairy Martin
Maluridae	<i>Malurus elegans</i>	Red-winged Fairy Wren
	<i>Malurus splendens</i>	Splendid Fairy-wren
Meliphagidae	<i>Acanthorhynchus superciliosus</i>	Western Spinebill
	<i>Lichenostomus virescens</i>	Singing Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Anthochaera lumulata</i>	Western Wattlebird
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Lichmera indistincta</i>	Brown Honeyeater

Family	Species	Common Name
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
	<i>Melithreptus lunatus</i>	White-naped Honeyeater
	<i>Phylidonyris nigra</i>	White-cheeked Honeyeater
	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-Lark
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Estrildidae	<i>Stagonopleura oculata</i>	Red-eared Firetail
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote
	<i>Pardalotus striatus</i>	Striated Pardalote
Petroicidae	<i>Petroica multicolor</i>	Pacific Robin
	<i>Petroica multicolor boodang</i>	Scarlet Robin
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Eopsaltria georgiana</i>	White-breasted Robin
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin
	<i>Microeca fascians</i>	Jacky Winter
Megaluridae	<i>Megalurus gramineus</i>	Little Grass Bird
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
Timaliidae	<i>Zosterops lateralis</i>	Silveryeye
Cacatuidae	<i>Calyptorhynchus banksii naso</i>	Red-tailed Black-Cockatoo
	<i>Calyptorhynchus banksii</i>	Forest Red-tailed Cockatoo
	<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo
	<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo
	<i>Eolophus roseicapillus</i>	Galah
	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	<i>Cacatua sanguinea</i>	Little Corella
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Purpureicephalus spurius</i>	Red-capped Parrot
	<i>Neophema elegans</i>	Elegant Parrot
	<i>Platycercus icterotis</i>	Western Rosella
	<i>Polytelis anthopeplus</i>	Regent Parrot
Tytonidae	<i>Tyto alba</i>	Barn Owl
	<i>Tyto javanica</i>	Eastern Barn Owl

**Table 3. Amphibians potentially found in the vicinity of the project area**

Family	Species	Common Name	Family	Species	Common Name
Hylidae	<i>Litoria moorei</i>	Motor Bike Frog	Myobatrachidae	<i>Crinia georgiana</i>	Quacking Frog
	<i>Litoria adelaidensis</i>	Slender Tree Frog		<i>Crinia glauerti</i>	Clicking Frog
	<i>Litoria moorei</i>	Motorbike Frog		<i>Crinia insignifera</i>	Squelching Froglet
Limnodynastidae	<i>Heleioporus eyrei</i>	Moaning Frog		<i>Geocrinia leai</i>	Ticking Frog
	<i>Heleioporus psammophilus</i>	Sand Frog		<i>Myobatrachus gouldii</i>	Turtle Frog
	<i>Limnodynastes dorsalis</i>	Western Banjo Frog			

**Table 4. Mammals potentially found in the vicinity of the project area**

	Species	Common Name		Species	Common Name
Suidae	<i>Sus scrofa</i>	Pig (feral)	Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum
Canidae	<i>Vulpes vulpes</i>	Red Fox	Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit
Felidae	<i>Felis catus</i>	House Cat	Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	Peramelidae	<i>Isodon obesulus</i>	Southern Brown Bandicoot
Dasyuridae	<i>Antechinus flavipes</i>	Yellow-footed Antechinus	Equidae	<i>Equus caballus</i>	Domestic Horse
	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Muridae	<i>Hydromys chrysogaster</i>	Water Rat
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum		<i>Mus musculus</i>	House Mouse
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo			

**Table 5. Reptiles potentially found in the vicinity of the project area**

Family	Species		Family	Species	
Agamidae	<i>Pogona minor</i>	Bearded Dragon		<i>Ctenotus labillardieri</i>	
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python		<i>Ctenotus ora</i>	Coastal Plains Skink
Carphodactylidae	<i>Underwoodisaurus milii</i>	Barking Gecko		<i>Egernia kingii</i>	King's Skink
Elapidae	<i>Demansia psammophis</i>			<i>Egernia napoleonis</i>	
	<i>Elapognathus coronatus</i>	Crowned Snake		<i>Hemiergis initialis</i>	
	<i>Notechis scutatus</i>	Tiger Snake		<i>Hemiergis quadrilineata</i>	
	<i>Parasuta gouldii</i>			<i>Lerista distinguenda</i>	
	<i>Parasuta nigriceps</i>			<i>Lerista elegans</i>	
	<i>Pseudonaja affinis</i>	Dugite		<i>Menetia greyii</i>	
	<i>Pseudonaja mengdeni</i>	Gwardar		<i>Morethia lineocellata</i>	
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko	Typhlopidae	<i>Anilius australis</i>	
Pygopodidae	<i>Delma fraseri</i>			<i>Anilius pinguis</i>	
	<i>Lialis burtonis</i>		Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor
	<i>Pygopus lepidopodus</i>	Common Scaly Foot		<i>Varanus rosenbergi</i>	Heath Monitor
Scincidae	<i>Acritoscincus trilineatum</i>			<i>Varanus tristis</i>	
	<i>Cryptoblepharus buchananii</i>		Chelidae	<i>Chelodina colliei</i>	Oblong Turtle

Terrestrial vertebrate fauna or signs of same recorded in the project area included pigs (Plate 7), Brushtail Possums (Plates 8 and 9), Western Grey Kangaroos (Plate 10) and rabbits (Plate 11). There were diggings that resembled those of Southern Brown Bandicoots in numerous locations (Plate 12), but none had the 'classical' V shaped nose cone, so it was difficult to be sure.



**Plate 7. Pig diggings**



**Plate 8. Brushtail Possum scratching**



**Plate 9. Brushtail Possum scats**



**Plate 10. Western Grey Kangaroo tracks**



**Plate 11. Rabbit burrow**



**Plate 12. Possible Southern Brown Bandicoot digging**

#### 4.2.1 Black-Cockatoo habitat assessment

The locations of 114 eucalypts with a diameter at breast height were recorded (Appendix D), and their locations area shown in Figure 2. Sixteen of these trees were dead, 59 were jarrah and 39 were marri. Nineteen trees contained a hollow (Plates 13 and 14) that could be suitable as a nesting site for black-cockatoos, however, these trees were not climbed and hollows were not closely inspected, so it is likely the many of these hollows on closer inspection would not be unsuitable as nesting sites for black-cockatoos due to a burnt interior, inappropriate internal dimensions, jagged floor, etc. There was no obvious evidence of chewing around hollow entrances to suggest hollows were a black-cockatoo nesting site.

There was evidence that Banksia cones had been chewed by Carnaby's or Baudin's Black-Cockatoos (Plate 15) and either Forest Red-tailed or Carnaby's Black-Cockatoos had chewed marri nuts (Plate 16) in the project area.



**Plate 13. Dead tree hollow that may provide a suitable nesting site for black-cockatoos**



**Plate 14. Tree containing a hollow that may provide a suitable nesting site for black-cockatoos**



**Plate 15. Banksia cone chewed by a black-cockatoo**



**Plate 16. Marri nut chewed by a black-cockatoo**

#### 4.3 Conservation significant fauna

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the Western Australia (WA) *Wildlife Conservation Act 1950*. The WA *Wildlife Conservation Act 1950* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, the DPaW maintains a list of fauna that require monitoring under five priorities based on DPaW's knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *Wildlife Conservation Act 1950* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DPaW wishes to monitor potential impacts on these



species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *WA Wildlife Conservation Act* are provided in Appendix C.

Nine threatened species of fauna and six migratory species of birds identified under the *EPBC Act 1999* potentially occur in the vicinity of the project area. There are 15 Schedule species listed under the *WA Wildlife Conservation Act 1950* and 12 species listed on the DPAW's Priority Fauna List that potentially occur in the vicinity of the project area. The following is an assessment of the likelihood of each of the species being impacted in the project area. Table 6 is a summary of this information.

**Table 6. Species that are potentially found in the vicinity of the project area and are listed as being of conservation significance under state or commonwealth government legislation or with DPAW**

Species	Status under the Wildlife Conservation Act / DPAW	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
<i>Botaurus poiciloptilus</i> Australasian Bittern	Schedule 1	Endangered	Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Calyptrorhynchus latirostris</i> Carnaby's Black-Cockatoo	Schedule 1	Endangered	Could be seen foraging in the project area and may nest in the project area or the adjacent remnant bushland.
<i>Rostratula benghalensis</i> Painted Snipe	Schedule 1	Endangered	Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Calyptrorhynchus banksii naso</i> Forest Red-tailed Black-Cockatoo	Schedule 1	Vulnerable	Could be seen foraging in the project area and may nest in the project area or the adjacent remnant bushland.
<i>Calyptrorhynchus baudinii</i> Baudin's Black-Cockatoo	Schedule 1	Vulnerable	Could be seen foraging in the project area. Unlikely to nest in the area.
<i>Dasyurus geoffroii</i> Chuditch	Schedule 1	Vulnerable	Possibly present in the project area. Unknown impact.
<i>Leipoa ocellata</i> Malleefowl	Schedule 1	Vulnerable	Not present in the project area. Low potential impact.
<i>Pseudocheirus occidentalis</i> Western Ringtail Possum	Schedule 1	Vulnerable	Very low possibility of being present in the project area due to lack of preferred habitat. Low potential impact.
<i>Setonix brachyurus</i> Quokka	Schedule 1	Vulnerable	Not present in the project area but may be present in surrounding areas. Low potential impact.
<i>Apus pacificus</i> Fork-tailed Swift	Schedule 3	Migratory	May infrequently fly over the project area. Low potential impact.
<i>Haliaeetus leucogaster</i> White-bellied Sea-eagle	Schedule 3	Migratory	May infrequently fly over the project area. Low potential impact.
<i>Merops ornatus</i> Rainbow Bee-eater	Schedule 3	Migratory	May be found in the project area and may utilise some of the area for breeding at appropriate time of the year. Low potential impact.
<i>Ardea alba</i> Great Egret	Schedule 3	Migratory Wetland	Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Ardea ibis</i> Cattle Egret	Schedule 3	Migratory Wetland	Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Pandion cristatus</i> Osprey	Schedule 3	Migratory Wetland	May infrequently fly over the project area. Low potential impact.
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	Schedule 1		Possibly in the project area. Unknown impact.
<i>Morelia spilota imbricata</i> Carpet Python	Schedule 4		Low possibility of being found in the project area. Low potential impact.
<i>Falco peregrinus</i> Peregrine Falcon	Schedule 4		Unlikely to be a resident in the project area. Low potential impact.
<i>Ctenotus ora</i> Coastal Plains Skink	Priority 3		Maybe be found in the project area. Unknown impact as this is a relatively recently named species with patchy distribution. .
<i>Ninox connivens</i> Barking Owl	Priority 2		Possibly present in the project area. Low potential impact.
<i>Ixobrychus flavicollis</i> Black Bittern	Priority 3		Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Burhinus grallarius</i> Bush Stone-curlew	Priority 4		Unlikely to be found in the project area. Low potential impact.
<i>Ixobrychus minutus</i> Little Bittern	Priority 4		Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Falculculus frontatus</i>	Priority 4		Potentially found in the project area. Low potential impact as it

Species	Status under the Wildlife Conservation Act / DPAW	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
Crested Shrike-tit			will move to adjacent areas when disturbed.
<i>Synemon gratiosa</i> Graceful Sun-Moth	Priority 4		Its presence in the project area is unknown as an appropriate survey has not been undertaken.
<i>Macropus irma</i> Western Brush Wallaby	Priority 4		Not recorded in the project area. Low potential impact.
<i>Hydromys chrysogaster</i> Water Rat	Priority 4		Not present in project area due to lack of suitable habitat. Low potential impact.
<i>Charadrius rubicollis rubicollis</i> Hooded Plover	Priority 4		Unlikely to be found in the project area due to lack of suitable habitat. Low potential impact.
<i>Falsistrellus mackenziei</i> Western False Pipistrelle	Priority 4		Unlikely to be found in the project area. Low potential impact.
<i>Isodon obesulus fusciventer</i> Southern Brown Bandicoot	Priority 5		Possibly present in low numbers, if so would require management to reduce potential impacts.

**Australasian Bittern (*Botaurus poiciloptilus*)** – Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

The Australasian Bittern has a distribution from Moora through much of the south-west and east to Mt Arid; however, it is rarely recorded. It is almost always found in dense *Typha*, *Baumea* and sedges in freshwater or brackish swamps (Johnstone and Storr 1998). Garnett et al. (2011) reported its population across Australia as less than 2000 and in decline. Most of the Western Australian records come from Lake Muir. It was recorded in the Atlas of Living Australia in the general area but its specific location is unknown. The lack of a suitable wetland in the project area would indicate that it is unlikely to be present.

**Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)** – Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) is a large, pied, cockatoo. Garnett et al. (2011) and the DSEWPac (2011) reported that Carnaby's Black-Cockatoo inhabits the south-west of Western Australia, from Kalbarri to as east on the south coast as Esperance. It breeds inland and moves to the coastal areas when chicks have fledged (Saunders et al. 1985). Carnaby's Black-Cockatoos are highly gregarious, usually seen in trios, small parties or large flocks (up to 5000 birds; Perry 1948). These flocks usually contain males, females and immature birds.

In some locations, breeding populations have decreased or become locally extinct (Saunders 1986, Saunders and Ingram 1987). For example, in the Coomallo Creek area north of Perth, Black-Cockatoos laid 74 clutches in 1973, 75 in 1974, 82 in 1975 but only 20 in 1994 and 19 in 1996 (Saunders and Ingram 1987). Saunders (1986) reported finding 13 nests at Manmanning in 1969 but by 1977, the species had stopped breeding in the area. Saunders (1990) reported failed nestings due to predation by a cat, galahs broke Carnaby's Black-Cockatoo eggs and took over nests, while other adult birds were killed by vehicles and Wedge-tailed Eagles (*Aquila audax*).

Carnaby's Black-Cockatoos are partly migratory and partly sedentary (Higgins 1999). In the drier regions of their geographic range where most of the native vegetation has been cleared (e.g. wheatbelt), Carnaby's Black-Cockatoos are postnuptial migrants (Saunders 1980, Saunders and Ingram 1995). After breeding, individuals in these areas migrate to feed in higher rainfall areas including the Swan Coastal Plain, and to a lesser extent, forests dominated by *E. marginata* (Jarrah), *C. calophylla* (Marri) and *E. diversicolor* (Karri; Saunders 1980). On the Swan Coastal Plain, Carnaby's Black-Cockatoos have been recorded foraging in most suburbs and in pine plantations within the greater Perth metropolitan area (Perry 1948). Vagrants have been recorded on Rottne Island (Winnett 1989) and Garden Island (Wykes et al. 1999). These later two sightings clearly indicate that Carnaby's Black-Cockatoo will fly considerable distances over non-vegetated areas to forage.

Garnett et al. (2011) estimated there were between 10,000 and 60,000 birds in the population.

Saunders (1980) recorded non-breeding cockatoos at Coomaloo Creek foraging within a 50km radius of their breeding area, whereas, cockatoos at Manmanning moved a much greater distance to the coastal plain during their non-breeding season. These data suggest that Carnaby's Black-Cockatoo move from areas where there is little food to southern and western coastal areas where food is presumably more plentiful during summer and autumn (Davies 1966, Saunders 1980).

Carnaby's Black-Cockatoo breed between July and November mostly in eucalypt woodland (Saunders 1980, 1986). Carnaby's Black-Cockatoo nest in tree hollows that are created by fire, fungi, termites or old age, with hollows between 2.5 and 12m above the ground (Saunders 1979a, Higgins 1999). Hollows are large, ranging from 10 to over 250cm in depth (Higgins 1999). These hollows are usually in live or dead smooth-barked *Eucalyptus salmonophloia* (Salmon Gum) or *Eucalyptus wandoo* (Wandoo). However, Carnaby's Black-Cockatoo will also nest in *E. longicornis* (Red Morrell), *E. loxophleba* (York Gum), *E. gomphocephala* (Tuart), *E. rudis* (Flooded Gum), *E. salubris* (Gimlet), *E. occidentalis* (Swamp Yate) and *C. calophylla* (Higgins 1999, Cale 2003). When breeding, they most often forage in the surrounding shrubland and kwongan heath (Higgins 1999). On the Swan Coastal Plain, breeding could occur in *E. gomphocephala*, *E. rudis*, *E. occidentalis* and *C. calophylla*. Adults return to the same breeding area each year (Saunders 1977) and some use the same tree hollow for many years in succession to raise their chicks, others shift their nests among a number of trees in the same area (Saunders and Ingram 1998).

Eggs are laid on a mat of wood chips chewed from the sides of the hollow. Clutches are 1-2, but most often only one chick is raised. Incubation takes 29 days, and only the female incubates and broods (Johnstone and Kirkby 2011). Initially the female will return to the nest mid-morning to feed the chick, but after about 2-3 weeks both parents leave in the early morning and return late evening.

Young remain with their parents until the parents return to the breeding area in the following year (Saunders 1980). Immature birds probably do not move into the breeding areas until they are ready to breed, although little is known of the movements of immature Carnaby's Black-Cockatoo until they are ready to breed (Saunders 1977).

The breeding success of Carnaby's Black-Cockatoo is believed to be strongly influenced by the availability of food at breeding sites (Saunders et al. 1985). Saunders (1977) found that birds that foraged within one or two kilometres from nesting sites had greater fledgling success than those from populations that had to travel up to four kilometres to obtain food. In a study that monitored Carnaby's Black-Cockatoo's breeding over 25 years at Coomaloo Creek, Saunders and Ingram (1998) showed that the number of breeding attempts halved by the end of the study. During this period, native vegetation cover was reduced from 90% in 1959 to 25% in 1996. Their study revealed that although there was a surplus of trees with hollows of sufficient sizes, clearing of adjacent foraging habitat had adversely impacted on the success of breeding birds. Therefore, breeding sites typically have nearby areas of scrub and heath where birds forage on seeds and flowers of numerous trees and shrubs including *Banksia*, *Hakea*, *Dryandra*, *Grevillea* and *Callistemon* spp. (Robinson 1965, Saunders 1980, Higgins 1999). Unlike other cockatoo species, Carnaby's Black-Cockatoo will not utilise cereal crops (Saunders et al. 1985), but will feed on *Erodium* seed (Saunders 1980).

At Coomaloo Creek, Carnaby's Black-Cockatoo travelled on average 1.4km from their nests to forage, whereas at Manmanning they foraged more widely and travelled an average of 2.5km from their nest to forage (Saunders 1980). At Manmanning, road and railway reserves were extensively used for foraging, presumably as this was the closest food source to their nests. The availability of food near the nest influenced the time spent incubating eggs and fledging body mass (Saunders 1980). At Manmanning, Carnaby's Black-Cockatoo traversed agricultural land to forage in remnant plots of uncleared land.

The social organisation of breeding Carnaby's Black-Cockatoo is known (Saunders 1974, 1977, 1979b, 1980, Saunders et al. 1985, Saunders 1986, Higgins 1999). Carnaby's Black-Cockatoo start reproducing at about four years of age and continue for at least 15 years (Cale 2003). Strong pair bonds are then formed, often for life. Females lay one or two eggs asynchronously with an average of 8 days (range 1-12) between the laying of the first and second egg. Egg laying usually occurs in early July to mid-October, with inland birds laying approximately three weeks later than those closer to the coast. Females incubate their 1-2 eggs for 29 days (Saunders 1982). When two eggs are laid, it is rare for both nestlings to successfully fledge. The female alone broods and feeds the

young birds. Initially, the female, and later the chick, rely on the male for food during the brooding and hatching of the eggs (Saunders 1977, Saunders 1982). After two to three weeks, both parents forage and return at mid-morning and dusk to feed the young (Saunders 1977, Saunders 1982). The young are dependent on parents for several months after fledgling. Fledglings are independent after about 10-11 weeks (Saunders 1977).

Saunders (1980) reported Carnaby's Black-Cockatoo at Coomallo Creek (breeding area) foraged mostly on native plants, with the only exception being *Erodium* sp.. Higgins (1999) reported the habitat of Carnaby's Black-Cockatoo was uncleared or remnant woodlands dominated by *Eucalyptus*, particularly *E. wandoo* and *E. salmonophloia* and often in shrubland or kwongan heathland dominated by *Hakea*, *Dryandra*, *Banksia* and *Grevillea* and seasonally in *Pinus* plantations and less often in *C. calophylla*, *E. diversicolor* or *E. marginata*.

The belief that Carnaby's Black-Cockatoo numbers are in serious decline has led to a recovery plan being released in 2012 (DEC 2012). This plan details the current status of the cockatoo and provides conservation measures to increase the population. The five broad recovery actions in this plan are:

- Protect and manage important habitat – identify, protect and manage habitat critical for survival (nesting, foraging and roosting) for Carnaby's Black-Cockatoos across their breeding and non-breeding range;
- Conduct research to inform management – undertake research into the biology, ecology, and conservation management of Carnaby's Black-Cockatoo;
- Undertake regular monitoring – monitor population parameters, habitat, threats and status of the Carnaby's Black-Cockatoo;
- Manage other impacts – monitor the impacts and implement strategies to reduce other factors detrimentally affecting Carnaby's Black-Cockatoo, and support rehabilitation programs;
- Undertake information and communication activities – develop and distribute awareness raising and guidance materials for decision makers, establish joint management agreements and provide for improved sharing of information between agencies; and
- Engage with the broader community – engage with and involve people across the community in the conservation of Carnaby's Black-Cockatoo.

Carnaby's Black-Cockatoo had foraged on the *Banksia* flowers and fruit and marri nuts in the project area. Recorded as breeding closer to the coast so there is a potential for Carnaby's Black-Cockatoo to nest in appropriate hollows in the project area.

**Painted Snipe (*Rostratula benghalensis*)** – Endangered under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

The Painted Snipe's geographic distribution includes much of Australia excluding the inland sandy deserts. It inhabits shallow, vegetated temporary or infrequently filled wetlands, sometimes where there are trees or shrubs or samphire. Occasionally it has been recorded in brackish wetlands, salt marshes, claypans, sewage farms and other water ways. There is some evidence of partial migration for this species on the east coast.

Due a lack of suitable habitat in the project area and it not being recorded in the vicinity of the project area, it is Terrestrial Ecosystems' view that it is unlikely to be found in the project area.

**Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

The Forest Red-tailed Black-Cockatoo is one of three large black-cockatoos found in Western Australia. *Calyptorhynchus banksii naso* frequents the humid to sub-humid south-west of Western Australia from Gingin in the north, to Albany in the south and west to Cape Leeuwin and Bunbury (Department of Sustainability Environment Water Population and Communities 2011). It was mostly seen in the hill interior, but small numbers of birds were seen at Mundijong, Baldivis, Karnup, Stakehill, Pinjarra, Coolup and in the Lake Clifton area (Johnstone and Kirkby 2011). In 2011, there was an increase in the number of Forest Red-tailed Black-Cockatoo

on the coastal strip north from Rockingham to the northern metropolitan suburbs. The reason for the recent increase in abundance is unknown.

Forest Red-tailed Black-Cockatoo nest hollows have been recorded between 6.5 and 33m above the ground, with entrance sizes ranging from 10 x 12cm to 44 x 150cm and a depth of 0.3-8.2m (Johnstone et al. 2013b, a). Breeding occurs in all months, but peaks in April-June and August-October with an incubation period of 29-31 days. A female broods her hatchling for the first 3-10 days after hatching and then leaves the nest each day at dawn and returns to feed the chick at dusk. Hatchlings are fully feathered at about 48 days. The majority of nests are in marri, but they have also been recorded in jarrah, blackbutt, bullich and wandoo. Nest sites are often clustered in an area.

Johnstone and Kirkby (2011) reported the Forest Red-tailed Black-Cockatoo to feed mostly on seeds from *C. calophylla*, *E. marginata*, but also on *Allocasuarina fraseriana* (Sheoak), *Persoonia longifolia* (Snottygobble), *Eucalyptus patens* (Blackbutt) and introduced species such as *M. azedarach* (Cape Lilac) and *Corymbia citriodora* (Lemon-scented Gum).

Loss of breeding habitat in the form of suitable hollows and adequate feeding resources in the vicinity of nesting hollows to enable adults to feed chicks is a primary threat. Abbott (1998) reported that trees within its known breeding distribution was not a factor in limiting breeding. He estimated there were about 15,000 birds and Garnett et al. (2011) thought about 10% of these birds bred each year. Competition for nesting hollows by other cockatoos, Wood Ducks, Galahs and feral Honey Bees appears to also be a significant threat (Garnett et al. 2011).

Forest Red-tailed Black-Cockatoos were recorded in the general vicinity and are likely to forage on the sheoak, jarrah and marri nuts in the project area. Recorded as breeding to the north of the project area, so there is a potential for Forest Red-tailed Black-Cockatoos to nest in appropriate hollows in the project area.

**Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

Baudin's Black-Cockatoo occurs in the humid and sub-humid forests of Western Australia, an area within the 750mm isohyet (Chapman 2007). Its range extends from Gidgegannup and Clackline in the north to about 50km east of Albany and all the forest to the south-west coast (Chapman 2007).

Baudin's Black-Cockatoo is typically found in vagrant flocks and utilises the taller, more open *E. marginata*, *C. calophylla* and *E. diversicolor* forests, where it feeds mainly on *C. calophylla* seeds and various Proteaceous species. Johnstone and Kirkby (2008) reported Baudin's Black-Cockatoo feeding on the seeds of *C. calophylla*, *E. marginata*, *A. fraseriana*, *Banksia grandis*, *B. quercifolia*, *B. littoralis*, *B. ilicifolia*, *Hakea erinacea*, *H. prostrata*, *H. stenocarpa*, *H. trifurcata*, *H. lasianthoides*, *H. ruscifolia*, *H. lissocarpha*, *H. varia*, *H. cristata*, *H. marginata*, *Dryandra sessilis*, *D. squarrosa*, *D. praemorsa*, *Grevillea wilsonii*, *Xanthorrhoea preissii*, *Kingia australis*, *Reedia spathacea*, *Pinus radiata*, *Erodium* spp., *Jacaranda* spp., *Macadamia* spp., *Carya illinoensis*, *Malus* spp., *Pyrus* spp., *Diospyros* spp. and *Quercus* spp.; and the nectar, buds and flowers of *C. calophylla*, *C. citriodora*, *E. marginata*, *E. wandoo*, *B. grandis*, *D. sessilis*, *D. lindleyana*, *D. squarrosa*, *Darwinia citriodora* and *Callistemon* spp. They also eat insect larvae and insects from under the bark. Baudin's Black-Cockatoo damages apples and pears in domestic and commercial orchards, and for this reason has been shot by orchardists (Chapman 2007).

Johnstone and Kirkby (2008) suggested that once chicks had fledged, birds leave the nesting area and family groups amalgamate to form larger flocks. These large flocks arrive in the non-breeding central and northern parts of the Darling Scarp in early February and March. This postnuptial nomad is seen in Collie, Bannister, North Dandalup, Serpentine, Jarrahdale, Wungong, Mundaring and Chidlow, and sometimes venture on to the adjacent coastal plain at Maida Vale, Kelmscott, Armadale, Byford, Mundijong, Lake Clifton, Bunbury, Capel, Busselton and Dunsborough (Johnstone and Kirkby 2008, Johnstone and Kirkby 2011). During the non-breeding period, Baudin's Black-Cockatoo utilises a number of roosts on a regular basis. Johnstone and Kirkby (2008) have recorded some of the larger roosts at Gidgegannup, Piesse Brook, Nganguring, Mundaring, Araluen, Wungong, North Dandalup and Serpentine. Other roosts are at Chidlow, Parkerville, Kalamunda, Kelmscott, Roleystone,

Bedforddale, Gleneagle, Mundijong, Jarrahdale, Bannister and Crossman. Most of these roost sites are tall emergent eucalypts or Blackbutt and they are often near watercourses and in sheltered gullies. They seldom venture as far west as the project area.

It is known to breed in the southern forests north to Collie and east to near Kojonup in large vertical hollows of *E. diversicolor*, *C. calophylla* and *E. wandoo* (Johnstone and Kirkby 2008). Johnstone and Storr (1998) reported eggs are laid in August to December, with a clutch of 1-2, but normally only a single chick is fledged. Only the female incubates and broods.

Garnett et al. (2011) estimated the population to be around 10,00-15,000, with only 10% breeding in any year.

Garnett et al. (2011) reported the primary threat to this species is a lack of suitable hollows. Competition for hollows comes from other cockatoos, Galahs, Australian Shelducks, Wood Ducks and feral Honey Bees (Johnstone and Kirkby 2008, Garnett et al. 2011). Inadequate feeding resources in the vicinity of nesting hollows to enable adults to feed chicks are also a threat.

The Recovery Plan for Baudin's and Forest Red-tailed Black-Cockatoos (Chapman 2007) seeks to:

- develop and promote non-lethal means of stopping Baudin's damaging fruit in orchards;
- eliminate illegal shooting;
- develop and implement strategies to allow for the use of noise emitting devices in orchards;
- develop and implement as protocol for the easy removal of honeybees from nesting hollows;
- determine and implement ways to minimise the effects of mining on habitat loss;
- identify factors affecting the number of breeding attempts and breeding success and manage nest hollows to increase recruitment reduce habitat loss;
- map feeding and breeding habitat critical to the survival of this species;
- determine the population and distribution and patterns of movement for both species; and
- maintain the Cockatoo Care program.

Baudin's Black-Cockatoo were recorded in the surveys of the mineral sands project and are likely to forage in the project area on the Banksia seeds and marri nuts.

**Chuditch, Western Quoll (*Dasyurus geoffroii*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

The Chuditch was originally found in over 70% of Australian woodlands; however, since European settlement its range has diminished to a patchy distribution throughout the Jarrah forest and mixed Karri - Marri - Jarrah forest of south-west WA. They have been known to occupy a wide range of habitats including woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. The Chuditch creates dens in hollow logs or burrows and have also been recorded in tree hollows and cavities. They are opportunistic feeders, and forage on the ground at night, feeding on invertebrates, small mammals, birds and reptiles.

Chuditch has not been recorded during the surveys in the vicinity of the project area, however, there is a low possibility that they could be in the remnant vegetation in low numbers.

**Malleefowl (*Leipoa ocellata*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

Malleefowl are relatively large, mostly terrestrial birds that tend to be sedentary, nesting in the same general area year after year (Firth 1962a, Priddel and Wheeler 2003). Density of the birds is generally highest in areas of higher rainfall and on more fertile soils (Firth 1962a, Copley and Williams 1995, Benshemesh 2007) and where shrub diversity is greatest (Woinarski 1989). Malleefowl are now primarily found in semi-arid and arid shrublands and low woodlands dominated by mallee (*Eucalyptus* sp.) in the more temperate areas (Firth 1962b, a). Grazed areas generally have lower densities (Benshemesh 2007).

A sandy or gravelly substrate and abundance of leaf litter are requirements for the construction of the birds' incubator mounds (Firth 1959, 1962a). Jones and Goth (2008) indicated malleefowl mounds were 60-90 cm high and 3.7m wide, however, there is considerable variability in the size, which is often influenced by how often the mound has been used. Malleefowl frequently use already constructed mounds instead of building a new mound each year (Priddel and Wheeler 2003). Malleefowl that reuse an existing mound tend to rake more material from the surrounding area each year on to the existing mound, with the consequence that some of the older mounds are higher than 100 cm and wider than 5 m. Density of the canopy cover is an important feature associated with high breeding densities (Firth 1962a, Benshemesh 2007) and it is this dense mallee vegetation that can make ground searches for malleefowl mounds difficult.

There are no Malleefowl mounds in the project area, no footprints were observed during the site inspection and the open understorey is unsuitable for this species in the presence of foxes. It is therefore Terrestrial Ecosystems' view that it is highly unlikely that Malleefowl are in the project area.

**Western Ringtail Possum (*Pseudocheirus occidentalis*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

The Western Ringtail Possum is an arboreal mammal with a body weight between 820–1020g. This species is regularly encountered by urban development throughout its distribution which has contracted from what appears to have been a patchy distribution covering the south west of Western Australia from south-east of Geraldton to the Nullarbor with the most inland recording from the Tuatanning Nature Reserve (de Tores *et al.* 1995). The distribution encompassed a variety of vegetation types including coastal peppermint (*Agonis flexuosa*), and peppermint/tuart (*Eucalyptus gomphocephala*) associations, Eucalypt and Casuarina (*Allocasuarina huegeliana*) woodlands, and mallee heath from the Hampton Tableland (Baynes 1987). Presently it is almost exclusively restricted to the coastal Peppermint woodland and coastal Peppermint/Tuart associations from the Yalgorup area to Two Peoples Bay. The only known natural extant inland populations are in the lower Collie River Valley, Perup Nature Reserve, around Albany and surrounding forest block near Manjimup. DPaW has translocated individuals to Yalgorup National Park and it is possible they are present in the peppermint woodland to the west of the project area near the Forrest Highway. Factors thought to have contributed to this species decline include habitat loss, modification or fragmentation, changing fire regimes, disease, competition and predation by introduced predators (Clarke *et al.* 2008; DEWHA 2008).

No dreys were observed during the site visit, and it is Terrestrial Ecosystems' view that it is unlikely that Western Ringtail Possums are present in the project area.

**Quokka (*Setonix brachyurus*)** – Vulnerable under the *EPBC Act 1999* and Schedule 1 under the *Wildlife Conservation Act 1950*

Quokkas were originally very common on the Swan Coastal Plain, however, their distribution is now limited to Rottnest Island and a few isolated areas in the south-west of WA. On the mainland, they prefer densely vegetated areas around wetlands and streams, whereas on Rottnest Island they inhabit low scrubby coastal vegetation where water is not readily available year-round. They are herbivorous, and feed on leaves, bark, succulent plants and grasses. There are no recent records of Quokka being found in the vicinity of the project area.

Quokkas were not seen during the site visit and the openness of the understorey and presence of foxes in the area would strongly suggest that Quokkas are not in the project area.

**Fork-tailed Swift (*Apus pacificus*)** - Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

The Fork-tailed Swift breeds in north-east and mid-east Asia and winters in Australia and south New Guinea (Johnstone and Storr 1998). They arrive in the Kimberley in late September and in the Pilbara in November and the south-west in December, leaving late in April. Johnstone and Storr (1998) reported them as common in the Kimberley and uncommon to moderately common along the north-west, west and south-east coasts and scarce

elsewhere. They are occasionally seen in large flocks and can be attracted to thunderstorms or cyclonic events in the northern parts of the state.

As this is a migratory species, ground disturbance activities on a localised scale are unlikely to significantly impact on Fork-tailed Swifts. They could infrequently be seen flying over the project area.

**White-bellied Sea-Eagle (*Haliaeetus leucogaster*)** – Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

The White-bellied Sea-eagle is the second largest bird of prey found in Australia. This eagle has been seen in a variety of habitats and not always near the ocean, but they are more commonly seen in coastal areas. Birds form permanent pairs that inhabit territories throughout the year. These eagles are normally seen perched high in a tree, or soaring over waterways and adjacent land.

Terrestrial Ecosystems' assessment is that the White-bellied Sea-Eagle may infrequently be seen in the general area, but development of the project area is unlikely to significantly impact on this species.

**Rainbow Bee-eater (*Merops ornatus*)** - Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

Rainbow Bee-eaters are abundant in Australia, and found in many parts of Western Australia except the sandy deserts and dry arid interior. Johnstone and Storr (1998) described them as resident, breeding visitors and postnuptial nomads. They are generally migratory, moving south in late September and early October, having wintered from the Gascoyne to Indonesia.

Rainbow Bee-eaters are regularly seen across most of the wetter areas of Western Australia including around the project area. Given their abundance and wide spread distribution, ground disturbance activities on a localised scale are unlikely to significantly impact on Rainbow Bee-eaters.

**Great Egret (*Ardea alba*)** - Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

Hérons and egrets all depend to some extent upon surface water for hunting. The Great Egret is the largest of the Australian egrets, and is an elegant, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mudflats. Its diet consists of a range of small, aquatic invertebrates and small vertebrates (Firth 1976).

Given the dependence of the Great Egret upon wetlands and waterways, it is unlikely to be seen in the project area.

**Cattle Egret (*Ardea ibis*)** - Migratory under the *EPBC Act 1999* and Schedule 3 under the *Wildlife Conservation Act 1950*

The smallest of the Australian egrets, this species has undertaken an invasion of Australia from the north, where it was originally more common in the Indonesian archipelago than Australia (Simpson and Day 2004). This invasion may have been assisted by the opening up of farming land and irrigation schemes, providing the pasturelands and shallow wetlands in which it prefers to forage. Johnstone and Storr (1998) noted the species distribution in Western Australia as being confined to the irrigation areas surrounding Kununurra, however, its migratory nature and current invasive tendencies suggest that it may occur elsewhere in the state, and may still be expanding its distribution.

Given the dependence of the Cattle Egret upon wetlands, waterways and pastures, it is unlikely to be seen in the project area.



**Osprey (*Pandion haliaetus*)** – Migratory under the EPBC Act 1999 and Schedule 3 under the *Wildlife Conservation Act 1950*

The Osprey is a large raptor that is mostly found in coastal areas, off-shore islands and the lower sections of rivers. It mainly feeds on fish and large lizards.

This species is unlikely to be recorded in the project area due to a lack of suitable habitat.

**Brush-tailed Phascogale (*Phascogale tapoatafa*)** – Schedule 1 under the *Wildlife Conservation Act 1950*

The Brush-tailed Phascogale is a small arboreal dasyurid that forages in mature tree, large logs and dead standing trees. They are highly mobile and agile enabling rapid movement to escape predators or catch prey in trees.

This species was formerly widespread in dry open sclerophyll forests and woodland with sparse ground cover. It was recorded in both the Western Australian Museum and NatureMap records in the vicinity of the project area, but these could be duplicate records. The habitat in the project area would be suitable for Brush-tailed Phascogales, but their possible presence could only be determined by a trapping survey.

**Carpet Python (*Morelia spilota imbricata*)** – Schedule 4 under the *Wildlife Conservation Act 1950*

This species is a large python found across the south west of Western Australia, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. Carpet Pythons inhabit forest, heath, or wetland areas and shelter in the hollows of large trees. This species is widespread within some sections of the southwest, mostly in coastal areas, but is not in high density across its distribution. There are no recent records of this species in the vicinity of the project area.

The Carpet Python was not seen during the site visit and it is Terrestrial Ecosystems' opinion that there is a low possibility of Carpet Pythons being present in the project area.

**Peregrine Falcon (*Falco peregrinus*)** - Schedule 4 under the *WA Wildlife Conservation Act 1950*

Johnstone and Storr (1998) reported the Peregrine Falcon as being widespread including on some off-shore islands, but was absent from most deserts. They went on to suggest it was mainly seen about cliffs along coasts, rivers and ranges and wooded watercourses and lakes, but Terrestrial Ecosystems has seen them in a variety of other habitats. There is a record of a Peregrine Falcon in the Atlas of Living Australia for the general area, but the date and location of this record is unknown.

Ground disturbance activities on a localised scale are unlikely to significantly impact on the Peregrine Falcon.

**Coastal Plains Skink (*Ctenotus ora*)** - - Priority 3 with DPaW

The Coastal Plains Skink is found in open eucalypt woodland over *Banksia attenuata* and *B. grandis* on white sands (Kay and Keogh 2012), however, another specimen was found in marri over heath in sandy soils. Its distribution is restricted to the southwest of Western Australia coastal plain west of the Darling Scarp. The distribution map provided by Kay and Keogh (2012) would suggest the project area is too far to the east of the known distribution of *C. ora*; however due to a lack of records in the vicinity of the project area and it being a newly described species, it could be recorded in the project area.

**Barking Owl (*Ninox connivens*)** – Priority 2 with DPaW

The Barking Owl is a large owl found in the Kimberley, Pilbara and southwest. In the southwest its distribution extends from Northam to the coast, east as far as Katanning and Bremer Bay (Johnstone and Storr 1998). It is mostly found in dry sclerophyll woodland near water course, wetlands or forest edges (Garnett et al. 2011).

Although common in the Kimberley is relatively rare in the southwest. It has not been recorded in other surveys in the area or listed in the databases searched; however the habitat is typical of descriptions for this species. It is therefore Terrestrial Ecosystems assessment that the Barking Owl may be present in the project area but this could not be determined without a survey.

**Black Bittern (*Ixobrychus flavicollis*)** – Priority 3 with DPaW

The Black Bittern has populations in the Kimberley, Pilbara and the south-west of WA. It is found on freshwater pools, swamps and lagoons in areas normally well screen with trees or vegetation.

This species is unlikely to be recorded in the project area due to a lack of suitable habitat.

**Bush Stone-curlew (*Burhinus grallarius*)** – Priority 4 with DPaW

The Bush Stone-curlew is a mostly ground-dwelling cryptic species that is found in the Kimberley and the western part of central and southern Western Australia. It has a preference for lightly wooded areas often sheltering during the day in or near thickets. This bird will remain stationary to avoid detect, will ultimately fly from the area before it is impacted by vegetation clearing. It is unlikely to be in the project area, as it has not been recorded in any of the other surveys or databases for this area is regularly predated by foxes and cats.

**Little Bitten (*Ixobrychus minutus*)** – Priority 4 with DPaW

The Little Bitten is widespread in Australia with a stable population of 5,000 mature individuals found mostly in the south-east and south-west of Australia (Garnett et al. 2011). It has a preference for dense beds of *Baumea*, *Typha* and other tall rushes in freshwater swamps, lakes and rivers (Johnstone and Storr 1998).

This species is unlikely to be recorded in the project area due to a lack of suitable habitat.

**Crested Shrike-tit (*Falcunculus frontatus leucogaster*)** – Priority 4 with DPaW

The Crested Shrike-tit has a preference for woodlands, scrubs and open Eucalypt forests, particularly, wandoo, flat-topped yate, karri, tingle, flooded gum, salmon gum and gimlet. The project area is on the western edge of its known distribution (Johnstone and Storr 2004), so there is a low possibility it could be seen in the project area, but it will move once vegetation clearing commences so any impacts are likely to be low.

**Graceful Sun-moth (*Synemon gratiosa*)** – Priority 4 with DPaW

This species has brightly coloured orange hind-wings, and is similar in appearance to a butterfly. The breeding season is late February to early April, during which time adults are active during the day and they are thought to breed exclusively on *Lomandra* species, in particular *L. hermaphrodita* and *L. maritima*. Graceful Sun-moths occur along the Swan Coastal Plain between Moore River and Preston Beach and the species is under threat due to vegetation clearing and damage to the environment.

No survey was undertaken for the Graceful Sun-moth in the project area, but since they have been delisted from the EPBC list, these surveys are no longer required.

**Western Brush Wallaby (*Macropus irma*)** – Priority 4 with DPaW

This species was very common in the early days of settlement, however, its range has been seriously reduced and fragmented due to clearing for agriculture and there is a significant decline in abundance within most remaining habitat. It is now distributed across the south-west of WA from north of Kalbarri to Cape Arid. The optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets.

It was not seen during the site visit and Terrestrial Ecosystems' view is that it is not present in the project area.

**Water Rat (*Hydromys chrysogaster*)** – Priority 4 with DPaW

The water rat is found mainly near permanent bodies of freshwater, occasionally at temporary waterholes. It is also found in the streams, wetland, lakes and estuaries in the southwest of WA.

As there is no wetland supporting permanent or near permanent water in the project area, it is Terrestrial Ecosystems' view that the Water Rat it is not present in the project area.

**Hooded Plover (*Charadrius rubricollis*)** – Priority 4 with DPaW

This species frequents the margins and shallows of salt lakes, also along coastal beaches, where it forages for invertebrates along the water's edge. There is a record of the Hooded Plover in the vicinity of the project area in Atlas of Living Australia.

It is Terrestrial Ecosystems' view that given the lack of suitable habitat it is unlikely to be seen in the project area.

**Western False Pipistrelle (*Falsistrellus mackenziei*)** – Priority 4 with DPaW

This insectivorous species is the largest vespertilinoid in WA and is confined to southwest WA, south of Perth and east to the wheatbelt. It is known to utilise the mature Karri forests but has also been recorded in Jarrah and Tuart woodland on the Swan Coastal Plain. There was no record of this bat being recorded during other surveys at the Waroona mineral sands project or in the other databases, so it is Terrestrial Ecosystems' view it is unlikely to be in the project area.

**Quenda or Southern Brown Bandicoot (*Isoodon obesulus fusciventer*)** – Priority 5 with DPaW

Quenda prefer dense scrub (up to one metre high), with swampy vegetation but are found in a variety of other habitats. They will often feed in adjacent forest and woodland that is open grassland, pasture and crop land lying close to dense cover.

There were diggings similar to those of Southern Brown Bandicoots in the project area, but we found none where it was obvious that a pointed nose had created cone shape depression in the leaf litter or surface soils. The open understorey and presence of foxes in the project area would ensure numbers are maintained at a low level if they were present.

#### **4.4 Risk assessment**

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity in a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. The risk assessment is provisional as the proposed development has not been finalised and as such, a precautionary approach has been taken when conducting the risk assessment. Tables 7, 8 and 9 provide a summary of the risk assessment associated with this project.

The assessment contained in Table 9 is supported by more detailed discussion in sections above and the management recommendations below.

**Table 7: Fauna impact risk assessment descriptors**

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. These criteria do not fit all circumstances (e.g. adequacy of fauna survey data); however, they are useful in providing the reader with an appreciation of the level of likelihood and consequences of an event. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the events or impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 9.

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur or one or more conservation significant species may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur or one or more conservation significant species could be present at sometime.
C	Moderate	The environmental event should occur or one or more conservation significant species should be present at sometime.
D	Likely	The environmental event will probably occur or one or more conservation significant species will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur or one or more conservation significant species is expected to be present in most circumstances.
Consequences		
Level	Description	Criteria
1	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.
2	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
3	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of conservation significance in the project area.
4	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as ‘vulnerable’ or ‘endangered’ under the <i>EPBC Act (1999)</i> at a regional scale.
Acceptability of Risk		
Level of risk	Management of risk	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. Will require a referral to the Commonwealth under the <i>EPBC Act 1999</i> .	
Extreme	Unacceptable, project should be redesigned or not proceed.	

**Table 8. Levels of acceptable risk**

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequences	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

**Table 9. Risk assessment**

		Before Management			With Management			
Factor	Potential Impact	Inherent Risk			Risk Controls / Management	Residual Risk		
		Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Inadequate fauna survey data.	Unknown loss of fauna, fauna of conservation significance, fauna assemblage(s) in development site.	C	2	Low				
Inadequate knowledge of potential impacts.	Unknown or poorly assessed impact(s) on fauna assemblage and conservation significant species.	A	2	Low				
Inadequate bioregional data for contextual purposes.	Incomplete analysis of data and appreciation of impacts on biodiversity values in a regional context.	C	2	Low				
Removal of habitat – site scale.	Almost complete loss of terrestrial fauna in cleared areas, severe impact on local fauna assemblage.	E	2	Moderate				
Significant reduction of habitats – local scale.	Loss of fauna and fauna habitat and impacts on local fauna assemblage (excluding conservation significant species).	A	2	Low				
Significant reduction of habitats – landscape scale.	Loss of fauna and fauna habitat and impacts on fauna in a landscape context (excluding conservation significant species).	A	1	Low				
Significant reduction of habitats – regional scale.	Loss of fauna and fauna habitat and impacts on fauna in a bioregional context (excluding conservation significant species).	A	1	Low				

		Before Management			With Management		
Factor	Potential Impact	Inherent Risk			Residual Risk		
		Likelihood	Consequence	Significance			
Impact on resident or visiting conservation significant terrestrial species.	Loss of a localised population or a few individuals – <i>Calyptorhynchus banksii naso</i> .	A	3	Low			
	Loss of a localised population or a few individuals – <i>Calyptorhynchus latirostris</i> .	C	3	Moderate			
	Loss of a localised population or a few individuals – <i>Calyptorhynchus baudinii</i> .	B	3	Low			
	Loss of a localised population or a few individuals – <i>Calyptorhynchus banksii</i> .	C	3	Moderate			
	Loss of a localised population or a few individuals – <i>Phascogale tapoatafa</i> .	C	3	Moderate			
	Loss of a localised population or a few individuals – <i>Synemon gratiosa</i> .	B	2	Low			
	Loss of a localised population or a few individuals – <i>Dasyurus geoffroii</i> .	B	3	Moderate			
	Loss of a localised population or a few individuals – <i>Morelia spilota imbricata</i> .	B	2	Low			
	Loss of a localised population or a few individuals – <i>Ctenotus ora</i> .	C	2	Low			
	Loss of a localised population or a few individuals – <i>Ninox connivens</i> .	A	2	Low			
	Loss of a localised population or a few individuals – <i>Falcunculus frontatus</i> .	A	2				
	Loss of a localised population or a few individuals – <i>Haliaeetus leucogaster</i> .	A	3	Low			
	Loss of a localised population or a few individuals – <i>Isodon obesulus</i> .	B	2	Low			

		Before Management			With Management			
Factor	Potential Impact	Inherent Risk			Risk Controls / Management	Residual Risk		
		Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
	Loss of a localised population or a few individuals – <i>Merops ornatus</i> .	B	2	Low				



## 5 DISCUSSION

### 5.1 Adequacy of available vertebrate fauna data

The EPA *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3* (EPA 2002), *Guidance Statement for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56* (EPA 2004) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA / DEC 2010) are the three relevant documents to assess the adequacy of the available information and reporting for vertebrate fauna surveys in Western Australia.

Other than two surveys for the Waroona minerals sands project area, little is known of the vertebrate fauna in the project area or similar habitat in the region. Searches of DPaW's, Atlas of Living Australia and the Western Australian Museum databases pick up historical records, often dating back before the area was cleared for agriculture. Survey data for the minerals sands project includes numerous water and shore birds that have been attracted to the large ponds in this area.

There is generally a paucity of information about the fauna assemblages south of the Perth metropolitan to Bunbury.

### 5.2 Biodiversity values of the site

#### 5.2.1 Condition of fauna habitat and extent of habitat degradation

There is a large cleared section of native vegetation (Figure 2) that was previously been used for sand extraction on the eastern side and another disused mining area in the south-west corner that abuts the regrown vegetation in the power line corridor. Most of the remaining area is a woodland of jarrah (*E. marginata*), marri (*C. calophylla*), sheoak (*A. fraseriana*) and *Banksia* sp. over sparsely vegetated shrubs, grasses and herbs on grey sands. There is a line of scattered jarrah and marri trees along the eastern boundary with little understorey that provide limited foraging opportunities for black-cockatoos. There is a small section west of the central point that is dense shrubs on white sands that extends to the track that runs north-south through the project area.

The jarrah, marri, sheoak and *Banksia* woodland is generally in good condition. There are some tracks though the area and evidence of pigs foraging in the leaf litter in other areas.

#### 5.2.2 Ecological linkages

Currently, the project area is on the eastern edge of a large remnant of native vegetation but is separated by regrown vegetation in the power line corridor. There is a wetland in the native vegetation to the west of the project area that is mostly sparsely vegetated. The western boundary of the project area is the regrown vegetation along the power line corridor.

The eastern side of the project area is pasture used to graze cattle. To the north there are fragmented patches of native vegetation that joins a wetland, beyond which it is pasture.

#### 5.2.3 Size and scale of the proposed disturbance and potential impacts

The project area is approximately one fifth of the remnant patch of native vegetation. Its loss is probably not significant, but should a proportion of the remaining vegetation be subsequently cleared, then this would result in the loss of a significant patch of native vegetation between the South Western and Forrest Highways in the vicinity of Waroona.

#### 5.2.4 Conservation significant species

The three species of black-cockatoo are likely to forage in the project area, but their survival is unlikely to depend on this area. There were multiple tree hollows that could provide a nest site for either Carnaby's or Forest Retailed Black-Cockatoos, but no evidence of nesting (e.g. chewed bark around hollow entrances)



was seen during the site visit. Brush-tailed Phascogales, Chuditch, Coastal Plains Skinks and Carpet Pythons could be in the project area, but this could only be determined by a trapping survey. The Rainbow Bee-eater may occasionally forage and breed in the sand in the project area, and Fork-tailed Swifts, White-bellied Sea-eagles, Osprey and Peregrine Falcons may infrequently be seen in the skies above the project area, but none would be dependent on this area for their survival.

It is possible there is a small population of Southern Brown Bandicoots in the area, but they would be in a continual struggle to survive given the present of foxes and the openness of the understorey vegetation.

### 5.3 Potential environmental impacts

Clearing of vegetation will potentially affect vertebrate fauna in a number of ways, including:

- death/injury of fauna during vegetation clearing and development;
- loss of habitat; and
- fragmentation of fauna habitat.

Besides the initial mortality of fauna during vegetation clearing and earthworks, there will also be an ongoing indirect impact, largely consisting of the loss and degradation of habitat resources, feeding areas and shelter sites for mobile species.

#### 5.3.1 Impacts on the fauna assemblage and fauna habitat

Level 1 fauna assessments are, in essence, an assessment of the risks associated with the proposed disturbance on the fauna either known or potentially in the area. Table 10 is a summary of that risk assessment for clearing vegetation and developing the project area.

**Table 10. A summary of the assessed risk of impact on the fauna and fauna habitat at the project area**

Issues	Assessment				
	No		Yes		
Formal conservation status for the area:	X				
Specifically for fauna					
Level of alteration to the original faunal habitat	Very High			Very Low	
	1	2	3	4	5
surface soil			X		
vegetation			X		
by salinity					X
by non-farmed exotic species					X
by farmed species				X	
level of habitat fragmentation				X	
Knowledge of:	Very High			Very Low	
	1	2	3	4	5
species in each project area			X		
assemblage structure in the project area			X		
presence of rare and protected species			X		
presence of range restricted species					X
presence of short range endemic invertebrates					?
presence of stygofauna					?
ecosystem values		X			
regional species and regional assemblages				X	
regional ecosystems				X	
Capacity to assess biodiversity values in the project area:	Very High			Very Low	
	1	2	3	4	5
species level	X				
ecosystem levels	X				
ecological functional values	X				
regional significance of faunal assemblage			X		
Consequences of the proposed disturbance in the context of the:	Very High			Very Low	
	1	2	3	4	5



Issues	Assessment			
level of existing disturbance			X	
size of area to be disturbed			X	
scale of the disturbance		X		
significance of fauna habitat in a regional context			X	
extent to which the area is a refuge for fauna			X	
extent to which the disturbance will impact on rare or protected fauna				X
extent to which the fauna habitat is an ecologically important remnant			X	
extent to which the habitat is part of an ecological linkage(s) or corridor(s)		X		
heterogeneity of habitat				X
abundance of the habitat in the bioregion			X	

### 5.3.2 Impacts on Black-Cockatoos

It is likely that Carnaby's and Baudin's forage on *Banksia* sp. cones and marri nuts and Forest Red-tailed Black-Cockatoos would forage in the marri, jarrah and sheoak nuts in the project area.

Table 11 provides a summary of the assessed potential impact on Black-Cockatoos associated with the action of clearing the vegetation based on the criteria set out in the Department of Sustainability, Environment, Water, Population and Communities (2012) referral guidelines for Black-Cockatoos. This is followed by a more detailed assessment to support this summary table. Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2011) do not define what is quality foraging habitat for Black-Cockatoos, so the criteria of clearing or degrading more than 1ha of *quality foraging habitat* is difficult to assess.

**Table 11. Summary assessment of whether an action will have a significant impact on the two species of Black-Cockatoos**

High risk of significant impacts: referral recommended	Carnaby's Black-Cockatoo	Baudin's Black-Cockatoo	Forest Red-tailed Black-Cockatoo
Clearing of any known nesting tree.	No nesting trees were recorded on the project area.	No nesting trees were recorded on the project area.	No nesting trees were recorded on the project area.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat.	The project is inside the DPaW mapped potential breeding habitat.	The project is outside the DPaW mapped potential breeding habitat.	Is within the vicinity of known breeding locations.
Clearing of more than 1ha of quality foraging habitat.	Clearing the remainder of the project area will remove more than 1ha of foraging habitat.	Clearing the remainder of the project area will remove more than 1ha of foraging habitat.	Clearing the remainder of the project area will remove more than 1ha of foraging habitat.
Clearing or degradation (including pruning the top canopy) of a known night roosting site.	Finn et al. (2014) recorded roosting sites for red-tail and white-tailed black-cockatoo near Waroona, but they appear east of the project area on the small scaled map provided.	Finn et al. (2014) recorded roosting sites for red-tail and white-tailed black-cockatoo near Waroona, but they appear east of the project area on the small scaled map provided.	Finn et al. (2014) recorded roosting sites for red-tail and white-tailed black-cockatoo near Waroona, but they appear east of the project area on the small scaled map provided.
Creating a gap of greater than 4 km between patches of black cockatoo habitat (Breeding, foraging or roosting).	Clearing will not create a gap of greater than 4km between patches of Black-Cockatoo	Clearing will not create a gap of greater than 4km between patches of Black-Cockatoo	Clearing will not create a gap of greater than 4km between patches of Black-Cockatoo



	habitat.	habitat.	habitat.
Uncertainty: referral recommended or contact the department			
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	Clearing will impact on more than 1ha of foraging habitat.	Clearing will impact on more than 1ha of foraging habitat.	Clearing will impact on more than 1ha of foraging habitat.
Clearing or disturbance in areas surrounding black-cockatoo breeding, foraging or night roosting habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological changes, increased human visitation or fire.	Based on the recent Great Cocky count (Finn et al. 2014), there are roost sites to the east of the project area. The exact locations of these roosts are not shown so the distance from the project area cannot be determined from the report, but is approximately 8km away.	Based on the recent Great Cocky count (Finn et al. 2014), there are roost sites to the east of the project area. The exact locations of these roosts are not shown so the distance from the project area cannot be determined from the report, but is approximately 8km away.	Based on the recent Great Cocky count (Finn et al. 2014), there are roost sites to the east of the project area. The exact locations of these roosts are not shown so the distance from the project area cannot be determined from the report, but is approximately 8km away.
Actions that do not directly affect the listed species but that have a potential for indirect impacts such as increasing competitors for nest hollows.	The project area contains trees with hollows that are currently used by species that could be in direct competition for these hollows with Black-Cockatoos should they decide to nest in this area (e.g. Brushtail Possums and bees).	The project area contains trees with hollows that are currently used by species that could be in direct competition for these hollows with Black-Cockatoos should they decide to nest in this area (e.g. Brushtail Possums and bees).	The project area contains three trees with hollows that are currently used by species that could be in direct competition for these hollows with Black-Cockatoos should they decide to nest in this area (e.g. Brushtail Possums and bees).
Actions with the potential to introduce known plant disease such as <i>Phytophthora</i> spp. To an area where the pathogen was not previously known.	<i>Phytophthora</i> is already present in the project area. Appropriate hygiene standards will be required to stop the movement of this disease across the site and to other sites.	<i>Phytophthora</i> is already present in the project area. Appropriate hygiene standards will be required to stop the movement of this disease across the site and to other sites.	<i>Phytophthora</i> is already present in the project area. Appropriate hygiene standards will be required to stop the movement of this disease across the site and to other sites.
Low risk of significant impacts: referral may not be required.			
Actions that do not affect black-cockatoo habitat or individuals.			
Actions whose impacts occur outside the modelled distribution of the three black-cockatoos.			



*Clearing of any known nesting tree (high risk)*

Forest Red-tailed Black-Cockatoos are known to nest in farm land, rural residential, rural remnants and eucalypt woodlands and could nest in or near the project area. The project area is inside the known potential area of nesting sites for Carnaby's Black-Cockatoo as shown on the DPaW maps. These 22km circles representing breeding sites on the DPaW maps probably relate to the Carnaby's nesting site around the Forrest Highway and inland from Preston Beach.

*Clearing of any part or degradation of breeding habitat (high risk)*

Breeding habitat for Carnaby's Black-Cockatoo is defined as woodland or forest, but also breeds in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of *E. salmonophloia*, *E. wandoo*, *E. gomphocephala*, *E. marginata*, *E. rudis*, *E. loxophleba*, *E. accedens*, *C. calophylla* and *E. diversicolor*. Baudin's Black-Cockatoo generally breed in woodlands and forest, and nests are in *E. salmonophloia*, *E. wandoo*, *E. gomphocephala*, *E. marginata*, *E. rudis*, *E. loxophleba*, *E. accedens*, *C. calophylla* and *E. diversicolor*. Forest Red-tailed Cockatoos nests are found in hollows in live or dead trees of *C. calophylla*, *E. diversicolor*, *E. wandoo*, *E. megacarpa*, *E. patens*, *E. gomphocephala* and *E. marginata* (Department of Sustainability Environment Water Population and Communities 2012; p.15). It is Terrestrial Ecosystems assessment that Baudin's Black-Cockatoo is unlikely to nest in the project area, as there are no other nesting locations for this species nearby, however, although no nests were recorded, suitable hollows may be available in some trees for Carnaby's and Forest Red-tail Black-Cockatoos.

*Clearing of more than 1ha of quality foraging habitat (high risk)*

The definition of what is 'quality habitat' is unknown, but the trees in the project area are on the Commonwealth Governments list of foraging species for Carnaby's, Baudin's and the Forest Red-tailed Black-Cockatoo. It is proposed that in excess of 1ha of vegetation recorded as foraging habitat will be cleared.

*Clearing or degradation including pruning the top canopy of a known roosting site (high risk)*

There is no evidence to indicate that white or red-tailed black-cockatoos roost in the project area, however, nocturnal surveys were not included in the site assessment. Forest Red-tailed Black-Cockatoos regularly shift their roosting sites, and could periodically roost in the project area for a short period. The recently released 2014 Great Cocky count (Finn et al. 2014) indicates roosting sites for both white and red-tail black-cockatoo to the east of the project in the vicinity of Waroona.

*Degradation (such as through altered hydrology or fire regimes) of more than 1ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat (uncertainty)*

It is proposed that in excess of 1ha of black-cockatoo foraging habitat will be cleared.

*Clearing or disturbance in areas surrounding black cockatoo habitat that has the potential to degrade habitat through the introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire (uncertainty)*

The area to be cleared will initially be used as a sand extraction pit. This development will increase human visitation to the area.

*Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows (uncertainty)*

There was no other obvious indirect impact that clearing the vegetation might have on black-cockatoos.



Action with the potential to introduce know plant diseases such as *Phytophthora* spp. (uncertainty)

Clearing of the vegetation is only likely to spread diseases such as *Phytophthora* spp., if appropriate standards of hygiene are not maintained in the equipment used to clear the vegetation. This aspect is able to be effectively managed and controlled by the developer. However, unless effective hygiene measures are put in place the movement of trucks shifting sand from the site could increase the spread of *Phytophthora* spp.

## 5.4 Native vegetation clearing principles

The *Environmental Protection Act (1986)* provides criteria to judge the potential impact of a development on clearing native vegetation. These criteria have been listed in Table 13 with a response to indicate how clearing of the vegetation in the project area might be judged against these principles.

**Table 14. Assessment of impact on fauna using the Native Vegetation Clearing Principles**

<b>Principle</b>	<b>Response</b>
It comprises a high level of biological diversity.	Clearing vegetation will not compromise a high level of biodiversity.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Clearing the vegetation will not result in the loss of significant habitat necessary for the maintenance of fauna indigenous to Western Australia.
It includes, or is necessary for the continued existence or, rare flora.	Not applicable.
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community, but could support a number of conservation significant species.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The project forms part of a remnant plot of native vegetation situated in surrounding pasture.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area is not a wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	Not applicable.
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing of the project area will reduce the overall size of the remnant vegetation.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Not applicable.
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	Not applicable.



## 6 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

It is the owner's intention to clear the vegetation in the project area to expand the area for sand mining.

The project area supports a *E. marginata*, *C. calophylla*, *A. fraseriana* and *Banksia* sp. woodland over sparsely vegetated shrubs over grasses and herbs on grey sands. There is a large cleared section of native vegetation that was previously used for sand extraction on the eastern side and another disused mining area in the south-west corner that abuts the regrown vegetation in the power line corridor. There is a small section west of the central point that is dense shrubs on white sands that extends to the track that runs north-south through the project area.

The impact of clearing the 20ha of potential black-cockatoo foraging habitat and nesting sites has been assessed against the criteria listed in the Commonwealth Government referral guidelines for black cockatoos, and such an action would trigger at least one of the criterion for a referral to the Commonwealth Government under the EPBC Act (1999).

Brush-tailed Phascogale were reported as present in the vicinity of the project area, but were not caught during fauna surveys at the sand mine. The size of the remnant patch of vegetation is large enough to sustain a population of Brush-tailed Phascogale and some of the habitat is suitable. There is a low possibility the project area supports Chuditch, Coastal Plains Skinks or Carpet Pythons and their possible presence can only be determined by a trapping program. Other conservation significant species such as the Rainbow Bee-eater, Peregrine Falcon and White-bellied Sea-Eagles that may infrequently be seen in the project area will move into adjacent areas once clearing commences and will not be significantly impacted.

Clearing the vegetation will result in the loss of numerous small vertebrates. The project area supports Brush-tailed Possums, which should be addressed in the fauna management plan for the area.

### 6.1 Recommendations

It is recommended that:

- the proposed action is referred to the Commonwealth Government under the EPBC Act; and
- a vertebrate fauna management plan is prepared and implemented prior to and during the vegetation clearing program to protect and mitigate impacts on vertebrate fauna.



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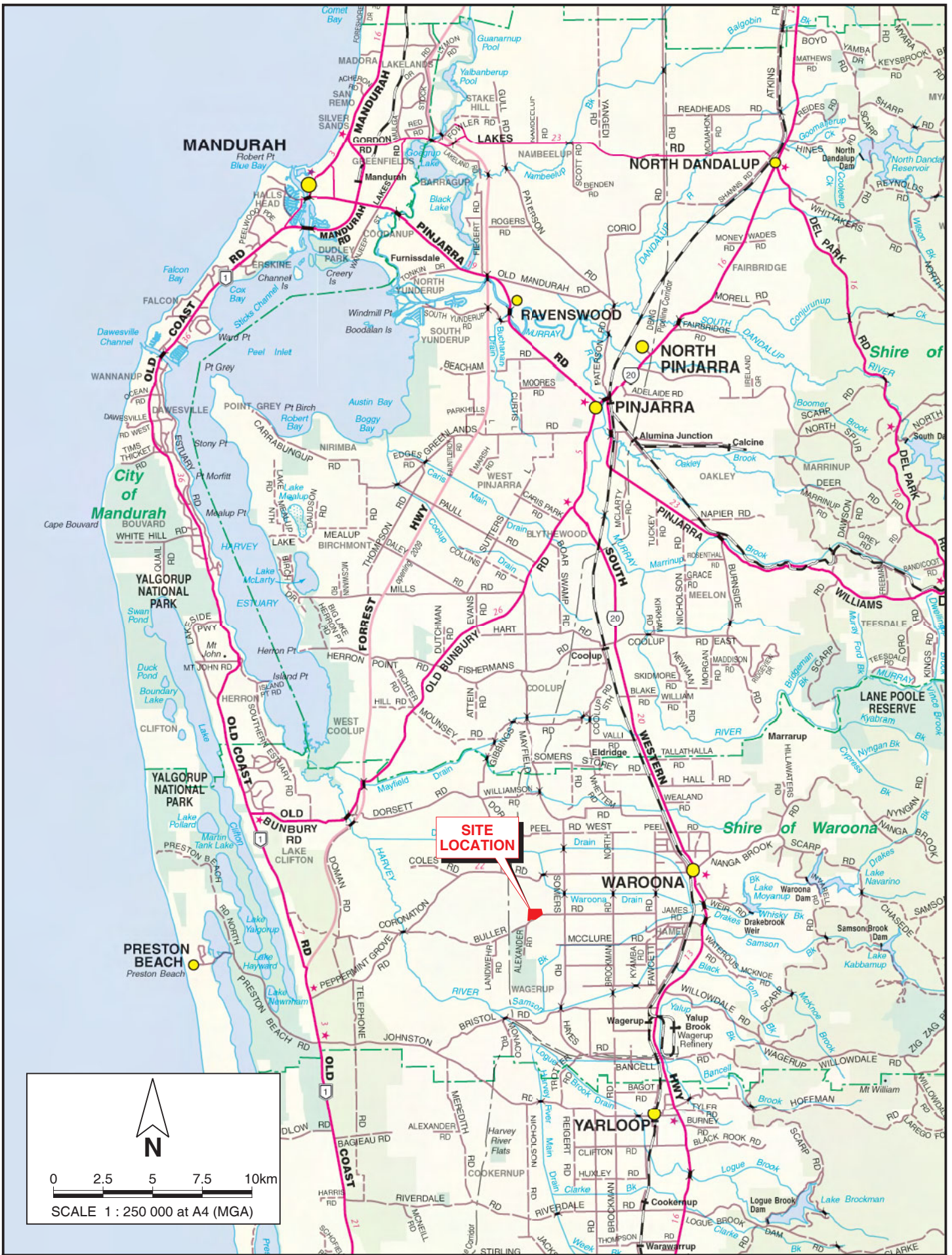


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**TERRESTRIAL ECOSYSTEMS**

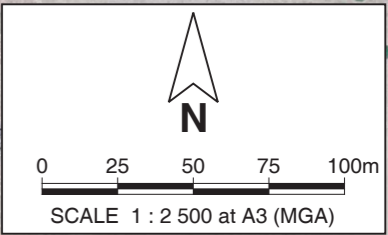
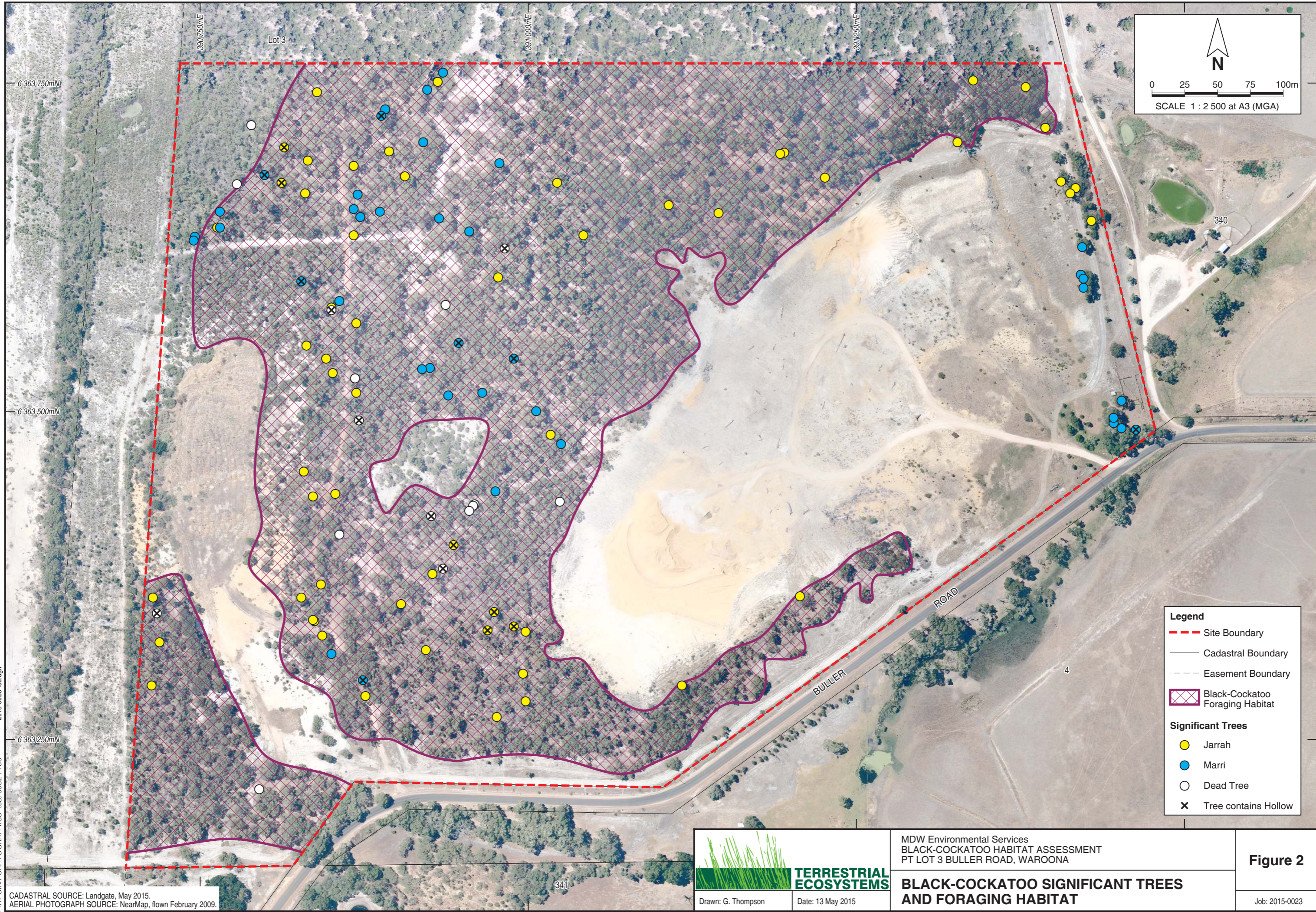
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MDW Environmental Services  
 BLACK-COCKATOO HABITAT ASSESSMENT  
 PT LOT 3 BULLER ROAD, WAROONA

**SITE LOCATION**

**Figure 1**

Job: 2015-0023



**Legend**

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Black-Cockatoo Foraging Habitat

**Significant Trees**

- Jarrah
- Marri
- Dead Tree
- ✕ Tree contains Hollow

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CADASTRAL SOURCE: Landgate, May 2015.  
AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2009.

**TERRESTRIAL ECOSYSTEMS**  
Drawn: G. Thompson      Date: 13 May 2015

MDW Environmental Services  
BLACK-COCKATOO HABITAT ASSESSMENT  
PT LOT 3 BULLER ROAD, WAROONA

**BLACK-COCKATOO SIGNIFICANT TREES  
AND FORAGING HABITAT**

**Figure 2**  
Job: 2015-0023

Appendix A  
Search Results from the *EPBC Act* (1999)  
On-line Database  
Vertebrate Fauna Assessment – Lot 3 Buller Road, Waroona





# EPBC Act Protected Matters Report

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

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

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

Report created: 09/05/15 15:40:33

[Summary](#)

[Details](#)

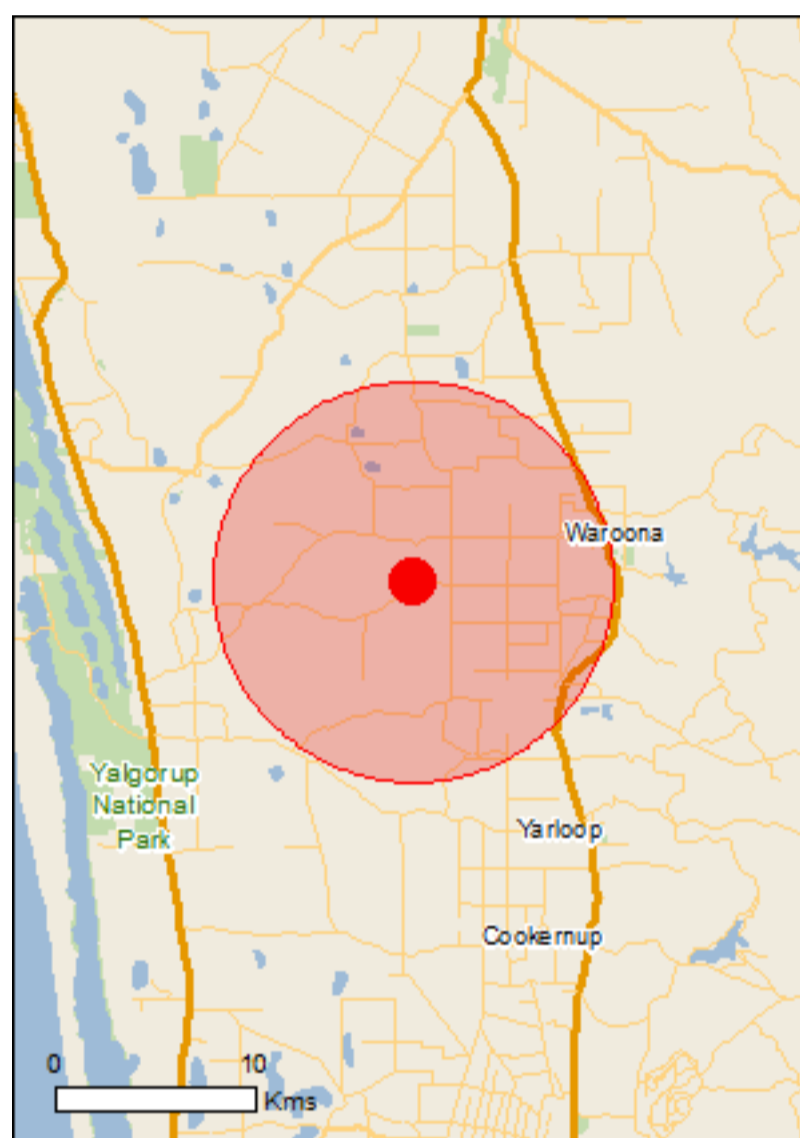
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

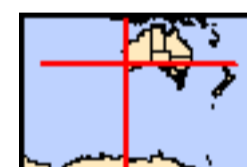
[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 10.0Km



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	1
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	2
<a href="#">Listed Threatened Species:</a>	22
<a href="#">Listed Migratory Species:</a>	7

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	8
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	1
<a href="#">Invasive Species:</a>	23
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

### Wetlands of International Importance (Ramsar)

[\[ Resource Information \]](#)

Name	Proximity
<a href="#">Peel-yalgorup system</a>	Within 10km of Ramsar

### Listed Threatened Ecological Communities

[\[ Resource Information \]](#)

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

Name	Status	Type of Presence
<a href="#">Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain</a>	Endangered	Community known to occur within area
<a href="#">Claypans of the Swan Coastal Plain</a>	Critically Endangered	Community likely to occur within area

### Listed Threatened Species

[\[ Resource Information \]](#)

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
<a href="#">Calyptorhynchus baudinii</a> Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroi</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Setonix brachyurus</a> Quokka [229]	Vulnerable	Species or species habitat may occur within area

### Plants



Name	Status	Type of Presence
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
<a href="#">Centrolepis caespitosa</a> [6393]	Endangered	Species or species habitat likely to occur within area
<a href="#">Darwinia foetida</a> Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
<a href="#">Drakaea elastica</a> Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Eucalyptus balanites</a> Cadda Road Mallee, Cadda Mallee [24264]	Endangered	Species or species habitat may occur within area
<a href="#">Lambertia echinata subsp. occidentalis</a> Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
<a href="#">Synaphea sp. Fairbridge Farm (D.Papenfus 696)</a> Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Synaphea stenoloba</a> Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area

### Listed Migratory Species [\[ Resource Information \]](#)

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

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area

### Migratory Wetlands Species

Name	Threatened	Type of Presence
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Pandion cristatus</a> Eastern Osprey [82411]		Species or species habitat likely to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

### Commonwealth Land [\[ Resource Information \]](#)

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

Name
Commonwealth Land -

### Listed Marine Species [\[ Resource Information \]](#)

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

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area

## Extra Information

### State and Territory Reserves [\[ Resource Information \]](#)

Name	State
Buller	WA

### Regional Forest Agreements [\[ Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
<a href="#">South West WA RFA</a>	Western Australia

### Invasive Species [\[ Resource Information \]](#)

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

Name	Status	Type of Presence
------	--------	------------------

<b>Birds</b>		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area

Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
--	--	--

Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
--	--	--

Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
--	--	--

Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
---	--	--

Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
--	--	--

### Mammals

Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
--	--	--

Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
---	--	--

Mus musculus House Mouse [120]		Species or species
-----------------------------------	--	--------------------

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		habitat likely to occur within area  Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

## Plants

Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

# Caveat

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

# Coordinates

-32.8603 115.8356

# Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix B  
Fauna Surveys in the Vicinity of the  
Project Area  
Vertebrate Fauna Assessment – Lot 3 Buller Road, Waroona



**Appendix B. Fauna survey data in the vicinity of the project area**

		Surveys	A	B	C	D	E
Family	Species	Common Name			Waroona Mineral Sands	Waroona Mineral Sands	
<b>Birds</b>							
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu					X
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite	5		X		X
	<i>Lophoictinia isura</i>	Square-tailed Kite	5				
	<i>Haliastur sphenurus</i>	Whistling Kite	5				X
	<i>Accipiter fasciatus</i>	Brown Goshawk	5			X	
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	10				X
	<i>Aquila audax</i>	Wedge-tailed Eagle				X	
	<i>Ardea modesta</i>	Great Egret					X
	<i>Ardea pacifica</i>	White-necked Herron					X
	<i>Circus approximans</i>	Swamp Harrier					X
	<i>Hieraaetus morphnoides</i>	Little Eagle					X
Anatidae	<i>Biziura lobata</i>	Musk Duck	5				X
	<i>Stictonetta naevosa</i>	Freckled Duck	1				
	<i>Tadorna tadornoides</i>	Australian Shelduck			X	X	X
	<i>Chenonetta jubata</i>	Australian Wood Duck			X	X	X
	<i>Cygnus atratus</i>	Black Swan					X
	<i>Anas gracilis</i>	Grey Teal				X	X
	<i>Anas rhynchotis</i>	Australasian Shoveler					X
	<i>Anas castanea</i>	Chestnut Teal			X		
	<i>Anas superciliosa</i>	Pacific Black Duck			X	X	X
	<i>Anhinga novaehollandiae</i>	Australian Darter					X
	<i>Aythya australis</i>	Hardhead					X



Family	Species	Common Name	Surveys				
			A	B	C	D	E
					Waroona Mineral Sands	Waroona Mineral Sands	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	10				
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	1				X
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe					X
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover					X
	<i>Elseynornis melanops</i>	Black-fronted Dotterel	5				X
	<i>Pluvialis squatarola</i>	Grey Plover					X
	<i>Thinornis rubricollis</i>	Hooded Plover					X
	<i>Vanellus tricolor</i>	Banded Lapwing					X
Recurvirostridae	<i>Cladorhynchus leucocephalus</i>	Banded Stilt	10				X
	<i>Himantopus himantopus</i>	Black-winged Stilt					X
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet					X
Scolopacidae	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper					X
	<i>Calidris ferruginea</i>	Curlew Sandpiper					X
	<i>Calidris ruficollis</i>	Red-necked Stint					X
	<i>Limosa lapponica</i>	Bar-tailed Godwit					
	<i>Numenius minutus</i>	Little Curlew					X
	<i>Tringa glareola</i>	Wood Sandpiper	1				X
	<i>Tringa nebularia</i>	Common Greenshank					X
Laridae	<i>Chroicocephalus novaehollandiae</i>	Sliver Gull					X
	<i>Hydroprogne caspia</i>	Caspian Tern					X
Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern					X
	<i>Egretta novaehollandiae</i>	White-faced Heron			X	X	X
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill					X
	<i>Plegadis falcinellus</i>	Glossy Ibis					X
	<i>Threskiornis molucca</i>	Australian White Ibis			X	X	

Family	Species	Common Name	Surveys				
			A	B	C	D	E
					Waroona Mineral Sands	Waroona Mineral Sands	
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis			X	X	X
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove			X		X
	<i>Ocyphaps lophotes</i>	Crested Pigeon					X
	<i>Phaps chalcoptera</i>	Common Bronzewing			X	X	X
	<i>Phaps elegans</i>	Brush Bronzewing					X
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	10		X	X	X
	<i>Todiramphus sanctus</i>	Sacred Kingfisher					X
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater					X
Cuculidae	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo					
	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	10				X
	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo					X
	<i>Cacomantis pallidus</i>	Pallid Cuckoo	5				X
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook					X
Falconidae	<i>Falco berigora</i>	Brown Falcon					X
	<i>Falco cenchroides</i>	Nankeen Kestrel			X	X	X
	<i>Falco longipennis</i>	Australian Hobby			X		
	<i>Falco peregrinus</i>	Peregrine Falcon					X
Rallidae	<i>Gallirallus philippensis</i>	Buff-banded Rail	5				
	<i>Porzana fluminea</i>	Australian Spotted Crane					
	<i>Porphyrio porphyrio</i>	Purple Swamphen					X
	<i>Porzana pusilla</i>	Baillon's Crane	1				
	<i>Porzana fluminea</i>	Australian Spotted Crane	1				
	<i>Gallinula tenebrosa</i>	Dusky Moorhen	5				
	<i>Fulica atra</i>	Eurasian Coot	10				X
Otididae	<i>Ardeotis australis</i>	Australian Bustard					

Family	Species	Common Name	Surveys				
			A	B	C	D	E
					Waroona Mineral Sands	Waroona Mineral Sands	
Burhinidae	<i>Burhinus grallariu</i>	Bush Stone-curlew					X
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	1		X		X
	<i>Smicromis brevirostris</i>	Weebill					X
	<i>Gerygone fusca</i>	Western Gerygone			X	X	X
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	15		X	X	X
	<i>Acanthiza inornata</i>	Western Thornbill				X	X
	<i>Acanthiza apicalis</i>	Inland Thornbill	10				X
Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow					X
	<i>Artamus cyanopterus</i>	Dusky Woodswallow	5		X	X	X
	<i>Cracticus nigrogularis</i>	Pied Butcherbird					X
	<i>Cracticus torquatus</i>	Grey Butcherbird	5		X	X	X
	<i>Cracticus tibicen</i>	Australian Magpie	280		X	X	X
	<i>Strepera versicolor</i>	Grey Currawong	2				X
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella					X
Campephagidae	<i>Chlidonias leucopterus</i>	White-winged Black Tern					X
	<i>Coracina maxima</i>	Ground Cuckoo-Shrike	5				X
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike	25		X	X	
	<i>Lalage sueurii</i>	White-winged Triller					X
Atrichornithida	<i>Atrichornis clamosus</i>	Noisy Scrub-bird					X
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper			X		X
Corvidae	<i>Corvus bennetti</i>	Little Crow					X
	<i>Corvus coronoides</i>	Australian Raven			X	X	X
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	5		X		X
	<i>Petrochelidon nigricans</i>	Tree Martin				X	X
	<i>Petrochelidon ariel</i>	Fairy Martin			X		

Family	Species	Common Name	Surveys				
			A	B	C	D	E
					Waroona Mineral Sands	Waroona Mineral Sands	
Maluridae	<i>Malurus elegans</i>	Red-winged Fairy Wren					X
	<i>Malurus splendens</i>	Splendid Fairy-wren	10		X	X	X
Meliphagidae	<i>Acanthorhynchus superciliosus</i>	Western Spinebill	25				X
	<i>Lichenostomus virescens</i>	Singing Honeyeater	15		X		X
	<i>Anthochaera carunculata</i>	Red Wattlebird	5		X	X	X
	<i>Anthochaera lunulata</i>	Western Wattlebird					X
	<i>Epthianura albifron</i>	White-fronted Chat					X
	<i>Lichmera indistincta</i>	Brown Honeyeater			X	X	X
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	10				
	<i>Melithreptus lunatus</i>	White-naped Honeyeater					X
	<i>Phylidonyris nigra</i>	White-cheeked Honeyeater					X
	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater					X
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-Lark			X		X
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird					X
Estrildidae	<i>Stagonopleura oculata</i>	Red-eared Firetail					X
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit	5			X	
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler	1		X	X	X
	<i>Pachycephala rufiventris</i>	Rufous Whistler				X	X
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	5		X		X
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote					X
	<i>Pardalotus striatus</i>	Striated Pardalote	1		X	X	
Petroicidae	<i>Petroica multicolor</i>	Pacific Robin	2				
	<i>Petroica multicolor boodang</i>	Scarlet Robin			X	X	X
	<i>Eopsaltria australis</i>	Eastern Yellow Robin	5				
	<i>Eopsaltria georgiana</i>	White-breasted Robin					X

		Surveys	A	B	C	D	E
Family	Species	Common Name			Waroona Mineral Sands	Waroona Mineral Sands	
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin					X
	<i>Microeca fascinans</i>	Jacky Winter					X
Megaluridae	<i>Megalurus gramineus</i>	Little Grass Bird					X
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail			X	X	X
	<i>Rhipidura leucophrys</i>	Willie Wagtail	3		X	X	X
Timaliidae	<i>Zosterops lateralis</i>	Silvereye			X	X	X
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant				X	X
	<i>Phalacrocorax carbo</i>	Great Cormorant					X
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant					X
	<i>Phalacrocorax varius</i>	Pied Cormorant					X
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican					X
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	1		X		X
Procellariidae	<i>Pachyptila vittata</i>	Broad-billed Prion	1				
	<i>Pachyptila desolata</i>	Antarctic Prion	1				
	<i>Pachyptila belcheri</i>	Slender-billed Prion	1				
Cacatuidae	<i>Calyptorhynchus banksii naso</i>	Red-tailed Black-Cockatoo			X	X	
	<i>Calyptorhynchus banksii</i>	Forest Red-tailed Cockatoo					X
	<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo			X	X	X
	<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo					X
	<i>Eolophus roseicapillus</i>	Galah			X	X	X
	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet					X
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	20				
	<i>Cacatua sanguinea</i>	Little Corella					X
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck	5		X	X	X
	<i>Purpureicephalus spurius</i>	Red-capped Parrot	2		X	X	X

		Surveys					A	B	C	D	E
Family	Species	Common Name			Waroona Mineral Sands	Waroona Mineral Sands					
	<i>Neophema elegans</i>	Elegant Parrot				X				X	
	<i>Platycercus icterotis</i>	Western Rosella								X	
	<i>Polytelis anthopeplus</i>	Regent Parrot								X	
Tytonidae	<i>Tyto alba</i>	Barn Owl	6		X						
	<i>Tyto javanica</i>	Eastern Barn Owl									
<b>Mammals</b>											
Suidae	<i>Sus scrofa</i>	Pig	1	1							
Canidae	<i>Vulpes vulpes</i>	Red Fox			X	X					
Felidae	<i>Felis catus</i>	House Cat	5	1	X	X					
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	1	1							
Dasyuridae	<i>Antechinus flavipes</i>	Yellow-footed Antechinus	50	10							
	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	6	6							
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum	10								
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo			X	X					
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	1	1		X					
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit			X	X					
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			X						
Peramelidae	<i>Isoodon obesulus</i>	Southern Brown Bandicoot			X	X					
Equidae	<i>Equus caballus</i>	Domestic Horse	5	1							
Muridae	<i>Hydromys chrysogaster</i>	Water Rat		2							
	<i>Mus musculus</i>	House Mouse	15	3							
<b>Amphibians</b>											
Hylidae	<i>Litoria moorei</i>	Motor Bike Frog								X	
	<i>Litoria adelaidensis</i>	Slender Tree Frog				X				X	
	<i>Litoria moorei</i>	Motorbike Frog	5	1							

Family	Species	Common Name	Surveys				
			A	B	C	D	E
					Waroona Mineral Sands	Waroona Mineral Sands	
Limnodynastidae	<i>Heleioporus eyrei</i>	Moaning Frog	15	3			
	<i>Heleioporus psammophilus</i>	Sand Frog				X	X
	<i>Limnodynastes dorsalis</i>	Western Banjo Frog				X	
Myobatrachidae	<i>Crinia georgiana</i>	Quacking Frog	10	2	X	X	X
	<i>Crinia glauerti</i>	Clicking Frog	5	1	X		X
	<i>Crinia insignifera</i>	Squelching Froglet	70	14		X	X
	<i>Geocrinia leai</i>	Ticking Frog				X	
	<i>Myobatrachus gouldii</i>	Turtle Frog					X
<b>Reptiles</b>							
Agamidae	<i>Pogona minor minor</i>	Bearded Dragon	1	1			
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python		1			
Carphodactylidae	<i>Underwoodisaurus milii</i>	Barking Gecko	5	1	X		
Elapidae	<i>Demansia psammophis reticulata</i>		5	1			
	<i>Elapognathus coronatus</i>	Crowned Snake	30	6			
	<i>Notechis scutatus</i>	Tiger Snake	17	17	X		
	<i>Parasuta gouldii</i>		4	4			
	<i>Parasuta nigriceps</i>		3	3			
	<i>Pseudonaja affinis</i>	Dugite			X		
	<i>Pseudonaja affinis affinis</i>	Dugite	31	30			
	<i>Pseudonaja mengdeni</i>	Gwardar	1	1			
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko	5	1			
Pygopodidae	<i>Delma fraseri</i>		5	1			
	<i>Lialis burtonis</i>		50	10			
	<i>Pygopus lepidopodus</i>	Common Scaly Foot	1	1			
Scincidae	<i>Acritoscincus trilineatum</i>		5	1			

Family	Species	Common Name	Surveys				
			A	B	C	D	E
	<i>Cryptoblepharus buchananii</i>				X		
	<i>Ctenotus labillardieri</i>		15	3	X		
	<i>Egernia kingii</i>	King's Skink	10	2	X		
	<i>Egernia napoleonis</i>		5	1			
	<i>Hemiernis initialis initialis</i>		5	1			
	<i>Hemiernis quadrilineata</i>		25	5			
	<i>Lerista distinguenda</i>		5	1			
	<i>Lerista elegans</i>		5	1			
	<i>Menetia greyii</i>		5				
	<i>Morethia lineocellata</i>		15	3			
Typhlopidae	<i>Ramphotyphlops australis</i>		5	5			
	<i>Ramphotyphlops pinguis</i>		1	1			
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor	1	1			
	<i>Varanus rosenbergi</i>	Heath Monitor			X		
Chelidae	<i>Chelodina colliei</i>	Oblong Turtle	5	1			

A NatureMap

B Western Australian Museum

C GHD (2004) Environmental Assessment Flora and Fauna Survey. Unpublished report for Iluka Resources Ltd, Waroona.

D Ninox Wildlife Consulting (2005) Vertebrate Fauna Assessment Waroona Mineral Sands Project Area. Unpublished report for Iluka Resources, Perth

E Atlas of Living Australia



Appendix C  
Definitions of Significant Fauna under the  
*WA Wildlife Conservation Act 1950*  
Vertebrate Fauna Assessment – Lot 3 Buller Road, Waroona

**APPENDIX C**  
**DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WESTERN AUSTRALIAN WILDLIFE**  
**CONSERVATION ACT 1950**

In Western Australia, all native fauna species are protected under the *Western Australian Wildlife Conservation Act 1950-1979*. Fauna species that are considered rare, threatened with extinction or have a high conservation value are specially protected under the Act. In addition, some species of fauna are covered under the 1991 ANZECC convention, while certain birds are listed under the Japan and Australian Migratory Bird Agreement (JAMBA) and the China and Australian Migratory Bird Agreement (CAMBA).

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2014* recognises four schedules of taxa. These are:

**Schedule 1** – fauna which are rare or likely to become extinct and are Declared to be fauna in need of special protection;

**Schedule 2** – fauna which are presumed to be extinct and are Declared to be fauna in need of special protection;

**Schedule 3** – birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction which are Declared to be fauna in need of special protection; and

**Schedule 4** – fauna that are in need of special protection, for reasons other than mentioned in Schedules 1, 2 or 3.

In addition to the above classifications, DPAW also classifies fauna under five different Priority codes:

**Priority one** – *Taxa with few, poorly known populations on threatened lands*. Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

**Priority two** – *Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands*. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat from habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to Declaration as threatened fauna.

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

**Priority four** – *Taxa in need of monitoring*. Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are not considered currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are Declining significantly but are not yet threatened.

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

# Appendix D

## Location of Significant Trees

**Vertebrate Fauna Assessment – Lot 3 Buller Road, Waroona**

## Appendix D. Location and type of significant trees

UTM Zone	UTM Easting	UTM Northing	Tree type	Hollow
50	391406	6363675	Jarrah	
50	391417	6363670	Jarrah	
50	391413	6363666	Jarrah	
50	391429	6363645	Jarrah	
50	391422	6363625	Marri	
50	391421	6363604	Marri	
50	391423	6363601	Marri	
50	391423	6363594	Marri	
50	391446	6363491	Marri	
50	391452	6363487	Marri	
50	391463	6363486	Marri	Yes
50	391446	6363495	Marri	
50	391452	6363508	Marri	
50	391379	6363747	Jarrah	
50	391394	6363716	Jarrah	
50	391339	6363752	Jarrah	
50	391327	6363705	Jarrah	
50	391226	6363678	Jarrah	
50	391195	6363697	Jarrah	
50	391192	6363696	Jarrah	
50	391145	6363651	Jarrah	
50	391107	6363657	Jarrah	
50	391042	6363634	Jarrah	
50	391022	6363674	Jarrah	
50	390978	6363689	Marri	
50	390982	6363624	Dead	Yes
50	390977	6363602	Jarrah	
50	390989	6363540	Marri	Yes
50	391006	6363500	Marri	
50	391017	6363482	Jarrah	
50	391025	6363475	Marri	
50	391024	6363431	Dead	
50	390975	6363439	Marri	
50	390959	6363429	Dead	
50	390939	6363512	Marri	
50	390965	6363514	Marri	
50	390947	6363552	Marri	Yes
50	390925	6363533	Marri	
50	390937	6363581	Dead	
50	390955	6363637	Marri	
50	390932	6363647	Marri	
50	390919	6363532	Marri	
50	390926	6363420	Dead	Yes
50	390958	6363428	Dead	
50	390955	6363424	Dead	
50	390943	6363398	Jarrah	Yes
50	390935	6363380	Dead	Yes
50	390927	6363376	Jarrah	
50	390974	6363347	Jarrah	Yes
50	390969	6363333	Jarrah	Yes
50	390989	6363336	Jarrah	Yes
50	390998	6363332	Jarrah	
50	390996	6363300	Jarrah	
50	390998	6363279	Jarrah	
50	390976	6363267	Jarrah	

UTM Zone	UTM Easting	UTM Northing	Tree type	Hollow
50	390922	6363318	Jarrah	
50	390903	6363353	Jarrah	
50	391207	6363359	Jarrah	
50	391117	6363291	Jarrah	
50	390876	6363283	Jarrah	
50	390874	6363295	Marri	Yes
50	390850	6363315	Marri	
50	390837	6363340	Jarrah	
50	390836	6363341	Jarrah	
50	390827	6363358	Jarrah	
50	390842	6363368	Jarrah	
50	390856	6363406	Dead	
50	390843	6363329	Jarrah	
50	390836	6363435	Jarrah	
50	390829	6363454	Jarrah	
50	390853	6363437	Jarrah	
50	390871	6363493	Dead	Yes
50	390869	6363514	Jarrah	
50	390868	6363525	Dead	
50	390851	6363529	Jarrah	
50	390846	6363540	Jarrah	
50	390869	6363567	Jarrah	
50	390831	6363550	Jarrah	
50	390850	6363577	Dead	Yes
50	390850	6363579	Jarrah	
50	390856	6363584	Marri	
50	390827	6363599	Marri	Yes
50	390867	6363634	Jarrah	
50	390872	6363648	Marri	
50	390867	6363654	Marri	
50	390870	6363665	Marri	
50	390887	6363652	Marri	
50	390906	6363679	Jarrah	
50	390920	6363705	Marri	
50	390888	6363725	Marri	Yes
50	390891	6363730	Marri	
50	390894	6363698	Jarrah	
50	390867	6363687	Jarrah	
50	390935	6363758	Marri	
50	390931	6363751	Jarrah	
50	390923	6363745	Marri	
50	390839	6363743	Jarrah	
50	390832	6363691	Jarrah	
50	390814	6363701	Jarrah	Yes
50	390799	6363680	Marri	Yes
50	390812	6363674	Jarrah	Yes
50	390830	6363666	Jarrah	
50	390778	6363673	Dead	
50	390765	6363652	Marri	
50	390765	6363640	Marri	
50	390763	6363640	Jarrah	
50	390746	6363633	Marri	
50	390745	6363630	Marri	
50	390789	6363718	Dead	
50	390795	6363212	Dead	
50	390713	6363291	Jarrah	
50	390719	6363324	Jarrah	

<b>UTM Zone</b>	<b>UTM Easting</b>	<b>UTM Northing</b>	<b>Tree type</b>	<b>Hollow</b>
50	390717	6363346	Dead	Yes
50	390714	6363358	Jarrah	