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GOLDEN WEST RESOURCES LIMITED

WILUNA WEST IRON ORE PROJECT

LEVEL 2 FAUNA ASSESSMENT SPRING 2011

Prepared for: ***Golden West Resources Limited***

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EXECUTIVE SUMMARY

Golden West Resources Limited ('GWR') proposes to develop an Iron Ore mining operation at Wiluna West. The Wiluna West Project is 100% owned and managed by GWR, with the exception of Mining Lease 53/1078 and Exploration Licence 53/1089. GWR has a Joint Venture agreement with the owners of these tenements, Jindalee Resources with GWR having an 80% holding and Jindalee Resources having a 20% holding. The Wiluna West Project comprises 440 km² of tenements covering a 45 km strike of the Joyners Find Greenstone belt.

The Project is located approximately 700 kilometres northeast of Perth and 40 kilometres west of Wiluna in the north-eastern Goldfields of Western Australia.

In order to pursue mining opportunities at Wiluna West, GWR commissioned Keith Lindbeck and Associates (KLA) to undertake a comprehensive Level 2 fauna assessment of vegetated areas that are likely to be disturbed in the near future.

In accordance with the Environmental Protection Authority (EPA) Statement and Guidelines, multiple seasonal surveys are required. This survey satisfied the requirements for a spring survey, taking advantage of recent, heavy rainfall events.

The scope of work for the fauna assessment was to:

- generally describe the vegetation associations in the study area;
- identify habitat that may be of significance to fauna indigenous to Western Australia;
- identify any habitats of particular conservation significance for fauna within the study area;
- prepare a fauna inventory (baseline information) of the area using a combined approach of desk-top research including a review of existing literature and a site specific, seasonal fauna survey comprising a suite of established survey techniques;
- identify fauna of conservation significance in the area,
- provide a risk assessment to determine potential impacts to fauna of conservation significance; and
- provide recommendations, including the management of perceived impacts to fauna habitats and fauna of conservation significance within the study area.

Results

From a fauna perspective, the vegetation can broadly be described as Mulga shrubland interspersed with areas of BIF. The overall condition of the vegetation within the survey areas can generally be described as 'Very Good' to 'Excellent' (after Keighery 1994).

Pitfall traps, aluminium box traps, funnel traps and cage traps were established in seven trapping grids and four additional satellite sites and were open collectively for a total of 3164 trap nights.

The systematic surveys recorded 25 reptile species, four native terrestrial mammal species, no non-native terrestrial mammal species, five species of bats and 32 bird species, giving a total of 66 vertebrate fauna species.

The reptiles captured comprised five dragon species (Agamidae), six diplodactylid species (Diplodactylidae), one knob-tail species (Carphodactylidae), three gecko species (Gekkonidae), one pygopodid (Pygopodidae), six species of skink (Scincidae), two varanids species (Varanidae) and one elapid (Elapidae) totalling 141 individuals. No reptile species of conservation significance were recorded.

Overall, the trap rate for the survey was reasonable (4.5%) which is not surprising given the warmer temperatures at that time of the year. The numbers of reptile captures between sites did not differ dramatically. However, the least number were captured at the most easterly site (Site 2) that was plagued with ants.

Liopholis kintorei formerly *Egernia kintorei* Great Desert Skink is listed as Vulnerable: Taxa facing a high risk of extinction in the wild in the medium-term future under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 for the area. However, the areas surveyed for proposed mining activities within the Wiluna West Project area are located south of the known distributional range of the Great Desert Skink, in addition to which these areas do no support preferred habitat for the species.

For the terrestrial mammals, four species of native terrestrial mammals representing the Family Dasyuridae netted 14 individuals, and no non-native mammals were captured. The trap rate of 0.44% suggests that at the time of the survey the area supported very low numbers of mammals.

While three species of mammals of conservation significance potentially occur in the area, none and no evidence of any were seen. However, two *Sminthopsis longicaudata* Long-tailed Dunnart were captured at two different sites. *Sminthopsis longicaudata* is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. As demonstrated by the results of this and other surveys regionally, *S. longicaudata* tends to be in low abundance within its distributional range.

Anabat detectors record the presence of bats, rather than the numbers present. Five species of bats were recorded and at all seven sites. Thus, it is reasonable to assume that the diversity of bats present extends throughout the Wiluna West Project area.

The systematic bird censuses yielded a total of 443 individuals of 32 species from 16 Families. One *Turnix velox* Little Button-quail was captured in a pitfall trap that brings these totals collectively to 444 individual birds numbering 33 species from 17 Families.

The results of the 20 minute surveys indicated that passerines (n = 397) represented a majority (90%) of species recorded in the area with only 46 individuals accounting for the non-passerines (10%). This trend was consistent at each site.

Within the passerines, *Artamus personatus* Masked Woodswallow within the Artamidae accounted for more birds (n = 142, 36%) than all other species and *Nymphicus hollandicus* Cockatiel (n = 15) were the most ubiquitous of the non-passerines. The distribution of birds throughout the survey area was markedly different due to the propensity of Masked Woodswallows, with an almost four-fold increase in numbers of this species recorded between sites. That there was no obvious habitat attribute that could account for the large numbers of the Woodswallows at three of the seven sites, there appeared to be no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities. Notwithstanding this, the total number of birds recorded during the systematic sampling suggests that resources and/or habitat required were adequate to maintain the numbers and diversity of avifauna present.

Of the bird species of conservation significance listed for the area, the White-browed Babbler and the Crested Bellbird was seen and/or heard within the survey area. Malleefowl have been known from the Wiluna West area for many years. Two Malleefowl were seen opportunistically during the survey period at the southern section of C Ridge in the area of the active mound. No active Malleefowl mounds were recorded in the area proposed for disturbance in the C3, C4 or Bowerbird deposit areas. The majority of the

mounds identified in these areas appeared not to have been used by Malleefowl for many years.

Evidence of fauna recorded opportunistically that were not recorded during the systematic sampling (including spotlighting) include two amphibian (*Litoria rubella* Little Red Tree Frog and *Cyclorana platycephala* Water-holding Frog), one reptile (*Chelodina steindachneri* Flat-shelled Turtle) and four species of mammal. Both *Macropus robustus* Euro and *Macropus rufus* Red Kangaroo were seen opportunistically and evidence (droppings) of their presence was noted throughout the survey area, albeit sparsely. Evidence of *Oryctolagus cuniculus* Rabbit (droppings) and *Camelus dromedaries* Camel (tracks) were noted and one camel was followed along the main track between B and C Ridges. Many unidentified bats were also heard and seen opportunistically. Opportunistic recordings accounted for an additional nine bird species not recorded during the systematic sampling.

The removal of up to 1,000 hectares of native vegetation collectively from areas C3, C4 and Bowerbird will impact on fauna. However, the vegetation proposed to be removed is not limited to the Wiluna West but is extensive regionally. Cowan (2001) reports that most fauna species in the Project area are wide ranging and usually occur in at least one, and often several, adjoining subregions. Further, fauna of conservation significance that may use this habitat are unlikely to be compromised by the removal of the vegetation for the proposed mining activities.

Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the initial stages (C3, C4 and Bowerbird) of the Wiluna West Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required;
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team to determine the actual number and status of mounds within the C3, C4 and Bowerbird deposit areas including a 100m buffer area.
- Following this survey and given the evidence of Malleefowl within the zone of impact, a referral should be submitted to DSEWPaC for approval in accordance with the EPBC Act 1999.
- Pending the results of the targeted Malleefowl survey and outcome of the DSEWPAC referral, a Malleefowl Management Plan be developed and implemented.
- Develop and implement fire management strategies to protect Malleefowl habitat.
- Develop and implement feral animal control for the protection of Malleefowl adults and chicks.

TABLE OF CONTENTS

Page No.

TABLES

FIGURES

PLATES

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

Golden West Resources Limited ('GWR') proposes to develop an Iron Ore mining operation at Wiluna West. The Wiluna West Project is 100% owned and managed by GWR, with the exception of Mining Lease 53/1078 and Exploration Licence 53/1089. GWR has a Joint Venture agreement with the owners of these two tenements, Jindalee Resources, with GWR having an 80% holding and Jindalee Resources having a 20% holding.

The Wiluna West Project is located approximately 700 kilometres northeast of Perth and 30 kilometres southwest of Wiluna in the north-eastern Goldfields of Western Australia (Figure 1).

The Project comprises 440 km² of tenements covering a 45 km strike of the Joyners Find Greenstone belt. High grade hematite mineralisation occurs within three main Banded Iron Formation (BIF) ridges known as Units A, B and C (Figure 2). GWR have developed a 14 year mining plan that incorporates different areas of both B and C ridges.

In order to pursue mining opportunities at Wiluna West, GWR commissioned Keith Lindbeck and Associates (KLA) to undertake a comprehensive Level 2 fauna assessment of vegetated areas that are likely to be disturbed in the near future, namely in the C3, C4 and Bowerbird deposit areas (Figure 3). This assessment will complement previous surveys undertaken in the area (Ninox 2005, 2006, 2008).

1.2 SCOPE OF STUDY

The Environmental Protection Authority (EPA) (2004) guidelines indicate that multiple, seasonal surveys are required for baseline information. Ninox Wildlife Consulting has conducted three seasonal surveys in the Wiluna West Project area:

- Spring 2005 (Ninox 2005) conducted 31 October – 9 November 2005 including B Ridge and to the north and east of B Ridge
- Spring 2006 (Ninox 2006) conducted 15 – 24 September 2006 along B Ridge and
- Spring 2007 (Ninox 2008) conducted 23 – 31 October 2007 along C Ridge and immediately north of C Ridge (Figure 3).

Given that these surveys were undertaken between four and six years ago, and that GWR now has a more definitive mining plan, KLA was commissioned in August 2011 to undertake a comprehensive Level 2 fauna assessment specifically in the C3, C4 and Bowerbird deposit areas.

The surveys conducted by Ninox (2005, 2006 and 2008) did not include searches for invertebrates. In 2007, a Short-range Endemic Invertebrate (SRE) survey of 25 sites was conducted on the eastern slopes of both C and B Ridge (Figure 4) (ATA Environmental 2007).

Thus, a vertebrate and SRE survey was planned and implemented in accordance with Environmental Protection Authority (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002), Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*" (EPA 2004), Guidance Statement No. 20 "*Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*" (EPA 2009) and "*Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*" (EPA and DEC 2010). The results of the previous vertebrate (Ninox 2005, 2006 and 2008) and

invertebrate (ATA Environmental 2007) surveys were used to provide contextual data for the comprehensive Level 2 survey.

The scope of work for the Level 2 fauna survey in the C3, C4 and Bowerbird deposit areas was to:

- generally describe the vegetation associations in the study area;
- identify habitat that may be of significance to fauna indigenous to Western Australia;
- identify any habitats of particular conservation significance for fauna within the study area;
- develop an inventory of terrestrial vertebrate fauna species and terrestrial SRE species identified from within the survey area using a combined approach of desk-top research including a review of existing literature and a site specific, seasonal fauna survey comprising a suite of established survey techniques;
- assess the inventory in the regional context by comparisons with available data from other localities within the region;
- identify fauna of conservation significance in the area,
- provide a risk assessment to determine potential impacts to fauna of conservation significance; and
- provide recommendations, including the management of perceived impacts to fauna habitats and fauna of conservation significance within the study area.

Figure 1 - Location of Wiluna West Project

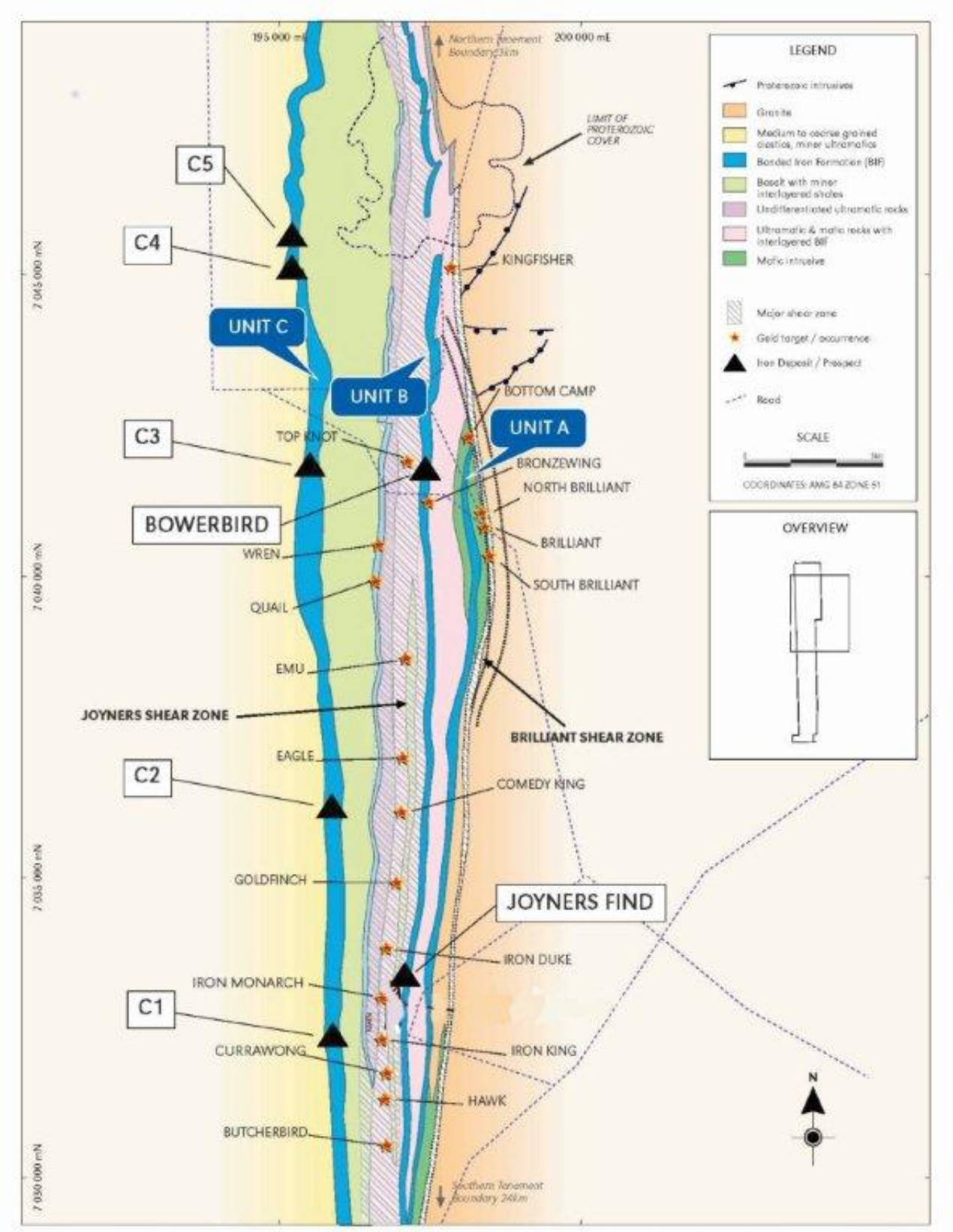


Figure 2 - Regional geology of the Wiluna West Project

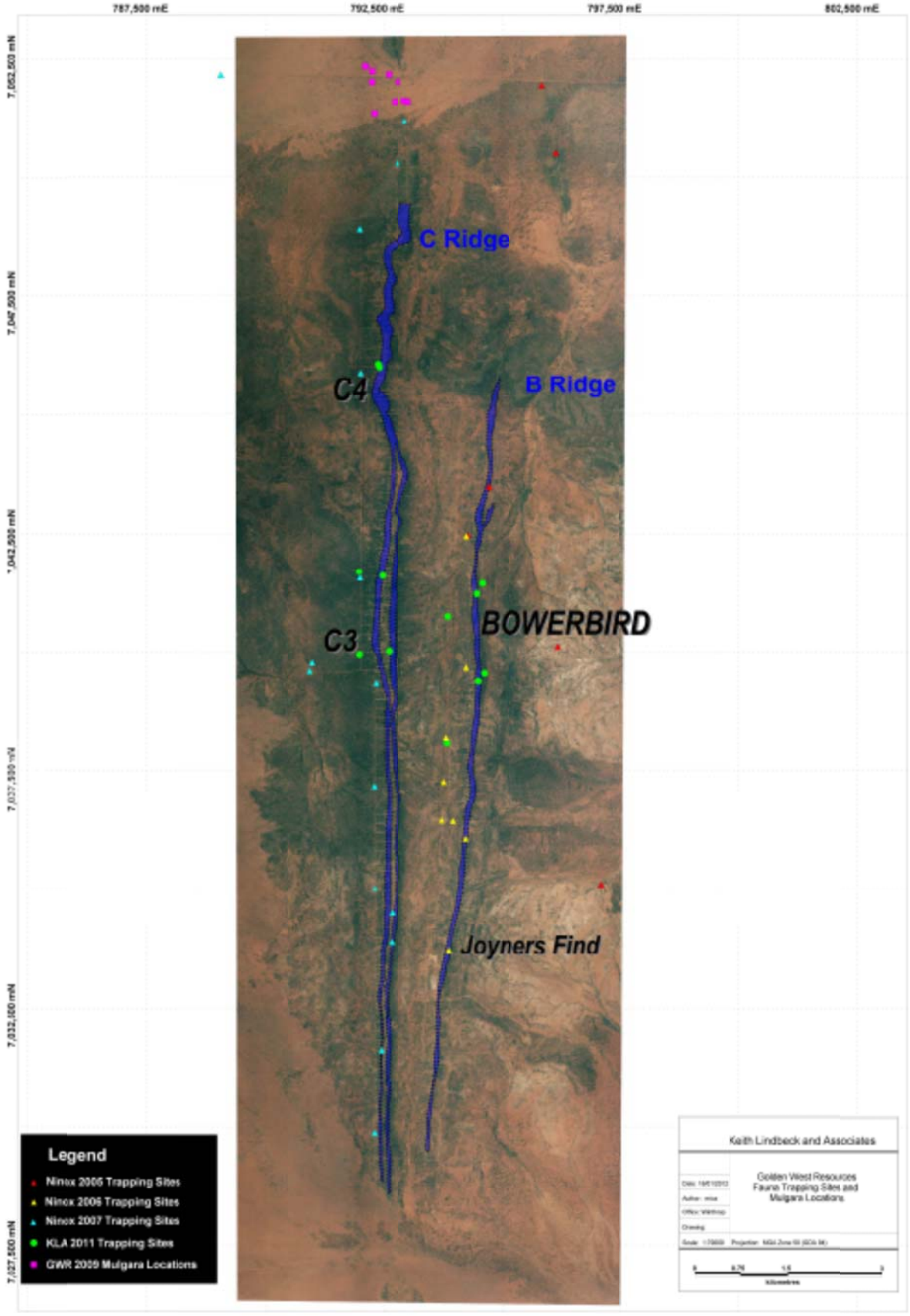


Figure 3 - Location of C3, C4, Bowerbird and vertebrate trapping sites

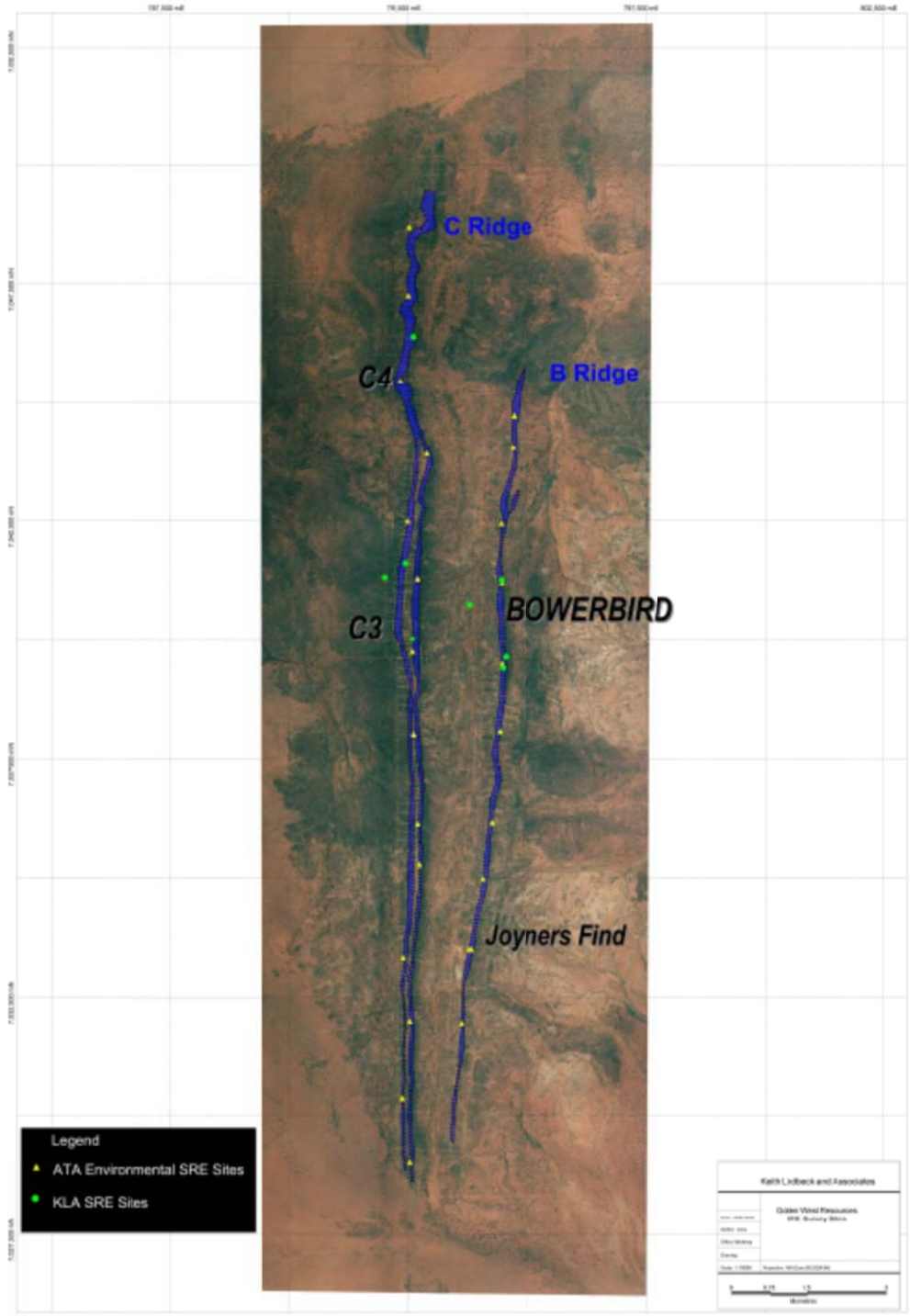


Figure 4 - Location of SRE survey sites

1.3 PURPOSE OF THIS REPORT

This report describes the methodology employed for one seasonal fauna survey of the area encompassing the proposed mining activity and associated disturbances within the C3, C4 and Bowerbird deposit areas. It documents the current knowledge of the potentially-occurring and surveyed fauna in the broader area and provides the results of the Spring 2011 survey conducted in the subject area. It also provides recommendations that include minimising impacts of the proposed project on fauna habitat and assemblages.

The report is intended as a supporting document to accompany GWR's mining approval submissions to satisfy statutory requirements.

The survey is subject to limitations and these are discussed in more detail in the appropriate sections.

2.0 EXISTING ENVIRONMENT

The Wiluna West Project is located approximately 700 kilometres northeast of Perth and 40 kilometres west of Wiluna in the north-eastern Goldfields of Western Australia (Figure 1). The Wiluna West Project area is narrow (~5 km wide) and linear (~40 km long) with the C3 and C4 deposit areas in the northern portion of C Ridge and Bowerbird also in the northern portion of the Project area but on B Ridge (Figure 3).

2.1 CLIMATE

The Wiluna West Project area is located in the Desert Bioclimate which is characterised by 12 months dry with little rain falling in both the summer and winter (Beard 1990).

The nearest official meteorological station is located at Wiluna, approximately 40 km northeast of the survey area. Recordings of the local climatic conditions commenced at Wiluna in 1901 (Bureau of Meteorology 2012) and the data from this station is presented in this report.

2.1.1 Temperature

For Wiluna, the mean annual minimum temperature is 14.3^{o}C and the mean annual maximum temperature is 29.2^{o}C (Figure 5). The coldest month is July (mean minimum temperature 5.4^{o}C), the hottest is January (mean maximum temperature 37.9^{o}C), and diurnal temperature variations are relatively consistent throughout the year (Figure 5).

Mean minimum and maximum temperatures for the survey period were higher with those recorded historically for November. The mean minimum temperature for the November 2011 survey period was 19.2^{o}C, compared to 17.8^{o}C mean minimum recorded over the last 108 years for the area, and the mean maximum temperature for the November survey period (36.6^{o}C) was higher that the long-term average of 34.0^{o}C over the same period of time (Bureau of Meteorology 2012).

Table 1 lists the minimum and maximum temperature recordings for the periods spanning the fauna survey (9 November 2011 to 18 November 2011). Of the recordings, only one (14.1^{o}C) was lower than the mean minimum temperature for November and the long-term mean minimum and the temperature on the second to last day of the survey (39.8^{o}C) was the highest temperature for the whole month of November, and more than 10^{o}C higher than the

long-term annual average.

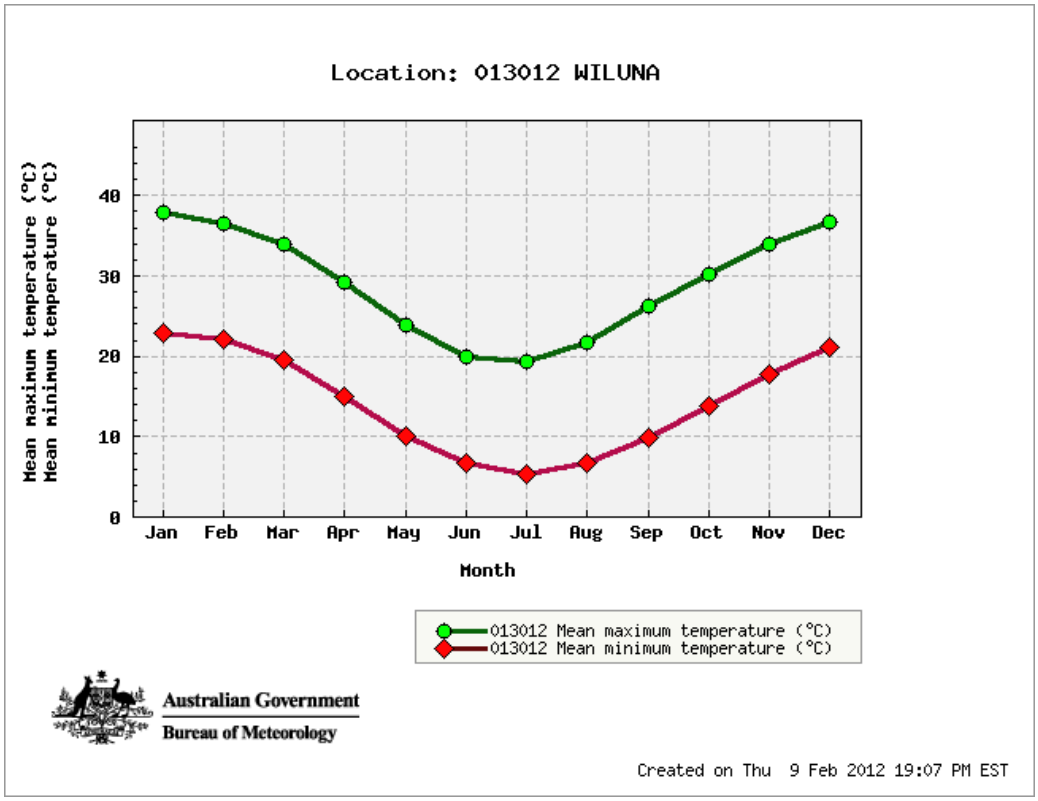


Figure 5 – Mean maximum and minimum temperatures at Wiluna Meteorological Station

Table 1 - Daily temperatures for selected dates in October 2011 for Wiluna

2011	Temperature	
Date	Min °C	Max °C
9-Nov		27.5
10-Nov	14.1	35.5
11-Nov	19.8	39.0
12-Nov	19.0	39.5
13-Nov	18.3	35.5
14-Nov	18.4	36.5
15-Nov	19.4	37.0
16-Nov	21.5	38.8
17-Nov	19.9	39.8
18-Nov	22.0	36.8

2.1.2 Rainfall

The annual average rainfall at Wiluna is 257.3 mm which falls (≥ 1 mm) on approximately 29.1 rain days (Bureau of Meteorology 2012) (Figure 6).

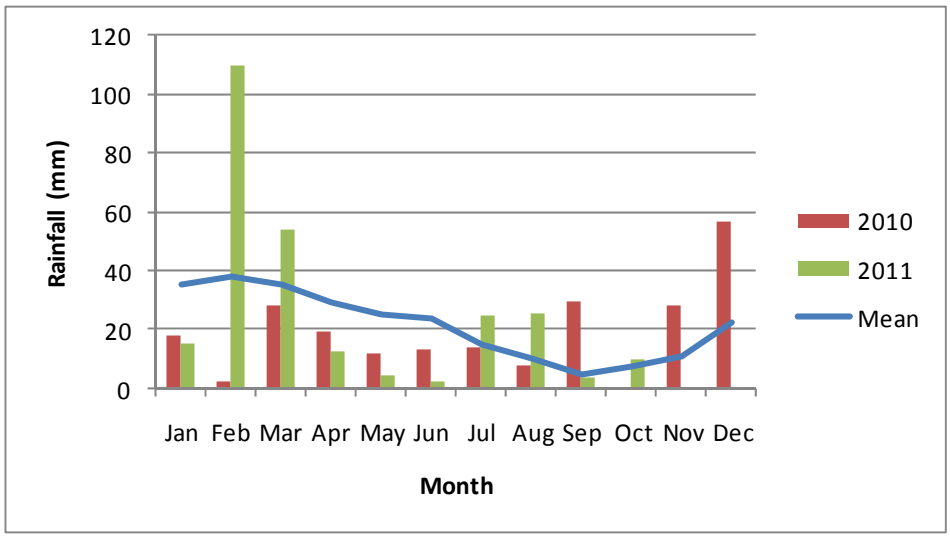


Figure 6 - Rainfall data for the Wiluna Meteorological Station

Rainfall in the preceding 12 months does not conform to long term averages. Excessive rainfall was recorded for November and December 2010 and for February and March 2011. Marginally more than average rainfall was recorded for July, August and October with an average amount (4 mm) recorded for September. For all other months, far less than average rainfall was recorded (Figure 6).

While no rain was recorded during the survey, up to 63.5 mm had already been recorded for the month of November, which has a mean rainfall of 11 mm.

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The Wiluna Project area is located in the Murchison IBRA bioregion within the East Murchison subregion (MUR1) which totals over 7 million hectares (Cowan 2001). The East Murchison subregion lies on the Yilgarn Craton's "Eastern Goldfields" and "Southern Cross" Terrains.

The East Murchison bioregion is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and Halosarcia shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Paleodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

The subregion is rich and diverse in both its flora and fauna. However, most species are wide ranging and usually occur in at least one, and often several, adjoining

subregions (Cowan 2001). Notwithstanding this, known special values in relation to the landscape, ecosystem, species and genetic values in the subregion include:

- Rare Features such as calcrete aquifers in the northern parts that support a large variety of Short Range Endemic (SRE) subterranean aquatic fauna,
- Rare terrestrial species include Great Desert Skink *Egernia kintorei,* Malleefowl *Leipoa ocellata*, Alexandra's Parrot *Polytelis alexandrae* and Mulgara *Dasycercus cristicauda*, Yellow-bellied Black Snake *Pseudechis butleri*, and
- Lake Barlee which represents a most important breeding site for Banded Stilts *Cladorhynchus leucocephalus* and refugia for many other water birds (Burbidge and Fuller 1982 cited in Cowan 2001).

2.3 VEGETATION AND FLORA

The Wiluna West Project Area lies within the Austin Botanical District of the Murchison Region in the Eremean Province as defined by Beard (1990). The vegetation formations in this botanical district can be summarised as mulga (*Acacia aneura*) low woodlands or tall shrublands associated with red loams over siliceous hardpan and scattered mulga and mallee over spinifex hummock grasslands on gently undulating sandplain (Van Vreeswyk 1998).

Recon Environmental was commissioned by Golden West Resources Ltd to map native vegetation communities and identify any significant vegetation communities or Declared Rare Flora/Priority species in the Wiluna West Project area (Read 2010).

No Threatened Ecological Communities (TEC's) as defined by the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999, or DEC were observed in the survey area (Read 2010). However part of the Wiluna West Project area falls within the Priority Ecological Community: Wiluna West (P1).

No plant taxa located in the survey area are gazetted as Declared Rare Flora pursuant to subsection 2 of section 23F of the Wildlife Conservation Act (1950). No plant taxa listed as Threatened pursuant to Schedule 1 of the EPBC Act (1999) were located in the survey area.

No Declared Plants pursuant to Section 37 of the *Agriculture and Related Resources Protection Act, 197*6, as listed by the Department of Agriculture and Food, Western Australia (Read 2010) were observed within the survey area. Six introduced weed species were identified in the survey area.

Fourteen priority flora were recorded in the Wiluna West Project area: four Priority 1 species (*Eremophila congesta*, *Ptilotus astrolasius* var. *luteous*, *Ptilotus chrysocomus*, *Eremophila ?anomala)*, one Priority 2 species (*Beyeria lapidicola*), eight Priority 3 species (*Calytrix uncinata*, *Eremophila arachnoides* subsp. *arachnoides*, *Homalocalyx echinulatus*, *Maireana prosthecochaeta*, *Olearia mucronata*, *Prostanthera ferricola*, *Tribulus adelacanthus*, *Sauropus ramosissimus*), and one Priority 4 species (*Baeckea* sp. Melita Station). All Priority Flora recorded within the survey area are found in other parts of Western Australia and are not restricted to the Wiluna West Project area (Read 2010).

Ten major vegetation units recognised in the areas proposed for disturbance in C3, C4 and the Bowerbird deposit areas are classified into four Types (Read 2010) (Table 2).

Table 2 - Vegetation Types in C3, C4 and Bowerbird deposit areas (after Read 2010)

Type	Description
1	Stony Ironstone Mulga Shrublands on rocky slopes and crests, frequently on BIF
2	Mosaics of *Acacia* over *Triodia* grasslands or low myrtaceous-*Eremophila* shrublands, with isolated mallees of *Eucalyptus kingsmillii* subsp. *kingsmillii*
3	*Acacia aneura*, and less frequently *Acacia balsamea* (P4) and *A. cuthbertsonii* subsp. *cuthbertsonii* tall open shrublands over shrubs including *Scaevola spinescens*, *Senna artemisioides* subsp. *helmsii*, *Eremophila flabellata*, and scattered *Maireana convexa*, *M. georgei*, and *Ptilotus obovatus*
4	Tall open shrubland of *Acacia aneura* and A. *tetragonophylla*, occasionally with isolated emergent trees of *Acacia pruinocarpa,* over a mosaic of shrubland and chenopods.

Following the comprehensive survey conducted by Read (2010), Native Vegetation Solutions (NVS) was commissioned to conduct a targeted Priority Flora survey within the C3, C4 and Bowerbird deposit areas (NVS 2012). Two Priority 1 species (*Eremophila congesta*, *Ptilotus chrysocomus*), no Priority 2 species, three Priority 3 species (*Calytrix uncinata*, *Homalocalyx echinulatus*, *Prostanthera ferricola*), and no Priority 4 species were recorded.

3.0 LITERATURE REVIEW

The Wiluna West Project is located 40 kilometres west of the town of Wiluna which has been the hub of mining activity since the late 1800's. In addition to the surveys conducted in the Wiluna West Project area (Section 1.2), a number of ecological studies have been conducted in the region that provide useful contextual information. A more dated study (Dunlop 1990) has been included for comparison.

The locations of these studies and their descriptions are briefly summarised in Table 3. Fauna recorded from these surveys is included in Appendix A and comparisons are discussed in each section. A survey for Short-range Endemic invertebrates (SREs) was undertaken within the Wiluna West Project area in 2007 (ATA Environmental 2007) and has been included in Table 3

Table 3 - Previous studies in the vicinity of the Wiluna West Project area

Citation	Title	Description of Study	Approximate distance from Wiluna West Project area
Dunlop (1990)	The small vertebrate ground fauna of mulga habitats near Wiluna, Western Australia	Pit trapping with drift lines and opportunistic hand-collection.	~30 km southeast
McKenzie *et al.* (1994)	The Biological Survey of the Eastern Goldfields of Western Australia. Part 10: Sandstone-Sir Samuel and Laverton-Leonora Study Areas	Comprehensive (vertebrate) fauna survey	~100 km southeast
Ninox (2005)	A vertebrate fauna survey of the Wiluna West Project Area, Western Australia	Spring Level 2 terrestrial fauna with trapping sites to the east and north of Bowerbird	Within the Wiluna West Project area
Ninox (2006)	A vertebrate fauna survey of the Wiluna West Project Area #2 Western Australia	Spring Level 2 terrestrial fauna assessment with trapping sites west of Bowerbird	Within the Wiluna West Project area
Ninox (2008)	A vertebrate fauna survey of the Wiluna West Project Area #3 Western Australia	Spring Level 2 terrestrial fauna assessment with trapping sites along the length of C Ridge	Within the Wiluna West Project area
Outback Ecology (2002)	Lake Way Baseline Terrestrial Fauna Studies	Spring Level 2 terrestrial fauna baseline assessment at Lake Way.	~40 km southeast
Outback Ecology (2011)	Toro Energy Wiluna Uranium Project Terrestrial Fauna Assessment 2010	Autumn Level 2 terrestrial vertebrate and invertebrate short-range endemic fauna survey	~40 km southeast
Outback Ecology (2008)	Toro Energy Lake Way Baseline Terrestrial Fauna Survey	Spring Level 2 terrestrial fauna baseline assessment at Lake Way and Centipede project areas.	~40 km southeast
ATA Environmental (2007)	Golden West Resources Wiluna Project. Short Range Endemic Invertebrate Survey	Short-range Endemic Invertebrate survey eastern slopes of B and C Ridges	Within the Wiluna West Project area

4.0 SURVEY METHODOLOGY

Three Level 2 surveys have been conducted previously in the Wiluna West project area (Ninox 2005, 2006, 2008). While it is recognised that these previous vertebrate surveys have only been conducted in Spring, GWR's request (in August) to conduct a survey meant that another survey will be conducted during the spring months, rather than defer for six months to conduct a survey during the autumn months. The results of this survey, together with those of the previous surveys were submitted to the Department of Minerals and Petroleum (DMP) and the Environmental Management Branch (EMB) of the Department of Environment and Conservation (DEC) . Both the DMP and the EMB of the DEC determined that the results of these surveys collectively are sufficient to provide adequate baseline information such that a further autumn\winter survey will not be required. However, the DMP indicated that they may consult with the DEC for a final determination and the EMB of the DEC indicated that the DEC is unable to comment on the adequacy of the SRE surveys as the results were not available at that time. The results have subsequently been sent to the DEC and no response has been received to the time of this publication.

4.1 DATABASE SEARCHES

The online EPBC Protected Matters Search Tool was used to determine any species listed under the EPBC Act 1999 for the area.

A search was commissioned of the Threatened and Priority Fauna Database held by the DEC as recognised under the Western Australian *Wildlife Conservation Act* (WCA) 1950 and considered by the DEC as species of conservation significance.

DEC's *NatureMap* was searched for records of fauna specimens vouchered at the Western Australian Museum and the Birds Australia Atlas Database was searched for bird species listed within the survey area.

A species search was conducted of the International Union for Conservation of Nature (IUCN) database (IUCN 2012) and a search was commissioned of the Western Australian Museum invertebrate database.

Categories and descriptions of the conservation status of fauna species are provided in Appendix B and the results of the databases searches are shown in Appendix A.

4.2 SURVEY TIMING

EPA Guidance Statement No. 56 states that the most important seasonal activity times for many vertebrate faunal groups are related to rainfall and temperature (EPA 2004). A survey in the season that follows the season of maximum rainfall is generally the most productive and important survey time. Therefore, and conventionally, fauna surveys are conducted bi-seasonally in spring and autumn.

The bioclimate of the East Murchison is generally described as desert (Beard 1990). Rainfall is approximately 257 mm per annum and mostly falls over the summer and autumn months (December – June) (Section 2.1). Rainfall in the preceding 12 months does not conform to long term averages. In the previous six months, marginally more than average rainfall was recorded for July, August and October with an average amount (4 mm) recorded for September (Figure 6). For all other months, far less than average rainfall was recorded. However, 63.5 mm of rain was recorded in the first week of November, compared with a mean of 11 mm of rain for November. Timing of the survey was, therefore, optimal being undertaken during the spring months following a recent

maximum rainfall event.

The vertebrate fauna survey was conducted over a ten-day period from 9 November to 18 November 2011.

Given the logistics and financial burden of conducting comprehensive fauna survey, invertebrates surveys are often conducted at the same time as vertebrate surveys. EPA Guidance Statement No. 20 states that SRE taxa are easier to locate and collect during seasonally wet conditions (EPA 2009). The optimal survey period in the Wiluna area (Goldfields, Mid-West, north) is generally in relation to the cyclone season which extends from November to April (EPA 2009). While there was no cyclone activity immediately prior to or during the survey period, 63.5 mm of rain was recorded over three days during the first week of November. Thus, the survey for SRE's was well timed.

4.3 FAUNA SURVEY TEAM

The team assisting with the establishment of the trapping grids and conducting the Autumn 2011 survey comprised Dr Vi Saffer, Erica MacIntyre and Hamish Burnett from KLA. Mark Peddey from Orbit Drilling assisted with the mechanical digging of the holes for the pit traps, Miles Tarbotton and Gary Green from Wiluna West assisted with the installation of the trapping equipment (first two days of the survey).

A "LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES" SF008258 was issued to Dr Vi Saffer as an instrument under Regulation 17 of the *Wildlife Conservation Act 1950* to undertake this survey (Appendix C). Authorised persons associated with the licence included Erica MacIntyre and Hamish Burnett.

Analysis of bat recordings was completed by Dr Kyle Armstrong and Yuki Konishi of 'Specialised Zoological'.

Taxa specialists at the Western Australian Museum identified vouchered specimens (Burger *et al.* 2012 and Volschenk (2012).

4.4 FAUNA SAMPLING

As per the recommendations of the EPA (2004) and EPA and DEC (2010), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia* for herpetofauna and mammals and Christidis and Boles (2008) for avifauna. The authorities used for herpetofauna are Doughty and Maryan (2010) and for mammals How *et al*. (2010).

Nomenclature and taxonomic order for invertebrates follows that as provided by the Western Australian Museum.

KLA acknowledges that the taxonomy of Western Australia vertebrates and invertebrates is continually being revised and the taxonomy of some of the species listed in the document might have changed since the publication of this report.

4.4.1 Reconnaissance survey

In accordance with EPA Position Statement No. 3 (EPA 2004), a reconnaissance survey was conducted. Two half days and one full day (2 November to 4 November) were spent by Dr Vi Saffer and Ms Erica MacIntyre within the Wiluna West Project area to delineate key fauna values, to determine fauna habitat types and to determine potential trapping site locations.

Twelve species of birds were identified during the reconnaissance survey and are listed in Appendix A. One active Malleefowl mound was inspected during the survey and was recorded (Section 5.5).

4.4.1 Trapping site selection

In order to take advantage of recent rainfall events, Wiluna commissioned KLA to conduct a comprehensive Level 2 fauna survey in spring 2011. An attempt was made to sample terrestrial vertebrate fauna in representative vegetation communities along the length of the areas proposed for disturbance, and replicate these within the major groups where possible. The locations of previous trapping sites (Ninox 2006, 2008) in these areas was also considered. The comprehensive vegetation survey of the Wiluna West Project area recently completed (Read 2010) together with aerial images was used to provide some indication of where trapping grids would preferentially be sited. In addition, selective trapping was conducted in areas of BIF where it was not possible to install conventional pit traps. Thus, seven 'conventional' trapping grids (Sites 1 to 7) were established with one within the proposed C4 deposit area (Site 1) and Sites 2 to 7 in the C3 and Bowerbird deposit areas and associated infrastructure (Table 4)(Figure 7). In additional, four smaller satellite sites (Sites 8 to 11) were located in areas of BIF (Table 4) (Figure 7). Thus, it is reasonable to suggest that the major vegetation units within the specific areas subject of this comprehensive survey were adequately sampled.

Table 4 - Vegetation type, unit and condition at trapping locations

Site	Vegetation Type*	Vegetation Unit	Condition **
1	4	*Acacia* shrubland	Very Good
2	3	Tall open *Acacia* shrubland over sparse understory	Very Good to Excellent
3	3	*Acacia* shrubland over *Eremophila* spp. and patch of *Aluta maisonneuvei* subsp. *auriculata*	Very Good to Excellent
4	2	*Acacia* shrubland with occasional *eucalypts*	Very Good
5	3	Tall open *Acacia* shrubland	Excellent
6	2	*Acacia* shrubland over *Eremophila* spp., *Triodia* sp. and scattered eucalypts	Excellent
7	2	*Acacia* shrubland over *Eremophila* spp., *Triodia* sp. and scattered eucalypts	Excellent
8	1	BIF in association with *Acacia* shrubland	Very Good to Excellent
9	1	BIF in association with *Acacia* shrubland	Very Good to Excellent
10	1	BIF in association with *Acacia* shrubland	Very Good to Excellent
11	1	BIF in association with *Acacia* shrubland	Very Good to Excellent

* In accordance with Read (2010)

** In accordance with Keighery (1994)

In accordance with the Keighery (1994) vegetation condition scales (Appendix D), the overall condition of the vegetation within the survey area can generally be described as 'Very Good' to 'Excellent' (Table 4). Almost all disturbances within the area were directly related to vehicular tracks associated with recent exploration activity. While every attempt was made to locate sampling sites in areas of least disturbance, access and practicality resulted in most sites being within close proximity to vehicular tracks or existing disturbance.

Table 4 lists the eleven sampling areas and their respective vegetation associations and Plates 1 to 11 provide photographic representation of the trapping areas.

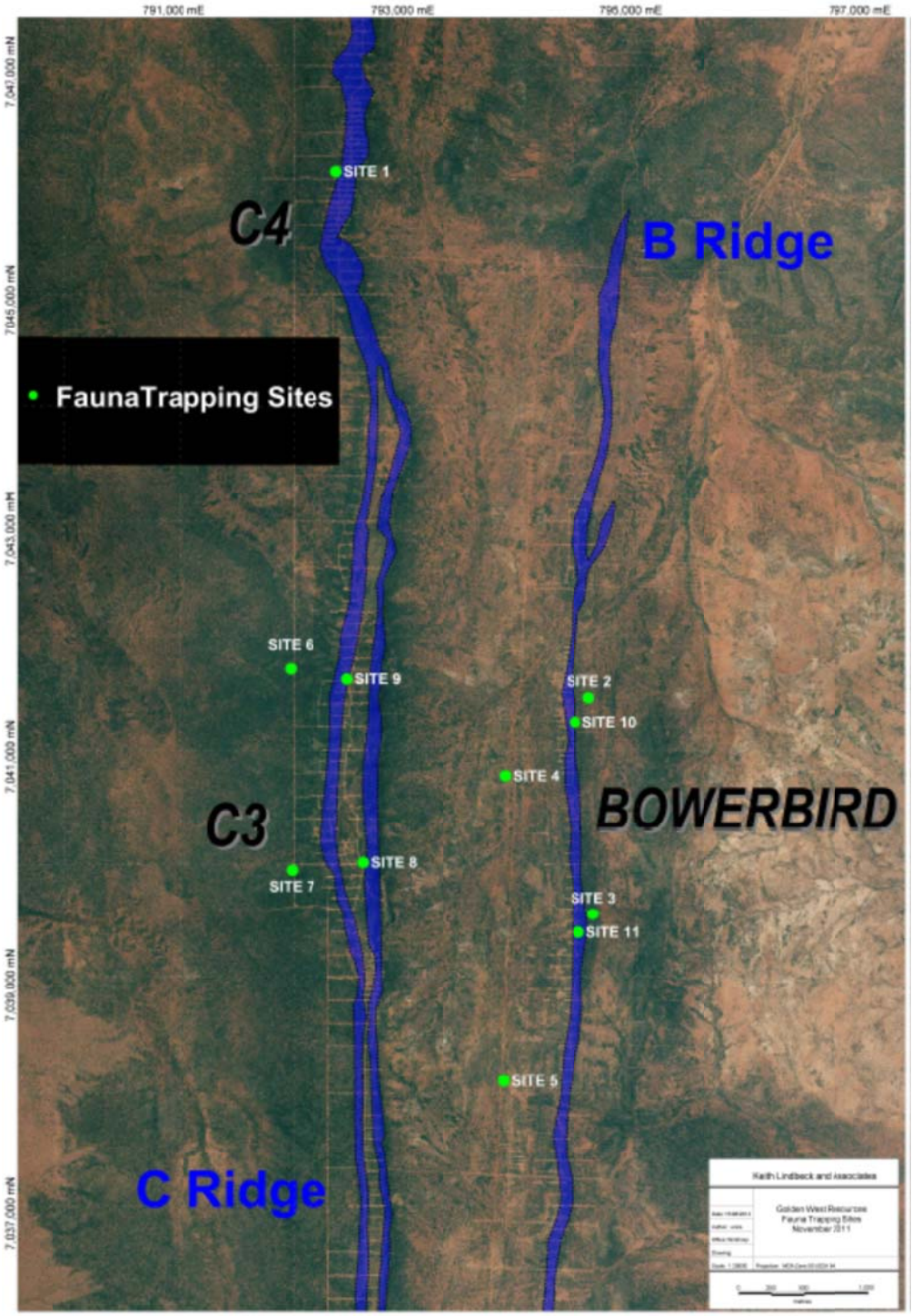


Figure 7 - Location of vertebrate trapping sites

Plate 1 - Site 1 *Acacia* shrubland

Plate 2 - Site 2 Tall open *Acacia* shrubland

Plate 3 - Site 3 *Acacia* shrubland over *Eremophila* spp. and patch of *Aluta maisonneuvei* subsp. *auriculata*

Plate 4 - Site 4 Acacia shrubland with occasional eucalypts

Plate 5 - Site 5 Tall open *Acacia* shrubland

Plate 6 - Site 6 *Acacia* shrubland over *Eremophila* spp., *Triodia* sp. and scattered eucalypts

Plate 7 - Site 7 *Acacia* shrubland over *Eremophila* spp., *Triodia* sp. and scattered eucalypts

Plate 8 - Site 8 Banded Iron Formation in association with *Acacia* shrubland

Plate 9 - Site 9 Banded Iron Formation in association with *Acacia* shrubland

Plate 10 - Site 10 Banded Iron Formation in association with *Acacia* shrubland

Plate 11 - Site 11 Banded Iron Formation in association with *Acacia* shrubland

4.4.2 Systematic censuring of terrestrial vertebrate fauna

The extensive diversity of Australia's terrestrial habitats is such that no single approach accurately samples all species within a community (Garden *et al.* 2007). It is acknowledged that surveys aimed at detecting multiple species must employ a suitable combination of survey methods (see Garden *et al.* 2007).

In order to maximise the capture rate of diverse vertebrate faunal species, systematic fauna sampling was undertaken using four trapping techniques:

- Pitfall traps (20 L buckets buried in the ground with the rims flush with the ground surface),
- Funnel traps,
- Elliot-type aluminium box traps (8cm x 9 cm x 32 cm), and
- Medium and large cage traps.

The systematic fauna sampling consisted of seven trapping grids (Sites 1 to 7) and an additional four smaller sites (Sites 8 to 11) located within the area proposed to be disturbed at C3, C4 and Bowerbird (Figure 3 and Figure 7). The additional smaller sites were located within areas of BIF where the use of conventional trapping grids was not achievable.

Trapping grids conventionally comprised 20 pitfall traps, 20 funnel traps, 16 aluminium box traps in a four by five configuration with four large cage traps at each corner (Figure 8 and Figure 9). This pattern was achieved for four of the seven trapping grid sites. For the remaining sites, two rows of ten trapping units were installed (Figure 8 and Figure 10). A 6m x 30cm drift line fence was extended over all buckets at all sites to increase the efficacy of the pitfall traps. In spite of the use of mechanical equipment, six holes could not be excavated deep enough to accommodate a 20 L bucket. In these instances, additional funnels traps were installed. Further, up to ten pitfall traps had to be closed

during the survey due to the presence of excessive ants. In these instances additional funnels traps were used. These changes are reflected in Table 5.

The four smaller sites (Sites 8 to 11) consisted of three pairs of traps at each site with two pairs comprising an aluminium box trap, a funnel trap and medium cage trap and the third pair comprising an aluminium box trap and a large cage trap.

All traps were open for seven consecutive nights, overlapping for nine nights. The overall trapping effort is shown in Table 5.

All traps were checked as soon after sunrise as possible each morning. Universal bait was placed in all aluminium box traps and cage traps and renewed at least once during the survey, and when required.

In addition to the above trapping techniques, two Bushnell Trophy Cam™ Remote Cameras were deployed with each camera left *in* situ at each site for 24 hours on a rotational basis (Table 6). One camera was also left at the active Malleefowl mound at the south of C Ridge, outside of the current survey area. At each of the trapping grids, the cameras were secured to a star picket just above ground level and in the BIF areas, the cameras were strategically positioned using rocks to stabilise the units. The cameras were operated in accordance with the DEC's Standard Operating Procedure for *Remote operation of cameras* (DEC 2011).

Opportunistic observations were carried out when inspecting traps on site, when travelling between sites and when conducting bird surveys in the area. Hand-foraging for reptiles was conducted opportunistically and during spot-lighting forays and included turning over rocks and logs, peeling off bark, *etc.*

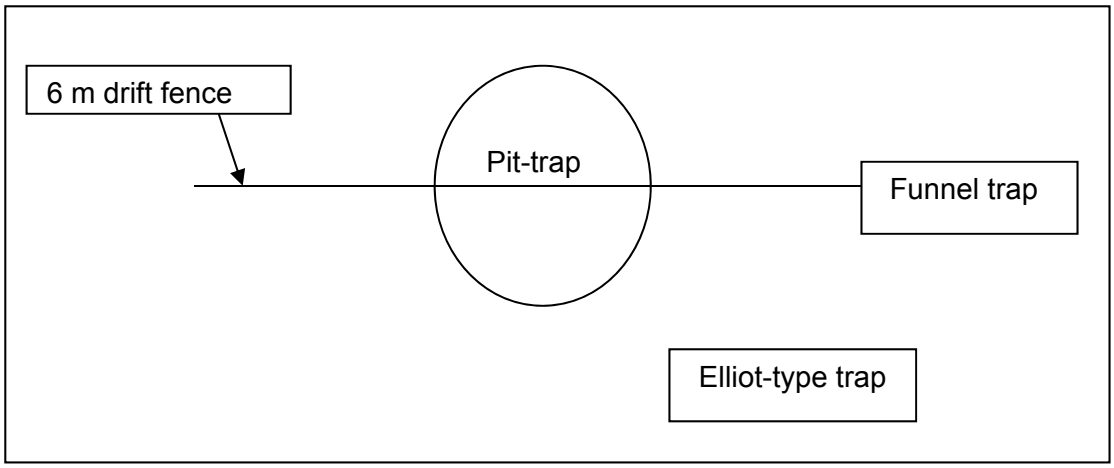


Figure 8 - Schematic diagram of trapping unit

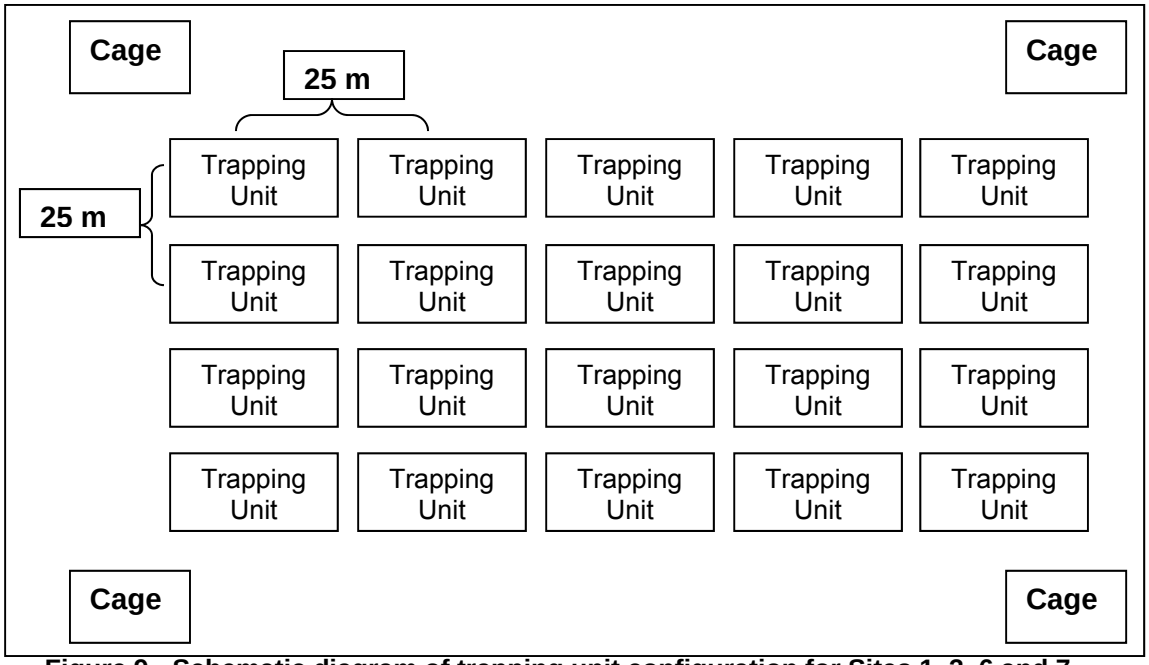
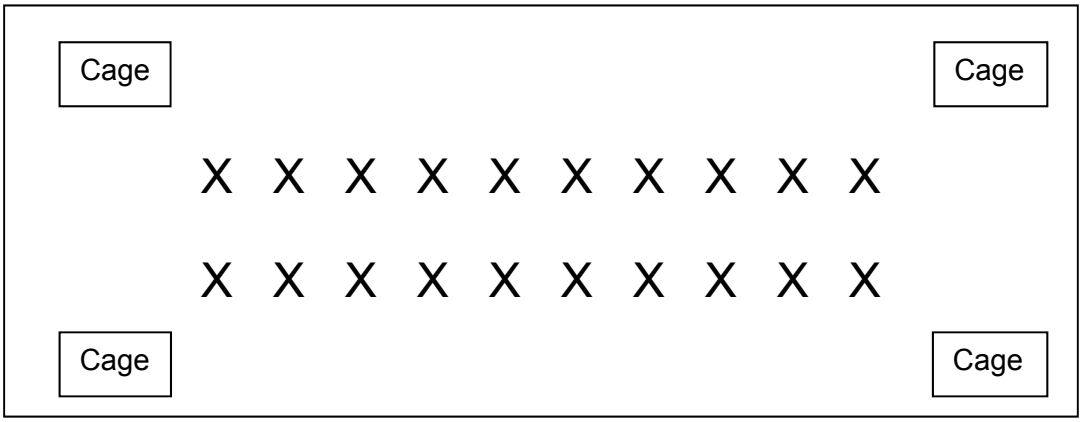


Figure 9 - Schematic diagram of trapping unit configuration for Sites 1, 3, 6 and 7



X = Trapping Unit

Figure 10 - Schematic diagram of trapping unit configuration for Sites 2, 4 and 5

Table 5 - Trapping grid locations and trapping effort

Spring survey (November 2011)						
Site	Location	Trap type	Date opened	Date closed	Nights Open	Total trapping effort
Site 1:	S26 40 36.5	Pit	9-Nov	15-Nov	7	140
	E119 56 16.7	Funnel	9-Nov	15-Nov	7	140
		Elliot-type	9-Nov	15-Nov	7	112
		Cage (large)	9-Nov	15-Nov	7	28
Site 2:	S26 43 02.2	Pit	10-Nov	16-Nov	7	103
	E119 57 39.4	Funnel	10-Nov	16-Nov	7	177
		Elliot-type	10-Nov	16-Nov	7	112
		Cage (large)	10-Nov	16-Nov	7	28
Site 3:	S26 44 03.7	Pit	10-Nov	16-Nov	7	96
	E119 57 42.4	Funnel	10-Nov	16-Nov	7	184
		Elliot-type	10-Nov	16-Nov	7	112
		Cage (large)	10-Nov	16-Nov	7	28
Site 4:	S26 43 24.9	Pit	9-Nov	15-Nov	7	133
	E119 57 13.7	Funnel	9-Nov	15-Nov	7	147
		Elliot-type	9-Nov	15-Nov	7	112
		Cage (large)	9-Nov	15-Nov	7	28
Site 5:	S26 44 51.5	Pit	10-Nov	16-Nov	7	138
	E119 57 15.4	Funnel	10-Nov	16-Nov	7	142
		Elliot-type	10-Nov	16-Nov	7	112
		Cage (large)	10-Nov	16-Nov	7	28
Site 6:	S26 42 56.0	Pit	11-Nov	17-Nov	7	140
	E119 56 04.9	Funnel	11-Nov	17-Nov	7	140
		Elliot-type	11-Nov	17-Nov	7	112
		Cage (large)	11-Nov	17-Nov	7	28
Site 7:	S26 43 53.0	Pit	11-Nov	17-Nov	7	140
	E119 56 06.8	Funnel	11-Nov	17-Nov	7	140
		Elliot-type	11-Nov	17-Nov	7	112
		Cage (large)	11-Nov	17-Nov	7	28
					Sub-total	2940

Site 8:	S26 43 50.4	Elliot-type	11-Nov	17-Nov	7	21
	E119 56 29.2	Funnel	11-Nov	17-Nov	7	14
		Cage (medium)	11-Nov	17-Nov	7	14
		Cage (large)	11-Nov	17-Nov	7	7
Site 9:	S26 42 58.5	Elliot-type	11-Nov	17-Nov	7	21
	E119 56 22.8	Funnel	11-Nov	17-Nov	7	14
		Cage (medium)	11-Nov	17-Nov	7	14
		Cage (large)	11-Nov	17-Nov	7	7
Site 10:	S26 43 09.3	Elliot-type	11-Nov	17-Nov	7	21
	E119 57 35.1	Funnel	11-Nov	17-Nov	7	14
		Cage (medium)	11-Nov	17-Nov	7	14
		Cage (large)	11-Nov	17-Nov	7	7
Site 11:	S26 44 09.1	Elliot-type	11-Nov	17-Nov	7	21
	E119 57 37.9	Funnel	11-Nov	17-Nov	7	14
		Cage (medium)	11-Nov	17-Nov	7	14
		Cage (large)	11-Nov	17-Nov	7	7
					Sub-total	224
					GRAND TOTAL	3164

Table 6 - Dates and Sites of remote camera placement during 2011 Spring survey

Site	Unit 1	Unit 2
1	14-Nov	
2	15-Nov	
3	16-Nov	
4		16-Nov
5	12-Nov	
6	13-Nov	
7		12-Nov
8		11-Nov
9	12-Nov	
10		14-Nov
11		15-Nov

4.4.3 Birds surveying

Surveying of birds was carried out using a combination of techniques including:

- Four, 20 minute, 2 ha surveys at each of the seven trapping grid sites in accordance with Atlas Search Methods for the Atlas of Australian Birds.
  Censuses were commenced as soon after sunrise as practicable and commencement was rotated through the sites to reduce time of day bias where practicable (Table 7).
- Opportunistic observations when inspecting traps on site, when travelling between sites and in the area, and when conducting other surveys in the area.

Table 7 - Dates and times systematic birds censuses commenced at each site

Date:	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	**Total (mins)**
Site	Time commenced (hrs)*								
1	0755	0715	0605		1030				80
2	0855	0820	0645	0605					80
3	0940		0735	0710	0625				80
4	0650	0610	0855	0800					80
5	0600	1025	0840	0805					80
6					0945	0645	0610	0725	80
7				0955	0915	0615	0645		80
Total									**560**

* Censuses continued for 20 minutes at each site.

4.4.3.1 Malleefowl Mound audit

As part of the comprehensive fauna assessment, KLA was provided with the co-ordinates of 28 Malleefowl mounds that had been recorded previously both within and outside of the areas likely to be disturbed in the near future, namely in the C3, C4 and Bowerbird deposit areas. Using these GPS co-ordinates, an audit was conducted to determine the status of all 28 mounds. Approximate size and age of the mounds (years since last use) were also estimated.

Opportunistic observations of Malleefowl mounds were also undertaken during the entire period of the fauna assessment, when inspecting traps on site, when travelling between sites and in the area, and when conducting other surveys in the area.

4.4.4 Bat surveying

Bat echolocation calls were recorded using Anabat SD1 detectors, which detect and record ultrasonic echolocation calls emitted during bat flight. Two Anabat detectors were used and were positioned on the ground in each trapping grid site before sunset and retrieved the following morning. Table 8 lists the dates that bat recordings were taken at each site.

The calls were stored on a compact flash card, downloaded and sequences were examined using AnalookW software.

Table 8 - Dates bat calls were recorded at each site during the 2011 survey

Site	Unit 1	Unit 2
1	16-Nov	10-Nov
2	11-Nov	16-Nov
3	12-Nov	11-Nov
4	10-Nov	13-Nov
5	13-Nov	12-Nov
6	15-Nov	14-Nov
7	14-Nov	15-Nov

4.4.5 SRE surveys

Invertebrate groups targeted during the survey were those considered most likely to potentially contain SRE taxa including:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pseudoscorpionida (pseudoscorpions); and
- Pulmonata (land snails).

In accordance with generic advice from the Office of the EPA (OEPA), 10 m x 10 m quadrats were established and up to one hour was spent searching for invertebrates in each of these quadrats. A total of ten quadrats were established with five within 50 m of each of the BIF sites and five within 50 m of the vertebrate trapping sites. Searches were conducted primarily on the south-eastern aspect within the landscape including at the bases of trees, rocks and in gullies *etc.* and included searching under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground.

All specimens were collected in accordance with Western Australian Museum guidelines. For example, spiders were placed in a freezer for approximately 10 minutes to sedate them. They were then placed in cold 75% or 100% Ethanol to narcotise them before the third left leg was removed and placed in a separated vial of 100% ethanol.

In addition to the above searches, a collection of leaf litter and soils was collected from each quadrat and transferred back to Perth for examination. Collections were made from shadowed moist areas, for example, from the south eastern aspect of the bases of tree trunks, large rocks or overhanging rocks etc*.* Large particles were removed and the remaining collection was examined under a 10X20 Dissecting Microscope. All invertebrate fauna or parts thereof were collected and preserved in accordance with the Western Australian Museum guidelines and sent to appropriate specialists at the Museum for identification.

Searches were also conducted for invertebrates during the spotlighting surveys (Section 4.4.6). In addition to generally searching for SRE's during spotlighting forays, a 390nm Ultraviolet Lantern was used to detect and collect scorpions that fluoresce under UV light (Plate 12).

Specific pitfall traps for invertebrates were not installed. However, invertebrates are known to be captured in pitfall traps installed for vertebrate fauna. Up to 134 pitfall traps were open for seven consecutive nights resulting in 938 trap-nights.

Plate 12 - Scorpion sp. detected under UV light

4.4.6 Spotlighting survey

Spotlighting was conducted from a slow-moving vehicle (~ 10 km/hr) using high-powered hand-held spotlights and commenced at least one hour after sunset. In addition, spotlighting forays with head-torches were conducted twice on foot for approximately 15 minutes each during each spotlighting evening. Spotlighting was conducted on two evenings during the survey with a total of 14 hours spent spotlighting (Table 9).

Searches for both vertebrate and invertebrate taxa were undertaken during these forays and included searching in rock crevices, under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground.

Spotlighting was conducted immediately adjacent to and within 10 km of all sites.

Table 9 - Dates and duration of spotlighting forays, including numbers of personnel involved

Date	Time commenced (hrs)	Duration	Number of observers, including driver	Total (hrs)
12-Nov	1920	2 hr 10 min	3	6.5 hr
14-Nov	1920	2 hr 30 min	3	7.5 hr
TOTAL				**14 hrs**

4.5 SURVEY LIMITATIONS

Not all areas within the Wiluna West Project area were ground-truthed or sampled equally for fauna. Vehicular access, road conditions and rocky terrain prevented sampling in the centre of all associations, and regular checking of fauna traps in these areas would, therefore, not have been possible. Notwithstanding this, seven trapping grids were located within the C3, C4 and Bowerbird deposit areas, in addition to four satellite sites that were located on the BIF ridges.

As indicated above (Section 4.2.2), not all sites could accommodate the same trapping grid pattern. Where buckets could not be installed, other grid patterns and trapping techniques (funnels and medium-sized cages) were used so that the overall trapping effort was not compromised. Similarly, where ants became a problem, a lid was secured onto the bucket in each instance and an additional funnel was used instead.

5.0 VETEBRATE FAUNA INVENTORY

5.1 OVERVIEW OF VERTEBRATE FAUNA OF THE SURVEY AREA

Overall, 154 individuals from 29 non-volant terrestrial species were captured during the systematic sampling, in addition to one bird species that was captured in a cage trap at Site 7. Of the bird species, 443 individuals representing 16 Families were recorded during the systematic sampling.

Figure 11 provides a visual representation of the number of fauna recorded from each major vertebrate group and Table 10 provides a summary of the number of species recorded for each of the seven trapping grid sites and four additional satellite sites. A summary of all species known and likely to be present in the survey areas is provided in Appendix A. This includes a summary of all the results of the data searches, all species recorded during regional surveys, all species recorded during the reconnaissance survey and all species recorded during the systematic sampling, opportunistic sightings and evidence, and spotlighting.

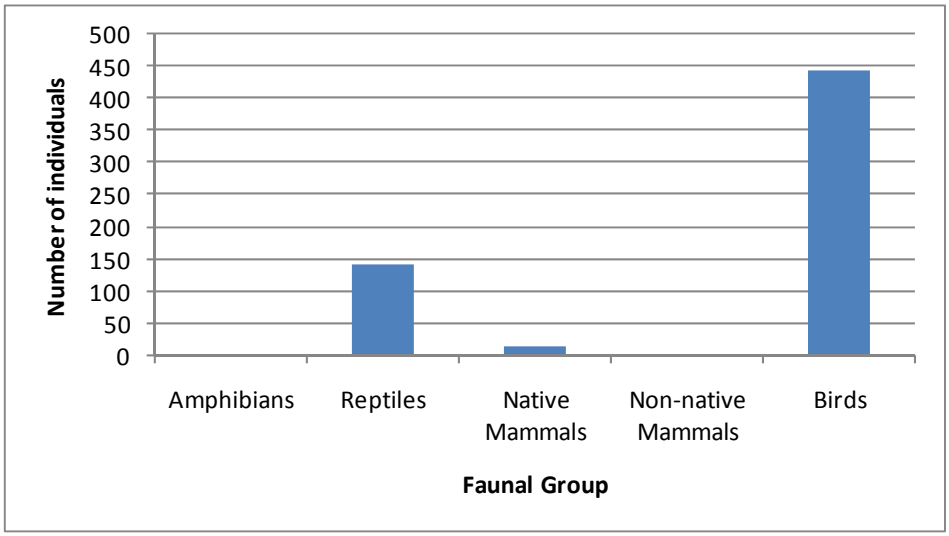


Figure 11 - Number of individual terrestrial vertebrates recorded during the systematic surveys

Table 10 - Number of individual terrestrial vertebrates recorded at each site

Faunal group	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11		Total
Reptiles	**24**	**14**	**19**	**18**	**25**	**22**	**17**	**1**	**1**	0	0		**141**
Native mammals	**1**	0	**1**	**5**	**1**	**2**	**3**	**0**	**0**	**0**	**0**		**13**
Non-native mammals	0	0	0	0	0	0	0	0	0	0	0		**0**
Birds Caged	0	0	0	0	0	0	**1**	0	0	0	0		**1**
Total	**25**	**14**	**20**	**23**	**26**	**24**	**21**	**1**	**1**	**0**	**0**		**155**

5.2 AMPHIBIANS

5.2.1 The assemblage

No frog species were captured during the systematic survey period.

However, *Litoria rubella* Little Red Tree Frog was heard and seen opportunistically and both *L. rubella* and *Cyclorana platycephala* Water-holding Frog were heard and then seen during a spotlighting foray.

5.2.2 Discussion

No amphibian species of conservation significance are listed for the area using the EPBC Protected Matters Search Tool, or are on the DEC Threatened and Priority Fauna Database list or are listed on the IUCN Red List of Threatened species (IUCN 2012). No amphibian species have been vouchered at the Western Australian Museum for this area.

Amphibians generally are extremely under-represented in field surveys. Collectively, only six species of frogs from two Families (Hylidae and Limnodynastidae) have been recorded during all previous regional surveys. While *L. rubella* (Family: Hylidae) was recorded during three of the regional surveys (Dunlop 1990, Ninox 2005, Outback Ecology 2002), *C. platycephala* (Family: Hylidae) was recorded in only one of the regional surveys (McKenzie *et al.* 1994). Of the species not recorded during the present survey, *Cyclorana maini* (Family: Hylidae) was recorded in only one other survey (McKenzie *et al.* 1994) and two of the three species of burrowing ground frogs (*Neobatrachus* sp. and *N. wilsmorei*), Family: Limnodynastidae) were recorded by Dunlop (1990) and the remaining species (*N. kunapalari*) was only recorded by McKenzie *et al.* (1994).

The Wiluna West Project area has no granite outcrops or natural permanent water source. Any water on the ground is the result of episodic rainfall and does not remain *in situ* for very long. Therefore, the species of frogs which would inhabit such an environment tend to be burrowing species which have evolved to aestivate during dry conditions when little water is around. While *Litoria rubella* is likely to use cracks and crevices during drier conditions, *Cyclorana platycephala* is recognised as a burrowing species that encases itself in a special mucous membrane which slows water loss and allows it to survive underground until the next rainfall event moistens the ground and water pools on the surface.

Given the topography of the Project area, ephemeral pools of water depend on local rainfall and do not form consistently at any one location following rainfall events. Notwithstanding this, the Wiluna West Project area does support some habitat for some species of frogs.

5.3 REPTILES

5.3.1 The assemblage

Twenty-five species of reptiles were captured from all sites totalling 141 individuals from eight Families (Table 11 and Appendix A). The reptiles captured comprised five dragon species (Agamidae), six diplodactylid species (Diplodactylidae), one knob-tail species (Carphodactylidae), three gecko species (Gekkonidae), one pygopodid (Pygopodidae), six species of skink (Scincidae), two varanids species (Varanidae) and one elapid (Elapidae).

Species from four Families accounted for 91% of the reptiles captured and included the agamids which were the most ubiquitous (n = 40, 28.4%), followed by the geckoes (n = 33, 23.4%), skinks (n = 29, 20.6%) and the diplodactylids (n = 26, 18.4%). Nine varanids represented 6% on the reptiles captured and the remaining species (n = 4) represented less than 3% of all reptiles captured collectively: two knob-tailed geckoes *Nephrurus vertebralis* (Plate 13) were captured at Site 1, and Site 7 produced one *Delma butleri* (Pygopodidae) and one *Brachyurophis approximans* (Elapidae).

Plate 13 - *Nephrurus vertebralis*

Of the agamids, *Ctenophorus scutulatus* (n = 17) (were captured most often followed by an equal number of *Pogona minor* and *Ctenophorus caudicinctus* (n = 8). While five *Caimanops amphiboluroides* were identified, only two *Tympanocryptis cephalus* were captured with one at Site 2 and one at Site 4.

Thirty *Gehyra variegata* were captured with as many as nine captured at Site 3 and as few as one at Site 7. Of the remaining three geckoes captured, two *Heteronotia bynoei* were captured at Site 2 and one *Gehyra punctata* was captured at Site 5.

Menetia greyii (n = 13) outnumbered all other skinks captured, followed by *Egernia depressa* (n = 9) (Plate 14). The remaining four species numbered three or less of each.

More *Lucasium wombeyi* (n = 7) were captured than all other diplodactylids. However, this was closely followed by *Diplodactylus granariensis* (n = 6). The least number of diplodactylids captured was *Lucasium squarrosum* (n = 2), with both captured at Site 5.

Plate 14 - *Egernia depressa* Pygmy Spiny-tailed Skink

There was little difference in the number of reptiles captured at six of the seven trapping sites with as many 25 captured at Site 5 and as few as 17 captured at Site 7. Site 2 produced the least number of reptiles (n = 14). Two *Ctenophorus caudicinctus* were the only reptiles captured in the smaller satellite sites with one captured at Site 8 and one at Site 9.

Pitfall traps with drift line fencing proved to be the most effective trapping apparatus (68%, n = 96) followed by funnel traps which netted nearly 30% (n = 42) of all other reptiles. Three *Varanus gouldii* were the only species captured in the large wire mesh cages. No reptiles were captured in the aluminium box traps.

Six species of reptiles were recorded opportunistically. Of these, the only species not recorded during the systematic survey was *Chelodina steindachneri* Flat-shelled Turtle. This turtle was recorded during a spot lighting foray trying to take a *Cyclorana platycephala* in one of the transient pools of water.

Table 11 - Reptiles species recorded (including method) during systematic fauna survey

FAMILY	Species	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon	0	1	2	0	0	0	3	1	1	0	0
	Ctenophorus scutulatus		6	0	1	3	3	4	0	0	0	0	0
	Caimanops amphiboluroides		3	0	1	0	0	0	1	0	0	0	0
	Pogona minor		0	1	2	2	3	0	0	0	0	0	0
	Tympanocryptis cephalus	Pebble Dragon	0	1	0	1	0	0	0	0	0	0	0
Diplodactylidae	*Diplodactylus granariensis*		0	1	1	2	2	0	0	0	0	0	0
	Diplodactylus pulcher		0	0	0	0	2	0	2	0	0	0	0
	Lucasium squarrosum		0	0	0	0	2	0	0	0	0	0	0
	Lucasium stenodactylum		0	3	0	0	0	0	0	0	0	0	0
	Lucasium wombeyi		0	0	1	0	0	4	2	0	0	0	0
	Strophurus wellingtonae		1	0	0	1	0	2	0	0	0	0	0
Carphodactylidae	*Nephrurus vertebralis*		2	0	0	0	0	0	0	0	0	0	0
Gekkonidae	*Gehyra punctata*		0	0	0	0	1	0	0	0	0	0	0
	Gehyra variegata		2	5	9	3	6	4	1	0	0	0	0
	Heteronotia binoei	Bynoe's Gecko	0	2	0	0	0	0	0	0	0	0	0
Pygopodidae	*Delma butleri*		0	0	0	0	0	0	1	0	0	0	0
Scincidae	*Ctenotus leonhardii*		1	0	0	0	0	0	2	0	0	0	0
	Ctenotus mimetes		0	0	0	0	0	2	0	0	0	0	0
	Egernia depressa	Pygmy Spiny-tailed Skink	4	0	0	0	3	1	1	0	0	0	0
	Eremiascincus richardsonii	Broad-banded Sand Swimmer	0	0	0	1	0	0	0	0	0	0	0
	Menetia greyii		2	0	2	2	1	4	2	0	0	0	0
	Morethia butleri		0	0	0	1	0	0	0	0	0	0	0
Varanidae	*Varanus caudolineatus*		1	0	0	2	0	0	1	0	0	0	0
	Varanus gouldii	Bungarra or Sand Monitor	2	0	0	0	2	1	0	0	0	0	0
Elapidae	*Brachyurophis approximans*		0	0	0	0	0	0	1	0	0	0	0
	Trapping method	Pitfall	15	11	12	12	16	14	16	0	0	0	0
		Aluminium box	0	0	0	0	0	0	0	0	0	0	0
		Funnel	8	3	7	4	9	8	1	1	1	0	0
		Cage	1	0	0	2	0	0	0	0	0	0	0
	Total		24	14	19	18	25	22	17	1	1	0	0
	Cumulative total		24	38	57	75	100	122	139	140	141	141	141

5.3.2 Discussion

Being ectotherms, reptiles are most active during higher temperatures between September and April (EPA and DEC 2010). As the survey was conducted in November, it was assumed that a high number of diverse reptiles would be captured. The results substantiate the assumption inasmuch as a total of 141 individual reptiles from 25 species representing eight Families were captured during the systematic survey. Further, given the different trapping techniques and that the traps were open for a total of 3164 trap nights, the trap rate of 4.5% was reasonable.

Species from four Families (agamids > geckoes > skinks > diplodactylids) comprised 91% of all species captured with only 13 individuals captured from the remaining four Families (varanids > carphopdactylids > pygopodids > elapids).

The numbers of reptile captures between six of the seven trapping sites did not differ dramatically (25><17). However, the least number (n = 14) was captured at Site 2. This Site was the most easterly site and was plagued with ants. In these instances, additional funnel traps were installed in place of the pitfall traps. As determined by the overall results, the most effective trapping technique for reptiles was pitfall traps. Therefore, it is not surprising that the least amount of reptiles was captured at this site. While no reptiles were captured in the aluminium box traps, only the larger varanids (*Varanus gouldii*) were captured in the large cage traps.

Using the EPBC Protected Matters Search Tool, only one reptile is listed for the area under the EPBC Act 1999. *Liopholis kintorei* formerly *Egernia kintorei* Great Desert Skink is listed as Vulnerable: Taxa facing a high risk of extinction in the wild in the medium-term future (Mace and Stuart 1994). The current distribution consists of seven sparsely distributed, isolated populations, with three occurring in Western Australia in the Great Sandy Desert, the Gibson Desert and the Great Victoria Desert (Storr *et al*. 1999). The preferred habitat of this species includes sand-flats and clay-based or loamy soils vegetated with Spinifex (Wilson and Swan 2010). Thus, the areas surveyed for proposed mining activities within the Wiluna West Project area are located south of the known distributional range of the Great Desert Skink, in addition to which these areas do not support preferred habitat for the species.

No species of conservation significance are listed on the IUCN Red List of Threatened species (IUCN 2012) or on the DEC Threatened and Priority Fauna Database and none of the species captured or seen opportunistically were identified as species of conservation significance.

Forty-seven species of reptiles have been vouchered at the Western Australian Museum for this area with the most ubiquitous represented by the Agamids (n = 9) followed by eight species each of the Diplodactylids and Elapids. Skink species numbered seven and the remaining species numbered four Pygopodids and four Varanids, two Gecko species, two Carphodactylid species and one species of each of Blind snakes and pythons (Appendix A). Of the 47 species, 30 were not captured or sighted during the survey and, conversely, of the species captured, eight have not been vouchered with the Western Australian Museum for this area (*Pogona Minor, Diplodactylus granariensis, Lucasium squarrosum, Lucasium wombeyi, Gehyra punctata, Ctenotus mimetes, Menetia greyii* and *Morethia butleri*).

Overall, it is not surprising that more reptiles have been vouchered at the Western Australian Museum for this area that have been collected over many years and in all seasons, rather than the species captured during this seven day survey. Notwithstanding this, using a log/log transformation of the accumulated number of species captured during

the seven night trapping programme, a strong linear relationship occurred between sampling intensity (nights) and the number of species (R^2 = 0.939) (Figure 12). While an asymptote has not been reached, up to 80% of all species captured were captured by the third night. It is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

The many variables associated with other studies in the area in relation to timing and duration of surveys and to trapping techniques make comparisons difficult. In relation to the surveys conducted previously in the Wiluna West Project area (Ninox 2005, 2006 and 2008), 12 species of reptiles have been recorded previously that were not recorded during this current survey, 13 species were recorded during this survey that were not recorded previously and 14 species were common to this and previous surveys.

While it is noted that all Ninox surveys previously conducted in the Wiluna Project area, in addition to this present survey, have been conducted in Spring, and the warmer temperatures are conducive to trapping ectothermic reptiles, up to 51 reptile species have been collected regionally that have not been collected at Wiluna (Appendix A). Conversely, only two species were captured during this survey that have not been recorded in regionally (*Lucasium wombeyi* and *Ctenotus mimetes*).

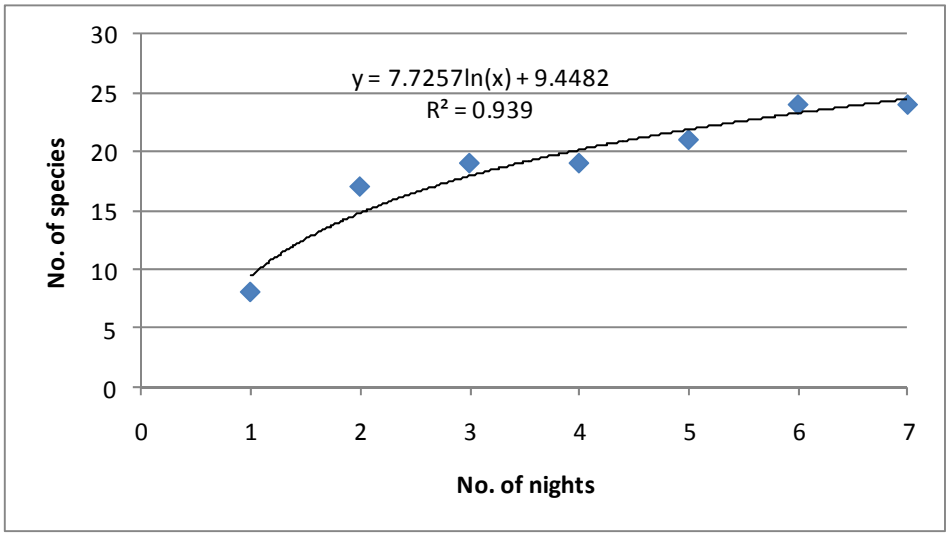


Figure 12 - Species accumulation curve for reptiles captured during the systematic fauna survey

5.4 MAMMALS

5.4.1 The assemblage

Four species of native terrestrial mammals totalling 14 individuals and representing only one family (Dasyuridae) were captured during the survey period (Table 12).

More *Sminthopsis dolichura* Little Long-tailed Dunnart (n = 5) were captured than the remaining three species: *S. macroura* Striped-faced Dunnart (Plate 15) and *S. longicaudata* Long-tailed Dunnart both netted three individuals each and there were only two *Ningaui ridei* captured.

Plate 15 - *Sminthopsis macroura*
Striped-faced Dunnart

No non-native mammals were captured.

Site 4 proved to be the most productive inasmuch as five mammals representing three species were captured at that site. All three *Ningaui ridei* were the only mammals captured at Site 7, two of the five *S. dolichura* were the only mammals captured at Site 6 and only one mammal was captured at each of Sites 1, 3 and 5. No mammals were captured at Site 2 or at any of the satellite sites on the BIF (Sites 8, 9, 10 or 11).

Interestingly, all 14 animals were captured in pitfall traps with none in funnels, box traps or cage traps.

Both *Macropus robustus* Euro and *Macropus rufus* Red Kangaroo were seen opportunistically and evidence (droppings) of their presence was noted throughout the survey area, albeit sparsely. Evidence of *Oryctolagus cuniculus* Rabbit (droppings) and *Camelus dromedaries* Camel (tracks) were noted and one camel was followed along the main track between B and C Ridges. All sightings are included in Appendix A.

Many unidentified bats were also heard and seen opportunistically.

Kyle Armstrong and Yuki Konishi of Specialised Zoological analysed the bat calls recorded on the Anabats (Armstrong and Konishi 2012). The presence of five species of bats was identified with most recording unambiguous identification (Table 13). Some low frequency calls (<30 kHz) could have been one of two species. However, both species were recorded elsewhere from high quality diagnostic call sequences.

Bats were recorded at all of the seven trapping grid sites with all species recorded at four of the seven sites. *Scotorepens balstoni* Inland Broad-nosed Bat was the only species not heard at Site 3, *Nyctophilus geoffroyi* Lesser Long-eared Bat was the only species not heard at Site 5 and *Chalinolobus gouldii* Gould's Wattled Bat and *Vespadelus finlaysoni* Finlayson's Cave Bat were the only species heard at Site 7. No recordings of bats were made with the second Anabat at Site 7.

Table 12 - Mammal species recorded (including method) during the systematic fauna survey

Family	Species	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11
Dasyuridae	*Ningaui ridei*	Wongai Ningaui	0	0	0	0	0	0	3	0	0	0	0
	Sminthopsis dolichura	Little long-tailed Dunnart	1	0	0	2	0	2	0	0	0	0	0
	Sminthopsis longicaudata	Long-tailed Dunnart	0	0	0	1	1	0	0	0	0	0	0
	Sminthopsis macroura	Stripe-faced Dunnart	0	0	1	2	0	0	0	0	0	0	0
Trapping method		Pitfall	1	0	1	5	1	2	3	**0**	**0**	**0**	**0**
		Aluminium box	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**
		Funnel	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**
		Cage	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**
Total			**1**	**0**	**1**	**5**	**1**	**2**	**3**	**0**	**0**	**0**	**0**
Cumulative Total			**1**	**1**	**2**	**7**	**8**	**10**	**14**	**14**	**14**	**14**	**14**

Table 13 - Site by species matrix of bat identifications recorded during the systematic fauna survey

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7	
		Anabat	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	+	+	+	+	+	+	+	NC	+	+	+	+	+	-
	Nyctophilus geoffroyi	Lesser Long-eared Bat	+	+	+	+	+	+	+	-	-	-	+	+	-	-
	Scotorepens balstoni	Inland Broad-nosed Bat	+	-	+	+	-	-	+	-	+	-	+	+	-	-
	Vespadelus finlaysoni	Finlayson's Cave Bat	+	+	+	-	+	+	+	+	+	+	+	-	+	-
Molossidae	*Mormopterus sp. 3*	Freetail-bat	+	+	+	+	+	-	+	-	+	NC	+	+	-	-

NC = Needs confirmation

5.4.2 Discussion

Four different trap types were open for a total of 3164 trap nights during the seven-day survey. The capture of 14 individual mammals during this period translates into a trap rate of 0.44%, which suggests that at the time of the survey the area supported very low numbers of mammals. However, as up to four species of native mammal were captured, diversity of species present in relation to numbers of mammals caught was relatively high.

Given the low numbers of mammals captured, it is difficult to comment on any significance of spatial differences. However, more mammals (n = 5) and three of the four species of mammals were captured at Site 4. There did not appear to be any distinguishable landform, vegetation association or other characteristic at Site 4 to account for these numbers. Less than three mammals were captured at each of the remaining trapping sites with no mammals captured at Site 2 or at any of the four smaller satellite sites located in areas of BIF. It is noted that the Wiluna West Project area had been subject to extensive exploration over a long period of time and the low numbers of mammals may be a result of this disturbance. Interestingly no non-native mammals were captured. Given the level of disturbance, it was expected that at least some *Mus musculus* House Mouse would have been captured.

Pitfall traps and aluminium box traps are usually the most effective in capturing small mammals (EPA and DEC 2010). In this study, all 14 mammals were captured in pitfall traps and none were captured in aluminium box traps, funnels or cage traps.

Using the EPBC Protected Matters Search Tool and interrogating the DEC Threatened and Priority Fauna Database, only three species of conservation significance potentially occur in the area:

- *Rhinonicteris aurantius* Pilbara Leaf-nosed Bat, also known as Orange Leafnosed Bat, is classified as Vulnerable under EPBC Act 1999,
- *Dasycercus cristicauda* Crest-tailed Mulgara is classified as Threatened under the Wildlife Conservation Act 1950, and
- *Macrotis lagotis* Bilby is classified as Threatened under the Wildlife Conservation Act 1950.

The Bilby is also listed on the IUCN Red List of Threatened species (IUCN 2012) for the area, albeit at the southern-most extent of its range.

No individuals or evidence of these species were recorded during the survey (See Section 6 for discussion on each of these species). However, two *Sminthopsis longicaudata* Long-tailed Dunnart were captured with one at Site 4 and one at Site 5. *Sminthopsis longicaudata* is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. The preferred habitat of this species is varied and includes rocky scree and plateau areas, generally with little vegetation or spinifex hummock grassland, shrubs, and open Mulga woodland (Burbidge *et al.* 2008, Terrestrial Ecosystems 2011). Within its distributional range, *S. longicaudata* tends to be in low abundance, as demonstrated by the results of this survey.

The EPBC Protected Matters Search Tool also lists *Capra hircus* Goat, *Felis catus* Cat, *Oryctolagus cuniculus* Rabbit and *Vulpes vulpes* Red Fox as invasive species likely to occur in the area. Of these, only *O. cuniculus* was seen, in addition to *Camelus dromedarius.* Unconfirmed, anecdotal reports suggest that few cats and dogs occur in the vicinity of the Wiluna West area. No individuals or evidence of any of the other feral species were seen during the survey. Notwithstanding this, the low number of mammals in the area may be attributable to a degree of predation.

Given the low numbers of mammals captured, a species accumulation curve may not depict mammal presence adequately. However, a log/log transformation of the accumulated number of species captured during the seven night trapping programme resulted in a strong linear relationship between sampling intensity (nights) and the number of species (R^2 = 0.8779) (Figure 13). While an asymptote has not been reached, three of the four species were captured by the third night of trapping. It is reasonable to assume that all common species present at the time of the survey are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

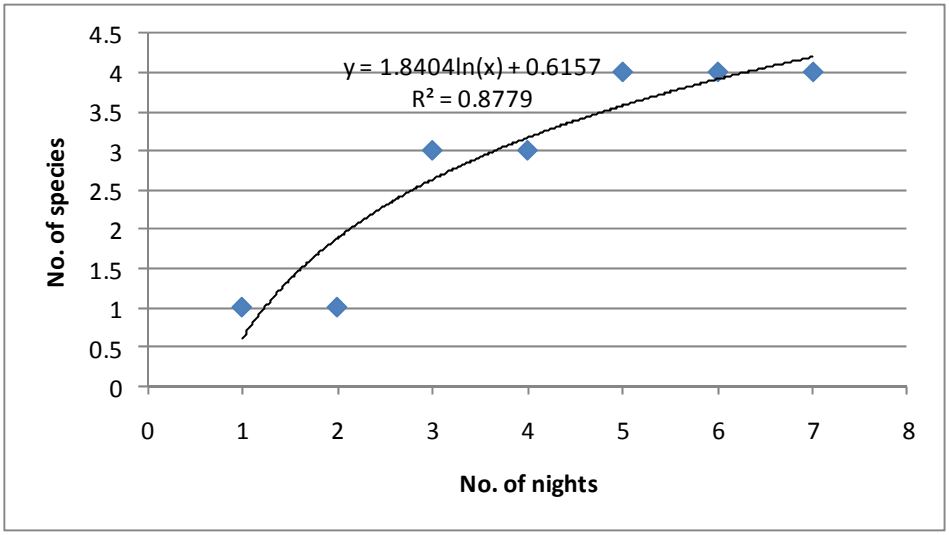


Figure 13 - Species accumulation curve for non-volant native mammals captured during the systematic fauna survey

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all seven sites, with unambiguous identification of all five species at all seven sites. The results indicated that only two species were recorded at Site 7. However, only one Anabat recorded with a malfunction of the second unit at that site. This scenario highlights the importance of recording calls for the minimum of two nights using two different units. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Wiluna West Project area.

That only sixteen species of mammals have been vouchered at the Western Australian Museum for this area may reflect the low species diversity in the area or may be an artefact of the lack of surveys undertaken in the area. Of all the species captured in the pitfall traps during the survey, only two of the three *Sminthopsis* (*S. dolichura* and *S. longicaudata)* have not been vouchered at the Museum previously. Of the five bat species recorded in the area, only (*Mormopterus* sp. 3) was not on the Museum list (Appendix A). Conversely, ten mammal species have been vouchered at the Museum that were not recorded during the survey (Appendix A).

Comparing the species captured during the previous trapping programmes at Wiluna West (Ninox 2005, 2006 and 2008), 14 species were recorded previously that were not recorded during the current survey and only 11 species were common to the Ninox surveys and the current survey. Conversely, only two species were recorded during this survey that were not recorded during the Ninox surveys (*S. longicaudata* and *Macropus fuliginosus*) (Appendix A).

As noted for the reptiles, comparisons with other studies are limited due to differences in timing, trapping programs and taxonomic changes. However, it is interesting to note that only 37 mammal species have been recorded collectively during all regional surveys (Appendix A). Once again only *S. longicaudata* has not been captured elsewhere, whereas 24 species have been captured regionally that were not recorded during this survey. The presence of feral animals and their destructive nature either by direct predation (*F. Catus*, *V. vulpes* or *Canis* spp. (Dog/Dingo)) or destruction of habitat through grazing, digging or trampling (*C. hircus, O. cuniculus, C. dromedaries* or *Bos taurus* European Cattle) cannot be overlooked.

5.5 BIRDS

5.5.1 The assemblages

A total of 443 individual birds representing 32 species from 16 Families were recorded during the systematic sampling immediately after sunrise (Table 14). One *Turnix velox* Little Button-quail was captured in a pitfall trap at Site 7 that brings these totals collectively to 444 individual birds numbering 33 species from 17 Families. This *T. velox* was the only bird species to be captured during the survey period.

These results indicated that passerines (n = 397) represent a majority (90%) of species recorded in the area with only 46 individuals accounting for the non-passerines (10%) (Table 14). Of the non-passerines, 15 *Nymphicus hollandicus* Cockatiel were the most ubiquitous with seven or less recorded for each of the remaining nine species.

Within the passerines, *Artamus personatus* Masked Woodswallow within the Artamidae accounted for more birds (n = 142, 36%) than all other species (Table 14). Following Artamidae, *Acanthiza uropygialis* Chestnut-rumped Thornbill (n = 56) within the Acanthizids accounted for 79% of the Acanthizids and 14% of the passerines. Each of the remaining species represented less that 10% of the passerines.

More birds were recorded at Site 4 (n = 113, 26%) than at the other sites, followed by 19% (n = 86) at Site 3. However, *A. personatus* accounted for up to 46% (n = 52) and 63% (n = 54) of all birds at these sites respectively. Only 61 and 32 of all other species were recorded at these sites respectively. Notwithstanding this, more birds were recorded at Site 4 excluding *A. personatus* and the least number of birds was recorded at Site 2 (n = 30) where no *A. personatus* were recorded at all.

Pomatostomus superciliosus White-browed Babbler which is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database for the area was recorded four times at Site 1.

Oreoica gutturalis Crested Bellbird is also listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database, but not for this area. The species was recorded 16 times with less than four birds recorded at each of the Sites except at Site 2 where no *O. gutturalis* were recorded.

Opportunistic recordings accounted for an additional nine bird species not recorded during the systematic sampling (Appendix A). Conversely, 19 bird species recorded during the systematic surveys were not seen or heard opportunistically (Appendix A). Two Malleefowl were seen opportunistically during the survey period (Section 5.5.2). Malleefowl are classified as Vulnerable under the EPBC Act 1999 as well as a Schedule 1 species: 'Rare and likely to become extinct' under the Western Australian *Wildlife Conservation Act 1950.*
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Table 14 - Avifauna species recorded during systematic sampling

Family	Species	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Columbidae	*Phaps chalcoptera*	Common Bronzewing	1	0	0	2	1	3	0
	Geopelia cuneata	Diamond Dove	6	0	0	0	1	0	0
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	0	0	0	0	0	0	1
Cacatuidae	*Eolophus roseicapillus*	Galah	0	0	2	0	0	0	0
	Nymphicus hollandicus	Cockatiel	9	6	0	0	0	0	0
Psittacidae	*Platycercus zonarius*	Australian Ringneck (Ring-necked Parrot)	0	0	0	0	0	0	2
	Platycercus varius	Mulga Parrot	0	0	2	0	3	0	0
	Neopsephotus bourkii	Bourke's Parrot	2	0	0	0	0	0	0
Cuculidae	*Chalcites basalis*	Horsfield's Bronze Cuckoo	0	0	1	1	1	0	1
	Cuculus pallidus	Pallid Cuckoo	0	0	0	1	0	0	0
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird	0	0	0	3	0	0	1
Maluridae	*Malurus splendens*	Splendid Fairy-wren	6	0	0	2	3	5	2
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat	2	0	0	0	0	0	0
	Smicrornis brevirostris	Weebill	3	0	0	0	2	0	0
	Acanthiza apicalis	Inland Thornbill	0	1	0	2	3	0	0
	Acanthiza robustirostris	Slaty-backed Thornbill	0	0	0	2	0	0	0
	Acanthiza uropygialis	Chestnut-rumped Thornbill	10	0	3	10	7	9	17
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater	0	0	1	0	1	0	0
	Manorina flavigula	Yellow-throated Miner	0	4	2	0	0	0	0
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	3	6	3	15	3	0	3
	Epthianura tricolor	Crimson Chat	0	0	2	0	2	1	0
	Pomatostomus temporalis	Grey-crowned Babbler	0	3	0	5	0	0	11
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	4	0	0	0	0	0	0
Campephagidae	*Lalage sueurii*	White-winged Triller	1	1	2	4	0	0	0

Family	Species	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	1	3	5	6	1	4	3
	Colluricincla harmonica	Grey Shrike-thrush	2	0	4	1	2	4	3
	Oreoica gutturalis	Crested Bellbird	2	0	3	4	2	2	3
Artamidae	*Artamus personatus*	Masked Woodswallow	4	0	54	52	22	5	5
	Cracticus torquatus	Grey Butcherbird	0	1	0	0	1	1	0
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	0	0	0	0	1	0	0
Corvidae	*Corvus* sp.		0	2	0	0	0	0	0
Petroicidae	*Petroica goodenovii*	Red-capped Robin	6	3	2	3	5	2	3
		Subtotal	**62**	**30**	**86**	**113**	**61**	**36**	**55**
		Cumulative total	**62**	**92**	**178**	**291**	**352**	**388**	**443**

5.5.1.1 Malleefowl presence

Results of the audit of 28 Malleefowl mounds confirmed one active mound, 22 inactive mounds and five locations where mounds could not be found (Table 15 and Figure 14). Additionally, two Malleefowl were seen opportunistically during the survey period at the southern section of C Ridge in the area of the one active mound (Figure 14).

While determining when a mound might have been last used can be somewhat subjective, as all the inactive mounds appeared not to have been used for many years. Photographic representation of a selection of mounds at varying ages has been included for reference (Plates 12 - 15).

Table 15 - Results of Malleefowl mound audit of November 2011

Mound ID	Location	Size (m)	Approximate Age (years)
ACTIVE MOUNDS			
A1	50 J 792608 7033500	6 x 6	Currently active
INACTIVE MOUNDS			
IA2	50 J 791867 7040640	5 x 5	>50
IA3	50 J 791987 7041243	5 x 5	<30
IA4	50 J 792254 7038805	6 x 6	>50
IA5	50 J 792300 7038470	3 x 3	old
IA7	50 J 792370 7038442	5 x 5	>50
IA8	50 J 792321 7038050	3 x 3	>50
IA9	50 J 792247 7038020	10 x 10	>50
IA10	50 J 792689 7037892	5 x 5	~50
IA11	50 J 792495 7037856	4 x 4	>50
IA13	50 J 792359 7037777	4 x 4	-
IA14	50 J 792390 7037626	4 x 4	>50
IA15	50 J 792726 7037563	4 x 4	~50
IA16	50 J 792708 7037532	3 x 3	>50
IA17	50 J 792203 7037330	4 x 4	>100
IA18	50 J 791839 7041435	4 x 4	>50
IA19	50 J 792307 7037146	7 x 7	>100
IA20	50 J 792561 7036782	-	>100
IA22	50 J 792716 7036317	2.5 x 2.5	>50
IA23	50 J 792648 7036282	8 x 8	>50
IA25	50 J 791993 7048141	4 x 4	>50
IA26	50 J 792074 7041815	3 x 3	>50
IA27	50 J 792147 7041599	4 x 4	>50
MOUNDS NOT FOUND			
IA1	50 J 791859 7040700		
IA6	50 J 792330 7038454		
IA12	50 J 792719 7037828		
IA21	50 J 792350 7036515		
IA24	50 J 792300 7034000		

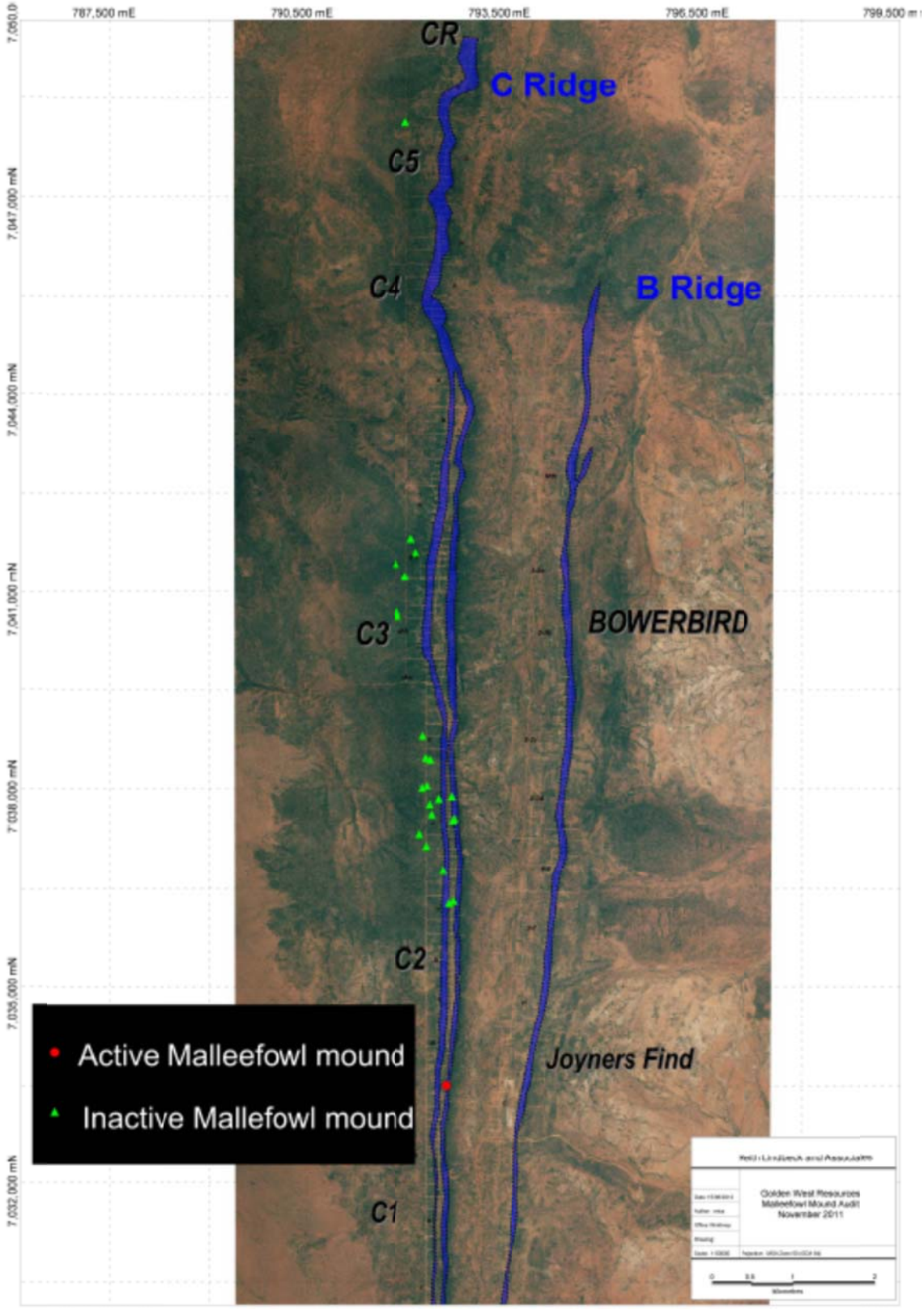

Figure 14 - Locations of Malleefowl mounds audited in the Wiluna West Project area

Plate 16 - Active Malleefowl mound

Plate 17 – Inactive Malleefowl Mound (<30 years since last use)

Plate 18 – Inactive Malleefowl Mound (>50 years since last use)

Plate 19 – Inactive Malleefowl Mound (>100 years since last use)

5.5.2 Discussion

In accordance with EPA Guidelines (EPA 2004) the timing of this spring survey was optimal inasmuch as more than average rainfall had been recorded in the first week of November, immediately prior to this survey, and temperatures were higher than normal (Section 2).

The bird censuses yielded a total of 443 individuals of 32 species from 16 Families. The majority of birds were passerines (90%) and this trend was consistent at each site. Within the passerines, 36% were represented by Artamids with the Masked Woodswallow accounting for all Artamids bar three Grey Butcherbirds. Excluding the Woodswallows, the Acanthizids were the most well represented (18%) followed closely by the Meliphagids (16%). Masked Woodswallows are primarily insectivores and food resources particularly following the vegetative response to the recent rainfall were evidently sufficient to support the numbers recorded of these species.

The distribution of birds throughout the survey area was markedly different due to the propensity of Masked Woodswallows, with an almost four-fold increase in numbers recorded at Site 4 (n = 113) than at Site 2 (n = 30). There was no obvious habitat attribute that could account for the large numbers of the Woodswallows at three of the sites (Site 3, 4 and 5) with few to no Woodswallows recorded at the remaining sites. These results suggest that there is no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities.

Of the species of conservation significance, four White-browed Babblers were recorded once at Site 1 and opportunistically, and the Crested Bellbird was seen and/or heard at six of the seven sites and recorded opportunistically throughout the survey area.

Anecdotally, Malleefowl have been known from the Wiluna West area for many years. Two Malleefowl were seen opportunistically during the survey period at the southern section of C Ridge in the area of the active mound. No active Malleefowl mounds were recorded in the area proposed for disturbance in the C3, C4 or Bowerbirds deposit areas. The majority of the mounds identified in these areas appeared not to have been used for many years, with some utilised by varanids and rabbits. Notwithstanding this, a targeted Malleefowl (mound) survey will be recommended immediately prior to disturbance. Malleefowl are also known to re-visit and re-use old mounds (S. Dennings *pers comm.*).

No other species of conservation significance or evidence of their presence was recorded during the survey. The White-browed Babbler, Crested Bellbird and Malleefowl and other species of conservation significance listed to potentially occur in the area will be discussed in Section 6.1.

A species accumulation curve for birds recorded during the survey (Figure 15) indicates that 60% of species were recorded during the first morning of observations and up to 88% were recorded on the second morning. The third and fourth mornings each recorded two additional species. A log/log transformation of the accumulated number of species captured during the four morning survey periods resulted in a strong linear relationship between sampling intensity (days) and the number of species (R^2 = 0.9577) (Figure 15). While an asymptote has not been reached, it is reasonable to assume that all common species present at the time of the survey are represented in the curve but rare and migratory species would only be detected with a far higher sampling intensity that would incorporate the seasonality of all potential bird species that may occur in the area.

Thirteen bird species were recorded during the reconnaissance survey conducted by KLA in October 2011 and all these species were seen and heard during the systematic surveys (Appendix A).

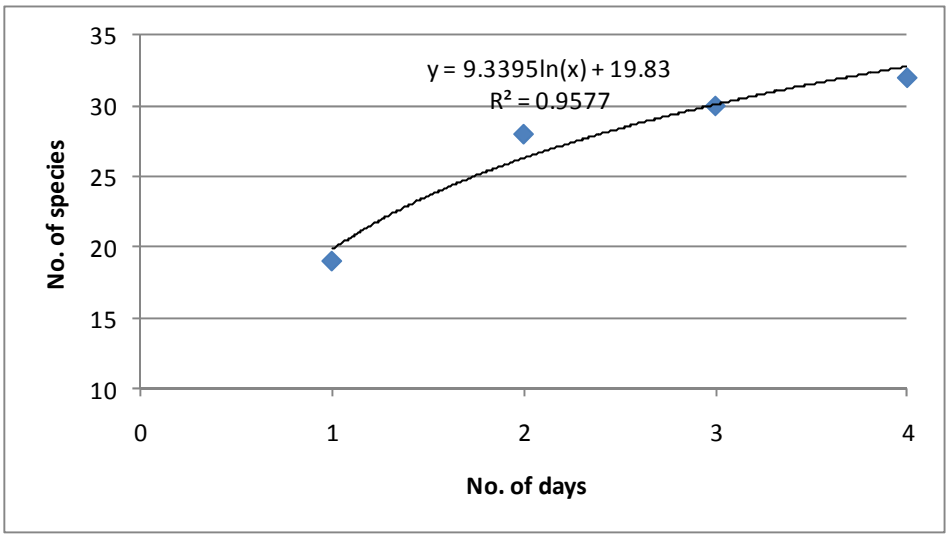

Figure 15- Species accumulation curve for birds recorded during systematic sampling

Of the bird species vouchered at the Western Australian Museum for the area, six species were recorded during the survey and six were not (Appendix A).

Interrogation of the Birds Australia Atlas database listed 75 species for the area (Appendix A). Of these 75 bird species, 39 were recorded and 26 species were not recorded systematically and opportunistically during the survey. An additional ten species were recorded during the survey that were not included in the Birds Australia database list for the area (Appendix A).

A total of 40 bird species were recorded during this survey that were recorded during the surveys conducted previously at Wiluna West (Ninox 2005, 2006 and 2007) (Appendix A). However, 24 species were recorded during those surveys that were not recorded during this survey and eight were recorded during this survey that were not recorded during the previous surveys in the local area.

As noted elsewhere, a comparison with other regional surveys is limited given the seasonal, temporal and habitat differences. Notwithstanding this, other regional surveys have listed a total of 55 additional species collectively that have not been recorded during this and previous surveys at Wiluna West(Appendix A). No bird species were recorded during this survey, either during the systematic sampling or opportunistically, that have not been recorded elsewhere (Appendix A).

5.6 SHORT-RANGE ENDEMIC INVERTEBRATES

5.6.1 Results

No SREs are listed under the EPBC Act 1999 or were on the list from the DEC Threatened and Priority fauna database for the area.

Database results from the Western Australian Museum indicate three species of spiders, one pseudoscorpion species and one scorpion species have been vouchered from an area within 20 km of the Project area (Table 16). None of these species were determined to be SREs.

Table 16 - Results of Western Australian Museum invertebrate database search

Order	Family	Species	Location	Collected
Araneae	Araneidae	*Argiope protensa*	25 km W. of Wiluna	22/08/1989
		Cyrtophora parnasia	25 km W. of Wiluna	22/08/1989
	Salticidae	*Menemerus* `bracteatus grp`	Millbillillie Station	31/03/2009
Pseudoscorpiones			Millbillillie Station	31/03/2009
Scorpiones	Buthidae	*Lychas* `harveyi`	30 km W. of Wiluna	2/02/1980

A total of 24 invertebrates comprising three spiders, eight pseudoscorpions and 13 scorpions were collected during this survey and vouchered at the Western Australian Museum (Table 17). Only two specimens were collected from soil samples and the remainder from pitfall traps and visual searches (Table 17).

Results indicate that the spiders were either juvenile or female and therefore could not be identified to species level and that the pseudoscorpions require taxonomic revision (Burger *et al.* 2012). Therefore, it was not possible to determine if any of the specimens submitted where SREs (Burger *et al.* 2012). None of the 13 scorpions that were identified are considered SREs (Volschenk 2012).

Discussion

A review of Short-Range Endemism in the Australian invertebrate fauna (Harvey 2002). detailed a set of criteria for nomination as an SRE that included:

- a naturally small range of less than 10,000 km^2,
- poor powers of dispersal;
- confinement to discontinuous habitats;
- usually highly seasonal, only active during cooler, wetter periods; and
- low levels of fecundity

The Western Australian fauna contains a number of SRE taxa including millipedes, land snails, trap-door spiders, some pseudoscorpions, slaters, and onychophorans. While the assessment of invertebrates for proposed disturbances has previously been ignored, it is now a requirement for submission with Environmental Impact Assessment documents.

In accordance with EPA guidelines (EPA 2009) and OEPA advice, searches were undertaken during the Level 2 survey. In spite of recent rainfall, there was little to no composting of leaf litter due to the long-term lack of average rainfall. It was, therefore, not surprising that only two specimens were collected from the soil/litter samples.

In relation to mygalomorph spiders, the best taxonomic features in their identification are found within the genitalia of males. Males are known to ‘run’ during rainfall events or immediately after in search of females. While more than average rainfall was recorded immediately prior to the survey, only three spiders were collected during the survey. Unfortunately, of the spiders identified, one was female and one was a juvenile. Therefore,

it was not possible to identify them to species and, therefore, not possible to comment on their possible endemicity. While it is recognised that two of the three spiders were collected in areas of BIF, GWR does not intend removing all BIF from the area and substantial sections of BIF will remain. Similarly, the vegetation proposed to be disturbed is not limited to the areas proposed for disturbance. It is unlikely, therefore, that the spiders collected and present in the C3, C4 and Bowerbird area are limited to these areas and that they are likely to be found elsewhere.

Table 17 - Identifications of specimens collected during survey, mode of collection and SRE status

Order	Family	Genus	Species	Total number collected			SRE status
				Pitfall Trap	Visual searching	Soil samples	
Araneae	Zodariidae				1		no comment
	Barychelidae	*Aurecocyrpta*	`sp female`		1		Currently not possible to say if it represents SRE
	Idiopidae	*Eucyrtops*	`sp juv`		1		Currently not possible to say if it represents SRE
Pseudoscorpiones	Olpiidae	*Beierolpium*	`sp. 8/3`		3		Possibly SRE but full taxonomic revision required
		Beierolpium	`sp. juv.`			1	unable to determine
		Indolpium			2	1	unlikely to represent SRE
		Austrohorus			1		Currently not possible to say if it represents SRE
Scorpiones	Buthidae	*IIsometroides*	'goldfields1'	3			Not an SRE
		Lychas	'annulatus'	1	1		Not an SRE
			jonesae	1	3		Not an SRE
			'splendens'	3	1		Not an SRE

Three genera of pseudoscorpions were collected (Family: Olpiidae). Of these, *Indolpium* spp. are not likely to represent SREs, whereas both *Autrohorus* spp. and *Beierolpium* `sp. 8/3` require systematic revision to determine their degree of endemicity. As discussed above, while it is recognised that five of the eight pseudoscorpions were collected in areas of BIF, GWR does not intend removing all BIF from the area and substantial sections of BIF, and similar vegetation associations will remain. Further, all specimens collected were not confined to discontinuous habitats. The conservation status of all these species is, therefore, not likely to be altered by the proposed mining activity in the local area.

A previous SRE survey conducted in the Wiluna Project area netted ten spiders of which only one (*Conothele* sp., Family: Ctenizidae) was identified as a juvenile mygalomorph (ATA Environmental 2007) (Section 3). As mentioned above, it is not possible to identify

the species based on juvenile features. Therefore, the conservation classification of this species was not able to be determined.

A more recent invertebrate survey was conducted at the proposed Wiluna Uranium Project, ~15-40 km from the Wiluna West Project area (Outback Ecology 2011). A total of 95 invertebrate specimens were collected comprising 14 mygalomorph spiders, six pseudoscorpions, 34 scorpions, six slaters and 35 terrestrial snail specimens. collectively of which five were identified as putative SREs. Of these five, three were mygalomorphs (*Aname* MYG177, *Aname* MGY176 and *Kwonkan* MYG175), one was a pseudoscorpion (*Beierolpium* 'sp. 8/2') and one was a scorpion (*Urodacus* 'yeelirrie')(Outback Ecology 2011).

It is noted that large areas of habitats within the Wiluna Uranium Project area comprise salt lakes and dunes. Further, the habitats in which these putative specimens were found comprised isolated, sheltered habitats or microhabitats. The invertebrate assemblage in these areas, therefore, is likely to be very different from that in the predominantly *Acacia* shrubland in the Wiluna West Project area.

5.7 SPOTLIGHTING

5.7.1 The assemblages

A total of four hours and forty minutes over two evenings totalling 14 spotlighting hours were spent traversing the survey areas. Established tracks were followed within and adjacent to the survey area; the trapping grid areas were not entered so that mammals in the immediate areas of the traps would not be disturbed.

Collectively, during spotlighting and head-torch searches, two amphibians, five reptiles, three species of mammal and six bird species were recorded (Table 18) (Appendix A).

5.7.2 Discussion

The diversity and number of fauna recorded during the spotlighting surveys is likely to be attributable to the timing of the survey with more fauna being active during the warmer spring months. Further, the presence of frogs and the turtle is certainly the result of the more than average rainfall that was recorded during the week prior to the survey. However, given the low number of mammals captured during the systematic survey, it was not surprising that only one small mammal was recorded during the evening surveys.

Of all the fauna recorded during the spotlighting surveys, one frog (*Cyclorana platycephala)*, one reptile (*Chelodina steindachneri)* and four bird species (*Podargus strigoides, Eurostopodus argus, Gerygone fusca* and *Cracticus nigrogularis*) were recorded that were not recorded during the diurnal surveys, both systematic and opportunistic. This result highlights the value of nocturnal observations as an adjunct to diurnal monitoring.

Table 18 - Fauna species recorded during spotlighting surveys

Family	Species	Common name
AMPHIBIAN		
Hylidae	*Cyclorana platycephala*	Water-holding Frog
	Litoria rubella	Little Red Tree Frog
REPTILE		
Cheluidae	*Chelodina steindachneri*	Flat-shelled Turtle
Agamidae	*Ctenophorus caudicinctus*	Ring-tailed Dragon
	Tympanocryptis cephalus	Pebble Dragon
Gekkonidae	*Gehyra variegata*	
Scincidae	*Morethia butleri*	
MAMMALS		
Macropodidae	*Macropus rufus*	Red Kangaroo, Marlu
Chiroptera		Unidentified species
Dasyuridae	*?Sminthopsis*	?Dunnart
BIRDS		
Columbidae	*Geopelia cuneata*	Diamond Dove
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Eurostopodidae	*Eurostopodus argus*	Spotted Nightjar
Acanthizidae	*Gerygone fusca*	Western Gerygone
Artamidae	*Artamus personatus*	Masked Woodswallow
	Cracticus nigrogularis	Pied Butcherbird

6.0 ENVIRONMENTAL IMPACTS

6.1 THREATENING PROCESSES

Threatening process relevant to fauna with the Murchison bioregion generally include grazing pressure, increased vegetation fragmentation, changed hydrology, feral animals (especially goats, foxes and rabbits), changed fire regimes, pollution and proximity to mining activities (ANRA 2009).

With particular reference to the proposed mining activities in the nominated areas at Wiluna West, all of the above threatening processes may affect the resident fauna;

- Wiluna West Project area is located on Lake Way Pastoral Lease which is an active cattle station. Cattle free range and do cause damage to native vegetation through grazing and trampling,
- Establishment of tracks for pastoral activities, public access and/or mining activities (exploration and construction) removes native vegetation, causes fragmentation and encourages degradation through dust settling on adjacent vegetation,
- Removal or diversions of natural water flow across the landscape or the creation of artificial water bodies developed during mining operations changes local hydrology,
- Feral animals cause fundamental changes to ecosystems as a result of resource depletion (grazing by, for example, goats, camels and rabbits), alteration of edaphic features (digging and trampling) and predation by foxes, feral cats and feral dogs,
- Altered fire regimes from anthropogenic causes, intentional or accidental change vegetation communities with concomitant changes in resident fauna assemblages,
- Mining activities are responsible for many threatening processes including air and water pollution, collisions with vehicles and other equipment, noise and vibrations, dust including air contamination and the effects of dust settling on vegetation, unnatural light throughout the night, *etc.*

6.2 IMPACTS ON FAUNA OF CONSERVATION SIGNIFICANCE

Native fauna species that are rare, threatened with extinction, or have high conservation value are protected by law under the Federal EPBC Act 1999, in addition to the Western Australian WCA 1950.

The EPBC Act 1999 lists one reptile (Great Desert Skink *Liopholis kintorei*), one mammal (Pilbara Leaf-nosed Bat *Rhinonicteris auranta*) and six bird species (Slender-billed Thornbill (western) *Acanthiza iredalei iredalei,* Princess Parrot, Alexandra's Parrot *Polytelis alexandrae,* Fork-tailed Swift *Apus pacificus,* Great Egret *Ardea alba modesta,* Rainbow Bee'eater *Merops ornatus* and Oriental plover *Charadrius veredus*) of national importance likely to occur within and adjacent to the area proposed for mining activity, and the DEC Threatened and Priority Fauna Database lists two threatened mammals and five threatened bird species (Table 19). The Bilby is the only fauna listed on the IUCN Red List of Threatened species (IUCN 2012) for the area. A short description of each of the species follows, including their likelihood of occurrence and potential impact on their conservation status.

Oreoica gutturalis Crested Bellbird and *Sminthopsis longicaudata* Long-tailed Dunnart are also listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database, but not for this area. A short description of these species will also be included.

Table 19 - Conservation significant terrestrial fauna potentially occurring in area

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE				PREVIOUS RECORD
		EPBC	WCA	DEC	IUCN Red List	
RETILES						
Liopholis kintorei	Great Desert Skink	Vulnerable				
MAMMALS						
Crest-tailed Mulgara	*Dasycercus cristicauda*		S1			2007 Near Wiluna 2009 Yeelirrie
Bilby, Dalgyte	*Macrotis lagotis*		S1		Vulnerable	1984 Wiluna
Rhinonicteris aurantius	Orange (Pibara) Leafnosed-bat	Vulnerable				-
AVIFAUNA						
Leipoa ocellata	Malleefowl		S1			2006, West Project Area 2007 Near Wiluna
Apus pacificus	Fork-tailed Swift	Migratory				-
Ardea modesta	Great Egret	Migratory				-
Ardeotis australis	Australian Bustard			P4		1978 Wiluna 1982 South of Wiluna 2009 Yeelirrie
Burhinus grallarius	Bush Stone-curlew			P4		1979 Wiluna 2009 Yeelirrie
Charadrius veredus	Oriental Plover	Migratory Wetland species				-
Polytelis alexandrae	Princess Parrot	Vulnerable				-
Merops ornatus	Rainbow Bee-eater	Migratory				-
Amytornis striatus subsp. *striatus*	Striated Grasswren			P4		1984 Sandstone-Wiluna Road
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable				-
Pomatostomus superciliosus	White-browed Babbler			P4		1978 Near Wiluna

- **Great Desert Skink *Egernia kintorei***

  The Great Desert Skink is also known colloquially as the Tjakura, Warrama or Mulyamiji

  Family: Scincidae

  Conservation Status: Vulnerable under EPBC Act 1999
  "The Recovery Plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011" (McAlpin 2001) is available online at :
  http://www.environment.gov.au/biodiversity/threatened/publications/recovery/great-desert-skink/index.html#11

  Distribution: Historically, the Great Desert Skink was recorded from widely scattered localities across the western deserts region (McAlpin 2001). The current distribution consists of seven sparsely distributed, isolated populations, with three occurring in Western Australia in the Great Sandy Desert, the Gibson Desert and the Great Victoria Desert (Storr *et al.* 1999).

  Ecology: The Great Desert Skink is a large burrowing skink that is crepuscular to nocturnal. It excavates large complex multi-entranced communal burrow systems and uses at least one large external latrine (Wilson and Swan 2010). Up to ten individuals may inhabit one burrow system. Females give birth to from one to seven live young in early summer. Young Desert Skinks grow rapidly and during good seasons reach sexual maturity in their second year (McAlpin 2001).

  The Great Desert Skink's occupy a variety of habitats within the western deserts region with potentially suitable habitat extending over tens of thousands of hectares. However, sandplain vegetated by spinifex and scattered shrubs seems to be the habitat type most widely used (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012). Great Desert Skinks are omnivorous, eating a wide range of invertebrates (principally termites) and also any vertebrates small enough to be swallowed.

  Likelihood of occurrence: While the EPBC 1999 Protected Matters Search Tool suggests this species may occur in the survey area, the site appears to be at the southwestern extent of its range. Further, there is no preferred habitat within the survey area. An area to the north of Wiluna West Project area does comprise some Spinifex sandplains. However, this area is up to 10 km from the proposed disturbance and is not proposed to be disturbed in the short or long term.

  Potential Impacts: Given that this species is not likely to be present in the area proposed for disturbance, the conservation status of the Great Desert Skink is not likely to be altered by the proposed mining activity in the survey areas.

- ***Dasycercus cristicauda* Crest-tailed Mulgara, Minyiminyi**

  Family: Dasyuridae

  Conservation Status: Schedule 1: Rare and likely to become extinct under the Western Australian *Wildlife Conservation Act 1950*

  There is currently some uncertainty on the taxonomic status of Mulgara in Western Australia but it is believed that the Mulgara previously considered to be *Dasycercus cristicauda,* are actually *Dasycercus blythi* (Brush-tailed Mulgara). *D. blythi* is listed as a Priority 4 species, Taxa in need of monitoring, on the DEC Threatened and Priority Fauna Database.

Distribution: The Crest-tailed Mulgara is a medium-sized (60-158 g) carnivorous marsupial that was formerly assumed to be widespread but patchy in sandy regions of arid central Australian and Western Australia (Menkhorst and Knight 2011). In recent times, it has been found in the southern Simpson Desert where the borders on the Northern Territory, Queensland and South Australia converge, and in the Tirari and Strzelecki Deserts of South Australia (van Dyck and Strahan 2008).

Ecology: The Crest-tailed Mulgara is a sociable mammal that constructs burrows on sand dunes with a sparse cover of Sandhill Canegrass (*Zygochloa* paradoxa) and areas around salt lakes with Nitre Bush (*Nitraria billardieri*) (van Dyck and Strahan 2008). It is mostly nocturnal but diurnal at times. Breeding for this species is seasonal with up to eight young born at the end of winter/beginning of spring. It is an opportunistic or non-specialist carnivore, eating a range of invertebrates, lizards and small mammals.

Likelihood of occurrence: Mulgara were captured in 2007 at Wiluna and 2009 at Yeelerrie. However, given the taxonomic confusion, it is likely that these Mulgara were Brush-tailed Mulgara *Dasycercus blythi* rather than the Crest-tailed Mulgara. No evidence of Mulgara or Crest-tailed Mulgara's preferred habitat was evident in the survey area.

Potential Impacts: Given the above, and the conservation status of the Crest-tailed Mulgara is not likely to be altered by the proposed mining activity in the survey areas.

- ***Macrotis lagotis*** **Bilby, Dalgyte**

Family: Thylacomyidae

Conservation Status: Vulnerable under the EPBC Act 1999
The "National recovery plan for the Greater Bilby (*Magrotis lagotis*) (Pavey 2006) is available online at: http://www.environment.gov.au/biodiversity/threatened/publications/m-lagotis.html.
The Bilby is also listed on the IUCN Red List of Threatened species (IUCN 2012).

Distribution: The distribution of the Bilby formerly extended throughout the arid and semi-arid areas of Australia (Menkhorst and Knight 2011). The species now occurs in two separate geographic areas: one extending from the western deserts region (Tanami, Great Sandy and Gibson) of the Northern Territory and Western Australia to the Pilbara and Kimberley regions, and the second in southwestern Queensland (Pavey 2006). In Western Australia, the Bilby population is highly fragmented with species occurring in the Gibson Desert and Great Sandy Desert bioregions, the Dampierland bioregion and in the Central Kimberley and Ord-Victoria Plains bioregions (Pavey 2006).

Ecology: The Bilby is mostly solitary and constructs long, deep burrow systems for daytime shelter (Menkhorst and Knight 2011). Habitat favoured by Bilbies include mulga shrubland on stony plains, along the lower slopes of ranges, in sandplains and in sand dune systems (Pavey 2006). Bilbies emerge from their burrows well after dark to forage in topsoil for arthropods, tubers and fungi, leaving numerous pits to 10 cm deep. Litters of two occur mostly from March to May but can occur at all times if conditions are good.

Likelihood of occurrence: The area proposed for disturbance appears to be southwest of the known distribution of the Bilby. Further there have been no recent recordings of the Bilby in the area. No Bilbies or evidence of their presences was recorded during the survey.

The greatest threats to the Bilby include altered fire regimes, grazing of rabbits and livestock, in addition to the trampling effect of the ungulate hooves, predation by foxes and feral dogs and cats and long periods of drought. The areas proposed for disturbance at Wiluna West have been subject to almost all of the threats to varying degrees over time. The likelihood of the Bilby residing or persisting in the area is small.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Rhinonicteris aurantius* (Pilbara form) Pilbara Leafnosed-bat**

Family: Hipposideridae

Conservation Status: Vulnerable under EPBC Act 1999
"Approved Conservation Advice for *Rhinonicteris aurantius* (Pilbara form) (Pilbara Leaf-nosed Bat)(Threatened Species Scientific Committee 2008) is available online at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66887-conservation-advice.pdf

Distribution: The Pilbara Leafnosed-bat is known only from the Pilbara and Gascoyne regions of Western Australia in Barlee Range Nature Reserve (Threatened Species Scientific Committee 2008). While the Pilbara Leafnosed-bat appears morphologically similar to the northern form (Orange Leafnosed-bat), is separated from these other populations by ~400 km of desert, and has small magnitude differences in the size of the noseleaf, forearm and rostral part of the skull (Threatened Species Scientific Committee 2008).

Ecology: The Pilbara Leafnosed-bat roosts in caves and abandoned, deep and partially flooded mines that trap pockets of warm, humid air. It may also occupy smaller, less complex mines for part of the year (Van Dyck and Strahan, 2008).

The Pilbara Leafnosed-bat hunts through riparian vegetation in gorges, and over hummock grassland and sparse tree and shrub savannah (Threatened Species Scientific Committee 2008).

Likelihood of occurrence: The current known distribution of the Pilbara Leafnosed-bat does not include the areas proposed for disturbance at Wiluna West. Anabat detectors were located in all areas proposed for disturbance and while the presence of five species of bats was identified, the calls of the Pilbara Leanosed-bat were not recorded or identified. The presence of this species is, therefore, not likely to occur in the Wiluna West area.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- **Malleefowl *Leipoa ocellata***

Family: Megapodidae

Conservation Status: Schedule 1: Rare and likely to become extinct under the Western Australian *Wildlife Conservation Act 1950*

Distribution: The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation (Birds Australia 2012).

Ecology: The Malleefowl is a large, ground-dwelling bird that roosts in trees but rarely flies. The species is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. Mounds are up to one metre in height and 3 m to 5 m in diameter. Breeding occurs from September to April and chicks emerge independently, approximately seven weeks after hatching.

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably.

Likelihood of occurrence: The most recent records of Malleefowl on the DEC Threatened and Priority Fauna Database include one in 2006 and one in 2007 both within the Wiluna area. Anecdotally Malleefowl are known to occur in the area. During the Level 2 survey, two Malleefowl were seen at the southern section of C Ridge in the area of the one active mound (Section 5.5.1.1). Twenty-two inactive mounds were also recorded.

Potential Impacts: While breeding Malleefowl are more sedentary, radio-tracking studies have shown that over the course of a year adults may range over one to several square kilometre, and also that there may be considerable overlap in home-ranges (Benshemesh 2007). While the proposed disturbances are likely to have some impact on habitat availability for the local Malleefowl, the component vegetation associations are not limited but are extensive locally. Therefore, it is not likely that the proposed mining activities will alter the conservation classification of the Malleefowl. The presence of Malleefowl in the area is addressed in the recommendations (Section 6.5).

- ***Apus pacificus*** **Fork-tailed Swift**

Family: Apodidae

Conservation Status: Migratory Marine under EPBC Act 1999
This species is also listed in the CAMBA, JAMBA and ROKAMBA agreements.

Distribution: The Fork-tailed Swift breeds in northeast and mid-east Asia and winters in south New Guinea and Australia (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

Ecology: The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths.

Likelihood of occurrence: Given the ecology of this species, the swift may include the area within its aerial forays and migratory path.

Potential Impacts: There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DSEWPaC 2012). Due to the wide range of this species, the conservation status is unlikely to be altered by the disturbance associated with the proposed mining activity.

- **Great Egret *Ardea alba modesta***

  Family: Ardeidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Great Egret has been recorded across much of Western Australia but avoids the driest regions of the western and central deserts (McKilligan 2005).

  Ecology: The Great Egret, also known as the White Egret is common to very common in well-watered Kimberley flatlands and scarce to moderately common elsewhere. Preferred habitat includes shallow freshwaters and shallow saltwaters, and rarely dry pastures.

  Likelihood of occurrence: Given the lack of preferred habitat of this species in the project area, it is not likely to occur within the survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Ardeotis australis* Australian Bustard**

  Family: Otitidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

  Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portion of the State (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea.

  Ecology: The Australian Bustard is a large ground-dwelling bird known to occur in open or lightly wooded country. It is nomadic and ranges over very large areas, largely dependent on rainfall and hence food availability. Although not flightless, Bustards spend the greater proportion of time on the ground.

  Likelihood of occurrence: The Australian Bustard is not uncommon in the Goldfields, albeit scarce. The DEC Threatened and Priority Fauna Database list two dated sightings (1978 and 1982) near Wiluna and a more recent recording at Yeelerrie in 2009. Given the range and mobility of this species and if present, it is likely to avoid disturbance and moved to less disturbed areas.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Burhinus grallarius*** **Bush Stone-curlew**

  Family: Burhinidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

  Distribution: The Bush Stone-curlew occupies much of the western part of Western Australia, and is also found in eastern Australia and New Guinea (Johnstone and Storr 1998). It is common to uncommon in subhumid and semiarid zones and near coast in arid zones and is rare to uncommon and locally extinct further south.

  Ecology: The Bush Stone-curlew is a well camouflaged, ground nesting bird that inhabits lightly wooded open woodlands. Its nest is a slight or no depression on the ground and eggs are laid from July to January.

  Likelihood of occurrence: The DEC Threatened and Priority Fauna Database lists two sightings of this species with one in 1979 and the other in 2009 in Yeelerrie. Given the lack of preferred habitat, it is not likely that this species would utilise the *Acacia* shrublands and BIF areas within survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Charadrius veredus*** **Oriental Plover**

  Family: Charadriidae

  Conservation Status: Migratory Wetland Species under the EPBC Act 1999. Also included in JAMBA and ROKAMBA agreements (Appendix B).

  Distribution: This species is a migrant from Mongolia and Russia that usually inhabits semi-arid areas in the northern half of Western Australia and occasionally along the south coast. It prefers open grasslands, claypans or gibberstone plains in semi-arid regions inland and is seen less often on marine, tidal mudflats typically used by other plovers (Morcombe 2003).

  Ecology: On arrival in Australia the Oriental Plover does occupy coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands before dispersing further inland where they then inhabit flat open semi-arid or arid grasslands where the grass is short and sparse, and interspersed with hard bare ground (DSEWPaC 2012).

  Likelihood of occurrence: Given the lack of preferred habitat, the Oriental Plover is not likely to utilize the area of proposed disturbance.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Potytelis alexandrae*** **Princess Parrot**

  Family: Psittacidae

  Conservation Status: Vulnerable under EPBC Act 1999

  Distribution: Little is known about the Princess Parrot even to the exact extent of its geographical distribution. However, it is confined to arid regions of Western Australia, the Northern Territory, and South Australia and it is believed that the population is mainly concentrated in the Great Sandy, Gibson, Tanami and Great Victoria Deserts, and in the central ranges (DSEWPaC 2012).

  Ecology: The Princess Parrot inhabits sand dunes and sand flats in the arid zone of western and central Australia (DSEWPaC 2012). It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus*, *Casuarina* or *Allocasuarina* trees; an understorey of shrubs such as *Acacia* (especially *A*. *aneura*), *Cassia*, *Eremophila*, *Grevillea*, *Hakea* and *Senna*; and a ground cover dominated by *Triodia* species. It is also known to frequent *Eucalyptus* or *Allocasuarina* trees in riverine or littoral areas.

  Likelihood of occurrence: Due to the paucity of information about this species, accurate estimates of it conservation significance and likelihood of occurrence are difficult to make. However, the Princess Parrot is not listed on the DEC Threatened Fauna database or the Birds Australia database for the area surveyed and has not been vouchered at the Western Australia Museum for this area. The Wiluna West Project area also appears to be south of the known distributional range of the species. Therefore the Princess Parrot is not likely to utilize the area proposed for mining activity.

  Potential Impacts: Based on the limited information to date on this species, its conservation status is not likely to be altered by the proposed mining activity in the survey areas

- **Rainbow Bee-eater** ***Merops ornatus***

  Family: Meropidae

  Conservation Status: Migratory under EPBC Act 1999

  Distribution: The Rainbow Bee-eater is distributed across much of mainland Australia, and is a common summer migrant to southern Australia. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

  Ecology: Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They generally migrate south at the beginning of spring and breed from November to January. They require open areas with loamy soft soils soft enough for nest tunneling yet firm enough to support the tunnel.

  Likelihood of occurrence: The Rainbow Bee-eater usually migrates south in late September early October and north from February to April (Johnstone and Storr 1998). While the Bee-eater is not included in the species list from the Western Australian Museum or from Birds Australia as having been recorded from this area, and it was not seen or heard during the survey, it would not be unexpected for the Rainbow Bee-eater to use this area within its migratory path.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- **Striated Grasswren *Amytornis striatus striatus***

Family: Maluridae

Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

Distribution: The Striated Grasswren occurs across the eastern deserts of Western Australia including much of the Gibson, Great Sandy and Great Victoria deserts, with isolated populations between Wiluna and Meekatharra, and another near Queen Victoria Spring (Johnstone and Storr 2004). It is locally common but generally scarce.

Ecology: Like many Grasswrens, the Straited Grasswren is elusive and shy. Its preferred habitat is mainly spinifex habitat with or without lows shrubs and herbage, on sandy or loamy plains and also found amongst bushy *Acacia* on sandridges and interdunes usually with spinifex (Johnstone and Storr 2004).

Likelihood of occurrence: The Striated Grasswren is not included in the species list from the Western Australian Museum or from Birds Australia as having been recorded from this area, nor was it seen or heard during the survey. Further, as there is no preferred habitat in the areas proposed for disturbance, it is not likely to occur in the area.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Acanthiza iredalei iredalei* Slender-billed Thornbill**

Family: Acanthizidae

Conservation Status: Vulnerable under EPBC Act 1999

Distribution: The Slender-billed Thornbill is sparsely distributed in disjunct populations across the southern arid and semi-arid portion of Western Australia and western South Australia.

Ecology: The preferred habitat for this species includes chenopod shrublands, treeless or sparsely wooded flatlands and saline flats associated with salt lakes. The Thornbill forages mainly on the ground and in low vegetation, increasing its vulnerability to predation by cats and foxes.

Likelihood of occurrence: Given the absence of preferred habitat for this species, it is not likely to be present in the area proposed for disturbance. None were identified during the comprehensive survey.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Pomatostomus superciliosis ashbyi*** **White-browed Babbler (western wheatbelt)**

  Family: Pomatostomidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The White-browed Babbler is endemic to mainland Australia and occurs mainly in the arid and semi-arid zones south of the Tropic of Capricorn. Scattered populations are found in outback Northern Territory and Western Australia, particularly in the south-western corner of Western Australia.

  Ecology: The White-Browed Babbler is a gregarious bird that travels in flocks and has a strong community affinity. It is found in dry sclerophyll woodlands with a shrubby understorey, mulga, acacias, mallee, cypress pine scrubs, timber, scrub along watercourses and saltbush, and forages on or near the ground for insects and seeds.

  Likelihood of occurrence: The White-browed Babbler was both seen and heard during the survey. The only recording of the species on the DEC Threatened and Priority Fauna Database was in 1978 near Wiluna. This species also appears on both the Western Australian Museum and Birds Australia lists as having been recorded for the area.

  Potential Impacts: Advice from the OEPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the locality of this project area and the large, intact and undisturbed bushland locally, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

- ***Oreoica gutturalis gutturalis*** **Crested Bellbird (southern)**

  Family: Pachycephalidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The distributional range of the Crested Bellbird extends across the greater part of the State but not the wetter regions (north and west Kimberley, Darling Range and deep South-West).

  Ecology: This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of Western Australia. It forages mainly on the ground, primarily for insects, and breeds from March through to December across the State.

  Likelihood of occurrence: The Crested Bellbird was seen and heard during the reconnaissance survey and throughout the Level 2 survey.

  Potential Impacts: The Crested Bellbird (southern) is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database for the Goldfields, Midwest, Wheatbelt and South Coast. While the Wiluna West areas falls within the Goldfields region, the conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly

suggests that its conservation classification will not be compromised by the proposed mining activities at Wiluna.

- **Long-tailed Dunnart *Sminthopsis longicauda***

  Family: Dasyuridae

  Conservation Status: Priority 4 - Taxa in need of monitoring on the DEC Threatened and Priority Database.

  Distribution: This species is patchily distributed but can be locally common. It is found in the Pilbara, Murchison, Northeastern Goldfields, Ashburton and Gibson Desert regions of Western Australia. It is also found in small areas in the Northern Territory (McKenzie *et al.* 2008).

  Ecology: The Long-tailed Dunnart, a nocturnal species, prefers rocky habitats that support low open woodlands or *Acacia* shrublands with an understorey of Spinifex (McKenzie *et al.* 2008). It is the only dunnart with a tail at least twice the length of its head and body combined with a terminal tuft of long hairs (Menkhorst and Knight 2011). The main diet of this species is arthropods and it appears to be a spring-summer breeder (van Dyck and Strahan 2008)

  Likelihood of occurrence: Two individuals were captured during the Spring survey. There have been no other recordings of this species in the Wiluna area.

  Potential Impacts: Recent surveys conducted in the Goldfields suggest that the distributional range of the Long-tailed Dunnart is far greater than previously mapped, and that they are present in low abundance over an extensive part of Western Australia, excluding the southern portion of the state (Terrestrial Ecosystems 2011, KLA 2012). Further, the habitat favoured by this Dunnart is not limited to rugged rocky landscapes that support a low open woodland or shrubland of *Acacias* with an understorey of spinifex hummock and (occasionally) perennial grasses and cassias (Burbidge *et al.* 2008), but that they are also found in flat open mulga woodland with a limited understorey of vegetation (Terrestrial Ecosystems 2011). The Dunnarts recorded during this survey were captured in open *Acacia* shrubland with occasional eucalypts

  Given the above, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey areas.

  The Protected Matters Search Tool for the EPBC Act 1999 also lists the Goat *Capra hircus*, Cat *Felis catus*, Rabbit *Oryctolagus cuniculus* and Fox *Vulpes vulpes* as invasive species for the area. While unconfirmed anecdotal reports suggest that dogs and the occasional cat have been seen in the area, none were seen and no evidence of their presence was identified during the survey. Only Rabbit droppings and sightings of the Camel were recorded during the survey. Notwithstanding this, a program to control feral animals may be considered by GWR.

6.3 POTENTIAL IMPACTS

The EPA objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected (Threatened) fauna consistent with the provision of the WCA 1950.

The greatest impact of the proposed mining activity at Wiluna West is loss of fauna habitat. As part of the development of mining operations for the C3, C4 and Bowerbird Deposit areas, the clearing and removal of approximately 1,000 ha of native vegetation is anticipated. It is inevitable that there will be some localised loss of fauna due to direct mortality arising from clearing of the vegetation and construction activities for the mining operations. For those taxa that can move from disturbance, the habitats within the survey area are widely represented throughout the region. However, for those vertebrate taxa that cannot move away from any disturbances, and in relation to potential impacts implied in Section 6.2, it is unlikely that the loss of individuals associated with the direct mortalities and compromise of proximal habitat values would be sufficient to affect the overall conservation status of any of the species recorded from the survey area.

Similarly, the ongoing impacts from mining activities including vehicular movements, noise and associated dust generation and machinery noise are not likely to alter the conservation status of any species that may persist in adjacent areas. Any invasion and dispersal of weed species may cause deterioration of the condition of the remaining vegetation and the invasion and/or spread of non-native mammals pose a threat to indigenous species in terms of predation and resource limitation.

6.4 HABITATS OF SIGNIFICANCE TO FAUNA INDIGENOUS TO WESTERN AUSTRALIA

Development of mining operations and associated infrastructure will result in the loss of native vegetation, removal of faunal habitat, fragmentation of currently contiguous habitat and loss of areas for dispersal of native fauna.

The vegetation proposed to be disturbed for the mining operation at C3, C4 and Bowerbird does not support any TECs or DRF. However part of the Wiluna West Project area falls within the Priority Ecological Community: Wiluna West (P1) and five Priority flora species were recorded in the broader area (NVS 2012).

Most of the significant flora species that have been identified in the Wiluna West Project area are not limited or restricted to the BIF; and all species of Priority flora identified in the survey area are found in other areas outside of the limit of the flora survey (Read 2010). Cowan (2001) also reports that most flora and fauna species within at least the East Murchison bioregion are wide ranging and usually occur in at least one, and often several, adjoining subregions.

From a fauna perspective, the vegetation can broadly be described as Mulga shrubland interspersed with areas of BIF. The overall condition of the vegetation within the survey areas can generally be described as 'Very Good' to 'Excellent' (after Keighery 1994). Almost all disturbances within the area were directly related to vehicular tracks associated with recent exploration activity. Six introduced weed species were identified in the survey area (Read 2010). Specific weeds were limited to particular habitats but were sparse throughout.

Thus, while the removal of up to 1,000 ha of this native vegetation in overall 'Very Good' to 'Excellent' condition will impact on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context. As observed during this spring survey, there

appeared to be no unique, restricted or fauna-specific habitat types within the Wiluna West or local area. Additionally, as discussed elsewhere in this report, fauna of conservation significance that may use this habitat are unlikely to be compromised by the removal of the vegetation for the proposed mining activities.

6.5 RECOMMENDATIONS

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the initial stages (C3, C4 and Bowerbird) of the Wiluna West Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required;
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna: and

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team to determine the actual number and status of mounds within the C3, C4 and Bowerbird deposit areas including a 100m buffer area.
- Following this survey and given the evidence of Malleefowl within the zone of impact, a referral should be submitted to DSEWPaC for approval in accordance with the EPBC Act 1999.
- Pending the results of the targeted Malleefowl survey and outcome of the DSEWPAC referral, a Malleefowl Management Plan be developed and implemented.
- Develop and implement fire management strategies to protect Malleefowl habitat.
- Develop and implement feral animal control for the protection of Malleefowl adults and chicks.

7.0 REFERENCES

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APPENDIX A
Species likely to occur in the area and species identified in the area

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous Studies in and around study area								KLA reconnaissance survey 2011	Spring Survey 2011		
						Previous surveys At GWR			Surveys within local and regional areas								
						Ninox 2005	Ninox 2006	Ninox 2007	CSIRO 1978	Dunlop 1990	Mckenzie *et al* 1994	Outback Ecology Services 2002, 2008	Ouback Ecology Services 2009, 2010		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
AMPHIBIANS																	
HYLIDAE																	
Cyclorana maini	Sheep Frog	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
Cyclorana platycephala	Water-holding Frog	-	-	+	-	-	-	-	+	-	+	-	-	-	-	-	+
Litoria rubella	Little Red Tree Frog	-	-	-	-	+	-	-	+	+	-	+	-	+	-	+	+
LIMNODYNASTIDAE																	
Neobatrachus sp.		-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Neobatrachus kunapalari	Kunapalari Frog	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Neobatrachus wilsmorei	Plonking Frog	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-
REPTILES																	
CHELUIDAE																	
Chelodina steindachneri	Flat-shelled Turtle	-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	+
AGAMIDAE																	
Amphibolurus longirostris		-	-	+	-	-	-	-	+	-	-	+	+	-	-	-	-
Caimanops amphiboluroides		-	-	-	-	-	+	-	+	-	+	-	-	-	+	-	-
Ctenophorus caudicinctus	Ring-tailed Dragon	-	-	-	-	+	+	+	+	+	+	-	-	-	+	+	+
Ctenophorus caudicinctus subsp. *mensarum*		-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Ctenophorus isolepis	Crested Dragon	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-
Ctenophorus isolepis subsp. *gularis*	Central Military Dragon	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Ctenophorus nuchalis	Central Netted Dragon	-	-	+	-	-	-	-	+	+	+	+	+	-	-	-	-
Ctenophorus pictus	Painted Dragon	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Ctenophorus reticulatus	Western Netted Dragon	-	-	+	-	-	-	-	+	+	+	-	-	-	-	+	-
Ctenophorus salinarum	Salt Pain Dragon	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-
Ctenophorus scutulatus		-	-	+	-	-	-	+	+	+	-	-	+	-	+	-	-
Moloch horridus	Thorny Devil	-	-	+	-	-	-	-	+	-	+	+	-	-	-	-	-
Pogona minor		-	-	-	-	-	+	-	-	+	+	-	-	-	+	+	-
Pogona minor subsp. *minima*	Dwarf Bearded Dragon	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Pogona minor subsp. *minor*		-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	-
Tympanocryptis cephalus	Pebble Dragon	-	-	+	-	-	-	-	+	+	-	-	-	-	+	-	+

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DIPLODACTYLIDAE																	
Diplodactylus conspicillatus	Fat-tailed Gecko	-	-	+	-	-	-	-	+	+	+	+	+	-	-	-	-
Diplodactylus granariensis		-	-	-	-	-	+	+	-	+	-	-	-	-	+	-	-
Diplodactylus granariensis subsp. *rex*		-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-
Diplodactylus pulcher		-	-	+	-	-	+	+	+	+	+	-	-	-	+	-	-
Lucasium damaeum		-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Lucasium squarrosum		-	-	-	-	+	+	+	-	-	-	-	-	-	+	-	-
Lucasium stenodactylum		-	-	+	-	-	-	+	-	-	-	+	+	-	+	-	-
Lucasium wombeyi		-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Rhynchoedura ornata	Beaked Gecko	-	-	+	-	-	-	+	+	+	+	+	+	-	-	-	-
Strophurus elderi		-	-	+	-	-	-	-	+	+	-	+	+	-	-	-	-
Strophurus strophurus		-	-	+	-	-	-	-	+	+	-	+	+	-	-	-	-
Strophurus wellingtonae		-	-	+	-	+	-	+	-	-	+	-	-	-	+	-	-
CARPHODACTYLIDAE																	
Nephrurus laevissimus		-	-	-	-	-	-	-	+	-	-	+	+	-	-	-	-
Nephrurus vertebralis		-	-	+	-	-	-	+	-	+	-	-	+	-	+	-	-
Nephrurus wheeleri		-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-
Nephrurus wheeleri subsp. *wheeleri*		-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
GEKKONIDAE																	
Gehyra punctata		-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-
Gehyra purpurascens		-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Gehyra variegata		-	-	+	-	+	+	+	+	+	+	+	+	-	+	-	+
Heteronotia binoei	Bynoe's Gecko	-	-	+	-	+	+	+	+	-	+	+	+	-	+	-	-
PYGOPODIDAE																	
Delma butleri		-	-	+	-	-	-	-	-	+	+	+	-	-	+	-	-
Delma nasuta		-	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-
Lialis burtonis		-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-
Pygopus lepidopodus	Common Scaly Foot	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Pygopus nigriceps		-	-	+	-	-	-	-	-	+	-	+	+	-	-	-	-
SCINCIDAE																	
Cryptoblepharus plagiocephalus		-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-

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Ctenotus ariadnae		-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Ctenotus atlas		-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Ctenotus calurus		-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Ctenotus helenae		-	-	-	-	-	-	-	+	-	+	-	+	-	-	-	-
Ctenotus leonhardii		-	-	+	-	-	-	-	+	+	+	+	-	-	+	-	-
Ctenotus mimetes		-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Ctenotus pantherinus	Leopard Ctenotus	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Ctenotus pantherinus subsp. ocellifer		-	-	+	-	-	-	-	+	-	-	+	+	-	-	-	-
Ctenotus quattuordecimlineatus		-	-	-	-	-	-	-	+	-	+	+	+	-	-	-	-
Ctenotus schomburgkii		-	-	+	-	-	+	+	-	+	+	+	-	-	-	-	-
Ctenotus severus		-	-	-	-	-	-	-	-	-		-	+	-	-	-	-
Egernia depressa	Pygmy Spiny-tailed Skink	-	-	+	-	-	-	-	+	+	+	-	+	-	+	-	-
Egernia formosa		-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Eremiascincus richardsonii	Broad-banded Sand Swimmer	-	-	+	-	-	-	-	+	+	+	-	-	-	+	-	-
Lerista bipes		-	-	-	-	-	-	-	+	-	+	+	+	-	-	-	-
Lerista desertorum		-	-	-	-	-	-	+	+	+	-	+	+	-	-	-	-
Lerista muelleri		-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-
Lerista nichollsi		-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Lerista sp. Ninox (2008) *muelleri/rhodonoides*		-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-
Liopholis inornata		-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Liopholis kintorei	Great Desert Skink	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Menetia greyii		-	-	-	-	+	+	+	+	-	+	+	+	-	+	+	-
Morethia butleri		-	-	-	-	-	-	-	+	-	+	+	+	-	+	-	+
Tiliqua multifasciata	Central Blue-tongue	-	-	+	-	-	-	-	+	-	+	-	-	-	-	-	-
Tiliqua occipitalis	Western Bluetongue	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
VARANIDAE																	
Varanus brevicauda	Short-tailed Pygmy Monitor	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
Varanus caudolineatus		-	-	+	-	-	+	-	+	+	+	-	-	-	+	-	-
Varanus eremius	Pygmy Desert Monitor	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Varanus giganteus	Perentie	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Varanus gouldii	Bungarra or Sand Monitor	-	-	+	-	-	-	-	+	+	-	+	+	-	+	-	-

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Varanus panoptes	Yellow-spotted Monitor	-	-	-	-	+	+	+	-	+	+	-	-	-	-	-	-
Varanus panoptes subsp. *rubidus*		-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-
TYPHLOPIDAE																	
Ramphotyphlops bituberculatus		-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Ramphotyphlops hamatus		-	-	-	-	-	+	-	-	+	+	+	+	-	-	-	-
Ramphotyphlops waitii		-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
BOIDAE																	
Antaresia childreni	Children's Python	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Antaresia perthensis	Pygmy Python	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
ELAPIDAE																	
Brachyurophis approximans		-	-	+	-	-	-	-	-	-	-	-	+	-	+	-	-
Brachyurophis fasciolatus subsp. *fasciolatus*		-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Brachyurophis semifasciatus		-	-	-	-	-	-	-	+	-	-	-	-		-	-	-
Demansia psammophis	Yellow-faced Whipsnake	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Demansia psammophis subsp. *cupreiceps*		-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-
Demansia psammophis subsp. *reticulata*		-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
Parsuta monachus		-	-	+	-	-	+	-	+	+	-	-	+	-	-	-	-
Pseudechis australis	Mulga Snake	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pseudonaja modesta	Ringed Brown Snake	-	-	+	-	-	+	-	+	+	-	-	+	-	-	-	-
Pseudonaja nuchalis	Gwardar; Northern Brown Snake	-	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-
Simoselaps bertholdi	Jan's Banded Snake	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-
Suta fasciata	Rosen's Snake	-	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-
MAMMALS																	
TACHYGLOSSIDAE																	
Tachyglossus aculeatus	Echidna	-	-	-	-	+	+	+	+	-	+	+	+	-	-	-	-
DASYURIDAE																	
Antechinomys laniger	Kultarr	-	-	+	-	-	-	+	+	-	+	-	-	-	-	-	-

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Dasycercus cristicauda	Crest-tailed Mulgara	-	+	+	-	-	-	+	-	-	-	-	-				
Ningaui ridei	Wongai Ningaui	-	-	+	-	+	+	+	+	+	+	+	+	-	+	-	-
Pseudantechinus woolleyae	Woolley's Pseudantechinus	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-
Sminthopsis crassicaudata	Fat-tailed Dunnart	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Sminthopsis dolichura	Little long-tailed Dunnart	-	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-
Sminthopsis hirtipes	Hairy-footed Dunnart	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Sminthopsis longicaudata	Long-tailed Dunnart	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Sminthopsis macroura	Stripe-faced Dunnart	-	-	+	-	+	+	+	-	+	+	-	+	-	+	-	-
Sminthopsis ooldea	Ooldea Dunnart	-	-	+	-	-	-	-	+	+	+	-	-	-	-	-	-
THYLACOMYIDAE																	
Macrotis lagotis	Bilby, Dalgyte	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
MACROPODIDAE																	
Macropus fuliginosus	Western Grey Kangaroo	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+
Macropus robustus erubescens	Euro	-	-	+	-	+	+	+	+	-	+	+	+	-	-	+	+
Macropus rufus	Red Kangaroo	-	-	+	-	+	-	-	-	-	+	+	+	-	-	-	-
CHIROPTERA																	
HIPPOSIDERIDAE																	
Rhinonicteris aurantia (Pilbara form)	Pilbara Leaf-nosed Bat	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EMBALLONURIDAE																	
Taphozous hilli	Hill's Sheathtail Bat	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-
VESPERTILIONIDAE																	
Chalinolobus gouldii	Gould's Wattled Bat	-	-	+	-	-	+	+	+	-	+	+	+	-	+	-	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	+	-	+	-	+	-	-	+	+	+	-	+	-	-
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	+	-	-	-	+	-	-	+	+	+	-	+	-	-
Vespadelus baverstocki	Inland Forest Bat	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Vespadelus finlaysoni	Finlayson's Cave Bat	-	-	+	-	-	-	+	-	-	+	+	+	-	+	-	-

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MOLOSSIDAE																	
Mormopterus beccarii	Beccari's Freetail Bat	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Mormopterus planiceps ('sp. 3')	Southern Freetail Bat	-	-	-	-	-	-	-	-	-	-	+	+	-			
Mormopterus sp. 3		-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
Tadarida australis	White-striped Freetail Bat	-	-	+	-	-	-	-	+	-	-	+	-	-	-	-	-
MURIDAE																	
*Mus musculus**	House Mouse	-	-	+	-	+	+	+	+	+	+	+	+	-	-	-	-
Notomys alexis	Spinifex Hopping-mouse	-	-	-	-	-	+	+	-	-	+	+	-	-	-	-	-
Pseudomys hermannsburgensis	Sandy Inland Mouse	-	-	+	-	-	+	+	+	+	+	+	-	-	-	-	-
LEPORIDAE																	
Oryctolagus cuniculus*	Rabbit	+	-	-	-	+	+	+	+	-	-	+	+	-	-	+	-
CANIDAE																	
Canis lupis dingo	Dingo	-	-	-	-	+	+	+	-	-	-	+	+	-	-	-	-
*Canis lupis familiaris**	Dog	-	-	-	-	+	+	+	-	-	-	+	+	-	-	-	-
*Vulpes vulpes**	Red Fox	+	-	-	-	-	-	-	+	-	-	+	+	-	-	-	-
FELIDAE																	
*Felis catus**	Cat	+	-	-	-	+	-	-	+	-	-	+	+	-	-	-	-
BOVIDAE																	
*Bos taurus**	European Cattle	-	-	-	-	+	-	-	-	-	+	+	+	-	-	-	-
*Equus asinus**	Donkey	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
*Equus caballus**	Horse	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
*Capra hircus**	Goat	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Ovis aries**	Sheep	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-
CAMELIDAE																	
*Camelus dromedarius**	One-humped Camel	-	-	-	-	+	-	-	-	-	+	+	-	-	-	+	-

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AVIFAUNA																	
CASUARIIDAE																	
Dromaius novaehollandiae	Emu	-	-	-	+	+	+	+	-	-	+	+	-	-	-	-	-
MEGAPODIIDAE																	
Leipoa ocellata	Malleefowl	+	+	-	-	-	+	+	-	-	-	-	-	-	-	+	-
ANATIDAE																	
Cygnus atratus	Black Swan	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Tadorna tadornoides	Australian Shelduck	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-	-
Chenonetta jubata	Australian Wood Duck	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Anas gracilis	Grey Teal	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Anas superciliosa	Pacific Black Duck	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
PODICIPEDIDAE																	
Poliocephalus poliocephalus	Hoary-headed Grebe	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
COLUMBIDAE																	
Phaps chalcoptera	Common Bronzewing	-	-	-	+	+	+	+	+	-	+	+	+	-	+	-	-
Ocyphaps lophotes	Crested Pigeon	-	-	-	+	+	+	+	+	-	+	+	+	-	-	+	-
Geopelia cuneata	Diamond Dove	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	+
PODARGIDAE																	
Podargus strigoides	Tawny Frogmouth	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-	+
EUROSTOPODIDAE																	
Eurostopodus argus	Spotted Nightjar	-	-	+	+	-	-	-	+	-	-	+	-	-	-	-	+
AEGOTHELIDAE																	
Aegotheles cristatus	Australian Owlet-nightjar	-	-	-	+	-	+	-	+	-	+	+	+	-	-	-	-
APODIDAE																	
Apus pacificus	Fork-tailed Swift	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-

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ARDEIDAE																	
Ardea pacifica	White-necked Heron	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
Ardea modesta alba	Western Great Egret	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ACCIPITRIDAE																	
Elanus axillaris	Black-shouldered Kite	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Lophoictinia isura	Square-tailed Kite	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-
Hamirostra melanosternon	Black-breasted Buzzard	-	-	-	+	+	-	-	-	-	-	+	+	-	-	-	-
Haliastur sphenurus	Whistling Kite	-	-	-	+	-	-	-	+	-	-	+	+	-	-	-	-
Milvus migrans	Black Kite	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
Accipiter fasciatus	Brown Goshawk	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Accipiter cirrocephalus	Collared Sparrowhawk	-	-	-	-	+	+	-	+	-	+	+	-	-	-	-	-
Aquila morphnoides	Little Eagle	-	-	-	+	-	-	-	+	-	-	+	+	-	+	-	-
Aquila audax	Wedge-tailed Eagle	-	-	-	+	-	+	+	+	-	+	+	+	-	-	-	-
Circus assimilis	Spotted Harrier	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
FALCONIDAE																	
Falco cenchroides	Australian Kestrel	-	-	-	+	+	+	-	+	-	+	+	+	-	-	+	-
Falco berigora	Brown Falcon	-	-	-	+	-	+	+	+	-	+	+	+	-	-	-	-
Falco longipennis	Australian Hobby	-	-	-	+	+	-	-	+	-	-	+	-	-	-	-	-
Falco peregrinus	Peregrine Falcon	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
RALLIDAE																	
Tribonyx ventralis	Black-tailed Native-hen	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
OTIDIDAE																	
Ardeotis australis	Australian Bustard	-	+	-	-	+	+	-	-	-	+	-	-	-	-	-	-
BURHINIDAE																	
Burhinus grallarius	Bush Stone-curlew	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-

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						Previous surveys At GWR			Surveys within local and regional areas								
						Ninox 2005	Ninox 2006	Ninox 2007	CSIRO 1978	Dunlop 1990	Mckenzie *et al* 1994	Outback Ecology Services 2002, 2008	Ouback Ecology Services 2009, 2010		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
RECURVIROSTRIDAE																	
Himantopus himantopus	Black-winged Stilt	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Recurvirostra novaehollandiae	Red-necked Avocet	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Cladorhynchus leucocephalus	Banded Stilt	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
CHARADRIIDAE																	
Charadrius ruficapillus	Red-capped Plover	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Charadrius veredus	Oriental Plover	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Elseyornis melanops	Black-fronted Dotterel	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
Erythrogonys cinctus	Red-kneed Dotterel	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Vanellus tricolor	Banded Lapwing	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
SCOLOPACIDAE																	
Actitis hypoleucos	Common Sandpiper	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Tringa nebularia	Common Greenshank	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Tringa glareola	Wood Sandpiper	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Calidris alba	Sanderling	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Calidris ruficollis	Red-necked Stint	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Calidris subminuta	Long-toed Stint	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Calidris acuminata	Sharp-tailed Sandpiper	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Calidris ferruginea	Curlew Sandpiper	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
TURNICIDAE																	
Turnix velox	Little Button-quail	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-
GLAREOLIDAE																	
Glareola maldivarum	Oriental Pratincole	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
CACATUIDAE																	
Eolophus roseicapillus	Galah	-	-	+	+	+	+	-	+	-	+	+	+	-	+	+	-
Cacatua sanguinea	Little Corella	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Nymphicus hollandicus	Cockatiel	-	-	-	-	-	-	-	+	-	+	-	-	+	+	-	-

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PSITTACIFORMES																	
Polytelis alexandrae	Princess Parrot	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barnardius zonarius	Australian Ringneck	-	-	-	+	+	+	-	+	-	+	+	+	-	+	-	-
Barnardius zonarius subsp. *zonarius*	Port Lincoln Parrot	-	-	+	-	-	-	-	-	-	-	+	+				
Psephotus varius	Mulga Parrot	-	-	-	+	+	+	+	+	-	+	+	+	-	-	-	-
Melopsittacus undulatus	Budgerigar	-	-	-	-	-	+	-	+	-	+	-	-	+	+	-	-
Neopsephotus bourkii	Bourke's Parrot	-	-	+	+	-	+	-	-	-	+	-	-	-	+	-	-
CULCULIDAE																	
Chalcites basalis	Horsfield's Bronze Cuckoo	-	-	-	+	-	-	-	-	-	+	-	-	-	+	-	-
Chalcites osculans	Black-eared Cuckoo	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-
Cacomantis pallidus	Pallid Cuckoo	-	-	-	+	-	-	-	+	-	+	-	+	-	+	+	-
STRIGIDAE																	
Ninox novaeseelandiae	Southern Boobook Owl	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
HALCYONIDAE																	
Todiramphus pyrrhopygius	Red-backed Kingfisher	-	-	-	-	-	+	-	+	-	+	-	+	-	-	-	-
Todiramphus sanctus	Sacred Kingfisher	-	-	-	+	-	-	-	+	-	-	-	-		-	-	-
MEROPIDAE																	
Merops ornatus	Rainbow Bee-eater	+	-	-	-	-	-	-	+	-	-	+	+	-	-	-	-
CLIMACTERIDAE																	
Climacteris affinis	White-browed Treecreeper	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
PTILONORHYNCHIDAE																	
Ptilonorhynchus maculatus	Spotted Bowerbird	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Ptilonorhynchus guttatus	Western Bowerbird	-	-	+	+	+	+	+	+	-	-	+	-	+	+	+	-
MALURIDAE																	
Malurus splendens	Splendid Fairy-wren	-	-	+	+	+	+	+	+	-	-	+	+	-	+	+	-

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Malurus leucopterus	White-winged Fairy-wren	-	-	-	-	-	-	-	+	-	+	+	+	-	-	-	-
Malurus lamberti	Variegated Fairy-wren	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Amytornis striatus subsp. *striatus*	Striated Grasswren	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
ACANTHIZIDAE																	
Pyrrholaemus brunneus	Redthroat	-	-	-	+	+	+	+	+	-	-	+	+	-	+	-	-
Smicrornis brevirostris	Weebill	-	-	-	+	-	+	+	+	-	+	+	+	-	+	-	-
Gerygone fusca	Western Gerygone	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+
Acanthiza robustirostris	Slaty-backed Thornbill	-	-	-	+	+	+	+	-	-	+	+	+	+	+	-	-
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	+	+	+	+	+	-	+	+	+	-	-	-	-
Acanthiza uropygialis	Chestnut-rumped Thornbill	-	-	-	+	+	+	+	+	-	+	+	+	-	+	-	-
Acanthiza iredalei iredalei	Slender-billed Thornbill	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acanthiza apicalis	Inland Thornbill	-	-	+	+	+	+	+	+	-	-	+	+	+	+	-	-
Aphelocephala leucopsis	Southern Whiteface	-	-	-	+	-	+	+	-	-	+	-	-	-	-	-	-
PARDALOTIDAE																	
Pardalotus striatus	Striated Pardalote	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-
Pardalotus striatus subsp. *murchisoni*		-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
MELIPHAGIDAE																	
Certhionyx variegatus	Pied Honeyeater	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
Lichenostomus virescens	Singing Honeyeater	-	-	-	+	+	+	+	+	-	+	+	+	-	+	-	-
Lichenostomus leucotis	White-eared Honeyeater	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-
Lichenostomus keartlandi	Grey-headed Honeyeater	-	-	-	-	-	-	-	-	-	-	+	-	-			
Lichenostomus ornatus	Yellow-plumed Honeyeater	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Lichenostomus plumulus	Grey-fronted Honeyeater	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Lichenostomus penicillatus	White-plumed Honeyeater	-	-	-	+	-	-	-	+	-	+	+	+	-	-	-	-
Purnella albifrons	White-fronted Honeyeater	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-
Manorina flavigula	Yellow-throated Miner	-	-	-	+	+	+	+	+	-	+	+	+	-	+	+	-

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Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	-	-	+	+	+	-	+	-	+	+	+	+	+	+	-
Epthianura tricolor	Crimson Chat	-	-	-	-	-	-	+	+	-	+	-	-	-	+	-	-
Epthianura aurifrons	Orange Chat	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
Lichmera indistincta	Brown Honeyeater	-	-	-	+	-	-	-	-	-	+	+	-	-	-	-	-
POMATOSTOMIDAE																	
Pomatostomus temporalis	Grey-crowned Babbler	-	-	-	+	+	+	+	+	-	-	+	+	+	+	+	-
Pomatostomus superciliosus	White-browed Babbler	-	-	+	+	-	+	+	+	-	+	+	-	-	+	+	-
Pomatostomus superciliosus subsp. *ashbyi*	White-browed Babbler	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PSOPHODIDAE																	
Cinclosoma cinnamomomeum	Cinnamon Quail-thrush	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	-	-	+	-	+	+	+	-	-	-	-	-	-	-	+	-
Psophodes occidentalis	Chiming Wedgebill	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
NEOSITTIDAE																	
Daphoenositta chrysoptera	Varied Sittella	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-
CAMPEPHAGIDAE																	
Coracina maxima	Ground Cuckoo-shrike	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	-	+	+	+	+	+	-	+	+	+	-	+	-	-
Lalage sueurii	White-winged Triller	-	-	-	-	-	+	-	+	-	+	+	-	-	+	-	-
PACHYCEPHALIDAE																	
Pachycephala rufiventris	Rufous Whistler	-	-	-	+	+	+	+	+	-	+	+	+	+	+	-	-
Colluricincla harmonica	Grey Shrike-thrush	-	-	-	+	+	+	+	+	-	+	+	-	-	+	+	-
Oreoica gutturalis	Crested Bellbird	-	-	-	+	+	+	+	+	-	+	-	+	+	+	+	-
ARTAMIDAE																	
Artamus personatus	Masked Woodswallow	-	-	-	+	-	+	-	-	-	+	-	-	+	+	+	+
Artamus superciliosus	White-browed Woodswallow	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-

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Artamus cinereus	Black-faced Woodswallow	-	-	-	+	+	-	+	-	-	+	+	+	+	-	+	-
Artamus minor	Little Woodswallow	-	-	-	-	+	+	-	-	-	+	-	-	-	-	-	-
Cracticus torquatus	Grey Butcherbird	-	-	-	+	+	+	+	-	-	-	+	+	-	+	+	-
Cracticus nigrogularis	Pied Butcherbird	-	-	-	+	+	+	+	-	-	+	+	+	-	+	+	+
Cracticus tibicen	Australian Magpie	-	-	-	+	-	-	+	-	-	-	+	+	-	-	-	-
Strepera versicolor	Grey Currawong	-	-	-	+	+	-	+	-	-	+	+	-	-	+	-	-
RHIPIDURIDAE																	
Rhipidura leucophrys	Willie Wagtail	-	-	-	+	+	+	+	+	-	+	+	+	+	+	-	-
CORVIDAE																	
Corvus bennetti	Little Crow	-	-	-	+	-	+	-	-	-	+	+	+	-	+	-	-
Corvus orru	Torresian Crow	-	-	-	+	+	+	-	-	-	-	-	-	-	-	+	-
MONARCHIDAE																	
Grallina cyanoleuca	Magpie-lark	-	-	-	+	+	-	-	+	-	+	+	-	-	-	-	-
PETROICIDAE																	
Petroica goodenovii	Red-capped Robin	-	-	-	+	+	+	+	+	-	+	-	+	+	+	+	-
Melanodryas cucullata	Hooded Robin	-	-	-	+	-	+	-	+	-	+	-	-	-	-	-	-
HIRUNDINIDAE																	
Cheramoeca leucosternus	White-backed Swallow	-	-	-	-	-	+	-	+	-	-	+	-	-	-	-	-
Hirundo neoxena	Welcome Swallow	-	-	-	+	+	+	-	+	-	-	+	-	-	-	-	-
Petrochelidon ariel	Fairy Martin	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Petrochelidon nigricans	Tree Martin	-	-	-	+	-	-	-	+	-	-	+	+	-	-	-	-
MEGALURIDAE																	
Cincloramphus mathewsi	Rufous Songlark	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
Cincloramphus cruralis	Brown Songlark	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
NECTARINIIDAE																	
Dicaeum hirundinaceum	Mistletoebird	-	-	-	+	+	-	-	+	-	+	-	-	-	-	-	-

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ESTRILDIDAE																	
Taeniopygia guttata	Zebra Finch	-	-	-	+	-	+	-	+	-	+	+	+	-	-	-	-
MOTACILLIDAE																	
Anthus novaseelandiae	Australian Pipit	-	-	-	+	+	-	-	+	-	+	+	-	-	-	+	-

APPENDIX B
Categories used in the assessment of conservation status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 and the WA Wildlife Conservation Act 1950.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

APPENDIX C
Department of Environment and Conservation Regulation 17 Permit

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
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PERSON NO. 78973

DATE OF ISSUE 26/09/2011
VALID FROM 25/10/2011
DATE OF EXPIRY 25/11/2011

LICENSING OFFICER

(VI)

LICENSEE:
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DR V SAFFER
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W.A. 6149

AMENDED
17/10/2011 Date
OPS Initial

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

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Correspondence: **Locked Bag 30**
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WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED 1 TO 9) ARE ATTACHED.

PURPOSE LEVEL 2 FAUNA SURVEY FOR GOLDEN WEST RESOURCES LTD FOR THE WILUNA WEST PROJECT. FAUNA SAMPLING WILL BE VIA ASSISTED DRY PITFALL, ELIOTT, CAGE AND FUNNEL TRAPS. VERTEBRATE FAUNA SPECIES WILL BE IDENTIFIED AND RELEASED AT POINT OF CAPTURE. SHORT RANGE ENDEMIC INVERETEBRATES WILL BE COLLECTED THROUGH TARGETED SEARCH. EXCAVATION OF MYGALOMORPH SPIDER BURROWS WILL BE LIMITED TO A MAXIMUM OF ONE BURROW/SPECIMEN PER SAMPLING SITE WITH MALES AND MATURE INDIVIDUALS TARGETED WHERE POSSIBLE.

AUTHORISED PERSONS
MS ERICA MACINTYRE
MS MERRI BARTLETT
MR HAMISH BURNETT

WILDLIFE CONSERVATION REGULATIONS 1970

Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF00 3258)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaker during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

APPENDIX D
Keighery, B.J. (1994) Vegetation Condition Scales

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). Basic vegetation structure severely impacted by disturbance.
Scope for regeneration but not to a state approaching good condition without intensive management.
For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.
These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.