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Goldsworthy Fauna Assessment

BHP Billiton Pty Ltd

February 2013

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Biologic Environmental Survey (Biologic) was commissioned by BHP Billiton Iron Ore Pty Ltd to undertake a Level 1 fauna assessment of BHP Billiton Iron Ore's (BHPBIO's) Goldsworthy Tenement (mining leases ML235SA and ML249SA); hereafter referred to as the 'Study Area'. The Study Area is located approximately 95 km north east of Port Hedland, within the Pilbara region of Western Australia (Figure 1.1) and covers an area of approximately 69.5 km^2.

The purpose of the assessment was to:

1. Undertake a comprehensive literature and database review of previous fauna surveys and records within and close to the Study Area.
2. Undertake a fauna habitat assessment of the Study Area, including mapping of fauna habitats present and identification of any habitats suitable to support conservation significant species.
3. Undertake a targeted survey within the Study Area for the conservation significant species, in particular the Pilbara Leaf-nosed Bat (*Rhinonicterus aurantia*), Northern Quoll (*Dasyurus hallucatus*), Mulgara (*Dasycercus* spp.), Pilbara Olive Python (*Liasis olivaceus barroni*), Greater Bilby (*Macrotis lagotis*) and Ghost Bat (*Macroderma gigas*).
4. Obtain genetic samples for any conservation significant species recorded within the Study Area for lodgement with the Western Australian Museum (WAM) and Department of Environment and Conservation (DEC).
5. Provide a contemporary overview of vertebrate fauna within the Study Area, with consolidated data from all surveys undertaken to date.

A total of 212 vertebrate faunal species may occur in the Goldsworthy Study Area, based upon previous records, known distributions and habitat preferences. Upon completion of the current study, a total of 101 native vertebrate taxa have been recorded within the Study Area. This comprises 20 native mammal species, 67 bird species, 14 reptile species and one amphibian species. A further four species of introduced mammals have also been recorded.

Thirteen conservation significant species have been recorded within the Study Area to date:

- Ghost Bat (*Macroderma gigas*) - listed as Priority 4 by the DEC and as Vulnerable by the IUCN;
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia* Pilbara form) – Listed as Vulnerable under the EPBC Act and on Schedule 1 of the WC Act;
- Greater Bilby (*Macrotis lagotis*) – Listed as Vulnerable under the EPBC Act, on Schedule 1 under the WC Act, and as Vulnerable by the IUCN;

- Mulgara (*Dasycercus* sp.) - Listed as Vulnerable under the EPBC Act and on Schedule 1 of the WC Act;
- Northern Quoll (*Dasyurus hallucatus*) - Listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act Endangered and as Endangered by the IUCN;
- Western Pebble-mound Mouse (*Pseudomys chapmani*) - Listed as Priority 4 by the DEC (only inactive mounds were recorded at Goldsworthy);
- Australian Bustard (*Ardeotis australis*) - Listed as Priority 4 by the DEC;
- Rainbow Bee-eater (*Merops ornatus*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act;
- Peregrine Falcon (*Falco peregrinus*) - Listed on Schedule 4 under the WC Act;
- Pictorella Mannikin (*Heteromunia pectoralis*) - Listed as Priority 4 by the DEC;
- Wood Sandpiper (*Tringa glareola*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act;
- Swinhoe's Snipe (*Gallinago megala*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act; and
- Sharp-tailed Sandpiper (*Calidris accuminata*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.

Based on habitats available within the Study Area, an additional 14 conservation significant species are considered to potentially occur.

Eight broad fauna habitats were identified within the Study Area:

- Gorge/Gully/Breakaway Systems;
- Major Drainage Line;
- Crests and Slopes;
- Gibber Plain;
- Sand Plain with Pindan;
- Sand Plain with Hummock Grass;
- Gilgai with tussock grass; and
- Disturbed Areas (including the old pit, waste dumps and town site).

The habitats of greatest significance were the Gorge/Gully/Breakaway Systems, Sand Plains with Pindan and the Major Drainage Line habitats, which could provide habitat for a number of conservation significant fauna, including but not limited to, the Northern Quoll, Ghost Bat, Greater Bilby, and Mulgara.

1 INTRODUCTION

The Mount Goldsworthy mine was the first major iron ore mine in the Pilbara. It operated for 20 years prior to closing in 1982. The mine is located within the Ellarine Range, which divides the alluvial plains extending south to the De Grey River and north to the Indian Ocean. The mine site and associated infrastructure consisted of a main open cut pit measuring 1200m by 500m and 200 m deep, various waste dumps, an ore-processing plant, railway infrastructure and a 1000 person mining town (Pilbara Flora, 2009). The mine void extended 177m below the pre-mining water table (Wooley, 2005).

On completion of mining, the pit was abandoned and has slowly filled with water. Water levels, recorded since 1992, are about 50 m below the pre-mining water table (Wooley, 2005). The water is rising at a rate of 2.1 m/yr. The rate of inflow is predicted to decrease with time as the water level rises and the flow gradient towards the void decreases. Initial pit-lake salinity following mine closure was apparently between 1400 to 2000 mg/L. Since 1992, the salinity has been increasing at a rate of 200 mg/L/yr, although chemistry is not changing significantly. There is a temperature gradient in the water body and a constant temperature of 22˚C at a depth of 20 m. The pH is neutral and nutrient levels are low, which will minimize biological colonisation of the water body. The water body is well mixed with respect to the major ions (Johnson and Wright, 2003).

The entire Goldsworthy mine area was rehabilitated by BHP between 1992 and 1993. This involved removal of redundant infrastructure (including the mining town), reshaping and moonscaping of waste dump blatters, ripping of flat areas and reseeding with native vegetation.

BHPBIO is seeking to undertake further work at the Goldsworthy site, including drilling, requiring a native vegetation clearing permit (NVCP). To facilitate the NVCP application, Biologic Environmental Survey (Biologic) was commissioned by BHPBIO to undertake a desktop assessment and a Level 1 fauna survey. The aim was to determine the presence of conservation significant species within or adjacent to the Goldsworthy tenement, and also those conservation significant species likely to occur

This report provides:

1. A comprehensive fauna literature and database review for the Study Area (including a summary of previous fauna survey results, literature search and relevant specimen databases) considering:
    - Threatened fauna or Migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act*;
    - Declared Threatened Fauna and Other Specially Protected Fauna listed under the latest *WA Wildlife Conservation (Specially Protected Fauna) Notice (WC Act)*;

- Priority Fauna recognised by the Department of Environment and Conservation (DEC); and
- Fauna listed on the IUCN Red List.

2. A fauna habitat assessment to describe and map fauna habitat within the Study Area. Additionally, significant fauna habitats or features (e.g. caves, waterholes) are mapped.

3. An assessment of the likelihood of habitat within the Study Area to support significant species listed in point 1 above.

4. A list of all fauna species recorded, via primary or secondary evidence, within the Study Area, including those recorded during previous surveys; and

5. The results of a targeted survey for species of conservation significance (as listed in 1, above). Maps are provided showing the locations of species recorded during the survey, and previous records of conservation significant fauna determined via the literature and database reviews.

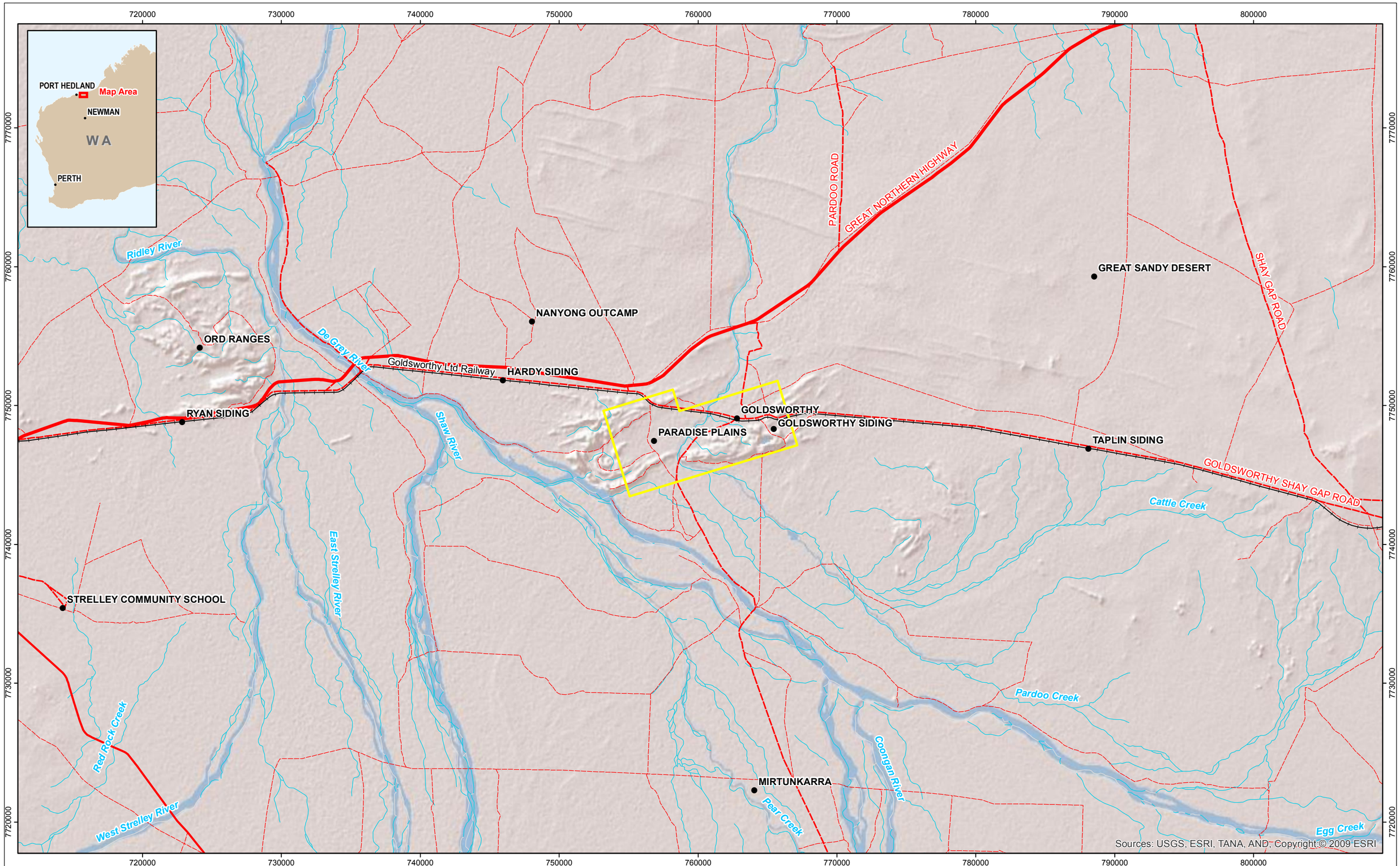

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FIGURE 1.1		Date:	26/11/2012
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Datum: GDA94

Projection: MGA Zone 50

GOLDSWORTHY

REGIONAL LOCATION
FIGURE 1.1

Legend

Study Area

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2 ENVIRONMENT

2.1 Biogeography

The Study Area falls within the Pilbara biogeographical region as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Creswell, 1995). The Pilbara bioregion has high endemic species richness and also represents a biocline between the tropical northern Kimberley region and the arid interior. It is divided into four sub-regions. The Study Area, sited in the north eastern extremity of the Pilbara, lies within the transition zone between the Chichester (PIL1) and the Roebourne (PIL4) sub-regions. 85% of the Study Area lies within the Chichester subregion, while the remaining 15% in the south of the Study Area is in the Roebourne subregion. The Study Area also lies close to the Pilbara borders with the Dampierland (7 km to the north) and Great Sandy Desert bioregions (0.5 km north at the closest point) (Kendrick, 2001). Botanically, it is situated towards the north-eastern corner of the Pilbara Region Eremean Botanical Province, at the boundary of the Fortescue and Canning Botanical Districts and adjacent to the Great Sandy Desert Region (Beard, 1990). Beard categorises the vegetation types of the Goldsworthy area as tree-steppes and shrub-steppes dominated by *Eucalyptus leucophloia* or *Acacia pyrifolia* over *Triodia pungens* grasslands.

The Goldsworthy mining areas are located within the mixed Archaean rock type called the Gorge Creek Group, consisting of undivided banded iron-formation and metamorphosed siliciclastic sedimentary formation (GSWA, 2008). These formations constitute the Ellarine Ranges.

The sandplains to the north of the Ellarine Ranges are part of the Grey Supergroup, consisting of siliciclastic sedimentary and metamorphosed formations (GSWA, 2008).

The sandplains to the south of the Ellarine Ranges are part of the Warrawoona Group, consisting of mafic, ultramafic, felsic volcanic and intrusive rocks and sedimentary metamorphosed rocks (GSWA, 2008).

2.2 Climate

The Pilbara region has a semi-desert to tropical climate. Rainfall events within the region are often sporadic and can occur within both summer and winter months, but mostly during the former season. Summer rainfall is a result of either tropical storms in the north or tropical cyclones that impact upon the coast and move inland. The winter rainfall is generally lighter and is the result of cold fronts moving north easterly across the state (Leighton, 2004). The average annual rainfall ranges from about 200 to 350 mm, but there are significant fluctuations between years (Department of Water, 2012) with up to 1200 mm falling in some locations in some years (McKenzie *et al.*, 2009).

Temperatures vary significantly throughout the year with average maximum summer temperatures reaching 35°C to 40°C and winter temperatures generally fluctuating between 22°C and 30°C.

Long-term climatic data is not available for the Goldsworthy site itself. However, meteorological data has been recorded at the Bureau of Meteorology (BOM) weather station Port Hedland (Station 4032), 97 km west of the Study Area, providing an excellent indication of climatic conditions experienced at the Study Area. The average monthly temperature and rainfall observations at Port Hedland Airport were plotted against the longer-term (1942-2011) averages in Figure 2.1. Weather was recorded at Goldsworthy (BOM Station # 4074) for 26 years from 1966 to 1992 and appears comparable to the Port Hedland data (Pilbara Flora, 2009).

The climate of the Goldsworthy region is semi-arid, hot and mostly dry, with an average annual rainfall of 347 mm at Goldsworthy and 312 mm at the Port Hedland Airport. Most rainfall generally occurs in the summer rain season from December to June with occasional major deluge events from cyclones. The highest daily rainfall event was 387.1 mm recorded on 27 January 1967 (Bureau of Meteorology, 2012). Scattered thunderstorms provide the majority of non-cyclonic rain and an average of 15 to 20 thunderstorms occur each year, mostly during summer. Infrequent and unreliable winter rain also occurs. Daily temperatures are often greater than 40°C for extended periods during summer.

Massive rainfall is associated with the summer cyclone season. These large rainfall events can result in flash flooding and extensive overland flooding. Watercourses are generally dry for most of the year and only flow after significant rainfall events. Creek flows subside rapidly, often within a few days to a week. River systems can flow for several weeks to a month before drying up. Water, however, is retained in waterholes along the watercourses and in rock pools in gorges for many months into the dry season.

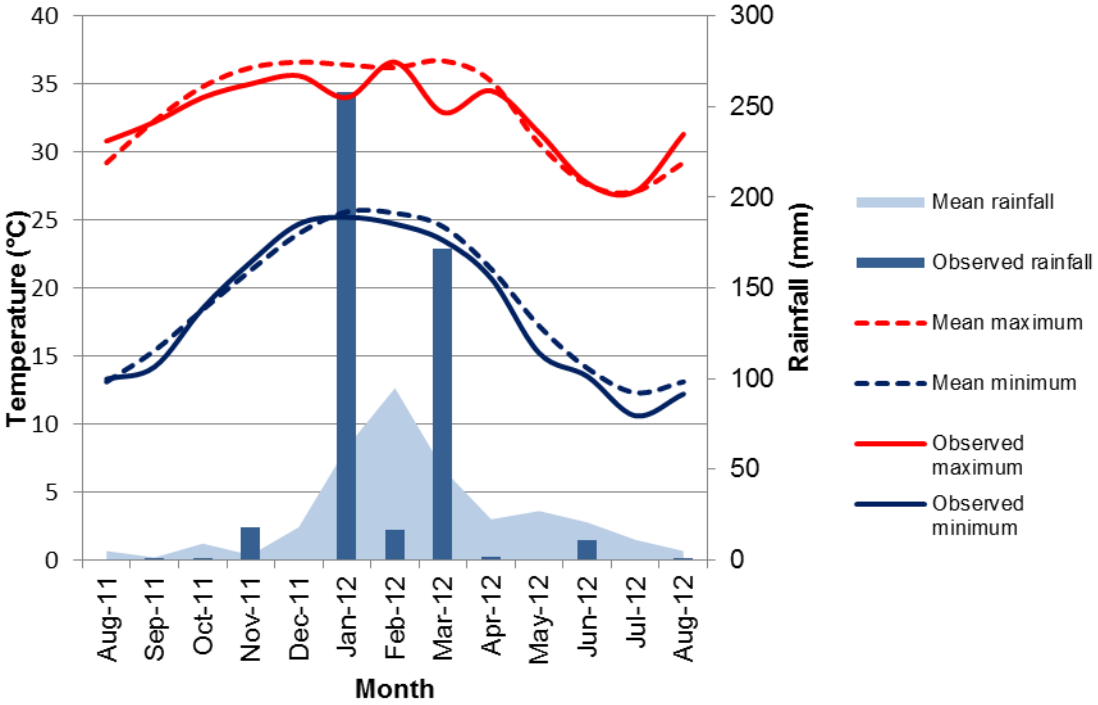


Figure 2.1 Average monthly temperature and rainfall observations at Port Hedland Airport from August 2011 to August 2012, compared with longer-term climatic averages (Bureau of Meteorology, 2012).

2.3 Existing Land Use

Pastoralism and mining are the major industries of the Pilbara region. Although there are no direct on-going mining activities in close proximity to the Study Area, it is traversed by the Port Hedland to Yarrie railway. The Study Area contains the old Mount Goldsworthy mine site with a large flooded pit, a much smaller subsidiary pit, and extensive overburden storage areas. Although access to the flooded pit is blocked off by bunds, it is still accessible for light vehicles with sufficient clearance. Anecdotal reports suggest that the flooded pit is utilised by members of the public for water sports on occasion. Cattle are grazed on the lower-lying areas of the Study Area, which is located within the Pardoo and De Grey pastoral leases.

3 METHODOLOGY

3.1 Compliance

This review and field survey was carried out in a manner compliant with WA Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of fauna in WA:

- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3* (ecologia Environmental Consultants, 2001);
- *Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. No. 56.* (EPA, 2004); and
- *Technical Guide –Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Biota Environmental Services, 2002)*.

Survey guidelines released by the then Commonwealth Department of Environment, Water, Heritage and Arts for amphibians (ecologia Environmental Consultants, 1998), reptiles (Biota Environmental Services, 2001), birds (ecologia Environmental Consultants, 1999), bats (Department of Environment, 2010d), threatened mammals (ecologia Environmental Consultants, 2000); and those defined in 'BHPBIO Guidance for Vertebrate Fauna Surveys in the Pilbara' (SPR-IEN-EMS-012) were also considered.

3.2 Literature and Database Review

A review of all publicly available literature relevant to the Study Area and nearby areas, and additional reports commissioned and held by BHPBIO, was undertaken in September 2012. The reports reviewed are listed below (Table 3.1).

Table 3.1 Reports used for the review.

Survey Title	Consultant	Year	Survey Type
Flora and vegetation survey of the Goldsworthy minesite	Pilbara Flora	2009	Single phase Level 1
Fauna Assessment of the Pardoo Direct Shipping Ore Project: an unpublished report for Atlas Iron Ltd	Bamford Consulting Ecologists	2007	Level 1 with some elements of Level 2
Goldsworthy Extension Project Biological Assessment Survey	Ecologia Environment	2005	Level 2 Fauna and Flora
Poondano Targeted Fauna Assessment	Outback Ecology Services	2009	Level 1
A genetic analysis of the Northern Quoll population in the Poondano Region of the Pilbara	Rapallo	2011	Genetic analysis

Two databases were searched to obtain information on species previously recorded during field surveys (NatureMap) or species likely to occur within the Study Area (Protected Matters Database) (Table 3.2):

- DEC's NatureMap database – a search was undertaken on 25 September 2012. The search provided results from a 20km radius from the centrum of the Study Area. 20 km was chosen as this gives a buffer of 1256 km^2 but avoids catching the coastal habitats such as mangroves and shoreline.
- Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) Protected Matters Database – a search was undertaken on 25 September 2012. The search provided results from a 20 km radius based around the centrum of the Study Area.

These database search results are attached as Appendix H.

Table 3.2 Databases used for the review.

Provider	Database	Parameters
Department of Environment and Conservation	NatureMap. Accessed 25 September 2012	Circle of radius 20 km centred on the point - 119º 20' 35 " E, 20º 21' 10" S
Department of Sustainability, Environment, Water, Populations and Communities	Protected Matters Database Search Tool. Accessed 25 September 2012	Circle of radius 20 km centred on the point - 119º 20' 35 " E, 20º 21' 10" S

3.3 Field Assessment

A field assessment was undertaken by Biologic between the 16th and 23rd August 2012. The purpose of this survey was to verify the data collated during the literature and database reviews, map and describe the fauna habitats present within the Study Area, and undertake targeted surveys for fauna of conservation significance.

3.3.1 Survey team

Mr Morgan O'Connell Project Manager / Senior Ecologist

Dr Andrew Gardner Senior Zoologist

Mr Bob Bullen of Bat Call WA, analysed the recordings from the Songmeter SM2BAT and Echometer detector systems used during the survey. Breanne Menezies, Senior Ecologist with BHP Billiton Iron Ore, assisted with the survey between the 21st and 22nd August 2012.

3.3.2 Climatic conditions

Data recorded at the BHPBIO Yarrie mine site weather station 90 km ESE of the Study Area for August 2012 is presented in Figure 3.1 (Compliance Monitoring, 2012), and are an indication of the climatic conditions immediately before, during and after the study (16th – 23rd August 2012). No rain fell during the survey. There was morning fog on the 14th and 15th of August, which dispersed by around 8 a.m. Otherwise the weather was fine, with light winds and sunshine. Long-term meteorological data at Port Hedland Airport is presented in Figure 2.1.

The climatic parameters during the study fall within the long-term average values for the month of August. The long-term average rainfall in the area during August is 4.9 mm, but no rainfall was reported during the study period. The area received a total of 11 mm in the three preceding months (May-July 2012) indicating that dry conditions prevailed leading up to the survey period. This is typical of winter in the area. At Port Hedland, the mean daily global solar exposure for August 2012 was 20.6 MJm^2 close to the long term average of 20.7 MJm^2, and well within the recorded range of 16.7-22.7 MJm^2.

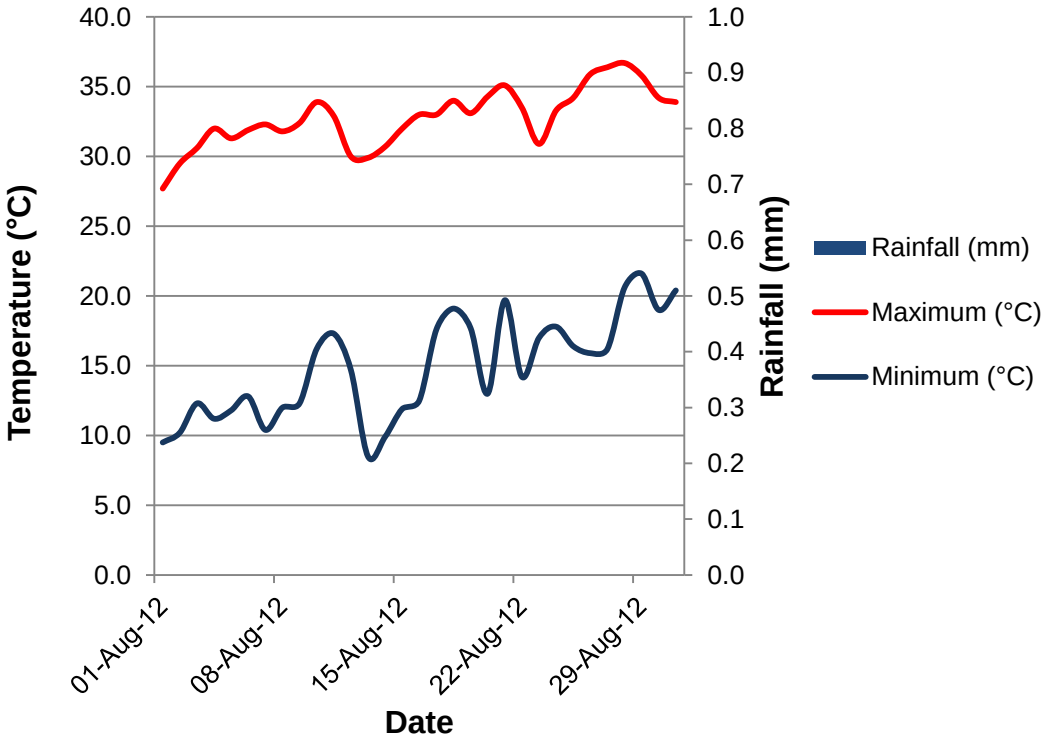


Figure 3.1 Daily temperatures and rainfall at BHPBIO Yarrie mine during August 2012 (Compliance Monitoring, 2012). The field study was between 17 and 23 August 2012. No rain fell at the Study Area during the survey.

3.3.3 Bat surveys

Sixteen overnight recordings of bat echolocation calls were made with three SM2BAT detectors (Wildlife Acoustics, USA) in habitats deemed more likely to be attractive as foraging grounds to bats, such as water pools and cave entrances (Department of Environment, 2010d). The jumper and audio settings used for the SM2BAT followed the manufacturer's recommendations contained in the user manual (Wildlife Acoustics, 2010).

Selectable filters and triggers were also set using the manufacturer's recommendations. A further five recording sessions were completed using an Echo Meter EM3 active detector (Wildlife Acoustics, USA). Recording localities are shown on Figure 3.2.

Bat calls were analysed by Mr Bob Bullen of Bat Call WA, a recognised expert in the field.

3.3.4 Motion sensitive cameras

Motion sensitive video cameras were used to survey for larger mammals, including introduced predators. Four cameras were utilised, set at various locations such as rock ledges and outside burrows (Figure 3.2; Appendix A). A total of 330 hours of motion camera surveys was undertaken within the Study Area. The resulting footage was analysed visually.

3.3.5 Trapping

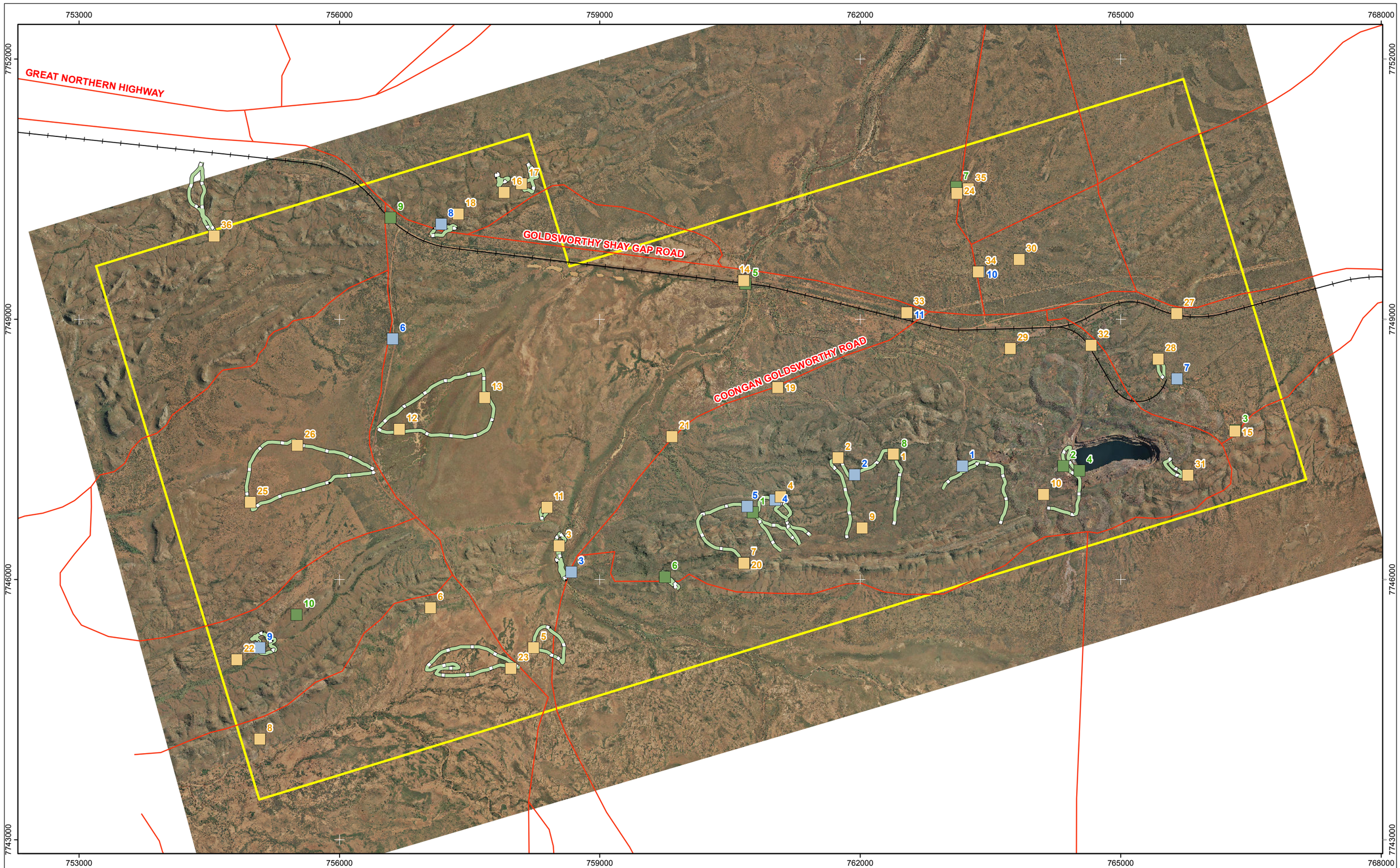
No trapping was undertaken in this level 1 fauna assessment.

3.3.6 Walking transects

Transects were walked across the most significant habitat types. These were meandering transects to record species of significance. Habitats were actively searched for burrows, scratching, diggings and scats of target species (mainly Mulgara, Northern Quoll, Pilbara Olive Python and Greater Bilby). When diggings, burrows or scats were observed, a general search of the area determined the extent of burrows. Walking transects are shown on Figure 3.2.

3.3.7 Incidental records

At all times while surveying, all records pertaining to species not previously recorded during the survey, rare or conservation significant fauna or other fauna of interest were documented. These records included indirect evidence such as tracks, scats and any other traces, as well as incidental sightings of live animals. Efforts were made to target likely microhabitats, such as by turning rocks, logs and anthropogenic debris such as discarded tyres, plywood sheets etc.



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GOLDSWORTHY

SAMPLING HABITATS
FIGURE 3.2

Legend

- Study Area
- **Fauna Sample Sites**
  - Bat Detector
  - Habitat Assessment
  - Motion Camera
- Walking Transects
- BHP Billiton Railway

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3.3.8 Targeted surveys for conservation significant fauna

Targeted searches for conservation significant fauna were undertaken during the survey work. Transects of most major and minor gully systems in the Study Area were conducted for potential Ghost Bat and Pilbara Leaf-nosed Bat caves, as well as suitable locations for Pilbara Olive Python, Northern Quoll and Peregrine Falcon (*Falco peregrinus*) (locations surveyed are shown in Figure 3.2). Caves were assessed for secondary evidence of bat use (scat and feeding middens).

3.3.9 Habitat assessment

Thirty six fauna habitat assessments were conducted (Appendix D). Habitats in the Study Area were assessed using methodology and terminology adapted from the Australian Soil and Land Survey Field Handbook (Commonwealth Scientific and Industrial Research Organisation, 2009) and modified to suit the survey requirements according to BHPBIO guidelines. The characteristics recorded during the habitat assessments were:

- site information, photo and location;
- landform: slope, relative inclination of slope, morphological type and landform type;
- vegetation: disturbance, condition, leaf litter %, twig litter %, wood litter, dead stags and hollow bearing trees, broad floristic formation, tree structure (tall, mid and low), shrub structure (tall, mid and low), grass structure (tall, mid and low), dominant trees, shrubs, mistletoes, grasses and herbs;
- land surface: microrelief, sheet erosion, rill erosion, gully erosion, gully depth, abundance and size of coarse fragments, rock outcropping, water bodies, comments on nests, burrows, roosts and diggings;
- soil: texture, colour; and
- substrate: bare ground, rock size, rock type, rock outcropping.

Fauna habitats were also assessed for the likelihood that they may support conservation significant fauna. All major fauna habitats present within the Study Area were sampled and scored for significance (High, Medium or Low) according to the criteria shown Table 3.3 below. Conservation significant habitats are discussed in Section 6.

Table 3.3 Fauna habitat significance assessment criteria.

Score	Criteria
High	Habitat supports EPBC Act listed threatened fauna. OR Habitat for species listed as above is present in the Study Area, and there are records of that species within 50 km of the Study Area. If limited surveys have been undertaken in the vicinity of the Study Area then a precautionary approach will be used and the species will be considered likely to be present. OR Uncommon habitat is critical habitat for a population of DEC listed Priority fauna. For example, if habitat is limited in the region and the habitat in the Study Area forms a significant portion of the known habitat for a Priority species, it would be scored as High significance. OR Habitat that only occurs in small isolated geographic areas.
Medium	Habitat supports DEC listed Priority fauna that are largely restricted to that habitat type within the Study Area. OR Habitat supports EPBC Act listed Migratory fauna. OR Habitat supports a particularly diverse and uncommon faunal assemblage. Habitat that occurs throughout region, and does not occur in small or isolated areas, is excluded.
Low	Habitat is widespread, common, and does not solely support any significant fauna.

3.3.10 Potential limitations and constraints

EPA Guidance Statement No. 56 (EPA, 2004) outlines several potential limitations to fauna surveys. These aspects are assessed and discussed in Table 3.4 below.

Table 3.4 Survey limitations and constraints.

Potential limitation or constraint	Applicability to this survey
Experience of personnel.	The field personnel involved in the survey each had five or more years of fauna survey experience. The two ecologists involved have a total of over 30 years of field survey experience.
Scope (faunal groups sampled and whether any constraints affect this).	The scope was a Level 1 survey and was conducted within that framework. No nocturnal work was undertaken; this reduced the ability for opportunistic detection of nocturnally active species.
Proportion of fauna identified	All observed fauna were identified at the point of observation. All recorded bat calls were identified; however due to identical characteristics in the calls of some bat species within a genus, it was not possible to differentiate all species using calls. Nevertheless all conservation significant species of bats were identified to species level.
Sources of information (recent or historic) and availability of contextual information	A number of surveys have been undertaken in the Study Area and the surrounding region. DEC has also completed the Pilbara Biological Survey which provided information on regional distribution of selected species. These reports were available at the time of reporting.
Proportion of the task achieved	A Level 1 survey of the Study Area was completed, and related to the results of surveys in the broader area.
Disturbances (e.g. fire or flood).	The weather during the survey was fine and did not affect access or the ability of the zoologists to assess habitat or detect species.
Intensity of survey.	A Level 1 survey was identified by BHPBIO as the requirement for this survey.
Completeness of survey.	The Level 1 survey is complete.
Resources (e.g. degree of expertise available).	All resources required to complete the survey were available.

Potential limitation or constraint	Applicability to this survey
Remoteness or access issues.	All areas in the tenement were accessible either by vehicle or on foot; all habitats within the Study Area were surveyed and all habitats considered to be suitable for conservation significant species were surveyed.

3.4 Taxonomy and Nomenclature

The latest checklist of mammals, reptiles and amphibians published by the WA Museum (WAM 2010) were used as a guide to the current taxonomy and nomenclature of these groups. This updated list in turn is formulated using up-to-date taxonomical literature. For birds, the current checklist of Australian birds, maintained by Birds Australia, was used. The bird list is based on the most recent review of the systematics and taxonomy of Australian birds by (Christidis and Boles, 2008).

3.5 Assessment of Conservation Significance

Within Western Australia, all native fauna is protected under the Wildlife Conservation Act 1950 (WC Act) and any action that has the potential to impact on native fauna needs to be approved by relevant State and/or Federal departments as dictated by the State Environmental Protection Act 1986 and the Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Some species of fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are called conservation significant species. A summary of applicable legislation and status codes is provided in Table 3.5. Additional information on Status Codes is provided in Appendix B.

A number of migratory bird and marine species are prioritised for conservation under the EPBC Act or international agreements. In addition the International Union for the Conservation of Nature (IUCN) compiles a ‘Red List’ upon which species at risk of extinction are listed.

For some species there is insufficient information to determine their status. These species are generally considered by the EPA/DEC as ‘conservation significance’ for all development related approvals and are listed on a ‘Priority List’ which is regularly reviewed and maintained by the DEC.

DEC also identifies ‘Threatened Ecological Communities’ (TECs) that are naturally occurring biological assemblages found to fit into one of the four categories (Table 3.5). Possible threatened ecological communities that do not meet these survey criteria are added to DEC’s ‘Priority Ecological Communities’ (PECs) lists under Priorities 1, 2 and 3.

Table 3.5 Conservation significance assessment guidelines.

Level	Act	Status Codes
International	Taxa listed under the following International Conventions: -Japan – Australia Migratory Bird Agreement (JAMBA) -China – Australia Migratory Bird Agreement (CAMBA) -Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) Additional may be listed as Migratory under the federal Environment Protection and Biodiversity Conservation Act 1999. The IUCN lists species at risk of extinction under nine categories.	EPBC Migratory IUCN Extinct IUCN Extinct in the Wild IUCN Critically Endangered IUCN Endangered IUCN Vulnerable IUCN Near Threatened IUCN Least Concern IUCN Data Deficient IUCN Not Evaluated
Federal	Environment Protection and Biodiversity Conservation Act 1999. The Department of Environment, Water, Heritage and the Arts lists Threatened fauna, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of six categories.)	Extinct Extinct in the Wild Critically Endangered Endangered Vulnerable Conservation Dependent Migratory
State	Wildlife Conservation Act 1950. At a state level, native fauna species are protected under the Act. Species in need of conservation are given a ranking: Schedule 1 (species that is rare or is likely to become extinct), Schedule 2 (species presumed to be extinct), Schedule 3 (migratory birds protected under an international agreement), and Schedule 4 (other specially protected fauna	Schedule 1 Schedule 2 Schedule 3 Schedule 4
State	DEC Priority list. The DEC produces a list of Priority species and PECs that have not been assigned statutory protection under the Wildlife Conservation Act 1950. This system gives a ranking from Priority 1 to Priority 5. The TECs are ranked in four categories ranging from 'presumed totally destroyed' to 'vulnerable'	Priority 1 Priority 2 Priority 3 Priority 4 Priority 5 Presumed Totally Destroyed Critically Endangered Endangered Vulnerable

4 RESULTS

4.1 Desktop Review

4.1.1 Previous surveys

No previous fauna assessments or surveys of the Goldsworthy site could be located. A survey of the flora and vegetation of the Mount Goldsworthy pit area was undertaken by Pilbara Flora (2009). The closest mining area to Mount Goldsworthy in the Pardoo DSO project of Atlas Iron Ltd sited in the Ord Range, approximately 35 km to the north west. A level 1 fauna assessment was undertaken in 2007 (Bamford Consulting Ecologists, 2007). A flora and vegetation survey (Woodman Environmental Consulting, 2007) and a subterranean fauna survey (Environmental, 2007) have also been undertaken at the Pardoo DSO site.

Eighty six species of vertebrate were found at the Pardoo site (Bamford Consulting Ecologists, 2007) during the fauna assessment: one species of fish, four species of amphibians, 20 species of reptiles, 49 species of birds and twelve species of mammals. This inventory included 6 species of conservation significance as follows:

- Crested Mulgara *Dasycercus cristatus* (Listed on Schedule 1 under the WC Act and as Vulnerable under the EPBC Act). Identified by six active burrows with recent tracks. Mulgara burrows were recorded in the centre of the lease area in spinifex/loam habitat on plain, adjacent to an ephemeral drainage line and low hills.
- Western Pebble Mound Mouse *Pseudomys chapmani* (Listed as Priority 4 by the DEC). Identified by 5 inactive and 2 active pebble mounds. All of these mounds were located on (or near) the top of the range on gravel flats.
- Northern Quoll *Dasyurus hallucatus* (Listed on Schedule 1 under the WC Act, as Endangered under the EPBC Act, and as Endangered by the IUCN). Identified from recent tracks in a gully to the north of the Ord Range.
- Peregrine Falcon *Falco peregrinus* (Listed on Schedule 4 under the WC Act). One pair seen over the Ord Range.
- Rainbow Bee-eater *Merops ornatus* (Listed on Schedule 3 under the WC Act and as Migratory under the EPBC Act). Common in lower lying plains.
- Pilbara Olive Python *Lialis olivaceus barroni* (Listed on Schedule 1 under the WC Act and as Vulnerable under the EPBC Act). Two individuals recorded. Both specimens were recorded on the vehicle track close to the top of the range adjacent to outcropping rocks and near gullies.

In 2005, a series of level 2 surveys were conducted at four sites near Yarrie, east south east from Goldsworthy: Nimingarra (47 km from Goldsworthy), Sunrise Hill (53 km), Cattle Gorge (79 km) and Yarrie (83 km) by ecologia Environment for BHP Billiton Pty. Ltd. (ecologia Environment, 2005). These are sites on a series of rocky ridges in the Chichester subregion (Thackway and Creswell, 1995). In these surveys, a total of 193 vertebrate species were recorded, being 28 species native mammals (plus three introduced), 91 species of birds, 60 species of reptiles and four species of amphibians. Twelve species of conservation significance were recorded during these surveys, as follows:

- Crested Mulgara *Dasycercus cristatus* (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act). One observed at Cattle Gorge on alluvial outwash plain.
- Western Pebble Mound Mouse *Pseudomys chapmani* (listed as Priority 4 by the DEC). Ten captured at Yarrie on hillside with hummock grassland.
- Lakeland Downs Short-tailed Mouse *Leggadina lakedownensis* (listed as Priority 4 by the DEC). Captured at Yarrie in hillside with tussock grass.
- Northern Quoll *Dasyurus hallucatus* (listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Endangered by the IUCN). Recorded at all four sites.
- Pilbara Leaf-nosed Bat *Rhinonicteris aurantius* (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act). Flight calls recorded at Nimingarra and Cattle Gorge.
- Peregrine Falcon *Falco peregrinus* (listed on Schedule 4 under the WC Act).
- Rainbow Bee-eater *Merops ornatus* (listed Migratory under the EPBC Act and on Schedule 3 under the WC Act).
- Eastern Osprey *Pandion cristatus* (listed as Migratory under the EPBC Act).
- Arabian Bustard *Ardeotis australis* (listed as Priority 4 by DEC).
- Bush Stone-curlew *Burhinus grallarius* (listed as Priority 4 by DEC).
- Star Finch (western subspecies) *Neochmia ruficauda subclarescens* (listed as Priority 4 by DEC).
- Pilbara Olive Python *Lialis olivaceus barroni* (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act). One observed in Gorge/Gully habitat at Cattle Gorge.

A further seven species of migratory birds listed under JAMBA/CAMBA were recorded: Wood Sandpiper (*Tringa glareola*), Common Sandpiper (*Actitis hypoleucos*), Fork-tailed

Swift (*Apus pacificus*), Great Egret (*Ardea alba*), Marsh Sandpiper (*Tringa stagnatilis*), Greenshank (*Tringa nebularia*) and Snipe (*Glareola* sp.).

At Poondano, located 65 km west of Goldsworthy, a reconnaissance fauna survey and targeted fauna survey was undertaken by Outback Ecology in September 2009. Twenty seven vertebrate species were recorded (ten species of mammal, ten species of birds and seven species of reptiles). The following species of conservation significance were recorded;

- Northern Quoll *Dasyurus hallucatus* (listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Endangered by the IUCN). Core denning habitat in granite outcrops and ironstone mesas.
- Pilbara Leaf-nosed Bat *Rhinonicteris aurantius* (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act). One roost cave at Poondano Central, another individual roosting in a cave 9 km tpo the east and an association with Petermarer Pool..
- Ghost Bat *Macroderma gigas* (listed as Priority 4 by the DEC and Vulnerable by the IUCN). Thirteen caves within Poondano Central area support a Ghost Bat population of between 30 and 40 individuals. A regional roost cave 2 km to the north-east of Poondano Central appears to support 20 Ghost bats.

The most detailed genetic analysis of the Pilbara Northern Quolls was undertaken at Poondano, (Spencer *et al.*, 2011). In this study, ten nuclear genes were analysed from 55 individuals sampled from nine locations. The genetic profile indicated that the Pilbara population of Northern Quolls has dispersal of individuals between localities in the region, and that the Pilbara population is genetically coherent. The study also showed no evidence of a genetic bottleneck, with relatively high levels of within-population genetic variation at Poondano.

Table 4.1 details the survey effort for the above surveys.

Table 4.1 Summary of surveys within 50 km of the Study Area, including the current survey.

Survey	Fauna Assessment of the fauna of the Pardoo DSO Project	Sunrise Hill Biological Assessment Survey	Nimingarra Biological Assessment Survey	Current Survey Goldsworthy
Consultant	Bamford Consulting Ecologists	ecologia Environment	ecologia Environment	Biologic Environmental Survey
Year	2007	2005	2005	2012
Type	Desktop survey and single phase level 1 (with some elements of level 2) fauna survey	Single phase field survey with trapping	Single phase field survey with trapping	Desktop survey and single phase level 1 fauna survey
Duration	23rd to 27th April 2007	22nd November to 6th December 2004	2nd to 17th August 2004	17th to 23rd August 2012
No. of trapping sites	2	5	6	0
Site type	2 lines of 15 medium Elliott traps open for 3 nights	10 Elliott, 4 funnel, 3 bucket 2 PVC tube per site	10 Elliott, 4 funnel, 3 bucket 2 PVC tube per site	Targeted searches for conservation significant species and habitats
Trap nights	90	620 Elliott, 249 pitfall, 249 funnel, 60 cage traps	860 Elliott, 358 pitfall, 84 cage traps	0
Diurnal search (hours)	32	210	687	96
Nocturnal search (hours)	Spotlighting (16)	1598	25.7	none
Bird surveys (hrs)	Not specified	1860	1800	Opportunistic
Bird Survey method	Traversing the Study Area	Not specified	Not specified	Opportunistic
Bat recording nights	8	Not specified	Not specified	17
Bat recording hours	Not specified	119	247	204
Bat recording method	Anabat II and Mini 3	Anabat	Anabat	SM2BAT, Echometer EM3
Mammals (native)	10	10	14	19
Mammals (introduced)	2	2	3	4
Birds	49	45	52	44
Reptiles	20	30	34	9

Survey	Fauna Assessment of the fauna of the Pardoo DSO Project	Sunrise Hill Biological Assessment Survey	Nimingarra Biological Assessment Survey	Current Survey Goldsworthy
Amphibians	4	2	1	1
Total	85	86	104	77
Constraints	None specified	Hot weather limited trapping	Hot weather limited trapping	None encountered
Conservation significant species recorded	Western Pebble-mound Mouse [active and inactive mounds], Mulgara, Northern Quoll, Pilbara Olive Python, Rainbow Bee-eater, Peregrine Falcon	Northern Quoll, Bush Stone Curlew	Pilbara Leaf-nosed Bat, Northern Quoll	Ghost Bat, Pilbara Leaf-nosed Bat, Western Pebble-mound Mouse [inactive mounds], Northern Quoll, Greater Bilby, Mulgara, Australian Bustard, Rainbow Bee-eater
No. conservation significant species	6	2	2	8

4.1.2 Database searches

A NatureMap search, based on a circle of 20 km radius from the Study Area centre, reported a total of 13 mammal species (including two introduced), 105 bird species, 30 reptile species and four amphibian species, totalling 152 vertebrate species. See Appendix H. A further NatureMap search was undertaken using the Goldsworthy Study Area boundaries to determine records of species from the Study Area itself. This recorded 60 species of vertebrate, being three mammals, 54 birds, two reptiles and one amphibian.

The EPBC Protected Matters Report (Appendix H), based on a circle of 20 km radius from the Study Area centre listed six threatened species and three terrestrial migratory species as listed in Table 4.2. The search also listed an additional six migratory wetland and marine species.

Table 4.2 Terrestrial species listed on the EPBC Protected Matters Report, based on a circle of 20 km radius from the Study Area centre.

Species	Conservation status	Type of presence
Mammal species		
Mulgara *Dasycercus cristicauda*	Listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act.	Species or species habitat likely to occur within area
Northern Quoll *Dasyurus hallucatus*	Listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Endangered by the IUCN.	Species or species habitat likely to occur within area
Greater Bilby *Macrotis lagotis*	Listed as Vulnerable under the EPBC Act , on Schedule 1 under the WC Act and and as Vulnerable by the IUCN	Species or species habitat likely to occur within area
Northern Marsupial Mole *Notoryctes caurinus*	Listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act.	Species or species habitat likely to occur within area
Pilbara Leaf-nosed Bat *Rhinonicterus aurantia* (Pilbara population)	Listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act.	Species or species habitat likely to occur within area
Reptile species		
Great Desert Skink *Liopholis kintorei*	Listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act.	Species or species habitat likely to occur within area
Migratory terrestrial birds		
White-bellied Sea Eagle *Haliaeetus leucogaster*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	Species or species habitat likely to occur within area
Barn Swallow *Hirundo rustica*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	Species or species habitat likely to occur within area
Rainbow Bee-eater *Merops ornatus*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	Species or species habitat likely to occur within area

The following migratory marine birds and migratory wetland birds were also listed: Fork-tailed Swift (*Apus pacifica*), Great Egret (*Ardea alba*), Cattle Egret (*Egretta ariel*), Lesser

Frigate Bird (*Fregata ariel),* Oriental Pratincole (*Glareola maldivarum*) and Oriental Plover (*Charadrius veredus*).

The habitat required for the Northern Marsupial Mole *Notoryctes caurinus* and the Great Desert Skink *Liopholis kintorei*, i.e. sand ridges and plains, does not occur within the Goldsworthy Study Area, and these species are unlikely to be present.

The Pilbara Olive Python *Lialis olivaceus barroni*, listed as Vulnerable under the EPBC Act was not listed on the EPBC Protected Matters Report for Goldsworthy. However, this is clearly anomalous as there is excellent Olive Python habitat within the Study Area. This species was flagged by NatureMap and the nearest record from NatureMap is only 13 km away.

A NatureMap search within the actual Goldsworthy Study Area boundaries listed records of 60 vertebrate species. These comprise two species of reptiles, 54 species of birds, three species of mammals and one species of amphibian. Animals of conservation significance in this report are listed in Table 4.3.

Table 4.3 Species of conservation significance reported from within the Study Area on NatureMap.

Species	Conservation Status	Type of Presence
Mammal species		
Greater Bilby *Macrotis lagotis*	Listed as Vulnerable under the EPBC, on Schedule 1 under the WC Act and as Vulnerable by the IUCN	Recorded, NatureMap co ordinate is approximate.
Bird species		
Pictorella Mannikin *Heteromunia pectoralis*	Listed as Priority 4 by the DEC	1 record on the Pardoo Creek Major Drainage Line in NatureMap
Peregrine Falcon *Falco peregrinus*	Listed as Priority 4 by the DEC	1 record in NatureMap from the road along the railway . Hence probably a flight record.
Rainbow Bee-eater *Merops ornatus*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	5 records within the Study Area boundary on NatureMap
Short-tailed Sandpiper *Calidris acuminate*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	1 record in NatureMap from the vicinity of the old pit
Swinhoe's Snipe *Gallinago megala*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	1 record in NatureMap from the vicinity of the old pit
Wood Sandpiper *Tringa glareola*	Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.	1 record in NatureMap from the vicinity of the old pit

4.2 Current Field Survey

A targeted species survey undertaken by Biologic between 17th and 23rd August 2012 recorded a total of 77 native vertebrate fauna species, comprising 19 mammals, 45 birds, twelve reptiles and one amphibian (Appendix C).

Of the total mammal species, ten species of bats were identified by analysis of ultrasound call recordings. A further four species of introduced (and naturalised) species of large mammals were also reported during the field survey.

Eight species of conservation significant fauna were recorded during the current survey:

- Ghost Bat *Macroderma gigas* listed as Priority 4 by the DEC and Vulnerable by the IUCN. By calls and scats;
- Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act. By calls;
- Western Pebble-mound Mouse *Pseudomys chapmani* listed as Priority 4 by the DEC. By inactive mounds;
- Northern Quoll *Dasyurus hallucatus* listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Endangered by the IUCN. By scats and motion camera footage;
- Greater Bilby *Macrotis lagotis* listed as Vulnerable under the EPBC Act, on Schedule 1 under the WC Act and and as Vulnerable by the IUCN. By active burrows and scats;
- Mulgara *Dasycercus* sp. Listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act. By active burrows and scats;
- Australian Bustard *Ardeotis australis* listed as Priority 4 by the DEC. By discovery of two recently killed birds and observation of one live individual; and
- Rainbow Bee-eater *Merops ornatus* listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act. By many observations.

4.3 Fauna Species Expected to Occur in the Study Area

The number of potentially occurring vertebrate species in the Study Area, based on all species recorded in the Study Area to date, plus those recorded in surveys within a 50m km radius of the Study Area (i.e. those at the Pardoo DSO project, Sunrise Hill and Nimingarra), and those within a 20 km circle of Goldsworthy recorded by DEC NatureMap, totals 212 species of native vertebrate. This comprises 36 species of native mammals (with a further eight introduced species), 115 species of birds, 62 species of reptiles and seven species of amphibians.

Detailed lists of the fauna expected to occur in the Study Area based on literature and database searches, are presented in Appendix C. Species profiles and conservation listings are presented in Section 5, which only considers conservation significant fauna.

As there are no previous fauna surveys of the Goldsworthy Study Area itself, the list of species actually recorded from the site is based on a NatureMap search using the Study Site boundaries and the present survey. These species are discussed in Section 4.4 Some species identified during the database searches as potentially occurring within the Study Area have not been recorded to date, despite suitable habitat being present. The absence of these records may be for a number of reasons, including: 1) the current survey provides the only detailed fauna assessment of the site, and some species will not have been recorded even if they were present; 2) some species are transient and may only be present on rare occasions and thus have not been recorded during the field survey; 3) some species may occur in similar ecological niches to other species present within the study area, and thus are not present despite suitable habitat being available.

4.4 Fauna Species Recorded within the Goldsworthy Study Area

To date, a total of 101 native vertebrate fauna species have been recorded from within the Study Area. This comprises 20 species of native mammals (with a further four introduced species), 67 species of birds, 14 species of reptiles and one species of amphibian.

4.4.1 Native mammals

Of the 36 native mammals that may potentially occur within the Study Area, 20 species (~56%) from ten families have been recorded to date. The current survey recorded eighteen species of native mammals that had not previously been recorded from the area. These were: Short-beaked Echidna *Tachyglossus aculeatus* (from scats), Northern Quoll *Dasyurus hallucatus* (from scats and motion cameras), Mulgara *Dasycercus* sp. (from burrows and scats), Common Wallaroo *Macropus robustus*, Red Kangaroo *Macropus rufus*, Ghost Bat *Macroderma gigas* (from scats and calls), Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (from calls), Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris* (from calls), Common Sheathtail Bat *Taphozous georgianus* (from calls and observation), Northern Free-tailed Bat *Chaerephon jobensis* (from calls), White-striped Free-tailed Bat *Tadarida australis* (from calls), Gould's Wattled Bat *Chalinolobus gouldii* (from calls), Lesser Long-eared Bat *Nyctiphilus geoffroyi* (from calls), Little Broad-nosed Bat *Scotorepens greyii* (from calls), Finlayson's Cave Bat *Vespadelus finlaysoni* (from calls and observations), Western Pebble-mound Mouse *Pseudomys chapmani* (from mounds), Common Rock Rat *Zyzomys argurus* (on motion camera) and Dingo *Canis lupus dingo*. Note that no active mounds of the Pebble-mound mouse were located on the site.

4.4.2 Birds

A total of 115 species of birds potentially occur in the Study Area, of which 67 (~58%) have been recorded to date within the Study Area boundaries. Of these, 14 species were

first reported from the Study Area during the current study. These were Common Bronzewing *Phaps chalcoptera*, White-faced Heron *Egretta novaehollandiae*, Black-shouldered Kite *Elanus axillaris*, Australian Bustard *Ardeotis australis*, Galah *Eolophus rosiecapillus*, Pheasant Coucal *Centropus phasianinus*, Horsfield's Bronze Cuckoo *Chalcites basalis*, Red-backed Kingfisher *Todiramphus pyrrhopygius*, White-winged Triller *Lalage sueurii*, Grey Shrike-thrush *Colluicincla harmonica*, Magpie Lark *Grallina cyanoleuca*, Spinifex Bird *Eremiornis carteri*, Fairy Martin *Petrochelidon ariel*, Australasian Pipit *Anthus novaeseelandiae*.

4.4.3 Reptiles

Of the 62 species of reptiles that may occur in the Study Area, 14 (~23%) have been recorded to date. The current survey recorded twelve species new to the Study Area. These are the Flat-shelled Turtle *Chelodina steindachneri*, Crested Dragon *Ctenophorus isolepis*, Marbled Velvet Gecko *Oedura marmorata*, Spotted Rock Dtella *Gehyra punctata*, Leopard Ctenotis *Ctenotis pantherinus*, Rock Ctenotis *Ctenotis saxatilis*, Sand Monitor *Varanus gouldi*, Yellow-spotted monitor *Varanus panoptes*, Pilbara Rock Monitor *Varanus pilbarensis*, Black-headed python *Aspidites melanocephalus* (on motion camera), Western Brown Snake *Pseudechis mengdeni*, and Mulga Snake *Pseudechis australis* (on motion camera and sloughed skin).

4.4.4 Amphibians

Only one of the seven potentially occurring amphibians in the have been recorded to date within the Study Area (~14%). This is the Giant Frog *Cyclorana australis*. No new species were recorded for the Study Area.

4.4.5 Introduced Fauna

Four species of introduced mammals have being recorded at Goldsworthy: Cat **Felis catus*, Camel **Camelus dromedarius*, Pig **Sus scrofa*, and Cow **Bos Taurus*. A further three species may occur as they have been recorded within 50 km of the Study Area: House Mouse **Mus musculus*, Dog **Canis lupus*, Red Fox **Vulpes vulpes*, and Rabbit **Oryctolagus cuniculus*. As much of the Study Area is covered by pastoral lease, cattle are common in the area. The Dingo **Canis lupus dingo* is categorised as a native mammal in this report following Corbett (1995). However, it is highly likely that the individuals occurring in the area are hybrids with feral dogs.

4.5 Fauna Habitats within the Study Area

Eight major fauna habitats were identified within the Study Area: Major Drainage Line, Crest and Slope, Gorge/Gully/Breakaway, Gibber Plain, Sand Plain with Pindan, Sand Plain with Hummock Grass, Tussock grass with patches of Gilgai and Disturbed Areas (including the old pit, waste dumps and town site). Habitat descriptions are presented in Table 4.4 and raw data results are presented in Appendix D. The habitat assessments

were analysed to determine the key characteristics that differentiated each habitat (Table 4.2). The extent of each fauna habitat outside of the Study Area is provided where available. The habitats are mapped in Figure 4.1.

753000 756000 759000 762000 765000 768000

7752000

7749000

7746000

7743000

GREAT NORTHERN HIGHWAY

GOLDSWORTHY SHAY GAP ROAD

COONGAN GOLDSWORTHY ROAD

biologic

FIGURE 4.1		Date:	17/01/2013
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Projection: MGA Zone 50

GOLDSWORTHY

FAUNA HABITATS
FIGURE 4.1

Legend

Study Area

Habitat Types

- Crest / Slope
- Disturbed Areas
- Gibber Plains
- Gorge/Gully/Breakaway
- Major Drainage Line
- Sand Plain with Hummock Grass
- Sand Plain with Pindan
- Tussock Grass with patches of Gilgai

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Table 4.4 Major fauna habitat descriptions.

Habitat	Description	Distinguishing habitat characteristics	Extent outside Study Area	Significant species associated with habitat	Photo
Crest/Slope	Crests and slopes of rocky range, dominated by *Eucalyptus* woodlands, *Acacia* and *Grevillea* shrublands and Triodia spp. low hummock grasslands.	These fauna habitats tend to be open, structurally simple, and are dominated by varying species of spinifex. A common feature of these habitats is a rocky substrate, often with exposed bedrock, and skeletal red soils.	Extensive areas of Crest/Slope habitat are found throughout the Pilbara, from the Ophthalmia Range in the south to the Ord Range in the north east.	Crest/Slope habitat supports local populations of Western Pebble-mound Mouse. This species is largely restricted to this habitat type. Pilbara Olive Python may pass through this habitat during dispersal. Ghost Bat from nearby caves may forage in this habitat, as may Peregrine Falcons. Northern Quoll is common throughout the northern Pilbara and this species is likely to forage in this habitat. This species prefers large rocky outcrops (normally associated with Gorge/Gully/Breakaway habitat) for denning but they are known to occur in small outcrops less than $50m^2$.	
Gorge/Gully/ Breakaway	Gorges and gullies are rugged, steep-sided valleys incised into the surrounding landscape. Gorges tend to be deeply incised, with vertical cliff faces, while gullies are more open. Few Gorge/Gully/Breakaway habitats occur in the Study Area.	Gorges, gullies and breakaways are very rocky, with large rock fragments and more rock outcropping than other fauna habitats. Caves and rock pools are most often encountered in this habitat type. Vegetation can be dense and complex in areas of soil deposition or sparse and simple where erosion has occurred.	Gorges, gullies and breakaways are common features of the Pilbara, but because they tend to be narrow, linear features, they represent a small proportion of the total land area.	The Gorge/Gully/Breakaway habitats of the Study Area provide potential habitat for Pilbara Olive Python, and Northern Quoll. A number of caves with evidence of use by Ghost Bat were discovered. Pilbara Leaf-nosed Bats may potentially use the gullies for foraging.	

Habitat	Description	Distinguishing habitat characteristics	Extent outside Study Area	Significant species associated with habitat	Photo
Major Drainage Line	This habitat is created by episodic rainfall that scours the landscape when draining. Drainage off the Ellarine ranges has created Major Drainage Lines bordered by woodlands of Coolibah (*Eucalyptus victrix*) and River Red Gum (*E. camaldulensis*).	Mature River Red Gums, Coolibahs over river pools and open, sandy or gravelly riverbeds characterise this habitat type. The eucalypt species (*E. victrix* and *E. camaldulensis*) typically contain a number of significant tree hollows used by parrots and owls for roosting and nesting. The vegetation adjacent to the main channel or channels is denser, taller and more diverse than adjacent terrain and can include reedbeds around pools.	Major Drainage Line habitats drain large areas of catchment, and because they tend to be relatively narrow, linear features, they represent a small proportion of the total land area. This habitat can be found throughout the Pilbara.	This habitat supports, Rainbow Bee-eater and potentially Star Finch. A high diversity of bird species utilise the habitat. Provides potential breeding and/or foraging sites for Grey Falcon and Peregrine Falcon. Provides habitat and dispersal opportunities for Pilbara Olive Python and Northern Quoll.	
Gibber Plain	Flat treeless plain with the surface covered by small to medium cobbles.	Open and exposed habitat with a high proportion of bare rock and soil.	True Gibber plain is an uncommon habitat in the Pilbara however it is very similar in terms of providing fauna habitat to a gravelly plain.	Gibber plains support a low biomass, and are probably not utilised extensively by any of the significant species.	
Sand Plain with Pindan	Sand plains of red sand with moderate to dense cover of *Acacia* spp.	The dense *Acacia* shrubland provides extensive shelter and a relatively complex structure, while the sandy substrate provides ease of burrowing.	This habitat type is common to the north and east of the Study Site, but the Goldsworthy site is at the south western margin.	Sandy substrate supports many vertebrate species and provides excellent habitat for Greater Bilby and potentially Mulgara. The substrate is easily dug into for burrows and foraging.	

Habitat	Description	Distinguishing habitat characteristics	Extent outside Study Area	Significant species associated with habitat	Photo
Sand Plain with Hummock Grass	Sand plains with hummocks of *Triodia* spp. Generally lacking anything more than a scattered to sparse shrub or tree layer.	Flat plains with *Triodia* spp. and scattered *Acacia* spp. The ease of burrowing and shelter supports a rich reptile fauna and populations of significant mammals.	Widespread in the region. Sandplain habitat is extensive north of the Chichester Range.	Supports Mulgara and potentially Greater Bilby.	
Tussock Grass with patches of Gilgai	Plains of heavy dark clays with cracks and sinkholes (Gilgai). Supports dense growth of tussock grasses.	Extensive tussock grass plain. May be flooded after rain, and retain pools for some time. Where water has pooled and subsequently dried, sink holes and deep cracks tend to form.	True Tussock grasslands over cracking clay are reasonably common near to the Pilbara Coast in the Yamerina Land System. Other large grasslands occur through and to the north of the Chichester Range and south of the Fortescue Marsh.	May support wetland species of migratory birds after rain. May provide foraging and burrowing habitat for Greater Bilby.	
Disturbed Areas	The old mine pits, waste dumps (rehabilitated or not), old town site.	These varied habitats tend to have poorly developed communities, and a higher proportion of weeds. Although the rehabilitated waste dumps have developed considerable vegetation cover, they do not support a similar fauna to undisturbed crest / slope habitat.	Confined to Study Area.	The open water and wetland margins of the pit provide habitat for migratory waders and foraging areas for bats.	

5 CONSERVATION SIGNIFICANT FAUNA

Species are defined as 'Conservation Significant' if they are listed under agreements at international (e.g. IUCN, JAMBA, CAMBA, Bonn), regional (EPBC Act 1999) or state (WC Act 1950, Priority list of DEC) level. Explanations of conservation status under these Acts and Agreements are provided in Table 3.5 and Appendix B.

Based on the results of previous surveys in the Study Area, a review of regional surveys, and database searches (Section 3.2), and the habitats present in the Study Area, it was determined that 27 species (seven native mammals, 18 birds and two reptiles) of conservation significance have the potential to occur in the Study Area. Of these species, thirteen have been recorded in the Study Area to date (Table 4.5):

- Ghost Bat (*Macroderma gigas*) - listed as Priority 4 by the DEC and as Vulnerable by the IUCN;
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius* (Pilbara)) - listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act;
- Greater Bilby (*Macrotis lagotis*) - listed as Vulnerable under the EPBC Act, on Schedule 1 under the WC Act and as Vulnerable by the IUCN;
- Northern Quoll (*Dasyurus hallucatus*) - listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Vulnerable by the IUCN;
- Mulgara (*Dasycercus* sp) - listed as Vulnerable under the EPBC Act and as Schedule 1 under the WC Act;
- Western Pebble-mound Mouse (*Pseudomys chapmani*) - Listed as Priority 4 by the DEC;
- Australian Bustard (*Ardeotis australis*) - Listed as Priority 4 by the DEC;
- Rainbow Bee-eater (*Merops ornatus*) - Listed on Schedule 3 under the WC Act and as Migratory under the EPBC Act;
- Peregrine Falcon (*Falco peregrinus*)- Listed on Schedule 4 under the WC Act;
- Pictorella Mannikin (*Heteromunia pectoralis*) - Listed as Priority 4 by the DEC;
- Sharp-tailed Sandpiper (*Calidris acuminata*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act;
- Wood Sandpiper (*Tringa glareola*) Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act; and
- Swinhoe's Snipe (*Gallinago megala*) - Listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act.

Table 5.1 shows conservation significant species recorded from adjacent areas and those that potentially occur within the Study Area. Locations of conservation significant fauna recorded within the Study Area are presented in Figure 5.1 and Appendix E.

To simplify the classification of pebble mounds, they have been characterised as active / recently active or inactive. Active or recently active indicates that the mounds are either currently used or the mound structure is clearly evident and therefore may be used again in the future. Inactive mounds are those that are weathered, flat and appear completely abandoned.

Table 5.1 Summary of conservation significant fauna recorded in or adjacent to the Study Area and those that may potentially occur in the Study Area.

Species	EPBC	WCA	DEC Priority	IUCN	Survey				Combined database searches
					ecologia Sunrise Hill 2005	*ecologia* Nimingarra 2005	Pardoo DSO EPA 2008	Current survey	
WITHIN THE STUDY AREA									
Mammals									
Ghost Bat *Macroderma gigas*			P4	VU				•	
Pilbara Leaf-nosed Bat *Rhinonicteris aurantius*	VU	S1				•		•	•
Greater Bilby *Macrotis lagotis*	VU	S1		VU			•	•	•
Northern Quoll *Dasyurus hallucatus*	EN	S1		EN	•	•	•	•	•
Mulgara *Dasycercus* sp.	VU	S1					•	•	•
Western Pebble-mound Mouse *Pseudomys chapmani*			P4				•	•	
Birds									
Australian Bustard *Ardeotis australis*			P4					•	
Rainbow Bee-eater *Merops ornatus*	MG	S3			•	•	•	•	•
Peregrine Falcon *Falco peregrinus*		S4							•
Pictorella manikin *Heteromunia pectoralis*			P4						•
Sharp-tailed Sandpiper *Calidris acuminata*	MG	S3							•
Wood Sandpiper *Tringa glareola*	MG	S3							•
Swinhoe's Snipe *Gallinago megala*	MG	S3							•
ADJACENT RECORDS – SPECIES POSSIBLY OCCURRING IN STUDY AREA									
Birds									

Species	EPBC	WCA	DEC Priority	IUCN	Survey				Combined database searches
					ecologia Sunrise Hill 2005	*ecologia* Nimingarra 2005	Pardoo DSO EPA 2008	Current survey	
Eastern Osprey *Pandion cristatus*	MG								•
Fork-tailed Swift *Apus pacifica*	MG	S3							•
Eastern Great Egret *Ardea alba*	MG	S3							•
Cattle Egret *Ardea ibis*	MG	S3							•
White-bellied Sea Eagle *Haliaeetus leucogaster*	MG	S3							•
Star Finch (western subspecies) *Neochmia ruficauda subclarescens*			P4			•			•
Bush Stone-curlew *Burhinus grallarius*			P4			•			•
Barn Swallow *Hirundo rustica*	MG	S3							•
Reptiles									
Pilbara Olive Python *Liasis olivaceus barroni*	VU	S1							•
SPECIES IDENTIFIED AS POTENTIALLY OCCURRING IN THE GENERAL AREA BUT UNLIKELY TO OCCUR WITHIN THE STUDY AREA									
Mammals									
Northern Marsupial Mole *Notoryctes caurinus*	EN	S1		DD					•
Birds									
Lesser Frigate Bird *Fregata ariel*	MG	S3							•
Oriental Plover *Charadrius veredus*	MG	S3							•
Oriental Pratincole *Glareola maldivarum*	MG	S3							•
Reptiles									
Great Desert Skink *Liopholis kintorei*	VU	S1		VU					•

753000 756000 759000 762000 765000

7752000 7749000 7746000 7743000

GREAT NORTHERN HIGHWAY

GOLDSWORTHY SHAY GAP ROAD

COONGAN GOLDSWORTHY ROAD

PLNB

WPMM RB NQ RB AB BD GB M

biologic

FIGURE 5.1		Date:	30/01/2013
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Drawn by GSM	Requested by D.G	GSM Reference GW_Fauna_habitats	

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Datum: GDA94

Projection: MGA Zone 50

GOLDSWORTHY

SIGNIFICANT FAUNA LOCALITIES FIGURE 5.1

Legend

Significant Fauna

- Australian Bustard (AB)
- Rainbow Bee-eater (RB)
- Western Pebble-mound mouse (WPMM)
- Bilby, Dalgyte (BD)
- Ghost Bat (GB)
- Mulgara (M)
- Northern Quoll (NQ)
- Pilbara Leaf-nosed Bat (PLNB)
- Study Area

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5.1 Conservation Significant Fauna Recorded from the Study Area

Thirteen species of conservation significant fauna have being recorded in the Study Area to-date (Table 5.2). Each of the species recorded is presented in taxonomic order and discussed in the following section. Significant fauna species localities are shown on Figure 5.1 and presented in Appendix E.

5.1.1 Mammals

Ghost Bat (*Macroderma gigas*)

The Ghost Bat is listed as Priority 4 by the DEC and as Vulnerable by the IUCN. The Ghost Bat was delisted from the EPBC Act in April 2001. The Ghost Bat formerly occurred over a wide area of central, northern and southern Australia but has declined significantly in the southern parts of its range in recent years (Armstrong and Anstee 2000). It now occurs in only a few highly disjunctive sites across northern Australia and in Western Australia is now confined to the Kimberly and Pilbara.

The distribution of Ghost Bats is influenced by the availability of suitable caves and mine shafts for roost sites. Ghost Bats in the Pilbara roost in deep, complex caves beneath bluffs of low rounded hills composed of Marra Mamba or Brockman Iron Formation, granite rock piles and abandoned mine shafts (Armstrong and Anstee 2000). Armstrong and Anstee (2000) noted that most caves used by Ghost Bats in bluff caves have narrow entrances (less than 0.5m^2) that opened into larger chambers. They roost either individually or in colonies up to 1500 (Churchill, 2008) and move between a number of caves, both seasonally and as dictated by weather changes. During breeding, female Ghost Bats congregate into maternity roosts generally selecting very warm caves during pregnancy and lactation (Hutson *et al.*, 2001) although recent evidence in the Hamersley Range indicates that Ghost Bats breed in caves with similar temperature and humidity as outside (M O'Connell, pers. comm. 2012)

The first evidence for the occurrence of this species in the Study Area comes from the current study. Scats from this species were observed at three caves (Caves 2, 4, 5 Appendix F) within the Study Area (Figure 5.1) and calls of this species were detected at one cave (Cave 6, BD6) and probably at a second (Cave 4, BD1) Appendix E, G. Ghost Bats have been recorded nearby at Cattle Gorge and Callawa (approximately 80km to the east) including a natural cave maternity roost containing up to ten pregnant females (M O'Connell, pers. comm.). Three mine shafts are located approximately 5 km south of the Study Area (767453E 7743173N, 767235E 7742898N, 767266E 7742876N, Dean Tuck, pers. comm. 2012). These may represent important roost habitat for this species.

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)

The Pilbara Leaf-nosed Bat is classified as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act. This species requires warm (28 – 32 ºC) and highly humid

(96 – 100%) roost sites in caves and/or mine shafts. This is a result of their limited ability to conserve heat and water (Armstrong, 2001). Such caves are relatively uncommon in the Pilbara (Armstrong and Anstee 2000; Armstrong, 2001), which limits the availability of diurnal roosts for this species. The few known roosts of this species are concentrated in mine shafts in the eastern Pilbara, and at Barlee Range Nature Reserve (Department of Environment, 2010d) which are thought to contain most of the region's population.

Although no suitable roosts were recorded during the survey, this species apparently utilises the Study Area for foraging. Calls were recorded at BD6 (Figure 3.2) on the 16th and 17th August 2012. As all calls were recorded between 11 p.m. and midnight, it is likely that there is an unknown roost in the vicinity of Goldsworthy. It is unlikely that this roost is in the Study Area as extensive SM2 recordings (16 nights) were placed throughout the area. The units did not pick this species up until late in the evening suggesting that the bats took several hours to reach the recording devices and therefore travelled from outside of the Study Area. It is most likely that the Study Area is utilised for foraging, in particular the Gorge/Gully/Breakaway habitat containing rock pools and the Major Drainage Line habitat.

Pilbara Leaf-nosed Bat is known from the general area with a numerous continuous records around Cattle Gorge, Nimingarra, Shay Gap and Callawa (ecologia Environment, 2005). The nearest confirmed roost location is Cattle Gorge (80km to the east) consisting of a small number of individuals (DSEWPaC, 2012).

Greater Bilby (*Macrotis lagotis*)

The Greater Bilby is listed as Vulnerable under the EPBC Act, on Schedule 1 under the WC Act and as Vulnerable by the IUCN due to range reduction; it now occupies less than 20% of its original range (Southgate, 1990a), inhabiting arid and semi-arid regions throughout most of the Australian mainland in disjunct populations (Johnson, 2008). The Greater Bilby utilises a variety of habitats, usually on landforms with level to slow slope topography and light to medium soils (Worthington Wilmer *et al.*, 1999). Three major vegetation types associated with the Greater Bilby are listed by Southgate (1990b) including: open tussock grassland on uplands and hills, Mulga woodland/scrubland on ridges and rises and hummock grassland in plains and alluvial areas. Other habitats used by the species include stony downs, cracking clays, desert Sandplains and dune fields, spinifex grassland and *Acacia* spp. scrublands on red earths (Johnson, 2008). Home ranges may be temporary, and there is some suggestion that Greater Bilbies are nomadic, following food availability (Johnson, 2008).

Recent Greater Bilby burrows, diggings and scats were recorded in the Sand Plain with Pindan habitat in the north eastern part of the Study Area, although no animals were observed on the motion cameras set up outside burrows. Signs of activity (recent burrows, diggings and scats) were located at several localities within this habitat type. It is

not possible to determine the status of the population without further study. No signs of the Greater Bilby were found in tussock grass on Gilgai habitat. Traces of old burrows and diggings, which may be referable to Greater Bilby, were also recorded in the south of the Study Area in an eroded sand plain with remnant raised sand areas, and on the sand plain in the west of the Area (Figure 5.1). However no recent activity or scats were found in these other sand plains.

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is listed as Endangered under the EPBC Act, on Schedule 1 under the WC Act and as Endangered by the IUCN. Northern Quolls have experienced significant declines in eastern and northern Australia, mainly due to an expansion of the Cane Toad's (**Rhinella marina*) range; these are ingested resulting in death. (Tidemann *et al.*, 1985). At present Northern Quolls are locally common in the north part of the Pilbara region (generally within 150 km of the coast) but are uncommon in more southern areas.

Northern Quolls favour rocky areas such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, Major Drainage Lines and treed creek lines, as well as structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs (DSEWPaC, 2011). Rocky habitats are usually of high relief, often rugged and dissected but can also include tor fields or caves in low lying areas such as in Western Australia. Dens are made in rock crevices, tree holes or occasionally termite mounds (Threatened Species Scientific Committee, 2005). In the Pilbara region, the species tends to prefer the Rocklea, Macroy and Robe land systems (Biota Environmental Sciences, 2009). The Northern Quoll has also been recorded in other land systems which comprise sandstone and dolomite hills and ridges, shrublands, sandy plains, clay plans and tussock grasslands and coastal fringes including dunes islands and beaches.

Northern Quolls appear to be fairly common at the Goldsworthy site in areas with rock outcrops and were recorded at 6 locations from scats, and one of these locations also by motion camera (Figure 5.1). This species is far more common in the north of its range in the Pilbara when compared to the south (Hamersley Range). Within the Study Area, denning habitat is mostly confined to the Gorge/Gully/Breakaway habitat; however, it is also possible for this species to den within small rocky outcrops located throughout Crest / Slope habitat (Figure 4.1).

Mulgara (*Dasycercus* sp.)

Uncertainty over the taxonomy and nomenclature of *Dasycercus* existed for a considerable time until it was revised using molecular and morphological characters by Adams *et al*. (Biota Environmental Services, 2004). More recently, Woolley (2010a) re-assigned the *D. cristicauda* to a separate species *D. blythi*, and the taxon then known as *D. hillieri* to the current name *D. cristicauda.* The Crest-tailed Mulgara (*D. cristicauda*) is listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act. The Brush-

tailed Mulgara (*D. blythi)* is currently listed as Priority 4 by the DEC; however the DSEWPAC is currently considering this species for listing under the EPBC Act. In view of the uncertainty, Mulgara sp. are listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act using the precautionary principle.

The two current species appear to have largely non-overlapping ranges and habitat parameters: *D. blythi* is closely associated with *Triodia* sandplain and swales between low dunes from south-western Queensland across the Simpson, Tanami, and Great Sandy Deserts of southern and central Northern Territory and central Western Australia, including parts of the Pilbara (Department of Environment, 2010b), while *D. cristicauda* is known from salt lakes, southern Simpson, Tirari and Strzelecki Deserts in southern Northern Territory and northern South Australia Canning Stock route in central Western Australia and from Ooldea and along the Nullarbor Plain at Fisher and Rawlinna (Woolley 2008). However there is a zone of sympatry in central Australia and the latter is also likely to occur in the Pilbara region, but this requires confirmation (Department of Environment, 2010c).

Given the recent taxonomical changes and existing complexity in the nomenclature, the identity of Mulgara (*Dasycercus* spp.) recorded from the Study Area remain questionable. Due to the close proximity to the Great Sandy Desert and previous reliable nearby records of Crest-tailed Mulgara (Bamford Consulting Ecologists, 2007) the records made during this survey could be treated as Crest-tailed Mulgara. However due to many recent records in the Pilbara confirmed by genetic analysis as Brush-tailed Mulgara, the records in the Study Area are most likely to be Brush-tailed Mulgara. No trapping was undertaken during this Level 1 survey, and hence genetic samples were could not be collected.

The Study Area contains extensive areas of Sandplain habitat, preferred by this species. Traces of Mulgara in the form of recent burrows and scats were recorded on the sandplains with Hummock grass on the western side of the site (Figure 5.1).

Western Pebble-mound Mouse (*Pseudomys chapmani*)

The Western Pebble-mound Mouse is currently listed as Priority 4 by the DEC. This species has experienced a significant decline in their range through the Gascoyne and Murchison, and is now considered endemic to the Pilbara (Van Dyck and Strahan, 2008). This species almost exclusively occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Van Dyck and Strahan, 2008).

The characteristic mounds constructed by colonies of these mice were common on hill slopes and crests in the ranges to the west of the Goldsworthy pit. However all the mounds observed during the current survey were disused, and no active mounds were located. These disused mounds consist of clusters of similar-sized small stones on the ground surface. Only two individual mounds were mapped (Figure 5.1), but, given their

widespread distribution within the hill slope / crest habitat, and the amount of this habitat available, it is likely that the Western Pebble-mound Mouse is a resident within the Study Area.

5.1.2 Birds

Australian Bustard (*Ardeotis australis*)

The Australian Bustard is listed as Priority 4 by the DEC and as Least Concern by the IUCN. It occurs across most of mainland Australia, but is listed in WA primarily due to a decline in its range in the south of the state. It is a nomadic species occurring in a wide variety of habitats including gravel plains, riverine habitats and open or lightly wooded grasslands (including *Triodia* spp. sandplains). Remains of two individuals that had been recently killed (cooked and eaten) were found during the present survey. It is presumed that they were captured either within the Study Area or close by. One live individual was observed on sand plain with hummock grasses. Evidence on breeding has not been recorded in the Study Area, but is possible as suitable habitat in the form of open areas for courtship displays and more sheltered, vegetated areas to raise young are present within the Study Area. Thus, the habitat of the Australian Bustard is well represented within the Pilbara and Study Area occurring in Crest / Slope and the Sand Plains habitat.

Rainbow Bee-eater (*Merops ornatus*)

The Rainbow Bee-eater is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. This species has broad habitat requirements and lives almost anywhere suitable for hawking insects. The demographics of the species are complex, with populations in WA being resident, breeding visitors, post-nuptial nomads, passage migrants and winter visitors (Johnstone and Storr, 1998). Many individuals move northwards to overwinter in Indonesia.

This species is common within the Study Area and was recorded at 13 sites. Potential nesting habitat for this ground-nesting species exists in all the described habitats. This species is most likely to nest in the banks of the Major Drainage Line habitat.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Vulnerable under the EPBC Act and Schedule 4 under the WC Act, and is considered rare or scarce over much of its range, including the Pilbara (Johnstone and Storr, 1998). Inland it is most often encountered along cliffs above rivers, ranges and wooded watercourses and lakes, where it hunts birds (Johnstone and Storr, 1998). It nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines.

The Peregrine Falcon was recorded on the site in NatureMap, although it was not observed during the current assessment. However, several sections of the Study Area contains suitable hunting habitat for Peregrine Falcon, primarily associated with Major

Drainage Line habitats. Potential breeding habitats may occur in the ranges, although, no rocky ledges with enough height were recorded during the survey. This species may potentially nest on the mine pit walls, although none were observed during two inspections. Eggs are mainly laid in September (Johnstone and Storr, 1998), and hence if breeding pairs were resident, it is likely that they would have been recorded.

Pictorella Mannikin (*Heteromunia pectoralis*)

This species is listed as Priority 4 by the DEC. The present distribution runs from Fitzroy River valley, WA, to upper Burdekin, and central-western Cape York Peninsula (Woinarski and Tidemann, 1991). Pictorella Mannikins are found near water in *Acacia* shrublands that have a grassy understorey and in *Triodia* hummock grassland, where they feed on seeds on the ground, as well as insects (Blakers *et al*., 1984). They appear to be highly mobile, sometimes breeding in eucalypt woodland well north of their usual (Slater *et al.*, 2009).

This species rarely occurs in the Pilbara. It is listed as being on the Goldsworthy site in NatureMap, but none were seen during the current survey. It is likely that this species is only present occasionally when food is available in the Study Area. A record of this species was made further south along BHPBIO mainline rail (Biologic, in prep.) representing possibly the most southerly record for this species.

Sharp-tailed Sandpiper (*Calidris acuminata*)

This species is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is recorded as being on the Goldsworthy site in NatureMap, but none were seen during the current survey. Its habitat is fresh and salt water wetlands, to which it is a visitor in all months. Eighty Mile Beach has peak numbers in August to September (Johnstone and Storr, 1998). May occasionally use the edges of the flooded pit.

Wood Sandpiper (*Tringa glareola*)

This species is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is recorded as being on the Goldsworthy site in NatureMap, but none were seen during the current survey. Its habitat is mainly shallow fresh waters and occasionally brackish swamps. May utilise the Study Area when temporary ponds and marshes are formed after heavy rains (Johnstone and Storr, 1998).

Swinhoes's Snipe (*Gallinago megala*)

This species is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is recorded as being on the Goldsworthy site in NatureMap, but none were seen during the current survey. Its habitat is mainly freshwater swamps, but also rushy edges of lagoons (Johnstone and Storr, 1998). It may utilise the edges of the flooded pit, although with steep sides and the continual rise in the water level, there is little development of

reeds. Hence this species is unlikely to be anything other than an occasional visitor to the Study Area.

Table 5.2 Conservation significant fauna occurring in the Study Area.

Species	Significance	Preferred habitat	Extent of the habitat in the Study Area and the region	Records
Ghost Bat *Macroderma gigas*	DEC Priority 4 IUCN: Vulnerable	Roosts in deep complex caves beneath bluffs of low rounded hills, granite rock piles and abandoned mines (Armstrong and Anstee, 2000).	The caves in the Study Area are suitable as feeding roosts and possibly day roosts. Caves exist throughout the Chichester and Hamersley Range.	Scats were recorded in three caves and calls near one (possibly two) (this survey). Numerous records from Cattle Gorge, Callawa, Cunderline (ecologia Environment, 2005). Known from mineshafts in large numbers, south of the De Grey river, north of Marble Bat.
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia*	EPBC Act: Vulnerable WC Act: Schedule 1	Hot, humid roost caves. Forages in Gorge/Gully/Breakaway habitat and along watercourses, particularly where water is present.	None of the caves in the Study Area were deemed to be suitable for Pilbara Leaf-nosed Bat. The extent of suitable habitat for this species in the surrounding region is little known.	Recorded on SM2 in the Study Area. Very few known roost locations exist for this species in the Pilbara. Nearest known roost site is 80km to the east (ecologia Environment, 2005).
Greater Bilby *Macrotis lagotis*	EPBC Act: Vulnerable WC Act: Schedule 1 IUCN: Vulnerable	Three major vegetation types associated with the Greater Bilby are listed by Southgate (1990b) including: open tussock grassland on uplands and hills, Mulga woodland/shrubland on ridges and rises and hummock grassland in plains and alluvial areas. Other habitats used by the species include stony downs, cracking clays, desert sandplains and dune fields, spinifex grassland and *Acacia* spp. shrublands on red earths (Johnson, 2008).	Areas of sandplain with tussock grasses, hummock grasses and pindan woodland within the Study Area are considered potentially suitable habitats for this species. Sand Plain habitat exists throughout the Pilbara.	Fresh digging and scats scattered within the Study Area were reported during the current study. The species was also reported at Goldsworthy previously (NatureMap). This species is known from the Abydos-Woodstock area however very few records exist.
Northern Quoll *Dasyurus hallucatus*	EPBC Act: Endangered WC Act: Schedule 1 IUCN: Endangered	Northern Quolls favour rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, Major Drainage Lines and treed creek lines, as well as structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs (DSEWPaC, 2011c).	Much of the Study Area is suitable foraging habitat and rocky outcrops form suitable denning habitat. Similar habitats are present in many areas of the Chichester and Hamersley Range.	Recording in numerous locations in the Study Area. Common throughout the Northern Pilbara where Ranges occur, including Cattle Gorge, Nimingarra and Sunrise Hill 80km to the east of the Study Area (ecologia Environment, 2005)
Mulgara *Dasycercus* sp.	Crest-tailed Mulgara EPBC Act: Vulnerable WC Act: Schedule 1 - or - Brush-tailed Mulgara DEC: Priority 4	Arid, sandy areas, preferring mature spinifex on sandy soils (Biota 2002). Brush-tailed Mulgara are said to inhabit spinifex grasslands with medium to dense cover, while Crest-tailed Mulgara inhabit more sparsely-vegetated areas (Masters, 2008).	Sandplain habitats of the Study Area represent suitable habitat for this species. Sandplains are also present in areas surrounding the Study Area.	Not previously recorded in the Study Area. Mulgara burrows and scats were located on a sandplain in the west of the Study Area. Although the species cannot be determined with certainty without a specimen or DNA analysis, it is more likely to be the Brush-tailed Mulgara. The Brush-tailed Mulgara or its burrows are commonly encountered through the Abydos area.

Species	Significance	Preferred habitat	Extent of the habitat in the Study Area and the region	Records
Western Pebble Mound Mouse *Pseudomys chapmani*	DEC: Priority 4	Gentler slopes of rocky ranges where ground is covered with a stony mantle and vegetated by spinifex, often with sparse overstorey of eucalypts and scattered shrubs (Van Dyck and Strahan, 2008)	Suitable crest / slope habitat exists over most of the hill ranges. Suitable habitat is also common in surrounding area and throughout the Pilbara.	All records in this survey were of inactive mounds. Records of this species exist throughout the Pilbara.
Australian Bustard *Ardeotis australis*	DEC: Priority 4 IUCN: LC	Open or lightly wooded grasslands (Johnstone and Storr, 1998)	Suitable habitat common within the Study Area and surrounding region.	Recorded within the study area by two recently killed individuals and one live individual. Records of this species exist throughout the Pilbara.
Rainbow Bee-eater *Merops ornatus*	EPBC Act: Migratory WC Act: Schedule 3	Lightly wooded, preferably sandy country near water (Johnstone and Storr, 1998)	Suitable habitat common within the Study Area and surrounding region.	Recorded from several locations within the Study Area Records of this species exist throughout the Pilbara.
Peregrine Falcon *Falco peregrinus*	EPBC Act: Vulnerable WC Act: Schedule 1	Cosmopolitan, will hunt in any habitat, soaring at height or from a perch; often near cliffs (Armstrong and Anstee 2000). Nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines.	All habitats of the Study Area are suitable for hunting Peregrine Falcon, and there are cliffs potential suitable to be support nesting, especially the pit walls.	Nomadic species known to occur throughout the Pilbara.
Pictorella Mannikin *Heteromunia pectoralis*	DEC: Priority 4	Near water in acacia shrublands that have a grassy understorey and in *Triodia* hummock grassland, where they feed on seeds on the ground, as well as insects (Blakers *et al.*, 1984).	Suitable habitat occurs in the Study Area and outside. However this species rarely occurs in the Pilbara (Pizzey and Knight, 2003)	It is listed as being on the Goldsworthy site in NatureMap, but none were seen during the current survey.
Sharp-tailed Sandpiper *Calidris acuminata*	EPBC Act: Migratory WC Act: Schedule 3	Fresh and salt water wetlands	Very small areas of suitable habitat In the Study Area. Extensive habitat on the coast. Possible suitable habitat on the Study Area after heavy rains.	It is listed as being on the Goldsworthy site in NatureMap, but none were seen during the current survey.
Wood Sandpiper *Tringa glareola*	EPBC Act: Migratory WC Act: Schedule 3	Shallow fresh and brackish wetlands, swamps.	Very small areas of suitable habitat In the Study Area. Extensive habitat on the coast. Possible suitable habitat on the Study Area after heavy rains.	It is listed as being on the Goldsworthy site in NatureMap, but none were seen during the current survey.
Swinhoe's Snipe *Gallinago megala*	EPBC Act: Migratory WC Act: Schedule 3	Freshwater marshes and reedy lagoons.	Possible suitable habitat on the Study Area after heavy rains.	It is listed as being on the Goldsworthy site in NatureMap, but none were seen during the current survey.

5.2 Conservation Significant Fauna Potentially Occurring in the Study Area

5.2.1 Mammals

Northern Marsupial Mole (*Notoryctes caurinus*)

This species is poorly known, but found in sand dune habitats in the Great Sandy and Little Sandy Deserts. While the Study Area lies close to the Great Sandy Desert, there is no suitable habitat in the Study Area. It is listed as Endangered under the EPBC Act and Schedule 3 under the WC Act.

5.2.2 Birds

Eastern Osprey (*Pandeon cristatus*)

The Eastern Osprey is listed as Migratory under the EPBC Act. They are found in coastal and estuarine areas, and also follow major rivers inland. This species is unlikely to utilise the Study Area.

Fork-tailed Swift (*Apus pacificus)*

This species is entirely aerial within the Pilbara and thus does not utilise the terrestrial surface. It is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act, as it breeds in north-east and east Asia, wintering in Australia and southern New Guinea (Johnstone and Storr, 1998).

This species is expected to utilise the skies above the Study Area sporadically in the summer months, being attracted to thunderstorms and cyclonic systems (Johnstone and Storr, 1998).

Eastern Great Egret (*Ardea modesta)*

The Eastern Great Egret is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. This species is described as dispersive and migratory in parts of its range (DEWHA, 2010d), with some regular seasonal movements. Favoured breeding habitat relevant to the Study Area includes wooded swamps and river pools with *Eucalyptus camaldulensis* and *Melaleuca argentea* (Johnstone and Storr, 1998). During the wet season and after heavy rain, however, egrets could be attracted to temporary pools throughout the Study Area, including man-made water bodies.

This species could occur within the Study Area as a foraging visitor or a temporary resident during the wet season when temporary water pools provide suitable habitats.

Cattle Egret (*Ardea ibis*)

Cattle Egrets are listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is a widespread and a common species according to migration movements and surveys of breeding localities. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east

Australia. In Western Australia and the Northern Territory, the Cattle Egret is located from Wyndham to Arnhem Land. The Cattle Egret utilises a variety of natural and anthropogenic habitats and occurs in tropical and temperate grasslands, inland wetlands, wooded lands and farm lands. It has also been seen in arid and semi-arid regions; however this is extremely rare. This species has a symbiotic relationship with grazers.

This species could occur within the Study Area as a foraging visitor or a temporary resident during the wet season when temporary water pools provide suitable habitat.

Lesser Frigate (*Fregata minor*)

The Lesser Frigate is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. This seabird breeds on tropical islands in the south Atlantic, Indian and Pacific Oceans. They are moderately common in the seas off the Pilbara and may occur inland during cyclones (Johnstone and Storr 1998). This species is unlikely to utilise the Study Area.

Oriental Plover (*Charadrius veredus*)

The Oriental Plover is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is a non-breeding visitor to Australia, where it occurs in both coastal and inland areas. Along the coast the Oriental Plover inhabits estuarine mudflats, beaches and near coastal grasslands. Inland it occurs in flat, open, semi-arid or arid grasslands (DEWHA, 2010). On migration to Northern Australia (September – November), Oriental Plovers gather in flocks on open, thinly vegetated, grassland plains (Morcombe, 2004). There are few records of the Oriental Plover in the Pilbara (Australia, 2012), and it is possible that this species may be an infrequent visitor to the Study Area.

This species could utilise the Study Area for foraging, during the wet season when temporary water pools provide suitable habitats.

Oriental Pratincole (*Glareola maldivarum*)

The Oriental Pratincole is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. This species breeds in India and SE Asia, and migrates to northern Australia in November, leaving again between February and April. The Oriental Pratincole inhabits an array of habitats close to water ranging from muddy flood plains to open inland plains and tussock grasslands to stony plains. It also visit anthropogenic water bodies and open fields. It occurs on coastal and riverine plains of the Kimberley and Pilbara (Johnstone and Storr, 1998), and may occur in the Study Area.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

This large raptor is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. It is considered to be moderately common in Pilbara islands as well as in large inland water bodies. This species also visits near-coastal wetlands and other lotic waters in the region.

Given the large home range and mobility of this species, it is possible that this species would utilise sections of the Study Area.

Star Finch (western subspecies) (*Neochmia ruficauda subclarescens*)

The 'western' population of the Star Finch (western subspecies) is considered by the DEC to represent a separate subspecies (*N r subclarescens*), distinct from Kimberley and Northern Territory birds (*N. r. clarescens*). These birds are generally uncommon and patchily distributed in the Pilbara and are listed as Priority 4 by the DEC and as Near Threatened by the IUCN. The Star Finch prefers areas of dense vegetation, such as reedbeds (Johnstone and Storr, 2004) and woodlands near water (Armstrong and Anstee 2000).

Due to the presence of waterbodies in the Study Area (flooded pit, pools) it is possible that this species occurs in the Study Area.

Bush Stone-curlew (*Burhinus grallarius*)

The Bush Stone-curlew is listed as Priority 4 by DEC and as Near Threatened by the IUCN. It is patchily distributed across much of mainland Australia, inhabiting areas of open forest and woodland with open areas, fallen dead timber or leaf litter (del Hoyo *et al*., 1996). Inland, this species is associated with watercourses.

Suitable habitat in the Study Area includes drainage areas and open areas fringed by denser woodland. It is likely that this species occurs in the Study Area.

Barn Swallow (*Hirundo rustica)*

The Barn Swallow is listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. Barn Swallows are summer visitors (September to early April), occurring in small numbers. They are likely to occur on the Study Site occasionally, probably over the flooded pit.

Table 5.3 Conservation significant fauna potentially occurring in the Study Area.

Name	Significance	Preferred habitat	Extent of habitat in the Study Area	Records	Likelihood of occurrence in the Study Area
Mammals					
Northern Marsupial *Mole* *Notoryctes caurinus*	EPBC Act: Endangered WC Act: Schedule 1	Sand dune areas and aeolian sands.	No suitable habitat within the Study Area, though suitable habitat does occur further to the east.	Not recorded within the Study Area.	**Very Low**
Birds					
Eastern Osprey *Pandion cristatus*	EPBC Act: Migratory WC Act: Schedule 3	Lentic water bodies, both freshwater and marine.	The coastal and near-cost habitats (beach, dunes, tidal flats, riverine and mangroves) further north to the Study Area provide suitable habitat for this species.	Known from along the Pilbara coast, although there are no records within 20 km of the Study Area (NatureMap)	**Medium**
Fork-tailed Swift *Apus pacificus*	EPBC Act: Migratory WC Act: Schedule 3	Species is entirely aerial in the region and does not utilise fauna habitats directly.	Species will fly over all areas of the Study Area and surrounding region.	No records within 20 km of the Study Area (NatureMap)	**High**
Eastern Great Egret *Ardea modesta*	EPBC Act: Migratory WC Act: Schedule 3	Inhabits a wide array of semi-aquatic habitats including beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	Suitable habitats may exist along the coast, but not in the Study Area	No records within 20 km of the Study Area (NatureMap)	**Low**
Cattle Egret *Ardea ibis*	EPBC Act: Migratory WC Act: Schedule 3	Cattle Egrets prefer inundated grasslands and wetlands, and are uncommon in arid and semi-arid regions (Marchant and Higgins, 1990). This species occasionally uses swamps with tall emergent vegetation, e.g. *Typha* sp. or wooded swamps.	Marginally suitable habitat is potentially available when inundated after heavy rain.	There are sporadic records of vagrant Cattle Egrets in the inland Pilbara, (Birds Australia, 2011).	**Medium**
Lesser Frigatebird *Fregata minor*	EPBC Act: Migratory WC Act: Schedule 3	Oceanic and coastal habitats	None, although may occur inland during cyclones.	No records within 20 km of the Study Area (NatureMap)	**Low**

Name	Significance	Preferred habitat	Extent of habitat in the Study Area	Records	Likelihood of occurrence in the Study Area
Oriental Plover *Charadrius veredus*	EPBC Act: Migratory WC Act: Schedule 3	Estuarine mudflats, beaches and near coastal grasslands. Inland it occurs in flat, open, semi arid or arid grasslands (DEWHA, 2010).	Suitable habitat occurs, particularly during / after heavy rains.	No records within 20 km of the Study Area (NatureMap)	**Medium**
Oriental Pratincole *Glareola maldivarum*	EPBC Act: Migratory WC Act: Schedule 3	Close to water ranging from muddy flood plains to open inland plains and tussock grasslands to stony plains	Suitable habitat occurs, particularly during after heavy rains.	No records within 20 km of the Study Area (NatureMap)	**Medium**
White-bellied Sea-eagle *Haliaeetus leucogaster*	EPBC Act: Migratory WC Act: Schedule 3	Lentic water bodies, both freshwater and marine.	The coastal and near-cost habitats (beach, dunes, tidal flats, riverine and mangroves) further north to the Study Area provide suitable habitat for this species.	Recorded within 20 km of the Study Area (NatureMap)	**Medium**
Star Finch (western subspecies) *Neochmia ruficauda subclarescens*	DEC: Priority 4 IUCN: Near Threatened	Prefers areas of dense vegetation, such as reed beds (Johnstone and Storr, 2004) and woodlands near water (Slater *et al*., 2009).	Suitable habitats is not present within the Study Area.	Recorded within 20 km of the Study Area (NatureMap)	**Medium to High**
Bush Stone-curlew *Burhinus grallarius*	DEC: Priority 4 IUCN: Near threatened	Inhabits areas of open forest and woodland with open areas, fallen dead timber or leaf litter. Inland, it is associated with watercourses.	Suitable habitat in the Study Area includes drainage areas and open areas fringed by denser woodland, such as the grooved Mulga woodlands in the central and northern parts of the Study Area.	This species is a common resident in the region. No tracks were observed in the current survey.	**High**
Barn Swallow *Hirundo rustica*	EPBC Act: Migratory WC Act: Schedule 3	Open country and agricultural lands, especially near water.	Similar habitats occur within the northern section of the Study Area	Given its known range within Australia, it is likely that this species visits the northern regions of the Study Area during the migratory period, mostly September to March.	**Medium**
Reptiles					
Great Desert Skink *Liopholis kintorei*	EPBC Act: Vulnerable WC Act: Schedule 1	Arid sand flats and dunes,and clay-based or loamy soils with Spinifex	Little or no suitable habitat within the Study Area. Suitable habitat occurs further east.	Not recorded within the study Area.	**Low**
Pilbara Olive Python *Liasis olivaceus barroni*	EPBC Act: Vulnerable WC Act: Schedule 1	Associated with drainage systems, including areas with localised drainage and semi-permanent watercourses (DSEWPaC, 2011a).	Deep rocky gullies are present but not common in the Study Area. However they are a common feature in mountain ranges within Pilbara.	Recorded at Pardoo (Bamford Consulting Ecologists, 2007) and from 13 km from the Study Area (NatureMap)	**High**

6 IMPORTANT FAUNA HABITATS

The expected faunal richness in an area is proportional to the amount of habitat variation and floristic diversity, since both of these will influence the number of different habitats available for fauna. Accordingly, an area with high variation of habitat types could harbour a higher diversity of fauna and vice versa. Across the Study Area, eight different habitats were encountered.

The most significant fauna habitats within the Study Area are Gorge/Gully/Breakaway, Sand Plain with Pindan, Sand Plain with Hummock Grass and Major Drainage Lines (Table 6.1, Figure 6.1). Gorge/Gully/Breakaway Systems occupy a comparatively small area within the Study Area, but are vital habitats for conservation significant fauna including, but not limited to, Northern Quolls, Ghost Bats, Pilbara Leaf-nosed Bats and potentially Olive Pythons. Caves (Figure 6.1) and rock shelters within and outside gorges and gullies provide important habitat for conservation significant bats. Three caves contained evidence of Ghost Bat activity (scats collected) (Appendix F). Two were deemed feeding roosts only, while one was a feeding roost and could also possibly be a day roost. Caves recorded during the study did not possess characteristics required by the Pilbara Leaf-nosed Bats.

Permanent water in the Pilbara is a very important habitat for fauna, as there are few locations where water is available year round. Also, these could provide important foraging grounds for an array of other fauna within the area. Four water bodies in addition to the flooded pit were recorded within the Study Area (Figure 6.1). However, it was not possible to ascertain whether these water bodies are permanent. Two of the water bodies were small rock pools in gorges, and two were river pools in the Pardoo Creek. After rain, there would be many further transient water bodies on the site.

Table 6.1 Fauna Habitats with high significance scores.

Fauna habitat	Score	Rationale
Gorge/Gully/Breakaway Systems	High	The Gorge/Gully/Breakaway habitat may provide suitable habitat for Northern Quolls (listed as Endangered under the EPBC Act, on Schedule 1 under WC Act and as Endangered by the IUCN), potentially Pilbara Olive Pythons (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act) and caves and rock shelters within gorges provide temporary roosts and transitional habitats for bats, including Ghost Bats (listed as a Priority 4 species by the DEC). Furthermore gorges and gullies could be day time retreats for other larger mammals and reptiles.
Major Drainage Line	High	These could support migratory bird species such as the Rainbow Bee-eaters (listed as Migratory under the EPBC Act and on Schedule 3 under the WC Act) and waders, as well as a locally high diversity of bird species. Provides potential breeding and/or foraging sites for the Peregrine Falcon (listed under Schedule 4 of the WC Act). Provides habitat and dispersal opportunities for the Pilbara Olive Python (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act) and Bush Stone-curlew (Priority 4 by DEC). Potential habitat for the Northern Quoll.
Sand Plains with Pindan	High	This habitat support Greater Bilbies (listed as Vulnerable under the EPBC Act, on Schedule 1 under the WC Act and as Vulnerable by the IUCN) , providing suitable substrate for burrows and adequate food and shelter.

Fauna habitat	Score	Rationale
Sand Plain with Hummock Grass	High	This habitat support Mulgara (listed as Vulnerable under the EPBC Act and on Schedule 1 under the WC Act), providing suitable substrate for burrows and adequate food and shelter. May provide habitat for Greater Bilby.

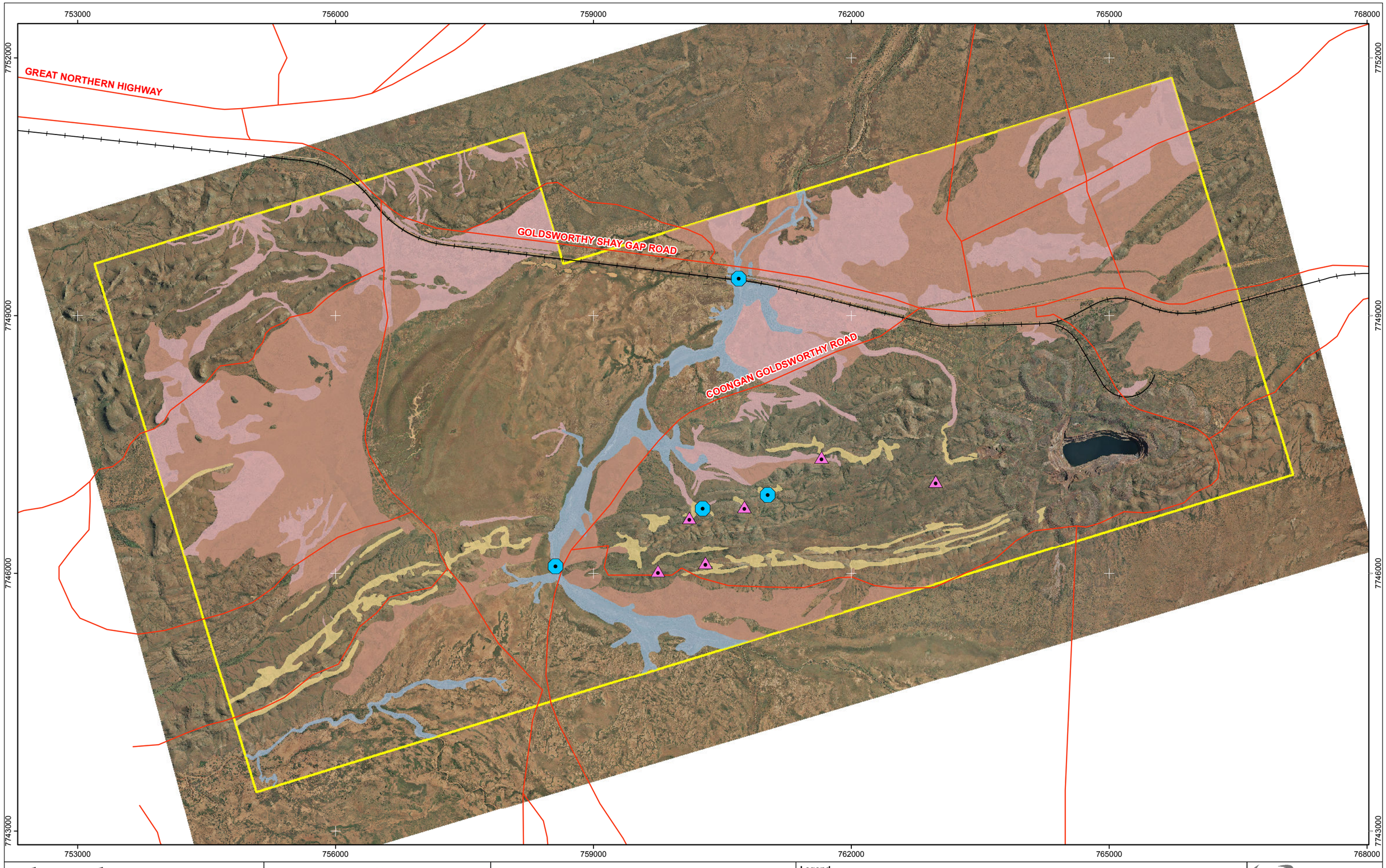

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FIGURE 6.1		Date:	14/01/2013
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GOLDSWORTHY

SIGNIFICANT FAUNA HABITATS
FIGURE 6.1

Legend

- Study Area
- BHP Billiton Railway

Significant Fauna Habitats

- Cave
- Water body

Significant Habitat Types

- Gorge/Gully/Breakaway
- Major Drainage Line
- Sand Plain with Hummock Grass
- Sand Plain with Pindan

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7 SUMMARY

The present survey is the first detailed fauna survey of the Study Area, although there are some records from within the Study Area on the DEC NatureMap. There are faunal studies at several sites within 50 km and a number of significant species have been recorded.

In total, 105 species of vertebrates have been recorded within the Study Area, comprising 19 native and four introduced mammals, 67 birds, 14 reptiles and one amphibian. The purpose of the survey was to target conservation significant species. Due to this non-systematic methodology of the current survey, it is not possible to construct meaningful accumulation curves. Additional nocturnal, fossorial and sub-fossorial reptiles and mammals would be recorded by trapping and more intensive searches including night work.

Thirteen conservation significant species have been recorded to date from the Study Area. Eight of these are listed under the EPBC Act, eight are listed under the WC Act and five are on the DEC priority list. The presence of Greater Bilbies, Northern Quoll, Pilbara Olive Python and Mulgara in the Study Area all serve to emphasize the high quality and diversity of habitats in the Study Area.

The Rainbow Bee-eater is locally common and many records exists within and the vicinity of the Study Area. The Australian Bustard and Peregrine Falcon are widespread species, but no live animals were seen in the Study Site during the current survey. The characteristic mounds constructed by colonies of Western Pebble-mound Mice are fairly common in the Study Area in suitable habitat of hill crests and slopes, although only inactive mounds were recorded. Arguably this species is widespread and not dependant on habitats in the Study Area. The Ghost Bat is wide-spread in the Pilbara and inhabits a wide variety of habitats if suitable caves and mine shafts for roost sites are present. Caves with evidence of Ghost Bat activity were recorded in the Study Area, two were deemed as feeding roost and one was deemed as a feeding roost or possible day roost. Although calls of Pilbara Leaf-nosed Bats were recorded, these are likely to roost outside the Study Area. The conservation-significant water birds previously recorded in the Study Area are likely to use the site on a transient basis.

A further 14 species of conservation significance were deemed as potentially occurring within the Study Area. Eleven of these species are birds which are unlikely to use the Study Area on a permanent basis. Of the potentially occurring reptiles, it is highly likely that the Pilbara Olive Python does occur within the Study Area, making use of the Gorge/Gully/Breakaway habitat. The Great Desert Skink and Northern Marsupial Mole are considered very unlikely to occur in the Study Area.

Gorge/ Gully, Major Drainage Line, and the Sand Plain (Pindan and Hummock), which are are of high conservation significance locally as a result of providing suitable habitat for a number of conservation significant species.

In 2008, areas under rehabilitation were considered as having vegetation communities that could not be considered as native vegetation. They were rated as being in very poor condition and lacking in conservation significant flora species (Pilbara Flora, 2009). Opportunistic searches within the storage areas indicated that the rehabilitation of the mine overburden storage areas has not been successful in terms of providing suitable habitat for native vertebrate species, as none were recorded from these areas.

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APPENDIX A SURVEY SITE LOCATIONS

Survey Type	Northing	Easting	Survey
Habitat assessment 1	-20.353085	119.513344	Current Survey
Habitat assessment 2	-20.353548	119.507240	Current Survey
Habitat assessment 3	-20.363132	119.476631	Current Survey
Habitat assessment 4	-20.357710	119.500992	Current Survey
Habitat assessment 5	-20.373802	119.473991	Current Survey
Habitat assessment 6	-20.369783	119.462563	Current Survey
Habitat assessment 7	-20.364637	119.497040	Current Survey
Habitat assessment 8	-20.383755	119.443962	Current Survey
Habitat assessment 9	-20.360790	119.510040	Current Survey
Habitat assessment 10	-20.357048	119.529984	Current Survey
Habitat assessment 11	-20.359186	119.475227	Current Survey
Habitat assessment 12	-20.351263	119.458839	Current Survey
Habitat assessment 13	-20.347836	119.468178	Current Survey
Habitat assessment 14	-20.335241	119.496552	Current Survey
Habitat assessment 15	-20.350138	119.550957	Current Survey
Habitat assessment 16	-20.326460	119.469986	Current Survey
Habitat assessment 17	-20.325531	119.471893	Current Survey
Habitat assessment 18	-20.328779	119.464958	Current Survey
Habitat assessment 19	-20.346312	119.500488	Current Survey
Habitat assessment 20	-20.364668	119.497070	Current Survey
Habitat assessment 21	-20.351591	119.488899	Current Survey
Habitat assessment 22	-20.375509	119.441277	Current Survey
Habitat assessment 23	-20.375984	119.471535	Current Survey
Habitat assessment 24	-20.325838	119.519905	Current Survey
Habitat assessment 25	-20.359108	119.442513	Current Survey
Habitat assessment 26	-20.353130	119.447624	Current Survey
Habitat assessment 27	-20.337996	119.544365	Current Survey
Habitat assessment 28	-20.342745	119.542397	Current Survey
Habitat assessment 29	-20.341887	119.526077	Current Survey
Habitat assessment 30	-20.332592	119.526871	Current Survey
Habitat assessment 31	-20.354818	119.545853	Current Survey
Habitat assessment 32	-20.341432	119.534964	Current Survey
Habitat assessment 33	-20.338329	119.514580	Current Survey
Habitat assessment 34	-20.333990	119.522415	Current Survey
Habitat assessment 35	-20.325356	119.521156	Current Survey
Habitat assessment 36	-20.331446	119.438087	Current Survey
Bat detector 1	-20.359357	119.497944	Current Survey
Bat detector 2	-20.354061	119.532097	Current Survey
Bat detector 3	-20.350020	119.551026	Current Survey

Survey Type	Northing	Easting	Survey
Bat detector 4	-20.354486	119.533894	Current Survey
Bat detector 5	-20.335589	119.496739	Current Survey
Bat detector 6	-20.366203	119.488355	Current Survey
Bat detector 7	-20.325181	119.519814	Current Survey
Bat detector 8	-20.353129	119.513460	Current Survey
Bat detector 9	-20.329265	119.457532	Current Survey
Bat detector 10	-20.370723	119.447798	Current Survey
Motion Cam 1	-20.354186	119.520964	Current Survey
Motion Cam 2	-20.355305	119.509100	Current Survey
Motion Cam 3	-20.365835	119.478027	Current Survey
Motion Cam 4	-20.358076	119.500375	Current Survey
Motion Cam 5	-20.358751	119.497331	Current Survey
Motion Cam 6	-20.341873	119.457961	Current Survey
Motion Cam 7	-20.344788	119.544478	Current Survey
Motion Cam 8	-20.329882	119.463094	Current Survey
Motion Cam 9	-20.374237	119.443803	Current Survey
Motion Cam 10	-20.333982	119.522532	Current Survey
Motion Cam 11	-20.338412	119.514619	Current Survey
Walking Transect 1	-20.354260	119.544360	Current Survey
Walking Transect 2	-20.343530	119.542600	Current Survey
Walking Transect 3	-20.356090	119.530110	Current Survey
Walking Transect 4	-20.355130	119.520680	Current Survey
Walking Transect 5	-20.354590	119.510090	Current Survey
Walking Transect 6	-20.359710	119.501580	Current Survey
Walking Transect 7	-20.359030	119.494420	Current Survey
Walking Transect 8	-20.366190	119.488500	Current Survey
Walking Transect 9	-20.364720	119.476740	Current Survey
Walking Transect 10	-20.372630	119.475030	Current Survey
Walking Transect 11	-20.375140	119.467270	Current Survey
Walking Transect 12	-20.370660	119.447710	Current Survey
Walking Transect 13	-20.373320	119.443940	Current Survey
Walking Transect 14	-20.355360	119.448570	Current Survey
Walking Transect 15	-20.348340	119.464230	Current Survey
Walking Transect 16	-20.327820	119.435870	Current Survey
Walking Transect 17	-20.324640	119.472450	Current Survey
Walking Transect 18	-20.330370	119.462640	Current Survey
Walking Transect 19	-20.324860	119.521290	Current Survey
Walking Transect 20	-20.333940	119.522480	Current Survey

APPENDIX B CONSERVATION STATUS CODES

International Union for Conservation of Nature

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CE)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Extinct (EX)	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (EW)	Taxa known to survive only in captivity.
Critically Endangered (CE)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Migratory (MG)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA) China-Australia Migratory Bird Agreement (CAMBA) Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

Wildlife Conservation Act 1950

Category	Definition
Schedule 1 (S1)	Rare and Likely to become Extinct.
Schedule 2 (S2)	Extinct.
Schedule 3 (S3)	Migratory species listed under international treaties.
Schedule 4 (S4)	Other Specially Protected Fauna.

Department of Environment and Conservation Priority codes

Category	Definition
Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4 (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX C FAUNA RECORDED IN THE STUDY AREA AND IDENTIFIED IN DATABASE SEARCHES

Mammals

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
TACHYGLOSSIDAE												
Tachyglossus aculeatus	Echidna								•	•		•
DASYURIDAE												
Dasycercus blythi	Brush-tailed Mulgara			**P4**						•		•
Dasycercus cristicauda	Crest-tailed Mulgara	**VU**	**S1**					•				
Dasykaluta rosamondae	Little Red Kaluta								•			
Dasyurus hallucatus	Northern Quoll	**EN**	**S1**		**EN**	•	•	•	•	•	•	•
Planigale sp. 1	Undescribed Pilbara Planigale					•	•					
Pseudantechinus woolleyae	Woolley's Pseudantechinus									•		
Sminthopsis macroura	Stripe-faced Dunnart						•					
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart								•	•		
THYLACOMYIDAE												
Macrotis lagotis	Bilby, Dalgyte	**VU**	**S1**		**VU**					•	•	•
MACROPODIDAE												
Macropus robustus	European Cattle					•	•	•	•	•	•	•
Macropus rufus	Red Kangaroo, Marlu							•	•		•	•
Petrogale rothschildi	Rothschild's Rock-wallaby					•	•					
MEGADERMATIDAE												

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Macroderma gigas	Ghost Bat			P4	VU							•
HIPPOSIDERIDAE												
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	S1				•	•				•
EMBALLONURIDAE												
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat						•					•
Taphozous georgianus	Common Sheathtail-bat					•	•	•		•		•
Taphozous hilli	Hill's Sheathtail-bat								•			
MOLOSSIDAE												
Chaerephon jobensis	Northern Freetail-bat							•				•
Tadarida australis	White-striped Freetail-bat											•
VESPERTILIONIDAE												
Chalinolobus gouldii	Gould's Wattled Bat					•	•	•			•	•
Nyctophilus geoffroyi	Lesser Long-eared Bat						•	•				•
Scotorepens greyii	Little Broad-nosed Bat					•	•	•				•
Vespadelus finlaysoni	Finlayson's Cave Bat					•	•	•				•
MURIDAE												
**Mus musculus*	House Mouse						•	•	•		•	
Notomys alexis	Spinifex Hopping-mouse									•		
Leggadina lakedownensis	Short-tailed Mouse			P4					•			
Pseudomys chapmani	Western Pebble-mound Mouse			P4					•	•	•	•

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Pseudomys delicatulus	Delicate Mouse								•			
Pseudomys desertor	Desert Mouse							•	•	•		
Pseudomys hermannsburgensis	Sandy Inland Mouse							•	•			
Zyzomys argurus	Common Rock-rat					•	•	•	•		•	•
BOVIDAE												
**Bos taurus*	European Cattle					•		•	•			•
CANIDAE												
**Canis lupus dingo*	Dingo						•			•		•
**Canis lupus*	Dog										•	
**Vulpes vulpes*	Red Fox									•		
CAMELIDAE												
**Camelus dromedarius*	Dromedary, Camel											•
FELIDAE												
**Felis catus*	Cat					•			•	•	•	•
LEPORIDAE												
**Oryctolagus cuniculus*	Rabbit										•	
SURIDAE												
Sus scrofa												•

Birds

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
CASUARIIDAE												
Dromaius novaehollandiae	Emu										•	
PHASIANIDAE												
Coturnix ypsilophora	Brown Quail					•	•	•	•	•	•	•
ANATIDAE												
Anas gracilis	Grey Teal							•			•	
Anas superciliosa	Pacific Black Duck							•			•	
Aythya australis	Hardhead							•			•	
Cygnus atratus	Black Swan										•	
RALLIDAE												
Fulica atra	Eurasian coot										•	
Gallirallus philippensis	Buff-banded Rail							•				
Porzana tabuensis	Spotless Crake					•						
PODICIPEDIDAE												
Tachybaptus novaehollandiae	Australasian Grebe										•	•
COLUMBIDAE												
Geophaps plumifera	Spinifex Pigeon					•	•	•	•	•	•	•
Geopelia cuneata	Diamond Dove					•	•	•	•	•	•	•
Geopelia striata	Peaceful Dove						•	•		•	•	•
Ocyphaps lophotes	Crested Pigeon					•	•	•	•		•	•

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Phaps chalcoptera	Common Bronzewing					•	•					•
EUROSTOPODIDAE												
Eurostopodus argus	Spotted Nightjar						•	•	•	•	•	•
AEGOTHELIDAE												
Aegotheles cristatus	Australian Owlet-nightjar						•	•		•	•	•
PHALACROCORACIDAE												
Phalacrocorax melanoleucos	Little Pied Cormorant							•				
Phalacrocorax sulcirostris	Little Black Cormorant										•	
PELECANIDAE												
Pelecanus conspicillatus	Australian Pelican							•				
CICONIIDAE												
Ephippiorhynchus asiaticus	Black-necked Stork										•	
ARDEIDAE												
Ardea modesta	Eastern Great Egret	**MG**						•			•	
Ardea pacifica	White-necked Heron						•	•		•	•	•
Egretta novaehollandiae	White-faced Heron						•	•	•		•	•
Nycticorax caledonicus	Nankeen Night-Heron										•	
CICONIIDAE												
Ephippiorhynchus asiaticus australis	Black-necked Stork							•				
THRESKIORNITHIDAE												

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Platalea flavipes	Yellow-billed Spoonbill							•				
Plegadis falinellus	Glossy Ibis							•			•	
Platalea regia	Royal Spoonbill							•			•	
Threskiornis molucca	Australian White Ibis										•	
Threskiornis spinicollis	Straw-necked Ibis							•			•	
ACCIPITRIDAE												
Aquila audax	Wedge-tailed Eagle					•				•	•	•
Haliaeetus leucogaster	White-bellied Sea-eagle	**MG**	**S3**								•	
Accipiter cirrocephalus	Collared Sparrowhawk										•	
Accipiter fasciatus	Brown Goshawk						•	•		•	•	•
Circus assimilis	Spotted Harrier					•	•	•		•	•	•
Elanus axillaris	Black-shouldered Kite						•		•			•
Haliastur sphenurus	Whistling Kite					•	•	•		•	•	•
Milvus migrans	Black Kite										•	
Hieraaetus morphnoides	Little Eagle					•		•				
Pandion cristatus	Eastern Osprey	**MG**						•				
FALCONIDAE												
Falco berigora	Brown Falcon					•	•	•	•		•	•
Falco cenchroides	Nankeen Kestrel					•	•	•	•		•	•
Falco longipennis	Australian Hobby					•		•				
Falco peregrinus	Peregrine Falcon		**S4**								•	

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
GRUIDAE												
Grus rubicunda	Brolga										•	
OTIDIDAE												
Ardeotis australis	Australian Bustard			**P4**				•				•
BURHINIDAE												
Burhinus grallarius	Bush Stone-curlew			**P4**			•	•			•	
RECURVIROSTRIDAE												
Himantopus himantopus	Black-winged Stilt										•	
CHARADRIIDAE												
Charadrius ruficapillus	Red-capped Plover							•			•	
Elseyornis melanops	Black-fronted Dotterel							•	•	•		
Erythrogonys cinctus	Red-kneed Dotterel							•			•	
Vanellus miles	Masked Lapwing										•	
SCOLOPACIDAE												
Gallinago megala	Swinhoe's Snipe	**MG**	**S3**					•			•	
Calidris acuminata	Sharp-tailed Sandpiper	**MG**	**S3**								•	
Tringa glareola	Wood Sandpiper	**MG**	**S3**					•			•	
Tringa stagnatilis	Marsh Sandpiper	**MG**	**S3**					•				
Tringa nebularia	Common Greenshank	**MG**	**S3**					•			•	
Actitis hypoleucos	Common Sandpiper	**MG**	**S3**					•			•	

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
TURNICIDAE												
Turnix velox	Little Button-quail						•		•	•	•	•
CACATUIDAE												
Eolophus roseicapillus	Galah					•	•	•	•	•	•	•
Cacatua sanguinea	Little Corella					•	•	•	•		•	•
Nymphicus hollandicus	Cockatiel									•	•	
PSITTACIDAE												
Barnardius zonarius	Australian Ringneck								•			
Melopsittacus undulatus	Budgerigar									•	•	•
CUCULIDAE												
Centropus phasianinus	Pheasant Coucal					•	•	•			•	•
Chalcites basalis	Horsfield's Bronze-Cuckoo						•	•	•	•		•
Cacomantis pallidus	Pallid Cuckoo									•	•	
STRIGIDAE												
Ninox connivens	Barking Owl										•	
Ninox novaeseelandiae	Southern Boobook							•			•	
HALCYONIDAE												
Dacelo leachii	Blue-winged Kookaburra					•	•	•	•	•	•	
Todiramphus pyrrhopygius	Red-backed Kingfisher					•	•	•	•	•		•
Todiramphus sanctus	Sacred Kingfisher							•	•	•	•	

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
MEROPIDAE												
Merops ornatus	Rainbow Bee-eater	**MG**	**S3**			•	•	•	•	•	•	•
CLIMACTERIDAE												
Climacteris melanura	Black-tailed Treecreeper									•	•	
MALURIDAE												
Amytornis striatus whitei	Striated Grasswren					•	•	•	•		•	•
Malurus lamberti	Variegated Fairy-wren						•	•	•		•	
Malurus leucopterus	White-winged Fairy-wren					•				•	•	
ACANTHIZIDAE												
Pyrrholaemus brunneus	Redthroat											
Smicrornis brevirostris	Weebill										•	
PARDALOTIDAE												
Pardalotus rubricatus	Red-browed Pardalote					•	•	•		•	•	•
Pardalotus striatus	Striated Pardalote								•		•	
MELIPHAGIDAE												
Acanthagenys rufogularis	Spiny-cheeked Honeyeater										•	
Certhionyx variegatus	Pied Honeyeater										•	
Lichenostomus keartlandi	Grey-headed Honeyeater					•	•	•	•		•	•
Lichenostomus penicillatus	White-plumed Honeyeater					•	•	•	•	•	•	•
Lichenostomus plumulus	Grey-fronted Honeyeater							•				

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Lichenostomus virescens	Singing Honeyeater					•	•	•	•	•	•	•
Lichmera indistincta	Brown Honeyeater					•	•	•	•		•	•
Melithreptus gularis	Black-chinned Honeyeater					•	•	•	•		•	
Manorina flavigula	Yellow-throated Miner					•		•	•	•	•	•
Epthianura tricolor	Crimson Chat										•	
Philemon citreogularis	Little Friarbird										•	
POMATOSTOMIDAE												
Pomatostomus temporalis	Grey-crowned Babbler							•		•	•	
NEOSITTIDAE												
Daphoenositta chrysoptera	Varied Sittella										•	
CAMPEPHAGIDAE												
Coracina novaehollandiae	Black-faced Cuckoo-shrike					•	•	•	•	•	•	•
Lalage sueurii	White-winged Triller					•	•	•		•	•	•
PACHYCEPHALIDAE												
Pachycephala rufiventris	Rufous Whistler								•		•	
Colluricincla harmonica	Grey Shrike-thrush					•	•	•	•		•	•
ARTAMIDAE												
Artamus cinereus	Black-faced Woodswallow					•	•	•	•	•	•	
Artamus leucorynchus	White-breasted Woodswallow										•	
Artamus minor	Little Woodswallow					•	•	•	•	•	•	•

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Artamus personatus	Masked Woodswallow										•	
Cracticus nigrogularis	Pied Butcherbird					•	•	•	•	•	•	
RHIPIDURIDAE												
Rhipidura leucophrys	Willie Wagtail					•	•	•	•	•	•	•
CORVIDAE												
Corvus bennetti	Little Crow										•	
Corvus orru	Torresian Crow					•	•	•	•	•	•	•
MONARCHIDAE												
Grallina cyanoleuca	Magpie-lark					•	•	•	•	•	•	•
PETROICIDAE												
Petroica goodenovii	Red-capped Robin										•	
ALAUDIDAE												
Mirafra javanica	Horsfield's Bushlark						•	•		•	•	•
ACROCEPHALIDAE												
Acrocephalus australis	Australian Reed-Warbler										•	
MEGALURIDAE												
Cincloramphus cruralis	Brown Songlark						•				•	
Cincloramphus mathewsi	Rufous Songlark							•		•	•	
Eremiornis carteri	Spinifexbird					•	•	•	•		•	•
TIMALIIDAE												

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Zosterops luteus	Yellow White-eye										•	
HIRUNDINIDAE												
Cheramoeca leucosterna	White-backed Swallow											
Hirundo neoxena	Welcome Swallow											
Petrochelidon ariel	Fairy Martin					•	•	•	•			•
Petrochelidon nigricans	Tree Martin						•			•		
NECTARINIIDAE												
Dicaeum hirundinaceum	Mistletoebird										•	
ESTRILDIDAE												
Emblema pictum	Painted Finch					•	•	•	•	•	•	•
Heteromunia pectoralis	Pictorella Mannikin			**P4**				•			•	
Neochmia ruficauda subclarescens	Star Finch (western subspecies)			**P4**				•			•	
Taeniopygia guttata	Zebra Finch					•	•	•	•	•	•	•
MOTACILLIDAE												
Anthus australis	Australasian Pipit										•	•
Anthus novaeseelandiae	Richard's Pipit					•		•	•	•		
PTILONORHYCHIDAE												
Ptilonorhynchus guttatus	Western Bowerbird					•	•	•	•			

Reptiles

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
CHELUIDAE												
Chelodina steindachneri	Flat-shelled Turtle						•					•
AGAMIDAE												
Ctenophorus caudicinctus caudicinctus	Ring-tailed Dragon					•	•	•	•	•	•	•
Ctenophorus isolepis	Crested Dragon								•	•	•	•
Ctenophorus nuchalis	Central Netted Dragon					•		•			•	
Diporiphora winneckei	Blue-lined Dragon						•				•	
Lophognathus longirostris								•	•	•		
Pogona minor mitchelli								•			•	
DIPLODACTYLIDAE												
Crenadactylus ocellatus	Clawless Gecko					•						
Diplodactylus conspicillatus	Fat-tailed Gecko					•	•	•	•	•	•	
Diplodactylus savagei	Yellow-spotted Pilbara Gecko					•	•	•				
Lucasium stenodactylum	Pale-snouted Ground Gecko						•	•				
Lucasium wombeyi							•	•				
Oedura marmorata	Marbled Velvet Gecko									•		•
Rhynchoedura ornata	Beaked Gecko					•					•	
Strophurus ciliaris						•	•				•	
CARPHODACTYLIDAE												

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Nephurus levis pilbarensis						•	•					
GEKKONIDAE												
Gehyra punctata	Spotted Rock Dtella					•	•	•	•	•		•
Gehyra purpurascens									•			
Gehyra variegata	Tree Dtella					•	•	•		•	•	
Heteronotia binoei	Bynoe's Gecko							•	•	•		
Heteronotia spelea	Desert Cave Gecko					•	•	•	•			
PYGOPODIDAE												
Delma elegans	Pilbara Delma						•					
Delma pax						•					•	
Delma tincta							•	•		•		
Lialis burtonis	Burton's legless lizard					•			•	•		
SCINCIDAE												
Carlia munda						•	•	•	•			
Carlia triacantha	Desert Rainbow Skink					•		•				
Cryptoblepharus plagiocephalus	Fence Skink								•			
Ctenotus duricola											•	
Ctenotus helenae							•					
Ctenotus pantherinus	Leopard Ctenotus								•	•	•	•
Ctenotus piankai								•				

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Ctenotus rubicundus						•	•					
Ctenotus saxatilis	Rock Ctenotus					•	•	•	•	•	•	•
Cyclodomorphus melanops	Slender Blue-tongue								•			
Egernia depressa	Pygmy Spiny-tailed Skink					•	•		•	•		
Lerista bipes						•	•	•	•		•	
Lerista jacksoni											•	
Lerista muelleri						•	•	•				
Lerista vermicularis									•			
Menetia greyii	Dwarf Skink						•				•	
Morethia ruficauda	Fire-tailed Skink								•			
Varanus acanthurus	Spiny-tailed Monitor						•	•		•	•	
Varanus brevicauda	Short-tailed Pygmy Monitor										•	
Varanus caudolineatus	Stripe-tailed Monitor						•					
Varanus eremius	Desert Pygmy Monitor						•				•	
Varanus giganteus	Perentie					•	•	•				
Varanus gouldii	Bungarra or Sand Monitor					•						•
Varanus panoptes	Yellow-spotted Monitor						•		•			•
Varanus pilbarensis	Pilbara Rock Monitor					•			•	•		•
Varanus tristis	Black-headed Monitor					•		•				
TYPHLOPIDAE												

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
Ramphotyphlops ammodytes											•	
Ramphotyphlops grypus									•			
BOIDAE												
Antaresia perthensis	Pygmy Python					•		•		•	•	
Antaresia stimsoni	Stimson's Python					•	•	•		•		
Aspidites melanocephalus	Black-headed Python											•
Aspidites ramsayi	Woma										•	
Liasis olivaceus barroni	Pilbara Olive Python	**VU**	**S1**					•		•	•	
ELAPIDAE												
Acanthophis pyrrhus	Desert Death Adder							•		•	•	
Brachyurophis approximans							•					
Demansia psammophis	Yellow-faced Whipsnake					•	•		•	•		
Demansia rufescens	Rufous Whipsnake					•						
Furina ornata	Moon Snake						•		•			
Pseudechis australis	Mulga Snake							•	•	•		•
Pseudonaja mengdeni	Western Brown Snake									•		
Pseudonaja modesta	Ringed Brown Snake					•					•	
Pseudonaja nuchalis								•			•	
Simoselaps anomalus	Desert Banded Snake						•					
Suta punctata	Spotted Snake									•	•	

Amphibians

Family and Species	Common Name	EPBC	WCA	DEC	IUCN	Sunrise Hill ecologia 2005	Nimingarra ecologia 2005	Cattle Gorge ecologia 2005	Yarrie ecologia 2005	Pardoo DSO Bamford 2007	Goldsworthy NatureMap 20 km	Current Survey Goldsworthy Biologic 2012
HYLIDAE												
Cyclorana australis	Giant Frog									•	•	•
Cyclorana maini	Main's Frog								•	•		
Litoria caerulea	Green Tree Frog						•	•	•	•		
Litoria rubella	Desert Tree Frog					•	•	•	•	•		
MYOBATRACHIDAE												
Neobatrachus aquilonius	Northern Burrowing Frog								•			
Limnodynastes spenceri	Spencers Frog							•	•			
Uperoleia russelli	Russell's Toadlet										•	
Uperoleia glandulosa	Glandular Toadlet					•		•			•	
LIMNODYNASTIDAE												
Notaden nichollsi	Desert Spadefoot									•	•	
Platyplectrum spenceri	Centralian Burrowing Frog								•			

APPENDIX D HABITAT ASSESSMENT DATA

Site #	Habitat 01	Habitat 02	Habitat 03	Habitat 04	Habitat 05	Habitat 06	Habitat 07	Habitat 08	Habitat 09	Habitat 10	Habitat 11	Habitat 12	Habitat 13	Habitat 14	Habitat 15	Habitat 16	Habitat 17	Habitat 18
GCS GDA94 Latitude (Decimal Degrees)	-20.353085	-20.353548	-20.363132	-20.357710	-20.373802	-20.369783	-20.364637	-20.383755	-20.360790	-20.357048	-20.359186	-20.351263	-20.347836	-20.335241	-20.350138	-20.326460	-20.325531	-20.328779
GCS GDA94 Longitude (Decimal Degrees)	119.513344	119.507240	119.476631	119.500992	119.473991	119.462563	119.497040	119.443962	119.510040	119.529984	119.475227	119.458839	119.468178	119.496552	119.550957	119.469986	119.471893	119.464958
Landform	Gorge/Gully/Breakaway	Gorge/ gully	Major drainage line	Gorge/ gully	Sandplain	Crest/ slope	Crest/slope	Crest/slope	Crest/slope	Artificial habitat	Stony plain	Tussock grassland	Tussock grassland	Major drainage line	Drainage line	Crest/slope	Crest/slope	Crest/slope
Survey Start Date	8/17/2012	8/17/2012	8/18/2012	8/18/2012	8/18/2012	8/18/2012	8/18/2012	8/18/2012	8/19/2012	8/19/2012	8/19/2012	8/19/2012	8/19/2012	8/19/2012	8/19/2012	8/20/2012	8/20/2012	8/20/2012
Vegetation Association	*Ficus* low open woodland	tree sp	*Eucalyptus* open woodland	unknown tree open low woodland	*Triodia* open hummock grassland	*Triodia* moderately dense hummock grassland	*Petalostylis* open shrubland	*Triodia* moderately dense hummock grassland	Triodia moderately dense hummock grassland	*Grevillea* medium open shrubland	*Triodia* scattered tussock grassland	*Triodia* scattered tussock grassland	*Triodia* open tussock grassland	*Eucalyptus* medium open trees	*Acacia* medium shrubland	*Acacia* medium open shrubs	*Triodia* moderately dense hummock grassland	*Triodia* moderately dense hummock grassland
Trees >5m	-	-	6	0	2	-	-	0	2	-	0	-	0	6	0	-	-	-
Trees <5m	-	6	6	2	0	-	-	0	6	-	0	-	0	20	0	2	-	-
Shrubs >2m	2	2	0	20	0	6	2	0	6	6	0	-	0	2	20		6	2
Shrubs 1-2m	6	2	0	20	2	-	6	6	2	6	0	-	0	2	20	20	6	2
Shrubs 0.5-1m	6	2	0	20	0	-	2	2	0	2	0	-	0	0	20	2	-	20
Shrubs < 0.5m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spinifex	2	6	0	6	20	85	20	50	50	6	0	-	0	0	6	50	50	50
Soft grasses	6	2	50	6	20	0	2	0	0	6	2	-	50	0	2	2	2	2
Sedges	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0
Herbs	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0
Mistletoes	1	0	1	1	0	0	0	0	0	0	0	-	0	1	0	0	0	0
Soil Type	Clay loam	Clay loam	Clayey Sand	Clay loam	Clayey Sand	Clay loam	Clay loam	-	Clay loam	Clay loam	Clayey Sand	-	Light medium clay	Sand	Clay loam	Clay loam	Clay loam	Clay loam
Soil Colour	Red	Red	Brown	Red	Orange	Red	Red		Red	Red	Pale		Orange	Red	Orange	Red	Red	Red
Rock Type	ironstone	ironstone	ironstone	ironstone	-	ironstone	ironstone outcropping on top	-	-	ironstone rubble, overburden	ironstone	-	-	-	pale rock, orange on the outside	-	ironstone, outcrops with boulders	ironstone rocky area
Rock Size	Boulders	Boulders	Fine gravel	Boulders	-	Coarse gravel	Coarse gravel	-	Coarse gravel	Large cobbles	Small cobbles	-		Large cobbles	Small cobbles	Boulders	Boulders	Boulders
Rocky Outcropping	Present	Present	Present	Present	Absent	Present	Present	-	Absent	Present	Absent	-	Absent	Absent	Absent	Present	Present	Present
Bare Ground (% cover)	40	20	20	5	30	10	20	20	40	60	0	-	30	70	30	10	20	20
Leaf Litter (% cover)	5	5	2	10	0	0	2	0	0	2	0	-	0	0	2	10	5	5
Twig Litter (% cover)	2	2	2	5	0	0	0	0	0	5	0	-	0	2	0	5	5	2

Site #	Habitat 01	Habitat 02	Habitat 03	Habitat 04	Habitat 05	Habitat 06	Habitat 07	Habitat 08	Habitat 09	Habitat 10	Habitat 11	Habitat 12	Habitat 13	Habitat 14	Habitat 15	Habitat 16	Habitat 17	Habitat 18
Logs (% cover)	0	2	5	5	0	0	0	0	0	0	0	-	0	5	0	2	0	0
Logs (average size)	0	1 by .2	3 by .3	2 by 0.3	NA	0	NA	NA	NA	NA	NA	-	NA	3 by .2	NA	1 by .2	NA	NA
Hollow Bearing Trees	1	1	8	3	0	0	0	0	0	0	0	-	0	6	0	0	0	0
Hollow bearing trees (average size)	.2 by .2	.2 by .2	150 dia	150mm	NA	NA	NA	NA	NA	NA	NA	-	NA	150 dia	NA	NA	NA	NA
Description of subterranean Roosts	none	nil, small cracks and crevices	none	none	none	possibly an occasional cave	occasional nearby	-	none	none	none	-	nil, although deep cracks in the gilgai occur	none	none	cracks and crevices present	cracks and crevices,	cracks and crevices in abundance
Description of observed nests/roosts	none	Kestrel nesting nearby	occasional nests in large Eucalypts. one raptor nest	occasional	none	none	none	none	none	none	none	-	none	raptor nests	none	none	none	none
Disturbances	none	none	weeds, pigs, cattle	none	cattle, *Acacia farnsiana*	none	none	-	none	rehab	cattle	-	heavily influenced by cattle	cattle	cattle	none	none	none

Site #	Habitat 19	Habitat 20	Habitat 21	Habitat 22	Habitat 23	Habitat 24	Habitat 25	Habitat 26	Habitat 27	Habitat 28	Habitat 29	Habitat 30	Habitat 31	Habitat 32	Habitat 33	Habitat 34	Habitat 35	Habitat 36
GCS GDA94 Latitude (Decimal Degrees)	-20.346312	-20.364668	-20.351591	-20.375509	-20.375984	-20.325838	-20.359108	-20.353130	-20.337996	-20.342745	-20.341887	-20.332592	-20.354818	-20.341432	-20.338329	-20.333990	-20.325356	-20.331446
GCS GDA94 Longitude (Decimal Degrees)	119.500488	119.497070	119.488899	119.441277	119.471535	119.519905	119.442513	119.447624	119.544365	119.542397	119.526077	119.526871	119.545853	119.534964	119.514580	119.522415	119.521156	119.438087
Landform	Drainage line	Drainage line	Stony plain	Crest/slope	Sandplain	Stony/ sandplain	Sandplain	Sandplain	Crest/slope	Sandplain	Sandplain	Sandplain	Crest/slope	Stony/ sandplain	Sandplain	Sandplain	Sandplain	Drainage line
Survey Start Date	8/20/2012	8/20/2012	8/20/2012	8/20/2012	8/21/2012	8/21/2012	8/21/2012	8/21/2012	8/21/2012	8/22/2012	8/22/2012	8/22/2012	8/22/2012	8/22/2012	8/22/2012	8/22/2012	8/22/2012	8/23/2012
Vegetation Association	*Acacia* medium moderately dense shrubland	*Acacia* over spinifex	Spinifex plain	Spinifex hillside	Spinifex and tussock grass on eroded sand pain	*Acacia* over spinifex	*Acacia* medium open shrubs	*Triodia* open grassland	*Acacia* medium open shrubland	*Triodia* hummock grassland	*Triodia* open hummock grassland	*Acacia* medium open shrubs	Spinifex and low *Acacia* shrubs	*Acacia* over spinifex and tussock on plan	*Triodia* open hummock grass	*Triodia* open hummock	*Triodia* open hummock grass	*Acacia* medium over *Triodia* hummock
Trees >5m	-	0	0	2	0	0	-	-	-	-	-	0	0	0	-	0	-	2
Trees <5m	-	0	0	0	0	0	-	-	2	-	-	2	2	20	-	2	-	0
Shrubs >2m	2	20	2	2	0	6	20	2	20	6	0	2	6	20	20	20	2	50
Shrubs 1-2m	50	20	0	6	0	2	2	2	20	50	2	50	6	6	2	20	6	20
Shrubs 0.5-1m	6	2	0	2	0	0	0	2	20	2	6	6	2	0		6	2	2
Shrubs < 0.5m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spinifex	20	20	20	50	50	50	20	50	20	20	50	20	20	20	50	20	20	20
Soft grasses	2	0	0	0	6	0	2	6	2	0	0	0	0	6	0	0	0	0
Sedges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Herbs	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0
Mistletoes	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Soil Type	Loamy Sand	Clay loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sand	Sand	Sand	Sand	Sand	Sand	Loamy Sand	Sandy loam	Sand	Sand	Sand	Sandy loam
Soil Colour	Orange	Orange	Orange	Orange	Orange	Orange	Red	Red	Red	Red	Red	Red	Brown	Brown	Red	Red	Red	Brown
Rock Type		-	-	Granite	-	Quartzite	-	-	-	Amphibolite	-	-	-	-	-	-	-	Quartzite
Rock Size	Coarse gravel	-	Fine gravel	Large cobbles	-	Coarse gravel	Fine gravel	-	-	-	Fine gravel	-	Large cobbles	Coarse gravel	-	-	-	Fine gravel
Rocky Outcropping	Absent	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent		Absent	Absent
Bare Ground (% cover)	60	10	50	40	40	50	40	30	20	30	20	20	40	10	30	30	40	10
Leaf Litter (% cover)	20	10	0	0	0	0	5	2	5	2	2	5	5	60	2	2	2	5
Twig Litter (% cover)	10	0	0	0	0	0	0	0	2	2	2	2	2	10	2	2	0	2
Logs (% cover)	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Logs (average size)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 cm	NA	NA	NA	NA
Hollow Bearing Trees	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Hollow bearing trees (average size)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Site #	Habitat 19	Habitat 20	Habitat 21	Habitat 22	Habitat 23	Habitat 24	Habitat 25	Habitat 26	Habitat 27	Habitat 28	Habitat 29	Habitat 30	Habitat 31	Habitat 32	Habitat 33	Habitat 34	Habitat 35	Habitat 36
Description of subterranean Roosts	none	none	-	-	-	none seen	none	none	some small Varanid burrows	burrows and forging digs everywhere	none	burrows and digging	None seen	none	burrows and digging	burrows - bilby	none	-
Description of observed nests/roosts	none	none	-	-	-	none seen	none	none	none	none	none	-	none seen	-	none	none	none	none
Disturbances	cattle	none	-	-	none	none	cattle	cattle	none	none	cattle	-	500m from spoil heap	none	none	cattle	cattle	none

Habitat Assessment Site Photos

Site 1

Site 2

Site3

Site 4

Site 5

Site 6

Site 7

Site 8

Site 9

Site 10

Site 11

Site 12

Site 13

Site 14

Site 15

Site 16

Site 17

Site 18

Site 19

Site 20

Site 21

Site 22

Site 23

Site 24

Site 25

Site 26

Site 27

Site 28

Site 29

Site 30

Site 31

Site 32

Site 33

Site 34

Site 35

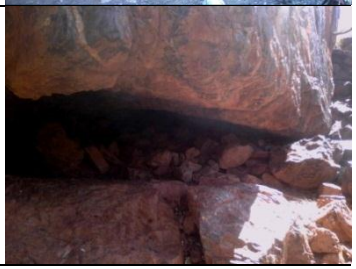
Site 36

APPENDIX E LOCATIONS OF CONSERVATION SIGNIFICANT FAUNA RECORDED FROM THE STUDY AREA

Species		Conservation Status	Easting	Northing	Notes
Ghost Bat	*Macroderma gigas*	DEC Priority 4 IUCN Vulnerable	-20.3653	119.4937	
Ghost Bat	*Macroderma gigas*	DEC Priority 4 IUCN Vulnerable	-20.3595	119.4978	
Ghost Bat	*Macroderma gigas*	DEC Priority 4 IUCN Vulnerable	-20.3561	119.5193	
Ghost Bat	*Macroderma gigas*	DEC Priority 4 IUCN Vulnerable	-20.3662	119.4884	
Pilbara Leaf-nosed Bat	*Rhinonicteris aurata*	EPBC Vulnerable WC Act Schedule 1	-20.3662	119.4884	
Greater Bilby	*Macrotis lagotis*	EPBC Vulnerable WC Act Schedule 1 IUCN Vulnerable	-20.3435	119.5429	
Greater Bilby	*Macrotis lagotis*	EPBC Vulnerable WC Act Schedule 1 IUCN Vulnerable	-20.3744	119.4757	
Greater Bilby	*Macrotis lagotis*	EPBC Vulnerable WC Act Schedule 1 IUCN Vulnerable	-20.3726	119.4749	
Greater Bilby	*Macrotis lagotis*	EPBC Vulnerable WC Act Schedule 1 IUCN Vulnerable	-20.3743	119.4738	
Greater Bilby	*Macrotis lagotis*	EPBC Vulnerable WC Act Schedule 1 IUCN Vulnerable	-20.3726	119.4749	
Mulgara	*Dasycercus sp*	EPBC Vulnerable WC Act Schedule 1	-20.3586	119.4453	
Mulgara	*Dasycercus sp*	EPBC Vulnerable WC Act Schedule 1	-20.3587	119.4451	
Mulgara	*Dasycercus sp*	EPBC Vulnerable WC Act Schedule 1	-20.3586	119.4452	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Vulnerable	-20.3606	119.4919	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Endangered	-20.3254	119.4719	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Endangered	-20.3264	119.4733	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Endangered	-20.3254	119.472	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Vulnerable	-20.3301	119.4638	
Northern Quoll	*Dasyurus hallucatus*	EPBC Endangered WC Act Schedule 1 IUCN Endangered	-20.3564	119.5191	
Western Pebble-mound Mouse	*Pseudomys chapmani*	DEC Priority 4	-20.3616	119.5083	Inactive mound
Western Pebble-mound Mouse	*Pseudomys chapmani*	DEC Priority 4	-20.3250	119.4574	Inactive mound
Australian Bustard	*Ardeotis australis*	DEC Priority 4	-20.3462	119.4574	Dead

Species		Conservation Status	Easting	Northing	Notes
Australian Bustard	*Ardeotis australis*	DEC Priority 4	-20.3353	119.497	Dead
Australian Bustard	*Ardeotis australis*	DEC Priority 4	-20.3577	119.4479	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3549	119.5099	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3669	119.4909	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3647	119.4971	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3541	119.5254	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3586	119.5297	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3532	119.5134	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3263	119.4698	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3263	119.4731	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3364	119.4576	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3705	119.4474	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3745	119.4454	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.3295	119.4365	
Rainbow Bee-eater	*Merops ornatus*	EPBC Migratory WC Act Schedule 3	-20.363	119.5008	

APPENDIX F DETAILS OF OVERHANGS AND CAVES RECORDED IN THE STUDY AREA

Cave Name	Description and position	Significant records	Suitability for Ghost Bat	Suitability for Pilbara Leaf-nosed Bat	Overall value	Photo
Cave 1	Single open entrance measures 2.5 m across by 0.4m high. Approx 9 m deep. Sloping rocky floor. In single sided gorge, mid slope. 50K 0761655 7747354 88.9 m alt.	No bats present, but guano from microbats, probably *Taphozous georgianus* and *Vespadellus Finlayson* was seen. Echidna scats and quills.	Not suitable as permanent roost. Potential to be used as a feeding roost, although no scats were found	Not suitable. Open entrance results in similar temperature and humidity conditions internally, suggesting that this cave is unsuitable for Pilbara Leaf-nosed Bat.	Low	
Cave 2	Single entrance (10 m wide by 2m high in centre), and single chamber approx. 20 m deep. Large entrance means that the cave has some light even at the back. 50K 0760303 7746122 74.6 m. Upper slope in small rock band.	*Taphozous georgianus* and *Vespadelus finlaysoni* present. 21-50 recent scats of *Macroderma gigas*	Suitable as a feeding roost	Not suitable. Open entrance results in similar temperature and humidity conditions internally, suggesting that this cave is unsuitable for Pilbara Leaf-nosed Bat.	Medium	
Cave 3	Single entrance 3 by 1 m. Cave depth 5 m . 50K 0760116 7746644 56.8m Lower slope. Water 30 m away.	No bats	Appears to be unsuitable for Ghost Bat as a roost.	Appears to be unsuitable for Pilbara Leaf-nosed Bat.	Low	

Cave Name	Description and position	Significant records	Suitability for Ghost Bat	Suitability for Pilbara Leaf-nosed Bat	Overall value	Photo
Cave 4	Solid arched entrance with a further small entrance hole to the R facing cave. Entrance 1.8 by 1.5 m. Approx 15 m deep. 50K 0760757 7746775, 98.2 m Mid slope in gorge. Seasonal water present.	*Taphozous georgianus* and *Vespadelus finlaysoni* present. 51-100 old and recent scats of *Macroderma gigas*. EM3 deployed.	Definite feeding roost and may be suitable as a day roost.	May be unsuitable for Pilbara Leaf-nosed Bat due to proximity to water. However the open entrance results in similar temperature and humidity conditions internally.	Medium	
Cave 5	Rock shelter with wide entrance 16 by 1.4 m. Depth 5 m. 50K 0762984 7747066 88.3m Lower slope, Gully	No bats present, but recent 2 Ghost bat (*Macroderma gigas*) scats present. Guano from *Taphozous georgianus* and *Vespadelus finlaysoni* present. Possible Northern Quoll tracks.	Feeding roost only	Not suitable.	Low	
Cave 6	Rock shelter with wide entrance under breakaway. No water present. 50K 0759750 7746030 88.8m Mid slope	SM2 deployed (BD6) No bats present No Ghost Bat scats	Not suitable	Not suitable		

APPENDIX G REPORT ON THE BATS AT GOLDSWORTHY

Goldsworthy, Pilbara WA,
Fauna Survey
August 2012

Echolocation Survey of Bat Activity.

Prepared for Biologic Environmental

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Issue 1
Prepared by: R. D. Bullen – Bat Call WA
17 September 2012

Background

Microbat species presence, with an estimate of activity level, is presented for a study area at the Goldsworthy Mine in the northern Pilbara, WA. Biologic Environmental (BE) carried out an echolocation based survey during August 2012. Bat Call WA has reviewed the recordings made and provided species lists for the bats present.

Habitats

Ten habitats were surveyed that include locations on ridge lines, on stony and sandy plains, on ephemeral drainage lines and in the old pit. Details are given in Table 1.

Bat Fauna

A microbat list of ten echolocating species was confirmed as present by their ultrasonic calls including both target species. A number of Pilbara leaf-nosed bat calls were detected. In addition calls with the characteristics of the Ghost bat were recorded.

Pilbara leaf-nosed bat calls were detected on two nights at site BD6. On the 17th August a single call was recorded at 11PM. On the following night a series of 16 calls was detected between 11PM and midnight. The timing of these calls indicates that one or more bats were foraging in the area. The location of the Goldsworthy mine is 75 kilometres from the nearest known roosts of this species. It is unlikely, although possible, that this species would travel this distance during the dry season to forage. The available data (author's unpublished database) suggests that maximum distances of 20 km are typical during the dry season. This suggests that there is a previously unknown roost in the district. The late timing of the detections suggests that the roost lies outside the study area.

Characteristics of the calls recorded are presented in Table 2. Bat activity level for the other species present was confirmed as typical of the inland Pilbara with levels between High to Low depending on night and temperature, see criteria below. Results are presented in Table 3.

Survey Timing, Moon Phase and Weather

The echolocation survey was conducted between the 17th and 22nd August 2012. The survey was conducted in a warm and dry period. Minimum overnight temperatures were warm with temperatures between 10 and 15 deg C. The moon in this period was between new and first quarter.

Survey Team

The bat sampling work was conducted by staff of BE. No activities were conducted that directly impacted upon the bat fauna present.

R.D. Bullen of Bat Call WA completed analysis of echolocation recordings.

Systematic Sampling

Sixteen overnight recordings were made with SM2BAT detectors (Wildlife Acoustics, USA). The jumper and audio settings used for the SM2BAT followed the manufacturers recommendations for bat detection contained in the user manual (Wildlife Acoustics 2010). Selectable filters and triggers were also set using the manufacturers recommendations. A further five recording sessions were completed using an Echo Meter EM3 active detector (Wildlife Acoustics, USA).

For all recordings, once reformatted as .wav files, COOL EDIT 2000 (Now available as AUDITION from Adobe Systems Inc.) was used to display each "continuous call" sequence (EPA and DEC 2010) for identification. Only good quality call sequences were used. Details of calls analysed are provided in Table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in Bullen and McKenzie 2002, McKenzie and Bullen 2003 and McKenzie and Bullen 2009.

Bat activity was then characterised as "Low", "Medium" or "High" based on the rate of call sequences recorded.

- Low species activity is referred when a species is recorded with call spacing less often than ten minutes,
- Medium species activity refers to call recordings more often than 10 minutes but less often than two minutes apart for a significant time period followed by sporadic records for the remainder of the session.
- High species activity refers to call recording more often than two minutes apart for significant periods followed by reasonably regular records for the remainder of the session.

Further details of the calls analysed including graphical presentations are available from Bat Call WA on request.

Survey Limitations

The site surveyed was accessible on foot and the recorders were set at ground level. SM2 passive bat sound recordings began at sunset and continued until sunrise.

Bat species density is impossible to estimate from echolocation records. Bat activity is therefore substituted as an approximate guide to the relative numbers of each species using the study area.

References

ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6-9.

Bullen R.D. and McKenzie N.L. (2002). Differentiating Western Australian Nyctophilus (Chiroptera: Vespertilionidae) echolocation calls. *Australian Mammalogy*. 23: 89-93

EPA and DEC (2010). Technical guide – terrestrial vertebrate fauna surveys for environmental impact assessment (eds B.M. Hyder, J. Dell and M.A. Cowan). Environmental Protection Authority and Department of Environment and Conservation, Perth Western Australia.

McKenzie N.L. and Bullen R.D. (2003). Identifying Little Sandy Desert bat species from their echolocation calls. *Australian Mammalogy* 25: 73-80.

McKenzie, N.L. and Bullen R.D. (2009). The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. *Rec. West. Aust. Mus. (Supplement)* 78: 123-155.

Wildlife Acoustics (2010). Song Meter User Manual, Model SM2, with Song Meter SM2BAT 192kHz Stereo or 384kHz Mono Ultrasonic Recorders addendum.

Table 1 Site Specific details.

Location	Date	Site description	Easting	Northing
BD1	20th – 21st Aug	Gorge site	760763	7746773
BD2	17th – 18th Aug	Pit rim above water	764339	7747305
BD3	19th – 21st Aug	Minor drainage line	766323	7747722
BD4	22nd Aug	Bottom of pit	764526	7747225
BD5	19th – 20th Aug	Minor drainage line with water hole	760677	7749407
BD6	17th – 18th Aug	Cave entrance	759750	7746030
BD7	21st – 22nd Aug	Stony sand plain	763105	7750523
BD8	17th – 18th Aug	Gorge site	762394	7747438
BD9	19th Aug	Hill slope site	756592	7750169
BD10	20th Aug	Boulder strewn slope	755507	7745593

Note 1: All sites are in zone 50K

Table 2: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peakC} kHz	Ave. Q	Typical Duration msec	Typical Call Shape
Chaerephon jobensis (Miller 1902)	Northern free-tailed bat	22	5	8 - 15	Shallow FM
Chalinolobus gouldii (Grey 1841)	Gould's wattled bat	32	10	7 - 11	FM
Macroderma gigas (Dobson 1880)	Ghost bat	40 – 52 variable	2 – 20 variable	variable	Complex FM
Nyctophilus geoffroyi Leach 1821	Lesser long-eared bat	47	2.5	5	Steep FM
Rhinonicteris aurantia (Gray 1845)	Pilbara leaf-nosed bat	120	30	5 - 8	CF
Saccolaimus flaviventris (Peters 1867)	Yellow-bellied sheath-tailed bat	18	9	12 - 21	CF - FM
Scotorepens greyii (Gray 1843)	Little broad-nosed bat	38	10	7 - 13	FM
Tadarida australis (Grey 1838)	White-striped free-tailed bat	12	7	12 - 23	CF– shallow FM
Taphozous georgianus Thomas 1915	Common sheath-tailed bat	24.5	14	9 - 18	CF– shallow FM
Vespadelus finlaysoni (Kitchener, Jones and Caputi 1987)	Inland cave bat	55	14	4 - 8	FM

Note: FpeakC and Q are defined in McKenzie and Bullen 2003, 2009.

Table 3. Microbat lists obtained by site

Site	Detector/Recorder	*Chaerephon jobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Tadarida australis*	*Taphozous georgianus*	*Vespadelus finlaysoni*
BD2	Two overnight recordings using SM2BAT detector	High	Low				Low	Low		High	Med
BD3	Three overnight recordings using SM2BAT detector	Low	Low					Low	Low		Low
BD4	Overnight recording using SM2BAT detector	High					Low			Low	Low
BD5	Two overnight recordings using SM2BAT detector	Med	High		Low			Low	Low		Med

Site	Detector/Recorder	*Chaerephon jobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Tadarida australis*	*Taphozous georgianus*	*Vespadelus finlaysoni*
BD6	Two overnight recordings using SM2BAT detector	Low	Low	Low (1 Call)		Low (1 Call on 17th and 16 on 18th)		Low		Med	High
BD7	Two overnight recordings using SM2BAT detector	Low	Low				Low				Low
BD8	Overnight recording using SM2BAT detector	Low	Low				Low	Low		Low	
BD9	Overnight recording using SM2BAT detector	Low									
BD10	Overnight recording using SM2BAT detector	Low	Low					Low	Low	Low	

Site	Detector/Recorder	*Chaerephon jobensis*	*Chalinolobus gouldii*	*Macroderma gigas*	*Nyctophilus geoffroyi*	*Rhinonicteris aurantia*	*Saccolaimus flaviventris*	*Scotorepens greyii*	*Tadarida australis*	*Taphozous georgianus*	*Vespadelus finlaysoni*
EM3 @ BD1 Note 2											
20 Aug	6PM to 8PM series			Probable Note 2							Pres't
20 Aug	Midnight series			Probable Note 2							
21 Aug	6PM to 8PM series										Pres't

Note 1: Low activity refers to call spacings that repeat less often than 10 minutes.
Med activity refers to call records that repeat more often than 10 minutes but less often than 2 minutes for significant periods of time then sporadically for the duration of the recording.
High activity refers to calls that repeat more often than 2 minutes for significant periods of time then periodically for the duration of the recording.

Note 2: This is the first use of the Echometer unit. There is a lot of electronic noise at low frequencies that partially masks the Ghost bat audible calls. The identifications therefore are listed as probable.

Table 4 SM2 Audio settings used during survey.

Parameter	Setting
Sample rate	384,000 kHz
Channel used	Left
Compression protocol	WAC4 (12 bit audio samples)
Gain – left channel	0.00
Digital high pass filter Left channel	fs/48 (giving 8 kHz minimum frequency)
Digital low pass filter Left channel	Off
Triggering level Left channel	6SNR (adaptive +6 dB triggering)
Triggering window Left channel	1.0 sec.

Note: These settings are as recommended in Wildlife Acoustics (2010) except the high pass filter.

Figure 1. Location of study area sites in relation to local features. The Pilbara leaf-nosed bats and the Ghost bat calls were detected at site BD6 designated by the orange pin.

APPENDIX H REPORTS FROM DEC NATUREMAP AND THE EPBC

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Andrew Gardner on 25/09/2012

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Mammals
Method	'By Circle'
Centre	119°29' 35" E,20°21' 10" S
Buffer	20km
Group By	Family

Family	Species	Records
Canidae	1	1
Dasyuridae	2	2
Emballonuridae	1	1
Felidae	1	1
Leporidae	1	1
Macropodidae	2	2
Muridae	3	5
Thylacomyidae	1	1
Vespertilionidae	1	1
TOTAL	**13**	**15**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Canidae					
1.	25454	*Canis lupus*			
Dasyuridae					
2.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
3.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			
Emballonuridae					
4.	24175	*Taphozous georgianus (Common Sheathtail-bat)*			
Felidae					
5.	24041	*Felis catus (Cat)*			
Leporidae					
6.	24085	*Oryctolagus cuniculus (Rabbit)*			
Macropodidae					
7.	25489	*Macropus robustus (Euro)*			
8.	24136	*Macropus rufus (Red Kangaroo)*			
Muridae					
9.	24223	*Mus musculus (House Mouse)*			
10.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse, Ngadji)*		P4	
11.	24248	*Zyzomys argurus (Common Rock-rat)*			
Thylacomyidae					
12.	24168	*Macrotis lagotis (Bilby)*		T	
Vespertilionidae					
13.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Andrew Gardner on 25/09/2012

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Birds
Method	'By Circle'
Centre	119°29' 35" E,20°21' 10" S
Buffer	20km
Group By	Family

Family	Species	Records
Acanthizidae	1	1
Accipitridae	7	34
Aegothelidae	1	4
Alaudidae	1	8
Anatidae	4	21
Ardeidae	4	7
Artamidae	4	24
Burhinidae	1	5
Campephagidae	2	23
Caprimulgidae	1	6
Casuariidae	1	2
Centropodidae	1	1
Charadriidae	3	5
Ciconiidae	1	2
Climacteridae	1	6
Columbidae	5	46
Corvidae	2	17
Cracticidae	1	12
Cuculidae	1	1
Dicaeidae	1	1
Dicruridae	2	36
Estrilidae	4	36
Falconidae	3	28
Gruidae	1	1
Halcyonidae	2	16
Maluridae	3	12
Meliphagidae	10	68
Meropidae	1	19
Motacillidae	1	1
Neosittidae	1	1
Pachycephalidae	2	7
Pardalotidae	2	16
Pelecanidae	1	5
Petroicidae	1	1
Phalacrocoracidae	1	4
Phasianidae	1	2
Podicipedidae	1	3
Pomatostomidae	1	7
Psittacidae	4	28
Rallidae	1	2
Recurvirostridae	1	1
Scolopacidae	5	5
Strigidae	2	15
Sylviidae	4	9
Threskiornithidae	4	6
Turnicidae	2	12
Zosteropidae	1	2
TOTAL	**105**	**569**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	30948	*Smicrornis brevirostris (Weebill)*			
Accipitridae					
2.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
3.	25536	*Accipiter fasciatus (Brown Goshawk)*			
4.	24285	*Aquila audax (Wedge-tailed Eagle)*			
5.	24289	*Circus assimilis (Spotted Harrier)*			
6.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
7.	24295	*Haliastur sphenurus (Whistling Kite)*			
8.	25542	*Milvus migrans (Black Kite)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Aegothelidae					
9.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
Alaudidae					
10.	25545	*Mirafra javanica (Horsfield's Bushlark)*			
Anatidae					
11.	24312	*Anas gracilis (Grey Teal)*			
12.	24316	*Anas superciliosa (Pacific Black Duck)*			
13.	24318	*Aythya australis (Hardhead)*			
14.	24322	*Cygnus atratus (Black Swan)*			
Ardeidae					
15.	25556	*Ardea alba (Great Egret)*			
16.	24340	*Ardea novaehollandiae (White-faced Heron)*			
17.	24341	*Ardea pacifica (White-necked Heron)*			
18.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
Artamidae					
19.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
20.	25567	*Artamus leucorynchus (White-breasted Woodswallow)*			
21.	24355	*Artamus minor (Little Woodswallow)*			
22.	24356	*Artamus personatus (Masked Woodswallow)*			
Burhinidae					
23.	24359	*Burhinus grallarius (Bush Stone-curlew)*		P4	
Campephagidae					
24.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
25.	24367	*Lalage tricolor (White-winged Triller)*			
Caprimulgidae					
26.	24368	*Eurostopodus argus (Spotted Nightjar)*			
Casuariidae					
27.	24470	*Dromaius novaehollandiae (Emu)*			
Centropodidae					
28.	25600	*Centropus phasianinus (Pheasant Coucal)*			
Charadriidae					
29.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
30.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
31.	25577	*Vanellus miles (Masked Lapwing)*			
Ciconiidae					
32.	25578	*Ephippiorhynchus asiaticus (Black-necked Stork)*			
Climacteridae					
33.	25582	*Climacteris melanura (Black-tailed Treecreeper)*			
Columbidae					
34.	24401	*Geopelia cuneata (Diamond Dove)*			
35.	25585	*Geopelia striata (Peaceful Dove)*			
36.	24403	*Geopelia striata subsp. placida*			
37.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
38.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
Corvidae					
39.	24416	*Corvus bennetti (Little Crow)*			
40.	25593	*Corvus orru (Torresian Crow)*			
Cracticidae					
41.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
Cuculidae					
42.	24435	*Cuculus pallidus (Pallid Cuckoo)*			
Dicaeidae					
43.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
Dicruridae					
44.	24443	*Grallina cyanoleuca (Magpie-lark)*			
45.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Estrilidae					
46.	24631	*Emblema pictum (Painted Finch)*			
47.	24633	*Heteromunia pectoralis (Pictorella Mannikin)*		P4	
48.	25685	*Neochmia ruficauda (Star Finch)*			
49.	30870	*Taeniopygia guttata (Zebra Finch)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Falconidae					
50.	25621	*Falco berigora (Brown Falcon)*			
51.	25622	*Falco cenchroides (Australian Kestrel)*			
52.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Gruidae					
53.	24484	*Grus rubicunda (Brolga)*			
Halcyonidae					
54.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
55.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Maluridae					
56.	25647	*Amytornis striatus (Striated Grasswren)*			
57.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
58.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
Meliphagidae					
59.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
60.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
61.	24570	*Epthianura tricolor (Crimson Chat)*			
62.	24575	*Lichenostomus keartlandi (Grey-headed Honeyeater)*			
63.	24578	*Lichenostomus penicillatus (White-plumed Honeyeater)*			
64.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
65.	25661	*Lichmera indistincta (Brown Honeyeater)*			
66.	24583	*Manorina flavigula (Yellow-throated Miner)*			
67.	25665	*Melithreptus gularis (Black-chinned Honeyeater)*			
68.	25668	*Philemon citreogularis (Little Friarbird)*			
Meropidae					
69.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Motacillidae					
70.	25670	*Anthus australis (Australian Pipit)*			
Neosittidae					
71.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
Pachycephalidae					
72.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
73.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Pardalotidae					
74.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
75.	25682	*Pardalotus striatus (Striated Pardalote)*			
Pelecanidae					
76.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
Petroicidae					
77.	24659	*Petroica goodenovii (Red-capped Robin)*			
Phalacrocoracidae					
78.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
Phasianidae					
79.	25701	*Coturnix ypsilophora (Brown Quail)*			
Podicipedidae					
80.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
Pomatostomidae					
81.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
Psittacidae					
82.	25715	*Cacatua roseicapilla (Galah)*			
83.	25716	*Cacatua sanguinea (Little Corella)*			
84.	24736	*Melopsittacus undulatus (Budgerigar)*			
85.	24742	*Nymphicus hollandicus (Cockatiel)*			
Rallidae					
86.	25727	*Fulica atra (Eurasian Coot)*			
Recurvirostridae					
87.	25734	*Himantopus himantopus (Black-winged Stilt)*			
Scolopacidae					
88.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
89.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
90.	24792	*Gallinago megala (Swinhoe's Snipe)*		IA	
91.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
92.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Strigidae					
93.	25747	*Ninox connivens (Barking Owl)*			
94.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
Sylviidae					
95.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
96.	24833	*Cincloramphus cruralis (Brown Songlark)*			
97.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
98.	24837	*Eremiornis carteri (Spinifex-bird)*			
Threskiornithidae					
99.	24842	*Platalea regia (Royal Spoonbill)*			
100.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
101.	24844	*Threskiornis molucca (Australian White Ibis)*			
102.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
Turnicidae					
103.	24848	*Turnix pyrrhothorax (Red-chested Button-quail)*			
104.	24851	*Turnix velox (Little Button-quail)*			
Zosteropidae					
105.	24857	*Zosterops luteus (Yellow White-eye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Andrew Gardner on 25/09/2012

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Reptiles
Method	'By Circle'
Centre	119°29' 35" E,20°21' 10" S
Buffer	20km
Group By	Family

Family	Species	Records
Agamidae	7	12
Boidae	3	4
Diplodactylidae	3	9
Elapidae	4	7
Gekkonidae	1	1
Pygopodidae	1	1
Scincidae	6	42
Typhlopidae	2	5
Varanidae	3	8
TOTAL	**30**	**89**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Agamidae					
1.	25458	*Ctenophorus caudicinctus (Ring-tailed Dragon)*			
2.	24865	*Ctenophorus caudicinctus subsp. caudicinctus*			
3.	25459	*Ctenophorus isolepis (Crested Dragon)*			
4.	24876	*Ctenophorus isolepis subsp. isolepis*			
5.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
6.	24900	*Diporiphora winneckei (Blue-lined Dragon)*			
7.	24907	*Pogona minor subsp. minor*			
Boidae					
8.	25318	*Antaresia perthensis (Pygmy Python)*			
9.	25236	*Aspidites ramsayi (Woma)*		S	
10.	25238	*Liasis olivaceus subsp. barroni (Pilbara Olive Python)*		T	
Diplodactylidae					
11.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
12.	24982	*Rhynchoedura ornata (Beaked Gecko)*			
13.	24924	*Strophurus ciliaris subsp. aberrans*			
Elapidae					
14.	25243	*Acanthophis pyrrhus (Desert Death Adder)*			
15.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
16.	25264	*Pseudonaja nuchalis (Gwardar)*			
17.	25307	*Suta punctata (Spotted Snake)*			
Gekkonidae					
18.	24959	*Gehyra variegata*			
Pygopodidae					
19.	25002	*Delma pax*			
Scincidae					
20.	25036	*Ctenotus duricola*			
21.	25064	*Ctenotus pantherinus subsp. ocellifer*			
22.	25073	*Ctenotus saxatilis (Rock Ctenotus)*			
23.	25125	*Lerista bipes*			
24.	30929	*Lerista jacksoni*			
25.	25184	*Menetia greyii*			
Typhlopidae					
26.	25270	*Ramphotyphlops ammodytes*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
27.	25277	*Ramphotyphlops grypus*			

Varanidae

28.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
29.	25210	*Varanus brevicauda (Short-tailed Pygmy Monitor)*			
30.	25212	*Varanus eremius (Pygmy Desert Monitor)*			

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Andrew Gardner on 25/09/2012

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Species Group	Amphibians
Method	'By Circle'
Centre	119°29' 35" E,20°21' 10" S
Buffer	20km
Group By	Family

Family	Species	Records
Hylidae	1	2
Limnodynastidae	1	12
Myobatrachidae	2	30
TOTAL	**4**	**44**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Hylidae					
1.	25371	*Cyclorana australis (Giant Frog)*			
Limnodynastidae					
2.	25430	*Notaden nichollsi (Desert Spadefoot)*			
Myobatrachidae					
3.	25439	*Uperoleia glandulosa (Glandular Toadlet)*			
4.	25445	*Uperoleia russelli (Northwest Toadlet)*			

Conservation Codes
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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Andrew Gardner on 28/09/2012

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Polygon'
Group By Family

Family	Species	Records
Accipitridae	5	10
Aegothelidae	1	1
Agamidae	1	1
Alaudidae	1	2
Ardeidae	1	2
Artamidae	3	10
Boidae	1	2
Campephagidae	1	8
Caprimulgidae	1	1
Charadriidae	1	1
Columbidae	4	16
Corvidae	1	5
Cracticidae	1	2
Dasyuridae	1	1
Dicruridae	2	8
Estrildidae	4	16
Falconidae	3	12
Halcyonidae	1	1
Hylidae	1	1
Maluridae	1	1
Meliphagidae	9	24
Meropidae	1	5
Muridae	1	2
Pachycephalidae	1	2
Pardalotidae	2	5
Phasianidae	1	1
Podicipedidae	1	1
Psittacidae	2	5
Scolopacidae	3	3
Strigidae	1	4
Sylviidae	1	2
Thylacomyidae	1	1
Turnicidae	1	2
TOTAL	**60**	**158**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Accipitridae					
1.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
2.	25536	*Accipiter fasciatus (Brown Goshawk)*			
3.	24285	*Aquila audax (Wedge-tailed Eagle)*			
4.	24289	*Circus assimilis (Spotted Harrier)*			
5.	24295	*Haliastur sphenurus (Whistling Kite)*			
Aegothelidae					
6.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
Agamidae					
7.	24865	*Ctenophorus caudicinctus subsp. caudicinctus*			
Alaudidae					
8.	25545	*Mirafra javanica (Horsfield's Bushlark)*			
Ardeidae					
9.	24341	*Ardea pacifica (White-necked Heron)*			
Artamidae					
10.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
11.	24355	*Artamus minor (Little Woodswallow)*			
12.	24356	*Artamus personatus (Masked Woodswallow)*			
Boidae					
13.	25318	*Antaresia perthensis (Pygmy Python)*			
Campephagidae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
14.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
Caprimulgidae					
15.	24368	*Eurostopodus argus (Spotted Nightjar)*			
Charadriidae					
16.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
Columbidae					
17.	24401	*Geopelia cuneata (Diamond Dove)*			
18.	25585	*Geopelia striata (Peaceful Dove)*			
19.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
20.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
Corvidae					
21.	25593	*Corvus orru (Torresian Crow)*			
Cracticidae					
22.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
Dasyuridae					
23.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			
Dicruridae					
24.	24443	*Grallina cyanoleuca (Magpie-lark)*			
25.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Estrilidae					
26.	24631	*Emblema pictum (Painted Finch)*			
27.	24633	*Heteromunia pectoralis (Pictorella Mannikin)*		P4	
28.	25685	*Neochmia ruficauda (Star Finch)*			
29.	30870	*Taeniopygia guttata (Zebra Finch)*			
Falconidae					
30.	25621	*Falco berigora (Brown Falcon)*			
31.	25622	*Falco cenchroides (Australian Kestrel)*			
32.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Halcyonidae					
33.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
Hylidae					
34.	25371	*Cyclorana australis (Giant Frog)*			
Maluridae					
35.	25647	*Amytornis striatus (Striated Grasswren)*			
Meliphagidae					
36.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
37.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
38.	24570	*Epthianura tricolor (Crimson Chat)*			
39.	24575	*Lichenostomus keartlandi (Grey-headed Honeyeater)*			
40.	24578	*Lichenostomus penicillatus (White-plumed Honeyeater)*			
41.	24581	*Lichenostomus virescens (Singing Honeyeater)*			
42.	25661	*Lichmera indistincta (Brown Honeyeater)*			
43.	24583	*Manorina flavigula (Yellow-throated Miner)*			
44.	25665	*Melithreptus gularis (Black-chinned Honeyeater)*			
Meropidae					
45.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Muridae					
46.	24248	*Zyzomys argurus (Common Rock-rat)*			
Pachycephalidae					
47.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
Pardalotidae					
48.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
49.	25682	*Pardalotus striatus (Striated Pardalote)*			
Phasianidae					
50.	25701	*Coturnix ypsilophora (Brown Quail)*			
Podicipedidae					
51.	25705	*Tachybaptus novaehollandiae (Australasian Grebe)*			
Psittacidae					
52.	25716	*Cacatua sanguinea (Little Corella)*			
53.	24736	*Melopsittacus undulatus (Budgerigar)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Scolopacidae					
54.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
55.	24792	*Gallinago megala (Swinhoe's Snipe)*		IA	
56.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
Strigidae					
57.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
Sylviidae					
58.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
Thylacomyidae					
59.	24168	*Macrotis lagotis (Bilby)*		T	
Turnicidae					
60.	24851	*Turnix velox (Little Button-quail)*			

Conservation Codes
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Australian Government

Department of Sustainability, Environment, Water, Population and Communities

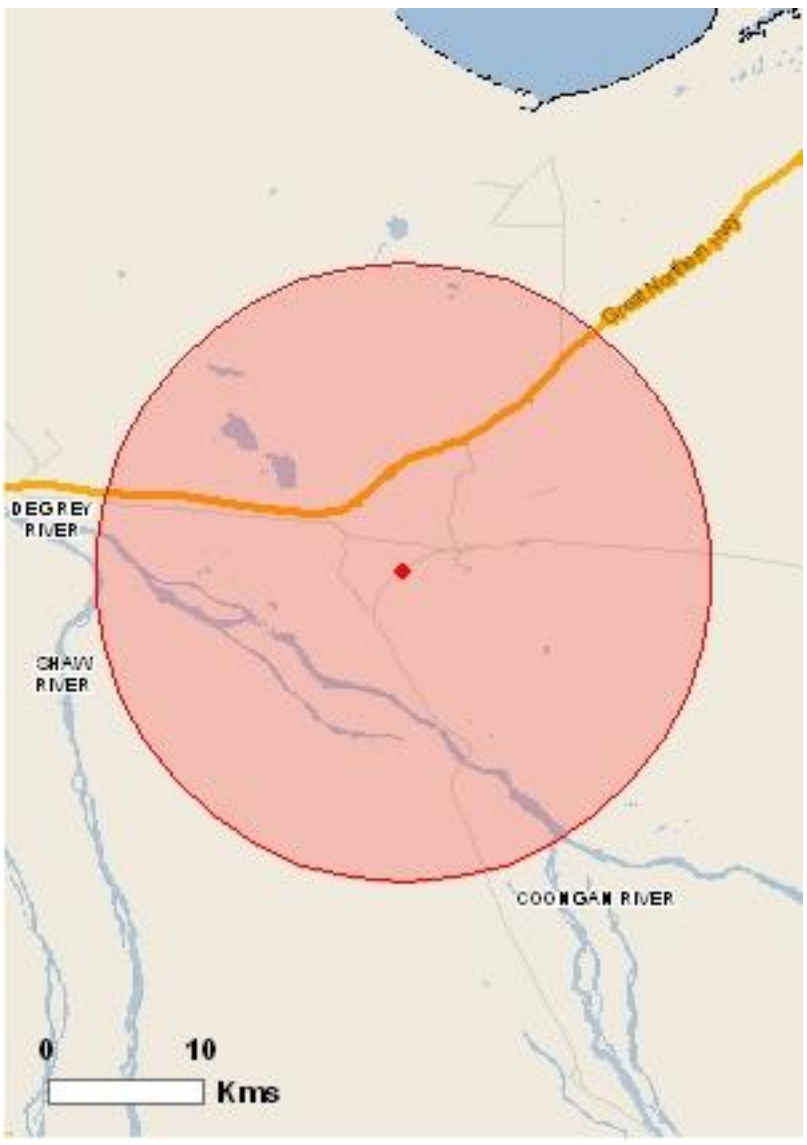
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

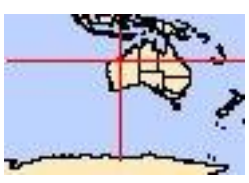
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 25/09/12 17:12:11



Coordinates

Buffer: 20.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	6
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	1
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Mammals		
Dasycercus cristicauda Mulgara [328]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Notoryctes caurinus Karkarratul, Northern Marsupial Mole [295]	Endangered	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Foraging, feeding or related behaviour known to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Foraging, feeding or related behaviour known to occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Historic		
Mulyie Station Homestead Group	WA	Indicative Place

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
De Grey River	WA

Coordinates

-20.35278 119.49306

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

Please feel free to provide feedback via the Contact Us page.

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