*13 November 2008*



# RGP5
# LEVEL 2 FAUNA SURVEY
# CHICHESTER DEVIATION

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## EXECUTIVE SUMMARY

BHP Billiton Iron Ore Pty Ltd (BHPBIO) is currently proposing to implement a range of projects to expand the capacity of its existing Western Australia Iron Ore operations. The overall project is known as Rapid Growth Project 5 (RGP5).

The project area is located approximately 210 km south of Port Hedland and 150 km north-west of Newman in the Pilbara. The existing rail corridor is located on Special Lease 3116/3687 and the proposed new corridor on pending Miscellaneous Licence L45/147. The proposed rail corridor through the Chichester Range is approximately 23 km long and 1 km wide and splits from the existing rail line at chainage 237.00, just south of Hesta Siding, and runs to chainage 220 just south of Shaw Siding.

Following consultation with stakeholders, BHPBIO and Calibre-Engenium Joint Venture (CEJV) commissioned *ecologia* Environment (*ecologia*) to undertake a two-phase biological survey of the vertebrate fauna of the study area as part of the environmental impact assessment process for the project. The survey area occurs in the Pilbara biogeographic region, and based on the location and the scale of the development, Guidance Statement No. 56 recommended that a Level 2 survey be undertaken (comprehensive field survey).

The first phase of the survey was carried out in October 2007 and the second in April 2008. Systematic and opportunistic sampling methods were used to assess the faunal assemblages of the project area. Seven trapping sites were assessed over the two phases, and a further 18 sites were assessed for faunal habitats and opportunistically searched.

An initial review of available references and species database sets indicated that 35 native mammal species, 139 bird species, 100 reptile species and 6 amphibian species potentially occur in the survey area (Appendix A, Table S.1.1). Nineteen species of conservation significance, comprising eight mammals, nine birds and two reptiles, could potentially occur within the survey area.

Three conservation significant mammal species (Ghost Bat, Northern Short-tailed Mouse and Western Pebble-mouse) and seven conservation significant bird species (Australian Bustard, Bush Stone-curlew, Star Finch (Western), Grey Falcon, Rainbow Bee-eater, Fork-tailed Swift and Wood Sandpiper) were recorded during this survey.

Overall the development of the rail deviation through the Chichester Range is not expected to significantly impact on any conservation significant species primarily due to the relatively small width of the proposed disturbance area and the large areas of similar habitat adjacent to the project area.

Three habitat types that were recorded in the survey area have been identified as being poorly represented in surrounding areas and therefore of greater significance to regional diversity. These are the permanent wetland habitats at Bamboo Springs, located near the northern junction of the rail deviation, the cracking clays located in the northern areas of the project area and a creekline near site CH07 (chainage 241.5 km).

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

| Requirement | Relevance to Project | Project Compliance |
|---|---|---|
| Impact on Biodiversity | Where impact on biodiversity cannot be avoided, the proponent must demonstrate that the impact will not result in unacceptable loss. | The project is unlikely to cause significant declines to rare fauna populations, although some individuals may be lost. Impacts to vertebrate fauna are discussed in Section 6 |
| State, National and International Agreements, Legislation and Policy on Biodiversity | Information gathered for environmental impact assessment in Western Australia meets State, National and International Agreements, Legislation and Policy in regard to biodiversity conservation. | State, national and international agreements were referred to in the production of this report. Impacts to species listed under relevant legislature are addressed in Section 5. |
| EPA Standards, Requirements and Protocols | The quality of information and scope of field surveys meets the standards, requirements and protocols as determined and published by the EPA. | The current survey conforms to a Level 2 survey, comprising background research and a detailed two phase fauna survey, as per EPA Guidance Statement No. 56. |
| Biodiversity Conservation and Ecological Function Values | Sufficient information is provided to address biodiversity conservation and ecological function values. | Background literature, database searches and a two phase detailed fauna survey provide the information required to assess environmental risks associated with the proposed rail deviation. Fauna assemblages and habitats observed are described in Section 4 and potential impacts to biodiversity and ecological function are discussed in Section 6.2. |
| State Biological Databases | Terrestrial biological surveys will be made publicly available and will contribute to the bank of data available for the region. | Survey data will be submitted to DEC for inclusion into their database. |

# 1 INTRODUCTION

BHP Billiton Iron Ore Pty Ltd (BHPBIO) is currently proposing to implement a range of projects to expand the capacity of its existing Western Australia Iron Ore operations. The overall project is known as Rapid Growth Project 5 (RGP5).

One of the projects includes the construction of a new section of rail line through the Chichester Range north of Cowra and south of Shaw Sidings along BHPBIO's existing Newman to Port Hedland rail line.

BHPBIO commissioned *ecologia* Environment (*ecologia*) to undertake a two-phase Level 2 vertebrate fauna survey of the BHPBIO rail duplication corridor between Shaw and Cowra Sidings. The survey included background research and a detailed fauna survey, designed in consideration of the Environmental Protection Authority's Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (2004). The field survey was undertaken in spring (11th – 24th Oct 2007) and autumn (19th April – 1st May 2008).

## 1.1 PROJECT BACKGROUND

The project area is located approximately 210 km south of Port Hedland and 150 km north-west of Newman in the Pilbara (Figure 1.1). The proposed new corridor is located on pending Miscellaneous Licence L45/147. The proposed rail corridor through the Chichester Range is approximately 23 km long and 1 km wide and splits from the existing rail line at chainage 237, just south of Hesta Siding, to chainage 220 just south of Shaw Siding. The section of rail line to be duplicated runs between the Chichester split (chainage 237) and Cowra Siding (chainage 250).

These proposed works will:

- reduce the time taken to transport materials from BHPBIO's mine sites to its shipping facilities at Port Hedland;
- reduce the overall carbon footprint of BHPBIO Pilbara operations by lowering the gradient of the rail network; and
- ensure that the upgrade occurs in a way that allows future expansions to occur, with minimum disruptions to the operation of the existing rail line.

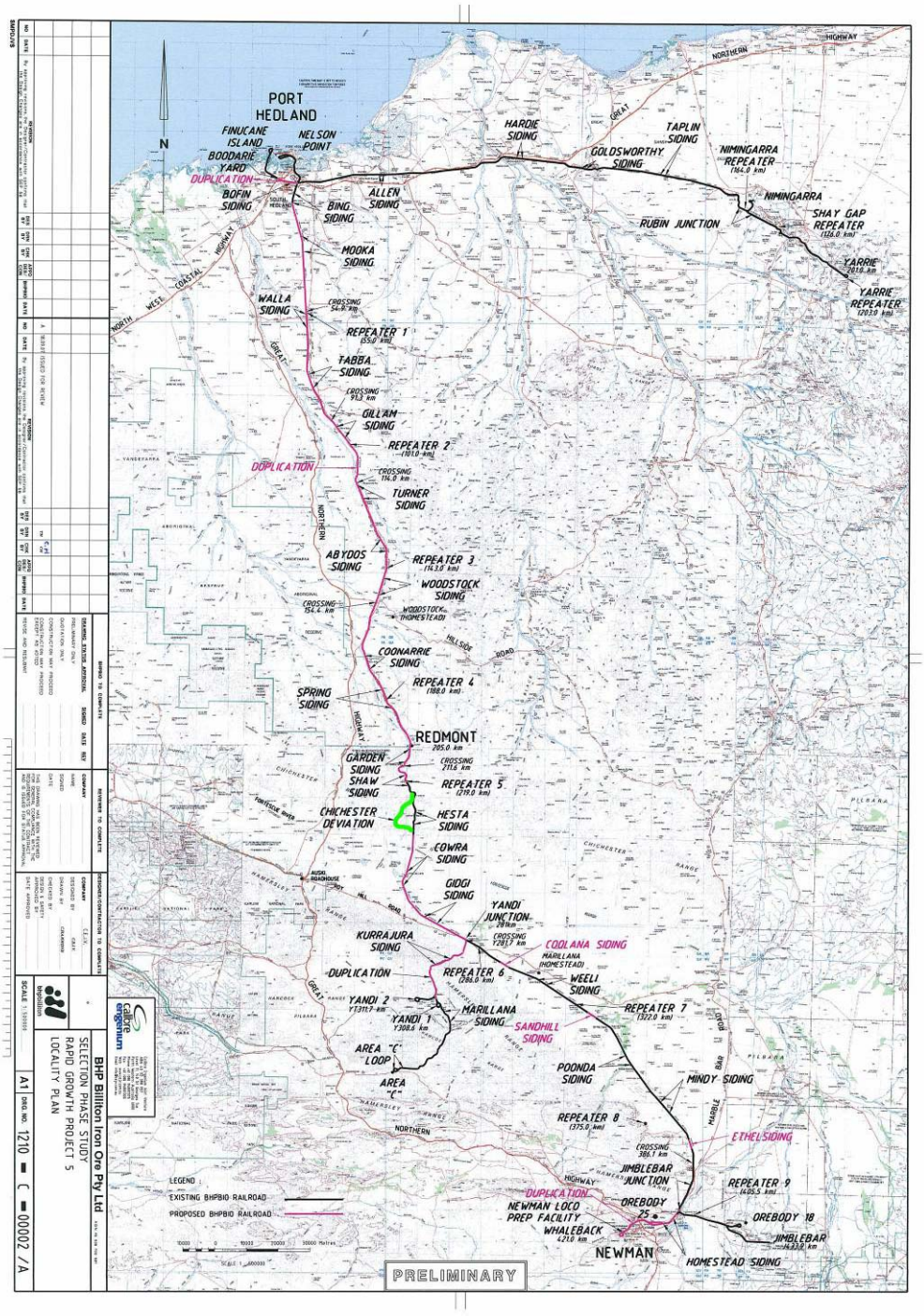


Figure 1.1 – Location of the survey area (highlighted bright green)

## 1.2 LEGISLATIVE FRAMEWORK

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

objectives of the Act are addressed. Three of these principles are relevant to native fauna and flora:

**The Precautionary Principle**

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

**The Principles of Intergenerational Equity**

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

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

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

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

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

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

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

## 1.3 SURVEY OBJECTIVES

BHPBIO commissioned *ecologia* to undertake a baseline biological survey of the vertebrate fauna of the Chichester Deviation as part of the environmental impact assessment for the project.

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

- maintain the abundance, species diversity and geographical distribution of terrestrial fauna; and

- protect Specially Protected (Threatened) fauna, consistent with the provisions of the WC Act.

The study aimed to provide sufficient information to the EPA to assess the impact of the project on the vertebrate fauna of the area, thereby ensuring that these objectives will be upheld.

The following requirements documented in the EPA Guidance Statement No. 56 and Position Statement No. 3, were addressed:

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

# 2 EXISTING ENVIRONMENT

## 2.1 CLIMATE

Climatic data were collected at Redmont Camp weather observation station (BOM, 2008) and are shown in Figure 2.1. The survey area experiences relatively hot and dry conditions from September until December. High temperatures and rainfall continue until the end of March, after which temperatures and rainfall begin to drop. Winter daytime averages are relatively mild (above 25°C) with cool nights. Rainfall declines until August before the onset of cyclonic weather events in December.

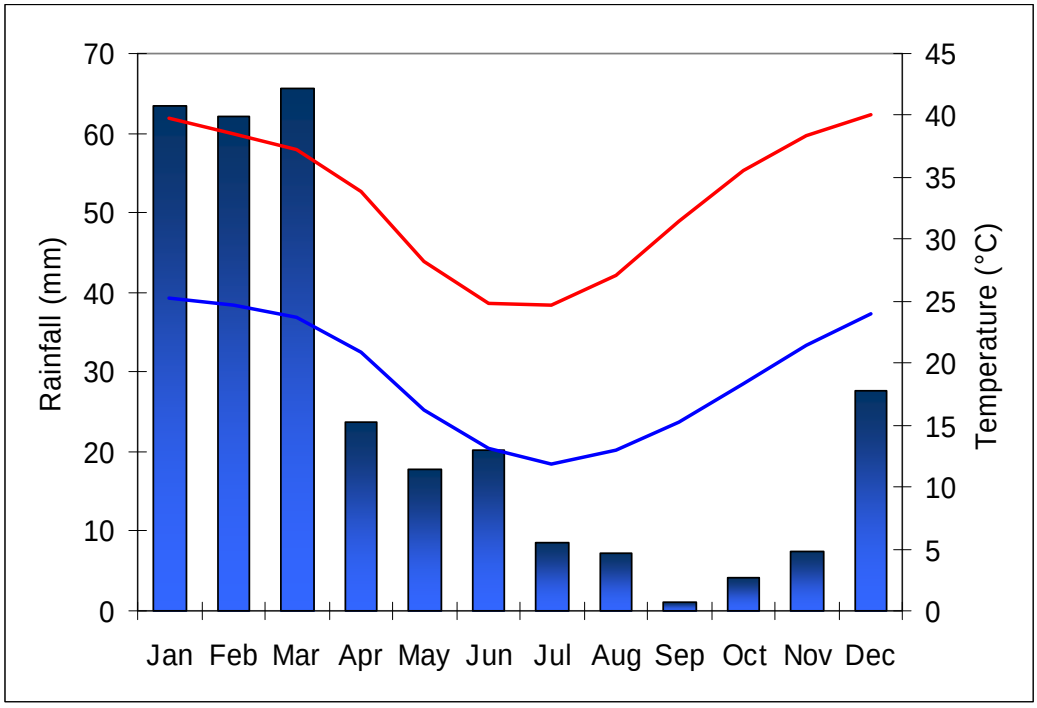


**Figure 2.1 – Climatic data for Redmont**

Daily temperature and rainfall records from the time period covered by both phases of the survey are presented below (Figure 2.2) with the data from the Wittenoom weather station. The Wittenoom weather station is the nearest currently recording weather station to the survey area. Ambient air temperatures for both phases of the survey were relatively high, allowing for the assessment of reptile, bird and mammal assemblages. A lack of appreciable rainfall resulted in a low amphibian representation.

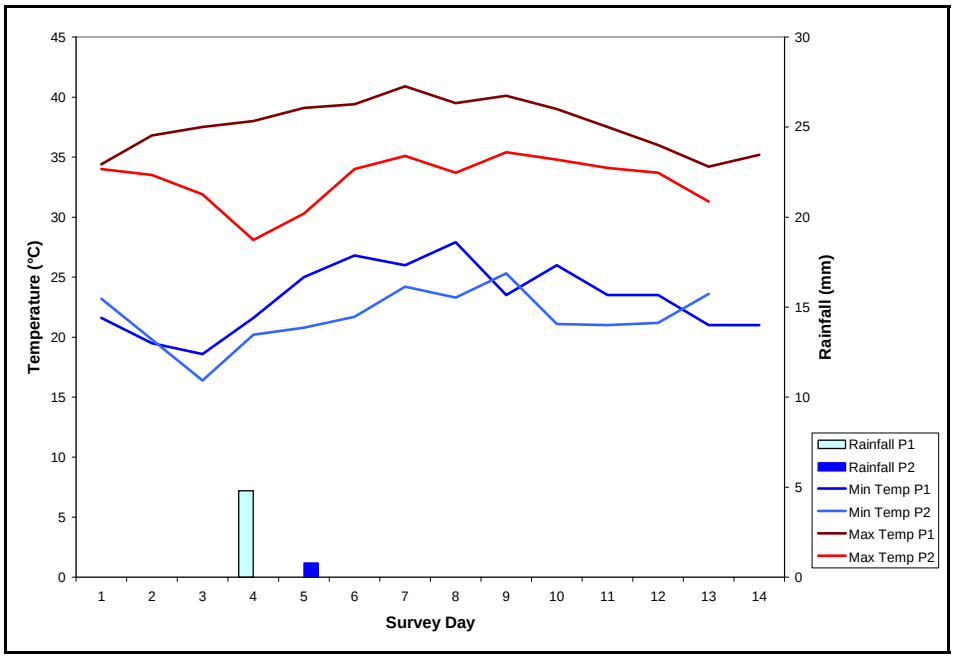


**Figure 2.2 – Daily temperature and rainfall during survey period**

## 2.2 BIOGEOGRAPHY

The Chichester Deviation survey area traverses the Fortescue (PIL-2) and Chichester (PIL-1) subregions of the Pilbara bioregion of Western Australia in IBRA v6.1 (Thackway and Cresswell 1995). The Chichester subregion is described as "Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* (formerly *Triodia pungens*) hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges" (Kendrick and McKenzie 2001).

The biogeography of the Fortescue subregion is summarised as follows: "Alluvial plains and river frontage. Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east. Deeply incised gorge systems in the western (lower) part of the drainage. River gum woodlands fringe the drainage lines. Northern limit of Mulga (*Acacia aneura*). An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput *Melaleuca* woodlands" (Kendrick 2001).

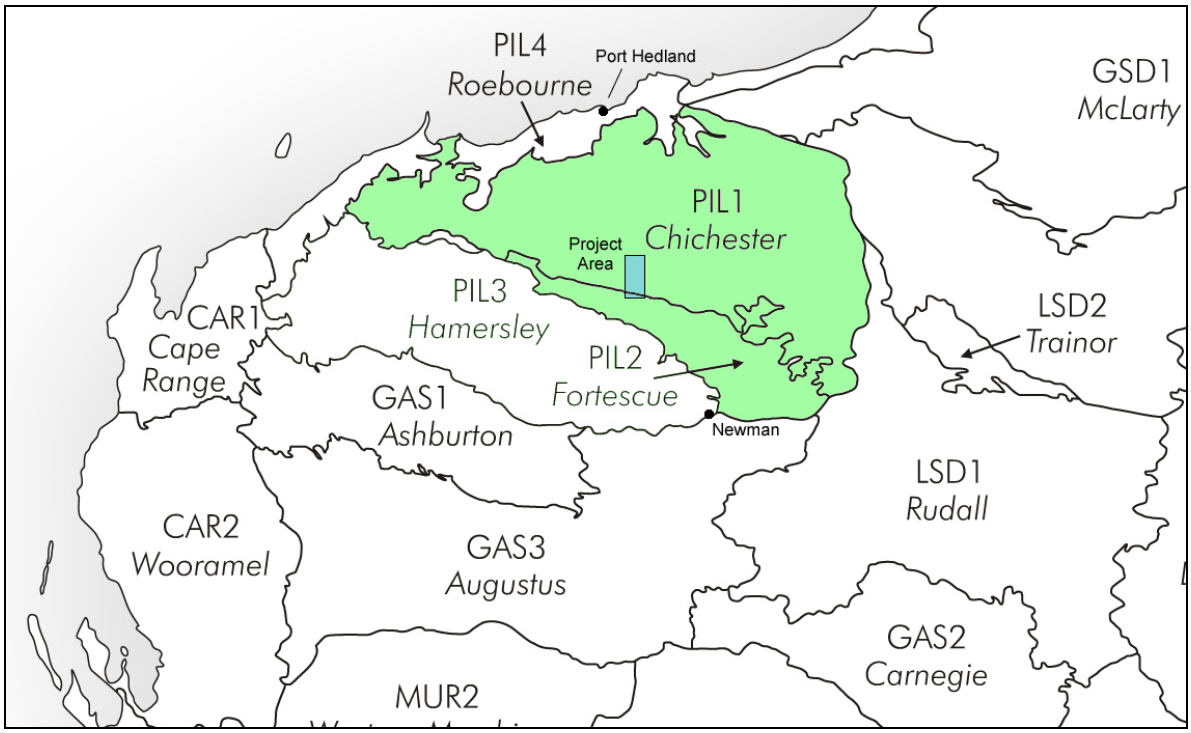


**Figure 2.3 – Biogeographical subregions of north Western Australia**

## 2.3 LAND SYSTEMS

The survey area crosses six land systems as described by (van Vreeswyk *et al.* 2004) (Figure 2.4). Table 2.1 details the extent of each of these land systems in the Pilbara and an estimate of the proposed level of impact on each land system based on the length of the rail corridor in each. Greatest potential impact will be to the Christmas Land System.

These land systems can be further classified into four land types that are listed below.

- Hills and ranges with spinifex grasslands – Capricorn, McKay and Newman
- Stony Gilgai plains with tussock grassland and spinifex grasslands – Wona
- Wash plains on hardpan with groved mulga shrublands (sometimes with spinifex understorey) – Jamindie
- Alluvial plains with snakewood shrublands - Christmas

The majority of the land systems associated with the Chichester Deviation consist of spinifex / tussock grasslands on stony plains or hills. Upper and middle storey vegetation varies from dense mulga and eucalypt woodland through to low shrubland with no vegetation over one metre. Although the species diversity of the vegetation remains very similar, structural diversity amongst the vegetation creates a variety of fauna habitat types. This vegetation structure can then be dramatically altered by environmental factors such as fire.

**Table 2.1 – Land systems and levels of associated impacts**

| Land System | Habitat | Total area of land system in WA ($km^2$) | Approx. length of rail corridor in each landsystem (km) | Percentage of the Land System area occurring in survey area (%) |
|---|---|---|---|---|
| **Christmas** | Stony alluvial plains supporting snakewood and mulga shrublands with sparse tussock grasses | 232 | 1.8 | 0.155 |
| **Jamindie** | Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey | 2 074 | 4.3 | 0.041 |
| **Newman** | Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands | 14 580 | 6.2 | 0.009 |
| **McKay** | Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands | 4 202 | 6.8 | 0.032 |
| **Capricorn** | Hills and ridges of sandstone and dolomite supporting shrubby hard and soft spinifex grasslands | 5 296 | 0.9 | 0.003 |
| **Wona** | Basalt upland gilgai plains supporting tussock grasslands and minor hard spinifex grasslands | 1 815 | 2.9 | 0.032 |

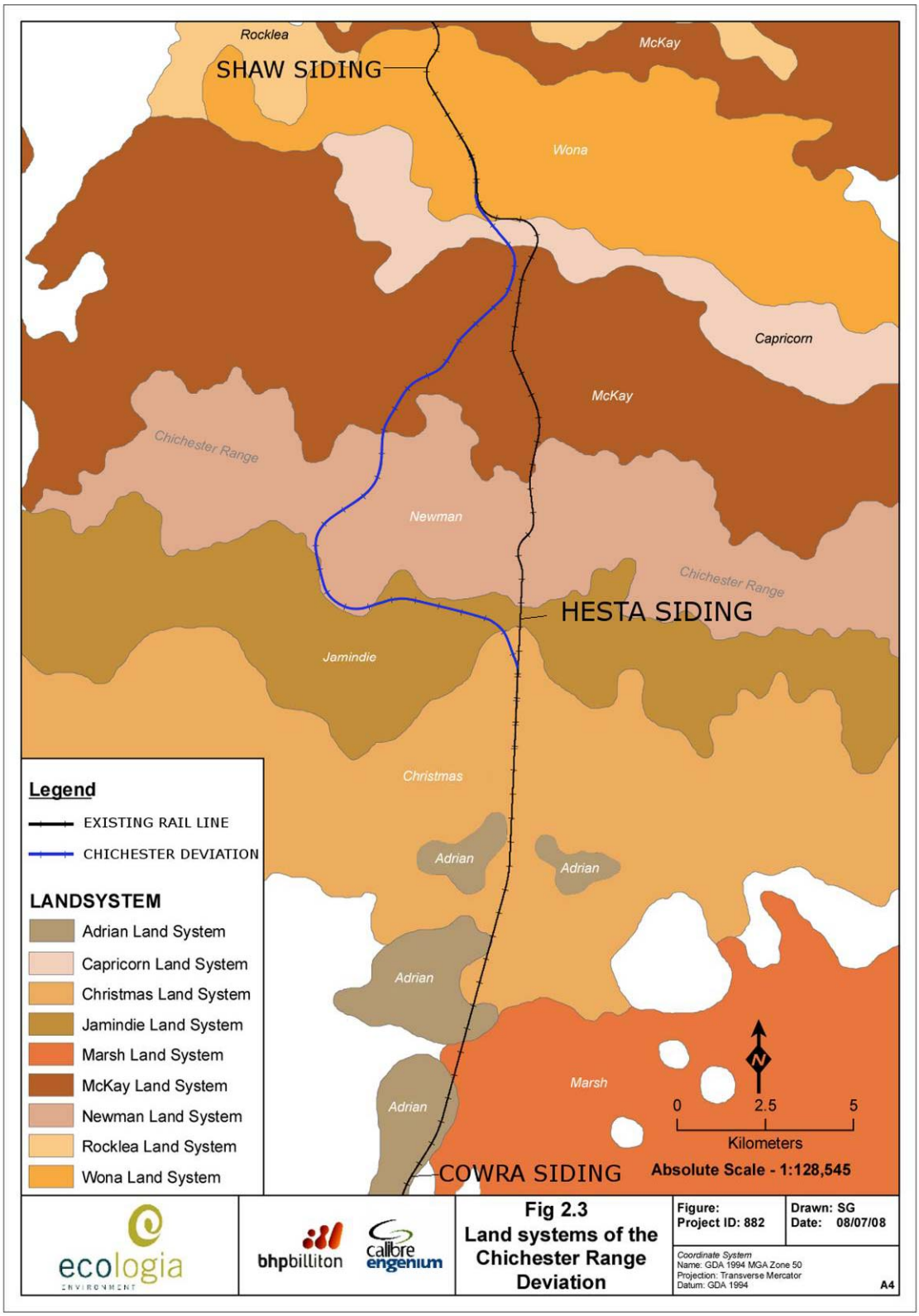


**Figure 2.4 – Land systems of the Chichester Deviation**

## 2.4 VEGETATION

(Beard 1975) classified the vegetation of the Pilbara, and within the project area are four main types as described below.

- *Acacia aneura* (Mulga) in groved patterns with an understorey of *Triodia pungens* on the lower slopes;
- Tree steppe of snappy gum *Eucalyptus leucophloia* and *Triodia wiseana* hummock grass on the hill slopes with *Acacia aneura* (Mulga) low woodland in the valleys;
- Shrub steppe of *Acacia pyrifolia* (kanji) and mixed hummock grasses including *Triodia pungens* and *T. wiseana* on the gentler basalt slopes and flats;
- Short tussock grassland of mixed species on the gilgai plains of cracking clay;

Recent botanical surveys of the area (*ecologia* 2008a) have identified nine vegetation types, with some types further classified into subtypes on the basis of structure and species composition of the dominant strata and on landform. The vegetation types mapped were associated with the following landforms: rocky hill slopes, minor drainage channels on the hill slopes, creeklines, floodplains, gilgai plains and hard clay plains and are listed below.

**1:** Astrebla pectinata tussock grassland on the gilgai plains;

**2:** *Acacia xiphophylla* open scrubland on the drainage areas of the gilgai plains;

**3:** *Acacia aneura* low woodland on the hard clay pans;

**4a:** *Acacia aneura* low open forest; or

**4b:** *Acacia ayersiana* and *Acacia aneura* low open forest on the drainage areas of the foot slope;

**5:** *Acacia citrinoviridis* open low forest on the creek lines of the flat areas;

**6:** *Acacia citrinoviridis* and *Corymbia hamersleyana* low woodland on the creek lines / floodplainds of the flat areas;

**7a:** *Eucalyptus victrix* open forest, over *Melaleuca glomerata* shrubland; or

**7b**: *Petalostylis labicheoides* and mixed *Acacia* spp. high shrubland; or

**7c:** *Corymbia* spp. and *Hakea chordophylla* low open woodland on the creek lines of the Chichester Ranges;

**8a:** *Eucalyptus leucophloia* low open woodland, over *Triodia basedowii* hummock grassland; or

**8b:** *Acacia aneura* low woodland; or

**8c:** *Acacia rhodophloia* high shrubland on the rocky hill slopes; and

**9a:** Mixed *Acacia* spp. open heath; or

**9b:** *Acacia aneura* low open forest on the drainage channels of the rocky hill slopes.

# 3 SURVEY METHODS

The survey methods adopted by *ecologia* are aligned with Guidance Statement No. 56 (EPA, 2004) and Position Statement No. 3 (EPA, 2002). The survey area occurs in the Pilbara biogeographic region. Based on the location and the scale of the development, Guidance Statement No. 56 recommends that a Level 2 survey be undertaken (comprehensive field survey). The purpose of a comprehensive field survey is to enhance the level of knowledge at a local scale, and requires:

"One or more visit/s in each season appropriate to the bioregion and the faunal group being surveyed. Generally, maximum survey will be the season that follows the season of maximum rainfall, but there will be need to time surveys according to seasonal activity patterns of some faunal groups (e.g. molluscs or amphibians)."

## 3.1 DETERMINATION OF SURVEY SAMPLING DESIGN AND INTENSITY

Prior to the development of survey methods, a review was undertaken of factors likely to influence survey design (Table 3.1).

**Table 3.1 – Factors likely to influence survey design (from EPA, 2004)**

| FACTOR | RELEVANCE | COMMENT |
|---|---|---|
| Bioregion – level of existing survey/ knowledge of the region and associated ability to predict accurately. | Pilbara bioregion is well studied. | Published literature and unpublished survey reports were available when developing the survey design (Biota 2004) (*ecologia* 2005). The survey was structured to focus on all identified fauna habitats and their potential for harbouring conservation significant fauna. |
| Landform special characteristics/ specific fauna/ specific context of the landform characteristics and their distribution and rarity in the region. | Landforms are typical of surrounding areas. | The survey area consists of undulating Archaean granite and basalt plains including significant areas of basaltic ranges supporting various vegetation types as shown in Section 2.3 and Figure 2.4. Based on assessments of the rail corridor, these landforms are typical of the region. |
| Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present. | Time of best survey is the month after cyclonic rains. | During the period of the current survey the Pilbara region did not receive significant rainfall due to cyclonic events although several areas received reasonable thunderstorm rainfall. The first phase was conducted in spring (11$^{th}$ – 24$^{th}$ Oct 2007) and the second phase was conducted in autumn (19$^{th}$ April – 1$^{st}$ May 2008) after over 200 mm in the previous 2 months. |
| Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/ area curves). | Little previous survey work has been conducted in the area surrounding the Chichester Deviation. | Data were available from a report on the fauna of the FMG rail corridor (Biota, 2004) located to the south and east of the survey area and a report from a Level 1 survey conducted in the same area as the Chichester Rail Deviation (*ecologia*, 2005). The information presented was not suitable for the generation of species accumulation curves. Further information has subsequently been collected by *ecologia* along the rail line to the north and south of the Chichester Deviation. |
| Number of different habitats or degree of similarity between habitats within a survey area. | The survey area contained a diverse array of fauna habitats. | Four fauna habitats were encountered, as discussed in Section 4.2. Survey sites were established in locations allowing the assessment and description of the various fauna habitats present within the survey area. |
| Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods). | Two phases of surveys were conducted in spring and autumn. No significant rainfall events occurred during the survey. | Climatic factors did not preclude any sampling methods from being used in this survey. Due to dry conditions pre survey, recorded Amphibian assemblages are not thought to be representative. |

| | | |
|---|---|---|
| Sensitivity of the environment to the proposed activities. | The survey area contained a diverse array of fauna habitats. | The region encompassing the Chichester Deviation is not thought to be greatly affected by the proposed activities. However three habitat types (Bamboo Springs, cracking clays and major creek lines) have been identified as being sensitive and / or poorly represented in the survey area. This is further discussed in Section 6.1. |
| Size, shape and location of the proposed activities. | The survey area is approximately 1 km wide and approximately 40 km long between Shaw and Cowra sidings. | During transects zoologists ensured that all major fauna habitats were described in order to determine the potential for conservation significant fauna to occur throughout the lease area. |
| Scale and impact of the proposal. | The construction of the rail duplication will only impact the immediate rail area. | Impacts during construction will be significant but localised to the project footprint. Subsequent impacts will be minimal. |

## 3.2 LITERATURE REVIEW AND DATABASE SEARCHES

Several databases were consulted in the formulation of potential fauna and conservation significant fauna lists. The databases are listed below with search parameters described in parentheses:

- Western Australian Museum (WAM) FaunaBase (north west corner Lat 21.85, Long 118.75; south east corner Lat 22.525, Long 119.23)
- Birds Australia Birdata (One degree block containing point -22.01881, 119.02261)
- Department of Environment, Heritage, Water and the Arts (DEWHA) protected matters database (north west corner Lat 22° 06', Long 118° 57'; south east corner 22°16', Long 119° 02')
- Department of Environment and Conservation (DEC) Threatened fauna database (north west corner Lat 22° 06', Long 118° 57'; south east corner 22°16', Long 119° 02')

The following reports were also consulted:

- Biota (2004): Fauna habitats and fauna assemblages of the proposed FMG Stage A rail corridor
- *ecologia* (2005): Roy Hill exploration project
- *ecologia* (2008c): RGP5 Fauna Survey: Quarry 8
- *ecologia* (2008d): RGP5 Targeted Survey: Quarry 1, 2, 4 and East Turner River Northern Quoll Survey.

Results of previous surveys, Birdata and WAM database surveys are presented in Appendix A as a list of potential species. Results from DEWHA and DEC databases are used to determine conservation significant species lists (Section 5.2).

## 3.3 SURVEY TIMING

The survey was conducted in spring between the 11th – 24th October 2007 and autumn between 19th April – 1st May 2008.

## 3.4 SITE SELECTION

A review of aerial photographs and land system maps of the survey area resulted in the selection of several potential sites within the survey area. Seven sites were selected for the Level 2 survey (Figure 3.1) focusing on four habitat types. To complement the Level 2 survey, 6 opportunistic sites (Figure 3.1) were selected within the rail deviation footprint to identify all fauna habitats associated with the proposed Chichester Deviation and to assess the entire route for signs of, and suitable habitat for, conservation significant species. The location of each site and the associated land systems and vegetation communities are

shown in Table 3.2. Descriptions of the fauna habitat associated with vegetation types and photographs of each site are presented in Table 3.3. Sites CH01 and CH02 were burnt between the survey phases and are shown in their unburnt and burnt states in Table 3.3.

**Table 3.2 – Location of survey sites**

| LAND SYSTEM | VEGETATION COMMUNITY (VEGETATION UNIT) | SITE | LOCATIONS |
|---|---|---|---|
| Level 2 Survey | | | |
| McKay | Mulga woodland (3) | CH01 | 706149e 7547408n |
| McKay | Spinifex grassland (5) | CH02 | 704990e 7546048n |
| Newman | Eucalypt woodland (8) | CH03 | 704673e 7544323n |
| Jamindie | Mixed shrubland (8) | CH04 | 705585e 7541671n |
| Newman / Jamindie | Mulga woodland (3) | CH05 | 703270e 7541012n |
| Newman / Jamindie | Eucalypt / mulga woodland (3) | CH06 | 702958e 7542253n |
| Jamindie | Eucalypt / mulga woodland (9ii) | CH07 | 708218e 7540498n |
| Opportunistic Survey | | | |
| Wona | Mixed grassland (2) | OPP A | 707253e 7553727n |
| Wona | Mixed spinifex / grassland (2) | OPP B | 707597e 7552209n |
| Capricorn / Wona | Eucalypt woodland (8) | OPP C | 707857e 7551887n |
| Capricorn / McKay | Eucalypt woodland (5) | OPP D | 708528e 7550935n |
| McKay | Spinifex grassland (5) | OPP E | 707376e 7548659n |
| Newman | Spinifex grassland (5) | OPP F | 703049e 7543264n |

Note: Datum WGS 84, Zone 50K

**Table 3.3 – Site descriptions and site photos**

| SITE VEGETATION DESCRIPTION AND FAUNA HABITATS | SITE PHOTO |
|---|---|
| **Level 2 Survey** | |
| **Site: CH01**<br>**Mulga woodland on stony plain (Veg Unit 3)**<br>Mulga woodland over scattered spinifex on rocky red soils. |  |
| **Site: CH02**<br>**Spinifex on stony, rocky hill slope (Veg Unit 8)**<br>Scattered acacia / eucalypts over dense spinifex hummocks on rocky hill slope. |  |
| **Site: CH03**<br>**Mixed woodland on rocky gully / drainage line (Veg Unit 7)**<br>Very open eucalypt woodland over mixed moderately dense shrubs over scattered spinifex and grasses on rocky sandy soils. |  |

| SITE VEGETATION DESCRIPTION AND FAUNA HABITATS | SITE PHOTO |
|---|---|
| **Site: CH04**<br>**Drainage line (Veg Unit 7)**<br>Mixed shrubs over mixed grasses / spinifex on rocky sandy soils. |  |
| **Site: CH05**<br>**Mulga woodland on stony plain (Veg Unit 3)**<br>Open acacia / eucalypt woodland over mixed shrubs over spinifex on rocky soils. |  |
| **Site: CH06**<br>**Eucalypt / mulga woodland on rocky plain (Veg Unit 3)**<br>Very open eucalypt / mulga woodland over mixed shrubs over spinifex on rocky soils. |  |

| SITE VEGETATION DESCRIPTION AND FAUNA HABITATS | SITE PHOTO |
|---|---|
| **Site: CH07**<br>**Eucalypt / mulga woodland on rocky plain (Veg Unit 6)**<br>Mixed acacia woodland over dense mixed grassland / spinifex hummocks on rocky clay soils. |  |
| **Fire affected sites of Phase 2** | |
| **Site: CH01**<br>**Fire affected**<br>**Mulga woodland on rocky plain (Veg Unit 3)**<br>Burnt mulga woodland over regenerating spinifex on rocky red soils. |  |
| **Site: CH02**<br>**Fire affected**<br>**Regenerating spinifex on rocky hill slope (Veg Unit 8)**<br>Scattered acacia / eucalypts over very open small spinifex hummocks on rocky hill slope. |  |

| SITE VEGETATION DESCRIPTION AND FAUNA HABITATS | SITE PHOTO |
|---|---|
| **Opportunistic Survey** | |
| **Site: OPP A**<br>**Grass plain (Veg Unit 1)**<br>Open grassy plain on cracking clays. Scattered acacia sp. |  |
| **OPP B**<br>**Rocky plain (Veg Unit 1)**<br>Spinifex and grass covered open rocky plain with scattered mulga and other low shrubs (*Acacia* sp.), and scattered *Grevillia* sp. |  |
| **Site: OPP C**<br>**Drainage line (Veg Unit 7)**<br>Moderately tall young eucalypt sp. over scattered small shrubs and grasses in rocky creek line. |  |

| SITE VEGETATION DESCRIPTION AND FAUNA HABITATS | SITE PHOTO |
|---|---|
| **Site: OPP D**<br>**Rocky hill slope (Veg Unit 8)**<br>Raised plateau. Very open *Eucalyptus leucophloia* / *Corymbia* sp. over mixed acacia shrubs over spinifex / mixed grass hummocks on stony / rocky soil. |  |
| **Site: OPP E**<br>**Rocky plain (Veg Unit 8)**<br>Scattered young corymbia / eucalypt trees over mixed acacia shrubs over small / medium soft spinifex clumps that are scattered / moderately dense on stony red soils. Plain dissected by minor drainage channels. |  |
| **Site: OPP F**<br>**Spinifex on rocky Ridgetop (Veg Unit 7)**<br>Very scattered eucalypts over scattered low shrubs over moderately dense low / medium spinifex on rocky soils. |  |

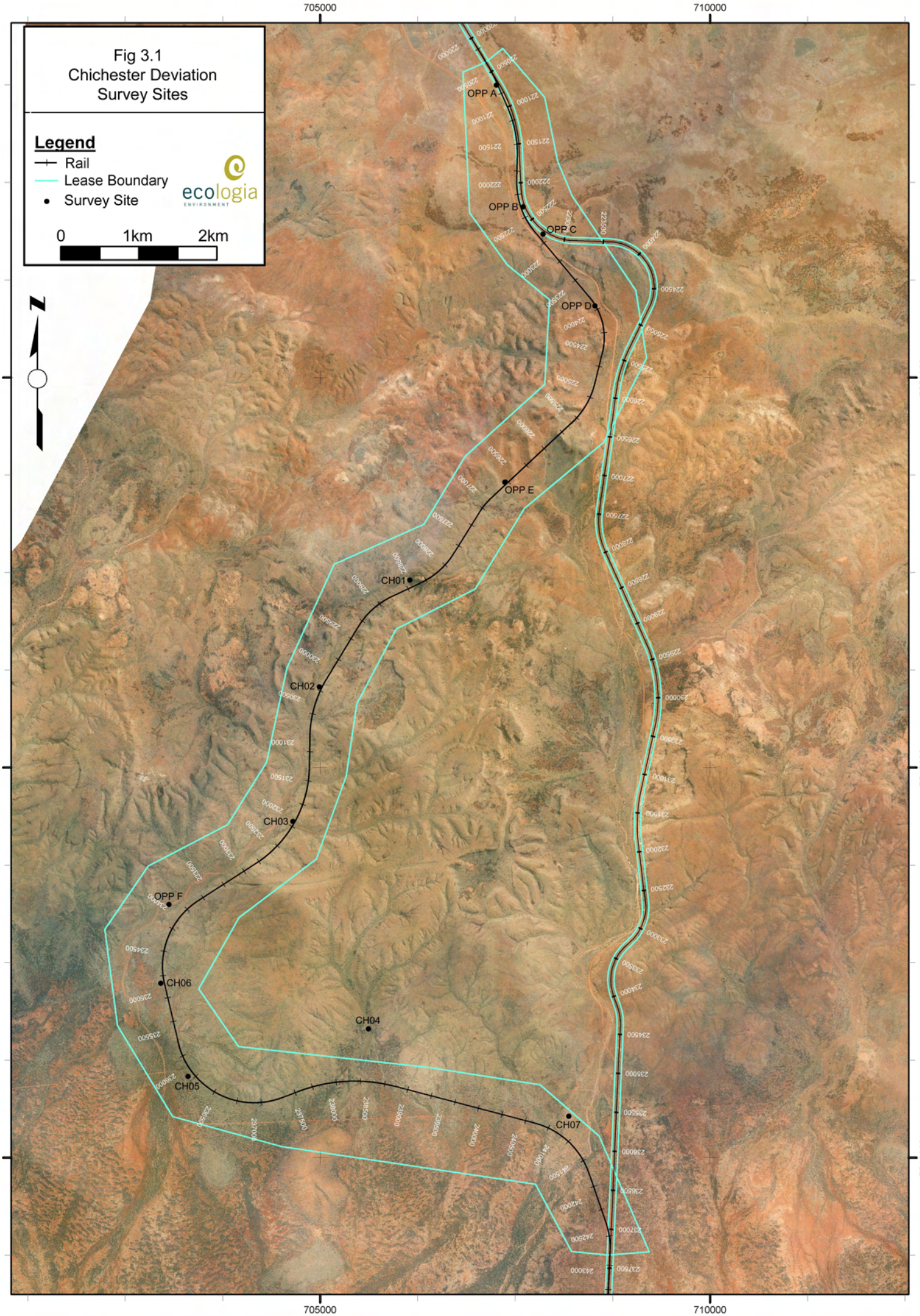
Fig 3.1
Chichester Deviation
Survey Sites
Legend
Rail
Lease Boundary
Survey Site
ecologia
ENVIRONMENT
0
1km
2km
N
705000
710000
7550000
7545000
7540000
OPP A
OPP B
OPP C
OPP D
OPP E
OPP F
CH01
CH02
CH03
CH04
CH05
CH06
CH07

## 3.5 SAMPLING METHODS

The survey was undertaken using a variety of sampling techniques, including systematic and opportunistic sampling. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between habitats and seasons. Opportunistic sampling includes data collected non-systematically from both fixed sampling sites and as opportunistic records from chance encounters with fauna. Total survey effort is presented in Table 3.5 on the next page.

Trapping effort is recorded as the number of trapnights surveyed at each survey site. A trapnight is defined as a single working trap open for one night. Each site was surveyed for 10 nights and contained 10 pitfall traps, 20 funnel traps, 20 Elliott traps and 2 cage traps. The sites were configured with 10 pitfall traps placed 25m apart with associated traps consisting of 2 funnels placed at the ends each drift fence and two Elliott traps, one placed near the pit, and another Elliott trap placed between the pit locations as shown in Figure 3.2. A cage trap was places near the first and last pitfall trap at each site.

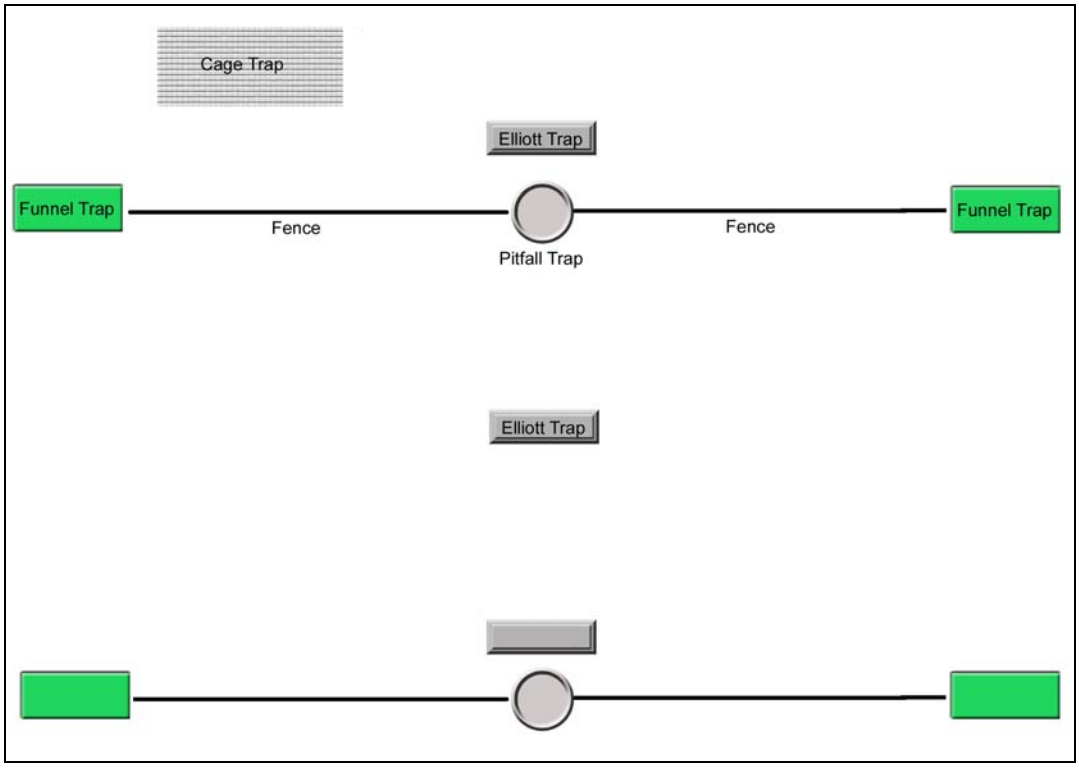


**Figure 3.2 – Layout of traps at each site**

**Table 3.4 – Survey effort**

| SITE | TRAPNIGHTS | | | | | | | | BIRD SURVEY | | BAT RECORDINGS | | DIURNAL OPP. SEARCHING | | NOCTURNAL OPP. SEARCHING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PIT | | FUNNEL | | ELLIOTT | | CAGE | | | | | | | | | |
| | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 | Phase 1 | Phase 2 |
| CH01 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 230 | 40 | 60 | 140 | 255 | 120 | 210 | - |
| CH02 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 180 | 140 | 50 | 140 | 90 | 180 | 120 | 180 |
| CH03 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 220 | 160 | 110 | 140 | 210 | 180 | - | 180 |
| CH04 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 200 | 120 | 110 | 140 | 120 | 270 | 120 | 120 |
| CH05 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 200 | 245 | 120 | 100 | 240 | 180 | 120 | 120 |
| CH06 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 220 | 200 | 50 | 140 | - | 180 | 210 | 120 |
| CH07 | 100 | 100 | 200 | 200 | 200 | 200 | 20 | 20 | 300 | 180 | 110 | 140 | - | 180 | - | 150 |
| OPP Sites | | | | | | | | | 284 | 60 | 110 | | 1030 | 840 | 120 | 240 |
| **Totals** | **700** | **700** | **1400** | **1400** | **1400** | **1400** | **140** | **140** | **1834** | **1145** | **720** | **940** | **1945** | **2130** | **900** | **1110** |

All values other than trapnights are the total amount of time spent conducting each activity reported in minutes.

### 3.5.1 SYSTEMATIC SAMPLING

#### 3.5.1.1 Terrestrial Mammals and Herpetofauna

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

#### 3.5.1.2 Trap Specifications

- Pit-fall traps and drift fences: Five PVC pipes (16 cm diameter, minimum 50 cm deep) and five 20 L plastic buckets (30 cm diameter, 40 cm deep) were established at each site. A six metre flywire drift fence (30 cm high) bisected the pits, directing fauna into the traps.
- Elliott box traps: Twenty medium sized Elliott box traps (9 x 9 x 32 cm) were located in each site, and baited with Universal Bait (a mixture of peanut butter, rolled oats and sardines). One trap was placed in association with the pit trap whilst one trap was placed in between pit traps.
- Funnel traps: Funnel traps (Ecosystematica Type III) were placed in association with drift fences. Twenty traps were used per site with a trap being placed at each end the drift fence.
- Cage traps: Two traps were used per site with one trap placed at each end of the trap line.

#### 3.5.1.3 Avifauna

Twenty-minute set-time surveys were used to document the avifauna present at each of the fauna sites. During each set-time survey an ornithologist recorded the number of individuals of each species seen while actively searching a 2.0 ha area. This technique is the basis for the ongoing continental-scale avifaunal survey of Australia: the Birds Australia Atlas project.

Survey effort was concentrated between the three hours post-dawn and three hours pre-dusk, as these were deemed to be the optimal time to record most bird species. Surveys between these times were also conducted, as these surveys may yield species less frequently observed in the early morning or late evening, e.g. diurnal raptors.

#### 3.5.1.4 Bats

Bat echolocation calls were recorded using an ANABAT II system (Titley Electronics, Ballina, NSW) and identified by Mr Bob Bullen. A recording was made at each site starting just before dusk. A summary of recording duration is presented in Table 3.5.

### 3.5.2 OPPORTUNISTIC SAMPLING

#### 3.5.2.1 Nocturnal Searching

The study area was searched at night using a combination of road transects using vehicle-mounted spotlights and opportunistic ground searches using head torches and hand held spotlights for nocturnal species such as geckos, snakes and nocturnal birds.

#### 3.5.2.2 Diurnal Searching

Opportunistic sites were hand searched for cryptic species, which comprised searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows, recording tracks, diggings and scats, and over-turning logs and stones. Sites were selected on the basis of their representative nature of the study area, and also based upon whether they were well-represented by the systematic trapping effort.

#### 3.5.2.3 Opportunistic Sightings

The presence of species was recorded while searching, travelling and during trap establishment within the study area during the day and night. Tracks, diggings, scats, burrows and nests were recorded where possible.

### 3.6 ANIMAL ETHICS

Surveying was conducted as per *ecologia*'s Animal Ethics Code of Practice, which conforms to Section 5 of the Australian code of practice for the care and use of animals for scientific purposes (NHMRC 2004).

In most cases, fauna were identified in the field and released at the point of capture. Where the taxonomy of specimens was not clearly discernable, or when species were collected that are known to exhibit significant morphological variation or are not yet fully described, voucher specimens were lodged with the W.A. Museum. Voucher specimens were maintained according to WA Museum guidelines to ensure minimum stress to captured animals.

### 3.7 TAXONOMY AND NOMENCLATURE

Field identification of vertebrate species was based on the field guides listed in Table 3.5.

**Table 3.5 – Guides used for reference or identification**

| Family | Field Guide |
|---|---|
| Mammals | (Menkhorst and Knight 2001), (Van Dyck and Strahan 2008) |
| Skinks | (Storr *et al.* 1999) |
| Bats | (Churchill 1998; Menkhorst and Knight 2001) |
| Dragons | (Storr *et al.* 1983; Cogger 2000) |
| Birds | (Johnstone and Storr 1998; Johnstone and Storr 2004; Simpson and Day 2004) |
| Varanids | (Storr *et al.* 1983; Cogger 2000) |
| Snakes | (Storr *et al.* 2002) |
| Geckos | (Storr *et al.* 1990; Cogger 2000) |
| Reptiles | (Cogger 2000; Wilson and Swan 2008) |
| Legless Lizards | (Storr *et al.* 1990; Cogger 2000) |
| Amphibians | (Cogger 2000; Tyler *et al.* 2000) |

Nomenclature for mammals and reptiles and amphibians within this report are as per the WA Museum's FaunaBase. Nomenclature for birds is according to the latest taxonomy of Australian Birds (Christidis and Boles 2008) and reptiles according to (Wilson and Swan 2008).

## 3.8 DATA ANALYSIS

### 3.8.1 SPECIES RICHNESS

The number of species present (species richness) is the simplest and most intuitive representation of species diversity (Fowler and Cohen 1990; Magurran 2004) and is a basic indicator of diversity used for this survey. It can be defined as the number of species of a given taxon in the chosen assemblage.

### 3.8.2 SPECIES ACCUMULATION CURVES

Aspects of the level of survey adequacy and completeness can be estimated using species accumulation curves (SACs). SACs graphically illustrate when the number of species identified in a survey plateaus and consequently illustrates whether the survey has identified the majority of the species present and thus adequately surveyed the faunal assemblage of the study area (Thompson and Withers 2003). Various mathematical formulas are then used to estimate the number of species present in a particular area based on the survey results (Colwell *et al.* 2004; Colwell 2005). The classical richness estimator Chao 1 (Colwell 2005) is reported in this study.

### 3.8.3 PATN ANALYSIS

PATN analysis is a method used to identify relationships between sets of objects using quantitative multivariate data. PATN analysis has been used in this report to determine similarities between sites based on the faunal assemblages detected at each site. Presence / absence data was used in the program PATN (Belbin 1989) to identify and describe fauna habitat types based on the detected faunal assemblages.

## 3.9 SURVEY TEAM

The survey was planned and executed by *ecologia* Environment under licence number SF006018, granted by the DEC. Personnel involved in the survey, their qualifications and experience are listed in Table 3.6 below.

**Table 3.6 – Personnel involved in the survey**

| Survey Members | Qualifications | Experience | Phase 1 | Phase 2 |
|---|---|---|---|---|
| Dr Stewart Ford (Ornithologist) | PhD | 15 years | ✓ | |
| George Swann (Ornithologist) | | 40 years | ✓ | ✓ |
| Thomas Rasmussen (Herpetologist) | | 8 years | ✓ | ✓ |
| Simon Pynt (Herpetologist) | BSc | 6 years | ✓ | ✓ |
| Damien Cancilla (Zoologist) | BSc (Hon) | 5 years | | ✓ |
| Matt Landers (Field Assistant) | BSc | 1 year | ✓ | |
| Terry Rose (Field Assistant) | BSc | 1 year | ✓ | |

# 4 RESULTS

## 4.1 FAUNA ASSEMBLAGES

Based on current species distributions, information from database searches and previous survey records, 35 native mammal species (and eight introduced species), 139 bird species, 100 reptile species and 6 amphibian species potentially occur in the survey area (Appendix A). The following sections describe the species recorded during the *ecologia* survey. Tables presenting the fauna species recorded in the project areas are presented in Appendix B.

### 4.1.1 MAMMALS

Twenty native species of mammal (Appendix B1), out of a potential 35 (Appendix A1) were recorded during both phases of this survey. Mammal species recorded include 9 bat species (*Macroderma gigas*, *Saccolaimus flaviventris*, *Taphozous georgianus*, *Chaerephon jobensis*, *Mormopterus beccarii*, *Nyctophilus geoffroyi*, *Chalinolobus gouldii*, *Scotorepens greyii* and *Vespadelus finlaysoni*) out of a potential 11 species, 6 rodent species (*Notomys alexis*, *Leggadina lakedownensis*, *Pseudomys chapmani*, *Pseudomys desertor*, *Pseudomys hermannsburgensis* and *Zyzomys argurus*), 4 dasyurid species ( *Dasykaluta rosamondae*, *Sminthopsis macroura*, *Ningaui timealeyi* and *Planigale* sp.) out of a potential 10 species and Euro (*Macropus robustus*).

Eight conservation significant mammal species potentially occur in the survey area, two of which, the Ghost Bat (*Macroderma gigas*) and the Northern Short-tailed Mouse (*Leggadina lakedownensis*) were recorded during this survey. Active / recently active mounds of the Western Pebble-mouse (*Pseudomys chapmani*) were also recorded during this survey.

Introduced mammals, comprising of House Mouse, Dog/Dingo, Cat, Rabbit and European Cattle were also recorded.

### 4.1.2 BIRDS

One hundred and thirty-nine bird species from 52 families potentially occur in the survey area (Appendix A2). Of these, 94 species from 44 families were recorded during this survey (Appendix B2). Nine conservation significant species potentially occur within the survey area, seven of which were recorded during this survey: Australian Bustard (*Ardeotis australis*), Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*), Wood Sandpiper (*Tringa glareola*), Grey Falcon (*Falco hypoleucos*), Bush-stone Curlew (*Burhinus grallarius*) and Star Finch (*Neochmia ruficauda subclarescens*). The Bush-stone Curlew was recorded from a call heard outside the survey area (Figure 5.1), but it is likely that this species occurs in the survey area as well.

### 4.1.3 REPTILES

Of 100 reptiles species potentially occurring, 57 species were recorded during the survey. The skinks (Scincidae), geckos (Gekkonidae) and venomous snakes (Elapidae) were well represented with 15, 12 and seven species found from these families respectively. No reptiles of conservation significance were recorded within the project area. Two further species of conservation significance, the Pilbara Olive Python (*Liasis olivaceus barroni*) and a species of blind snake (*Ramphotyphlops ganei*) were identified as potentially occurring in the survey area.

### 4.1.4 AMPHIBIANS

Six amphibian species have been identified as potentially occurring within the survey area (Appendix A4). A single amphibian species, *Litoria rubella*, was recorded during the survey (Appendix B) in a puddle in a creekbed near site CH07. All of the potential species, except *L. rubella*, are burrowing frogs that can survive long periods of drought by remaining buried deep in the soil substrate. Minimal amphibian records were thought to be caused by this cryptic survival strategy combined with little rainfall occurring prior and during the surveys.

## 4.2 FAUNA HABITATS

The survey aimed to sample all terrestrial and avian fauna by utilising sites located in discrete habitats. The degree of difference between sites can be measured by examining the grouping of the fauna assemblages recorded from each site. Similar habitats, and the physical or environmental factors that make up the habitat, are expected to support similar fauna. Therefore, by analysing the similarity of site faunal assemblages, we are able to examine the similarity of the fauna habitats – assuming that habitat is the factor determining the fauna assemblage.

Between the two phases of the survey, a fire burnt through sites CH01 and CH02, altering the habitat structure and form. As a result, each survey phase for sites CH01 and CH02 was treated separately.

### 4.2.1 HABITAT TYPES (TERRESTRIAL FAUNA)

Habitat types as indicated by the terrestrial fauna assemblages recorded were divided into: mulga woodland over long unburnt dense grass hummocks, open mixed woodland over dense understorey on rocky ground, dense spinifex grassland on rocky scree slope and regenerating vegetation after recent fire activity. These groupings are shown in Table 4.1 and Figure 4.1, below. Figure 4.1 shows that there was little difference between the fauna assemblages at most sites, but site CH02 (pre-burning) was significantly different from all others.

**Table 4.1 – Habitat types associated with sites surveyed based on terrestrial fauna assemblages**

| Sites | Habitat Type | Land system |
|---|---|---|
| CH01a, CH07 | Mulga woodland over long unburnt dense grass hummocks | McKay, Jamindie |
| CH03, CH04, CH05, CH06 | Open woodland over patchy to dense understorey on rocky ground | Newman, Jamindie |
| CH02a | Dense spinifex grassland on rocky scree slope | McKay |
| CH01b, CH02b | Regenerating vegetation after recent fire activity | McKay |

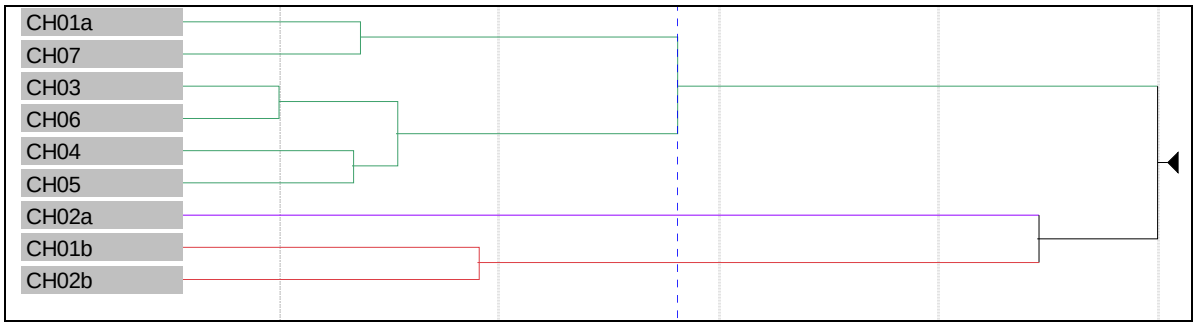


**Figure 4.1 – Terrestrial fauna assemblage groupings**

### 4.2.2 HABITAT TYPES (AVIAN FAUNA)

Six major fauna habitats (Table 4.2) have been identified by PATN analysis using the avian fauna assemblages identified by this survey (Figure 4.2). Habitat types were: mulga woodland over spinifex hummocks, open woodland over dense grass hummocks, rocky hill slope after regenerating fire, open woodland over dense understorey on rocky ground, rocky hill side with dense spinifex hummocks and regenerating mulga woodland over regenerating spinifex.

**Table 4.2 – Habitat types associated with sites surveyed based on avian assemblages**

| Sites | Habitat Type | Land system |
|---|---|---|
| CH01a, CH3, | Mulga woodland over spinifex hummocks | McKay, Newman |
| CH07 | Open woodland over dense grass hummocks | Jamindie |
| CH02b | Rocky hill slope regenerating after fire | McKay |
| CH04, CH05, CH06 | Open woodland over dense understorey on rocky ground. Dense understorey can be patchy | Jamindie, Newman |
| CH02a | Rocky hill side with dense spinifex hummocks | McKay |
| CH01b | Burnt mulga woodland, open canopy with regenerating spinifex | McKay |

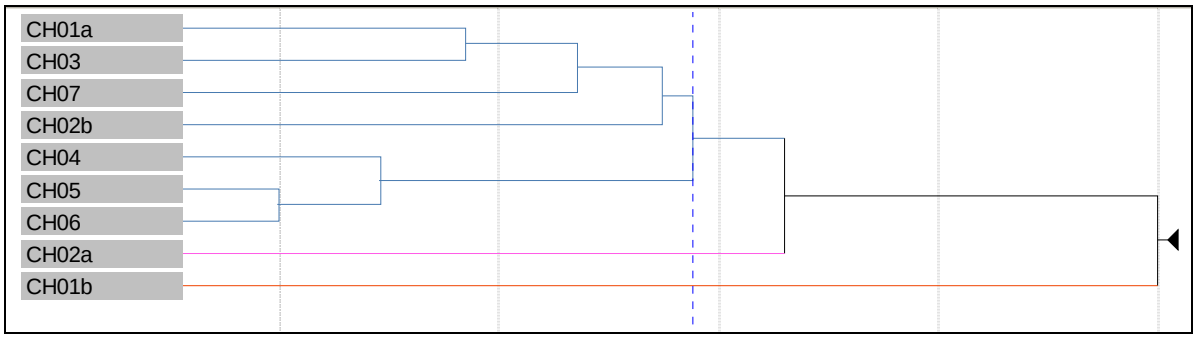


**Figure 4.2 – Avifaunal assemblage groupings**

### 4.2.3 HABITAT TYPES BASED ON FAUNAL ASSEMBLAGES

Both PATN analyses have separated the second phases of sites CH01 and CH02 into distinct habitat types loosely related to the other survey sites indicating a major effect of fire on the terrestrial and avian fauna assemblages inhabiting these sites.

Sites CH04, CH05 and CH06 have been grouped in both analyses, indicating a distinct habitat type (open woodland over dense understorey) that separates both the terrestrial

and avian assemblages. Site CH03 grouped with these sites using the terrestrial data but separated in the avian data set indicating a similarity in terrestrial fauna habitat, but a distinct difference for avian habitat preferences. However the greatest difference in faunal assemblages was site CH02 relative to all other sites, which was separated in terrestrial and avian analyses and reflects the very different physiognomic factors unique to this site: aspect (steeper 30-40° slope), vegetation (dense spinifex with little overstorey) and substrate (rocky scree on skeletal soil).

## 4.3 SURVEY ADEQUACY

The number of potential fauna species is the maximum number of species likely to utilise the survey area. Tables presented in Appendix A are based on the WAM FaunaBase, Birdata (2008), species distribution maps published in field guides, and from previous biological surveys from similar regional areas. Potential species lists may include numerous non-residential and/or transient species and do not take into consideration population fluctuations. The total number of potential species when compared with those observed and those predicted (from the species accumulation curves) is presented in Table 4.3.

**Table 4.3 – Observed, potential and expected species richness**

| Taxa | Observed | Estimated (Chao1) | Obs/Est % | Potential | Obs/Pot % |
|---|---|---|---|---|---|
| Mammals | 25 | 19.35 ± 1.04 | 131% | 43 | 58% |
| Birds | 95 | 75.00 ± 3.66 | 127% | 136 | 70% |
| Reptiles | 57 | 60.5 ± 4.23 | 94% | 100 | 57% |
| Amphibians | 1 | N/A | N/A | 6 | 17% |

Sampling adequacy can be assessed using randomised species accumulation curves (SACs), which show the trend in total number of species recorded (species richness) as the number of individuals sampled increases. The total number of species recorded approaches a plateau (the asymptote) when the majority of species present in an area has been recorded.

SACs were not generated for amphibian species caught as only one species was recorded. Additionally, SACs are limited in that they only utilise data that are collected systematically. Opportunistic data was excluded because it was not collected in a comparable manner. This is seen in the Observed / Estimated percentages (Table 4.3), where the number of species observed is higher than the number estimated from the SACs.

Species accumulation curves generated for mammals (Figure 4.3) and reptiles (Figure 4.5) do not appear to be approaching an asymptote. This suggests that not all species within the project area were recorded. The species accumulation curve generated for birds (Figure 4.4) does appear to be approaching an asymptote, indicating that the majority of species present in the survey area were recorded.

In Table 4.3, the observed number is the actual number of species observed during the survey. Comparing this with the estimated number, which is based on species accumulation curves, shows that 131% of the estimated mammal species, 127% of the estimated bird species and 94% of the estimated reptile species were recorded during sampling. The estimate of the total number of mammals and birds was lower than the number observed because 42% of the observed mammal species and 25% of the observed bird species were recorded opportunistically. Mammal species not included in the species accumulation curve analysis included all of the recorded bat species (9 species), *Leggadina lakedownensis*, and *Bos taurus*. Bird species recorded opportunistically are not included in the species accumulation curve analysis included Australasian Grebe, Australian Reed-Warbler, Black-fronted Dotterel, Black-shouldered

Kite, Brown Goshawk, Brown Quail, Bush Stone-curlew, Eastern Barn Owl, Fairy Martin, Fork-tailed Swift, Grey Falcon, Horsfield's Bushlark, Pacific Black Duck, Southern Boobook, Spotless Crake, Spotted Harrier, Spotted Nightjar, Star Finch, Tree Martin, Wedge-tailed Eagle, Welcome Swallow, Whistling Kite, White-faced Heron, White-necked Heron and Wood Sandpiper.

When the number of taxa observed is compared with the potential number occurring based on WAM FaunaBase, Birds Australia Atlas Database (Birdata) and field guides, the percentages are overall moderately lower, suggesting that the survey is incomplete. Potential species lists based on database and field guide searches tend to overestimate the number of fauna potentially occurring in an area, as they include fauna that may not normally inhabit the habitats within it and species only present sporadically during certain seasons or conditions. Additionally, it is difficult to predict the effect that habitat quality, successional stage or completeness may have on the fauna of a given area. For these reasons, the species estimators based on actual collected data are more likely to be accurate, although the potential for greater species richness should not be ruled out.

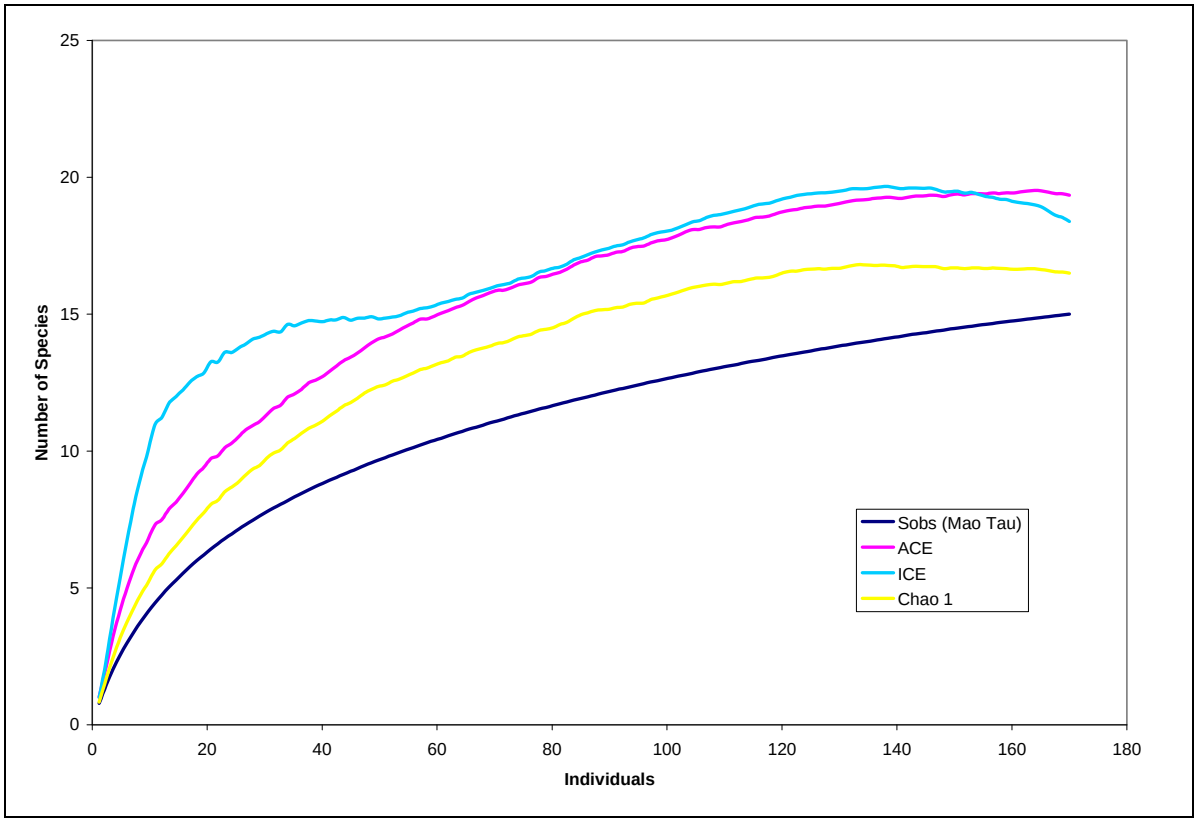


**Figure 4.3 – Species accumulation curve for Mammal species recorded**

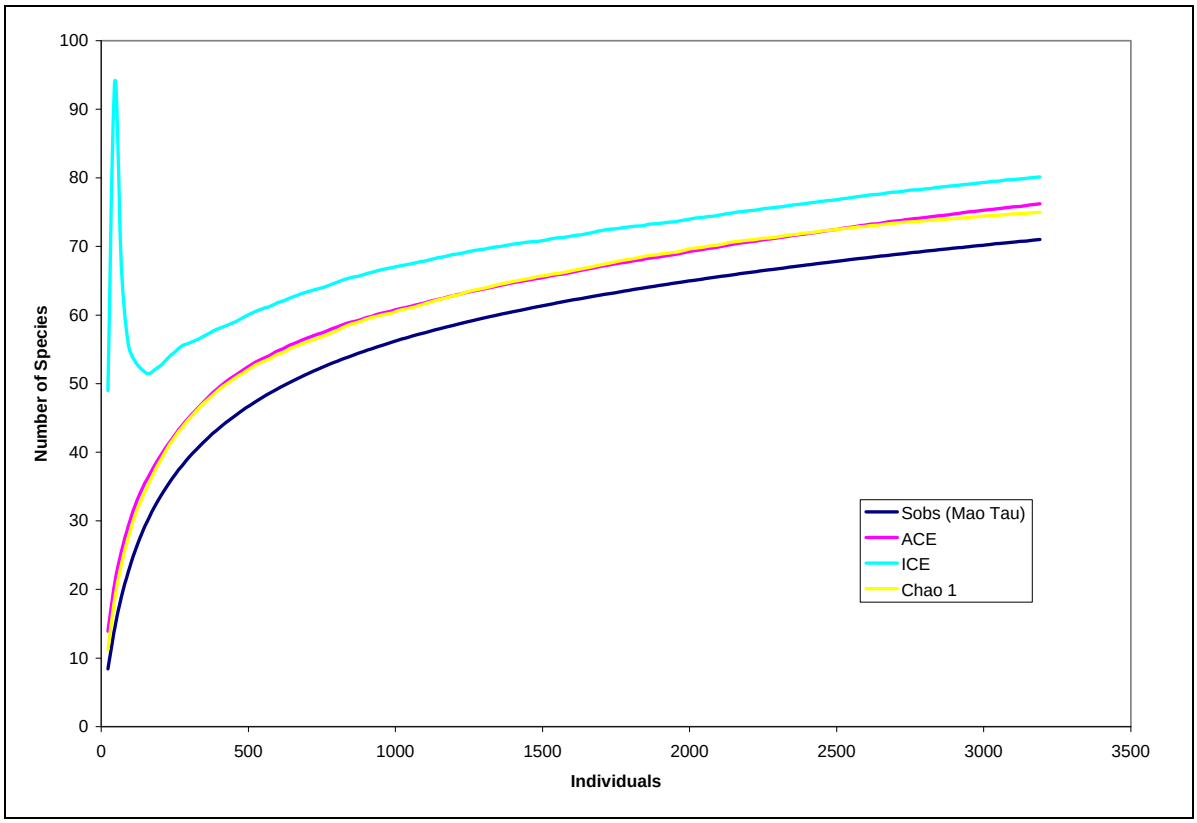


**Figure 4.4 – Species accumulation curve for Bird species recorded**

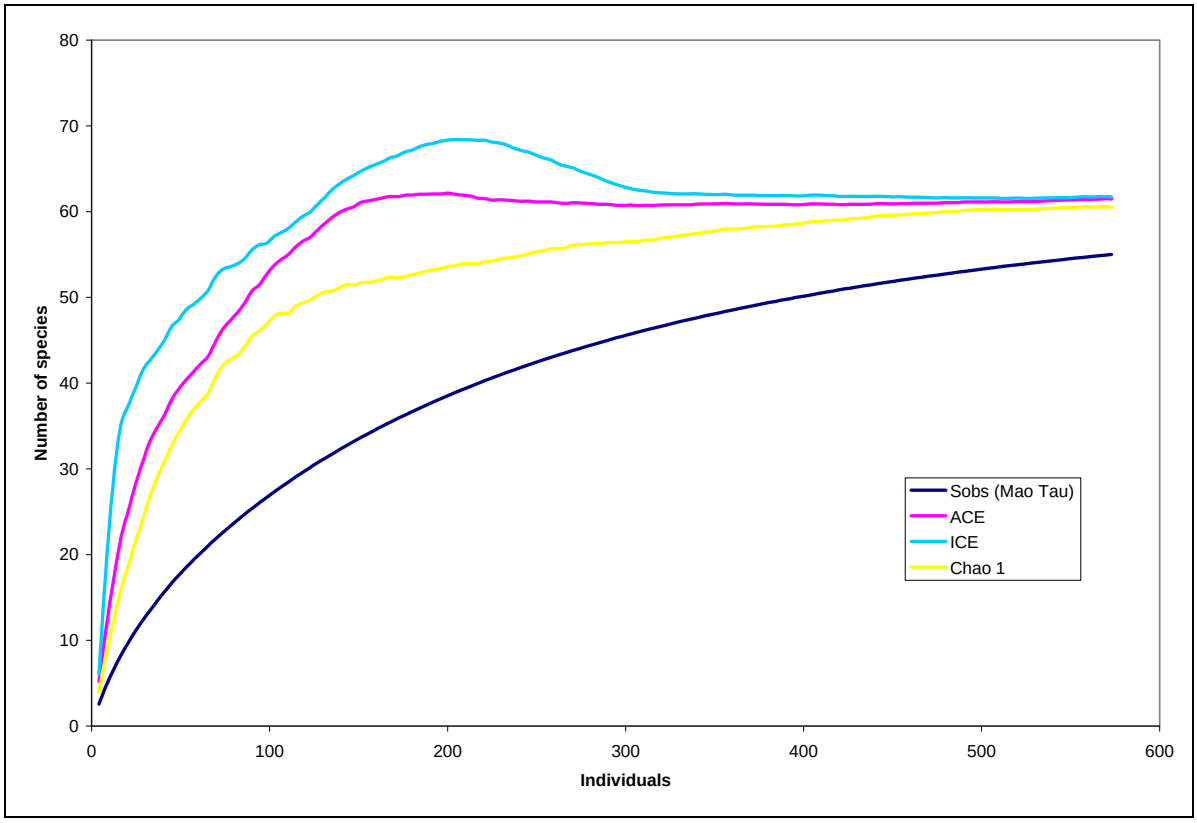


**Figure 4.5 – Species accumulation curve for Reptile species recorded**

## 4.4 SURVEY LIMITATIONS

Limitations of the current survey are summarised in Table 4.4 below.

**Table 4.4 – Summary of survey limitations**

| CONSTRAINT | RELEVANT (yes/no) | COMMENT |
|---|---|---|
| Competency/ experience of the consultant carrying out the survey. | No | All survey staff were experienced in both fauna survey techniques and in their individual specialised roles (Section 3.9). |
| Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions). | No | All sampling methods were employed, with no constraints. |
| Proportion of fauna identified, recorded and/ or collected. | No | Based on SACs and relevant estimators (Table 4.3) the majority of the fauna species that occur in the survey area were recorded. |
| Sources of information (previously available information as distinct from new data). | No | Several previous biological surveys have been conducted in the region of the Chichester range. Two biological surveys were available prior to the completion of this report. |
| The proportion of the task achieved and further work which might be needed. | No | Seven trapping sites and six opportunistic sites were surveyed during this survey. No further work is required for this section of the rail duplication. |
| Timing/ weather/ season/ cycle. | No | Two phases were conducted in spring and autumn. Phase 2 was conducted in April with over 200 mm of rainfall in the previous two months. |
| Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention). | Yes | A large scale fire occurred between the two phases of this survey resulting in changes to habitats at sites CH01 and CH02. |
| Intensity (in retrospect was the intensity adequate). | No | The survey intensity was adequate. All habitat types were surveyed. |
| Completeness (e.g. was relevant area fully surveyed). | No | Seven Level 2 sites and six opportunistic sites were surveyed during this survey. The project footprint was fully surveyed. |
| Resources (e.g. degree of expertise available in animal identification to taxon level). | No | Sufficient expertise and resources were available during this survey (Section 3.9). |
| Remoteness and/ or access problems. | No | Suitable resources were available to access all areas of the project footprint. |
| Availability of contextual (e.g. biogeographic) information on the region. | No | Sufficient contextual information was available on the Pilbara region and the survey area. |
| Efficacy of sampling methods (i.e. any groups not sampled by survey methods). | No | Survey methods were suitable to record all vertebrate fauna groups although a lack of rainfall resulted in an under representation of amphibian fauna. |

# 5 CONSERVATION SIGNIFICANT FAUNA

## 5.1 STATUTORY FRAMEWORK

Fauna species that have been formally recognised as rare, threatened with extinction, or as having high conservation value are protected by law under Commonwealth and State legislation. At the national level, fauna are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Within WA, rare fauna are listed under the *Western Australian Wildlife Conservation Act 1950: Wildlife Conservation (Specially Protected Fauna) Notice 2008* (WC Act). International Agreements include the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

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

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

## 5.2 CONSERVATION SIGNIFICANT FAUNA POTENTIALLY OCCURING IN THE STUDY AREA

Table 5.1, overleaf, provides an overview of the conservation significant fauna that were recorded during the survey or that have the potential to occur within the project areas. Potential to occur is based on the habitats present in the project areas, known distribution, DEWHA and DEC database searches and the results of previous biological surveys in the surrounding region. Also included in Table 5.1 is a summary of the species' conservation status, preferred habitat and likelihood of occurrence based on habitat requirements and previous records. Each species is considered more fully in Sections 5.3. Nineteen species of conservation significance potentially occur in the area of the Chichester Rail Deviation, including 8 mammal species, 9 bird species and 2 reptile species. A further four migratory bird species (White-bellied Sea-Eagle *Haliaeetus leucogaster*, Great Egret *Ardea alba*, Cattle Egret *Ardea ibis* and Oriental Plover *Charadrius veredus*) were identified during the EPBC protected matters database search. These are restricted to coastal and wetland area and are not expected to occur in or around the project area and as such are not included in the conservation significant species summary.

**Table 5.1 – Conservation significant fauna potentially occurring in study area.**

| SPECIES | CONSERVATION SIGNIFICANCE | | | HABITAT | PREVIOUS RECORDS | LIKELIHOOD OF OCCURRENCE | REGIONAL IMPACTS |
|---|---|---|---|---|---|---|---|
| | EPBC | WCA | DEC | | | | |
| Mammals | | | | | | | |
| Ghost Bat (*Macroderma gigas*) | | | P4 | Wide range of habitats; natural rockpiles in the local area. | Recorded this survey. | **HIGH – NON-RESIDENT** Call recorded at CH03. There were no potential roost caves or caverns in the rail corridor. | **LOW** No suitable roost locations recorded. Development will not significantly impact foraging habitat. |
| Northern Short-tailed Mouse (*Leggadina lakedownensis*) | | | P4 | Wide range of habitats, all on seasonally inundated red or white sandy-clay soils. | Recorded this survey and during a recent Level 1 survey at Quarry 8 (*ecologia* Environment 2008b). | **HIGH – RESIDENT** Recorded on cracking clays just south of Shaw Siding and several recent records. | **LOW** Extensive suitable habitat adjacent to project area. Low impact to habitat in project area. |
| Western Pebble-mouse (*Pseudomys chapmani*) | | | P4 | Spurs and rocky hills with many small pebbles vegetated by hummocks of large spinifex. | 20 mounds recorded during this survey. | **HIGH – RESIDENT** Numerous active or recently active mounds were located suggesting species is resident. | **LOW** Suitable habitat common across Pilbara. Low impact from development on local populations. |
| Northern Quoll (*Dasyurus hallucatus*) | EN | S1 | | Rocky areas, also eucalypt forest and woodland. | Recorded north and southwest of the survey area (Strahan 1995; *ecologia* 2008d). | **MEDIUM** Recent records from Abydos plain and Quarry 4 approx. 90 km to the north (scats and tracks). Also known from Hamersley range area which is approx 30 km to the south. | **LOW** Suitable habitat only recorded near Bamboo Spring. Specimens recorded in surrounding areas. |
| Greater Bilby (*Macrotis lagotis*) | VU | S1 | | Spinifex hummock grassland and acacia scrub. Large multi-entranced burrow systems characteristic. | Regional records from within 7 km of study area (DEC rare fauna database). | **MEDIUM** Nearby records of the species, but no burrows were observed within the rail corridor. | **LOW** No suitable habitat located in the project area. Low likelihood of utilising project corridor if present due to fauna habitats present. |

| SPECIES | CONSERVATION SIGNIFICANCE | | | HABITAT | PREVIOUS RECORDS | LIKELIHOOD OF OCCURRENCE | REGIONAL IMPACTS |
|---|---|---|---|---|---|---|---|
| | EPBC | WCA | DEC | | | | |
| Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) | VU | S1 | | Roosts in hot, humid caves. | No records in the region. No suitable habitat within the survey area. | **LOW** No suitable roost sites within project area and no nearby records. | **LOW** No suitable habitat present. Low likelihood of occurrence in the project area. |
| Long-tailed Dunnart (*Sminthopsis longicaudata*) | | | P3 | Rocky habitat with spinifex or open habitat with a rocky mantle. | No previous records, but suitable habitat is present. | **LOW** No nearby records but potentially suitable habitat is present. | **LOW** Low likelihood of occurrence. Widespread populations across arid regions. |
| Brush-tailed Mulgara (*Dasycercus blythi*) | | | P4 | Sandy areas with moderately dense spinifex with 'runways' between clumps. | Not recorded within 50 km, but some suitable habitat exists in southern areas. | **LOW** Not recorded and no nearby records, but some potential habitat is present | **LOW** Suitable habitat in adjacent areas. Low likelihood of occurrence. |
| Birds | | | | | | | |
| Rainbow Bee-eater (*Merops ornatus*) | Mig | | | Open country, most vegetation types, dunes, banks. | Recorded this survey. | **HIGH – RESIDENT** May breed within study area | **LOW** Relatively common and abundant species. Nomadic and suitable habitat adjacent to project area. |
| Fork-tailed Swift (*Apus pacificus*) | Mig | | | Almost entirely aerial lifestyle. Nomadic. | Recorded during survey to the north of the project area. | **HIGH – OVERFLYING VISITOR** Will not use habitats present in the study area | **LOW** Almost entirely aerial. Will not use habitat within project area |
| Wood Sandpiper (*Tringa glareola*) | Mig | | | Coastal wetlands, casual in interior. | No previous records, but recorded during the survey at Bamboo Springs | **HIGH – VISITOR ON PASSAGE** Species uses Bamboo Springs wetland on passage | **LOW** Only suitable habitat is Bamboo Spring. Can easily move to suitable habitat nearby. |
| Australian Bustard (*Ardeotis australis*) | | | P4 | open grasslands, chenopod flats and low heathland. | Recorded this survey | **HIGH – NOMADIC VISITOR** May breed within project area. | **LOW** Locally common. Suitable habitat adjacent to project area. |

| SPECIES | CONSERVATION SIGNIFICANCE | | | HABITAT | PREVIOUS RECORDS | LIKELIHOOD OF OCCURRENCE | REGIONAL IMPACTS |
|---|---|---|---|---|---|---|---|
| | EPBC | WCA | DEC | | | | |
| Bush Stone-curlew (*Burhinus grallarius*) | | | P4 | Lightly wooded country next to daytime shelter of thickets or long grass. | Recorded opportunistically to the north of the project area (see Figure 5.1). | **HIGH – RESIDENT** Species is likely to occur within project area | **LOW** Suitable habitat adjacent to project area. Territory of individuals large enough to allow movement away from disturbances |
| Star Finch (Western) *(Neochmia ruficauda subclarescens*) | | | P4 | Vegetation around watercourses. | Recorded this survey at Bamboo Spring. | **HIGH – RESIDENT** Resident and potentially breeds at Bamboo Spring. | **LOW** Impacts restricted to those affecting Bamboo Spring. Small proportion of population affected by project. |
| Grey Falcon (*Falco hypoleucos*) | | | P4 | Lightly wooded coastal and riverine plains. | Recorded this survey at Repeater 5 (outside project area). | **HIGH – HUNTING VISITOR** Proximity of the breeding pair suggests it is likely that the area will be used for hunting on occasion | **LOW** Foraging area much larger than area impacted by the project. Capable of moving away from disturbances. |
| Peregrine Falcon (*Falco peregrinus*) | | S4 | | Coastal cliffs, riverine gorges and wooded watercourses. | Recorded in area by DEC. May hunt in the project area. | **MEDIUM – HUNTING VISITOR** Recorded just north of study area and may use lease for hunting. | **LOW** Foraging area much larger than area impacted by the project. Capable of moving away from disturbances. |
| Night Parrot (Pezoporus occidentalis) | EN | S1 | CR | *Triodia* hummock grassland or chenopod shrublands. Thick unburnt vegetation most suitable | Three individuals observed at Minga Well, Approx 30km from the project area (Bamford and Mahony 2005) | **MEDIUM – RESIDENT** Suitable habitat in some unburnt pockets of vegetation. Recorded nearby. | **LOW** Impacts from project development will not disturb significant area of habitat. Suitable habitat nearby. |
| Reptiles | | | | | | | |
| *Ramphotyphlops ganei* | | | P1 | Unknown. Previous record found in clay / loam with spinifex. | Recorded in survey area (*ecologia* 2005) | **HIGH – RESIDENT** Species is likely to still be resident in the project area, despite not being recorded. | **LOW** Suitable habitat (moist gorges) in adjacent areas. Limited records but widely dispersed. |

| SPECIES | CONSERVATION SIGNIFICANCE | | | HABITAT | PREVIOUS RECORDS | LIKELIHOOD OF OCCURRENCE | REGIONAL IMPACTS |
|---|---|---|---|---|---|---|---|
| | EPBC | WCA | DEC | | | | |
| Pilbara Olive Python (*Liasis olivaceus barroni*) | VU | S1 | | Gorges and escarpments, Areas of permanent water. | No records in the region. Limited suitable habitat exists in the survey area. | **MEDIUM – RESIDENT WITH RESTRICTED DISTRIBUTION** Generally no suitable habitat for the species, except for permanent water, associated vegetation and rocky cliff at Bamboo Springs. | **LOW** Potential occurrence restricted to Bamboo Spring. Suitable habitat in adjacent areas. |

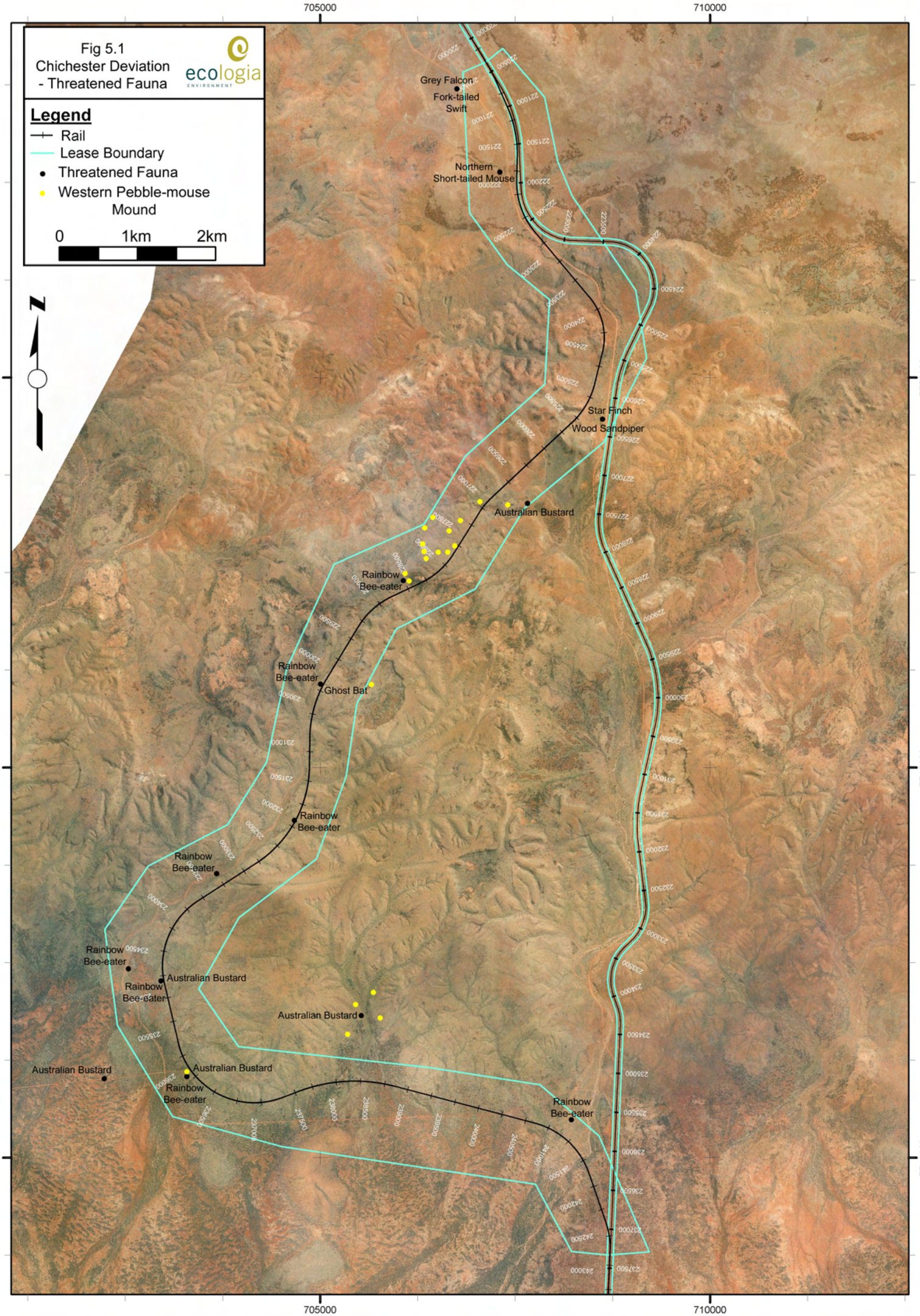
Fig 5.1
Chichester Deviation
- Threatened Fauna
ecologia
ENVIRONMENT
Legend
Rail
Lease Boundary
Threatened Fauna
Western Pebble-mouse Mound
0
1km
2km
N
705000
710000
7550000
7545000
7540000
Grey Falcon
Fork-tailed Swift
Northern Short-tailed Mouse
Star Finch
Wood Sandpiper
Australian Bustard
Rainbow Bee-eater
Ghost Bat

## 5.3 SUMMARY OF ASSOCIATED CONSERVATION SIGNIFICANT FAUNA

Listed below are descriptions of the conservation significant species that potentially occur in the survey area, including their biology and habitat preferences and a discussion of how these relate to their likelihood of occurrence within the survey area.

### 5.3.1 MAMMALS

#### 5.3.1.1 Ghost Bat (*Macroderma gigas*) – DEC Priority 4

The Ghost bat is a large microchiropteran (150 g) and is Australia's only strictly carnivorous bat. It has a patchy but widespread distribution across northern Australia, in a range of habitats from the arid Pilbara to the lush rain forests of north Queensland. Suitable habitat appears to be determined by the availability of suitable roosting sites (Strahan 1995). Preferred roosting habitats in the Pilbara include caves beneath bluffs of low, rounded hills composed of Marra Mamba geology, and granite rockpiles. They have also been known to roost in large colonies within sandstone caves, under boulder piles and in abandoned mines (Churchill 1998).

The Ghost Bat preys on a variety of animal species taking captured items to an established feeding site to be eaten. These feeding sites are usually a rock overhang or small cave, and are easily recognised by the accumulation of discarded prey parts littering the floor (Richards *et al.* 2008). Foraging occurs in an area of approximately 60 ha, in a radius of approximately two kilometres from its roost (Tidemann *et al.* 1985).

Ghost Bat distribution has steadily contracted northwards both before and after European colonisation. Local populations are focussed on maternity sites with little interpopulation migration (Worthington-Wilmer *et al.* 1994; Hoyle *et al.* 2001) which makes the species of considerable conservation concern since, although Ghost Bats disperse widely when not breeding, to date only 10 maternity sites have been found (Richards *et al.* 2008). Ghost Bats are regarded as being shy of human presence and may abandon roosts if disturbed.

A single call was recorded during this survey from site CH03, a wooded gully surrounded by rocky ridges. Roost sites may exist in the lateritic breakaways that occur on the ridge tops of the Chichester Range, but there were no locations within the project boundary that appeared to be suitable as roost sites, and the individual recorded is therefore likely to have been foraging in the study area, but not resident.

Ghost Bats are unlikely to be affected by the development of the rail deviation works due to a lack of suitable roosting sites with in the project area and minimal loss of foraging habitat due to clearing and ground disturbance associated with the development of this project.

#### 5.3.1.2 Northern Short-tailed mouse (*Leggadina lakedownensis*) – DEC Priority 4

The Northern Short-tailed Mouse is found infrequently across northern Australia with some possibility that two populations exist, divided by the Gulf of Carpentaria (Moro and Kutt 2008). The species has been recorded from diverse habitats ranging from the monsoon tropic coast to semiarid climates, including spinifex and tussock grasslands, samphire and sedgelands, *Acacia* shrublands, tropical *Eucalyptus* and *Melaleuca* woodlands and stony ranges. Most habitats, however, are seasonally inundated on red or white sandy-clay soils (Moro and Kutt 2008). Populations can fluctuate greatly, with the first report coming from a population eruption on the Cape York Peninsula in 1969 (Moro and Kutt 2008), but generally this species is secretive and infrequently encountered.

Inhabiting a single entranced burrow during the day, this nocturnal and largely solitary species shows varied reproductive abilities with two litters of four young being produced in

suitable seasons but long-term monitoring indicates that environmental factors are not the sole causal factor (Moro and Kutt 2008). Potential threatening processes have been identified as loss of habitat, habitat degradation and feral predation (Kutt and Kemp 2005).

Individuals were recorded to the north of the Chichester Range in opportunistic observations near sites of cracking clays. One individual was captured in a pitfall trap that was opportunistically installed in the cracking clay area and a second individual was observed being eaten by a Stimson's python during a nocturnal road spotting survey just to the north of the project area (*ecologia* 2008c). There are also DEC records of the species in the nearby area and further north of Shaw Siding, suggesting that the species is resident within the study area.

Suitable habitat was recorded to the north of the project area and will remain largely unaffected by the current project. Development of the project area will not, therefore, have a significant impact on the local population.

#### 5.3.1.3 Western Pebble-mouse (*Pseudomys chapmani*) – DEC Priority 4

The Western Pebble-mouse was first described in 1980, at which time it was discovered that the mounds of pebbles found on stony slopes in the Pilbara were attributable to this species. Preferred habitat is the gentle slopes of rocky ranges where the ground is stony and vegetated by spinifex and a sparse overstorey of eucalypts and scattered shrubs of senna, acacia and ptilotus. Mounds can cover an area of 0.5-9.0 $m^2$ containing many thousands of pebbles averaging 3.5 g (Start 2008). A single mound can house up to 25 mice and breeding can occur at any time of year.

This species occurs across central and southern Pilbara and extends into smaller ranges of the Little Sandy Desert (Start 2008). Abandoned mounds have been found in the Gascoyne and Murchison, indicating a recent decline in distribution. This decline is most likely attributable to foxes and exotic herbivores. However, the species appears relatively secure in its remaining range (Start 2008).

Pebble mounds were recorded throughout the survey area with the majority found in the north (Figure 5.1). Twenty one active or recently active mounds were recorded opportunistically within the rail corridor. Suitable habitat can be found across much of the survey area and the species is likely to be resident.

Suitable habitat for Western Pebble-mice is common but patchily distributed in the Pilbara bioregion. Consequently, Western Pebble-mice are locally common where suitable habitat exists. The northern areas of the project corridor and adjacent areas of rolling, dissected plateau covered in a stony mantle provide ample suitable habitat for the species, and it is in these areas that the majority of active or recently active pebble mounds were observed. Given the reasonably large adjacent areas of suitable habitat, the local population is not expected to be significantly affected in the longer term by the development of this project. Regionally, extant populations are widespread (Start 2008) and as such will not be impacted by the development of this project.

#### 5.3.1.4 Northern Quoll (*Dasyurus hallucatus*) – EPBC Act Endangered, WC Act Schedule 1

The Northern Quoll is the smallest of the quolls. They are nocturnal and opportunistic omnivores feeding primarily on large insects, small vertebrates and soft fruits. Northern Quolls are both terrestrial and arboreal and use a variety of den sites including rock crevices, tree hollows, logs, termite mounds, house roofs and goanna burrows (Oakwood 2008). Most successful breeding occurs near creeklines and individuals readily drink when water is available.

Northern Quolls formerly occurred across northern Australia from the Pilbara region in Western Australia to south-eastern Queensland. A 75% reduction in habitat range occurred during the 20th century, so that the species is now restricted to the Pilbara and north Kimberley in Western Australia and to a few discreet populations across the Northern Territory and eastern Queensland (Braithwaite and Griffiths 1994).

Northern quolls could potentially occur within the project area but no individuals or signs of this species were recorded within the survey area. An individual and other signs (scats and tracks) were observed in the Redmont Camp lease (25 km north of the survey area) during the first phase of this survey. Individuals have also been recorded further north at numerous locations on the Abydos plain (*ecologia* 2008d) and between Port Hedland and Quarry 3 (*ecologia* 2008b), and to the south in the Hamersley Range (Strahan 1995) suggesting a widespread distribution and that they may occur in the project area despite a lack of evidence.

Areas likely to support Northern Quolls are those that are near potential den sites, such as rocky areas prone to forming cracks and crevices, tree hollows in eucalypts along creeklines, and termite mounds. Areas within the project area Northern Quolls are most likely to inhabit include rocky areas near Bamboo Springs where permanent water provides a source of water and potential prey. They are likely to disperse as juveniles during the wet summer months and may inhabit other areas of the lease at these times as well, particularly if standing water is present, such as may occur along the creekline within the western portion of the project corridor, or the larger creekline that is crossed by the rail corridor where it turns south (referred to in Section 6.1.3).

Because very few areas within the project corridor provide suitable habitat for northern quolls, and individuals are found across much of northern Australia, including off shore islands, the development of the project is not expected to significantly impact this species.

#### 5.3.1.5 Greater Bilby (*Macrotis lagotis*) – EPBC Act Vulnerable, WC Act Schedule 1

The Greater Bilby is a medium-sized, ground-dwelling, nocturnal marsupial that construct extensive tunnel systems (Johnson 2008). Greater Bilbies occur in a variety of habitats, including spinifex grassland, acacia shrubland, open woodland, and cracking clays (Maxwell *et al.* 1996; Johnson 2008).

The species underwent a sudden and widespread collapse in population size in the early 1900s, and the distribution may still be contracting and fragmenting. Reasons for the decline include predation by feral predators, competition from rabbits and livestock, reduced food as a result of changed fire regimes, and drought (Maxwell *et al.* 1996; Johnson 2008).

The closest record of the Greater Bilby, from the DEC threatened fauna database, occurs within 7 km of the southern end of the rail deviation. The likelihood that Greater Bilbies occur in the deviation section of the rail project is low, because their favoured habitat is mostly located in the mulga shrublands to the south of the lease where it has previously been recorded (DEC database). No suitable habitat was found within the rail deviation. Development of the rail deviation is unlikely to impact this species regionally and the proposed disturbance within the project area represents a low threat to the local populations, if present, as it is unlikely that the species would utilise areas close to the railway for constructing burrows.

#### 5.3.1.6 Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) – EPBC Act Vulnerable, WC Act Schedule 1

The Pilbara Leaf-nosed Bat is the Pilbara form of the Orange Leaf-nosed Bat (*Rhinonicteris aurantia*), which occurs across the Kimberley and Northern Australia. While it is considered a separate form, formal reclassification has been hampered by the small sample size of the

Pilbara population. Both forms are morphologically similar, but differ in the size of the noseleaf, forearm and rostral part of the skull (Armstrong 2008).

Recent evidence suggests two main stronghold areas for the Pilbara Leaf-nosed Bat: north of Marble Bar and in the western Pilbara (Armstrong 2008). In the western Pilbara, they roost in caves formed in gorges that dissect siliceous sedimentary geology. It is most often observed in flight over waterholes in gorges, although they are rare even in the Hamersley Ranges where this habitat is common (Armstrong 2008). The Pilbara Leaf-nosed Bat chooses roosts in areas of high relief with gorges and watercourses (Armstrong 2001). This seems to be related to maintaining high ambient temperatures and relative humidity, although caves with these conditions are uncommon (Armstrong 2008).

This species was not recorded during this survey and there appears to be no suitable roost habitat (deep caves and caverns associated with permanent or semi-permanent waterbodies to provide humidity) within the project area, and the species is though to be absent.

No impact to the species as a result of the proposed rail development is anticipated.

#### 5.3.1.7 Long-tailed Dunnart (*Sminthopsis longicaudata*) – DEC Priority 3

The Long-tailed Dunnart is a small carnivorous marsupial (15-25 g), distinguished from other *Sminthopsis* species by the length of its tail: more than twice the head-body length (Strahan 1995). The Long-tailed Dunnart appears to be a spring-summer breeder with records from the Murchison region of pouch young from October through to dispersing young trapped as late as April (Burbidge and Johnson 2008).

Recent observations of this species indicate that it is found in widely scattered localities across the arid zone of Western Australia into the southern areas of the Northern Territory. It is mostly found in rocky country, but occasionally in open country with a gravel / stony mantle, where it feeds on arthropods such as beetles, ants, spiders, cockroaches, centipedes, grasshoppers, and larvae (Burbidge *et al.* 2008).

No individuals were recorded during this survey and there have been no nearby records (DEC rare fauna database), but suitable habitat exists amongst the rocky ridges of the Chichester range and in the northern sections of the study area where there are undulating stony plains. The presence of the species within the study area cannot be ruled out but it is considered unlikely to be present.

The impact of this project on the Long-tailed Dunnart to be considered very low due to a low likelihood of occurrence in the project area and widespread regional populations across arid Australia.

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

The Brush-tailed Mulgara has only recently been reclassified and separated from the genetically and morphologically distinct Crest-tailed Mulgara (*Dasycercus cristicauda*) (Woolley 2006). The more widespread Brush-tailed Mulgara is listed as Priority 4 (fauna in need of monitoring) in the DEC Priority and Threatened Fauna list (2008).

Brush-tailed Mulgara are a medium-sized dasyurid with a characteristic short thick tail that is covered in black hairs for most of its length (Woolley 2008). They occur sporadically on spinifex grasslands throughout much of the arid zone (Woolley 2008). Believed to be generally solitary, Brush-tailed Mulgara construct several single entranced, multi-tunnelled burrows within their home range (Woolley 2008). Brush-tailed Mulgara are nocturnal hunters, feeding on arthropods and small vertebrates. Breeding is believed to occur in late winter to spring (Woolley 2008).

There are no nearby records of the species but some suitable habitat exists, particularly on flatter floodplain areas in the southern part of the study area (adjacent to the existing BHPBIO rail line). It is not thought that the species is resident within the project area.

Brush-tailed Mulgara was not recorded during systematic or opportunistic surveys throughout the project area, although there is some potentially suitable habitat present in the southern areas of the project corridor. Extensive areas of similar habitat occur on both sides of the project corridor to the south, and the project will not significantly impact regional populations provided that increases in feral fauna and fire are prevented.

### 5.3.2 BIRDS

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

The Rainbow Bee-eater is a striking, colourful bird that lives almost anywhere suitable for hawking insects - principally bees, flies, dragonflies and grasshoppers. They are scarce to common throughout much of Western Australia, except for the arid interior, preferring lightly wooded, preferably sandy, country near water (Johnstone and Storr 1998) and can occur as a resident, breeding visitor, postnuptial nomad, passage migrant or winter visitor.

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

Rainbow Bee-eaters were recorded at sites CH01, CH02, CH03, Ch05, CH06 and CH07 and 9 individuals were also recorded opportunistically (Figure 5.1). Suitable habitat was recorded across most of the survey area with breeding tunnels found in river banks along the main creekline (Figure 5.2), suggesting that the species is a breeding resident.

**Figure 5.2 – Rainbow Bee-eater nesting tunnel located in a river bank (Map 50K 702561E 7542848N)**

Rainbow Bee-eaters are common and wide ranging, nesting in burrows dug into sandy soil. Young, which may be present between August and November, could be killed during clearing (Johnstone and Storr 1998) but adults are expected to be able to avoid harm. Breeding pairs may continue to utilise the project area, and the loss of some young birds as a result of the proposed development is possible, but because of the species abundance no significant effect on the local or regional population is expected.

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

The Fork-tailed Swift is a small insectivorous species with an almost entirely aerial habit. This species is distributed from central Siberia and throughout Asia, breeding in north-east and mid-east Asia, and wintering in Australia and south New Guinea. In Western Australia the species begins to arrive in the Kimberley in late September, in the Pilbara in November and in the South-west by mid-December (Johnstone and Storr 1998).

In Western Australia, the Fork-tailed Swift is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone and Storr 1998).

Two individuals were recorded to the north of the survey area near Repeater 5. Due to their aerial and nomadic lifestyle, Fork-tailed Swifts are likely to overfly the project area at times but will not directly utilise the habitats within the project area.

This almost entirely aerial, migratory species does not directly use habitats within the project area and will not be affected by the Chichester Range Deviation.

#### 5.3.2.3 Wood Sandpiper (*Tringa glareola*) – EPBC Act Migratory

Wood Sandpipers inhabit well watered areas, especially coastal plains and plains about lower courses of larger rivers, but are casual in the interior (Johnstone and Storr 1998). They breed in the northern hemisphere and visit the southern hemisphere during the northern winter, and are present in Australia from August to May preferring shallow fresh waters, and rarely saltlakes and estuaries (Johnstone and Storr 1998).

Although it was recorded in the study area it is unlikely to be resident, but probably occurs transiently on its southwards passage. It was recorded during phase 1 but not in phase 2.

Because Wood Sandpipers are likely to occur transiently whilst on passage, they are unlikely to be impacted by development within the project area. Bamboo Springs is a permanent wetland that may be important to the species as a stopover point while on migration. An individual was present at Bamboo Springs from 14$^{th}$ to 16$^{th}$ October 2008 (but not thereafter) lending weight to this suggestion.

#### 5.3.2.4 Australian Bustard (*Ardeotis australis*) – DEC Priority 4

Australian Bustards are a large ground-dwelling bird that occurs Australia-wide and utilises a number of open habitats, including open or lightly-wooded grasslands, chenopod flats, plains and heathlands (Johnstone and Storr 1998). It is unmistakeable in the field, being the only bird of its size and shape, and is usually encountered either singly or in small single-sex groups. Occasionally it occurs in flocks of more than 30 in remote areas (Blakers *et al.* 1984).

Australian Bustards are a nomadic species, ranging over very large areas, and thus its abundance varies locally and seasonally from scarce to common, largely dependent on rainfall and food availability. The Australian Bustard breeds when conditions are favourable. In northern Australia, this is generally late in the wet season or early in the dry (January to March).

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

Australian Bustards were recorded at sites CH01, CH04, CH05 and CH06 as well as 3 opportunistic observations within the study area. This species appears to be relatively common in the survey area with suitable habitat occurring across much of the proposed rail corridor.

Because Australian Bustards are mobile and relatively common in the Pilbara, and habitat suitable for the species is widespread and common in the surrounding areas, the proposed development will not affect the species regionally or locally.

#### 5.3.2.5 Bush Stone-curlew (*Burhinus grallarius*) – DEC Priority 4

The Bush Stone-curlew is a moderately large, nocturnal, ground dwelling bird characterised by a thick bill, long legs and short toes (Johnstone and Storr 1998). They occur across much of Australia, except the arid interior and central south coast, preferring lightly wooded country near thickets or long grass that act as daytime shelter. They are usually seen in pairs, although in the breeding season (August to January), small flocks gather.

Historically, this species was widely distributed throughout much of WA, but it is now considered rare, with an estimated Australian population of 15,000 individuals (Garnett and Crowley 2000). Since Bush Stone-curlews are a ground dwelling and non-migratory they are susceptible to local disturbances by humans and to predation by cats and foxes (Frith 1976). They are most common where land disturbance is minimal and generally become rare or extinct around human settlements (Johnstone and Storr 1998).

The single opportunistic record of this species was from a call recorded along the access road north of the project area during a nocturnal survey. This record is not within the survey area but its close proximity indicates that the species may occur in the project area because the habitats are similar.

Although Bush Stone-curlews are prone to disturbance, the development of the Chichester Deviation is not expected to result in significant impacts on local populations and is not expected to affect the viability of the population in the wider region.

#### 5.3.2.6 Star Finch (Western subspecies) (*Neochmia ruficauda subclarescens*) – DEC Priority 4

The Star Finch is found across northern Australia, including the Pilbara region where it is patchily distributed. It feeds mainly on small grass seeds, but also flying ants, termites and other small insects and spiders. Typical Star Finch habitat is long grass or rushes around swamps and lagoons or permanent pools. It is also found in irrigated crops and pastures. It usually occurs in pairs or small flocks. Breeding occurs between February and October. Both parents incubate the eggs and care for the young (Johnstone and Storr 2004).

Several individuals were recorded at Bamboo Springs (Figure 5.1) during the first phase of this survey, where thick reedbeds and vegetation surround small pools of permanent water. Seasonally suitable habitat can also be located in the creeklines where pools of water may form and remain for extended periods of time.

Preferring habitats consisting of long grasses and reeds beside permanent water, this species could potentially be affected by the Chichester Range Deviation. The only suitable habitat recorded during this survey (Bamboo Springs) is located close to where the rail deviation rejoins the original rail line. Any disturbance to this area will result in the loss of an important piece of habitat that is relatively rare in the local area and may form a corridor between larger areas of suitable habitat such as the Fortescue and the DeGrey Rivers. There is a high potential for significant disturbance due to the close proximity of this area to the proposed railway line, which will cause the loss of the local population of Star Finches. Avoiding disturbance to Bamboo Springs will prevent this loss, although the trampling of reeds by cattle remains a potential threat to the population.

#### 5.3.2.7 Grey Falcon (*Falco hypoleucos*) – DEC Priority 4

Grey Falcons are a rare, nomadic falcon, sparsely distributed across much of arid and semi-arid Australia. In Western Australia, they are restricted to the northern half, occurring in a variety of habitats ranging from wooded drainage systems through to open spinifex plains. Grey Falcons once occurred across much of Western Australia with sightings as far south as York and New Norcia during colonial times but the current distribution is now thought to be restricted to north of 26°S (Johnstone and Storr 1998). Because the distribution of this species is very scarce over an extremely large area, sightings of this species are very uncommon. Although there is no evidence of a significant decline in abundance, clearance of the arid zone for marginal farming has destroyed some habitat and has the potential to destroy more. Overgrazing may also affect prey abundance (Garnett and Crowley 2000).

Like other falcons this species preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops, although reptiles and mammals are also taken (Johnstone and Storr 1998). Two to three eggs are laid in winter in the nests of other birds of prey and ravens, typically in tall eucalypt trees near water (Garnett and Crowley 2000) and the nest is rarely used more than once (Johnstone and Storr 1998).

A breeding pair of Falcons was recorded during both phases of this survey nesting on Repeater 5. Three fledglings were recorded during phase 1 but only one was present during phase 2. The proximity of a breeding pair of Grey Falcons suggests that they are very likely to utilise the project area and surroundings as hunting grounds, but may not directly use the habitats present.

This species does not breed within the project area, has a large hunting range and a nomadic lifestyle and is therefore unlikely to be impacted significantly by the Chichester Range Deviation. Repeater towers may form important nesting sites for this species and relevant institutions should be notified if further breeding events take place as biological information for this species is limited.

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

This heavily built falcon is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. It most commonly occurs near cliffs along coasts, rivers and ranges and around wooded watercourses and lakes. Peregrines feed almost entirely on birds which are taken in flight.

They nests primarily on ledges in cliffs, granite outcrops and in quarries but may also nest in tree hollows around wetlands. Eggs are predominantly laid in September with a typical clutch size of three eggs (Johnstone and Storr 1998). The species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley, Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr 1998).

No individuals were recorded during this survey and there is little suitable breeding habitat within the survey area. This species has been recorded 3 km north of the survey area however (DEC database), and could be present at times while hunting. It is not expected to be resident within the project area.

The Peregrine Falcon is not expected to be significantly impacted by the proposed project. No potential breeding sites were present within the study area and development of the project will not significantly reduce the potential foraging area of this species.

#### 5.3.2.9 Night Parrot (*Pezoporus occidentalis*) – EPBC Act Endangered, DEC Critically Endangered, WC Act Schedule 1

The Night Parrot is a medium sized nocturnal parrot that spends much of its time on the ground. Historical evidence indicated that the Night Parrots distribution covered much of

semi arid and arid Australia. Extremely secretive and hard to flush there are only 6 accepted records of Night Parrot since 1935, with three from the Pilbara region (1979, 1980 and 2005) (Department of Environment Water Heritage and the Arts 2008). The most recent record is from Minga well during a fauna survey conducted for Fortescue Metals Group (Bamford and Mahony 2005).

Although biological information on this species is limited, preferred habitat is thought to be spinifex (Triodia spp) near water (Johnstone and Storr 1998), spinifex (*Triodia* spp) grasslands on stony or sandy terrain, samphire (Sarcocornia spp) and chenopod shrublands on claypans, floodplains or the margins of saltlakes, creeks or other water bodies (Department of Environment Water Heritage and the Arts 2008) and grassland to low open woodland, with or without spinifex (Garnett *et al.* 1993).

Suitable habitat, spinifex over sandy / stony terrain, is found across much of the project area with dense vegetation patches at site CH07 which would provide necessary cover. No observation were made during this survey, but the close proximity of the most resent observation only 30km to the east and the presence of suitable habitat within the project area result in a medium possibility that Night Parrots exist in the project area.

Large areas of suitable habitat occur adjacent to the project area and individuals are able to move away from any disturbances. Development of this project is not expected to significantly impact this species.

### 5.3.3 REPTILES

#### 5.3.3.1 *Ramphotyphlops ganei* – DEC Priority 1

This blind snake has been recorded in widely separated areas around Newman. Little is known about its biology but it is probably associated with moist gorges (Wilson and Swan 2008). No individuals were recorded during this survey but an individual was recorded within the survey area (Figure 5.1) during a previous biological survey (*ecologia* 2005), and the species could still be resident in moist gorges intersected by the study area.

The habitats within the project area are well represented to the east and west and the species is therefore expected to occur in adjacent areas. The project should not significantly impact the regional population of the species.

#### 5.3.3.2 Pilbara Olive Python (*Liasis olivaceus barroni*) – EPBC Act Vulnerable, WC Act Schedule 1

The Pilbara subspecies of the Olive Python only occurs in the ranges of the Pilbara region of Western Australia. It is isolated from the northern subspecies (*L. o. olivaceus*) in the Kimberley, Northern Territory, and south-west Queensland by the Great Sandy Desert (Wilson and Swan 2008).

Olive Pythons can grow to 2.5 m. In the Pilbara they inhabit watercourses and areas of permanent water in rocky gorges and gullies (Pearson 2006). In warmer conditions the Olive python can move widely, usually in close proximity to water and rock outcrops (Threatened Species Scientific Committee 2008). In late winter or early spring males will travel large distances to find and mate with females. Eggs are laid in November and hatch approximately two months later.

Population size estimates are difficult to determine due to the species cryptic nature and lack of a reliable trapping or survey technique (Threatened Species Scientific Committee 2008).

The main threats to this subspecies are likely to come from predation by feral cats and foxes, competition with foxes for food, and destruction of habitat (Pearson 2006).

No individuals were recorded during this survey and the gullies intersected by the study area were deemed unlikely to harbour the species, as there were no permanent or semi-permanent pools. At Bamboo Springs in the northern part of the study area, however, such habitat exists in proximity to a rocky slope and this was considered to be the only area that Pilbara Olive Pythons could potentially occur in. Diurnal and nocturnal searches did not find any individuals around the springs, but because they are cryptic and shy they are easily overlooked and could still be present.

The regional population is not expected to be significantly impacted by the development of the Chichester deviation as suitable habitat is likely to be present in other areas of the Chichester Range.

# 6 IMPACT ASSESSMENT

The duplication of the BHPBIO Newman to Port Hedland rail from Cowra siding north to Shaw siding will involve a clearing and construction phase followed by ongoing activity following construction, during which there will be greater human activity in the area. The following threatening processes have been identified.

- Vegetation clearing and the associated removal of fauna habitat will result in the loss of local vertebrate communities, a reduction in biodiversity and a loss of ecological function, as well as displacement of local fauna into surrounding areas where they are likely to face competition from established individuals. When a particular habitat type is scarce these negative effects are enhanced.
- Clearing can also cause direct mortality especially of fossorial fauna and fauna which in the face of danger instinctively hide in burrows or under vegetation.
- Human activity (e.g. rubbish and food scraps) and habitat fragmentation may result in an increase in feral fauna which will have a negative impact on native diversity and ecological function due to increased predation and resource competition.
- Accidental fire arising from clearing, building and other activities could cause direct fauna mortality as well as a short to long term loss of habitat.
- Any dust created during clearing, construction and driving on unsealed roads can have a negative affect on native vegetation, reducing its value as fauna habitat.
- Noise made by machinery can have a negative affect on fauna in adjacent areas.
- Vehicle strikes can cause fauna mortality.

The greatest potential threats to diversity as a result of construction and ongoing use of the railway are an increase in the number of feral fauna through inadequate waste management, the introduction of weeds and subsequent degradation of fauna habitats present and fire, which can significantly alter large areas of habitat rendering them unsuitable for fauna habitation.

## 6.1 IMPACTS ON FAUNA HABITATS

Open to very open woodlands over spinifex on rocky soils comprise much of the dominant habitat types that will be impacted by the deviation of the BHPBIO rail through the Chichester Range. These are widespread throughout the region and significant impacts to regional biodiversity are not anticipated, although there are likely to be short-term reductions in diversity as fauna and fauna habitats within the impact footprint are disturbed.

Fauna habitats centred on drainage lines such as creek lines and rocky gullies are moderately common in the region and provide a greater diversity of microhabitats for vertebrate fauna than ridges or plains. Loss of these habitats during the construction of the rail will have a greater impact on the fauna assemblage of the immediate area but, because they are common in surrounding areas, reductions in diversity are expected to be localised and short-term.

Three habitat types that were recorded in the survey area have been identified as being poorly represented in surrounding areas and therefore of greater significance to regional diversity. These are the permanent wetland habitats at Bamboo Springs, located near the northern junction of the rail deviation, the cracking clays located in the northern areas of the project area and a major creekline near site CH07. These are discussed below:

### 6.1.1 BAMBOO SPRINGS

The area around Bamboo Springs is a significant habitat type that is not well represented in surrounding areas. It is an area of permanent water, resulting from a flowing spring, thick vegetation and reed beds which provides suitable habitat to conservation significant species such as Star Finch, migratory birds such as Wood Sandpiper and potentially Northern Quoll and Pilbara Olive Python. Other species recorded here alone were Spotless Crake (which was breeding) and Star Finch. Observations of cattle damaging this area were recorded during this survey indicating a potential impact on this habitat type not related to the development of the rail duplication. If the rail duplication does not disturb this habitat type, trampling and introduction of weeds by cattle will remain the predominant risk to the sensitive reed habitats fringing the water pools.

### 6.1.2 CRACKING CLAY HABITAT

The cracking clay habitat, associated with mixed tussock grassland on the low lying flat / plains (vegetation unit 4), is located between the northern edge of the rocky ridges of the project area northwards to about Garden Siding South and provides a unique fauna habitat associated with several species, including the conservation-significant Northern Short-tailed Mouse. However, the area of this habitat proposed to be disturbed by the rail duplication is very small in relation to the extensive area of cracking clays to the north, and the proposed development will not significantly impact fauna assemblages associated with this habitat type.

### 6.1.3 CREEKLINE WITH DENSE UNDERSTOREY

Located to the south of site CH07, at chainage 241500, is a major creek with fringing tall eucalypts and a well developed understorey. Although creeklines of this type occur in the surrounding areas, recent fires have significantly altered areas with well developed understorey and the associated fauna habitats. Consequently, the fauna habitats associated with well developed riparian understorey are not well represented in the local area as most of the sites do not have the lower vegetation stratum that is found in this area. Large numbers of bird species were observed in this area, some of which are associated with denser wetland vegetation, such as Pheasant Coucal. The creekline is considered to be an important refuge within the local area for these species until similar understorey habitat in adjacent areas regenerates from recent fires over the next five to ten years.

## 6.2 IMPACTS TO FAUNA ASSEMBLAGES

### 6.2.1 BIODIVERSITY

The diversity of fauna assemblages of the subregion as a whole is unlikely to be significantly affected by the duplication of the BHPBIO rail system discussed in this report. Most terrestrial fauna are expected to be able to move to adjacent areas of suitable habitat, but sedentary fauna (e.g. burrowing species or species using leaf-litter or wood to shelter in) are likely to be impacted. Vegetation communities may also be affected by secondary impacts such as fire, dust and weeds as indicated above, reducing the quality of local (or in the case of fire, potentially large areas) fauna habitats available and thereby reducing local diversity in the short term. Following construction, diversity is expected to recover as vegetation communities regenerate in rehabilitated areas and stabilise.

### 6.2.2 ECOLOGICAL FUNCTION

Large-scale impacts to drainage and fauna habitats will be avoided during construction and so the ecosystem functions of the local area and region will not be significantly affected by

the development of the rail duplication. Local fauna losses are anticipated but should recover following construction. Impacts are restricted to the rail corridor and although the rail may cause some restrictions to fauna movements, most fauna are expected to be able to cross the rail corridor. Those that are not may become isolated within the area between the existing and new railways. The extent to which this could impact ecological function in this area is unknown.

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# Appendix A: Fauna potentially occurring in the study area

## Appendix A1 – Mammal species potentially occurring in the survey area

| Family / Species | Common Name | Conservation Status | | | DEC Rare Fauna Search | WAM | Van Dyck and Strahan 2008 | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WAC | DEC | | | | | |
| TACHYGLOSSIDAE | | | | | | | | | |
| *Tachyglossus aculeatus* | Short-beaked Echidna | | | | | | ✓ | | |
| DASYURIDAE | | | | | | | | | |
| *Dasycercus blythi* | Brush-tailed Mulgara | | | | | | ✓ | | |
| *Dasykaluta rosamondae* | Kaluta | | | | | | ✓ | ✓ | |
| *Dasyurus hallucatus* | Northern Quoll | | | | | | ✓ | | |
| *Planigale* sp. | Pilbara Planigale. sp (Undescribed) | | | | | | | ✓ | ✓ |
| *Pseudantechinus roryi* | Rory's Pseudantechinus | | | | | | ✓ | | |
| *Pseudantechinus woolleyae* | Wooley's Pseudantechinus | | | | | | ✓ | | |
| *Ningaui timealeyi* | Pilbara Ningaui | | | | | ✓ | ✓ | ✓ | |
| *Sminthopsis longicaudata* | Long-tailed Dunnart | | | | | | ✓ | | |
| *Sminthopsis macroura* | Stripe-faced Dunnart | | | | | ✓ | ✓ | ✓ | |
| *Sminthopsis ooldea* | Ooldea Dunnart | | | | | | ✓ | | |
| THYLACOMYIDAE | | | | | | | | | |
| *Macrotis lagotis* | Bilby | VU | | | ✓ | ✓ | | | |
| MACROPODIDAE | | | | | | | | | |
| *Lagorchestes conspicillatus* | Spectacled Hare-wallaby | | | | | | ✓ | | |
| *Macropus robustus erubescens* | Euro / Common Wallaroo | | | | | ✓ | ✓ | | |
| *Macropus rufus* | Red Kangaroo | | | | | | ✓ | | ✓ |
| *Petrogale rothschildi* | Rothschild's Rock-wallaby | | | | | | ✓ | | |
| MEGADERMATIDAE | | | | | | | | | |
| *Macroderma gigas* | Ghost Bat | | | | | | ✓ | | |

| Family / Species | Common Name | Conservation Status | | | DEC Rare Fauna Search | WAM | Van Dyck and Strahan 2008 | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WAC | DEC | | | | | |
| HIPPOSIDERIDAE | | | | | | | | | |
| *Rhinonicteris aurantia* | Pilbara Leaf-nosed Bat | VU | | | | | ✓ | | |
| EMBALLONURIDAE | | | | | | | | | |
| *Saccolaimus flaviventris* | Yellow-bellied Sheath-tailed Bat | | | | | | ✓ | ✓ | ✓ |
| *Taphozous georgianus* | Common Sheath-tailed Bat | | | | | | ✓ | | |
| MOLOSSIDAE | | | | | | | | | |
| *Chaerephon jobensis* | Northern Free-tailed Bat | | | | | | ✓ | ✓ | ✓ |
| *Mormopterus beccarii* | Beccari's Free-tailed Bat | | | | | | ✓ | | |
| *Tadarida australis* | White-striped Free-tailed Bat | | | | | | ✓ | | |
| VESPERTILIONIDAE | | | | | | | | | |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | | | | | | ✓ | | ✓ |
| *Chalinolobus gouldii* | Gould's Wattled Bat | | | | | | ✓ | ✓ | ✓ |
| *Chalinolobus morio* | Chocolate Wattled Bat | | | | | | ✓ | | |
| *Scotorepens greyii* | Little Broad-nosed Bat | | | | | ✓ | ✓ | ✓ | ✓ |
| *Vespadelus finlaysoni* | Finlayson's Cave Bat | | | | | ✓ | ✓ | | ✓ |
| MURIDAE | | | | | | | | | |
| *Leggadina lakedownensis* | Northern Short-tailed Mouse | | | P4 | ✓ | ✓ | ✓ | ✓ | |
| *Notomys alexis* | Spinifex Hopping-mouse | | | | | | ✓ | | |
| *Pseudomys chapmani* | Western Pebble-mouse | | | P4 | | | ✓ | | |
| *Pseudomys delicatulus* | Delicate Mouse | | | | | | ✓ | | |
| *Pseudomys desertor* | Desert Mouse | | | | | ✓ | ✓ | ✓ | |
| *Pseudomys hermannsburgensis* | Sandy Inland Mouse | | | | | ✓ | ✓ | ✓ | |
| *Zyzomys argurus* | Common Rock-rat | | | | | ✓ | ✓ | ✓ | |

| Family / Species | Common Name | Conservation Status | | | DEC Rare Fauna Search | WAM | Van Dyck and Strahan 2008 | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WAC | DEC | | | | | |
| **Mus musculus* | House Mouse | | | | | | ✓ | ✓ | |
| CANIDAE | | | | | | | | | |
| **Canis lupus* | Dingo/Dog | | | | | | ✓ | ✓ | ✓ |
| **Vulpes vulpes* | Fox | | | | | | ✓ | | |
| FELIDAE | | | | | | | | | |
| **Felis catus* | Cat | | | | | | ✓ | | |
| LEPORIDAE | | | | | | | | | |
| **Oryctolagus cuniculus* | Rabbit | | | | | | ✓ | | |
| EQUIDAE | | | | | | | | | |
| **Equus asinus* | Donkey | | | | | | ✓ | ✓ | |
| CAMELIDAE | | | | | | | | | |
| **Camelus dromedarius* | One-humped Camel | | | | | | ✓ | | |
| BOVIDAE | | | | | | | | | |
| **Bos Taurus* | Cow | | | | | | ✓ | | |

***Introduced species**

## Appendix A2 – Bird species potentially occurring in the survey area

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| CASUARIIDAE | | | | | | | | | | |
| *Dromaius novaehollandiae* | Emu | | | | | | ✓ | ✓ | ✓ | |
| PHASIANIDAE | | | | | | | | | | |
| *Coturnix pectoralis* | Stubble Quail | | | | | | | ✓ | ✓ | |
| ANATIDAE | | | | | | | | | | |
| *Dendrocygna eytoni* | Plumed Whistling-Duck | | | | | | ✓ | | | |
| *Tadorna tadornoides* | Australian Shelduck | | | | | | ✓ | | | |
| *Chenonetta jubata* | Australian Wood Duck | | | | | | ✓ | ✓ | | |
| *Malacorhynchus membranaceus* | Pink-eared Duck | | | | | | | ✓ | | |
| *Anas gracilis* | Grey Teal | | | | | | ✓ | ✓ | | |
| *Anas superciliosa* | Pacific Black Duck | | | | | | ✓ | ✓ | | |
| *Aythya australis* | Hardhead | | | | | | ✓ | ✓ | | |
| PODICIPEDIDAE | | | | | | | | | | |
| *Tachybaptus novaehollandiae* | Australasian Grebe | | | | | | ✓ | ✓ | | |
| *Poliocephalus poliocephalus* | Hoary-headed Grebe | | | | | | | ✓ | | |
| COLUMBIDAE | | | | | | | | | | |
| *Phaps chalcoptera* | Common Bronzewing | | | | ✓ | | ✓ | ✓ | | ✓ |
| *Ocyphaps lophotes* | Crested Pigeon | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Geophaps plumifera* | Spinifex Pigeon | | | | ✓ | | ✓ | ✓ | ✓ | |
| *Geopelia cuneata* | Diamond Dove | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Geopelia striata* | Peaceful Dove | | | | | | ✓ | ✓ | | |
| PODARGIDAE | | | | | | | | | | |
| *Podargus strigoides* | Tawny Frogmouth | | | | ✓ | | ✓ | ✓ | | |
| EUROSTOPODIDAE | | | | | | | | | | |
| *Eurostopodus argus* | Spotted Nightjar | | | | ✓ | | ✓ | ✓ | | ✓ |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| AEGOTHELIDAE | | | | | | | | | | |
| *Aegotheles cristatus* | Australian Owlet-nightjar | | | | | | ✓ | ✓ | ✓ | ✓ |
| ANHINGIDAE | | | | | | | | | | |
| *Anhinga novaehollandiae* | Australasian Darter | | | | | | ✓ | | | |
| PHALACROCORACIDAE | | | | | | | | | | |
| *Microcarbo melanoleucos* | Little Pied Cormorant | | | | | | ✓ | ✓ | | |
| *Phalacrocorax sulcirostris* | Little Black Cormorant | | | | | | ✓ | | | |
| CICONIIDAE | | | | | | | | | | |
| *Ephippiorhynchus asiaticus* | Black-necked Stork | | | | | | ✓ | | ✓ | |
| ARDEIDAE | | | | | | | | | | |
| *Ardea pacifica* | White-necked Heron | | | | | | ✓ | ✓ | | |
| *Ardea modesta* | Eastern Great Egret | | | | | | ✓ | ✓ | | |
| *Ardea ibis* | Cattle Egret | | | | | | ✓ | | | |
| *Egretta novaehollandiae* | White-faced Heron | | | | | | ✓ | ✓ | | ✓ |
| *Egretta garzetta* | Little Egret | Mig | | | | | ✓ | | | |
| *Nycticorax caledonicus* | Nankeen Night-Heron | | | | | | | ✓ | | |
| THRESKIORNITHIDAE | | | | | | | | | | |
| *Threskiornis spinicollis* | Straw-necked Ibis | | | | | | ✓ | ✓ | | |
| *Platalea regia* | Royal Spoonbill | | | | | | ✓ | | | |
| *Platalea flavipes* | Yellow-billed Spoonbill | | | | | | ✓ | ✓ | | |
| ACCIPITRIDAE | | | | | | | | | | |
| *Elanus axillaris* | Black-shouldered Kite | | | | | | | | ✓ | |
| *Lophoictinia isura* | Square-tailed Kite | | | | | | ✓ | | ✓ | |
| *Hamirostra melanosternon* | Black-breasted Buzzard | | | | | | | ✓ | ✓ | |
| *Haliastur sphenurus* | Whistling Kite | | | | | | ✓ | ✓ | ✓ | |
| *Milvus migrans* | Black Kite | | | | | | ✓ | ✓ | ✓ | |
| *Accipiter fasciatus* | Brown Goshawk | | | | | | ✓ | ✓ | | |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| *Accipiter cirrocephalus* | Collared Sparrowhawk | | | | | | ✓ | ✓ | ✓ | |
| *Circus assimilis* | Spotted Harrier | | | | | | | ✓ | ✓ | |
| *Circus approximans* | Swamp Harrier | | | | | | | | ✓ | |
| *Aquila audax* | Wedge-tailed Eagle | | | | | | ✓ | ✓ | | |
| *Hieraaetus morphnoides* | Little Eagle | | | | | | ✓ | ✓ | | |
| FALCONIDAE | | | | | | | | | | |
| *Falco cenchroides* | Nankeen Kestrel | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Falco berigora* | Brown Falcon | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Falco longipennis* | Australian Hobby | | | | | | ✓ | ✓ | ✓ | |
| *Falco hypoleucos* | Grey Falcon | | | P4 | | | | ✓ | | |
| *Falco peregrinus* | Peregrine Falcon | | | | | | ✓ | ✓ | ✓ | |
| RALLIDAE | | | | | | | | | | |
| *Gallirallus philippensis* | Buff-banded Rail | | | | | | ✓ | | | |
| *Tribonyx ventralis* | Black-tailed Native-hen | | | | | | | ✓ | | |
| *Porzana tabuensis* | Spotless Crake | | | | | | | | | |
| OTIDIDAE | | | | | | | | | | |
| *Ardeotis australis* | Australian Bustard | | | P4 | | | ✓ | ✓ | ✓ | ✓ |
| BURHINIDAE | | | | | | | | | | |
| *Burhinus grallarius* | Bush Stone-curlew | | | P4 | | | | ✓ | | |
| RECURVIROSTRIDAE | | | | | | | | | | |
| *Himantopus himantopus* | Black-winged Stilt | | | | | | | ✓ | | |
| *Recurvirostra novaehollandiae* | Red-necked Avocet | | | | | | | ✓ | | |
| CHARADRIIDAE | | | | | | | | | | |
| *Elseyornis melanops* | Black-fronted Dotterel | | | | ✓ | | ✓ | ✓ | | |
| *Erythrogonys cinctus* | Red-kneed Dotterel | | | | | | | ✓ | | |
| TURNICIDAE | | | | | | | | | | |
| *Turnix velox* | Little Button-quail | | | | | | ✓ | ✓ | ✓ | |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| LARIDAE | | | | | | | | | | |
| *Chlidonias hybrida* | Whiskered Tern | | | | | | | ✓ | | |
| CACATUIDAE | | | | | | | | | | |
| *Calyptorhynchus banksii* | Red-tailed Black-Cockatoo | | | | | | | ✓ | | |
| *Eolophus roseicapillus* | Galah | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Cacatua sanguinea* | Little Corella | | | | | | ✓ | ✓ | | |
| *Nymphicus hollandicus* | Cockatiel | | | | | | ✓ | ✓ | ✓ | |
| PSITTACIDAE | | | | | | | | | | |
| *Barnardius zonarius* | Australian Ringneck | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Melopsittacus undulatus* | Budgerigar | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Pezoporus occidentalis* | Night Parrot | EN | S1 | CR | | | | ✓ | | |
| CUCULIDAE | | | | | | | | | | |
| *Centropus phasianinus* | Pheasant Coucal | | | | | | | | ✓ | |
| *Chalcites basalis* | Horsfield's Bronze-Cuckoo | | | | ✓ | | ✓ | ✓ | | ✓ |
| *Chalcites osculans* | Black-eared Cuckoo | | | | | | | | ✓ | |
| *Cacomantis pallidus* | Pallid Cuckoo | | | | | | ✓ | ✓ | ✓ | |
| STRIGIDAE | | | | | | | | | | |
| *Ninox connivens* | Barking Owl | | | | | | | ✓ | | |
| *Ninox novaeseelandiae* | Southern Boobook | | | | | | ✓ | ✓ | | |
| TYTONIDAE | | | | | | | | | | |
| *Tyto javanica* | Eastern Barn Owl | | | | | | ✓ | ✓ | | |
| HALCYONIDAE | | | | | | | | | | |
| *Dacelo leachii* | Blue-winged Kookaburra | | | | | | ✓ | ✓ | | |
| *Todiramphus pyrrhopygius* | Red-backed Kingfisher | | | | | | ✓ | ✓ | | |
| *Todiramphus sanctus* | Sacred Kingfisher | | | | ✓ | | ✓ | ✓ | | |
| MEROPIDAE | | | | | | | | | | |
| *Merops ornatus* | Rainbow Bee-eater | Mig | | | | | ✓ | ✓ | ✓ | ✓ |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| CLIMACTERIDAE | | | | | | | | | | |
| *Climacteris melanura* | Black-tailed Treecreeper | | | | | | | ✓ | | |
| PTILONORHYNCHIDAE | | | | | | | | | | |
| *Ptilonorhynchus guttatus* | Western Bowerbird | | | | ✓ | | ✓ | ✓ | | |
| MALURIDAE | | | | | | | | | | |
| *Malurus leucopterus* | White-winged Fairy-wren | | | | ✓ | | ✓ | ✓ | ✓ | |
| *Malurus lamberti* | Variegated Fairy-wren | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Stipiturus ruficeps* | Rufous-crowned Emu-wren | | | | ✓ | | | ✓ | | |
| *Amytornis striatus* | Striated Grasswren | | | | ✓ | | ✓ | ✓ | | |
| ACANTHIZIDAE | | | | | | | | | | |
| *Pyrrholaemus brunneus* | Redthroat | | | | | | ✓ | | | |
| *Smicrornis brevirostris* | Weebill | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Gerygone fusca* | Western Gerygone | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Acanthiza robustirostris* | Slaty-backed Thornbill | | | | ✓ | | | ✓ | ✓ | |
| *Acanthiza uropygialis* | Chestnut-rumped Thornbill | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Acanthiza apicalis* | Inland Thornbill | | | | | | ✓ | | ✓ | |
| PARDALOTIDAE | | | | | | | | | | |
| *Pardalotus rubricatus* | Red-browed Pardalote | | | | ✓ | | ✓ | ✓ | | ✓ |
| *Pardalotus striatus* | Striated Pardalote | | | | | | ✓ | ✓ | | |
| MELIPHAGIDAE | | | | | | | | | | |
| *Certhionyx variegatus* | Pied Honeyeater | | | | | | | ✓ | | ✓ |
| *Lichenostomus virescens* | Singing Honeyeater | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Lichenostomus keartlandi* | Grey-headed Honeyeater | | | | ✓ | | ✓ | ✓ | | |
| *Lichenostomus penicillatus* | White-plumed Honeyeater | | | | ✓ | | ✓ | ✓ | ✓ | |
| *Manorina flavigula* | Yellow-throated Miner | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Epthianura tricolor* | Crimson Chat | | | | | | ✓ | ✓ | ✓ | ✓ |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| *Sugomel niger* | Black Honeyeater | | | | | | | ✓ | | |
| *Lichmera indistincta* | Brown Honeyeater | | | | ✓ | | ✓ | ✓ | | |
| *Melithreptus gularis* | Black-chinned Honeyeater | | | | | | | ✓ | | |
| *Conopophila whitei* | Grey Honeyeater | | | | | | | | | |
| POMATOSTOMIDAE | | | | | | | | | | |
| *Pomatostomus temporalis* | Grey-crowned Babbler | | | | ✓ | | ✓ | ✓ | | |
| *Pomatostomus superciliosus* | White-browed Babbler | | | | | | ✓ | | ✓ | ✓ |
| PSOPHODIDAE | | | | | | | | | | |
| *Cinclosoma castaneothorax* | Chestnut-breasted Quail-thrush | | | | ✓ | | | | ✓ | |
| *Psophodes occidentalis* | Chiming Wedgebill | | | | | | ✓ | | | ✓ |
| NEOSITTIDAE | | | | | | | | | | |
| *Daphoenositta chrysoptera* | Varied Sittella | | | | | | | ✓ | ✓ | |
| CAMPEPHAGIDAE | | | | | | | | | | |
| *Coracina maxima* | Ground Cuckoo-shrike | | | | | | | ✓ | | |
| *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Lalage sueurii* | White-winged Triller | | | | | | ✓ | ✓ | ✓ | |
| PACHYCEPHALIDAE | | | | | | | | | | |
| *Pachycephala rufiventris* | Rufous Whistler | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Colluricincla harmonica* | Grey Shrike-thrush | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Oreoica gutturalis* | Crested Bellbird | | | | | | ✓ | ✓ | ✓ | ✓ |
| ARTAMIDAE | | | | | | | | | | |
| *Artamus personatus* | Masked Woodswallow | | | | | | ✓ | ✓ | | |
| *Artamus cinereus* | Black-faced Woodswallow | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| *Artamus minor* | Little Woodswallow | | | | | | ✓ | ✓ | ✓ | |
| *Cracticus torquatus* | Grey Butcherbird | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Cracticus nigrogularis* | Pied Butcherbird | | | | | | ✓ | ✓ | ✓ | |
| *Cracticus tibicen* | Australian Magpie | | | | ✓ | | ✓ | ✓ | | |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| RHIPIDURIDAE | | | | | | | | | | |
| *Rhipidura albiscapa* | Grey Fantail | | | | | | | | ✓ | |
| *Rhipidura leucophrys* | Willie Wagtail | | | | | | ✓ | ✓ | ✓ | ✓ |
| CORVIDAE | | | | | | | | | | |
| *Corvus bennetti* | Little Crow | | | | | | ✓ | ✓ | | ✓ |
| *Corvus orru* | Torresian Crow | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| MONARCHIDAE | | | | | | | | | | |
| *Grallina cyanoleuca* | Magpie-lark | | | | | | ✓ | ✓ | ✓ | ✓ |
| PETROCIDAE | | | | | | | | | | |
| *Petroica goodenovii* | Red-capped Robin | | | | | | ✓ | ✓ | ✓ | ✓ |
| *Melanodryas cucullata* | Hooded Robin | | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| ALAUDIDAE | | | | | | | | | | |
| *Mirafra javanica* | Horsfield's Bushlark | | | | | | ✓ | ✓ | ✓ | |
| ACROCEPAHLIDAE | | | | | | | | | | |
| *Acrocephalus australis* | Australian Reed-warbler | | | | | | ✓ | ✓ | | |
| MEGALURIDAE | | | | | | | | | | |
| *Cincloramphus mathewsi* | Rufous Songlark | | | | | | ✓ | ✓ | ✓ | |
| *Cincloramphus cruralis* | Brown Songlark | | | | | | ✓ | ✓ | ✓ | |
| *Eremiornis carteri* | Spinifexbird | | | | ✓ | | | ✓ | ✓ | |
| HIRUNDINIDAE | | | | | | | | | | |
| *Hirundo neoxena* | Welcome Swallow | | | | | | ✓ | | | |
| *Petrochelidon ariel* | Fairy Martin | | | | | | ✓ | ✓ | | |
| *Petrochelidon nigricans* | Tree Martin | | | | | | ✓ | ✓ | ✓ | |
| NECTARINIIDAE | | | | | | | | | | |
| *Dicaeum hirundinaceum* | Mistletoebird | | | | ✓ | | ✓ | ✓ | | |
| ESTRILDIDAE | | | | | | | | | | |
| *Taeniopygia guttata* | Zebra Finch | | | | | | ✓ | ✓ | ✓ | ✓ |

| Family / Species | Common Name | Conservation Status | | | WAM | DEC Rare Fauna | Birdata | Johnstone and Storr (1998, 2004) | Biota 2004 | *ecologia* 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPBC | WCA | DEC | | | | | | |
| *Neochmia ruficauda* | Star Finch | | | P4 | | | | ✓ | | |
| *Emblema pictum* | Painted Finch | | | | | | ✓ | ✓ | ✓ | ✓ |
| MOTACILLIDAE | | | | | | | | | | |
| *Anthus novaeseelandiae* | Australasian Pipit | | | | | | ✓ | ✓ | ✓ | ✓ |

## Appendix A3 – Reptile species potentially occurring in the survey area

| Family Species | Common Name | EPBC | WCA | DEC | WAM | DEC Rare Fauna | Wilson and Swan (2008) | Storr *et al.* (1999) | Storr *et al.* (2002) | Biota 2004 | ecologia 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GEKKONIDAE | | | | | | | | | | | |
| *Crenadactylus ocellatus* | Clawless Gecko | | | | | | ✓ | | | | |
| *Diplodactylus conspicillatus* | Fat-tailed Gecko | | | | | | ✓ | | | ✓ | |
| *Diplodactylus mitchelli* | | | | | ✓ | | ✓ | | | ✓ | |
| *Diplodactylus pulcher* | | | | | | | ✓ | | | | |
| *Diplodactylus savagei* | | | | | ✓ | | ✓ | | | ✓ | |
| *Gehyra pilbara* | | | | | | | ✓ | | | | |
| *Gehyra punctata* | | | | | ✓ | | ✓ | | | | ✓ |
| *Gehyra variegata* | | | | | ✓ | | ✓ | | | ✓ | ✓ |
| *Heteronotia binoei* | Bynoe's Gecko | | | | ✓ | | ✓ | | | ✓ | ✓ |
| *Lucasium stenodactylum* | Sand-plain Gecko | | | | ✓ | | ✓ | | | ✓ | ✓ |
| *Lucasium wombeyi* | | | | | ✓ | | ✓ | | | ✓ | |
| *Nephrurus wheeleri cinctus* | Banded Knob-tailed Gecko | | | | ✓ | | ✓ | | | ✓ | ✓ |
| *Oedura marmorata* | Marbled Velvet Gecko | | | | ✓ | | ✓ | | | ✓ | |
| *Rhynchoedura ornata* | Beaked Gecko | | | | | | ✓ | | | ✓ | |
| *Strophurus elderi* | Jeweled Gecko | | | | | | ✓ | | | | |
| *Strophurus jeanae* | | | | | ✓ | | ✓ | | | | |
| *Strophurus strophurus* | Western Spiny-tailed Gecko | | | | | | ✓ | | | | |
| *Strophurus wellingtonae* | | | | | | | ✓ | | | ✓ | ✓ |
| PYGOPODIDAE | | | | | | | | | | | |
| *Delma butleri* | | | | | | | ✓ | | | | |
| *Delma elegans* | | | | | ✓ | | ✓ | | | ✓ | |
| *Delma haroldi* | | | | | | | ✓ | | | | |
| *Delma nasuta* | | | | | ✓ | | ✓ | | | ✓ | |

| Family Species | Common Name | EPBC | WCA | DEC | WAM | DEC Rare Fauna | Wilson and Swan (2008) | Storr *et al.* (1999) | Storr *et al.* (2002) | Biota 2004 | ecologia 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Delma pax* | | | | | ✓ | | ✓ | | | ✓ | |
| *Delma tincta* | | | | | ✓ | | ✓ | | | ✓ | |
| *Lialis burtonis* | Burton's Snake-lizard | | | | ✓ | | ✓ | | | | ✓ |
| *Pygopus nigriceps* | Western Hooded Scaly-foot | | | | ✓ | | ✓ | | | ✓ | ✓ |
| SCINCIDAE | | | | | | | | | | | |
| *Carlia munda* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Carlia triacantha* | | | | | | | | | | ✓ | |
| *Cryptoblepharus carnabyi* | | | | | | | ✓ | ✓ | | | |
| *Cryptoblepharus plagiocephalus* | | | | | ✓ | | ✓ | ✓ | | | |
| *Ctenotus duricola* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Ctenotus grandis titan* | | | | | | | ✓ | ✓ | | | |
| *Ctenotus helenae* | | | | | | | ✓ | ✓ | | ✓ | ✓ |
| *Ctenotus leonhardii* | | | | | | | | ✓ | | | |
| *Ctenotus pantherinus ocellifer* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Ctenotus robustus* | | | | | ✓ | | | | | | |
| *Ctenotus rubicundus* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Ctenotus rutilans* | | | | | | | ✓ | | | | |
| *Ctenotus saxatilis* | | | | | ✓ | | ✓ | ✓ | | | ✓ |
| *Ctenotus schomburgkii* | | | | | | | ✓ | ✓ | | ✓ | |
| *Ctenotus serventyi* | | | | | | | ✓ | ✓ | | | |
| *Ctenotus uber* | | | | | | | ✓ | ✓ | | ✓ | |
| *Cyclodomorphus melanops melanops* | Spinifex Slender Blue-tongue | | | | | | ✓ | ✓ | | ✓ | ✓ |
| *Egernia depressa* | Pygmy Spiny-tailed Skink | | | | ✓ | | ✓ | ✓ | | | ✓ |
| *Egernia formosa* | | | | | ✓ | | ✓ | ✓ | | | |
| *Egernia pilbarensis* | | | | | ✓ | | ✓ | ✓ | | | |
| *Egernia striata* | Night Skink | | | | | | | ✓ | | | |

| Family Species | Common Name | EPBC | WCA | DEC | WAM | DEC Rare Fauna | Wilson and Swan (2008) | Storr *et al.* (1999) | Storr *et al.* (2002) | Biota 2004 | ecologia 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Eremiascincus fasciolatus* | Narrow-banded Sand-swimmer | | | | | | ✓ | | | | |
| *Eremiascincus richardsonii* | Broad-banded Sand-swimmer | | | | | | ✓ | ✓ | | | |
| *Glaphyromorphus isolepis* | | | | | | | ✓ | ✓ | | | |
| *Lerista bipes* | | | | | | | ✓ | ✓ | | | |
| *Lerista muelleri* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Menetia greyii* | | | | | ✓ | | | ✓ | | ✓ | ✓ |
| *Menetia surda* | | | | | | | ✓ | ✓ | | | |
| *Morethia ruficauda exquisita* | | | | | | | ✓ | ✓ | | | |
| *Notoscincus ornatus ornatus* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Proablepharus reginae* | | | | | ✓ | | ✓ | ✓ | | ✓ | |
| *Tiliqua multifasciata* | Centralian Blue-tongue | | | | | | ✓ | ✓ | | ✓ | |
| AGAMIDAE | | | | | | | | | | | |
| *Amphibolurus longirostris* | Long-nosed Dragon | | | | | | ✓ | | | | ✓ |
| *Caimanops amphiboluroides* | Mulga Dragon | | | | ✓ | | | | | ✓ | |
| *Ctenophorus caudicinctus caudicinctus* | Ring-tailed Dragon | | | | ✓ | | ✓ | | | ✓ | ✓ |
| *Ctenophorus isolepis* | Central Military Dragon | | | | | | ✓ | | | | |
| *Ctenophorus nuchalis* | Central Netted Dragon | | | | | | ✓ | | | | |
| *Ctenophorus reticulatus* | Western Netted Dragon | | | | | | ✓ | | | ✓ | |
| *Ctenophorus scutulatus* | Lozenge-marked Dragon | | | | | | ✓ | | | | |
| *Diporiphora valens* | | | | | | | ✓ | | | ✓ | |
| *Pogona minor* | Dwarf Bearded Dragon | | | | | | ✓ | | | | ✓ |
| *Tympanocryptis cephalus* | Pebble Dragon | | | | ✓ | | ✓ | | | | |
| VARANIDAE | | | | | | | | | | | |
| *Varanus acanthurus* | Spiny-tailed Monitor | | | | ✓ | | ✓ | | | | ✓ |
| *Varanus brevicauda* | Short-tailed Pygmy Monitor | | | | | | ✓ | | | ✓ | |
| *Varanus bushi* | | | | | | | ✓ | | | | |

| Family Species | Common Name | EPBC | WCA | DEC | WAM | DEC Rare Fauna | Wilson and Swan (2008) | Storr *et al.* (1999) | Storr *et al.* (2002) | Biota 2004 | ecologia 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Varanus eremius* | Pygmy Desert Monitor | | | | ✓ | | ✓ | | | | |
| *Varanus giganteus* | Perentie | | | | | | ✓ | | | | |
| *Varanus gouldii* | Sand Goanna | | | | | | ✓ | | | ✓ | |
| *Varanus panoptes* | Yellow-spotted Monitor | | | | | | ✓ | | | ✓ | |
| *Varanus pilbarensis* | Pilbara Rock Monitor | | | | ✓ | | ✓ | | | | |
| *Varanus tristis* | Black-headed Monitor | | | | | | ✓ | | | ✓ | |
| TYPHLOPIDAE | | | | | | | | | | | |
| *Ramphotyphlops ammodytes* | | | | | ✓ | | ✓ | | ✓ | ✓ | |
| *Ramphotyphlops ganei* | | | | P1 | | | | | ✓ | | ✓ |
| *Ramphotyphlops grypus* | Beaked Blind Snake | | | | | | ✓ | | ✓ | | |
| *Ramphotyphlops hamatus* | | | | | ✓ | | | | ✓ | | |
| *Ramphotyphlops pilbarensis* | Pilbara Blind Snake | | | | | | ✓ | | ✓ | | ✓ |
| *Ramphotyphlops waitii* | | | | | | | | | ✓ | | |
| BOIDAE | | | | | | | | | | | |
| *Antaresia perthensis* | Pygmy Python | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| *Antaresia stimsoni* | Stimson's Python | | | | | | ✓ | | ✓ | | |
| *Aspidites melanocephalus* | Black-headed Python | | | | | | ✓ | | ✓ | | |
| *Liasis olivaceus barroni* | Pilbara Olive Python | VU | S1 | | | | ✓ | | ✓ | | |
| ELAPIDAE | | | | | | | | | | | |
| *Acanthophis wellsi* | Pilbara Death Adder | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| *Brachyurophis approximans* | North-western Shovel-nosed Snake | | | | | | ✓ | | ✓ | | ✓ |
| *Demansia psammophis cupreiceps* | Yellow-faced Whipsnake | | | | ✓ | | ✓ | | ✓ | ✓ | |
| *Demansia rufescens* | Rufous Whipsnake | | | | | | ✓ | | ✓ | | |
| *Furina ornata* | Moon Snake | | | | | | ✓ | | ✓ | ✓ | ✓ |
| *Parasuta monachus* | Monk Snake | | | | | | ✓ | | ✓ | | ✓ |
| *Pseudechis australis* | Mulga Snake | | | | ✓ | | ✓ | | ✓ | | ✓ |

| Family Species | Common Name | EPBC | WCA | DEC | WAM | DEC Rare Fauna | Wilson and Swan (2008) | Storr *et al.* (1999) | Storr *et al.* (2002) | Biota 2004 | ecologia 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pseudonaja modesta* | Ringed Brown Snake | | | | | | ✓ | | ✓ | | |
| *Pseudonaja nuchalis* | Gwardar | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| *Simoselaps anomalus* | Desert Banded Snake | | | | | | ✓ | | | | |
| *Suta fasciata* | Rosen's Snake | | | | ✓ | | ✓ | | ✓ | | ✓ |
| *Suta punctata* | Little Spotted Snake | | | | ✓ | | ✓ | | ✓ | ✓ | |
| *Vermicella snelli* | Pilbara Bandy-Bandy | | | | | | ✓ | | ✓ | | ✓ |

## Appendix A4 – Amphibian species potentially occurring in the survey area

| Family / Species | Common Name | WAM | Tyler *et al.* 1994 | Biota 2004 | *ecologia* 2005 | Present survey |
|---|---|---|---|---|---|---|
| HYLIDAE | | | | | | |
| *Cyclorana maini* | Main's Frog | ✓ | ✓ | ✓ | ✓ | |
| *Cyclorana platycephala* | Water-holding Frog | ✓ | ✓ | | | |
| *Litoria rubella* | Desert Tree Frog | ✓ | ✓ | | | |
| MYOBATRACHIDAE | | | | | | |
| *Limnodynastes spenceri* | Spencer's Frog | ✓ | ✓ | | | |
| *Notaden nichollsi* | Desert Spadefoot | ✓ | ✓ | | | |
| *Uperoleia russelli* | Russell's Toadlet | ✓ | ✓ | ✓ | | |

# Appendix B: Fauna recorded during surveying

## Appendix B1 - Mammal species recorded

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| DASYURIDAE | | | | | | | | | | | | | | | | | |
| *Dasykaluta rosamondae* | Kaluta | | | | | | | | | | | | 3 | 6 | 2 | 26 | |
| *Sminthopsis macroura* | Stripe-faced Dunnart | | | 2 | | | 1 | | | | | | | | 1 | | |
| *Ningaui timealeyi* | Pilbara Ningaui | 1 | 6 | | | | | 8 | | | | | | | | 2 | |
| *Planigale* sp. | Pilbara Planigale species complex | | | | | | | | | | 1 | | | | | | |
| MACROPODIDAE | | | | | | | | | | | | | | | | | |
| *Macropus robustus* | Euro / Common Wallaroo | | | | 1 | 1 | | | 1 | | | | | | | | 2 |
| MEGADERMATIDAE | | | | | | | | | | | | | | | | | |
| *Macroderma gigas* | Ghost Bat | | | | | | | | | | A | | | | | | |
| EMBALLONURIDAE | | | | | | | | | | | | | | | | | |
| *Saccolaimus flaviventris* | Yellow-bellied Sheath-tailed Bat | | | | | | | | | | | A | | | | | |
| *Taphozous georgianus* | Common Sheath-tailed Bat | | | | A | A | | | A | | | | | | | | |
| MOLOSSIDAE | | | | | | | | | | | | | | | | | |
| *Chaerephon jobensis* | Northern Free-tailed Bat | | | | | | | A | | | | A | A | | | | |
| *Mormopterus beccarii* | Beccari's Free-tailed Bat | | | | | | | | | A | | | A | | | | |
| VESPERTILIONIDAE | | | | | | | | | | | | | | | | | |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | | | A | A | | A | A | | | | A | | | A | | |
| *Chalinolobus gouldii* | Gould's Wattled bat | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | |
| *Scotorepens greyii* | Little Broad-nosed Bat | A | | A | A | A | A | A | A | A | A | A | A | A | A | A | |
| *Vespadelus finlaysoni* | Finlayson's Cave Bat | A | | A | A | | A | A | A | A | A | A | A | | A | A | |
| MURIDAE | | | | | | | | | | | | | | | | | |
| *Notomys alexis* | Spinifex Hopping-mouse | | | | 1 | | | | | | | | | | | | |
| *Leggadina lakedownensis* | Northern Short-tailed mouse | | | | | | | | 1 | | | | | | | | 1 |
| *Pseudomys chapmani* | Western Pebble-mouse | 2M | | | | 1M | | 1M | 4M | 2M | | | | 1M | | 1M | 12M |
| *Pseudomys desertor* | Desert Mouse | 1 | 2 | | | 1 | | 13 | | 2 | 1 | 2 | 2 | 1 | 3 | 2 | |

## RGP5 CHICHESTER RANGE DEVIATION

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Pseudomys hermannsburgensis* | Sandy Inland Mouse | 3 | | 9 | 8 | 8 | 5 | 11 | | | | | | | | | |
| *Zyzomys argurus* | Common Rock-rat | | 8 | | | | | | | | | | | | | | 1 |
| **Mus musculus* | House Mouse | | | | | | | | | | 5 | | 1 | | | 3 | |
| CANIDAE | | | | | | | | | | | | | | | | | |
| **Canis lupus familiaris* | Dingo/Dog | 1 | | | | 1 | | | | | | | | | | | |
| FELIDAE | | | | | | | | | | | | | | | | | |
| **Felis catus* | Cat | | | | | | | | | | 1 | | | | | | |
| LEPORIDAE | | | | | | | | | | | | | | | | | |
| **Oryctolagus cuniculus* | Rabbit | | | | | | | | | 1 | 1 | | | | | | |
| BOVIDAE | | | | | | | | | | | | | | | | | |
| **Bos taurus* | Cattle | | | | | | | | 23 | | | | | | | 10 | 18 |

*Introduced species
A – Calls detected using ANABAT
M – Western Pebble-mouse Mounds

## Appendix B2 – Bird species recorded

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| CASUARIIDAE | | | | | | | | | | | | | | | | | |
| *Dromaius novaehollandiae* | Emu | | | | | | | | | | | | | 5 | | | |
| PHASIANIDAE | | | | | | | | | | | | | | | | | |
| *Coturnix ypsilophora* | Brown Quail | | | | | | | | 1 | | | | | | | | 1 |
| ANATIDAE | | | | | | | | | | | | | | | | | |
| *Anas superciliosa* | Pacific Black Duck | | | | | | | | 4 | | | | | | | | 2 |
| PODICIPEDIDAE | | | | | | | | | | | | | | | | | |
| *Tachybaptus novaehollandiae* | Australasian Grebe | | | | | | | | 1 | | | | | | | | 1 |
| COLUMBIDAE | | | | | | | | | | | | | | | | | |
| *Phaps chalcoptera* | Common Bronzewing | 7 | 6 | | | 1 | | 1 | | | 2 | 1 | 1 | | | 2 | 5 |
| *Ocyphaps lophotes* | Crested Pigeon | 16 | | 13 | 26 | 6 | 12 | 3 | 5 | | 12 | | 5 | 2 | 10 | 24 | |
| *Geophaps plumifera* | Spinifex Pigeon | 1 | | 5 | | | | | 25 | | 2 | 10 | | | 17 | | 17 |
| *Geopelia cuneata* | Diamond Dove | 10 | | 6 | 1 | 11 | 2 | 3 | 19 | 10 | 3 | 11 | | 4 | 8 | 1 | 1 |
| *Geopelia striata* | Peaceful Dove | | | | | | | | | | | | | | | 1 | |
| PODARGIDAE | | | | | | | | | | | | | | | | | |
| *Podargus strigoides* | Tawny Frogmouth | | | | | | | | | | | 1 | | | | | |
| EUROSTOPODIDAE | | | | | | | | | | | | | | | | | |
| *Eurostopodus argus* | Spotted Nightjar | | | | | | | | 2 | | | | | | | | |
| AEGOTHELIDAE | | | | | | | | | | | | | | | | | |
| *Aegotheles cristatus* | Australian Owlet-nightjar | 1 | | | | | | | 1 | | 1 | | | | | | 1 |
| APODIDAE | | | | | | | | | | | | | | | | | |
| *Apus pacificus* | Fork-tailed Swift | | | | | | | | 2 | | | | | | | | |
| ARDEIDAE | | | | | | | | | | | | | | | | | |
| *Ardea pacifica* | White-necked Heron | | | | | | | | | | | | | | | | 1 |
| *Egretta novaehollandiae* | White-faced Heron | | | | | | | | 1 | | | | | | | | |
| ACCIPITRIDAE | | | | | | | | | | | | | | | | | |
| *Elanus axillaris* | Black-shouldered Kite | | | | | | | 8 | 2 | | | | | | | | |

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Lophoictinia isura* | Square-tailed Kite | | | | | | | | | | | 1 | | | | | 1 |
| *Haliastur sphenurus* | Whistling Kite | | | | | | | | | | | | | | | | 2 |
| *Accipiter fasciatus* | Brown Goshawk | | | | | | | | | | | | | | | | 1 |
| *Circus assimilis* | Spotted Harrier | | | | | | | | 1 | | | | | | | | |
| *Aquila audax* | Wedge-tailed Eagle | | | | | | | | 1 | | | | | | | | 2 |
| *Hieraaetus morphnoides* | Little Eagle | | | | 1 | | | | 2 | | | | | | | | |
| FALCONIDAE | | | | | | | | | | | | | | | | | |
| *Falco cenchroides* | Nankeen Kestrel | | | | | | | | | | 2 | 1 | | | | | 2 |
| *Falco berigora* | Brown Falcon | | | 2 | | | | | | | | 1 | | | 1 | 1 | |
| *Falco hypoleucos* | Grey Falcon | | | | | | | | 4 | | | | | | | | 17 |
| RALLIDAE | | | | | | | | | | | | | | | | | |
| *Porzana tabuensis* | Spotless Crake | | | | | | | | 6 | | | | | | | | |
| OTIDIDAE | | | | | | | | | | | | | | | | | |
| *Ardeotis australis* | Australian Bustard | 2 | | | 3 | | 2 | | 3 | | | | | 1 | | | |
| BURHINIDAE | | | | | | | | | | | | | | | | | |
| *Burhinus grallarius* | Bush Stone-curlew | | | | | | | | 1 | | | | | | | | |
| CHARADRIIDAE | | | | | | | | | | | | | | | | | |
| *Elseyornis melanops* | Black-fronted Dotterel | | | | | | | | 2 | | | | | | | | 1 |
| SCOLOPACIDAE | | | | | | | | | | | | | | | | | |
| *Tringa glareola* | Wood Sandpiper | | | | | | | | 2 | | | | | | | | |
| TURNICIDAE | | | | | | | | | | | | | | | | | |
| *Turnix velox* | Little Button-quail | 1 | | 1 | 1 | 1 | | | 1 | | | | | 2 | | 1 | |
| CACATUIDAE | | | | | | | | | | | | | | | | | |
| *Eolophus roseicapillus* | Galah | 25 | 10 | 17 | 16 | | | 16 | 55 | | 6 | 6 | | | | 2 | |
| *Cacatua sanguinea* | Little Corella | | | 25 | | | | 4 | 27 | | | | | | | | 45 |
| *Nymphicus hollandicus* | Cockatiel | 6 | 3 | 15 | | | | 2 | 16 | | 1 | | | | | | |
| PSITTACIDAE | | | | | | | | | | | | | | | | | |
| *Barnardius zonarius* | Australian Ringneck | | 4 | | 7 | 2 | 1 | 5 | | | 8 | 8 | 4 | | 6 | 16 | |
| *Melopsittacus undulatus* | Budgerigar | 1 | | | | | | | | | | 5 | | | | 3 | 20 |

## RGP5 CHICHESTER RANGE DEVIATION

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| CUCULIDAE | | | | | | | | | | | | | | | | | |
| *Centropus phasianinus highami* | Pheasant Coucal | 1 | | | | | | 1 | 1 | | | | | | | | 2 |
| *Chalcites basalis* | Horsfield's Bronze-Cuckoo | | | | | | | | | 1 | | | | | 1 | | |
| *Cacomantis pallidus* | Pallid Cuckoo | 4 | 2 | 3 | | | | 3 | | | | | | | | 2 | |
| STRIGIDAE | | | | | | | | | | | | | | | | | |
| *Ninox novaeseelandiae* | Southern Boobook | | | | | | | | | | | | | | | | 1 |
| TYTONIDAE | | | | | | | | | | | | | | | | | |
| *Tyto javanica* | Eastern Barn Owl | | | | | | | | 2 | | | | | | | | 1 |
| HALCYONIDAE | | | | | | | | | | | | | | | | | |
| *Dacelo leachii* | Blue-winged Kookaburra | | | | | | | 2 | 2 | | | | | | | 5 | |
| *Todiramphus pyrrhopygius* | Red-backed Kingfisher | | | 3 | | | | 14 | | | | | 1 | 2 | | 6 | |
| *Todiramphus sanctus* | Sacred Kingfisher | | | | | | | 2 | 2 | | | | | | | | |
| MEROPIDAE | | | | | | | | | | | | | | | | | |
| *Merops ornatus* | Rainbow Bee-eater | 2 | 1 | | | 3 | 2 | 8 | | | | 15 | | | 2 | 2 | 9 |
| PTILONORHYNCHIDAE | | | | | | | | | | | | | | | | | |
| *Ptilonorhynchus guttatus* | Western Bowerbird | 2 | | 2 | 1 | | | | 1 | | | 4 | | 2 | 1 | | 2 |
| MALURIDAE | | | | | | | | | | | | | | | | | |
| *Malurus leucopterus* | White-winged Fairy-wren | | | 7 | 9 | | | 18 | 7 | | | | 5 | | | 12 | 1 |
| *Malurus lamberti* | Variegated Fairy-wren | 26 | 14 | 17 | 1 | 2 | 8 | 21 | 5 | | 21 | 9 | | | 32 | 2 | 4 |
| ACANTHIZIDAE | | | | | | | | | | | | | | | | | |
| *Smicrornis brevirostris* | Weebill | 10 | 2 | 13 | 12 | | 5 | | 2 | 2 | | | | | | | |
| *Gerygone fusca* | Western Gerygone | | | | | 2 | | | | | | | | 2 | | | |
| *Acanthiza robustirostris* | Slaty-backed Thornbill | | | | | | | | | | | | | 2 | | | |
| *Acanthiza uropygialis* | Chestnut-rumped Thornbill | | | | | | | 1 | 14 | | 3 | | 4 | 1 | 5 | | |
| *Acanthiza apicalis* | Inland Thornbill | 4 | | | | | 1 | | | | 2 | | | 1 | 12 | | |
| PARDALOTIDAE | | | | | | | | | | | | | | | | | |
| *Pardalotus rubricatus* | Red-browed Pardalote | | | 4 | | | | | 1 | | | | | 4 | 1 | | 2 |
| *Pardalotus striatus* | Striated Pardalote | 1 | | | | | | | | | 2 | 8 | | | | | |
| MELIPHAGIDAE | | | | | | | | | | | | | | | | | |

## RGP5 CHICHESTER RANGE DEVIATION

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Lichenostomus virescens* | Singing Honeyeater | 31 | 10 | 30 | 20 | 19 | 14 | 27 | 17 | 2 | 2 | 14 | 17 | 35 | 23 | 20 | 6 |
| *Lichenostomus keartlandi* | Grey-headed Honeyeater | | 10 | 3 | | | | | 22 | | 3 | 20 | 3 | 14 | 5 | | 3 |
| *Lichenostomus penicillatus* | White-plumed Honeyeater | | | | | | | 10 | 26 | | | | | | | 6 | |
| *Manorina flavigula* | Yellow-throated miner | 18 | | 8 | 8 | 5 | 3 | | 7 | 2 | 15 | | 12 | | 11 | | |
| *Acanthagenys rufogularis* | Spiny-cheeked Honeyeater | 2 | | 1 | 4 | 2 | 2 | 13 | 2 | | | | 9 | 19 | 14 | 26 | 3 |
| *Conopophila whitei* | Grey Honeyeater | 1 | | | | | | | | | | | | | | | |
| *Epthianura tricolor* | Crimson Chat | | | | | | | | | 3 | | | | | | | |
| *Lichmera indistincta* | Brown Honeyeater | | | | | | | | | | | 5 | 1 | 3 | 7 | 2 | 13 |
| *Melithreptus gularis* | Black-chinned Honeyeater | | | 4 | | | | | | | | 6 | | | | | |
| POMATOSTOMIDAE | | | | | | | | | | | | | | | | | |
| *Pomatostomus temporalis* | Grey-crowned Babbler | | | | | | | 1 | | | | | | | | 3 | |
| *Pomatostomus superciliosus* | White-browed Babbler | 4 | 2 | | | | 25 | | 1 | | | | 10 | 8 | 17 | | |
| CAMPEPHAGIDAE | | | | | | | | | | | | | | | | | |
| *Coracina maxima* | Ground Cuckoo-Shrike | | | 3 | | | | | | | 2 | | | | | | 2 |
| *Coracina novaehollandiae* | Black-faced Cuckoo-shrike | 1 | 4 | 3 | 5 | 5 | 1 | 1 | 5 | 1 | 7 | 1 | 4 | 3 | 1 | 2 | 1 |
| *Lalage sueurii* | White-winged Triller | 1 | | 3 | | | | | 2 | 2 | | | | 1 | | 1 | |
| PACHYCEPHALIDAE | | | | | | | | | | | | | | | | | |
| *Pachycephala rufiventris* | Rufous Whistler | 31 | 13 | 6 | 3 | 16 | 15 | 19 | 2 | 2 | 8 | 7 | 6 | 33 | 23 | 10 | 2 |
| *Colluricincla harmonica* | Grey Shrike-thrush | 10 | 12 | 11 | | 4 | 6 | 7 | 2 | 2 | 3 | 19 | | 7 | 8 | 1 | |
| *Oreoica gutturalis* | Crested Bellbird | 2 | 3 | 7 | 8 | 4 | 9 | 4 | | 1 | 5 | 13 | 9 | 22 | 7 | 3 | 1 |
| ARTAMIDAE | | | | | | | | | | | | | | | | | |
| *Artamus cinereus* | Black-faced Woodswallow | 11 | 5 | 10 | 14 | 5 | 2 | 11 | 8 | 8 | 13 | 27 | 21 | | 14 | 8 | 5 |
| *Artamus minor* | Little Woodswallow | 6 | 8 | | | | | | 1 | | | 6 | | | | | |
| *Cracticus torquatus* | Grey Butcherbird | 6 | 3 | 5 | 9 | 1 | 7 | 9 | 2 | | 3 | | 6 | 10 | 3 | 12 | |
| *Cracticus nigrogularis* | Pied Butcherbird | 3 | 5 | 5 | 7 | 4 | 6 | 5 | 2 | 1 | 13 | 16 | 6 | 6 | 4 | 5 | |
| *Cracticus tibicen* | Australian Magpie | | | 5 | | | | | | | 1 | 5 | | | | 1 | |
| RHIPIDURIDAE | | | | | | | | | | | | | | | | | |
| *Rhipidura leucophrys* | Willie Wagtail | 7 | 12 | 6 | 2 | 9 | 8 | 5 | 6 | 1 | 6 | 3 | 6 | 8 | 3 | 1 | |
| CORVIDAE | | | | | | | | | | | | | | | | | |

| FAMILY - Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Corvus bennetti* | Little Crow | | | | | | | 1 | | | | | | | | | |
| *Corvus orru* | Torresian Crow | 2 | | | 1 | 1 | 1 | 1 | 2 | | 1 | 9 | | | 5 | 3 | |
| MONARCHIDAE | | | | | | | | | | | | | | | | | |
| *Grallina cyanoleuca* | Magpie-lark | | | 1 | | | | | 5 | | 4 | | | | | | |
| PETROCIDAE | | | | | | | | | | | | | | | | | |
| *Petroica goodenovii* | Red-capped Robin | | | | | | | 2 | | | | | | 4 | 3 | | |
| *Melanodryas cucullata* | Hooded Robin | 6 | 3 | | | | 3 | | 1 | | 7 | 3 | 5 | 3 | 3 | 1 | |
| ALAUDIDAE | | | | | | | | | | | | | | | | | |
| *Mirafra javanica* | Horsfield's Bushlark | | | | | | | | 3 | | | | | | | | 1 |
| ACROCEPAHLIDAE | | | | | | | | | | | | | | | | | |
| *Acrocephalus australis* | Australian Reed-Warbler | | | | | | | | 5 | | | | | | | | 2 |
| MEGALURIDAE | | | | | | | | | | | | | | | | | |
| *Cincloramphus mathewsi* | Rufous Songlark | | | | | | | | 1 | | | | | | | 1 | 1 |
| *Eremiornis carteri* | Spinifexbird | 6 | 21 | 5 | | | | 16 | 3 | | | | | | | 9 | |
| HIRUNDINIDAE | | | | | | | | | | | | | | | | | |
| *Hirundo neoxena* | Welcome Swallow | | | | | | | | 1 | | | | | | | | |
| *Petrochelidon ariel* | Fairy Martin | | | | | | | | 5 | | | | | | | | 1 |
| *Petrochelidon nigricans* | Tree Martin | | | | | | | | 4 | | | | | | | | |
| ESTRILDIDAE | | | | | | | | | | | | | | | | | |
| *Taeniopygia guttata* | Zebra Finch | 1 | | 19 | | 110 | 44 | 176 | 106 | 11 | 6 | 3 | 14 | 8 | 207 | 32 | 72 |
| *Neochmia ruficauda* | Star Finch | | | | | | | | 2 | | | | | | | | |
| *Emblema pictum* | Painted Finch | 30 | 2 | | | | | | 727 | | | | | | | 2 | |
| MOTACILLIDAE | | | | | | | | | | | | | | | | | |
| *Anthus novaeseelandiae* | Australasian Pipit | | | | | | | | 1 | 1 | | | | | | | |

## Appendix B3 – Herpetofauna recorded during the survey

| Family – Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| **REPTILES** | | | | | | | | | | | | | | | | | |
| AGAMIDAE | | | | | | | | | | | | | | | | | |
| *Amphibolurus longirostris* | Long-nosed Dragon | | | | | | 1 | | 2 | | 1 | 5 | 1 | | | | |
| *Caimanops amphiboluroides* | Mulga Dragon | | | | | | 1 | | 1 | | | | | | | | |
| *Ctenophorus caudicinctus* | Ring-tailed Dragon | | | 7 | | 10 | 6 | | 12 | 6 | 1 | 10 | 5 | 16 | 17 | | |
| *Ctenophorus isolepis* | Central Military Dragon | | | | | | | | 2 | 2 | | | | | | | |
| *Ctenophorus nuchalis* | Central Netted Dragon | | | | | | | | | | | | | 1 | | | |
| *Ctenophorus reticulatus* | Western Netted Dragon | | | | | | | | | | | 1 | | | 1 | | |
| *Pogona minor* | Western Bearded Dragon | 1 | | | | | | | | | | | | 1 | | 2 | |
| GEKKONIDAE | | | | | | | | | | | | | | | | | |
| *Diplodactylus savagei* | | | | | | | | | | | 3 | | | | | | |
| *Lucasium stenodactylum* | Sand-plain Gecko | | | 1 | | 3 | | | | | | | | 1 | | | |
| *Lucasium wombeyi* | | | | | | 1 | 2 | | | | | | | | | | |
| *Oedura marmorata* | Marbled Velvet Gecko | | | | | | | | | | | | | | | | 1 |
| *Rhynchoedura ornata* | Beaked Gecko | | | 1 | 1 | 2 | | | | | | | | | | 1 | |
| *Strophurus elderi* | Jeweled Gecko | | 2 | | | | | | | | | | | | | | |
| *Strophurus wellingtonae* | | | | 1 | | 1 | 1 | | | | | | 1 | | | | |
| *Nephrurus wheeleri* | Banded Knob-tailed Gecko | 2 | | 1 | 1 | | | | | | | | | | | | |
| *Gehyra punctata* | | | 4 | | | | | | | | 6 | | | | | | |
| *Gehyra variegata* | | 18 | 1 | 2 | | 12 | 2 | 3 | 2 | 2 | 1 | | 2 | 9 | 5 | 1 | 1 |
| *Heteronotia binoei* | Bynoe's Gecko | 7 | 4 | 2 | | 2 | | 1 | | 2 | 11 | 1 | 1 | | | 3 | |
| *Heteronotia spelea* | Desert Cave Gecko | | | | | | | | | | | | | | | | 1 |
| PYGOPODIDAE | | | | | | | | | | | | | | | | | |
| *Delma elegans* | | | 3 | | | | | | | | | | | | | | |
| *Delma nasuta* | | 1 | 1 | | | | | 1 | | | | | | | | | |
| *Delma pax* | | 1 | 1 | | | | | 1 | | | | 1 | | | | | |
| *Delma tincta* | | 1 | | | | | | | | | | | | | | 1 | |

| Family – Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Lialis burtonis* | Burton's Snake-lizard | 2 | | | | | | | 1 | | | | | 1 | | | |
| *Pygopus nigriceps* | Western Hooded Scaly-foot | | | | | | | 1 | | | | | | | | | |
| SCINCIDAE | | | | | | | | | | | | | | | | | |
| *Carlia munda* | | 8 | | 4 | | 5 | 1 | 4 | 3 | | | | 1 | 3 | 2 | 4 | |
| *Cryptoblepharus plagiocephalus* | | | | | | | | | | | | | | 1 | | | |
| *Ctenotus duricola* | | | | | | | | | | | | | 1 | | | | |
| *Ctenotus grandis titan* | | | | | | | | | | | | | 5 | | | 8 | |
| *Ctenotus helenae* | | 4 | | 2 | | 1 | | | | | | 2 | | | | 1 | |
| *Ctenotus pantherinus* | | | | | | 1 | 1 | 3 | | | | 2 | 1 | 1 | 5 | 7 | |
| *Ctenotus rubicundus* | | | 3 | | | | | | | | 1 | 1 | | | | | |
| *Ctenotus saxatilis* | | 1 | 18 | 9 | 11 | 6 | 1 | | | 3 | 4 | 44 | 17 | 14 | 10 | 16 | |
| *Ctenotus uber* | | | | | | | | | | 3 | | | | | | | |
| *Cyclodomorphus melanops* | Spinifex Slender Blue-tongue | 1 | 1 | | | | 1 | | | | | | | | | | |
| *Lerista muelleri* | | | 2 | 1 | | 1 | 1 | | | 1 | | | 1 | | | | |
| *Menetia greyii* | | 1 | 1 | | | | | | | | 1 | | | | | | |
| *Morethia ruficauda* | | | 2 | | | | | | | | | | | | | | |
| *Proablepharus reginae* | | | 1 | 2 | | | | | | | | | | | | | |
| *Tiliqua multifasciata* | Centralian Blue-tongue | | | | | | 1 | 3 | | | | | 1 | 1 | | 1 | |
| VARANIDAE | | | | | | | | | | | | | | | | | |
| *Varanus acanthurus* | Spiny-tailed Monitor | 1 | 2 | 3 | 3 | 3 | 9 | 2 | | | | 1 | 1 | | 5 | 1 | |
| *Varanus bushi* | | 1 | | | | | 1 | | | | | | | | | | |
| *Varanus caudolineatus* | Stripe-tailed Monitor | 1 | | | | | | | 1 | 1 | | | | | | | |
| *Varanus eremius* | Pygmy Desert Monitor | | | | | | | 1 | | | | | | | | | |
| *Varanus panoptes* | Yellow-spotted Monitor | | | | | | | | 1 | | | | | | | | |
| *Varanus tristis* | Black-headed Monitor | 1 | 2 | | | | | | 2 | | | | 2 | | | | |
| TYPHLOPIDAE | | | | | | | | | | | | | | | | | |
| *Ramphotyphlops ammodytes* | | | 1 | | | | | | | | | | | | | | |

| Family – Species | Common Name | Phase 1 | | | | | | | | Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 | OPP |
| *Ramphotyphlops grypus* | | | | | | | | 1 | | | | | 1 | | | | |
| BOIDAE | | | | | | | | | | | | | | | | | |
| *Antaresia stimsoni* | Stimson's Python | | | | | | 1 | | 1 | | | | | | | | 1 |
| *Aspidites melanocephalus* | Black-headed Python | | | | | | | | 1 | | | | | | | | |
| ELAPIDAE | | | | | | | | | | | | | | | | | |
| *Acanthophis wellsi* | Pilbara Death Adder | | 3 | 1 | | | | | | | | | | | | | |
| *Brachyurophis approximans* | North-western Shovel-nosed snake | 1 | 1 | | | 1 | | | | | | | 1 | | | | |
| *Demansia psammophis* | Yellow-faced Whipsnake | | | 1 | | | | | | | | 1 | | 3 | | | |
| *Demansia rufescens* | Rufous Whipsnake | 1 | | 1 | | 1 | | | | | | | | | 1 | 1 | |
| *Pseudechis australis* | Mulga Snake | | | | | | | 1 | 6 | | | | | | | 1 | |
| *Pseudonaja modesta* | Ringed Brown Snake | | | | | | | 1 | | | | | | | | | |
| *Pseudonaja nuchalis* | Gwardar | | | | | 1 | | | | | | 1 | | | | | |
| **AMPHIBIANS** | | | | | | | | | | | | | | | | | |
| HYLIDAE | | | | | | | | | | | | | | | | | |
| *Litoria rubella* | Desert Tree Frog | | | | | | | | | | | | | | | 1 | 1 |

## Appendix C: Conservation Classification

**Table C.1 – Definitions of relevant categories under the EPBC Act**

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

**Table C.2 – Definition of Schedules under the Wildlife Conservation Act 1950**

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

**Table C.3 – Definition of DEC Priority Codes**

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

| | |
|---|---|
| | before consideration can be given to declaration as threatened fauna. |
| Priority Four (P4) | Taxa in need of monitoring.<br>Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands. |
| Priority Five (P5) | Taxa in need of monitoring.<br>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. |