Pilbara Copper-Zinc Project

Level 1 Terrestrial Fauna Survey

November 2012

Outback Ecology Services
1/71 Troy Terrace
Jolimont WA 6014
Ph: +61 (08) 9388 8799
Fax: +61 (08) 9388 8633
admin@outbackecology.com

Pilbara Copper-Zinc Project: Level 1Terrestrial Fauna Survey

Distribution:

Company	Copies	Contact Name
Venturex Resources Limited	1 (electronic)	Tim Sudgen, Andrew Robertson

Document Control for Job Number: VPX-FS-0611

Document Status	Author	Reviewer	Signature	Date of Issue
Draft Report	B. Parsons, T. Lee-Steere	D.Jasper		3 May 2011
Final Report	B. Parsons, P. Bolton	T. File		19 September 2011
Final Report v2	B. Parsons, P. Bolton, T. Derham			30 October 2012
Final Report v3	T. Derham			15 November 2012

Executive Summary

Venturex Resources Limited (Venturex) commissioned Outback Ecology to undertake a terrestrial fauna desktop study and subsequent reconnaissance survey of the Pilbara Copper-Zinc Project (the Study area). The Study area is situated 80 km south-east of Port Hedland encompassing an area of 7,623 hectares, of which approximately 178 ha will be disturbed by the Project. Venturex proposes to develop an underground copper-zinc mine with a production rate of approximately 700,000 - 850,000 tonnes per annum. Works will incorporate an underground mine with twin decline access ramps, processing plant topsoil stockpiles, laydown/hardstand area, workshops and associated facilities, water treatment facility and associated evaporation ponds, cemented backfill batch plant, accommodation camp, access tracks and haul roads to Marble Bar Road. A temporary waste rock landform is proposed to house waste for a period of 1-3 years prior to all waste being returned underground as backfill.

The specific objectives of the terrestrial fauna desktop study were to:

- develop an inventory of terrestrial vertebrate fauna species and invertebrate short-range endemic (SRE) species identified within or likely to be present within the Study area;
- provide a description of vertebrate fauna habitat, sensitive habitat and terrestrial SRE invertebrate fauna habitat expected to occur within the Study area;
- assess desktop findings in the regional context by comparisons with available data from other localities within the bioregion; and
- identify knowledge gaps pertaining to terrestrial fauna within the Study area and recommend further investigations required to address these gaps in accordance with regulatory guidelines.

The specific objectives of the reconnaissance survey were to:

- ground truth the occurrence of fauna habitat within the Study area, specifically focused on Northern Quoll habitat, habitat for conservation significant bats (*Rhinonicteris aurantia* and *Macroderma gigas*) and habitat for SRE invertebrate species; and
- provide advice on any requirement for further fauna surveys.

Conclusions contained within this report are based on a desktop study and reconnaissance survey only (i.e. no sampling of fauna was conducted as part of this study). A general assessment was made as to the likelihood of particular species of conservation significance occurring within the Study area, given the broad habitat types likely to occur, and specific habitat features occurring therein. This report does not include an impact assessment, for which a separate report will be forthcoming following refinement of the Project footprint.

Six broad terrestrial fauna habitats were recorded within the Study area, comprising Spinifex Stony Plains, Rocky Foothills, Scree Slope, Spinifex Sandplains, Drainage Line and Rocky Ridges and Gorges. An additional two significant fauna habitats of limited extent were identified: Rubble Piles and Ficus Groves.

Based on database search findings and a review of relevant literature within the surrounding region, it is possible that a total of 392 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 53 mammals (44 native), 211 birds, 116 reptiles, five fish and seven amphibian species.

Based on a more specific review of previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007), it is possible that a total of 151 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 27 mammals (22 native), 83 birds, 34 reptiles, five fish and two amphibian species.

A total of 23 conservation significant fauna species could potentially occur within the Study area, comprising:

- Eight species listed under the *Environment Protection and Biodiversity Act 1999* (EPBC Act) and the *Wildlife Conservation Act 1950* (WC Act): Northern Quoll, Mulgara, Greater Bilby, Pilbara Leaf-nosed Bat, Night Parrot, Pilbara Olive Python, Peregrine Falcon and Woma;
- Ten species listed as Priority 4 Fauna by the Department of Environment and Conservation (DEC): Ghost Bat, Spectacled Hare-wallaby, Western Pebble-mound Mouse, Long-tailed Dunnart, Lakeland Downs Mouse, Australian Bustard, Bush Stone-curlew, Grey Falcon, Star Finch, and *Ramphotyphlops ganei* (a blind snake); and
- Five species listed as Migratory under the EPBC Act: Fork-tailed Swift, Cattle Egret, Oriental Plover, Rainbow Bee-eater and Night Parrot.

Potential SRE invertebrate fauna habitat within the Study area is most likely to include Rocky Ridges and Gorges, and Drainage Lines habitat. Additionally, Rubble Piles and the Ficus Groves represent habitat isolates that may support SRE species. The remaining landscape within the Study area appears relatively uniform and does not correspond to typical SRE habitat; i.e. these habitat types were widespread, well connected and extensive throughout the surrounding landscape.

Three potential SRE species are known to occur in the region surrounding the Study area. Based on the broad habitats which occur, there is potential for all three of these species to occur within the Study area. The millipede *Antichiropus* 'abydos' has been collected 6.5km west of the Study area and the mygalomorph spider *Kwonkan* 'MYG200' has been collected 37 km south of the Study area. The pseudoscorpion *Feaella sp.* 'Sulphur Springs' is known from a single specimen collected from the Study area in 2007.

Previous survey effort within the Study area has provided a sound baseline and combined with existing data in the literature and from fauna databases, has adequately documented the faunal assemblages likely to be present.

On-ground reconnaissance suggests that much of the habitat within the Study area is of marginal quality for the conservation significant Pilbara Leaf-nosed Bats and Ghost Bats. Rocky Ridge and Gorge habitat is the habitat type most likely to support these species; however, deep, substantial caves required by these

species for breeding appear to be largely absent within this habitat type. In particular, there is little habitat considered of high quality for these species within proposed impact footprints (i.e. habitat containing deep, substantial caves). Should these species be making use of any minor caves within these areas, it is likely that they would be used as foraging or night roosts only. Despite this, disturbance to Rocky Ridge and Gorge habitat should be minimised, particularly within the valley and gorge system surrounding Sulphur Springs itself.

Northern Quolls are known to occur within the Study area with preferred habitat consisting of Rocky Ridge and Gorge habitat and Drainage Line habitat. A substantial portion of high quality Drainage Line habitat coincides with the proposed impact footprints, and is likely to impact upon Northern Quoll populations at a localised scale. The majority of Rocky Ridge and Gorge habitat lacks deep, substantial caves, crevices and outcropping required by this species as denning habitat, with the exception of the valley and gorge system surrounding Sulphur Springs itself. Disturbance to the high quality Drainage Line habitat and above mentioned valley and gorge should be minimised.

With consideration to the scale of the proposed project, the level of potential impacts and current knowledge of terrestrial fauna in the Study area, it is recommended that a Northern Quoll monitoring program be established for the Pilbara Copper-Zinc Project, consistent with EPBC guidelines for the species. The primary objectives of this monitoring program would be to:

- design and conduct a baseline population survey to provide quantitative data on Northern Quoll demographics and distribution in the Study area;
- provide pre-disturbance baseline population data that can be used to monitor the impacts of the Project on localised Northern Quoll populations; and
- develop future monitoring and management recommendations for the Northern Quoll within the Study area.

The pseudoscorpion *Feaella sp.* 'Sulphur Springs' is only known from one location, which may coincide with proposed impact footprint of the Project. Additionally, *Feaella sp.* 'Sulphur Springs' may occur in association with Drainage Line habitat; of which a considerable portion occurs within the proposed haulage route footprint in the northwest of the Study area. Subsequently a targeted terrestrial invertebrate SRE survey for *Feaella sp.* 'Sulphur Springs' is recommended with the aim of gaining a better understanding the species distribution outside of the proposed impact footprints. In addition, potential habitat for *Feaella sp.* 'Sulphur Springs' should be mapped and assessed outside proposed impact areas.

Database searches were also conducted for the Whim Creek Copper Project study area and surrounds. The search of the Western Australian Museum SRE Database provided a nil return for this Whim Creek Copper Project study area and is therefore not considered further in this assessment.

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

1. INTRODUCTION

1.1 Project Background and Location

The Study area is situated approximately 80 km south-east of Port Hedland (**Figure 1**) encompassing an area of 7,623 hectares. A map of the conceptual layout of the project is shown in (**Figure 2**).

Outback Ecology understands that Venturex Resources Limited (Venturex) proposes to develop an underground mine with a production rate of approximately 700,000 - 850,000 tonnes per annum at the Pilbara Copper-Zinc Project (the Project). The Project will comprise the underground development of the Sulphur Springs deposit, processing of ore at an on site concentrate plant and haulage of concentrate from the Project to Port Hedland via road train for export. The initial project life will be approximately nine years.

Primarily, the following facilities will be developed as part of the proposed underground mine:

- 1.3 – 1.5 million tonnes per annum (tpa) capacity processing plant;
- twin decline access;
- ventilation rises;
- a waste rock stockpile (with intention for waste rock to be re-deposited underground);
- a 50 man camp;
- airstrip (possibly all weather);
- local site roads;
- ROM trucking pad;
- haulage road directly north to the Marble Bar road;
- associated workshops and offices;
- clearing footprint of approximately 178 hectares (ha);
- waters supply – for potable water and dust suppression; and
- water treatment plant, with a small, lined sludge drying pond.

The original project proposal was assessed as a PER under Part IV of the Environmental Protection Act (EP Act) in 2007. The PER was assessed under the bilateral agreement between the Commonwealth and WA government. The draft PER was “placed on hold” due to the EPA’s concerns regarding the design, long-term operations and closure of the TSF.

The environmental impacts for the proposed single underground operation at the Project would be expected to be significantly reduced in comparison to those outlined in the 2007 draft PER. The significant reductions in impacts are associated with the:

- reduction in physical disturbance area of the area described in the 2007 draft PER (590 ha) to approximately 178 ha;
- significant reduction in acid generation from waste rock and tailings due to the removal of an open pit and the underground storage of waste rock and tailings;

- reduced water demand – water use will be limited to camp facility requirements and dust suppression (in and at the mine and on haul road); and
- reduction in emissions of light, noise, atmospheric emissions and risk of leaks and spills.

1.2 Report Scope and Objectives

This desktop study was designed and conducted as far as practicable in accordance with:

- Western Australian Environmental Protection Authority's (EPA) Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (Environmental Protection Authority 2002);
- EPA Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (Environmental Protection Authority 2004);
- *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (Environmental Protection Authority and Department of Environment and Conservation 2010); and
- Guidance Statement No. 20 *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (Environmental Protection Authority 2009).

The specific objectives of the terrestrial fauna desktop study were to:

- Develop an inventory of terrestrial vertebrate fauna species and terrestrial short-range endemic (SRE) invertebrate fauna species that have been recorded or likely to occur within the Study area;
- Provide a description of vertebrate fauna habitat, sensitive habitat and terrestrial SRE invertebrate fauna habitat expected to occur within the Study area;
- Assess desktop findings in the regional context by comparisons with available data from other localities within the bioregion; and
- Identify knowledge gaps pertaining to terrestrial fauna within the Study area and recommend further investigations required to address these gaps in accordance with regulatory guidelines.

The specific objectives of the reconnaissance survey were to:

- ground truth the occurrence of fauna habitat within the Study area, specifically focused on Northern Quoll habitat, habitat for conservation significant bats (*Rhinonicteris aurantia* and *Macroderma gigas*) and habitat for SRE invertebrate species; and
- to provide advice on any requirement for further fauna surveys.

In addition to these objectives, a search of relevant databases for vertebrate and SRE invertebrate fauna within the Whim Creek area and surrounds has been included as an attachment for use in future approvals documentation.

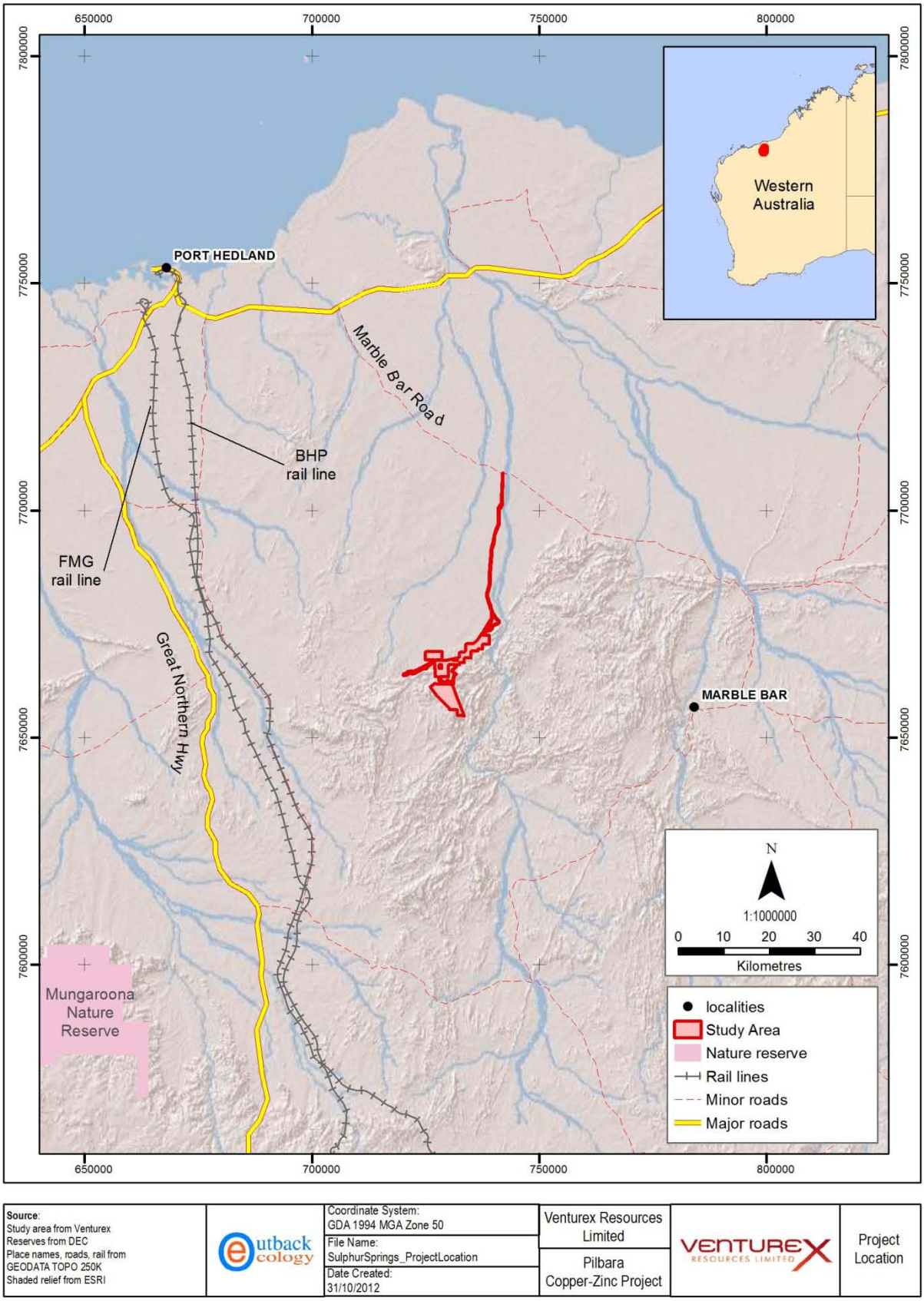

Figure 1: Regional location of the Study area

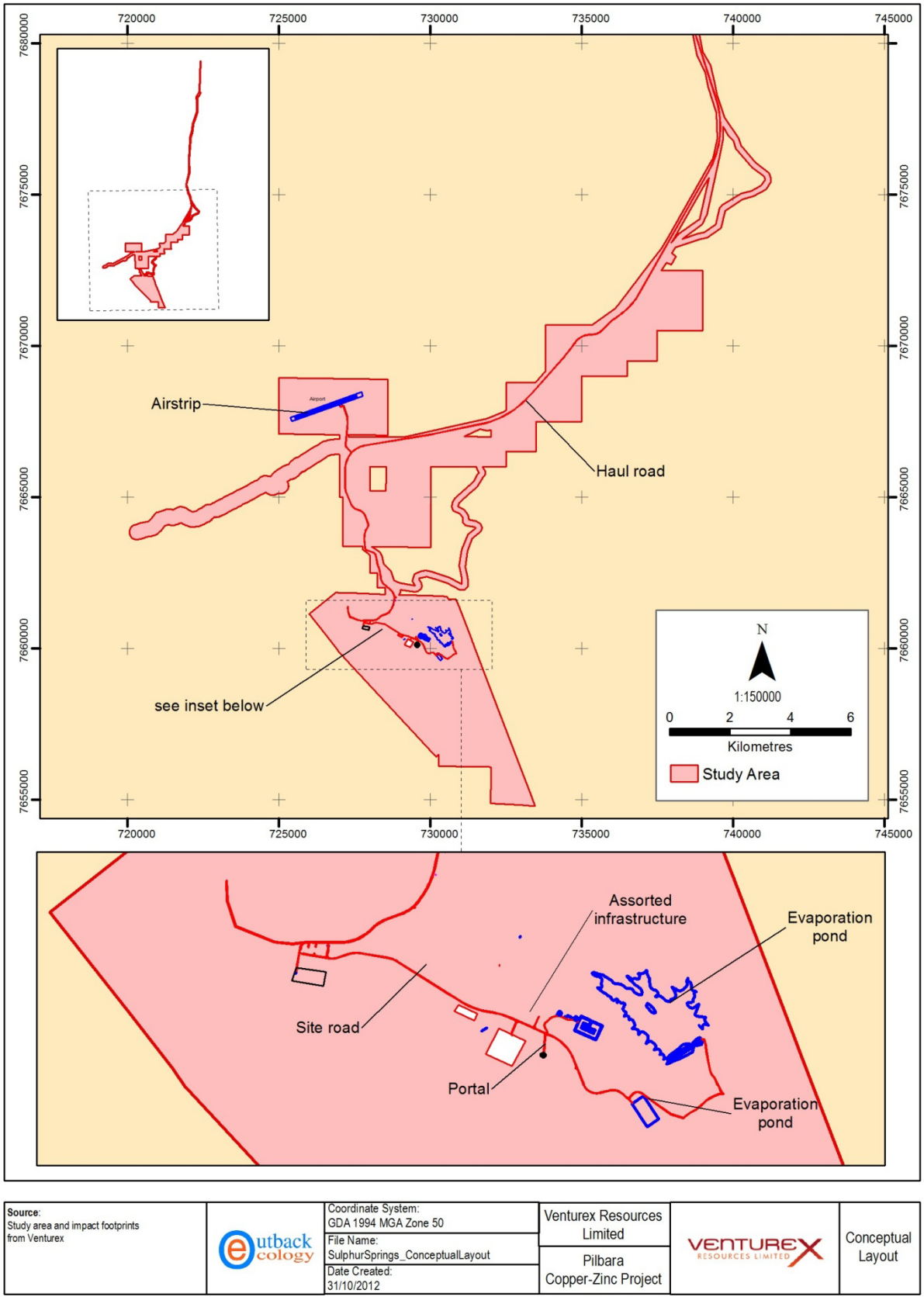

Figure 2: The Study area and conceptual project layout.

2. EXISTING ENVIRONMENT

2.1 Biogeographic Region

The Study area occurs within the Pilbara bioregion which encompasses approximately 178,500 km^2 (McKenzie *et al.* 2009). The Pilbara bioregion has a semi-arid to arid tropical climate, with active drainage in the Fortescue, De Grey and Ashburton river systems (McKenzie *et al.* 2003). The Pilbara has a high level of fauna biodiversity and species endemism. However, a combination of invasive weeds, altered fire regimes, feral predators and grazing by introduced herbivores is causing ecosystem degradation and consequently a loss of vegetation and of native species, in particular mammals within the critical weight range of 35 – 5,500 g body mass (McKenzie *et al.* 2003).

The Pilbara bioregion is further classified into the Chichester, Roebourne, Fortescue Plains, and Hamersley sub-bioregions using the Interim IBRA classification system (McKenzie *et al.* 2003). The Study area falls largely within the Chichester sub-bioregion with a small portion of the Haul Road falling within the Roebourne sub-bioregion (**Figure 3**).

The Chichester sub-bioregion is the largest sub-bioregion encompassing 47% (83,700 km^2) of the Pilbara region (McKenzie *et al.* 2009). It is characterised by undulating Archaean granite and basalt plains with significant areas of basalt ranges (Kendrick and McKenzie 2001). The basalt plains host a shrub steppe of *Acacia inaequilatera* over *Triodia* spp. hummock grasslands, while tree steppes of *Eucalyptus leucophloia* occur on the ranges (Kendrick and McKenzie 2001). The northern part of the Chichester sub-bioregion is relatively flat and undulating, being dominated by large alluvial floodplains associated with the De Grey River system and its tributaries (McKenzie *et al.* 2009). The Chichester sub-bioregion lies predominantly inland from the coast (**Figure 3**).

The Roebourne sub-bioregion is situated on the Pilbara's north-western fringe and covers an area of 18,910km^2 (McKenzie *et al.* 2009). The uplands of the Roebourne sub-bioregion, which are of relevance to the Study area, are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite (Kendrick and Stanley 2001).

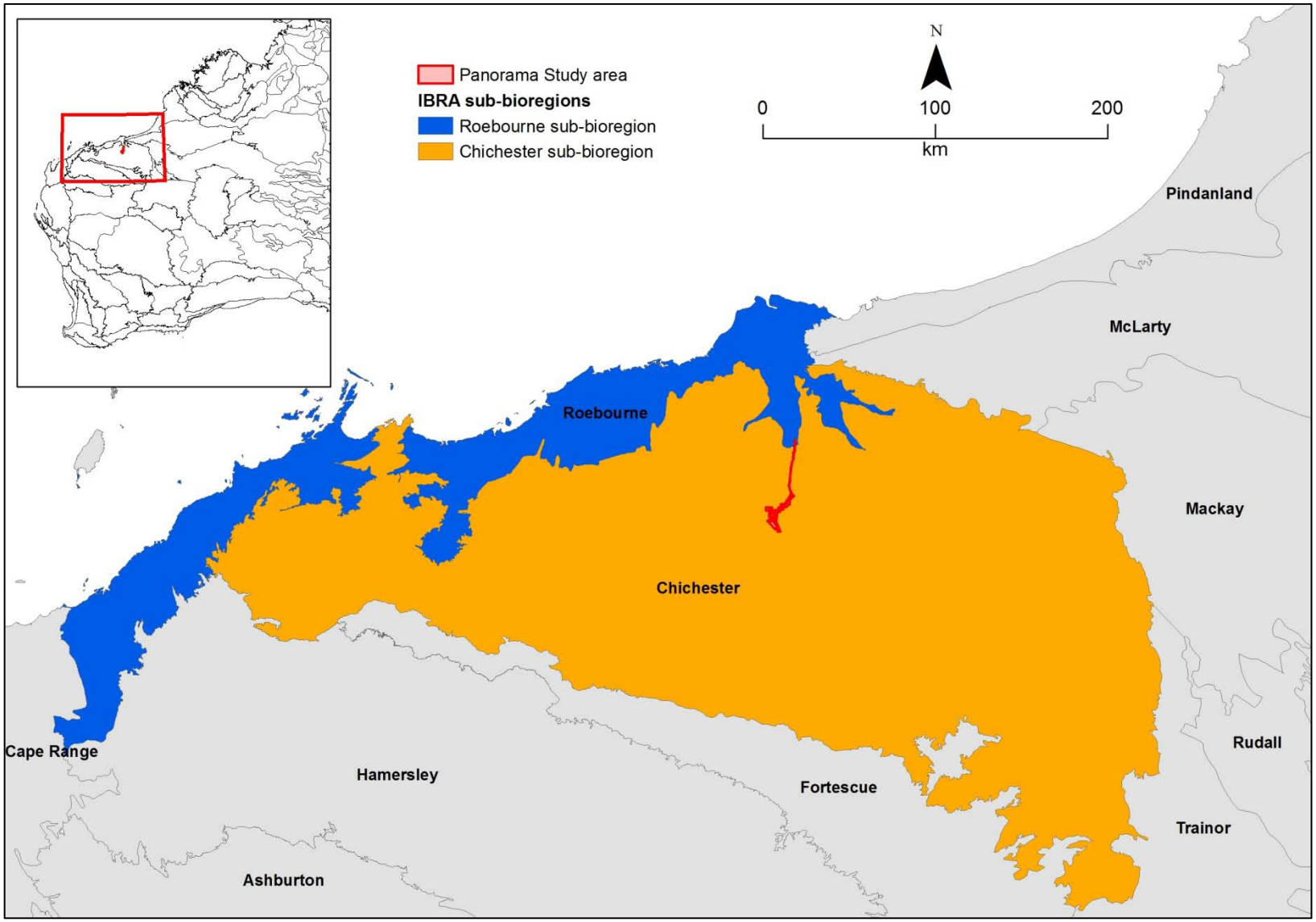

Figure 3: The location of the Study area with respect to IBRA sub-bioregions

2.2 Climate

The study area is located within the northern section of the Pilbara bioregion, which experiences a semi-arid to arid-tropical climate that is characterised by hot summers and relatively warm, dry winters (Bureau of Meteorology 2011). Tropical cyclones can occur between the months of January to April, bringing sporadic drenching rainfall events (How *et al.* 1991).

The nearest Bureau of Meteorology (BOM) weather station to the Project is located at Marble Bar, approximately 55 km to the east of the Study area. Weather data collected from the Marble Bar Meteorological Station indicates rainfall occurs mainly in the first half of the year with a mean average rainfall of approximately 360mm (Bureau of Meteorology 2011) (**Figure 4**). Rainfall within the Study area can be highly localised and unpredictable with substantial fluctuations occurring from year to year (Bureau of Meteorology 2011, Leighton 2004). This variability is illustrated in **Figure 5**.

Marble Bar typically experiences a very hot summer with the mean maximum temperature reaching 40.1°C and a mean minimum temperature of 25.7°C (**Figure 4**). Over the whole year, Marble Bar averages 98 days above 40° (Leighton 2004). Winter occurs from June to August when the mean maximum temperature for Marble Bar is 28°C and the mean minimum temperature is 12.8°C (**Figure 4**).

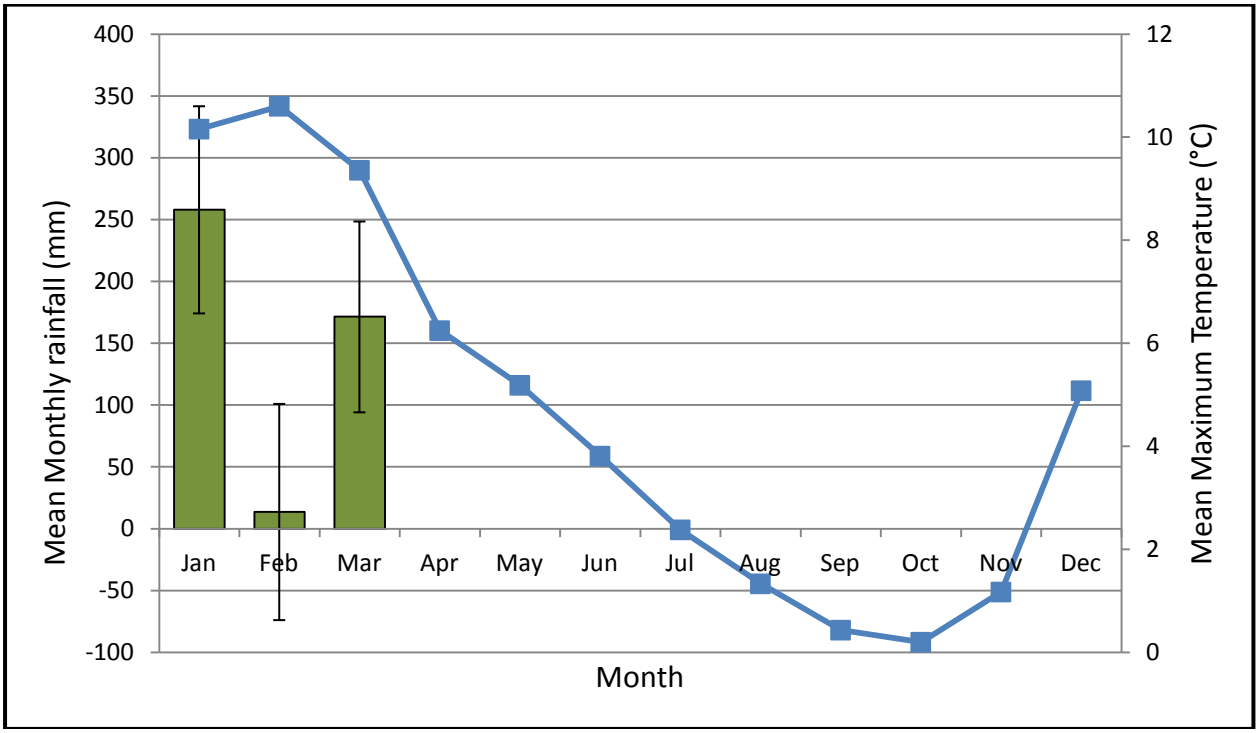

Figure 4: Mean rainfall and temperature for Marble Bar Weather Station (1895 – 2010) (BOM 2011)

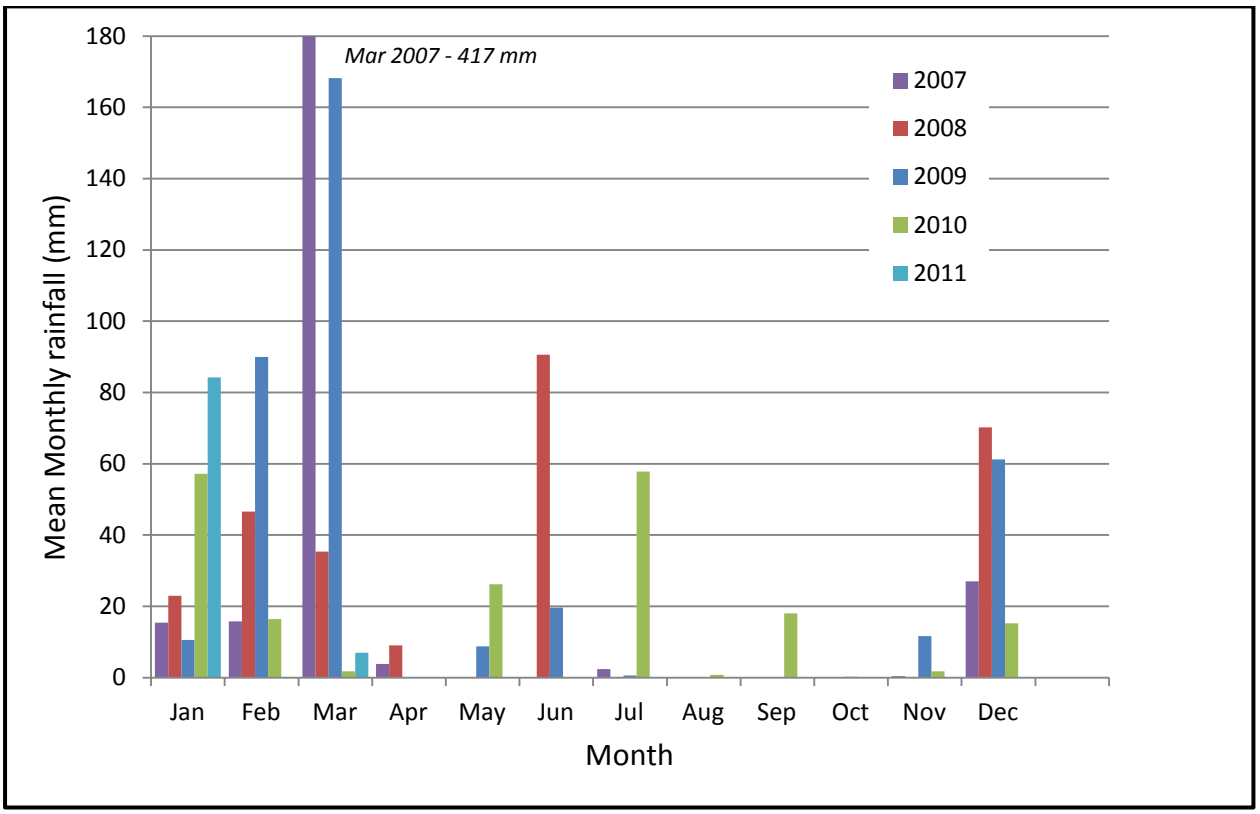

Figure 5: Monthly rainfall for Marble Bar 2007- March 2011 (BOM, 2011)

2.3 Land Systems of the Study Area

A regional survey was undertaken in the Pilbara between 1995 and 1999 by the Department of Agriculture (now the Department of Agriculture and Food) and the Department of Land Administration (now Landgate) to develop a comprehensive description of the biophysical resources and the vegetation composition and soil condition within the region. This information was used by van Vreeswyk *et al*. (2004) to classify and map the land systems of the Pilbara region based on landform, soil, vegetation, geology and geomorphology. An assessment of land systems provides an indication of the occurrence and distribution of fauna habitats within and surrounding the Study area.

The Study area contains eight land systems: Capricorn, Rocklea, Boolgeeda, Uaroo, Satirist, Platform, Macroy and River. The characteristics and extent of these land systems are summarised in **Table 1** and are mapped in **Figure 6**. Of these eight land systems, the Capricorn and Rocklea land systems are likely to be of particular significance to conservation significant fauna occurring within the Study area. These land systems, which consists of hills and ridges of volcanic and other rocks supporting hard Spinifex, is likely to support Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Ghost Bat (*Macroderma gigas*) and Rothschild's Rock-wallaby (*Petrogale rothschildi*), with Pebble-mound Mouse (*Pseudomys chapmani*) likely to be present on stony slopes. Finer scale mapping of specific fauna habitats is presented in **Section 4.1**.

Table 1: Land systems occurring within the Study area

Land System	Brief Description	Total area (ha) within Study area	Proportion of Study area (%)
Capricorn Land System	Hills and ridges of sandstone and dolomite supporting low shrublands or shrubby spinifex grasslands.	3,656	48.0
Rocklea Land System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	1,932	25.3
Boolgeeda Land System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	904	11.9
Uaroo Land System	Broad sandy plains supporting shrubby hard and soft spinifex grasslands.	525	6.9
Satirist Land System	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands.	293	3.8
Platform Land System	Dissected slopes and raised plains supporting hard spinifex grasslands.	163	2.1
Macroy Land System	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands.	124	1.6
River Land System	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands.	26	0.3

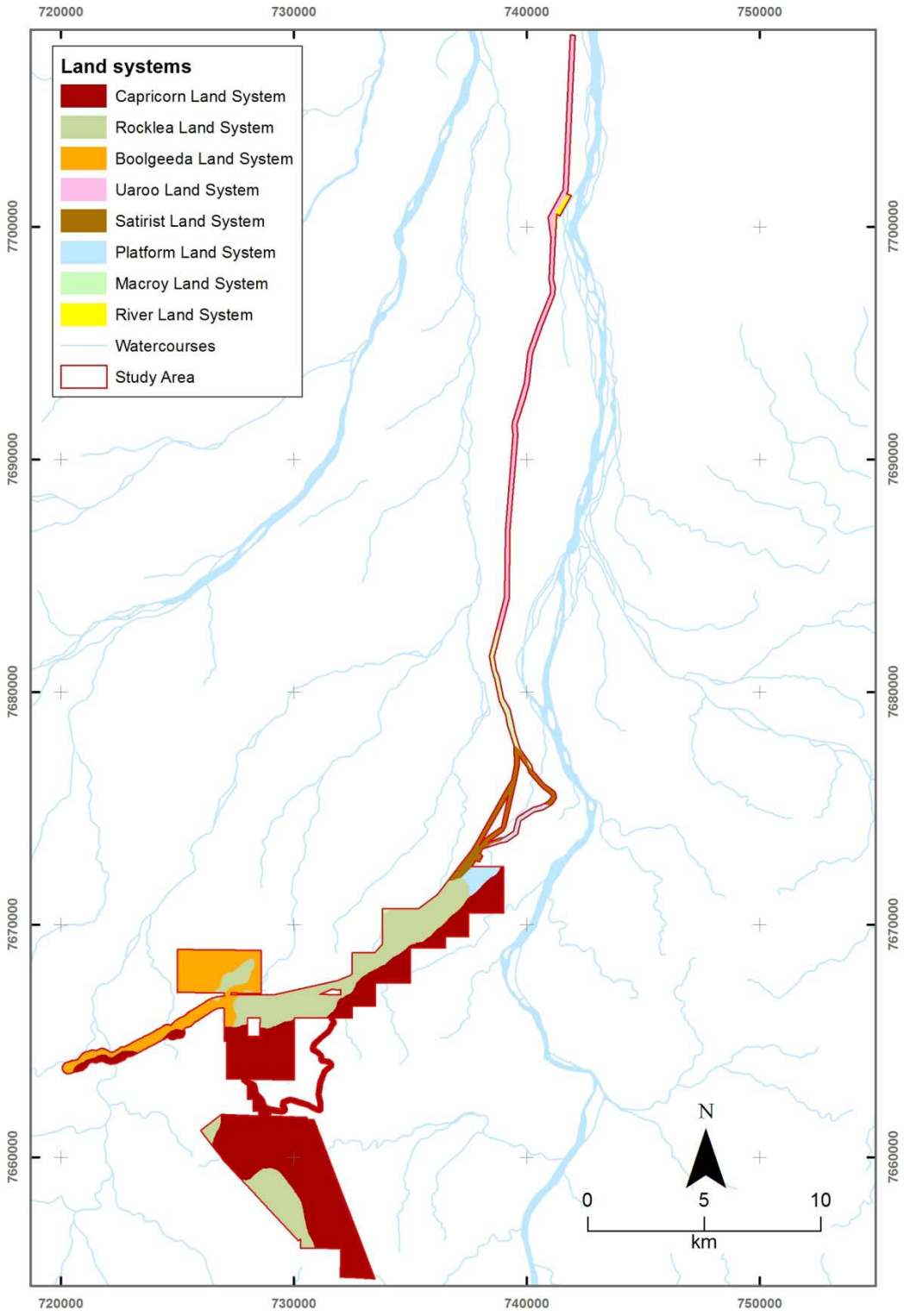

Figure 6: Land systems occurring within and surrounding the Study area

2.4 Land Use

Land tenure in the Pilbara consists primarily of pastoral leases, with other crown reserves such as Aboriginal reserves and leasehold reserves also forming a large proportion. National parks and reserves and unallocated crown land are the other major land use categories present in the region. The first mining exploration in the Pilbara commenced in the early 1800s and currently this area provides the majority of Western Australia's petroleum, gas and iron ore exports, while gold mining is also an important industry (Australian Natural Resources Atlas 2007).

In the Chichester subregion, the dominant land uses are pastoralism (i.e. grazing of native pasture by cattle), Aboriginal lands and reserves, unallocated crown land (UCL) and crown reserves, conservation, and mining (Kendrick and McKenzie 2001). The Chichester subregion has 6.56% of its land surface reserved under some form of conservation. The subregion contains Millstream-Chichester National Park, Mungaroona Range Nature Reserve and Meentheena ex-pastoral lease (Kendrick and McKenzie 2001).

Mungaroona Range Nature Reserve is the only substantial nature reserve that exists near the Study area (**Figure 1**). Knowledge of the fauna of this nature reserve is limited (Department of Environment and Conservation 2007). It is proposed that all of the Mungaroona Range Nature Reserve will be gazetted as 'wilderness' under the *Conservation and Land Management Act 1984*. The Department of Environment and Conservation (DEC) considers the Mungaroona Range Nature Reserve warrants gazettal as a wilderness area based on the following criteria:

- The reserve more than exceeds the minimum size criterion of 20 000 hectares;
- There is currently no vehicle access into the reserve, no built infrastructure and visitation to the reserve is exceptionally low; and
- Given the reserve's considerable remoteness and lack of impacts from modern technological society, much of the area's biodiversity and natural systems are likely to be intact.

In relation to land tenure, the Project is located within mining tenements M45/494, M45/1001 and M45/653 and spans both pastoral lease and unallocated crown land and lies on the Njamal Native Title Claim area. Land use across the study area includes exploration activities and cattle grazing (**Figure 7**).

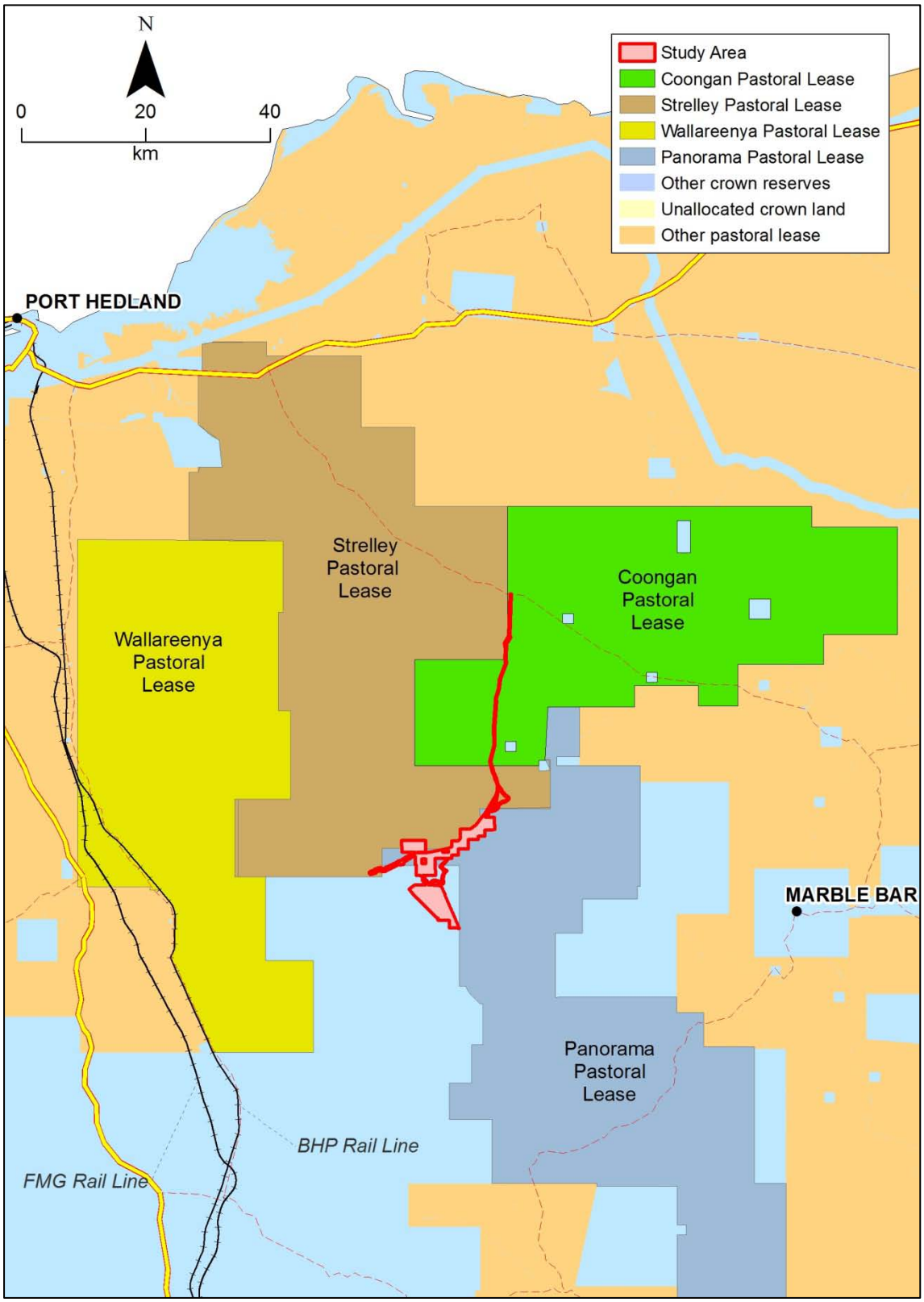

Figure 7: Land use within and surrounding the Study area

3. SURVEY ASSESSMENT AND METHODOLOGY

The methods used to assess the potential occurrence of terrestrial vertebrate fauna and SRE invertebrate fauna within the Study area include database searches (Section 3.1), a literature review (Section 3.2) and a reconnaissance survey (Section 3.3).

3.1 Database Searches

Database searches were undertaken to provide a list of mammals, reptiles, amphibians, bird species and SRE invertebrate fauna species that have previously been recorded or have the potential to occur within the Study area. The search area consisted of a 75 kilometre buffer around the Study area. Database searches of these areas were made using the following databases and internet tools:

- DEC's NatureMap database (Department of Environment and Conservation 2010a).
- Threatened and Priority Fauna Database held by the DEC (Department of Environment and Conservation 2010b).
- The Birds Australia New Atlas 1998 – 2010 database (Birds Australia 2010).
- The Environmental Reporting Tool (Department of Sustainability Environment Water Population and Communities 2010a).
- Western Australian Museum SRE Database – arachnids and millipedes (Western Australian Museum 2010).

The above searches were also conducted for the Whim Creek Study area and surrounds and have been included as an attachment for use in future approvals documentation. The search of the Western Australian Museum SRE Database provided a nil return for the Whim Creek Study area and is therefore, not considered further.

Presence of fauna species recorded in regional summary documents was also considered in this report. Documents included:

- Birds of the Pilbara Region, Western Australia (Storr 1984);
- A Biodiversity Audit of Western Australian's 53 Biogeographical Subregions (Kendrick and McKenzie 2001);
- The Australian Natural Resources Atlas (Australian Natural Resources Atlas 2007) of the National Land and Water Resources Audit;
- An introduction to the Pilbara Biological Survey 2002-2007 (McKenzie *et al.* 2009);
- Pilbara Biological Survey 2002-2007: Environmental Associations of small ground-dwelling mammals in the Pilbara region, Western Australia (Gibson and McKenzie 2009);
- Pilbara Biological Survey 2002-2007: Birds in a vast arid upland: avian biogeographical patterns in the Pilbara region of Western Australia (Burbidge *et al.* 2010); and
- Pilbara Biological Survey 2002-2007: The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats (McKenzie and Bullen 2009).

3.2 Literature Review

A literature review was undertaken to provide a list of mammals, birds, reptiles, amphibians, fish and invertebrate SRE fauna species that have been previously recorded within the vicinity of the Study area. The following two sections distinguish between those surveys that were conducted within the Study area or its immediate surrounds and those that were conducted near the Study area. These surveys are described below and the location of each Study area (where available) is shown in **Figure 8**. A key detailing the surveys examined within the literature review is provided in **Table 2**. A detailed inventory of the vertebrate fauna recorded in each of these surveys is provided in **Attachment A.**

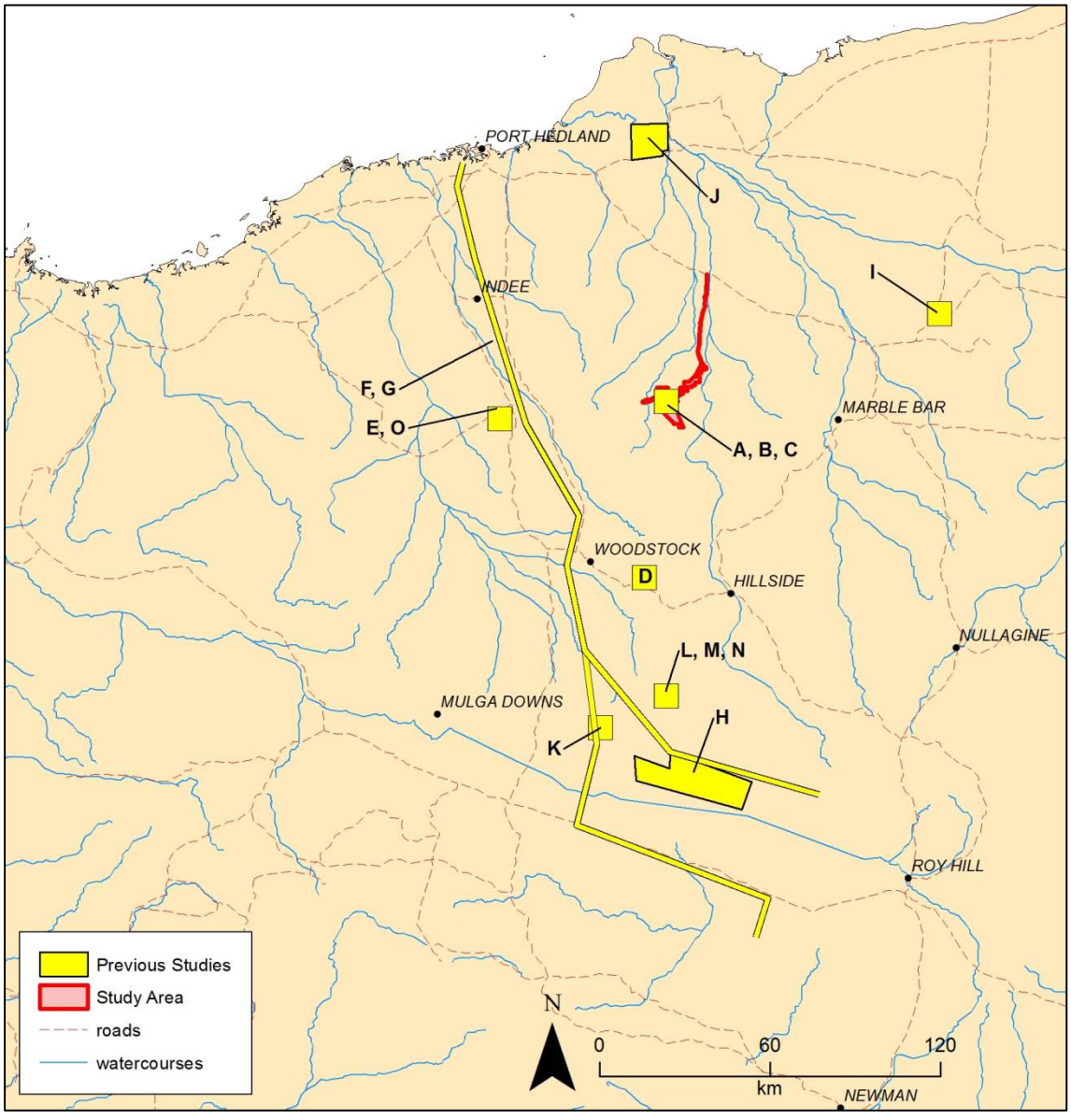

Figure 8: Location of previous fauna surveys within the surrounding region

Table 2: Key to map of location of previous fauna surveys within the surrounding region

Map Label	Reference
Fauna surveys in/near the Study area	
A	Bamford Consulting Ecologists. (2001) Sulphur Springs Project Area: Baseline Fauna Study as Part of the Sulphur Springs Feasibility Study, Prepared for Astron Environmental.
B	Biota. (2007) Sulphur Springs Project: Mine Site and Haul Road Corridor Targeted Fauna Survey, Prepared for CBH Resources Ltd.
C	MOLHAR Pty Ltd. (2007) Field Survey for conservation significant bats near Sulphur Springs, Pilbara: field survey and management advice, Prepared for CBH Resources Ltd.
Fauna surveys in the region	
D	How, R. A., Dell, J. and Cooper, N. K. (1991) Ecological Survey of Abydos-Woodstock Reserve, Western Australia: Vertebrate Fauna. Records of the Western Australian Museum Supplement 37: 78-125.
E	Mattiske Consulting Pty Ltd. (2000) Flora, Vegetation and Vertebrate Fauna of the Proposed Expansion at Wodgina, Prepared for Sons of Gwalia Ltd.
F	Biota. (2002) Proposed Hope Downs Rail Corridor From Weeli Wolli Siding to Port Hedland - Vertebrate Fauna Survey, Hope Downs Management Services Vertebrate Fauna Survey.
G	Biota. (2004) Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor, Fortescue Metals Group Fauna Habitat and Fauna Assemblage Report.
H	Bamford Consulting Ecologists. (2005) Fauna Survey of Proposed Iron Ore Mine, Cloud Break, Prepared for Fortescue Metals Group Ltd.
I	Outback Ecology Services. (2006) Spinifex Ridge Molybdenum Project: Terrestrial Vertebrate Fauna Baseline Surveys (2005-2006), Unpublished report prepared for Atlas Iron Limited.
J	Bamford Consulting Ecologists. (2007) Fauna Assessment of the Pardoo Direct Shipping Ore Project Atlas Iron Limited, Prepared for Enesar Consulting Pty Ltd.
K	ecologia. (2008) RGP 5 Level 2 Fauna Survey: Chichester Deviation, A report commissioned by BHP Billiton Iron Ore Pty Ltd.
L	Ninox Wildlife Consulting. (2009) A Fauna Survey of the Proposed Hope Downs 4 Mining Area Near Newman, Western Australia, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.
M	Ninox Wildlife Consulting. (2009) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor: Option 1 Near Newman, Western Australia, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.
N	Ninox Wildlife Consulting. (2009) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Option 6 Infrastructure Corridor Near Newman, Western Australia, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.
O	Outback Ecology. (2009) Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment, Prepared for Atlas Iron Limited.

3.2.1 Fauna Surveys in the Study Area

Four terrestrial vertebrate fauna surveys have been conducted within or in areas adjacent to the Study area. A brief synopsis of these surveys is presented in chronological order below.

Bamford Consulting Ecologists (2001) Sulphur Springs Project Area: Baseline Fauna Study as Part of the Sulphur Springs Feasibility Study

This comprehensive fauna assessment was conducted over two periods: June and September 2001. Survey methods included: systematic trapping for amphibians, reptiles and mammals; census for birds; spotlighting for nocturnal reptiles, birds and mammals; mist-netting, harp trapping and ultra-sonic detecting for bats; and active searches.

The Sulphur Springs study area was considered a locally significant example of a Pilbara landscape possessing rocky hills, small gorges and undulating plains. Rocky hills, gorges and cliff-lines were identified as important habitat for mammals, reptiles and birds, including Ghost Bats (*Macroderma gigas*) and Peregrine Falcons (*Falco peregrinus*). Although limited in extent, watercourses and riparian vegetation were also considered highly significant fauna habitats.

A total of 137 species were recorded during the surveys, comprising 22 mammals, 80 birds, 29 reptiles, two amphibians and four fish species.

Conservation significant fauna recorded during this survey included:

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Mulgara (*Dasycercus cristicauda*) burrows (EPBC Act – Endangered; WC Act – Schedule 1);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (EPBC Act - Vulnerable; WC Act – Schedule 1);
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) (DEC - Priority 3);
- Four species listed as Priority 4 under the DEC Priority List: Western Pebble-mound Mouse (*Pseudomys chapmani*), Ghost Bat (*Macroderma gigas*), Australian Bustard (*Ardeotis australis*), and Bush Stone-curlew (*Burhinus grallarius*).

The Study concluded that future developments of the area should endeavour to minimise impacts on the surrounding habitats, particularly given the watercourse on which the proposed mine area and existing access road are located is one of the most distinctive environmental features of the project area. The watercourse provides important habitat for many of the identified fauna species and permanent pools along the Strelley and Shaw River systems were found to be used by waterbirds and freshwater fish and may support significant fauna such as the Olive Python.

Biota (2007) Sulphur Springs Project: Mine Site and Haul Road Corridor Targeted Fauna Survey

This Level 2 survey was conducted to assess the haul road associated with the Sulphur Springs project in August-September 2006. The survey incorporated a variety of sampling techniques including pitfall trapping, Elliott traps, harp traps, avifauna census and opportunistic recording.

The study area encompassed two habitat types: a narrowly incised valley supporting mid-dense to dense riparian vegetation and small to medium sized pools of water; and low stony hills, vegetated with *Triodia* hummock grasslands.

The survey recorded a total of 73 vertebrate fauna species, comprising 12 mammals, 41 birds, 18 reptiles and two amphibians.

Conservation significant fauna recorded during the survey comprised:

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Mulgara (*Dasycercus cristicauda*) burrows (EPBC Act – Endangered; WC Act – Schedule 1);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (EPBC Act - Vulnerable; WC Act – Schedule 1);
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) (DEC - Priority 3); and
- Four species listed as Priority 4 under the DEC Priority List: Western Pebble-mound Mouse (*Pseudomys chapmani*), Ghost Bat (*Macroderma gigas*), Australian Bustard (*Ardeotis australis*), and Bush Stone-curlew (*Burhinus grallarius*).

Invertebrate taxa prone to short-range endemism collected during the survey included terrestrial snails, mygalomorph spiders and pseudoscorpions. The only species collected during the survey that was identified as representing a potential SRE species was the pseudoscorpion *Feaella sp* 'Sulphur Springs' represented by a single specimen (728157 mE; 7660995 mN; UTM, zone 50, WGS84). The specimen was collected beneath slate like rock on the south face of a low cliff adjacent to a narrowly incised ephemeral drainage line. Biota (2007) speculated that specimens may also occur on the gabbro rock piles across the study area.

Biota (2007) recommend that additional survey work be undertaken to delineate distribution and habitat of *Feaella sp* 'Sulphur Springs' and that additional taxonomic work should be undertaken to resolve the identity of the specimen. As a result, additional survey work was undertaken with the assistance of Dr Mark Harvey from the WA Museum in October 2007 (M. Harvey pers. comm. September 2011). The survey was unsuccessful in collecting additional specimens of *Feaella sp* 'Sulphur Springs'.

MOLHAR (2007) Sulphur Springs Project: Field Survey for Conservation Significant Bats near Sulphur Springs, Pilbara

This targeted bat survey was conducted to determine the presence of the Pilbara Leaf-nosed Bat over the plain north from the Lalla Rookh mine, focussing on the area pertaining to the Plains Access Road lease, as well as to determine the areas where foraging occurred within 20 km of the mine site. Surveys were also carried out to determine the presence of cave roosts in close proximity to the Sulphur Springs Valley Road, and in the wider area.

Surveys helped to assess the potential effect of water drawdown and roost habitat suitability based on historical drawings of the underground structure of the Lalla Rookh mine; and assess possible responses to reducing bat roadkills by seeking background information on previous occurrences.

Several conclusions could be drawn from the survey results. Pilbara Leaf-nosed Bats were found to forage at least 750 m over the flat plain north of the Lalla Rookh mine, and beyond the northern extent of the miscellaneous lease in the vicinity of this roost. The species also forages in five deep gullies examined in the area, and they can be found as far east as the North Pole Mining Centre, and west to Strelley Gorge, however the survey did not identify diurnal roost sites in the most prospective gullies in the area.

Given that no other roost sites are currently known from near the project area, and the general lack of deep caves, it was concluded that bats foraging in the ranges adjacent to the proposed Project area would roost in the Lalla Rookh mine. Therefore, the Pilbara leaf-nosed bat might be capable of nightly foraging bouts of a significant distance, up to 32 km round trip commuting distance, given that Strelley Gorge is 16 km from Lalla Rookh. It was also concluded that dewatering by up to 15 m near the Lalla Rookh Mine might still allow for humid microclimates suitable for bat habitation to be maintained.

3.2.2 Fauna Surveys in the Region

The following 13 surveys have been conducted in the Study area surrounds. A brief synopsis of these surveys is presented in chronological order below.

How et al. (1991) Ecological Survey of Abydos-Woodstock Reserve, Western Australia

This publication represented the first major survey of the region and was conducted by the Western Australian Museum (WAM) from 1988 to 1990. The survey sought to determine the richness and diversity of vertebrate fauna and identify unique fauna communities of conservation value within the Abydos-Woodstock Reserve, located approximately 60 km to the south of the Study area (**Figure 8**).

Sampling of vertebrate fauna was conducted over nine sessions during a two and a half year period. Sampling techniques included pitfall and Elliott traps, mist nets, active searches and avifauna censuses.

A total of 179 vertebrate fauna species were recorded, comprising 14 mammals, 92 birds, 68 reptiles and five amphibian species. Fauna abundance remained reasonably consistent across different habitats and

seasons, although species composition varied significantly. Further, species richness was seen to decrease substantially after fire, particularly for mammals.

The Abydos-Woodstock Reserve was found to be depauperate in avifauna, due largely to the lack of free-standing water and mulga plains, which are known to support a greater diversity in the southern Pilbara. Rocky slope, ridge, plateau and rockpile habitats were deemed of particular importance to mammal and reptile assemblages.

Thirteen conservation significant fauna species were recorded during the survey, comprising:

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Mulgara (*Dasycercus cristicauda*) burrows (EPBC Act – Endangered; WC Act – Schedule 1);
- Pilbara Olive Python (*Liasis olivaceus barroni)* (EPBC Act – Vulnerable; WC Act – Schedule 1);
- Common Slender Blue-tongue (*Cyclodomorphus branchialis*) (WC Act -Schedule 1);
- *Ctenotus nigrilineatus* (DEC - Priority 1);
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) (DEC - Priority 3);
- Four species listed as Priority 4 under the DEC Priority List: Western Pebble-mound Mouse (*Pseudomys chapmani*), Ghost Bat (*Macroderma gigas*), Bush Stone-curlew (*Burhinus grallarius*), and Australian Bustard (*Ardeotis australis*); and
- Three migratory species listed under the EPBC Act, Common Greenshank (*Tringa nebularia*), Fork-tailed Swift (*Apus pacificus*), and Rainbow Bee-Eater (*Merops ornatus*).

Mattiske Consulting. (2000) Flora, Vegetation and Vertebrate Fauna of the Proposed Expansion at Wodgina

This Level 1 fauna assessment reviewed the terrestrial fauna potentially occurring at the Wodgina Tantalum Mine, which is situated approximately 55 km west of the Study area (**Figure 8**). One objective of this assessment was to identify the potential impacts of the proposed expansion of the Wodgina Tantalum Mine on local fauna assemblages and habitat. However the emphasis of this report was on the flora and vegetation of the area and consequently only provided a cursory discussion of potential fauna.

Five key fauna habitats were described, including Eucalyptus woodlands, Acacia shrublands, hummock grasslands, adits and caves, and water bodies.

Four conservation significant fauna species were identified as possibly occurring in the area, comprising:

- Pilbara Olive Python (*Liasis olivaceus barroni)* (EPBC Act – Vulnerable; WC Act – Schedule 1);
- Two species listed as Schedule 4 under the WC Act, the Peregrine Falcon (*Falco peregrinus*) and Woma (*Aspidites ramsayi*); and
- Grey Falcon (*Falco hypoleucos*)- Priority 4.

Biota (2002b) Proposed Hope Downs Rail Corridor From Weeli Wolli Siding to Port Hedland - Vertebrate Fauna Survey

This Level 2 fauna survey was conducted on the Hope Downs Rail Corridor from Port Hedland to Weeli Wolli siding in April and June 2001. The study area assessed for this proposed railway corridor consists of a long, linear corridor that passes 45 km to the west of the Sulphur Springs Study area (**Figure 8**). This fauna assessment incorporated a variety of sampling techniques including pitfall traps, Elliott traps, funnel traps, and cage traps, systematic hand searching, targeted searching, AnaBat echolocation recording, harp trapping for bats and avifauna census.

Six habitats were identified during this assessment comprising of sand dune, Fortescue basin flats, cracking clay, major drainage lines, granite rock piles, and mangrove and mudflats.

A total of 243 vertebrate fauna species were recorded, comprising 39 mammals, 125 birds, 73 reptiles and six amphibians.

Twelve conservation significant vertebrate fauna species were recorded from this survey, comprising:

- Two species listed as Endangered under the EPBC Act and Schedule 1 under the WC Act, the Northern Quoll (*Dasyurus hallucatus*) and Mulgara (*Dasycercus cristicauda*) (burrows, diggings and tracks only);
- One species listed as Vulnerable under the EPBC Act and Schedule 1 under the WC Act, the Bilby (*Macrotis lagotis* – burrows only);
- Two species listed as Schedule 4 under the WC Act, the Peregrine Falcon (*Falco peregrinus*) and Woma (*Aspidites ramsayi*); and
- Seven species listed as Priority 4 on the DEC Priority Species List, the Ghost Bat (*Macroderma gigas*); Lakeland Downs Mouse (*Leggadina lakedownensis*); Pebble-mound Mouse (*Pseudomys chapmani*); Australian Bustard (*Ardeotis australis*); Bush Stone-curlew (*Burhinus grallarius*); Eastern Curlew (*Numenius madagascariensis*); and *Ctenotus nigrilineatus*.

Biota (2002a) An Assessment of the Distribution of the Mulgara (Dasycercus cristicauda) and Bilby (Macrotis lagotis) along and adjacent to the Proposed Hope Downs to Port Hedland Rail Corridor

This Level 1 targeted fauna assessment surveyed areas where evidence of Bilby and Mulgara had been recorded during a previous survey of the proposed rail corridor study area. Thirty separate locations comprising of over 200 individual data points corresponding to Mulgara activity were recorded. Field investigations confirmed that the primary habitat for the Mulgara in this study area comprised sandy or sandy clay plains dominated by *Triodia*. Two additional Bilby diggings were recorded from the same locality as previously recorded in Spinifex hummock grassland.

Biota (2004) Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor

This Level 2 fauna survey was undertaken over the FMG Stage A Rail Corridor between March and April 2004. The FMG rail corridor study area passes 45 km to the west of the Sulphur Springs Study area (**Figure 8**). This fauna assessment incorporated a variety of sampling techniques including pitfall traps, Elliott traps, funnel traps, cage traps, hand searching and avifauna census.

Thirteen vegetation types occurred within the study area, comprising Littoral Vegetation – shrub dominated; Sandy Plain Vegetation – Spinifex dominated; Sandy Plain Vegetation – Tree/shrub dominated; Stony Plain and Hill Vegetation – Spinifex dominated; Drainage and Sandy Plain Vegetation – Tree/shrub dominated; Minor Creeklines, Drainage Areas and Floodplains; Granite Outcrop Vegetation; Granite Ridge Vegetation; Quartz Ridge Vegetation; Dolerite Dyke Vegetation; Cracking Clay Vegetation; Vegetation of Clayey/Sandy Plains; and Sand Dune Vegetation.

A total of 176 vertebrate species were recorded, comprising 25 mammals, 84 birds, 58 reptiles, six amphibians and three fish.

Six conservation significant vertebrate fauna species were recorded from this survey, comprising:

- Mulgara (*Dasycercus cristicauda*) (EPBC Act – Endangered; WC Act – Schedule 1);
- Peregrine Falcon (*Falco peregrinus*) (WC Act - Schedule 4); and
- Four species listed as Priority 4 under the DEC Priority List: Lakeland Downs Mouse (*Leggadina lakedownensis*); Australian Bustard (*Ardeotis australis*); Bush Stone-curlew (*Burhinus grallarius*); and Grey Falcon (*Falco hypoleucos*).

Bamford Consulting Ecologists (2005) Fauna Survey of the Proposed Cloud Break Iron Ore Mine

This Level 2 fauna survey was conducted between April and May 2005. The Cloud Break study area assessed during this survey is located 120 km south of the Sulphur Springs Study area (**Figure 8**). This survey incorporated a variety of sampling techniques including systematic trapping, active searching, bird surveys and AnaBat echolocation recordings.

Six fauna habitat types occurred within the Cloud Break Study area including Spinifex plains, samphire flats, woodlands, ridges, gullies and drainage lines.

A total of 152 vertebrate species were recorded, comprising of 25 mammals, 98 birds, 28 reptiles and one amphibian.

Four conservation significance fauna species were recorded during this survey:

- Night Parrot (*Pezoporus occidentalis*) (EPBC Act – Endangered; WC Act – Schedule 1)
- Peregrine Falcon (*Falco peregrinus*) (WC Act – Schedule 4); and

- Two species listed as Priority 4 under the DEC Priority List, Australian Bustard (*Ardeotis australis*) and Star Finch (*Neochmia ruficauda subclarescens*).

Outback Ecology Services (2006) Spinifex Ridge Molybdenum Project: Terrestrial Vertebrate Fauna Baseline Surveys 2005-2006

Outback Ecology conducted this Level 2 fauna survey between July and August 2005. The study area is situated approximately 90 km east of the Sulphur Springs Study area (**Figure 8**). This fauna assessment incorporated a variety of sampling techniques including pitfall traps, Elliott traps, funnel and cage traps, systematic hand searching, targeted searching, spotlighting, AnaBat echolocation recording and avifauna censusing.

Six fauna habitat types occurred within the study area including Spinifex plains, riverine Eucalypts, basalt ridge, rocky lower to mid slope, rock gullies and minor drainage lines.

A total of 119 vertebrate species were recorded, comprising of 26 mammals, 63 birds, 26 reptiles and four amphibians.

Three conservation significance fauna species were recorded in the study area;

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (EPBC Act - Vulnerable; WC Act – Schedule 1);and
- Rainbow Bee-eater (*Merops ornatus*) (EPBC Act – Migratory).

Bamford Consulting Ecologists (2007) Pardoo Direct Shipping Ore Project Fauna Assessment

Bamford Consulting conducted this fauna survey in April 2007. The Pardoo study area is located approximately 85km north of the Sulphur Springs Study area (**Figure 8**). This fauna assessment consisted of a literature review and an extended site inspection with the key objectives of documenting the vertebrate fauna and habitats present within the study area, assessing their conservation significance, and identifying potential impacts from the proposed operations.

Five fauna habitat types occurred within the Study area including Spinifex plains, major watercourses, ephemeral drainage lines, rocky hills and gorges and gullies.

A total of 89 vertebrate species were recorded, comprising of 12 mammals, 51 birds, 21 reptiles, four amphibians and one fish.

Five conservation significance fauna species were recorded in the study area;

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Mulgara (*Dasycercus cristicauda*) burrows (EPBC Act – Endangered; WC Act – Schedule 1);
- Pilbara Olive Python (*Liasis olivaceus barroni)* (EPBC Act – Vulnerable; WC Act – Schedule 1);

- Peregrine Falcon (*Falco peregrinus)* (WC Act - Schedule 4); and
- Pebble-mound Mouse (*Pseudomys chapmani*) (DEC - Priority 4).

ecologia (2008) RGP 5 Level 2 Fauna Survey: Chichester Deviation

This Level 2 survey of the Chichester Deviation of the BHP Billiton rail corridor was conducted in October 2007 and April 2008. The study area was located approximately 110 km south of the Sulphur Springs Study area (**Figure 8**). Fauna sampling techniques implemented during the survey included: pitfall traps, Elliott traps, funnel traps, and cage traps; systematic hand searching; targeted searching; spotlighting; AnaBat echolocation recording for bats; and avifauna census.

Six broad fauna habitats were identified during this survey comprising Mulga woodland over spinifex hummocks; Open woodland over dense grass hummocks; Rocky hill slope regenerating after fire; Open woodland over dense understorey on rocky ground; Rocky hill side with dense spinifex hummocks; and burnt mulga woodland, open canopy with regenerating spinifex.

Three conservation significant fauna species were recorded during this survey, comprising:

- Ghost Bat (*Macroderma gigas*) (DEC -Priority 4);
- Lakeland Downs Mouse (*Leggadina lakedownensis*) (DEC -Priority 4); and
- Western Pebble-mouse (*Pseudomys chapmani*) (DEC -Priority 4).

Ninox Wildlife Consulting (2009a) A Fauna Survey of the Proposed Hope Downs 4 Mining Area Near Newman, Western Australia

Two detailed surveys were conducted as part of this assessment, in May and September 2008. The study area for this survey is located approximately 95 km south of the Sulphur Springs Study area (**Figure 8**). The surveys incorporated a variety of sampling techniques including: pitfall, Elliott, funnel and cage traps; harp trap and AnaBat echolocation recordings for bats; targeted searching; and avifauna census.

Four broad habitat types were identified from vegetation associations comprising Spinifex with Eucalypts, Ridges and Ranges (two categories), and Mulga Groves.

A total of 71 vertebrate fauna species were recorded during the May survey, comprising six mammals, 19 reptiles and 46 birds. A total of 84 fauna species were recorded in the September 2008 survey, comprising seven mammals, 22 reptiles and 55 birds.

Three species of conservation significance were recorded during the 2008 surveys, comprising:

- Two species listed as Priority 4 under the DEC Priority List: Western Pebble-mound Mouse (*Pseudomys chapmani*) and Australian Bustard (*Ardeotis australis*) (DEC- Priority 4); and
- Rainbow Bee-eater (*Merops ornatus*) (EPBC Act - Migratory).

Ninox Wildlife Consulting (2009b) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor: Option 1 Near Newman, Western Australia

A detailed Level 2 fauna survey was undertaken over the Hope Downs Infrastructure Corridor Option 1 study area in May 2008. The study area was located approximately 95 km south of the Sulphur Springs Study area (**Figure 8**). Fauna sampling techniques included pitfall traps, Elliott traps, AnaBat echolocation recording for bats, opportunistic records and avifauna census.

Four major plant communities were defined in this survey: grassland with emergent mulga on cracking clays; low open mulga woodland on sandy loam and plains; Triodia hummock grassland on gravely soils; and open Eucalypt woodland on major creeklines.

A total of 71 species were recorded during this survey comprising 11 mammal, 37 bird and 23 reptile species.

Two species of conservation significance were recorded:

- Western Pebble-mound Mouse (*Pseudomys chapmani*) (DEC - Priority 4); and
- Australian Bustard (*Ardeotis australis*) (DEC - Priority 4).

Ninox Wildlife Consulting (Ninox Wildlife Consulting 2009c) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Option 6 Infrastructure Corridor Near Newman, Western Australia

Two detailed Level 2 fauna surveys were conducted as part of this assessment; a spring survey in September 2008 and an autumn survey in April 2009. The study area assessed for the proposed Hope Downs 4 Option 6 infrastructure corridor is located approximately 95 km south of the Sulphur Springs Study area (**Figure 8**). The surveys incorporated a variety of sampling techniques including: pitfall, Elliott, funnel and cage traps; AnaBat echolocation recordings for bats; targeted searching; and avifauna census.

Three significant fauna habitats were identified within the study area including riverine woodlands, spinifex grasslands and Mulga woodlands.

A total of 105 vertebrate fauna species were recorded during these surveys, comprising 19 mammal, 62 bird, 23 reptiles and one amphibian species. Thirty-two species of reptile were recorded during this September 2008 survey and 41 species in April 2009.

Two fauna species of conservation significance were recorded in the study area:

- the Australian Bustard (*Ardeotis australis*) (DEC – Priority 4); and
- the Western Pebble-mound Mouse (*Pseudomys chapmani*) (DEC – Priority 4).

Outback Ecology (2009) Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment

A detailed Level 2 survey was conducted over the Wodgina DSO Project study area in April 2009. This study area is located approximately 55 km west of the Sulphur Springs Study area (**Figure 8**). This survey incorporated a variety of sampling techniques including pitfall traps, Elliott traps, funnel traps, and cage traps, systematic hand searching, targeted searching, spotlighting, AnaBat echolocation recording and avifauna census.

A total of 90 vertebrate fauna species were recorded, comprising 18 mammals, 45 birds, 25 reptiles and two amphibians.

Six conservation significant fauna species were recorded within this study area, comprising:

- Northern Quoll (*Dasyurus hallucatus*) (EPBC Act - Endangered; WC Act – Schedule 1);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) (EPBC Act - Vulnerable; WC Act – Schedule 1);
- Three species listed as Priority 4 under the DEC Priority List: Western Pebble-mound Mouse (*Pseudomys chapmani*); Ghost Bat (*Macroderma gigas*); and Long-tailed Dunnart (*Sminthopsis longicaudata*); and
- Rainbow Bee-eater (*Merops ornatus*) (EPBC Act – Migratory).

Fourteen Ghost Bat roost locations were recorded within the study area of which four were considered significant roost sites supporting large numbers of Ghost Bats. The four significant roost sites all occurred outside of the Wodgina DSO Stage 1 Project disturbance area.

3.3 Reconnaissance Survey

The objective of the reconnaissance survey was to ground truth the occurrence of fauna habitat within the Study area, specifically focused on Northern Quoll (*Dasyurus hallucatus*) habitat, habitat for conservation significant bats (*Rhinonicteris aurantia* and *Macroderma gigas*) and habitat for SRE invertebrate species. Several methods were used to address this objective including targeted searching and opportunistic recording.

3.3.1 Targeted Searching

Targeted searches were conducted in habitats with the potential to support the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*) within the Study area (**Figure 9**). This involved searching caves, crevices, gorges and ridge lines for any evidence of these species, including scats, individuals, bones and carcasses. Time spent conducting targeted searches totalled four person hours during the reconnaissance survey.

3.3.2 Opportunistic Sampling

The presence of conservation significant species was recorded wherever and whenever possible within the Study area during the reconnaissance survey. The location of any conservation significant species recorded opportunistically was taken by GPS.

3.3.3 Habitat Assessment

Definitions of fauna habitat used in this survey are consistent with classifications used elsewhere in biodiversity assessments. Identification and mapping of broad fauna habitats within the Study area, and those of particular relevance to conservation significant fauna, provides a useful framework within which to discuss species occurrence. Prior to the reconnaissance survey, broad habitat types present within the Study area were identified from analysis of aerial imagery and topographical mapping.

Representative areas were selected within selected major habitat types to conduct habitat assessments. Each representative area was given a rating of excellent, very good, good, moderate, degraded or completely degraded based on the overall condition of the habitat for fauna. Existing disturbance at each site was characterised and the potential for the habitat to support species of conservation significance was assessed.

3.4 Taxonomy and Nomenclature

Nomenclature and taxonomy of all vertebrate fauna species follows that of the Western Australian Museum (WAM) provided in the *Checklist of the Vertebrates of Western Australia* for amphibians, reptiles and mammals (Western Australian Museum 2010), and for the *Bird's Australia Checklist of Australian Birds*, based on Christidis and Boles (2008). Relevant texts from which information on general patterns of distribution were obtained included:

- Mammals (non-volant) - Van Dyck and Strahan (2008) and Menkhort and Knight (2004);
- Bats - Churchill (2008);
- Birds - Johnstone and Storr (1998, 2004), Pizzey and Knight (2007) and Morcombe (2003);
- Reptiles - Storr *et al.* (1999, 2002), Cogger (2000) and Wilson and Swan (2008);
- Amphibians - Cogger (2000).

3.5 Limitations and Constraints

Conclusions contained within this report are based on a desktop study and reconnaissance survey only (i.e. no sampling of fauna was conducted as part of this study). The reconnaissance survey comprised habitat assessment and ground-truthing and targeted searches of selected habitats (Rocky Ridge and Gorge, Drainage Line). A general assessment was made as to the likelihood of particular species of conservation significance occurring within the Study area, given the broad habitat types likely to occur, and specific habitat features occurring therein.

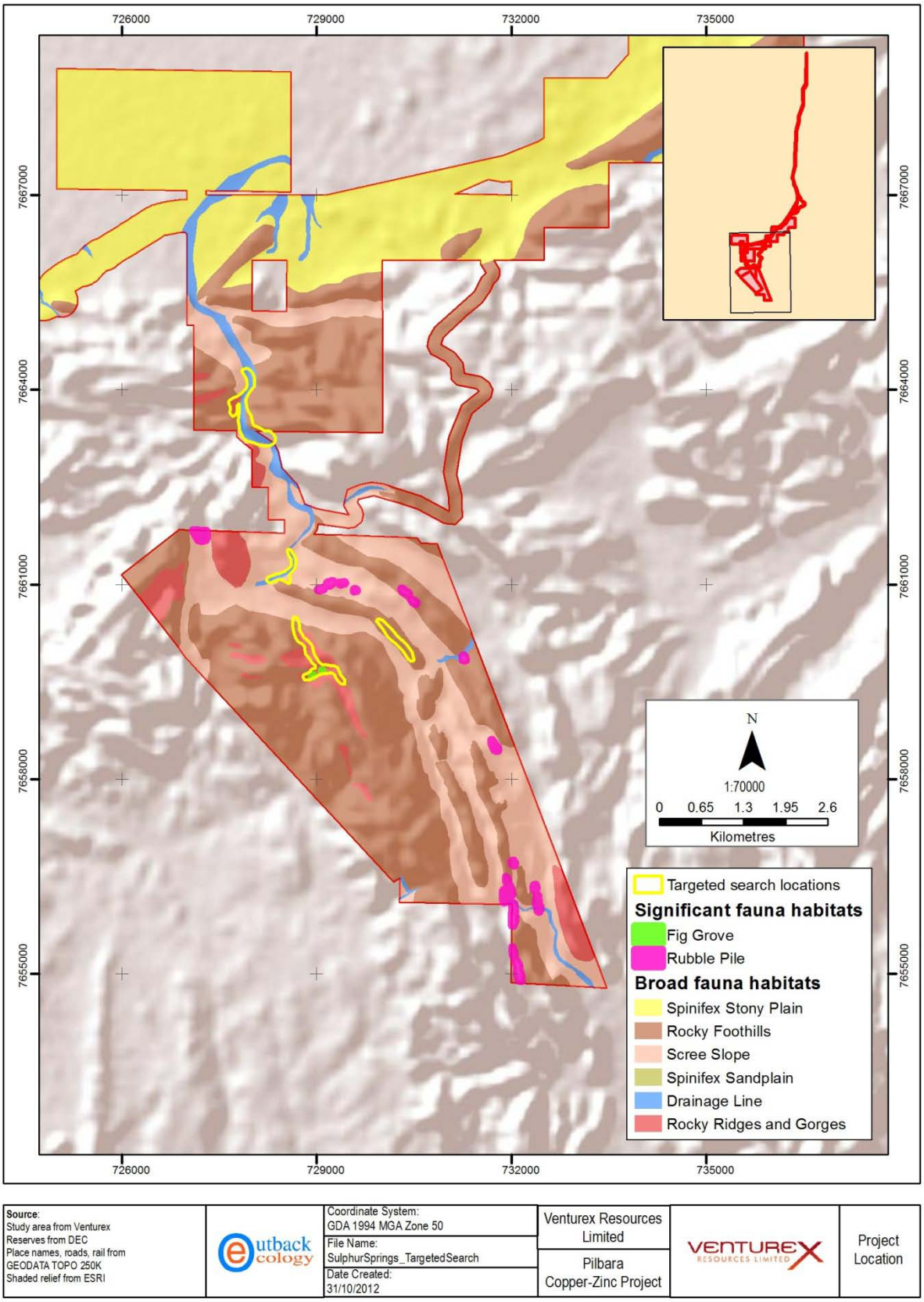

Figure 9: Location of targeted searches conducted within the study area

4. RESULTS AND DISCUSSION

4.1 Fauna Habitats Present within the Study area

The Study area consists of two main areas: the main infrastructure area; and the haul road corridor, which extends to the north. The combined extent of these study areas totals 7,623 ha. Of the range of habitats encompassed, some are considered widespread and typical of the Pilbara bioregion and some are considered uncommon and of limited extent.

A total of six broad fauna habitats were identified in the Study area (**Table 3**; **Figure 10**) on the basis of location, landform, substrate, vegetation community, degree of disturbance (e.g. mining, fire) and the fauna habitat which they offer:

- Spinifex Stony Plains;
- Rocky Foothills;
- Scree Slope;
- Spinifex Sandplains;
- Drainage Line; and
- Rocky Ridges and Gorges.

An additional two significant fauna habitats of limited extent were identified:

- Rubble Piles; and
- Ficus Groves.

A brief description of each habitat identified, with a focus on the complexity and the quality that each provides for the local fauna assemblages and specific suitability for conservation significant species, is provided below in order of extent of its occurrence within the Study area.

Table 3: Habitat summary

Broad Fauna Habitat	Hectares in Study area (ha)	Proportion of habitat within Study area (%)
Spinifex Stony Plains	2,689	35.3
Rocky Foothills	2,487	32.6
Scree Slope	1,416	18.6
Spinifex Sandplains	590	7.7
Drainage Line	215	2.8
Rocky Ridges and Gorges	211	2.8
Rubble Piles	13.1	0.2
Ficus Groves	0.1	< 0.01
Total	**7,623**	**100.0**

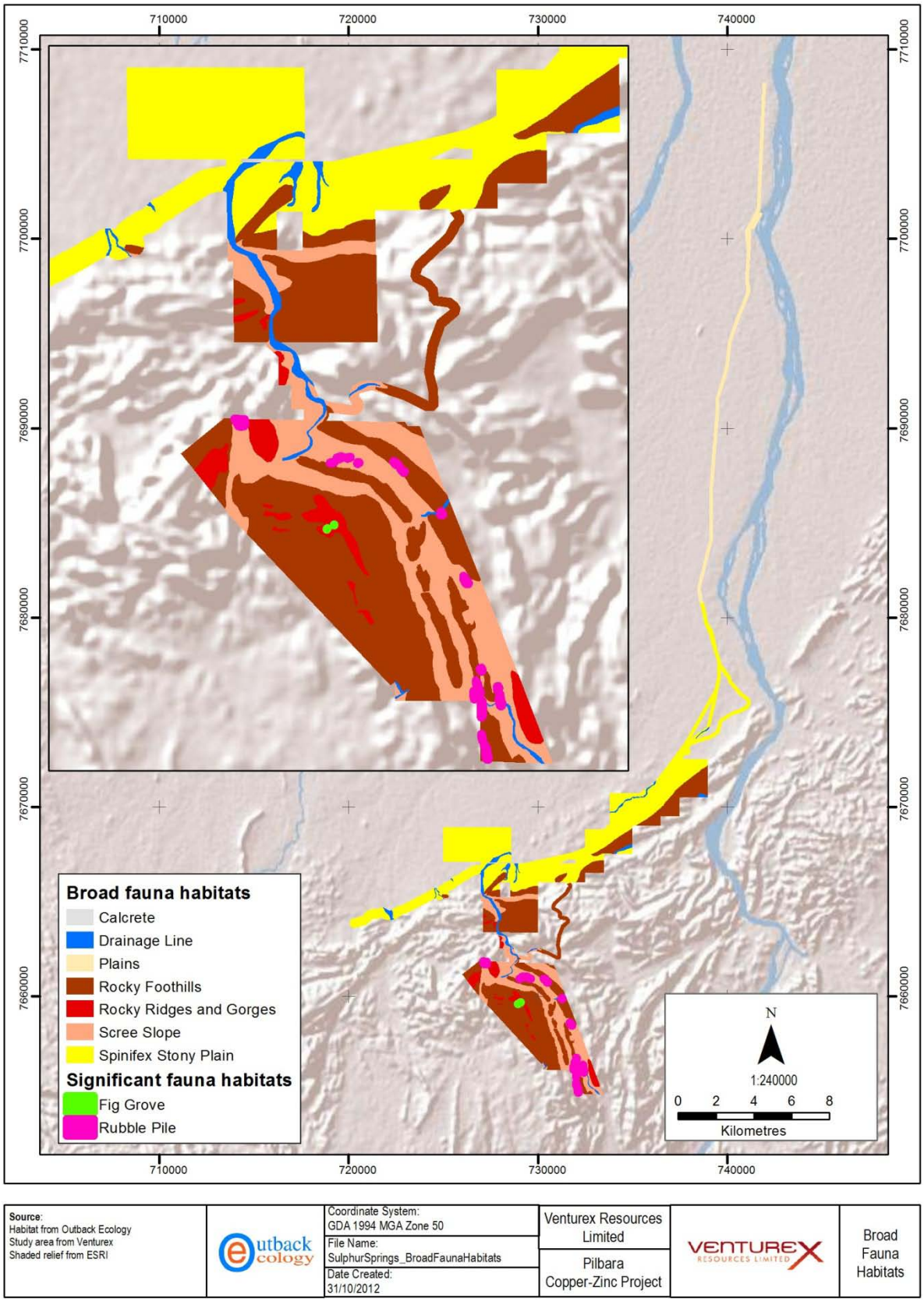

Figure 10: Habitat mapping for the Study area

4.1.1 Spinifex Stony Plains

Approximately 35% of the Study area consists of Spinifex Stony Plains habitat with the majority of this habitat type occurring in the central portion of the Study area (**Figure 10**). Some of the Haul Road consists of this habitat type, which is widespread throughout the surrounding landscape (e.g. Macroy, Satirist land system, **Table 1**; **Figure 6**).

The value of Plains habitat (both Spinifex Sandplain and Stony Plain) in supporting fauna assemblages is often closely related to its fire history, with areas retaining a mosaic of fire ages often providing the best habitat (Parr and Andersen 2006, Southgate *et al.* 2007, Woinarski 1999). Newly burnt habitat may be used for foraging, where as long unburnt areas may be used for shelter and breeding. It is common for large swathes of sandplain habitat to be burnt on a frequent basis (Burrows *et al.* 2006) as part of pastoral operations in order to promote new palatable growth and prevent regrowth of non-palatable Acacia species (Van Vreeswyk *et al.* 2004, Wright and Clarke 2007). In contrast, Stony Plains are of marginal value to pastoral operations as they do not support the same diversity of palatable grasses as sandplains; however, are also subject to frequent burning (Van Vreeswyk *et al.* 2004).

The conservation significant Spectacled Hare-wallaby (Priority 3 Fauna) and Brush-tailed Mulgara (Priority 4 Fauna) are commonly recorded within this habitat in areas where large, long unburnt hummocks of Spinifex exist (e.g. (Biota 2002b, 2004)). These are considered important habitat elements for these species (Menkhorst and Knight 2004). Additional conservation significant species that may occur in this habitat included the Australian Bustard (*Ardeotis australis*), Bush Stone-curlew (*Burhinus grallarius*) and the Rainbow Bee-eater (*Merops ornatus*). Mounds of the Western Pebble-mound Mouse (*Pseudomys chapmani*) may be recorded where stony pebbles and gravel occur. Spinifex Stony Plain habitat is known to support populations of this species as it possesses the small even sized pebbles required to construct mounds (Menkhorst and Knight 2004, Van Dyck and Strahan 2008).

SRE invertebrate species are unlikely to occur in the Spinifex Stony Plains as this habitat is widespread and well connected in the surrounding landscape.

4.1.2 Rocky Foothills

Approximately 33 % of the Study area consists of Rocky Foothills habitat with the majority of this habitat type occurring in the southern portions of the Study area (**Figure 10**). The habitat consists of those hills that do not commonly feature ridges, caves and gorges, and hence do not tend to possess microclimates that are favourable to fauna species. This habitat type also corresponds with the Capricorn land system, which is well represented throughout the surrounding landscape (**Table 1**; **Figure 6**).

Conservation significant species that may occur within this habitat type include the Australian Bustard (*Ardeotis australis*), Bush Stone-Curlew (*Burhinus grallarius*) and the Western Pebble-mound Mouse (*Pseudomys chapmani*).

SRE invertebrate fauna are unlikely to occur in the Rocky Foothills as this habitat is exposed and extensive in the surrounding landscape.

4.1.3 Scree Slope

Scree Slope habitat comprises approximately 19 % of the overall Study area, occurring mostly in the southern portion of the Study area (**Figure 10**). This fauna habitat forms part of the Capricorn land system, which is not typically utilised for pastoralism, resulting in much of this habitat remaining in good condition (Van Vreeswyk *et al.* 2004). Scree Slopes also represent a transition between Plains habitat and the more rugged Rocky Foothills and Rocky Ridges and Gorges.

The conservation significant Western Pebble-mound Mouse (*Pseudomys chapmani*) is commonly detected in this habitat via its characteristic mounds (How *et al.* 1991, Outback Ecology 2011). Other conservation significant species likely to occur within this habitat include the Australian Bustard (*Ardeotis australis*) and Rainbow Bee-eater (*Merops ornatus*).

SRE invertebrate fauna are unlikely to occur in the Scree Slopes as this habitat is largely exposed and extensive.

4.1.4 Spinifex Sandplain

Approximately 8% of the study area consists of Spinifex Sandplain with the majority of this habitat type occurring in the Haul Road portion of the Study area (**Figure 10**). Spinifex Sandplain is widespread throughout the surrounding landscape (e.g. Uaroo land system, **Table 1**; **Figure 6**).

The conservation significant Spectacled Hare-wallaby (Priority 3 Fauna) may occur within this habitat where large, long unburnt hummocks of Spinifex exist. These are considered important habitat elements for this species (Menkhorst and Knight 2004). Additional conservation significant species likely to occur in this habitat include the Australian Bustard (*Ardeotis australis*), Bush Stone-curlew (*Burhinus grallarius*) and the Rainbow Bee-eater (*Merops ornatus*).

SRE invertebrate fauna are unlikely to occur in the Spinifex Sandplain habitat, as this habitat is extensive and well connected to similar habitats in the surrounding landscape.

4.1.5 Drainage Line

Drainage Line habitat consists of rivers, creeks and minor watercourses and forms approximately 2.6 % of the overall Study area. This habitat type, which is subject to regular flooding, is typically less than 20 m in width and often supports a thin band of Eucalypt and Acacia species as well as isolated groups of Melaleuca trees and sedges. Drainage Line habitat may support soft spinifex and buffel grass (*Cenchrus*

ciliaris – an introduced weed), which is considered palatable to livestock, often leading to degradation from grazing (Van Vreeswyk *et al.* 2004).

Drainage Line habitat represents important habitat for fauna as it provides a range of microhabitats and a stable source of resources (How *et al.* 1991). More specifically, nectarivorous avifauna benefit from the flowering plants that line the banks of drainage lines (Burbidge *et al.* 2010) and mammal and reptile fauna may congregate around permanent water pools (How *et al.* 1991). In particular, amphibian species would be most likely to occur within this habitat type. Their linear arrangement provides linkages between other more permanent sources of food and water (How *et al.* 1991) and are therefore important for allowing fauna to move throughout the landscape. For example, migratory bird species are also known to use Drainage Line habitat as a conduit for movement (Bamford *et al.* 2008, Storr 1984).

Conservation significant species that may occur within this habitat type include the Northern Quoll (*Dasyurus hallucatus*), Australian Bustard (*Ardeotis australis*) and Bush Stone-Curlew (*Burhinus grallarius*).

There is potential for SRE invertebrate fauna to occur within the Drainage Line habitat as this habitat has sheltered areas of dense vegetation that are uncommon in the surrounding landscape. Although this habitat is not extensive in the landscape, it is relatively well connected along its length.

4.1.6 Rocky Ridges and Gorges

Approximately three percent of the Study area consists of this habitat type, consisting of isolated occurrences throughout the southern and central portions of the Study area (**Figure 10**). Rocky Ridges and Gorges is relatively uncommon habitat within the broader landscape as they are comprised specifically of those hills featuring outcropping ironstone, fallen boulders, caves, overhangs and crevices. This habitat type is considered important for fauna and may support a number of species of conservation significance (Bamford Consulting Ecologists 2008, How *et al.* 1991). Gorges provide shelter and water sources for habitat specific species such as the Pilbara Olive Python (*Liasis olivaceus barroni*). Deep, humid caves provide roost habitats for conservation significant bat species, the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*). Ridge habitats provide important breeding habitat, and nursery dens for the Northern Quoll (*Dasyurus hallucatus*) (Van Dyck and Strahan, 2008).

There is potential for SRE invertebrate fauna to occur within the Rocky Ridges and Gorges as this habitat consists of sheltered areas with cooler more moist microclimates that are uncommon in the landscape. Additionally, this habitat tends to be isolated from other similar habitats in the landscape.

4.1.7 Rubble Piles

Rubble Piles comprise approximately 0.2 % of the overall Study area, occurring mostly in the southern portion (**Figure 10**). The Rubble Piles consist of large blocky boulders of dark gabbro which generally lack vegetation, however occasionally larger trees of *Ficus* or *Terminalia* may occur. This habitat is uncommon

in the Study area and uncommon in the surrounds. This habitat is also relatively unique and isolated in comparison to other habitats in the landscape. As a result, there is potential for this habitat to support invertebrate species with restricted distributions.

4.1.8 Ficus Groves

The Ficus Groves comprise less than 0.01 % of the overall Study area and occur in close association with the Rocky Ridges and Gorges habitat (**Figure 10**). The Ficus Groves are made up of large trees of *Ficus brachypoda* which grow in sheltered and rocky areas. The often deep decaying leaf litter and shelter provided by the trees creates a moist sheltered environment that is uncommon and isolated from similar habitat in the surrounding landscape. As a result, this habitat has the potential to support invertebrate species with restricted distributions.

4.2 Vertebrate Fauna of the Study Area

Based on database search findings and a review of relevant literature within the surrounding region, it is possible that a total of 392 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 53 mammals (44 native), 211 birds, 116 reptiles, five fish and seven amphibian species.

Based on a more specific review of previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007), it is possible that a total of 151 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 27 mammals (22 native), 83 birds, 34 reptiles, five fish and two amphibian species.

A complete list of vertebrate fauna species previously recorded and/or expected to occur within the Study area and surrounds is presented in **Appendix A**.

4.2.1 Mammals

Based on the data from the review of database searches and previous surveys in the region, a total of 44 native mammal species have the potential to utilise the Study area; 22 of which have been recorded within or in close proximity to the Study area (Bamford Consulting Ecologists 2001, Biota 2007) (**Attachment A**). Fourteen bat species have the potential to utilise the Study area, six of which have been recorded within the Study area; two of these are of conservation significance (the Pilbara Leaf-nosed Bat and the Ghost Bat). Seven non-volant conservation significant mammals have the potential to utilise the Study area, comprising the Northern Quoll, Mulgara, Greater Bilby, Spectacled Hare-wallaby, Western Pebble-mound Mouse, Long-tailed Dunnart and Lakeland Downs Mouse.

4.2.2 Birds

Based on the data from the review of database searches and previous surveys in the region, a total of 211 bird species have the potential to utilise the Study area; 83 of which have been recorded within or in close proximity to the Study area (Bamford Consulting Ecologists 2001, Biota 2007) (**Attachment A**). Eight

conservation significant birds have the potential to utilise the Study area, comprising the Night Parrot, Peregrine Falcon, Australian Bustard, Bush Stone-curlew, Grey Falcon, Star Finch, Eastern Curlew and Flock Bronzewing. An additional four migratory species have the potential to utilise the Study area, comprising the Fork-tailed Swift, Cattle Egret, Oriental Plover and Rainbow Bee-eater, although the Cattle Egret and Oriental Plover would only be present irregularly, either as nomads or migrants occurring during particular climatic conditions.

4.2.3 Reptiles

Based on the data from the review of database searches and previous surveys in the region, a total of 116 reptile species have the potential to utilise the Study area; 34 of which have been recorded within the Study area (Bamford Consulting Ecologists 2001, Biota 2007) (**Attachment A**). Five conservation significant reptiles have the potential to utilise the Study area, comprising the Pilbara Olive Python, Woma, *Ramphotyphlops ganei* (a blind snake), the Spotted Ctenotus and Pin-striped Finesnout Ctenotus.

4.2.4 Amphibians

Based on the data from the review of database searches and previous surveys in the region, seven amphibian species have the potential to utilise the Study area; two of which have been recorded within the Study area (Bamford Consulting Ecologists 2001, Biota 2007) (**Attachment A**). None of these amphibians are of conservation significance.

4.2.5 Fish

Based on the data from the review of database searches and previous surveys in the region, five fish species have the potential to occur within water bodies in the Study area; all of which have been recorded within the Study area (Bamford Consulting Ecologists 2001, Biota 2007) (**Attachment A**). None of these fish species are of conservation significance.

4.2.6 Introduced and Declared Fauna Species

Previous fauna surveys and database searches have revealed that ten introduced species have the potential to occur within the Study area. These include: European Cattle, Dromedary, Dingo, Fox, Donkey, Horse, Feral Cat, European Rabbit, House Mouse and Rock Dove (**Attachment A)**.

4.3 Conservation Significant Vertebrate Fauna Species

The conservation significance of terrestrial vertebrate fauna potentially occurring within the Study area is described in the following sections, including:

- Threatened fauna species listed under the EPBC Act and specially protected fauna listed under the WC Act (Section 4.3.1);
- Priority fauna recognised by DEC (Section 4. 3.2);
- Migratory species listed under the EPBC Act and international agreements, which include the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement

(CAMBA), Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals) (Section 4.3.3).

In the following sections, the likelihood of conservation significant fauna occurring within the Study area has been ranked using the following definitions:

Confirmed - presence in Study area recorded unambiguously during the last ten years (i.e. recent surveys of Study area or via database searches).

Very Likely – Study area lies within the species' known distribution and contains suitable habitat(s), plus the species generally occurs in suitable habitat and has been recorded nearby in the last 20 years.

Likely – Study area lies within the species' known distribution and the species has been recorded nearby in the last 20 years; however, either:
a) contains habitat that is marginally suitable, or only a small area of suitable habitat;
b) the species is generally rare and patchily distributed in suitable habitat.

Possible - Outside chance of occurrence based on:
a) Study area is just outside the known distribution; however, contains suitable and sufficient habitat (species may be common, rare, or patchy); or
b) Study area lies within the known distribution but species is very rare and/or patchily distributed; or
c) Study area lies on the edge or within the known distribution and has suitable habitat, but the species has not been recorded in the area for over 20 years.

Unlikely – Study area lies outside the species known distribution, does not contain suitable habitat and the species has not been recorded in the area for over 20 years.

4.3.1 Threatened Species

Legislation has been developed at a Commonwealth and State level to protect fauna species that have been formally recognized as rare, threatened with extinction, or as having high conservation value. At the national level, fauna are protected under the EPBC Act. Within Western Australia, fauna can be listed under various Schedules within the WC Act. Definitions of conservation significance are presented in **Attachment B**.

There are eight threatened fauna species that have the potential to occur within the Study area: Night Parrot (*Pezoporous occidentalis*), Northern Quoll (*Dasyurus hallucatus*), Mulgara (*Dasycercus cristicauda/blythi*), Greater Bilby (*Macrotis lagotis*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Pilbara

Olive Python (*Liasis olivaceus barroni*), Peregrine Falcon (*Falco peregrinus*) and Woma (*Aspidites ramsayi*) (**Table 4**).

Table 4: Threatened fauna species potentially occurring within the Study area

Common name (*Scientific name*)	Likelihood	Conservation Status		No of previous surveys recorded	No. of database searches recorded	Reason for likelihood
		EPBC Act[1]	WC Act[2, 3]			
Mammals						
Northern Quoll (*Dasyurus hallucatus*)	Confirmed	EN	S1	9	3	recorded within the Study area during previous surveys
Mulgara[#] (*Dasycercus cristicauda/blythi*)	Confirmed	VU	S1	6	2	recorded within the Study area during previous survey
Greater Bilby (*Macrotis lagotis*)	Possible	VU	S1	2	1	presence of suitable habitat, recent records within surrounding region
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	Confirmed	VU	S1	5	3	recorded within the Study area during previous surveys
Birds						
Night Parrot (*Pezoporus occidentalis*)	Possible	EN	S1	1	-	presence of suitable habitat, recent records adjacent to Study area
Peregrine Falcon (*Falco peregrinus*)	Likely	-	S4	6	2	presence of suitable habitat, recent records adjacent to Study area, patchily distributed
Reptiles						
Pilbara Olive Python (*Liasis olivaceus barroni*)	Very Likely	VU	S1	4	2	presence of suitable habitat, recent records adjacent to Study area
Woma (*Aspidites ramsayi*)	Possible	-	S4	1	-	presence of suitable habitat, recent records in surrounding region, patchily distributed species

[1]EPBC Act: E Endangered, VU Vulnerable
[2]WC Act: Schedule 1, S4
[3] DEC Priority Species List: Priority 1, P2, P3, P4
[#] – *Dasycercus cristicauda* and *D. blythi* are treated as one species within this report as taxonomic uncertainty exists for previous records of this species within Study area and surrounds

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is listed as Endangered under the EPBC Act and listed as Schedule 1 under the WC Act. Optimal habitat for the Northern Quoll consists of dissected rocky escarpments which provide shelter such as rock crevices and caves and support higher densities of Northern Quolls than habitats such as *Eucalyptus* woodlands and human settlements (Van Dyck and Strahan 2008). Adult male home ranges are over 100 hectares and overlap with female home range (King 1989).

Northern Quolls breed once a year and the majority of adult males die off after mating at approximately one year of age (Van Dyck and Strahan 2008). Northern Quoll abundance is highly cyclical, with annual reproduction that is highly synchronised within a population. Breeding seasons may vary by a few weeks between nearby populations (Schmitt *et al.* 1989). Females have a short life span with the oldest female recorded in the wild being three years of age.

The population of Northern Quolls in the Pilbara is at its lowest after the mating season which occurs in the winter months, as a significant proportion of males have died off and young have not yet begun to forage independently. Therefore the population density is expected to be highest in the summer months, prior to the mating season and when juveniles are foraging independently.

Several threatening processes have contributed to decline in Northern Quoll populations across Australia, such as inappropriate fire regimes, predation, and poisoning as a result of ingesting cane toads (Department of Environment Water Heritage and the Arts 2010). The Pilbara is considered to be one of the remaining strong holds of Northern Quolls as the cane toad is encroaching the Kimberley region and populations in the Northern Territory are known to have been decimated and become locally extinct within a year of contact with cane toads (Van Dyck and Strahan 2008).

DEC threatened and priority fauna database records indicate that the Northern Quoll has been recorded from Wodgina, Poondano and Marble Bar (Department of Environment and Conservation 2010b). Northern Quolls were considered “clearly abundant” within the Study area during a survey in 2001, although the species was limited to Rocky Ridge habitat. It is very likely that the Northern Quoll occurs within Drainage Line habitat within the study area, as it possesses a reliable and semi-permanent water source and is situated adjacent to high quality Rocky Ridge habitat also.

- **Mulgara (*Dasycercus cristicauda*)**

The Mulgara prefers spinifex grasslands on sandy soils, constructing burrows on the flats between sand dunes (Van Dyck and Strahan, 2008). Introduced grazers namely cattle and rabbits, altered fire regimes and predation by cats and foxes have contributed to the population decline of this species (Maxwell *et al.* 1996, Van Dyck and Strahan 2008).

DEC threatened and priority fauna database records indicate that the Mulgara has been recorded from Kangan and Port Hedland, with the most recent record being in 2009 (Department of Environment and Conservation 2010b). During a Level 1 fauna survey within the Sulphur Springs Study area, numerous diggings for Mulgara were recorded around the Plains Access Road, with the species also captured along the Valley Access Road (Biota 2007).

- **Bilby (*Macrotis lagotis*)**

The Bilby (Vulnerable – EPBC Act, Schedule 1 – WC Act) was formerly associated with a variety of inland habitats including desert sandplains and dune fields with hummock grasslands and massive red earths and *Acacia* shrubland (Maxwell *et al.* 1996). Bilbies dig large burrows in the sandy substrates that can reach up to three metres long and 1.8 metres deep (Van Dyck and Strahan 2008). They are not reliant on surface water and receive most of their water requirements from food sources. Their diet consists of insects, larvae, seeds, bulbs, fruit and fungi (Van Dyck and Strahan 2008). The Bilby has undergone a widespread population decline as a result of altered fire regimes, predation by the European Red Fox (*Vulpes vulp*es) and feral cats and grazing pressure from introduced herbivores and livestock.

Bilby diggings have been recorded near the Study area at Kangan in 2001 and from Marble Bar in 2006 (Department of Environment and Conservation 2010b). It has also been recorded from the southern portion of the proposed Hope Downs rail corridor (Biota 2002b) and from a survey of the Cloudbreak Project (Bamford Consulting Ecologists 2005). It is possible that the species could occur within the Study area where sandy habitat supporting mature hummock grasslands exists (e.g. within the Haul Road corridor) although it was not recorded during previous surveys of the study area (Bamford Consulting Ecologists 2001, Biota 2007).

- **Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia)***

The Pilbara Leaf-nosed Bat is classified as Vulnerable under the EPBC Act. This species is subject to several threatening processes including flooding and human impacts such as mining (Department of Environment Water Heritage and the Arts 2010). The Pilbara Leaf-nosed Bat has specific habitat requirements occupying warm, very humid roost sites in caves and mines (MOLHAR Pty Ltd 2007, Van Dyck and Strahan 2008). This enables the species to persist in arid temperatures by limiting water loss and energy expenditure. The Pilbara Leaf-nosed Bat is sensitive to human disturbance and the best method of detection is through recording echolocation calls while it flies from roost sites or forages within gorges (Van Dyck and Strahan 2008).

DEC records indicate that the Pilbara Leaf-nosed Bat has been recorded from Sulphur Springs and Poondano, near Port Hedland in 2009 (Department of Environment and Conservation 2010b). Positive AnaBat echolocation recordings for this species were recorded by previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007) although sightings of the species were unconfirmed. Habitat within proposed impact areas assessed as part of the 2011 habitat assessment were deemed

unlikely to possess breeding roosts for the species as the rocky ridges did not appear to possess deep caves or crevices required by the species. In the absence of these habitat features, the presence of the species within this habitat is likely to be transitory.

- **Night Parrot (*Pezoporous occidentalis*)**

The Night Parrot is listed as Critically Endangered under the EPBC Act and as Schedule 1 under the WC Act. There have been very few confirmed records of the Night Parrot, with only 24 specimens in museum collections. The Night Parrot inhabits arid and semi-arid areas that are characterised by having dense, low vegetation. Based on accepted records, the habitat of the Night Parrot consists of *Triodia* grasslands in stony or sandy environments (Department of Sustainability Environment Water Population and Communities 2010b). In 2005 the presence of a single Night Parrot was recorded within the Fortescue Metals Group Cloud Break site, south east of the Study area (Bamford Consulting Ecologists 2005).

It is possible that the Night Parrot could occur within the Study area, although any estimate of likelihood of occurrence is putative, owing to the paucity of data for the species.

- **Peregrine Falcon (*Falco peregrinus*)**

The Peregrine Falcon is listed as Schedule 4 under the WC Act 1950. It is a nomadic species that utilises a wide range of habitats across Australia, including rocky escarpments and gorges, cliffs, tree lined watercourses, open woodland and *Acacia* shrublands (Pizzey and Knight 2007). This species has a home range of approximately 20 – 30 km throughout the year.

The Peregrine Falcon was not recorded by previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007); however, it has been recorded from a range of projects in the surrounding region, including surveys of the Hope Downs and FMG railway corridor projects (Biota 2002b, 2004) and the WA Museum survey of the Abydos-Woodstock Reserve (How *et al.* 1991). The species is found in most habitats but prefers inland cliffs and open woodlands near water for nesting (Pizzey and Knight 2007). Consequently, the species may favour Rocky Ridge habitat as it may provide more secure nesting sites than the other habitats within the study area. It is likely that this species would utilise the study area intermittently; however, it is unlikely to be dependent on the habitat within it given its mobility and the availability of suitable habitat within the region.

- **Pilbara Olive Python (*Liasis olivaceus barroni*)**

The Pilbara Olive Python is ranked as Vulnerable under the EPBC Act and listed as Schedule 1 and ranked as Vulnerable under the WC Act. This species inhabits rocky escarpments, deep gullies and gorges within the Pilbara region and is often recorded near water holes and riverine habitats (Wilson and Swan 2008). Radiotelemetry has found that the Pilbara Olive Python occupies a distinct home range. However males travel long distances during their breeding season from June to July to locate females (Department of Environment Water Heritage and the Arts 2010).

The Pilbara Olive Python was not recorded by previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007); however, it has been recorded from a range of projects in the surrounding region, including the WA Museum survey of the Abydos-Woodstock Reserve (How *et al.* 1991). Given that Rocky Ridges and Gorges habitat is present within the Study area it is very likely that the Pilbara Olive Python could occur.

- **Woma or Ramsay's Python (*Aspidites ramsayi*)**

The Woma Python is listed under Schedule 4 of the WC Act. This species occurs in arid zones of Western Australia in woodland habitats, heathland and shrubland habitats often containing spinifex. The south-west Wheatbelt population appears to be threatened as opposed to the northern populations (Storr *et al.* 2002).

This species was not recorded within the study area during previous surveys (Bamford Consulting Ecologists 2001, Biota 2007); however, the Woma has been recorded during the survey of the southern section of the Hope Downs railway corridor (Biota 2002b). Consequently, it is possible that the Woma could occur within the Study area.

4.3.2 Priority Species

DEC recognises species not listed under the WC Act but for which there is some concern, and subsequently has produced a supplementary list of 'Priority' fauna. Definitions of Priority fauna are listed in **Appendix B**.

Fifteen listed Priority species have the potential to occur within the Study area and are listed in **Table 5** and **Appendix A**, and discussed below. Five of these species were recorded within the Study area during previous surveys: Ghost Bat (*Macroderma gigas*), Spectacled Hare-wallaby (*Lagorchestes conspicillatus subsp. leichardti),* Western Pebble-mound Mouse (*Pseudomys chapmani*), Australian Bustard (*Ardeotis australis*) and Bush Stone-curlew (*Burhinus grallarius*).

Table 5: Priority species recorded or with the potential to occur within the Study area

Common name (*Scientific name*)	Likelihood	Conservation Status		No of previous surveys recorded	No. of database searches recorded	Reason for likelihood
		EPBC Act	WC Act[1]			
Mammals						
Ghost Bat (*Macroderma gigas*)	Confirmed	-	P4	8	2	recorded within the Study area during previous survey
Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*)	Confirmed		P3	3	2	recorded within the Study area during previous survey
Western Pebble-mound Mouse (*Pseudomys chapmani*)	Confirmed	-	P4	11	2	recorded within the Study area during previous surveys
Long Tailed Dunnart (*Sminthopsis longicaudata*)	Possible	-	P4	1	-	presence of suitable habitat, recent records in surrounding region, patchily distributed species
Lakeland Downs Mouse (*Leggadina lakedownensis*)	Likely	-	P4	3	1	presence of suitable habitat, recent records in surrounding region, patchily distributed species
Mangrove Freetail-bat *(Mormopterus cobourgiana)*	Unlikely	-	P1	1	-	no suitable habitat within study area
Birds						
Australian Bustard (*Ardeotis australis*)	Confirmed	-	P4	10	3	recorded within the Study area during previous survey
Bush Stone-curlew (*Burhinus grallarius*)	Confirmed	-	P4	8	3	recorded within the Study area during previous survey
Grey Falcon (*Falco hypoleucos)*	Possible	-	P4	3	2	presence of suitable habitat, recent records in surrounding region, patchily distributed species
Star Finch (*Neochima ruficauda*)	Possible	-	P4	3	-	presence of suitable habitat, recent records in surrounding region
Eastern Curlew (*Numenius madagascariensis*)	Unlikely	-	P4	1	1	no suitable habitat within the Study area
Flock Bronzewing (*Phaps histrionica*)	Unlikely	-	P4	-	1	presence of suitable habitat, towards periphery of species range, patchily distributed species

Common name (*Scientific name*)	Likelihood	Conservation Status		No of previous surveys recorded	No. of database searches recorded	Reason for likelihood
		EPBC Act	WC Act[1]			
Reptiles						
Ramphotyphlops ganei	Possible	-	P1	1	1	presence of suitable habitat, recent records in surrounding region, ecology and habitat preferences poorly known
Spotted Ctenotus *(Ctenotus uber johnstonei)*	Unknown	-	P2	4	-	few records for this species, ecology and habitat preferences poorly known
Pin-striped Finesnout Ctenotus *(Ctenotus nigrilineatus)*	Unknown	-	P2	1	1	few records for this species, ecology and habitat preferences poorly known

[1] DEC Priority Species List: Priority 1, P2, P3, P4

- **Ghost Bat (*Macroderma gigas*)**

The Ghost Bat is listed as Priority 4 by the DEC. The Ghost Bat is Australia's only carnivorous bat and is known to feed on a variety of vertebrate species including large insects, frogs, lizards, small mammals and other bats (Van Dyck and Strahan, 2008). Ghost bats occupy a variety of habitats from the arid Pilbara to the rainforests of Northern Queensland (Van Dyck and Strahan 2008). Ghost Bats roost in undisturbed caves usually with several entrances, in deep fissures or abandoned mine shafts (Menkhort and Knight 2004).

Ghost Bats mate between July and August with females bearing a single young around September. Mothers form nursery colonies and genetic testing has shown that the entire species is centralised upon regional maternity sites, of which approximately ten are known to exist (Van Dyck and Strahan, 2008). In the Pilbara, a number of natural formations are used by the Ghost Bat intermittently as short-term transient roosts and for feeding activity by an individual or small numbers of individuals, whilst others are used by maternity colonies (Armstrong and Anstee 2000).

The structure of a roost site is largely indicative of its use. The transient day roosts or feeding sites of Ghost Bats are often shallow overhangs and crevices with microclimates similar to ambient conditions, whereas roosts for breeding activity have a relative humidity of above 80% (Armstrong and Anstee 2000). Domed ceilings which create humid microclimates are often present in, but not exclusive to maternity caves. Deep, humid and complex mine shafts and deep humid caves with several chambers and dome ceilings are associated with permanent Ghost Bat occupancy and maternity roosts (Hall *et al.* 1997).

Roost sites have been identified in the surrounds during a fauna assessment of the Wodgina DSO study area, located 55 km to the west of the study area (Outback Ecology, 2009). Two sites were considered to be regionally significant and were found to contain large aggregations of between 40 – 70 bats (Outback Ecology, 2009).

The Ghost Bat was recorded by a previous survey within the Study area (Bamford Consulting Ecologists 2001).

- **Spectacled Hare-Wallaby (*Lagorchestes conspicillatus*)**

The Spectacled Hare-Wallaby is listed as Priority 3 by the DEC. This species inhabits *Triodia* hummock grasslands and *Acacia* shrublands and has declined dramatically within the Pilbara region, possibly due to fox predation and altered fire regimes which have prevented the development of large tussock grasslands required for adequate shelter (Van Dyck and Strahan 2008). The Spectacled Hare-Wallaby has been recorded near the Study area at Pilgangoora in 1994 (Department of Environment and Conservation 2010b).

Unconfirmed records of the Spectacled Hare-Wallaby were detailed in a survey by Bamford (2001), and so it is very likely that this species could occur in the northern portion of the Study area.

- **Western Pebble-mound Mouse (*Pseudomys chapmani*)**

The Western Pebble-mound Mouse is listed as Priority 4 species by the DEC. This mouse constructs mounds out of small pebbles that can cover 0.5 to 9.0 m² (Van Dyck and Strahan 2008). Breeding for this species can occur throughout the year. Females may produce several litter per year of up to four young (Van Dyck and Strahan 2008).

Suitable habitat for the species is patchy but populations are widespread throughout the ranges of the central and southern Pilbara (Van Dyck and Strahan 2008). Furthermore, evidence of the mouse has been has been frequently recorded within the region surrounding the Study area (Bamford Consulting Ecologists 2001, 2007, 2008, Biota 2004, How and Cooper 2002, How *et al.* 1991). The Western Pebble-mound Mouse was recorded during previous surveys of the study area (Bamford Consulting Ecologists 2001, Biota 2007).

It should be noted that the prevalence of mounds within the study area and surrounds is not a reliable indicator of abundance or even presence as mounds are often used by successive generations (Van Dyck and Strahan 2008) and persist in the landscape for many years. All of the mounds recorded recently may represent signs of a population that has declined substantially in recent times.

- **Long-tailed Dunnart (*Sminthopsis longicaudata*)**

The Long-tailed Dunnart is classified as Priority 4 under the WC Act 1950. This species lives in arid rocky areas and has been recorded from flat topped hills, plateaus, granite outcrops and rocky scree slopes. In the winter, the Long-tailed Dunnart feeds entirely on arthropods and under cold conditions this species may utilise torpor as a strategy to conserve energy (Van Dyck and Strahan 2008).

Although suitable rocky habitat for this species occurs within the Study area and wider region, the species is only represented by a single record in this area; namely, from Wodgina, which is located 30 km to the south (Outback Ecology Services 2009).

- **Lakeland Downs Mouse (*Leggadina lakedownensis*)**

The Lakeland Downs Mouse is classified as Priority 4 by the DEC and utilises a variety of different habitats including spinifex and tussock grasslands, samphire and sedgelands, *Acacia* shrublands, tropical *Eucalyptus* woodlands and stony ranges. Most of these habitats are seasonally inundated on red or white sandy-clay soils (Van Dyck and Strahan 2008). Previous records of the Lakeland Downs Mouse were recorded during both the proposed Hope Downs and FMG railway corridor surveys (Biota 2002b, 2004). Records also occur from Chichester and Marble Bar in 2001 (Department of Environment and Conservation 2010b).

This species was not recorded during previous surveys (Bamford Consulting Ecologists 2001, Biota 2007); however, it is considered likely to occur as suitable habitat for this species does occur within the study area.

- **Australian Bustard (*Ardeotis australis)***

The Australian Bustard is listed as Priority 4 by DEC and has a wide distribution across Australia. The Australian Bustard inhabits open dry woodlands of Mulga, arid scrublands and Spinifex tussock grasslands (Johnstone and Storr 1998, Morcombe 2003). The DEC priority and threatened fauna database shows that this species has previously been recorded near Kangan, Marble Bar and Boodarie and Port Hedland with the most recent recording being from 2008 (Department of Environment and Conservation 2010b). It has also been recorded from a number of previous surveys nearby and in the wider region (**Attachment A**). The Australian Bustard was recorded within the Study area during a previous survey (Bamford Consulting Ecologists 2001).

- **Bush Stone-curlew *(Burhinus grallarius*)**

The Bush Stone-curlew is classified as Priority 4 by the DEC and is found in open woodland and forest particularly near water courses or swampy areas (Geering *et al.* 2007). The Bush Stone-curlew was recorded during a previous survey within the Study area (Bamford Consulting Ecologists 2001) and has been frequently recorded in the surrounding area (**Attachment A**).

- **Grey Falcon (*Falco hypoleucos)***

The Grey Falcon is listed as Priority 4 by the DEC. This species mainly occurs around inland ephemeral and permanent drainage systems where annual rainfall is less than 500mm (Garnett and Crowley 2000). The Grey Falcon inhabits lightly wooded countryside especially stony plains and *Acacia* scrublands (Morcombe 2003). This species can be rare, resident or nomadic to most of the semi-arid interior of Western Australia.

The species was recorded during a survey of the FMG rail corridor (Biota 2004) and records for the species exist within databases (Birds Australia 2010, Department of Environment and Conservation 2010b). It is possible that this species may occur within the Study area as suitable habitat is present although this species is patchily distributed and so its presence may be intermittent.

- **Star Finch (western) (*Neochmia ruficauda*)**

The western race of the Star Finch is classified as Priority 4 by the DEC. This species occurs in lush, green woodland vegetation along temporary or permanent water courses, the margins of swamps or in green crops (Morcombe 2003). The Star Finch can be seen in pairs or in small flocks of up to 20 birds feeding on seed heads in low vegetation or on the ground (Morcombe 2003). This species is susceptible to changes that impact on riparian ecosystems (Bamford Consulting Ecologists 2008).

The Star Finch has been recorded from the WA Museum survey of the Abydos-Woodstock Reserve (How *et al.* 1991), the fauna survey of the Cloudbreak area (Bamford Consulting Ecologists 2005) and from the fauna survey of the BHP RGP5 Chichester railway deviation (ecologia 2008) (**Attachment A**). The Star Finch has not previously been recorded within the Study area; however, this species could intermittently occur in woodland vegetation and temporary water pools, especially after significant rainfall events.

- **Unnamed Blind Snake *(Ramphotypholops ganei*)**

Ramphotyphlops ganei is listed as Priority 1 and is endemic to the Pilbara region. There is a lack of data pertaining to this species' habitat requirements as few specimens have been recorded (Department of Environment and Conservation 2010b). *Ramphotypholops ganei* is thought to be associated with moist gorge and gully habitats.

Suitable habitat for this species within the study area is present (i.e. Rocky Ridge habitat) although it was not recorded during previous surveys (Bamford Consulting Ecologists 2001, Biota 2007). Therefore it may possibly occur in the study area but any estimate of likelihood of occurrence is putative, owing to the paucity of data for the species.

- **Pin-striped Finesnout *Ctenotus* (*Ctenotus nigrilineatus*)**

Ctenotus nigrilineatus is classified as Priority 2 by the DEC. The species is known from *Triodia pungens* hummock grassland at the base of granite outcrops near Woodstock in the hilly interior of the Pilbara (Wilson and Swan 2008). Previous records of *C*. *nigrilineatus* exist for Marble Bar in 1990 and the Abydos Plain in 2001 (Department of Environment and Conservation 2010b, How *et al.* 1991).

Suitable habitat for this species within the study area is limited (i.e. occurrences of granite) and it was not recorded during previous surveys (Bamford Consulting Ecologists 2001, Biota 2007). Therefore it may possibly occur in the study area but any estimate of likelihood of occurrence is putative, owing to the paucity of data for the species.

- **Spotted *Ctenotus* (*Ctenotus uber johnstonei*)**

Ctenotus uber johnstonei is classified as Priority 2 by the DEC and is known from hard reddish soils from interior Western Australia (Wilson and Swan 2008). Previous records of *C*. *uber johnstonei* are scant although it has been recorded from both the northern and southern portions of the FMG rail corridor (Biota 2004). The species may possibly occur in the study area but any estimate of likelihood of occurrence is putative, owing to the scarcity of data for the species.

Species recorded from previous surveys within the region and / or recorded form database searches that are considered unlikely to occur within the Study area are briefly discussed below.

- **Mangrove Freetail Bat (*Mormopterus cobourgiana*)**

This species occurs in Western Australian coastal areas from the Exmouth Gulf to Broome and is restricted to mangrove forests and other dense vegetation associated with coastal waterways (Churchill, 2008). As there is no suitable habitat present within the study area, this species is unlikely to occur.

- **Eastern Curlew (*Numenius phaeopus*)**

The Eastern Curlew is a migratory species that breeds in damp bogs and marshes in Siberia and Mongolia. The majority of the species migrates south to Australia with a major stronghold in southeast Queensland (Geering *et al.* 2007). Within Western Australia, Roebuck Bay and Eighty Mile Beach are considered sites of international importance to the species (Bamford *et al.* 2008). Although the study area is within the range of the species, there is no suitable habitat present and so the species is unlikely to occur.

- **Flock Bronzewing (*Phaps histrionica*)**

This species is patchy and nomadic across its range, which extends from central NSW and Queensland across to the north-western coast of Western Australia (Pizzey, 2007). Its preferred habitat is treeless grassy plains, saltbush, Spinifex and mulga. Although habitat within the Study area may be suitable, there are very few records existing for the species within the surrounding region. A record for the species exists

some 55 km to the east of the Study area; however, this record is dates back to 1957 (Department of Environment and Conservation, 2010). It is unlikely this species occurs in the study area.

4.3.3 Migratory Bird Species

Migratory species are listed under the EPBC Act and international agreements including the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

The database searches and literature review identified 27 migratory species that have the potential to occur within the Study area (**Table 6**). Of these, 22 were considered unlikely to occur within the Study area and are excluded from further consideration. The remaining five species are discussed briefly below.

Table 6: Migratory species recorded or with the potential to occur within the Study area

Common name (*Scientific name*)	Likelihood	Conservation Status		No of previous surveys recorded	No. of database searches recorded	Reason for likelihood
		EPBC Act[1]	WC Act[2]			
Australian Reed-Warbler (*Acrocephalus australis*)	Unlikely	M	S3	2	2	no suitable habitat within the Study area
Common Sandpiper (*Actitis hypoleucos*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Fork-tailed Swift (*Apus pacificus*)	Likely	M	S3	3	2	Aerial species, may occur within Study area
Cattle Egret (*Ardea ibis*)	Possible	M	S3	-	2	marginal habitat within the Study area
Ruddy Turnstone (Arenaria interpres)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Curlew Sandpiper (*Calidris ferruginea*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Red-necked Stint (*Calidris ruficollis*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Long-toed Stint (*Calidris subminuta*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Greater Sand Plover (*Charadrius leschenaultii*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Oriental Plover (*Charadrius veredus*)	Possible	M	S3	-	2	suitable habitat present within the Study area
White-winged Black Tern (*Chlidonias leucopterus*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area

Common name (*Scientific name*)	Likelihood	Conservation Status		No of previous surveys recorded	No. of database searches recorded	Reason for likelihood
		EPBC Act[1]	WC Act[2]			
Eastern Reef Egret (*Egretta sacra*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Oriental Pratincole (*Glareola maldivareum)*	Unlikely	M	S3	-	2	no suitable habitat within the Study area
White-Bellied Sea Eagle (*Haliaeetus leucogaster*)	Unlikely	M	S3	-	2	no suitable habitat within the Study area
Barn Swallow (*Hirundo rustica*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Caspian Tern (*Hydroprogne caspia*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Rainbow Bee-eater (*Merops ornatus*)	Confirmed	M	S3	12	3	recorded during previous surveys of the Study area
Eastern Curlew (*Numenius madagascariensis*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Whimbrel (*Numenius phaeopus*)	Unlikely	M	S3	2	1	no suitable habitat within the Study area
Night Parrot (*Pezoporus occidentalis*)	Possible	M	S3	1	-	presence of suitable habitat, recent records adjacent to Study area
Glossy Ibis (*Plegadis falcinellus*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Pacific Golden Plover (*Pluvialis fulva*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Lesser Crested Tern (*Thalasseus bengalensis*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area
Grey-tailed Tattler (*Tringa brevipes*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Wood Sandpiper (*Tringa glareola*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Common Greenshank (*Tringa nebularia*)	Unlikely	M	S3	1	1	no suitable habitat within the Study area
Marsh Sandpiper (*Tringa stagnatilis*)	Unlikely	M	S3	-	1	no suitable habitat within the Study area

[1] EPBC Act, M = Migratory species
2 WC Act, S3 = Schedule 3

- **Fork-tailed Swift (*Apus pacificus*)**

The Fork-tailed Swift is a nomadic species that may be seen before and after storm fronts or tropical cyclonic events that are associated with an increase in insect activity which the species feeds on (Johnstone and Storr 2004). This species may fly over the study area without specifically utilising the habitats present. The Fork-tailed Swift was recorded during several studies within the surrounding region (Biota 2005, ecologia 2008, How *et al.* 1991). It is likely to occur within the Study area.

- **Cattle Egret (*Ardea ibis*)**

This species is associated with inland rivers and lakes that contain surface water. The Cattle Egret is highly mobile and can be found throughout most of the western fringes of the State in coastal areas and towards the semi-arid interior (Johnstone and Storr 1998).

Although this species has not been recorded during previous studies of the region, it is possible that it could occur within the Study area intermittently, when standing water is present after rainfall.

- **Oriental Plover (*Charadrius veredus*)**

The Oriental Plover breeds in northern China and Mongolia and the bulk of the population spends the non-breeding period in northern Australia (Bamford *et al.* 2008). All important sites in the non-breeding period are in northern Australia (Bamford *et al.* 2008). This species favours dry grasslands, particularly shorter grassland areas or recently burnt areas, rarely feeding in wet habitats but may occupy mudflats or beaches to roost when warm conditions prevail (Geering *et al.* 2007).

Although this species has not been recorded during previous studies of the region, it may occur within the study area intermittently, when standing water is present after rainfall.

- **Rainbow Bee-eater (*Merops ornatus*)**

The Rainbow Bee-eater occupies numerous habitats including open woodlands, sandpits, riverbanks, road cuttings, beaches, cliffs, mangroves and rain forests (Pizzey and Knight 2007). The Rainbow Bee-eater can occur as a resident, breeding visitor, passage migrant or winter visitor (Pizzey and Knight 2007).

This species is insectivorous, with bees and flies representing the bulk of its diet. The Rainbow Bee-eater nests in burrows dug at a slight angle in flat ground and sandy banks (Johnstone and Storr 1998). It is also known to nest in sandy embankments and cuttings and often perches on man-made structures such as power lines and fences (Johnstone and Storr 1998). As a consequence, it is commonly seen in areas occupied by humans such as mining camps and urban areas.

The Rainbow Bee-eater was recorded during previous surveys of the Study area (Bamford Consulting Ecologists 2001, Biota 2007) and is common in the surrounding region (**Attachment A**).

- **Night Parrot (*Pezoporus occidentalis*)**

This species is discussed in Section 4.3.1.

4.4 Terrestrial SRE Invertebrate Fauna Species

4.4.1 Short-range Endemism in Arid and Semi-arid Western Australia

Endemism refers to the restriction of a species to a particular area, at a continental, national or local scale (Allen *et al.* 2002). Short-range endemic species have naturally restricted ranges of less than approximately 10,000 square kilometres (Harvey 2002). A combination of intrinsic and extrinsic factors, such as dispersal capabilities or opportunities, habitat preferences, life history attributes, physiological attributes, habitat availability, biotic and abiotic interactions and historical factors, determine not only the geographic distribution of a taxon, but its propensity for population differentiation and speciation (Ponder and Colgan 2002).

In Western Australia, many terrestrial SRE invertebrate species have Gondwanan origins and are relics of previously widespread species common to the continents of the southern hemisphere during the mesic climates of the Miocene. The subsequent aridification of Australia during the Miocene through to Pleistocene resulted in the fragmentation and contraction of once common mesic habitats. Consequently, populations dependent on these mesic habitats were also fragmented, resulting in the evolution of SRE invertebrate fauna.

Taxa prone to short-range endemism tend to share several ecological and life-history characteristics, such as poor powers of dispersal, confinement to discontinuous habitats, highly seasonal activity patterns and low fecundity (Harvey 2002). The main invertebrate groups with these traits in the Pilbara region of WA include:

- Mygalomorph spiders;
- Scorpions;
- Pseudoscorpions;
- Millipedes;
- Slaters; and
- Snails.

Terrestrial invertebrate groups prone to short-range endemism and that potentially occur within the Study area are discussed below.

Mygalomorph spiders

Class: Arachnida Order: Araneae Sub-order: Mygalomorphae

Represented by some ten families and 241 named species, Mygalomorphae is a primitive group of spiders which constitute approximately 13% of Australia's described spider species (Brunet 1996, Main 2005). Mygalomorphs have several distinctive morphological features that differentiate them from modern araneomorph spiders including: parallel fangs, two pairs of book-lungs and the presence of four (sometimes six) spinnerets (ABRS 2010, Brunet 1996).

Unlike araneomorphs, mygalomorphs generally do not construct a web for capturing prey but instead build a burrow in which they wait for prey (Main 1982). Some species can spend their entire life in a single burrow (Main 1982). Burrow morphology is highly variable and a burrow may be up to 60 cm deep depending on the species and terrain (Brunet 1996). Females rarely venture from the burrow and it is usually the males which are observed above ground when they are wandering in search of females (Main 1982).

Harvey (2002) indicates that Mygalomorphae is likely to have SRE taxa, at least partly due to the group's limited powers of dispersal and low fecundity. The cryptic lifestyle and highly seasonal variation in above ground abundance makes collecting mygalomorphs problematic. The use of pitfall traps during the wetter parts of the year generally yield wandering males, whereas both sexes can be dug from the burrow at anytime. Mature male specimens are usually required for definitive species identifications based on morphology.

Pseudoscorpions

Class: Arachnida Order: Pseudoscorpionida

It is estimated that there are more than 700 species of pseudoscorpion in Australia; however, currently only 150 species are described with many specimens awaiting description. Pseudoscorpions are found in virtually all terrestrial habitats, most commonly amongst leaf litter and beneath rocks and bark (Harvey and Yen 1989). Pseudoscorpions are usually no more than several millimetres long and have a pair of pincer-like pedipalps which they use to subdue small invertebrate prey (Harvey and Yen 1989). Very few terrestrial pseudoscorpions are considered to be SRE (Environmental Protection Authority 2009). Hand collection, soil sieving, the processing of leaf litter in Tullgren funnels and wet pitfall trapping can be used to collect pseudoscorpions. Mature male specimens are usually required for definitive species identifications based on morphology.

Scorpions

Class: Arachnida Order: Scorpionida

Current classifications of the scorpions usually recognise five superfamilies, but only members of the Scorpionoidea and Buthoidea are present in Australia (ABRS 2010). Scorpions are nocturnal, solitary,

predatory arachnids that have a pair of pincer-like pedipalps and an elongate metasoma (tail) tipped with a sting. Australian scorpions may reach up to 12 cm in length (Harvey and Yen 1989). Some species construct spiral burrows that can extend up to 70 cm below ground.

Currently, many Australian scorpions belong to species-complexes in which a number of 'species' are grouped. With future taxonomic revision, the number of SRE species is likely to increase. Mature male specimens are usually required for definitive species identifications based on morphology. Males are generally active above ground on warm or humid nights, when they can be located using a UV spotlight under which they fluoresce. Scorpions can also be dug from their burrows and wandering males can be collected using pitfall traps.

Millipedes
Class: Diplopoda Orders: eg. Polydesmida, Chordeumatida, Polyzoniida, Spirostreptida

There are nine millipede orders present in Australia, represented by some 250 described species (ABRS 2010). Millipedes are elongate; generally detritivorous arthropods that usually have two legs per body segment. Little is known of the biology and ecology of Australian millipedes. The orders Polydesmidae and Chordeumatida either have, or are likely to have, representatives which are SREs. The propensity for short-range endemism in other millipede orders is unknown but considered low.

Millipedes are typically collected from mesic habitats and microhabitats and are commonly found among leaf litter and beneath rocks and bark in sheltered locations. Hand collection, soil sieving, the processing of leaf litter in Tullgren funnels and wet pitfall trapping are used to collect millipedes. Mature males which are generally present during the wetter parts of the year are usually required for definitive species identifications based on morphology.

Slaters
Class: Malacostraca Order: Isopoda

Slaters are terrestrial isopods that belong to the crustacean suborder Oniscoidea. They are generally detritivorous arthropods that usually do not exceed 15 mm in length. Seven families of slaters are known from Australia and nearly all species are undescribed (ABRS 2010). Slaters are found in tropical to arid climates, where they inhabit moist and sheltered locations such as those beneath rocks, logs and bark. Slaters can be collected by hand or by using wet pitfall traps. Slaters are likely to contain species which are SREs (Environmental Protection Authority 2009). Species identification based on morphology generally requires adult male specimens.

Snails

Class: Gastropoda Order: Eupulmonata

The Eupulmonata includes almost all terrestrial snails and slugs. There is approximately 1,000 species of slugs and snails in Australia. Snails tend to be either herbivorous or detritivorous. Snails prefer moist habitats and microhabitats and can be found in leaf litter, under rocks and logs and in crevices. In dryer areas snails may aestivate for an extended period up to 50 cm below ground. The best methods of collecting snails are by hand and by sieving leaf litter and soil. Many terrestrial snails have extremely restricted ranges and numerous species are known to be SREs, indeed some families consist entirely of SRE species (Environmental Protection Authority 2009, Harvey 2002). Mature live specimens are usually required for definitive species identifications based on morphology.

4.4.2 Potential Terrestrial Invertebrate SRE Fauna Habitat

SRE invertebrate fauna of arid and semi-arid Western Australia is typically associated with sheltered and mesic microhabitats, such as the south-west facing aspect of slopes, trees, boulders and rock piles, as well drainage systems, deep gorges, natural springs and fire refuges (Environmental Protection Authority 2009). SRE invertebrate fauna also tends to occur in isolated habitats such as outcrops and mesas (Environmental Protection Authority 2009).

Potential SRE habitat within the Study area is most likely to occur within Rocky Ridges and Gorges habitat and Drainage Lines habitat. The extent of these habitats is somewhat limited and in the case of Rocky Ridges and Gorges, it does not appear to be well connected within the wider landscape (**Figure 10**). Consequently, there may be some potential for SRE species to reside within this habitat type.

Additionally, two fauna habitats of limited extent have the potential to support SRE species, the Rubble Piles and the Ficus Groves Both the Rubble Piles and the Ficus Groves represent habitat isolates and have the potential to support SRE species (**Figure 10**).

The remaining landscape within the Study area appears relatively uniform and does not correspond to typical SRE habitat. All other habitat types were widespread, well connected and extensive throughout the surrounding landscape.

4.4.3 Terrestrial Invertebrate SRE Species Recorded Within or Near the Study area

A search of the Western Australian Museum SRE invertebrate collection yielded five records for three potential SRE species occurring within or in the region surrounding the Study area. The distribution of these species with respect to rangeland land systems is summarised below in **Table 7** and **Figure 11**. The complete set of database search results is included in **Attachment C**.

Table 7: Potential SRE species recorded within the surrounding region

SRE Group	Scientific name	Land systems in which species has been recorded	Closest record to Study area
Millipede	*Antichiropus* 'abydos'	Capricorn	6.5 west
Pseudoscorpion	*Feaella sp.* 'Sulphur Springs'	Capricorn	within Study area
Mygalomorph Spider	*Kwonkan* 'MYG200'	Talga	37 km south

Of the two SRE species not recorded within the Study area, there is potential for *Antichiropus* 'abydos to occur within the Study area as it has been recorded within the Capricorn land system, which forms 49% of the Study area. This land system is well represented within the surrounding region and so it likely that these species would also be represented elsewhere within the region. In contrast, *Kwonkan* 'MYG200' was only found in the Talga land system, which does not occur in the Study area, although this does not preclude this species from occurring within the Study area.

Feaella sp. 'Sulphur Springs' was recorded within the Study area (Biota 2007) and represents the only known record for this species (**Figure 12**). This species was collected from within the Drainage Line habitat and the distribution of this species may be closely associated with this habitat type. The Drainage Line habitat is a potential SRE habitat that it is relatively well connected along its length. This Drainage Line habitat coincides with a proposed haul road footprint for the Project.

Although the previous survey by Biota (2007) was undertaken prior to the release of EPA Guidance Statement 20 (EPA 2009), the methods used during the survey align with the Guidance Statement when considering the anticipated scale of the impact associated with an underground mining operation. The additional targeted survey conducted for *Feaella sp.* 'Sulphur Springs' completed in October 2007 was unsuccessful in locating specimens of this species and the distribution of this species remains unknown (M. Harvey, pers. comm. September 2011).

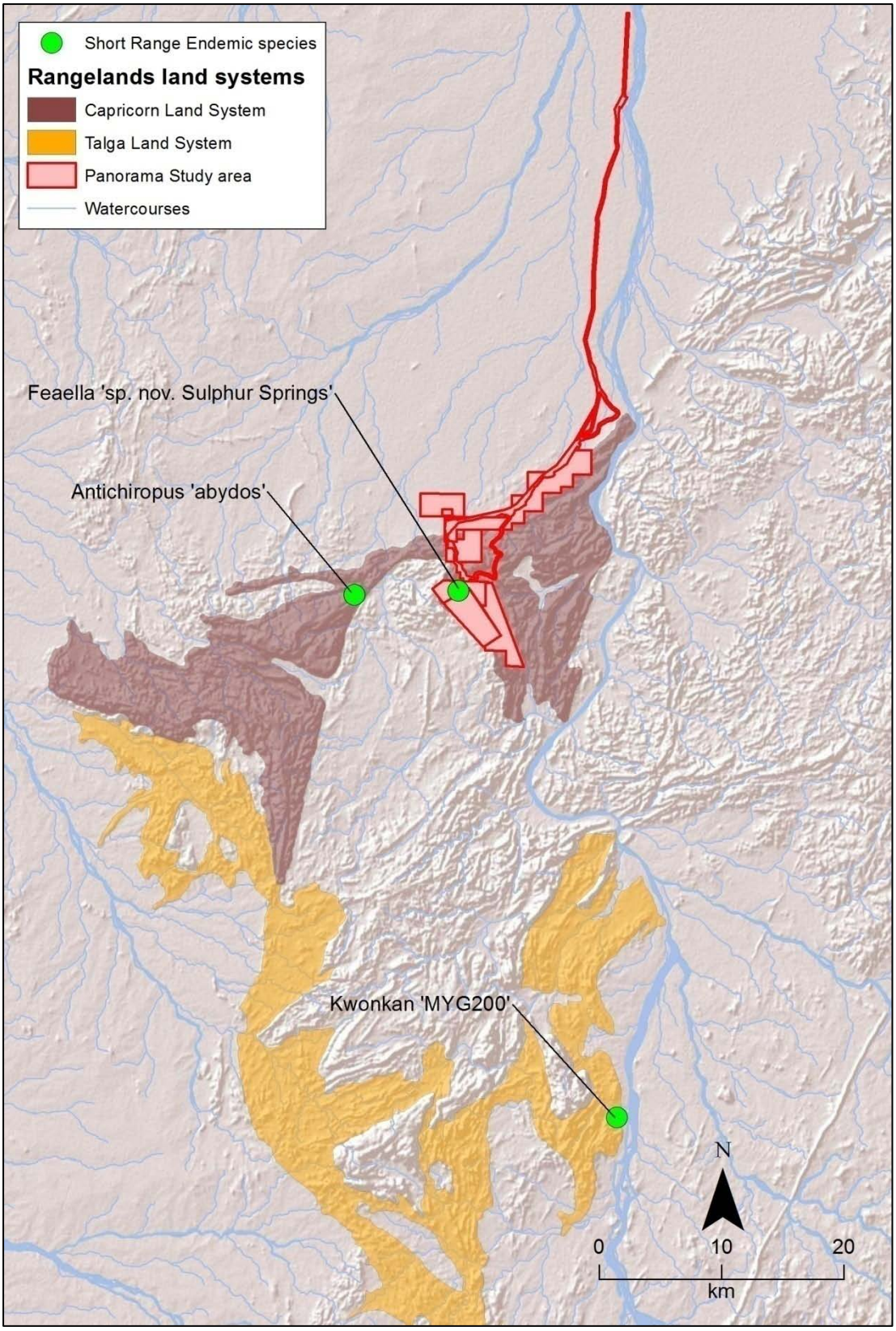

Figure 11: Location of potential SRE species recorded within the Study area and surrounding region

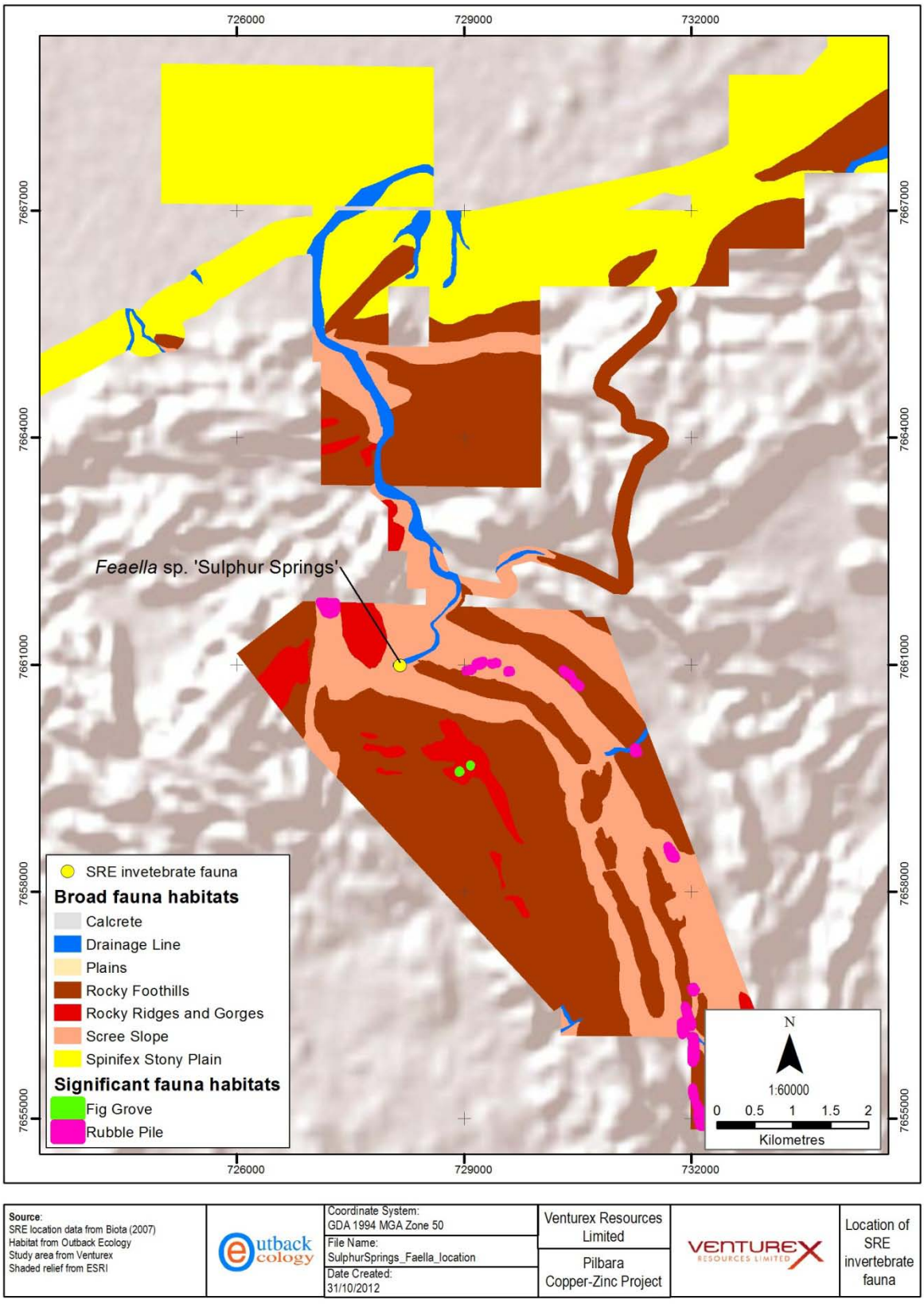

Figure 12: Location of the pseudoscorpion *Feaella* sp. 'Sulphur Springs' and habitats within the Study area

5. KNOWLEDGE GAPS AND RECOMMENDED ADDITIONAL STUDIES

Previous survey effort within the Study area has provided a sound baseline and combined with existing data in the literature and from fauna databases, has adequately documented the faunal assemblages likely to be present. However, some key knowledge gaps remain, which relate primarily to the distribution and abundance of the conservation significant Northern Quoll and also to the potential distribution of *Feaella* sp. 'Sulphur Springs' outside of areas likely to be impacted by the Project.

Two areas of habitat within the Study area consists of habitat that is likely to be critical to the survival of Northern Quoll

: 1) the substantial drainage line in the centre of the Study area (**Figure 10**); and 2) the Rocky Gorge/Gully surrounding Sulphur Springs itself (**Figure 10,** 729030S, 7659696E, UTM z50). Only the former is likely to be substantially affected by the Project as this habitat appears to coincide with a proposed haul route heading to the north.

Consistent with EPBC guidelines, it is recommended that a Northern Quoll monitoring program be conducted for the Pilbara Copper-Zinc Project, the primary objectives of which should be to:

- design and conduct a baseline population survey to provide quantitative data on Northern Quoll demographics and distribution in the Study area;
- provide pre-disturbance baseline population data that can be used to monitor the impacts of the Project on localised Northern Quoll populations; and

1. develop future monitoring and management recommendations for the Northern Quoll within the Study area.

The first survey conducted as part of this monitoring program should be undertaken pre-development and during the months of May to August to avoid any disturbance during the reproductive period.

As a minimum, a monitoring program should consider the following:

- the trapping program should be configured to address project impact and non-impact zones so that results are adequate to inform project siting and management options;
- trapping should be concentrated in habitat critical to the survival of the species with some consideration of non-rocky foraging and dispersal habitats;
- traps should be set for seven consecutive nights, unless two or more individuals are caught twice, in which case the traps should be closed after four nights of trapping;
- survey via trapping may be supplemented by one of several non-invasive survey techniques such as latrine searches in habitat critical to the survival of the species or use of motion sensitive cameras; however, these methods should be considered supplementary only.

The distribution of *Feaella* sp 'Sulphur Springs' may occur in association with Drainage Line habitat within and outside the Study area. Given that the project may impact upon the only recorded location of this species (728157 mE; 7660995 mN; UTM, zone 50, WGS84) and given that the Drainage Line habitat appears to coincide with a proposed haul route heading north, it is recommended that an additional targeted survey for this species be undertaken. The aim of this survey would be to determine if *Feaella* sp 'Sulphur Springs' has a distribution that extendes outside of proposed impact areas. Additionally, potential habitat for *Feaella sp.* 'Sulphur Springs' should be mapped and assessed both within and outside proposed impact areas.

Table 8 provides a summary of potential knowledge gaps identified from the desktop study and the action required to address each of these.

Table 8: Summary of desktop study knowledge gaps and actions required

Knowledge Gap	Action Required	Methods	Recommended Timing
Vertebrate Fauna			
Northern Quoll: Draft Commonwealth Survey and Monitoring Guidelines have been released. Populations and distribution of Northern Quolls in Rocky Ridge and Gorge and Drainage Line habitat that coincide with proposed impact footprints is not known.	As per DSEWPA draft guidelines, EPA Guidance Statement No 56 (EPA 2004) and Technical Guide (EPA 2010), a Level 2 targeted survey for Northern Quolls is recommended to: • assess the total population within Study area • assess the populations of Northern Quolls in impact and non-impact zones	Within suitable habitat, establish a standardised trapping layout to assess the Northern Quoll population (i.e. deployment of 20 Elliott traps per site for a total of up to seven nights). Where possible establish multiple sites within habitats to provide adequate replication.	Survey for Northern Quolls should be conducted between March and June so as to avoid the hottest parts of the year (increased risk of mortality) and breeding periods (disturbance to reproductive cycle).
SRE Invertebrate Fauna			
The distribution of *Feaella* sp 'Sulphur Springs' is only known from a single collection location. This location may coincide with proposed impact footprints.	Execute targeted SRE survey: • with the aim of extending the known distribution of *Feaella* sp 'Sulphur Springs' outside of proposed impact areas. • map and describe potential habitat for *Feaella* sp 'Sulphur Springs' outside of proposed impact areas. Undertake impact assessment on finalisation of disturbance footprint to determine risks to potential SRE species.	Targeted searching of sites in prospective habitats outside of proposed impact areas. Prospective habitats include: beneath slate like rock on the south face of low cliffs or areas adjacent to ephemeral drainage lines (Biota 2007). Map and describe potential habitat where *Feaella* sp 'Sulphur Springs' may occur within and outside proposed impact areas.	Although the only specimen of *Feaella* sp 'Sulphur Springs' was collected during September 2007, it is recommended that any follow up targeted surveys be conducted during or after the period of peak rainfall (EPA, 2009). For many invertebrates the period after peak rainfall coincides with peak activity and maturity. For the Study area, this coincides with January to April.

6. CONCLUSION

Six broad terrestrial fauna habitats occur within the Study area, comprising Spinifex Stony Plains, Rocky Foothills, Scree Slope, Spinifex Sandplain, Drainage Line and Rocky Ridges and Gorges. Additionally, two fauna habitats of limited extent were identified within the Study area: Rubble Piles and Ficus Groves.

Based on database search findings and a review of relevant literature within the surrounding region, it is possible that a total of 392 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 53 mammals (44 native), 211 birds, 116 reptiles, five fish and seven amphibian species.

Based on a more specific review of previous surveys within the Study area (Bamford Consulting Ecologists 2001, Biota 2007), it is possible that a total of 151 terrestrial vertebrate fauna species may potentially occur within the Study area, comprised of 27 mammals (22 native), 83 birds, 34 reptiles, five fish and two amphibian species.

Overall, 23 conservation significant fauna species could potentially occur within the Study area, excluding those considered as unlikely:

- Eight species listed under the EPBC Act and WC Act: Northern Quoll, Mulgara, Greater Bilby, Pilbara Leaf-nosed Bat, Night Parrot, Pilbara Olive Python, Peregrine Falcon and Woma;
- Ten species listed as Priority 4 Fauna by the DEC: Ghost Bat, Spectacled Hare-wallaby, Western Pebble-mound Mouse, Long-tailed Dunnart, Lakeland Downs Mouse, Australian Bustard, Bush Stone-curlew, Grey Falcon, Star Finch, and *Ramphotyphlops ganei* (a blind snake); and
- Five species listed as Migratory under the EPBC Act: Fork-tailed Swift, Cattle Egret, Oriental Plover, Rainbow Bee-eater and Night Parrot.

Potential SRE habitat within the Study area is most likely to occur within Rocky Ridges and Gorges and Drainage Lines habitat. Additionally, the Rubble Piles and the Ficus Groves represent habitat isolates that may support SRE species. The remaining landscape within the Study area appears relatively uniform and does not correspond to typical SRE habitat; i.e. these habitat types were widespread, well connected and extensive throughout the surrounding landscape.

Three potential SRE species are known to occur in the region surrounding the Study area. Based on the broad habitats which occur, there is potential for all three of these species to occur within the Study area. The millipede *Antichiropus* 'abydos' has been collected 6.5 km west of the Study area and the mygalomorph spider *Kwonkan* 'MYG200' has been collected 37 km south of the Study area. The pseudoscorpion *Feaella sp. '*Sulphur Springs' is known from a single specimen collected from the Study area in 2007.

Previous survey effort within the Study area has provided a sound baseline and combined with existing data in the literature and from fauna databases, has adequately documented the faunal assemblages likely

to be present. A key remaining knowledge gap relates to the adequate assessment of Northern Quoll, particularly within Drainage Line and Rocky Ridge and Gorge habitat that coincides with proposed impact footprints. A further key knowledge gap relates to the only known record of the pseudoscorpion *Feaella sp.* 'Sulphur Springs' being recorded form within a potential impact area. Additionally, *Feaella sp.* 'Sulphur Springs' may occur in association with Drainage Line habitat; of which a considerable portion occurs within the proposed haulage route footprint in the northwest of the Study area.

With consideration to the scale of the proposed project, the level of potential impacts and current knowledge of terrestrial fauna in the Study area, it is recommended that a Northern Quoll monitoring program be established for the Pilbara Copper-Zinc Project, consistent with EPBC guidelines for the species. The primary objectives of this monitoring program would be to:

- design and conduct a baseline population survey to provide quantitative data on Northern Quoll demographics and distribution in the Study area;
- provide pre-disturbance baseline population data that can be used to monitor the impacts of the Project on localised Northern Quoll populations; and
- develop future monitoring and management recommendations for the Northern Quoll within the Study area.

A targeted terrestrial invertebrate SRE survey for *Feaella sp.* 'Sulphur Springs' is recommended with the aim of gaining a better understanding of the species distribution outside of the proposed impact footprint. In addition, potential habitat for *Feaella sp.* 'Sulphur Springs' should be mapped and assessed both within and outside proposed impact areas.

7. REFERENCES

ABRS. (2010) *Australian Biological Resources Study.* Department of Sustainability, Environment, Water, Population and Communities. Available online at. Accessed on.

Allen, G. R., Midgley, S. H. and Allen, M. (2002) *Field Guide to the Freshwater Fishes of Australia.* Western Australian Museum, Perth.

Armstrong, K. N. and Anstee, D. (2000) The ghost bat in the Pilbara: 100 years on. *Australian Mammalogy* 22: 93-101.

Australian Natural Resources Atlas. (2007) *Rangelands overview - Pilbara.* Available online at http://www.anra.gov.au/topics/rangelands/overview/wa/ibra-pil.html. Accessed on 01/06/2010.

Bamford Consulting Ecologists. (2001) *Panorama Project Area: Baseline Fauna Study as Part of the Sulphur Springs Feasibility Study*, Prepared for Astron Environmental.

Bamford Consulting Ecologists. (2005) *Fauna Survey of Proposed Iron Ore Mine, Cloud Break*, Prepared for Fortescue Metals Group Ltd.

Bamford Consulting Ecologists. (2007) *Fauna Assessment of the Pardoo Direct Shipping Ore Project Atlas Iron Limited*, Prepared for Enesar Consulting Pty Ltd.

Bamford Consulting Ecologists. (2008) *Fauna Assessment of the Wodgina Tailings Storage Facility 3*, Prepared for Enviroworks Consulting.

Bamford, M., Watkins, D., Bancroft, W., Tischler, G. and Wahl, J. (2008) *Migratory Shorebirds of the East Asian - Australasian Flyway: Population Estimates and Internationally Important Sites.* Wetlands International - Oceania, Canberra, Australia.

Biota. (2002a) *An Assessment of the Distribution of the Mulgara Dasycercus cristicauda and Bilby Macrotis lagotis Along and Adjacent to the Proposed Hope Downs to Port Hedland Rail Corridor*, Hope Downs Management Services Survey Report.

Biota. (2002b) *Proposed Hope Downs Rail Corridor From Weeli Wolli Siding to Port Hedland - Vertebrate Fauna Survey*, Hope Downs Management Services Vertebrate Fauna Survey.

Biota. (2004) *Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor*, Fortescue Metals Group Fauna Habitat and Fauna Assemblage Report.

Biota. (2005) *Fauna Habitats and Fauna Assemblage of the FMG Stage B Rail Corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas Mine Areas*, Report prepared for Fortescue Metals Pty Ltd.

Biota. (2007) *Panorama Project: Mine Site and Haul Road Corridor Targeted Fauna Survey*, Prepared for CBH Resources.

Birds Australia. (2010) *Birdata: Custom Atlas Bird Lists.* Available online at http://www.birdata.com.au/custom.vm. Accessed on 07/07/2010.

Brunet, B. (1996) *Spider watch: A Guide to Australian Spiders.* New Holland Publishers Pty Ltd, Sydney, NSW.

Burbidge, A. H., Johnstone, R. E. and Pearson, D. J. (2010) Birds in a vast arid upland: avian biogeographical patterns in the Pilbara region of Western Australia. *Records of the Western Australian Museum Supplement* 78: 247-270.

Bureau of Meteorology. (2011) *Climate Data Online.* Available online at http://www.bom.gov.au./climate/data/index.shtml. Accessed on 19/09/2011.

Burrows, N. D., Burbidge, A. A., Fuller, P. J. and Behn, G. (2006) Evidence of altered fire regimes in the Western Desert region of Australia. *Conservation Science Western Australia* 5(3): 272-284.

Department of Environment and Conservation. (2007) *Millstream-Chichester National Park and Mungaroona Range Nature Reserve: Draft Management Plan*, Produced by the Traditional Owners - Millstream Park Council, Department of Environment and Conservation and the Conservation Commission of Western Australia.

Department of Environment and Conservation. (2010a) *Naturemap: Mapping Western Australia's Biodiversity.* Available online at http://naturemap.dec.wa.gov.au./default.aspx. Accessed on 07/06/2010.

Department of Environment and Conservation (2010b) *Threatened and Priority Fauna Database*. Available online at https://secure.dec.wa.gov.au/apex/pls/fauna/f?p=faunasurveypublic.

Department of Environment Water Heritage and the Arts. (2010) *Species Profile and Threats Database.* Available online at http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Accessed on 06/07/2010.

Department of Sustainability Environment Water Population and Communities. (2010a) *Environmental Reporting Tool: Information for Decision Makers.* Available online at http://www.environment.gov.au/erin/ert/index.html. Accessed on 19/10/2010.

Department of Sustainability Environment Water Population and Communities. (2010b) *Pezoporus occidentalis — Night Parrot.* Available online at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59350. Accessed on 01/08/2010.

Department of Sustainability Environment Water Population and Communities. (2011) *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll, Dasyurus hallucatus*, EPBC Act Policy Statement 3.25.

ecologia. (2008) *RGP 5 Level 2 Fauna Survey: Chichester Deviation*, A report commissioned by BHP Billiton Iron Ore Pty Ltd.

Environmental Protection Authority. (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection*, Position Statement No 3. March 2003.

Environmental Protection Authority. (2004) *Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, No 56. June, 2004.

Environmental Protection Authority. (2009) *Guidance for the Assessment of Environmental Factors: Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*, No 20. May, 2009.

Environmental Protection Authority and Department of Environment and Conservation. (2010) *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.* (eds. B.M. Hyder, J.Dell, M.A. Cowan) Perth, W.A.

Garnett, S. and Crowley, G. (2000) *The Action Plan for Australian Birds.* Environment Australia and the Royal Australia Ornithologists Union, Canberra, A.C.T.

Geering, A., Agnew, L. and Harding, S. (2007) *Shorebirds of Australia.* CSIRO Publishing, Collingwood, Vic.

Gibson, L. A. and McKenzie, N. L. (2009) Environmental Associations of small ground-dwelling mammals in the Pilbara region, Western Australia. *Records of the Western Australian Museum Supplement* 78: 91-122.

Hall, L., Richards, G., McKenzie, N. and Dunlop, N. (1997) The importance of abandoned mines as habitat for bats. In: P. Hale and D. Lamb (eds) *Conservation Outside Nature Reserves*. Centre for Conservation Biology, the University of Queensland, St Lucia, Queensland, pp 326-333

Harvey, M. S. (2002) Short range endemism in the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* 16: 555-570.

Harvey, M. S. and Yen, A. L. (1989) *Worms to Wasps: An illustrated guide to Australia's terrestrial invertebrates.* Oxford University Press, Melbourne, Vic.

How, R. A. and Cooper, N. K. (2002) Terrestrial small mammals of the Abydos Plain in the north-eastern Pilbara, Western Australia. *Journal of the Royal Society of Western Australia* 85: 71-82.

How, R. A., Dell, J. and Cooper, N. K. (1991) Ecological Survey of Abydos-Woodstock Reserve, Western Australia: Vertebrate Fauna. *Records of the Western Australian Museum Supplement* 37: 78-125.

Johnstone, R. E. and Storr, G. M. (1998) *Handbook of Western Australian Birds. Vol 1. Non-passerines (Emu to Dollarbird).* Western Australian Museum, Perth, W.A.

Johnstone, R. E. and Storr, G. M. (2004) *Handbook of Western Australian Birds Vol. 2 Passerines (Blue-winged Pitta to Goldfinch)* Western Australian Museum, Perth, W.A.

Kendrick, P. and McKenzie, N. L. (2001) Pilbara 1 (PIL1 - Chichester subregion). In: *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management, Kensington, W.A., pp 547-558

Kendrick, P. and Stanley, F. (2001) Pilbara 1 (PIL4 - Roebourne subregion). In: *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management, Kensington, W.A., pp 581-593

King, D. (1989) An assessment of the hazard posed to northern quolls (*Dasyurus hallucatus*) by aerial baiting with 1080 to control dingoes. *Australian Wildlife Research* 16(5): 569-74.

Leighton, K. A. (2004) Climate. In: A.M.E. van Vreeswyk, A.L. Payne, K.A. Leighton and P Hennig (eds) *An Inventory and Condition Survey of the Pilbara Region, Western Australia*. Technical Bulletin No. 92. Western Australian Department of Agriculture, Perth, W.A.

Main, B. Y. (1982) *Adaptations to arid habitats by mygalomorph spiders.* Peacock Publications, Frewville, South Australia.

Main, B. Y. (2005) *The Mygalomorph Spiders from the Mt Gibson Region, Western Australia, Including Species Apparently Endemic to the Area.*, Prepared for ATA Environmental.

Mattiske Consulting. (2000) *Flora, vegetation and vertebrate fauna of the proposed expansion at Wodgina*, Prepared for Sons of Gwalia Ltd.

Maxwell, S., Burbidge, A. A. and Morris, K. (1996) *Action Plan for Australian Marsupials and Monotremes* Environment Australia, Canberra, A.C.T.

McKenzie, N. L. and Bullen, R. D. (2009) The echolocation calls, habitat relationships, foraging niches and communities of Pilbara microbats. *Records of the Western Australian Museum Supplement* 78: 123-155.

McKenzie, N. L., May, J. E. and McKenna, S. (2003) *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia: A Contribution to the Development of Western Australia's Biodiversity Conservation Strategy.* Department of Conservation and Land Management, Kensington, W.A.

McKenzie, N. L., van Leeuwen, S. and Pinder, A. M. (2009) Introduction to the Pilbara Biodiversity Survey, 2002-2007. *Records of the Western Australian Museum Supplement* 78: 3-89.

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

MOLHAR Pty Ltd. (2007) *Field Survey for conservation significant bats near Sulphur Springs, Pilbara: field survey and management advice*, Prepared for CBH Resources Ltd.

Morcombe, M. (2003) *Field Guide to Australian Birds: Second Edition.* Oxford University Press, South Melbourne, Australia.

Ninox Wildlife Consulting. (2009a) *A Fauna Survey of the Proposed Hope Downs 4 Mining Area Near Newman, Western Australia*, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.

Ninox Wildlife Consulting. (2009b) *A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor: Option 1 Near Newman, Western Australia*, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.

Ninox Wildlife Consulting. (2009c) *A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Option 6 Infrastructure Corridor Near Newman, Western Australia*, Prepared for Mattiske Consulting Pty Ltd on behalf of Pilbara Iron Company (Services) Pty Ltd.

Outback Ecology. (2006) *Spinifex Ridge Molybdenum Project: Terrestrial Vertebrate Fauna Baseline Surveys (2005-2006)*, Unpublished report prepared for Atlas Iron Limited.

Outback Ecology. (2011) *Mt Dove DSO Project Terrestrial Vertebrate Fauna Assessment 2011*, Prepared for Atlas Iron Ltd.

Outback Ecology Services. (2009) *Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment*, Prepared for Atlas Iron Limited.

Parr, C. L. and Andersen, A. N. (2006) Patch mosaic burning for biodiversity conservation: a critique of the pyrodiversity paradigm. *Conservation Biology* 20(6): 1610-1619.

Pizzey, G. and Knight, F. (2007) *Field Guide to the Birds of Australia.* Harper Collins Publishers, Sydney, NSW.

Ponder, W. and Colgan, D. (2002) What makes a narrow-range taxon?-Insights from Australian freshwater snails. *Invertebrate Systematics* 16(4): 571-582.

Schmitt, L., Bradley, A., Kemper, C., Kitchener, D., Humphreys, W. and How, R. (1989) Ecology and physiology of the northern quoll, *Dasyurus hallucatus* (Marsupialia, Dasyuridae), at Mitchell Plateau, Kimberley, Western Australia. *Journal of Zoology* 217(4): 539-558.

Southgate, R., Paltridge, R., Masters, P. and Carthew, S. (2007) Bilby distribution and fire: a test of alternative models of habitat suitability in the Tanami Desert, Australia. *Ecography* 30(6): 759-776.

Storr, G. M. (1984) Birds of the Pilbara Region, Western Australia. *Records of the Western Australian Museum Supplement* 16.

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

Van Dyck, S. and Strahan, R. (2008) *The Mammals of Australia. Third edition* The Australian Museum Trust and Queensland Museum, Sydney, NSW.

Van Vreeswyk, A. M. E., Payne, A. L., Leighton, K. A. and Hennig, P. (2004) *An Inventory and Condition Survey of the Pilbara Region, Western Australia*, WA Department of Agriculture Technical Bulletin No. 92.

Western Australian Museum. (2010) *The Western Australian Museum Short Range Endemic Invetebrate Database.* Available online at. Accessed on 06/12/2010.

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

Woinarski, J. C. Z. (1999) Fire and Australian birds: a review. In: A. M. Gill, J. C. Z. Woinarski and A. York (eds) *Australia's biodiversity: responses to fire: plants, birds and invertebrates*. Environment Australia, Canberra, ACT, pp 55-111

Wright, B. R. and Clarke, P. J. (2007) Resprouting responses of Acacia shrubs in the Western Desert of Australia – fire severity, interval and season influence survival. *International Journal of Wildland Fire* 16(3): 317-323.

Attachment A

Vertebrate Species Recorded in Study Area and Surrounds

Attachment A– Vertebrate Species Recorded in Study Area and Surrounds

Legend

Abbreviations/Symbols

*	Introduced Species
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*: EN Endangered, VU Vulnerable M Migratory
WC Act	Western Australian Wildlife Conservation Act 1950 and Department of Environment and Conservation's Threatened and Priority Fauna Rankings: S1 Schedule 1 Rare or likely to become extinct, S3 Migratory birds protected under an international agreement, S4 In need of special protection P1 Priority 1 Fauna, P2, P3, P4, P5

Previous Surveys in Study area

A	Bamford Consulting Ecologists. (2001) Sulphur Springs Project Area: Baseline Fauna Study as Part of the Sulphur Springs Feasibility Study
B	Biota. (2007) Sulphur Springs Project: Mine Site and Haul Road Corridor Targeted Fauna Survey

Previous Surveys in surrounding region

D	How *et al*. (1991) Ecological Survey of Abydos-Woodstock Reserve, Western Australia: Vertebrate Fauna
F	Biota. (2002) Proposed Hope Downs Rail Corridor From Weeli Wolli Siding to Port Hedland - Vertebrate Fauna Survey
G	Biota. (2004) Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor
H	Bamford Consulting Ecologists. (2005) Fauna Survey of Proposed Iron Ore Mine, Cloud Break
I	Outback Ecology Services. (2006) Spinifex Ridge Molybdenum Project: Terrestrial Vertebrate Fauna Baseline Surveys (2005-2006)
J	Bamford Consulting Ecologists. (2007) Fauna Assessment of the Pardoo Direct Shipping Ore Project Atlas Iron Limited
K	ecologia. (2008) RGP 5 Level 2 Fauna Survey: Chichester Deviation
L	Ninox Wildlife Consulting. (2009) A Fauna Survey of the Proposed Hope Downs Mining Area Near Newman, Western Australia
M	Ninox Wildlife Consulting. (2009) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Infrastructure Corridor: Option 1 Newman
N	Ninox Wildlife Consulting. (2009) A Vertebrate Fauna Survey of the Proposed Hope Downs 4 Option 6 Infrastructure Corridor Newman
O	Outback Ecology. (2009) Wodgina DSO Project: Terrestrial Vertebrate Fauna Assessment

Database Searches – centroid: 119.207784 E, -21.157591 S

Birds Aust.	Birds Australia Atlas Database Search (December 2010)
DEC TPFS	Department of Environment and Conservation's Threatened and Priority Fauna Database Search (December 2010)
ERT	Department of Sustainability, Environment, Water, Population and Communities database search (October 2010)
Nature Map	Department of Environment and Conservation's Nature Map Database (December 2010)

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Mammals																				
BOVIDAE																				
*Bos taurus**	European Cattle				*	*	*					*		*		*				
CAMELIDAE																				
*Camelus dromedarius**	Dromedary			*		*			*	*	*	*								
CANIDAE																				
*Canis lupus**	Dingo			*			*	*	*	*	*	*	*	*	*					
*Vulpes vulpes**	Fox						*						*						*	
DASYURIDAE																				
Dasycercus blythei	Brush-tailed Mulgara		P4															*		
Dasycercus cristicauda	Crest-tailed Mulgara	EN	S1	*		*	*	*	*	*			*					*	*	
Dasykaluta rosamondae	Kaluta			*		*	*	*	*	*	*	*		*	*					
Dasyurus hallucatus	Northern Quoll	EN	S1	*	*	*	*	*	*	*		*	*			*		*	*	*
Ningaui ridei	Wongai Ningaui								*	*										
Ningaui timealeyi	Pilbara Ningaui			*	*	*	*	*	*	*	*	*		*	*					*
Planigale ingrami	Long-tailed Planigale			*			*	*	*	*	*	*		*		*				*
Planigale maculata	Common Planigale					*									*					
Pseudantechinus macdonnellensis	Fat-tailed False Antechinus						*	*												
Pseudantechinus roryi	Tan False Antechinus			*		*														
Pseudantechinus woolleyae	Woolley's Pseudantechinus					*							*		*	*				
Sminthopsis longicaudata	Long-tailed Dunnart		P4															*		
Sminthopsis macroura	Stripe-faced Dunnart				*	*	*	*	*	*	*	*		*						
Sminthopsis ooldea	Ooldea Dunnart														*					
Sminthopsis youngsoni	Lesser hairy-footed Dunnart					*	*	*	*	*		*								
EMBALLONURIDAE																				
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat										*	*		*	*	*				
Taphozous georgianus	Common Sheathtail-bat			*		*	*	*			*	*	*	*	*	*				*
EQUIDAE																				
*Equus asinus**	Donkey					*	*	*	*	*	*									
*Equus caballus**	Horse										*									
FELIDAE																				
*Felis catus**	Cat			*		*	*	*	*	*	*	*	*	*		*			*	
HIPPOSIDERIDAE																				
Rhinonicteris aurantius (Pilbara form)	Pilbara Leaf-nosed Bat	VU	S1	*	*							*				*		*	*	*
LEPORIDAE																				
*Oryctolagus cuniculus**	Rabbit													*					*	
MACROPODIDAE																				
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby (mainland)		P3	*		*												*		*
Macropus robustus	Common Wallaroo			*	*	*	*	*	*	*	*	*	*	*	*	*				*
Macropus rufus	Red Kangaroo						*	*			*				*					*
Petrogale rothschildi	Rothschild's Rock-wallaby			*		*	*	*	*	*		*				*				*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
MEGADERMATIDAE																				
Macroderma gigas	Ghost Bat		P4	*		*		*				*		*		*		*		*
MOLOSSIDAE																				
Austronomus australis	White-striped Freetail-bat			*			*	*			*				*	*				
Chaerephon jobensis	Northern Freetail-bat						*	*			*	*		*	*	*				
Mormopterus beccarii	Beccari's Freetail-bat											*		*						
Mormopterus loriae cobourgiana	Mangrove Freetail-bat		P1					*												
MURIDAE																				
Leggadina lakedownensis	Lakeland Downs Mouse		P4				*	*	*	*				*				*		
*Mus musculus**	House Mouse			*	*	*	*	*	*	*	*			*						*
Notomys alexis	Spinifex Hopping-mouse						*	*					*	*						
Pseudomys chapmani	Pebble-mound Mouse		P4	*	*	*	*				*	*	*	*	*	*		*		*
Pseudomys delicatulus	Delicate Mouse			*		*	*	*	*	*					*					*
Pseudomys desertor	Desert Mouse			*	*		*	*	*	*	*	*	*	*	*					*
Pseudomys hermannsburgensis	Sandy Inland Mouse			*	*	*	*	*	*	*		*		*	*					
Zyzomys argurus	Common Rock-rat			*	*	*	*	*	*	*	*	*		*	*	*				*
TACHYGLOSSIDAE																				
Tachyglossus aculeatus	Short-beaked Echidna			*		*	*	*	*	*	*		*							
THYLACOMYIDAE																				
Macrotis lagotis	Greater Bilby	VU	S1				*				*							*		
VESPERTILIONIDAE																				
Chalinolobus gouldii	Gould's Wattled Bat						*	*	*	*	*	*		*	*	*				
Chalinolobus morio	Chocolate Wattled Bat														*					
Nyctophilus arnhemensis	Arnhem Long-eared Bat							*												
Nyctophilus geoffroyi	Lesser Long-eared Bat										*	*		*						
Scotorepens greyii	Little Broad-nosed Bat				*	*	*	*	*	*	*	*		*	*	*				
Vespadelus finlaysoni	Inland Cave Bat			*		*	*	*		*	*	*		*	*	*				*
Birds																				
ACANTHIZIDAE																				
Acanthiza apicalis	Inland Thornbill						*							*	*					
Acanthiza robustirostris	Slaty-backed Thornbill						*		*	*	*			*						
Acanthiza uropygialis	Chestnut-rumped Thornbill						*		*	*	*			*	*					
Aphelocephala leucopsis	Southern Whiteface										*									
Aphelocephala nigricincta	Banded Whiteface											*								
Gerygone fusca	Western Gerygone			*		*	*				*	*		*	*		*			*
Gerygone levigaster	Mangrove Gerygone																			
Gerygone tenebrosa	Dusky Gerygone							*									*			
Pyrrholaemus brunneus	Redthroat														*					
Smicrornis brevirostris	Weebill			*		*	*	*	*	*	*	*		*	*		*			*
ACCIPITRIDAE																				
Accipiter cirrocephalus	Collared Sparrowhawk			*		*			*	*	*	*					*			*
Accipiter fasciatus	Brown Goshawk			*	*	*	*	*	*	*			*	*		*	*			*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Aquila audax	Wedge-tailed Eagle			*	*	*	*	*	*	*	*	*	*	*	*		*			*
Circus approximans	Swamp Harrier								*	*							*			
Circus assimilis	Spotted Harrier			*		*		*	*	*	*		*	*			*			*
Elanus axillaris	Black-shouldered Kite			*		*	*	*	*	*			*	*			*			*
Haliaeetus leucogaster	White-bellied Sea-Eagle	M															*		*	
Haliastur indus	Brahminy Kite							*									*			
Haliastur sphenurus	Whistling Kite			*			*	*	*	*	*		*	*	*		*			*
Hamirostra melanosternon	Black-breasted Buzzard							*	*	*					*					
Hieraaetus morphnoides	Little Eagle			*		*		*	*	*	*	*	*	*	*		*			*
Lophoictinia isura	Square-tailed Kite								*	*				*	*		*			
Milvus migrans	Black Kite					*	*	*	*	*	*	*	*			*	*			*
Pandion cristatus	Eastern Osprey																*			
ACROCEPHALIDAE																				
Acrocephalus australis	Australian Reed-Warbler	M					*	*						*			*			*
AEGOTHELIDAE																				
Aegotheles cristatus	Australian Owlet-nightjar			*		*		*	*	*	*	*	*	*	*	*				*
ALAUDIDAE																				
Mirafra javanica	Horsfield's Bushlark						*	*	*	*	*		*	*			*			
ANATIDAE																				
Anas gracilis	Grey Teal					*		*			*						*			*
Anas rhynchotis	Australasian Shoveler																*			
Anas superciliosa	Pacific Black Duck			*		*	*	*	*	*	*			*			*			*
Aythya australis	Hardhead																*			
Chenonetta jubata	Australian Wood Duck							*									*			*
Cygnus atratus	Black Swan										*						*			
Dendrocygna eytoni	Plumed Whistling-Duck																*			
Malacorhynchus membranaceus	Pink-eared Duck										*						*			*
Tadorna tadornoides	Australian Shelduck										*									
ANHINGIDAE																				
Anhinga novaehollandiae	Australasian Darter			*		*		*	*	*							*			*
APODIDAE																				
Apus pacificus	Fork-tailed Swift	M				*			*	*				*			*		*	
ARDEIDAE																				
Ardea ibis	Cattle Egret	M															*		*	
Ardea intermedia	Intermediate Egret																*			
Ardea modesta	Eastern Great Egret			*				*					*				*		*	*
Ardea pacifica	White-necked Heron			*		*		*			*	*	*	*	*		*			*
Butorides striata	Striated Heron							*									*			
Egretta garzetta	Little Egret							*									*			
Egretta novaehollandiae	White-faced Heron			*	*	*	*		*	*	*	*		*			*			*
Egretta sacra	Eastern Reef Egret	M															*			
Ixobrychus flavicollis	Black Bittern																*			

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Nycticorax caledonicus	Nankeen Night Heron			*	*	*		*				*					*			*
ARTAMIDAE																				
Artamus cinereus	Black-faced Woodswallow			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Artamus leucorynchus	White-breasted Woodswallow																*			
Artamus minor	Little Woodswallow			*	*	*	*	*					*	*	*	*	*			*
Artamus personatus	Masked Woodswallow				*	*	*		*	*					*		*			
Artamus superciliosus	White-browed Woodswallow							*												
Cracticus nigrogularis	Pied Butcherbird			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Cracticus tibicen	Australian Magpie			*	*	*	*	*	*	*	*	*		*	*		*			*
Cracticus torquatus	Grey Butcherbird						*	*	*	*	*			*	*		*			
BURHINIDAE																				
Burhinus grallarius	Bush Stone-curlew		P4	*		*		*	*	*		*		*			*	*		*
CACATUIDAE																				
Cacatua sanguinea	Little Corella			*		*	*	*	*	*	*	*		*	*	*	*			*
Eolophus roseicapillus	Galah			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Nymphicus hollandicus	Cockatiel			*	*	*	*	*	*	*	*		*	*		*	*			*
CAMPEPHAGIDAE																				
Coracina maxima	Ground Cuckoo-shrike										*			*	*		*			*
Coracina novaehollandiae	Black-faced Cuckoo-shrike			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Lalage sueurii	White-winged Triller			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
CASUARIIDAE																				
Dromaius novaehollandiae	Emu					*	*	*	*	*	*			*			*			*
CHARADRIIDAE																				
Charadrius leschenaultii	Greater Sand Plover	M															*			
Charadrius ruficapillus	Red-capped Plover							*									*			
Charadrius veredus	Oriental Plover	M															*		*	
Elseyornis melanops	Black-fronted Dotterel			*		*	*	*	*	*	*	*	*	*		*	*			*
Erythrogonys cinctus	Red-kneed Dotterel										*						*			
Pluvialis fulva	Pacific Golden Plover	M															*			
Vanellus miles	Masked Lapwing																*			
Vanellus tricolor	Banded Lapwing																*			
CICONIIDAE																				
Ephippiorhynchus asiaticus	Black-necked Stork			*				*	*	*						*	*			*
CLIMACTERIDAE																				
Climacteris melanura	Black-tailed Treecreeper												*				*			
COLUMBIDAE																				
*Columba livia**	Rock Dove																*			
Geopelia cuneata	Diamond Dove			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Geopelia humeralis	Bar-shouldered Dove							*									*			
Geopelia striata	Peaceful Dove			*		*		*				*	*	*			*			*
Geophaps plumifera	Spinifex Pigeon			*	*	*	*	*	*	*		*	*	*	*	*	*			*
Ocyphaps lophotes	Crested Pigeon			*	*	*	*	*	*	*	*			*	*		*			*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Phaps chalcoptera	Common Bronzewing			*	*	*	*	*			*			*	*		*			*
Phaps histrionica	Flock Bronzewing		P4														*			
CORVIDAE																				
Corvus bennetti	Little Crow					*		*			*	*		*	*		*			*
Corvus orru	Torresian Crow			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
CUCULIDAE																				
Cacomantis pallidus	Pallid Cuckoo			*	*	*	*	*	*	*	*		*	*	*	*	*			*
Centropus phasianinus	Pheasant Coucal			*	*			*				*		*			*			*
Chalcites basalis	Horsfield's Bronze-Cuckoo			*	*		*	*	*	*	*	*	*	*	*		*			*
Chalcites osculans	Black-eared Cuckoo					*	*	*									*			
ESTRILDIDAE																				
Emblema pictum	Painted Finch			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Neochmia ruficauda subclarescens	Star Finch (western)		P4			*					*			*			*			
Taeniopygia guttata	Zebra Finch			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
EUROSTOPODIDAE																				
Eurostopodus argus	Spotted Nightjar			*		*		*	*	*	*	*	*	*	*	*	*			*
FALCONIDAE																				
Falco berigora	Brown Falcon			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Falco cenchroides	Nankeen Kestrel			*		*	*	*	*	*	*	*	*	*	*	*	*			*
Falco hypoleucos	Grey Falcon		P4						*	*	*			*			*	*		
Falco longipennis	Australian Hobby					*		*	*	*	*		*		*	*	*			*
Falco peregrinus	Peregrine Falcon		S4			*	*	*	*	*	*		*		*		*	*		
Falco subniger	Black Falcon															*	*			
GLAREOLIDAE																				
Glareola maldivarum	Oriental Pratincole	M															*		*	
Stiltia isabella	Australian Pratincole					*											*			
GRUIDAE																				
Grus rubicunda	Brolga																*			
HAEMATOPODIDAE																				
Haematopus fuliginosus	Sooty Oystercatcher																*			
Haematopus longirostris	Australian Pied Oystercatcher							*									*			
HALCYONIDAE																				
Dacelo leachii	Blue-winged Kookaburra			*	*	*		*	*	*	*	*	*	*	*		*			*
Todiramphus chloris	Collared Kingfisher																*			
Todiramphus pyrrhopygius	Red-backed Kingfisher			*	*	*	*	*	*	*	*	*	*	*	*		*			*
Todiramphus sanctus	Sacred Kingfisher			*		*	*	*	*	*		*	*	*	*	*	*			*
HIRUNDINIDAE																				
Cheramoeca leucosterna	White-backed Swallow																*			*
Hirundo neoxena	Welcome Swallow													*			*			
Hirundo rustica	Barn Swallow	M																	*	
Petrochelidon ariel	Fairy Martin					*	*	*	*	*	*	*		*		*	*			*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Petrochelidon nigricans	Tree Martin			*		*	*	*	*	*			*	*	*	*	*			*
LARIDAE																				
Chlidonias hybrida	Whiskered Tern																*			
Chlidonias leucopterus	White-winged Black Tern	M															*			
Chroicocephalus novaehollandiae	Silver Gull							*									*			
Gelochelidon nilotica	Gull-billed Tern							*									*			
Hydroprogne caspia	Caspian Tern	M						*									*			
Sternula nereis	Fairy Tern																*			
Thalasseus bengalensis	Lesser Crested Tern	M															*			
Thalasseus bergii	Crested Tern							*									*			
MALURIDAE																				
Amytornis striatus	Striated Grasswren			*		*			*	*					*	*				*
Malurus lamberti	Variegated Fairy-wren			*	*	*	*	*	*	*	*	*		*	*	*	*			*
Malurus leucopterus	White-winged Fairy-wren					*	*	*	*	*	*	*	*	*	*		*			*
Malurus splendens	Splendid Fairy-wren														*					
Stipiturus ruficeps	Rufous-crowned Emu-wren			*		*	*	*			*				*		*			
MEGALURIDAE																				
Cincloramphus cruralis	Brown Songlark			*		*		*	*	*	*						*			*
Cincloramphus mathewsi	Rufous Songlark			*			*	*	*	*			*	*			*			*
Eremiornis carteri	Spinifexbird			*		*	*	*	*	*	*	*		*	*	*	*			*
MELIPHAGIDAE																				
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					*	*	*	*	*	*	*		*	*		*			
Certhionyx variegatus	Pied Honeyeater			*		*			*	*						*	*			*
Conopophila whitei	Grey Honeyeater													*		*				
Epthianura aurifrons	Orange Chat										*									
Epthianura tricolor	Crimson Chat			*		*		*	*	*				*			*			*
Lichenostomus keartlandi	Grey-headed Honeyeater			*	*	*	*	*	*	*	*	*		*	*	*	*			*
Lichenostomus leucotis	White-eared Honeyeater																			
Lichenostomus ornatus	Yellow-plumed Honeyeater																			
Lichenostomus penicillatus	White-plumed Honeyeater			*	*	*	*	*	*	*	*	*	*	*	*		*			*
Lichenostomus plumulus	Grey-fronted Honeyeater			*							*				*	*				
Lichenostomus virescens	Singing Honeyeater			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Lichmera indistincta	Brown Honeyeater			*	*	*	*	*	*	*	*	*		*	*	*	*			*
Manorina flavigula	Yellow-throated Miner			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Melithreptus gularis	Black-chinned Honeyeater			*	*				*	*	*	*		*	*		*			*
Purnella albifrons	White-fronted Honeyeater					*														
Sugomel niger	Black Honeyeater						*	*	*	*						*				
MEROPIDAE																				
Merops ornatus	Rainbow Bee-eater	M		*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*
MONARCHIDAE																				
Grallina cyanoleuca	Magpie-lark			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
MOTACILLIDAE																				

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Anthus novaeseelandiae	Australasian Pipit					*		*	*	*	*	*	*	*	*		*			*
NECTARINIIDAE																				
Dicaeum hirundinaceum	Mistletoebird			*		*	*	*	*	*	*				*		*			*
NEOSITTIDAE																				
Daphoenositta chrysoptera	Varied Sittella								*	*	*									
OTIDIDAE																				
Ardeotis australis	Australian Bustard		P4	*		*	*	*	*	*	*	*		*	*		*	*		*
PACHYCEPHALIDAE																				
Colluricincla harmonica	Grey Shrike-thrush			*	*	*	*		*	*	*	*		*	*	*	*			*
Oreoica gutturalis	Crested Bellbird			*		*	*	*	*	*	*			*	*		*			*
Pachycephala lanioides	White-breasted Whistler																*			
Pachycephala melanura	Mangrove Golden Whistler							*												
Pachycephala rufiventris	Rufous Whistler			*			*	*	*	*	*	*		*	*		*			*
PARDALOTIDAE																				
Pardalotus rubricatus	Red-browed Pardalote			*	*	*	*	*	*	*		*	*	*			*			
Pardalotus striatus	Striated Pardalote			*					*	*	*			*	*	*	*			*
PELECANIDAE																				
Pelecanus conspicillatus	Australian Pelican			*		*	*	*									*			*
PETROICIDAE																				
Melanodryas cucullata	Hooded Robin						*		*	*	*			*	*		*			
Peneonanthe pulverulenta	Mangrove Robin							*									*			
Petroica goodenovii	Red-capped Robin					*	*	*	*	*	*			*	*		*			*
PHALACROCORACIDAE																				
Microcarbo melanoleucos	Little Pied Cormorant			*				*				*					*			*
Phalacrocorax sulcirostris	Little Black Cormorant			*		*	*	*				*								*
Phalacrocorax varius	Pied Cormorant							*												
PHASIANIDAE																				
Coturnix pectoralis	Stubble Quail					*			*	*							*			
Coturnix ypsilophora	Brown Quail			*							*		*	*			*			*
PODARGIDAE																				
Podargus strigoides	Tawny Frogmouth			*	*	*		*	*	*	*	*		*			*			*
PODICIPEDIDAE																				
Podiceps cristatus	Great Crested Grebe																*			*
Poliocephalus poliocephalus	Hoary-headed Grebe																*			
Tachybaptus novaehollandiae	Australasian Grebe					*		*						*			*			*
POMATOSTOMIDAE																				
Pomatostomus superciliosus	White-browed Babbler						*		*	*	*			*	*					
Pomatostomus temporalis	Grey-crowned Babbler						*	*			*		*	*	*		*			*
PSITTACIDAE																				
Barnardius zonarius	Australian Ringneck			*		*	*	*	*	*	*	*		*	*		*			*
Melopsittacus undulatus	Budgerigar			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Neopsephotus bourkii	Bourke's Parrot										*						*			

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Pezoporus occidentalis	Night Parrot	EN, M	S1								*									
Psephotus varius	Mulga Parrot							*												
Purpureicephalus spurius	Red-capped Parrot																			*
PSOPHODIDAE																				
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush								*	*										
PTILONORHYNCHIDAE																				
Ptilonorhynchus guttatus	Western Bowerbird			*	*		*	*						*	*	*	*			*
Ptilonorhynchus maculatus	Spotted Bowerbird					*						*								
RALLIDAE																				
Fulica atra	Eurasian Coot																*			*
Gallinula tenebrosa	Dusky Moorhen																			
Gallirallus philippensis	Buff-banded Rail																*			
Porphyrio porphyrio	Purple Swamphen																*			
Porzana tabuensis	Spotless Crake													*			*			*
Tribonyx ventralis	Black-tailed Native-hen										*						*			
RECURVIROSTRIDAE																				
Himantopus himantopus	Black-winged Stilt							*	*	*							*			*
Recurvirostra novaehollandiae	Red-necked Avocet																*			
RHIPIDURIDAE																				
Rhipidura albiscapa	Grey Fantail						*				*	*			*		*			
Rhipidura leucophrys	Willie Wagtail			*	*	*	*	*	*	*	*	*	*	*	*	*	*			*
Rhipidura phasiana	Mangrove Grey Fantail							*									*			
SCOLOPACIDAE																				
Actitis hypoleucos	Common Sandpiper	M						*									*			
Arenaria interpres	Ruddy Turnstone	M															*			
Calidris ferruginea	Curlew Sandpiper	M															*			
Calidris ruficollis	Red-necked Stint	M															*			
Calidris subminuta	Long-toed Stint	M															*			
Numenius madagascariensis	Eastern Curlew	M	P4					*									*			
Numenius phaeopus	Whimbrel	M						*									*			
Tringa brevipes	Grey-tailed Tattler	M						*									*			
Tringa glareola	Wood Sandpiper	M												*			*			
Tringa nebularia	Common Greenshank	M				*											*			
Tringa stagnatilis	Marsh Sandpiper	M															*			
STRIGIDAE																				
Ninox connivens	Barking Owl					*									*		*			
Ninox novaeseelandiae	Southern Boobook Owl			*		*		*	*	*	*	*		*	*		*			*
THRESKIORNITHIDAE																				
Platalea flavipes	Yellow-billed Spoonbill																*			
Platalea regia	Royal Spoonbill																*			
Plegadis falcinellus	Glossy Ibis	M															*			
Threskiornis molucca	Australian White Ibis							*									*			

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Threskiornis spinicollis	Straw-necked Ibis			*		*		*			*						*			*
TIMALIIDAE																				
Zosterops lateralis	Silvereye																			
Zosterops luteus	Yellow White-eye							*									*			
TURNICIDAE																				
Turnix velox	Little Button-quail			*		*	*	*	*	*	*	*	*	*	*	*	*			*
TYTONIDAE																				
Tyto javanica	Eastern Barn Owl					*					*			*			*			*
Reptiles																				
AGAMIDAE																				
Amphibolurus longirostris	Long-nosed Dragon			*		*	*	*	*	*	*	*	*	*	*	*				*
Caimanops amphiboluroides	Mulga Dragon						*		*	*				*	*					
Ctenophorus caudicinctus	Ring-tailed Dragon			*	*	*	*	*	*	*	*	*	*	*	*	*				*
Ctenophorus isolepis	Central Military Dragon					*	*	*	*	*		*	*	*						*
Ctenophorus nuchalis	Central Netted Dragon					*	*	*			*			*						*
Ctenophorus reticulatus	Western Netted Dragon						*				*			*	*					*
Ctenophorus rubens																				*
Ctenophorus scutulatus	Lozenge-marked Dragon																			*
Diporiphora valens	Pilbara Two-line Dragon						*	*												
Diporiphora winneckei	Canegrass Dragon					*														
Pogona minor minor	Dwarf Bearded Dragon					*	*	*				*		*	*					
Tympanocryptis cephalus	Pebble Dragon								*	*										
CHELIDAE																				
Chelodina steindachneri	Flat-shelled Turtle					*			*	*	*									*
ELAPIDAE																				
Acanthophis pyrrhus	Desert Death Adder					*							*							
Acanthophis wellsi	Pilbara Death Adder						*							*	*					
Brachyurophis approximans	North-western Shovel-nosed Snake					*			*	*				*						
Demansia psammophis	Yellow-faced Whip Snake					*	*	*	*	*			*	*	*					*
Demansia rufescens	Rufous Whipsnake			*					*	*				*		*				*
Furina ornata	Orange-naped Snake					*	*		*	*		*				*				*
Parasuta monachus	Monk Snake														*					
Pseudechis australis	King Brown Snake					*	*	*	*	*		*		*	*					
Pseudonaja modesta	Ringed Brown Snake					*								*		*				
Pseudonaja nuchalis	Western Brown Snake					*	*	*					*	*						*
Simoselaps anomalus	Desert Banded Snake						*	*												
Suta fasciata	Rosen's Snake						*		*	*					*					*
Suta punctata	Little Spotted Snake					*	*	*	*	*			*							
Vermicella snelli					*		*								*					*
GEKKONIDAE																				
Crenadactylus ocellatus	Clawless Gecko			*																
Diplodactylus conspicillatus	Fat-tailed Diplodactylus					*	*	*	*	*	*	*	*							*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Diplodactylus pulcher	Fine-faced Gecko														*					
Diplodactylus savagei	Yellow-spotted Pilbara Gecko			*	*									*	*	*				*
Gehyra pilbara	Pilbara Dtella			*		*														
Gehyra punctata	Spotted Dtella			*		*	*	*					*	*	*					*
Gehyra purpurascens	Purplish Dtella																			
Gehyra variegata	Tree Dtella			*	*	*	*	*	*	*	*	*	*	*	*	*				*
Heteronotia binoei	Bynoe's Gecko			*		*	*	*	*	*	*	*	*	*	*	*				*
Heteronotia planiceps	Bynoe's Prickly Gecko															*				
Heteronotia spelea	Desert Cave Gecko						*				*			*		*				*
Lucasium stenodactylum	Crowned Gecko				*	*	*	*	*	*		*		*	*	*				
Lucasium wombeyi	Pilbara Ground Gecko				*				*	*				*						
Nephrurus levis	Three-lined Knob-tail					*			*	*										
Nephrurus wheeleri	Banded Knob-tail						*							*	*					
Oedura marmorata	Marbled Velvet Gecko					*	*							*						
Rhynchoedura ornata	Beaked Gecko					*	*							*	*					*
Strophurus ciliaris	Spiny-tailed Gecko						*	*				*								
Strophurus elderi	Jewelled Gecko			*	*	*	*	*	*	*				*						
Strophurus jeanae	Southern Phasmid Gecko					*			*	*										
Strophurus wellingtonae	Western Shield Spiny-tailed Gecko						*		*	*				*	*					
PYGOPODIDAE																				
Delma butleri	Unbanded Delma															*				*
Delma elegans	Pilbara Delma			*										*						*
Delma haroldi	Neck-barred Delma						*								*					
Delma nasuta	Sharp-snouted Delma			*			*	*	*	*		*		*	*	*				*
Delma pax	Peace Delma			*	*	*	*	*	*	*				*	*	*				*
Delma tincta	Excitable Delma					*	*	*	*	*		*	*	*	*					
Lialis burtonis	Burton's Snake-lizard			*		*	*	*	*	*	*	*	*	*	*					
Pygopus nigriceps	Hooded Scaly-foot						*	*						*	*					
PYTHONIDAE																				
Antaresia perthensis	Pygmy Python			*		*	*	*	*	*			*							*
Antaresia stimsoni	Stimson's Python					*	*	*	*	*		*	*	*		*				
Aspidites melanocephalus	Black-headed Python					*	*		*	*	*			*	*					
Aspidites ramsayi	Woma		S4				*													
Liasis olivaceus barroni	Olive Python (Pilbara)	VU	S1			*							*					*	*	
SCINCIDAE																				
Carlia munda	Shaded-litter Rainbow-skink			*	*	*	*	*	*	*	*			*	*	*				
Carlia triacantha	Desert Rainbow-skink						*	*	*	*					*	*				
Cryptoblepharus buchananii															*					
Cryptoblepharus plagiocephalus	Callose-palmed Shinning-skink			*		*	*				*			*						
Cryptoblepharus ustulatus															*					
Ctenotus ariadnae	Ariadna's Ctenotus								*	*										
Ctenotus duricola					*	*	*	*	*	*				*	*					*

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Ctenotus grandis	Grand Ctenotus					*	*	*	*	*		*		*						*
Ctenotus helenae	Clay-soil Ctenotus					*	*	*	*	*		*		*	*					*
Ctenotus nigrilineatus	Pin-striped Finesnout Ctenotus		P1			*												*		
Ctenotus pantherinus	Leopard Ctenotus					*	*	*	*	*	*		*	*	*					*
Ctenotus piankai	Coarse Sands Ctenotus											*								
Ctenotus robustus	Robust Ctenotus						*													*
Ctenotus rubicundus	Ruddy Ctenotus			*					*	*	*			*		*				*
Ctenotus rutilans	Rusty-shouldered Ctenotus														*					
Ctenotus saxatilis	Stony-soil Ctenotus			*	*	*	*	*	*	*	*	*	*	*	*	*				*
Ctenotus schomburgkii	Barred Wedgesnout Ctenotus					*			*	*					*					
Ctenotus serventyi	North-western Sandy-loam Ctenotus					*				*										*
Ctenotus uber johnstonei			P2				*		*	*				*	*					
Cyclodomorphus melanops	Spinifex Slender Blue-tongue			*	*	*	*	*	*	*	*			*	*	*				*
Egernia depressa	Pygmy Spiny-tailed Skink					*	*	*					*							*
Egernia formosa	Goldfields Crevice-skink			*	*	*														*
Egernia pilbarensis	Pilbara Crevice-skink																			
Eremiascincus fasciolatus	Narrow-banded Sand-swimmer																			
Eremiascincus richardsonii	Broad-banded Sand-swimmer					*	*	*												
Lerista bipes	North-western Sandslider					*	*	*	*	*		*								*
Lerista clara																				
Lerista desertorum	Central Deserts Robust Slider																			
Lerista jacksoni																				*
Lerista muelleri	Wood Mulch-slider			*	*	*	*	*	*	*	*			*	*	*				*
Lerista neander	Pilbara Robust Slider														*					
Lerista verhmens																				*
Lerista zietzi															*					
Liopholis striata	Nocturnal Desert-skink					*														
Menetia greyii	Common Dwarf Skink					*	*	*	*	*	*	*		*	*					
Menetia surda	Western Dwarf Skink			*								*			*					
Menetia surda surda																				*
Morethia ruficauda	Lined Firetail Skink			*	*	*	*	*	*	*	*	*		*	*	*				*
Notoscincus ornatus	Ornate Soil-crevice Skink			*	*	*			*	*										*
Proablepharus reginae	Western Soil-crevice Skink			*		*	*	*	*	*				*						*
Tiliqua multifasciata	Centralian Blue-tongue					*	*	*	*	*	*	*		*	*					
TYPHLOPIDAE																				
Ramphotyphlops ammodytes							*	*	*	*	*			*						*
Ramphotyphlops diversus	Northern Blind Snake					*														
Ramphotyphlops ganei			P1															*		
Ramphotyphlops grypus	Long-beaked Blind Snake					*	*	*	*	*	*			*	*	*				*
Ramphotyphlops hamatus	Pale-headed Blind Snake					*									*					
Ramphotyphlops pilbarensis																				

Scientific Name	Common Name	Conservation Status		Surveys in Study Area		Surveys in Surrounding Region											Database Seacrhes			
		EPBC Act	WC Act	A	B	D	F (sth)	F (nth)	G (nth)	G (sth)	H	I	J	K	L, M, N	O	Birds Aust.	DEC TPFS	ERT	Nature Map
Ramphotyphlops waitii	Beaked Blind Snake														*					
VARANIDAE																				
Varanus acanthurus	Ridge-tailed Monitor			*		*	*	*	*	*	*	*	*	*	*	*				*
Varanus brevicauda	Short-tailed Pygmy Monitor					*	*	*	*	*	*				*					*
Varanus bushi	Pilbara Mulga Monitor						*							*	*					
Varanus caudolineatus	Stripe-tailed Monitor					*					*			*						
Varanus eremius	Pygmy Desert Monitor				*	*	*	*	*	*				*						*
Varanus giganteus	Perentie			*		*	*	*				*				*				*
Varanus gouldii	Gould's Goanna					*	*	*	*	*										
Varanus panoptes	Yellow-spotted Monitor					*	*		*	*	*			*	*					
Varanus pilbarensis	Pilbara Rock Monitor					*							*							
Varanus tristis	Black-headed Monitor				*	*	*				*			*	*					
Amphibians																				
HYLIDAE																				
Cyclorana australis	Giant Frog						*	*	*	*			*							
Cyclorana maini	Main's Frog					*	*	*	*	*		*	*		*	*				*
Litoria rubella	Desert Tree Frog			*	*	*	*	*	*	*	*	*	*	*		*				*
LIMNODYNASTIDAE																				
Neobatrachus sutor	Shoemaker Frog																			
Notaden nichollsi	Desert Spadefoot Toad						*	*	*	*			*							*
Platyplectrum ornatus	Ornate Burrowing Frog																			*
Platyplectrum spenceri	Spencer's Burrowing Frog					*	*	*	*	*		*								*
MYOBATRACHIDAE																				
Uperoleia glandulosa	Glandular Toadlet					*														
Uperoleia russelli	Russell's Toadlet			*	*	*	*	*	*	*		*								*
Fish																				
CLUPEIDAE																				
Nematalosa erebi	Bony Bream			*																
DIODONTIDAE																				
Allomycterus pilatus	Australian Burrfish																			
MELANOTAENIIDAE																				
Melanotaenia australis	Western Rainbowfish			*																
PLOTOSIDAE																				
Neosilurus hyrtlii	Hyrtl's Catfish			*																
TERAPONTIDAE																				
Amniataba percoides	Barred Grunter			*									*							
Leiopotherapon unicolor	Spangled Perch			*																
				141	**73**	**190**	**182**	**201**	**176**	**178**	**147**	**119**	**89**	**177**	**153**	**91**	**181**	**17**	**15**	**174**

Attachment B

Definitions of Conservation Significance Status

Status	Code	Description
Categories used in EPBC Act Protected Matters Report		
Endangered	E	A taxon is Endangered when the best available evidence indicates that it is considered to be facing a very high risk of extinction in the wild.
Vulnerable	V	A taxon is Vulnerable when the best available evidence indicates that it is considered to be facing a high risk of extinction in the wild.
Migratory	M	Species migrate to, over and within Australia and its external territories.
Schedules of the Western Australian Wildlife Conservation Act 1950		
Schedule 1	S1	Fauna that is rare or likely to become extinct.
Schedule 2	S2	Fauna that is presumed to be extinct.
Schedule 3	S3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds.
Schedule 4	S4	Fauna that is in need of special protection, otherwise than for the reasons mentioned above
Priority Fauna Codes used by the Western Australian DEC		
Priority 1 Taxa with few, poorly known populations on threatened lands.	P1	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 2 Taxa with few, poorly known populations on conservation lands.	P2	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 3 Taxa with several, poorly known populations, some on conservation lands	P3	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 4 Taxa in need of monitoring	P4	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
Priority 5 Taxa in need of monitoring	P5	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.

Attachment C
Short Range Endemic Invertebrate Database Search of the Western Australian Museum Collection, December 2010 for the Sulphur Springs Study Area

Short Range Endemic Invertebrate Database Search of the Western Australian Museum Collection, December 2010 for the Sulphur Springs Study Area

Family	Scientific Name	Notes	Latitude	Longitude
Diplopoda	Antichiropus 'abydos'	T107885 Paradoxosomatidae Antichiropus 'abydos' Abydos, ca. 64 km W. Marble Bar	-21.14222222	119.1150028
Diplopoda	Antichiropus 'abydos'	T107886 Paradoxosomatidae Antichiropus 'abydos' Abydos, ca. 64 km W. Marble Bar	-21.14222222	119.1150028
Araneae	Kwonkan 'MYG200'	T102701 Nemesiidae Kwonkan 'MYG200' Mt Webber	-21.52510556	119.3278111
Pseudoscorpiones	Feaella 'sp. nov. Sulphur Springs'	T78157 Feaellidae Feaella 'tealei' Sulphur Springs, site SUSS 11	-21.13805556	119.1969444
Pseudoscorpiones	Feaella 'sp. nov. Sulphur Springs'	T63963 Feaellidae Feaella 'tealei' Sulphur Springs, site SUSS 11	-21.13805556	119.1969444

Sulphur Springs Database Search: bounding coordinates

Top Left 20°42'23.1"S 118°43'52.3"E

Bottom Right 21°36'25.1"E 119°41'39"E

Whim Creek Database Search: bounding coordinates

Top Left 20°24'14.1"S 117°21'00.8"E

Bottom Right 21°18'23.1"S 118°18'29.3"E

NB –database search for the Whim Creek study area provided a NIL return.

Attachment D

Database Searches for Vertebrate Species Occurring Within the Whim Creek Study Area and Surrounds

Attachment D– Database Searches for Vertebrate Species Occurring Within the Whim Creek Study Area and Surrounds

Legend

Abbreviations/Symbols

*	Introduced Species
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*: EN Endangered, VU Vulnerable M Migratory
WC Act	Western Australian Wildlife Conservation Act 1950 and Department of Environment and Conservation's Threatened and Priority Fauna Rankings:
	S1 Schedule 1 Rare or likely to become extinct, S3 Migratory birds protected under an international agreement, S4 In need of special protection
	P1 Priority 1 Fauna, P2, P3, P4, P5

Database Searches – centroid: 117.827678° E, -20.854009° S

Birds Aust.	Birds Australia Atlas Database Search (December 2010)
DEC TPFS	Department of Environment and Conservation's Threatened and Priority Fauna Database Search (December 2010)
ERT	Department of Sustainability, Environment, Water, Population and Communities database search (October 2010)
Nature Map	Department of Environment and Conservation's Nature Map Database (December 2010)

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Mammals							
CANIDAE							
*Vulpes vulpes**	Fox					*	
DASYURIDAE							
Dasycercus cristicauda	Crest-tailed Mulgara	VU	S1			*	
Dasyurus hallucatus	Northern Quoll	EN	S1		*	*	*
Ningaui timealeyi	Pilbara Ningaui						*
FELIDAE							
*Felis catus**	Cat					*	
HIPPOSIDERIDAE							
Rhinonicteris aurantius (Pilbara form)	Pilbara Leaf-nosed Bat	VU	S1			*	
LEPORIDAE							
*Oryctolagus cuniculus**	Rabbit					*	
MACROPODIDAE							
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby (mainland)		P3				*
Petrogale lateralis lateralis	Black-flanked rock-wallaby	VU	S1		*		
MEGADERMATIDAE							
Macroderma gigas	Ghost Bat		P4		*		
MURIDAE							
Hydromys chrysogaster	Water-rat		P4		*		
Leggadina lakedownensis	Lakeland Downs Mouse		P4		*		
Pseudomys chapmani	Pebble-mound Mouse		P4		*		
VESPERTILIONIDAE							
Vespadelus finlaysoni	Inland Cave Bat						*
Birds							
ACANTHIZIDAE							
Gerygone fusca	Western Gerygone			*			
Gerygone tenebrosa	Dusky Gerygone			*			
Smicrornis brevirostris	Weebill			*			
ACCIPITRIDAE							
Accipiter cirrocephalus	Collared Sparrowhawk			*			*
Accipiter fasciatus	Brown Goshawk			*			*
Aquila audax	Wedge-tailed Eagle			*			*
Circus approximans	Swamp Harrier			*			
Circus assimilis	Spotted Harrier			*			*
Elanus axillaris	Black-shouldered Kite			*			*

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Haliaeetus leucogaster	White-bellied Sea-Eagle	M		*		*	*
Haliastur indus	Brahminy Kite			*			
Haliastur sphenurus	Whistling Kite			*			*
Hieraaetus morphnoides	Little Eagle			*			*
Lophoictinia isura	Square-tailed Kite			*			
Milvus migrans	Black Kite			*			
Pandion cristatus	Eastern Osprey			*			
ACROCEPHALIDAE							
Acrocephalus australis	Australian Reed-Warbler	M		*			*
ALAUDIDAE							
Mirafra javanica	Horsfield's Bushlark			*			
ANATIDAE							
Anas gracilis	Grey Teal			*			*
Anas rhynchotis	Australasian Shoveler			*			
Anas superciliosa	Pacific Black Duck			*			*
Aythya australis	Hardhead			*			*
Chenonetta jubata	Australian Wood Duck			*			
Cygnus atratus	Black Swan			*			
Dendrocygna eytoni	Plumed Whistling-Duck			*			
Malacorhynchus membranaceus	Pink-eared Duck			*			
ANHINGIDAE							
Anhinga novaehollandiae	Australasian Darter			*			
APODIDAE							
Apus pacificus	Fork-tailed Swift	M		*		*	
ARDEIDAE							
Ardea ibis	Cattle Egret	M		*		*	
Ardea intermedia	Intermediate Egret			*			
Ardea modesta	Eastern Great Egret			*			*
Ardea pacifica	White-necked Heron			*			*
Butorides striata	Striated Heron			*			
Egretta garzetta	Little Egret			*			
Egretta novaehollandiae	White-faced Heron			*			*
Egretta sacra	Eastern Reef Egret	M		*			
Ixobrychus flavicollis	Black Bittern			*			
Nycticorax caledonicus	Nankeen Night Heron			*			*
ARTAMIDAE							
Artamus cinereus	Black-faced Woodswallow			*			*

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Artamus leucorynchus	White-breasted Woodswallow			*			
Artamus minor	Little Woodswallow			*			*
Artamus personatus	Masked Woodswallow			*			*
Cracticus nigrogularis	Pied Butcherbird			*			*
Cracticus tibicen	Australian Magpie			*			*
Cracticus torquatus	Grey Butcherbird			*			
BURHINIDAE							
Burhinus grallarius	Bush Stone-curlew		P4	*	*		*
CACATUIDAE							
Cacatua sanguinea	Little Corella			*			*
Eolophus roseicapillus	Galah			*			*
Nymphicus hollandicus	Cockatiel			*			*
CAMPEPHAGIDAE							
Coracina maxima	Ground Cuckoo-shrike			*			
Coracina novaehollandiae	Black-faced Cuckoo-shrike			*			*
Lalage sueurii	White-winged Triller			*			*
CASUARIIDAE							
Dromaius novaehollandiae	Emu			*			
CHARADRIIDAE							
Charadrius leschenaultii	Greater Sand Plover	M		*			
Charadrius ruficapillus	Red-capped Plover			*			
Charadrius veredus	Oriental Plover	M		*		*	
Elseyornis melanops	Black-fronted Dotterel			*			*
Erythrogonys cinctus	Red-kneed Dotterel			*			
Pluvialis fulva	Pacific Golden Plover	M		*			
Vanellus miles	Masked Lapwing			*			
Vanellus tricolor	Banded Lapwing			*			
CICONIIDAE							
Ephippiorhynchus asiaticus	Black-necked Stork			*			
CLIMACTERIDAE							
Climacteris melanura	Black-tailed Treecreeper			*			*
COLUMBIDAE							
*Columba livia**	Rock Dove			*			
Geopelia cuneata	Diamond Dove			*			*
Geopelia humeralis	Bar-shouldered Dove			*			
Geopelia striata	Peaceful Dove			*			*

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Geophaps plumifera	Spinifex Pigeon			*			*
Ocyphaps lophotes	Crested Pigeon			*			*
Phaps chalcoptera	Common Bronzewing			*			
Phaps histrionica	Flock Bronzewing		P4	*	*		
CORVIDAE							
Corvus bennetti	Little Crow			*			
Corvus orru	Torresian Crow			*			*
CUCULIDAE							
Cacomantis pallidus	Pallid Cuckoo			*			*
Centropus phasianinus	Pheasant Coucal			*			
Chalcites basalis	Horsfield's Bronze-Cuckoo			*			
Chalcites osculans	Black-eared Cuckoo			*			
ESTRILDIDAE							
Emblema pictum	Painted Finch			*			*
Neochmia ruficauda	Star Finch			*			
Taeniopygia guttata	Zebra Finch			*			*
EUROSTOPODIDAE							
Eurostopodus argus	Spotted Nightjar			*			
FALCONIDAE							
Falco berigora	Brown Falcon			*			*
Falco cenchroides	Nankeen Kestrel			*			*
Falco hypoleucos	Grey Falcon		P4	*	*		
Falco longipennis	Australian Hobby			*			
Falco peregrinus	Peregrine Falcon		S4	*	*		
Falco subniger	Black Falcon			*			
GLAREOLIDAE							
Glareola maldivarum	Oriental Pratincole	M		*		*	
Stiltia isabella	Australian Pratincole			*			
GRUIDAE							
Grus rubicunda	Brolga			*			
HAEMATOPODIDAE							
Haematopus fuliginosus	Sooty Oystercatcher			*			
Haematopus longirostris	Australian Pied Oystercatcher			*			
HALCYONIDAE							
Dacelo leachii	Blue-winged Kookaburra			*			*
Todiramphus chloris	Collared Kingfisher			*			
Todiramphus pyrrhopygius	Red-backed Kingfisher			*			*

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Todiramphus sanctus	Sacred Kingfisher			*			*
HIRUNDINIDAE							
Cheramoeca leucosterna	White-backed Swallow			*			
Hirundo neoxena	Welcome Swallow			*			
Hirundo rustica	Barn Swallow	M				*	
Petrochelidon ariel	Fairy Martin			*			
Petrochelidon nigricans	Tree Martin			*			*
LARIDAE							
Chlidonias hybrida	Whiskered Tern			*			
Chlidonias leucopterus	White-winged Black Tern	M		*			
Chroicocephalus novaehollandiae	Silver Gull			*			
Gelochelidon nilotica	Gull-billed Tern			*			
Hydroprogne caspia	Caspian Tern	M		*			
Sternula nereis	Fairy Tern			*			
Thalasseus bengalensis	Lesser Crested Tern	M		*			
Thalasseus bergii	Crested Tern			*			
MALURIDAE							
Malurus lamberti	Variegated Fairy-wren			*			*
Malurus leucopterus	White-winged Fairy-wren			*			
Stipiturus ruficeps	Rufous-crowned Emu-wren			*			
MEGALURIDAE							
Cincloramphus cruralis	Brown Songlark			*			
Cincloramphus mathewsi	Rufous Songlark			*			*
Eremiornis carteri	Spinifexbird			*			
MELIPHAGIDAE							
Acanthagenys rufogularis	Spiny-cheeked Honeyeater			*			
Certhionyx variegatus	Pied Honeyeater			*			
Epthianura tricolor	Crimson Chat			*			
Lichenostomus keartlandi	Grey-headed Honeyeater			*			*
Lichenostomus penicillatus	White-plumed Honeyeater			*			*
Lichenostomus virescens	Singing Honeyeater			*			*
Lichmera indistincta	Brown Honeyeater			*			*
Manorina flavigula	Yellow-throated Miner			*			*
Melithreptus gularis	Black-chinned Honeyeater			*			

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
MEROPIDAE							
Merops ornatus	Rainbow Bee-eater	M		*		*	*
MONARCHIDAE							
Grallina cyanoleuca	Magpie-lark			*			*
MOTACILLIDAE							
Anthus novaeseelandiae	Australasian Pipit			*			*
NECTARINIIDAE							
Dicaeum hirundinaceum	Mistletoebird			*			*
OTIDIDAE							
Ardeotis australis	Australian Bustard		P4	*	*		*
PACHYCEPHALIDAE							
Colluricincla harmonica	Grey Shrike-thrush			*			*
Oreoica gutturalis	Crested Bellbird			*			*
Pachycephala lanioides	White-breasted Whistler			*			
Pachycephala rufiventris	Rufous Whistler			*			
PARDALOTIDAE							
Pardalotus rubricatus	Red-browed Pardalote			*			*
Pardalotus striatus	Striated Pardalote			*			*
PELECANIDAE							
Pelecanus conspicillatus	Australian Pelican			*			*
PETROICIDAE							
Melanodryas cucullata	Hooded Robin			*			
Peneonanthe pulverulenta	Mangrove Robin			*			
Petroica goodenovii	Red-capped Robin			*			
PHALACROCORACIDAE							
Microcarbo melanoleucos	Little Pied Cormorant			*			*
Phalacrocorax carbo	Great Cormorant						*
PHASIANIDAE							
Coturnix pectoralis	Stubble Quail			*			
Coturnix ypsilophora	Brown Quail			*			
PODARGIDAE							
Podargus strigoides	Tawny Frogmouth			*			
PODICIPEDIDAE							
Podiceps cristatus	Great Crested Grebe			*			
Poliocephalus poliocephalus	Hoary-headed Grebe			*			*
Tachybaptus novaehollandiae	Australasian Grebe			*			*
POMATOSTOMIDAE							

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Pomatostomus temporalis	Grey-crowned Babbler			*			*
PSITTACIDAE							
Barnardius zonarius	Australian Ringneck			*			*
Melopsittacus undulatus	Budgerigar			*			*
Neopsephotus bourkii	Bourke's Parrot			*			
PTILONORHYNCHIDAE							
Ptilonorhynchus guttatus	Western Bowerbird			*			
RALLIDAE							
Fulica atra	Eurasian Coot			*			
Gallirallus philippensis	Buff-banded Rail			*			
Porphyrio porphyrio	Purple Swamphen			*			
Porzana tabuensis	Spotless Crake			*			
Tribonyx ventralis	Black-tailed Native-hen			*			
RECURVIROSTRIDAE							
Himantopus himantopus	Black-winged Stilt			*			
Recurvirostra novaehollandiae	Red-necked Avocet			*			
RHIPIDURIDAE							
Rhipidura albiscapa	Grey Fantail			*			
Rhipidura leucophrys	Willie Wagtail			*			*
Rhipidura phasiana	Mangrove Grey Fantail			*			
SCOLOPACIDAE							
Actitis hypoleucos	Common Sandpiper	M		*			
Arenaria interpres	Ruddy Turnstone	M		*			
Calidris ferruginea	Curlew Sandpiper	M		*			
Calidris ruficollis	Red-necked Stint	M		*			
Calidris subminuta	Long-toed Stint	M		*			
Numenius madagascariensis	Eastern Curlew	M	P4	*	*		
Numenius phaeopus	Whimbrel	M		*			
Tringa brevipes	Grey-tailed Tattler	M		*			
Tringa glareola	Wood Sandpiper	M		*			
Tringa nebularia	Common Greenshank	M		*			
Tringa stagnatilis	Marsh Sandpiper	M		*			
STRIGIDAE							
Ninox connivens	Barking Owl			*			*
Ninox novaeseelandiae	Southern Boobook Owl			*			*
THRESKIORNITHIDAE							
Platalea flavipes	Yellow-billed Spoonbill			*			
Platalea regia	Royal Spoonbill			*			

Scientific Name	Common Name	Conservation Status		Database Searches			
		EPBC Act	WC Act	Birds Australia	DEC TPFS	ERT	Nature Map
Plegadis falcinellus	Glossy Ibis	M		*			
Threskiornis molucca	Australian White Ibis			*			
Threskiornis spinicollis	Straw-necked Ibis			*			*
TIMALIIDAE							
Zosterops luteus	Yellow White-eye			*			
TURNICIDAE							
Turnix velox	Little Button-quail			*			
TYTONIDAE							
Tyto javanica	Eastern Barn Owl			*			
Reptiles							
AGAMIDAE							
Ctenophorus isolepis	Central Military Dragon						*
ELAPIDAE							
Demansia psammophis	Yellow-faced Whip Snake						*
GEKKONIDAE							
Gehyra punctata	Spotted Dtella						*
PYTHONIDAE							
Aspidites ramsayi	Woma		S4		*		
Liasis olivaceus barroni	Olive Python (Pilbara)	VU	S1			*	
SCINCIDAE							
Ctenotus pantherinus	Leopard Ctenotus						*
Cyclodomorphus melanops	Spinifex Slender Blue-tongue						*
Lerista nevinae			P1		*		
VARANIDAE							
Varanus acanthurus	Ridge-tailed Monitor						*
Varanus eremius	Pygmy Desert Monitor						*
Varanus gouldii	Gould's Goanna						*
Amphibians							
HYLIDAE							
Cyclorana maini	Main's Frog						*
				181	**14**	**14**	**84**