20 July 2009



Tropicana Gold Project

Operational Area

Vertebrate Fauna Assessment

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TROPICANA GOLD PROJECT

OPERATIONAL AREA VERTEBRATE FAUNA ASSESSMENT

TROPICANA JOINT VENTURE

20 July 2009

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ecologia
ENVIRONMENT
1025 Wellington Street
WEST PERTH WA 6005
Phone: 08 9322 1944
Fax: 08 9322 1599
Email: admin@ecologia.com.au
www.*ecologia*.com.au

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EXECUTIVE SUMMARY

The Tropicana JV (TJV) is currently undertaking a pre-feasibility study on the viability of establishing the Tropicana Gold Project (TGP). The proposed mining operation is located approximately 330 km east north-east of Kalgoorlie, and 15km west of the Plumridge Lakes Nature Reserve, on the western edge of the Great Victoria Desert (GVD) biogeographic region of Western Australia. The climate is described as arid, with summer and winter rain averaging 150 –180mm (Barton and Cowan 2001). Since the discovery of the deposit in 2002, gold mineralisation has been identified over a strike length of approximately four kilometres with two areas of significant mineralisation, termed the Tropicana and Havana deposits (the Resource Area), which form the basis of the proposed TGP. It is currently proposed that the TGP would operate for approximately 10 - 15 years to realize the potential of the resource

The project is a joint venture between AngloGold Ashanti Australia Limited (70% stakeholder and Manager) and the Independence Group NL (30% stakeholder).

ecologia Environment was commissioned by AngloGold Ashanti Australia (AGAA) on behalf of the Tropicana JV to undertake a vertebrate fauna assessment of the proposed Operational Area, the results of which are presented in this document.

The survey area is situated in the Helms Botanical District, near the border of the Great Victoria Desert and the Nullarbor Plain, within the Eremaean Botanical Province. Beard (1975) described four distinct vegetation units within close proximity to and including the Tropicana project area:

1. Tree (*Eucalyptus gongylocarpa, E. youngiana* [usually mallee]) and shrub steppe between sand hills with hummock grassland (*Triodia basedowii*). *($e_{19}lre_{20}Srt_2Hi$).*
2. Patches of *Acacia aneura* (mulga) low woodland between sand ridges *(a_1li).*
3. Tree steppe *Acacia aneura* (mulga) / *Casuarina pauper* (sheoak) [syn. *C. cristata*] woodland on sandplain *($a_1c_2Lrt_2Hi$).*
4. Lightly wooded succulent steppe: *Acacia aneura* (mulga) with *Atriplex* (Saltbush) or *Kochia* (now *Maireana*). *(a_1Lrk_1Ci).*

A vertebrate fauna assessment was conducted over three sampling events. These events where undertaken in November 2006, March 2007, and March 2008. Further surveys targeting southern marsupial moles (listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999*) were also undertaken in August 2007.

Survey methods were devised following consideration of the Environmental Protection Authority's Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* and Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* and in consultation with staff at the Department of Environment and Conservation. Conformance of the project to EPA Position Statement No. 3 is detailed in Table S.1, below.

Eighteen sampling sites were established in the Operational Area such that the major fauna habitats and areas of proposed disturbance were sampled. Each site comprised a combination of pit fall traps, Elliott box traps, funnel traps and cage traps. Traps remained open for a period of ten nights.

Bird surveys were conducted at each of the sampling sites and opportunistically throughout the survey area. Bat recordings were made at each site using an ANABAT bat detector. Reptiles and mammals were actively searched for during the day and night, and all habitats were assessed for their potential to harbour conservation significant fauna.

A summary of the total survey effort for the three sampling phases, including species specific surveys are provided below:

Pit fall traps	Elliott traps	Funnel traps	Cage traps	Active searches	Night searches	ANABAT recordings	Bird surveys
3120 trap nights	6240 trap nights	4600 trap nights	560 trap nights	110.58 person hours	60.5 person hours	86.33 hours	85.17 hours

Two trapping sites specifically targeting Sandhill Dunnarts (listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999*) were established during the second phase of surveying.

To determine whether Southern Marsupial Moles (which are listed as Endangered under the Federal *Environmental Protection and Biodiversity Conservation Act 1999*) were present, survey techniques developed by Benshemesh (2005) were used. A total of 225 marsupial mole survey trenches were dug throughout the survey area.

Faunal assemblages were relatively diverse, with 22 species of native mammal (not including abandoned nests of Stick-nest Rats *Leporillus* sp. which are presumed extinct in the area), 73 species of bird, 70 species of reptile and one species of amphibian recorded during the survey

Conservation-significant species recorded were the Australian Bustard (listed Priority 4 by the Department of Environment and Conservation), Peregrine Falcon (Schedule 4 under the Western Australian *Wildlife Conservation Act 1950*) and Rainbow Bee-eater (listed Migratory under the Federal *Environment Protection and Biodiversity Conservation Act 1999*). Secondary evidence of Southern Marsupial Mole (listed Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999*) were found in many of the sandy locations of the survey area. Six inactive mounds of the Malleefowl (listed Vulnerable under the Federal *Environment Protection and Biodiversity Conservation Act 1999*) were recorded in the survey area.

A risk assessment was undertaken to determine potential impacts to vertebrate fauna and possible residual impacts. It identified the following potential impacts:

- Habitat loss and fragmentation through clearing of native vegetation.
- Vehicle strikes on surface-dwelling and burrowing fauna have the potential to cause fauna mortality.
- Increased risk of fire associated with movement of employees and machinery.
- Degradation of fauna habitat due to invasion and spread of weeds.
- Increased movement of feral fauna in the area resulting in increased predation pressure and/or increased competition.
- Disruption to resident fauna due to increased noise, vibrations and dust pollution.

The risk assessment identified several strategies to minimise impacts to native fauna:

Construction and Operational Activities

- Vegetation clearing boundaries should be clearly defined and marked in the field. Clearing should be planned to retain habitat corridors where practicable.
- Clearance programs should be designed to occur over a period of time to allow movement of individuals away from clearing activities.

- Cleared areas should be rehabilitated as soon as is practicable. Rehabilitation should include placing cleared vegetation and logs within the area, as these provide fauna refuge. Following rehabilitation, areas should be monitored and, if necessary, treated for weed invasion.
- Existing cleared areas should be used in preference to removing new vegetation.
- Unauthorised off-track driving and parking should be discouraged, in order to reduce damage to vegetation and the possibility of spinifex fires.
- Ensure that appropriate fire fighting equipment is available at all times and staff are appropriately trained in emergency response.
- Weed hygiene measures should be devised and implemented.
- Putrescible waste hygiene measures should be implemented and enforced at all work sites to reduce the likelihood of foxes and cats being attracted to the area.
- Site personnel should be discouraged from feeding native and introduced fauna. An animal baiting scheme targeting feral species (e.g. Fox 1080) should be considered in consultation with the DEC.
- Reduce vehicle speed in area known to be critical habitat for conservation significant species. Educate road users about reducing vehicle speeds at dawn, dusk and at night when animal activity on roads is highest, and slowing down when they see animals on the road.
- Lighting will be designed to avoid excess spill from work area. Lights should also be turned off for a sustained period if excessive concentrations of fauna congregate
- Management measure should be implemented to prevent access to man made water sources by feral species.

Conservation Significant Fauna

- Site personnel should be familiarised with potential species of conservation significance and report all sightings to environmental personnel.
- Disturbances to yellow sand dune areas should be avoided where practical, as these may be listed as a Priority Ecological Community (pending delineation by DEC) and may also provide habitat for Sandhill Dunnarts and Southern Marsupial Moles.
- To limit impacts on potential nesting sites removal in large mature trees, particularly *Eucalyptus gongylocarpa* trees with hollows will be avoided outside the main mining and processing area. Within the processing and mining area where practical trees will be retained.
- Whenever large, mature *Eucalyptus gongylocarpa* trees with hollows need to be removed during site construction, these trees should be retained to be used during rehabilitation.

Additional Survey Work

- If impacts to chenopod shrubland are identified in any future expansion projects, targeted surveys for Slender-billed Thornbill should be undertaken prior to disturbance.
- Additional fauna surveys, if conducted, should aim to sample vegetation communities not targeted in previous surveys.

Table S.1 Conformance of assessment to relevant EPA Position Statement No. 3

REQUIREMENT	RELEVANCE TO PROJECT	SURVEY COMPLIANCE
Impact on Biodiversity	Where impact on biodiversity cannot be avoided, the proponent must demonstrate that the impact will not result in unacceptable loss.	The Operational Area is located in a region of contiguous vegetation with little degradation from mining, pastoralism or agriculture. Six conservation significant species have been recorded (of which two by indirect means). Where possible, the proponent has relocated aspects of the proposed mine away from sandy areas that have shown evidence of possible Southern Marsupial Mole traces, and has reduced other impacts to dunes to avoid impacting the species. All conservation significant species have been identified in surrounding areas outside the proposed impact footprint and the project will not result in a significant impact to populations of any of the conservation significant species.
State, National and International Agreements, Legislation and Policy on Biodiversity	Information gathered for environmental impact assessment in Western Australia meets State, National and International Agreements, Legislation and Policy in regard to biodiversity conservation.	Impacts to species listed under relevant legislation are addressed in Section 6.4. The relevance of the potential impacts of the proposed mining operation to principles outlined in the *Environmental Protection Act 1986* is discussed in Section 8.0.
EPA Standards, Requirements and Protocols	The quality of information and scope of field surveys meets the standards, requirements and protocols as determined and published by the EPA.	The current survey conforms to a Level 2 survey, comprising a desktop assessment, a reconnaissance survey and comprehensive field survey, as per Guidance Statement No. 56. Additional surveys targeting conservation significant fauna (Southern Marsupial Moles and Sandhill Dunnarts) were undertaken in addition to baseline trapping surveys.
Biodiversity Conservation and Ecological Function Values	Sufficient information is provided to address biodiversity conservation and ecological function values.	The survey provides baseline local ecosystem diversity information against which changes in biodiversity and ecological function can be assessed by, for example, monitoring fauna assemblages in adjacent areas. Adverse changes to diversity and function are not anticipated outside of the identified impact footprint.
State Biological Databases	Terrestrial biological surveys will be made publicly available and will contribute to the bank of data available for the region.	Survey data were submitted to DEC as per licence regulations (Licence to Take Fauna for Scientific Purposes No. SF5489 and SF6420). Additionally, the data contained herein are expected to be made public as part of the Public Environmental Review process (copyright applies).

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The Tropicana Joint Venture (TJV) is currently undertaking a pre-feasibility study on the viability of establishing the Tropicana Gold Project (TGP), which is centred on the Tropicana and Havana gold deposits. The proposed TGP is located approximately 330 km east north-east of Kalgoorlie, and 15km west of the Plumridge Lakes Nature Reserve, on the western edge of the Great Victoria Desert (GVD) biogeographic region of Western Australia (Figure 1.1). The project is a joint venture between AngloGold Ashanti Australia Limited (70% stakeholder and Manager) and the Independence Group NL (30% stakeholder).

The TGP consists of three main components (Figure 1.1):

- Operational Area - This area contains the mine, processing plant, aerodrome, village and other associated infrastructure;
- Water Supply Area - Two basins have been investigated, the Minigwal Trough and Officer Basin; and
- Infrastructure Corridor - Two corridors are proposed (Tropicana-Transline for communication and Pinjin for the site access road).

As part of the approvals process, a Level 2 fauna assessment was required in accordance with Guidance Statement No. 56 (EPA 2004). *ecologia* Environment (*ecologia*) was commissioned by the TJV to undertake a vertebrate fauna assessment to be incorporated into the environmental impact assessment for the project.

Initially, *ecologia* conducted two phases of sampling within the proposed Operational Area, in November 2006 and March 2007.

After consultation with the TJV and other stakeholders, it was decided that a supplementary single phase level 2 fauna survey, as well as a targeted survey determining the presence of Southern Marsupial Moles (*Notoryctes typhlops*), were required to focus on the areas that are proposed to have the highest impact, such as the main mine pit, tailings dams, waste dumps and production areas. These additional surveys were carried out in August 2007 and March 2008, respectively. The total surveyed area comprised approximately 8,000 ha. The results of these surveys are reported in this document.

1.2 PREVIOUS FAUNA STUDIES

The fauna of the western Great Victoria Desert has received little attention compared with other areas of the state, such as the Pilbara, where studies similar to this are common. In this report, data from two previous fauna studies were included. These were studies from Plumridge Lakes (Burbidge *et al.* 1976) and Mulga Rock (Martinick and Associates Pty Ltd 1986).

The Plumridge Lakes Nature Reserve is located within 25 km of the Tropicana project, spanning both the Shield and Central subregions of the Great Victoria Desert bioregion. The Mulga Rock survey, conducted approximately 15 km north of the Queen Victoria Spring Nature Reserve, is located approximately 100 km south-south-west of Tropicana.

Additionally, in 2008 the TJV sponsored a comprehensive fauna survey at Neale Junction Nature Reserve in conjunction with the Department of Environment and Conservation (DEC). The DEC is currently preparing the results of this survey.

1.3 LEGISLATIVE FRAMEWORK

The *Environmental Protection Act 1986* is "an Act to provide for an Environmental Protection Authority, for the prevention, control and abatement of environmental pollution, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing." Section 4a of this Act outlines five principles that are required to be addressed to ensure that the objectives of the Act are addressed. Three of these principles are relevant to native fauna and flora:

- *The Precautionary Principle*

  Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

- *The Principles of Intergenerational Equity*

  The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

- *The Principle of the Conservation of Biological Diversity and Ecological Integrity*

  Conservation of biological diversity and ecological integrity should be a fundamental consideration.

In addition to these principles, surveys undertaken as part of the Environmental Impact Assessment (EIA) process are required to address guidelines produced by the Environmental Protection Authority (EPA), in this case Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact in Western Australia* (EPA 2004), and principles outlined in the EPA's Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002).

Native flora and fauna in Western Australia are protected at a Federal level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and at a State level under the *Wildlife Conservation Act 1950* (WC Act).

The EPBC Act was developed to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance, to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources, and to promote the conservation of biodiversity. The EPBC Act includes provisions to protect native species (and in particular prevent the extinction, and promote the recovery, of threatened species) and to ensure the conservation of migratory species. In addition to the principles outlined in Section 4a of the EPBC Act, Section 3a of the EPBC Act includes a principle of ecologically sustainable development dictating that decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.

The WC Act was developed to provide for the conservation and protection of wildlife in Western Australia. Under Section 14 of this Act, all flora and fauna within Western Australia is protected; however, the Minister may, via a notice published in the Government Gazette, declare a list of fauna taxa identified as likely to become extinct, or is rare, or otherwise in need of special protection. The current listing was gazetted in August 2008.

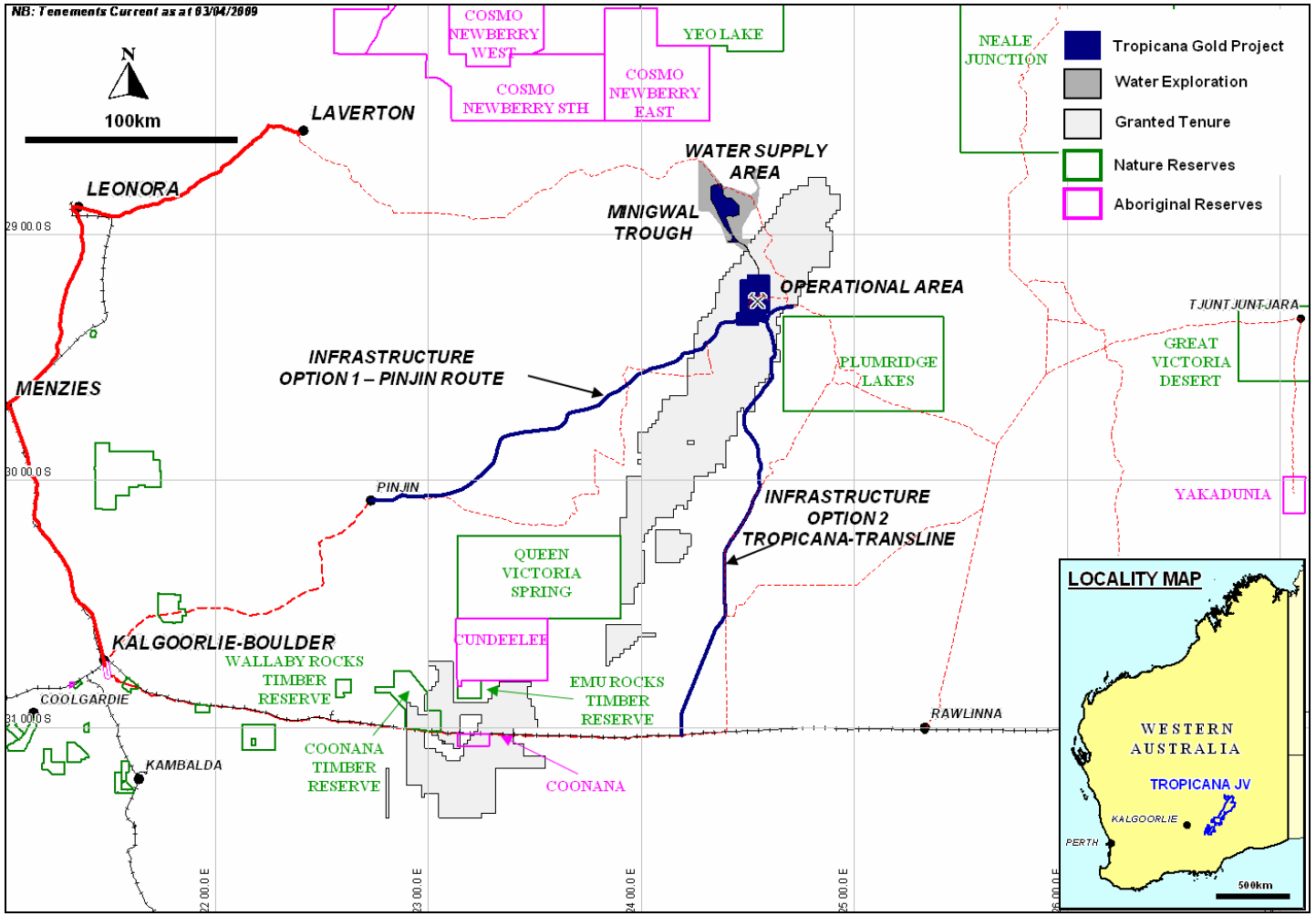

Figure 1.1 Location of the Tropicana Gold Project area (including the proposed Operational Area)

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1.4 SURVEY OBJECTIVES

The TJV commissioned *ecologia* to undertake a baseline biological survey of the vertebrate fauna of the proposed Operational Area as part of the environmental impact assessment for the Tropicana Gold Project.

The EPA's objectives with regard to fauna management are to:

- maintain the abundance, species diversity and geographical distribution of terrestrial fauna; and
- protect Specially Protected (Threatened) fauna, consistent with the provisions of the *Wildlife Conservation Act 1950.*

The objective of the survey was to provide sufficient information to the EPA to assess the impact of the TGP on the vertebrate fauna of the area, while acknowledging the requirements documented in the EPA's Guidance Statement No. 56 and Position Statement No. 3.

This survey report provides:

- A review of background information (including literature and database searches);
- An inventory of vertebrate fauna species occurring in the proposed operational footprint, incorporating recent published and unpublished records;
- An inventory of species of biological and conservation significance recorded or likely to occur within the proposed operational footprint and surrounds;
- A description of fauna habitats occurring in the proposed operational footprint;
- A description of the characteristics of the faunal assemblage;
- An appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area which are relevant to the current study;
- Maps of rare fauna occurrence;
- A review of regional and biogeographical significance, including the conservation status of species recorded in the survey area; and
- A risk assessment to determine likely impacts of threatening processes on vertebrate fauna within the proposed operational footprint.

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2.0 BIOPHYSICAL ENVIRONMENT

2.1 CLIMATE

The proposed Operational Area is located on the western edge of the Great Victoria Desert. The climate is described as arid, with summer and winter rain (Barton and Cowan 2001). Average weather conditions for the Operational Area can be interpreted from weather data collected from the closest Bureau of Meteorology weather stations: Laverton to the north-west and Balgair to the south-east. A summary of climatic data for these two locations is provided in Table 2.1 and Figure 2.1 below.

Table 2.1 Summary of climatic data for Laverton and Balgair.

Statistic	J	F	M	A	M	J	J	A	S	O	N	D
Laverton												
Mean max (°C)	35.8	34.8	31.9	27.2	22.1	18.5	17.8	20.0	24.5	28.0	32.1	34.9
Mean min (°C)	20.5	20.0	18.0	13.9	9.5	6.6	5.2	6.4	9.5	12.8	16.6	19.3
Mean rainfall (mm)	24.3	30.1	30.7	22.6	24.1	24.4	16.4	13.7	8.2	8.5	13.6	17.1
Balgair												
Mean max (°C)	32.8	31.9	29.5	26.3	22.3	19.1	18.7	20.6	24.2	26.7	29.2	30.9
Mean min (°C)	16.3	16.7	14.8	11.9	9.0	6.1	5.2	5.9	8.3	10.5	12.8	14.7
Mean rainfall (mm)	21.1	27.7	30.8	21.3	24.0	24.8	17.2	19.1	17.3	15.6	23.6	36.4

Laverton: 28.63 °S 122.41°E. Records from 1899 – 2007.
Balgair: 31.09 °S 125.66°E. Records from 1982 – 2007.

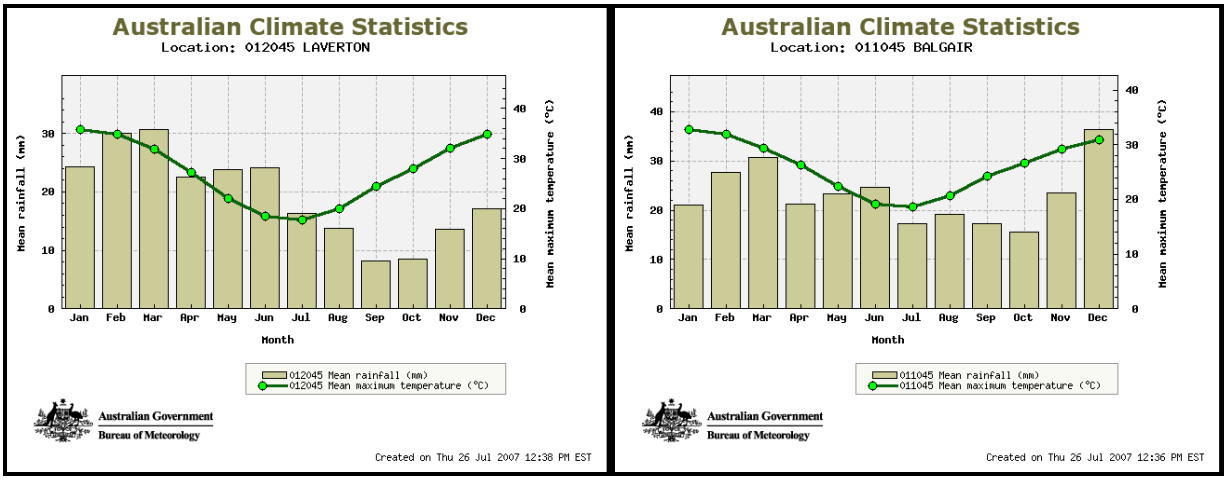

Figure 2.1 Mean monthly rainfall and mean maximum temperature data for Laverton and Balgair weather stations (Bureau of Meteorology 2008)

The proposed Operational Area experiences dry conditions year round, with approximately 200 – 300 mm of rainfall per year. The majority of rainfall occurs during the summer months,

generally associated with cyclonic rainfall extending into the interior. This may result in heavy rainfall between January and April (Laverton received 233.6 mm in February 1995). Conversely, during all months of the year, the region can experience no rainfall, while the lowest amount of annual rainfall received in the area was 65.6 mm at Laverton (1928) and 140.7 mm at Balgair (1991).

Temperature extremes are also experienced in the region, with the highest maxima at Laverton and Balgair being 46.1 °C (1957) and 47.6 °C (1991) respectively. Lowest minima may extend into negative values during the winter months, with the lowest minimum reaching -2.4 °C at Laverton (1969) and -5.0 °C at Balgair (2006).

2.2 FLORA AND VEGETATION

The flora and vegetation of the Operational Area has been the subject of a detailed investigation by *ecologia* (2008), and is briefly summarised here. The proposed Operational Area is situated in the Helms Botanical District, near the border of the Great Victoria Desert and the Nullarbor Plain, within the Eremaean Botanical Province. At a broad scale, Beard (1975) described four distinct vegetation units within close proximity to and including the Operational Area:

1. Tree (*Eucalyptus gongylocarpa, E. youngiana* [usually mallee]) and shrub steppe between sand hills with hummock grassland (*Triodia basedowii*). *($e_{19}lre_{20}Srt_2Hi$).*
2. Patches of *Acacia aneura* (mulga) low woodland between sand ridges *(a_1li).*
3. Tree steppe *Acacia aneura* (mulga) / *Casuarina pauper* (sheoak) [syn. *C. cristata*] woodland on sandplain *($a_1c_2Lrt_2Hi$).*
4. Lightly wooded succulent steppe: *Acacia aneura* (mulga) with *Atriplex* (Saltbush) or *Kochia* (now *Maireana*). *(a_1Lrk_1Ci).*

The survey area is primarily located within the first vegetation complex (mulga between sandhills complex with longitudinal sand ridges), but aspects of all four vegetation units are present in the Operational Area.

2.3 BIOGEOGRAPHY AND LANDFORMS

The proposed Operational Area is located in the Great Victoria Desert (GVD) bioregion, in the Central (GVD2) sub-region near its border with the Shield (GVD1) sub-region, as defined by Thackway and Cresswell in the Interim Biogeographic Regionalisation of Australia (IBRA) Version 6.1 (Department of Environment Water Heritage and the Arts 2004)Figure 2.2.

The Central subregion of the Great Victoria Desert is described by Barton and Cowan (2001) as an arid, active sand-ridge desert with extensive dune fields of deep Quaternary aeolian sands overlying Permian strata of the Gunbarrel Basin. Landforms consist of salt lakes and major valley floors with lake derived dunes. Sand plains with extensive seif dunes running east west, occasional outcropping (breakaways) and quartzite hills provide minor relief (Barton and Cowan 2001).

The subregion covers an area of 14,286,995 ha. Of this total, 9.11% is vested in conservation estates.

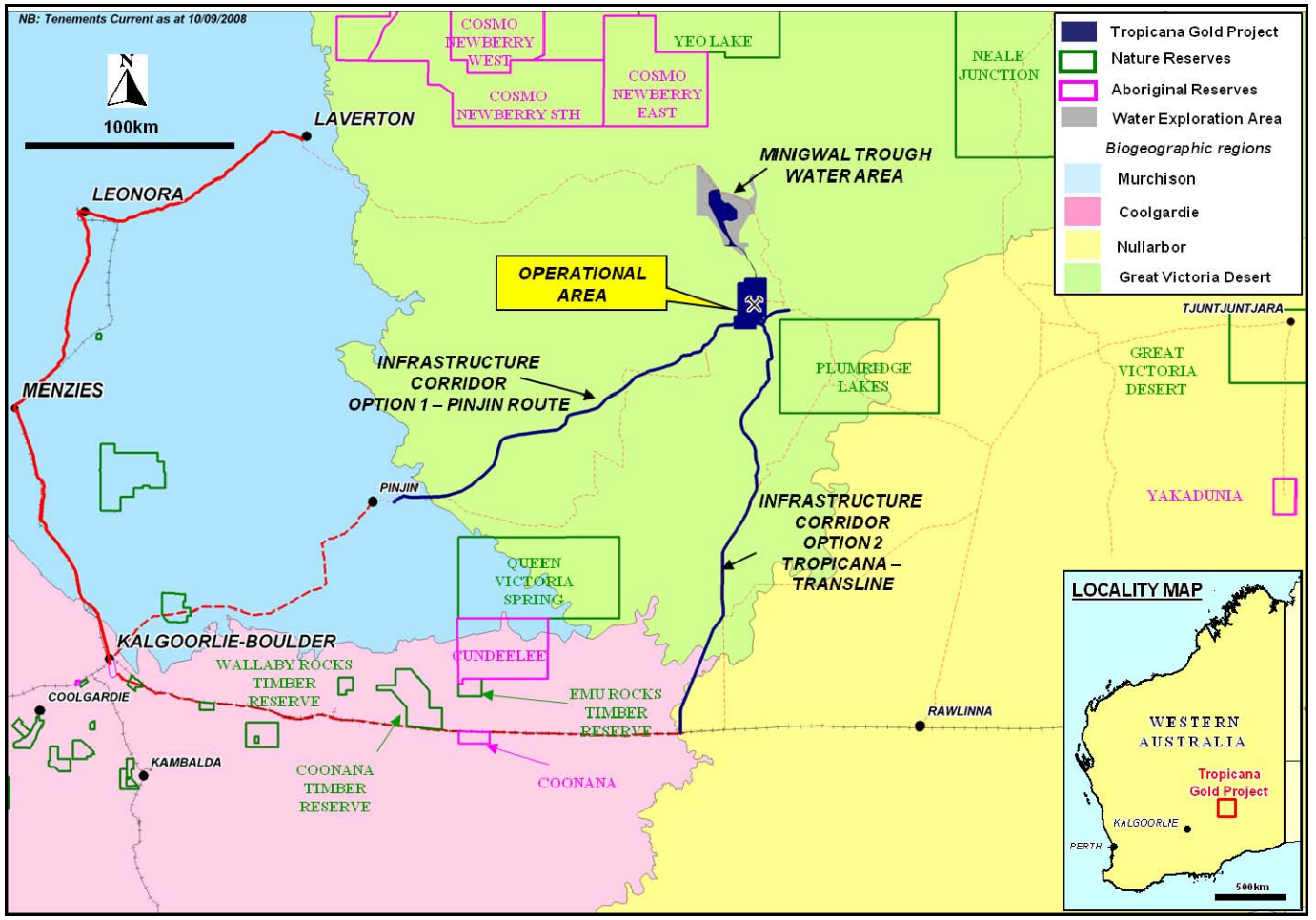

Figure 2.2 The Biogeographic regions associated with the Tropicana Gold Project

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3.0 SURVEY METHODS

The survey methods adopted by *ecologia* are aligned with the EPA's Guidance Statement No. 56 (Environmental Protection Authority 2004) and Position Statement No. 3 (EPA 2002). Prior to the development of survey methods, a review was undertaken of factors likely to influence survey design (Table 3.1).

Because the survey area is located in the GVD, a very large area of limited existing biological information, a Level 2 survey (comprehensive field survey) was required based on recommendations found in Guidance Statement No. 56. The purpose of a comprehensive field survey is to enhance the level of knowledge at a local scale, and requires one or more visit/s in each season appropriate to the bioregion and the faunal groups being surveyed (Environmental Protection Authority 2004).

In addition to standard sampling methods used for generalised fauna surveys, targeted surveys for four species that could potentially occur in the Operational Area were undertaken. These were the Southern Marsupial Mole (*Notoryctes typhlops),* Sandhill Dunnart (*Sminthopsis psammophila*) Malleefowl (*Leipoa ocellata*) and Mulgara (*Dasycercus sp.*). Methods specific to each species are described below in section 3.6.

3.1 STAKEHOLDER CONSULTATION

Following the completion of the first phase of surveying, a letter detailing trapping methods used, results and proposed trapping methods for a second phase of surveying was sent to Mr. Nicholas Woolfrey, Mr. Mark Cowan, Mr. John Dell and Dr. Karl Brennan from the Department of Environment and Conservation (APPENDIX A). Based on the stakeholder responses (APPENDIX A), trapping methodology was revised to include two Sandhill Dunnart trapping sites (SHD1 and SHD2) and the construction of trenches to determine the presence of Southern Marsupial Moles.

3.2 LITERATURE REVIEW AND DATABASE SEARCHES

The following databases were consulted in the formulation of potential fauna (and conservation significant fauna) lists using search coordinates 29°S, 124°E (NW corner) and 30°S, 125°E (SE corner):

- Western Australian Museum FaunaBase;
- Birds Australia "Birdata" database;
- Department of Environment, Heritage, Water and the Arts Protected Matters database;
- Department of Environment and Conservation Threatened fauna database.

3.3 SURVEY TIMING

Vertebrate fauna surveys were conducted over three seasons in the operational area, taking place in November 2006 and March 2007 (Sites 1 to 10 and Sandhill Dunnart Sites 1 and 2) with a supplementary survey in March 2008 (Sites 11 to 18). Further surveys targeting Southern Marsupial Moles (listed as Endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999*) were undertaken in August 2007.

Table 3.1 Factors likely to influence survey design.

FACTOR	RELEVANCE	COMMENT
Bioregion – level of existing survey/ knowledge of the region and associated ability to predict accurately.	The proposed operation is located on the boundary of the Central and Shield sub-regions of the Great Victoria Desert biogeographic region (IBRA). Fauna surveys at Plumridge Lakes and Queen Victoria Spring had been undertaken at the time of planning. A recent comprehensive survey of Neale Junction Nature Reserve is also available for comparison of results.	The scope of the operation requires a Level 2 survey. Given the lack of existing contextual information, three seasons of surveying with a trapping duration of ten nights (per phase) was considered necessary to document fauna of the Operational Area and to determine the presence of conservation significant species.
Landform special characteristics/ specific fauna/ specific context of the landform characteristics and their distribution and rarity in the region.	The proposed Operational Area contains three distinct vegetation units as described by Beard (1975). Landform mapping was not available for the Operational Area at the commencement of the survey.	Survey sites were located in all major vegetation units, with replicates placed such that variation within the dominant vegetation units was sampled. All fauna habitats were sampled.
Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The arid climate of the region suggests that rainfall greatly influences fauna assemblages.	Each phase of surveying was timed to coincide with periods of warm, wet conditions to maximise fauna capture rates.
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/ area curves).	At the time of planning, no fauna surveys of similar scope had been undertaken in the region.	A three-phase survey with a trapping duration of ten nights per phase was considered necessary.
Number of different habitats or degree of similarity between habitats within a survey area.	Based on available vegetation mapping at the start of the survey, three main habitats were thought to occur in the survey area.	Eighteen survey sites for the general fauna survey were located in all major vegetation units, and fauna habitats with replicates placed such that variation within the dominant vegetation units was sampled.
Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods).	The region experiences cyclonic rain during the summer months.	The second survey coincided with heavy cyclonic rain. This greatly reduced trap captures of reptiles during this time.
Sensitivity of the environment to the proposed activities.	Areas containing spinifex are susceptible to frequent and widespread fires and large areas within the survey area had been burnt. Sand dunes with spinifex provide potential habitat for Sandhill Dunnart.	Two sites specifically targeting Sandhill Dunnarts were established in Phase 2.

3.4 SITE SELECTION

Eighteen survey sites were established within the proposed Operational Area (Figure 3.1; APPENDIX B). Sites were selected to correspond with major vegetation communities and landforms present within the survey area, and to correspond with main areas of potential impact. Thus, all major habitat types occurring in the proposed Operational Area were sampled. To enable sites to be checked as early as possible each day, sites were located close to existing tracks.

3.5 SAMPLING METHODS FOR GENERAL FAUNA

The survey was undertaken using a variety of sampling techniques, including systematic and opportunistic sampling. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between habitats and seasons. Opportunistic sampling includes data collected non-systematically at fixed sampling sites. Total survey effort for general fauna is presented in Table 3.2.

3.5.1 Systematic Sampling

3.5.1.1 Terrestrial Mammals and Herpetofauna

Trapping for terrestrial mammals and herpetofauna was undertaken using a standardised trapping format comprising a combination of pit-fall traps, Elliott box traps, funnel traps and cage traps:

- Pit-trap and drift fence: Five PVC pipe (16 cm diameter, minimum 50 cm deep) and five 20 L plastic buckets (30 cm diameter, 40 cm deep) were established at each site. A 6 m length of flywire fencing (30 cm high) bisected the pits, directing fauna into the traps.
- Elliott box traps: Twenty medium-sized Elliott box traps (9 x 9 x 32 cm) were located at each site, and baited with universal bait (peanut butter, rolled oats and sardines).
- Funnel traps: Funnel traps (Ecosystematica Type III) were placed in association with drift fences. Ten funnel traps were used per site during the Phase 1 survey with traps being placed at the end of the drift fence. Twenty traps were used per site during the second and third phases of survey (a trap at either end of each fence).
- Cage traps: Two traps were used per site with one trap placed at each end of the trap line.

3.5.1.2 Avifauna

Twenty minute surveys were used to document the avifauna present at each of the fauna sites. During each survey an ornithologist recorded the number of individuals of each species seen while searching a 2.0 ha area.

Survey effort was concentrated between the post-dawn (06:00-09:00) and pre-dusk (15:00-19:00) time periods, as this is when most birds are active.

3.5.1.3 Bats

Bat echolocation calls were recorded using an ANABAT II bat detector (Titley Electronics, Ballina NSW) coupled to a minidisc recorder. Mr. Bob Bullen subsequently identified acoustic calls.

Calls were recorded at each of the survey sites and opportunistically throughout the project area.

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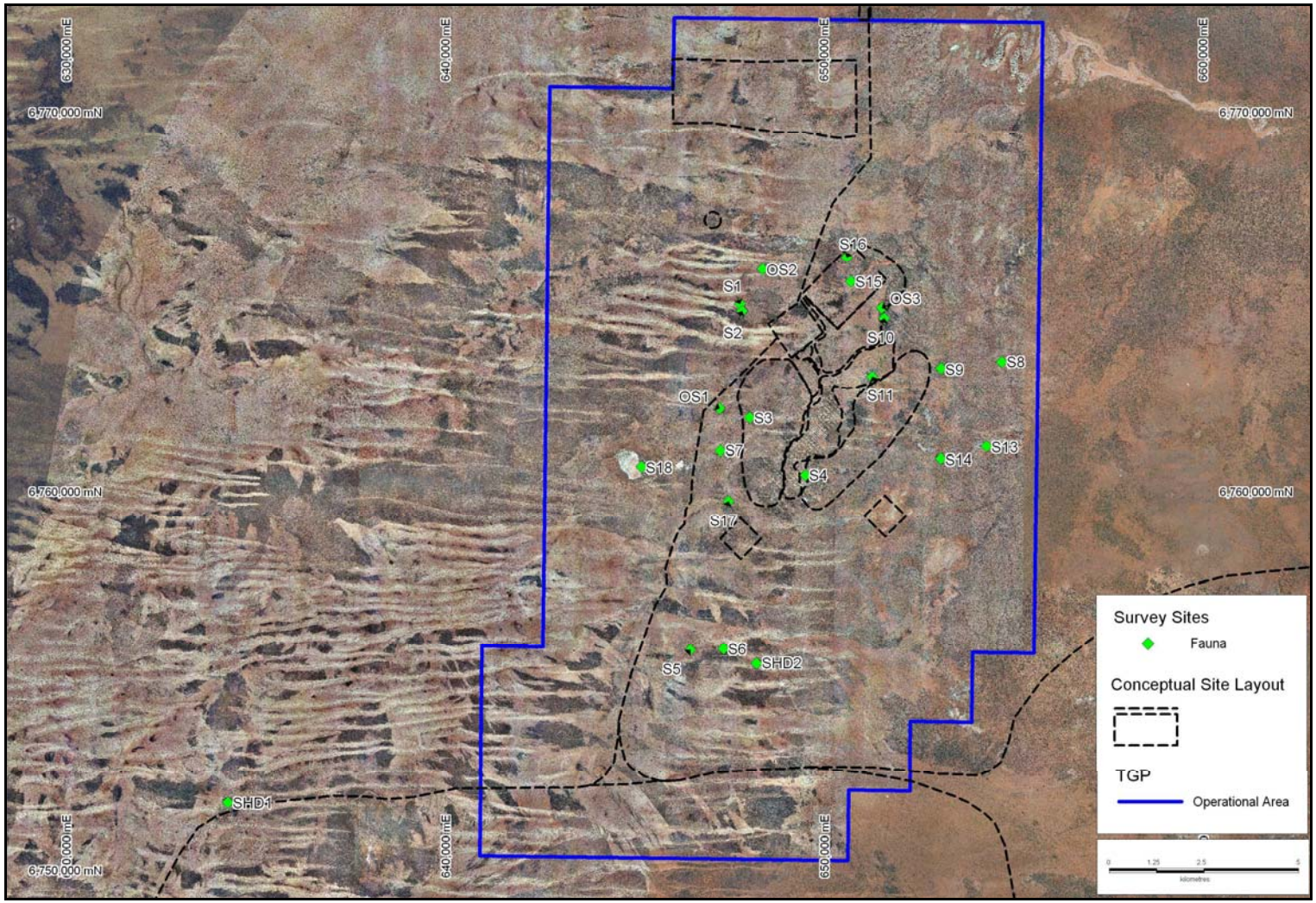

Figure 3.1 Locations of survey sites

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3.5.2 Opportunistic Sampling

3.5.2.1 Nocturnal Searching

The survey area was searched at night using vehicle-based road transects and on-foot opportunistic searches for nocturnal species.

3.5.2.2 Diurnal Searching

Established trapping sites and additional opportunistic sites throughout the survey area were actively searched during the day for cryptic herpetofauna. Techniques used included searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, over-turning logs and stones, investigating burrows and recording tracks, diggings and scats.

3.5.2.3 Secondary Evidence

Tracks, diggings, scats, burrows and nests were recorded when encountered.

3.5.2.4 Opportunistic Sightings

Additional species opportunistically observed during trap establishment, or whilst driving around the survey area, were recorded.

3.6 SPECIES-SPECIFIC SURVEY METHODOLOGY

3.6.1 Southern Marsupial Mole (*Notoryctes typhlops*)

Survey methods used to determine the presence of Southern Marsupial Moles in the survey area were devised following consultation with Dr. Joe Benshemesh from Monash University and review of Benshemesh (2005).

The cryptic subterranean habits of the Southern Marsupial Mole *Notoryctes typhlops* make direct examination virtually impossible, but indirect methods provide a reliable means for determining the distribution and abundance of marsupial moles. The most efficient means of surveying marsupial moles is to count the number of mole tunnels underground. These signs persist for a number of years accumulating underground, providing a high yield of counts relatively easily (Benshemesh 2005).

A total 75 sites consisting of 225 trenches were dug within the operational area. A further 41 sites consisting of 123 trenches were established to the east to the operational area as a regional comparison. Locations of the sites are shown in Figure 3.3.

Mole trenches with dimensions (in centimetres) 120 L × 80 D × 40 W (Figure 3.2) were dug into the ground. On dunes, trenches were installed on the northern slope at the peak, middle and foot. Trenches were oriented east-west to maximise exposure of the main face to the sun, reducing the drying time. Drying is necessary to allow the backfilled mole tunnels (mole holes) to become visible, particularly older ones and Benshemesh (2005) states that the typical drying time is three to five days. Checking involved searching for all apparent mole holes, and measuring their location, appearance, condition and several other factors after Benshemesh (2005), as follows:

- Dmin, Dmax: the minimum and maximum diameter of each mole hole;
- Angle: the angle of the long axis of the mole hole from the horizontal;
- Depth: depth of the mole hole from the surface;
- X: distance from the left edge of the face; and
- Trench face size: dimensions of the trench face

Several subjective scores were used to record how distinct each mole hole was (Benshemesh 2005):

- Clarity: the clarity of the mole hole on a scale from 1 (unclear) to 3 (very clear);
- Confidence: that what is measured is in fact a mole hole, on a scale from 1 (unconfident) to 3 (very confident);
- Tap test: record whether there is any difference between the amounts of sand that falls away when tapping within the mole hole relative to the surrounding sand. This was scored as 1 (no difference) to 3 (large difference); and
- Age: a subjective evaluation of the appearance of the mole hole. Age descriptions used and their meaning are given as follows:
    - Fresh: loose sand pours from the mole hole with little or no provocation;
    - Recent: clear and sharp edged; sand inside is firm but not free-flowing;
    - Oldish: neither recent nor highly degraded;
    - Old: mole hole faint and easily missed; sand inside appears firm but is softer than surrounding sand; and
    - Very old: very faint and very easily missed, but often made apparent by flinging sand.

Trench faces were left to dry for a period of five days to allow drying before examination. In some cases, heavy rainfall was experienced during the drying time, preventing examination of the trenches for mole holes. These failed attempts are not included in the survey effort reported in this report.

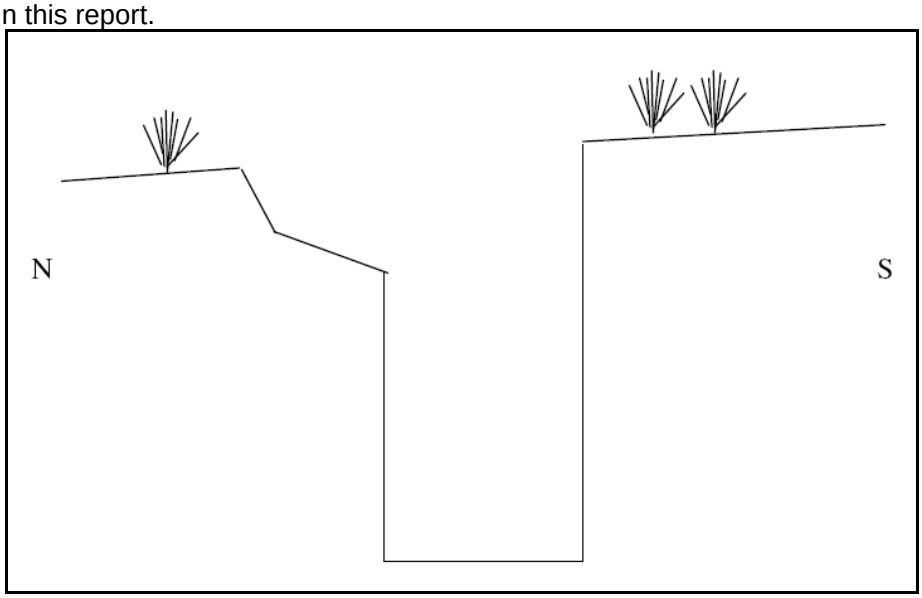

Figure 3.2 Cross-section of trench structure (from Benshemesh, 2005).

3.6.2 Sandhill Dunnart (*Sminthopsis psammophila*)

Trapping methodology for the Sandhill Dunnart emulated trapping methods developed by Mr. Glen Gaikhorst and Ms. Cathy Lambert during their ongoing research on the Sandhill Dunnart in the Great Victoria Desert as part of a conservation program conducted by the Perth Zoo.

Trapping sites consisted of 20 very large pit traps (PVC pipes measuring 60 cm in width and 100 cm depth) located on three 50 m long parallel fence lines (aluminium flywire fencing, 60 cm in height with 40 cm above ground). To complement the oversized pit traps a further four

lines of ten medium Elliott box traps, located parallel to the fence lines, were also installed. Elliott traps were spaced approximately 5 m apart. Traps were open for nine nights at SHD1 and seven nights at SHD2.

Prior to the commencement of the second phase of surveying, survey staff from *ecologia* visited the Perth Zoo to view photographs of trapping sites utilised by Mr. Gaikhorst and Ms. Lambert. Survey staff also visited the location of one of Gaikhorst and Lambert's trapping sites to examine known suitable habitat for the Sandhill Dunnart. Global Positioning System (GPS) coordinates were also obtained of locations near the Operational Area at which Sandhill Dunnarts had been recorded. The above information was used to determine the most likely locations within or adjacent to the Operational Area that may have been suitable to support Sandhill Dunnarts.

Preferred habitat for Sandhill dunnarts was determined to incorporate open areas supporting large, mature spinifex on low yellow sand dunes (Gaikhorst pers. comm.; Churchill 2001; Pearson and Churchill 2008). Although no habitats matching this type were found within the project area, two trapping sites were established in areas considered most similar to such habitat. These sites, SHD1 and SHD2, were located 15 km SW and 6 km south of the Operational Area, respectively

In April 2007, Mr. Gaikhorst visited the Sandhill Dunnart sites to conduct a habitat assessment.

3.6.3 Malleefowl (*Leipoa ocellata*)

Methods used to determine the occurrence of Malleefowl included observations of habitats adjacent to tracks (searching for Malleefowl mounds) during normal surveying activities and targeted searches of thicker vegetation, e.g. mulga patches, for Malleefowl mounds.

3.6.4 Mulgara (*Dasycercus cristicauda* or *Dasycercus blythi*)

Occurrence of both mulgara species is thought to be determined by the presence of suitable spinifex hummock habitats, sometimes associated with drainage systems and/or low shrubs (Caton 2007; Koertner *et al.* 2007). Due to the habit of individuals building and using multiple burrows within their territory (Caton 2007), areas where mulgara are present are typically characterised by several medium-sized burrows located amongst spinifex hummocks.

Searches of suitable sites were lead by personnel with previous mulgara survey experience and survey personnel studied photographs of suitable habitat and burrow systems prior to the start of surveys.

Personnel searched for areas of moderately aged, sizeable spinifex clumps with 'runways' between them along which mulgara could potentially forage. The few areas that appeared suitable were searched by fauna personnel for the characteristic burrow systems belonging to the species.

3.7 DATA ANALYSIS

3.7.1 Species Richness

The number of species present (species richness) is a simple representation of species diversity (Fowler and Cohen 1990; Magurran 2004) and is a basic indicator of diversity used for this survey.

3.7.2 Randomised Species Accumulation Curves

Using the trapping results, species accumulation curves were generated based on accumulations randomised 10,000 times using EstimateS (Version 8.0) software (Colwell 2005). Fauna data were plotted as the number of species observed against individuals as the

ordinate. Total species richness was estimated using the ICE estimator (Colwell and Coddington 1994; Magurran 2004).

3.7.3 Multivariate analysis

PATN analyses were conducted on presence-absence data for mammals and reptiles at sites 1-18.

3.7.4 Southern Marsupial Mole Habitat Preference Analyses

Contingency chi-squared analysis incorporating Fisher's exact tests (both one and two-tailed) was used for statistical analysis of nominal Southern Marsupial Mole data such as location (dune vs. interdune) and sand colour (yellow, red, or yellow-red).

3.8 REGIONAL HABITAT ASSESSMENT

During the Phase 1 survey, a brief assessment of approximately four hours was undertaken at Plumridge Lakes Nature Reserve and Queen Victoria Spring Nature Reserve to determine similarities to the Operational Area. The assessment comprised noting similarities in vegetation structure, landforms and fire history.

3.9 ANIMAL ETHICS

Surveying was conducted in accordance with *ecologia*'s Animal Ethics Code of Practice, which conforms to Section 5 of the *Australian code of practice for the care and use of animals for scientific purposes* (NHMRC 2004). In most cases, fauna were identified in the field and released at the point of capture. Where the taxonomy of specimens was not clearly discernable, or when species were collected that are known to exhibit significant morphological variation or are not yet fully described, voucher specimens were lodged with the WA Museum as per licence conditions (Appendix C). Voucher specimens were maintained according to WA Museum guidelines (unpublished) to ensure minimum stress to captured animals. Any individuals found to be dead in the trap upon clearing were also lodged with the Museum.

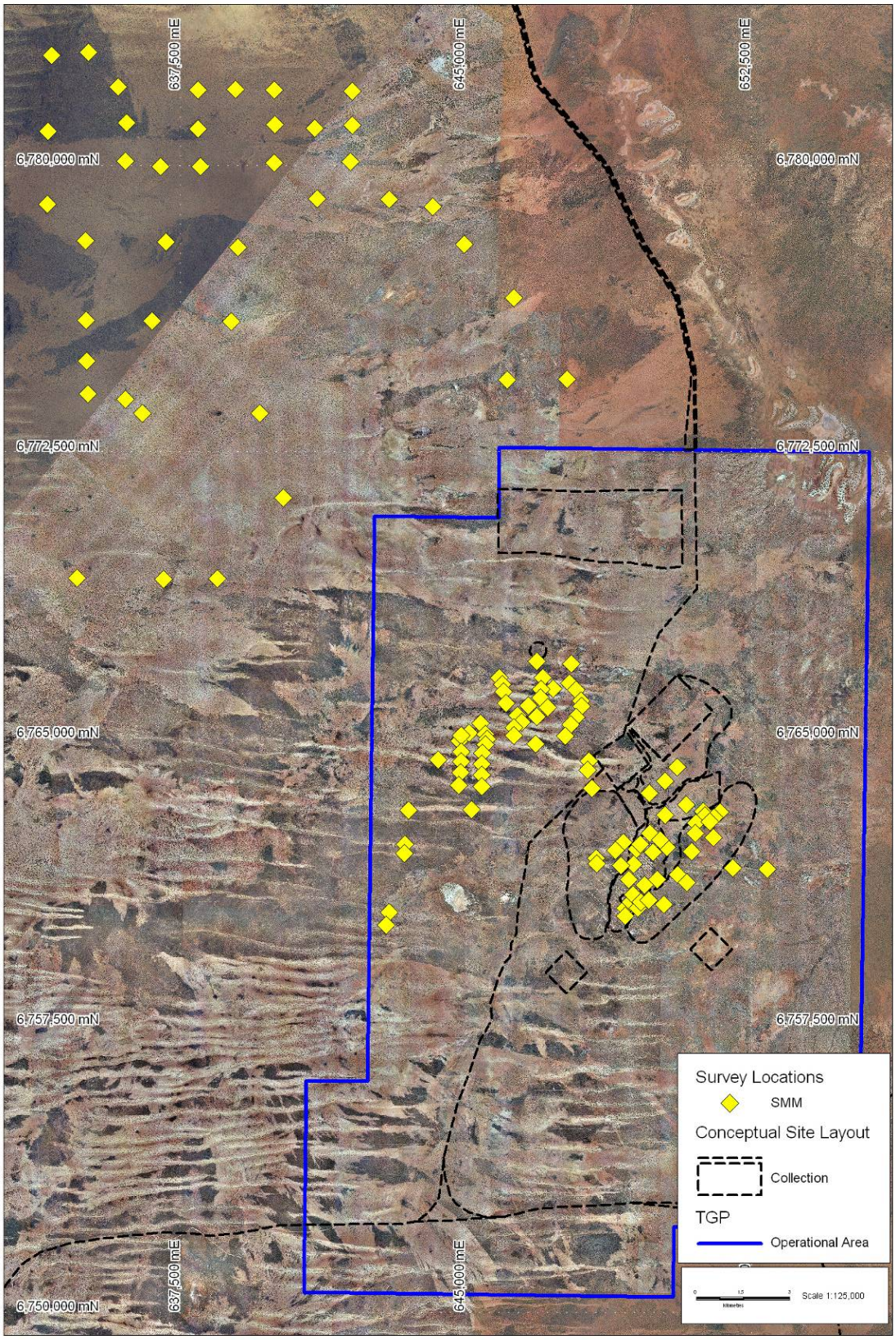

Figure 3.3 Locations of marsupial mole survey sites

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Table 3.2 Survey Effort.

SITE	Pit Traps (trap nights)			Funnel Traps (trap nights)			Elliott Traps (trap nights)			Cage Traps (trap nights)			Bird Survey (min)			Diurnal Searching (min)			Bat Recording (min)			Nocturnal Searching (min)		
	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3
Site 1	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	270	120	-	240	80	-	-	-	-
Site 2	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	240	120	-	240	-	-	-	-	-
Site 3	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	300	120	-	240	80	-	-	-	-
Site 4	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	240	120	-	240	80	-	-	-	-
Site 5	100	100	-	100	200	-	200	200	-	20	20	-	200	120	-	240	120	-	240	-	-	-	-	-
Site 6	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	240	120	-	240	-	-	-	-	-
Site 7	100	100	-	100	200	-	200	200	-	20	20	-	180	140	-	240	120	-	240	50	-	-	-	-
Site 8	100	100	-	100	200	-	200	200	-	20	20	-	180	140	-	240	120	-	480	90	-	-	-	-
Site 9	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	255	120	-	240	80	-	-	-	-
Site 10	100	100	-	100	200	-	200	200	-	20	20	-	180	120	-	240	120	-	240	80	-	-	-	-
Site 11	-	-	100	-	-	200	-	-	200	-	-	20	-	-	280	-	-	180	-	-	180	-	-	120
Site 12	-	-	100	-	-	200	-	-	200	-	-	20	-	-	160	-	-	240	-	-	180	-	-	120
Site 13	-	-	100	-	-	200	-	-	200	-	-	20	-	-	220	-	-	300	-	-	180	-	-	180
Site 14	-	-	100	-	-	200	-	-	200	-	-	20	-	-	240	-	-	300	-	-	180	-	-	120
Site 15	-	-	100	-	-	200	-	-	200	-	-	20	-	-	240	-	-	330	-	-	180	-	-	480
Site 16	-	-	100	-	-	200	-	-	200	-	-	20	-	-	300	-	-	270	-	-	180	-	-	120
Site 17	-	-	100	-	-	200	-	-	200	-	-	20	-	-	220	-	-	360	-	-	180	-	-	120
Site 18	-	-	100	-	-	200	-	-	200	20	-	-	-	-	240	-	-	300	-	-	180	-	-	180
SHD1	-	180	-	-	-	-	-	360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SHD2	-	140	-	-	-	-	-	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Opportunistic Sites	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	350	300	-	480	80	-	1440	750	-
COMBINED TOTAL	**3,120**			**4,600**			**6,240**			**560**			**5,110**			**6,635**			**5,180**			**3,630**		

Note: P1 = Phase 1, P2 = Phase 2, P3 = Phase 3

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3.10 TAXONOMY AND NOMENCLATURE

Nomenclature for birds is according to Christidis and Boles (2008) and reptiles according to Wilson and Swan (2008). Field guides used for identification are listed in Table 3.3.

Table 3.3 Field guides used for identification.

Fauna Group	Field Guide
Mammals	Menkhorst and Knight (2001)
Bats	Churchill (1998), Menkhorst and Knight (2001)
Birds	Simpson and Day (2004)
Reptiles	Cogger (2000), Wilson and Swan (2008)
Geckos	Cogger (2000), Wilson and Swan (2008)
Skinks	Storr *et al*. (1999), Wilson and Swan (2008)
Dragons	Cogger (2000), Wilson and Swan (2008)
Varanids	Cogger (2000), Wilson and Swan (2008)
Legless Lizards	Cogger (2000), Wilson and Swan (2008)
Snakes	Storr *et al*. (2002), Wilson and Swan (2008)
Amphibians	Tyler *et al.* (2000), Cogger (2000)

3.11 SURVEY TEAM

Project Manager: Belinda Barnett/Stewart Ford

Field Staff: Belinda Barnett, Damien Cancilla, Dawn Fleming, Stewart Ford, Elizabeth Fox, Jason Nolthenius, Morgan O'Connell, Simon Pynt, Thomas Rasmussen, Anton Smit, George Swann and Jeff Turpin.

The survey was conducted under DEC Licences SF5489 and SF6420.

3.12 ACKNOWLEDGMENTS

ecologia wishes to acknowledge the input of DEC stakeholders into the design of the second and third phases of surveying, and is grateful to the following people for technical assistance provided on the project.

- Mr Bob Bullen analysed bat recordings for all surveys.
- Mammal and reptile voucher specimens were identified by Norah Cooper and Brad Maryan of the WA Museum.
- Glen Gaikhorst and Cathy Lambert provided technical advice on trapping methodology for Sandhill Dunnarts and Mr Gaikhorst also visited Sandhill Dunnart sites to advise on habitat suitability.
- Joe Benshemesh provided technical advice on Southern Marsupial Mole survey techniques and analysed results from survey trenches.

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4.0 RESULTS

4.1 FAUNA ASSEMBLAGES

A total of 22 species of native mammal and an additional six non-native mammals), 73 species of bird, 70 species of reptile and one species of amphibian were recorded during the survey. Detailed lists of the fauna recorded during the survey are presented in APPENDIX D.

4.1.1 Mammals

Twenty-two species of native mammal were recorded during surveying. This total does not include a species of Stick-nest Rat (*Leporillus* sp.) which formerly occurred in the area, based on the presence of old, abandoned nests in breakaways. The total does include Southern Marsupial Moles (*Notoryctes typhlops*) which were inferred to be present based on the presence of fresh tunnels thought to be traces of this species (see Section 4.4).

The remaining mammals recorded comprise four species of Dunnart (*Sminthopsis crassicaudata*, *S. dolichura*, *S. hirtipes* and *S. ooldea*), Southern Ningaui (*Ningaui yvonnae*), three species of macropod (Red Kangaroo *Macropus rufus*, Euro *Macropus robustus* and Western Grey Kangaroo *Macropus fuliginosus*), eight bat species (*Chalinolobus gouldii*, *Nyctophilus geoffroyi*, *Scotorepens balstoni*, *Tadarida australis*, *Taphozous hilli*, *Vespadelus finlaysoni*, *Mormopterus sp.* (species 3, (Adams *et al.* 1988)) and *Nyctophilus sp.* (central form), three native rodents (Spinifex Hopping Mouse *Notomys alexis*, Sandy Inland Mouse *Pseudomys hermannsburgensis* and Desert Mouse *P. desertor*), the Dingo (*Canis lupus dingo*) and the Echidna *Tachyglossus aculeatus*.

The record of Echidna occurs at a south-eastern range extension on previous records in Western Australia (WA Museum FaunaBase).

The record of the Desert Mouse is of interest because the species has been recorded rarely in the southern Great Victoria Desert. Alpers *et al.* (2003) recorded the species north-west of Queen Victoria Springs approximately 350 km to the south-east of its then most southern known locality at Wanjari Nature Reserve, near Mt. Keith. One distinctive individual was recorded from Site 2, in mulga shrubland within a dune system. This record lies 185 km north-east of the Alpers *et al*. (2003) record, and helps to confirm the distribution extension that they described.

One bat species recorded during the survey was also of significance. The record of *Taphozous hilli* comprises a range extension, as it was recorded approximately 150 km south of its previous known range. Only one additional bat species (*Vespadelus baverstocki*) which could potentially occur within the survey area due to the presence of suitable habitat was not recorded during this survey.

A number of old stick-nest rat nests were also observed within small caves and overhangs in breakaway areas within the survey area (Two sites were recorded located at - Map 51J 634XXX 675XXX and 647XXX 6766XXX). Stick-nest rats are presumed to be extinct on mainland Australia, being last recorded in the Gibson Desert in the early 1900s (Strahan 1995). The nests observed were all old, inactive and in the process of decay.

Targeted surveys for mulgara sp. and Sandhill Dunnart were unsuccessful. Little habitat considered to be suitable for mulgara was found, and searches undertaken in the few areas that looked prospective did not yield any signs of the species. No Sandhill Dunnarts were caught at any of the survey sites, nor at the two targeted survey sites set up especially to capture the species. Overall, the habitats within the project area did not appear to be suitable for Sandhill Dunnart, when compared with habitats south of the project area that were known to support the species (Gaikhorst and Lambert, pers. comm.).

4.1.2 Birds

In total, 73 bird species from 34 families were recorded. The most common families were the Acanthizidae (thornbills: seven species), Meliphagidae (honeyeaters: nine species) and Artamidae (woodswallows and butcherbirds: six species).

Although few conservation significant birds were recorded (Australian Bustard, Peregrine Falcon and Rainbow Bee-eater), there were several records of interest. Four species recorded during the survey occur at the edge or outside the extent of their known range; these are the Red Wattlebird (*Anthochaera carunculata*), Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*), Brown Honeyeater (*Lichmera indistincta*) and Grey Currawong (*Strepera versicolor*). These species typically occur in temperate south-west Western Australia and were mostly recorded during Phase 2 in habitat containing flowering Eucalypts.

Six Malleefowl mounds were also discovered as a result of targeted surveys and opportunistically, but non were active or recently active.

Table 4.1 Location of Malleefowl Mounds recorded in the survey area

Map 51J	Easting	Northing
1	647XXX	6755XXX
2	649XXX	6760XXX
3	647XXX	6761XXX
4	646XXX	6765XXX
5	649XXX	6674XXX
6	630XXX	6804XXX

Also of conservation interest are the Scarlet-chested Parrots (*Neophema splendida*), recorded during Phases 2 and 3. This species has a scattered distribution across central Australia, with most records from the Great Victoria Desert (Birds Australia, 2007). The range of this species fluctuates substantially in response to climatic conditions (Garnett and Crowley 2000). Irruption may be in response to rainfall, but use of habitat may also be related to fire history, with at least some records including those during this survey coming from recently burnt areas (Robinson *et al.* 1980; Blakers *et al.* 1984). The Scarlet-chested Parrot has suffered large declines in distribution, especially in the Western Australian goldfields, and there are no records from the Western Australian coast since 1854. This species has also shown recent decline in Queensland, New South Wales and South Australia and is listed under the Action Plan of Australian Birds as “Least Concern” (Garnett and Crowley 2000).

4.1.3 Reptiles

In total, 70 reptile species were recorded within the survey area. The species assemblage recorded comprised 10 front-fanged snakes (family Elapidae), 11 dragons (Agamidae), 25 skinks (Scincidae), five legless lizards (Pygopodidae), 11 geckoes (Gekkonidae), two blind snakes (Typhlopidae) and six goannas (Varanidae).

A record of note is *Lerista taeniata. L. taeniata* is listed in the literature as occurring in the Kimberley region of Western Australia, as well as the Northern Territory and South Australia (Storr *et al.* 1999). Since the publication of Storr *et al.* (1999), *L. taeniata* has been recorded at Widgiemooltha and Zanthus in the eastern Goldfields/Nullarbor Plain regions. These records, in addition to the two records from this survey indicate that this species could occur anywhere in the arid to semi-arid interior (B. Maryan, *pers. comm*. 2006), and is not restricted to Purnululu National Park, as indicated in the literature.

4.1.4 Amphibians

Two individuals from the genus *Neobatrachus* were recorded during Phase 2. These were lodged alive with the W.A. Museum but were unable to be identified to species level and are therefore listed as *Neobatrachus* sp. in this report. Based on current distribution maps, these specimens could potentially be either *N. aquilonius* or *N. sutor*, both of which are not threatened.

4.1.5 Non-native Mammal Species

Five species of non-native mammal were recorded within the survey area during the course of the current survey. These were the House Mouse (*Mus musculus*), Fox (*Vulpes vulpes*), Rabbit (*Oryctolagus cuniculus*), Feral Cat (*Felis catus*) and Camel (*Camelus dromedarius*).

4.1.6 Regionally Endemic Fauna

None of the fauna recorded are endemic to the central subregion of the Great Victorian Desert.

4.2 SURVEY ADEQUACY

4.2.1 Comparison with Previous Surveys

No previous trapping surveys have been undertaken within the survey area, making it difficult to gauge the adequacy of the survey. WA Museum records of fauna from the area are similarly poor relative to well-surveyed areas such as the Pilbara, and previous records are therefore based on distribution maps as well as WA Museum and other records (APPENDIX E). Of 36 (extant) mammals previously recorded or expected to occur in the region, 28 (77% of potential) were recorded during the surveys, of which 22 were native. These numbers do not include abandoned nests of a species of Stick-nest Rat (*Leporillus* sp.) now extinct in the area.

Of 117 bird species potentially occurring within the survey area, 77 species were recorded, representing 65% of the potential avifauna. These results suggest that the fauna assemblage was undersampled relative to the fauna assemblage potentially occurring in the region. However, potential species lists include many migrant or vagrant species that only occur in the region occasionally and therefore may not be observed during discrete surveys.

Four amphibians and 105 reptiles were expected to occur; one unidentified amphibian was recorded, and 70 reptile species (66% of potential) were recorded.

4.2.2 Species Accumulation Curves

In order to examine the likelihood that additional species occur in the survey area, species accumulation curves (SAC) were generated for mammals, reptiles and birds. These used data collected systematically (terrestrial trapping/bird survey data) only.

The species accumulation curve is represented by *Sobs* (*Mao Tau*), the number of species observed, in the figures below. As the number of individuals collected increases, the number of species observed increases rapidly and usually begins to flatten, sometimes reaching an asymptote. Our data were randomised 10,000 times to produce the smooth lines observed in the figures below. *ICE* and *Chao 2* are non-parametric functions that allow the estimation of the total number of species occurring within an area, based on survey data. These have been chosen for use here because they are relatively robust for heterogeneous samples (Magurran 2004). *MMMeans* is the Michaelis-Menten function, which historically was fitted to accumulation data to predict total number of species for a given size or amount of effort (in this case, number of individuals captured), but has largely been superseded by estimators such as *ICE* and *Chao 2*.

4.2.2.1 Mammals

The small mammal fauna have been well sampled (Figure 4.1), with estimates for the total number of mammal species being 12 (ICE) and 11 species (Chao 2). This is eclipsed by the actual number recorded (27) but suggests that there may be an additional one to two species of small mammal present in the area that were not recorded during the survey.

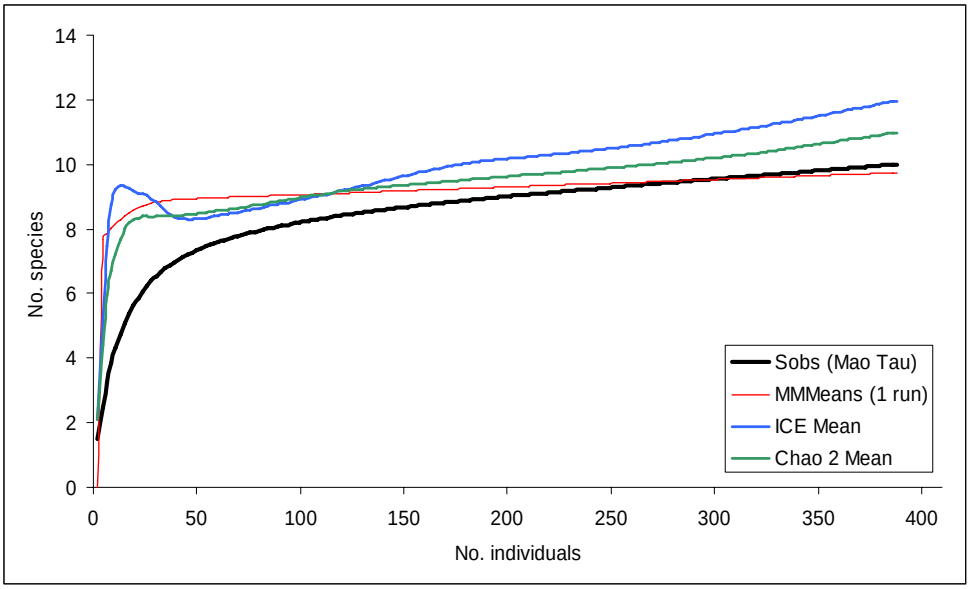

Figure 4.1 Species accumulation curve for mammals (trapping data only).

4.2.2.2 Birds

The bird assemblage of the survey area was well sampled, as demonstrated in Figure 4.2, which shows the number of species observed during surveys (Sobs) nearing the asymptote. Estimators of total species richness, ICE and Chao 2, continue to increase in the figure, suggesting that further sampling would increase the number of bird species. ICE predicts that 67 species occur in the survey area, Chao 2 predicts 74.

In fact, 77 species were recorded, a combination of those recorded during systematic surveying (63 species) and opportunistically (14 species). This agrees favourably with the ICE and Chao 2 estimators, suggesting that all bird species present were recorded.

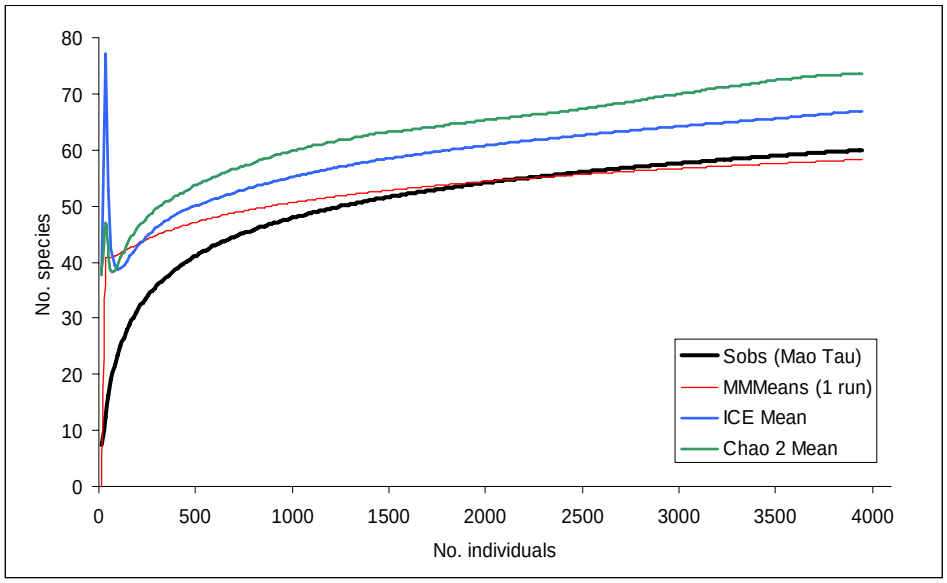

Figure 4.2 Species accumulation curve for birds (survey data only).

4.2.2.3 Reptiles

The species accumulation curve for reptiles (Figure 4.3) shows that the survey has effectively sampled the potential reptile assemblage for the area. The number of species observed (Sobs) has nearly reached the asymptote and the estimators ICE and Chao 2 have stabilised (and are declining in the case of Chao 2). ICE suggests that 73 species are present in the survey area and Chao 2 suggests 72; these estimates are very close to the total number observed (70) suggesting that the reptiles were adequately surveyed.

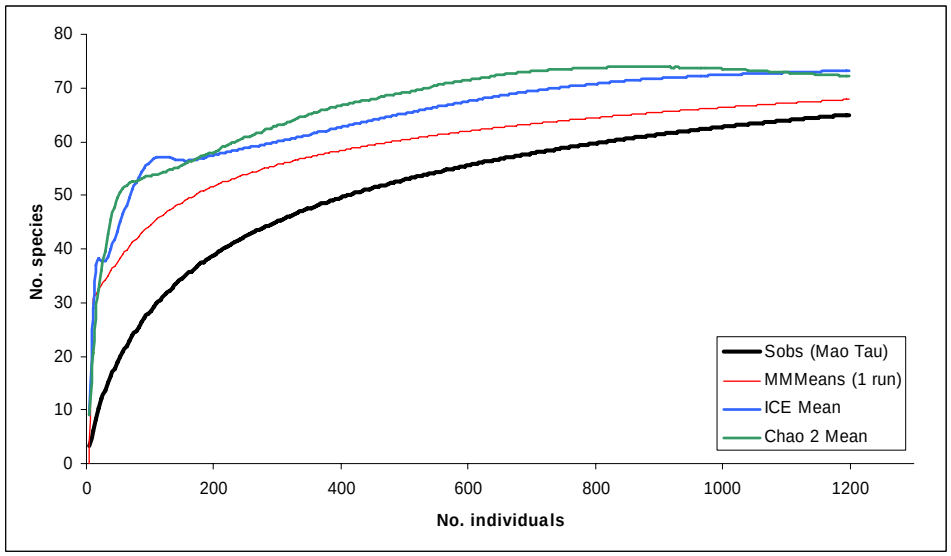

Figure 4.3 Species accumulation curve for reptiles (trapping data only).

4.3 FAUNA HABITATS AND COMMUNITIES

4.3.1 TJV Exploration Lease

Multivariate analysis of trapping data (i.e. mammals and herpetofauna) from sites 1-18 using PATN indicates the presence of seven distinct habitats and communities within the survey area (Figure 4.4). Fauna communities appear to be influenced primarily by over-storey species as discussed in Table 4.2, which shows the habitat groupings based on the results of the dendrogram.

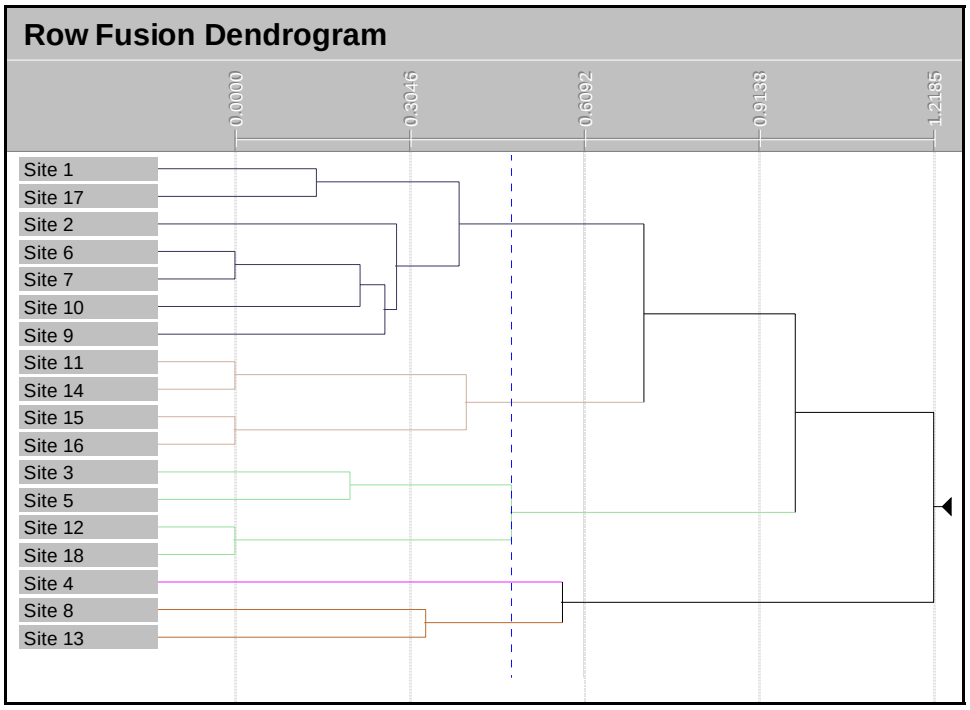

Figure 4.4 Dendrogram of trapping data at sites 1-18 using Pearson presence/absence.

Table 4.2 Habitat group descriptions.

Habitat group	Sites	Description
Group 1	1, 17	**Yellow - Yellow/Orange sand dune areas with an overstorey of scattered *Eucalyptus* mallee**. These regions could potentially be designated as Priority Ecological Communities (PEC) Priority 3 (Department of Environment and Conservation 2008), although further clarification from DEC is required. Like most of the sand dune habitat in the area, this area was regenerating following a fire which passed through the area in the last 5 – 10 years. These sites supported large numbers of the gecko *Nephrurus laevissimus* and species such as *Amphibolurus longirostris*, *Pseudonaja nuchalis*, *Ctenotus brooksi*, *Eremiascincus richardsonii* and *Lerista taeniata.*
Group 2	2, 6, 7, 9, 10	**Mulga (*Acacia aneura*) woodland with a dense understorey of mature *Triodia basedowii* hummock grassland**. Common species at these sites were *Ctenotus helenae*, *C. quattuordecimlineatus* and *Mus musculus.* Site 10 was the only site at which *Acanthophis pyrrhus*; *Diplodactylus conspicillatus*, *Ctenotus grandis*, *C. leonhardii*, and *Varanus brevicauda* were recorded.
Group 3	11, 14, 15, 16	**Soft sandy plains with vegetation communities that include burnt and unburnt eucalypt woodlands, and *Acacia* woodlands over spinifex and other small shrubs**. This group has a very diverse faunal assemblage with high species richness for reptile, dasyurids, skinks and geckos. *Notomys alexis* was abundant in these sites. This group is representative of both the areas of highest impact from proposed mining operations and the most common landform in the Operational Area.
Group 4	3, 5	**Low red sand dunes with an overstorey of *Callitris columellaris* pines and *Eucalyptus* spp. mallee trees**. The mid-storey consists of a shrub layer with mixed *Acacia* shrubs and an understorey of mature moderately dense *Triodia* hummock grasses. These sites were dominated by skinks such as *Ctenotus dux*, *C. helenae* and *C. quattuordecimlineatus* and *Ctenophorus clayi*, *Delma nasuta*, *Cyclodomorphus melanops*, *Proablepharus reginae* and *Tiliqua occipitalis* were recorded in these habitats.
Group 5	12, 18	**Sandy dune vegetation**. The faunal assemblages that occur in Group 5 are dominated by skinks and geckos, but several species appear to be unique to this group. This includes *Ctenotus isolepis*, *Lucasium damaeus*, *Strophurus elderi* and *Varanus eremius* which generally prefer spinifex hummocks on sandy soils. A distinct shift is also present in small mammal occurrence with an increase in *Ningaui yvonnae* and a decrease in *Notomys alexis*.
Group 6	4	***Eucalyptus* mallee woodland with an understorey of mixed *Acacia* shrubs and *Triodia* hummock grasses**. This habitat supports a large number of legless reptiles (elapid snakes and pygopod lizards), such as *Brachyurophis fasciolatus*, *Parasuta monachus* and *Pseudechis australis.*
Group 7	8, 13	***Casuarina pauper* woodland with an open understorey of low mixed shrubs and scattered soft grasses**. The substrate comprises red sand which is underlain by calcrete approximately 40 – 50 cm below the surface. The most common species at these sites were *Gehyra variegata* and *Lerista bipes. Heteronotia binoei*, *Cryptoblepharus carnabyi*, and *Varanus giganteus* were characteristic of this habitat group.

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4.3.2 Regional areas

4.3.2.1 Plumridge Lakes Nature Reserve

The Plumridge Lakes Nature Reserve is located within 25 km of the proposed Operational Area, and is located within both the Shield and Central subregions of the Great Victoria Desert bioregion. Areas accessible by road within the north-east section of the nature reserve were examined. This area, superficially, is very similar to the proposed Operational Area, with respect to broad vegetation structure and landforms. Although some areas have been recently burnt, much of the area on the Plumridge East - West Track (at the time of observation), was healthy and showed no indication of fire damage.

The reserve supports at least 10 mammal, 39 bird, 11 reptile and 1 amphibian species (Burbidge *et al.* 1976). One mammal, 10 birds, one reptile and one amphibian recorded previously in the Plumridge Lakes nature Reserve were not recorded during this survey of the Operational Area. This is likely to be due to a lack of suitable habitat within the operation area rather than survey effort. These are Wongai Ningaui (*Ningaui ridei*), Grey Teal, White-faced Heron, Little Button-quail, Eastern Barn Owl, Pied Honeyeater, Chestnut Quail-thrush, White-winged Triller, Gilbert's Whistler, Brown Songlark, Desert Trilling Frog (*Neobatrachus centralis*) and the gecko *Nephrurus vertebralis*. These species include water-associated species and grassland inhabitants - habitats that are absent from the survey area.

4.3.2.2 Queen Victoria Springs Nature Reserve

The Queen Victoria Springs Nature Reserve is located approximately 100 km south-south-west of the proposed Operational Area. It is located within the Shield subregion of the Great Victoria Desert IBRA bioregion. This sub-region and Nature Reserve appear to be superficially very different to the majority of areas within the survey area, but is most similar to the habitats in the southern portion of the Operational Area. Of the 11 mammal, 27 bird and 23 reptile species recorded by Martinick & Associates (1986), only a few were not recorded during this survey. These were three mammals (*Dasycercus* sp., Wongai Ningaui and Sandhill Dunnart), three birds (Whistling Kite, Rufous Treecreeper and Torresian Crow) and two reptiles (*Cyclodomorphus branchialis* and *Ctenotus leae*).

4.3.2.3 Neale Junction Nature Reserve

A recent, comprehensive fauna survey of the Neale Junction Nature Reserve (NJNR) recorded 17 native and 4 non-native mammal, 60 bird and 64 reptile species. NJNR is located in the Central subregion of the GVD. Habitats at NJNR are dominated by extensive sandy dune and interdune systems supporting *Eucalyptus gongylocarpa* woodlands and interdunal mulga shrublands, but other habitats such as mulga associated with breakaways, salt lake associated vegetation (e.g. chenopod shrublands, *Casuarina pauper* woodland) and open grassy plains are present, and there is therefore some overlap with habitats observed within the proposed Operational Area of the TGP.

Three mammals recorded at NJNR were not recorded during this survey. These were: Brush-tailed Mulgara (*Dasycercus blythi*), Wongai Ningaui (*Ningaui ridei*) and Rory's Pseudantechinus (*Pseudantechinus roryi*).

Twelve bird species recorded at NJNR were not recorded in the survey area, these were: Barn Owl, Brown Goshawk, Bush Stone-Curlew, Chestnut-breasted Quail-thrush, Grey-crowned Babbler, Major Mitchell's Cockatoo, Red-browed Pardalote, Rufous Treecreeper, Southern Boobook, Striated Grasswren, Variegated Fairy-wren and White-winged Fairy-wren.

Twelve reptile species present at NJNR were not recorded during this survey: *Aspidites ramsayi*, *Ctenophorus* sp. nov., *Ctenotus leae*, *C. nasutus*, *C. piankai*, *Delma desmosa*,

Diporiphora winneckei, *Eremiascincus fasciolatus*, *Lucasium stenodactylum*, *Ramphotyphlops margaretae*, *Simoselaps anomalus* and *Tympanocryptis cephalus.*

Although disparities are apparent it should be noted that the majority of the fauna at NJNR and in the proposed Operational footprint were similar. Eighteen species of mammal, 48 species of bird and 52 species of reptile occurred at both the Neale Junction Nature Reserve and within the Operational footprint, suggesting that overall the fauna assemblages of the two areas are very similar. The similarities between the assemblages of the two areas are further explored in a separate report (*ecologia*, in prep).

4.4 SOUTHERN MARSUPIAL MOLE SURVEYS

Marsupial mole surveys within the Operational Area aimed to map the distribution of moles throughout the areas of greatest potential impact. Ninety mole survey sites were installed across the Operational Area in a range of potentially suitable and unsuitable habitat for the species. Each consisted of three mole survey trenches for a total of 270 trenches.

Traces of Southern Marsupial Moles were found in all of the sand dune surveyed within the Operational Area, with the majority in the soft, sandy dune systems on the western side of the Operational Area (Figure 5.3). A total of 41 survey sites were found to have traces of marsupial moles (APPENDIX D).

Regional marsupial mole surveys recorded marsupial mole traces at five survey sites in areas not generally associated with preferred mole habitat. Three of these records came from flat sandy plains with relatively compact reddish sands. This indicates that moles are capable of traversing large distances of what is generally considered unsuitable habitat. It should be noted though that the exact conditions of the soils at the time of marsupial mole use cannot be determined and changes in soil conditions caused by soil moisture could cause some areas to become suitable for varying periods of time.

4.4.1 Factors affecting mole distribution

4.4.1.1 Location: dune vs. interdune

Traces of marsupial moles were significantly more common on dunes than in interdunal areas (two-tailed Fisher's exact test, p=0.0003). This indicates that the looser, sandier soils that are more commonly found on dunes form the preferred habitat of this species. It should also be noted that some interdunal areas have similar soil characteristic to surrounding dunes and that the soil type present at any specific location should be the indicating factor as opposed to the sites location in the landscape, i.e. on or between dunes.

4.4.1.2 Sand colour: 'yellow' vs. 'red'

When setting up the marsupial mole survey sites, there was an apparent difference between the colours of the sand dunes in the centre of the mining area (red) compared with the dunes on the western side of Operational Area (yellow), and at each mole site the colour of the sand was classified as red, yellow or a mixture (yellow-red). A significant difference between the frequency of mole presence according to sand colour (Contingency chi-squared test: $\chi^2_{2,\ 71} = 11.75$, $p = 0.0028$) was recorded. Moles were more often found on yellowish sands, and sands classified as yellow-red, than on red sands. There was no difference between sands classified as yellow and yellow-red (Two-tailed Fisher's exact test: $p = 0.148$). These results are also correlated with sand softness; yellow dunes were, in general, made up of softer, deeper sands than red dunes, and were also connected by softer interdunal areas, providing more habitat and more potential linkages for Southern Marsupial Moles.

4.4.1.3 Fire history

Another factor that may influence mole distribution is fire history. Data relating to burn history was not consistently collected and so statistical analysis was not possible; however, mole holes were found in both burnt and unburnt locations during the first survey and no difference was apparent to field staff. The effect of fire on Southern Marsupial Mole remains unknown.

4.4.2 Vegetation

A final factor potentially affecting the distribution of marsupial moles is the vegetation occurring at a given location. Because of the complexity of the data collected and the range of differing vegetation types identified it was not possible to conduct a meaningful statistical analysis based on this factor. We found that Marble Gum *Eucalyptus gongylocarpa* and White Cypress Pine *Callitris columellaris* were often associated with deeper sands, but an examination of the data showed that despite this, these were not a reliable indicator of mole presence. At several locations these species were present but marsupial moles traces were not found, whereas they were found in habitats such as mallee, mulga and mixed *Acacia* spp. woodland where deep, soft sand was present.

Overall, it appeared to be substrate softness which was the principal determinant of the presence or absence of marsupial mole traces.

4.4.3 Mole Hole Characteristics

Mole hole data are presented in APPENDIX D and summarised in Table 4.3 below. As described in Benshemesh (2005), they were generally symmetrical (both modal values 50 mm). Most were horizontal and were found most frequently at a depth of about 25 cm, although they were recorded up to 76 cm deep.

Table 4.3 Summary data for recorded mole holes.

Factor	Mean	Standard Error	Maximum	Minimum
Dmin (mm)	52.22	0.78	80	30
Dmax (mm)	69.76	3.79	400	35
Depth (mm)	256.45	10.34	760	30

The age of the mole holes was classified as fresh, recent, oldish, old, or very old as per guidelines contained in Benshemesh (2005). Oldish mole holes accounted for most of the observations, as expected, but over a third of mole holes were either fresh or recent (Figure 4.5).

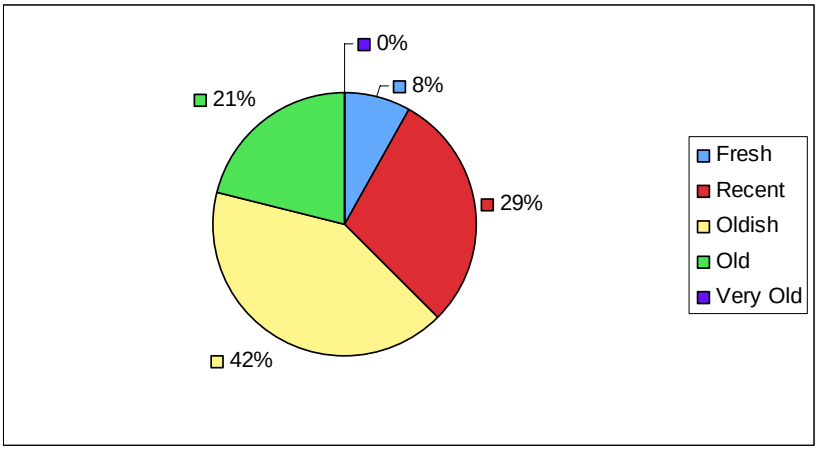

Figure 4.5 Proportional view of mole hole age classifications.

4.4.4 Survey Limitations and Constraints

Guidance Statement No. 56 requires that the limitations of a survey be considered and reported on. These are summarised in Table 4.4 below.

Table 4.4 Summary of survey limitations.

CONSTRAINT	RELEVANT (yes/no)	COMMENT
Competency/ experience of the consultant carrying out the survey.	No	All members of the survey team (see Section 3.11) have appropriate training, experience and mentoring in fauna identification and fauna surveys.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	Partial	Mammal, bird and reptile faunal groups were sampled during all phases of surveying. Amphibians were under-represented in the field data despite heavy rainfall during the first and second phases of the survey. Conditions suitable for the emergence of desert frog species are not well understood but given the uniform annual rainfall pattern of the project area it is possible that frogs do not emerge en masse following any specific rainfall event as would usually be expected (Dimmitt and Rurbal 1980). There were no other constraints on sampling methods.
Proportion of fauna identified, recorded and/ or collected.	No	74% of the potential regional pool of mammal species, 65% of potential bird species and 62% of potential reptile species were recorded. Species accumulation curves showed that within the local area, nearly all mammal, reptile and bird species were recorded. With the exception of one frog species, all fauna sampled were identified to species level.
Sources of information (previously available information as distinct from new data).	Yes	Very few surveys have been undertaken in the region. Available literature was examined as well as a review made of WA Museum FaunaBase to determine likely species composition in the area.

CONSTRAINT	RELEVANT (yes/no)	COMMENT
The proportion of the task achieved and further work which might be needed.	No	The survey is complete following three phases of trapping, dedicated Southern Marsupial Mole surveys and the construction of two targeted Sandhill Dunnart trapping sites.
Timing/ weather/ season/ cycle.	Partial – rainfall during second survey	The first survey was conducted in late spring and corresponded with a period of warm weather, high humidity and occasional periods of light rain. This resulted in high faunal activity and high capture rates. The second survey corresponded with a short period of cyclonic rain. This reduced reptile captures but increased bird activity and allowed the emergence of some burrowing frogs. Heavy rainfall also reduced the amount of survey time available for opportunistic searching. Conditions during the third survey were warm and dry resulting in good fauna activity.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	Yes – rainfall during second survey	Although heavy rainfall occurred during the 2nd survey which reduced capture rates of reptiles. It is not believed that this affected the overall results of the survey as there were two additional survey periods which involved retile searches.
Intensity (in retrospect was the intensity adequate).	No	Survey intensity was adequate.
Completeness (e.g. was relevant area fully surveyed).	No	Site locations were selected to represent all habitat types that occur in the project area. The area of direct impact was also specifically targeted during the third phase of surveys.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	All individuals were identified to species level, except for one unknown species of amphibian. Voucher collections were made of all species requiring identification using keys and lodged with the WA Museum for confirmation of identity.
Remoteness and/ or access problems.	No	Although certain areas of the project area were not accessed, all habitat types were represented in surveying and areas of high impact specifically targeted. No access restrictions were encountered.
Availability of contextual (e.g. biogeographic) information on the region.	Yes	Little contextual information is available for the region. In light of this, the survey was conducted both within the potential key impact areas as well as in surrounding areas to provide local, contextual information.
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	No	Sampling methods were adequate for the requirements of the survey. Note that additional targeted fauna surveys for conservation significant species not included in this report, have been conducted by other consultants.

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5.0 CONSERVATION SIGNIFICANT FAUNA

5.1 STATUTORY FRAMEWORK

Fauna species that have been formally recognised as rare, threatened with extinction, or as having high conservation value are protected by law under Commonwealth and State legislation. At the national level, fauna are protected under the EPBC Act. Within WA, rare fauna are listed under the WC Act. International Agreements include the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

Schedule 1 of the Commonwealth EPBC Act contains a list of species that are considered Critically Endangered, Endangered, Vulnerable, Extinct, Extinct in the wild and Conservation Dependent. Definitions of categories relevant to fauna occurring or potentially occurring in the project area are provided in Appendix F.

Classification of rare and endangered fauna under the WC Act recognises four distinct schedules, as listed in Appendix F. In addition, the DEC maintains a Priority Fauna list which includes those removed from the WC Act and other species known from only a few populations or in need of monitoring. Five Priority Codes are recognised, as detailed in Appendix F.

5.2 CONSERVATION SIGNIFICANT FAUNA OCCURRING OR POTENTIALLY OCCURRING IN THE PROJECT AREA

A search of databases (including the Department of Environment, Water, Heritage and the Arts Protected Matters database and the Department of Environment and Conservation's Threatened Fauna database) indicated that four species of mammal, eleven species of bird and two species of reptile that are listed as being of conservation significance have been recorded, or have the potential to occur, in the survey area (Table 5.1).

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Table 5.1 Conservation significant fauna occurring or potentially occurring in survey area.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE
	EPBC	WCA	DEC			
MAMMALS						
Southern Marsupial Mole *Notoryctes typhlops*	EN	S1		Little is known about ecology, but believed to occur in aeolian dunes with various vegetation types.	One specimen from Queen Victoria Springs NR (Pearson and Turner 2000).	**KNOWN TO OCCUR** Fresh marsupial mole traces (mole holes) were recorded in the project area.
Crest-tailed Mulgara *Dasycercus cristicauda*	VU	S1		On sand dunes with Sandhill Canegrass (*Zygochloa paradoxa*) or areas around salt lakes with Nitre Bush (*Nitaria billardieri*).	Unlikely to occur in the region (see Section 5.4.1.1).	**NONE** Considered to be absent from the region, possibly extinct in Western Australia.
Brush-tailed Mulgara *Dasycercus blythi*			P4	Sand dune swales or along the base of dunes with medium to dense spinifex (*Triodia* sp.) hummocks.	One individual trapped at Mulga Rock in 1985 (Martinick and Associates Pty Ltd 1986). One individual trapped at Queen Victoria Springs NR in 1987 (Pearson 1991). Recorded at Neale Junction (*ecologia* 2009) and 50 km south of project area (*ecologia* obs.).	**MODERATE** Records from surrounding region. Suitable habitat is sparse within the Operational Area but may increase as regeneration of spinifex continues following widespread fires in previous years. Targeted searches yielded no individuals or burrow systems.
Sandhill Dunnart *Sminthopsis psammophila*	EN	S1		Sand dunes with large mature *Triodia* hummock grasses.	Records from approx. 50 km SSW of Tropicana on Plumridge West Track (G. Gaikhorst, pers. comm.).	**LOW** Recent fire history across much of the Operational Area results in little suitable habitat for the species. Habitats observed in the Operational Area were different to those known to support Sandhill Dunnart south of the project area. Targeted trapping grids utilising oversize PVC pipe traps designed specifically to capture this species did not trap any individuals.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE
	EPBC	WCA	DEC			
BIRDS						
Peregrine Falcon *Falco peregrinus*		S4		Wide range of habitats; breeds on rocky cliff ledges.	Recorded during the survey.	**KNOWN TO OCCUR** Unlikely to breed within project area due to lack of likely breeding sites, but hunts within area.
Australian Bustard *Ardeotis australis*			P4	Open or lightly wooded country.	One record from 1984 at Plumridge Lakes NR; several records from project area.	**KNOWN TO OCCUR** Recorded in project area.
Rainbow Bee-eater *Merops ornatus*	M			Lightly wooded, preferably sandy country near water.	Birds Australia records from the area.	**KNOWN TO OCCUR** Recorded in project area.
Fork-tailed Swift *Apus pacificus*	M			Low to very high airspace over varied habitat, almost entirely aerial, particularly associated with storm fronts	Recorded during Level 1 survey (*ecologia* 2008)	**KNOWN TO OCCUR** Recorded in project area
Princess Parrot *Polytelis alexandrae*	VU		P4	Lightly wooded country.	Anecdotal records of birds at Plumridge Lakes NR, recorded from Neale Junction (2008).	**MODERATE** Suitable habitat occurs. Sightings at Plumridge Lakes suggest species may occur.
Malleefowl *Leipoa ocellata*	VU	S1		Mallee eucalypt woodland and scrub with sandy substrate.	Recent sighting south of Plumridge Lakes NR. Old, inactive mounds present within project area.	**MODERATE** Most suitable habitat has been burnt within last 5 – 10 years. Several mounds recorded in the project area. Likely to return to project area when habitat matures sufficiently
Naretha Blue Bonnet *Northiella haematogaster narethae*		S4		Lightly wooded plains on the periphery of the Nullarbor Plain.	18 individuals observed at Plumridge Lakes NR in 1984.	**LOW** Edge of range for the species in WA.
Grey Falcon *Falco hypoleucos*			P4	Shrubland, grassland and wooded watercourses. Nests in disused nests of other bird species.	One record from 1992 at Plumridge Lakes NR.	**LOW** Suitable foraging habitat occurs but few potential breeding locations. Sightings at Plumridge Lakes suggest species may occur.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE
	EPBC	WCA	DEC			
Slender-billed Thornbill (western) *Acanthiza iredalei iredalei*	VU			Chenopod shrub steppe in treeless or sparsely wooded flatlands.	No previous records in vicinity. Known from south (Rawlinna to Eucla) and east (Lake Ballard) of Tropicana.	**VERY LOW** No previous records from area. No suitable habitat.
Cattle Egret *Ardea ibis*	M			Short grass (especially damp pastures) and wetlands, usually in the company of cattle.	No records from area.	**VERY LOW** No suitable habitat present.
Oriental Plover *Charadrius veredus*	M			Sparsely vegetated plains, including samphire and short-grass flats. Also coastal areas (beaches and tidal flats).	No records from area; nearest record from central Gibson Desert (Birdata).	**VERY LOW** Little suitable habitat present.
REPTILES						
Carpet Python (south-west subspecies) *Morelia spilota imbricata*			P4	Semi-arid coastal and inland habitats, banksia woodland, eucalypt woodlands and grasslands	Only one regional record located within 25 km south-west to the project area.	**MODERATE** Record from within 30 km to the project area which suggests species may occur.
Great Desert Skink *Egernia kintorei*	VU			Regenerating hummock grassland on red dunes and plains.	Closest record ENE of Laverton, approx. 150 km from the Tropicana Operational Area	**LOW** Suitable habitat occurs; however project area is not within current distribution. Nearest record is over 100 km away. Rare.

Description of conservation significance codes provided in Appendix F. EPBC = *Environment Protection and Biodiversity Conservation Act 1999*; WCA = *Wildlife Conservation Act 1950 Specially Protected Fauna Notice 2008*(*2*); DEC = Department of Environment and Conservation Priority Fauna list

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5.3 CONSERVATION SIGNIFICANT FAUNA RECORDED IN THE PROJECT AREA

5.3.1 Mammals

5.3.1.1 Southern Marsupial Mole (*Notoryctes typhlops*) – EPBC Act Endangered

Also known as the Itjaritjari, the Southern Marsupial Mole is a small fossorial marsupial that has adapted to a life almost entirely spent underground (Benshemesh 2008). Almost unique in the world of fossorial animals, *N. typhlops* does not build tunnel systems or 'swim' through the sand but instead it tunnels through the lightly compacted sands of the central deserts and backfills the tunnels behind itself (Benshemesh 2008). To date nothing is known about the social behaviour or reproductive biology of *N. typhlops*. *N. typhlops* appears to inhabit most of the vast sand dune deserts of central Australia and while it has been rarely observed in the wild, recent research indicates that this species may be more common than once thought (Benshemesh 2008).

Traces of Southern Marsupial Moles (mole holes) have been found in survey trenches on almost all sand dunes and some sandy flat areas within the survey area, and the species is likely to occur in most of the dune systems within the Operational Area (Figure 5.3).

5.3.2 Birds

5.3.2.1 Peregrine Falcon (*Falco peregrinus*) – WC Act Schedule 4

The Peregrine Falcon is a nomadic or sedentary falcon that is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. It most commonly occurs near cliffs along coasts, rivers and ranges and around wooded watercourses and lakes. Peregrines feed almost entirely on birds, especially parrots and pigeons.

Peregrine Falcons primarily nests on ledges in cliffs, granite outcrops and in quarries, but may also nest in tree hollows around wetlands (Johnstone and Storr 1998). The species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley, Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr 1998).

One individual was opportunistically sighted close to Site 18 during this survey (Figure 5.2). Due to the widespread distribution of this species in Australia and the extent of suitable habitat outside of the survey area, as well as the apparent lack of a suitable breeding location within the Operational Area, the impacts of the project on the species are expected to be negligible.

5.3.2.2 Australian Bustard (*Ardeotis australis*) – Priority 4 (DEC)

The Australian Bustard is a large ground-dwelling bird occurring in open or lightly wooded grasslands, chenopod flats and plains (Johnstone and Storr 1998). It has a broad distribution covering much of mainland Australia. It is nomadic and may range over very large areas, largely dependent on rainfall and hence food availability. At night it roosts in trees, or on the ground in treeless areas. During the day, it flies out onto the plains for food. The Bustard has a varied diet, feeding on grasses, seeds, fruit, insects and small vertebrates. It is commonly seen in areas affected by locust or mouse plagues. Alteration of its grassland habitat by sheep and rabbits, predation by foxes and cats and illegal shooting have caused a decline in the Bustard's numbers and range in the last century (Frith 1976).

Several individuals were recorded during the survey, both as sighted individuals and as identifiable tracks. Three individuals were recorded at Site 11 and a single individual was recorded at Site 1. Single individuals were opportunistically observed near the existing

airstrip, south of the proposed Operational Area along the existing access track – if we mention these other prospects we need to include a map showing their location to put them into context otherwise we should remove reference to these area from the text) and on the Plumridge Lakes East-West track, approximately 40 km south of proposed Operational Area. Tracks were also recorded at Sites 1 and 3

Due to the extent of suitable habitat outside the survey area and the nomadic nature of this species, the impact of the proposed project on the Australian Bustard is likely to be negligible.

5.3.2.3 Rainbow Bee-eater (*Merops ornatus*) – EPBC Act Migratory

The Rainbow Bee-eater is a striking, colourful bird that lives almost anywhere suitable for hawking insects, principally bees, flies, dragonflies and grasshoppers. Part of the population migrates between Australia and Indonesia, moving south over summer and breeding in Australia (Johnstone and Storr 1998). They are scarce to common throughout much of Western Australia, except for the arid interior, preferring lightly wooded, preferably sandy, country near water (Johnstone and Storr 1998).

It nests in burrows dug usually at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks (Simpson and Day 2004). Eggs are laid at the end of the metre long tunnel from August to January and the young fledge after approximately 30 days.

Rainbow Bee-eaters were recorded commonly during the first phase of surveying, with 56 records from eight of the ten survey sites. No individuals were recorded during the second phase and only one specimen during the third phase, which reflects the migratory nature of this species.

It is a common bird in WA, and due to its ability to travel large distances and its diverse habitat preferences, this species is unlikely to be impacted by the project.

5.3.2.4 Fork-tailed Swift (*Apus pacificus*) – EPBC Act Migratory

The Fork-tailed Swift is a small insectivorous species with a white throat and rump and a deeply forked tail (Morcombe 2000). It is distributed from central Siberia and throughout Asia, breeding in north-east and mid-east Asia, and wintering in Australia and south New Guinea. It is a relatively common trans-equatorial migrant from October to April throughout mainland Australia (Simpson and Day 2004). In Western Australia the species begins to arrive in the Kimberley in late September, the Pilbara in November and in the South-west by mid-December (Johnstone and Storr 1998). In Western Australia, the Fork-tailed Swift is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone and Storr 1998).

Fork-tailed swifts are nomadic in response to broad-scale weather pattern changes. They are attracted to thunderstorms where they can be seen in flocks, occasionally up to 2,000 birds. They rarely land, living almost exclusively in the air and feeding entirely on aerial insects, especially nuptial swarms of beetles, ants, termites and native bees (Simpson and Day 2004).

This species lives almost entirely aerial and was recorded in high number. Fork-tailed Swifts are not thought to be impacted by the project.

5.4 CONSERVATION SIGNIFICANT FAUNA POTENTIALLY OCCURRING IN THE PROJECT AREA

5.4.1 Mammals

5.4.1.1 Crest-tailed Mulgara (*Dasycercus cristicauda*) – EPBC Vulnerable, WC Act Schedule 1

The Crest-tailed Mulgara (*Dasycercus cristicauda*) is a relatively new species resulting from the reclassification of the *Dasycercus* genus based on genetic and morphological data (Woolley 2006) The Mulgara (*D. cristicauda*) was split into two species, The Crest-tailed Mulgara (*D. cristicauda*) and the Brush-tailed Mulgara (*D. blythi*) with the Ampurta (*D. hillieri*) being combined with the Crest-tailed Mulgara.

Since previous records did not distinguish between the two species there is some ambiguity over the exact distribution of both species, however in recent times the Crest-tailed Mulgara has been found in the central Simpson Desert at the junction between South Australia, Queensland and the Northern Territory (Masters 2008). Historic records indicate that it previously also occurred on the Canning Stock Route and Nullarbor Plain in Western Australia. The Crest-tailed Mulgara is known for the characteristic crest of black hairs on its tail, and is bigger and more brightly coloured than the Brush-tailed Mulgara.

Considered to be solitary in natural conditions, it digs and inhabits burrows predominantly on dunes with a sparse cover of Sandhill Canegrass (*Zygochloa paradoxa*) or areas around salt lakes with Nitre Bush (*Nitraria billardieri*) (Masters 2008). These habitats are not present in the project area and, indeed, the species is thought to be extinct in Western Australia.

Recent records of mulgara from Neale Junction Nature Reserve to the north-east have been classified as Brush-tailed Mulgara (*ecologia* 2009) and it is likely that it is this species, considered next, that occurs in the region.

5.4.1.2 Brush-tailed Mulgara (*Dasycercus blythi)* – DEC Priority 4

The Brush-tailed Mulgara has only recently been reclassified and separated from the genetically and morphologically distinct Crest-tailed Mulgara (*Dasycercus cristicauda*) (Woolley 2006). The more widespread Brush-tailed Mulgara is not listed in the EPBC Act (1999) at present and is listed as Priority 4 (fauna in need of monitoring) on the DEC Priority and Threatened Fauna list (2008). However, since previous records did not distinguish between the two species there is ambiguity over the exact distribution of both species.

Brush-tailed Mulgara occur in spinifex grasslands throughout much of the arid zone, digging their burrows in the flats between low sand dunes (Woolley 2008). Believed to be generally solitary, Brush-tailed Mulgara construct several single entranced, multi-tunnelled burrows within their home range (Woolley 2008).

According to distribution maps contained in Van Dyck and Strahan (2008), and given the recent records of this species during a survey at Neale Junction Nature Reserve (*ecologia* 2009), it is considered that Brush-tailed Mulgara is the mulgara species inhabiting the region surrounding the Operational Area.

Although the few areas of marginally suitable habitat comprising moderately dense spinifex (Masters 1993; Baker *et al.* 1994; Baker 1996; Baker and Johnson 2001) located within the operational area were searched during all phases of this survey, no individuals or their burrows were recorded; however, they were recorded to the south of the project area by *ecologia* personnel. The species may be temporally absent from the Operational Area as a result of recent fires and the resultant lack of suitable mature spinifex hummock habitat but may be expected to occur as regeneration of spinifex progresses.

5.4.1.3 Sandhill Dunnart (*Sminthopsis psammophila*) – EPBC Act Endangered, WC Act Schedule 1

The Sandhill Dunnart is found in a variety of sandy habitats, usually on dune systems with an understorey of spinifex, and an overstorey of eucalypt woodland, mallee or desert oak (*Allocasuarina decaisneana*) (Maxwell *et al.* 1996; Pearson and Churchill 2008). Their distribution appears to be limited to the Great Victoria Desert of Western and South Australia.

Sandhill Dunnarts are nocturnal, sheltering during the day in nests constructed in hummock grass or in burrows underneath. They feed on a variety of small to medium-sized invertebrates. Sandhill Dunnarts are active creatures with large home ranges of approximately 7.5ha and the ability to move large distances in a relatively short time with movements of almost 2 km occurring in only 2 hours (Pearson and Churchill 2008). Breeding occurs in spring to early autumn, with up to eight young becoming independent in late autumn (Pearson and Churchill 2008).

There have been few recorded captures of this species, and hence there has been no recorded decline, but this species has probably been affected by predation by foxes and cats, and alteration of habitat due to changed fire regimes (Maxwell *et al.* 1996).

The two targeted survey sites, utilising oversize PVC pit traps designed specifically to capture this species, were set up but did not trap any individuals. The sites were located in habitats that most closely resembled that known to be occupied by populations south of the project area, but no identical or closely similar habitat could be found within the operational area or its surroundings despite searches by fauna personnel.

A targeted survey for Sandhill Dunnarts also failed to record this species in the Tropicana project area (Gaikhorst and Lambert 2008) and it is considered that the species is absent from the operational area.

5.4.2 Birds

5.4.2.1 Princess Parrot (*Polytelis alexandrae*) – EPBC Act Vulnerable, DEC Priority 4

The Princess Parrot is a scarce to uncommon, nomadic, and patchily distributed species. As a result, its biology and ecology have never been well studied in the wild (Garnett and Crowley 2000). The Princess Parrot occurs in the sandy deserts of central Australia (Garnett and Crowley 2000), principally concentrated in the Great Sandy, Gibson, Tanami and Great Victoria deserts (Blyth and Burbidge 1997). The preferred habitat is lightly wooded country including desert oak (*Casuarina decaisneana*), open mallee-spinifex and open marble gum (*Eucalyptus gongylocarpa*) woodland (Johnstone and Storr 1998). Because of their nomadic habit, Princes Parrots are able to exploit the sudden availability of food resulting from the unpredictable and patchy rainfall associated with the arid regions of Australia. Princess Parrots are irregular visitors in most areas, with intervals of up to 20 years between sightings (Blyth and Burbidge 1997).

Princess parrots nest in tree hollows in eucalypts, laying between two and six eggs usually in spring, although it is possible that breeding can occur any time following rainfall (Forshaw and Cooper 2002).

Princess Parrots have a moderate likelihood of occurring in the Operational Area due to suitable habitat occurring across much of the region. However, due to the nomadic nature of this species, there is a low likelihood of recording it during discrete short-term surveys.

5.4.2.2 Malleefowl (*Leipoa ocellata*) – EPBC Act Vulnerable, WC Act Schedule 1

The Malleefowl is found in mallee eucalypt woodland and scrub, as well as dry forest dominated by other eucalypts, mulga and other *Acacia* species, where they feed on seeds and herbage (Benshemesh 2000). They require a sandy substrate with leaf litter to build

nesting mounds (Frith 1976) and hence highest densities of Malleefowl appear to occur in long unburnt areas with suitable substrate and vegetation cover. Pairs occupy permanent territories (Benshemesh 2000).

Agricultural clearing has eliminated and fragmented much of the Malleefowl's habitat, which has resulted in localised extinction and fragmentation of populations. In the arid zone, cessation of traditional burning practices, homogenisation of the once fine-scale burning mosaic and fires on an unprecedented scale seem to be the primary causes of extinctions (Benshemesh 2000).

Six inactive Malleefowl mounds were recorded during the surveys and had their age classified as either 'old' or 'moderately old', based on classifications found in Bancroft and Bamford (2006) (Figure 5.2). One 'old' inactive eroded Malleefowl mound was recorded at Site 4. Three 'moderately old' inactive mounds were recorded in dense mulga at Site 6 and Site 7. These mounds, while having a well defined central depression, showed some sign of weathering, and had some plant colonisation (see Figure 5.1, Table 5.2)

Figure 5.1 Malleefowl mound recorded near Site 6

Thirteen Malleefowl mounds were recorded in the Operational area during species specific surveys conducted in 2008 (URS 2008).

The likelihood of Malleefowl occurring in the survey area is moderate even though the majority of suitable habitat has been burnt within the last 10 years, thus lowering its suitability as habitat, and all mounds being recorded as inactive. As the habitat matures over the next decade and becomes increasingly suitable, the likelihood of Malleefowl occurring in the Operational Area will increase accordingly.

Table 5.2 Malleefowl mound age classification (from Bancroft and Bamford 2006)

Category	Description
Active	Fresh scratchings, loose soil and mound dug out in preparation for the breeding season or mounded for breeding. Mounds containing abundant but weathered plant material and shell fragments have been used regularly over at least the previous few years.
Recently used (1-5 years)	No signs of very recent activity, such as scratchings. Soil surface compacted and little plant material present. However, mound slopes still steep and no plants growing in mound.
Moderately old (5-25 years)	No recent activity, soil compacted and no plant material. Surface of mound showing some weathering, such as loose soil and debris accumulating in central depression, and some plant colonisation possibly present.
Old (26-100 years)	Mound moderately to very weathered, often with a veneer of gravel on the slopes because of removal of fine materials from the surface. Some bushes growing on mound.
Very old (l00+ years)	Mound very weathered. Profile low and central depression poorly defined. Bushes and even small trees growing on mound.

5.4.2.3 Naretha Blue Bonnet (*Northiella haematogaster narethae*) – WC Act Schedule 4

The Naretha subspecies of the Blue Bonnet has a restricted distribution along the wooded northern and western fringes of the Nullarbor Plain and into the southern parts of the Great Victoria Desert (Johnstone and Storr 1998). This parrot is moderately common to common, occurring in casuarina or acacia woodland, often near chenopod shrubland (Garnett and Crowley 2000). They breed in late winter and spring, building nests in hollows and cracks of larger Eucalypts and Acacias. The Naretha Blue Bonnet feeds on the seeds of native and exotic plants. Although there is no sign of a decline in this species, it has a very restricted distribution.

Naretha Blue Bonnets have a low likelihood of occurring in the area due to limited amounts of suitable habitat occurring across the Operational Area and location of the TGP on the edge of the Naretha Blue Bonnets currently identified distribution.

5.4.2.4 Grey Falcon (*Falco hypoleucos*) – DEC Priority 4

Grey Falcons are a rare, nomadic, smoke-grey raptor species with bright orange-yellow legs and feet, a bill with yellow base, black tip and orange-yellow cere (Venn 2003). It is sparsely distributed across much of arid and semi-arid Australia. In Western Australia, they are restricted to the northern half, occurring in a variety of habitats ranging from wooded drainage systems through to open spinifex plains. Grey Falcons once occurred across much of Western Australia, with sightings as far south as York and New Norcia during colonial times. However, the current distribution is now thought to be restricted to north of 26°S (Johnstone and Storr 1998). Because the distribution of this species is very scarce over an extremely large area, sightings of this species are very uncommon.

The Grey Falcon occurs very sparsely in a wide variety of arid habitats including open woodlands and open acacia shrubland, hummock and tussock grasslands, low shrublands and may also be seen around swamps and waterholes that attract prey (Ehmann and Watson 2008). Like other falcons this species preys primarily on birds, such as parrots and pigeons, although reptiles and mammals are also taken (Ehmann and Watson 2008). Two to three eggs are laid in winter in the nests of other birds of prey and ravens, typically in tall eucalypt trees near water (Garnett and Crowley 2000; Ehmann and Watson 2008). It is mostly nomadic when not breeding but may also become a longer term resident in coastal

and moister inland refuge areas. They occur largely where Peregrine Falcons are scarce or absent (Olsen and Olsen 1985).

Clearing and grazing of arid zone habitat, destruction of raptors because they were thought to prey on domestic poultry, and the use of pesticides have had an adverse effect on the species (Venn 2003).

The Grey Falcon has a low likelihood of occurrence in the survey area. Although the survey area occurs outside of the Grey Falcons current distribution, the 1992 record from Plumridge Lakes suggest that this species may occasionally occur in the Operational Area.

5.4.2.5 Slender-billed Thornbill (western subspecies) (*Acanthiza iredalei iredalei*) – EPBC Act Vulnerable

The western subspecies of the Slender-billed Thornbill is a small bird (6g) that occurs in the arid and semi-arid zones of southern Western Australia and South Australia. Slender-billed Thornbills are uncommon, rare or extinct across most of their range with the exception of populations on the mid-west coast, where they are considered moderately common (Johnstone and Storr 2004)

Slender-billed Thornbills are found predominantly in chenopod shrublands, in treeless or sparsely wooded flatlands, and also samphire and low melaleuca scrubs (Johnstone and Storr 2004; Pavey 2006). They are usually observed in pairs or small groups of up to 10 birds, feeding on small invertebrates caught on the ground or in low shrubs.

Habitat destruction of the chenopod vegetation by livestock and rabbits has resulted in a very reduced and disjointed distribution across southern Western Australia (Recher and Davis 2000; Johnstone and Storr 2004). Invasive alien tramp ants have also been identified as a threat to the western Slender-billed Thornbill in Western Australia (EPBC 2008)

5.4.2.6 Cattle Egret (*Ardea ibis*) – EPBC Act Migratory

The Cattle Egret has a worldwide distribution, occurring across India, south east Asia, Papua New Guinea, Australia and New Zealand (Johnstone and Storr 1998; McKilligan 2005; Seedikkoya *et al.* 2005). The Cattle Egret is a partial migrant occurring in the better-watered areas of Australia. In Western Australia they are casual visitors to the Kimberley and also occasionally to south west corner, principally in autumn (Johnstone and Storr 1998).

Cattle Egrets occur typically in small flocks in grassy habitats and wetlands, particularly damp pastures, and are usually found in the company of cattle or other livestock (Johnstone and Storr 1998; Seedikkoya *et al.* 2005). Unlike most herons, they feed largely on insects.

The likelihood of Cattle Egrets occurring in the area is very low. No suitable habitat occurs in the Operational Area and the species is a very occasional visitor to this state.

5.4.2.7 Oriental Plover (*Charadrius veredus*) – EPBC Act Migratory

The Oriental Plover is a wading bird that occurs in southern areas of the Kimberly (Fitzroy Valley), north-eastern interior (Lake Gregory) and north-west coastal plains (80 Mile Beach). It occurs on steppe-like, sparsely vegetated plains where they feed largely on insects (Johnstone and Storr 1998). Oriental Plovers breed in Mongolia, south Siberia and north China, returning to Australia over summer.

The likelihood of this species occurring in the area is very low. Very little suitable habitat occurs in the Operational Area, which is also well out side of the oriental plovers current distribution.

5.4.3 Reptiles

5.4.3.1 Great Desert Skink (*Egernia kintorei*) – EPBC Act Vulnerable, WC Act Schedule 1

The Great Desert Skink is a large communal skink found in the western deserts region of central Australia. It is found on sandplains and clay-based or loamy soils vegetated with spinifex, where it excavates large, complex, multi-entranced burrows (Wilson and Swan, 2003). Up to 10 individuals can inhabit a single burrow system. Burrows can usually be identified by the large communal latrine area outside the burrow entrance that the individuals habitually use to defecate (McAlpin 2001). The species is crepuscular to nocturnal, with an omnivorous diet consisting of a wide range of invertebrates, particularly termites, small vertebrates, and the leaves, flowers and fruit of several plant species, particularly the Bush Tomato (*Solanum* spp.) (McAlpin 2001). The Desert Skink enters hibernation in late autumn to early winter, emerging in early spring to begin breeding (McAlpin 1997).

The Great Desert Skink appears to prefer a mosaic landscape with vegetation of different ages. They are most common in sites that have been burnt three to fifteen years previously, and with at least 50% bare ground (McAlpin 2001). The current distribution of this species appears to consist of several isolated populations. Strongholds are in the Tanami Desert, Uluru, and an area of the Gibson Desert north of Warburton (McAlpin 2001). They have disappeared from several former habitats, including much of the Gibson and Great Sandy Deserts (McAlpin 2001). The main threats come from changed fire regimes and predation from feral predators.

The likelihood of Great Desert Skinks occurring in the area is low. Although suitable habitat is found in the Operational Area, the project area is not within current distribution estimates with the nearest record of occurrence over 100 km away. Significant survey effort during this survey and surveys at Neale Junction failed to locate any individuals of this species, supporting the assertion that the species has a low likelihood of occurrence in the project area.

5.4.3.2 South-west Carpet Python (*Morelia spilota imbricata*) – WC Act Schedule 4

The South-west Carpet Python (*Morelia spilota imbricata*) inhabits temperate climatic areas with good winter rains and dry summers. This sub-species occurs in semi-arid coastal and inland habitats, banksia woodland, eucalypt woodlands, and grasslands of south-west Western Australia, from Northampton, south to Albany and eastwards to Kalgoorlie

The South-west Carpet Python has declined in distribution due to the loss of bushland habitat for land developments and agriculture, and changed fire regimes. For example, habitat destruction has been implicated in the decline of *M. s. imbricata* populations in the Esperance area (Department of Environment and Conservation 2007). Predation by exotic predators (foxes and feral cats) may have also contributed to the decline of python populations.

The Python has been recorded recently in the Tropicana region, with one road-killed specimen collected 25km south-west to the project area (GPS co-ordinate 628XXX.X 6733XXX). This was lodged with the Western Australia Museum (voucher number R137180).

The very few records from this eastern region in Western Australia are likely to be more indicative of a lack of surveys in these areas to date, rather than extreme rarity. We conclude that there is a moderate likelihood that this species occurs within suitable habitat patches (most likely eucalypt woodland) in the project area.

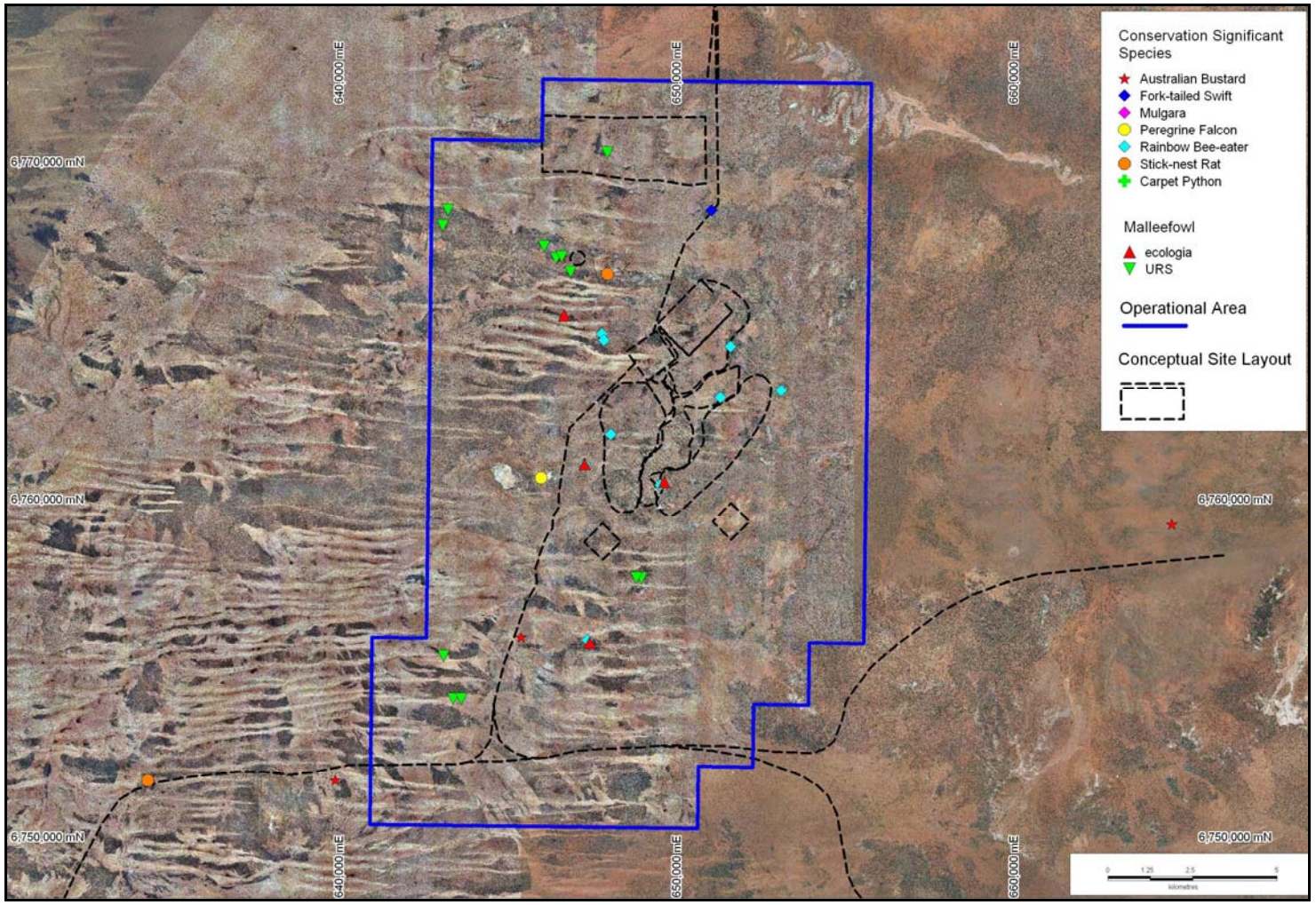

Figure 5.2 Conservation significant fauna locations.

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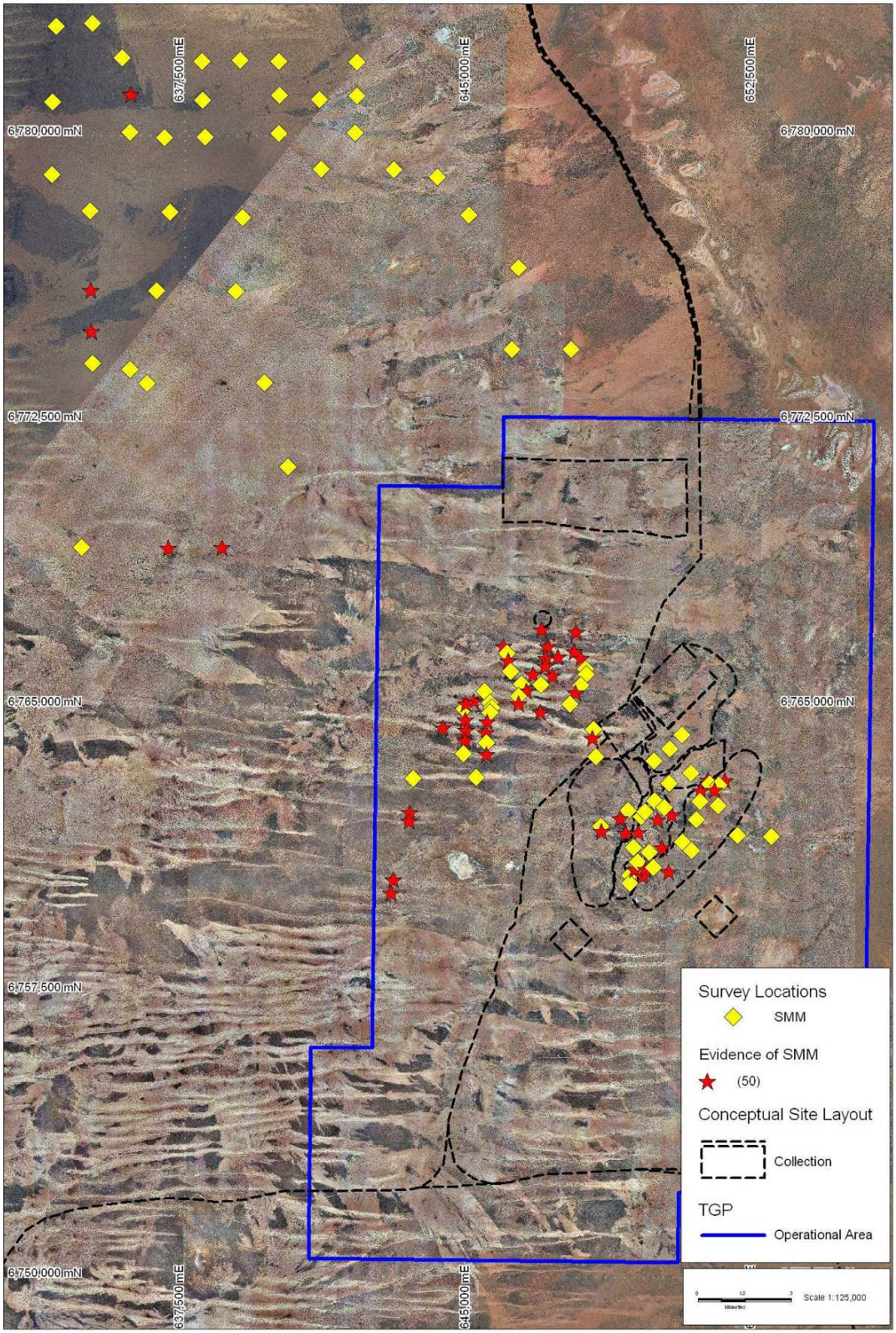

Figure 5.3 Locations where Marsupial Mole presence was detected.

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6.0 IMPACT ASSESSMENT

6.1 THREATENING PROCESSES

A risk assessment (APPENDIX G) was undertaken by *ecologia* to determine potential impacts arising from the TGP on vertebrate fauna and residual impacts following the implementation of the management strategies identified in this document (Section 7.0). Significance of the risks was classified as either High (site/issue specific management programmes required, advice/approval from regulators required), Medium (specific management and procedures must be specified) or Low (managed by routine procedures) (APPENDIX G). All of the residual risks identified during the risk assessment were classified as either medium or low.

Impacts identified in the risk assessment can be classified as:

Direct Impacts

- Habitat loss and fragmentation through clearing of native vegetation; and
- Vehicle strikes on surface-dwelling and burrowing fauna have the potential to cause fauna mortality.

Secondary Impacts

- Increased risk of fire associated with movement of employees and machinery;
- Degradation of fauna habitat due to invasion and spread of weeds;
- Increased movement of feral fauna in the area resulting in increased predation pressure and/or increased competition;
- Disruption to resident fauna due to increased noise, vibration, light and dust pollution; and
- Potentially increased population densities of feral fauna due to increased availability of surface water.

Vegetation clearing

The primary impact on native fauna arising from the project will be the loss of fauna habitat in the disturbance footprint. This will result in the loss of small and sedentary fauna that are unable to move out of the area prior to the disturbance occurring. The site layout should be designed to ensure that habitat corridors are retained and thereby limited fragmentation of the landscape occurs.

Clearing of vegetation is both an unavoidable part of the planned project and the most direct localised impact on fauna communities in the Operational Area. Impacts from vegetation clearing include both direct mortality of fauna that occur in the area and the reduction of available habitat. Locally this is significant but due to the large areas of undisturbed habitat that occur in the surrounding region, the regional impacts will not be significant.

Clearance programs should be designed to occur over a period of time to allow the movement of fauna away from clearing activities. All areas should be rehabilitated as soon as is practical and areas that are to be cleared should be delineated and if possible habitat corridors should be maintained across cleared areas.

Fire

The proposed operational area is located in a large area of native vegetation that has largely avoided impacts from human activities (e.g. pastoralism, agriculture and forestry). The main degradation of habitat in the region occurs from frequent and widespread fires. Spinifex grasslands are most susceptible to fire, and large areas within the Operational

Area have been burnt in the past 5 years. Most yellow sand dunes investigated within the project area had been burnt in recent years, removing possible habitat for Sandhill Dunnarts. The impacts of wildfire have been observed in the surrounding region with many of the Sandhill Dunnart monitoring sites utilised by Glen Gaikhorst and Cathy Lambert being burnt within recent years. The cause of most fires in the area is most likely associated with lightning strikes associated with summer thunder storms.

Most vegetation communities throughout arid Australia have become adapted to a regime of fires lit by Aboriginal people. However, early European explorers to the southern Great Victoria Desert reported little burning in the area (Churchill 2001), suggesting this area may be vulnerable to the impacts of fire.

As well as the direct loss of habitat, fires have also resulted in habitat fragmentation in the area. Fire tends to travel along the sand dunes (where spinifex grows), isolating the dune swales from surrounding areas. This may either limit animal movements between the swales, or increase the predation risk due to an absence of ground cover.

To prevent further degradation of habitat from wildfire, the TJV would benefit from implementing strict fire controls, ensuring that appropriate fire fighting equipment is available at all times and staff are appropriately trained in emergency response. TJV is also advised to discourage personnel from greenfields driving through dune fields or areas with mature spinifex and educate personnel on the impacts of fire on native fauna and vegetation.

In addition to the increased fire risk, discussed above, potential secondary impacts arising from the project include the introduction of weed species, the increase and/or introduction of non-native fauna populations, and disruption to fauna communities from dust, vibration and noise pollution.

Spread of weeds

If adequate weed hygiene measures are not implemented, the introduction of weed species to the area is possible. Disturbance to and clearing of native vegetation during construction can facilitate weed colonisation, resulting in these species dominating the understorey to the exclusion of annuals and eventually larger perennials. Of 20 studies on environmental weed impact in Australia, 19 demonstrated that weed species contribute to a decline in species richness, canopy cover or frequency of native species. Although no studies have been undertaken in sub-tropical Australia, studies on vertebrates in tropical Australia (Braithwaite *et al.* 1989; Griffin *et al.* 1989), South Africa (Winterbottom 1970) and the United States (Brock *et al.* 1986) indicate a substantial decline in species richness and abundance following the introduction of exotic weed species.

Vehicle Strikes

Vehicle strikes constitute a relatively small impact on regional vertebrate fauna. Incidents are relatively rare and typically affect only single individuals. Any incidents that involve conservation significant species should be reported to local authorities such as DEC staff and bodies frozen and sent to either DEC or WAM representatives.

Feral Fauna

Human habitation may result in the introduction and expansion of non-native fauna populations. Increased food and water resources allow these species to reach numbers that otherwise would not be possible in the arid zones of Australia. At the time of surveying, large numbers of House Mice (*Mus musculus*) were present at the exploration camp and laydown areas, with population numbers likely increasing due to the availability of food resources. Dingo (*Canis lupus dingo*), Fox (*Vulpes vulpes*) or Cat (*Felis catus*) prints were observed on most sand dunes investigated. Control of non-native fauna within the vicinity of the Operational Area should be considered in consultation with DEC. Mice

numbers can be controlled using domestic rat bait, and as these baits are not cumulative they should have no impact on native predatory species, although impacts to native species directly consuming the baits may occur if not carefully managed. Consideration may also be given to actively reducing non-native predator numbers through baiting and/or trapping.

Artificial water sources such as evaporation ponds or water sumps may provide increased water resources that could support higher numbers of feral fauna as water supplies are typically restricting factors for these non arid adapted species. All artificial water sources should be suitably managed to prevent access by feral fauna.

Noise, Light and Dust Pollution

The effects of noise, vibration, light pollution and dust pollution on native fauna are well documented. Damage to vegetation may arise from airborne particulate matter, resulting in altered species composition, reduced growth and biomass and increased ecosystem stress. This may result in insect infestations and plant disease epidemics (Grantz *et al.* 2003). A decline in vegetation quality is likely to impact faunal assemblages, affecting food and habitat resources.

Noise and light pollution may disrupt fauna species, or even alter community structure due to the neophobic response of wildlife to new stimuli. Over time most species will either habituate to the noise events associated with mining operations, or move to a suitable distance away from the noise source so that the noise event is no longer disturbing (Larkin 1996; Radle 1998). Due to the large areas of relatively undisturbed habitat in the region, movement of some individuals away from noise sources will not cause significant impacts. Bat species are an exception and are sensitive to both light and noise pollution, particularly approaching and during the maternity season (Mann *et al.* 2002). Noise pollution may encourage the promotion of bat species with low frequency echolocation calls (generally larger species) which may alter the natural species composition in an area(Zagorodniuk 2003).

Noise and light sources may also attract fauna species to areas of the mine infrastructure that provide suitable microhabitats and resources (food wastes, grass and water). Insects attracted to light sources may attract insectivorous species and thus increase the frequency of fauna-human interactions in these locations. Feral predators may associate human activity with food resources and become attracted to these areas. Generally, significant impacts are not expected to arise due to these interactions and in some instances the interaction can be beneficial to particular fauna groups, such as bats and introduced predators. An increase in introduced predator densities is highly undesirable because of potential impacts to native fauna inhabiting nearby areas.

Ecological light pollution may also disrupt bird migrations, particularly nocturnally migrating species when environmental conditions force them to fly lower to the ground, such as at night (Longcore and Rich 2004). Birds can become trapped in artificially lit areas as they will not move out into dark areas where they have difficulty navigating. Trapped individuals may become exhausted, collide with other individuals or suffer from increased predation (Longcore and Rich 2004). Many bat species are attracted to insects that congregate around light sources (Frank 1988) which may form a positive impact, the increased abundance of prey benefits only those species that exploit light sources and thus could result in altered ecological community structures (Longcore and Rich 2004).

6.2 IMPACTS ON FAUNA HABITATS

The main disturbance footprint for the project is within and adjacent to the main mining and infrastructure area where the pit, waste dumps, TSF and processing plant will be located. Large portions of these areas have been burnt within the previous five to ten years and

consequently the quality of habitat is less than that of the surrounding areas. Because of the alteration in habitat by fire it is difficult to determine the natural vegetation and fauna communities present prior to the disturbance, but it is likely to be *Eucalyptus gongylocarpa* and/or *Callitris columellaris* woodland over spinifex, a community which is well represented in the surrounding areas and region.

Though the majority of the fauna habitats located within the central mining and infrastructure area will be removed, large areas of similar habitat, with almost identical fauna habitat types and assemblages, have been recorded in the surrounding region. The Great Victoria Desert region is also one of the few remaining areas that has had limited disturbances from human activities such as pastoralism and mining resulting in large areas of relatively pristine habitat. As such the regional impact of the proposed mining operations will be limited in terms of faunal habitats.

6.3 IMPACTS ON FAUNAL ASSEMBLAGES

While there will be a localised impact on biodiversity (i.e. loss of fauna from within clearance areas), it is not anticipated that the project will have a major or ongoing impact on fauna biodiversity, provided that sufficient management measures are implemented (see Section 7.0).

Possible impacts to biodiversity will occur if habitat suitable to support conservation significant species (see next section) is removed, or the site layout results in habitat fragmentation. Considering that the proposed Operational Area is located in an area with little disturbance or degradation (with the exception of fire), and local habitats are regionally well represented, it is anticipated that the project will not significantly reduce the biodiversity of the adjacent areas or the region.

6.4 IMPACTS ON FAUNA SPECIES OF CONSERVATION SIGNIFICANCE

Any development of the proposed Operational Area on or in close proximity to dune systems could potentially have an impact on Southern Marsupial Moles. Compaction of soil and destruction of dune systems will both directly impact individual animals and cause a reduction in suitable habitat. Due to the paucity of information available for this species, it is unknown if individual Marsupial Moles will move away from construction activities or whether disturbance of suitable habitat will result in animal mortalities. It is noted that the TJV have, since the discovery of marsupial mole traces in the Operational Area, prevented driving on dunes and closed tracks that cross dunes, as well as relocating planned infrastructure locations to avoid dune areas, and this should be continued where possible.

Three other species of conservation significance, Peregrine Falcon, Australian Bustard and Rainbow Bee-eater, were recorded during surveying. Secondary evidence to indicate the presence (at least historically) of Malleefowl was also observed, and suitable habitat for both Sandhill Dunnarts and Mulgara sp. also occurs in and around the project area.

As discussed in Section 5.3, the Peregrine Falcon, Australian Bustard and Rainbow Bee-eater have wide distributions covering most of mainland Australia and broad habitat requirements. Consequently, it is predicted that no significant impacts to these species will arise from the project.

No Malleefowl were recorded during the field surveys, and the four mounds recorded were thought to be at least five to 25 years since last use. The survey area is located on the edge of Malleefowl distribution and the habitat is marginal at best and is expected to be used only during times of exceptionally good conditions (Priddel and Wheeler 1989). Habitat loss due to the expansion of the agricultural industry is the primary cause of the reduction in Malleefowl populations, and competition with grazing stock is also an important impacting factor. Habitat destruction caused by large scale wild fires could influence the decline of this species in the arid zone.

Although the survey area is located in marginal habitat for Malleefowl, the very large reduction of available habitat in the Wheatbelt has increased the importance of these undisturbed areas. Development of the proposed operational area is not expected to significantly impact available habitat for Malleefowl in the project area, but fire prevention and management strategies should be implemented to avoid the occurrence of large scale wildfires.

Birds Australia has no modern records of Malleefowl in the vicinity of the survey area (Figure 6.1); however, an individual bird was sighted south of Plumridge Lakes Nature Reserve in 2007 (Pia Courtis, DEC Kalgoorlie). This indicates that Malleefowl may persist in areas that contain suitable habitat. Further targeted surveys have been undertaken in suitable habitat (i.e. areas which have not been burnt within the last twenty years) within the project area and a further thirteen inactive mounds have been discovered (URS 2008), further confirming the past presence of the birds in the area.

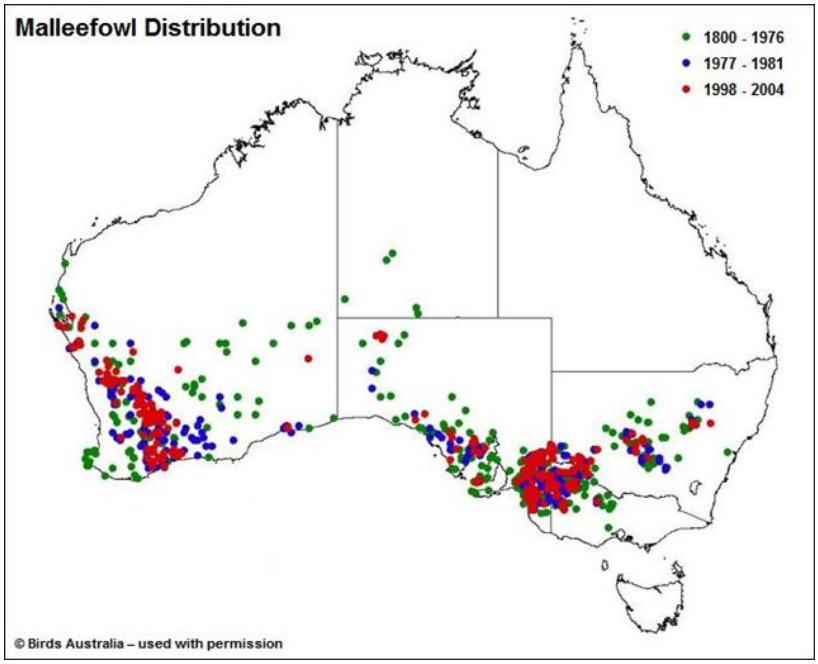

Figure 6.1 Malleefowl distribution (Birds Australia).

Although not recorded during the surveys, the Sandhill Dunnart has been recorded approximately 50 km south-west of the Operational Area (G. Gaikhorst and C. Lambert, pers comm.), and possibly suitable habitat occurred to the south of the Operational Area where the Sandhill Dunnart sites (SHD1 and SHD2) were located. Like most native fauna in the arid zone of Australia, Sandhill Dunnart population sizes and distributions fluctuate according to availability of resources. It is possible that under the right conditions Sandhill Dunnarts may migrate into the project area (provided suitable unburnt habitat is available). For this reason, it is important to preserve areas of large, mature spinifex favoured by the species as they regenerate following widespread fires in recent years.

The distribution of Brush-tailed Mulgara *Dasycercus blythi* (DEC Priority 4) encompasses the proposed Operational Area (Van Dyck and Strahan 2008). Secondary evidence of mulgara (in the form of active burrows and scats) was observed south-west of the project area by *ecologia* personnel and Brush-tailed Mulgara was recorded recently at Neale Junction Nature Reserve to the north-west. The species, which inhabits areas of dense

vegetation cover dominated by spinifex (Masters 1993; Baker *et al.* 1994; Baker 1996; *ecologia* 1996; Baker and Johnson 2001; Masters 2008), could potentially occur in the Operation Area but was not recorded during general or targeted surveys. It is possible that widespread fires in recent years have removed much of the suitable moderately dense spinifex in the operational area. There is also some evidence to suggest that they occur only sporadically in an area. For example, despite ongoing trapping at Queen Victoria Spring Nature Reserve over a period of 15 years (approx two weeks per year), there was only one mulgara record (D. Pearson, DEC, pers. comm.).

Species specific surveys (URS 2008) reported that there are no current resident populations of mulgara in the survey area and the lack of records reported here, despite adequate general and targeted surveying for the species, supports this assertion. The presence of regenerating and maturing spinifex hummock habitats and the presence of relatively close, known populations suggest that mulgara could colonise the project area in future.

The Slender-billed Thornbill *Acanthiza iredalei iredalei* (listed as Vulnerable under the EPBC Act) has a distribution incorporating the Operational Area, and the Birds Australia Birdata database indicates that it has been recorded within the vicinity. It inhabits chenopod shrub steppe in treeless or sparsely wooded flatlands. This habitat is not well represented in the survey area, and only occurs on the salt lakes to the north-east of the proposed Operational Area. Approximately four person hours were spent surveying this area on one afternoon, during which time no birds were sighted. If this habitat is to be directly impacted by the TGP, further surveys for this species should be undertaken.

7.0 MANAGEMENT RECOMMENDATIONS

7.1 CONSTRUCTION AND OPERATIONAL ACTIVITIES

- Vegetation clearing boundaries should be clearly defined and marked in the field. Clearing should be planned to retain habitat corridors where practicable.
- Clearance programs should be designed to occur over a period of time to allow movement of individuals away from clearing activities.
- Cleared areas should be rehabilitated as soon as is practicable. Rehabilitation should include placing cleared vegetation and logs within the area, as these provide fauna refuge. Following rehabilitation, areas should be monitored and, if necessary, treated for weed invasion.
- Existing cleared areas should be used in preference to removing new vegetation.
- Unauthorised off-track driving and parking should be discouraged, in order to reduce damage to vegetation and the possibility of spinifex fires.
- Ensure that appropriate fire fighting equipment is available at all times and staff are appropriately trained in emergency response.
- Weed hygiene measures should be devised and implemented.
- Putrescible waste hygiene measures should be implemented and enforced at all work sites to reduce the likelihood of foxes and cats being attracted to the area.
- Site personnel should be discouraged from feeding native and introduced fauna. An animal baiting scheme targeting feral species (e.g. Fox 1080) should be considered in consultation with the DEC.
- Reduce vehicle speed in area known to be critical habitat for conservation significant species. Educate road users about reducing vehicle speeds at dawn, dusk and at night when animal activity on roads is highest, and slowing down when they see animals on the road.
- Lighting will be designed to avoid excess spill from work area. Lights should also be turned off for a sustained period if excessive concentrations of fauna congregate
- Management measure should be implemented to prevent access to man made water sources by feral species.

7.2 CONSERVATION SIGNIFICANT FAUNA

- Site personnel should be familiarised with potential species of conservation significance and report all sightings to environmental personnel.
- Disturbances to yellow sand dune areas should be avoided where practical, as these may be listed as a Priority Ecological Community (pending delineation by DEC) and may also provide habitat for Sandhill Dunnarts and Southern Marsupial Moles.
- To limit impacts on potential nesting sites removal in large mature trees, particularly *Eucalyptus gongylocarpa* trees with hollows will be avoided outside the main mining and processing area. Within the processing and mining area where practical trees will be retained.
- Whenever large, mature *Eucalyptus gongylocarpa* trees with hollows need to be removed during site construction, these trees should be retained to be used during rehabilitation.

7.3 ADDITIONAL SURVEY WORK

- If impacts to chenopod shrubland are identified in any future expansion projects, targeted surveys for Slender-billed Thornbill should be undertaken prior to disturbance.
- Additional fauna surveys, if conducted, should aim to sample vegetation communities not targeted in previous surveys.

8.0 CONCLUSIONS

Three principles apply to native fauna assessments under the *Environmental Protection Act 1986*; the Precautionary Principle, the Principles of Intergenerational Equity and the Principle of the Conservation of Biological Diversity and Ecological Integrity.

The assessment described in this document has been undertaken in accordance with the EPA's Position Statement No. 3 and Guidance Statement No. 56. As outlined in Section 3.0, three phases over two seasons of surveying have been undertaken in the proposed Operational Area, and the survey described in this document is the first of this size and scope within the region.

The proposed Operational Area is located in a large area of contiguous native vegetation with few anthropogenic impacts arising from pastoralism, agriculture or mining. Establishment of the proposed mine will be confined to a relatively small area and given the high capture rates during surveying, and the large areas of undisturbed habitat that occurs in the surrounding region, it is unlikely that species of conservation significance, which may occur in the Operational Area, will be significantly impacted by the proposed project.

Localised loss of biodiversity is inevitable during construction and mining phases of this project; however the impacts are not likely to extend beyond this zone. Due to the restricted disturbance footprint and large areas of undisturbed habitats it is considered that the regions biodiversity and ecological integrity will be maintained. Current practices by the managers of this project that restrict access and disturbance to sensitive areas such as sand dune systems restrict disturbance to areas that may be of ecological importance and support the precautionary principle.

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APPENDIX A STAKEHOLDER CORRESPONDENCE

Appendix A1 Correspondence between *ecologia* and Department of Environment and Conservation regarding trapping methodology.

13 February 2007

Mr John Dell
Environmental Officer
Department of Environment and Conservation

Dear John

RE: Tropicana EIA Vertebrate Fauna Assessment

ecologia has been commissioned by AngloGold Ashanti Australia to undertake a vertebrate fauna assessment of the proposed Tropicana project in the eastern Goldfields region of Western Australia.

The Tropicana project (Tropicana) is located approximately 450 km north-east of Kalgoorlie in the eastern Goldfields/ Great Victoria Desert region of Western Australia. Exploration undertaken by AngloGold Ashanti Australia at Tropicana has located a strike length of approximately 800 m, with widths of 20 to 40 metres and grades of 1.5 to 8 g/t over mineable widths. AngloGold Ashanti Australia intend to progress from the exploration phase to pre-feasibility over the next two years.

The project has yet to be referred to the DEC; however it is anticipated that the level of assessment will be set at either Public Environmental Review (PER) or Environmental Protection Statement (EPS).

The closest Bureau of Meteorology (BOM) station to the Tropicana project is at Laverton, approximately 250 km to the north-west.

Laverton experiences warm dry weather for most of the year, with maxima during summer averaging in the high 30s (34.8 – 35.8 °C), while winter maxima range from the high teens to low 20s (17.8 – 20.0 °C). Minimum temperatures on average range from 5.2 °C in July to 20.5 °C in January. Mean rainfall at Laverton is 233.9 mm, with the highest rainfall occurring in February and March.

The project area is situated in the Helms Botanical District, near the border of the Great Victoria Desert and the Nullarbor Plain, within the Eremaean Botanical Province. Beard (1975) described three distinct vegetation units within close proximity to and including the Tropicana Gold Exploration Area:

1. *Acacia aneura* (mulga) low woodland between sand ridges.
2. Tree (*Eucalyptus gongylocarpa*, *E. youngiana*) and shrub steppe between sand hills with hummock grassland (*Triodia basedowii*).
3. *Acacia aneura* / *Casuarina cristata* (*C. pauper*) woodland (Mulga and sheoak).

It is located on the border of the Great Victoria Desert (GVD-1) and Nullarbor (NUL-1) regions of the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell 1995).

The first phase of a two phase vertebrate fauna survey of the Tropicana project area was conducted in November 2006 by *ecologia* Environment. The survey was undertaken by the following personnel:

- Belinda Barnett – Senior Biologist/ Project Manager
- Jeff Turpin – Senior Zoologist
- Morgan O'Connell – Biologist
- Tom Rasmussen – Zoologist

PHASE 1 SURVEY METHODS

Survey methods were devised following consideration of the Environmental Protection Authority's Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection and Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.

Ten survey sites were established in the project area such that the major fauna habitats and areas of

proposed disturbance were sampled. Each site comprised a combination of pit fall traps, Elliott box traps, funnel traps and cage traps. Traps remained open for a period of ten nights.

Bird surveys were conducted as per Birds Australia guidelines at each of the survey sites and opportunistically throughout the project area. Reptiles and mammals were actively searched for during the day and night.

A summary of survey effort is provided below:

Pit fall traps	Elliott traps	Funnel traps	Cage traps	Opportunistic searches	Night searching	Anabat recordings	Bird surveys
1000 trap nights	2000 trap nights	2000 trap nights	200 trap nights	43.25 hours	24 person hours	28 hours	30.33 hours

PHASE I SURVEY RESULTS

Sixty nine species of reptile, at least 15 species of native mammal (eight *Pseudomys* specimens have been lodged with the WA Museum which are still awaiting identification) and 62 species of bird were recorded during surveying. No amphibians were recorded during the survey.

Two species recorded during the survey exhibit range extensions according to current literature:

- *Taphozous hilli*

  This species of bat ranges from Warburton across to about Menzies and up to Tallering. This Tropicana record is south of this range by approximately 150 km.

- *Lerista taeniata*

  This species, which has previously been recorded in the Kimberley, Northern Territory and South Australia has recently been found near Zanthus, Widgiemooltha and now Tropicana. Distribution of this species is uncertain and it is now thought that it could occur anywhere in the arid to semi arid interior (B. Maryan, WA Museum, pers. comm.).

Plumridge Lakes Nature Reserve and Queen Victoria Springs Nature Reserve were investigated for similarities with the Tropicana project area. Queen Victoria Springs appears superficially different, and although containing sand dunes, they were much larger and supported different vegetation. Malleefowl tracks were observed in the Queen Victoria Springs Nature Reserve confirming that Malleefowl are in the general area. Plumridge Lakes has similar vegetation to Tropicana with large areas of *Acacia aneura*, spinifex plains, sandy spinifex plains, *Callitris* woodland, *Casuarina* woodland and clay pans. The areas near Plumridge are better vegetated than Tropicana due to less frequent fires, and would provide suitable habitat for Malleefowl if present.

No species of conservation significance were recorded within the project area; however an old mound which is likely to be a Malleefowl mound (the Malleefowl is listed under the Federal *Environment Protection and Biodiversity Conservation Act* and the State *Wildlife Conservation Act*) was found. Photographs of the mound have been given to an expert on Malleefowl's for confirmation of the find and age of the mound. An Australian Bustard (listed as Priority 4 by DEC) was observed on the Plumridge Lakes West Road, approximately 20 km from the project area. This species is likely to be present in the project area.

PROPOSED PHASE II SURVEY METHODS

The second phase of surveying is scheduled to be undertaken in early March 2007. Sites established during the Phase 1 survey (November 2006) will be reopened and used for the survey and an additional two (2) sites will be established, giving 12 sites in total. The proposed Phase 2 survey will use a variety of sampling techniques, including systematic and opportunistic sampling, as follows.

Trapping

Trapping for terrestrial mammals and herpetofauna will be undertaken using a standardised trapping format comprising a combination of pit-fall traps, Elliott box traps, funnel traps and cage traps. Traps will be open for a minimum of ten nights.

Trap Specifications

1. Pit-trap and drift fence: Five PVC pipe (16 cm diameter, minimum 50 cm deep) and five 20 L plastic

buckets (30 cm diameter, 40 cm deep) located at each site. A six metre flywire drift fence (30 cm high) bisects the pits, directing fauna into the traps. Pit traps are placed in a linear transect approximately 50 metres apart.

2. Aluminium box traps: Twenty medium sized aluminium box traps (9 x 9 x 32 cm) are located in each site and baited with Universal Bait (a mixture of peanut butter, rolled oats and sardines). One trap is placed at the end of the drift fence (ten traps in total), and one trap is placed in between each pit trap (ten traps in total).
3. Funnel traps: Two funnel traps are placed at the end of each drift fence (opposite end to that with the aluminium box trap), so that 20 traps in total will be placed at each site.
4. Cage traps: Two traps are located at each site, with one trap placed at each end of the trap line.

Avifauna

Twenty minute set-time surveys will be used to document the avifauna present at each of the six fauna sites. During each set-time survey an observer records numbers of each species seen while actively searching a 20 ha area over a fixed 20 minute time period. This technique is the basis for the ongoing continental-scale avifaunal survey of Australia: the Birds Australia Atlas project.

Nine set-time surveys will be undertaken at each site: six will be undertaken during the post-dawn (06:00-09:00) period and three will be undertaken during the pre-dusk (15:00-18:00) period. Opportunistic surveys (see below) between these times will be conducted as well, as these surveys may yield species less frequently observed in the early morning or late evening, e.g. diurnal raptors.

Bats

Bat echolocation calls will be detected using an ANABAT II system (Titley Electronics, Ballina, NSW). The ANABAT Bat Detector is able to transform ultrasonic bat echolocation calls for analysis with computer software. The transformed calls will be stored on Minidiscs and played back onto a PC for analysis. Records will be made in each habitat present in the project area.

Microhabitat Searching

Each trapping site will be hand searched for cryptic species, or those unlikely to be recorded in traps, for a minimum of two person hours. This will comprise searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows and recording tracks, diggings and scats, and over-turning logs and stones. Each trapping site will be searched for nocturnal species using head torches and spotlights for a minimum of two person hours.

Opportunistic Sampling will utilise the following techniques:

- Spotlighting
  The project area will be searched at night using a combination of road transects using vehicle-mounted spotlights and opportunistic ground searches using head torches and hand held spotlights for nocturnal species, such as geckos, snakes and nocturnal birds.
- Secondary Evidence
  Tracks, diggings, scats, burrows and nests will be recorded where possible.
- Opportunistic Searching
  Opportunistic sites will be selected on the basis of their representative nature of the project area, and also based upon whether they were well-represented by the systematic trapping effort. Each opportunistic site will be hand searched for cryptic species or those unlikely to be recorded in traps for a minimum of two person hours. This will comprise searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows and recording tracks, diggings and scats, and over-turning logs and stones.
- Opportunistic Sightings
  The presence of species observed while searching, travelling and during trap establishment within the project area during the day and night will be recorded.

Surveying will be conducted as per *ecologia*'s Animal Ethics Code of Practice, which conforms to Section 5 of the Australian code of practice for the care and use of animals for scientific purposes (Australian Government 2004: 39-43), WA Museum guidelines (unpublished) and *ecologia*'s Quarantine and Hygiene Policy.

In most cases, fauna will be identified in the field and released at the point of capture. Where the taxonomy of specimens is not clearly discernable, or when species are collected that are known to exhibit significant morphological variation, or are not yet fully described, or have been requested by staff at the WA Museum, vouchers specimens will be lodged with the W.A. Museum.

REQUEST

Please can you advise whether the proposed Phase 2 survey methods outlined in this document are anticipated to be sufficient to satisfy the requirements of the DEC for vertebrate fauna surveys conducted as part of the EIA process.

Yours sincerely,

Belinda Barnett

Senior Environmental Biologist

CC: Mr Mark Cowan – DEC
Mr Nick Woolfrey – DEC
Dr Karl Brennan – DEC
Mr Rob Mincham – AngloGold Ashanti Australia

Appendix A2 Correspondence between Department of Environment and Conservation and *ecologia* regarding trapping methodology.

Response 1 – Nic Woolfrey

Hello Belinda

In refer to your email (below) and letter to the Goldfields office dated 13 February 2006 requesting advice on whether the proposed Phase Two fauna survey methods outlined are anticipated to be sufficient to satisfy the requirements of the DEC for vertebrate fauna surveys conducted as part of the Environmental Impact Assessment process. The following advice is provided by Environmental Management Branch (EMB) on behalf of the Parks and Conservation Services Divisions.

Please note that you would also be well advised to consult with the EPA Service Unit to determine whether there are likely to be any additional requirements related to formal assessment under Part IV of the EP Act.

ecologia's proposal has been discussed with DEC's Goldfields Regional Ecologist Dr Karl Brennan, Principal Rangelands Ecologist Mark Cowan, and Goldfields Region Project EIA Coordinator Julie Patten. They have provided the following comments:

- The proposal documentation does not include details of the size of the resource area or the location of surveying sites within this area (only that 12 sites are located within this area). DEC recommends that survey sites are stratified across all (three?) vegetation units potentially impacted by the proposal. An assessment of how comprehensive the survey was likely to have been in terms of detecting species potentially occurring in the survey area should also be provided with the final survey report as evidence to government decision makers (i.e. what proportion of the total number of species likely to inhabit the area was encountered?).
- DEC recommends that some of the survey sites are located away from active drilling areas, as some of the areas within your proposed survey area have already been drilled down to 50m x 50m spacing and this may have already impacted on the fauna in those areas.
- No methods are currently proposed to detect the presence of marsupial moles (*Notoryctes*) which have the potential to occur in the study area. DEC suggests that at each site where there is potential habitat (eg: sandy areas) you adopt the survey methods advocated by the Marsupial Society of Australia. This would involve digging four survey trenches (100 cm long by 40 cm wide and 80 cm deep) at each site and then examining trenches for mole activity. Signs of mole activity and the best places to locate survey trenches are described on the society's website. (http://www.marsupialsociety.org/mole_patrol.html).
- As this area is proposed to be an open pit development, and the inferred resource depth is below the water table, the mining proposal is likely to involve pit dewatering. The potential for occurrence of Stygofauna within the project area should be considered as part of survey design with a view to determining, in consultation with DEC, whether field sampling is required and will be a factor taken into account in the EIA process.
- The start of the pre-dusk bird survey (15:00 to 18:00) is perhaps too early in the afternoon for birds to begin being active. DEC suggests that the survey times be adjusted back an hour to 16:00 to 19:00.
- It is unclear in the proposal for microhabitat searching what the scats will be used for. Could you please indicate whether hair and bone fragments from prey items in the scats of owls, foxes, cats and dogs will be able to be identified (by specialists if needed). This approach may provide additional information to indicating the presence of owls, foxes, cats and dogs and warrants further discussion with Dr Brennan with respect to feasibility. Additionally, it would be good if you could clarify that the recording of tracks, nests, diggings and burrows will be used to provide additional survey effort for threatened taxa, (woma pythons, mulgara, marsupial moles, malleefowl, etc).
- As the Tropicana Project area is in a relatively poorly surveyed area it would be worth talking to Dr Mark Harvey at the WA Museum's Department of Terrestrial Invertebrates to find out if the museum is interested in specimens of invertebrates caught in the pit traps.

Thank you or the opportunity to comment on the survey work methodology. If you have any further questions please contact Julie Patten or Karl Brennan at DEC's Goldfields Office on 90805555 in the first instance.

Nicholas (Nic) Woolfrey
Principal Coordinator - Development Approvals
Environmental Management Branch
Nature Conservation Division
Department of Environment and Conservation
Tel: 9334 0130, Fax 9334 0140

Response 2 – Mark Cowan

Hi Belinda,

Having had a look at your proposed phase two survey design for vertebrates at AngloGold's Ashanti's Tropicana project it would appear to me to be an adequate sampling strategy bearing in mind the following comments:

1) That as stated in the proposal all major habitat variation (floristics, vegetation structure, soil and topography) have been sampled.

2) Effort utilising appropriate sampling techniques be put in to detect any specially protected fauna that are known to occur in the bioregion across the entire project area and immediate surrounds for species including Sminthopsis psammophila, Dasycercus cristicauda and Nororyctes sp etc.

3) As discussed over the phone, the survey should be undertaken over a period when vertebrate activity has a reasonable probability of being high ie early to mid autumn for phase two.

Cheers

Mark

Mark Cowan
Principal Ecologist (Rangelands)
Dept. Environment and Conservation
PO Box 51 Wanneroo WA 6946
ph (08) 94055184
fax (08) 93061641
mobile 0427426344
mark.cowan@dec.wa.gov.au

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APPENDIX B SURVEY SITE INFORMATION

Appendix B1 Site details for Level 2 Fauna Surveys and Sandhill Dunnart sites.

Note: All GPS locations datum: WGS84 Zone 51J

Site and Description	Image
SITE 1 Yellow sand dune with scattered eucalypt mallee. Understorey comprises *Triodia basedowii* and regenerating low shrubs following a fire within the last five years. Co-ords: 647872E 6762076N Date Surveyed: November 2006 and March 2007	
SITE 2 Mulga *Acacia aneura* woodland with understorey of myrtaceous shrubs and scattered *Triodia basedowii* hummock grasses. Substrate is red loamy sand with scattered small pebbles. Co-ords: 647667E 6764885N Date Surveyed: November 2006 and March 2007	
SITE 3 Low red sand dune with overstorey of *Callitris columellaris* and eucalypt mallee trees and understorey of scattered *Acacia* shrubs and moderately dense *Triodia basedowii* hummock grassland. Co-ords: 647872E 6762076N Date Surveyed: November 2006 and March 2007	

Site and Description	Image
SITE 4 Eucalypt mallee woodland with understorey of scattered mixed *Acacia* shrubs and regenerating *Triodia basedowii* hummocks. Substrate comprises red sand. Co-ords: 649340E 6760575N Date Surveyed: November 2006 and March 2007	
SITE 5 Low red sand dune with scattered eucalypt mallee trees, understorey of scattered low *Acacia* shrubs and regenerating *Triodia basedowii* hummock grasses. Co-ords: 646306E 6755949N Date Surveyed: November 2006 and March 2007	
SITE 6 Mulga *Acacia aneura* woodland with understorey of *Eremophila* shrubs. Substrate comprises red loamy sand with scattered small pebbles. Co-ords: 647180E 6755986N Date Surveyed: November 2006 and March 2007	

Site and Description	Image
SITE 7 Eucalypt mallee, *Eucalyptus gongylocarpa* and *Callitris columellaris* woodland over understorey of moderately dense *Triodia* hummock grassland. Substrate comprises red sand. Co-ords: 647097E 6761212N Date Surveyed: November 2006 and March 2007	
SITE 8 *Casuarina pauper* woodland with understorey of low mixed shrubs and soft grasses. Understorey comprises red sand with calcrete outcropping and small rocks. Co-ords: 654527E 6763558N Date Surveyed: November 2006 and March 2007	
SITE 9 Eucalypt mallee woodland with understorey of sparse mixed shrubs and *Triodia basedowii* scattered hummocks. Substrate comprises red sandy loam. Co-ords: 652928E 6763391N Date Surveyed: November 2006 and March 2007	

Site and Description	Image
SITE 10 Mulga *Acacia aneura* woodland with understorey of dense *Triodia basedowii* hummock grassland and scattered myrtaceous shrubs. Substrate comprises red sandy loam with scattered small pebbles. Co-ords: 651424E 6764689N Date Surveyed: November 2006 and March 2007	
Site 11 Sand dune swale – open eucalypt/*Acacia* woodland over mixed understorey. Co-ords: 651122E 6763173N Date Surveyed: March 2008	
Site 12 Low dune systems including related swale. Co-ords: 649226E 6761912N Date Surveyed: March 2008	

Site and Description	Image
Site 13 Open *Casuarina pauper*/*Acacia aneura* woodland over open shrub woodland on rocky red soil. Co-ords: 654070E 6761323N Date Surveyed: March 2008	
Site 14 *Acacia aneura*/*Eucalyptus* sp. woodlands over soft grasses and spinifex (*Triodia basedowii*). Co-ords: 652908E 6761001N Date Surveyed: March 2008	
Site 15 Regenerating *Eucalyptus* sp. woodland over soft grasses and spinifex (*Triodia basedowii*). Co-ords: 650530E 6765662N Date Surveyed: March 2008	

Site and Description	Image
Site 16 *Acacia aneura*/*Eucalyptus* sp. woodlands over soft grasses and spinifex (*Triodia basedowii*). Co-ords: 650430E 6766323N Date Surveyed: March 2008	
Site 17 Sand dune crest with large *Eucalyptus* sp. and spinifex (*Triodia* sp.). Co-ords: 647303E 6759896N Date Surveyed: March 2008	
Site 18 Saline claypan with eucalypt mallee and spinifex (*Triodia* sp.). Co-ords: 645004E 6760821N Date Surveyed: March 2008	

Site and Description	Image
SHD1 Yellow sand dunes with overstorey of Callitris columellaris pines and eucalypt mallee, a mid-level storey of mixed shrubs and understorey of moderately dense mature Triodia hummock grasses. Co-ords: 634096E 6751901N Date Surveyed: March 2007	
SHD2 Yellow sand dunes with overstorey of Callitris columellaris pines and eucalypt mallee, a mid-level storey of mixed shrubs and understorey of moderately dense mature Triodia hummock grasses. Habitat covers a small area of approximately 400 m2; the surrounding area has been burnt within the last 5 years. Co-ords: 648054E 6755597N Date Surveyed: March 2007	

Appendix B2 Site details for southern marsupial mole survey trench sites

Location	Zone	Easting	Northing	Presence	Position	Vegetation	Dune height	Sand colour
M01	51J	646861	6767028	Present	Dune	Vegetated, small spinifex	10-20	Yellow-Red
M02	51J	647772	6766957	Present	Dune	Vegetated, medium spinifex	10	Yellow
M03	51J	645867	6766591	Present	Dune	Light spinifex	<10	Yellow
M04	51J	647021	6766590	Present	Dune	Medium mixed vegetation	<10	Yellow
M05	51J	645955	6766414	Absent	Interdune	Mallee scrub		Red
M06	51J	646969	6766284	Present	Dune	Medium succulent	<10	Yellow
M07	51J	647290	6766307	Present	Dune	Medium succulent	<10	Yellow
M08	51J	647716	6766450	Present	Dune	Open, sparse spinifex	10	Yellow-Red
M09	51J	645983	6766220	Present	Dune	Medium succulent	<10	Yellow
M10	51J	646957	6766069	Present	Dune	Medium succulent	10-20	Yellow
M11	51J	647887	6766274	Present	Dune	Open, very sparse spinifex	10	Yellow-Red
M12	51J	648022	6765988	Absent	Interdune	Shrub and eucalypts		Red
M13	51J	646048	6765925	Absent	Dune	Open dune, very sparse spinifex	<5	Yellow-Red
M14	51J	646640	6765859	Present	Interdune	Recently burnt, no spinifex		Red
M15	51J	647141	6765820	Present	Dune	Open vegetation, no spinifex	10-20	Yellow-Red
M16	51J	648036	6765850	Absent	Dune	Open low dune, very small spinifex	<5	Yellow
M17	51J	646344	6765603	Absent	Interdune	Mulga woodland		Yellow
M18	51J	646853	6765578	Absent	Interdune	Eucalypt woodland		Yellow-Red
M19	51J	647891	6765559	Absent	Interdune	Burnt Eucalypt woodland		Yellow-Red
M20	51J	645373	6765401	Absent	Dune	Sparse mixed scrub	10-20	Yellow
M21	51J	646462	6765423	Present	Dune	Mixed succulent	10-20	Yellow
M22	51J	647747	6765370	Present	Dune	Succulent and spinifex	<10	Yellow
M23	51J	645074	6765149	Present	Interdune	Burnt mallee		Red
M24	51J	645513	6765109	Absent	Interdune	Very open burnt acacia woodland		Red
M25	51J	646259	6765280	Absent	Dune	Open vegetation, no spinifex	<10	Yellow
M26	51J	644870	6765083	Present	Dune	Medium succulent	<10	Yellow

Location	Zone	Easting	Northing	Presence	Position	Vegetation	Dune height	Sand colour
M27	51J	645556	6764983	Absent	Dune	Very open vegetation	15	Yellow
M28	51J	646260	6765084	Present	Interdune	Burnt mallee		Yellow
M29	51J	646835	6764858	Present	Dune	Burnt eucalypts and succulents	<10	Yellow
M30	51J	647604	6765071	Absent	Dune	Mixed spinifex and trees	<10	Yellow
M31	51J	644830	6764941	Absent	Interdune	Mallee eucalypts		Red
M32	51J	645515	6764842	Absent	Interdune	Burnt mixed acacia woodland		Red
M33	51J	648221	6764407	Absent	Sandridge	Burnt, low mixed shrubs	<5	Yellow
M34	51J	644864	6764654	Present	Dune	Low mixed shrubs	<10	Yellow
M35	51J	645436	6764615	Present	Dune	Vegetated	21-30	Yellow
M36	51J	644269	6764449	Present	Dune	Burnt, low mixed shrubs	10-20	Yellow
M37	51J	644871	6764396	Present	Dune	Mixed succulents	<10	Yellow
M38	51J	645405	6764328	Present	Dune	Low dune, very open vegetation	<5	Yellow
M40	51J	648197	6764182	Present	Dune	Low open dune	<10	Yellow
M41	51J	644859	6764119	Present	Interdune	Dense *Melaleuca* sp.		Yellow-Red
M42	51J	645409	6764048	Absent	Interdune	Open *Callitris* / *Eucalyptus* spp. woodland		Red
M45	51J	648299	6763696	Absent	Dune	Low open dune	<5	Red
M46	51J	644810	6763770	Absent	Dune	Low shrubs and spinifex	<10	Yellow
M47	51J	645420	6763752	Present	Dune	Low dune, vegetated	<10	Yellow
M48	51J	643489	6763120	Absent	Dune	Spinifex and *Eucalyptus/Callitris* spp.	10	Yellow
M50	51J	645139	6763145	Absent	Dune	Spinifex	<5	Yellow
M53	51J	643394	6762230	Present	Dune	Spinifex and *Eucalyptus/Callitris* spp.	<10	Yellow
M56	51J	643379	6761996	Present	Dune	Spinifex, *Callitris* sp.	<10	Yellow
M58	51J	651239	6763090	Present	Dune	Low vegetated dune	<5	Red
M59	51J	651680	6763074	Present	Dune	Low vegetated dune	<10	Red
M60	51J	651287	6762977	Absent	Interdune	Clayey		
M61	51J	651516	6762940	Absent	Interdune	Vegetated, clayey		Red
M62	51J	651036	6762792	Present	Dune	Low vegetated dune	<5	Red

Location	Zone	Easting	Northing	Presence	Position	Vegetation	Dune height	Sand colour
M63	51J	651414	6762816	Present	Dune	Low dune, vegetated	<10	Red
M64	51J	651026	6762514	Absent	Interdune	Hard soil		Red
M65	51J	651506	6762402	Absent	Interdune	Hard soil		Red
M66	51J	648928	6762074	Present	Dune	Spinifex	<10	Yellow
M67	51J	649486	6762115	Absent	Dune	Mixed low vegetation	<10	Yellow-Red
M68	51J	649913	6762031	Present	Dune	Spinifex	<10	Red
M69	51J	650280	6762161	Present	Dune	Low dune, with spinifex	10-20	Red
M70	51J	650931	6762043	Absent	Dune	Low dune, with spinifex	<10	Red
M71	51J	648418	6761865	Absent	Interdune	Spinifex		Red
M72	51J	649408	6761704	Present	Dune	Spinifex	<10	Yellow
M73	51J	650559	6761444	Absent	Interdune	Dense spinifex		Red
M74	51J	652012	6761620	Absent	Dune	Well vegetated dune, spinifex	10-20	Red
M75	51J	652909	6761586	Absent	Dune	Tall, well vegetated dune	10-20	Red
M76	51J	648438	6761727	Present	Dune	Mixed vegetation	<10	Yellow
M77	51J	649073	6761682	Present	Dune	Spinifex	<10	Yellow
M78	51J	650020	6761310	Present	Dune	Spinifex	<10	Yellow-Red
M79	51J	650808	6761229	Absent	Dune	Dense, medium sized spinifex	<10	Red
M80	51J	650226	6763892	Absent	Open sandy plain	Open sandy plain		Red
M81	51J	649822	6763577	Absent	Open sandy plain	Open sandy plain		Red
M82	51J	650551	6764258	Absent	Flat sandy zone	Burnt open Acacia woodland, mixed low shrubs		Red
M83	51J	642974	6760458	Present	Dune	Spinifex and *Plectrachne* sp.	<10	Yellow-Red
M84	51J	642896	6760114	Present	Dune	Spinifex and *Plectrachne* sp.	<10	Yellow-Red

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APPENDIX C VOUCHER SPECIMENS LODGED WITH WA MUSEUM

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REGNO	GENUS	SPECIES	LATITUDE	LONGITUDE	Date of capture	SEX	SVL	WT	TISSUE
166701	*Lerista*	*rhodonoides*	29°18`59"S	124°30`56"E	04/11/2006	Male	44	1.4	LIVER
166702	*Ctenotus*	*brooksi*	29°18`59"S	124°30`56"E	06/11/2006	Male	46	1.2	LIVER
166703	*Eremiascincus*	*richardsonii*	29°18`59"S	124°32`14"E	00/11/2006	Female	80	7.7	LIVER
166704	*Diporiphora*	*reginae*	29°18`59"S	124°30`56"E	06/11/2006	Male	46	1.2	LIVER
166705	*Ctenotus*	*dux*	29°18`59"S	124°30`56"E	01/11/2006	Male	70	5.2	LIVER
166706	*Menetia*	*greyii*	29°14`56"S	124°34`25"E	08/11/2006	Unknown	31	0.1	LIVER
166707	*Cryptoblepharus*	*carnabyi*	29°14`56"S	124°34`25"E	03/11/2006	Female	48	1.4	LIVER
166708	*Delma*	*nasuta*	29°15`41"S	124°31`18"E	07/11/2006	Male	89	7.4	LIVER
166710	*Lerista*	*bipes*	29°14`56"S	124°34`25"E	09/11/2006	Female	56	0.6	LIVER
166711	*Ctenotus*	*greeri*	29°14`56"S	124°34`25"E	02/11/2006	Female	66	4.7	LIVER
166712	*Ctenotus*	*quattuordecimlineatus*	29°18`59"S	124°30`56"E	01/11/2006	Male	62	3.9	LIVER
166713	*Ctenotus*	*schomburgkii*	29°18`59"S	124°30`56"E	01/11/2006	Male	42	1.1	LIVER
166714	*Ctenotus*	*helenae*	29°14`14"S	124°35`24"E	03/11/2006				
166715	*Diplodactylus*	*damaeus*	29°15`41"S	124°31`18"E	02/11/2006	Male	52	2.0	LIVER
166716	*Egernia*	*inornata*	29°14`56"S	124°34`25"E	03/11/2006	Female	81	11.5	LIVER
166717	*Morethia*	*butleri*	29°19`00"S	124°30`23"E	06/11/2006	Male	52	2.1	LIVER
166720	*Lerista*	*desertorum*	29°19`00"S	124°30`23"E	01/11/2006	Female	83	3.9	LIVER
166721	*Lerista*	*taeniata*	29°18`59"S	124°30`56"E	01/11/2006	Male	40	0.6	LIVER
166722	*Morethia*	*butleri*	29°18`59"S	124°30`56"E	03/11/2006	Female	48	2.5	LIVER
166723	*Delma*	*butleri*	29°14`14"S	124°35`24"E	03/11/2006	Male	72	4.0	LIVER
166724	*Ramphotyphlops*	*endoterus*	29°16`09"S	124°30`50"E	07/11/2006	Male	290	4.5	LIVER
166725	*Ctenotus*	*greeri*	29°14`56"S	124°34`25"E	02/11/2006	Male	79	4.2	
166726	*Ramphotyphlops*	*endoterus*	29°16`29"S	124°32`14"E	08/11/2006				
166727	*Delma*	*petersoni*	29°16`59"S	124°30`50"E	04/11/2006	Male	105	13.6	LIVER

REGNO	GENUS	SPECIES	LATITUDE	LONGITUDE	Date of capture	SEX	SVL	WT	TISSUE
Discard	*Ctenotus*	*leonhardii*	29°14`14"S	124°35`24"E	11/11/2006				
Discard	*Ctenotus*	*greeri*	29°14`56"S	124°34`25"E	11/11/2006				
M64938	*Sminthopsis*	*dolichura*	29°19`00"S	124°30`23"E	9/11/2006				
M64939	*Mus*	*musculus*	29°18`59"S	124°30`56"E	8/11/2006				
M64940	*Pseudomys*	*hermannsburgensis*	29°15`41"S	124°31`18"E	8/11/2006				
M64941	*Pseudomys*	*hermannsburgensis*	29°18`59"S	124°30`56"E	4/11/2006				
M64942	*Pseudomys*	*hermannsburgensis*	29°15`41"S	124°31`18"E	5/11/2006				
M64943	*Pseudomys*	*hermannsburgensis*	29°15`41"S	124°31`18"E	6/11/2006				
M64944	*Notomys*	*alexis*	29°18`59"S	124°30`56"E	8/11/2006				
M64945	*Pseudomys*	*hermannsburgensis*	29°15`41"S	124°31`18"E	3/11/2006				
M64946	*Pseudomys*	*hermannsburgensis*	29°15`41"S	124°31`18"E	30/10/2006				
M64947	*Ningaui*	*yvonnae*	29°16`09"S	124°30`50"E	8/11/2006				
165862	*Ctenotus*	*greeri*	29°14`15"S	124°33`29"E	05/03/2007				
165863	*Neobatrachus*	*sp.*	29°14`15"S	124°33`29"E	12/03/2007				
165864	*Neobatrachus*	*sp.*	29°14`00"S	124°33`00"E	14/03/2007				
165865	*Ctenotus*	*quattuordecimlineatus*	29°16`09"S	124°30`50"E	10/03/2007				
165866	*Parasuta*	*monachus*	29°14`56"S	124°34`25"E	06/03/2007				
165867	*Proablepharus*	*reginae*	29°16`09"S	124°30`50"E	07/03/2007				
165868	*Diplodactylus*	*damaeus*	29°19`11"S	124°31`28"E	10/03/2007				
165869	*Diplodactylus*	*damaeus*	29°19`11"S	124°31`28"E	10/03/2007				
165870	*Diplodactylus*	*damaeus*	29°19`11"S	124°31`28"E	10/03/2007				
165871	*Ctenotus*	*greeri*	29°14`15"S	124°33`29"E	08/03/2007				
165872	*Proablepharus*	*reginae*	29°15`40"S	124°31`18"E	08/03/2007				
165873	*Delma*	*petersoni*	29°19`11"S	124°31`28"E	14/03/2007				

REGNO	GENUS	SPECIES	LATITUDE	LONGITUDE	Date of capture	SEX	SVL	WT	TISSUE
165874	*Delma*	*petersoni*	29°14`04"S	124°31`08"E	06/03/2007				
165875	*Lerista*	*taeniata*	29°21`17"S	124°22`53"E	13/03/2007				
165876	*Ctenophorus*	*cristatus*	29°19`11"S	124°31`28"E	10/03/2007				
165877	*Varanus*	*gilleni*	29°16`29"S	124°32`14"E	10/03/2007				
165878	*Ctenotus*	*greeri*	29°14`50"S	124°35`24"E	06/03/2007				
165879	*Ctenotus*	*greeri*	29°14`15"S	124°33`29"E	04/03/2007				
165880	*Neelaps*	*bimaculatus*	29°14`04"S	124°31`08"E	07/03/2007				
165881	*Neelaps*	*bimaculatus*	29°14`10"S	124°31`10"E	10/03/2007				
165882	*Ctenotus*	*quattuordecimlineatus*	29°14`10"S	124°31`10"E	10/03/2007				
165883	*Delma*	*butleri*	29°14`15"S	124°33`29"E	10/03/2007				
Discard	*Menetia*	*greyii*	29°14`56"S	124°34`25"E	11/03/2007				
Discard	*Ctenotus*	*leonhardii*	29°14`14"S	124°35`24"E	05/03/2007				
Discard	*Ctenotus*	*quattuordecimlineatus*	29°14`14"S	124°35`24"E	10/03/2007				
M64980	*Notomys*	*alexis*	29°16`09"S	124°30`50"E	10/03/2007				
M64982	*Sminthopsis*	*hirtipes*	29°16`09"S	124°30`50"E	05/03/2007				
M64979	*Notomys*	*alexis*	29°18`59"S	124°30`56"E	10/03/2007				
M64981	*Ningaui*	*yvonnae*	29°16`09"S	124°30`50"E	13/03/2007				
M64983	*Pseudomys*	*hermannsburgensis*	29°21`17"S	124°22`53"E	11/03/2007				

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APPENDIX D VERTEBRATE FAUNA RECORDED DURING SURVEYS

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Appendix D1 Mammals recorded.

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Sandhill Dunnart Sites		Southern Marsupial Mole Sites	Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	SHD1	SHD2	Mole holes	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P2	P2		P1	P2	P3
NATIVE FAUNA																																			
TACHYGLOSSIDAE																																			
Tachyglossus aculeatus	Short-beaked Echidna	S																															S		
DASYURIDAE																																			
Ningaui yvonnae	Southern Ningaui		1	2	2	2			1	6		1	3	1	4	4			1	6	1	2	10	8	1	5				2	4				
Sminthopsis crassicaudata	Fat-tailed Dunnart														1																				
Sminthopsis dolichura	Little Long-tailed Dunnart				3	9		7	3	3		3	1	2						1	1	5								2				
Sminthopsis hirtipes	Hairy-footed Dunnart		1							1					2										2									
Sminthopsis ooldea	Ooldea Dunnart			1												1		3						1				3						
MACROPODIDAE																																			
Macropus fuliginosus	Western Grey Kangaroo			1		1	1		1			1	3		2	5	3		3		3			14	1		7	3	5				3		10
Macropus robustus	Euro																						2										1		9
Macropus rufus	Red Kangaroo											2																2	1				3		1
NOTORYCTIDEA																																			
Notoryctes typhlops	Southern Marsupial Mole																															124 holes recorded			
EMBALLONURIDAE																																			
Taphozous hilli	Hill's Sheathtail Bat	A			A										A		A											A	A					A	
VESPERTILIONIDAE																																			
Chalinolobus gouldii	Gould's Wattled Bat	A	A	A	A		A		A	A	A	A	A	A	A		A	A	A	A	A		A	A	A	A		A	A				A	A	
Nyctophilus geoffroyi	Lesser Long-eared Bat				A		A			A	A			A					A	A			A			A	A		A						
Nyctophilus timoriensis	Greater Long-eared Bat	A												?																					
Scotorepens balstoni	Inland Broad-nosed Bat	A			A		A			A	A	A			A		A	A	A	A			A		A	A	A							A	
Vespadelus finlaysoni	Inland Cave Bat		A		A						A				A		A	A	A				A		A		A						A		
MOLOSSIDAE																																			
Mormopterus planiceps	Little Mastiff Bat		A	A	A				A		A			A				A						A	A		A	A	A						
Tadarida australis	White-striped Freetail Bat										A																								
MURIDAE																																			
Leporillus sp.	Stick-nest Rat																																S	S	
Notomys alexis	Spinifex Hopping Mouse	1	4	2								1			6	1	16			2			1	1		3				3				1	
Pseudomys desertor	Desert Mouse					1																													
Pseudomys hermannsburgensis	Sandy Inland Mouse	2	10			6		2		3			1			2		1	7	10		1	3		2	3				13	4				
CANIDAE																																			
Canis lupus dingo	Dingo	S			S		S6										5					S			S			S	1				1		4

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Sandhill Dunnart Sites		Southern Marsupial Mole Sites	Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	SHD1	SHD2	Mole holes	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P2	P2		P1	P2	P3
INTRODUCED FAUNA																																			
CAMELIDAE																																			
Camelus dromedarius	Camel	S			S					S	S	S	S						S		S						S						S	1	4
CANIDAE																																			
Vulpes vulpes	Fox										S	S										S					S						1	1	1
FELIDAE																																			
Felis catus	Feral Cat	S								S									S			S					S	S							1
LEPORIDAE																																			
Oryctolagus cuniculus	Rabbit										S												6	S		S		1				S	S	2
MURIDAE																																			
Mus musculus	House Mouse	8	14		2	13	2	2		7	2	10	33	9	2	2	4			21		3			3	22	16	9	1	11	4				1

Note: Secondary evidence of species presence by Anabat recordings are indicated with “A”. Species presence indicated by scat findings are indicated with “S”.

Appendix D2 Birds recorded.

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P1	P2	P3
CASUARIIDAE																																
Dromaius novaehollandiae	Emu																													S		
MEGAPODIIDAE																																
Leipoa ocellata	Malleefowl							M																	M							
PODICIPEDIDAE																																
Poliocephalus poliocephalus	Hoary-headed Grebe																														1	
COLUMBIDAE																																
Phaps chalcoptera	Common Bronzewing		2																										1	2		11
Ocyphaps lophotes	Crested Pigeon														13													2				
Geopelia cuneata	Diamond Dove																															2
PODARGIDAE																																
Podargus strigoides	Tawny Frogmouth																															4
AEGOTHELIDAE																																
Aegotheles cristatus	Australian Owlet-Nightjar												1																		1	4
ACCIPITRIDAE																																
Accipiter cirrocephalus	Collared Sparrowhawk															1																3
Aquila audax	Wedge-tailed Eagle											2																		1		12
Hieraaetus morphnoides	Little Eagle																		2						8							
FALCONIDAE																																
Falco cenchroides	Nankeen Kestrel		1																				2				1		2		6
Falco berigora	Brown Falcon				2		2	1				1									3			2							15
Falco longipennis	Australian Hobby																													2	1	1
Falco peregrinus	Peregrine Falcon																															1
RALLIDAE																																
Fulica atra	Eurasian Coot																														1	
OTIDIDAE																																
Ardeotis australis	Australian Bustard		S																											1	3	5
CHARADRIIDAE																																
Vanellus tricolor	Banded Lapwing																						4									
CACATUIDAE																																
Eolophus roseicapillus	Galah	1					5		2						3	19				1			4	1		2	2	2	6		163
Nymphicus hollandicus	Cockatiel																															8
PSITTACIDAE																																
Glossopsitta porphyrocephala	Purple-crowned Lorikeet																														16	
Polytelis anthopeplus	Regent Parrot																									2			8			
Barnardius zonarius	Australian Ringneck	19	13	1	2	1	9	2	6	15	1	5				12	10		5	11	1	7		4	2	7	18	6		6	4	35
Psephotus varius	Mulga Parrot		2				3			3				5	14	5	2			1		3			7			8	2	11	18
Melopsittacus undulatus	Budgerigar												1																			
Neophema splendida	Scarlet-chested Parrot																								2						32	3
CUCULIDAE																																
Chalcites basalis	Horsfield's Bronze-cuckoo	5	1		2		3		2		2	2	1						2		3				1		1			2		
Chalcites osculans	Black-eared Cuckoo						1														1				1							
Cacomantis pallidus	Pallid Cuckoo	1			1		1				1														1							

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P1	P2	P3
HALCYONIDAE																																
Todiramphus pyrrhopygius	Red-backed Kingfisher				1				2															1	1					1		
MEROPIDAE																																
Merops ornatus	Rainbow Bee-eater	16			7		9		3		3		2		1				11						5							
CLIMACTERIDAE																																
Climacteris affinis	White-browed Treecreeper																													2		
MALURIDAE																																
Malurus splendens	Splendid Fairy-wren				11	2	5	1						5	8		3	10				4	4					4	4	4	1	15
ACANTHIZIDAE																																
Pyrrholaemus brunneus	Redthroat			1	2	1	5	2								2		1		1		5				1				1		1
Smicrornis brevirostris	Weebill	19	12	14	15	16	8		34	36	27	21	8	3	12	13	30	36	24	22	44	11		50	34	34	2		15	4		67
Acanthiza robustirostris	Slaty-backed Thornbill			4																												
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				2								3		13													1	23		4	
Acanthiza uropygialis	Chestnut-rumped Thornbill	2	5	9	4	11	24	14	2	12	2	11	4	12	21	18	26	24	8	7		9	4			15	4	11	70	4		42
Acanthiza apicalis	Inland Thornbill	6	4	9	18	2	19	7	12	9	13	1	19	13	20	3	39	29	18	2		9	10	3	6	1	6	2			4	47
Aphelocephala leucopsis	Southern Whiteface																													2		
PARDALOTIDAE																																
Pardalotus striatus	Striated Pardalote		1						2	1		1				1				1		1			1						2	1
MELIPHAGIDAE																																
Lichenostomus virescens	Singing Honeyeater						2				2	1				3	1											6	5			2
Purnella albifrons	White-fronted Honeyeater		29			21	16			1		62		7						9		7		1		17		2		1	3	20
Manorina flavigula	Yellow-throated Miner	16	12	3	7	2	12		24	23	15	8	1	5	3	20	1		12	15	17	27	4	13	2	5	22	33		1		59
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	12	22		19	17	47	1	1	1	6	28	13	12		1	1	1	16	9	14	5	1		19	4	9	21	3	3	1	17
Anthochaera carunculata	Red Wattlebird	3			3		2		4		9		2						1		2						7			2		5
Epthianura tricolor	Crimson Chat																														3	
Lichenostomus plumulus	Grey-fronted Honeyeater	15	15		1	1				8	24	31		3	6	28	2	2		1	1	1			6	4			1		2	54
Lichmera indistincta	Brown Honeyeater					1																										
POMATOSTOMIDAE																																
Pomatostomus superciliosus	White-browed Babbler	1			7	1	4	13										12											5	2		44
NEOSITTIDAE																																
Daphoenositta chrysoptera	Varied Sittella																													6	5	10
CAMPEPHAGIDAE																																
Coracina maxima	Ground Cuckoo-Shrike				1														3		3	2					2		4	1		7
Coracina novaehollandiae	Black-faced Cuckoo-shrike	9			5		5		12	4	3	2	1			6			11	2	1	1	2	3	4	4	4			3		12
PACHYCEPHALIDAE																																
Pachycephala rufiventris	Rufous Whistler	9	3	6	11	1	13	3	1	3	2	3	12	3		4	9	14	14	2		3	3	1	14	7	2		3	2		10
Colluricincla harmonica	Grey Shrike-thrush	6	2		3	1	5		3	1	8	2	2	1		6			1				1	1	3				4	2		7
Oreoica gutturalis	Crested Bellbird	4	3	3	3	2	7	1	1	3	8	5	5	6	10	5	3	2	6	1	7	6		4	3	2	6		8	1	1	18
ARTAMIDAE																																
Artamus personatus	Masked Woodswallow								6										3		3				7					6		
Artamus cinereus	Black-faced Woodswallow	1							3	3			1															6	21	2		46
Cracticus torquatus	Grey Butcherbird	7	1	5	4	4	1	1	5	5		4	6	5	4	7	3	3	2	6	5	1		1	5	3	1	5	1			8
Cracticus nigrogularis	Pied Butcherbird	1	2	3	6	2		1	4	8		1		2	9			2	3	3	4	6	4	4	2		8	9	3			13
Cracticus tibicen	Australian Magpie	3	3		1	5	2	1		3		1	1		2				1	2	3	1					4	3			2	13

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P1	P2	P3
Strepera versicolor	Grey Currawong		2			2												1												2	1	
RHIPIDURIDAE																																
Rhipidura leucophrys	Willie Wagtail	2	3		3	1			4	4	1	1			4	3			1		1		3		1	1				1	1	4
CORVIDAE																																
Corvus bennetti	Little Crow	1			4		1				4	2	4	1			9		1		7	2					12					82
MONARCHIDAE																																
Grallina cyanoleuca	Magpie-Lark														1										1				2	1		6
PETROICIDAE																																
Microeca fascinans	Jacky Winter	3							1	1	7	4		2	3	18	1	5							5	11					11	6
Petroica goodenovii	Red-capped Robin	2			8	3	5	3	2		5	1	7	1	7	1		7	8	5	1				1	3			2		2	7
Melanodryas cucullata	Hooded Robin			2											7															4	6
HIRUNDINIDAE																																
Cheramoeca leucosterna	White-backed Swallow			2			12	1								1					2	1		9	6	3				1	12
Petrochelidon nigricans	Tree Martin								1																							
NECTARINIIDAE																																
Dicaeum hirundinaceum	Mistletoebird	6			2		2		4		9	1	3			2			1		1				6	1						1
ESTRILDIDAE																																
Taeniopygia guttata	Zebra Finch										21		18	6	1														3	2		14
MOTACILLIDAE																																
Anthus novaeseelandiae	Australasian Pipit																							9						1	1	34

Note: Secondary evidence of species presence by; scat findings are indicated with “S”; nest mound are indicated with “M”.

Appendix D3 Herpetofauna recorded.

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Sandhill Dunnart Sites		Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	SHD1	SHD 2	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P2	P2	P1	P2	P3
AMPHIBIANS																																		
MYOBATRACHIDAE																																		
Neobatrachus sp.	Unknown Neobatrachus													1																			1	
REPTILES																																		
AGAMIDAE																																		
Amphibolurus longirostris	Long-nosed Dragon	2																																
Caimanops amphiboluroides	Mulga Dragon				3																													1
Ctenophorus clayi	Black-collared Dragon																		1															
Ctenophorus cristatus	Crested Dragon		1	2	4		1	2	2		1		1	1	1	1	6	2													1	8		16
Ctenophorus fordi	Mallee Military Dragon																													3				
Ctenophorus isolepis	Central Military Dragon		1	3	2	1	1		4	1	2		2						2		3		2	2	2					2		26		30
Ctenophorus nuchalis	Central Netted Dragon																		2		1											5	1	3
Ctenophorus reticulatus	Western Netted Dragon										1														1		1	1				1	4
Diporiphora reginae	N/A	1																	1	4	1									1	1			1
Moloch horridus	Thorny Devil					2	1		2				3		2	4	1		2		1		1	2	6	2				1		1		1
Pogona minor	Dwarf Bearded Dragon	2	4	1	1	1			2		3			1	1						2	2	1	4	2	2				6	1	1		3
ELAPIDAE																																		
Acanthophis pyrrhus	Desert Death Adder												1																					
Brachyurophis fasciolatus	Narrow-banded Shovel-nosed Snake																				1											5		
Brachyurophis semifasciatus	Southern Shovel-nosed Snake	1																							1							8		
Demansia psammophis	Yellow-faced Whipsnake										3	1		1		2					1		1											
Neelaps bimaculatus	Black-naped Snake		1			1																												
Parasuta monachus	Monk Snake											1						1							1									
Pseudechis australis	Mulga Snake										1					1	1						1			1						1		
Pseudonaja modesta	Ringed Brown Snake																1															1		
Pseudonaja nuchalis	Gwardar		1																				1									2		
Simoselaps bertholdi	Jan's Banded Snake				2		1		1	1					1		1			1	2	3			2		2	1				1		
GEKKONIDAE																																		
Diplodactylus conspicillatus	Fat-tailed Gecko													1	1		2						1					1				5		1
Diplodactylus granariensis	Western Stone Gecko				2				2	1	3										1	1			1							3		
Gehyra purpurascens	N/A	1							3	1						1												3				4		3
Gehyra variegata	N/A	1				1											3	1		1			2	1			8	7	1					42
Heteronotia binoei	Bynoe's Gecko																											1				2		1
Lucasium damaeum	Beaded Gecko	1	1	1																2	1				1					9	5	4	3	4
Nephrurus laevissimus	Pale Knob-tailed Gecko	9	12	5	4				1						5	1			10	2	1	9	2		1					12	4	48	10	9
Nephrurus levis	Smooth Knob-tailed Gecko				1										1		1															3		2
Rhynchoedura ornata	Beaked Gecko										1		2		1									1			5					5		5
Strophurus elderi	Jeweled Gecko	6	2	2	1				2															2						1		3		
Strophurus strophurus	Western Spiny-tailed Gecko				1		1				1		4				1															5		7
PYGOPODIDAE																																		
Delma butleri	Butler's Legless Lizard								2				5	2					4					1						2		2		

FAMILY and Species	Common Name	Habitat Group 1			Habitat Group 2										Habitat Group 3				Habitat Group 4				Habitat Group 5		Habitat Group 6		Habitat Group 7			Sandhill Dunnart Sites		Opportunistic sightings (2006/2007)		Opportunistic sightings (2008)
		1		17	2		6		7		9		10		11	14	15	16	3		5		12	18	4		8		13	SHD1	SHD 2	OPP		OPP
		P1	P2	P3	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P3	P3	P3	P3	P1	P2	P1	P2	P3	P3	P1	P2	P1	P2	P3	P2	P2	P1	P2	P3
Delma nasuta	N/A																		1															
Delma petersoni	N/A		1						1										1												1			
Lialis burtonis	Burton's Legless Lizard										1	1						1	2		2						1			1		3		
Pygopus nigriceps	Western Hooded Scaly-foot		1						1		2		3		1	3	1	1			2				1		2					13		2
SCINCIDAE																																		
Cryptoblepharus carnabyi	N/A																										1						1	2
Ctenotus ariadnae	N/A																1	1																
Ctenotus brooksi	N/A	1		7																										4	10			
Ctenotus calurus	N/A								2				1																					
Ctenotus dux	Narrow-lined Ctenotus	3	4	1					1										4	5	7	1	1					2		1				2
Ctenotus grandis	N/A												2	6				1													1			
Ctenotus greeri	N/A										2			3		3	4	9									1	4	18			1		2
Ctenotus helenae	N/A			8	2	6			8	11	9	5	20	14	1	30	11	24		2		6	4	12	6	10		1	1	2				3
Ctenotus leonhardii	N/A												1				2	1											4					
Ctenotus pantherinus	Leopard Ctenotus												7	6		1	1			1			5											5
Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus	7	3	5	10	1	3		5	5	2	3	15	16	3	6	8	1	10	8	8	9	10	13	12	14				1	7			5
Ctenotus schomburgkii	N/A				4	2	3	4	4	4	5		5	6	2	5	16	10				2		2	2	1			1					31
Cyclodomorphus melanops	Spinifex Slender Blue-tongue								1	1																								
Egernia inornata	Desert Skink			1	1		1		1				3		1	1			1		1	1		2	1		3	1	1	2		1		
Egernia striata	Night Skink				1																					1	1					1		
Eremiascincus richardsonii	Broad-banded Sand-swimmer		1												1																	1		
Lerista bipes	N/A	6	6	10	3		3		2	10	11	1			4	3	5	1	16	7	23	25	10		10	10	19	10		7	2			2
Lerista desertorum	N/A					5			3	2	4		4	2	1	2		3			7	1	1		4	1	8					3		1
Lerista rhodonoides	N/A								1	1			1								1						4		1					
Lerista taeniata	N/A	1																												1				
Menetia greyii	N/A								1												1				1		2	1						1
Morethia butleri	N/A								1							1					1							1						
Proablepharus reginae	N/A									1										2										1				
Tiliqua multifasciata	Centralian Blue-tongue Lizard										1																							
Tiliqua occipitalis	Western Blue-tongue Lizard								1																							1		
TYPHLOPIDAE																																		
Ramphotyphlops endoterus	N/A								1																1									1
Ramphotyphlops waitii	N/A																1																	
VARANIDAE																																		
Varanus brevicauda	Short-tailed Pygmy Monitor												6																					
Varanus eremius	Pygmy Desert Monitor			3															1				1		1							1		1
Varanus giganteus	Perentie																										1							1
Varanus gilleni	Pygmy Mulga Monitor		3							1	1						1	1	1	1					1	1	1					1		
Varanus gouldii	Gould's Goanna	2		1	1		2					1			1		1	1				2	2		2	1			1			1		
Varanus tristis	Black-headed Monitor																										1					1		

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Appendix D4 Southern Marsupial Mole hole data.

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
M01	51J	646861	6767028	27/08/07	1	1	50	60	0°	150	130	1200 x 700	3	3	2	Recent
M01	51J	646861	6767028	27/08/07	2	1	55	80	0°	300	730	1200 x 800	3	3	2	Oldish
M01	51J	646861	6767028	27/08/07	2	2	60	60	0°	490	930	1200 x 800	3	3	2	Old
M02	51J	647772	6766957	27/08/07	3	1	60	150	20°	300	220	1200 x 650	3	3	3	Fresh
M02	51J	647772	6766957	27/08/07	3	2	60	80	10°	330	460	600 x 650	3	3	3	Fresh
M02	51J	647772	6766957	27/08/07	3	3	60	90	5°	460	220	600 x 650	3	3	3	Fresh
M03	51J	645867	6766591	27/08/07	2	1	55	55	5°	350	0	400 x 600	2	3	2	Oldish
M03	51J	645867	6766591	27/08/07	2	2	55	50	0°	200	220	400 x 600	2	3	2	Oldish
M03	51J	645867	6766591	27/08/07	2	3	60		5°	190	550	1200 x 700	2	3	2	Oldish
M03	51J	645867	6766591	27/08/07	2	4	50	55	25°	250	230	400 x 600	3	3	3	Recent
M03	51J	645867	6766591	27/08/07	2	5	45	50	0°	250	630	1200 x 700	2	3	2	Oldish
M03	51J	645867	6766591	27/08/07	3	1	55	50	15°	300	260	1200 x 700	3	3	3	Recent
M03	51J	645867	6766591	27/08/07	3	2	60	50	5°	320	0	1200 x 700	3	3	3	Recent
M06	51J	646969	6766284	28/08/07	1	1	50	50	0°	280	600	1200 x 800	3	3	3	Oldish
M06	51J	646969	6766284	28/08/07	2	1	70	65	0°	150	250	1000 x 600	3	3	3	Oldish
M06	51J	646969	6766284	28/08/07	3	1	55	70	15°	130	610	1000 x 600	3	3	3	Recent
M06	51J	646969	6766284	28/08/07	3	2	55	50	10°	300	0	1000 x 600	3	3	3	Recent
M07	51J	647290	6766307	28/08/07	3	1	50	60	20°	150	1100	1100 x 700	3	3	3	Recent
M08	51J	647716	6766450	28/08/07	1	1	55	55	5°	200	0	400 x 700	2	3	2	Old
M08	51J	647716	6766450	28/08/07	2	1	60	50	0°	150	50	1200 x 800	2	3	2	Oldish
M08	51J	647716	6766450	28/08/07	2	2	50	50	10°	400	670	1200 x 800	3	3	3	Recent
M08	51J	647716	6766450	28/08/07	2	3	80	50	0°	230	30	450 x 500	2	3	2	Oldish
M08	51J	647716	6766450	28/08/07	2	4	50	50	0°	200	700	1200 x 800	3	3	3	Recent
M09	51J	645983	6766220	28/08/07	1	1	55	60	0°	250	900	900 x 600	3	3	2	Oldish

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
M09	51J	645983	6766220	28/08/07	1	2	55	55	0°	180	370	1100 x 700	3	3	2	Oldish
M09	51J	645983	6766220	28/08/07	1	3	40	50	0°	450	550	1100 x 700	2	2	2	Old
M09	51J	645983	6766220	28/08/07	2	1	50	50	20°	120	0	1200 x 600	3	3	3	Recent
M10	51J	646957	6766069	28/08/07	1	1	55	55	0°	100	500	1200 x 700	3	3	3	Old
M10	51J	646957	6766069	28/08/07	2	1	45	70	0°	160	650	1200 x 600	3	2	2	Old
M10	51J	646957	6766069	28/08/07	2	2	50	60	0°	200	1040	1200 x 600	3	3	3	Oldish
M10	51J	646957	6766069	28/08/07	2	3	55	55	0°	200	0	600 x 600	3	3	3	Oldish
M10	51J	646957	6766069	28/08/07	2	4	50	90	0°	230	280	600 x 600	3	3	3	Oldish
M10	51J	646957	6766069	28/08/07	3	1	50	80	50°	210	320	400 x 600	3	3	3	Oldish
M11	51J	647887	6766274	28/08/07	2	1	50	70	0°	360	400	1200 x 800	3	3	2	Old
M14	51J	646640	6765859	28/08/07	2	1	30	70	5°	150	780	1200 x 800	2	3	2	Oldish
M14	51J	646640	6765859	28/08/07	2	2	40	90	0°	100	0	600 x 800	2	3	2	Oldish
M14	51J	646640	6765859	28/08/07	2	3	40	40	0°	200	50	600 x 800	2	3	2	Oldish
M14	51J	646640	6765859	28/08/07	2	4	40	90	0°	240	880	1200 x 800	2	3	2	Oldish
M15	51J	647141	6765820	28/08/07	2	1	50	45	5°	180	70	600 x 400	3	3	3	Oldish
M15	51J	647141	6765820	28/08/07	3	1	80	50	20°	40	50	1300 x 500	3	3	3	Recent
M15	51J	647141	6765820	28/08/07	3	2	60	80	40°	300	300	1300 x 500	3	3	3	Recent
M15	51J	647141	6765820	28/08/07	3	3	50	100	25°	200	1000	1300 x 500	3	3	3	Recent
M15	51J	647141	6765820	28/08/07	3	4	65	150	0°	200	1100	1300 x 500	3	3	3	Recent
M15	51J	647141	6765820	28/08/07	3	5	55	55	10°	30	1100	1300 x 500	3	3	3	Oldish
M15	51J	647141	6765820	28/08/07	3	6	55	80	30°	150	900	1300 x 500	3	3	3	Oldish
M21	51J	646462	6765423	28/08/07	2	1	55	65	10°	300	400	1200 x 800	3	3	2	Old
M21	51J	646462	6765423	28/08/07	3	1	55	70	15°	150	50	500 x 600	3	3	3	Oldish
M21	51J	646462	6765423	28/08/07	3	2	55	60	0°	120	270	500 x 600	3	3	3	Oldish
M22	51J	647747	6765370	28/08/07	1	1	50	55	5°	250	370	600 x 600	2	2	2	Old
M23	51J	645074	6765149	29/08/07	2	1	55	55	5°	250	0	1200 x 600	3	3	3	Recent

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
M23	51J	645074	6765149	29/08/07	2	2	50	80	5°	250	900	1200 x 600	3	3	3	Recent
M26	51J	644870	6765083	29/08/07	1	1	55	55	5°	400	0	1200 x 700	3	3	2	Old
M26	51J	644870	6765083	29/08/07	1	2	50	60	5°	300	70	1200 x 700	3	3	2	Old
M26	51J	644870	6765083	29/08/07	1	3	50	50	0°	270	200	1200 x 700	3	3	2	Oldish
M26	51J	644870	6765083	29/08/07	1	4	50	90	5°	260	280	1200 x 700	3	3	2	Oldish
M26	51J	644870	6765083	29/08/07	3	1	50	45	15°	100	430	1000 x 700	3	3	2	Old
M28	51J	646260	6765084	29/08/07	3	1	30	35	15°	250	420	1100 x 600	3	3	3	Oldish
M29	51J	646835	6764858	29/08/07	3	1	35	50	60°	250	460	800 x 500	3	3	3	Recent
M34	51J	644864	6764654	29/08/07	1	1	50	50	5°	140	180	500 x 500	3	3	3	Oldish
M34	51J	644864	6764654	29/08/07	1	2	50	60	0°	120	110	500 x 700	2	2	2	Oldish
M34	51J	644864	6764654	29/08/07	2	1	60	80	0°	230	0	1200 x 800	2	3	2	Old
M34	51J	644864	6764654	29/08/07	2	2	40	170	35°	550	950	1200 x 500	2	3	2	Old
M35	51J	645436	6764615	29/08/07	2	1	50	55	0°	350	500	1100 x 700	3	3	3	Oldish
M35	51J	645436	6764615	29/08/07	3	1	45	80	0°	430	300	1200 x 700	2	3	2	Old
M35	51J	645436	6764615	29/08/07	3	2	50	100	0°	300	700	1200 x 700	2	3	3	Oldish
M36	51J	644269	6764449	29/08/07	1	1	50	45	0°	300	400	400 x 800	3	3	3	Recent
M36	51J	644269	6764449	29/08/07	1	2	40	135	10°	270	500	1200 x 800	3	3	3	Recent
M36	51J	644269	6764449	29/08/07	2	1	60	80	30°	250	150	1200 x 600	3	3	3	Recent
M36	51J	644269	6764449	29/08/07	2	2	70	80	0°	230	250	300 x 600	3	3	3	Recent
M36	51J	644269	6764449	29/08/07	3	1	35	35	0°	250	300	300 x 600	3	3	2	Old
M37	51J	644871	6764396	29/08/07	1	1	45	60	5°	120	320	350 x 700	3	3	3	Old
M37	51J	644871	6764396	29/08/07	1	2	50	45	0°	260	320	350 x 700	3	3	3	Oldish
M37	51J	644871	6764396	29/08/07	1	3	45	160	0°	280	240	1200 x 800	3	3	3	Oldish
M37	51J	644871	6764396	29/08/07	1	4	45	45	0°	220	150	400 x 800	2	3	2	Old
M37	51J	644871	6764396	29/08/07	2	1	55	55	15°	300	180	1200 x 800	3	3	3	Recent
M37	51J	644871	6764396	29/08/07	2	2	55	60	0°	300	900	1200 x 500	3	3	3	Recent

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
M38	51J	645405	6764328	29/08/07	3	1	60	50	0°	220	400	1200 x 700	3	3	3	Recent
M38	51J	645405	6764329	29/08/07	3	2	40	60	0°	180	600	900 x 700	3	3	3	Recent
M40	51J	648197	6764182	28/08/07	2	1	55	65	5°	180	100	600 x 800	2	3	3	Oldish
M41	51J	644859	6764119	29/08/07	3	1	55	60	10°	250	250	1100 x 400	2	2	2	Oldish
M47	51J	645420	6763752	29/08/07	2	1	50	50	5°	120	30	400 x 600	3	3	3	Oldish
M53	51J	643394	6762230	30/08/07	1	1	50	60	0°	200	50	1200x 800	3	3	3	Fresh
M53	51J	643394	6762230	30/08/07	1	2	45	40	0°	120	450	1200 x 800	3	3	3	Fresh
M53	51J	643394	6762230	30/08/07	1	3	45	45	0°	300	500	1200 x 800	3	3	3	Recent
M53	51J	643394	6762230	30/08/07	1	4	40	80	20°	170	1190	1200 x 800	3	3	3	Recent
M53	51J	643394	6762230	30/08/07	2	1	70	140	5°	180	200	1000 x 700	3	3	3	Fresh
M53	51J	643394	6762230	30/08/07	2	2	50	50	0°	220	300	450 x 700	3	3	3	Fresh
M56	51J	643379	6761996	30/08/07	3	1	45	210	0°	220	1030	1200 x 700	3	3	3	Oldish
M56	51J	643379	6761996	30/08/07	3	2	50	50	0°	270	1200	1200 x 700	3	3	3	Oldish
M58	51J	651239	6763090	29/08/07	1	1	50	50	20°	430	170	1200 x 800	2	3	2	Oldish
M58	51J	651239	6763090	29/08/07	1	2	50	50	0°	450	210	400 x 700	2	2	2	Old
M58	51J	651239	6763090	29/08/07	2	1	70	70	0°	300	300	500 x 700	3	3	2	Oldish
M59	51J	651680	6763074	29/08/07	2	1	60	45	15°	390	50	300 x 800	2	3	2	Oldish
M59	51J	651680	6763074	29/08/07	2	2	60	50	15°	330	840	1200 x 800	2	3	2	Oldish
M59	51J	651680	6763074	29/08/07	3	1	50	50	0°	380	230	300 x 800	3	3	3	Oldish
M59	51J	651680	6763074	29/08/07	3	2	55	55	5°	300	500	900 x 800	3	3	3	Oldish
M59	51J	651680	6763074	29/08/07	3	3	50	40	0°	250	0	330 x 800	3	3	3	Oldish
M59	51J	651680	6763074	29/08/07	3	4	50	45	15°	130	330	330 x 800	3	3	2	Oldish
M62	51J	651036	6762792	29/08/07	1	1	60	50	0°	140	150	1100 x 600	3	3	3	Recent
M62	51J	651036	6762792	29/08/07	1	2	60	60	0°	190	300	1100 x 600	3	3	3	Recent
M62	51J	651036	6762792	29/08/07	2	1	70	160	0°	220	250	1200 x 800	3	3	3	Recent
M62	51J	651036	6762792	29/08/07	2	2	50	50	10°	220	100	400 x 700	3	3	3	Recent

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
M63	51J	651414	6762816	29/08/07	2	1	50	50	5°	300	450	1200 x 800	2	3	2	Old
M63	51J	651414	6762816	29/08/07	3	1	35	400	5°	250	750	1200 x 700	3	3	3	Recent
M63	51J	651414	6762816	29/08/07	3	2	60	70	0°	100	1200	1200 x 700	3	3	3	Recent
M66	51J	648928	6762074	30/08/07	2	1	50	80	0°	340	720	1200 x 800	2	2	2	Old
M68	51J	649913	6762031	30/08/07	2	1	50	50	0°	450	200	300 x 700	3	3	3	Oldish
M68	51J	649913	6762031	30/08/07	3	1	40	50	0°	230	1210	1400 x 800	2	3	2	Old
M69	51J	650280	6762161	30/08/07	1	4	45	80	25°	390	40	300 x 600	3	3	3	Recent
M69	51J	650280	6762161	30/08/07	2	1	55	65	5°	450	300	1200 x 700	3	3	3	Oldish
M69	51J	650280	6762161	30/08/07	2	2	60	120	0°	200	550	1200 x 700	3	3	3	Recent
M69	51J	650280	6762161	30/08/07	2	3	70	110	0°	250	1000	1200 x 700	3	3	3	Recent
M72	51J	649408	6761704	30/08/07	1	1	50	70	10°	300	80	500 x 600	2	3	3	Old
M76	51J	648438	6761727	30/08/07	2	1	60	50	0°	430	250	2000 x 800	3	3	3	Fresh
M76	51J	648438	6761727	30/08/07	2	2	50	55	0°	70	2000	2000 x 800	3	3	3	Fresh
M76	51J	648438	6761727	30/08/07	2	3	55	80	5°	470	300	400 x 700	3	3	3	Fresh
M77	51J	649073	6761682	30/08/07	3	1	50	65	20°	760	240	350 x 600	2	3	3	Oldish
M78	51J	650020	6761310	29/08/07	3	1	50	50	0°	430	480	600 x 700	2	3	2	Old
M78	51J	650020	6761310	29/08/07	3	2	50	50	0°	430	250	600 x 700	2	3	2	Old
M83	51J	642974	6760458	30/08/07	3	1	60	50	0°	130	80	400 x 700	3	3	3	Oldish
M83	51J	642974	6760458	30/08/07	3	2	40	60	5°	240	70	400 x 700	2	2	2	Oldish
M84	51J	642896	6760114	30/08/07	2	1	60	50	10°	500	250	500 x 700	2	3	2	Old
M84	51J	642896	6760115	30/08/07	2	2	50	50	0°	130	700	1200 x 700	2	3	2	Old
M84	51J	642896	6760116	30/08/07	3	1	40	50	0°	210	60	1200 x 700	3	3	3	Recent
A26	51 J	0637046	6769172	26/09/07	1	1	50	55	0	230	900	1400 x 800	3	3	3	Recent
A26	51 J	0637046	6769172	26/09/07	1	2	45	60	0	80	900	1400 x 800	3	3	3	Recent
A26	51 J	0637046	6769172	26/09/07	1	3	40	40	0	150			3	3	2	Oldish
A27	51 J	0638461	6769185	26/09/07	1	1	50	50	0	80	80	1500 x 850	2	3	1	Old

SITE	ZONE	EASTING	NORTHING	DATE	TRENCH	HOLE	D min	D max	ANGLE	DEPTH	X	TRENCH FACE	CLARITY	CONFIDENCE	TAP TEST	AGE
A27	51 J	638461	6769185	26/09/07	1	2	40	45	0	150	1200	1500 x 850	1	1	1	Very old
A27	51 J	638461	6769185	26/09/07	1	3	45	55	0	300	170	800 x 300	3	3	2	Old
A27	51 J	638461	6769185	26/09/07	1	4	40	50	15	490	350	1500 x 850	2	3	1	Old to Very Old
A27	51 J	638461	6769185	26/09/07	2	1	40	40	0	270	770	1200 x 800	1	3	2	Old to Very Old
A27	51 J	638461	6769185	26/09/07	2	2	45	85	0	340	130	800 x 300	2	3	1	Old
Site 3	51 J	635029	6774869	29/01/08	2	1	50	55	5	260	320	1000 x 600	3	3	3	Oldish
Site 4	51 J	635009	6775945	29/01/08	1	1	50	55	5	110	520	1000 x 500	3	3	3	Oldish
Site 15	51 J	636073	6781103	30/01/08	1	1	40	45	0	90	400	1200 x 600	3	3	3	Oldish

Note: Sites all occur in zone 51 J. All measurements are in millimetres (mm). Trenches numbering is as: 1) Crest, 2) upper slope, 3) mid slope, 4) lower slope, along north facing side of site sand dune. "Trench Face" is measured as length x width. "X" is the distance from the left margin of the trench face. "Clarity", "Confidence" and "Tap Test" follow Benshemesh (2005) with 1 = not confident and 3 = very confident.

APPENDIX E REGIONAL VERTEBRATE FAUNA

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Appendix E1 Mammal species previously recorded or expected to occur within the region.

FAMILY and Species	COMMON NAME	Menkhorst and Knight (2004)	Plumridge Lakes (Burbidge *et al*., 1976)	Mulga Rocks (Martineck and Associates 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
TACHYGLOSSIDAE							
Tachyglossus aculeatus	Echidna	✓					✓
TYPHLOPIDAE							
Notoryctes typhlops	Southern Marsupial Mole	✓			✓		✓
DASYURIDAE							
Dasycercus sp. (*blythi or cristicauda*	Mulgara (Brush-tailed or Crest-tailed)	✓		✓	✓	✓	
Antechinomys laniger	Kultarr	✓					
Ningaui ridei	Wongai Ningaui	✓	✓	✓	✓	✓	
Ningaui yvonnae	Southern Ningaui	✓		✓	✓		✓
Pseudantechinus roryi	Rory's Pseudantechinus					✓	
Sminthopsis crassicaudata	Fat-tailed Dunnart	✓		✓	✓	✓	✓
Sminthopsis dolichura	Little Long-tailed Dunnart	✓		✓	✓		✓
Sminthopsis hirtipes	Hairy-footed Dunnart	✓		✓	✓	✓	✓
Sminthopsis ooldea	Ooldea Dunnart	✓		✓	✓	✓	✓
Sminthopsis psammophila	Sandhill Dunnart	✓		✓	✓		
MACROPODIDAE							
Macropus fuliginosus	Western Grey Kangaroo				✓	✓	✓
Macropus rufus	Red Kangaroo	✓	✓			✓	✓
Macropus robustus	Euro	✓					✓
EMBALLONURIDAE							
Taphozous hilli	Hill's Sheathtail Bat	✓					✓
MOLLOSIDAE							
Tadarida australis	White-striped Freetail Bat	✓			✓		✓
Mormopterus planiceps	Inland Freetail Bat	✓			✓		✓
VESPERTILIONIDAE							
Chalinolobus gouldii	Gould's Wattled Bat	✓			✓	✓	✓
Nyctophilus geoffroyi	Lesser Long-eared Bat	✓			✓	✓	✓
Nyctophilus sp. (central form)	Central Long-eared Bat				✓		✓

FAMILY and Species	COMMON NAME	Menkhorst and Knight (2004)	Plumridge Lakes (Burbidge *et al*., 1976)	Mulga Rocks (Martineck and Associates 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
Scotorepens balstoni	Inland Broad-nosed Bat	✓			✓		✓
Vespadelus finlaysoni	Inland Cave Bat	✓				✓	✓
Vespadelus baverstocki	Inland Forest Bat	✓					
MURIDAE							
Leporillus sp.	Stick-nest Rat	✓					Nests
Notomys alexis	Spinifex Hopping Mouse	✓	✓	✓	✓	✓	✓
Notomys mitchelli	Mitchell's Hopping Mouse	✓			✓		
Mus musculus	House Mouse	✓	✓	✓	✓	✓	✓
Pseudomys desertor	Desert Mouse	✓				✓	✓
Pseudomys bolami	Bolam's Mouse	✓					
Pseudomys hermannsburgensis	Sandy Inland Mouse	✓	✓	✓	✓	✓	✓
CANIDAE							
Vulpes vulpes	Red Fox	✓	✓			✓	✓
Canis lupus dingo	Dingo	✓	✓			✓	✓
FELIDAE							
Felis catus	House Cat	✓	✓		✓		✓
LEPORIDAE							
Oryctolagus cuniculus	European Rabbit	✓	✓		✓	✓	✓
BOVIDAE							
Capra hircus	Goat	✓					
CAMELIDAE							
Camelus dromedarius	One-humped Camel	✓	✓		✓	✓	✓

Appendix E2 Bird species previously recorded or expected to occur within the region.

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
CASUARIIDAE							
Dromaius novaehollandiae	Emu	✓	✓	✓		✓	✓
MEGAPODIIDAE							
Leipoa ocellata	Malleefowl	✓					✓
ANATIDAE							
Anas gracilis	Grey Teal	✓		✓			
PODICIPEDIDAE							
Poliocephalus poliocephalus	Hoary-headed Grebe	✓					✓
COLUMBIDAE							
Columba livia	Rock Dove	✓					
Phaps chalcoptera	Common Bronzewing	✓	✓	✓			✓
Ocyphaps lophotes	Crested Pigeon	✓			✓		✓
Geopelia cuneata	Diamond Dove	✓					✓
PODARGIDAE							
Podargus strigoides	Tawny Frogmouth	✓	✓	✓	✓	✓	✓
CAPRIMULGIDAE							
Eurostopodus argus	Spotted Nightjar	✓				✓	
AEGOTHELIDAE							
Aegotheles cristatus	Australian Owlet-nightjar	✓	✓	✓		✓	✓
APODIDAE							
Apus pacificus	Fork-tailed Swift	✓					
ARDEIDAE							
Egretta novaehollandiae	White-faced Heron	✓		✓			
ACCIPITRIDAE							
Haliastur sphenurus	Whistling Kite	✓	✓		✓		
Accipiter cirrhocephalus	Collared Sparrowhawk						✓

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
Accipiter fasciatus	Brown Goshawk	✓	✓			✓	
Circus assimilis	Spotted Harrier	✓					
Aquila audax	Wedge-tailed Eagle	✓	✓	✓		✓	✓
Hieraaetus morphnoides	Little Eagle	✓	✓				✓
FALCONIDAE							
Falco cenchroides	Nankeen Kestrel	✓	✓			✓	✓
Falco berigora	Brown Falcon	✓	✓		✓	✓	✓
Falco longipennis	Australian Hobby	✓	✓		✓	✓	✓
Falco hypoleucos	Grey Falcon	✓					
Falco subniger	Black Falcon	✓					
Falco peregrinus	Peregrine Falcon	✓					✓
RALLIDAE							
Fulica atra	Eurasian Coot	✓					✓
OTIDIDAE							
Ardeotis australis	Australian Bustard	✓	✓	✓	✓	✓	✓
BURHINIDAE							
Burhinus grallarius	Bush Stone-curlew					✓	
CHARADRIIDAE							
Charadrius ruficapillus	Red-capped Plover	✓	✓				
Vanellus tricolor	Banded Lapwing						✓
TURNICIDAE							
Turnix velox	Little Button-Quail	✓		✓		✓	
CACATUIDAE							
Lophochroa leadbeateri	Major Mitchell's Cockatoo	✓				✓	
Eolophus roseicapillus	Galah	✓	✓	✓		✓	✓
Nymphicus hollandicus	Cockatiel	✓	✓	✓			✓
PSITTACIDAE							
Glossopsitta porphyrocephala	Purple-crowned Lorikeet						✓
Polytelis anthopeplus	Regent Parrot	✓			✓		✓

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
Polytelis alexandrae	Princess Parrot	✓					
Barnardius zonarius	Australian Ringneck	✓	✓	✓	✓	✓	✓
Psephotus varius	Mulga Parrot	✓	✓	✓		✓	✓
Melopsittacus undulatus	Budgerigar	✓	✓			✓	✓
Neophema splendida	Scarlet-chested Parrot	✓	✓			✓	✓
Pezoporus occidentalis	Night Parrot	✓					
CUCULIDAE							
Chalcites basalis	Horsfield's Bronze-cuckoo	✓	✓			✓	✓
Chalcites osculans	Black-eared Cuckoo	✓	✓				✓
Cacomantis pallidus	Pallid Cuckoo	✓	✓	✓			✓
STRIGIDAE							
Ninox novaeseelandiae	Southern Boobook	✓	✓			✓	
TYTONIDAE							
Tyto javanica	Eastern Barn Owl	✓		✓		✓	
Tyto longimembris	Eastern Grass Owl	✓					
HALCYONIDAE							
Todiramphus pyrrhopygius	Red-backed Kingfisher	✓	✓	✓			✓
Todiramphus sanctus	Sacred Kingfisher	✓	✓				
MEROPIDAE							
Merops ornatus	Rainbow Bee-eater	✓	✓				✓
CLIMACTERIDAE							
Climacteris affinis	White-browed Treecreeper	✓	✓	✓			✓
Climacteris rufa	Rufous Treecreeper	✓			✓	✓	
MALURIDAE							
Malurus splendens	Splendid Fairy-wren	✓	✓			✓	✓
Malurus leucopterus	White-winged Fairy-wren	✓	✓			✓	
Malurus lamberti	Variegated Fairy-wren	✓				✓	
Malurus pulcherrimus	Blue-breasted Fairy-wren	✓					
Amytornis striatus striatus	Striated Grasswren	✓	✓			✓	

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
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	Slender-billed Thornbill	✓	✓				
Acanthiza apicalis	Inland Thornbill	✓	✓		✓	✓	✓
Aphelocephala leucopsis	Southern Whiteface	✓	✓	✓			✓
PARDALOTIDAE							
Pardalotus rubricatus	Red-browed Pardalote		✓			✓	
Pardalotus striatus	Striated Pardalote	✓	✓		✓	✓	✓
MELIPHAGIDAE							
Certhionyx variegatus	Pied Honeyeater	✓		✓			
Lichenostomus virescens	Singing Honeyeater	✓	✓			✓	✓
Lichenostomus leucotis	White-eared Honeyeater	✓					
Lichenostomus ornatus	Yellow-plumed Honeyeater	✓					
Lichenostomus plumulus	Grey-fronted Honeyeater	✓	✓		✓	✓	✓
Purnelli albifrons	White-fronted Honeyeater	✓	✓	✓	✓	✓	✓
Manorina flavigula	Yellow-throated Miner	✓	✓	✓	✓	✓	✓
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	✓	✓	✓		✓	✓
Anthochaera carunculata	Red Wattlebird	✓	✓		✓	✓	✓
Epthianura tricolor	Crimson Chat	✓	✓			✓	✓
Epthianura albifrons	White-fronted Chat	✓					
Sugomel niger	Black Honeyeater	✓	✓				
Lichmera indistincta	Brown Honeyeater	✓					✓
POMATOSTOMIDAE							
Pomatostomus temporalis	Grey-crowned Babbler					✓	

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
Pomatostomus superciliosus	White-browed Babbler	✓	✓	✓			✓
PSOPHODIDAE							
Cinclosoma castanotum	Chestnut Quail-thrush	✓		✓			
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	✓	✓	✓		✓	
NEOSITTIDAE							
Daphoenositta chrysoptera	Varied Sittella	✓					✓
CAMPEPHAGIDAE							
Coracina maxima	Ground Cuckoo-shrike	✓			✓	✓	✓
Coracina novaehollandiae	Black-faced Cuckoo-shrike	✓	✓	✓	✓	✓	✓
Lalage sueurii	White-winged Triller	✓	✓	✓			
PACHYCEPHALIDAE							
Pachycephala inornata	Gilbert's Whistler	✓		✓			
Pachycephala rufiventris	Rufous Whistler	✓	✓	✓		✓	✓
Colluricincla harmonica	Grey Shrike-thrush	✓	✓			✓	✓
Oreoica gutturalis	Crested Bellbird	✓	✓		✓	✓	✓
ARTAMIDAE							
Artamus personatus	Masked Woodswallow	✓					✓
Artamus cinereus	Black-faced Woodswallow	✓	✓	✓		✓	✓
Cracticus torquatus	Grey Butcherbird	✓	✓	✓	✓	✓	✓
Cracticus nigrogularis	Pied Butcherbird	✓	✓	✓	✓	✓	✓
Cracticus tibicen	Australian Magpie	✓	✓			✓	✓
Strepera versicolor	Grey Currawong	✓	✓				✓
DICRURIDAE							
Rhipidura albiscapa	Grey Fantail	✓					
RHIPIDURIDAE							
Rhipidura leucophrys	Willie Wagtail	✓	✓	✓	✓	✓	✓
CORVIDAE							
Corvus bennetti	Little Crow	✓	✓	✓			✓
Corvus orru	Torresian Crow	✓	✓		✓		

FAMILY NAME and Scientific name	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Neale Junction (*ecologia* 2009)	This survey
MONARCHIDAE							
Grallina cyanoleuca	Magpie-lark	✓	✓				✓
PETROICIDAE							
Microeca fascinans	Jacky Winter	✓	✓		✓	✓	✓
Petroica goodenovii	Red-capped Robin	✓	✓	✓	✓	✓	✓
Melanodryas cucullata	Hooded Robin	✓	✓	✓	✓	✓	✓
MEGALURIDAE							
Cincloramphus mathewsi	Rufous Songlark	✓					
Cincloramphus cruralis	Brown Songlark	✓	✓	✓			
HIRUNDINIDAE							
Cheramoeca leucosterna	White-backed Swallow	✓				✓	✓
Hirundo neoxena	Welcome Swallow	✓					
Petrochelidon nigricans	Tree Martin	✓					✓
NECTARINIIDAE							
Dicaeum hirundinaceum	Mistletoebird	✓	✓			✓	✓
ESTRILDIDAE							
Taeniopygia guttata	Zebra Finch	✓	✓			✓	✓
MOTACILLIDAE							
Anthus novaeseelandiae	Australasian Pipit	✓	✓	✓		✓	✓

Appendix E3 Herpetofauna previously recorded or expected to occur within the region.

FAMILY and Scientific Name	Common Name	Tyler *et al.* (1994)	Wilson and Swan (2008)	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Assoc. 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
AMPHIBIANS								
HYLIDAE								
Cyclorana platycephala	Water-holding Frog	✓						
MYOBATRACHIDAE								
Neobatrachus centralis	Desert Trilling Frog			✓				
Neobatrachus kunapalari	Kunapalari Frog	✓						
Neobatrachus sutor	Shoe-maker Frog	✓						
Neobatrachus sp.	Unidentified Neobatrachus							✓
REPTILES								
GEKKONIDAE								
Diplodactylus conspicillatus	Fat-tailed Gecko					✓	✓	✓
Diplodactylus granariensis	Western Stone Gecko		✓			✓		✓
Diplodactylus pulcher			✓			✓		
Gehyra purpurascens					✓	✓	✓	✓
Gehyra variegata			✓		✓	✓	✓	✓
Heteronotia binoei	Bynoe's Gecko		✓			✓	✓	✓
Lucasium damaeum	Beaded Gecko		✓	✓		✓	✓	✓
Lucasium maini			✓			✓		
Lucasium squarrosus			✓					
Lucasium stenodactylum						✓	✓	
Nephrurus laevissimus	Pale Knob-tailed Gecko		✓		✓	✓	✓	✓
Nephrurus levis	Smooth Knob-tailed Gecko		✓	✓		✓	✓	✓
Nephrurus vertebralis			✓	✓		✓		
Rhynchoedura ornata	Beaked Gecko		✓			✓	✓	✓
Strophurus assimilis	Thorn-tailed Gecko		✓			✓		

FAMILY and Scientific Name	Common Name	Tyler *et al.* (1994)	Wilson and Swan (2008)	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Assoc. 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
Strophurus elderi	Jeweled Gecko		✓		✓	✓	✓	✓
Strophurus strophurus	Western Spiny-tailed Gecko						✓	✓
Underwoodisaurus milli	Barking Gecko		✓			✓		
PYGOPODIDAE								
Delma butleri	Butler's Legless Lizard		✓			✓	✓	✓
Delma desmosa							✓	
Delma nasuta							✓	✓
Delma petersoni			✓		✓	✓		✓
Lialis burtonis	Burton's Legless Lizard		✓			✓	✓	✓
Pygopus nigriceps	Western Hooded Scaly-foot		✓			✓	✓	✓
SCINCIDAE								
Cryptoblepharus carnabyi	A skink		✓			✓		✓
Cryptoblepharus buchananii			✓			✓	✓	
Ctenotus atlas			✓		✓	✓		
Ctenotus ariadnae			✓					✓
Ctenotus brooksi			✓		✓	✓	✓	✓
Ctenotus calurus			✓			✓	✓	✓
Ctenotus dux	Narrow-lined Ctenotus		✓				✓	✓
Ctenotus grandis			✓				✓	✓
Ctenotus greeri			✓				✓	✓
Ctenotus helenae			✓			✓	✓	✓
Ctenotus leae			✓		✓	✓	✓	
Ctenotus leonhardii			✓					✓
Ctenotus nasutus							✓	
Ctenotus pantherinus	Leopard Ctenotus		✓			✓	✓	✓
Ctenotus piankai							✓	

FAMILY and Scientific Name	Common Name	Tyler *et al.* (1994)	Wilson and Swan (2008)	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Assoc. 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus		✓		✓	✓	✓	✓
Ctenotus schomburgkii			✓		✓	✓	✓	✓
Cyclodomorphus branchialis	Gilled Slender Blue-tongue				✓			
Cyclodomorphus melanops	Spinifex Slender Blue-tongue		✓			✓	✓	✓
Egernia depressa	Pygmy Spiny-tailed Skink		✓			✓		
Egernia inornata	Desert Skink		✓	✓	✓	✓	✓	✓
Egernia striata	Night Skink		✓			✓	✓	✓
Eremiascincus fasciolatus	Narrow-banded Sand-swimmer						✓	
Eremiascincus richardsonii	Broad-banded Sand-swimmer		✓			✓	✓	✓
Lerista bipes			✓		✓	✓	✓	✓
Lerista desertorum			✓			✓	✓	✓
Lerista muelleri			✓		✓	✓	✓	✓
Lerista picturata						✓		
Lerista taeniata								✓
Menetia greyii			✓	✓	✓	✓	✓	✓
Morethia boulengeri						✓		
Morethia butleri			✓		✓	✓	✓	✓
Morethia obscura			✓					
Proablepharus reginae			✓			✓	✓	✓
Tiliqua multifasciata	Centralian Blue-tongue		✓	✓		✓	✓	✓
Tiliqua occipitalis	Western Blue-tongue		✓	✓		✓	✓	✓
Tiliqua rugosa						✓		
AGAMIDAE								
Amphibolurus longirostris	Long-nosed Dragon		✓				✓	✓
Caimanops amphiboluroides	Mulga Dragon		✓				✓	✓

FAMILY and Scientific Name	Common Name	Tyler *et al.* (1994)	Wilson and Swan (2008)	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Assoc. 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
Ctenophorus caudicinctus	Ring-tailed Dragon		✓					
Ctenophorus clayi	Black-collared Dragon					✓	✓	✓
Ctenophorus cristatus	Crested Dragon		✓	✓		✓	✓	✓
Ctenophorus fordi	Mallee Military Dragon		✓			✓		✓
Ctenophorus isolepis	Central Military Dragon		✓	✓	✓	✓	✓	✓
Ctenophorus nuchalis	Central Netted Dragon		✓		✓	✓	✓	✓
Ctenophorus reticulatus	Western Netted Dragon		✓	✓	✓	✓	✓	✓
Ctenophorus salinarum	Claypan Dragon		✓			✓		
Ctenophorus scutulatus	Lozenge-marked Dragon		✓			✓		
Ctenophorus sp. aff. femoraliss							✓	
Diporiphora linga						✓		
Diporiphora reginae			✓			✓		✓
Diporiphora winneckei	Blue-lined Dragon	✓					✓	
Moloch horridus	Thorny Devil		✓		✓	✓	✓	✓
Pogona minor	Dwarf Bearded Dragon		✓	✓		✓	✓	✓
Tympanocryptis cephalus	Pebble Dragon						✓	
Tympanocryptis lineata						✓		
VARANIDAE								
Varanus brevicauda	Short-tailed Pygmy Monitor						✓	✓
Varanus eremius	Pygmy Desert Monitor		✓		✓	✓	✓	✓
Varanus giganteus	Perentie		✓				✓	✓
Varanus gilleni	Pygmy Mulga Monitor		✓			✓	✓	✓
Varanus gouldii	Gould's Goanna		✓		✓	✓	✓	✓
Varanus tristis	Black-headed Monitor		✓				✓	✓
TYPHLOPIDAE								
Ramphothyphlops bicolor							✓	
Ramphotyphlops bituberculatus	Prong-snouted Blind Snake		✓			✓		

FAMILY and Scientific Name	Common Name	Tyler *et al.* (1994)	Wilson and Swan (2008)	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Assoc. 1986)	FaunaBase	Neale Junction (*ecologia* 2009)	This survey
Ramphotyphlops endoterus			✓				✓	✓
Ramphotyphlops margaretae							✓	
Ramphotyphlops waitii			✓			✓		✓
PYTHONIDAE								
Antaresia stimsoni	Stimson's Python		✓					
Aspidites ramsayi	Woma Python		✓			✓	✓	
Morelia spilota imbricate	Carpet Python (south-west subspecies)		✓					
ELAPIDAE								
Acanthophis pyrrhus	Desert Death Adder		✓					✓
Brachyurophis fasciolatus	Narrow-banded Shovel-nosed Snake	✓				✓		✓
Brachyurophis semifasciatus	Southern Shovel-nosed Snake	✓			✓	✓		✓
Demansia psammophis	Yellow-faced Whipsnake		✓			✓	✓	✓
Furina ornata	Moon Snake		✓					
Neelaps bimaculatus	Black-naped Snake							✓
Parasuta monachus	Monk Snake		✓			✓	✓	✓
Pseudechis australis	Mulga Snake		✓			✓	✓	✓
Pseudonaja modesta	Ringed Brown Snake					✓	✓	✓
Pseudonaja nuchalis	Western Brown Snake		✓			✓		✓
Simoselaps anomalus	Desert Banded Snake						✓	
Simoselaps bertholdi	Jan's Banded Snake		✓			✓	✓	✓
Suta fasciata	Rosen's Snake		✓					

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APPENDIX F CONSERVATION CATEGORIES

Appendix F1 Definitions of relevant categories under the Environment Protection and Biodiversity Conservation Act.

CATEGORY	DEFINITION
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Migratory (M)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state; • The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); or • The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Appendix F2 Definition of Schedules under the Wildlife Conservation Act 1950.

SCHEDULE	DEFINITION
Schedule 1 (S1)	Fauna which are Rare or likely to become extinct, are declared to be fauna that is in need of special protection.
Schedule 2 (S2)	Fauna which are presumed to be extinct, are declared to be fauna that is in need of special protection.
Schedule 3 (S3)	Birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection.
Schedule 4 (S4)	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned above.

Appendix F3 Definition of Department of Environment and Conservation Priority Codes.

PRIORITY	DEFINITION
Priority One (P1)	Taxa with few, poorly known populations on threatened lands. Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Two (P2)	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities, on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Three (P3)	Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority Four (P4)	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 if present circumstances change. These taxa are usually represented on conservation lands.
Priority Five (P5)	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.

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APPENDIX G RISK ASSESSMENT

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Risk Issue	Event or Action	Impact	Inherent Risk			Controls	Residual Risk		
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Significance
Vegetation clearing	Clearing of fauna habitat	Loss of local vertebrate fauna communities	5	3	**15**	Clearing should be restricted to that which is necessary. Clearing boundaries should be clearly defined. Areas no longer required to be cleared should be rehabilitated as soon as is practicable.	4	2	**8**
	Clearing of fauna habitat	Adverse impact to ecological function and loss of local biodiversity	5	3	**15**	Largely unavoidable as areas are permanently changed. Adequate offsets should protect similar habitat in adjacent areas.	3	3	**9**
	Clearing of fauna habitat	Displacement of fauna into adjacent communities resulting in greater competition for resources in surrounding populations	5	2	**10**	Largely unavoidable as areas are permanently changed. Adequate offsets should protect similar habitat in nearby adjacent areas.	5	1	**5**
	Clearing of fauna habitat	Habitat fragmentation	4	2	**8**	Avoid unnecessary clearing of tracks between work areas.	3	2	**6**
	Clearing of fauna habitat	Loss of Conservation Significant Fauna	3	2	**6**	Possibly unavoidable impacts to conservation significant fauna inhabiting areas to be mined. Adequate offsets should protect similar habitat in adjacent areas, allowing populations to persist near the operational areas.	3	1	**3**
	Clearing of fauna habitat	Loss of regionally significant fauna habitat	5	2	**10**	Unavoidable impact to regionally significant, isolated fauna habitat. Adequate offsets should protect similar habitat in adjacent areas.	1	3	**3**
Fire	Wildfire as a result of clearing, construction or mining activities	Temporary destruction of fauna habitat	2	4	**8**	Adhere to fire prevention strategies.	1	4	**4**
	Increased frequency of fire	Lasting vegetation and ecosystem change as a result of changed fire regime	1	4	**4**	Adhere to fire prevention strategies.	1	4	**4**
Spread of weeds	Inadequate weed hygiene management during clearing and construction	Long-term reduction of fauna habitat quality over lease	2	4	**8**	Implement and audit weed hygiene measures. Remove weed outbreaks as soon as they are discovered to avoid extensive removal and rehabilitation costs at a later date.	1	3	**3**

Risk Issue	Event or Action	Impact	Inherent Risk			Controls	Residual Risk		
			Likelihood	Consequence	Risk Level		Likelihood	Consequence	Significance
Vehicle Strikes	Vehicle movements during construction and operation	Fauna mortality resulting in reduction of local fauna populations	5	1	**5**	Reduce speeds around dusk and dawn, when kangaroo activity is highest. In areas of significant fauna mortality, roadkill should be removed daily to avoid attracting eagles, buzzards, kites and other scavenging animals.	3	1	**3**
Feral Fauna	Access to unsealed food waste or artificial water sources	Increased abundance of introduced fauna	3	4	**12**	Adequate waste management and hygiene should prevent access to animals. Water sources should be fenced to prevent access by animals.	1	4	**4**
	Attraction or introduction of feral fauna to project area	Increased predation pressure on native fauna.	2	4	**8**	Baiting control programmes for foxes and cats should be introduced to counter potential increases in feral predator abundance	1	4	**4**
	Attraction or introduction of feral fauna to project area	Increased competition with native fauna.	2	4	**8**	Quarantine measures should be implemented to prevent house mouse and rat introduction.	1	4	**4**
Noise Pollution	High volume, localised noise events as a result of operations	Disruption of local fauna populations	3	2	**6**	Adhere to noise management procedures.	2	2	**4**
Light Pollution	Nocturnal light pollution as a result of operations	Altered fauna community structures	3	2	**6**	Develop light pollution management procedures if necessary. Use lighting levels appropriate to task required and safety standards. Reduce light pollution where possible. Use directional lighting equipment where possible.	2	2	**4**
	Nocturnal light pollution as a result of operations	Disruption of bird migration	2	4	**8**	As above.	1	4	**4**
Dust	Dust emissions arising from exploration activities	Localised damage to vegetation resulting in loss of fauna habitat	3	2	**6**	Adhere to dust management and suppression procedures.	2	2	**4**

Risk Assessment Rating		LIKELIHOOD				
		5: Almost Certain Is expected to occur in most circumstance	**4: Likely** Will probably occur in most circumstance	**3: Possible** Could occur	**2: Unlikely** Could occur but not expected	**1: Rare** Occurs in exceptional circumstances
CONSEQUENCES	**5: Catastrophic** Significant impact to fauna species of conservation significance or regional biodiversity	**25**	**20**	**15**	**10**	**5**
	4: Major Impact to fauna species of conservation significance in project area.	**20**	**16**	**12**	**8**	**4**
	3: Moderate Loss of fauna biodiversity in project area.	**15**	**12**	**9**	**6**	**3**
	2: Minor Short term or localised impact to fauna biodiversity.	**10**	**8**	**6**	**4**	**2**
	1: Insignificant No impact to fauna of conservation significance or biodiversity.	**5**	**4**	**3**	**2**	**1**

11-25	High risk, site/issue specific management programmes required, advice/approval from regulators required.
6 – 10	Medium risk, specific management and procedures must be specified.
1 – 5	Low risk, managed by routine procedures.