

Vertebrate Fauna Assessment Yeelirrie Project

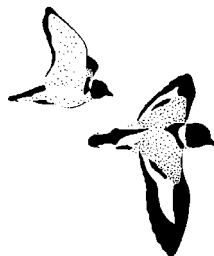
Baseline Report



Dingo pup at a cave in Yeelirrie (R. Browne-Cooper)

Prepared for: URS Australia Pty Ltd,
Level 3, 20 Terrace Rd,
East Perth,
WA, 6004

Prepared by: Mike Bamford, Natalia Huang and Jeff Turpin
M.J. & A.R. Bamford,
CONSULTING ECOLOGISTS.
23 Plover Way,
Kingsley,
WA, 6026



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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Background

BHP Billiton Yeelirrie Development Company Pty Ltd (BHP Billiton) proposes to develop the Yeelirrie project, located on Yeelirrie Station, near Wiluna, Western Australia. As part of the Environmental Review and Management Programme (ERMP) for the Yeelirrie project, Bamford Consulting Ecologists (BCE) was commissioned to conduct a Detailed Level 2 Vertebrate Fauna Assessment within the Yeelirrie Project area (the Project area), in accordance with Environment Protection Authority (EPA, Western Australia) Guidance Statement No. 56 (EPA 2004). The key objectives of the fauna assessment are listed below, with the last objective being addressed in the ERMP document.

- conduct a desktop review to identify the vertebrate fauna assemblage that may occur within or adjacent to the Project area and review this with respect to fauna habitats present;
- investigate the likelihood of conservation significant species being present, and locate and record evidence of these;
- identify and describe fauna habitats present, particularly those that are significant or fragile;
- identify general patterns of biodiversity within or adjacent to the Project area;
- identify any ecological processes within or adjacent to the Project area upon which fauna may depend and with which the proposal may interact; and
- identify potential impacts upon fauna.

Study area

Information for this report was collected from a defined field study area which includes the Project area and areas which were considered relevant in a regional context or for particular conservation significant fauna area, such as the Barr Smith Range. BCE's fauna surveys were concentrated in the centre of the Project area, within and nearby the resource. Sites investigated outside the Project area were identified during the desktop assessment as being of interest for regional context or to target species of conservation

significance. The total field study area covers approximately 100 000 ha. A desktop review was also undertaken to gather regional data and included database searches spanning approximately 50 km from the resource area.

Fauna assessment

The fauna assessment comprised an initial desktop review and site inspection in February 2009 with field surveys in March, July and November 2009 and May 2010. The desktop review was carried out by accessing a range of databases, published and unpublished sources. Field investigations included a site reconnaissance, two intensive trapping surveys (March and November 2009) and two surveys to target significant species (July 2009 and May 2010).

Fauna habitat

Eight major fauna habitats identified (from an elevation of high to low in the landscape) were:

- Granite Outcrops and Breakaways.
- Scattered Shrubs over Spinifex Sandplain.
- Mulga over Spinifex Sandplain.
- Acacia Woodland over Sparse Spinifex.
- Hardpan Mulga.
- Calcrete (including areas of *Eucalyptus gypsophila* woodland).
- Chenopod Shrubland on Sandplain.
- Calcrete Outwash.

In characterising fauna habitats, BCE utilised both field observations and vegetation communities recognised by Western Botanical (2010), however it should be noted that fauna habitats do not necessarily correspond exactly with them, as the emphasis with fauna habitats is upon vegetation structure, soil and topography rather than floristics.

Within the region, Granite Outcrops and Breakaways are well-represented outside the Project area but are poorly represented within the area, while all other habitats except Calcrete, Calcrete Outwash and Chenopod Shrubland on Sandplain are well-represented throughout. The Calcrete and Calcrete Outwash habitats are the most limited in extent and have a high proportional representation in the centre of the Project area.

The vertebrate fauna assemblage

The desktop review identified 292 vertebrate fauna species that may be expected to occur in the study area (10 frog, 88 reptile, 155 bird, 31 native mammal and eight introduced mammal species). The BCE field surveys in 2009 to 2010 recorded a total of 196 of these fauna species. This comprised four frog, 49 reptile, 82 bird, 21 native mammal and four introduced mammal species.

Conservation significant species

Thirty-five species of conservation significance are considered likely to occur in the study area. Of these, 20 are of high significance (Conservation Significance [CS] Level 1), being listed under legislation; seven are of moderate conservation significance (Conservation Significance Level 2), being listed as priority species by the Department of Environment and Conservation (DEC); and eight are of local significance (Conservation Significance Level 3), because they have restricted distributions or are listed as declining species in the region.

Eight conservation significant fauna species were recorded in the areas assessed during BCE's field surveys: the Bush Stone-curlew (CS2), Malleefowl (CS1), Peregrine Falcon (CS1), Australian Bustard (CS2), Rainbow Bee-eater (CS1), Brush-tailed Mulgara (CS2), Black-flanked Rock-Wallaby (CS1) and Greater Long-eared Bat (CS2). An additional five conservation significant species have been recorded previously at Yeelirrie including the Eastern Great Egret (CS1), Sharp-tailed Sandpiper (CS1), Major Mitchell's Cockatoo (CS1), Fork-tailed Swift (CS1) and Square-tailed Kite (CS3).

Even among species that were recorded, the significance of these findings are considered to be minor in most cases because the species is considered to be an irregular visitor (16 species), a resident but very widespread (e.g. Peregrine Falcon, Australian Bustard, Square-tailed Kite) or there is little, if any, habitat actually within the study area (eg. Great Desert Skink, the legless lizard *Aprasia picturata*, Long-tailed Dunnart, Kultarr). For six significant species, the study area may be of moderate importance. These are:

- Malleefowl - population known in region and considered to be significant by Benshemesh *et al.* (2008);
- Black-flanked Rock-Wallaby - population known in region;
- Slender-billed Thornbill - may be present with suitable habitat within the study area but only a small proportion in impact areas;
- Brush-tailed Mulgara – large local population found by BCE (see below);
- Bush Stone-curlew – local population found by BCE (see below);
- Greater Long-eared Bat – species found in area by BCE and suitable roosting habitat (tree hollows) within and close to the resource.

Most of the recorded significant species were found in low numbers and/or outside the resource area. The Brush-tailed Mulgara, however, was abundant in areas of open Mixed Shrubland on Spinifex sandplain across the Project area, with low densities recorded in some parts of the resource area. The Malleefowl population on Yeelirrie Station is significant (Benshemesh *et al.* 2008), and is likely to be confined to Acacia shrublands on sandplain in higher landscapes. One *inactive* mound was found by BCE approximately two kilometres north of the centre of the resource area and other mounds were found by the Malleefowl Preservation Group well to the north and south of the Project area, the closest being approximately 15 km from the centre of the resource area.

Patterns of distribution and abundance

Trapping and bird censusing provided some information on patterns of distribution and abundance of the general fauna assemblage. Reptiles were most abundant and species

rich in the Scattered Shrubs over Spinifex Sandplain, although they were also moderately well-represented at two of the four sampling sites in the Calcrete fauna habitat. These two sites had the best-developed eucalypt overstorey and therefore the best development of a leaf-litter layer. Mammals were also most abundant in the Scattered Shrubs over Spinifex Sandplain. Birds were most abundant and species rich in the two Mulga fauna habitats (Hardpan Mulga and Mulga over Spinifex Sandplain) but were also abundant and species rich at one of the Calcrete sites where *Eucalyptus gypsophila* formed a continuous woodland. This site had several species of birds that are thought to be dependent on eucalypt foliage that were present in only small numbers elsewhere. The closed Acacia Woodland over Sparse Spinifex was low in reptiles, mammals and birds.

Close to the resource area, where development of the mine and associated infrastructure will occur, lie the Calcrete and Calcrete Outwash habitats, with small areas of the two Mulga habitats, Mulga over Spinifex Sandplain and Hardpan Mulga, and the dense Acacia Woodland over Sparse Spinifex also included. A proposed quarry will incorporate a small area of granite breakaway adjacent to the Barr Smith Range. The Scattered Shrubs over Spinifex Sandplain habitat that was found to be rich in reptiles and mammals is largely outside the resource and immediate surrounds, as are most areas of the two Mulga habitats. Most of the woodland of *E. gypsophila* in Calcrete habitat, found to be rich in reptiles and birds, is situated within the north-west portion of the resource and extends north-west approximately 14 km.

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1. Introduction

1.1 Background

BHP Billiton Yeelirrie Development Company Pty Ltd (BHP Billiton) proposes to develop the BHP Billiton Yeelirrie Uranium Project (Yeelirrie project). As part of the Environmental Review and Management Programme (ERMP) for the project, Bamford Consulting Ecologists (BCE) was engaged to conduct a Detailed Level 2 Fauna Assessment of the vertebrate fauna within the Yeelirrie Project area (the Project area), in accordance with Environment Protection Authority (EPA, Western Australia) Guidance Statement No. 56 (EPA 2004). A Detailed Level 2 Fauna Assessment involves a comprehensive assessment including a desktop literature study and multiple field surveys to assess the fauna values in the region. This report presents the results of the desktop assessment and field surveys undertaken in March, July and November 2009, and May 2010. It incorporates and supercedes the preliminary desktop report (BCE 2009). Potential impact to fauna was assessed in consultation with BHP Billiton and has been addressed in the ERMP.

1.2 Study Objectives

The objectives of the fauna studies were to determine the fauna values of a site and the likely impacts of the proposed Yeelirrie project in accordance with EPA (Western Australia) Guidance Statement No. 56 (EPA 2004). This provides government agencies with the information needed to assess the significance of impacts under state and government legislation. The key objectives of fauna studies are listed below, with the first four objectives being covered in this report, and the final two covered in ERMP.

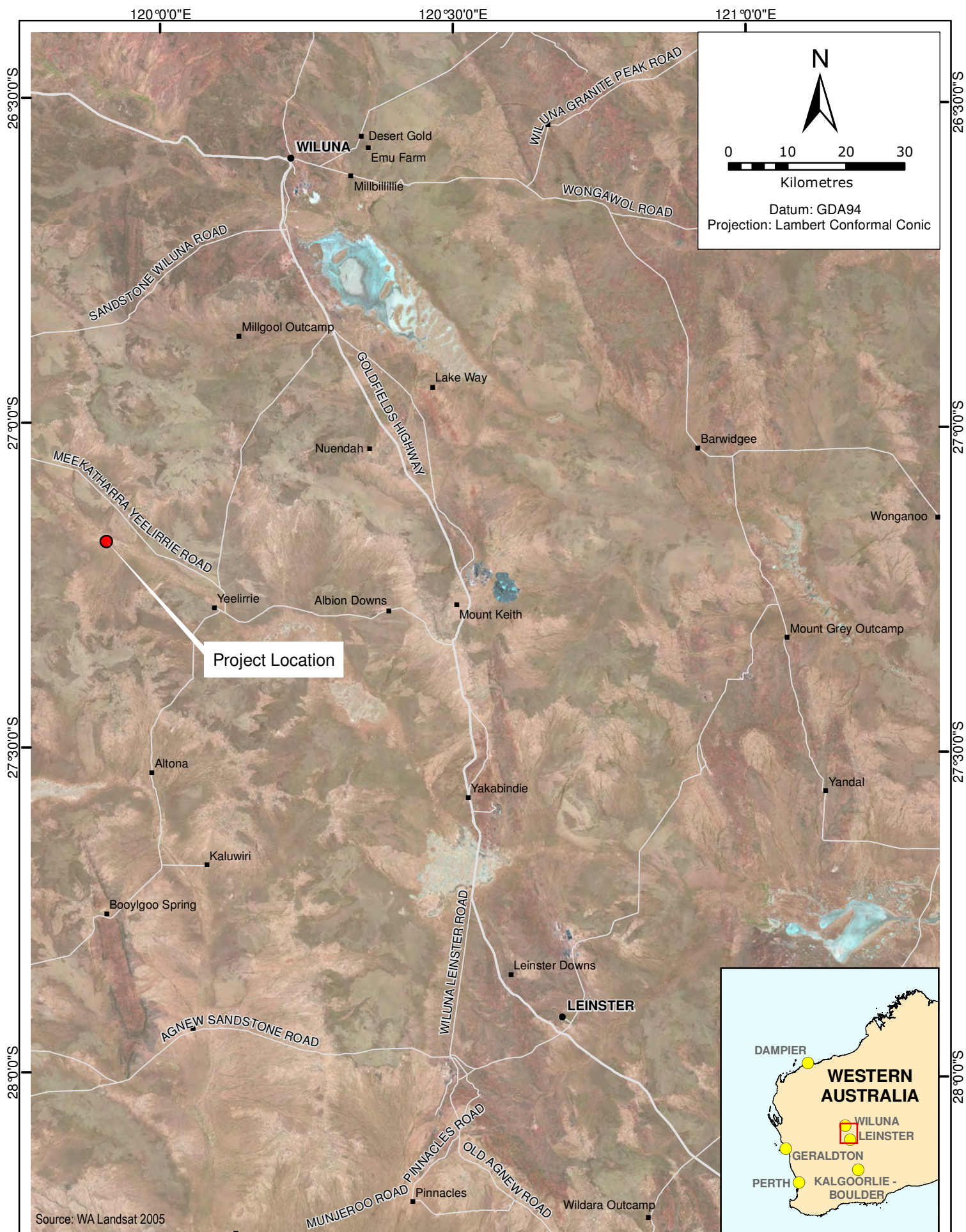
- conduct a desktop review to identify the vertebrate fauna assemblage that may occur within or adjacent to the Project area and review this with respect to fauna habitats present;
- investigate the likelihood of conservation significant species being present, and locate and record evidence of these;
- identify and describe fauna habitats present, particularly those that are significant or fragile;
- identify general patterns of biodiversity within or adjacent to the Project area;
- identify any ecological processes within or adjacent to the Project area upon which fauna may depend and with which the proposal may interact; and
- identify potential impacts upon fauna.


1.3 Location

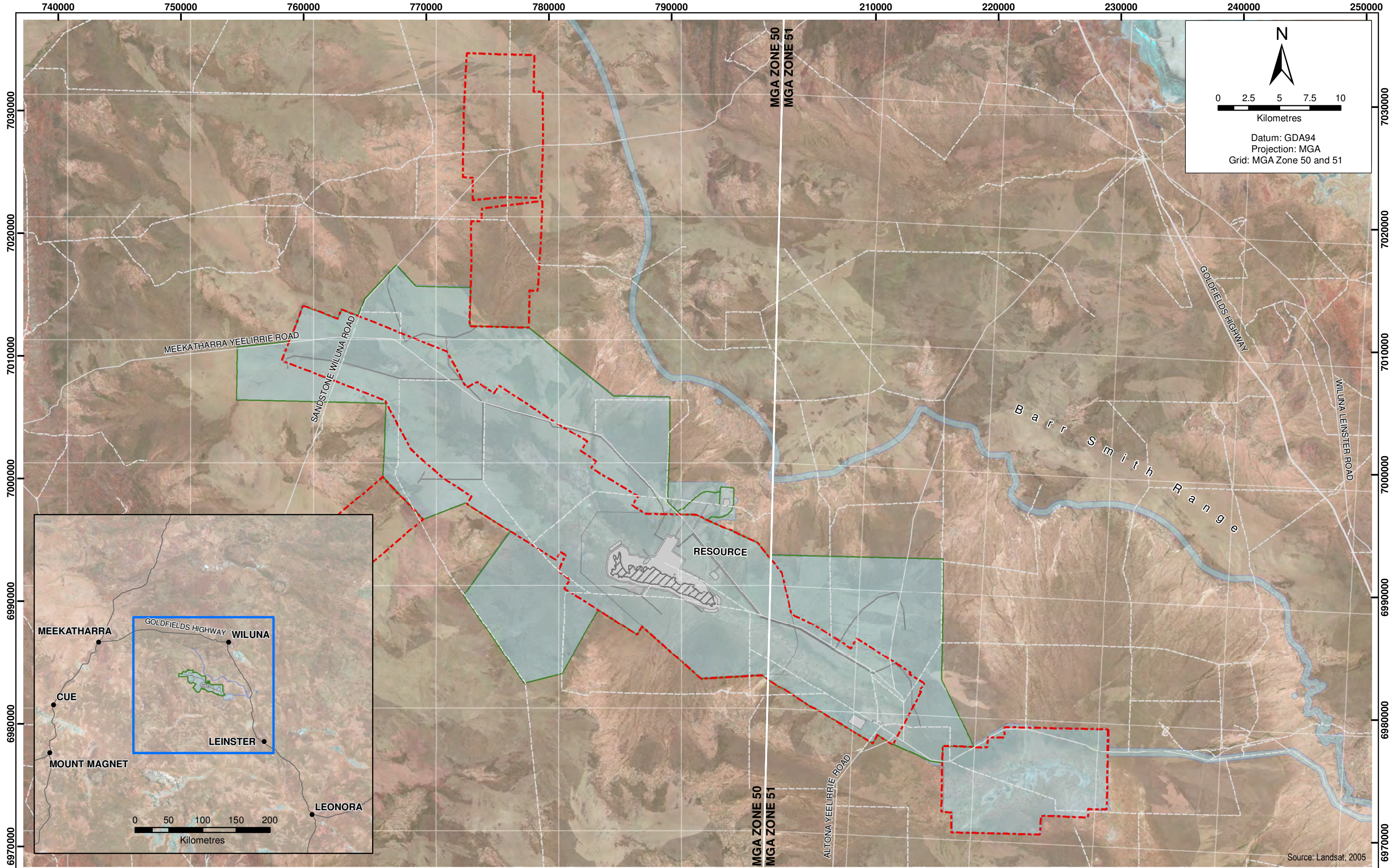
The Project area is located on Yeelirrie Station and forms part of the Shire of Wiluna (Figure 1). The site is located at an elevation of between 480 and 595 m above sea level, approximately 550 km due east of Geraldton, 500 km north of Kalgoorlie, 110 km north-west of Leinster, 80 km south of Wiluna and 60 km west of Mt Keith.

For the purposes of this report, the four main areas relating to the project are: the pit or resource area, Project area, the indicative Project footprint and the study area (Figure). The resource area is primarily situated in the centre of the Project area and is approximately 9 km in length and approximately 1.5 km wide. Other aspects of the Project area include the mine infrastructure such as the metallurgical plant and ore stockpiles, which will closely surround the resource. Mine infrastructure located further afield includes the quarry and access road to the quarry; the accommodation camp and access road to the camp, and a notional borefield and pipeline corridor, both of which are yet to be finalised at the time of writing this report. Collectively, the resource area and infrastructure components form the indicative Project footprint (Figure 2).

The study area covers approximately 100,000 ha and is defined as the area over which BCE carried out fauna surveys in the field. A desktop review was also undertaken to gather regional data and included database searches covering approximately 50 km from the resource area (Figure 2 - inset). The focus of field investigations was on the resource, its surrounding areas and fauna habitat extending outwards to the boundary of the Project area. However, some work was undertaken outside these areas to provide regional context or to target significant species (see Section 2.8). This included parts of the Barr Smith Range (40 km to the north and east of the Project area) which was identified on the basis of the desktop review as being of interest for significant species.



<div>BHP Billiton Yeelirrie Development Company Pty Ltd</div>	Project <div>Proposed Yeelirrie Development</div>			Title <div>Regional Location</div>	
<div>BAMFORD CONSULTING ECOLOGISTS</div>	Drawn: RNM/DL	Approved:KD	Date: 06/01/2011	Figure: 1	Rev. C
	Job No.: 42907132	File No.: 42907132-SUS-197_RC.mxd			A4



Legend

- Project Area

Study Area

Indicative Project Footprint
- Pit Outline

Desktop Review Area

Ministerial Temporary Reserve TR70/6899

Roads (GA, 2007)

- Major Road
- Minor Road
- Track

BHP Billiton
Yeelirrie Development
Company Pty Ltd



BAMFORD
CONSULTING
ECOLOGISTS

Project

Proposed Yeelirrie Development

Title

Vertebrate Fauna
Study Area

Drawn: DL/CJT

Approved: KD

Date: 03/02/2011

Job No.: 42907132

File No.: 42907132-SUS-198_RE.mxd

Figure: 2

Rev. E

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1.4 Project History

Yeelirrie Station was developed for pastoral production in 1925 and was subsequently largely destocked by Western Mining Corporation (WMC), whilst undertaking the previous exploration of the Yeelirrie Uranium Deposit between 1972 and 1981. From the early 1980s, the property ran a small number of sheep until quite recently when it was once again destocked as a result of predator (Dingo/Dog) problems.

Western Mining Corporation submitted an Environmental Impact Assessment (EIA) in 1978, providing an assessment of the Yeelirrie project as planned by WMC at the time. The EIA was approved by the Commonwealth Government under its *Environmental Protection and Administration Procedures 1974*, after satisfying the requirements of the Western Australian Government.

During 1972 through to December 1981, exploration for uranium was undertaken within the area now known as the resource (Outback Ecology 2009). Exploration included evaluation drilling and the excavation of test pits to determine ore viability. However, when the Federal Government implemented the “Three Uranium Mines Policy” 17 March 1983, the Yeelirrie project was placed into care and maintenance.

In mid 2004, Outback Ecology was commissioned by BHP Billiton Nickelwest to conduct rehabilitation of the exposed test pits and to provide an annual rehabilitation assessment. The information has been used to provide the Department of Mines and Petroleum (formerly Department of Industry and Resources) with several Annual Environmental Reports since this time.

BHP Billiton acquired the WMC Yeelirrie tenure in 2004 and following the change in policy on the development of new uranium mines by the West Australian Government in 2008, BHP Billiton officially informed the Government on 18 November 2008 of its intention to reactivate the Yeelirrie project.

1.5 Regional Description

The Project area lies within the Eastern Murchison subregion of the Murchison Bioregion (Figure 3). The regions are described by the Interim Biogeographical Regionalisation for Australia (IBRA) classification system (Environment Australia 2000, McKenzie et al. 2003; see Figure 3). The Murchison Bioregion falls within the Bioregion Group 2 classification (EPA 2004). Bioregions within Group 2 have been described as areas of “native vegetation that is largely contiguous but is used for commercial grazing”.

The general features of the Eastern Murchison subregion are summarised by Cowan (2001). The subregion comprises a rich interzone between the arid and mesic biotas of south-western Australia, corresponding roughly to the "line" between the Mulga/Spinifex country and the eucalypt environments (Dell *et al.* 1998, McKenzie and Hall 1992). The subregion is characterised by its internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. The climate is arid.

The dominant land use in this subregion is grazing, with smaller areas of crown reserves and mining. Only 1.4 per cent of the subregion is vested within conservation reserves (Cowan 2001). These include the proposed conservation pastoral leases Lake Mason and Kaluwirri, which lie approximately 30 km west of the Project area, and the Wanjarri Nature Reserve located 50 km east of the Project area.



<div>Client</div> <div>BHP Billiton Yeelirrie Development Company Pty Ltd</div>	<div>Project</div> <div>Proposed Yeelirrie Development</div>			<div>Title</div> <div>Project Location Showing IBRA Sub-Regions</div>	
	<div>BAMFORD CONSULTING ECOLOGISTS</div>	<div>Drawn: DL</div> <div>Job No.: 42907132</div>	<div>Approved:KD</div> <div>File No.: 42907132-SUS-199.mxd</div>	<div>Date: 06/01/2011</div>	<div>Figure: 3</div>

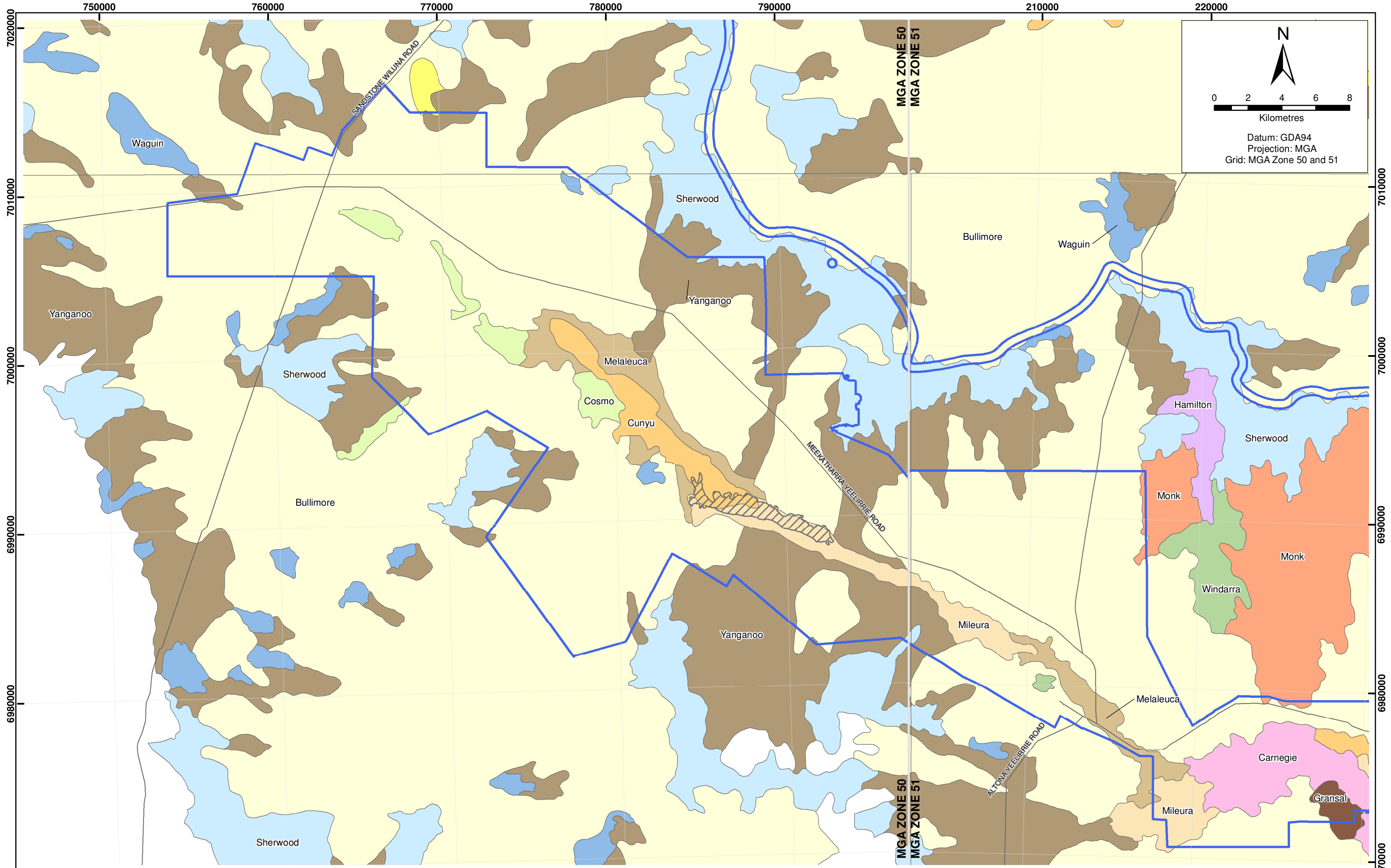
1.6 Land Types and Land Systems

Payne *et al.* (1998) and Pringle *et al.* (1994) classified and mapped the Land Types and Land Systems of the eastern Murchison and north-eastern Goldfields regions, including the study area. Land Types are classified according to similarities in landform, soil, vegetation, geology and geomorphology. There are seven major Land Types in the vicinity of the study area (Figure 4).

Land Types are further divided into Land Systems based on similarities of vegetation, landform and soil. The Land Systems in the region provide an indication of the fauna habitats present and are indicated on Table 1. The predominant Land Systems within the study area are the Melaleuca, Mileura, Cosmo, Cunyu, Bullimore and Yanganoo Land Systems. The Bullimore, Yanganoo and Sherwood Land System are also widespread in the areas adjacent to the study area.

Table 1. Land types and land systems represented within the study area. Land type codes after Payne *et al.* (1998).

Land Type Code	Land Type Description	Land Systems
4	Breakaways, stony plains and sandy surfaced plains on granite with mulga shrublands and minor halophytic shrublands.	Sherwood, Waguin
9	Stony plains and occasional low rises with Acacia-Eremophila shrublands.	Windarra
10	Sand plains with Spinifex hummock grasslands.	Bullimore
13	Wash plains on hardpan with mulga shrublands.	Hamilton, Ranch
14	Wash plains and sandy tracts on hardpan, with mulga shrublands and wanderrie grasses.	Monk, Yanganoo
16	Plains with deep sandy soils supporting Acacia shrublands and occasionally with wanderrie grasses.	Desdemona
18	Calcrete drainage plains with mixed halophytic and non-halophytic shrublands.	Cosmo, Cunyu, Melaleuca, Mileura



N

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Kilometres

Datum: GDA94
Projection: MGA
Grid: MGA Zone 50 and 51

Legend	
UTM Zones	WA Landsystems (DAGR)
Study Area	Bullimore Land System
Pit Outline	Carnegie Land System
Minor Road	Cosmo Land System
Cunyu Land System	Gransal Land System
Melaleuca Land System	Sherwood Land System
Mileura Land System	Windarra Land System
Millrose Land System	Yanganoo Land System
Waguin Land System	

<div>BHP Billiton Yeelirrie Development Company Pty Ltd</div> <div></div>	Project Proposed Yeelirrie Development			Title Study Area Showing Regional Land Systems	
	Drawn: DL/CJT Job No.: 42907132	Approved: KD File No.: 42907132-SUS-200.mxd	Date: 20/01/2011	Figure: 4	Rev. A A3

1.7 Soil Landscapes and Vegetation

The nominated resource lies within the trunk valley of the ancient Yeelirrie paleodrainage system. Soil landscape systems have been described by DC Blandford & Associates (2009) within the Project area.

The central zone of the valley floor is occupied by a variable calcrete system, which is orientated north-west to south-east and is characterised by outcropping calcrete rises and a series of flats and clay flats. The margins of the calcrete system are surrounded by a playa system, which has numerous irregular small to large playas that run approximately parallel to the calcrete expression. The playa system is a transition zone reflecting the interaction between the central calcrete and the surrounding sandplain system, and is the major drainage focus for surface runoff along the valley floor. The colluvial sandplain system extends from the central valley of the paleochannel to the granite breakaways.

Previous assessments at Yeelirrie have shown a clear association of vegetation communities with soil and landforms. Vegetation communities within the Project area have been described by Western Botanical (2010). A complete list of the vegetation communities present in the Project area and their relationship to the soil landscapes is provided in Appendix 1. Soil landscapes and vegetation communities assist in formulating fauna habitats of the study area.

2. Methods

2.1 Approach

This fauna assessment was carried out with reference to guidance and position statements published by the Western Australian EPA on fauna surveys and environmental protection (EPA 2002, EPA 2004), and Commonwealth biodiversity legislation (EPBC Act 1999). The level of fauna assessment required by the EPA is determined by the size and location of the proposed disturbance and the sensitivity of the surrounding environment in which the disturbance is planned.

As discussed in Section 1.5, the Project area lies within Bioregion Group 2 as classified by the EPA (2004). Due to the scale and nature of the Yeelirrie project, a Detailed Level 2 Fauna Assessment (desktop review in conjunction with a detailed survey) is required to satisfy EPA guidelines.

The fauna assessment thus has two components: a desktop review and a site survey. The purpose of the desktop review is to produce a species list that can be considered to represent the (vertebrate) fauna assemblage of the study area based on unpublished and published data using a precautionary approach. The purpose of the site survey is to gather information on this assemblage: confirm the presence of as many species as possible (with an emphasis on species of conservation significance), collect information on the distribution and abundance of this assemblage in relation to fauna habitats present, and to assess the fauna habitats themselves. The desktop review was completed in 2009 (Section 2.7), with site surveys carried out from 2009 to 2010 (Section 2.8).

2.2 Personnel

This fauna assessment document was prepared by Dr Mike Bamford, Mr Jeff Turpin and Ms Natalia Huang (B.Sc. Hons.). All personnel involved were experienced in fauna assessments (see Section 2.9, Table 8). Field work was conducted by:

- Dr Mike Bamford (B.Sc. Hons. Ph.D.)
- Jeff Turpin (B.Sc.)
- Peter Smith (Dip.Ag.)
- Brenden Metcalf (B.Sc. Hons.)
- Robert Browne-Cooper (B.Sc.)
- Cameron Everard (B.Sc.)

2.3 Licences and Permits

The field surveys were conducted under Department of Environment and Conservation (DEC) Regulation 17 licence number SF006794.

2.4 Nomenclature and Taxonomy

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) *Checklist of the Vertebrates of Western Australia* 2008. The authorities used for each vertebrate group are: amphibians and reptiles (Aplin and Smith 2001), birds (Christidis and Boles 2008), and mammals (How *et al.* 2001). English names of species, where available, will be used throughout the text; Latin species names are presented with corresponding English names in tables in the appendices.

2.5 Definition of Conservation Significance

The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and the *Western Australian Wildlife Conservation Act* 1950 (Wildlife Conservation Act). In addition, the Western Australian DEC recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report. A full description of the conservation significance categories, schedules

and priority levels mentioned below is provided in Appendix 2. These levels are:

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories.

Conservation Significance (CS) 2: Species listed as Priority by the DEC but not listed under State or Commonwealth Acts.

In Western Australia, the DEC has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DEC feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. An example of this is Woolley's Pseudantechinus (*Pseudantechinus woolleyae*), scats of which have been recorded within the study area (Appendix 3). It is not listed under Acts or in publications as being conservation significant, but would be classified at CS3 in

certain areas where it is found to have small, isolated populations. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3. The Western Australian Department of Environmental Protection, now DEC (2000), used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Perth Bushplan.

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition. They are listed in Appendix 3 and include the Cat, Fox, Rabbit and Goat.

2.6 Assessment of Fauna Habitats

Fauna habitats were assessed as part of the field investigations (see Section 3.2). Fauna habitats as used in this report are actually broad associations of soils, vegetation and landform, whereas habitat is strictly a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, both of which may occur on a wide variety of soils and vegetation types. Broadly described soil and vegetation associations, however, do provide a way of recognising the way in which the environment available for fauna is structured and distributed.

Fauna habitats do not necessarily correspond with Land Systems, Land Types, soil types or vegetation communities, but may reflect some of these elements. Vegetation structure, for example, can affect the recognition of fauna habitats even though the vegetation community may be considered to be the same; or similar vegetation structure may occur in different vegetation communities.

2.7 Desktop Assessment

Information on the fauna assemblage of the study area was drawn from a wide range of sources. These included databases, results of regional studies and results of some previous investigations at Yeelirrie.

Databases accessed were the DEC Naturemap (incorporating the Western Australian Museum's FaunaBase), Birds Australia's Atlas Database (BA), the DEC Threatened and Priority Fauna Database and the EPBC Protected Matters Search Tool (Table 2). In general, an approximate 50 km radius from the centre of the resource was applied to database searches (Table 2).

Regional information on fauna was available from Cowan (2001), who reported on vertebrate fauna, and particularly those of conservation significance, in the Murchison subregion. Thompson and Thompson (2006) prepared an inventory of 131 reptile species from a 10 year survey covering the area from Wiluna, south to Norseman, west to Merredin, and east to Laverton. Dell *et al.* (1998) summarise the results of surveys of fauna of the Eastern Goldfields undertaken from 1979 to 1981 by the Biological Surveys Committee of Western Australia. In addition to these databases and regional studies, there is information on fauna of Wanjarri Nature Reserve, 50 km east of Yeelirrie (DEC 2009).

There have been two previous studies at Yeelirrie. Observations on fauna were recorded at Yeelirrie Station during the previous mining trials (anon. 1978), and the Malleefowl Preservation Group (MPG) undertook systematic surveys for Malleefowl at Yeelirrie Station between 2000 and 2006 (Benshemesh *et al.* 2008).

Information from the above sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were: Allen *et al.* 2002 (freshwater fish); Tyler *et al.* 2000 (frogs); Storr *et al.* 1983, 1990, 1999 and 2002 (reptiles); Blakers *et al.* 1984; Barrett *et al.* 2003, Johnstone and Storr 1998, 2004; Storr 1984 (birds); Churchill 1998; Strahan 1995; Menkhorst and Knight 2001 (mammals).

Table 2. Types of records held on database, area searched and their source location

Database	Type of records held on database	Area searched
NatureMap (DEC 2009)	Records in the WAM and DEC databases. Includes historical data.	119°52' 60" E, 27°10' 30" S; Buffer = 40 kilometres
Birds Australia Atlas Database	Records of bird observations in Australia, 1998-2008.	One degree square containing 119.89194 E, -27.17131 S
DEC Threatened and Priority Fauna Database	Information and records on Threatened and Priority species in WA.	One degree square bounded by 118.957 E, -26.265 S and 120.817 E, -28.07 S
EPBC Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species and conservation estate.	119°52' 60" E, 27°10' 30" S; Buffer = 50 kilometres

2.7.1 Interpretation of species lists

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the study area. Therefore, some species that were returned by one or more of the data searches have been excluded because their ecology, or the habitat types within the study area, meant that it was highly unlikely that these species would be present. In general, however, species returned by the desktop review process are considered to be potentially present in the study area whether or not they were recorded during field surveys. This is because fauna are highly mobile, often seasonal and frequently cryptic. Therefore, the precautionary approach is taken in that if a species is expected to be present and suitable habitat is available, the assumption is made that the species is present or may be present within the life of the project (approximately 30 years). This approach is in accordance with recommendations on the use of the precautionary principle in EPA Guidance Statement No. 33 (EPA 2008). This is particularly important for significant species that are often rare and hard to find.

Interpretation of species lists generated through the desktop review included assigning an expected status within the study area to species of conservation significance. This

is particularly important for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive. The status categories used are:

- Resident: species with a population permanently present in the study area.
- Regular migrant or visitor: species that occurs within the study area regularly in at least moderate numbers, such as part of annual cycle.
- Irregular visitor: species that occur within the study area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the study area in at least moderate numbers and for some time.
- Vagrant: species that occurs within the study area unpredictably, in small numbers and/or for very brief periods. Therefore, the study area is unlikely to be of important for the species.
- Locally extinct: species that has not been recorded in the local area for at least 50 years and therefore almost certainly no longer present in the study area.

2.8 Field Surveys

The timing of field surveys was determined by Guidance Statement 56 (EPA 2004), which states: “fauna and faunal assemblage surveys conducted for baseline information should be multiple surveys conducted in each season appropriate to the bioregion and the faunal group. The most important seasonal activity times for many faunal groups are related to rainfall and temperature. Thus, a survey in the season that follows the time of maximum rainfall is generally the most productive and important survey time. However, in some cases there may also be a need to time surveys according to the seasonal activity patterns of particularly important species (such as Specially Protected Fauna or Priority species) or particular assemblages (e.g. amphibians [and migratory birds])”.

The study area was visited on 12 to 13 February 2009 (site inspection), and this was followed by four detailed fauna surveys: 22 to 30 March, 17 to 22 July and 2 to 11 November 2009, and 5 to 10 May 2010.

Fauna survey techniques are described in the following sections. The main sampling techniques used during each survey are outlined in Table 3. All sampling techniques

were conducted during the March and November 2009 surveys; sampling during July 2009 and May 2010 was restricted to searching for conservation significant fauna.

Table 3. Survey techniques and dates

Survey Technique	22-30 March 2009	17-22 July 2009	2-11 Nov 2009	5-10 May 2010
Pitfall traps	X		X	
Elliott traps (including targeted trapping for the Mulgara)	X		X	
Funnel traps	X		X	
Cage traps	X			
Bird censussing	X		X	
Bat surveys (Harp traps and Anabat)	X		X	
Spotlighting	X		X	
Targeted searching for Black-flanked Rock-Wallaby	X	X	X	X
Targeted searching for Crest-tailed Mulgara and Brush-tailed Mulgara	X	X	X	X
Targeted searching for Malleefowl	X	X	X	X
Searching for evidence of other conservation significant species	X	X	X	X
Opportunistic observations and searching	X	X	X	X

As the local region can experience both summer and winter rain, trapping was conducted during March and November 2009. Targeted searching for conservation significant fauna was conducted in July 2009 and May 2010. Targeted searching, such as for Rock-Wallaby tracks and scats, Malleefowl mounds and Mulgara burrows, is independent of season as evidence of these species is present throughout the year.

2.8.1 Systematic fauna trapping and censussing

Fifteen survey sites were established to sample fauna within the study area; 10 sites established and sampled in March 2009 and sampled again in November 2009, and five sites established and sampled in November 2009 only (Figure 5 and Appendix 4).

Sampling took place over five nights in each period except at sites 1, 2, 3 and 8 in March 2009, when sampling was limited to two nights. Survey sites were selected to be representative of the Project area and to sample the majority of the major fauna habitats present (see Figure 5 and Table 4). Soil and vegetation codes as they relate to each major fauna habitat are given in Appendix 1. A summary of sampling methods and effort at each site is provided in Table 4.

The survey sites (see descriptions in Table 4) were distributed so that there was replication across the key fauna habitats. No sites were located within the Chenopod Shrubland over Sandplain habitat as it was determined to be well outside the area of potential impact arising from the project. Fauna habitats are described in Section 3.2. Sites across the key fauna habitats include:

- Sites 1, 8, 11 and 13. Calcrete. Site 8 had the lowest representation of *E. gypsophila* woodland.
- Sites 2, 3 and 12. Calcrete outwash.
- Sites 4 and 6. Hardpan Mulga.
- Sites 5 and 7. Mulga over Spinifex sandplain.
- Sites 9 and 10. Scattered shrubs over Spinifex sandplain.
- Sites 14 and 15. Acacia woodland over sparse Spinifex.

Sampling within each survey site included:

- Ten sampling sites, defined by 10 pitfall traps, each trap consisting of a 20 L bucket, 40 cm deep and with a diameter of 28 cm, with a two metre drift-fence placed either side of the trap. Pitfall traps were open for five consecutive nights at most locations but less at some sites in March 2009 due to access problems. A total of 149 pitfall traps were used giving a total of 1115 trap-nights (Table 4).
- A funnel trap, placed on one of the drift-fences running from a pitfall trap, with a further two metres of fence added to the opposite side of the funnel trap. Funnel traps were generally established at every second (even-numbered) sampling site and were also operated over five nights. A total of 102 funnel traps were used during the survey (five at survey sites 1 to 10, ten at sites 11, 12, 13 and 15, and

12 funnel traps at Site 14 where one pitfall trap was damaged and lost), giving a total trapping effort of 695 trap-nights (Table 4).

- An Elliott trap, placed near every second (odd-numbered) sampling site, near the pitfall trap. Elliott traps were baited with universal bait (peanut butter, sardines and rolled oats) and re-baited when necessary. Three additional lines of Elliott traps (total of 30 Elliott traps) were established in habitat identified as suitable for *Mulgara* species, adjacent to survey site 10, during March 2009. An additional five Elliott traps were established at sites 9 and 10 during the November survey to also target *Mulgara* species (total of 10 per site). A total of 125 Elliott traps were operated during the survey. Most were open for five consecutive nights, with a total trapping effort of 835 trap-nights (Table 4).
- Cage traps were placed in habitats potentially supporting large mammals. A total of 10 cage traps was used during the survey, giving a total trapping effort of 100 trap-nights.
- Observations (visual and auditory) of all birds within 25 m of each sampling site were recorded.

A total trapping effort of 2745 trap-nights was conducted during the March and November 2009 surveys (Table 4). Coordinates of sampling locations, sampling effort and details of vegetation and soils at each sampling location appear in Appendices 4 and 5 respectively. Photographs of each sampling site appear in Section 3.2.

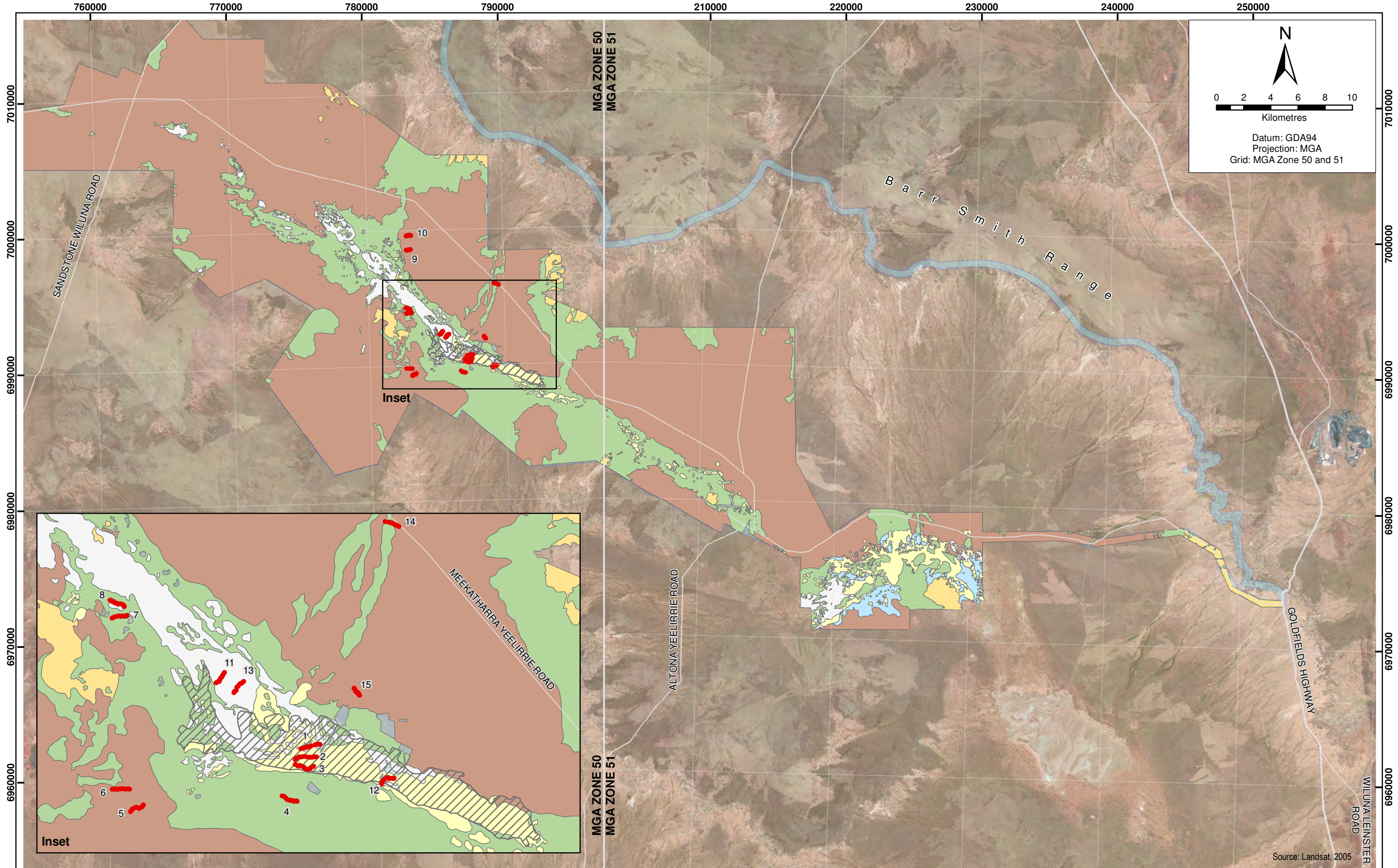
Table 4. Number of each trap type and sampling effort at each survey site. Sites are grouped by fauna habitat type. Vegetation descriptions and codes provided by Western Botanical (see Appendix 1).

Fauna Site	Fauna Habitat	Habitat Description	Pitfall Traps	Funnel Traps	Elliott Traps	Cage Traps	Sampling Nights - March	Sampling Nights – Nov	Total Trap nights
1	Calcrete	<i>Eucalyptus gypsophila</i> woodland (CEgW vegetation community), on hydrophobic loam, fine sandy soil, with weathered carbonate and chert nodules	10	5	5	0	2	5	140
13		<i>Eucalyptus gypsophila</i> woodland over <i>Acacia burkittii</i> and <i>Senna artemisioides</i> subsp. <i>filifolia</i> shrubland on stony loam, fine sandy over massive calcrete (CEgW vegetation community)	10	10	10	0	0	5	150
8		<i>Eucalyptus gypsophila</i> woodland and <i>Acacia burkittii</i> shrubland with patches of <i>Casuarina pauper</i> , on stony loam, fine sandy over massive calcrete (CEgW and CAbS vegetation communities)	10	5	5	0	1	5	120
11		Mosaic of <i>Acacia burkittii</i> shrubland, <i>Eucalyptus gypsophila</i> and <i>Casuarina pauper</i> open woodlands on a stony loam, fine sandy (Northcote, 1972), overlying carbonate rubble in a loam, fine	10	10	5	0	0	5	125










Fauna Site	Fauna Habitat	Habitat Description	Pitfall Traps	Funnel Traps	Elliott Traps	Cage Traps	Sampling Nights - March	Sampling Nights – Nov	Total Trap nights
		sandy matrix. The surface is typically a lag gravel dominated by weathered calcrete (Vegetation communities – CAbS, CEgW and CCpW)							
2	Calcrete outwash	Chenopod (<i>Maireana pyramidata</i> and <i>Atriplex</i> sp. Yeelirrie Station) shrubland (CMpS and CApS vegetation communities), on self-mulching, light to medium clays	10	5	5	0	2	5	140
3		<i>Melaleuca xerophila</i> open woodland (CMxS vegetation community), on self-mulching clay to 0.3m, over powdery calcrete to 1.4m, over gritty clay with gypsum crystals	10	5	5	0	2	5	140
12		<i>Lycium australe</i> shrubland on flats with variable silt/clay content and a surface of scattered lag gravels of quartz and calcrete with occasional pebbles (CLaS vegetation community)	10	10	10	0	0	5	150
4	Hardpan Mulga	Mulga (<i>Acacia aneura</i>) woodland with a sparse shrub understorey (PLAPoS vegetation community), on massive, indurated, gritty, loamy sand	10	5	5	0	5	5	200
6		Mulga (<i>A. aneura</i>) woodland over <i>Eremophila forrestii</i> subsp.	10	5	5	0	5	5	200

Fauna Site	Fauna Habitat	Habitat Description	Pitfall Traps	Funnel Traps	Elliott Traps	Cage Traps	Sampling Nights - March	Sampling Nights – Nov	Total Trap nights
		<i>Forrestii</i> (HPMS vegetation community), on massive indurated loamy sand							
5	Mulga over Spinifex sandplain	Mulga (<i>A. aneura</i>) woodland over Spinifex (<i>Triodia basedowii</i>) (SAMU vegetation community), on massive indurated loamy sand	10	5	5	0	5	5	200
7		Mulga (<i>A. aneura</i>) woodland over Spinifex (<i>T. basedowii</i>) hummock grassland (SAMU vegetation community), on a massive gritty loamy sand to 1.2m, overlying a massive mottled sandy loam, overlying weathering granite at 1.5m (roots at 1.3 ms below ground level)	10	5	5	0	5	5	200
9	Scattered shrubs over Spinifex sandplain	Spinifex (<i>T. basedowii</i>) hummock grassland with scattered recently burnt Acacia shrubs (SAWS vegetation community), on massive loamy sand, gritty in part to 1m, overlying highly indurated gravels with ferricrete and angular quartz	10	5	5 (Mar), 10 (Nov)	5	5	5	275
10		Spinifex (<i>T. basedowii</i>) hummock grassland with Mallee (<i>Eucalyptus</i> spp.) and scattered low shrubs on sand plain (SAMA vegetation community),	10	5	30 (Mar), 10 (Nov)	5	5	5	400

Fauna Site	Fauna Habitat	Habitat Description	Pitfall Traps	Funnel Traps	Elliott Traps	Cage Traps	Sampling Nights - March	Sampling Nights – Nov	Total Trap nights
		on a gritty, weak earthy fabric, loamy sand to 1.8 m, overlying a strongly indurated sediment with ferricrete and carbonate nodules, with abundant roots at 2m							
14	Acacia woodland over sparse Spinifex	Mulga (<i>A. aneura</i>) shrubland over Spinifex (<i>T. basedowii</i>), on red loamy sand to fine sandy loam (SAMU vegetation community)	9	12	10	0	0	5	155
15		Spinifex (<i>T. basedowii</i>) hummock grassland with <i>Acacia effusifolia</i> shrubland on red sands to sandy loams (SAWS vegetation community)	10	10	10	0	0	5	150
		Total Trap Nights	1115	695	835	100			2745



Legend

- | | | |
|--|---|---|
|  Study Area | Fauna Habitat derived from Western Botanical (Bamford, 2011) |  Granite Outcrops and Breakaways |
|  Pit Outline |  Calcrete |  Hardpan Mulga |
|  Trapping / Censussing Location |  Calcrete Outwash |  Mixed Shrubs over Spinifex sandplains |
| |  Chenopod shrubland over sandplain | |

**BHP Billiton
Yeelirrie Development
Company Pty Ltd**

 **BAMFORD
CONSULTING
ECOLOGISTS**

Project
Proposed Yeelirrie Development

Title
**Systematic Fauna Trapping
and Bird Censussing Locations**

Drawn: DL/CJT	Approved: KD	Date: 20/01/2011
Job No.: 42907132	File No.: 42907132-SUS-201_RD.mxd	

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2.8.2 Targeted surveying for conservation significant fauna

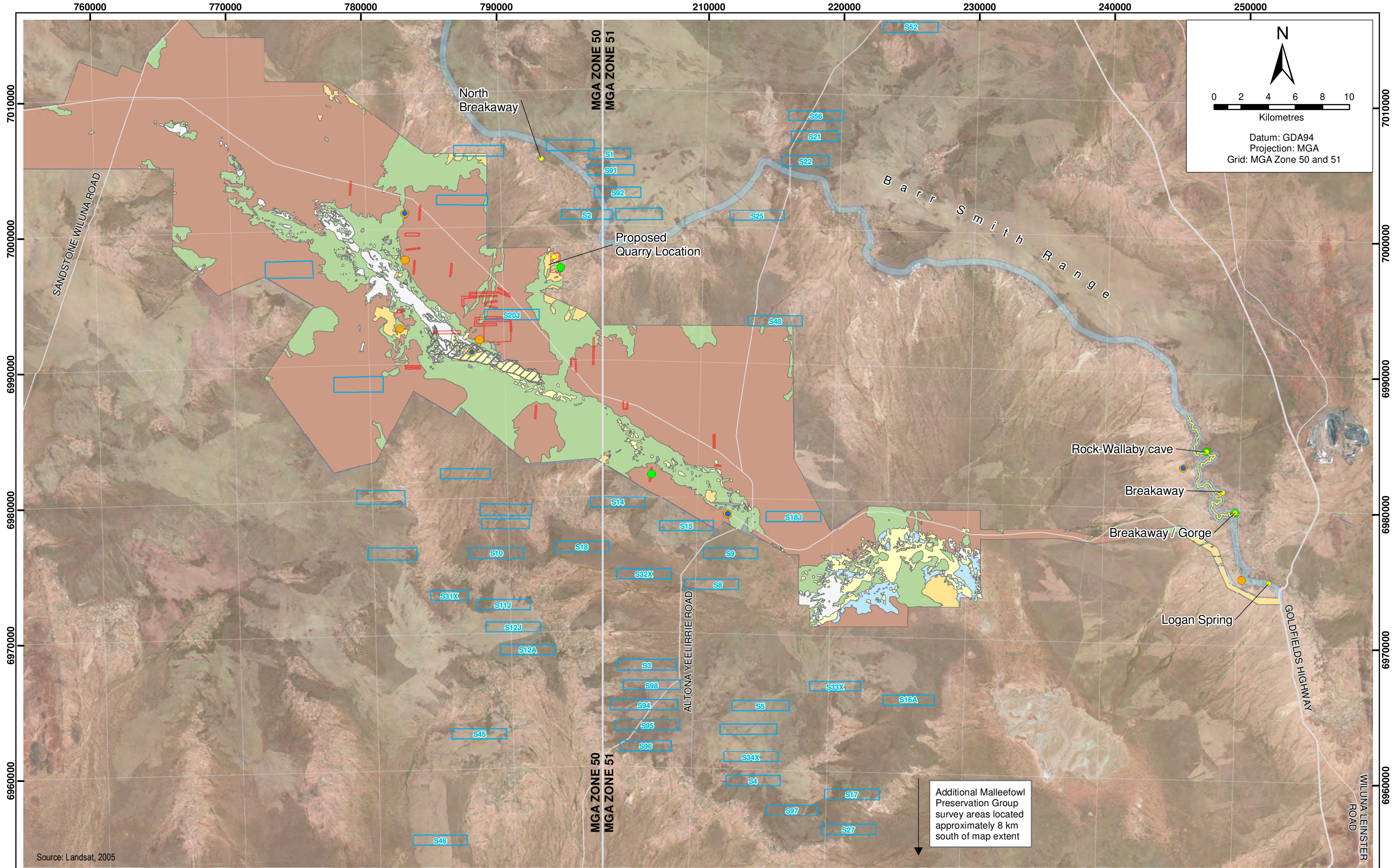
Significant fauna species identified during the desktop assessment include several that can be found by searching for evidence of their activities (e.g. scats, tracks, diggings, burrows), and therefore targeted surveys for these species were undertaken. Targeted surveys were conducted during all site surveys, within the Project area and within suitable adjacent habitat (see Table 3 and Figure 6). These surveys focussed on the Brush-tailed Mulgara, Crest-tailed Mulgara, Malleefowl, Slender-billed Thornbill, Black-flanked Rock-Wallaby, Greater Bilby, Great Desert Skink, Western Spiny-tailed Skink and Long-tailed Dunnart, and methods are outlined below. Some of these species can also be detected by trapping, but searching for evidence can be more efficient and provide reasonable estimates of distribution and abundance.

Survey transects within the Project area

Searching was conducted for both the Mulgara species (burrows, foraging holes, tracks, scats), the Malleefowl (tracks and mounds), Slender-billed Thornbill (tracks), Greater Bilby (tracks, burrows and scats), Great Desert Skink (burrow systems and scats) and Western Spiny-tailed Skink (scats in suitable logs or rocks). Searching was approached systematically by walking with personnel in a line, spaced about 30 m apart, so that a transect of known length and width (and therefore area) was searched. All personnel involved in searching were familiar with the evidence of each species, or were trained by experienced personnel on site.

Transects were surveyed throughout the Project area with a focus on areas where main project activities are likely to occur. Locations of transects are illustrated in Figure 6 and coordinates of transects are given in Appendix 6. There were 82 transects surveyed covering a total area of 842 ha.

A similar approach had been used by the Malleefowl Preservation Group (Benshemesh 2008) to survey for Malleefowl tracks and mounds. Locations of these transects are indicated on Figure 6.



<div><div><div><div></div></div><div>Study Area</div></div><div><div><div></div></div><div>Pit Outline</div></div><div><div><div></div></div><div>Anabat Location</div></div><div><div><div></div></div><div>Camera Trap Location</div></div><div><div><div></div></div><div>Harp Trap Location</div></div></div> <div><div><div></div></div><div>Bamford Consulting Ecologists Targeted Significant Fauna Transect</div></div> <div><div><div></div></div><div>Malleefowl Preservation Group Survey Area (Benshemesh <i>et al.</i> 2008)</div></div> <div><div><div></div></div><div>Rock-Wallaby Survey Location</div></div> <div><div><div></div></div><div>Rock-Wallaby Survey Transect</div></div>

Motion-sensitive cameras and searching along breakaways

There is potential for the Black-flanked Rock-Wallaby and Long-tailed Dunnart to occur in breakaway country to the north and south of the Project area (see Figure 6). The breakaway country to the north and east is known as the Barr Smith Range. Both species are difficult to detect but can be recorded using motion-sensitive cameras. These operate in daylight or at night, and were set in suitable habitat with universal bait (rolled oats, peanut paste and sardines) within the detection zone. Table 5 provides the locations and dates of motion sensitive camera surveys, including a camera set on a burrow system of the Brush-tailed Mulgara. Figure 6 indicates the location of motion sensitive cameras within the study area and the Barr Smith Range.

Table 5. Motion sensitive camera survey locations and periods.

Motion sensitive camera	Habitat	Zone	Easting	Northing	Comments / Survey Nights
1	Breakaway Cave	51J	247522	6984286	5 nights
2	Breakaway Cave	51J	247522	6984286	10 nights
3	Waterhole / Gully	51J	249744	6979810	10 nights
4	Granite Outcrop	50J	794326	6996916	5 nights
5	Spinifex Sandplain	51J	206575	6981657	Placed at Mulgara burrow system, 3 nights

In addition to the use of cameras, searching along breakaways was undertaken to look for the distinctive scats (droppings) of the Black-flanked Rock-Wallaby. Areas where searching was carried out are indicated on Figure 6. Search areas included a length of *ca.* 13 km from (51J) 246094E, 6986988N (location of a large gnamma hole) to (51J) 249760E, 6979813N in July 2009, and searches at specific locations as listed below.

- Proposed Quarry (50J, 793832E, 6997685N)
- North Breakaway (50J, 793078E, 7004956N)
- Rock Wallaby Cave (51J, 247522E, 6984286N)
- Breakaway (51J, 248783E, 6981306N)
- Breakaway / Gorge (51J, 249744E, 6979810N)
- Logan Spring (51J, 252334E, 6974639N)

2.8.3 Bat surveys

Bats were surveyed by using the Anabat detector and by trapping using Harp traps (Figure 6, Table 6). Echolocation calls were recorded using the Anabat system (Titley Electronics, Ballina, NSW), where calls were recorded through the Anabat II Bat Detector onto an audio recorder. At a later stage the recorded calls were assessed using Anabat software to analyse the call characteristics. Characteristics used in call analysis included:

- Fmax Maximum call frequency (kHz)
- Fc Characteristic frequency (kHz)
- Fpeak Frequency with peak number of cycles (kHz)
- DUR Duration of call (ms)

In March and November 2009, Anabat detectors and Harp traps were placed at several locations within the Project area and along a breakaway associated with the Barr Smith Range, approximately 40 km east of the resource (Figure 6). These locations were chosen as they were considered places where bats would concentrate, e.g. sources of permanent water. Table 6 presents the locations and dates of each bat survey using Anabat detectors and/or Harp traps.

Table 6. Bat survey locations, dates and survey technique. Zone 50J unless otherwise indicated.

Location	Easting	Northing	ANABAT Units		Harp Traps	
			1	2	2-bank	3-bank
March 2009						
Yeelirrie Homestead	806209	6978391	23- 26/03/2009	27- 29/03/2009	23- 29/03/2009	-
Afghan Well (51J)	245840	6983020	27/03/2009	-	-	27/03/2009
Breakaway (51J)	250331	6974833	28/03/2009	-	-	-
Rubble Bore	782841	6997710	29/03/2009	-	-	-
November 2009						
Yeelirrie Homestead	806209	6978391	5/11- 8/11/2009	9/11/2009-	-	5/11- 8/11/2009
Fauna Site 1	787620	6990787	6/11/2009	5/11/2009	6/11- 9/11/2009	-
Gnamma Hole	782338	6992651	8/11/2009	8/11/2009	-	-
Mulga woodland near Site 10	782902	7001128	-9/11/09	6/11/2009	-	7/11- 9/11/2009
Corner near Fauna Site 11	788172	6991689	-	5/11/2009-	-	-

2.8.4 Spotlighting

Spotlighting was conducted both on foot, using head-torches (referred to as head-torching), and from the vehicle using the vehicle headlights and a hand-held spotlight. Where necessary, animals were captured for identification purposes and then released. Spotlighting was conducted during both the March and November 2009 surveys when conditions were most suitable.

2.8.5 Opportunistic surveys

During all site visits, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included casual observations such as birds or reptiles seen while travelling through the site, and opportunistic searching for fauna, such as raking through leaf-litter and turning over logs.

Targeted opportunistic surveys outside the Project area were conducted in March 2009 (see Table 7 and Figure 6) and focused on fauna habitats not represented in the trapping survey sites. This ensured all major fauna habitats within the vicinity of the Project area were sampled to some extent. Opportunistic surveys included searching for evidence of conservation significant species and micro-habitat searching. Photographs of opportunistic survey sites are given in Section 3.2.

Table 7. Location of opportunistic surveys in March 2009

Site	Easting	Northing	Zone	Habitat / Comments
Barr Smith 1*	247522	6984285	51J	Breakaway
Barr Smith 2*	250269	6975009	51J	Breakaway, Granite Outcrops
Afghan Well	245840	6983020	51J	Granite Outcrops, Freshwater Soak
Dune 1	762753	7008929	50J	Sand Dune, Day survey and Spotlight

* Indicates breakaway areas which were revisited in July 2009 to search for the Black-flanked Rock-Wallaby.

2.9 Limitations

The EPA Guidance Statement 56 (EPA 2004) outlines a number of limitations that may arise during surveying. These survey limitations are discussed in the context of BCE fauna surveys at the Yeelirrie project in Table 8.

Table 8. Survey limitations as outlined by EPA (2004)

EPA Limitation	BCE Comment
Level of survey.	Level 2 (reconnaissance survey, detailed survey and targeted survey). Survey intensity was deemed adequate to identify significant fauna and habitats occurring in the Project area.

EPA Limitation	BCE Comment
Competency/experience of the consultant(s) carrying out the survey.	Bamford Consulting Ecologists has been undertaking work of this nature since 1989. All field-workers involved in this project have had extensive experience (more than ten years) in conducting fauna assessments.
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	Birds, mammals, reptiles and frogs sampled. Bats were sampled using Anabat detectors and harp traps. Targeted surveys for Malleefowl, both Crest-tailed and Brush-tailed Mulgara species and Black-flanked Rock-Wallaby conducted in areas of suitable habitat. No constraints limited sampling.
Proportion of fauna identified, recorded and/or collected.	All vertebrate fauna observed were identified. Some skins vouchered with the Western Australian Museum: <i>Menetia greyii</i> R139490 and R139491 collected in March 2009, <i>Menetia greyii</i> (F) R169916 (November 2009) <i>Ctenous hanloni</i> R169917 (November 2009).
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	Sources include previous reports on the fauna of the region (BCE); databases (BA, DEC, WAM, EPBC and BCE). Also fauna surveys conducted at Wanjarri Nature Reserve (DEC) and fauna records from Yeelirrie Station (anon, 1978).
The proportion of the task achieved and further work which might be needed.	Level 2 Survey complete. Due to survey findings further work may be needed to monitor mining impacts on significant fauna and habitats. Impacts are discussed within the <i>Fauna Assessment of the Yeelirrie Project: Impact Assessment Report</i> (BCE 2010)
Timing/weather/season/cycle.	Site reconnaissance conducted February 2009. Detailed field surveys conducted March 2009 and November 2009. Targeted surveys for conservation significant fauna conducted July 2009 and May 2010. Despite some rain in spring 2009, conditions were generally dry, which may have affected the presence and/or abundance of some species. However, it is the nature of arid and semi-arid environments that some species are nomadic or episodic.
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey.	No disturbances affected the survey.
Intensity. (In retrospect, was the intensity adequate?)	Survey intensity adequate to record conservation significant fauna and habitats.

EPA Limitation	BCE Comment
Completeness (e.g. was relevant area fully surveyed).	Field survey complete but as noted above, it is the nature of arid and semi-arid environments that some species are nomadic or episodic. Some species not recorded may be present under different conditions, but the habitat assessment allows such species to be considered.
Resources (e.g. degree of expertise available in animal identification to taxon level).	All vertebrate species identified to species (sometimes sub-species) level. All staff are trained and deemed competent to conduct animal identification to taxon level.
Remoteness and/or access problems.	No access problems.
Availability of contextual (e.g. biogeographic) information on the region.	Extensive regional (e.g. BCE database) information was available and was consulted.

3. Results

3.1 Meteorological Conditions during Field Surveys

Meteorological data for the survey were taken from the Bureau of Meteorology (BOM) station at Yeelirrie (BOM 2010). The first detailed field survey was conducted from the 22 to 30 March 2009. During this period the weather was warm with no rainfall. The daily maximum temperature recorded during this period ranged from 30.8°C to 39.5°C, with daily minima ranging from 13.8°C to 24.4° C. The second field survey was conducted from 17 to 22 July 2009, when conditions were fine but cool, with cold nights and no rainfall. Mean daily data for this period are not available, but mean maximum and minimum temperatures for the month of July 2009 are 19.3°C and 5.6°C respectively.

A third detailed field survey was conducted from the 2 to 11 November 2009. During this period the weather was warm with rainfall occurring on several days. The daily maximum temperature recorded at the Yeelirrie BOM station during this period ranged from 28.3°C to 39.7°C (mean of 35.1°C), with daily minima ranging from 12.5°C to 22.5° C (mean of 17.8°C). Only one mm of rainfall was recorded at Yeelirrie during this period. The fourth survey was conducted from 5 to 10 May 2010. This targeted survey was conducted during cooler conditions with no rainfall. Rainfall (approximately 80 mm) had occurred in the months prior to the survey and as a result many *Acacia* and *Eremophila* species were in flower. The mean daily maximum and minimum temperatures recorded during the survey period were 26.8°C and 7.5°C respectively.

3.2 Fauna Habitats

Eight major fauna habitats were identified during field investigations (Figure 5 and 6). From an elevation of high to low in the landscape, these were:

- **Granite Outcrops and Breakways.** Gravelly/sandy soils around, supporting mixed shrubland. Some areas of chenopod shrubland on heavier soil also present. Land Types 3 and 4.

- **Hardpan Mulga.** Mulga woodland with poorly-developed understorey on hard loam soils. Land Types 11 and 14.
- **Calcrete.** Low calcrete rises with Eucalypt open woodland (variable) over a sparse shrubland. Possibly consistent with Land Types 15 and 18 and the Mileura Land System, but generally non-saline.
- **Calcrete Outwash.** Clayey-loam and clay flats, subject to occasional inundation with some open claypans. Includes fringes of saline playa systems. Vegetation includes Acacia open shrubland, sometimes with thickets of *Melaleuca xerophila*, and chenopod shrub-heaths. Possibly consistent with the Land System Melaleuca.
- **Chenopod Shrubland over Sandplain.** These shrublands occur in sandy soils on the margins of playas in the southeast of the project area.
- **Scattered Shrubs over Spinifex Sandplain¹.** Sandplains supporting spinifex, scattered shrubs and open Acacia/Eucalypt woodland. Land Types 10, 12 and 13.
- **Mulga over Spinifex Sandplain¹.** Mulga woodland over Spinifex on sandy-loam soils.
- **Acacia Woodland over Sparse Spinifex¹.** Acacia woodland with Spinifex of variable density.

The fauna habitats correspond approximately with soil types (Blandford 2010) and the major vegetation groupings identified by Western Botanical (2010), but there are some inconsistencies where soils recorded on the surface during fauna habitat assessments differed from the main soil type identified in botanical surveys, and where vegetation structure crosses soils and vegetation type boundaries. Areas of each fauna habitat within the Project area are given in Table 9. Condition of habitat was generally good with low levels of weed invasion. Further information on weeds may be obtained from Western Botanical (2010).

¹ For the purposes of calculating the fauna habitat areas, fauna habitat categories with spinifex in common were grouped into one category: Mixed shrubs over Spinifex sandplain

Table 9. Areas of fauna habitat within the Project Area

Habitat type	Project area (ha)
Granite Outcrops and Breakaways	1,866
Mixed Shrubs over Spinifex Sandplain*	69,840
Hardpan Mulga	21,230
Calcrete	2,819
Calcrete Outwash	3,095
Chenopod Shrubland over Sandplain	1215
Bare and disturbed (not considered further in this study)	150

* Three fauna habitats not clearly defined by vegetation types so combined for the purposes of area calculation; all have spinifex in common.

The Granite outcrops and breakaways include the Barr Smith Range to the north and east of the Project area, and similar landforms to the south. They are very extensive, linear habitats that are mostly distant from the Project area, however a site located in the proposed quarry, approximately 10 km north of the resource, was surveyed, adjacent to the Barr Smith Range. The three habitats that contain spinifex are very extensive both within and outside the study area, while the Hardpan Mulga has a more limited distribution in the study area. The two calcrete habitats (Calcrete and Calcrete Outwash) are smallest in area and are concentrated in the resource and adjacent areas.

Some fauna habitats in the study area, particularly the Calcrete and Calcrete Outwash, appear to be distinctive in a regional context, e.g. they differ from those in the nearby Wanjarri Nature Reserve where sandy soils are much more extensive. The Calcrete and Calcrete Outwash habitats seem to be poorly-represented outside the resource and adjacent areas.

Photographs and descriptions of vegetation type at each survey site are presented in Plates 1 to 15 below. Photographs of habitats that were surveyed opportunistically or targeted for conservation significant fauna surveys are presented in Plates 16 to 22. Vegetation communities as defined by Western Botanical (2010) are given in parentheses and presented in Table 4. Fauna habitats as defined above are given in bold.



Plate 1. Site 1 : *Eucalyptus gypsophila* woodland on calcrete rise (CEgW vegetation community) - **Calcrete**



Plate 2. Site 2: Chenopod type vegetation comprising *Maireana pyramidata* and *Atriplex* sp. Yeelirrie Station shrubland on self-mulching clays in drainage depression (CMpS and CApS vegetation communities). – **Calcrete Outwash**



Plate 3. Site 3 : *Melaleuca xerophila* open woodland over clay/clay loam flats (CMxS vegetation community). – **Calcrete Outwash**



Plate 4. Site 4: Mulga (*Acacia aneura*) woodland with a sparse shrub understorey on sandy loam/clay loam (PLAPoS vegetation community). – **Hardpan Mulga**



Plate 5. Site 5 : Mulga (*A. aneura*) woodland over Spinifex (*Triodia basedowii*) on loamy sand (SAMU vegetation community). – **Mulga over Spinifex Sandplain**



Plate 6. Site 6 : Mulga (*A. aneura*) woodland over *Eremophila forrestii* subsp. *forrestii* on loamy sand (HPMS vegetation community). – **Hardpan Mulga**



Plate 7. Site 7: Mulga (*A. aneura*) woodland over Spinifex (*T. basedowii*) on loamy sand (SAMU vegetation community). – **Mulga over Spinifex Sandplain**



Plate 8. Site 8: *E. gypsophila* woodland and *Acacia burkittii* shrubland with patches of *Casuarina pauper* on orange clay loam with calcrete (CEgW and CAbS vegetation communities). - **Calcrete**



Plate 9. Site 9: Spinifex (*T. basedowii*) hummock grassland with scattered low *Acacia spp.* shrubs on sandplain (SAWS vegetation community). – **Scattered Shrubs over Spinifex Sandplain**



Plate 10. Site 10: Spinifex (*T. basedowii*) hummock grassland with Mallee (*Eucalyptus spp.*) and scattered low shrubs on sandplain (SAMA vegetation community). – **Scattered Shrubs over Spinifex Sandplain**



Plate 11. Site 11 : Mixed *E. gypsophila* and *Casuarina pauper* woodland over open *Acacia burkittii* shrubland on stony calcrete clay, with very sparse groundlayers (CEgW, CCpW and CAbS vegetation communities). - **Calcrete**



Plate 12. Site 12: *Lycium australe* shrubland on flats with variable clay content and some stoney calcrete (CLaS vegetation community). – **Calcrete Outwash**



Plate 13. Site 13: *E. gypsophila* woodland over mixed *Acacia* spp. and *Senna artemisioides* subsp. *filifolia* shrubland on stoney calcrete clay/loam (CEgW vegetation community). – **Calcrete**



Plate 14. Site 14: Mulga (*A. aneura*) woodland over Spinifex (*T. basedowii*) on red sandy loam (SAMU vegetation community). – **Acacia Woodland over Sparse Spinifex**



Plate 15. Site 15: *Acacia effusifolia* shrubland over Spinifex (*T. basedowii*) hummock land on red sandy loam (SAWS vegetation community). – **Acacia Woodland over Sparse Spinifex**



Plate 16. Barr Smith Range: Breakaway. Vegetation includes *Acacia* shrublands and scattered *Callitris columellaris*. Numerous caves, rock crevices and small cliffs occur along the Barr Smith Range. Some scattered rock holes (waterholes) also occur in protected parts of the range. – **Granite Outcrops and Breakaways**



Plate 17. Barr Smith Range: Waterholes along major creeklines. Some of these may be permanent and support Eucalypt stands. – **Granite Outcrops and Breakaways**



Plate 18. Barr Smith Range: Granite outcrops. Large granite hills occur on the flanks of the Barr Smith Range. Areas of outcropping include large, extensive rock piles. – **Granite Outcrops and Breakaways**



Plate 19. Quarry site. Low shrubland located just downslope of granite breakaway in quarry site. – **Granite Outcrops and Breakaways**



Plate 20. Closed Acacia shrubland and Mallee. Areas of closed Acacia shrubland and closed Mallee occur to the north of the Deposit. – **Hardpan Mulga**



Plate 21. Gnamma holes amongst granite outcropping. A small number of gnamma holes occur amongst granite outcropping at 50J, 782338E, 6992651N and at 782457E, 6992593N. – **Granite Outcrops and Breakaways**



Plate 22. Claypans with fringing Melaleuca shrubland. A series of freshwater claypans occur within the vicinity of the Deposit including at 50J, 782077E, 6993973N. This claypan holds water seasonally and would be seasonally significant for waterbirds. Skeletal remains of a number of waterbirds were found. – **Calcrete Outwash**

3.3 Vertebrate Fauna Assemblage

Vertebrate fauna species expected to occur in the region based upon the desktop review and those recorded during field investigations are presented in Appendix 3. The composition of vertebrate fauna expected to occur in the region and recorded within the study area is outlined in Table 10. The vertebrate fauna assemblage is expected to be composed of 292 species, including: 10 frog, 88 reptile, 155 bird, 31 native mammal and eight introduced mammal species. The field investigations confirmed the presence of 55% of these species (see Table 10). The expected fauna assemblage is substantially complete. Locally extinct species are listed in Appendix 3.

Thirty-five of the species expected to occur in the region are of conservation significance. Some species, such as the Greater Bilby, are unlikely to be extant within the region but have been included in species lists based on previous records, distribution and suitable habitat. The presence of eight of the conservation significant species was confirmed.

Table 10. Composition of vertebrate fauna expected to occur within the Project area and recorded during BCE surveys (March, July and November 2009 and May 2010).

Taxon	Number of species expected	Number Recorded by BCE	Significant fauna Expected			Significant fauna recorded at Yeelirrie		
			CS1	CS2	CS3	CS1	CS2	CS3
Fish	-	-	-	-	-	-	-	-
Frogs	10	4	-	-	-	-	-	-
Reptiles	88	49	1	-	1	-	-	-
Birds	155	82	16	4	5	6	3	1
Mammals	31 native, 8 feral	21 native, 4 feral	3	3	2	1	2	-
Total	292	160	20	7	8	7	5	1

Overall, the assemblage of vertebrate fauna expected to occur reflects the transition zone from the Murchison to the arid interior. This assemblage contains both species typical of the Murchison area (e.g. Woolley's Pseudantechinus, Stripe-tailed Monitor)

and species typical of the central Deserts (e.g. Striated Grasswren, Great Desert Skink) and some more typical of the south-west (such as the Grey Currawong, Regent Parrot, Malleefowl). As a result, a diverse fauna assemblage is expected to occur within the study area where ranges of species with predominantly southern, eastern or northern distributions overlap. Consequently, some fauna species expected in the region occur near the extreme edge of their range.

The assemblage within each vertebrate class is discussed below, including background information on species of conservation significance. Conservation significant categories are defined in Appendix 2. Summary information on conservation significant species is presented in Table 11. Detailed results of fauna investigations in the field are considered in Section 3.4.

3.3.1 Freshwater fish

Freshwater fish are not expected to occur in the study area and this was confirmed during surveys. Permanent water does occur in some small springs and rock holes and surface water is present following rain, however these water sources are confined to playas or watercourses with very intermittent flows. The watercourses appear to flow only into salt lake systems with no external drainage. Additionally, these watercourses do not appear to link to more extensive systems that support fish, therefore, during high flows there is no evidence to suggest that fish would enter these seasonal playas and watercourses.

3.3.2 Amphibians

A total of 10 frog species may occur in the vicinity of the study area and the presence of four of these was confirmed (Appendix 3). No frogs of conservation significance are expected to occur.

3.3.3 Reptiles

A total of 88 reptile species may occur in the study area and the presence of 49 species (55%) was confirmed (Appendix 3). A further four species have previously been recorded at Yeelirrie (anon. 1978). Fifty-four reptile species have been recorded at Wanjarri Nature Reserve (DEC 2009), some 50 km east of Yeelirrie.

Only two species from the past surveys, expected to occur in the region are considered to be of conservation significance and are discussed below. They were not recorded during the BCE survey.

Conservation Significance Level 1

Great Desert Skink

The Great Desert Skink is listed as Vulnerable under the EPBC Act. It is a large, burrowing lizard, with a scattered distribution and restricted to sandplain and gravelly habitats in the western deserts region of central Australia (Species Bank 2009). It is known to have disappeared from former habitats, particularly in the Gibson Desert and Great Sandy Desert regions.

The Great Desert Skink occupies a variety of habitat types within the Western Desert region. They generally occur on hummock grass sandplains characterised by a dominant cover of Spinifex grasses *Triodia basedowii* and *T. melvillei*. In the Tanami Desert and parts of the Great Sandy Desert, the Great Desert Skink also inhabits paleodrainage lines characterised by giant termite mounds and titree (*Melaleuca sp.*) shrubs (Species Bank 2009).

The decline of the Great Desert Skink has been attributed to altered fire regimes and predation by introduced predators (Species Bank 2009). The Great Desert Skink has been recorded from Wanjarri Nature Reserve (DEC 2009), but was not recorded in the current survey.

Conservation Significance Level 3

(New Legless Lizard) *Aprasia picturata*

This pygopod species has only been recently collected and described by Smith and Henry (1999) and is known only from the vicinity of Leonora and Wiluna. *Aprasia picturata* has only been recorded 35 km east of Leonora, and three and a half kilometres south of Minara Homestead (Smith and Henry 1999). At these locations, Smith and Henry (1999) recorded the species from a low greenstone ridge with pockets of sandy loam supporting a mixed Acacia shrubland and a low rocky ridge with sparse Acacia and *Eremophila* shrubs. It is considered conservation significant

due to its limited distribution and specialised habitat requirements (Wells 2007). It was not recorded in the current survey.

3.3.4 Birds

A total of 155 bird species may occur in the study area and the presence of 82 species (52%) was confirmed (Appendix 3). An additional 26 species previously recorded at Yeelirrie Station (anon. 1978), gives a total of 108 species (69% of those expected) recorded at Yeelirrie. Species recorded by anon. (1978) but not by BCE were mostly waterbirds, suggesting seasonal conditions differed between the two survey periods.

The list of bird species expected to occur within the study area includes 27 of conservation significance. These are discussed below. The Malleefowl, Peregrine Falcon, Bush Stone-curlew, Australian Bustard and Rainbow Bee-eater were the only conservation significant species recorded by BCE. Observations on these, including results of detailed surveys, are presented in Section 3.4.

At least one bird species, the Thick-billed Grasswren, is almost certainly regionally extinct (Blakers *et al.* 1984); a list of regionally extinct species appears in Appendix 3.

Conservation Significance Level 1

Malleefowl

The Malleefowl is listed as Vulnerable under the EPBC and Wildlife Conservation Acts. In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca pauperiflora* M. *sheathiana*), Bowgada (*Acacia ramulosa* var. *linophylla*) and also in other dense litter-forming shrublands including Mulga shrublands (*Acacia aneura*) (Johnstone and Storr 2004). It occurs across the southern part of Australia, with Yeelirrie probably close to the northern edge of its range. The species is threatened by the widespread clearing of habitat, habitat degradation (by fire and livestock) and fox predation.

Malleefowl have been previously recorded on Yeelirrie Station with 10 to 20 breeding pairs estimated to occur on the property (Benshemesh *et al.* 2008). The Benshemesh

data indicates Malleefowl are likely to be confined to *Acacia* shrublands on sandplain in higher landscapes. In the local area, Malleefowl have also been recorded from Wiluna, Mount Keith and Wanjarri Nature Reserve (DEC 2009). Benshemesh *et al.* (2008) considers the Yeelirrie population to be of high importance because it is one of the few examples known of a Malleefowl population in a low rainfall area. One inactive Malleefowl mound was recorded in *Acacia* woodland over sparse *Spinifex* during the BCE survey.

Princess Parrot

The Princess Parrot is listed as Vulnerable under the EPBC Act and as Priority 4 by DEC. This species occurs on red desert sandplains, dunes, along tree-lined watercourses and arid woodlands (DEC 2009). The Princess Parrot is highly nomadic, with its occurrence sporadic through the arid interior. This species has been recorded from Wanjarri Nature Reserve (DEC 2009), and may be a rare visitor to the study area where it may utilise the eucalypt woodland for breeding.

Slender-billed Thornbill

The western sub-species of the Slender-billed Thornbill is listed as Vulnerable under the EPBC Act. The Slender-billed Thornbill occurs in shrubland, typically in areas of saltmarsh dominated by samphire (*Tecticornia* spp.), bluebush (*Maireana* spp.) or saltbush (*Atriplex* spp.) around salt lakes, or in low heath on sandplain (Pavey 2006). The species occurs in a number of disjunct populations in Western Australia, from Shark Bay to the Nullarbor (Johnstone and Storr 2004). The species is declining in much of its range owing to the degradation of chenopod vegetation by livestock and rabbits (Johnstone and Storr 2004) and is considered to be Regionally Extinct in the Northern Territory (Pavey 2006).

The Slender-billed Thornbill has been recorded from the region, from near Meekatharra and Mount Magnet (Birds Australia 2009). While there appears to be no resident population in the study area, there is likely to be a population within 30 km to 50 km. The species uses chenopod shrublands that are often associated with paleodrainage systems, and may utilise the chenopod shrublands of the study area as an irregular visitor.

Peregrine Falcon

The Peregrine Falcon is classified as Specially Protected Fauna under Schedule 4 (Other Specially Protected Fauna) of the Wildlife Conservation Act. Blakers *et al.* (1984) consider that Australia is one of the strongholds of the species, since it has declined in many other parts of the world. The Peregrine Falcon lays its eggs in recesses of cliff faces, tree hollows or in large abandoned nests of other birds (Birds Australia 2009), and pairs maintain a home range of about 20 to 30 km² throughout the year. The species has a known distribution throughout Australia. The Peregrine Falcon has been recorded from Yeelirrie Homestead and from Wanjarri Nature Reserve (Birds Australia 2009), and was recorded from the Barr Smith Range in the BCE survey.

Major Mitchell's Cockatoo

Major Mitchell's Cockatoo is listed under Schedule 4 (Other Specially Protected Fauna) of the *Wildlife Conservation Act*. This species is sporadically distributed through arid and semi-arid Australia and may occur in woodland, sparsely timbered grasslands and shrublands, and rocky outcrops (DEC 2009). The Major Mitchell's Cockatoo has previously been recorded at Yeelirrie Station, where a small flock was seen in Mulga shrubland within the study area (anon. 1978).

Migratory Species:

Eastern Great Egret

Marsh Sandpiper

Common Greenshank

Wood Sandpiper

Common Sandpiper

Black-tailed Godwit

Red-necked Stint

Sharp-tailed Sandpiper

Curlew Sandpiper

Fork-tailed Swift

Rainbow Bee-eater

The above 11 species are listed as Migratory under the EPBC Act. The species and associated habitat covered under JAMBA are also protected under Schedule 3 of the Wildlife Conservation Act (see Table 11). Nine of these species are waterbirds that are occasionally recorded in small numbers and occur throughout inland Australia. This includes a previous record of the Sharp-tailed Sandpiper at Yeelirrie (anon. 1978).

Two of the migratory species, the Fork-tailed Swift and Rainbow Bee-eater, are land birds. The Fork-tailed Swift is a non-breeding summer visitor to Australia, with records widespread but biased by observer distribution (Higgins 1999). The Swift is an almost exclusively aerial species largely independent of terrestrial habitat types. It was previously recorded above playas surrounded by *Melaleuca xerophila* near the resource and surrounds (anon. 1978).

The Rainbow Bee-eater occurs year-around in the tropics of northern Australia and Indonesia with a southward migration to both south-eastern and south-western Australia in early spring. Southern birds return north in autumn (Johnstone and Storr 1998). It nests in burrows dug usually at a slight angle in flat ground, gently elevated slopes, sandy banks or cuttings, and often at the margins of roads or tracks. It has been previously recorded within the study area (Birds Australia 2009) from spinifex grassland with emergent trees and from *Eucalypt* woodland associated with the resource area and surrounds. When present, the Rainbow Bee-eater is common and prominent in natural and altered environments. Although a species of high conservation significance, it is abundant and versatile in its selection of nest sites.

Conservation Significance Level 2

Bush Stone-curlew

The ground-dwelling Bush Stone-curlew is listed as Priority 4 by the DEC and Near Threatened by Garnett and Crowley (2000). The Bush Stone-curlew inhabits lightly timbered open woodlands (DEC 2009) and dense Acacia shrublands including along drainage lines (J. Turpin, pers. obs.) and occurs throughout Australia. It is also known to occur in dense Acacia shrublands on Banded Ironstone ridges such as at Weld Range (J. Turpin and M. Bamford, pers. obs.). This species has suffered a significant

population decline and is now sparsely distributed in the southern parts of Western Australia (Birds Australia 2009). It was recorded in Hardpan Mulga, Calcrete and in the Barr Smith Range (Granite Outcrops and Breakaway habitat) in the current survey (see Section 3.4.3).

Grey Falcon

The Grey Falcon is classified as Priority 4 by the DEC and Near Threatened by Garnett and Crowley (2000). This species appears to have a distribution centred around ephemeral or permanent drainage lines throughout inland Australia, utilising old nests of other species situated in the tallest trees along the river systems (Garnett and Crowley 2000). The Grey Falcon has been recorded in the region, from near Meekatharra and Wiluna (Birds Australia 2009), but was not recorded in the current survey.

Australian Bustard

The Australian Bustard is classified as Priority 4 by the DEC and Near Threatened by Garnett and Crowley (2000). This species is associated with a variety of grassland, grassy woodland and shrubland habitats across Australia, but has declined in the south. The main threats to its survival are a combination of habitat loss/degradation and predation by introduced fauna (e.g. feral Cats and Foxes). The Australian Bustard has been previously recorded from Yeelirrie Station and also at Wanjarri Nature Reserve. Evidence of this species was recorded throughout the study area in all fauna habitats.

Striated Grasswren

The sandplain sub-species of the Striated Grasswren is listed as Priority 4 by DEC and near threatened by Garnett and Crowley (2000). This subspecies has disappeared from the southern fringes of its historical range, being listed by Birdlife International as the Western Central and Southern Inland Australia (BirdLife International 2009), and has declined in density over the remainder of its range (Garnett and Crowley 2000). Striated Grasswrens occur on sandplains dominated by mature *Triodia* hummock grassland with an overstorey of shrubs, usually mallee eucalypts. Fire is recognised as a major threat throughout this sub-species' range (Garnett and Crowley 2000). The Striated Grasswren has been recorded from the Wanjarri Nature Reserve, but was not recorded during the current survey.

Conservation Significance Level 3

Square-tailed Kite

Scarlet-chested Parrot

Both the Scarlet-chested Parrot and Square-tailed Kite are listed as Threatened (Least Concern) under the Action Plan for Australian Birds (Garnett and Crowley 2000). The Square-tailed Kite is sparsely distributed over much of the Australian mainland, with a few scattered records from the region (Birds Australia 2009). The Square-tailed Kite is a specialised predator of small birds taken from the canopy, foraging primarily over forest, woodland, mallee and heath (Garnett and Crowley 2000). This species has previously been recorded at Yeelirrie Station (anon. 1978), but was not recorded in the current survey.

The Scarlet-chested Parrot has declined over much of its range, formerly occurring across the Murchison and into the south-west of Western Australia. This species has also declined in the Goldfields (Garnett and Crowley 2000). Most recent records for the Scarlet-chested Parrot come from arid inland Australia including the Great Victoria Desert. This species has been recorded from the Wanjarri Nature Reserve, but was not recorded in the current survey.

Regent Parrot

The Regent Parrot has been identified by Saunders and Ingram (1995) as one of a number of south-west Australian woodland bird species recognised as declining. It is at the extreme north of its range in the region and is a rare visitor to Wanjarri Nature Reserve. It was not recorded in the current survey.

Rufous-crowned Emu-wren

The Rufous-crowned Emu-wren has a fragmented population in northern and central Australia and is generally uncommon. In general, the species is patchily distributed and within Wanjarri where it has been recorded (Species Bank 2009), it is near the limit of its range. The Rufous-crowned Emu-wren is associated with spinifex, particularly tall, dense and long-unburnt mature hummock grasslands. It was not recorded in the current survey.

Grey Honeyeater

The Grey Honeyeater is uncommon throughout the Murchison and Pilbara, being recorded from a few, scattered localities (Birds Australia 2009). This species inhabits *Acacia* woodlands and shrublands, particularly those dominated by Mulga (*Acacia aneura*), across arid central Australia. The Grey Honeyeater has been recorded at Wanjarri Nature Reserve (Species Bank 2009). It was not recorded in the current survey.

3.3.5 Mammals

A total of 39 mammal species may occur in the study area, including 31 native and eight introduced species. Of these, the presence of 25 species (21 native species being 67% of the native species expected) was confirmed (Appendix 3). Appendix 8 presents the results of the Anabat recordings and Harp trap captures of bats.

The list of mammal species expected to occur within the study area includes six of conservation significance. These are discussed below. The Brush-tailed Mulgara, Black-flanked Rock-Wallaby and Inland Long-eared Bat were the only conservation significant species recorded by BCE. Observations on these, including results of detailed surveys, are presented in Section 3.4.

At least seven mammal species are almost certainly regionally extinct; a list of regionally extinct species appears in Appendix 3.

Conservation Significance Level 1

Crest-tailed Mulgara

There are currently two recognised species of mulgara, the Crest-tailed Mulgara and the Brush-tailed Mulgara. Due to recent re-classifications there is some confusion in museum records and under legislation between these. For most of the last 30 years only the Crest-tailed Mulgara was recognised. More recently, Woolley (2005, 2006) re-assigned the species to the Brush-tailed Mulgara and Crest-tailed Mulgara. The historical taxonomic confusion means that the distribution of the two mulgara species is unclear (Woolley 2005, 2008) and even museum specimens need to be reviewed. However, both species have suffered significant population reduction and fragmentation over the past 80 years (Woolley 2008).

The Crest-tailed Mulgara is listed as Vulnerable under the EPBC and Wildlife Conservation Acts. It occurs primarily in Sandhill Canegrass (*Zygochloa paradoxa*) dominated dunes, Nitre Bush (*Nitraria billardiarei*) grasslands, and Sandhill Canegrass flats near salt lakes (Woolley 2008), and is known with certainty from some of the desert regions along the border between the Northern Territory and South Australia. The status of the species in Western Australia is unclear, while NatureMap has distinguished between the two species of mulgara, the identification of records has yet to be fully resolved. Department of Environment, Water, Heritage and the Arts (DEWHA) has not yet updated the EPBC Act 1999 database and this does not currently distinguish between the two species, listing only the Crest-tailed Mulgara. The species was not recorded in the current survey. The Brush-tailed Mulgara is discussed below (under Conservation Significance Level 2).

Greater Bilby

The Greater Bilby is listed as Vulnerable under the EPBC and Wildlife Conservation Acts. The species formerly utilised a wide range of habitat types across the continent. Extant populations are restricted to a variety of “tall shrublands, open woodlands, hummock grasslands and sparse forblands” (Maxwell *et al.* 1996). Threats to the

species are much the same as those affecting mulgara (see above), e.g. altered fire regimes, introduced grazers and predators. The species appears to remain widespread in the Great Sandy Desert (M. Bamford pers. obs.) and scattered populations occur across the northern Pilbara. In the Great Sandy Desert, the species appears most common in Acacia shrublands associated with paleodrainage lines, where the soils are sandy loams. The Greater Bilby was recorded near Wiluna and Leinster in 1981 (DEC Threatened Species Database 2008) but its status in the region of the study area is uncertain. It was not recorded in the current survey.

Black-flanked Rock-Wallaby

The Black-flanked Rock-Wallaby is listed as Vulnerable under the EPBC Act and Threatened (Schedule 1) under the *Wildlife Conservation Act*. It has declined over much of its range and now occurs in only a few scattered populations across in Western Australia, with very few known from the arid zone. These include a population east of the Fortescue River Roadhouse (Pilbara), in Cape Range, Ningaloo Station, Calvert Range (status uncertain), Durba Hills (status uncertain) and historic records from Weld Range and Mt Farmer near Cue (DEC 2009).

The main factors threatening Rock-Wallaby populations are predation from introduced predators, competition and habitat degradation due to introduced herbivores and over-abundant native herbivores and habitat degradation due to changed fire regimes (Species Bank 2009).

There are anecdotal accounts of Rock-Wallabies in the Barr Smith Range near the study area from DEC (M. Cowan pers. comm.), former residents of Yakabindie Station, and a sighting of two animals thought to be Rock-Wallabies in 2004 (G. Cockerton pers. comm.). Scats of the species, thought to be less than 5 years old, were recorded in the Barr Smith Range in the current survey.

Conservation Significance Level 2

Brush-tailed Mulgara

The Brush-tailed Mulgara is listed as Priority 4 by DEC. It has recently been separated from the similar Crest-tailed Mulgara as discussed above. The Brush-tailed

Mulgara can be separated from the Crest-tailed Mulgara on the basis of the following characteristics (Woolley 2005, 2006):

- appearance of black hairs on the distal half of the tail (a brush in the Brush-tailed Mulgara versus a dorsal crest in the Crest-tailed Mulgara);
- the number of upper pre-molar teeth (two in the Brush-tailed Mulgara versus three in the Crest-tailed Mulgara); and
- in females, the number of teats (six in the Brush-tailed Mulgara versus eight in the Crest-tailed Mulgara).

The Brush-tailed Mulgara is widely distributed in arid regions of the central and western parts of the country (Woolley 2008). It occurs in scattered populations at fairly low density, but may be locally abundant. The density of Brush-tailed Mulgara populations fluctuates depending on long-term climatic conditions and is also sensitive to fire (Woolley 2008). This species occupies spinifex (*Triodia* spp.) grasslands, and burrows in flats between sand dunes.

The Brush-tailed Mulgara has been recorded at Mount Keith and at the Wanjarri Nature Reserve, and is also associated with the Bullimore Land System (EPA 1996), which occurs throughout the Project area. This species was recorded in high abundance throughout Scattered Shrubs over Spinifex Sandplain habitat both within and adjacent to the study area.

Long-tailed Dunnart

The Long-tailed Dunnart is listed as Priority 4 by the DEC. The species appears to be a specialist of rocky habitats and has a probably fragmented distribution from the Pilbara and northern Murchison into the southern Northern Territory and northern South Australia (van Dyck and Strahan 2008). Possible threats include habitat alteration due to introduced herbivores e.g. cattle and rabbits, inappropriate fire regimes, invasion by buffel grass, and predation by cats and foxes (Pavey 2006). The Long-tailed Dunnart has been recorded approximately 100 km north-east of Wiluna (DEC 2009). Suitable habitat is present along the Barr Smith Range, but it was not recorded in the current survey.

Inland Greater Long-eared Bat

The inland sub-species of the Greater Long-eared Bat is listed as Priority 4 by the DEC. Its distribution is poorly-known, but populations occur in the Dundas, Jilbadji and Mt Manning Nature Reserves in Western Australia, and on several Conservation Parks in South Australia (DEWHA 2009b). It was recorded in the current survey.

Conservation Significance Level 3

Kultarr

The Kultarr occurs across central Australia extending into the Murchison. It prefers stoney, granitic plains dominated by *Acacia*, *Eremophila* and *Senna* shrublands (Strahan 1995). The Kultarr is uncommon over most of its range, and populations appear to fluctuate seasonally (Strahan 1995). Some eastern populations are now considered extinct. The Kultarr appears to occur sporadically across the Murchison and has been recorded at Wanjarri Nature Reserve (DEC 2009). It was not recorded in the current survey.

Desert Mouse

The Desert Mouse is a medium sized rodent (15 – 30 g) that has a widespread distribution throughout the arid zone of Australia (Menkhorst and Knight 2001). It is considered locally abundant in habitats containing samphire, sedge, nitrebush or mature spinifex grasslands (Alpers *et al.* 2003). The distribution of the species once extended from the Murray-Darling through the Flinders Ranges to the Gibson and Great Sandy Deserts, to the west coast and onto Bernier Island (Read *et al.* 1999, Menkhorst and Knight 2001). Since European colonisation there has been a contraction of the species' range to the central deserts (Kerle 1995, Read *et al.* 1999).

In Western Australia, the Desert Mouse occurs in the Pilbara and the Central Deserts. At the south-western extreme of its distribution, records come from near Wanjarri Nature Reserve (DEC 2009), Leonora (M. Bamford and J. Turpin, pers. obs.) and from Queen Victoria Spring (DEC 2009). It was not recorded during the current survey.

3.4 Results of Field Investigations

3.4.1 Observations on the recorded vertebrate assemblage

The aim of field investigations is not simply to record species but to gather information about the species and their relationship with the environment of the site. However, the number of species recorded in relation to the number of species expected does give a measure of the completeness of the coverage of the fauna assemblage, which is important in order to be reasonably confident that significant species and/or patterns have not been overlooked. The number of species recorded (160 species by BCE and 30 additional species recorded at Yeelirrie previously (anon. 1978)) represents 54% and 65% respectively of the number of species expected (see Table 10). The coverage of vertebrate classes just by the BCE surveys was 40 %, 55%, 54% and 67% for frogs, reptiles, birds and native mammals respectively. Recording over half the expected species in one year of surveys in an annually variable, arid environment, and in a year without exceptional rain, is a high return. For example, How and Dell (1990) recorded only 75% of the 26 reptile species found across an intensive three year study in any one year in a stable, predictable and high rainfall environment close to Perth.

Among the frogs, the recorded species were found around Yeelirrie Homestead (Main's Frog, Water-holding Frog and Desert Tree Frog) and near rockholes in the Barr Smith Range (Desert Tree-Frog and Western Toadlet) outside the Project area. Conditions were not generally suitable for recording frogs during any of the field surveys. The species expected but not recorded are therefore very likely to be present. All frogs in the area require surface water (ephemeral or permanent) for breeding and may utilise pools ranging from flooded rockholes to riverine pools. The playa areas are likely to be important for frog breeding, as they are freshwater systems.

The reptile assemblage recorded in the region confirmed the presence of a wide range of species, with elements typical of the Murchison area, the central deserts and some more typical of the south-west. Some typically arid desert dwelling species were trapped at the Scattered Shrubs over Spinifex Sandplain sites including skink lizards *Ctenotus ariadnae*, *Ctenotus grandis* and *Lerista desertorum*; and the Long-nosed Delma, *Delma nasuta*. These species occur at Yeelirrie Station near the south-west

extreme of their range. Reptile species more typical of the south-west include the Woodland Dark-flecked Morethia and a blind snake, *Ramphotyphlops bicolor*. The latter record at Yeelirrie represents a small northward extension of the species' known range. Among the 35 species expected but not recorded, 10 are snakes, a group that is regularly undersampled in fauna surveys as many species are cryptic with short activity periods. The lack of significant rain during survey periods may have affected the number of snakes recorded. Other species are close to the limit of their range in the area and while the lack of records may mean they are not present, they may also occur in small numbers and therefore be hard to detect.

Records of the reptile assemblage displayed strong differences between fauna habitats and this is discussed in the following section.

As with the reptiles, the bird assemblage recorded included Murchison, desert and south-west elements. The percentage of expected birds recorded is sensitive to annual conditions, with very few waterbirds included in the surveys; waterbirds made up a high proportion of the species observed by anon. (1978) but not by BCE. There were also lower numbers of desert species than expected which probably reflects the lack of rainfall during the survey periods. However, the expected assemblage of birds also includes species that, because of their mobility, may be very infrequent visitors or even vagrants to the region. Like reptiles, the bird assemblage varied between fauna habitats and this is discussed in the following section.

Mammals were recorded at the highest rate and some groups were well-represented, e.g. nine species of bats were confirmed out of an expected assemblage of 11 species. Rodents were an exception, with only one of four species confirmed, but this probably reflects dry conditions, as rodent populations fall drastically under poor conditions. The expected mammal assemblage also includes a few species, such as the Crest-tailed Mulgara and Greater Bilby, which are of high conservation significance and for which regional records exist, although both probably no longer occur in the region of the Project area. During surveys, evidence of two locally extinct mammal species was found. Old warrens of the Boodie were found regularly on targeted significant fauna survey transects and in all habitats, although possibly with a concentration in Calcrete and Hardpan Mulga habitats. Old nests of the Lesser Stick-nest Rat were found in

small caves along the Barr Smith Range in the Granite Outcrops and Breakaways habitat.

3.4.2 Patterns of distribution and abundance

The trapping and censussing at the 15 systematic sampling sites provide measures of abundance, which make it possible to compare species richness and abundance between fauna habitat types. Trapping and censussing data are presented in Appendix 6, with results summarised in Tables 13 and 14. Systematic sampling sites are shown previously in Figure 5. With both trapping and censussing results, sampling effort varied and this needs to be considered when examining data. Numbers of captures and records for reptiles, mammals and birds have been standardised to allow overall abundance to be compared between sites. Sampling effort can have a great influence on numbers of captures and records, but less of an effect on species richness.

Numbers of captures of reptiles and mammals (Table 13) were greatest at Sites 9 and 10 in habitat described as Scattered Shrubs over Spinifex Sandplain. Reptiles were particularly rich at Site 9 (20 reptile captures/100 trapnights) which had been more recently burnt than Site 10 (13.1 reptile captures/100 trapnights). The Brush-tailed Mulgara was well-represented at Site 10 (13 of 14 individuals trapped and none at Site 9) which was long-unburnt, compared with the recently-burnt Site 9. The greater effort with Elliott traps did not affect reptile captures or the captures of other mammals such as the Ningauai, common at both Sites 9 and 10, but recorded in only small numbers at just two other sites. Several species were recorded only at Site 9 and/or Site 10, and are therefore probably confined to that habitat.

Sites in Calcrete, Hardpan Mulga and Mulga over Spinifex Sandplain habitats were broadly similar in numbers of captures and species, but there was considerable variation between the sites on Calcrete. Sites 1 and 8 exhibited a complex vegetation structure and areas of friable soils with leaf-litter, whereas Sites 11 and 13 were largely open shrublands with hard soils and little leaf-litter. This made a great difference to the numbers of captures and species recorded (16 and 16.4 reptile captures/100 trapnights at Sites 1 and 8 respectively, compared with 1.3 and 1.4

reptile captures/100 trapnights at Sites 13 and 11). Site 11 had the lowest number of reptile species recorded (2) of any site.

Calcrete Outwash (Site 2, 3 and 12) was poor in species, as was Acacia Woodland over Sparse Spinifex habitat (Site 14 and 15), even after allowing for the slightly lower trapping effort at these than at most other sites. Capture rates of reptiles were also low.

Bird censussing results also revealed some trends within and between habitats (Table 14). In this case, the two fauna habitats with Mulga (Hardpan Mulga and Mulga over Spinifex Sandplain) tended to have the greatest numbers of records and species, but one of the Calcrete sites, Site 1, had the greatest number of species and records, and the highest recording rate (6.3 records/day) of any single site. Site 1 occurs in well-developed woodland of *E. gypsophila* and several of the abundant bird species are known to be associated with this canopy, such as the Weebill, Striated Pardalote and Australian Ringneck (Higgins and Peter 2002, Higgins 1999). Other Calcrete sites, the Calcrete Outwash sites and the spinifex sandplain sites, had intermediate numbers of records and species. The Acacia Woodland over Sparse Spinifex was poorest in species and records.

3.4.3 Observations on conservation significant species

Of the 35 species of conservation significance expected to occur within the study area, eight species were recorded by BCE and a further five species had been recorded by anon. (1978) at Yeelirrie. All species are listed in Table 11, indicating their level of significance and those that were recorded. Table 11 also indicates the likelihood of their status in the study area and the likely significance of the proposed development for each species. These are important considerations, as while a species may be recorded, it is of little conservation significance if the recorded individual/s is only a vagrant. Table 12 indicates the preferred habitat of each conservation significant species and the extent of this habitat within the study area, including how they relate to fauna habitat categories, soil type (Blandford & Associates 2010) and vegetation type (Western Botanical 2010).

Even among species that were recorded, the significance of the resource and immediate surrounds is considered to be minor in most cases because the species are considered to be an irregular visitor (16 species), a resident but very widespread (e.g. Peregrine Falcon, Australian Bustard, Square-tailed Kite) or there is little if any habitat actually within the resource and immediate surrounds (eg. Great Desert Skink, the legless lizard *Aprasia picturata*, Long-tailed Dunnart, Kultarr). The Crest-tailed Mulgara probably does not occur in the region but taxonomic uncertainty means it cannot be excluded from this list, while the Greater Bilby is probably locally extinct, but there remains the possibility that a population persists somewhere in the general region. For both these species the significance of the study area is considered to be minor.

For six of the significant species, the study area may be of moderate importance. These are:

- Malleefowl - population known in region and considered to be significant by Benshemesh *et al.* (2008);
- Black-flanked Rock-Wallaby - population known in region;
- Slender-billed Thornbill - may be present in suitable chenopod shrubland;
- Brush-tailed Mulgara – large local population found by BCE (see below);
- Bush Stone-curlew –local population found by BCE, mostly in Calcrete and Hardpan Mulga habitat (see below); and
- Inland Greater Long-eared Bat – species found in area by BCE and suitable roosting habitat (tree hollows).

Except for the Slender-billed Thornbill, all these species were recorded during the BCE field investigations. The only other significant species recorded by BCE was the Peregrine Falcon (a single bird seen over the Barr Smith Range). Appendix 7 presents all records of significant species from the BCE surveys. Details of all records of these significant species are discussed below. Discussion on potential habitat for the Slender-billed Thornbill is also presented.

Bush Stone-curlew

The Bush Stone-curlew was recorded from three locations during the Yeelirrie surveys (see Figure 7 and Appendix 7). These records included tracks and response to

call playback and were made in November 2009 and May 2010, suggesting the birds are resident. Most of the records were north-west of the resource in Calcrete and Hardpan Mulga habitats, but there were also records from along the Barr Smith Range. The species has previously been recorded from Yeelirrie Station and from Wanjarri Nature Reserve (Birds Australia 2009).

Australian Bustard

These birds were seen infrequently (see Appendix 7), but fresh tracks were found throughout the study area, along targeted significant fauna survey transects, and in all fauna habitats including sand dunes. Recorded tracks are shown in Figure 7.

Peregrine Falcon

A single sighting of the Peregrine Falcon was made in the Barr Smith Range (Figure 7). Based on observations of habitat, the species is very likely to breed on a cliff ledge in the Barr Smith Range, and therefore the study area is probably within the foraging territory of this pair.

Rainbow Bee-eater

The species was recorded opportunistically throughout all habitats within the study, specifically in November 2009, and is probably breeding on the margins of some tracks in sandy-loam soil.

Malleefowl

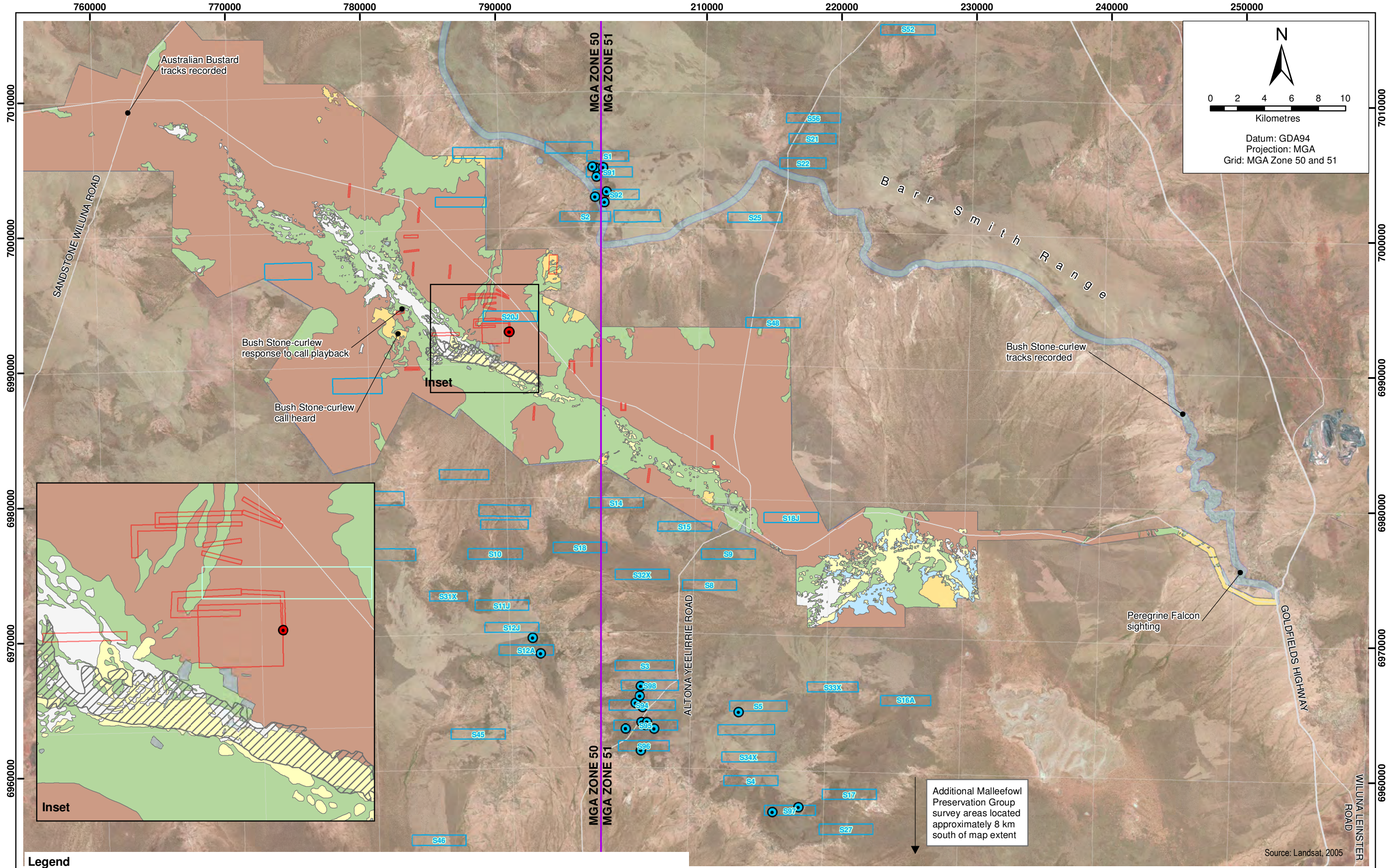
One Malleefowl mound was recorded during the BCE surveys (Figure 7). A recently used mound (within previous 10 years) was recorded amongst closed Acacia shrubland on the northern sandplain, at 790 511E, 6 992 350N, approximately 2 km north of the resource area (Figure 7). The mound was constructed from sand and raised with a well defined central depression (see Plate 23 below). There was leaf-litter and egg shell fragments within the depression and the mound had been constructed over an old track. Despite the presence of this mound, there was no evidence of Malleefowl being present during the BCE surveys within the study area as the distinctive Malleefowl tracks were not found during the Malleefowl and Brush-tailed Mulgara transect surveys.

Benshemesh *et al.* (2008) reported on extensive surveys for Malleefowl mounds and found that all mounds were located in Acacia shrublands to the north and south of the BCE study area, above the granite breakaways. The species seems to be most abundant high in the landscape in Acacia shrublands on gravelly, well drained soils. Locations of the transect surveys and mounds found by Benshemesh *et al.* (2008) are presented in Figure 7.



Plate 23. Malleefowl mound recorded by BCE in the study area.

Note the closed Acacia shrubland surrounding the mound. The mound was constructed from sand, with a diameter of approximately three metres. Egg shell fragments were found within the central depression indicating a successful and recent (approximately 10 years) breeding event.



Legend

- Study Area

Pit Outline

Bamford Consulting Ecologists Targeted Significant Fauna Transect

Inactive Malleefowl Mound
- Malleefowl Preservation Group Survey Area (Benshemesh *et al.* 2008)

Malleefowl Mound
- Fauna Habitat derived from Western Botanical (Bamford, 2011)**

Calcrete

Calcrete Outwash

Chenopod shrubland over sandplain
- Granite Outcrops and Breakaways

Hardpan Mulga

Mixed Shrubs over Spinifex sandplains

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Project
Proposed Yeelirrie Development

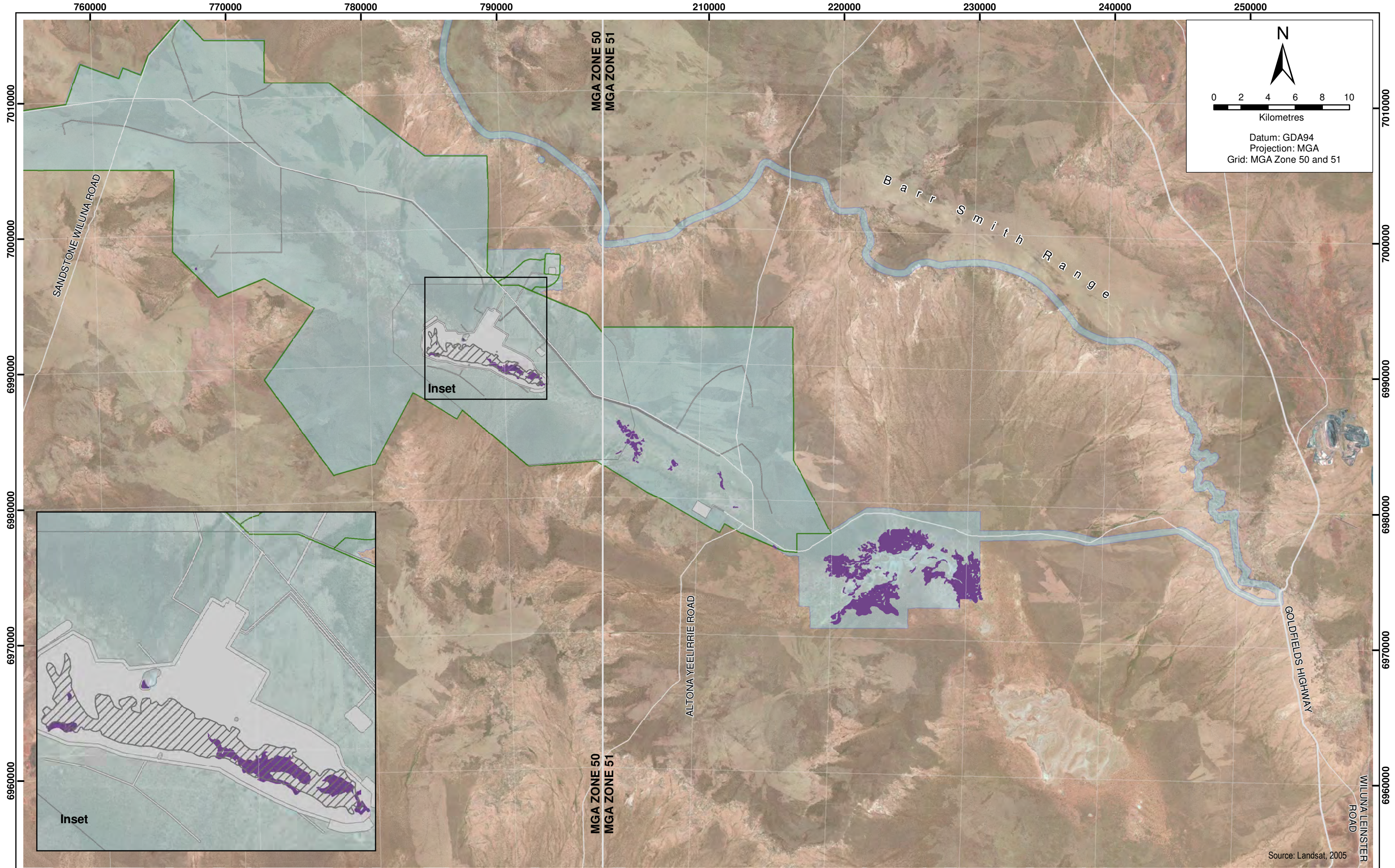
Drawn: DL/CJT	Approved: KD	Date: 20/01/2011
Job No.: 42907132	File No.: 42907132-SUS-205_RD.mxd	

Title
**Evidence of Malleefowl,
Bush Stone-curlew, Australian
Bustard and Peregrine Falcon**


Figure: 7	Rev. D A3
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Slender-billed Thornbill

The Slender-billed Thornbill was not observed during field investigations but suitable habitat is present within the study area and region. Based on interpretation of vegetation types recorded by Western Botanical, the species may occur in some vegetation types in the Calcrete Outwash and Chenopod Shrubland over Sandplain habitats. Components of these three faunal habitats were assessed by BCE, identifying suitable vegetation of dense tall chenopod shrubland. As a result, there may be 2370 ha of habitat for the species in the study area, of which 137 ha (5.7%) lies within the project footprint (Figure 8).



- Legend**
- Pit Outline
 - Project Area
 - Indicative Project Footprint
 - Study Area
 - Slender-billed Thornbill Habitat (derived from Western Botanical 2010)

<div>BHP Billiton Yeelirrie Development Company Pty Ltd</div>	<div>Project Proposed Yeelirrie Development</div>			<div>Title Slender-billed Thornbill Habitat</div>	
<div>BAMFORD CONSULTING ECOLOGISTS</div>					
	Drawn: DL/CJT	Approved: KD	Date: 21/01/2011	Figure: 8	Rev. B
	Job No.: 42907132	File No.: 42907132-SUS-246_RB.mxd			A3

Brush-tailed Mulgara

The Brush-tailed Mulgara was trapped at Sites 6 and 10, and evidence of the species (burrows, foraging holes, scats and tracks) was recorded extensively across the study area (Figure 9, Appendix 7 and Plates 24 and 25). Locations of transects and evidence of the Brush-tailed Mulgara are presented on Figure 9. It was most abundant in the habitat of Scattered Shrubs on Spinifex Sandplain (closely aligned with Bullimore Sandplain Landsystem), was less abundant in the two Mulga habitats and was absent from Acacia woodland on sparse spinifex, Calcrete, Calcrete Outwash and along the granite breakaways (Granite Outcrop and Breakaways habitat) (Plates 25 and 26). The May 2010 survey included a large part of the study area at locations proposed for infrastructure. The species was either uncommon or absent apart from in some of the area proposed for the processing plant, and tailing facilities, which had been recently burnt (within previous five years). Suitable habitat for the Brush-tailed Mulgara comprises approximately 69.9 % (69,840 ha) of the total Project area. Photographs of burrows and habitat are presented below.

A total of 154 burrow systems was recorded in 842 ha of search area. Some burrow systems had multiple entrances and may contain multiple burrows or animals, while there is the chance that several burrows are maintained by one individual. The burrow density of the areas searched are thus a minimum of 0.18 burrows/ha within the search areas. Burrow systems with obvious foraging and track signs were identified as active (Plate 24), although inactive burrows may also be utilised; a total of 86 active burrow systems was recorded or there was an active burrow density of approximately 0.1 burrows/ha. Given there is approximately 69,840 ha of suitable habitat within the Project area, there may be approximately 6,984 active burrow systems within this area. Brush-tailed Mulgara are generally considered to be solitary, with males and females found in the same burrow only during the mating season (van Dyck and Strahan 2008). Therefore, the Project area may support several thousand Brush-tailed Mulgara.

Because of the recent taxonomic revision of the two mulgara species, close attention was paid to identification of all Mulgara handled. Diagnostic features of the dentition and number of teats are presented in Plates 27 and 28 below.



Plate 24. Active Mulgara burrow system (Site 10).



Plate 25. Mulgara habitat – Scattered shrubs over Spinifex over sandplain.
Note the burrow systems in the foreground (Site 10).



Plate 26. Mulgara habitat – Mulga over Spinifex sandplain (Site 5).



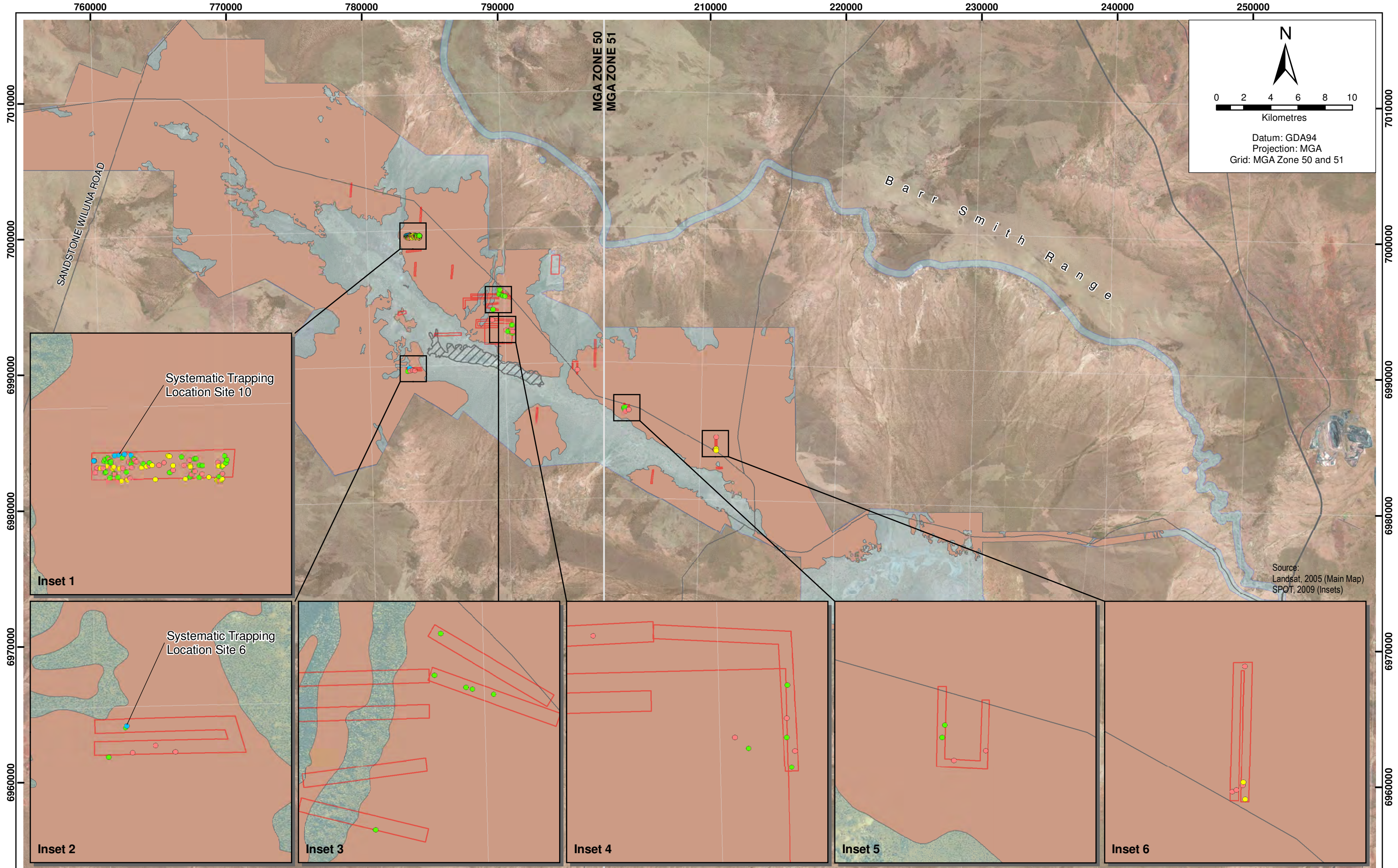
Plate 26. Brush-tailed Mulgara upper pre-molars (Site 10), November 2009.

Note the species has two upper pre-molars whereas the Crest-tailed Mulgara has three.



Plate 27. Brush-tailed Mulgara pouch showing four of the six teats (Site 10), November 2009.

This is a lactating female with young left in the burrow. The Crest-tailed Mulgara has eight teats.



Legend

- | | | | |
|-------------|---------------------------------|----------------------------------|--|
| Study Area | Mulgara Survey Locations | Foraging Holes, Scats and Tracks | Bamford Consulting Ecologists Targeted Significant Fauna Transects |
| Pit Outline | Burrow Active | Trapped | Suitable Mulgara Habitat |
| | Burrow Inactive | | |

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Project
Proposed Yeelirrie Development

Drawn: DL	Approved: KD	Date: 20/01/2011
Job No.: 42907132	File No.: 42907132-SUS-206_RD.mxd	

Title
**Evidence of the
Brush-tailed Mulgara**

Figure: 9	Rev. D A3
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Black-flanked Rock-Wallaby

Anecdotal reports of Black-flanked Rock-Wallabies in the Barr Smith Range provided cause for targeted searches of the animals or their distinctive scats (Creese 2007, see Plate 29), and motion-sensitive cameras were set. No Rock-Wallabies were seen or photographed, but scats were recorded from a small perched cave along the Barr Smith Range at 51J, 247522E, 6984286N and at 51J, 249549E, 6979633N; and 51J, 248175E, 6979824N, approximately 40 km east of the resource (Figure 10). A sample of scats was collected and later verified (by Scats About and Sonia Creese, see Appendix 10) as Rock-Wallaby scats. The only Rock-Wallaby species known from the region is the Black-flanked Rock-Wallaby. Many scats appeared old, however some scats had a dark coating, appeared fairly fresh and were estimated to be less than five years old (S. Creese pers. comm.).

There is extensive suitable habitat for the Black-flanked Rock-Wallaby along the Barr-Smith Range and breakaway area south of the Project area (see Plate 30), with a small portion of breakaway habitat nearby the proposed quarry.

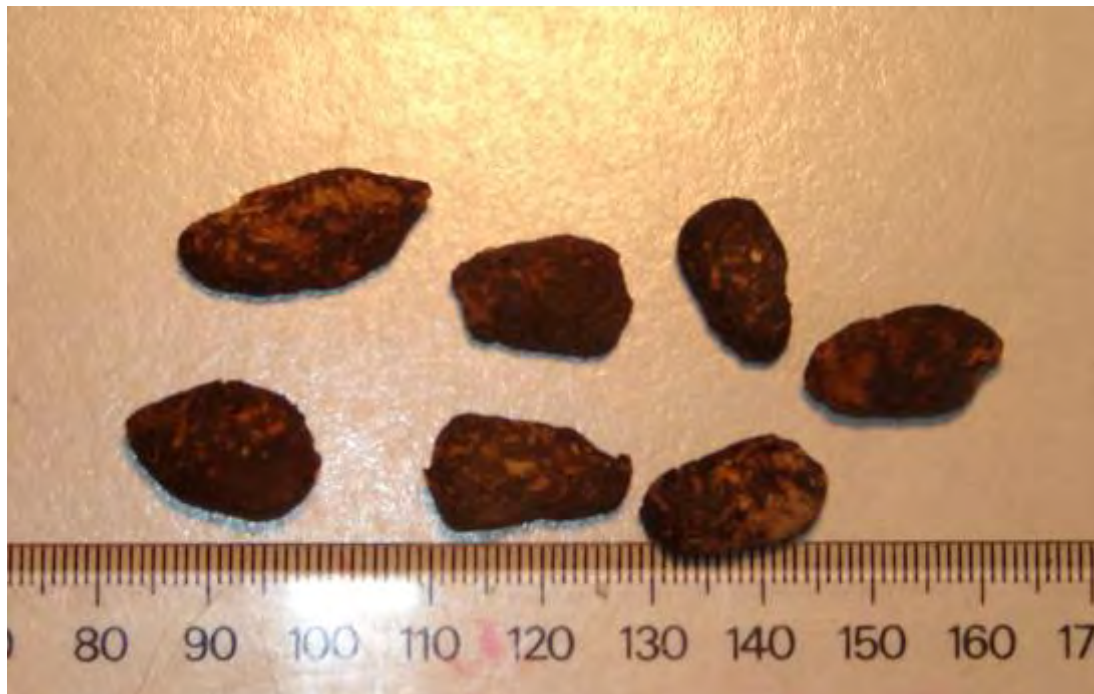


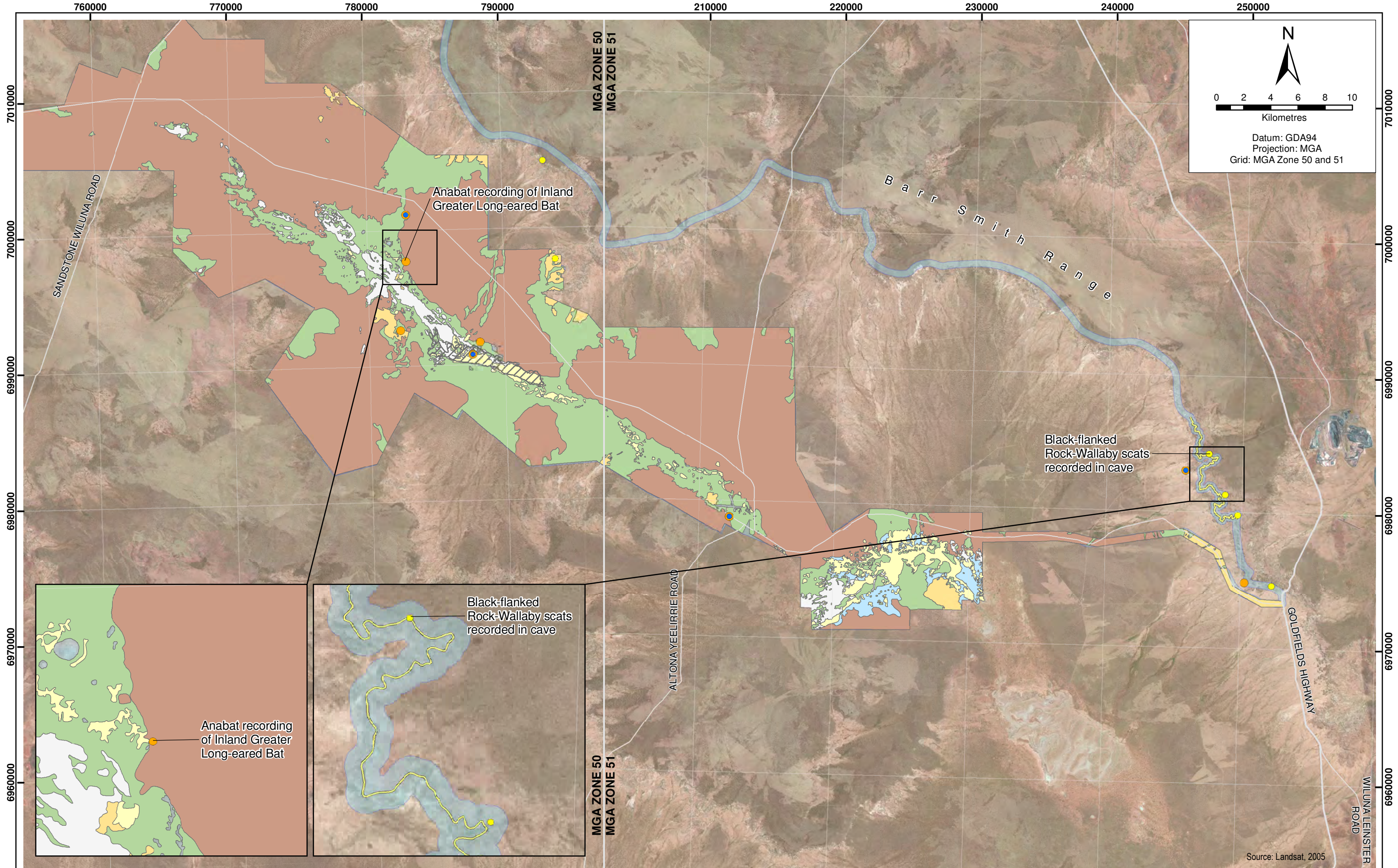
Plate 28. Some examples of the Rock-Wallaby scats collected from a small perched cave along the Barr Smith Range at 51J, 247522E, 6984286N.



Plate 29. Breakaway at Barr Smith Range, providing suitable habitat for the Black-flanked Rock-Wallaby. Old scats of the species were present at this location.

Inland Greater Long-eared Bat

One record of the Inland Greater Long-eared Bat was made with an Anabat recorder, at Rubble Bore (50J, 782841E, 6997710N) within the study area, approximately 6 km northwest of the resource (Appendix 8 and Figure 10). This species roosts singly or in small groups primarily in tree hollows (Churchill 1998) and is likely to utilise the *E. gypsophila* woodland in the Calcrete habitat within and northwest of the resource, as this represents the greatest concentration of large, hollow-bearing trees in the Project area.



N

0246810

Kilometres

Datum: GDA94
Projection: MGA
Grid: MGA Zone 50 and 51

Legend			
	Fauna Habitat derived from Western Botanical (Bamford, 2011)		

BHP Billiton
Yeelirrie Development
Company Pty Ltd

BAMFORD
CONSULTING
ECOLOGISTS

Project Proposed Yeelirrie Development		
Drawn: DL / CJT	Approved: KD	Date: 17/01/2011
Job No.: 42907132	File No.: 42907132-SUS-208_RD.mxd	

Title Evidence of the Black-flanked Rock-Wallaby and the Inland Greater Long-eared Bat	
Figure: 10	Rev. D A3

Table 11. Conservation status of significant fauna species expected to occur in the Project area.

+indicates species that were recorded by Anonymous (1978). ^Local records include: Project area (PA), Wanjarri Nature Reserve (WAN), Mount Keith Mine (MK). Conservation significance categories are defined in Appendix 2.

Species	Reason For Significance				Comments		
	EPBC Act	WA Wildlife Conservation Act	DEC Priority	Other	Recorded in study area	Status in study area	Local records^
CONSERVATION SIGNIFICANCE 1 (CSI)							
<i>Leipoa ocellata</i> Malleefowl	Vulnerable	Schedule 1 (Vulnerable)			Recorded	Resident	PA
<i>Falco peregrinus</i> Peregrine Falcon		Schedule 4			Recorded	Resident	PA
<i>Apus pacificus</i> Fork-tailed Swift	Migratory			JAMBA, CAMBA	Recorded+	Irregular Visitor	Yeelirrie
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory				Recorded	Regular Visitor	PA
<i>Lophocroa leadbeateri</i> Major Mitchell's Cockatoo		Schedule 4			Recorded+	Irregular Visitor	Yeelirrie
<i>Polytelis alexandrae</i> Princess Parrot	Vulnerable		P 4			Irregular Visitor	WAN
<i>Acanthiza iredalei</i> Slender-billed Thornbill	Vulnerable					Irregular Visitor	Meekatharra
<i>Petrogale lateralis</i> Black-flanked Rock-Wallaby		Schedule 1 (Threatened)			Recorded	Resident	study area
<i>Dasycercus cristicauda</i> Crest-tailed Mulgara	Vulnerable	Schedule 1 (Vulnerable)				Unknown	Unknown

Species		Reason For Significance				Comments		
		EPBC Act	WA Wildlife Conservation Act	DEC Priority	Other	Recorded in study area	Status in study area	Local records^
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable	Schedule 1 (Vulnerable)				Locally Extinct	Wiluna
<i>Egernia kintorei</i>	Great Desert Skink	Vulnerable	Schedule 1 (Threatened)				Unknown	WAN
<i>Limosa limosa</i>	Black-tailed Godwit	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	None
<i>Tringa nebularia</i>	Common Greenshank	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Cue
<i>Tringa stagnatalis</i>	Marsh Sandpiper	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Cue
<i>Tringa hypoleucos</i>	Common Sandpiper	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Meekatharra
<i>Tringa glareola</i>	Wood Sandpiper	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Cue
<i>Calidris ruficollis</i>	Red-necked Stint	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Cue
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Migratory	Schedule 3		JAMBA, CAMBA	Recorded+	Irregular Visitor	Yeelirrie
<i>Calidris ferruginea</i>	Curlew Sandpiper	Migratory	Schedule 3		JAMBA, CAMBA		Irregular Visitor	Lake Austin
<i>Ardea modesta</i>	Eastern Great Egret	Migratory	Schedule 3		JAMBA, CAMBA	Recorded+	Irregular Visitor	Yeelirrie

Species	Reason For Significance				Comments		
	EPBC Act	WA Wildlife Conservation Act	DEC Priority	Other	Recorded in study area	Status in study area	Local records^
CONSERVATION SIGNIFICANCE 2 (CS2)							
<i>Dasymercus blythi</i> Brush-tailed Mulgara			P 4		Recorded	Resident	PA
<i>Falco hypoleucos</i> Grey Falcon			P 4			Irregular Visitor	WAN
<i>Ardeotis australis</i> Australian Bustard			P 4		Recorded	Resident	PA
<i>Burhinus grallarius</i> Bush Stone-curlew			P 4		Recorded	Resident	PA
<i>Amytornis striatus</i> Striated Grasswren			P 4			Irregular visitor	WAN
<i>Sminthopsis longicaudata</i> Long-tailed Dunnart			P 3			Resident	Wiluna
<i>Nyctophilus timoriensis</i> Inland Greater Long-earedBat			P 4		Recorded	Resident	PA
CONSERVATION SIGNIFICANCE 3 (CS3)							
<i>Aprasia picturata</i> legless lizard				Restricted range, few records		Unknown	Wiluna
<i>Lophoictinia isura</i> Square-tailed Kite				Generally uncommon to rare	Recorded	Regular Visitor	Yeelirrie
<i>Polytelis anthopeplus</i> Regent Parrot				Edge of range		Vagrant	WAN
<i>Neophema splendida</i> Scarlet-chested Parrot				Western edge of range		Irregular Visitor	WAN

Species	Reason For Significance				Comments		
	EPBC Act	WA Wildlife Conservation Act	DEC Priority	Other	Recorded in study area	Status in study area	Local records^
<i>Stipiturus ruficeps</i> Rufous-crowned Emu-wren				Uncommon and patchily distributed		Resident	WAN
<i>Conopophila whitei</i> Grey Honeyeater				Generally uncommon to rare		Resident	WAN
<i>Antichinomys laniger</i> Kultarr				Generally uncommon to rare		Resident	MK
<i>Pseudomys desertor</i> Desert Mouse				Edge of range		Resident	MK

Table 12. Preferred habitat of conservation significant fauna species expected to occur in the Project area on the basis of fauna habitat, soil landscape and vegetation.

Species	Extent of preferred habitat in the Project area	BCE Fauna Habitat	Soil Landscapes (Blandford & Associates)	Vegetation Code (Western Botanical)
CONSERVATION SIGNIFICANCE 1 (CS1)				
<i>Leipoa ocellata</i> Malleefowl	Some; dense Acacia shrublands on sandplains Most habitat is thought to be associated outside the Project area, confined to Acacia Shrublands on Sandplain in higher landscapes	Acacia Woodland over Sparse Spinifex	Sand plain system	SAMU, HPMS, SAWS, SAMA
<i>Polytelis alexandrae</i> Princess Parrot	Some; <i>E. gypsophila</i> woodland patches	Calcrete	Calcrete system	CEgW, CMGbS
<i>Lophocroa leadbeateri</i> Major Mitchell's Cockatoo	Some; <i>E. gypsophila</i> woodland patches	Calcrete	Calcrete system	CEgW, CMGbS
<i>Merops ornatus</i> Rainbow Bee-eater	Extensive; woodlands on sandplains throughout the Project area	Spinifex Sandplain, Calcrete, Hardpan Mulga	Calcrete, playa and sand plain systems	Numerous including: CEgW, SAMU, SAMA
<i>Apus pacificus</i> Fork-tailed Swift	Not applicable; Aerial species	Not applicable	Not applicable	Not applicable
<i>Falco peregrinus</i> Peregrine Falcon	Minimal; potential breeding sites along Barr Smith Range and in <i>E. gypsophila</i> woodland on Deposit.	Granite Outcrops and Breakaways, Calcrete and Spinifex sandplain	Granite system, calcrete system and sand plain system	CEgW, GR, DRES, DRMS

Species	Extent of preferred habitat in the Project area	BCE Fauna Habitat	Soil Landscapes (Blandford & Associates)	Vegetation Code (Western Botanical)
Migratory Bird species: <i>Limosa limosa</i> Black-tailed Godwit <i>Tringa nebularia</i> Common Greenshank <i>Tringa stagnatalis</i> Marsh Sandpiper <i>Tringa hypoleucos</i> Common Sandpiper <i>Tringa glareola</i> Wood Sandpiper <i>Calidris ruficollis</i> Red-necked Stint <i>Calidris ferruginea</i> Curlew Sandpiper <i>Calidris acuminata</i> Sharp-tailed Sandpiper <i>Ardea modesta</i> Eastern Great Egret	Negligible; seasonal waterbodies in some areas.	Not applicable	Playa system	Seasonal wetlands including those associated with PLMf, PLAET, PLCh, PLELG
<i>Acanthiza iredalei</i> Slender-billed Thornbill	Some; small areas of chenopod shrublands in the Project area	Subsets of the Calcrete Outwash and Chenopod Shrubland on Sandplain	Playa system, calcrete system	PLCsMp, CMpS, CApS
<i>Petrogale lateralis</i> Black-flanked Rock-Wallaby	Negligible; rocky outcrops with caves and rock piles associated with the Barr Smith Range. May forage and move into the Project area during dispersal.	Granite Outcrops and Breakaways	Granite system	Qtz
<i>Dasyercus cristicauda</i> Crest-tailed Mulgara	Unknown due to recent taxonomic revision. Probably sand dunes and grasslands near salt lakes.	Unknown	Unknown	Unknown
<i>Macrotis lagotis</i> Greater Bilby	Extensive; Spinifex sandplains adjacent to Deposit.	Spinifex Sandplains	Sand plain system	May occur across numerous including SDSH, SASP, SAWS, SAMA, SAHS
<i>Liopholis kintorei</i> Great Desert Skink	Minimal; species prefers sandy soils whereas even sandplains in the Project area are a sandy-loam.	Spinifex Sandplains	Sand plain system	SDSH, SASP, SAMA, SAMU, SAWS

Species	Extent of preferred habitat in the Project area	BCE Fauna Habitat	Soil Landscapes (Blandford & Associates)	Vegetation Code (Western Botanical)
CONSERVATION SIGNIFICANCE 2 (CS2)				
<i>Dasycercus blythi</i> Brush-tailed Mulgara	Extensive; Spinifex sandplains adjacent to Deposit, areas of Mulga shrubland and open woodland to the south of Deposit.	Spinifex Sandplains	Sand plain system	SASP, SAWS, SAMA, SAHS, SAGS, SAMU, WABS, SDSH
<i>Burhinus grallarius</i> Bush Stone-curlew	Extensive; <i>E. gypsophila</i> woodland, dense Acacia shrublands, gnamma holes and <i>Casuarina</i> woodland.	All	All	Numerous including CEGW, CCpW, CAbS, CMxS, SAMU, SAWS, DRMS, GRMU
<i>Ardeotis australis</i> Australian Bustard	Some; sandplains adjacent to Deposit.	Spinifex Sandplains	Sand plain system	Numerous including SASP, SDSH, SAMA, SAHS
<i>Falco hypoleucos</i> Grey Falcon	Some; dense shrublands within the Project area	Spinifex Sandplains	Sand plain system	SAMU, SASP, SDSH
<i>Amytornis striatus</i> Striated Grasswren	Some; mature Spinifex Sandplains within the Project area	Spinifex sandplains	Sand plain system	SASP
<i>Nyctophilus major tor</i> Inland Greater Long-eared Bat	Negligible; rocky ridges and stony slopes with Spinifex associated with the Barr Smith Range. May forage and move into the Project area during dispersal.	Granite Outcrops and Breakaways	Granite system	GR, GRMS, GPOS, BCLS
<i>Sminthopsis longicaudata</i> Long-tailed Dunnart	Rocky ridges, stony slopes with Spinifex	Granite Outcrops and Breakaways	Granite system	GR, GRMS, GPOS, BCLS
CONSERVATION SIGNIFICANCE 3 (CS3)				
<i>Aprasia picturata</i>	Negligible; rocky areas associated with the Barr Smith Range.	Granite Outcrops and Breakaways	Granite system	GR, GRMS, GPOS, BCLS
<i>Lophoictinia isura</i> Square-tailed Kite	Some; <i>E. gypsophila</i> woodland patches within the Project area, extensive areas of Mulga shrubland.	Calcrete, Spinifex Sandplains	Calcrete system, Granite system	Numerous including SAMU, DRES, DRMS, GRMU, CEGW.

Species	Extent of preferred habitat in the Project area	BCE Fauna Habitat	Soil Landscapes (Blandford & Associates)	Vegetation Code (Western Botanical)
<i>Polytelis anthopeplus</i> Regent Parrot	Some, but usage probably infrequent.	Calcrete	Calcrete system	CEgW.
<i>Neophema splendida</i> Scarlet-chested Parrot	Some; <i>E. gypsophila</i> woodland patches and extensive areas of Mulga shrubland within the Project area. Potential breeding in <i>Eucalyptus gypsophila</i> woodland	Calcrete, Spinifex Sandplains	Calcrete system, Sand plain system	Numerous including CEgW, SAMU, SAWS, DRMS, DRES
<i>Stipiturus ruficeps</i> Rufous-crowned Emu-wren	Extensive; Spinifex Sandplains adjacent to Deposit.	Spinifex Sandplains	Sand plain system	SASP
<i>Conopophila whitei</i> Grey Honeyeater	Extensive; areas of Mulga shrubland within the Project area.	Spinifex Sandplains	Sandplain system, Granite system	SAMU, SAWS, DRMS, GRMU
<i>Antichinomys laniger</i> Kultarr	Minimal; Stony plains occurs mostly outside the Project area along the proposed Haul Road.	Granite Outcrops and Breakaways	Granite system	SAES
<i>Pseudomys desertor</i> Desert Mouse	Extensive; Spinifex Sandplains adjacent to Deposit, small areas of chenopod shrublands in the Project area.	Spinifex Sandplains, Calcrete Outwash	Sand plain system	SASP, SAWS, SAMA, SAHS, SAGS, SAMU, WABS, SDSH

Table 13. Number of reptile captures at each sampling site, combined for March and November 2009. Sites are grouped by Fauna Habitat type as described in Section 3.2.

No sampling undertaken in the Chenopod Shrubland on Sandplain and Granite Outcrops and Breakways habitat as these were considered outside the area of impact.

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia Woodland over sparse Spinifex		Total Number of Individuals
Site code:	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15	
Number of trapnights	140	150	120	125	140	140	150	200	200	200	200	225	350	155	150	
<i>Diplodactylus conspicillatus</i>			1						1	2						4
<i>Diplodactylus granariensis</i>			2									1			1	4
<i>Diplodactylus pulcher</i>							1									1
<i>Gehyra varigata</i>	14	1	2		1		2				1		1	1		23
<i>Heteronotia binoei</i>	1			2		3					1					7
<i>Nephurus vertebralis</i>			2			2	2	1	3		1					11
<i>Rhynchoedura ornata</i>	3		2									2			1	8
<i>Strophurus elderi</i>												6				6
<i>Strophurus strophurus</i>			1				1									2
<i>Strophurus wellingtonae</i>			1													1
<i>Delma nasuta</i>												1				1
<i>Lialis burtonis</i>												1				1

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia Woodland over sparse Spinifex		Total Number of Individuals
Site code:	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15	
Number of trapnights	140	150	120	125	140	140	150	200	200	200	200	225	350	155	150	
<i>Pygopus nigriceps</i>										1						1
<i>Ctenophorus isolepis</i>										1		6	11			18
<i>Ctenophorus nuchalis</i>					1											1
<i>Pogona minor</i>												1				1
<i>Varanus caudolineatus</i>								2		1	1					4
<i>Varanus eremius</i>																1
<i>Varanus gouldii</i>											1	2	2			5
<i>Varanus panoptes</i>					1		1							1		3
<i>Cryptoblepharus buchananii</i>		1	1			1										3
<i>Cryptoblepharus plagiocephalus</i>				1												1
<i>Ctenotus ariadnae</i>												2	1			3
<i>Ctenotus grandis</i>												1	6			7
<i>Ctenotus hanloni</i>												1				1
<i>Ctenotus helenae</i>												15	16			31

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia Woodland over sparse Spinifex		Total Number of Individuals
Site code:	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15	
Number of trapnights	140	150	120	125	140	140	150	200	200	200	200	225	350	155	150	
<i>Ctenotus leonhardii</i>									15	6		1		1	4	27
<i>Ctenotus pantherinus</i>												2	1			3
<i>Ctenotus schomburgkii</i>			3					2	1	3	9					18
<i>Egernia depressa</i>									1		1					2
<i>Eremiascincus richardsoni</i>		1	5			2										8
<i>Lerista desertorum</i>	1		1		1					1						4
<i>Lerista rhodonoides</i>	1					1	1		1			2	2			8
<i>Mentia greyii</i>	1				2			6	1	3	2		4			19
<i>Morethia butleri</i>		1	3		1						2					7
<i>Tiliqua occipitalis</i>													1			1
<i>Tiliqua multifasciata</i>												1	1			2
<i>Ramphotyphlops hamatus</i>	1															1
<i>Ramphotyphlops bicolor</i>								1								1
<i>Pseudonaja modesta</i>									1						1	2
<i>Pseudonaja nuchalis</i>						1										1

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia Woodland over sparse Spinifex		Total Number of Individuals
Site code:	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15	
Number of trapnights	140	150	120	125	140	140	150	200	200	200	200	225	350	155	150	
<i>Simoselaps bertholdii</i>	1				1		1									3
<i>Dasyercus blythi</i>									1				13			14
<i>Sminthopsis hirtipes</i>		1							1	1		4				7
<i>Sminthopsis macroura</i>				1	5											6
<i>Sminthopsis ooldea</i>		1														1
<i>Ningauai ridei</i>									1	2		10	6			19
N CAPTURES reptiles	23	4	23	3	8	9	9	12	24	18	19	45	46	3	7	355
N CAPTURES mammals	0	2	0	1	5	0	0	0	3	3	0	14	19	3	0	50
N species	8	6	12	2	8	6	7	5	9	10	9	18	13	3	4	
Reptile captures/100 trapnights	16.0	1.3	16.4	1.6	5.7	6.4	6.0	6	12	9	9.5	20	13.1	1.9	4.6	
Mammal captures/100 trapnights	0	1.3	0	0.8	3.5	0	0	0	1.5	1.5	0	6.2	5.4	1.9	0	

Table 14. Number of records of birds during censussing at each sampling site, combined for March and November 2009.

Fauna habitats as described in Section 3.2. See Appendix 3 for species names. No sampling undertaken in the Chenopod Shrubland on Sandplain and Granite Outcrops and Breakways habitat as these were considered outside the area of impact.

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia woodland over sparse Spinifex	
Site	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15
Species\N sampling days	7	5	7	5	7	7	5	10	10	10	10	10	10	5	5
Emu					1				1		1		1		
Crested Pigeon											1		1		
Wedge-tailed Eagle				1					2						
Brown Falcon									1						
Nankeen Kestrel	1														
Bush Stone-curlew			1												
Galah	1														
Australian Ringneck	2	3						1							
Mulga Parrot						2									
Horsfield's Bronze-Cuckoo				1											
White-winged Fairy-wren					13	2	4					4			
Inland Thornbill	2			3		2								2	
Slatey-backed Thornbill								3	5	3					

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia woodland over sparse Spinifex	
Site	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15
Species\N sampling days	7	5	7	5	7	7	5	10	10	10	10	10	10	5	5
Chestnut-rumped Thornbill							1	4	5	11	3		2		1
Yellow-rumped Thornbill						4		1	8	3					
Striated Pardalote	6	1									1				
Weebill	8	1		2											
Yellow-throated Miner	9	6	4	1	2	3			2		3				
Spiny-cheeked Honeyeater								1							
Singing Honeyeater		1		2		1	1	3			1	2			1
Grey-crowned Babbler	2	1				3	2				2				
Black-faced Cuckoo-shrike	2	1											1		
Rufous Whistler								1	2	3	1		1		
Grey Shrike-thrush							1				1				1
Crested Bellbird			2						1	1	4	1	3	2	1

Fauna Habitat	Calcrete				Calcrete outwash			Hardpan Mulga		Mulga over Spinifex sandplain		Scattered shrubs over Spinifex sandplain		Acacia woodland over sparse Spinifex	
Site	1	13	8	11	2	3	12	4	6	5	7	9	10	14	15
Species\N sampling days	7	5	7	5	7	7	5	10	10	10	10	10	10	5	5
Black-faced Woodswallow				2		4		2			2	1	6		
Masked Woodswallow			2							4					
Grey Butcherbird	1		1					1			1				1
Pied Butcherbird	6	1				1							2		1
Australian Magpie	1														1
Willie Wagtail	1						2		1	1	1		2		
Little Crow	1														
Torresian Crow								1							
Red-capped Robin			2					8	5	1	3				
Mistletoebird	1							1							
N records	44	15	12	11	15	22	11	27	29	27	23	8	17	4	7
Species Ricness	15	8	6	7	3	9	6	12	11	8	14	4	9	2	7
N records/day	6.3	5.0	1.7	2.2	2.1	3.1	2.2	2.7	2.9	2.7	2.3	0.8	1.7	0.8	1.4

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APPENDICES

Appendix 1. Soil landscapes (provided by D. C. Blandford and Assoc. 2009) and vegetation communities (provided by Western Botanical 2010).

Soil Landscape	Code	Vegetation Community Name
Granite system	SAES	Stony Acacia Eremophila Shrubland
	BCLS	Breakaway Chenopod Low Shrubland
	GFGGr	Granite Foot Slope Grassland
	GPOS	<i>Ptilotus obovatus</i> Shrubland
	Qtz	Quartz Ridge
	GR	Granite Rise
	GRMS	Mulga Shrubland on Granite Rise
Sand plain system	SASP	Sand plain Spinifex Hummock Grassland
	SAWS	Sand plain Spinifex Hummock Grassland with Wattles
	SAMA	Sand plain Spinifex Hummock Grassland with Mallee
	SAHS	Sand plain Spinifex Hummock Grassland with Heath
	SAGS	Sand plain Spinifex Hummock Grassland with <i>Eucalyptus gongylocarpa</i>
	SDSH	Sand Dune Shrubland
	SAMU	Sandplain Mulga Spinifex Hummock Grassland
Playa System	PLAPoS	<i>Acacia Ptilotus obovatus</i> Shrubland
	PLAET	<i>Acacia Eremophila</i> Thicket
	PLAMi	<i>Acacia Melaleuca interioris</i> Shrubland
	PLMf	<i>Muehlenbeckia florulenta</i> Shrubland
	PLCsMp	<i>Cratystylis subspinescens</i> and <i>Maireana pyramidata</i> Shrubland
	PLEmc	<i>Eremophila maculata</i> ssp. <i>brevifolia</i> Shrubland
	PLEml	<i>Eremophila malacoides</i> Shrubland
	PLEsp	<i>Eragrostis</i> sp. Grassland on Playa
	PLCh	Chenopods on Scalded Areas

Hardpan and Drainage System	WABS	Wanderrie Bank Grassy Shrubland
	HPMS	Hardpan Plain Mulga Shrubland
	DRMS	Drainage Tract Mulga Shrubland
	DRES	Drainage Line <i>Eucalyptus</i> Woodland
	GRMU	Mulga Groves on Hardpan Plains
Calcrete system	CEgW	<i>Eucalyptus gypsophila</i> Woodland on Calcrete
	CCpW	<i>Casuarina pauper</i> Woodland on Calcrete
	CMxS	<i>Melaleuca xerophila</i> Shrubland on Calcrete
	CAbS	<i>Acacia burkittii</i> Shrubland on Calcrete
	CMiS	<i>Melaleuca interioris</i> Shrubland on Calcrete
	CErG	<i>Eragrostis</i> sp. Grassland on Calcrete
	CAPs	<i>Atriplex</i> sp. Yeelirrie Station Shrubland on Calcrete
	CRdS	<i>Rhagodia</i> sp. Shrubland on Calcrete
	CMpS	<i>Maireana pyramidata</i> Shrubland on Calcrete
	CLaS	<i>Lycium australe</i> Shrubland on Calcrete
	CMGbS	Mulga <i>Grevillea berryana</i> Shrubland on Calcrete

Appendix 2. Assessment of conservation status

Table A. Categories used in the assessment of conservation status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation Act and the Western Australian Wildlife Conservation Act.

Extinct. Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild. Taxa known to survive only in captivity.
Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered. Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened. Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern. Taxa that are not Threatened.

Table B. Schedules used in the WA Wildlife Conservation Act

Schedule 1. Rare and Likely to become Extinct.
Schedule 2. Extinct.
Schedule 3. Migratory species listed under international treaties.
Schedule 4. Other Specially Protected Fauna.

Table C. WA Department of Conservation and Land Management Priority species (species not listed under the Conservation Act, but for which there is some concern).

<p>Priority 1. Taxa with few, poorly known populations on threatened lands.</p> <p>Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.</p> <p>Priority 3. Taxa with several, poorly known populations, some on conservation lands.</p> <p>Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.</p> <p>Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).</p>

Appendix 3. Vertebrate fauna assemblage of the study area, based on the desktop review and indicating those species confirmed to be present during BCE surveys (X).

Levels of Conservation Significance (Status) are discussed in the “Assessment of Conservation Significance” section. WAM indicates species recorded in the region by the Western Australian Museum, DEC indicates species recorded on DEC databases, Lit indicates species reported in the region from the literature. WJ indicates species recorded from Wanjarri Nature Reserve (DEC).

* indicates species previously recorded at Yeelirrie (anon. 1978).

FROGS

Species	Status	Source	Local Records	BCE
HYLIDAE (Tree frogs)				
<i>Cyclorana maini</i> Main's Frog		DEC WJ		X
<i>Cyclorana platycephala</i> Water-holding Frog		WAM		X
<i>Litoria rubella</i> Desert Tree Frog		Lit		X
MYOBATRACHIDAE (Ground frogs)				
<i>Limnodynastes spenceri</i> Spencer's Frog		WAM		
<i>Neobatrachus aquilonius</i> Northern Burrowing Frog		DEC WJ		
<i>Neobatrachus centralis</i> Trilling Frog		DEC WJ		
<i>Neobatrachus kunapalari</i> Kunapalari Frog		WAM		
<i>Neobatrachus sutor</i> Shoemaker Frog		Lit		
<i>Neobatrachus wilsmorei</i> Wilsmore's Frog		WAM		
<i>Pseudophryne occidentalis</i> Western Toadlet		WAM		X
Total Species Expected: 10				
Total Species Recorded: 4			3	4

REPTILES

Species	Status	Source	Local Records	BCE
CHELUIDAE (freshwater tortoise)				
<i>Chelodina steindachneri</i> Flat-shelled Tortoise	WAM			
GEKKONIDAE (geckoes)				
<i>Diplodactylus conspicillatus</i> Fat-tailed Gecko	WAM		*	X
<i>Diplodactylus granariensis rex</i> Goldfields Stone Gecko	WAM			X
<i>Diplodactylus pulcher</i> Western Saddled Ground Gecko	WAM			X
<i>Diplodactylus squarrosus</i> Mottled Ground Gecko	WAM			
<i>Diplodactylus stenodactylus</i> Pale-snouted Ground Gecko	Lit			
<i>Gehyra purpurascens</i> Purple Arid Dtella	Lit			
<i>Gehyra punctata</i> Spotted Rock Dtella	Lit		*	
<i>Gehyra variegata</i> Variegated Dtella	WAM		*	X
<i>Heteronotia binoei</i> Bynoe's Gecko	WAM		*	X
<i>Nephrurus vertebralis</i> Midline Knob-tail	WAM		*	X
<i>Nephrurus wheeleri</i> Southern Banded Knob-tail	WAM			
<i>Oedura marmorata</i> Marbled Velvet Gecko	Lit			
<i>Rhynchoedura ornata</i> Beaked Gecko	WAM			X
<i>Strophurus assimilis</i> Thorn-tailed Gecko	Lit			
<i>Strophurus elderi</i> Jewelled Gecko	WAM			X
<i>Strophurus strophurus</i> Western Ring-tailed Gecko	WAM			X
<i>Strophurus wellingtonae</i> Western Shield Spiny-tailed Gecko	WAM			X
<i>Underwoodisaurus milii</i> Barking Gecko	Lit			
PYGOPODIDAE (legless lizards)				
<i>Aprasia picturata</i>	CS2 Lit			
<i>Delma butleri</i> Unbanded Delma	WAM			X
<i>Delma nasuta</i> Long-nosed Delma	WAM			X
<i>Delma petersoni</i>	WAM			
<i>Lialis burtonis</i> Burton's Legless Lizard	WAM		*	X
<i>Pygopus nigriceps</i> Western Hooded Scaly-foot	WAM			X
AGAMIDAE (dragon lizards)				
<i>Caimanops amphiboluroides</i> Mulga Dragon	WAM			
<i>Ctenophorus caudicinctus</i> Ring-tailed Dragon	WAM		*	X
<i>Ctenophorus isolepis</i> Military Dragon	WAM		*	X
<i>Ctenophorus nuchalis</i> Central Netted Dragon	WAM		*	X

Species	Status	Source	Local Records	BCE
<i>Ctenophorus reticulatus</i> Western Netted Dragon	WAM		*	
<i>Ctenophorus salinarum</i> Claypan Dragon	WAM			
<i>Ctenophorus scutulatus</i> Lozenge-marked Dragon	WAM			X
<i>Lophognathus longirostris</i> Long-nosed Dragon	WAM			
<i>Moloch horridus</i> Thorny Devil	WAM		*	X
<i>Pogona minor</i> Western Bearded Dragon	WAM		*	X
<i>Tympanocryptis cephalo</i> Earless Pebble Dragon	WAM			
VARANIDAE (monitors or goannas)				
<i>Varanus brevicauda</i> Short-tailed Monitor	WAM			
<i>Varanus caudolineatus</i> Stripe-tailed Monitor	WAM			X
<i>Varanus eremius</i> Desert Pygmy Monitor	WAM			X
<i>Varanus giganteus</i> Perentie	Lit		*	X
<i>Varanus gouldii</i> Sand Goanna	WAM		*	X
<i>Varanus panoptes</i> Yellow-spotted Monitor	WAM			X
<i>Varanus tristis</i> Black-headed Monitor	WAM		*	
SCINCIDAE (skink lizards)				
<i>Cryptoblepharus buehananii</i> Fence Skink	WAM			X
<i>Cryptoblepharus plagiocephalus</i> Fence Skink	Lit			X
<i>Ctenotus ariadnae</i>	Lit			X
<i>Ctenotus calurus</i>	Lit			
<i>Ctenotus dux</i>	Lit			
<i>Ctenotus grandis</i>	Lit		*	X
<i>Ctenotus hanloni</i>	Lit			X
<i>Ctenotus helenae</i> Clay Soil Ctenotus	WAM		*	X
<i>Ctenotus leonhardi</i> Leonhardi's Ctenotus	WAM		*	X
<i>Ctenotus pantherinus</i> Leopard Skink	WAM			X
<i>Ctenotus quattuordecimlineatus</i>	WAM			
<i>Ctenotus schomburgkii</i> Barred Wedge-snout Ctenotus	WAM		*	X
<i>Ctenotus severus</i> Stern Rock Ctenotus	Lit			
<i>Ctenotus uber</i> Spotted Ctenotus	Lit			
<i>Egernia depressa</i> Pygmy Spiny-tailed Skink	WAM		*	X
<i>Egernia formosa</i> Goldfields Crevice Skink	Lit			
<i>Liopholis inornata</i> Desert Skink	WAM		*	X
<i>Liopholis kintorei</i> Great Desert Skink	CSI Lit			

Species	Status	Source	Local Records	BCE
<i>Liopholis striata</i> Night Skink	DEC			X
<i>Eremiascincus richardsonii</i> Broad-banded Sand-swimmer	WAM		*	X
<i>Lerista bipes</i>	Lit			
<i>Lerista desertorum</i>	WAM		*	X
<i>Lerista rhodenoides</i>	WAM		*	X
<i>Menetia greyii</i> Common Dwarf Skink	WAM		*	X
<i>Morethia butleri</i> Woodland Dark-flecked Morethia	WAM			X
<i>Tiliqua occipitalis</i> Western Blue-tongue	Lit		*	X
<i>Tiliqua multifasciata</i> Centralian Blue-tongue	WAM		*	X
TYPHLOPIDAE (blind snakes)				
<i>Ramphotyphlops bicolor</i> Dark-spined blind snake				X
<i>Ramphotyphlops hamatus</i> Northern Hook-snouted Blind Snake	WAM			X
<i>Ramphotyphlops waitii</i> Beaked Blind Snake	WAM			
BOIDAE (pythons)				
<i>Antaresia perthensis</i> Pygmy Python	WAM			
<i>Antaresia stimsoni</i> Stimson's Python	Lit			
ELAPIDAE (front-fanged snakes)				
<i>Acanthophis pyrrhus</i> Desert Death Adder	WAM			
<i>Brachyuropsis approximans</i> Northern Shovel-nosed Snake	WAM			
<i>Brachyuropsis semifasciata</i> Southern Shovel-nosed Snake	DEC			
<i>Brachyuropsis fasciolata</i> Narrow-banded Shovel-nosed Snake	WAM			
<i>Demansia psammophis</i> Yellow-faced Whipsnake	WAM			
<i>Parasuta monachus</i> Monk Snake	WAM			
<i>Pseudechis australis</i> Ringed Brown Snake	WAM			
<i>Pseudechis butleri</i> Spotted Mulga Snake	Lit			
<i>Pseudonaja modesta</i> Ringed Brown Snake	WAM			X
<i>Pseudonaja nuchalis</i> Gwardar	WAM		*	X
<i>Simoselaps bertholdi</i> Jan's Banded Snake	WAM			X
<i>Furina ornata</i> Moon Snake	Lit			
<i>Suta fasciata</i> Rosen's Snake	WAM		*	
Total Species Expected: 88				
Total Species Recorded by BCE and anon. (1978): 53			29	49

BIRDS

Species	Status	Source	Local Records	BCE
CASUARIIDAE (Cassowaries and emus)				
<i>Dromaius novaehollandiae</i> Emu	BA		*	X
MEGAPODIIDAE (Megapodes)				
<i>Leipoa ocellata</i> Malleefowl	CS1 Lit		*	X
PHASIANIDAE (Pheasants and allies)				
<i>Coturnix pectoralis</i> Stubble Quail	Lit			
ANATIDAE (swans and ducks)				
<i>Cygnus atratus</i> Black Swan	WAM		*	
<i>Tadorna tadornoides</i> Australian Shelduck	Lit		*	X
<i>Anas superciliosa</i> Pacific Black Duck	Lit		*	
<i>Anas gracilis</i> Grey Teal	Lit		*	
<i>Chenonetta jubata</i> Australian Wood Duck	Lit		*	
<i>Malacorhynchus membranaceus</i> Pink-eared Duck	Lit			
<i>Aythya australis</i> Hardhead	Lit			
PODICIPEDIDAE (grebes)				
<i>Tachybaptus novaehollandiae</i> Australasian Grebe	Lit			
<i>Poliiocephalus poliocephalus</i> Hoary-headed Grebe	WAM		*	
PHALACROCORACIDAE (cormorants)				
<i>Phalacrocorax melanoleucos</i> Little Pied Cormorant	BA			
<i>Phalacrocorax varius</i> Pied Cormorant	Lit			
<i>Phalacrocorax sulcirostris</i> Little Black Cormorant	Lit			
ARDEIDAE (herons and egrets)				
<i>Egretta novaehollandiae</i> White-faced Heron	BA		*	
<i>Ardea pacifica</i> White-necked Heron	WAM		*	
<i>Egretta modesta</i> Eastern Great Egret	CS1 Lit		*	
<i>Nycticorax caledonicus</i> Nankeen Night Heron	Lit			
THRESKIORNITHIDAE (ibis and spoonbills)				
<i>Threskiornis molucca</i> Australian White Ibis	Lit		*	
<i>Threskiornis spinicollis</i> Straw-necked Ibis	Lit		*	
ACCIPITRIDAE (Osprey, hawks and eagles)				
<i>Elanus axillaris</i> Black-shouldered Kite	Lit			
<i>Elanus scriptus</i> Letter-winged Kite	Lit		*	
<i>Lophoictinia isura</i> Square-tailed Kite	CS3 Lit		*	
<i>Hamirostra melanosternon</i> Black-breasted Buzzard	Lit			
<i>Milvus migrans</i> Black Kite	Lit			
<i>Haliastur sphenurus</i> Whistling Kite	BA		*	X
<i>Circus assimilis</i> Spotted Harrier	Lit			X

Species	Status	Source	Local Records	BCE
<i>Accipiter fasciatus</i> Brown Goshawk	Lit		*	
<i>Accipiter cirrhocephalus</i> Collared Sparrowhawk	Lit		*	X
<i>Aquila audax</i> Wedge-tailed Eagle	BA		*	X
<i>Hieraaetus morphnoides</i> Little Eagle	Lit		*	X
FALCONIDAE (Falcons)				
<i>Falco berigora</i> Brown Falcon	BA		*	X
<i>Falco longipennis</i> Australian Hobby	BA		*	X
<i>Falco hypoleucos</i> Grey Falcon	CS2 Lit			
<i>Falco subniger</i> Black Falcon	Lit			
<i>Falco peregrinus</i> Peregrine Falcon	CS1 BA			X
<i>Falco cenchroides</i> Nankeen Kestrel	BA		*	X
RALLIDAE (Rails, gallinules and coots)				
<i>Gallinula ventralis</i> Black-tailed Native-hen	Lit		*	
<i>Fulica atra</i> Eurasian Coot	Lit		*	
OTIDIDAE (Bustards)				
<i>Ardeotis australis</i> Australian Bustard	CS2 WAM		*	X
TURNICIDAE (Button-quails)				
<i>Turnix velox</i> Little Button-quail	Lit		*	
SCOLOPACIDAE (sandpipers)				
<i>Limosa limosa</i> Black-tailed Godwit	CS1 Lit			
<i>Tringa nebularia</i> Common Greenshank	CS1 Lit			
<i>Tringa stagnatalis</i> Marsh Sandpiper	CS1 Lit			
<i>Tringa hypoleucos</i> Common Sandpiper	CS1 Lit			
<i>Tringa glareola</i> Wood Sandpiper	CS1 Lit			
<i>Calidris ruficollis</i> Red-necked Stint	CS1 Lit			
<i>Calidris acuminata</i> Sharp-tailed Sandpiper	CS1 Lit		*	
<i>Calidris ferruginea</i> Curlew Sandpiper	CS1 Lit			
BURHINIDAE (Stone-curlews)				
<i>Burhinus grallarius</i> Bush Stone-curlew	CS2 BA		*	X
RECURVIROSTRIDAE (stilts and avocets)				
<i>Himantopus himantopus</i> Black-winged Stilt	Lit		*	
CHARADRIIDAE (Lapwings, plovers and dotterels)				
<i>Erythrogonys cinctus</i> Red-kneed Dotterel	Lit		*	
<i>Charadrius ruficapillus</i> Red-capped Plover	Lit		*	
<i>Charadrius melanops</i> Black-fronted Dotterel	Lit		*	
<i>Charadrius australis</i> Inland Dotterel	Lit			
<i>Vanellus tricolor</i> Banded Lapwing	BA		*	X

Species		Status	Source	Local Records	BCE
COLUMBIDAE (Pigeons and doves)					
<i>Phaps chalcoptera</i>	Common Bronzewing	BA		*	X
<i>Ocyphaps lophotes</i>	Crested Pigeon	BA		*	X
<i>Geopelia cuneata</i>	Diamond Dove	Lit		*	
CACATUIDAE (Cockatoos)					
<i>Eolophus roseicapilla</i>	Galah	BA		*	X
<i>Cacatua sanguinea</i>	Little Corella	Lit			
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	CS1 Lit		*	
<i>Nymphicus hollandicus</i>	Cockatiel	Lit		*	X
PSITTACIDAE (Parrots)					
<i>Barnardius zonarius</i>	Australian Ringneck	BA		*	X
<i>Psephotus varius</i>	Mulga Parrot	BA		*	X
<i>Melopsittacus undulatus</i>	Budgerigar	BA		*	X
<i>Neosephotus bourkii</i>	Bourke's Parrot	BA		*	
<i>Neophema elegans</i>	Elegant Parrot	Lit		*	X
<i>Neophema splendida</i>	Scarlet-chested Parrot	CS3 Lit		WJ	
<i>Polytelis alexandrae</i>	Princess Parrot	CS1 WAM		WJ	
<i>Polytelis anthopeplus</i>	Regent Parrot	CS3 Lit		WJ	
<i>Pezoporus occidentalis</i>	Night Parrot	CS1 Lit			
CUCULIDAE (Old world cuckoos)					
<i>Cuculus pallidus</i>	Pallid Cuckoo	BA			X
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	BA			
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	BA			X
STRIGIDAE (Hawk owls)					
<i>Ninox novaeseelandiae</i>	Southern Boobook	Lit		*	X
TYTONIDAE (Barn owls)					
<i>Tyto alba</i>	Barn Owl	Lit		*	
PODARGIDAE (Australian frogmouths)					
<i>Podargus strigoides</i>	Tawny Frogmouth	Lit		*	X
CAPRIMULGIDAE (Nightjars and allies)					
<i>Eurostopodus argus</i>	Spotted Nightjar	BA		*	X
AEGOTHELIDAE (Owlet-nightjars)					
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	BA		*	X
APODIDAE (Typical swifts)					
<i>Apus pacificus</i>	Fork-tailed Swift ^a	CS1 Lit		*	
HALCYONIDAE (Kingfishers)					
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	Lit		*	X

Species	Status	Source	Local Records	BCE
<i>Todiramphus sanctus</i> Sacred Kingfisher	Lit			
MEROPIIDAE (Bee-eaters)				
<i>Merops ornatus</i> Rainbow Bee-eater	CS1 Lit		*	X
CLIMACTERIDAE (Australo-Papuan treecreepers)				
<i>Climacteris affinis</i> White-browed Treecreeper	BA			
MALURIDAE (Fairy-wrens, emu-wrens and grasswrens)				
<i>Malurus splendens</i> Splendid Fairy-wren	BA			X
<i>Malurus lamberti</i> Variegated Fairy-wren	BA			X
<i>Malurus leucopterus</i> White-winged Fairy-wren	BA			X
<i>Amytornis striatus striatus</i> Striated Grasswren	CS2 WAM		WJ	
<i>Stipiturus ruficeps</i> Rufous-crowned Emu wren.	CS3 Lit		WJ	
PARDALOTIDAE (Pardalotes, scrubwrens, thornbills and allies)				
<i>Pardalotus rubricatus</i> Red-browed Pardalote	BA			
<i>Pardalotus striatus</i> Striated Pardalote	BA			X
<i>Calamanthus campestris</i> Rufous Fieldwren	Lit			
<i>Pyrrholaemus brunneus</i> Redthroat	BA			X
<i>Smicrornis brevirostris</i> Weebill	BA			X
<i>Gerygone fusca</i> Western Gerygone	BA			X
<i>Acanthiza apicalis</i> Inland Thornbill	BA			X
<i>Acanthiza uropygialis</i> Chestnut-rumped Thornbill	BA			X
<i>Acanthiza robustirostris</i> Slaty-backed Thornbill	BA			X
<i>Acanthiza iredalei</i> Slender-billed Thornbill	CS1 Lit			
<i>Acanthiza chrysorrhoa</i> Yellow-rumped Thornbill	BA			X
<i>Aphelocephala leucopsis</i> Southern Whiteface	BA			X
MELIPHAGIDAE (Honeyeaters)				
<i>Acanthagenys rufogularis</i> Spiny-cheeked Honeyeater	BA			X
<i>Manorina flavigula</i> Yellow-throated Miner	BA			X
<i>Lichenostomus virescens</i> Singing Honeyeater	BA			X
<i>Lichenostomus penicillatus</i> White-plumed Honeyeater	BA			X
<i>Lichenostomus plumulus</i> Grey-fronted Honeyeater	BA			
<i>Lichmera indistincta</i> Brown Honeyeater	BA			X
<i>Phylidonyris albifrons</i> White-fronted Honeyeater	BA			X
<i>Conopophila whitei</i> Grey Honeyeater	CS3 Lit			
<i>Certhionyx niger</i> Black Honeyeater	BA			
<i>Certhionyx variegatus</i> Pied Honeyeater	BA			
<i>Epthianura tricolor</i> Crimson Chat	BA			X

Species	Status	Source	Local Records	BCE
<i>Epthianura aurifrons</i> Orange Chat	WAM			
<i>Epthianura albifrons</i> White-fronted Chat	Lit			
PETROICIDAE (Robins)				
<i>Microeca leucophaea</i> Jacky Winter	BA			X
<i>Petroica goodenovii</i> Red-capped Robin	BA			X
<i>Melanodryas cucullata</i> Hooded Robin	BA			X
POMATOSTOMIDAE (Babblers)				
<i>Pomatostomus temporalis</i> Grey-crowned Babbler	BA			X
<i>Pomatostomus superciliosus</i> White-browed Babbler	BA			X
CINCLOSOMATIDAE (Quail-thrushes and allies)				
<i>Psophodes occidentalis</i> Chiming Wedgebill	BA			
<i>Cinclosoma castanotum</i> Chestnut Quail-thrush	BA			
<i>Cinclosoma castaneothorax</i> Chestnut-breasted Quail-thrush	BA			X
NEOSITTIDAE (Sitellas)				
<i>Daphoenositta chrysoptera</i> Varied Sittella	BA			X
PACHYCEPHALIDAE (Whistlers, shrike-thrushes and allies)				
<i>Oreoica gutturalis</i> Crested Bellbird	BA			X
<i>Pachycephala rufiventris</i> Rufous Whistler	BA			X
<i>Colluricincla harmonica</i> Grey Shrike-thrush	BA			X
DICRURIDAE (Monarchs, fantails and drongos)				
<i>Grallina cyanoleuca</i> Magpie-lark	BA			X
<i>Rhipidura fuliginosa</i> Grey Fantail	Lit			X
<i>Rhipidura f. albicauda</i> White-tailed Fantail	Lit			
<i>Rhipidura leucophrys</i> Willie Wagtail	BA			X
CAMPEPHAGIDAE (Cuckoo-shrikes and trillers)				
<i>Coracina novaehollandiae</i> Black-faced Cuckoo-shrike	BA		*	X
<i>Coracina maxima</i> Ground Cuckoo-shrike	BA		*	X
<i>Lalage sueurii</i> White-winged Triller	BA		*	X
ARTAMIDAE (Woodswallows, butcherbirds and currawongs)				
<i>Artamus personatus</i> Masked Woodswallow	Lit			X
<i>Artamus cinereus</i> Black-faced Woodswallow	BA			X
<i>Artamus minor</i> Little Woodswallow	BA			
<i>Cracticus torquatus</i> Grey Butcherbird	BA			X
<i>Cracticus nigrogularis</i> Pied Butcherbird	BA			X
<i>Gymnorhina tibicen</i> Australian Magpie	BA			X
<i>Strepera versicolor</i> Grey Currawong	BA		WJ	X
CORVIDAE (Crows and allies)				

Species	Status	Source	Local Records	BCE
<i>Corvus coronoides</i> Australian Raven	Lit			
<i>Corvus bennetti</i> Little Crow	BA			X
<i>Corvus orru</i> Torresian Crow	BA			X
PTILONORHYNCHIDAE (Bowerbirds)				
<i>Chlamydera guttata</i> Western Bowerbird	BA			X
MOTACILIDAE (Old world wagtails and pipits)				
<i>Anthus novaeseelandiae</i> Australasian Pipit	BA		*	X
PASSERIDAE (Sparrows, weaverbirds, waxbills and allies)				
<i>Taeniopygia guttata</i> Zebra Finch	BA			X
DICAEIDAE (Flowerpeckers)				
<i>Dicaeum hirundinaceum</i> Mistletoebird	BA			X
HIRUNDINIDAE (Swallows and martins)				
<i>Cheramoeca leucosternum</i> White-backed Swallow	BA		*	X
<i>Hirundo neoxena</i> Welcome Swallow	BA		*	X
<i>Hirundo nigricans</i> Tree Martin	BA			X
<i>Hirundo ariel</i> Fairy Martin	Lit		*	X
SYLVIIDAE (Old world warblers)				
<i>Cinclorhamphus mathewsi</i> Rufous Songlark	Lit			
<i>Cinclorhamphus cruralis</i> Brown Songlark	Lit			
Total Species Expected: 155		155	66	82
Total Species Recorded by BCE and anon (1978): 108				

MAMMALS

Note: Old, abandoned nests constructed by the Lesser Stick-nest Rat were recorded amongst breakaway along the Barr Smith Range. This species is considered extinct with no recent records and is not included in the sum of recorded species.

Species	Status	Source	Local Records	BCE
TACHYGLOSSIDAE (Echidnas)				
<i>Tachyglossus aculeatus</i> Echidna	WAM			X
DASYURIDAE (Dasyurids)				
<i>Dasyurus blythi</i> Brush-tailed Mulgara	CS2		MK	X
<i>Dasyurus cristicauda</i> Crest-tailed Mulgara	CS1 WAM			
<i>Antechinus laniger</i> Kultarr	CS3 WAM		WJ	
<i>Ningauia ridei</i> Wongai Ningauia	WAM		MK	X
<i>Pseudantechinus woolleyae</i> Woolley's Pseudantechinus	WAM		WJ	Scats
<i>Sminthopsis crassicauda</i> Fat-tailed Dunnart	WAM		WJ	
<i>Sminthopsis dolichura</i> Little Long-tailed Dunnart	Lit		WJ	
<i>Sminthopsis hirtipes</i> Hairy-footed Dunnart	Lit		WJ	X
<i>Sminthopsis longicauda</i> Long-tailed Dunnart	CS2 DEC			
<i>Sminthopsis macroura</i> Stripe-faced Dunnart	WAM		WJ	X
<i>Sminthopsis ooldea</i> Ooldea Dunnart	WAM		WJ	X
PERAMELIDAE (Bandicoots)				
<i>Macrotis lagotis</i> Greater Bilby	CS1 WAM			
MACROPODIDAE (Kangaroos, wallabies)				
<i>Macropus robustus</i> Euro, Biggada	WAM		WJ	X
<i>Macropus rufus</i> Red Kangaroo, Marlu	WAM		WJ	X
<i>Petrogale lateralis</i> Black-flanked Rock-Wallaby	CS1			Scats
EMBALLONURIDAE (Sheath-tail bats)				
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat				X
<i>Taphozous hillii</i> Hill's Sheath-tail-bat	Lit			
VESPERTILIONIDAE (Vespertilionid bats)				
<i>Chalinolobus gouldii</i> Gould's Wattle Bat	WAM		WJ	X
<i>Nyctophilus geoffroyi</i> Lesser Long-eared Bat	WAM		WJ	X
<i>Nyctophilus major tor</i> Inland Greater Long-eared Bat	CS2			X
<i>Scotorepens balstoni</i> Inland Broad-nosed Bat	WAM		WJ	X
<i>Vespadelus baverstocki</i> Inland Forest Bat	Lit		WJ	X
<i>Vespadelus finlaysoni</i> Finlayson's Cave Bat	WAM			X
<i>Vespadelus regulus</i> Southern Forest Bat	WAM		WJ	

Species	Status	Source	Local Records	BCE
MOLOSSIDAE (Freetail bats)				
<i>Mormopterus</i> sp. 3 (Adams <i>et al.</i> ,1988). Inland Freetail-bat	Lit			X
<i>Austronomus australis</i> White-striped Freetail-bat	WAM		WJ	X
MURIDAE (Rats and mice)				
<i>Mus musculus</i> House Mouse	INT WAM		MK	
<i>Notomys alexis</i> Spinifex Hopping-Mouse	WAM		MK	X
<i>Pseudomys desertor</i> Desert Mouse	CS3 Lit		MK	
<i>Pseudomys hermannsburgensis</i> Sandy Inland Mouse	WAM		MK	
LEPORIDAE (Rabbits and hares)				
<i>Oryctolagus cuniculus</i> Rabbit	INT Lit			X
CANIDAE (Dogs and foxes)				
<i>Canis lupus</i> Dog/Dingo	Lit			X
<i>Vulpes vulpes</i> Red Fox	INT Lit			X
FELIDAE (Cats)				
<i>Felis catus</i> Cat	INT Lit			X
BOVIDAE (Horned ruminants)				
<i>Capra hircus</i> Goat	INT Lit			
EQUIDAE (horses)				
<i>Equus asinus</i> Donkey	INT Lit			
<i>Equus caballus</i> Horse	INT Lit			
CAMELIDAE (camels)				
<i>Camelus dromedarius</i> Camel	INT Lit			X
Native Species Expected: 31 Native Species Recorded by BCE: 21 Introduced Species Expected: 8 Introduced Species Recorded: 4				
			21	25

Species considered extinct in the Statement Agreement Area

Common Name	Species Name
Thick-billed Grasswren	<i>Amytornis textilis</i>
Chuditch	<i>Dasyurus geoffroii</i>
Boodie	<i>Bettongia lesueur</i>
Rufous Hare-Wallaby	<i>Lagorchestes hirsutus</i>
Ghost Bat	<i>Macroderma gigas</i>
Golden Bandicoot	<i>Isodon auratus</i>
Pig-footed Bandicoot	<i>Chaeropus ecaudatus</i>
Lesser Stick-nest Rat	<i>Leporillus apicalis</i>

Note that this list is probably incomplete and the past status of some of these species in the area is uncertain. With the exception of the Lesser Stick-nest Rat and the Pig-footed Bandicoot, all species are extant elsewhere.

Appendix 4. GPS locations, survey periods and traps used at each sampling location.

Sample Location	Easting	Northing	Surveyed in March 2009	Surveyed in November 2009	Trap Type		
	WGS84	Zone: 50J			Pit	Funnel	Elliott
1.1	787620	6990787	+	+	P		E
1.2	787578	6990788	+	+	P	F	
1.3	787537	6990793	+	+	P		E
1.4	787506	6990785	+	+	P	F	
1.5	787408	6990754	+	+	P		E
1.6	787365	6990732	+	+	P	F	
1.7	787324	6990737	+	+	P		E
1.8	787287	6990722	+	+	P	F	
1.9	787241	6990718	+	+	P		E
1.10	787171	6990693	+	+	P	F	
2.1	787532	6990497	+	+	P		E
2.2	787483	6990495	+	+	P	F	
2.3	787426	6990486	+	+	P		E
2.4	787367	6990488	+	+	P	F	
2.5	787300	6990499	+	+	P		E
2.6	787239	6990514	+	+	P	F	
2.7	787186	6990509	+	+	P		E
2.8	787122	6990502	+	+	P	F	
2.9	787066	6990471	+	+	P		E
2.10	787027	6990447	+	+	P	F	
3.1	787463	6990269	+	+	P		E
3.2	787397	6990243	+	+	P	F	
3.3	787371	6990212	+	+	P		E
3.4	787308	6990197	+	+	P	F	
3.5	787263	6990229	+	+	P		E
3.6	787235	6990259	+	+	P	F	
3.7	787211	6990268	+	+	P		E
3.8	787145	6990296	+	+	P	F	
3.9	787087	6990296	+	+	P		E
3.10	787028	6990321	+	+	P	F	
4.1	787051	6989459	+	+	P		E

Sample Location	Easting	Northing	Surveyed in March 2009	Surveyed in November 2009	Trap Type		
	WGS84	Zone: 50J			Pit	Funnel	Elliott
4.2	787025	6989466	+	+	P	F	
4.3	786978	6989461	+	+	P		E
4.4	786938	6989473	+	+	P	F	
4.5	786900	6989486	+	+	P		E
4.6	786861	6989490	+	+	P	F	
4.7	786821	6989506	+	+	P		E
4.8	786792	6989539	+	+	P	F	
4.9	786751	6989573	+	+	P		E
4.10	786706	6989590	+	+	P	F	
5.1	783115	6989307	+	+	P		E
5.2	783140	6989331	+	+	P	F	
5.3	783165	6989368	+	+	P		E
5.4	783204	6989388	+	+	P	F	
5.5	783251	6989405	+	+	P		E
5.6	783286	6989394	+	+	P	F	
5.7	783323	6989374	+	+	P		E
5.8	783358	6989401	+	+	P	F	
5.9	783397	6989421	+	+	P		E
5.10	783424	6989459	+	+	P	F	
6.1	782704	6989852	+	+	P		E
6.2	782757	6989850	+	+	P	F	
6.3	782804	6989848	+	+	P		E
6.4	782840	6989848	+	+	P	F	
6.5	782885	6989848	+	+	P		E
6.6	782931	6989858	+	+	P	F	
6.7	782982	6989851	+	+	P		E
6.8	783015	6989844	+	+	P	F	
6.9	783070	6989848	+	+	P		E
6.10	783108	6989830	+	+	P	F	
7.1	782793	6993881	+	+	P		E
7.2	782811	6993891	+	+	P	F	
7.3	782855	6993911	+	+	P		E
7.4	782914	6993921	+	+	P	F	
7.5	782959	6993923	+	+	P		E
7.6	783004	6993919	+	+	P	F	
7.7	783042	6993923	+	+	P		E

Sample Location	Easting	Northing	Surveyed in March 2009	Surveyed in November 2009	Trap Type		
	WGS84	Zone: 50J			Pit	Funnel	Elliott
7.8	783094	6993914	+	+	P	F	
7.9	783127	6993922	+	+	P		E
7.10	783144	6993942	+	+	P	F	
8.1	782753	6994305	+	+	P		E
8.2	782801	6994277	+	+	P	F	
8.3	782844	6994277	+	+	P		E
8.4	782867	6994240		+	P	F	
8.5	782912	6994230		+	P		E
8.6	782940	6994211		+	P	F	
8.7	782981	6994215		+	P		E
8.8	783028	6994209		+	P	F	
8.9	783072	6994181		+	P		E
8.10	783092	6994154		+	P	F	
9.1	782881	6998560	+	+	P	F	
9.2	782918	6998571	+	+	P		E
9.3	782951	6998572	+	+	P	F	
9.4	782987	6998577	+	+	P		E
9.5	783024	6998582	+	+	P	F	
9.6	783062	6998596	+	+	P		E
9.7	783100	6998594	+	+	P	F	
9.8	783136	6998587	+	+	P		E
9.9	783171	6998595	+	+	P	F	
9.10	783209	6998596	+	+	P		E
10.1	782901	6999612	+	+	P	F	
10.2	782940	6999633	+	+	P		E
10.3	782983	6999643	+	+	P	F	
10.4	783019	6999642	+	+	P		E
10.5	783054	6999647	+	+	P	F	
10.6	783087	6999650	+	+	P		E
10.7	783126	6999656	+	+	P	F	
10.8	783168	6999655	+	+	P		E
10.9	783206	6999644	+	+	P	F	
10.10	783236	6999644	+	+	P		E
11.1	785413	6992538		+	P	F	
11.2	785394	6992510		+	P	F	E
11.3	785371	6992473		+	P	F	

Sample Location	Easting	Northing	Surveyed in March 2009	Surveyed in November 2009	Trap Type		
	WGS84	Zone: 50J			Pit	Funnel	Elliott
11.4	785359	6992450		+	P	F	E
11.5	785339	6992426		+	P	F	
11.6	785316	6992401		+	P	F	E
11.7	785301	6992373		+	P	F	
11.8	785287	6992326		+	P	F	E
11.9	785245	6992316		+	P	F	
11.10	785208	6992297		+	P	F	E
12.1	789353	6989950		+	P	F	
12.2	789324	6989941		+	P	F	E
12.3	789300	6989943		+	P	F	
12.4	789240	6989949		+	P	F	E
12.5	789217	6989969		+	P	F	
12.6	789189	6989962		+	P	F	E
12.7	789124	6989923		+	P	F	
12.8	789097	6989893		+	P	F	E
12.9	789072	6989862		+	P	F	
12.10	789060	6989818		+	P	F	E
13.1	785860	6992309		+	P	F	
13.2	785836	6992294		+	P	F	E
13.3	785810	6992276		+	P	F	
13.4	785779	6992263		+	P	F	E
13.5	785754	6992239		+	P	F	
13.6	785722	6992201		+	P	F	E
13.7	785696	6992178		+	P	F	
13.8	785681	6992111		+	P	F	E
13.9	785641	6992082		+	P	F	
13.10	785621	6992051		+	P	F	E
14.1	789607	6995885		+	P	F	
14.2	789573	6995899		+	P	F	E
14.3	789545	6995920		+	P	F	
14.4	789511	6995937		+	P	F	E
14.5	789462	6995959		+	P	F	
14.6	789434	6995970		+	P	F	E
14.7	789395	6995980		+	P	F	
14.8	789365	6995988		+	P	F	E
14.9	789332	6995991		+		2F	

Sample Location	Easting	Northing	Surveyed in March 2009	Surveyed in November 2009	Trap Type		
	WGS84	Zone: 50J			Pit	Funnel	Elliott
14.10	789289	6995999		+	P	2F	E
15.1	788583	6991922		+	P	F	
15.2	788572	6991940		+	P	F	E
15.3	788565	6991965		+	P	F	
15.4	788550	6991980		+	P	F	E
15.5	788525	6991989		+	P	F	
15.6	788515	6992006		+	P	F	E
15.7	788501	6992024		+	P	F	
15.8	788482	6992058		+	P	F	E
15.9	788475	6992085		+	P	F	
15.10	788458	6992099		+	P	F	E

Appendix 5. Vegetation and soil description of each sampling point

Site	Pit	Vegetation / Site description
1	1	Eucalyptus gypsophila woodland on calcrete rise with a shrubby understorey
1	2	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	3	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	4	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	5	Eucalyptus gypsophila woodland on calcrete rise
1	6	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	7	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	8	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	9	Eucalyptus gypsophila woodland on calcrete rise with dense leaf litter
1	10	Eucalyptus gypsophila woodland on calcrete rise
2	1	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	2	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	3	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	4	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	5	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	6	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	7	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	8	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	9	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
2	10	Chenopod (Maireana pyramidalis and Atriplex sp.) shrubland on self mulching clays
3	1	Melaleuca xerophila open woodland over clay/clay loam flats
3	2	Melaleuca xerophila open woodland over clay/clay loam flats
3	3	Melaleuca xerophila open woodland over clay/clay loam flats
3	4	Melaleuca xerophila open woodland over clay/clay loam flats
3	5	Melaleuca xerophila open woodland over clay/clay loam flats
3	6	Melaleuca xerophila open woodland over clay/clay loam flats

Site	Pit	Vegetation / Site description
3	7	Melaleuca xerophila open woodland over clay/clay loam flats
3	8	Melaleuca xerophila open woodland over clay/clay loam flats
3	9	Melaleuca xerophila open woodland over clay/clay loam flats
3	10	Melaleuca xerophila open woodland over clay/clay loam flats
4	1	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse grass & low shrub understorey on red sandy loam
4	2	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse grass & low shrub understorey on red sandy loam
4	3	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse grass & low shrub understorey on red sandy loam
4	4	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with no understorey on red sandy loam
4	5	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with no understorey on red sandy loam
4	6	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. with very sparse grass & low shrub understorey on red sandy loam
4	7	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. with very sparse grass & low shrub understorey on red sandy loam
4	8	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. with very sparse grass & low shrub understorey on red sandy loam
4	9	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. with very sparse grass & low shrub understorey on red sandy loam
4	10	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. with very sparse grass & low shrub understorey on red sandy loam
5	1	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>Triodia basedowii</i>) ground cover
5	2	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
5	3	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
5	4	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
5	5	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
5	6	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
5	7	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover

Site	Pit	Vegetation / Site description
5	8	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
5	9	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
5	10	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and <i>Grevillea</i> spp. shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
6	1	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) and isolated <i>Eucalyptus</i> spp. Woodland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
6	2	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
6	3	Open mixed shrub overstorey with open Spinifex (<i>T. basedowii</i>) ground cover
6	4	Open mixed shrub overstorey with open Spinifex (<i>T. basedowii</i>) ground cover
6	5	Open mixed shrub overstorey with open Spinifex (<i>T. basedowii</i>) ground cover
6	6	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and open Spinifex (<i>T. basedowii</i>) ground cover
6	7	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
6	8	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
6	9	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
6	10	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) Shrubland with scattered <i>Eremophila</i> spp. midstorey and scattered Spinifex (<i>T. basedowii</i>) ground cover
7	1	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	2	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	3	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	4	Open Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	5	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	6	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	7	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust

Site	Pit	Vegetation / Site description
7	8	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	9	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust
7	10	Open mixed shrubland with very sparse shrub understorey on sandy loam soils with a thin surface crust
8	1	Calcrete clay loam, Open <i>E. gypsophila</i> , <i>Casuarina pauper</i> and <i>Acacia burkittii</i> woodland over sparse low shrub
8	2	Orange clay loam, open <i>Acacia</i> spp. shrubland over low shrubs
8	3	Orange clay loam with calcrete stones, Open <i>C. pauper</i> woodland over open <i>Acacia</i> spp. shrublands
8	4	Orange clay loam with calcrete stones, Open <i>Acacia</i> spp. shrubland over sparse shrublands
8	5	Pale orange clay loam with calcrete, Open <i>E. gypsophila</i> woodland with very sparse low shrub
8	6	Pale orange clay loam with calcrete, Open <i>E. gypsophila</i> woodland, open <i>Acacia</i> shrublands
8	7	Pale orange clay loam with calcrete, Open <i>C. pauper</i> woodland, over low <i>Acacia</i> spp. shrubs
8	8	Pale orange clay loam with calcrete, Open <i>Acacia</i> spp. woodland, over sparse open shrubs
8	9	Orange/red loamy clay, Open mixed <i>Acacia</i> spp. woodland over low open shrubs
8	10	Calcrete clay loam, Open <i>E. gypsophila</i> and <i>C. pauper</i> woodland over sparse low shrub
9	1	Scattered Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	2	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	3	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	4	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	5	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	6	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	7	Open mixed <i>Acacia</i> spp. shrubland over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	8	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	9	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
9	10	Sparse mixed <i>Acacia</i> spp. over open Spinifex (<i>T. basedowii</i>) on red sandy loam
10	1	Open <i>Acacia</i> spp. dominant mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam

Site	Pit	Vegetation / Site description
10	2	Open <i>Acacia</i> spp. dominant mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
10	3	Open <i>Acacia</i> spp. dominant mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
10	4	Open Spinifex (<i>T. basedowii</i>) ground cover with scattered <i>Acacia</i> spp. shrubs and Mallee (<i>Eucalyptus</i> spp.)
10	5	Open Spinifex (<i>T. basedowii</i>) ground cover with scattered <i>Acacia</i> spp. shrubs and Mallee (<i>Eucalyptus</i> spp.)
10	6	Open Spinifex (<i>T. basedowii</i>) ground cover with scattered <i>Acacia</i> spp. shrubs and Mallee (<i>Eucalyptus</i> spp.)
10	7	Open <i>Acacia</i> spp. mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
10	8	Open <i>Acacia</i> mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
10	9	Open <i>Acacia</i> mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
10	10	Open <i>Acacia</i> mixed shrubland with open Spinifex (<i>T. basedowii</i>) ground cover on red sandy clay-loam
11	1	Red clay with stony calcrete, Open <i>Acacia</i> spp. shrubland over low shrubs
11	2	Red clay with stony calcrete, Open <i>Acacia</i> spp. shrubland over low shrubs
11	3	Stony calcrete clay, Mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	4	Stony calcrete clay, Mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	5	Stony calcrete clay, Mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	6	Stony calcrete clay, Sparse <i>E. gypsophila</i> over mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	7	Stony calcrete clay, Open <i>C. pauper</i> woodland over mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	8	Stony calcrete clay, Open <i>C. pauper</i> woodland over mixed open <i>Acacia</i> spp. shrubland with very sparse groundlayer
11	9	Stoney calcrete clay, Sparse low <i>Acacia</i> spp. shrubland
11	10	Stony calcrete clay, Open <i>E. gypsophila</i> over open <i>Acacia</i> spp. shrubland
12	1	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	2	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	3	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low

Site	Pit	Vegetation / Site description
		<i>Acacia</i> , some stoney calcrete
12	4	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	5	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	6	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	7	Tall <i>Lycium australe</i> shrubland on flats with variable clay content, with very sparse low <i>Acacia</i> , some stoney calcrete
12	8	Stoney calcrete clay/loam, Open mixed <i>Acacia</i> spp. shrubland
12	9	Stoney calcrete clay/loam, Open mixed <i>Acacia</i> spp. shrubland
12	10	Stoney calcrete clay/loam, <i>Melaleuca xerophila</i> / <i>Acacia</i> spp. shrubland
13	1	Stoney calcrete clay/loam, <i>E. gypsophila</i> woodland over mixed <i>Acacia</i> spp. shrubland
13	2	Stoney calcrete clay/loam, <i>E. gypsophila</i> woodland over mixed <i>Acacia</i> spp. shrubland
13	3	Stoney calcrete clay/loam, <i>E. gypsophila</i> woodland over mixed <i>Acacia</i> spp. shrubland
13	4	Stoney calcrete clay/loam, <i>E. gypsophila</i> woodland over mixed <i>Acacia</i> spp. shrubland
13	5	Stoney calcrete clay/loam, <i>E. gypsophila</i> woodland over mixed <i>Acacia</i> spp. shrubland
13	6	Stoney calcrete clay/loam, Open <i>E. gypsophila</i> woodland with very sparse shrub layer
13	7	Stoney calcrete clay/loam, Open <i>E. gypsophila</i> woodland with very sparse shrub layer
13	8	Stoney calcrete clay, Open <i>Acacia</i> spp. shrubland
13	9	Red loamy clay, Mixed <i>Acacia</i> spp. shrubland
13	10	Stony calcrete clay loam, Open <i>E. gypsophila</i> woodland over mixed open <i>Acacia</i> spp. Shrubland
14	1	Open Mallee (<i>Eucalyptus</i> spp.) and mixed <i>Acacia</i> spp. woodland over <i>T. basedowii</i> hummock grassland on red sandy loam
14	2	Open Mallee (<i>Eucalyptus</i> spp.) and mixed <i>Acacia</i> spp. woodland over hummock grassland on red sandy loam
14	3	Open Mallee (<i>Eucalyptus</i> spp.) and mixed <i>Acacia</i> spp. woodland over hummock grassland on red sandy loam
14	4	Open Mallee (<i>Eucalyptus</i> spp.) and mixed <i>Acacia</i> spp. woodland over hummock grassland on red sandy loam
14	5	Open Mallee (<i>Eucalyptus</i> spp.) and mixed <i>Acacia</i> spp. woodland over hummock grassland on red sandy loam
14	6	Closed mixed <i>Acacia</i> spp. woodland over open shrub layer and sparse hummock grasses on

Site	Pit	Vegetation / Site description
		red sandy loam
14	7	Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) shrubland (closed) with scattered Mallee (<i>Eucalyptus</i> spp.) over shrubs
14	8	Mulga (<i>Acacia ayresiana</i> and <i>A. aneura</i>) shrubland (closed) over shrubs
14	9	Mixed open <i>Acacia</i> spp. shrubland over mixed shrubs and sparse hummock grass
14	10	Closed <i>Acacia</i> spp. shrubland over mixed shrubs and hummocks
15	1	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	2	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	3	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	4	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	5	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	6	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	7	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	8	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	9	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam
15	10	Closed <i>Acacia</i> spp. shrubland over hummock grass on red sandy loam

Appendix 6: Fauna capture results for each survey site (Tables A-C).

Note the capture data are divided into two survey phases: Phase 1 (March 2009) and Phase 2 (November 2009). Opportunistic records (O) and total number of individuals captured (T) are listed.

Table A. REPTILES

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Species																																
<i>Diplodactylus conspicillatus</i>										2		1				1															10	14
<i>Diplodactylus granariensis</i>																2		1												1	2	6
<i>Diplodactylus pulcher</i>																							1								0	1
<i>Gehyra varigata</i>		14		1									1			2				1				2		1		1			4	27
<i>Heteronotia binoei</i>		1				3							1								2										0	7
<i>Nephurus vertebralis</i>					1	1	1					3	1			2							2								0	11
<i>Rhynchoedura ornata</i>		3														2	2													1	20	28
<i>Strophurus elderi</i>																	2	4													10	16
<i>Strophurus strophurus</i>																1								1							4	6

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
<i>Strophurus wellingtonae</i>																1															2	3
<i>Delma butleri</i>																															1	1
<i>Delma nasuta</i>																		1													2	3
<i>Lialis burtonis</i>																	1														5	6
<i>Pygopus nigriceps</i>											1																				2	3
<i>Ctenophorus caudicinctus</i>																															7	7
<i>Ctenophorus isolepis</i>											1						4	2	6	5											7	25
<i>Ctenophorus nuchalis</i>				1																											2	3
<i>Ctenophorus scutulatus</i>																															1	1
<i>Moloch horridus</i>																															1	1
<i>Pogona minor</i>																		1														1
<i>Varanus caudolineatus</i>							2		1					1																	0	4
<i>Varanus eremius</i>																															1	1
<i>Varanus giganteus</i>																															2	2
<i>Varanus gouldii</i>														1				2		2											0	5
<i>Varanus panoptes</i>				1																				1				1			2	5

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
<i>Cryptoblepharus buehneri</i>					1										1											1					2	5
<i>Cryptoblepharus plagiocephalus</i>																					1										0	1
<i>Ctenopus ariadnae</i>																	2		1												0	3
<i>Ctenopus grandis</i>																	1		6												0	7
<i>Ctenopus hanloni</i>																		1													0	1
<i>Ctenopus helenae</i>																	11	4	13	3											0	31
<i>Ctenopus leonhardii</i>									6		5	10					1											1		4	0	27
<i>Ctenopus pantherinus</i>																		2	1												0	3
<i>Ctenopus schomburgkii</i>							1	1	2	1		1	5	4		3															4	22
<i>Egernia depressa</i>												1	1																		6	8
<i>Egernia inornata</i>																															2	2
<i>Egernia striata</i>																															1	1
<i>Eremiascincus richardsoni</i>						2									1	4										1					0	8
<i>Lerista desertorum</i>	1			1						1						1															0	4

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
<i>Lerista rhodonoides</i>	1					1						1					2		1	1				1							0	8
<i>Mentia greyii</i>		1	2				3	3	2	1		1	2						3	1											0	19
<i>Morethia butleri</i>				1									2			3									1						0	7
<i>Tiliqua occipitalis</i>																			1												0	1
<i>Tiliqua multifasciata</i>																	1		1												1	3
<i>Ramphotyphlops hamatus</i>		1																													0	1
<i>Ramphotyphlops bicolor</i>								1																							0	1
<i>Pseudonaja modesta</i>												1																		1	0	2
<i>Pseudonaja nuchalis</i>						1																									1	2
<i>Simoselaps bertholdii</i>		1		1																				1							1	4
Total	2	21	2	6	1	8	7	5	11	7	5	19	13	6	1	22	27	18	32	14	0	3	0	9	0	3	0	3	0	7	103	355

Table B. MAMMALS

Note some species were recorded only by the presence of burrow systems (B), tracks (T) or scats (S).

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Species																																
<i>Tachyglossus aculeatus</i>							T					T		T			T		T	T											5	5
<i>Dasycercus blythi</i>												1							8	5											SB	14
<i>Pseudantechinus woolleyae</i>																															S	
<i>Sminthopsis hirtipes</i>										1		1					1	3							1						0	7
<i>Sminthopsis macroura</i>			1	4																	1										0	6
<i>Sminthopsis ooldea</i>																									1						0	1
<i>Ningauai ridei</i>										2	1						4	6	2	4											0	19
<i>Petrogale lateralis</i>																															S	0
<i>Macropus robustus</i>																															22	22
<i>Macropus rufus</i>																															6	6
<i>Notomys alexis</i>																															B	
<i>Bos taurus</i>																															S	

SURVEY SITE	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		O	T
SURVEY PHASE	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
<i>Canis lupis dingo</i>				T																1											7	8
<i>Felis catus</i>																		T	T	T											2	2
<i>Oryctolagus cuniculus</i>			T	1		S	T											T	T	T	T										2	3
<i>Vulpes vulpes</i>							T																								T	
Total	0	0	1	5	0	0	0	0	0	3	1	2	0	0	0	0	5	9	10	10	0	1	0	0	0	2	0	0	0	0	44	93

Table C. Targeted significant fauna survey transects through study area (Zone 50J and 51J)

Transect Number	Number Personnel	Start Easting	Northing	End Easting	Northing	Area (ha)
July 2009						
1	4	789561	6994507	788649	6994408	10
2	4	788620	6994234	789553	6993984	10
3	4	789603	6995176	790539	6994814	10
4	4	790485	6994957	789619	6995495	10
November 2009						
5	4	789530	6993295	790497	6993227	10
6	4	790497	6993227	790527	6992241	10
7	5	789530	6993295	787960	6993251	15
8	5	787927	6992778	789502	6992786	15
9	4	782694	6989860	783694	6989865	10
10	4	783740	6989697	782687	6989699	10
11	4	782888	6999620	783889	6999621	10
12	4	783878	6999518	782879	6999520	10
13	4	789595	6995161	787580	6995154	20
14	4	787579	6994897	789590	6994900	20
15	2	794920	6989518	794929	6990037	2.5
16	2	795288	6990047	795264	6989116	5
17	2	204662	6986874	204657	6986393	2.5
18	2	204338	6986404	204338	6986966	2.5
19	2	211180	6983636	211180	6984636	5
20	2	211100	6984632	211100	6983643	5
21	2	211680	6982332	211253	6982352	2.5
22	2	211242	6982401	211660	6982425	2.5
23	2	203843	6989262	203843	6989262	2.5
May 2010						
1	3	789500	6991500	790500	6991600	10
2	3	789500	6991600	790500	6991700	10
3	3	788500	6991600	789500	6991700	10
4	3	788500	6991700	789500	6991800	10
5	3	789500	6991700	790500	6991800	10
6	3	788500	6991800	789500	6991900	10
7	3	789500	6991800	790500	6991900	10
8	3	788500	6991900	789500	6992000	10
9	3	789500	6991900	790500	6992000	10
10	3	788500	6992000	789500	6992100	10
11	3	789500	6992000	790500	6992100	10
12	3	788500	6992100	789500	6992200	10
13	3	789500	6992100	790500	6992200	10
14	3	788500	6992200	789500	6992300	10
15	3	789500	6992200	790500	6992300	10
16	3	788500	6992300	789500	6992400	10
17	3	789500	6992300	790500	6992400	10

Transect Number	Number Personnel	Start Easting	Northing	End Easting	Northing	Area (ha)
18	3	788500	6992400	789500	6992500	10
19	3	789500	6992400	790500	6992500	10
20	3	788500	6992500	789500	6992600	10
21	3	789500	6992500	790500	6992600	10
22	3	788500	6992600	789500	6992750	15
23	3	789500	6992600	790500	6992700	10
24	5	788500	6992750	789500	6992900	15
25	5	789500	6992700	790500	6992850	15
26	5	789500	6992850	790500	6993000	15
27	5	786900	6994150	787050	6994700	15
28	5	787050	6994700	788050	6994850	15
29	5	787000	6994850	788000	6995000	15
30	5	787050	6994850	787200	6994150	15
31	3	783500	6996650	783600	6997650	10
32	3	783400	6996640	783500	6997650	10
33	3	782870	6998400	783970	6998500	10
34	3	782870	6998500	783970	6998600	10
35	3	784000	7000600	784100	7001700	10
36	3	783900	7000600	784000	7001700	10
37	3	786100	6996375	786200	6997375	10
38	3	786200	6996375	786300	6997375	10
39	3	792100	6991100	792200	6991200	10
40	3	792200	6991100	792300	6991200	10
41	3	792100	6985740	792200	6986740	10
42	3	792200	6985740	792300	6986740	10
43	3	206400	6981100	206500	6982100	10
44	3	206500	6981100	206600	6982100	10
45	3	778800	7002575	778900	7003575	10
46	3	778900	7002575	779000	7003575	10
47	3	784800	6992200	785800	6992300	10
48	3	785800	6992200	786800	6992300	10
49	3	784800	6992300	785800	6992400	10
50	3	785800	6992300	786800	6992400	10
51	3	782150	6993900	782750	6994000	6
52	3	796500	6989650	796600	6990650	10
53	3	796600	6989650	796700	6990650	10
54	3	796500	6990650	796600	6991650	10
55	3	796600	6990650	796700	6991650	10
56	3	793700	6996550	793800	6997950	14
57	3	793500	6996550	793600	6997950	14
58	3	793900	6996550	794000	6997950	14
59	3	794100	6996550	794200	6997950	14
					Total	842

Appendix 7. Locations of conservation significant fauna recorded by BCE during the 2009 and 2010 surveys (Tables A-B).

Table A. Records of captures and observations

Species	Status	Location (Zone)	Easting	Northing	Habitat	Comments
Bush Stone-curlew	CS2	Fauna Site 8. (50J)	782753	6994305	Calcrete woodland	One responded to call playback
Bush Stone-curlew	CS2	Gnamma Hole. (50J).	782368	6992519	Hardpan Mulga	One heard
Bush Stone-curlew	CS2	Gnamma Hole. (51J).	246094	6986988	Waterhole at Breakaway	Tracks
Bush Stone-curlew	CS2	South-west of Deposit	782251	6993793	Hardpan Mulga	
Australian Bustard	CS2	west of resource (50J)	762547	7009055	Sand Dune	One
Australian Bustard	CS2	Throughout study area			All	Tracks found throughout
Peregrine Falcon	CS1	Barr Smith Range. (51J)	250609	6975588	Granite Breakaway	One
Malleefowl (mound) (Profile 1, 3m wide)	CS1	North of Deposit. (50J)	790511	6992350	Closed Acacia over Spinifex sandplain. Unburnt Acacia.	Inactive mound: constructed over old track, egg shell fragments present, suggesting recent use, made of sand.
Rainbow Bee-eater	CS1	Throughout study area, including the Project area			All	Probably breeding
Brush-tailed Mulgara	CS2	Camera trap site (51J)	206575	6981657	Spinifex Sandplain	Individual recorded on camera trap
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10: (50J)	783175	6999647	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped

Species	Status	Location (Zone)	Easting	Northing	Habitat	Comments
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	783126	6999656	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	783087	6999650	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	783054	6999647	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 10. (50J)	782901	6999612	Spinifex Sandplain	Individual trapped
Brush-tailed Mulgara	CS2	Fauna Site 6. (50J).	782931	6989858	Spinifex with Open Mulga Shrubland	Individual trapped
Black-flanked Rock-Wallaby	CS1	Barr Smith Range. (51J)	247522	6984286	Cave along breakaway	Large number of scats recorded in cave.
Greater Long-eared Bat	CS2	Rubble Bore (50J)	782841	6997710	Mulga Woodland	Anabat recording

Table B. Brush-tailed Mulgara records based on burrows, foraging signs, tracks and/or scats. This tabulates the results of records from the Mulgara transects conducted throughout the study area.

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 1	5/11/09	North of Deposit	790509	6992878	burrow	1			Active	
Mul 1	5/11/09	North of Deposit	790500	6992634	burrow	1			Inactive	debris in burrow
Mul 1	5/11/09	North of Deposit	790495	6992492	burrow	1	yes		Active	fresh tracks
Mul 1	5/11/09	North of Deposit	790527	6992271	burrow	1	yes		Active	
Opp	5/11/09	North of Deposit	790211	6992417	burrow	1			Active	fresh spoil in burrow
Mul 2	6/11/09	North of Deposit	789086	6993273	burrow	1			Inactive	old
Mul 3	6/11/09	Site 3	782921	6989846	burrow	1		yes	Active	
Mul 3	6/11/09	Site 3	783139	6989708	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	782984	6999620	burrow	1			Active	
Mul 4	6/11/09	Site 10	783003	6999631	burrow	1			Active	
Mul 4	6/11/09	Site 10	783017	6999617	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	783022	6999604	burrow	6	yes		Active	
Mul 4	6/11/09	Site 10	783112	6999630	burrow	1			Active	
Mul 4	6/11/09	Site 10	783184	6999608	burrow	3			Inactive	
Mul 4	6/11/09	Site 10	783196	6999619	burrow	1			Active	
Mul 4	6/11/09	Site 10	783450	6999635	feeding sign	1				
Mul 4	6/11/09	Site 10	783459	6999631	feeding sign	1				

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 4	6/11/09	Site 10	783550	6999626	burrow	1			Active	
Mul 4	6/11/09	Site 10	783641	6999609	burrow	1	yes		Active	
Mul 4	6/11/09	Site 10	783654	6999610	burrow	3	yes		Active	
Mul 4	6/11/09	Site 10	783864	6999624	burrow	2		yes	Active	
Mul 4	6/11/09	Site 10	783644	6999518	burrow	3			Inactive	
Mul 4	6/11/09	Site 10	783637	6999518	burrow	1			Active	
Mul 4	6/11/09	Site 10	783483	6999527	burrow	3			Inactive	
Mul 4	6/11/09	Site 10	783139	6999524	burrow	1			Active	
Mul 4	6/11/09	Site 10	783050	6999517	burrow	1			Active	
Mul 4	6/11/09	Site 10	782908	6999524	burrow	1			Inactive	
Mul 6	9/11/09	Meeka Rd 1	795275	6989460	burrow	3			Inactive	Habitat altered by fire
Mul 7	9/11/09	Meeka Rd 2	204670	6986499	burrow	1			Inactive	
Mul 7	9/11/09	Meeka Rd 2	204437	6986423	burrow	1			Inactive	
Mul 7	9/11/09	Meeka Rd 2	204347	6986589	burrow	1	yes	yes	Active	
Mul 1	5/11/09	North of Deposit	790112	6992500	burrow	1			inactive	
Mul 1	5/11/09	North of Deposit	790552	6992390	burrow	1			inactive	
Mul 3	7/11/09	Transect 6	783285	6989659	burrow	8			inactive	
Mul 3	7/11/09	Transect 6	782969	6989660	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	782976	6999607	burrow	1			active	
Mul 4	7/11/09	Transect 10	782998	6999600	burrow	3		yes	active	

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 4	7/11/09	Transect 10	783028	6999605	burrow	1			active	
Mul 4	7/11/09	Transect 10	783157	6999597	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	783191	6999605	burrow	2	yes		active	
Mul 4	7/11/09	Transect 10	783202	6999611	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	783214	6999597	burrow	3			inactive	
Mul 4	7/11/09	Transect 10	783606	6999600	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	783883	6999594	burrow	2			active	
Mul 4	7/11/09	Transect 10	783847	6999494	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	783696	6999496	burrow	8			inactive	
Mul 4	7/11/09	Transect 10	783620	6999496	burrow	1			inactive	
Mul 4	7/11/09	Transect 10	783459	6999512	burrow	1		yes	active	
Mul 4	7/11/09	Transect 10	783051	6999510	burrow	12			inactive	
Mul 4	7/11/09	Transect 10	782986	6999527	burrow	8			active	
Mul 8	9/11/09		211162	6983755	burrow	2			inactive	
Mul 8	9/11/09		211156	6984636	burrow	1			inactive	
Mul 3	7/11/09	Site 6	782790	6989632	burrow	1			Active	
Mul 4	7/11/09	Site 10	782921	6999559	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	782949	6999556	forage					
Mul 4	7/11/09	Site 10	782966	6999555	burrow	2			Inactive	
Mul 4	7/11/09	Site 10	783002	6999570	forage					

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 4	7/11/09	Site 10	783026	6999559	forage	1			Inactive	
Mul 4	7/11/09	Site 10	783039	6999552	burrow	1				
Mul 4	7/11/09	Site 10	783046	6999563	forage					
Mul 4	7/11/09	Site 10	783088	6999550	forage					
Mul 4	7/11/09	Site 10	783111	6999552	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783178	6999557	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783251	6999554	forage					
Mul 4	7/11/09	Site 10	783290	6999560	forage					
Mul 4	7/11/09	Site 10	783312	6999566	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783331	6999568	forage					
Mul 4	7/11/09	Site 10	783379	6999566	burrow	5			Inactive	
Mul 4	7/11/09	Site 10	783483	6999562	forage					
Mul 4	7/11/09	Site 10	783565	6999563	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783612	6999552	forage					
Mul 4	7/11/09	Site 10	783610	6999560	forage					
Mul 4	7/11/09	Site 10	783678	6999562	burrow	1			Active	
Mul 4	7/11/09	Site 10	783699	6999559	burrow	1		yes	Active	
Mul 4	7/11/09	Site 10	783820	6999551	forage					
Mul 4	7/11/09	Site 10	783846	6999547	burrow	10		yes	Active	
Mul 4	7/11/09	Site 10	783855	6999555	forage					

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 4	7/11/09	Site 10	783846	6999455	forage					
Mul 4	7/11/09	Site 10	783838	6999449	forage					
Mul 4	7/11/09	Site 10	783823	6999443	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783817	6999448	forage					
Mul 4	7/11/09	Site 10	783811	6999443	forage					
Mul 4	7/11/09	Site 10	783803	6999450	forage					
Mul 4	7/11/09	Site 10	783745	6999470	forage					
Mul 4	7/11/09	Site 10	783574	6999462	forage					
Mul 4	7/11/09	Site 10	783351	6999464	forage					
Mul 4	7/11/09	Site 10	783143	6999466	forage					
Mul 4	7/11/09	Site 10	783102	6999458	forage					
Mul 4	7/11/09	Site 10	783073	6999460	burrow	1			Inactive	
Mul 4	7/11/09	Site 10	783002	6999459	burrow	1			Inactive	
Mul 8	9/11/09	Airfield Rd	211181	6983654	forage					
Mul 8	9/11/09	Airfield Rd	211167	6983780	forage					
Mul 8	9/11/09	Airfield Rd	211114	6983720	burrow	1			Inactive	
Mul 8	9/11/09	Airfield Rd	211086	6983708	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	783025	6999591	burrow	3			Active	
Mul 4	6/11/09	Site 10	783174	6999585	burrow	1			Active	
Mul 4	6/11/09	Site 10	783266	6999583	burrow	2			Active	

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
Mul 4	6/11/09	Site 10	783312	6999586	burrow	1			Active	
Mul 4	6/11/09	Site 10	783418	6999584	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	783814	6999577	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	783873	6999572	burrow	1	yes	yes	Active	
Mul 4	6/11/09	Site 10	783822	6999474	burrow	1			Active	
Mul 4	6/11/09	Site 10	783673	6999472	burrow	1			Active	
Mul 4	6/11/09	Site 10	783608	6999478	burrow	1			Active	
Mul 4	6/11/09	Site 10	783162	6999479	burrow	1			Inactive	
Mul 4	6/11/09	Site 10	783017	6999484	burrow	1			Active	
Mul 7	9/11/09	Meeka Rd 2	204365	6986682	burrow	1			Active	active burrow system
MAY 2010										
1	5/05/2010	Zone 50J	790 050	6 991 556	foraging hole					foraging holes
1	5/05/2010	Zone 50J	790 480	6 991 515	foraging holes					foraging holes
2	5/05/2010	Zone 50J	789 930	6 991 626	foraging holes					foraging holes
9	6/05/2010	Zone 50J	789 537	6 992 020	tracks		yes			tracks
12	6/05/2010	Zone 50J	789 280	6 992 115	tracks		yes			tracks
14	6/05/2010	Zone 50J	789 450	6 992 224	tracks		yes			tracks
14	6/05/2010	Zone 50J	789 300	6 992 210	Burrow				inactive	Burrow system
16	6/05/2010	Zone 50J	788 823	6 992 322	Burrow				inactive	2 inactive burrows
19	6/05/2010	Zone 50J	790 500	6 992 400	Burrow				inactive	2 inactive burrows

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
19	6/05/2010	Zone 50J	790 450	6 992 430	Burrow				inactive	1 inactive burrow
19	6/05/2010	Zone 50J	790 341	6 992 429	Burrow				inactive	1 inactive burrow
19	6/05/2010	Zone 50J	790 260	6 992 416	Burrow				inactive	1 inactive burrow
19	6/05/2010	Zone 50J	790 208	6 992 420	Burrow				inactive	1 inactive burrow
21	6/05/2010	Zone 50J	790 249	6 992 522	Burrow		yes		active	active burrow
21	6/05/2010	Zone 50J	790 288	6 992 533	Burrow				inactive	1 inactive burrow
21	6/05/2010	Zone 50J	790 408	6 992 526	Burrow				inactive	1 inactive burrow
25	7/05/2010	Zone 50J	790 140	6 992 722	foraging					1 foraging hole
25	7/05/2010	Zone 50J	790 196	6 992 742	foraging					1 foraging hole
26	7/05/2010	Zone 50J	790 099	6 992 898	foraging					1 foraging hole
31	7/05/2010	Zone 50J	783 515	6 997 477	foraging					2 foraging holes
31	7/05/2010	Zone 50J	783 511	6 997 377	Burrow		yes		active	warren of 5 holes
32	7/05/2010	Zone 50J	783 482	6 997 406	Foraging					2 old foraging holes
33	7/05/2010	Zone 50J	783 330	6 998 417	Foraging					old foraging hole
33	7/05/2010	Zone 50J	783 650	6 998 417	foraging					old foraging hole
33	7/05/2010	Zone 50J	783 768	6 998 422	foraging					old foraging hole
34	7/05/2010	Zone 50J	783 871	6 998 521	Burrow		yes	yes	active	Active burrow
34	7/05/2010	Zone 50J	783 625	6 998 520	Burrow				inactive	inactive burrow
34	7/05/2010	Zone 50J	783 376	6 998 522	Track					track
34	7/05/2010	Zone 50J	783 190	6 998 530	foraging					old foraging hole

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
34	7/05/2010	Zone 50J	783 108	6 998 521	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 019	7 001 513	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 013	7 001 493	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 014	7 001 437	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 013	7 001 122	Burrow		yes		active	Active burrow
35	8/05/2010	Zone 50J	784 014	7 001 005	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 012	7 000 946	Burrow				active	Active burrow
35	8/05/2010	Zone 50J	784 011	7 000 671	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 098	7 000 715	foraging					old foraging hole
35	8/05/2010	Zone 50J	784 088	7 000 682	tracks		yes			Tracks
35	8/05/2010	Zone 50J	784 081	7 000 601	foraging					old foraging hole
36	8/05/2010	Zone 50J	783 963	7 000 918	foraging					old foraging hole
36	8/05/2010	Zone 50J	784 000	7 000 993	Burrow				active	Active burrow
36	8/05/2010	Zone 50J	783 990	7 001 028	foraging					old foraging hole
36	8/05/2010	Zone 50J	783 985	7 001 043	Burrow				active	Active burrow system
36	8/05/2010	Zone 50J	783 985	7 001 289	foraging					old foraging hole
36	8/05/2010	Zone 50J	783 997	7 001 367	Burrow				active	Active burrow system
37	8/05/2010	Zone 50J	788 124	7 996 841	Burrow				active	Active burrow
38	8/05/2010	Zone 50J	786 225	7 996 379	Burrow			yes	active	Active burrow
38	8/05/2010	Zone 50J	786 218	7 997 215	foraging					old foraging hole

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
40	8/05/2010	Zone 50J	792 238	6 991 923	Burrow		yes		active	Active burrow in goanna digging with scats at entrance
40	8/05/2010	Zone 50J	792 222	6 992 633	Burrow		yes		active	Active burrow in goanna digging with scats at entrance
40	8/05/2010	Zone 50J	792 230	6 992 668	foraging					old foraging hole
41	8/05/2010	Zone 50J	792 115	6 986 541	Burrow				inactive	old foraging burrow
42	8/05/2010	Zone 50J	792 223	6 986 408	Burrow	yes			active	Active burrow
42	8/05/2010	Zone 50J	792 230	6 986 480	track					Track
43	8/05/2010	Zone 51	206 435	6 981 616	Burrow				inactive	Burrow system
43	8/05/2010	Zone 51	206 411	6 981 425	Burrow		yes		active	Active burrow in goanna digging with scats at entrance
45	9/05/2010	Zone 50J	778 809	7 003 450	Scat		yes			Scat
45	9/05/2010	Zone 50J	778 820	7 003 523	Track					Track
45	9/05/2010	Zone 50J	778 809	7 003 412	foraging					recent foraging hole
45	9/05/2010	Zone 50J	778 816	7 003 274	Track					Track
45	9/05/2010	Zone 50J	778 811	7 003 175	Burrow				active	Active burrow
45	9/05/2010	Zone 50J	778 810	7 002 580	track					Track
46	9/05/2010	Zone 50J	778 923	7 002 747	track					Track

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
46	9/05/2010	Zone 50J	778 917	7 002 833	track					Track
46	9/05/2010	Zone 50J	778 925	7 003 217	foraging					recent foraging hole
	6/05/2010	Zone 50J	789930	6991646	Burrow	2			active	
	6/05/2010	Zone 50J	789794	6991648	Burrow	1			inactive	Old
	6/05/2010	Zone 50J	789546	6991649	Burrow	1			inactive	Old
	6/05/2010	Zone 50J	789549	6991745	Burrow	1			active	
	6/05/2010	Zone 50J	790488	6992256	Burrow	1			active	
	7/05/2010	Zone 50J	790244	6992548	Burrow	1			inactive	Old
	7/05/2010	Zone 50J	783455	6996858	Burrow	1			inactive	Old
	7/05/2010	Zone 50J	783072	6998448	Burrow	1	Yes		active	Recent
	7/05/2010	Zone 50J	783166	6998446	Burrow	1			inactive	
	7/05/2010	Zone 50J	783639	6998559	Burrow	1			inactive	Old
	8/05/2010	Zone 50J	784063	7000985	Burrow	1			inactive	Old
	8/05/2010	Zone 50J	784073	7000826	Burrow	1		Yes	active	Recent
	8/05/2010	Zone 50J	783949	7000816	Burrow	1			inactive	Old?
	9/05/2010	Zone 50J	783959	7000944	Burrow	3			active	
	9/05/2010	Zone 50J	786149	6996854	Burrow	1		Yes	active	
	9/05/2010	Zone 50J	786259	6996367	Burrow	1			inactive	
	6/05/2010	50J	789680	6991591	Burrow	4	yes		active	active burrow system
	6/05/2010	50J	789159	6991979	Burrow	4			inactive	inactive burrow

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
	6/05/2010	50J	788841	6992274	Burrow	1			active	Active burrow
	6/05/2010	50J	790460	6992502	Burrow	1			active	1 active burrow
	6/05/2010	50J	790436	6992494	Burrow	3	yes	yes	active	active burrow
	6/05/2010	50J	790224	6992570	Burrow	1			active	1 burrow
	6/05/2010	50J	783567	6996828	Burrow	1	yes	yes	active	1 active burrow
	6/05/2010	50J	783424	6996840	Burrow	1	yes	yes	active	1 active burrow
	6/05/2010	50J	783421	6997058	Burrow	1			inactive	inactive burrow
	6/05/2010	50J	783507	6998492	Burrow	1			inactive	1 burrow with tracks
	6/05/2010	50J	783682	6998529	Burrow	2	yes		active	1 active burrow
	6/05/2010	50J	783829	6998596	Burrow	5	yes		active	1 active burrow
	6/05/2010	50J	783517	6998581	Burrow	1	yes		active	1 active burrow
	6/05/2010	50J	783401	6998584	Burrow	1	yes	yes	active	1 active burrow
	7/05/2010	50J	783262	6998580	Burrow	1	yes	yes	active	1 active burrow
	7/05/2010	50J	784070	7001634	Burrow	1			inactive	1 old inactive burrow
	7/05/2010	50J	784088	7000995	Burrow	2	yes	yes	active	2 active burrows
	7/05/2010	50J	784097	7000879	Burrow	10	yes		active	1 active burrow system
	7/05/2010	50J	784076	7000710	Burrow	2	yes	yes	active	1 active burrow
	7/05/2010	50J	783922	7001488	Burrow	1			inactive	1 old inactive burrow
	8/05/2010	50J	786200	6996533	Burrow	1			inactive	1 old inactive burrow
	8/05/2010	50J	786285	6996502	Burrow	3	yes	yes	active	active burrow system,

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
										scats at entrance to goanna hole
	8/05/2010	50J	786279	6996941	Burrow	1	yes	yes	active	numerous fresh scats and tracks in burrow entrance -goanna hole, fresh tracks of both goanna and mulgara at burrow entrance
	8/05/2010	50J	786254	6997211	Burrow	3	yes		active	1 active burrow
	8/05/2010	50J	792192	6992132	Burrow	1	yes		active	1 active burrow
	8/05/2010	50J	792299	6992220	Burrow	1	yes	yes	active	1 active burrow
	8/05/2010	50J	792194	6985979	Burrow	1	yes	yes	active	1 active burrow with tracks scats , goanna hole
	8/05/2010	50J	792284	6986497	Burrow	1	yes		active	1 active burrow
	8/05/2010	51J	206487	6981645	Burrow	1	yes	yes	active	1 active burrow
	8/05/2010	51J	206575	6981657	Burrow	10	yes	yes	active	active warren with 10 plus entrances
	9/05/2010	50J	783913	7001257	Burrow	1	yes	yes	active	1 active burrow
	9/05/2010	50J	790498	6992382	Digging					1 fresh digging
	9/05/2010	50J	783922	7001412	Digging					1 fresh digging

Transect	Date	Location	Record Easting	Record Northing	Record Type	# burrows/ entrances	Tracks Present	Scats Present	Status	Comments
	9/05/2010	50J	778895	7002896	Tracks					fresh tracks

Appendix 8. Details of bat species recorded (Tables A – D)

Table A. Details of bat call samples from Anabat detectors

Species	pulses	Dur	Fmax	Fmin	Fpeak
March 2009					
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	12	9.4 (± 1.5)	23.6 (± 0.9)	19.2 (± 0.4)	19.7 (± 0.5)
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	10	6.9 (± 1.9)	52.2 (± 6.2)	29.2 (± 1.2)	29.9 (± 0.9)
Inland Greater Long-eared Bat <i>Nyctophilus major tor</i>	19	5.5 (± 1.1)	61.3 (± 6.9)	42.6 (± 1.3)	42.7 (± 2.4)
Inland Broad-nosed Bat <i>Scotorepens balstoni</i>	14	5.0 (± 0.7)	63.0 (± 11.7)	35.0 (± 1.2)	35.3 (± 0.5)
Inland Forest Bat <i>Vespadelus baverstocki</i>	14	3.6 (± 0.7)	64.0 (± 7.2)	45.7 (± 1.1)	46.6 (± 1.3)
Inland Cave Bat <i>Vespadelus finlaysoni</i>	14	5.3 (± 1.4)	61.4 (± 3.7)	53.8 (± 0.4)	52.6 (± 0.5)
Inland Freetail Bat <i>Mormopterus aff. planiceps</i> (sp. 3)	14	11.0 (± 0.9)	30.0 (± 2.4)	26.0 (± 0.6)	26.2 (± 0.5)
White-striped Freetail Bat <i>Austronomus australis</i>	14	10.0 (± 3.5)	23.4 (± 4.9)	13.9 (± 0.1)	13.4 (± 1.0)
November 2009					
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	11	8.8 (± 3.4)	21.6 (± 4.5)	18.4 (± 0.2)	18.5 - 21.5
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	13	8.6 (± 1.4)	35.0 (± 1.6)	30.2 (± 0.4)	29.8 - 31.7
Inland Broad-nosed Bat <i>Scotorepens balstoni</i>	25	5.1 (± 1.2)	59.4 (± 11.6)	34.0 (± 0.8)	32.7 - 36.2
Inland Freetail Bat <i>Mormopterus aff. planiceps</i> (sp. 3)	12	9.5 (± 1.1)	26.9 (± 0.6)	25.7 (± 0.5)	25.6 - 27.5

Table B. Location of species records, based on either call recordings (A) or captures (C) in March 2009.

Species	Yeelirrie Homestead	Afghan Well	Breakaway	Rubble Bore
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	A			A
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	C, A	A		A
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>	C			
Inland Greater Long-eared Bat <i>Nyctophilus major tor</i>				A?
Inland Broad-nosed Bat <i>Scotorepens balstoni</i>	C, A		A	A
Inland Forest Bat <i>Vespadelus baverstocki</i>				A
Inland Cave Bat <i>Vespadelus finlaysoni</i>		A	A	
Inland Freetail Bat <i>Mormopterus</i> aff. <i>planiceps</i> (sp. 3)	C, A	A	A	A
White-striped Freetail Bat <i>Austronomus australis</i>	A	A		

Table C. Location of species records, based on call recordings (A), captures (C) or heard (H) in November 2009.

Species	Yeelirrie Homestead	Fauna Site 1	Gnamma Hole	Harp trap Site (Mulga woodland)	Corner near Fauna Site 11
Yellow-bellied Sheath-tail Bat <i>Saccolaimus flaviventris</i>	A				
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	A	A	A	A	A
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>	C				
Inland Broad-nosed Bat <i>Scotorepens balstoni</i>	A	A		A	A
Inland Freetail Bat <i>Mormopterus</i> aff. <i>planiceps</i> (sp. 3)	A		A	A	A
White-striped Freetail Bat <i>Tadarida australis</i>	H	H	H		H

Table D. Details of bats caught at Yeelirrie, in 2-bank Harp trap (March 2009) and 3-bank Harp trap (November 2009)

FA= Forearm measurement (mm)

Date	Location	Species	Sex	FA (mm)
24/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♂	
25/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♂	
25/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♀	
28/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♂	42.3
29/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♂	40.6
29/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♂	32.2
29/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♀	35.1
29/3/09	Yeelirrie HSD	<i>Scotorepens balstoni</i>	♂	36.2
29/3/09	Yeelirrie HSD	<i>Mormopterus</i> aff. <i>planiceps</i> (sp. 3)	♂	34.1
30/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♂	41.7
30/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♂	40.9
30/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♂	42.1
30/3/09	Yeelirrie HSD	<i>Chalinolobus gouldii</i>	♀	41.1
30/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♀	34.2
30/3/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♂	33.4
7/11/09	Yeelirrie HSD	<i>Nyctophilus geoffroyi</i>	♂	
8/11/09	Gnamma	<i>Nyctophilus geoffroyi</i>	♂	

Appendix 9. Rock Wallaby Scat Analysis



Georgeanna Story

ABN 86 874 479 856

Telephone 02 484 61238

Mobile 0429 779 928

PO Box 24,

Majors Creek NSW 2622

georgeanna@scatsabout.com.au

www.scatsabout.com.au

22nd October 2009

Jeff Turpin

3 Hellenic Rd

Roleystone WA 6111

To Jeff Turpin

Re: Herbivore Scats

The herbivore scats found within a cave near Wilnuna demonstrate characteristics consistent with typical features found in rock-wallaby scats. Rock-wallaby scats possess a cylindrical shape with a pinch at one end and are generally smaller than 35mm. A single hair was extracted from the unknown sample and displayed features similar to rock-wallaby hair, however in this case the single hair is not enough to provide a definite identification.

Potential herbivores at the site are *Petrogale lateralis*, *P. rothschildii*, *Macropod robustus* and *Capra hircus*. *C. hircus* can be ruled out with a size and shape significantly different to the unknown sample. It is also unlikely that the scats were from *M. robustus*. On occasion a scat from *M. robustus* may display a cylindrical shape consistent with rock-wallaby scats, however a shape more characteristic for *M.*

robustus is of a squarer nature. The dominant shape within a single deposition is square for *M. robustus* and pinched cylindrical for rock-wallabies. The consistency of shape in the unknown sample is pinched cylindrical. Attached are photos of the unknown sample (Figure 1), *P. xanthopus* (Figure 2), *P. rothschildi* (Figure 3) and *M. robustus* (Figure 4) for your consideration.

Using the above information, I feel that the unknown sample is most likely to be rock-wallaby scats. Unfortunately the similarities in rock-wallaby scats and hair have limited the ability for further identification.

Yours faithfully

Georgeanna Story



Figure 1. Unknown scats from Yeelirrie (identified as most likely a rock-wallaby)



Figure 2. *Petrogale xanthopsus* scats



Figure 3. *Petrogale rothschildi* scats



Figure 4. *Macropus robustus* scats