

Level 1 Vertebrate Fauna Risk Assessment for the Jaurdi Hills Mining Area



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Front Cover: *Ctenophorus scutulatus*

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EXECUTIVE SUMMARY

Beacon Minerals Limited, via Native Vegetation Solutions, has requested a Level 1 vertebrate fauna risk assessment for the Jaurdi Hills Mining Area ('project area'). The project area is located approximately 33km north-west of Coolgardie and 53km west of Kalgoorlie and has an area of 590ha.

The project area supports a diverse range of fauna habitats. These have been grouped into the following four fauna habitat types:

- mostly sparse eucalypt woodland (*E. campaspe*, *E. clelandii*, *E. salmonophloia*) over chenopod shrubland on red sandy-clay substrate;
- eucalypt thickets with a ground cover of leaf litter mostly in open depressions on red sandy-clay substrate;
- eucalypt woodland (*E. griffithsii*, *E. campaspe*) over *Acacia* sp. over mixed sclerophyll shrubland on a stony clay substrate; and
- highly disturbed and degraded areas.

There are no reptile, mammal or amphibian species of conservation significance likely to be in the project area. There is a very low possibility that Western Rosella, Peregrine Falcon and Fork-tailed Swift would be seen in the vicinity of the project area, but any potential impacts on these species are assessed as low. The Rainbow Bee-eater is recorded regularly in the region, so it could seasonally be in the project area, but will readily move if disturbed, particularly during the non-breeding period. All avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed. Small terrestrial vertebrate fauna will be lost in the vegetation clearing process, but this will not be a significant impact in a bioregional context.

Clearing of vegetation will potentially effect vertebrate fauna in numerous ways, including:

- death/injury of fauna during vegetation clearing and impacts with vehicles;
- loss of habitat;
- fragmentation of habitat;
- increase in feral fauna around the mining and infrastructure; and
- disturbance of fauna in nearby areas from light, noise, dust and vibrations.

To mitigate potential impacts, where possible, access routes should be aligned to existing tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area to minimise the impact on the terrestrial fauna, which are often dependent upon specific habitat types. Clearing should be minimised wherever possible and fragmentation of remnant vegetation should be avoided. Once areas are no longer required then they should be rehabilitated.

It is recommended that:

- all areas disturbed during mining are rehabilitated as soon as practical after they are no longer required;
- where possible, access routes are aligned to existing roads, tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area;
- pets are not permitted on the project;
- all waste and rubbish is contained in bins and regularly removed from the project or placed in land fill and covered to exclude feral and pest fauna having access;
- feeding of native fauna is prohibited;
- a log of all on-site drill holes is maintained detailing when they were capped, how and by whom; and
- a vertebrate fauna management plan is prepared and implemented for the life of the project prior to vegetation disturbance.

1 INTRODUCTION

1.1 Background

Beacon Minerals Limited, via Native Vegetation Solutions, has requested a Level 1 vertebrate fauna risk assessment for the Jaurdi Hills Mining Area ('project area'). The parent entity, Beacon Minerals Limited is a publically listed company which has a 100% interest in Beacon Mining Pty Ltd. Beacon Mining Pty Ltd is the operator of the Jaurdi Hills Project. The project area is located approximately 33km north-west of Coolgardie and 53km west of Kalgoorlie (Figure 1) and has an area of 590ha.

1.2 Project objectives

Terrestrial Ecosystems was commissioned to undertake a Level 1 terrestrial vertebrate fauna risk assessment for the Jaurdi Hills Mining Area (Figure 2).

The purpose of this fauna assessment was to provide information to enable an assessment of potential impacts on the vertebrate fauna assemblage from the proposed development. The methodology broadly follows that described in the Environmental Protection Authority (EPA) *Technical Guidance Terrestrial Fauna Surveys* (2016b), *Environmental Factor Guide Terrestrial Fauna* (2016a) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA / DEC 2010).

The objectives of this fauna risk assessment were to:

- provide an indication of the vertebrate fauna assemblages (reptiles, amphibians, small mammals and birds) near the project areas so that potential impacts on the fauna might be adequately assessed;
- assess the impact and environmental risks associated with vegetation disturbance on the fauna assemblage;
- 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 avoid, mitigate or minimise potential impacts on resident terrestrial fauna.

2 EXISTING ENVIRONMENT

2.1 Eastern Goldfield IBRA subregion

The project area is in the Coolgardie (COO3 – Eastern Goldfield) IBRA sub-region. The relief is subdued and comprises of gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The subregion supports large playa lakes in the western half which are remnants of an ancient major drainage system (Cowan 2002).

The vegetation is comprised of Mallees, Acacia thickets and shrub heath on sand plains. Diverse eucalypt woodlands occur around salt lakes, on ranges, and in valleys. Salt lakes support dwarf shrublands of samphire. Woodlands and *Dodonaea* shrubland occur on basic granulites of the Fraser Range (Cowan 2002). The area is rich in endemic Acacias.

2.2 Climate

Chart 1 shows the average mean monthly maximum and minimum temperatures and rainfall for the Kalgoorlie airport. Temperatures are highest in December – March. Rain comes in two peaks: in summer from storms coming from the north-west which are occasionally the result of cyclonic activity in the Pilbara and winter rains that are the result of low pressure cells that move in an easterly direction from the south-west of the state.

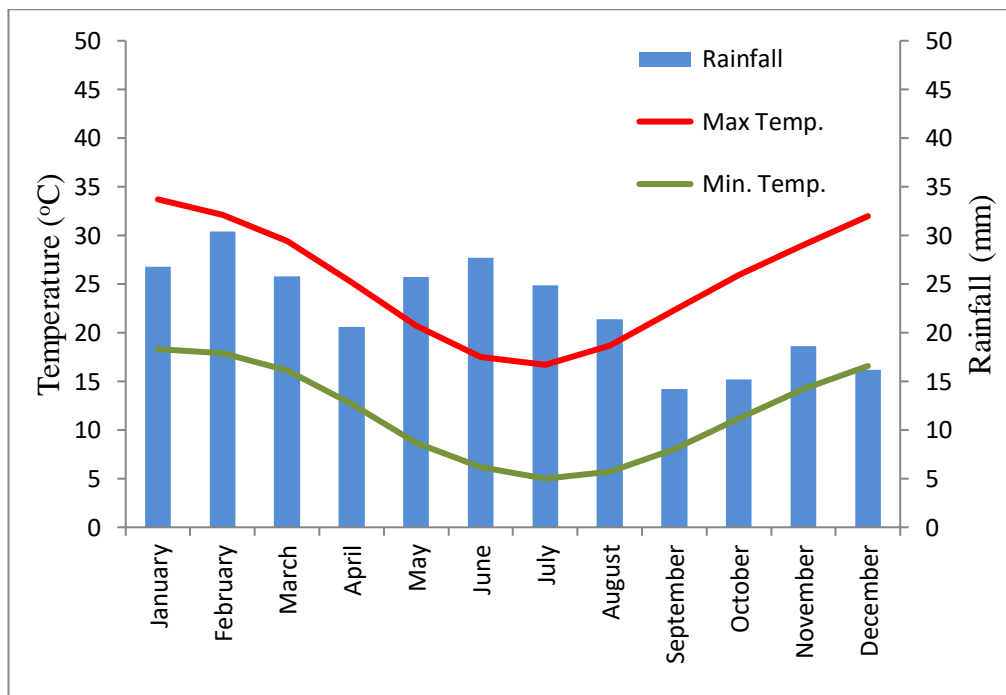


Chart 1. Mean monthly maximum and minimum temperatures and rainfall for Kalgoorlie

2.3 Land use history

The dominant land uses in this bioregion are pastoralism, crown reserves and mining. Mining is evident in many areas around Coolgardie, Broad Arrow, Ora Banda and Kalgoorlie, with numerous small abandoned and operational mines scattered throughout the landscape.

2.4 Great Western Woodlands

The project area is part of the Great Western Woodlands (Watson et al. 2008, pp. vi) that is being promoted by the Wilderness Society because the area contains the 'largest and healthiest temperate woodland remaining on our planet'. The Wilderness Society argued that the fauna and flora diversity in the area has evolved with the landscape during an unbroken biological lineage stretching back 250 million years.

There is pressure from numerous conservation groups for the preservation of the Great Western Woodlands, and it is likely that the Department of Biodiversity, Conservation and Attractions (DBCAs) will progressively become more involved in the protection of these woodlands.

3 EXISTING VERTEBRATE FAUNA DATA AND PREVIOUS BIOLOGICAL SURVEYS IN THE REGION

The frogs, reptiles, mammals and birds in the Eastern Goldfields IBRA subregion have been previously surveyed, mostly during Level 2 vertebrate fauna assessments. The trapping fauna surveys or assessments completed in the vicinity of the project area which contain fauna assemblage data and were reviewed as part of this assessment include:

- Bamford, M.J., Davies, S.J.J. F. and Ladd, P.G. (1990) *Biological Survey of the Kangaroo Hills and Calooli Timber Reserves, Coolgardie, Western Australia*, Unpublished report.
- Chapman A., Kealley I., McMillan D., McMillan P. and Rolland G. (1991) Biological Surveys of Four Goldfields Reserves. *Landnote* 1/91; 1-26.
- McKenzie NL; Rolfe JK and Youngson WK (1992) Vertebrate fauna. In The Biological Survey of the Eastern Goldfields of Western Australia; Part 8; Kurnalpi - Kalgoorlie Study Area, *Records of the Western Australian Museum*, Supplement, No 41.
- Ninox Wildlife Consulting (1999) *Fauna Survey for the White Foil Gold Project*, Unpublished report for Mines and Resources Australia Pty Ltd, Perth.
- Ninox Wildlife Consulting (2002) *A Vertebrate Fauna Assessment of the Proposed White Foil Haul Road Route Near Kalgoorlie, Western Australia*, Unpublished report for Mines and Resources Pty Ltd, Perth.
- Thompson, S. (2004) *Mine site rehabilitation index using reptile assemblage as a bio-indicator*. PhD Thesis, UWA and follow up surveys and data in the Department of Biodiversity, Conservation and Attractions' NatureMap, Atlas of Living Australia (AoLA) and Western Australian Museum (WAM) collections.

These fauna survey reports contain habitat similar to that in the project area, and will therefore report fauna assemblages similar to that in the project area.

There were also numerous Level 1 fauna assessment reports completed in the adjacent areas and surrounding region, however, these don't contain fauna assemblage data that would provide additional information for this assessment.

The trapping effort employed during most of these surveys is now considered inadequate to assess species richness or assemblage structure, however, they provide useful contextual information concerning the project area.

Taxonomy and nomenclature for fauna species used in this report are generally based on the Atlas of Living Australia. Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data were correct and we have only corrected obvious records where the nomenclature was known to be incorrect.

4 ASSESSMENT METHOD

4.1 Database searches

Several databases were consulted in the preparation of the potential fauna lists. A review of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government. A search was undertaken within a 50km area buffered around a point coordinate of 30.719229S 120.9388°E (Appendix C). 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 Eastern Goldfields IBRA subregion. The Department of Biodiversity, Conservation and Attractions (DBCA) threatened and priority species database was searched via the records in NatureMap and the AoLA was consulted for records of conservation significant species where required.

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) and Thompson and Thompson (2006) 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. Consequently, many species will be included in the lists produced from database searches but will not be present in the actual project area.

There are errors in most databases, including NatureMap, AoLA and the Western Australian Museum (WAM) collections. These errors occur because of a misidentification of individuals, taxonomic name changes and incorrect coordinates being entered into the database. Terrestrial Ecosystems was unable to verify the primary records, so it has used the information provided. Readers should therefore appreciate that species lists and fauna surveys reported in the appendices may include these errors.

4.2 Reconnaissance survey

The project area was searched on foot and by ATV for evidence of Malleefowl and other conservation significant fauna on 13 July 2017. The reconnaissance survey was also used to assess fauna habitat types and their condition.

Habitat suitable for Malleefowl was searched looking for their characteristic mound or tracks.

4.2.1 Survey and reporting staff

Dr Scott Thompson undertook the reconnaissance survey and fauna habitat assessment with the assistance of Eren Reid (Native Vegetation Solutions). Dr Graham Thompson prepared the report and Dr Scott Thompson reviewed the report before it was sent to the client. Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages based on Goldfields surveys and are therefore appropriately trained and experienced for the task of preparing this assessment.

4.3 Limitations

This fauna risk assessment is based on information contained in the State and Commonwealth government databases and other published and unpublished fauna survey data for the bioregion and a reconnaissance survey. 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.

Lists of species potentially in and around the project area have been compiled from records in AoLA, NatureMap, the WAM records and reports of fauna surveys undertaken in the bioregion. It should be appreciated that some records in AoLA, NatureMap and the WAM are very old and those species are no longer present in the area. Terrestrial Ecosystems has not been able to verify the primary data and is therefore not able to vouch for the accuracy of these records. These sources of data are known to contain errors, and this should be taken into account when reading this assessment.

The EPAs *Technical Guidance Terrestrial Fauna Surveys* (2016b) 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 assessment limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Competency and experience of the consultant carrying out this assessment	No	The zoologists that undertook the field survey and prepared this assessment are familiar with the vertebrate fauna of this bioregion and are experienced in these types of assessments.
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 able to vouch for the accuracy of this information. It is acknowledged that the taxonomy of Western Australian vertebrate fauna 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 on-line databases 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	Weather was suitable for a reconnaissance survey.
Disturbances which affected results of the survey	No	The project area contained tracks, mine pits, a waste dump and evidence of exploration activity in some areas. This minor level of disturbance has been considered in this assessment.
Intensity of survey effort	No	Not applicable.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	Yes, negligible	Access was not a significant limitation or constraint.
Availability of contextual information on the region	No	There is a reasonable quantity of fauna survey data available for this IBRA subregion.

Negligible = less than 20%.

5 RESULTS

5.1 Fauna habitats

The project area was visually assessed on 13 July 2017. The purpose of the reconnaissance survey was to determine fauna habitats and habitat condition and to identify any conservation significant species that may inhabit the area.

The project area supports a diverse range of fauna habitats. These have been grouped into the following four broad fauna habitat types:

- mostly sparse eucalypt woodland (*E. campaspe*, *E. clelandii*, *E. salmonophloia*) over chenopod shrubland on red sandy clay substrate (Plates 1-4);
- eucalypt thickets with a ground cover of leaf litter mostly in open depressions on red sandy clay substrate (Plates 5-6);
- eucalypt woodland (*E. griffithsii*, *E. campaspe*) over *Acacia* sp. over mixed sclerophyll shrubland on stony clay (Plates 7-8); and
- highly disturbed and degraded areas (Plates 9-12).

Within each of these eucalypt woodlands there were variations in the density of the eucalypt canopy ranging upwards from very open to moderately dense. Plates 1-12 provide an indication of the habitat types available.



Plate 1. Eucalypt woodland over chenopod shrubland



Plate 2. Eucalypt woodland over chenopod shrubland



Plate 3. Eucalypt woodland over chenopod shrubland



Plate 4. Eucalypt woodland over chenopod shrubland



Plate 5. Eucalypt thickets with a ground cover of leaf litter



Plate 6. Eucalypt thickets with a ground cover of leaf litter



Plate 7. Eucalypt woodland over *Acacia* sp. over mixed sclerophyll shrubland on a stony substrate



Plate 8. Eucalypt woodland over *Acacia* sp. over mixed sclerophyll shrubland on a stony substrate



Plate 9 Highly disturbed and degraded area



Plate 10. Highly disturbed and degraded area



Plate 11 Highly disturbed and degraded area



Plate 12. Highly disturbed and degraded area

5.2 Fauna habitat condition

The project area contains two mining pits, a poorly vegetated waste dump, numerous tracks, numerous vehicle tracks and there has been some recent exploration activity. Other than the areas disturbed by exploration, mining and mine infrastructure, the fauna habitat condition for most of the project area is in good to very good condition.

5.3 Bioregional vertebrate fauna

Appendix A provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix A. These differences are partially due to the low survey effort often deployed and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 2-5 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey reports listed in section 3.

Table 2. Birds potentially found near the project area

Family	Species	Common Name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl
Anatidae	<i>Stictonetta naevosa</i>	Freckled Duck
	<i>Anas gracilis</i>	Grey Teal
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Phaps elegans</i>	Brush Bronzewing
	<i>Ocyphaps lophotes</i>	Crested Pigeon
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
Anhingidae	<i>Anhinga melanogaster</i>	Australasian Darter
Ardeidae	<i>Ixobrychus sinensis</i>	Yellow Bittern
	<i>Nycticorax caledonicus</i>	Nankeen Night Heron
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite
	<i>Lophoictinia isura</i>	Square-tailed Kite
	<i>Aquila audax</i>	Wedge-tailed Eagle
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco berigora</i>	Brown Falcon
Rallidae	<i>Fulica atra</i>	Eurasian Coot
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittacidae	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet
Psittacidae	<i>Polytelis anthopeplus</i>	Regent Parrot
	<i>Platycercus icterotis</i>	Western Rosella
	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephotus varius</i>	Mulga Parrot
Cuculidae	<i>Chalcites basalis</i>	Horsfield's Bronze-cuckoo
	<i>Chalcites osculans</i>	Black-eared Cuckoo
	<i>Chalcites lucidus</i>	Shining Bronze-cuckoo
	<i>Cacomantis pallidus</i>	Pallid Cuckoo
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook
Tytonidae	<i>Tyto alba</i>	Barn Owl
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird
	<i>Ptilonorhynchus guttatus</i>	Western Bowerbird
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren
	<i>Malurus leucopterus</i>	White-winged Fairy-wren
	<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren
Acanthizidae	<i>Hylacola cauta</i>	Shy Heathwren
	<i>Calamanthus campestris</i>	Rufous Fieldwren
	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Smicrornis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill

Family	Species	Common Name
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
Pardalotidae	<i>Pardalotus punctatus punctatus</i>	Spotted Pardalote
	<i>Pardalotus rubricatus</i>	Red-browed Pardalote
	<i>Pardalotus striatus</i>	Striated Pardalote
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater
	<i>Lichenostomus virescens</i>	Singing Honeyeater
	<i>Lichenostomus leucotis</i>	White-eared Honeyeater
	<i>Lichenostomus flavicollis</i>	Yellow-throated Honeyeater
	<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater
	<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura aurifrons</i>	Orange Chat
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Sugomel niger</i>	Black Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Phylidonyris niger</i>	White-cheeked Honeyeater
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Psophodidae	<i>Cinlosoma castanotum</i>	Chestnut Quail-thrush
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
Pachycephalidae	<i>Pachycephala inornata</i>	Gilbert's Whistler
	<i>Pachycephala pectoralis</i>	Golden Whistler
	<i>Pachycephala simplex</i>	Grey Whistler
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
	<i>Oreoica gutturalis</i>	Crested Bellbird
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow
	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Cracticus tibicen</i>	Australian Magpie
	<i>Strepera versicolor</i>	Grey Currawong
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
Corvidae	<i>Corvus coronoides</i>	Australian Raven
	<i>Corvus bennetti</i>	Little Crow
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Melanodryas cucullata</i>	Hooded Robin
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin
	<i>Drymodes brunneopygia</i>	Southern Scrub-robin
Megaluridae	<i>Cincloramphus mathewsi</i>	Rufous Songlark
Timaliidae	<i>Zosterops lateralis</i>	Mauritius Olive White-eye
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon ariel</i>	Fairy Martin
	<i>Hirundo nigricans</i>	Tree Martin
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Estrildidae	<i>Taeniopygia guttata castanotis</i>	Zebra Finch
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit

Table 3. Mammals potentially found near the project area

Family	Species	Common Name
Bovidae	<i>Bos taurus</i>	Cattle
	<i>Capra hircus</i>	Goat
	<i>Ovis aries</i>	Sheep
Canidae	<i>Canis lupus</i>	Dingo
	<i>Vulpes vulpes</i>	Red Fox
Felidae	<i>Felis catus</i>	House Cat
Molossidae	<i>Austronomus australis</i>	White-striped Free-tail Bat
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat
	<i>Nyctophilus major</i>	Greater Long-eared Bat
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat
	<i>Vespadelus baverstocki</i>	Inland Forest Bat
Dasyuridae	<i>Vespadelus regulus</i>	Southern Forest Bat
	<i>Antechinomys laniger</i>	Kultarr
	<i>Ningauai ridei</i>	Wongai Ningauai
	<i>Ningauai yvomeae</i>	Mallee Ningauai
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
	<i>Sminthopsis gilberti</i>	Gilbert's Dunnart
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart
	Burramyidae	<i>Cercartetus concinnus</i>
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo
	<i>Osphranter robustus</i>	Euro
	<i>Osphranter rufus</i>	Red Kangaroo
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Muridae	<i>Mus musculus</i>	House Mouse
	<i>Notomys alexis</i>	Spinifex Hopping Mouse
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse
	<i>Pseudomys albocinereus</i>	Ash-grey Mouse
	<i>Pseudomys bolami</i>	Bolam's Mouse
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse

Table 4. Amphibians potentially found near the project area

Family	Species	Common Name
Hylidae	<i>Litoria moorei</i>	Motorbike Frog
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Kunapalari Frog
	<i>Neobatrachus pelobatoides</i>	Humming Frog
	<i>Neobatrachus sutor</i>	Shoemaker Frog
	<i>Neobatrachus wilsmorei</i>	Goldfields Bullfrog
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Orange-crowned Toadlet

Table 5. Reptiles potentially found near the project area

Family	Species	Common Name
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon
	<i>Ctenophorus cristatus</i>	Crested Dragon
	<i>Ctenophorus fordi</i>	Mallee Dragon
	<i>Ctenophorus isolepis</i>	Crested Dragon
	<i>Ctenophorus maculatus</i>	Spotted Dragon
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon
	<i>Ctenophorus pictus</i>	Painted Dragon
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon

Family	Species	Common Name
	<i>Ctenophorus salinarum</i>	Saltpan Dragon
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon
	<i>Moloch horridus</i>	Thorny Devil
	<i>Pogona minor</i>	Dwarf Bearded Dragon
	<i>Tympanocryptis cephalus</i>	Pebble Dragon
	<i>Tympanocryptis lineata</i>	Lined Earless Dragon
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python
Carphodactylidae	<i>Nephrurus laevisissimus</i>	Smooth Knob-tail
	<i>Nephrurus vertebralis</i>	Midline Knob-tail
	<i>Underwoodisaurus milii</i>	Barking Gecko
Diplodactylidae	<i>Amalosia reticulata</i>	Reticulated Velvet Gecko
	<i>Crenadactylus ocellatus</i>	Clawless Gecko
	<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus
	<i>Diplodactylus granariensis</i>	Wheat-belt Stone Gecko
	<i>Diplodactylus pulcher</i>	Fine-faced Gecko
	<i>Hesperoedura reticulata</i>	Reticulated Velvet Gecko
	<i>Lucasium maini</i>	Main's Ground Gecko
	<i>Oedura marmorata</i>	Marbled Velvet Gecko
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko
	<i>Strophurus elderi</i>	Jewelled Gecko
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko
Elapidae	<i>Acanthophis pyrrhus</i>	Desert Death Adder
	<i>Brachyuropis fasciolata</i>	Narrow-banded Burrowing Snake
	<i>Brachyuropis semifasciata</i>	Half-girdler Snake
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Furina ornata</i>	Orange-naped Snake
	<i>Neelaps bimaculatus</i>	Black-naped Burrowing Snake
	<i>Parasuta gouldii</i>	Gould's Snake
	<i>Parasuta monachus</i>	Monk Snake
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudonaja mengdeni</i>	Gwardar
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Suta fasciata</i>	Rosen's Snake
	<i>Suta suta</i>	Curl Snake
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko
	<i>Gehyra purpurascens</i>	Purplish Dtella
	<i>Gehyra variegata</i>	Tree Dtella
	<i>Hemidactylus frenatus</i>	Asian House Gecko
	<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko
	<i>Rhynchoedura ornata</i>	Western Beaked Gecko
Pygopodidae	<i>Aprasia repens</i>	Sedgeland's Worm-lizard
	<i>Delma australis</i>	Marble-faced Delma
	<i>Delma butleri</i>	Unbanded Delma
	<i>Delma fraseri</i>	Fraser's Delma
	<i>Lialis burtonis</i>	Burton's Snake-lizard
	<i>Pygopus lepidopodus</i>	Common Scaly-foot
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
Scincidae	<i>Cryptoblepharus australis</i>	Inland Snake-eyed Skink
	<i>Cryptoblepharus buechananii</i>	Buchanan's Snake-eyed Skink
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus
	<i>Ctenotus australis</i>	Western Limestone Ctenotus
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus
	<i>Ctenotus schomburgkii</i>	Schomburgk's Ctenotus
	<i>Ctenotus uber</i>	Spotted Ctenotus
	<i>Ctenotus xenopleura</i>	Wide-striped Ctenotus
	<i>Cyclodomorphus branchialis</i>	Common Slender Bluetongue
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Bluetongue
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	Goldfields Crevice-skink

Family	Species	Common Name
	<i>Egernia richardi</i>	Bright Crevice-skink
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer
	<i>Hemiergis initialis</i>	South-western Earless Skink
	<i>Hemiergis peronii</i>	Lowlands Earless Skink
	<i>Lampropholis guichenoti</i>	Pale-flecked Garden Skink
	<i>Lerista kingi</i>	King's Slider
	<i>Lerista picturata</i>	Southern Robust Slider
	<i>Lerista timida</i>	Timid Slider
	<i>Liopholis inornata</i>	Desert Skink
	<i>Liopholis striata</i>	Nocturnal Desert Skink
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Morethia adelaidensis</i>	Saltbush Morethia Skink
	<i>Morethia butleri</i>	Woodland Morethia Skink
	<i>Morethia obscura</i>	Shrubland Morethia Skink
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard
	<i>Tiliqua rugosa</i>	Bobtail
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake
	<i>Anilius bicolor</i>	Dark-spined Blind Snake
	<i>Anilius bituberculatus</i>	Prong-snouted Blind Snake
	<i>Anilius hamatus</i>	Pale-headed Blind Snake
	<i>Anilius waitii</i>	Waite's Blind Snake
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor
	<i>Varanus gouldii</i>	Gould's Goanna
	<i>Varanus tristis</i>	Black-headed Monitor
Chelidae	<i>Chelodina colliei</i>	Collie's Turtle

5.4 Conservation significant fauna species recorded or predicted to occur in the project area

Species listed under the *EPBC Act* or the *Wildlife Conservation Act 1950 (WC Act)* as being threatened or of conservation significance or are on the DBCA Priority and Threatened Species list and are potentially in the vicinity of the project area are shown in Table 6.

Conservation significant fauna are protected by the Commonwealth *EPBC Act*, 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 *WC Act*. The WA *WC Act* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, the DBCA maintains a list of fauna that require monitoring under four priority headings based on DBCA's knowledge of their distribution, abundance and threatening processes. The *EPBC Act* and *WC Act* 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 DBCA 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 *WC Act* are provided in Appendix B.

Five threatened species of fauna and six migratory species of birds were identified under the *EPBC Act* as potentially occurring in the vicinity of the project area. There are six species listed as threatened and nine listed as migratory under the *WC Act* and four species listed on the DBCA's Priority Fauna List that potentially occur in the region and one specially protected. The following is an assessment of the likelihood of each of the species listed in Table 6 being found in the project area and if they are found, the potential for impacting on the species during development.

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

Species	Status under the Wildlife Conservation Act / DBCA	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
<i>Pezoporus occidentalis</i> Night Parrot	Critically Endangered	Endangered	Not recorded in the vicinity of the project area. The impact is therefore likely to be very low.
<i>Calidris ferruginea</i> Curlew Sandpiper	Vulnerable	Critically Endangered	It is highly unlikely to be in the project area because of a lack of habitat.
<i>Ogyris subterrestris petrina</i> Arid Bronze Azure	Critically Endangered	Critically Endangered	The project area is outside this species known geographic range, so it is highly unlikely to be present in the area. Potential impacts are very low.
<i>Leipoa ocellata</i> Malleefowl	Vulnerable	Vulnerable	Potentially in the vicinity of the project area, however, it is unlikely to be impacted as there are no active mounds in the project area. There are limited areas of ideal habitat and this bird is mobile enough to move away from noise or disturbance.
<i>Dasyurus geoffroii</i> Chuditch	Vulnerable	Vulnerable	Unlikely to be in the project area
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory		It is unlikely that vegetation clearing will significantly impact on this species because it can easily move to adjacent undisturbed areas once clearing commences. There may be a low impact if a nest is disturbed during vegetation clearing.
<i>Apus pacificus</i> Fork-tailed Swift	Migratory	Migratory	It is unlikely that vegetation clearing will significantly impact on this species as they are an aerial species and rarely come to the ground. They can also easily move to adjacent undisturbed areas once clearing commences.
<i>Actitis hypoleucos</i> Common Sandpiper	Migratory	Migratory	This is a migratory wetland species, as such it is highly unlikely to be in the project area because of a lack of habitat.
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	Migratory	Migratory	This is a migratory wetland species, as such it is highly unlikely to be in the project area because of a lack of habitat.
<i>Calidris melanotos</i> Pectoral Sandpiper	Migratory	Migratory	This is a migratory wetland species, as such it is highly unlikely to be in the project area because of a lack of habitat.
<i>Motacilla cinerea</i> Grey Wagtail	Migratory	Migratory	Has not been recorded in the bioregion. They can also easily move to adjacent undisturbed areas once clearing commences, so the potential impact is very low.
<i>Tringa nebularia</i> Common Greenshank	Migratory	Migratory	It is highly unlikely to be in the project area because of a lack of habitat.

Species	Status under the Wildlife Conservation Act / DBCA	Status under the EPBC Act	Comment on potential impact that vegetation clearing will have on conservation significant species
<i>Thinornis rubricollis</i> Hooded Plover	Priority 4		It is highly unlikely to be in the project area because of a lack of habitat.
<i>Calidra alba</i> Great Egret	Migratory		It is highly unlikely to be in the project area because of a lack of habitat.
<i>Ardea ibis</i> Cattle Egret	Migratory		It is highly unlikely to be in the project area because of a lack of habitat.
<i>Falco peregrinus</i> Peregrine Falcon	Other specially protected fauna		Low potential to be in the area, and if it is, it is unlikely that vegetation clearing will significantly impact on this species because it can easily move to adjacent undisturbed areas once clearing commences.
<i>Acanthopis antarcticus</i> Southern Death Adder	Priority 3		Not recorded in the vicinity of the project area. Any impacts are likely to be very low in a bioregional context.
<i>Platycercus icterotis xanthogenys</i> (Mallee) Western Rosella	Priority 4		Low potential to be found in the eucalypt woodland, however, it would readily move to adjacent undisturbed areas once clearing commences. Overall potential for impact is low, when considered in a bioregional context.
<i>Nyctophilus major tor</i> Central Long-eared Bat	Priority 4		This species has been recorded in other surveys in the region, however, vegetation clearing is unlikely to significantly impact on this species, as it will readily move away from disturbance.

5.4.1 Potential impact on species of conservation significance

Night Parrot (*Pezoporus occidentalis*) – Critically Endangered under the *WC Act* and Endangered under the *EPBC Act*

The Night Parrot is a secretive, mainly nocturnal and mostly a ground dwelling species. Its geographical distribution is poorly understood, but it was probably distributed over much of semi-arid and arid Australia (Garnett et al. 2011). Sightings in north-west Queensland in the early 1990s were in a broad cross section of the habitats available (Garnett et al. 1993). There have been sightings in the Pilbara in 1980 and 2005, central WA in 1979, north-eastern South Australia in 1979, western Queensland in 1980, 1990, 1993 and 2006 (Garnett et al. 2011). There are recent confirmed records in Pullen Pullen Nature Reserve in western Queensland, in the Diamantina National Park, near Alice Springs and the inland Murchison/Pilbara in Western Australia. There have been numerous, mostly futile, investigations to determine the existence and location of this little-known species in Western Australia (Davies et al. 1988, Garnett et al. 1993, Blyth et al. 1996, Blyth and Boles 1997). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range.

The Night Parrot's pattern of movement is presumed to be partially nomadic. Its preferred habitat is *Triodia* grasslands in stony or sandy environments, samphire and chenopod shrub lands (Department of the Environment and Energy 2017b). It seems to prefer spinifex, but has been recorded in samphire, comes to water after dark and builds its nest deep in spinifex tussocks (Wilson 1937). The Night Parrot nest has a runway and a tunnel entrance and it lays clutches of two to four white eggs. Several reasons have been suggested for its decline, including habitat loss and degradation through clearing, grazing, altered fire regimes, reduced availability or quality of watering points and predation by feral species, in particular the cat (Garnett et al. 2011).

As there are no recent Night Parrot records near the project area, and it is highly unlikely to be present in the area.

Arid Bronze Azure (*Ogyris subterrestris petrina*) - Critically Endangered under the *WC Act* and the *EPBC Act*

The Arid Bronze Azure is known from two localities in Western Australia: Lake Douglas, 12km south-west of Kalgoorlie, and in the road and rail reserve adjacent to Barbalin Nature Reserve which is approximately 11km west of Mukinbudin. The Arid Bronze Azure has an obligate dependence on an ant (*Camponotus terebrans*), as larvae of *O. s. petrina* feeds either on ant's regurgitations or on the immature stages. Floristically diverse habitats are needed to sustain high densities of the host ant.

It has not been recorded near the project area, so potential impacts of clearing the project area on this species are very low.

Curlew Sandpiper (*Calidris ferruginea*) - Critically Endangered under the *WC Act 1950* and Endangered under the *EPBC Act*

Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers, and off-shore islands. In Western Australia, they are mostly transient in inland areas. They breed in arctic coasts of Asia and winter in Africa, Madagascar, south-Asia, Indo-Australia archipelago and Australia (Johnstone and Storr 1998). Large flock are seen at Port Hedland salt works, 80 Mile Beach, Roebuck Bay and Lake Macleod.

Curlew Sandpipers forage on mudflats and nearby shallow water drains of intertidal mudflats and sandy shores of estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in salt works and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters.

There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Malleefowl (*Leipoa ocellata*) – Vulnerable under the *WC Act* and the *EPBC Act*

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Recently their range has contracted due to fox predation and clearing of habitat. Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and, once breeding commences, they pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area.

Malleefowl have been recorded in other fauna surveys near the project area, but most of these are old records (Appendix A). There was no evidence (e.g. tracks or mounds) of Malleefowl in the project area, and there is limited quality habitat available for this species. It is therefore Terrestrial Ecosystems' assessment that Malleefowl may be found in the general vicinity, however, any impact on them would be low as they are unlikely to nest in the project area and they can easily move away from vegetation clearing or other disturbances.

Rainbow Bee-eater (*Merops ornatus*) - Migratory under the *WC Act*.

The Rainbow Bee-eater is widespread during late spring and summer in the southern section of WA, particularly in sandy areas that have access to water. This species was recorded in numerous fauna surveys in the goldfields near the project area (Appendix A), and could therefore be seen in the project area in late spring and summer. These migratory birds will readily move out of the area if disturbed, so there is unlikely to be a significant impact.

Fork-tailed Swift (*Apus pacificus*) - Migratory under the *EPBC Act* and the *WC Act*.

The Fork-tailed Swifts breed in north-east and mid-east Asia and winter in Australia and New Guinea. It arrives in the Kimberley in late September and in central and southern WA in November and leaves in late April. The Fork-tailed Swift may be an infrequent visitor to the area although it has not been recorded in previous surveys.

It is Terrestrial Ecosystems' assessment that the Fork-tailed Swift may infrequently be seen near the project area, but is unlikely to be impacted by the proposed developments as it is an aerial species and rarely comes to the ground.

Grey Wagtail (*Motacilla cinerea*) - Migratory under the *EPBC Act* and the *WC Act*

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water including rivers, streams and creeks where it feeds on insects. The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area. It is highly unlikely to be seen in the project area due to a lack of suitable habitat.

Hooded Plover (*Thinornis rubricollis*) – Priority 4 species with DBCA

This species frequents the margins and shallows of salt lakes, and also along coastal beaches, where it forages for invertebrates. It is found along the southern coast and salt lakes north to Port Gregory, Three Springs, Mt Gibson, Lake Brown, Lake Barlee, Lake Cowan and Eyre. It is an uncommon to common resident on the southern sea beaches from Cape Naturaliste east to Eyre but is also found on the fringes of inland salt lakes. It probably breeds in the samphire habitat along the boundary of some of the salt lakes in inland areas of WA.

There is no suitable habitat for this bird in the project area.

Great Egret (*Calidris alba*) - Migratory under the *WC Act*

Hérons and egrets all depend, to some extent upon surface water for hunting. This is a large, elegant, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mudflats.

There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Cattle Egret (*Ardea ibis*) - Migratory under the *WC Act*

The smallest of 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. This invasion may have been assisted by the opening of farming land and irrigation schemes, providing the pasturelands and shallow wetlands that the species prefers to forage in.

There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Peregrine Falcon (*Falco peregrinus*) – Other specially protected fauna *WC Act*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the project area. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years. Peregrine Falcons have not been recorded in other fauna surveys in adjacent areas.

It is Terrestrial Ecosystems' assessment that the Peregrine Falcon may infrequently be observed in the project area, however, vegetation clearing is unlikely to have a significant impact on this species as there is an abundance of similar habitat in adjacent areas.

Southern Death Adder (*Acanthophis antarcticus*) – Priority 3 with DBCA

The Southern Death Adder is a very cryptic snake that is found from the Darling Range, sections of the central wheatbelt and from Esperance offshore islands and across the Nullarbor Plain to the South Australian border. It is rarely caught in fauna surveys and only opportunistically encountered on roads and in undisturbed bushland. The Southern Death Adder is in very low densities across the goldfields.

There are no records of the Southern Death Adder in the Atlas of Living Australia near the project area, but this may reflect a lack of survey effort, so there is only a low probability it is in the project area, and if it was it would also be in neighbouring areas, so any potential impact on the species will be low.

Western Rosella (*Platycercus icterotis xanthogenys*) – Priority 4 with DBCA

The mallee form of the Western Rosella is found mostly in Eucalypt and Casuarina woodland and shrublands, especially Wandoo, Flooded Gums and Salmon Gums. It is generally not seen in the sparse open eucalypt woodland this far north and has not been recorded in other fauna surveys near the project area (Appendix A).

There is a very low probability that the Western Rosella could be found in the eucalypt woodland in very low densities, however, it would readily move to adjacent undisturbed areas once vegetation clearing commences. The overall potential for an impact is low, however, there may be localised impacts if a hollow containing a nesting bird was disturbed.

Central Long-eared Bat (*Nyctophilus major tor*) – Priority 4 with DBCA

This species is distributed across the southern and central wheatbelt, southern part of the Great Victoria Desert, parts of the eastern Goldfields and the Nullarbor coast. The project area is within its geographic range. It roosts in tree cavities, foliage and under loose bark.

Given that the proposed vegetation clearing represents a very small fraction of similar habitat in the general area, it is Terrestrial Ecosystems' assessment that the proposed clearing in the project area is unlikely to have a significant impact on this species.

Common Sandpiper (*Actitis hypoleucos*) – Migratory under the EPBC Act and the WC Act

The Common Sandpiper is a wetland migratory species. There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Sharp-tailed Sandpiper (*Calidris acuminata*) – Migratory under the EPBC Act and the WC Act

The Sharp-tail Sandpiper is a wetland migratory species. There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Pectoral Sandpiper (*Calidris melanotos*) – Migratory under the EPBC Act and the WC Act

The Pectoral Sandpiper is a wetland migratory species. There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

Common Greenshank (*Tringa nebularia*) – Migratory under the EPBC Act and the WC Act

The Common Greenshank is found in shallow fresh and salt waters where it forages for a diverse range of invertebrates. There is a low probability that this species would be seen in the project area after heavy rains had filled clay pans and salt lakes. When the clay pan in the project area contains water, then multiple other clay pans and salt lakes in adjacent areas would also contain water. This species will readily move from a disturbance and therefore is unlikely to be significantly impacted by the proposed development.

There is no suitable habitat for this species within or near the project area, so there are unlikely to be any significant impacts.

5.5 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 on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. 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 13.

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 some time.
C	Moderate	The environmental event should occur or one or more conservation significant species should be present at some time.
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</i> at a regional scale.
Acceptability of Risk		
Level of risk	Management Action Required	
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. May a referral to the Commonwealth under the <i>EPBC Act</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		
		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.	B	2	Low			
Inadequate bioregional data for contextual purposes.	Incomplete analysis of data and appreciation of impacts on biodiversity values in a regional context.	B	2	Low			
Removal of habitat – site scale.	Almost complete loss of terrestrial fauna in cleared areas, severe impact on local fauna assemblage.	E	1	Low			
Significant reduction of habitats – local scale.	Loss of fauna and fauna habitat and impacts on local fauna assemblage (excluding conservation significant species).	B	1	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			
Loss of conservation significant species	Loss of a localised population or a few individuals – <i>Leipoa ocellata</i> .	A	3	Low			
	Loss of a localised population or a few individuals – <i>Platycercus icterotis xanthogenys</i> .	A	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>Thinornis rubricollis</i>	A	2	Low				
	Loss of a localised population or a few individuals – <i>Acanthophis antarcticus</i>	A	2	Low				
	Loss of a localised population or a few individuals – <i>Nyctophilus major tor.</i>	B	2	Low				
	Loss of a localised population or a few individuals – <i>Merops ornatus</i> .	A	2	Low				
	Loss of a localised population or a few individuals – <i>Apus pacificus</i> .	A	2	Low				
	Introduced fauna populations increasing.	B	2	Low				
	Altered fire regimes adversely affecting fauna assemblages.	B	2	Low				
Road kills.	E	2	Low					
Nomadic avian species		B	1	Low				

6 DISCUSSION

6.1 Adequacy of available vertebrate fauna data

Environmental Protection Authority (EPA) *Technical Guidance Terrestrial Fauna Surveys* (2016b), *Environmental Factor Guide Terrestrial Fauna* (2016a) 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.

The adequacy of the data provided and the resulting assessment of potential impacts of vegetation clearing in the project area on terrestrial fauna should be assessed in the context of whether additional fauna survey data would provide a better understanding of potential impacts and therefore improve how these impacts might be managed. Terrestrial Ecosystems' view is that given the available fauna survey data and the abundance of similar habitat in adjacent areas, there is no justification for undertaking a more detailed Level 2 vertebrate fauna survey in the project area, as there is sufficient data to make an adequate assessment of potential impacts on the terrestrial vertebrate fauna in the project area.

6.2 Fauna assemblages

6.2.1 Amphibians

Amphibians typically found in eucalypt woodlands in the Goldfields are listed in Table 4. All the Limnodynastidae species are burrowing frogs and only come to the surface to feed and breed after substantial rain. *Pseudophryne occidentalis* finds shelter under rocks and in crevices during the dry periods and enters temporary ponds to breed after major rainfall events. All species have a wide-spread distribution and are abundant.

6.2.2 Reptiles

Reptile species richness in the project area will be comparable with similar eucalypt woodlands elsewhere in the bioregion. The list provided in Appendix A represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 40 species of reptiles, but many of these would be in low abundance (see Table 5). There is a very low possibility that the Southern Death Adder is present in the project area, as it has not been recorded in the general area and it has not been caught in other surveys in the adjacent areas.

6.2.3 Birds

Avian species richness in the Goldfields is influenced by rainfall and is generally higher in woodlands compared with chenopod shrublands and more sparsely vegetated areas. The list provided in Table 2 represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 20-70 species of birds, but many of these would be in very low numbers (see Appendix A). Birds typically move from an area once vegetation clearing commences, so the impact is relatively low if the area is small. However, eggs and chicks in nests are often lost during the clearing process. The Malleefowl is the most significant species that could be impacted by the proposed development, however, the habitat is not ideal and there was no evidence (e.g. mounds or tracks) to suggest that it was present.

6.2.4 Mammals

Mammal abundance in the semi-arid areas varies seasonably and from year-to-year depending on the available resources and previous rainfall. Table 3 provides an indication of the mammals that have been recorded in other surveys in the region. Small mammals that retreat to burrows and logs during the day are often lost during the clearing process. There are no known conservation significant mammals likely to be in the project area.

6.3 Biodiversity values of the site

There are insufficient data available to consider biodiversity at the genetic level.

Fauna habitat types represented in the project area are abundant and in very good condition in adjacent areas. Therefore, the fauna assemblage that is present in the project area will also be present and abundant in the adjacent

areas. The available fauna survey data (Appendix A) provides a good indication of the vertebrate fauna that are potentially in the project area.

The listed avian species of conservation significance potentially seen in the project area are the Western Rosella, Peregrine Falcon, Malleefowl and the migratory Rainbow Bee-eater and Fork-tailed Swift. All avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed.

6.3.1 Condition of fauna habitat and extent of habitat degradation

There were four broad fauna habitats in the project area:

- mostly sparse eucalypt woodland (*E. campaspe*, *E. clelandii*, *E. salmonophloia*) over chenopod shrubland on red sandy clay substrate;
- eucalypt thickets with a ground cover of leaf litter mostly in open depressions on red sandy clay substrate;
- eucalypt woodland (*E. griffithsii*, *E. campaspe*) over *Acacia* sp. over mixed sclerophyll shrubland on stony clay; and
- highly disturbed and degraded areas.

There is a track that runs down most of the spine of the project area and some exploration tracks. There are two mining pits, and a waste dump, outside these disturbance areas, the majority of these habitats are in good to very good condition.

6.3.2 Ecological linkages

The project area currently does not provide an important ecological linkage or fauna movement corridor. There are tracks that dissect the project area, but they are all relatively narrow and are unlikely to provide a barrier that would inhibit the movement of fauna within the general area.

6.3.3 Conservation significant species

There is a very low possibility that Western Rosella, Rainbow Bee-eater, Peregrine Falcon and Fork-tailed Swift would be seen in the general area, but any potential impacts on these species are assessed as low. All avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed.

As the proposed impact area is small relative to the available similar habitat in the adjacent areas and the broader region. The probability of significantly impacting on any conservation significant species in the project area is low.

6.3.4 Great Western Woodland

The project area is within the Great Western Woodland (Department of Environment and Conservation 2010) which is an area of special interest to the Wilderness Society and the DBCA. Currently, there are no specific management strategies in place that focus on the vertebrate fauna, however, the proposed state government management strategies for pest and fire will have an indirect impact, if they are implemented.

Conservation groups are keen for the Great Western Woodland to be preserved and will continually put pressure on DBCA and environmental regulators to limit development in this area.

6.4 Potential impacts on fauna

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

- death/injury of fauna during clearing, grading and vehicle strikes;
- loss of habitat;
- fragmentation of habitat;
- increase in feral fauna around the mining development; and
- disturbance of fauna in nearby areas from light, noise and dust.

These impacts are discussed below.

6.4.1 Direct impacts

6.4.1.1 Animal deaths during the clearing process and displacement of fauna

Clearing vegetation and construction activities will result in the loss of most small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which will inevitably result in these individuals being killed or injured in their burrows or as they attempt to escape. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species, however, long-term impacts are likely to be low.

6.4.1.2 Reduction or loss of activity areas and closure of burrows

Clearing vegetation and associated construction activities are likely to destroy reptile and mammal burrows or foraging habitat that are currently in use, or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

6.4.2 Indirect impacts

In addition to the obvious impact of vegetation clearing, there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. Edge effects include disruption to ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. Vehicle tracks also have the propensity to develop weed infestations which can impact on natural fauna habitats.

There are numerous potential indirect threats associated with vegetation clearing and the construction of infrastructure that could have a significant impact on the vertebrate fauna in the project area. Some of these are discussed below.

6.4.2.1 Habitat fragmentation

In addition to vegetation clearing, infrastructure including tracks have the potential to fragment habitat. Cleared linear tracks of land are 'unnatural' in much of the habitat. These linear structures that partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. A reduction in the population as a result of this infrastructure would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals known to be in the area.

As most of the tracks within the project area will be relatively narrow, the potential impact associated with habitat fragmentation is likely to be low.

6.4.2.2 Introduced fauna

An increase in human activity is often associated with an increase in the abundance of introduced species such as the house mice (*Mus musculus*), cats (*Felis catus*), foxes (*Vulpes vulpes*) and wild dogs (*Canis lupus*). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to areas via tracks.

House mice, cats, foxes and wild dogs are known to be established in the area. In many situations, they have become a 'naturalised' species in the Australian bush. Increases in dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance.

Infrastructure known to support feral species, such as rubbish disposal sites and bins, should be managed to minimise increases in these populations.

6.4.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads or tracks are constructed or upgraded, in particular affecting kangaroos, nocturnal birds and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges. Therefore, there is an increased propensity for these species to be killed by vehicles.

6.4.2.4 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from an area, or alter their activity periods.

6.4.3 Summary of impacts

Based on the available information, it is Terrestrial Ecosystems' view that clearing of the vegetation to establish a mine and associated infrastructure will not significantly impact on conservation significant species listed under the Commonwealth *EPBC Act* or WA *WC Act*. Fauna will be lost during the clearing process, but this impact is unlikely to be significant, as similar fauna habitat supporting similar fauna assemblages are abundant in adjacent areas.

6.5 Native vegetation clearing principles

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

Table 10. Assessment of impact on fauna and fauna assemblages using the Native Vegetation Clearing Principles

Principle	Response
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.	The project area does not contain habitat that is necessary for 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 community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant nor will the proposed clearing create a remnant.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The proposed impact area does not include a watercourse or 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 vegetation is unlikely to impact on the environmental values of the bioregion.
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.

7 MANAGEMENT STRATEGIES

To avoid, mitigate and minimise impacts on the fauna the following recommendations should be implemented.

7.1.1 Induction and awareness

All contractors and people involved in vegetation clearing, construction and operation of the facilities should be made aware of the possible presence and issues associated with terrestrial fauna in the area through the induction process.

Recommendation 1: Information on protecting fauna and reporting deaths and sightings of Malleefowl and other conservation significant species should be incorporated into the mine induction program.

7.1.2 Minimising habitat fragmentation

Loss of vegetation and habitat may contribute to the decline in the number of fauna on and in the vicinity of project area. Where possible, access routes should be aligned to existing tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area to minimise the impact on the terrestrial fauna, which are often dependent upon specific habitat types. Clearing should be minimised wherever possible and fragmentation of remnant vegetation should be avoided wherever possible. Once areas are no longer required then they should be rehabilitated.

Recommendation 2: All areas disturbed during mining are rehabilitated as soon as practical after they are no longer required.

Recommendation 3: Where possible, access routes are aligned to existing roads, tracks and other barriers or follow the boundaries of broad-scale vegetation associations in the area.

7.1.3 Minimising secondary impacts to the habitat

Pets and feral animals have the potential to impact on conservation significant species. Pets should not be permitted on the project and feral animal numbers monitored and controlled. All rubbish likely to attract animals should be suitably contained and disposed of so as not to encourage the feeding of fauna around the project.

Recommendation 4: Pets are not permitted on the project.

Recommendation 5: All waste and rubbish be contained in bins and regularly removed from the project or placed in land fill and suitably covered to exclude access to predator species.

Recommendation 6: Feeding of native fauna is prohibited.

7.1.4 Uncapped drill holes

Uncapped drill holes can pose a serious threat to small animals, including ground dwelling reptiles, frogs and small mammals. A log of all on-site drill holes should be maintained detailing when they were capped, how and by whom. All drill holes should be temporarily capped on completion of drilling and permanently capped or closed as soon as possible after exploration activities have ceased.

Recommendation 7: A log of all on-site drill holes be maintained detailing when they were capped, how and by whom.

7.1.5 Fauna management plan

Fauna management plans describe the procedures and protocols that must be implemented to avoid, mitigate and minimise impacts on fauna during the vegetation clearing, infrastructure development and operational stages of a

project. Such plans deal with the method of vegetation clearing, reducing fauna deaths on the roads, the impacts of artificial light spill, vibration, dust, feral species management, monitoring and recording conservation species, monitoring impacts on fauna in adjacent areas, staff inductions, etc.

Recommendation 8: A vertebrate fauna management plan is prepared and implemented for the life of the project prior to vegetation disturbance.

8 SUMMARY AND CONCLUSIONS

Beacon Minerals Limited, via Native Vegetation Solutions, has requested a Level 1 vertebrate fauna risk assessment for the Jaurdi Hills Mining Area. The project area is located approximately 33km north-west of Coolgardie and 53km west of Kalgoorlie and has an area of 590ha. Fauna survey data from other projects in the bioregion provide an adequate indication of the fauna assemblages likely to be encountered in the project area. These data are adequate to assess potential impacts on the vertebrate fauna potentially found in the project area.

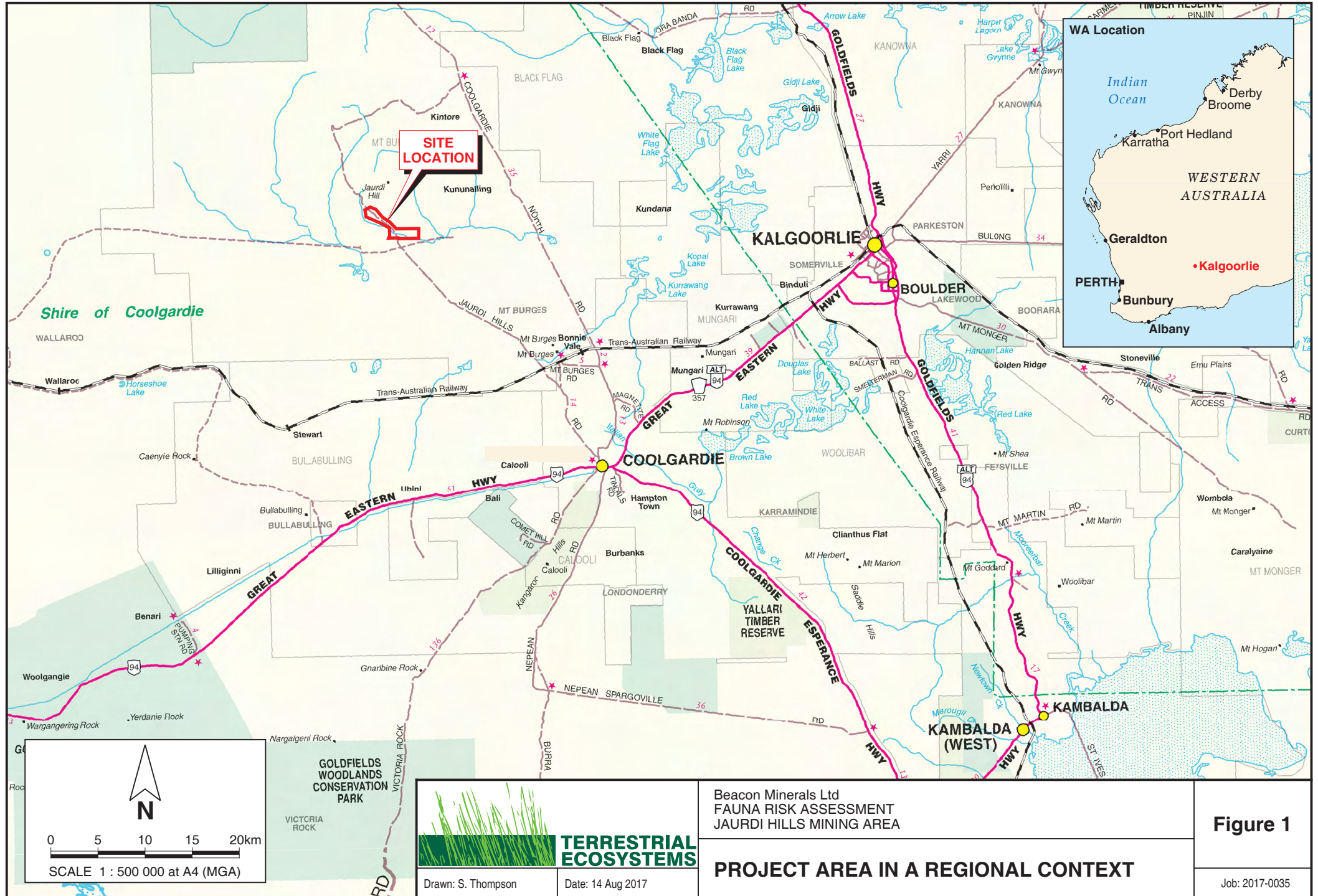
No conservation significant vertebrate fauna were assessed as likely to be significantly impacted by the proposed development. There is a low possibility that the Western Rosella, Peregrine Falcon, Fork-tailed Swift and the Rainbow Bee-eater may be present in the project area on rare occasions. All avian species potentially found in the project area are mobile and will readily move to adjacent areas if disturbed. The small terrestrial vertebrate fauna will be lost during the vegetation clearing program, but this loss is not significant in a bioregional context.

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Figures

Vertebrate Fauna Assessment – Jaurdi Hills Mining Area



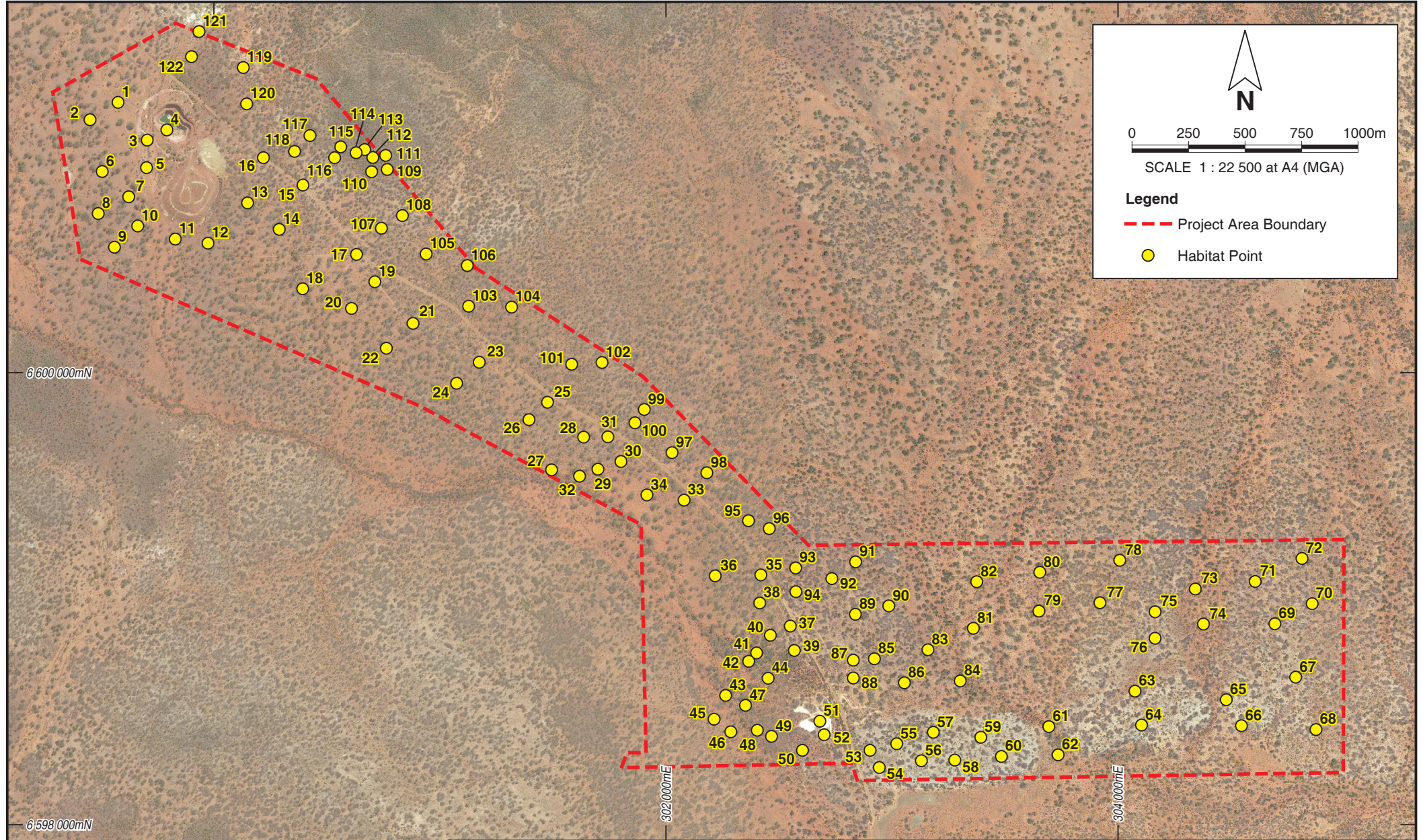
Beacon Minerals Ltd
 FAUNA RISK ASSESSMENT
 JAURDI HILLS MINING AREA

PROJECT AREA IN A REGIONAL CONTEXT

Figure 1

Drawn: S. Thompson Date: 14 Aug 2017

Job: 2017-0035



N

0 250 500 750 1000m

SCALE 1 : 22 500 at A4 (MGA)

Legend

- Project Area Boundary
- Habitat Point

TERRESTRIAL ECOSYSTEMS

Drawn: S. Thompson Date: 14 Aug 2017

Beacon Minerals Ltd
FAUNA RISK ASSESSMENT
JAURDI HILLS MINING AREA

PROJECT AREA

Figure 2

Job: 2017-0035

Appendix A
Vertebrate Fauna Recorded in Biological
Surveys in the Region
Vertebrate Fauna Assessment – Jaurdi Hills Mining Area

Note: Each column of data represents a different habitat type or survey site
 Numbers denote numbers captured during systematic trapping efforts; X = presence noted.

Appendix A. Fauna survey records in the vicinity of the project area

Family	Species	Common Name	Surveys			D													E			F	G															
			A	B	C	Site 1	Site 10	Site 2	Site 5	Site 9	Site 6	Site 12	Site 3	Site 8	Site 7	Site 11	Site 13	KK4	KK1	KK2	KK11	White Foil	Kurrawang NR #6	Kurrawang NR #4	Kurrawang NR #7	Kurrawang NR #2	Kurrawang NR #1	Kurrawang NR #3	Kurrawang NR #5									
Fish																																						
Cobitidae	<i>Carassius auratus</i>	Goldfish	X																																			
Terapontidae	<i>Leiopotherapon unicolor</i>	Spangled Perch	X																																			
Amphibians																																						
Hylidae	<i>Litoria moorei</i>	Motorbike Frog	X	1	1																																	
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Kunapalari Frog	X	19	27	8	1	1	1	1	1																											
	<i>Neobatrachus pelobatoides</i>	Humming Frog	X	2	2																																	
	<i>Neobatrachus sutor</i>	Shoemaker Frog	X	1	1													1	8																			
	<i>Neobatrachus wilsmorei</i>	Goldfields Bullfrog	X	2	6													1																				
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Orange-crowned Toadlet	X	31	31													2																				
Reptiles																																						
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	X																																			
	<i>Ctenophorus cristatus</i>	Crested Dragon	X	16	16	1	1				1	1	1						3		1	1																
	<i>Ctenophorus fordii</i>	Mallee Dragon	X	17	17													4					1															
	<i>Ctenophorus isolepis</i>	Crested Dragon	X	10	10																																	
	<i>Ctenophorus maculatus</i>	Spotted Dragon	X																																			
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	X																																			
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon	X	2	2																																	
	<i>Ctenophorus pictus</i>	Painted Dragon	X																																			
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	X	35	40					1								3	5																			
	<i>Ctenophorus salinarum</i>	Saltpan Dragon	X	11	10																																	
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon	X	12	19													8			1																	
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon	X	1	1																																	
	<i>Moloch horridus</i>	Thorny Devil	X	11	13	1					1							1																				
	<i>Pogona minor</i>	Dwarf Bearded Dragon	X																		1																	
	<i>Pogona minor minor</i>	Dwarf Bearded Dragon	X	19	18																	1																
	<i>Tympanocryptis cephalus</i>	Pebble Dragon	X		9										1																							
	<i>Tympanocryptis lineata</i>	Lined Earless Dragon	X	1																																		
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python	X	3																																		
Carphodactylidae	<i>Nephrurus vertebralis</i>	Midline Knob-tail	X	1	1													1																				
	<i>Underwoodisaurus milii</i>	Barking Gecko	X	34	56	1			2	2		1		2	1	2				2																		
Diplodactylidae	<i>Amalosia reticulata</i>	Reticulated Velvet Gecko	X	4	4														1																			

Family	Species	Common Name	Surveys			D													E				F	G						
			A	B	C	Site 1	Site 10	Site 2	Site 5	Site 9	Site 6	Site 12	Site 3	Site 8	Site 7	Site 11	Site 13	KK4	KK1	KK2	KK11	White Foil	Kurrawang NR #6	Kurrawang NR #4	Kurrawang NR #7	Kurrawang NR #2	Kurrawang NR #1	Kurrawang NR #3	Kurrawang NR #5	
	<i>Manorina flavigula</i>	Yellow-throated Miner	X	2				8		11	2	6	8			52		86	36	1	1			1	1					
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X			7	1		2	3	4	5		2	4	20		10	14	1					1		1			
	<i>Anthochaera carunculata</i>	Red Wattlebird	X			1			4	3	8	3	2	14	10			31		1				1	1	1	1	1	1	
	<i>Epthianura tricolor</i>	Crimson Chat	X	1																										
	<i>Epthianura aurifrons</i>	Orange Chat	X																											
	<i>Epthianura albifrons</i>	White-fronted Chat	X	1																										
	<i>Sugomel niger</i>	Black Honeyeater	X																											
	<i>Lichmera indistincta</i>	Brown Honeyeater	X			1		2						1	5				30	1									1	
	<i>Phylidonyris niger</i>	White-cheeked Honeyeater	X																											
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	X			2			1	4	1			5	4					5										
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler	X	4		6			15							1		5	28	1										
Psophodidae	<i>Cinclosoma castanotum</i>	Chestnut Quail-thrush	X	20		1		1	4	1		1										1							1	
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	X	3									7						15											
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-shrike	X																4				1							
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	X			3			1		6	7	2	2		6	13	9	1				1		1					
	<i>Lalage sueurii</i>	White-winged Triller	X						1							2														
Pachycephalidae	<i>Pachycephala inornata</i>	Gilbert's Whistler	X						1		1																			
	<i>Pachycephala pectoralis</i>	Golden Whistler					1		1																					
	<i>Pachycephala simplex</i>	Grey Whistler						1																						
	<i>Pachycephala rufiventris</i>	Rufous Whistler	X			2																								
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	X	1		3	3		1	2	1	1	3	1	1				1	1	1			1					1	
	<i>Oreoica gutturalis</i>	Crested Bellbird	X	4		2	2		2	6	2	5	4	2	2	5	5			1		1	1				1	1		
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow	X																											
	<i>Artamus cinereus</i>	Black-faced Woodswallow	X				1			1									1	7									1	
	<i>Artamus cyanopterus</i>	Dusky Woodswallow	X							2			6						3											
	<i>Cracticus torquatus</i>	Grey Butcherbird	X			1			3	2	4	2	3	1		5	3			1		1	1	1	1				1	
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	X					1			3	1		1					9	2	1		1	1	1				1	
	<i>Cracticus tibicen</i>	Australian Magpie	X	3						2	2	1		1					30	4	1			1						
	<i>Strepera versicolor</i>	Grey Currawong	X			4	1		2	4	1	2	3	3	5	2			7	7	1	1		1						
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail	X																											
	<i>Rhipidura leucophrys</i>	Willie Wagtail	X						1		4								1	2	1									
Corvidae	<i>Corvus coronoides</i>	Australian Raven	X			1			6	4	1	1	8	1	3															
	<i>Corvus bennetti</i>	Little Crow	X				1		1		3	1											1			1				
	<i>Corvus orru ceciliae</i>	Torresian Crow	X																											
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark	X																6		1				1					
Petroicidae	<i>Microeca fascians</i>	Jacky Winter	X	3						11						1		11	6							1			1	

Family	Species	Survey Name Common Name	A																		B	C																									
			Spinifex	Golden Arrow Trans	Golden Arrow Undist	Rose Trans	Salmon Gums	Gimlet South Trans	Palace Rehab	Davyhurst	Gimlet South Undist	Palace Undist	Security	Crossroads	Gimlet South Rehab	Golden Arrow Rehab	Palace Trans	Rose Rehab	Rose Undist	Wendy Gully Rehab	Wendy Gully Trans	Wendy Gully Undist	Floodplains	White Foil	Unknown																						
Amphibians																																															
Hylidae	<i>Litoria moorei</i>	Motorbike Frog																																													
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Kunapalari Frog	1	1																																											
	<i>Neobatrachus sutor</i>	Shoemaker Frog	9	6	1	9	5	3	6	5	1	0	3	0	2	2	1	2	7	2	2	1	9																								
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Orange-crowned Toadlet		5	1			1	147	1	1	8	4	9	5		4	158		2		2	2																								
Reptiles																																															
Agamidae	<i>Ctenophorus caudicinctus macropus</i>	Ring-tailed Dragon																																													
	<i>Ctenophorus cristatus</i>	Crested Dragon	1		1	3	1				3	5	1	0	1	1			1	2	4		1																								
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon			1	9	2	3	1	3	4	1	3	3	0	6			1	2	1	8	1	1	3	X																					
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon			3						2	2	2	2	5					2			1	1	3																						
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon													7																																
	<i>Moloch horridus</i>	Thorny Devil		1							5											1	1	1	7																						
	<i>Pogona minor</i>	Dwarf Bearded Dragon	1	3	9	1	4	2	2	4	2	0	1	1	3	3	1	4	2	1	2	1	0	8	1	8	2	1	4	4	2	4	2														
	<i>Tympanocryptis cephalus</i>	Pebble Dragon							1					7					2			1								1			X														
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python																																1													
Carphodactylidae	<i>Nephrurus laevisimus</i>	Smooth Knob-tail					1																																								
	<i>Underwoodisaurus milii</i>	Barking Gecko	1	1	7	5	2	2	6	8	3	1	231	2	0	1	6	1	8	2	2			2	8	3	9	7	4	7	9	8	1	0	3	7	3	3	2	8	1	0					
Diplodactylidae	<i>Amalosia reticulata</i>	Reticulated Velvet Gecko												1																																	
	<i>Diplodactylus granariensis</i>	Wheat-belt Stone Gecko	7	7	6	1	3	3	6	1	8	8	2	7	4	7	1	6	2	8	2	9	2	2	2	2	2	2	3	4	6	8	3	3	3	8	7	6	1								
	<i>Diplodactylus pulcher</i>	Fine-faced Gecko	5	3	2	7	8	3	8	1	1	8	6	2	1	8	8	123	8	0			6	3	4	100	1	3	4	6	1	2															
	<i>Lucasium maini</i>	Main's Ground Gecko	9	1	6			3	4	6		1	9	6	0	3	9	1	9	2					6	9			1	1	1																
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko	4	4	4	1	9		1	3		1	7	1				3	8	1	1				6	9		1	4	1	5	112															
Elapidae	<i>Brachyurophis semifasciata</i>	Half-girdlerd Snake	9		5		7					6	6	2	1																																
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake	1					1				1	4	2	1					1	1																							3			
	<i>Parasuta monachus</i>	Monk Snake	2		3	2	7			3	9	4	1	1	4	2			1	3	1	3							1	6																	
	<i>Pseudechis australis</i>	Mulga Snake			1	2	1			2	2							1		1						1	1																				
	<i>Pseudonaja mengdeni</i>	Gwardar	1																						1																						
	<i>Pseudonaja modesta</i>	Ringed Brown Snake	1		2							1																																			
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake						4				8	2	2			1											1																			
	<i>Suta fasciata</i>	Rosen's Snake						2					3			1																															
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko																																													
	<i>Gehyra purpurascens</i>	Purplish Dtella	1		1			1				1	1	9												6																					
	<i>Gehyra variegata</i>	Tree Dtella	23		28	13	14	27	2	38	37	45	39	6	18	1	1	3	37	3	1	12	2																								

Family	Species	Survey Name Common Name	A																		B	C			
			Spinifex	Golden Arrow Trans	Golden Arrow Undist	Rose Trans	Salmon Gums	Gimlet South Trans	Palace Rehab	Davyhurst	Gimlet South Undist	Palace Undist	Security	Crossroads	Gimlet South Rehab	Golden Arrow Rehab	Palace Trans	Rose Rehab	Rose Undist	Wendy Gully Rehab	Wendy Gully Trans	Wendy Gully Undist	Floodplains	White Foil	Unknown
	<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko	24	53	12	27	10	21	19	16	9	28	25	1	29	43	42	34	13	42	27	8			
	<i>Rhynchoedura ornata</i>	Western Beaked Gecko	4		23		3			5		20		41				1	106			9			
Pygopodidae	<i>Delma australis</i>	Marble-faced Delma	8		2	1				4	3	9				1			2			6			
	<i>Delma butleri</i>	Unbanded Delma	4											2								2			
	<i>Delma fraseri</i>	Fraser's Delma	1										1												
	<i>Lialis burtonis</i>	Burton's Snake-lizard	5			2																3			
	<i>Pygopus lepidopodus</i>	Common Scaly-foot	2				3			2	2											1			
Scincidae	<i>Cryptoblepharus australis</i>	Inland Snake-eyed Skink																							
	<i>Cryptoblepharus buechananii</i>	Buchanan's Snake-eyed Skink			1		3			10	12	5	3			1		7							
	<i>Cryptoblepharus plagioccephalus</i>	Peron's Snake-eyed Skink																							
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus	16									1	1								2	104			
	<i>Ctenotus schomburgkii</i>	Schomburgk's Ctenotus	2																			2			
	<i>Ctenotus uber johnstonei</i>	Spotted Ctenotus	46	2	48		6			29	13	5	44	27		1			3	2	1	25			
	<i>Cyclodomorphus melanops elongatus</i>	Spinifex Slender Bluetongue	24		6	2		1		1	2	2								2	2	24			
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink	15		2	1		3	1	57	68	3	27		3		2	2	3						X
	<i>Egernia formosa</i>	Goldfields Crevice-skink	1				4			8		2	8	1					14						
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer	3		4		6	2	1	5	4		6	2	1					1		1			
	<i>Hemiernis initialis brookeri</i>	South-western Earless Skink	12				1			4	5				1										
	<i>Lerista picturata</i>	Southern Robust Slider	14		17		20			18	18	5		1					5			20			
	<i>Lerista sp.</i>		5	1	3	3	15		1	23	4	6							6			2			
	<i>Liopholis inornata</i>	Desert Skink					4					8	2						71			2			
	<i>Liopholis striata</i>	Nocturnal Desert Skink					2						9									1			
	<i>Menetia greyii</i>	Common Dwarf Skink	6		6	11	3		4	19	3	23	17	4	2		4	12	18			1			
	<i>Morethia butleri</i>	Woodland Morethia Skink	4			4	7	3		14	1	6	4						17		1				
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	5		2					1			3									4			
	<i>Tiliqua rugosa</i>	Bobtail	2	3		1				3	1		2	1		1		3	2			1	1		
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake	14				7		2	8	14	7		7	1		3	1	2		1	6			
	<i>Anilius bicolor</i>	Dark-spined Blind Snake	1								1											1			
	<i>Anilius bituberculatus</i>	Prong-snouted Blind Snake	1	2	2					2	2	2	1		1				1		1				
	<i>Anilius hamatus</i>	Pale-headed Blind Snake	9	5	18	2	10	2	2	10	24	7	2	13		4	1		6	1	1	9			
	<i>Anilius sp.</i>	Anilius Cape Range Pop					1																		
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor	1		1		11			11	15		17	9				2	1			9			
	<i>Varanus gouldii</i>	Gould's Goanna	6	2	9	3	8	1	3	10	9	3	2	2	1	4	1	3	7	2	1		1		
	<i>Varanus tristis</i>	Black-headed Monitor	3			1	3			5	1														

Family	Species	Survey Name	A																	B	C				
			Spinifex	Golden Arrow Trans	Golden Arrow Undist	Rose Trans	Salmon Gums	Gimlet South Trans	Palace Rehab	Davyhurst	Gimlet South Undist	Palace Undist	Security	Crossroads	Gimlet South Rehab	Golden Arrow Rehab	Palace Trans	Rose Rehab	Rose Undist	Wendy Gully Rehab	Wendy Gully Trans	Wendy Gully Undist	Floodplains	White Foil	Unknown
Birds																									
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu																						X	
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl																							3
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon																						X	
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite																						X	
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah																						X	
	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet																						X	
	<i>Barnardius zonarius</i>	Australian Ringneck																						X	
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren																						X	
	<i>Malurus leucopterus</i>	White-winged Fairy-wren																						X	
Acanthizidae	<i>Smicromis brevirostris</i>	Weebill															1							X	
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill																						X	
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote																						X	
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater																						X	
	<i>Lichenostomus leucotis</i>	White-eared Honeyeater																						X	
	<i>Lichenostomus flavicollis</i>	Yellow-throated Honeyeater																						X	
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater																						X	
	<i>Purnella albifrons</i>	White-fronted Honeyeater																						X	
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater																						X	
	<i>Lichmera indistincta</i>	Brown Honeyeater																						X	
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler																						X	
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella																						X	
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-shrike																						X	
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike																						X	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush																						X	
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird																						X	
	<i>Cracticus tibicen</i>	Australian Magpie																						X	
	<i>Strepera versicolor</i>	Grey Currawong																						X	
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail																						X	
Corvidae	<i>Corvus coronoides</i>	Australian Raven																						X	
Petroicidae	<i>Microeca fascinans</i>	Jacky Winter																						X	
	<i>Petroica goodenovii</i>	Red-capped Robin																						X	
Hirundinidae	<i>Petrochelidon ariel</i>	Fairy Martin																						X	
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit	1						1	4													4		

Family	Species	Common Name	A																	B	C				
			Spinifex	Golden Arrow Trans	Golden Arrow Undist	Rose Trans	Salmon Gums	Gimlet South Trans	Palace Rehab	Davyhurst	Gimlet South Undist	Palace Undist	Security	Crossroads	Gimlet South Rehab	Golden Arrow Rehab	Palace Trans	Rose Rehab	Rose Undist	Wendy Gully Rehab	Wendy Gully Trans	Wendy Gully Undist	Floodplains	White Foil	Unknown
Mammals																									
Bovidae	<i>Capra hircus</i>	Goat																							X
	<i>Ovis aries</i>	Sheep																							X
Canidae	<i>Vulpes vulpes</i>	Red Fox																							X
Vespertilionidae	<i>Nyctophilus major</i>	Greater Long-eared Bat						1																	
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr				1	1												1						
	<i>Ningauai ridei</i>	Wongai Ningauai	1																						
	<i>Ningauai sp.</i>	Ningauai Sp.	35	3	22		2			2					1			4		2	17				
	<i>Ningauai yvonneae</i>	Mallee Ningauai	1																						
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus																					1		
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	2	11	15	63	5	14	67		2	12	4	26	32	27	57	143	28	121	100	24	108		
	<i>Sminthopsis crassicaudata centralis</i>	Fat-tailed Dunnart																							
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	63	16	25	5	34	4	2	47	15	36	46	11	2	17	4	2	28	7	4	32	2		
	<i>Sminthopsis sp.</i>	Dunnart Sp.									2														
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum	23	11	32	11	15	23	9	37	62	20	8	17	27	3	8	20	22	9	6	16			
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo																							X
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit							1		1		1			1									X
Muridae	<i>Mus musculus</i>	House Mouse	26	36	2	33	6	62	49	19	25	24	10	18	128	24	47	56	22	181	88	13	31		
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse								1					1										
	<i>Pseudomys albocinereus</i>	Ash-grey Mouse																			1				
	<i>Pseudomys bolami</i>	Bolam's Mouse	9	39	3	19	30	11		49	13	13	1	8	20	35	4	25	24			5	4		
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	8	9	3		9	3		9	5	4		2	5	7			14	2	1	5	2		

- A Thompson, S. (2004) *Mine site rehabilitation index using reptile assemblage as a bio-indicator*. PhD Thesis, UWA and follow up surveys
- B Ninox Wildlife Consulting (2002) *A Vertebrate Fauna Assessment of the Proposed White Foil Haul Road Route Near Kalgoorlie, Western Australia*. Unpublished report for Mines and Resources Pty Ltd, Perth.
- C Incidental records in Terrestrial Ecosystems' fauna survey database.

Appendix B
Definitions of Significant Fauna under the
WA Wildlife Conservation Act 1950
Vertebrate Fauna Assessment – Jaurdi Hills Mining Area

APPENDIX B
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE EPBC ACT AND THE WESTERN AUSTRALIAN
WILDLIFE CONSERVATION ACT 1950

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of ‘Specially Protected Fauna’ declared to be ‘likely to become extinct’ pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F(2) of the Wildlife Conservation Act.

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

CR Critically endangered species

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN Endangered species

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU Vulnerable species

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX Presumed extinct species

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA Migratory birds protected under an international agreement

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD Conservation dependent fauna

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS Other specially protected fauna

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Priority species

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

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

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

P1 Priority 1: Poorly-known species

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

P2 Priority 2: Poorly-known species

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

P3 Priority 3: Poorly-known species

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

P4 Priority 4: Rare, Near Threatened and other species in need of monitoring

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

Appendix C
Results of the *EPBC Act* Protected
Matters Search
Vertebrate Fauna Assessment – Jaurdi Hills Mining Area



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: 29/07/17 16:57:49

[Summary](#)

[Details](#)

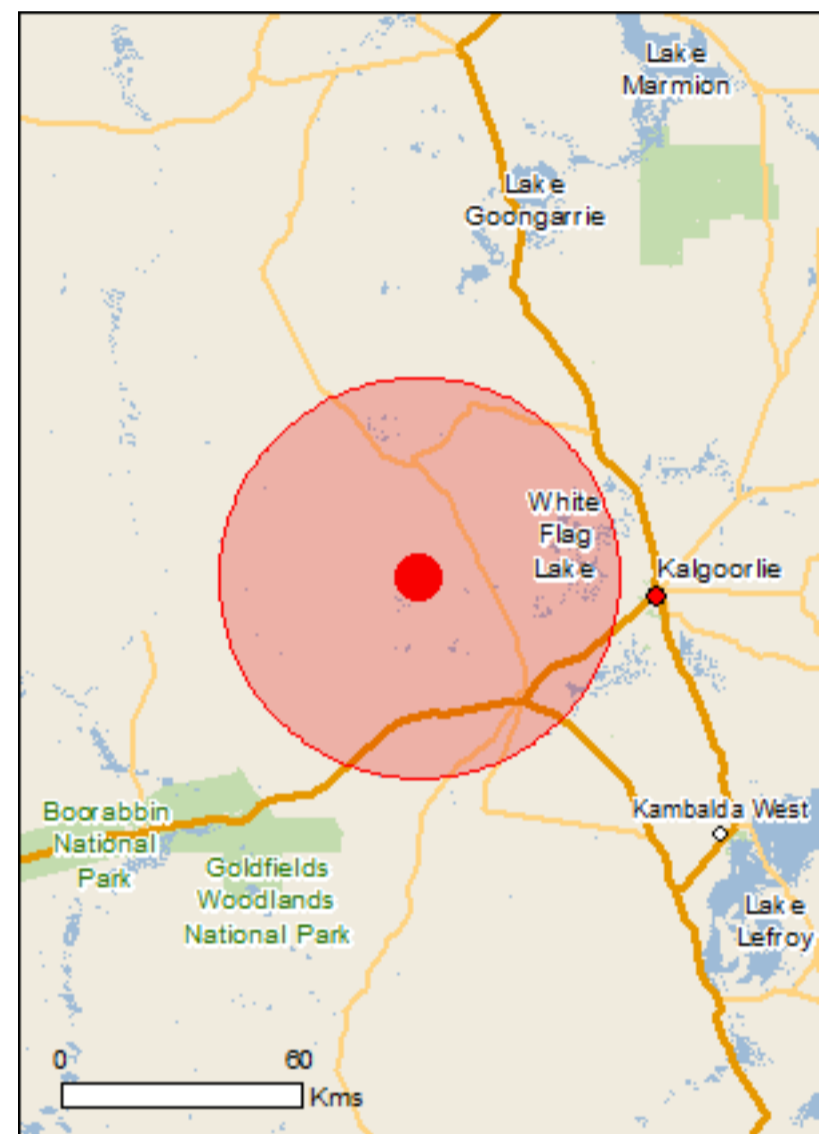
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

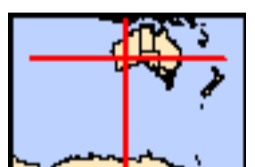
[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 50.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	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>

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Historic		
Goldfields Water Supply Scheme, Western Australia	WA	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area

Insects		
Ogyris subterrestris petrina Arid Bronze Azure [77743]	Critically Endangered	Species or species habitat may occur within area

Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area

Plants		
Gastrolobium graniticum Granite Poison [14872]	Endangered	Species or species habitat likely to occur within area
Ricinocarpos brevis [82879]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species		
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Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

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

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

Name
Commonwealth Land -

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

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Clear And Muddy Lakes	WA
Credo	WA
Goldfields Woodlands	WA
Kangaroo Hills Timber Reserve	WA
Kurrawang	WA
Rowles Lagoon	WA
Scahill Timber Reserve	WA
Wallaroo Rock	WA

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		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

Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area

Reptiles

Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
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Nationally Important Wetlands

Name	State
Rowles Lagoon System	WA

[[Resource Information](#)]

Caveat

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

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

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

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

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-30.71923 120.9388

Acknowledgements

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

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

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

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