20 July 2009



Tropicana Gold Project
Minigwal Trough Water Area and Pipeline Corridor
Level 1 Fauna Survey

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TROPICANA GOLD PROJECT
MINIGWAL TROUGH WATER AREA AND PIPELINE CORRIDOR

LEVEL 1 FAUNA SURVEY

TROPICANA JOINT VENTURE

20 July 2009

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Executive Summary

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

As part of the proposed TGP the TJV intends to establish a borefield with the capability of supplying sufficient water for the processing needs of the proposed mine. The project was referred to the EPA in May 2008 and the Commonwealth Department of the Environment, Water, Heritage and Arts in June 2008. Both organisations have determined that the project including the Minigwal Trough Water Supply area needs to complete a formal environmental impact assessment. As part of the Environmental Assessment process *ecologia* Environment (*ecologia*) was commissioned to undertake a survey for Southern Marsupial Moles (*Notoryctes typhlops*) and a Level 1 vertebrate fauna assessment in accordance with Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) for the Minigwal Trough Water Supply Area. This document outlines the methods used to complete the Level 1 vertebrate fauna survey of the proposed water supply area and associated pipeline infrastructure corridor.

The survey methods used by *ecologia* are aligned with the Environmental Protection Authority's Position Statement No. 3 (EPA 2002) and Guidance Statement No. 56 (EPA 2004). The Level 1 fauna assessment was undertaken using a variety of sampling techniques, comprising 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.

A total of 580 minutes of bird surveying and 780 minutes of foraging for reptiles, mammals and amphibians was undertaken at 26 locations within the study area. Locations were arranged to document fauna habitats that were suited to conservation significant species potentially occurring in the area.

In addition, a total of 240 minutes was spent conducting nocturnal surveys, and 185 minutes of bat recordings were made. Secondary evidence of animals was also recorded, as were opportunistic sightings of fauna during activities on site.

Six mammal, 36 bird and six reptile species were observed during the survey.

Fifteen species of conservation significance potentially occur in the survey area. Evidence of two species was recorded during the survey. These were Malleefowl and Australian Bustard.

Malleefowl (*Leipoa ocellata*)

Malleefowl are listed as Vulnerable under the *Environmental Protection and Biodiversity Conservation Act* (1999) and as Schedule 1 under the *WA Wildlife Conservation Act* (1950). An inactive nesting mound was located in dense mulga woodland indicating the former occurrence of Malleefowl within the survey area, particularly concentrated around areas of dense *Acacia* mulga and *Eucalyptus* mallee. Although Malleefowl may persist in the region, the lack of evidence of recent activity during this and other surveys (URS 2008; *ecologia* 2009c) suggests otherwise, and the proposed disturbance is unlikely to affect the species.

Australian Bustard (*Ardeotis australis*)

The Australian Bustard is listed as a Priority 4 (Taxa in need of monitoring) species on the Department of Environment and Conservation Priority and Threatened Fauna list (2008). Tracks of this large bird were found in an area of long unburnt eucalypt woodland with a spinifex understorey. This species has been frequently observed to the south of the survey area (*ecologia* 2009c) and is thought to be relatively common in the region. Because of their nomadic nature and ability to avoid disturbance, Australian Bustards will not be affected by the proposal.

Other conservation significant species considered to have a medium or higher likelihood of occurrence were Southern Marsupial Mole, Peregrine Falcon and Rainbow Bee-eater.

General impacts to fauna were determined using a risk analysis (APPENDIX B). This identified several threatening processes and impacts to fauna habitats, biodiversity and ecological function within the survey area. In order to reduce overall fauna impacts, the following mitigating processes are suggested:

- Restrict clearing to that which is absolutely necessary;
- Areas cleared as part of construction should be rehabilitated as soon as is practical;
- Selection of infrastructure locations should avoid sand dune systems, areas of large spinifex clumps and areas of dense mulga or mallee;
- Avoid removing larger eucalypts which may provide roosts, nesting or feed sites for conservation significant parrot species, and ;
- Contractors should be aware of the potential for Rainbow Bee-eaters to breed in sandy embankments and along tracks and should avoid nest tunnels if present;
- Disturbances to unburned sand dune areas should be minimised, as these areas may provide habitat for Sandhill Dunnarts and Southern Marsupial Moles (SMM).
- Ensure that appropriate fire fighting equipment is available during construction;
- Fire prevention strategies should be an integral component of risk assessments for construction contractors;
- Consideration should be given to controlling numbers of feral animals within the region to reduce predation pressure on conservation significant fauna, including Malleefowl and SMM; and,
- Limit vehicle speeds in areas where conservation significant species are likely to occur and limit dawn and dust activities to only that which is absolutely necessary.

Table S.1.1 Conformance of project to EPA Position Statement No 3.

REQUIREMENT	RELEVANCE TO PROJECT	PROJECT 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 development of the Minigwal Trough Water Area will have minimal impact on the biodiversity of the region due to the small amount of land that requires clearing. No significant impacts to conservation significant species are anticipated.
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.	Prior to the field survey a list of rare fauna listed under State, Federal and International agreements potentially occurring in the survey area was prepared and these fauna were targeted during diurnal and nocturnal searches. Impacts to species listed under relevant legislature are addressed in Section 4.0.
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.	Because of the location of the proposed development and the scale of impact, a Level 1 survey has been conducted which conforms to EPA Guidance Statement No. 56 (EPA 2004). This comprised a literature review and reconnaissance survey.
Biodiversity Conservation and Ecological Function Values	Sufficient information is provided to address biodiversity conservation and ecological function values.	Impacts to species are addressed in Section 4.0. A risk assessment has also been conducted (APPENDIX B) to identify threatening process and methods for managing them.
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 have been collated and have been submitted to DEC as per fauna licensing conditions under licence SF006420.

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The Tropicana JV (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 prospects. The proposed TGP is located approximately 330 km east north-east of Kalgoorlie, and 15 km 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% and Manager) and the Independence Group NL (30%).

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

1. Operational Area - This area contains the mine, processing plant, aerodrome, village and other associated infrastructure.
2. Water Supply Area - Two basins have been investigated, the Minigwal Trough and Officer Basin.
3. Infrastructure Corridor - Two options are under consideration (Cable Haul and Pinjin Road options).

As part of the proposed TGP the TJV intends to establish a bore field with the capability of supplying sufficient water for the processing. The project was referred to the W.A. EPA in May 2008 and the Commonwealth Department of the Environment, Water, Heritage and Arts in June 2008. Both organisations have determined that the TGP, including the Minigwal Trough Water Supply area, needs to complete a formal environmental impact assessment. As part of the Environmental Assessment process *ecologia* Environment (*ecologia*) was commissioned to undertake a survey to determine the impacts of the development to the native fauna in the proposed Minigwal Trough Water Supply and Pipeline corridor, and in particular to determine whether Southern Marsupial Moles (*Notoryctes typhlops*) (SMMs) were present.

1.2 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 complied with. 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, projects 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 EPA Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002).

Native 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).

1.3 SURVEY OBJECTIVES

TJV commissioned *ecologia* to undertake a Level 1 fauna survey of the vertebrate fauna in the water supply area and pipeline corridor (Figure 1.2) as part of their EIA requirements.

The Environmental Protection Authority (EPA) supports the following objectives with regard to fauna management:

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

The aim of this study was to provide sufficient information to the EPA to assess the impact of the project on the vertebrate fauna of the area.

Specifically, the aims of the surveys were to:

- provide a review of background information (including literature and database searches);
- identify and describe the fauna habitat types found within the proposed area;
- determine the suitability of habitat to support Sandhill Dunnart (*Sminthopsis psammophila*; EPBC Act Endangered), Southern Marsupial Mole (*Notoryctes typhlops*, EPBC Act Endangered), Brush-tailed Mulgara (*Dasycercus blythi*; EPBC Act Vulnerable), and Malleefowl (*Leipoa ocellata*, EPBC Act Vulnerable);
- where suitable habitat exists, to undertake a search for secondary evidence and Malleefowl mounds;
- determine the suitability of habitat to support any other rare fauna potentially impacted by the construction project; and
- provide a risk assessment to determine likely impacts of threatening processes on vertebrate fauna within the survey area.

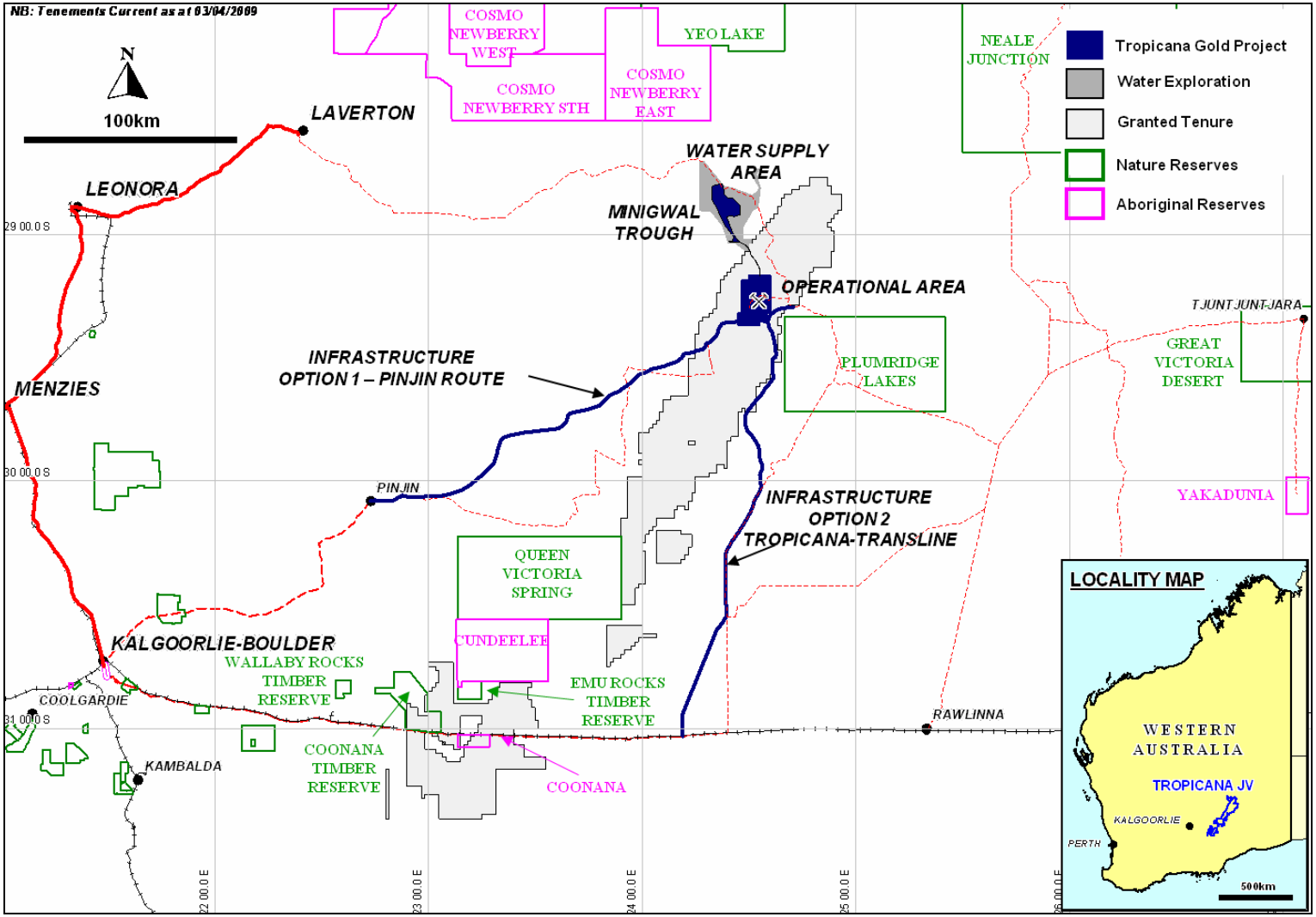

Figure 1.1 Location of the proposed Tropicana Gold Project.

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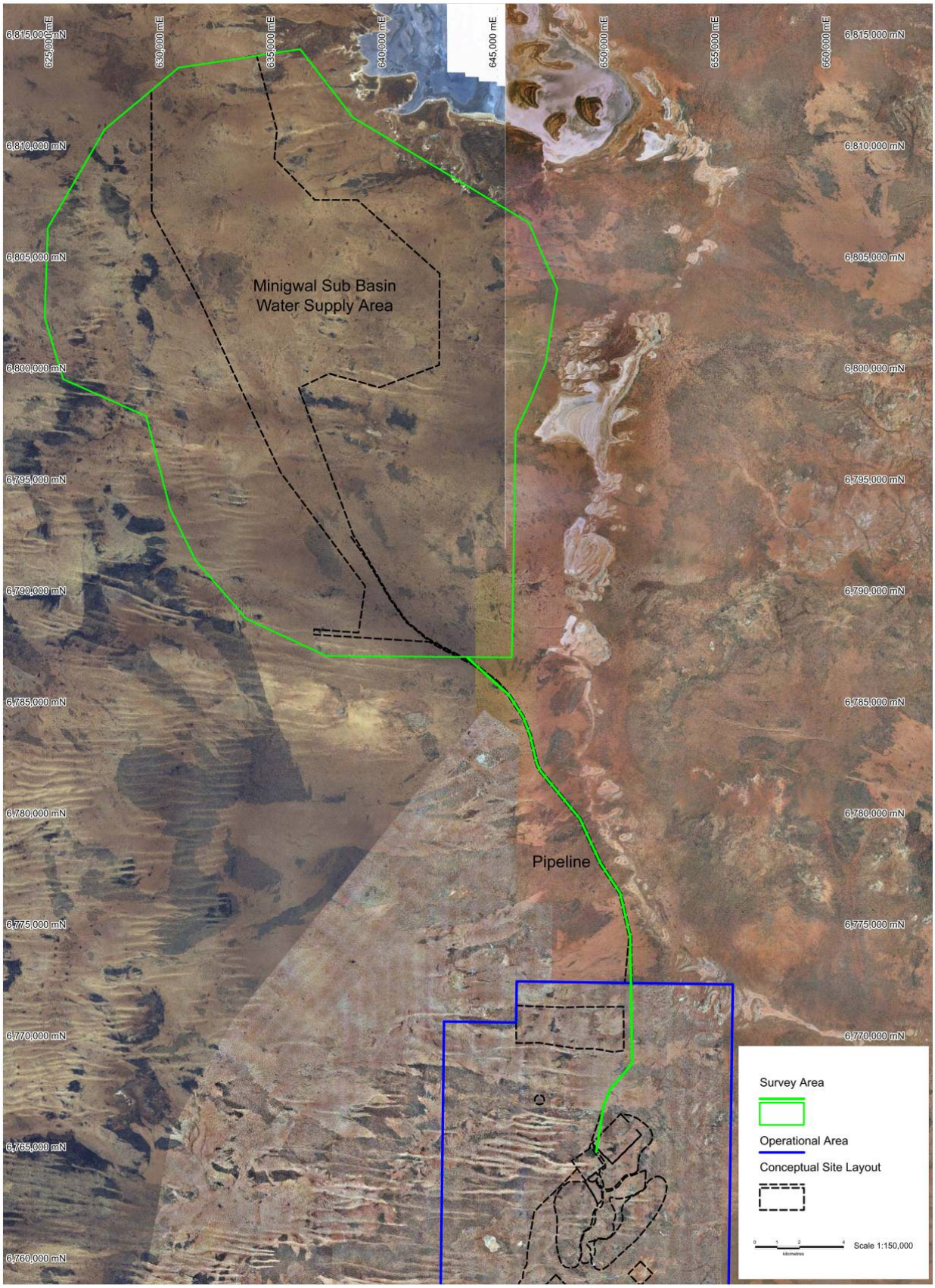

Figure 1.2 Location of Minigwal Trough Water Supply area and pipeline corridor.

1.4 BIOPHYSICAL ENVIRONMENT

1.4.1 CLIMATE

The proposed TGP is located east north-east of Kalgoorlie, on the western edge of the Great Victoria Desert. Representative weather conditions for the study area can be interpreted from weather data recorded by the Bureau of Meteorology (2008) from Laverton, 220 km north-west, and Balgair, 230 km south-east. A summary of climatic data for these two locations is provided in Figure 1.3.

The Tropicana project area experiences dry conditions year round, with approximately 200 – 300 mm of rainfall per year which is above the regional average (Bureau of Meteorology 2008). 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 (the highest maximum for Laverton was 233.6 mm in February 1995). Conversely, during all months of the year, the region can experience no rainfall.

Temperature extremes are 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).

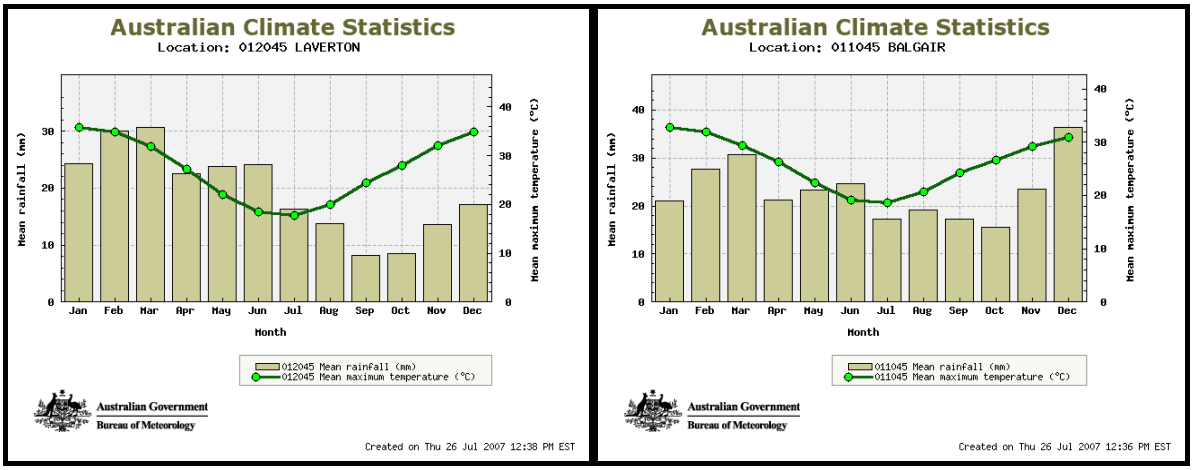

Figure 1.3 Average monthly climatic data from Laverton and Balgair.

1.4.2 BIOGEOGRAPHY

The proposed TGP lies within the Great Victoria Desert biogeographic region (Figure 1.4), as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) v6.1 (DEWHA 2004). On a finer scale, the tenements are located on the border of the Central and Shield subregions. The Great Victoria Desert biogeographic region is described as an arid active sand-ridge desert with extensive dune fields of deep Quaternary Aeolian sands. The vegetation consists primarily of *Eucalyptus gongylocarpa*, mulga and *E. youngiana* over hummock grassland (Barton and Cowan 2001).

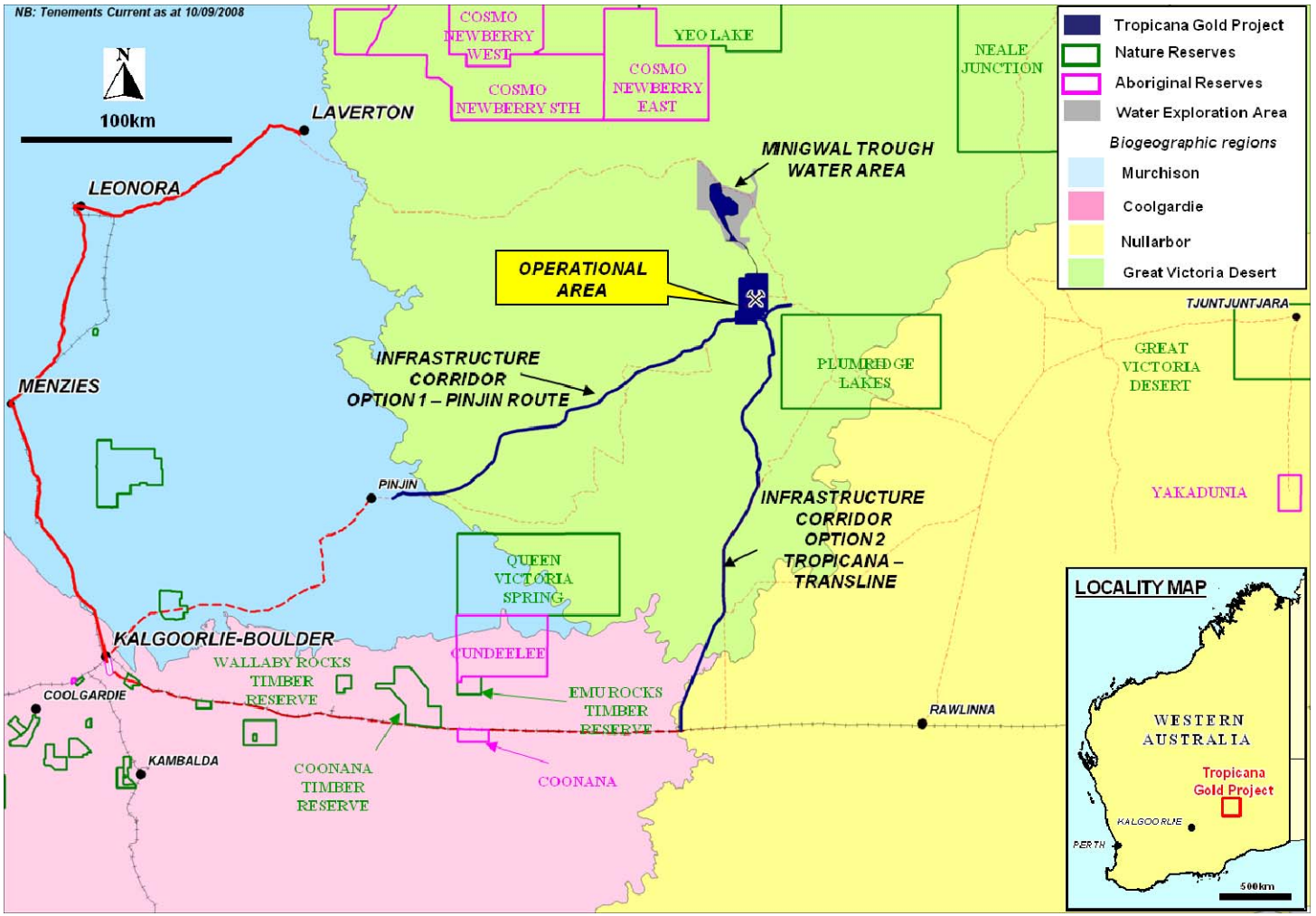

Figure 1.4 The Biogeographic regions associated with the Tropicana Gold Project (including the Minigwal Trough Water Supply Area).

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1.4.3 VEGETATION

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 three distinct vegetation units:

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

These vegetation types are widely represented in the surrounding region.

2.0 METHODOLOGY

The survey methods adopted by *ecologia* are aligned with EPA Guidance Statement No. 56 (EPA 2004) and Position Statement No. 3 (EPA 2002).

2.1 LITERATURE REVIEW AND DATABASE SEARCHES

The survey area is remote and very few fauna surveys had been completed prior to the commencement of baseline surveys by the TJV. Two published reports were available for review by Burbidge *et al.* (1976) and Martinick and Associates (1986). Since the commencement of exploration within the region the TJV has commissioned a number of level 1 and 2 fauna surveys and a series of targeted threatened species surveys for the Southern Marsupial Mole, Sandhill Dunnart, Malleefowl and other fauna species. This high level of survey effort has resulted in a deeper knowledge of the fauna assemblages within the TGP area.

Prior to the commencement of this survey a desktop survey of regional fauna was completed for the Minigwal Trough survey area. Several databases were consulted in the formulation of potential fauna and conservation significant fauna lists including:

- Western Australian Museum (WAM) FaunaBase;
- Birds Australia Birdata;
- Department of Environment, Water, Heritage and the Arts (DEWHA) protected matters database;
- Department of Environment and Conservation (DEC) threatened fauna database; and
- Relevant references (Section 2.6).

2.2 SURVEY TIMING

The Level 1 fauna survey was conducted during the period of the 18th March 2008 to 20th March 2008.

2.3 SITE SELECTION

Twenty-six sites were selected to represent all major fauna habitats present. Anabat recordings were made at site 19 and site 25. Site descriptions and photographs are given in APPENDIX A and site locations are given in Table 2.1 and Figure 2.1.

Table 2.1 GPS coordinates of fauna survey sites.

Site No.	Easting	Northing
1	649700	6766480
2	649773	6767025
3	650068	6767749
4	651055	6768913
5	651000	6772550
6	650982	6774607
7	650302	6776529
8	649654	6777914
9	648755	6779874
10	648000	6780780
11	646940	6782078
12	646784	6782400
13	646466	6783720
14	646170	6784489
15	645517	6785504
16	643642	6787182
17	647150	6782480
18	637026	6788285
19	638241	6790739
20	634309	6793655
21	633490	6793966
22	639436	6797282
23	640272	6797786
24	639535	6799254
25	630315	6804728
26	635130	6810050

Note: Datum WGS 84; Zone 51J

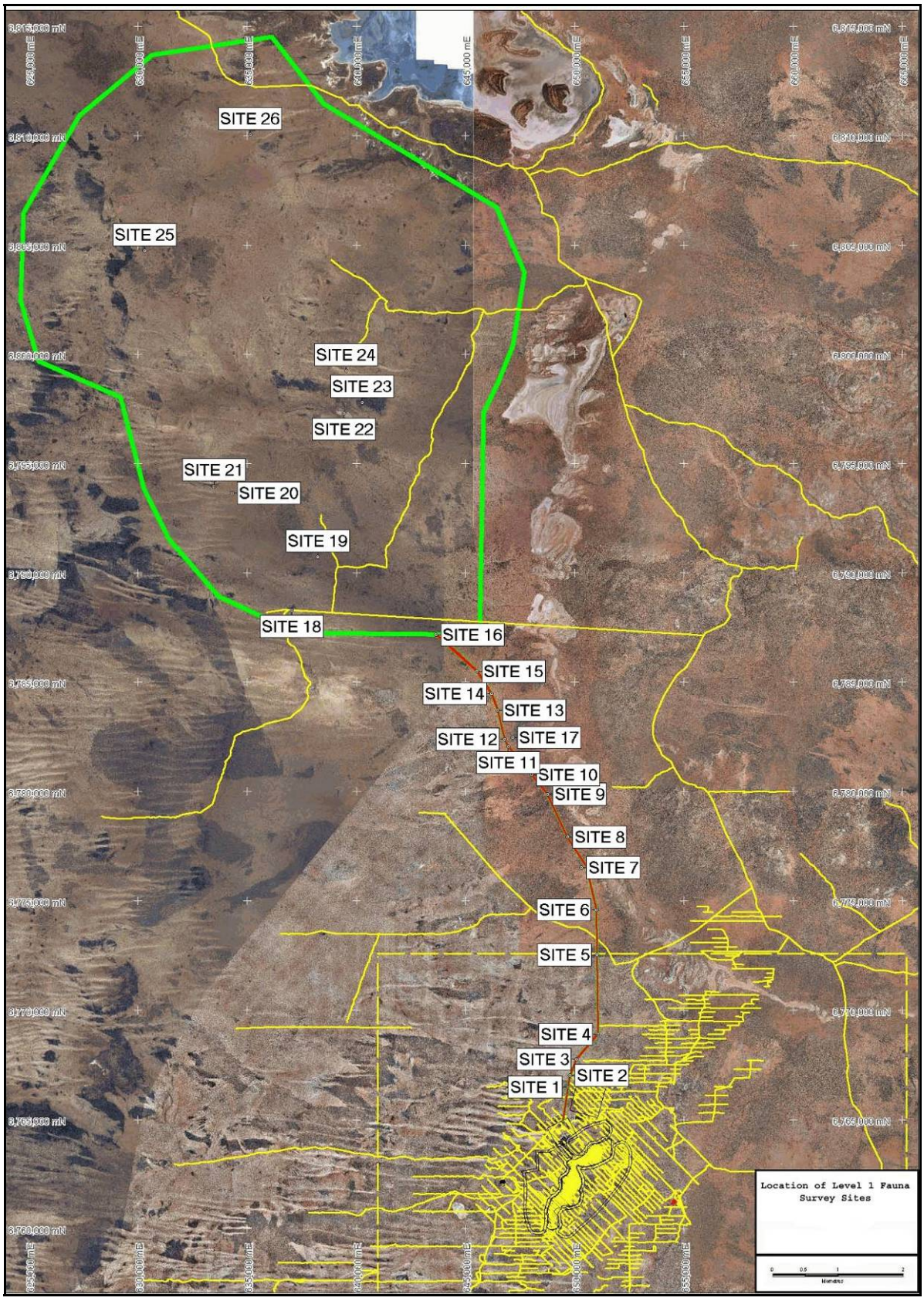

Figure 2.1 Location of fauna survey sites in the Minigwal Trough Water Supply area and pipeline corridor.

2.4 SAMPLING METHODS

2.4.1 Systematic Sampling

2.4.1.1 Avifauna

Twenty minute surveys were used to document the avifauna present at each site. During each survey an ornithologist recorded the number of individuals of each species seen while actively searching a 2 ha area. This survey method is the one recommended for the ongoing Birds Australia *Atlas of Australian Birds* project. Surveys were conducted throughout the daylight hours.

2.4.1.2 Bats

Bat echolocation calls were 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 were stored on Minidiscs and played back onto a PC for analysis. Mr. Bob Bullen identified acoustic calls to species.

2.4.2 Opportunistic Sampling

2.4.2.1 Spotlighting

Nocturnal searches were conducted one each night of the survey (Sites 19 and 25). Head torches and hand held spotlights were used to search for nocturnal fauna such as geckos, snakes, mammals and nocturnal birds.

2.4.2.2 Foraging

Discrete fauna habitats were searched for all mammal, reptile and amphibian species. Search methods included 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. Search locations were selected based on their suitability for conservation significant fauna.

2.4.2.3 Secondary Evidence

Bones, tracks, diggings, scats, burrows and nests were recorded where possible.

2.4.2.4 Opportunistic Sightings

Observations were recorded while searching and travelling within the study area during the day and night.

2.4.3 Species Specific Sampling

Fourteen conservation species were identified as potentially occurring in the survey area. Preferred habitat for each species (Table 2.2) was identified and these areas were specifically targeted during the Level 1 survey.

Table 2.2 Preferred habitat of conservation significant species

PREFERRED HABITAT	SPECIES	REFERENCES
Long unburnt spinifex on sand dunes	Sandhill Dunnarts, Brush-tailed Mulgara	(Gaikhorst pers. comm.; Masters 2003; Koertner *et al.* 2007)
Sand dunes	Southern Marsupial Mole	(Benshemesh 2004; Benshemesh 2005a)
Long unburnt mallee/mulga thickets	Malleefowl	(Benshemesh 1992; Benshemesh 2000; Garnett and Crowley 2000)
Regenerating hummock grassland on red dunes and plains	Great Desert Skink	(Pavey 2006a; McGuire 2008, McAlpin, 2001 #73)
Eucalypt woodlands	Princess Parrot, Naretha Blue Bonnet, Peregrine Falcon, Grey Falcon, Australian Bustard, Rainbow Bee-eater, Cattle Egret, Oriental Plover	(Johnstone and Storr 1998; Garnett and Crowley 2000)
Chenopod shrub steppe in treeless or sparsely wooded flatlands	Slender-billed Thornbill	(Garnett and Crowley 2000; Pavey 2006b; DEWHA 2008)

2.5 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 all cases, fauna were identified in the field and released at the point of capture.

2.6 TAXONOMY AND NOMENCLATURE

Nomenclature for mammals and amphibians within this report are as per the W.A. Museum's Faunabase. Nomenclature for birds is according to Christidis and Boles (2008) and reptiles according to Wilson and Swan (2008). References used for identification are listed in Table 2.3.

Table 2.3 References used for fauna identification.

Fauna Group	Reference
Mammals	Menkhorst and Knight (2004)
Bats	Churchill (1998), Menkhorst and Knight (2004)
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)

2.7 IMPACT RISK ASSESSMENT

A risk assessment (APPENDIX B) was undertaken to determine potential impacts arising from the development on vertebrate fauna and the residual impacts following the implementation of management strategies identified in this document (Section 6.0). Significance of the risks is 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).

2.8 SURVEY TEAM

The project manager was Stewart Ford and field personnel were Damien Cancilla and George Swann.

The survey was conducted under DEC Licence SF6420.

2.9 FAUNA SURVEY DESIGN

Prior to the development of survey methods, a review was undertaken of factors likely to influence survey design (Table 2.4).

Table 2.4 Factors likely to influence survey design (from EPA, 2004; 12-13).

FACTOR	RELEVANCE	COMMENT
Bioregion – level of existing survey/ knowledge of the region and associated ability to predict accurately.	The project is located on the boundary of the Central and Shield sub-regions of the Great Victoria Desert biogeographic region (IBRA). The current level of knowledge for the survey area is high because several recent Level 2 fauna surveys have been undertaken in the region.	Given the amount of existing contextual information (*ecologia* 2009c), the bioregion group (Group 4) and the level of impact, a Level 1 survey was considered adequate to assess the potential effect of disturbance in the survey area
Landform special characteristics/ specific fauna/ specific context of the landform characteristics and their distribution and rarity in the region.	The survey area contains three distinct vegetation units as described by Beard (1975).	Survey sites were located in all major vegetation units, with vehicle transects placed such that variation within the dominant vegetation units was sampled.
Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The arid climate of the survey area suggests that rainfall greatly influences fauna assemblages in the region.	None of the potential conservation significant fauna were likely to be absent due to seasonal factors.
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/ area curves).	Three Level 2 surveys and four SMM surveys had been completed recently (*ecologia* 2009c).	A Level 1 survey assessing habitat types preferred by conservation significant fauna was deemed adequate.

FACTOR	RELEVANCE	COMMENT
Number of different habitats or degree of similarity between habitats within a survey area.	Based on available vegetation mapping, five main vegetation types (fauna habitats) were thought to occur in the survey area.	Twenty-six survey sites were distributed among the five fauna habitats (Section 3.1) observed, with vehicle transects placed such that variation within the dominant vegetation units was sampled.
Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods).	Rainfall was recorded on each night.	There were no climatic constraints on sampling methods.
Sensitivity of the environment to the proposed activities.	The fauna habitats present in the study area were well represented outside of it and consisted of fire-sensitive mulga shrublands and dunes.	The habitats present were not considered to be sensitive to clearing and other mechanical disturbances as proposed for the survey area, and the fauna habitat quality is not expected to be significantly reduced.

3.0 RESULTS

3.1 FAUNA HABITATS OF THE SURVEY AREA

Five major fauna habitat types were identified in the survey area: recently burnt open eucalypt woodland, dense open eucalypt woodland, mulga thickets, sand dune systems and claypans. The land area encompassed by each habitat type is listed in Table 3.1.

Recently burnt open eucalypt woodland

Large areas of the survey area have been extensively burnt within the last 5 years, and this constitutes the habitat type with the largest area (94.2%). These areas are distinguished by regenerating open eucalypt mallee woodland over small to medium sized spinifex. The current small size of the understorey species and a distinct reduction in the amount of leaf litter reduces potential fauna refuge sites and increases predation likelihood.

Dense open eucalypt woodland

Areas of long unburnt eucalypt woodland are an important fauna habitat type as the number of microhabitats is generally greater than in more open or recently burnt areas. Larger spinifex clumps were found in these locations and represent an important refuge for fauna.

Mulga thickets

Thickets of mulga (*Acacia* spp.) woodland were associated with soils of higher clay content and formed fairly monotypic associations with limited understorey growth. However, mulga woodlands typically support diverse faunal assemblages when in good condition. The dense structure of some mulga woodlands are preferred by some species such as Malleefowl because of increased availability of leaf litter for use in nesting mounds (Priddel *et al.* 2007).

Sand dune systems

Sand dune systems are found across much of the region but only occur across a limited area (1.1%) within the Minigwal Trough and pipeline corridor, which has been designed to avoid this habitat type. Fauna diversity can be high on sand dune systems, and some species of conservation significance are dependent on them, e.g. Sandhill Dunnart and SMM. Dune systems, if unburnt for a sufficient period of time, often have very large spinifex clumps which provide suitable refuge sites for many fauna species including the conservation significant Brush-tailed Mulgara and Sandhill Dunnart. Much of the sand dune systems found within the survey area have been recently burnt and as such provide limited suitability for species that prefer long unburnt areas.

Claypans

Claypan habitat assemblages were located in low depressions and are the terminus of several drainage lines. They are often uncommon in the landscape. Claypan associations are rich in habitat diversity and often incorporate several unique habitats. A small claypan was present in the survey area with soft gypsum/clay soil structure and large eucalypt “islands”. The habitat changed to thick mallee rimming the claypan (5 m wide) to thicker dune vegetation assemblages (20 m wide) into eucalypt/callitris woodlands and mulga associations, all within 200 m of the claypan. The diversity of habitats within a small area leads to greater potential for vertebrate species richness.

Table 3.1 Area encompassed by each fauna habitat type within the Minigwal Trough Water Supply Area (Pipeline excluded).

FAUNA HABITAT TYPE	LAND AREA (ha)	% TOTAL AREA
Recently burnt open eucalypt woodland	41,490	94 2%
Long unburnt open eucalypt woodland	1420	3 2%
Mulga woodlands	630	1.4 %
Sand dune systems	470	1.1 %
Claypan	20	0.04 %
	44,030	**100 %**

3.2 FAUNA ASSEMBLAGES

Based on WAM and DEC records, distribution maps and surveys previously undertaken in the region, 32 native and six introduced mammal, 113 bird, 101 reptile and four amphibian species may be expected to occur in the survey area. Detailed lists of the fauna previously recorded and those recorded in the present study are given in APPENDIX C and APPENDIX D.

3.2.1 Mammals

Thirty-two native and six introduced mammal species potentially occur in the survey area. In this study, seven mammals were encountered during the survey, three of which were introduced species (APPENDIX C). The Red Kangaroo (*Macropus rufus*) and the Western Grey Kangaroo (*Macropus fuliginosus*) were recorded within the survey area. Camel (*Camelus dromedarius*), Cat (*Felis catus*) and Dingo/Dog (*Canis lupus*) tracks were observed on several roads, and several dingo scats were collected. Two bat species, Gould's Wattled Bat (*Chalinobus gouldii*) and Inland Broad-nosed Bat (*Scotorepens balstoni*), were recorded (APPENDIX C), both of which are common in the region.

Rainfall prevented survey trenches dug to ascertain the presence of Southern Marsupial Mole from drying in time to reveal mole traces.

3.2.2 Birds

In total, 113 bird species may occur within the survey area, of which 38 were recorded during the current survey (APPENDIX C). Notable records were of a single Malleefowl mound which had no signs of recent activity and Australian Bustard tracks.

3.2.3 Reptiles

Six species of reptile were encountered during the reconnaissance survey (APPENDIX C), of a potential 101 species (APPENDIX D). Four species of dragon lizard were observed. Several snake tracks were observed on the dune slopes and varanid tracks and burrows were also noted at several sites. The most frequently observed species was the Thorny Devil (*Moloch horridus*) of which several recently hatched individuals were observed.

3.2.4 Amphibians

No amphibian species were observed during the survey, despite wet conditions. A total of four amphibians are expected to occur within the survey area (APPENDIX D) during wetter months.

3.3 SURVEY LIMITATIONS

Limitations of the survey are discussed in Table 3.2 below.

Table 3.2 Summary of survey limitations.

CONSTRAINT	RELEVANT (yes/no)	COMMENT
Competency/ experience of the consultant carrying out the survey.	No	Experienced and competent personnel were used.
Scope (what fauna groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	Yes	Rainfall prevented SMM survey trenches from drying. However, only 1.1% of the area is expected to be suitable for SMM and these areas will likely be avoided.
Proportion of fauna identified, recorded and/ or collected.	No	All fauna were identified to species level in the field.
Sources of information (previously available information as distinct from new data).	No	Several surveys relevant to the area and region have recently been completed and were available.
The proportion of the task achieved and further work which might be needed.	No	The Level 1 survey was fully completed.
Timing/ weather/ season/ cycle.	Partial	Cool autumn weather and rainfall events limited the amount of observed fauna and resulted in low reptile activity during the survey, but weather conditions did not affect fauna habitat assessment.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	No	There were no disturbances.
Intensity (in retrospect was the intensity adequate).	No	The intensity was consistent with EPA guidelines for a Level 1 survey.
Completeness (e.g. was relevant area fully surveyed).	No	Systematic and opportunistic surveys were conducted in the majority of vegetation blocks. All fauna habitats were sampled.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	All animals observed were able to be identified to species level. All tracks and scats were identified to genus level.
Remoteness and/ or access problems.	Yes	The overall survey area extends over 44,030 km^2, much of which was not directly assessed. Surveys were carried out at 26 Level 1 Fauna sites selected using aerial photography as being representative of potential habitats within the survey area.
Availability of contextual (e.g. biogeographic) information on the region.	No	The Great Victoria Desert region has not been extensively surveyed but a significant amount of information is now available specifically related to the local area.
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	Yes	The sampling methods used covered all fauna groups adequately with the exception of SMM.

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4.0 CONSERVATION SIGNIFICANT FAUNA

Fifteen species of conservation significance have the potential to occur in the survey area. Their likelihood of occurrence, and expected status if present, is summarised in Table 4.1. Evidence of two of these species was found during the survey: Malleefowl and Australian Bustard.

Table 4.1 Conservation significant fauna occurring or potentially occurring in the survey area.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE AND EXPECTED STATUS IF PRESENT
	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 320 km west of the survey area in Queen Victoria Springs Nature Reserve (Pearson and Turner 2000) and recent records south of survey area (*ecologia* 2009c).	**HIGH – BREEDING RESIDENT** Thought to be common throughout the region, particularly in sand dunes and areas of deep soft sands. Likely to occur on the very limited areas of sand dune within the study area.
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 – BREEDING RESIDENT** Suitable habitat within survey area had largely been burnt. Generally associated with dunes, of which there are few in the project area.
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* 2009a) and 50 km south of Tropicana Gold project area (*ecologia* obs.).	**LOW – BREEDING RESIDENT** Scattered records in the surrounding region. Suitable habitat may occur at times but area was recently burnt rendering much of the project area unsuitable. No burrows found during searches.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE AND EXPECTED STATUS IF PRESENT
	EPBC	WCA	DEC			
BIRDS						
Peregrine Falcon *Falco peregrinus*		S4		Cliff edges along rivers, ranges, and wooded waterways.	Sighted in the Tropicana project area during an *ecologia* Level 2 fauna survey in March, 2008 (*ecologia* 2009c).	**HIGH – BREEDING RESIDENT / HUNTING VISITOR** Suitable habitat exists, and this species was recorded close to the Minigwal Trough area recently during another survey.
Australian Bustard *Ardeotis australis*			P4	Occurs in open or lightly wooded country.	One record from 1984 at Plumridge Lakes.	**HIGH – BREEDING VISITOR OR RESIDENT** Recorded in survey area.
Rainbow Bee-eater *Merops ornatus*	M			Lightly wooded, preferably sandy country near water.	Commonly recorded south of Minigwal Trough (*ecologia* 2009c).	**HIGH – BREEDING VISITOR** Recorded south of survey area.
Malleefowl *Leipoa ocellata*	VU	S1		Mallee eucalypt woodland and scrub with sandy substrate.	Recent sighting south of Plumridge Lakes. Several inactive mounds recorded south of Minigwal Trough (URS 2008; *ecologia* 2009c)	**MEDIUM – BREEDING RESIDENT** Inactive mound recorded in survey area.
Princess Parrot *Polytelis alexandrae*	VU		P4	Lightly wooded country.	Anecdotal records of birds at Plumridge Lakes NR. Recorded at Neale Junction 150 km ENE of survey area	**LOW – BREEDING NOMAD** Suitable habitat occurs. Sightings at Plumridge Lakes NR suggest species may occur at times.
Slender-billed Thornbill (western) *Acanthiza iredalei iredalei*	VU			Chenopod shrub steppe in treeless or sparsely wooded flatlands.	No previous records but within theoretical distribution. Known from south (Rawlinna to Eucla) and east (Lake Ballard) of Tropicana.	**LOW – VAGRANT** No previous records from area. Little suitable habitat exists in survey area.
Naretha Blue Bonnet *Northiella haematogaster narethae*		S4		Inhabitant of lightly wooded plains on the periphery of the Nullarbor Plain.	18 individuals observed at Plumridge Lakes NR in 1984.	**LOW – CASUAL VISITOR** Suitable habitat occurs but Survey area is 50 km north of normal distribution. Sightings at Plumridge Lakes NR suggest species may occur at times.

SPECIES	CONSERVATION SIGNIFICANCE			HABITAT	PREVIOUS RECORDS	LIKELIHOOD OF OCCURRENCE AND EXPECTED STATUS IF PRESENT
	EPBC	WCA	DEC			
Grey Falcon *Falco hypoleucos*			P4	Shrubland, grassland and wooded watercourses.	One record from 1992 at Plumridge Lakes NR.	**LOW – HUNTING NOMAD** Suitable habitat occurs. Sightings at Plumridge Lakes NR suggest species may occur at times.
Cattle Egret *Ardea ibis*	M			Short grass (especially damp pastures) and wetlands, usually in the company of cattle	No records from region.	**VERY LOW – VAGRANT** No suitable habitat present.
Oriental Plover *Charadrius veredus*	M			Sparsely vegetation plains, including samphire and short-grass flats. Also coastal areas (beaches and tidal flats).	No records from region.	**VERY LOW – VAGRANT** Little suitable habitat present.
REPTILES						
Great Desert Skink *Egernia kintorei*	VU	S1		Regenerating hummock grassland on red dunes and plains.	Closest record ENE of Laverton, approx. 150 km from Tropicana JV tenements.	**LOW – BREEDING RESIDENT** Suitable habitat occurs; however nearest record is over 100 km away.

Notes: Description of conservation significance codes provided in APPENDIX E
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

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4.1 CONSERVATION SIGNIFICANT FAUNA DESCRIPTIONS

Fifteen species of conservation significance have the potential to occur within the survey area (Table 4.1), consisting of four mammal species, ten bird species and one reptile. Of the ten bird species of conservation significance potentially occurring in the survey area, three of these species (Rainbow Bee-eater *Merops ornatus*, Cattle Egret *Ardea ibis* and Oriental Plover *Charadrius veredus*) are Migratory species. Rainbow Bee-eaters are widespread and common over much of Australia and the regional population will not be impacted by development within the survey area. Cattle Egret and Oriental Plover are very unlikely to occur and are not expected to be impacted. All other species are described below.

4.1.1 Mammals

4.1.1.1 Southern Marsupial Mole (*Notoryctes typhlops*) – Endangered (EPBC); Schedule 1 (WC Act)

Also known by the indigenous name of Itjaritjari, the SMM is a small fossorial marsupial that has adapted to a life spent almost entirely underground. It rarely ventures above ground and does not build open 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). These tunnels are evident when survey trenches are dug.

SMM have been recorded from the deserts of central Australia, including the Tanami, Great Victoria and Simpson Deserts (Benshemesh 2004). The species' preferred habitat is longitudinal sand dunes, interdune flats and possibly also the sandy soils along river flats (Maxwell *et al.* 1996; Benshemesh 2004).

No decline in abundance has been documented due to the extremely cryptic nature of this species, but the lack of records in recent years, particularly given the increase in human visitation to the area of occupancy, gives some cause for concern (Maxwell *et al.* 1996). The most likely cause for any decline in abundance is predation from feral foxes and cats, changed fire regimes, and trampling and habitat changes as a result of cattle and camel populations (Maxwell *et al.* 1996; Benshemesh 2004).

SMM appear to be relatively common in areas of sand dunes and soft sand plains of the region, as tunnels likely to have been made by the species were recorded during other, targeted surveys for the species conducted in and around the Tropicana operational area (see data points included on Figure 4.1) (*ecologia* 2009c) and SMM remains have been found at Neale Junction Nature Reserve in dog scats (*ecologia* 2009a).

Any development in the survey area on or in close proximity to dune systems could potentially impact SMM. Compaction of dune soil (e.g. by creating tracks over dunes) and destruction of dunes could directly impact individual animals and cause a reduction in quality of habitat. Provided dune systems are avoided and dunes are not impacted during the development of the water supply area, there is unlikely to be a significant impact to this species, which is well represented in more extensive habitats outside of the survey area.

It is worth noting that only approximately 1.1% of the study area consisted of dune habitat, which has been mapped (Figure 6.1) and is easily avoided.

4.1.1.2 Sandhill Dunnart – Endangered (EPBC), Schedule 1 (WC Act)

Sandhill Dunnarts are 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.

They have large home ranges of approximately 7.5 ha and the ability to move great 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 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 (Pearson and Churchill 2008).

Several individuals have been captured south of the survey area (Gaikhorst and Lambert 2008) and are potentially present is dune systems of the region that have long unburnt spinifex.

No suitable habitat was observed during this survey due to recent fires within the survey area, suggesting that the likelihood of occurrence of the species was very low. Disturbance to dune systems may reduce the amount of available habitat, but as the project footprint largely avoids the dune systems within it, no significant impacts are expected.

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

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). According to recent distribution maps (Woolley 2008), Brush-tailed Mulgara inhabit Western Australia and they are the more likely of the two mulgara species to inhabit parts of the Operational Area where suitable spinifex is available. We anticipate that the only possibly mulgara species in the region is Brush-tailed Mulgara, for reasons outlined in (*ecologia* 2009c).

This is supported by recent records from Neale Junction where *D. blythi* was recorded recently (*ecologia* 2009a). No individuals or their burrows were recorded during the survey; however, mulgara are known from the region and may use the survey area when suitable spinifex habitat is present. Because much of the study area contained recently burnt spinifex that was unsuitable for mulgara, they are currently thought to be absent.

4.1.2 Birds

4.1.2.1 Peregrine Falcon – Schedule 4 (WC Act)

The Peregrine Falcon occurs most commonly near cliffs along coasts, rivers and ranges and around wooded watercourses and lakes. Peregrines feed almost entirely on birds, especially parrots and pigeons. They primarily nest on ledges in cliffs, granite outcrops and in quarries, but may also nest in tree hollows around wetlands (Johnstone and Storr 1998; Olsen *et al.* 2006). The Peregrine Falcon is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. 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).

Limiting factors and threats to this species include human disturbance at nest sides, decline of prey caused by introduced mammal predators and reproductive failure following exposure to pesticides (Cooper and Beauchesne 2007).

One individual was recorded within the proposed operational area and close to the Minigwal Trough area (*ecologia* 2009c). However, due to the widespread distribution of this species in Australia and the extent of suitable habitat outside of the study area, impacts on this species are expected to be negligible.

4.1.2.2 Australian Bustard – Priority 4 (DEC)

Australian Bustards are large a ground-dwelling bird that occur Australia-wide and utilise a number of open habitats, including open or lightly wooded grasslands, chenopod flats, plains and heathlands (Johnstone and Storr 1998).

It is a nomadic species, ranging over very large areas and its abundance varies locally and seasonally from scarce to common, largely dependent on rainfall and food availability. The bustard has an omnivorous diet, feeding on grasses, seeds, fruit, insects and small vertebrates.

Although the population size is still substantial, there has been a large historical decline in abundance, particularly south of the tropics, but also across northern Australia (Garnett and Crowley 2000). This is a result of hunting, degradation of its grassland habitat by sheep and rabbits and predation by foxes and cats (Frith 1976; Garnett and Crowley 2000). Bustards readily desert nests in response to disturbance by humans, sheep or cattle (Garnett and Crowley 2000).

Tracks of this species were found in open eucalypt woodland over spinifex (Figure 4.1; UTM 638251E, 6790739N) and they have been observed to the south of the survey area on several occasions (*ecologia* 2009c; *ecologia* 2009b). Due to the extent of suitable habitat outside the study area and the nomadic nature of this species, no impacts are anticipated.

4.1.2.3 Malleefowl – Vulnerable (EPBC), Schedule 1 (WC Act)

Malleefowl are a large, distinctive, ground-dwelling bird. They are well-known for their habit of constructing large mounds (up to 1.5 m diameter) of sand, soil and vegetation in which they lay clutches of approximately 16 eggs that are incubated through a combination of the sun's direct heat and heat generated by the decomposition of vegetation (Benshemesh 2005b).

Large mounds can remain in the landscape for many years and can be used to map Malleefowl distribution. The highest breeding densities are typically found in vegetation that is at least 40 years post fire (Woinarski 1989; Benshemesh 1990; Benshemesh 1992) and they rarely breed in vegetation that has been burnt within the last 15 years (Tarr 1965; Crowley *et al.* 1969).

Malleefowl prefer habitat consisting of scrubs and thickets of eucalypt mallee or acacia mulga and other dense litter-forming shrublands (Johnstone and Storr, 1998). They feed on seeds and herbage, including wheat (Benshemesh 1999).

Once common and widespread across the semi-arid regions of southern Australia, Malleefowl have declined severely in the last century, with a 20% decrease in abundance and 50% decrease in area of occupancy (Garnett and Crowley 2000; Benshemesh 2005b). Their distribution is currently highly fragmented, increasing the risk of extinction (Benshemesh 2000). Their decline is mainly due to habitat loss and fragmentation caused by clearing for agriculture and the subsequent degradation of remnant patches by sheep, as well as predation by foxes (Johnstone and Storr 1998; Garnett and Crowley 2000).

Several large thickets of mulga were surveyed for evidence of Malleefowl, resulting in one Malleefowl mound recorded on the western edge of the survey area at 629xxxE, 6804xxxN (Figure 4.1). The nest mound appears to have been unused for approximately 4-5 years (S. Dennings, Malleefowl Preservation Group, personal communication) and no other evidence of Malleefowl occurrence in the area was found, suggesting that Malleefowl are not currently present within the survey area.

Removal of dense vegetation thickets will impact this species as loss of habitat is one of the main causes of its decline over the past century. However, as much of the survey area is not expected to be impacted and potential impact areas avoid areas of thick vegetation, no significant impacts are expected to occur.

4.1.2.4 Princess Parrot – Vulnerable (EPBC), Priority 4 (DEC)

This medium-sized, gregarious parrot is a scarce to uncommon, nomadic, and patchily distributed species. It is usually found in pairs, family groups or small flocks of up to 30 individuals (Johnstone and Storr 1998), although occasionally it congregates in loose flocks of up to 100 birds (Forshaw and Cooper 2002).

Princess Parrots occur in the sandy deserts of central Australia, principally concentrated in the Great Sandy, Gibson, Tanami and Great Victoria deserts (Blyth and Burbidge 1997). Their 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, Princess 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). The total population of this species in Australia has been estimated at 5000 individuals and they are believed to have suffered a decline in numbers over the last 100 years (Garnett and Crowley 2000).

There are several areas of open eucalypt woodland that correspond with potential habitat for Princess Parrots in the survey area. The nomadic nature of this species means that they may be occasional visitors to the survey area. The proposed development is unlikely to represent a threat to this species provided that breeding birds are not disturbed and clearing of large eucalypt trees is avoided due to their potential as nesting sites. However, due to the low level of impacts expected from this project, the likelihood of this event occurring is negligible, suggesting that the proposed disturbance will not affect the species.

4.1.2.5 Slender-billed Thornbill (western subspecies) – Vulnerable (EPBC)

The western subspecies of the Slender-billed Thornbill occurs in the arid and semi-arid zones of southern Western Australia and South Australia. They are found predominantly in chenopod shrublands, in treeless or sparsely wooded flatlands, and also samphire and low melaleuca scrubs (Johnstone and Storr 2004).

Habitat destruction of chenopod vegetation by livestock and rabbits has resulted in a very reduced and disjointed distribution of the species across southern Western Australia (Recher and Davis 2000; Johnstone and Storr 2004). As a result, Slender-billed Thornbills are uncommon, rare or extinct across most of their range with the exception of populations on the mid-west coast (Johnstone and Storr 2004).

Their preferred chenopod vegetation is only found to the north of the survey area around Lake Rason and the likelihood of Slender-Billed Thornbill occurrence within the area is very

low. The proposed project is not expected to significantly impact this species as all suitable habitat is outside of the project impact area.

4.1.2.6 Naretha Blue Bonnet – Schedule 4 (WC Act)

The Naretha 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). It is moderately common to common, occurring in casuarina or acacia woodland, often near chenopod shrubland (Garnett and Crowley 2000) and breeds in late winter and spring, building nests in hollows and cracks of larger eucalypts and acacias.

Although there is no sign of a decline in this species, it has a very restricted distribution.

Potential habitat occurs in the survey area but the species' normal distribution ends approximately 50 km southeast of the survey area. No records in this or other recent surveys in the area suggest that while it is possible for the species to occur at times, this is unlikely, and the species will not be impacted by the proposed development.

4.1.2.7 Grey Falcon – Priority 4 (DEC)

Grey Falcons are a rare, nomadic raptor, sparsely distributed across much of arid and semi-arid Australia. In Western Australia, they are generally 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 but the current distribution is now thought to be restricted to north of 26°S (Johnstone and Storr 1998).

Because the species is scarce and occurs over a large area, sightings of this species are uncommon. Although there is no evidence of a significant decline in abundance, clearance of the arid zone for marginal farming has destroyed some habitat and has the potential to destroy more. Overgrazing may also affect prey abundance (Garnett and Crowley 2000).

The nomadic nature of this species and the limited understanding of its distribution and ecology mean that the species is unlikely to occur in the survey area. The proposed development is unlikely to significantly affect the species.

4.1.3 Reptiles

4.1.3.1 Great Desert Skink – Vulnerable (EPBC), Schedule 1 (WC Act)

Great Desert Skink is a large reddish-brown skink found in the western deserts of central Australia where it inhabits sandplains and clay-based or loamy soils vegetated with spinifex, excavating large, complex, multi-entranced burrows (Wilson and Swan 2008).

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.

Although possible suitable habitat exists throughout the survey area, Great Desert Skinks were not found on this survey and no previous records in the surrounding region have been made, with the nearest record 150 km to the north. The species is thought to have a low likelihood of presence given the recent fire history of much of the survey area, and therefore the proposed disturbance should not affect the species.

4.2 REGIONALLY ENDEMIC FAUNA

Regionally endemic vertebrate fauna include those species restricted to a particular region or sub-region, in this case the Great Victoria Desert. The only vertebrate that appears to be endemic to the Great Victoria Desert region is *Ramphotyphlops margaretae* (Barton and Cowan 2001). This species is known from only two specimens collected from Lake Throssel and south of Neale Junction Nature Reserve to the north of the survey area (Brennan *et al.* 2009), and it is unknown whether it may occur in the survey area. Given the localised nature of the proposed disturbance, its possible preference for salt lake margins and saltpans (largely absent from the project area, and more common in surrounding areas) and its continued existence outside of the survey area, the species is unlikely to be impacted by the proposed works. Nevertheless, the small area of claypan within the project area has been put forward as an area where disturbance should be avoided, if possible (Section 6.2).

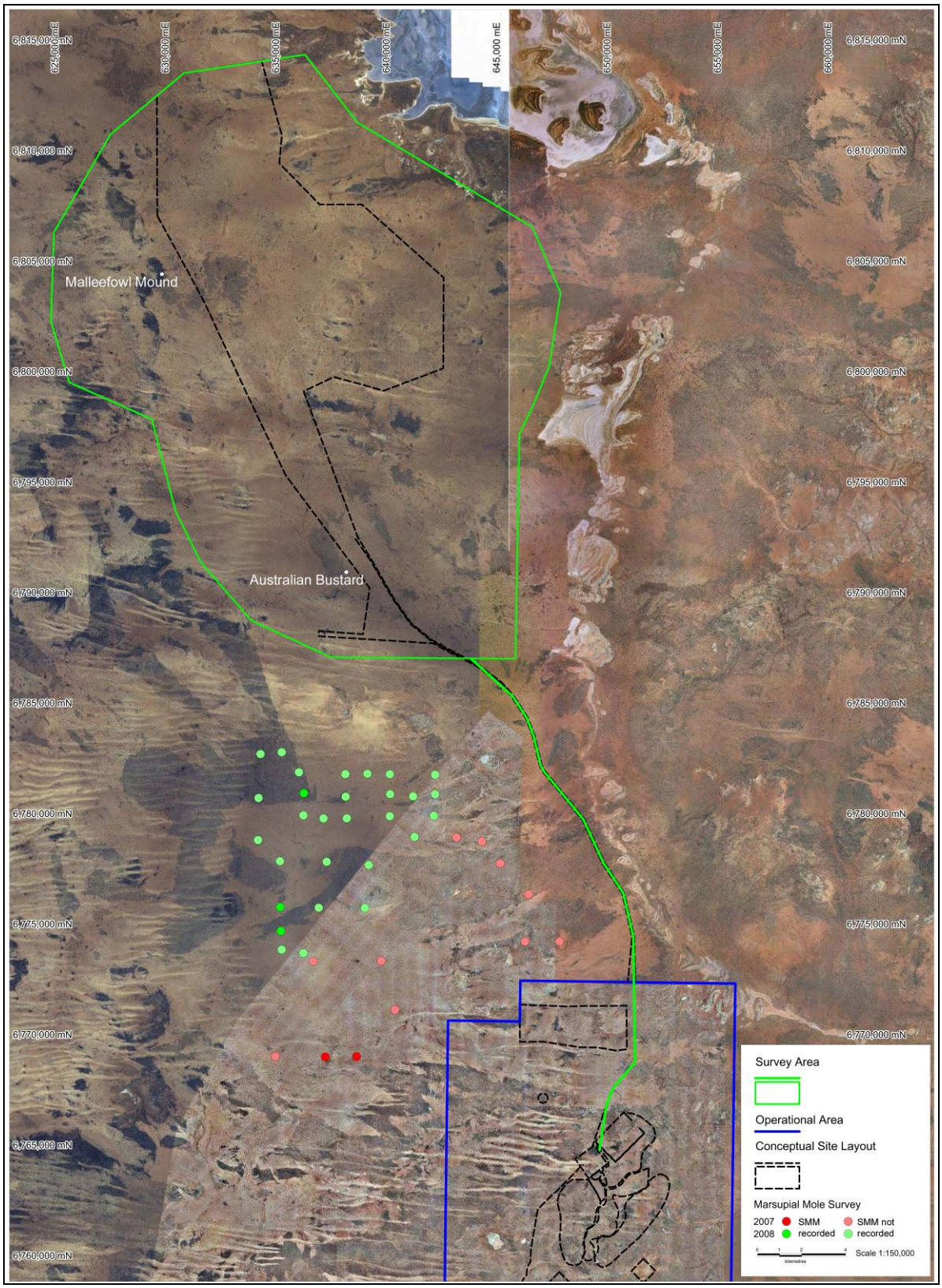

Figure 4.1 Locations of conservation significant species within the survey area.

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5.0 IMPACT ASSESSMENT

5.1 THREATENING PROCESSES

A risk assessment (APPENDIX B) was undertaken by *ecologia* to determine potential impacts arising from development in the Minigwal Trough Water Supply Area and pipeline infrastructure on vertebrate fauna and residual impacts following the implementation of the management strategies identified in this document (Section 6.0). 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 B). 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;
- Potentially increased population densities of feral fauna due to increased availability of surface water.
- Disruption to resident fauna due to increased noise, vibration, light and dust pollution; and

5.1.1 Vegetation clearing

Clearing of vegetation is both an unavoidable part of the planned project and the most direct localised impact on fauna communities in the Minigwal Trough Water Supply Area. 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. Other impacts from vegetation clearing include both direct mortality of fauna that occur in the area during clearing operations 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, regional impacts will not be significant.

Clearance programs should ideally be designed to occur over a period of time to allow the movement of fauna away from clearing activities. Disused areas should be rehabilitated as soon as is practical and areas that are to be cleared should be delineated and clearing should avoid habitat fragmentation where possible.

5.1.2 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. Specimens should be frozen and sent to either DEC or WAM representatives.

5.1.3 Fire

The proposed water supply 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 Minigwal Trough area have been burnt in the past 5 years. Most yellow sand dunes investigated within the survey area had been burnt in recent years, removing possible habitat for Sandhill Dunnarts. The cause of most fires in the area is most likely associated with lightning strikes associated with summer thunderstorms.

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, 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, TJV should implement strict fire controls, such as ensuring that appropriate fire equipment is readily available onsite, vehicles are fitted with fire extinguishers, and staffs are trained in their use. TJV is also advised to discourage personnel from creating new tracks through dune fields or areas with mature spinifex and educate personnel on the impacts of fire on native fauna and vegetation.

5.1.4 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. This is particularly pertinent to long corridors, such as the pipeline corridor, as there is much greater potential for weeds spreading compared with block clearing in a local area. 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.

5.1.5 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. Roads and tracks allow greater movement of feral species through landscapes and construction of new tracks increase the accessibility of these new areas to feral predators such as foxes and cats. Resent studies (Newsome *et al.* 2001; Glen *et al.* 2007) indicate that dingo populations actively reduce cat and fox populations through mesopredator competition and as part of any control measures, selective targeting that excludes dingo mortality should be considered.

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 fenced off or designed to prevent access by all fauna.

5.1.6 Dust Pollution

The effects of 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.

5.1.7 Noise and Light Pollution

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 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.

5.2 IMPACTS ON FAUNA ASSEMBLAGES

5.2.1 Biodiversity

The development of the Minigwal Trough Water Area and pipeline corridor will have minimal effects on the biodiversity of the region due to the limited amount of clearing required. Due to the large areas of similar vegetation throughout the survey area and throughout the surrounding region, the amount of habitat that the projected pipeline corridor and production bores will disturb is negligible. Certain areas that relate to individual species of conservation significance should be avoided, with specific examples discussed below.

5.2.2 Ecological Function

Due to the largely undisturbed ecological communities of the region, impacts caused by the development on the ecological function of the survey area will be negligible. Frequent large scale fires can have a major impact on ecological function as they will remove the preferred habitat of several conservation significant species.

5.3 IMPACTS ON CONSERVATION SIGNIFICANT FAUNA

5.3.1 Southern Marsupial Mole

Any development of the area on or in close proximity to dune systems could potentially impact SMM. Compaction of soil and destruction of dune systems could 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 SMMs will move away from construction activities or whether disturbance of suitable habitat will result in animal mortalities. Avoidance of the small areas of dunes and soft, sandy areas (Figure 6.1) is recommended where possible.

5.3.2 Peregrine Falcon

Nearby record suggests that the area is used for hunting, but the lack of likely breeding locations suggests that the species will not be impacted.

5.3.3 Australian Bustard

These wide ranging, nomadic species could potentially breed within the study area, but are unlikely to be impacted as minimal clearing is anticipated. The surrounding area contains similar suitable habitat and will be unimpacted.

5.3.4 Rainbow Bee-eater

Although it is unknown whether this species would breed within the project area, there is ample suitable sandy habitat. Adults are unlikely to be impacted by development but if a breeding colony or pair is located, clearing could impact young.

5.3.5 Malleefowl

Clearing of any patches of dense vegetation, particularly dense *Acacia* shrubland, may potentially impact Malleefowl, if still present, by reducing the amount of suitable habitat within the survey area. An increase in feral predators caused by improved access along tracks and increased availability of food and water could also increase potential predation pressure on the Malleefowl.

5.3.6 Australian Bustard

Due to the limited amount of clearing of preferred habitat required by this development and the large areas of suitable habitat in the surrounding region, there is little expected impact on this species.

6.0 RECOMMENDATIONS

6.1 GENERAL RECOMMENDATIONS

The following management items are recommended to mitigate impacts of the development on native fauna:

- Restrict clearing to that which is absolutely necessary;
- Areas cleared as part of construction should be rehabilitated as soon as is practical;
- Selection of infrastructure locations should avoid sand dune systems, areas of large spinifex clumps and areas of dense mulga or mallee;
- Avoid removing larger eucalypts which may provide roosts, nesting or feed sites for conservation significant parrot species, and ;
- Contractors should be aware of the potential for Rainbow Bee-eaters to breed in sandy embankments and along tracks and should avoid nest tunnels if present;
- Disturbances to unburned sand dune areas should be minimised, as these areas may provide habitat for Sandhill Dunnarts and Southern Marsupial Moles (SMM).
- Ensure that appropriate fire fighting equipment is available during construction;
- Fire prevention strategies should be an integral component of risk assessments for construction contractors;
- Consideration should be given to controlling numbers of feral animals within the region to reduce predation pressure on conservation significant fauna, including Malleefowl and SMM; and
- Limit vehicle speeds in areas where conservation significant species are likely to occur and limit dawn and dust activities to only that which is absolutely necessary.

6.2 AREAS TO BE AVOIDED

Several areas have been identified that should be avoided during construction and operation of the Minigwal Trough water supply area, as they contain areas of higher quality or fire-remnant habitat that is suitable for several conservation significant fauna species.

These areas included four habitat types: dense eucalypt woodland, mulga thickets, sand dune systems and claypans. These areas are shown in Figure 6.1.

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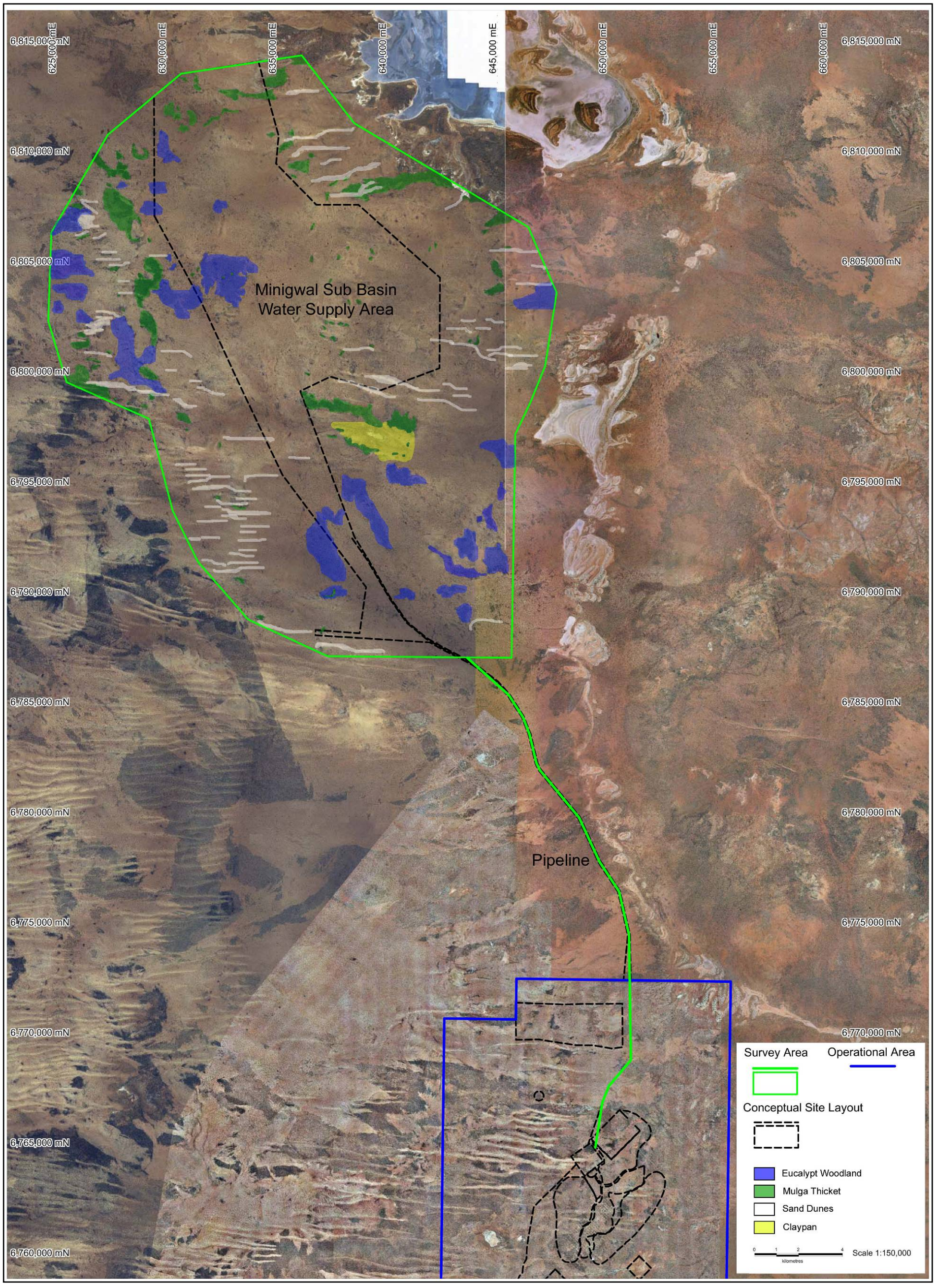

Figure 6.1 Locations of habitat that should be avoided.

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7.0 REFERENCES

Barton, B. and Cowan, M. (2001). Great Victoria Desert 2 (GVD2 - Great Victoria Desert Central subregion). In *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002* Department of Conservation and Land Management. Perth. pp 351-357.

Beard, J. S. (1975). *Vegetation Survey of Western Australia: Great Victorian Desert*. University of Western Australia Press, Perth.

Benshemesh, J. (1990). Management of Malleefowl with regard to fire. In *The Mallee Lands, a Conservation Perspective*. (J. C. Noble, P. J. Joss and G. K. Jones, Eds.). CSIRO. Melbourne. pp 206-211.

Benshemesh, J. (1992). The conservation ecology of Malleefowl, with particular regard to fire. Monash University.

Benshemesh, J. (1999). Draft National Recovery Plan for Malleefowl. Version 5. E. Australia, Canberra.

Benshemesh, J. (2000). National Recovery Plan for Malleefowl. Department of Environment Water Heritage and the Arts.

Benshemesh, J. (2004). Recovery Plan for Marsupial Moles *Notoryctes typhlops* and *N. caurinus*, 2005-2010. Northern Territory Department of Infrastructure Planning and Environment, Alice Springs.

Benshemesh, J. (2005a). Manual for Marsupial Mole Survey and Monitoring by Trenches. Anangu-Pitjantjatjara Land Management and the Department of Heritage and Environment (SA).

Benshemesh, J. (2005b). National Recovery Plan for Malleefowl 2006-2010. Department of Environment Water Heritage and the Arts, Adelaide.

Benshemesh, J. (2008). Itjaritjari, *Notoryctes typhlops*. In *Mammals of Australia*, 3rd Edition. (S. Van Dyck and R. Strahan, Eds.). Reed New Holland. Sydney. pp 412-413.

Blyth, J. and Burbidge, A. (1997). What do we know about the Princess Parrot *Polytelis alexandrae*? *Eclectus*, **3**: 26-29.

Braithwaite, R. W., Lonsdale, W. M. and Esthbergs, J. A. (1989). Alien vegetation and native biota in tropical Australia: impact of *Mimosa pigra*. *Biological Conservation*, **48**: 189-210.

Brennan, K., Ford, S., Woolley, P., Barrett, S., Waldock, J. and Hitchcock, B. (2009). Desert Diversity. *Landscope*, **24**: 32-39.

Brock, C. E., Brock, C. H., Jepson, K. L. and Ortega, J. C. (1986). Ecological effects of planting African lovegrasses in Arizona. *National Geographic Research*, **2**: 456-463.

Burbidge, A. A., McKenzie, N. L., Chapman, A. and Lambert, P. M. (1976). The wildlife of some existing and proposed reserves in the Great Victoria and Gibson Deserts, Western Australia. *Wildlife Research Bulletin of Western Australia*, **5**: 1-16.

Bureau of Meteorology. (2008). from http://www.bom.gov.au.

Christidis, L. and Boles, W. E. (2008). *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Collingwood.

Churchill, S. (1998). *Australian Bats*. Reed New Holland, Sydney.

Churchill, S. (2001). Recovery Plan for the Sandhill Dunnart (*Sminthopsis psammophila*). Department for Environment and Heritage South Australia, Adelaide.

Cogger, H. G. (2000). *Reptiles and Amphibians of Australia*. Reed New Holland, Sydney.

Cooper, J.M., Beauchesne, S.M. (2007). COSEWIC status report on Peregrine Falcon *Falco peregrinus*. Committee on the status of endangered wildlife in Canada, Errington, BC. Canada.

Crowley, R. D., Heislers, A. and Ealey, E. H. M. (1969). Effects of fire on wildlife. *Proceedings Fire Ecology Symposium*. Monash University.

Department of the Environment, Water, Heritage and the Arts (2004). Interim Biogeographic Regionalisation for Australia (IBRA), version 6.1.

DEWHA (2008). Approved Conservation for *Acanthiza iredalei iredalei* (Slender-billed Thornbill(western). Environment Protection and Biodiversity Conservation Act 1999.

ecologia Environment (2009a). Neale Junction Nature Reserve Fauna Assessment in collaboration with Department of Environment and Conservation. Unpublished report for Tropicana Joint Venture.

ecologia Environment (2009b). Tropicana Gold Project Infrastructure Corridor - Cable Haul Rd Option. Level 1 Fauna Survey. Unpublished report for Tropicana Joint Venture.

ecologia Environment (2009c). Tropicana Gold Project Operational Area Vertebrate Fauna Assessment. Unpublished Report for Tropicana Joint Venture.

Environmental Protection Authority (2002). Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection. Perth.

Environmental Protection Authority (2004). Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Perth.

Forshaw, J. M. and Cooper, W. T. (2002). *Australian Parrots*. Alexander Editions, Robina.

Frith, A. J. (1976). *Readers Digest Complete Birds of Australia*. Readers Digest, Sydney.

Gaikhorst, G. and Lambert, C. (2008). Tropicana Gold Project: Sandhill Dunnart Survey of the Proposed Operational Area and Infrastructure Corridors (Pinjin and Bypass). Unpublished report for Tropicana Joint Venture.

Garnett, S. T. and Crowley, G. M. (2000). *The Action Plan for Australian Birds*. Environment Australia, Canberra.

Glen, A. S., Dickman, C. R., Soulé, M. E. and Mackey, B. G. (2007). Evaluating the role of the dingo as a trophic regulator in Australian ecosystems. *Austral Ecology*, **32**(5): 492-501.

Grantz, D. A., Garner, J. H. B. and Johnson, D. W. (2003). Ecological effects of particulate matter. *Environment International*, **29**: 213-239.

Griffin, G. F., Stafford-Smith, D. M., Morton, S. R., Allan, G. E. and Masters, K. A. (1989). Status and implications of the invasion of Tamarisk (*T. aphylla*) on the Finke River, Northern Territory, Australia. *Journal of Environmental Management*, **29**: 297-315.

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

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

Koertner, G., Pavey, C. R. and Geiser, F. (2007). Spatial ecology of the mulgara in arid Australia: impact of fire history on home range size and burrow use. *Journal of Zoology*, **273**: 350-357.

Larkin, R. P. (1996). Effects of military noise on wildlife: a literature review. *USACERL Technical report 96/21*.

Mann, S. L., Steidl, R. J. and Dalton, V. M. (2002). Effects of cave tours on breeding *Myotis velifer*. *Journal of Wildlife Management*, **66**: 618-624.

Martinick and Associates Pty Ltd (1986). Mulga Rock Flora, Fauna and Radioecology Survey. Unpublished report for PNC Exploration (Australia) Pty Ltd.

Martinick and Associates Pty Ltd. (1986). Mulga Rock Flora, Fauna and Radioecology Survey. Unpublished report for PNC Exploration (Australia) Pty Ltd.

Masters, P. (2003). Movement patterns and spatial organisation of the mulgara, *Dasycercus cristicauda* (Marsupialia: Dasyuridae), in central Australia. *Wildlife Research*, **30**: 339-344.

Maxwell, S., Burbidge, A. A. and Morris, K. D., Eds. (1996). *The 1996 Action Plan for Australian Marsupials and Monotremes*. Wildlife Australia, Canberra.

McAlpin, S. (2001). The recovery plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011. Arid Lands Environment Centre, Alice Springs.

McGuire, L. (2008). Australian Threatened Species. Great Desert Skink *Egernia kintorei*. Australian Government.

Menkhorst, P. and Knight, F. (2004). *A Field Guide to the Mammals of Australia*. Oxford University Press, Melbourne.

Newsome, A. E., Catling, P. C., Cooke, B. D. and Smyth, R. (2001). Two ecological universes separated by the dingo barrier fence in semi-arid Australia: interactions between landscapes, herbivory and carnivory, with and without dingoes. *Rangeland Journal*, **23**: 71-98.

National Health and Medical Research Council (2004). Australian code of practice for the care and use of animals for scientific purposes. Canberra.

Olsen, J., Fuentes, E., Dykstra, R. and Rose, A. B. (2006). Male Peregrine Falcon *Falco peregrinus* fledged from a cliff-nest found breeding in a stick-nest. *Australian Field Ornithology*, **23**: 8-14.

Pavey, C. (2006a). Threatened species of the Northern Territory: Great Desert Skink, Tjakura, *Egernia kintorei*. Department of Natural Resources Environment and the Arts, Parks and Wildlife Commission Northern Territory.

Pavey, C. (2006b). Threatened species of the Northern Territory: Slender-billed Thornbill (western subspecies). Department of Natural Resources Environment and the Arts. Parks and Wildlife Commission Northern Territory.

Pearson, D. (1991). First records of the mulgara, *Dasycercus cristicauda*, from the Gibson Desert and Queen Victoria Spring nature reserves. *Western Australian Naturalist*, **18**: 159-161.

Pearson, D. and Turner, J. (2000). Marsupial moles pop up in the Great Victoria and Gibson Deserts. *Australian Mammalogy*, **22**: 115-119.

Pearson, D. J. and Churchill, S. K. (2008). Sandhill Dunnart, *Sminthopsis psammophila*. In *Mammals of Australia*, 3rd Edition. (S. Van Dyck and R. Strahan, Eds.). Reed New Holland. Sydney. pp 156-158.

Priddel, D., Wheeler, R. and Copley, P. (2007). Does the integrity or structure of mallee habitat influence the degree of fox predation on Malleefowl (*Leipoa ocellata*)? *Emu*, **107**: 100-107.

Radle, A. L. (1998). "The Effect of Noise on Wildlife: A Literature Review." from http://interact.uoregon.edu/MediaLit/FC/WFAEResaearch/radle.html.

Recher, H. F. and Davis, W. E. (2000). A contribution to the natural history of the Slender-billed Thornbill *Acanthiza iredalei* in Western Australia. *Australian Bird Watcher*, **18**: 297-305.

Simpson, K. and Day, N. (2004). *Field Guide to the Birds of Australia*. Penguin Group, Camberwell.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (1999). *Lizards of Western Australia I: Skinks.* Western Australian Museum, Perth.

Storr, G. M., Smith, L. A. and Johnstone, R. E. (2002). *Snakes of Western Australia*. Western Australian Museum, Perth.

Tarr, H. E. (1965). The Mallee-fowl in Wyperfeld National Park. *Australian Bird Watcher*, **2**: 140-144.

Tyler, M. J., Smith, L. A. and Johnstone, R. E. (2000). *Frogs of Western Australia*. Western Australian Museum, Perth.

URS Australia (2008). Tropicana Gold Project: Malleefowl and Mulgara Survey - Operational Area. Unpublished report for Tropicana Joint Venture.

Wilson, S. and Swan, G. (2008). *A Complete Guide to Reptiles of Australia*. New Holland Publishers, Sydney.

Winterbottom, J. M. (1970). The birds of alien *Acacia* thickets of the South African Western Cape. *Zoologica Africana*, **5**: 49-57.

Woinarski, J. C. Z. (1989). Broombush harvesting in southeastern Australia. In *Mediterranean landscapes in Australia: mallee ecosystems and their management.* (J. C. Noble and R. A. Bradstock, Eds.). CSIRO. Melbourne. pp 362-378.

Woolley, P. A. (2006). Studies on the Crest-tailed Mulgara *Dasycercus cristicauda* and the Brush-tailed Mulgara *Dasycercus blythi* (Marsupialia: Dasyuridae). *Australian Mammalogy*, **28**: 117-120.

Woolley, P. A. (2008). Brush-tailed Mulgara, *Dasycercus blythi*. In *The Mammals of Australia*. (S. Van Dyck and R. Strahan, Eds.). Reed New Holland. Sydney. pp 47-48.

Zagorodniuk, I. V. (2003). Bat communities in urban areas: species selection by the frequency of their ultrasonic signals. *Proceedings of the National Academy of Sciences of the Ukraine*, **8**: 184-189.

APPENDIX A FAUNA SURVEY SITE DESCRIPTIONS

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Site 1
Dense mulga (*Acacia aneura)* woodland over large shrubs on clayey soil.

Site 2
Scattered mallee (mixed *Eucalyptus* spp.) over spinifex (*Triodia basedowii*) on red sandy soils.

Site 3
Scattered mallee (mixed *Eucalyptus* spp.) over spinifex (*T. basedowii*) on red sandy soils.

Site 4
Unburnt scattered mallee (mixed *Eucalypt* spp.) over spinifex (*T. basedowii*) on red sandy soils.

Site 5
Scattered mallee (mixed *Eucalypt* spp.) and mulga (*Acacia* spp.) over spinifex (*T. basedowii*) on red sandy soils.

Site 6
Scattered mallee (mixed *Eucalypt* spp.) over spinifex (*T. basedowii*) on red sandy soils.

Site 7
Unburnt scattered mallee (mixed *Eucalypt* spp.) over spinifex (*T. basedowii*) on red sandy soils.

Site 8
Unburnt mallee (*E. youngiana*) over mixed species understorey over spinifex (*T. basedowii*) on red sands.

Site 9
Unburnt eucalypt woodland over spinifex (*T. basedowii*).

Sites 10 to 16
Large area of long unburnt *E. gongylocarpa* woodland over mixed *A. aneura* and *Casuarina* sp. over spinifex (*T. basedowii*) on sandy soils.

Site 17
Quartzite ridge with mixed *Acacia* spp. over small mixed shrubs over quartz rocks.

Site 18
Dense mulga (*Acacia aneura*) woodland over very sparse shrub understorey on clayey sands.

Site 19
Very open woodland (*E. gongylocarpa*) over *Acacia aneura* and *Casuarina pauper* over spinifex (*T. basedowii*) on red sandy soils.

Site 20
Low sand dune with mixed Eucalypt, over mixed dune vegetation (*Acacia*, *Callitris* and *Grevillia* spp. and ericoid shrubs).

Site 21
Interdune swale with mixed mulga (*A. aneura)* and *Callitris* sp. over very sparse to absent spinifex (*T. basedowii*) on clayey stony soils.

Site 22 (Photo 1)
Moderately sized claypan (first photo) with "islands" of eucalypts in the centre of soft clay/gypsum claypan/ephemeral lake (second photo). This is surrounded by 5-15m wide border of mallee which then changes into dune sands with large spinifex (*T. basedowii*) and *Acacia* and *Casuarina* spp. (third photo).

Site 22 (Photo 2)
"islands" of eucalypts in the centre of soft clay/gypsum claypan/ephemeral lake

Site 22 (Photo 3)
5-15m wide border of mallee which then changes into dune sands with large spinifex (*T. basedowii*) and *Acacia* and *Casuarina* spp.

Site 23
Dense mulga (*Acacia aneura)* woodland over sparse shrub understorey on clayey sands.

Site 24
Large dune with mixed vegetation. No large spinifex as it has been burnt within the last 3 years.

No image available.

Site 25
Large area of long unburnt *E. gongylocarpa* and *Callitris* sp. over spinifex (*T. basedowii*) on red sandy soils.

Site 26
Large area of very open mallee (Mixed *Eucalyptus* spp.) over spinifex (*T. basedowii*) on sandy soils. Regenerating from fire 1-2 yrs.

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APPENDIX B RISK ASSESSMENT

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Appendix B1 Fauna impact risk assessment

Risk Issue	Aspect (Event)	Impact	Likelihood	Consequence	Risk Level	Significance	Controls	Likelihood	Consequence	Risk Level	Significance
Vegetation clearing	Removal of fauna habitat	Loss of local vertebrate fauna communities.	5	2	10	**Med**	Clearing should be restricted to that which is necessary. Clearing boundaries should be defined in the field. Use existing tracks where possible. Cleared areas not in use should be rehabilitated once construction is completed.	2	2	4	**Low**
Vegetation clearing	Removal of fauna habitat	Adverse impact to ecological function and fauna biodiversity.	4	2	8	**Med**	Clearing should be restricted to that which is necessary. Where possible, avoid clearing sensitive or highly diverse environments, such as claypans and eucalypt woodland. Cleared areas not in use should be rehabilitated once construction is completed.	1	2	2	**Low**
Vegetation clearing	Removal of fauna habitat	Loss of conservation significant fauna.	2	4	8	**Med**	Avoid clearing sand dunes, mallee thickets and long unburnt spinifex that form habitat for conservation significant species	1	4	4	**Low**
Vehicle Strikes	Earthworks	Fauna mortality. Burrowing animals such as some skinks, snakes, amphibians and SMM may not be able to avoid machinery during clearing operations.	4	4	16	**High**	Minimise or avoid earthworks where possible. Avoid sand dune systems.	2	3	6	**Med**

Risk Issue	Aspect (Event)	Impact	Likelihood	Consequence	Risk Level	Significance	Controls	Likelihood	Consequence	Risk Level	Significance
Vehicle Strikes	Surface vehicle movements during construction and operation phases.	Fauna mortality due to vehicle or machinery strikes.	3	3	9	**Med**	Reduce speed and nocturnal driving in avoidance areas. Ensure contractors are aware of native fauna populations.	1	4	4	**Low**
Fire	Fire arising from clearing activities	Degradation of fauna habitat and populations in adjacent areas.	2	4	8	**Med**	A fire prevention strategy should be implemented. Ensure that appropriate fire fighting equipment is available during construction. Avoid smoking near dry vegetation or parking vehicles above it.	1	4	4	**Low**
Fire	Fire arising from clearing activities	Fauna mortality.	2	4	8	**Med**	As above.	1	4	4	**Low**
Increased feral fauna	Habitat fragmentation and presence of food wastes	Increased competition and/or predation pressure on native fauna	2	4	8	**Med**	Selective feral predator control to reduce local population may be considered. Minimise the number of access tracks as they aid in the dispersal and movement of feral fauna.	2	4	8	**Med**
Noise pollution	Noise from clearing and construction activities	Disruption of local fauna populations.	3	2	6	**Med**	Noise controls should be implemented during clearing and building activities.	2	2	4	**Low**
Dust	Dust emissions arising from clearing	Damage to adjacent vegetation resulting in loss of fauna habitat or reduction of fauna habitat value.	2	2	4	**Low**	Dust suppression measures should be implemented, including a reduction of road speeds on unsealed roads and road watering if necessary.	1	2	2	**Low**

Appendix B2 Likelihood and Consequence criteria used in the fauna impact risk assessment

Likelihood:		
Value	**Description**	**Criteria**
5	Almost Certain	Environmental issue will occur, is currently a problem or is expected to occur in most circumstances.
4	Likely	Environmental issue has been a common problem in the past and there is a high probability that it will occur in most circumstances.
3	Possible	Environmental issue may have arisen in the past and there is a high probability that it could occur at some time.
2	Unlikely	Environmental issue may have occurred in the past and there is a moderate probability that it could occur at some time but not expected.
1	Rare	Environmental issue has not occurred in the past and there is a very low probability that it may occur in exceptional circumstances.

Consequence:		
Value	**Description**	**Criteria**
5	Catastrophic	Significant impact to fauna species of conservation significance or regional biodiversity
4	Major	Impact to fauna species of conservation significance in survey area.
3	Moderate	Loss of fauna biodiversity in survey area.
2	Minor	Short term or localised impact to fauna biodiversity.
1	Insignificant	No impact to fauna of conservation significance or biodiversity.

Appendix B3 Risk Matrix used in the fauna impact risk assessment

RISK MATRIX		LIKELIHOOD				
		5 – ALMOST CERTAIN	**4 – LIKELY**	**3 – POSSIBLE**	**2 – UNLIKELY**	**1 – RARE**
		Is expected to occur in most circumstance	Will probably occur in most circumstance	Could occur	Could occur but not expected	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**

High risk, site/issue specific management programs required, advice/approval from regulators required.
Medium risk, specific management and procedures must be specified.
Low risk, managed by routine procedures.

APPENDIX C FAUNA RECORDED

Appendix C1 Mammals

FAMILY and Species	Common Name
MACROPODIDAE	
Macropus rufus	Red Kangaroo
Macropus fuliginosus	Western Grey Kangaroo
VESPERTILIONIDAE	
Chalinolobus gouldii	Gould's Wattled Bat
Scotorepens balstoni	Inland Broad-nosed Bat
CANIDAE	
†*Canis lupus dingo*	Dingo
FELIDAE	
**Felis catus*	Cat
CAMELIDAE	
**Camelus dromedarius*	Camel

* Introduced fauna

† Local Dingo populations appear to be hybridised with domestic dogs

Appendix C2 Birds

FAMILY and species	Common Name
CASUARIIDAE	
Dromaius novaehollandiae	Emu
MEGAPODIIDAE	
Leipoa ocellata	Malleefowl (inactive mound only)
CAPRIMULGIFORMES	
Eurostopodus argus	Spotted Nightjar
APODIDAE	
Apus pacificus	Fork-tailed Swift
ACCIPITRIDAE	
Aquila audax	Wedge-tailed Eagle
FALCONIDAE	
Falco cenchroides	Nankeen Kestrel
Falco berigora	Brown Falcon
OTIDIDAE	
Ardeotis australis	Australian Bustard (tracks only)
CACATUIDAE	
Eolophus roseicapillus	Galah
PSITTACIDAE	
Barnardius zonarius	Australian Ringneck
CUCULIDAE	
Cacomantis pallidus	Pallid Cuckoo
HALCYONIDAE	
Todiramphus pyrrhopygius	Red-backed Kingfisher
CLIMACTERIDAE	
Climacteris rufa	Rufous Treecreeper
MALURIDAE	
Malurus splendens	Splendid Fairy-wren
Malurus leucopterus	White-winged Fairy-wren

FAMILY and species	Common Name
ACANTHIZIDAE	
Pyrrholaemus brunneus	Redthroat
Smicrornis brevirostris	Weebill
Acanthiza uropygialis	Chestnut-rumped Thornbill
Acanthiza apicalis	Inland Thornbill
MELIPHAGIDAE	
Lichenostomus virescens	Singing Honeyeater
Lichenostomus plumulus	Grey-fronted Honeyeater
Purnella albifrons	White-fronted Honeyeater
Manorina flavigula	Yellow-throated Miner
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Anthochaera carunculata	Red Wattlebird
CAMPEPHAGIDAE	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
PACHYCEPHALIDAE	
Pachycephala rufiventris	Rufous Whistler
Colluricincla harmonica	Grey Shrike-thrush
Oreoica gutturalis	Crested Bellbird
ARTAMIDAE	
Artamus cinereus	Black-faced Woodswallow
Artamus minor	Little Woodswallow
Cracticus torquatus	Grey Butcherbird
Cracticus nigrogularis	Pied Butcherbird
Cracticus tibicen	Australian Magpie
RHIPIDURIDAE	
Rhipidura leucophrys	Willie Wagtail
PETROICIDAE	
Microeca fascinans	Jacky Winter
Melanodryas cucullata	Hooded Robin
MOTACILLIDAE	
Anthus novaeseelandiae	Australasian Pipit

Appendix C3 Reptiles

FAMILY and species	**Common Name**
AGAMIDAE	
Ctenophorus isolepis	Central Military Dragon
Ctenophorus cristata	Crested Dragon
Moloch horridus	Thorny Devil
Pogona minor	Dwarf Bearded Dragon
SCINCIDAE	
Ctenotus quattuordecimlineatus	Fourteen-lined Skink
Ctenotus helenae	

APPENDIX D REGIONAL FAUNA INFORMATION

Appendix D1 Mammals previously recorded or expected to occur within the region.

FAMILY and Species	Common Name	WAM FaunaBase	Menkhorst and Knight (2004)	Plumridge Lakes (Burbidge *et al.*, 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
TACHYGLOSSIDAE						
Tachyglossus aculeatus	Echidna		✓			✓
DASYURIDAE						
Antechinomys laniger	Kultarr		✓			
Dasycercus cristicauda	Mulgara	✓	✓		✓	
Ningaui ridei	Wongai Ningaui	✓	✓	✓	✓	
Ningaui yvonnae	Mallee Ningaui	✓	✓		✓	✓
Notoryctes typhlops	Southern Marsupial Mole	✓	✓			
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 robustus	Euro		✓			✓
Macropus rufus	Red Kangaroo		✓	✓		✓
EMBALLONURIDAE						
Taphozous hilli	Hill's Sheathtail Bat		✓			✓
MOLLOSIDAE						
Mormopterus planiceps	Inland Freetail Bat	✓	✓			✓
Tadarida australis	White-striped Freetail Bat	✓	✓			✓
VESPERTILIONIDAE						
Chalinolobus gouldii	Gould's Wattled Bat	✓	✓			✓
Chalinolobus morio	Chocolate Wattled Bat	✓				
Nyctophilus geoffroyi	Lesser Long-eared Bat	✓	✓			✓
Nyctophilus timoriensis	Greater Long-eared Bat	✓				✓
Scotorepens balstoni	Inland Broad-nosed Bat	✓	✓			✓
Vespadelus baverstocki	Inland Forest Bat		✓			
Vespadelus finlaysoni	Inland Cave Bat		✓			✓
Vespadelus regulus	Southern Forest Bat	✓				
MURIDAE						
Leporillus conditor	Greater Stick-nest Rat		✓			✓ (nest)
**Mus musculus*	House Mouse	✓	✓	✓	✓	✓
Notomys alexis	Spinifex Hopping Mouse	✓	✓	✓	✓	✓
Notomys mitchelli	Mitchell's Hopping Mouse	✓	✓			
Pseudomys bolami	Bolam's Mouse		✓			
Pseudomys desertor	Desert Mouse		✓			✓
Pseudomys hermannsburgensis	Sandy Inland Mouse	✓	✓	✓	✓	✓

FAMILY and Species	Common Name	WAM FaunaBase	Menkhorst and Knight (2004)	Plumridge Lakes (Burbidge *et al.*, 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
CANIDAE						
Canis lupis dingo	Dingo		✓	✓		✓
**Vulpes vulpes*	Red Fox		✓	✓		✓
FELIDAE						
**Felis catus*	House Cat	✓	✓	✓		✓
BOVIDAE						
**Capra hircus*	Goat		✓			
CAMELIDAE						
**Camelus dromedarius*	One-humped Camel	✓	✓	✓		✓
LEPORIDAE						
**Oryctolagus cuniculus*	European Rabbit	✓	✓	✓		✓

* introduced fauna

Appendix D2 Birds previously recorded or expected to occur within the region.

FAMILY and Species	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
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	✓	✓	✓	✓	
CAPRIMULIGIDAE						
Eurostopodus argus	Spotted Nightjar	✓				
AEGOTHELIDAE						
Aegotheles cristatus	Australian Owlet-nightjar	✓	✓	✓		✓
APODIDAE						
Apus pacificus	Fork-tailed Swift	✓				
ARDEIDAE						
Egretta novaehollandiae	White-faced Herron	✓		✓		
ACCIPITRIDAE						
Haliastur sphenurus	Whistling Kite	✓	✓		✓	
Accipiter fasciatus	Brown Goshawk	✓	✓			
Circus assimilis	Spotted Harrier	✓				
Aquila audax	Wedge-tailed Eagle	✓	✓	✓		✓
Hieraaetus morphnoides	Little Eagle	✓	✓			✓
FALCONIDAE						
Falco berigora	Brown Falcon	✓	✓		✓	✓
Falco cenchroides	Nankeen Kestrel	✓	✓			✓
Falco hypoleucos	Grey Falcon	✓				
Falco longipennis	Australian Hobby	✓	✓		✓	✓
Falco peregrinus	Peregrine Falcon	✓				
Falco subniger	Black Falcon	✓				
RALLIDAE						
Fulica atra	Eurasian Coot	✓				✓
OTIDIDAE						
Ardeotis australis	Australian Bustard	✓	✓	✓	✓	✓

FAMILY and Species	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
CHARADRIIDAE						
Charadrius ruficapillus	Red-capped Plover	✓	✓			
TURNICIDAE						
Turnix velox	Little Button-Quail	✓		✓		✓
CACATUIDAE						
Lophochroa leadbeateri	Major Mitchell's Cockatoo	✓				
Eolophus roseicapilla	Galah	✓	✓	✓		✓
Nymphicus hollandicus	Cockatiel	✓	✓	✓		
PSITTACIDAE						
Glossopsitta porphyrocephala	Purple-crowned Lorikeet					✓
Polytelis anthopeplus	Regent Parrot	✓			✓	✓
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						
Todirhamphus pyrrhopygius	Red-backed Kingfisher	✓	✓	✓		✓
Todirhamphus 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	✓				
Amytornis striatus	Striated Grasswren	✓	✓			
ACANTHIZIDAE						
Pyrrholaemus brunneus	Redthroat	✓	✓			✓
Smicrornis brevirostris	Weebill	✓	✓		✓	✓

FAMILY and Species	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
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 punctatus	Spotted Pardalote					✓
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	✓	✓		✓	✓
Purnella albifrons	White-fronted Honeyeater	✓	✓	✓	✓	✓
Manorina flavigula	Yellow-throated Miner	✓	✓	✓	✓	✓
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	✓	✓	✓		✓
Anthochaera carunculata	Red Wattlebird	✓	✓		✓	✓
Ephthianura tricolor	Crimson Chat	✓	✓			✓
Ephthianura aurifrons	Orange Chat					✓
Ephthianura albifrons	White-fronted Chat	✓				
Sugomel niger	Black Honeyeater	✓	✓			
Lichmera indistincta	Brown Honeyeater	✓				✓
POMATOSTOMIDAE						
Pomatostomus superciliosus	White-browed Babbler	✓	✓	✓		✓
PSOPHODIDAE						
Cinclosoma castanotus	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	✓	✓	✓		

FAMILY and Species	Common Name	Simpson and Day (2004)	Birdata	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
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	✓	✓			✓
RHIPIDURIDAE						
Rhipidura albiscapa	Grey Fantail	✓				
Rhipidura leucophrys	Willie Wagtail	✓	✓	✓	✓	✓
CORVIDAE						
Corvus bennetti	Little Crow	✓	✓	✓		✓
Corvus orru	Torresian Crow	✓	✓		✓	
MONARCHIDAE						
Grallina cyanoleuca	Magpie-lark	✓	✓			✓
PETROICIDAE						
Microeca fascinans	Jacky Winter	✓	✓		✓	✓
Petroica goodenovii	Red-capped Robin	✓	✓	✓	✓	✓
Melanodryas cucullata	Hooded Robin	✓	✓	✓	✓	✓
MEGALURIDAE						
Cinclorhamphus mathewsi	Rufous Songlark	✓				
Cinclorhamphus cruralis	Brown Songlark	✓	✓	✓		
HIRUNDINIDAE						
Cheramoeca leucosterna	White-backed Swallow	✓				✓
Hirundo neoxena	Welcome Swallow	✓				
Petrochelidon nigricans	Tree Martin	✓				✓
NECTARINIIDAE						
Dicaeum hirundinaceum	Mistletoe-Bird	✓	✓			✓
ESTRILDIDAE						
Taeniopygia guttata	Zebra Finch	✓	✓			✓
MOTACILLIDAE						
Anthus novaeseelandiae	Australasian Pipit	✓	✓	✓		✓

Appendix D3 Herpetofauna previously recorded or expected to occur within the region.

FAMILY and Species	Common Name	WAM FaunaBase	Tyler *et al.* 1994	Wilson and Swan 2008	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
AMPHIBIANS							
MYOBATRACHIDAE							
Cyclorana platycephala	Water-holding Frog		✓				
Neobatrachus centralis	Desert Trilling Frog				✓		
Neobatrachus kunapalari	Kunapalari Frog		✓				
Neobatrachus suta	Shoe-maker Frog		✓				
REPTILES							
GEKKONIDAE							
Diplodactylus conspicillatus	Fat-tailed Gecko	✓					✓
Diplodactylus granariensis	Western Stone Gecko	✓		✓			✓
Diplodactylus maini		✓		✓			
Diplodactylus pulcher		✓		✓			
Gehyra purpurascens		✓				✓	✓
Gehyra variegata		✓		✓		✓	✓
Heteronotia binoei	Bynoe's Gecko	✓		✓			✓
Lucasium damaeum	Beaded Gecko	✓		✓	✓		✓
Lucasium squarrosum				✓			
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	✓		✓			
Strophurus elderi	Jewelled Gecko	✓		✓		✓	✓
Strophurus strophurus	Western Spiny-tailed Gecko						✓
Underwoodisaurus milli	Barking Gecko	✓		✓			
PYGOPODIDAE							
Delma butleri	Butler's Legless Lizard	✓		✓			✓
Delma nasuta							✓
Delma petersoni		✓		✓		✓	✓
Lialis burtonis	Burton's Legless Lizard	✓		✓			✓
Pygopus nigriceps	Western Hooded Scaly-foot	✓		✓			✓

FAMILY and Species	Common Name	WAM FaunaBase	Tyler *et al.* 1994	Wilson and Swan 2008	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
SCINCIDAE							
Cryptoblepharus carnabyi		✓		✓			✓
Cryptoblepharus plagiocephalus	Common Fence Skink	✓		✓			
Ctenotus ariadnae				✓			
Ctenotus atlas		✓		✓		✓	
Ctenotus brooksi		✓		✓		✓	✓
Ctenotus calurus		✓		✓			✓
Ctenotus dux	Narrow-lined Ctenotus			✓			✓
Ctenotus grandis				✓			✓
Ctenotus greeri				✓			✓
Ctenotus helenae		✓		✓			✓
Ctenotus leae		✓		✓		✓	
Ctenotus leonhardii				✓			✓
Ctenotus pantherinus ocellifer	Leopard Ctenotus	✓		✓			✓
Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus	✓		✓		✓	✓
Ctenotus schomburgkii		✓		✓		✓	✓
Cyclodomorphus branchialis (potential misidentification)	Gilled Slender Blue-tongue					✓	
Cyclodomorphus melanops elongatus	Spinifex Slender Blue-Tongue	✓		✓			✓
Egernia depressa	Pygmy Spiny-tailed Skink	✓		✓			
Egernia formosa		✓					
Egernia inornata	Desert Skink	✓		✓	✓	✓	✓
Egernia striata	Night Skink	✓		✓			✓
Eremiascincus richardsonii	Broad-banded Sand-swimmer	✓		✓			✓
Lerista bipes		✓		✓		✓	✓
Lerista desertorum		✓		✓			✓
Lerista picturata		✓					
Lerista rhodonoides		✓		✓		✓	✓
Lerista taeniata							✓
Menetia greyii		✓		✓	✓	✓	✓
Morethia boulengeri		✓					
Morethia butleri		✓		✓		✓	✓
Morethia obscura				✓			
Proablepharus reginae		✓		✓			✓
Tiliqua multifasciata	Centralian Blue-tongue	✓		✓	✓		✓

FAMILY and Species	Common Name	WAM FaunaBase	Tyler *et al.* 1994	Wilson and Swan 2008	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
Tiliqua occipitalis	Western Blue-tongue	✓		✓	✓		✓
Tiliqua rugosa		✓					
AGAMIDAE							
Caimanops amphiboluroides	Mulga Dragon			✓			✓
Ctenophorus caudicinctus	Ring-tailed Dragon			✓			
Ctenophorus clayi	Black-collared Dragon	✓					✓
Ctenophorus cristatus	Crested Dragon	✓		✓	✓		✓
Ctenophorus fordi	Mallee Military Dragon	✓		✓			✓
Ctenophorus isolepis gularis	Central Military Dragon	✓		✓	✓	✓	✓
Ctenophorus nuchalis	Central Netted Dragon	✓		✓		✓	✓
Ctenophorus reticulatus	Western Netted Dragon	✓		✓	✓	✓	✓
Ctenophorus salinarum	Claypan Dragon	✓		✓			
Ctenophorus scutulatus	Lozenge-marked Dragon	✓		✓			
Diporiphora linga		✓					
Diporiphora reginae		✓		✓			✓
Diporiphora winneckei	Canegrass Blue-lined Dragon			✓			
Lophognathus longirostris	Long-nosed Dragon			✓			✓
Moloch horridus	Thorny Devil	✓		✓		✓	✓
Pogona minor	Dwarf Bearded Dragon	✓		✓	✓		✓
Pogona nullarbor		✓					
Tympanocryptis lineata houstoni		✓					
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 panoptes	Yellow-spotted Monitor						

FAMILY and Species	Common Name	WAM FaunaBase	Tyler *et al.* 1994	Wilson and Swan 2008	Plumridge Lakes (Burbidge *et al.* 1976)	Mulga Rocks (Martineck and Associates 1986)	Tropicana (*ecologia* 2009)
Varanus tristis	Black-headed Monitor			✓			✓
TYPHLOPIDAE							
Ramphotyphlops bituberculatus	Prong-snouted Blind Snake	✓		✓			
Ramphotyphlops endoterus				✓			✓
Ramphotyphlops waitii		✓		✓			
PYTHONIDAE							
Antaresia stimsoni	Stimson's Python			✓			
Aspidites ramsayi	Woma Python	✓		✓			
Morelia spilota	Carpet Python			✓			
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	Orange-naped; Moon Snake			✓			
Neelaps bimaculatus	Black-naped Snake						✓
Parasuta monachus	Monk Snake	✓		✓			✓
Pseudechis australis	Mulga Snake	✓		✓			✓
Pseudonaja modesta	Five-ringed Brown Snake	✓					✓
Pseudonaja nuchalis	Western Brown Snake	✓		✓			✓
Simoselaps bertholdi	Jan's Banded Snake	✓		✓			✓
Suta fasciata	Rosen's Snake			✓			

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APPENDIX E CONSERVATION CLASSIFICATIONS

Appendix E1 Categories of 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 E2 Schedules of 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 E3 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 (conservation dependent) 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.